DICOM Conformance Statement

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syngo® RT Planning System VC10 on *syngo*® VA11A

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DICOM Conformance Statement

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1 CONFORMANCE STATEMENT OVERVIEW

The *syngo*® RT Planning system is comprised of a storage system (*syngo*® RT Planning Application Server), client review workstations (*syngo*® RT Planning Client) and connectivity to DICOM modalities and healthcare information systems. By default one *syngo*® RT Planning (AE) is used. It is possible to configure usage of multiple different AEs for the individual DICOM services.

The *syngo*® RT Planning system:

- stores objects (images, reports, encapsulated PDF) sent to it by service class users
- takes responsibility for storage of the objects
- allows object queries based on several query models
- retrieves and transmits requested objects
- displays images to a user
- imports and exports objects from portable interchange media

The *syngo*® RT Planning system conforms to the DICOM 3.0 2009 Standard and supports the network services as described in Table 1-1 and the media services as described in Table 1-2.

Table 1-1 Network Services

SOP Classes	Service Class User (SCU)	Service Class Provider (SCP)
Verification		
Verification Service	Yes	Yes
Transfer		
12-lead ECG Waveform Storage	Yes	Yes
Ambulatory ECG Waveform Storage	Yes	Yes
Basic Text Structured Report Storage	Yes	Yes
Cardiac Electrophysiology Waveform Storage	Yes	Yes
Color Softcopy Presentation State Storage (store &forward only)	Yes	Yes
Comprehensive Structured Report Storage	Yes	Yes
Computed Radiography Image Storage	Yes	Yes
Computed Tomography Image Storage	Yes	Yes
CSA Non-Image Storage	Yes	Yes
Digital Mammography Image Storage for Presentation	Yes	Yes
Digital Mammography Image Storage for Processing	Yes	Yes
Digital X-Ray Image Storage for Presentation	Yes	Yes
Digital X-Ray Image Storage for Processing	Yes	Yes
Encapsulated PDF Storage	Yes	Yes
Enhanced Computed Tomography Image Storage (store & forward only)	Yes	Yes

SOP Classes	Service Class User (SCU)	Service Class Provider (SCP)
Enhanced Magnetic Resonance Storage	Yes	Yes
Enhanced MR Color Image Storage	Yes	Yes
Enhanced Structured Report Storage	Yes	Yes
General ECG Waveform Storage	Yes	Yes
Grayscale Softcopy Presentation State Storage (store & forward only)	Yes	Yes
Hemodynamic Waveform Storage	Yes	Yes
Key Object Selection Document Storage	Yes	Yes
Magnetic Resonance Image Storage	Yes	Yes
MR Spectroscopy Storage	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage	Yes	Yes
Multi-frame True Color Secondary Capture Image Storage	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes
PET Image Storage	Yes	Yes
Procedure Log Storage	Yes	Yes
Raw DataStorage	Yes	Yes
Real World Value Mapping Storage	Yes	Yes
RT Beams Treatment Record Storage	Yes	Yes
RT Dose Storage	Yes	Yes
RT Image Storage	Yes	Yes
RT Ion Beams Treatment Record Storage	Yes	Yes
RT Ion Plan Storage	Yes	Yes
RT Plan Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
RT Treatment Summary Record Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Segmentation Storage	Yes	Yes
Spatial Fiducials Storage	Yes	Yes
Spatial Registration Storage	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Ultrasound Multi-Frame Image Storage	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes
X-Ray Radiation Dose Structured Report Storage	Yes	Yes
X-Ray Radio-Fluoroscopic Image Storage	Yes	Yes
Query / Retrieve		
Patient Root – Query/Retrieve Information Model – FIND	Yes	Yes
Patient Root – Query/Retrieve Information Model – MOVE	Yes	Yes
Study Root – Query/Retrieve Information Model – FIND	Yes	Yes

SOP Classes	Service Class User (SCU)	Service Class Provider (SCP)
Study Root – Query/Retrieve Information Model – MOVE	Yes	Yes
Patient/Study Only – Query/Retrieve Information Model – FIND	Yes	Yes
Patient/Study Only – Query/Retrieve Information Model – MOVE	Yes	Yes
Workflow Management		
Storage Commitment Push Model	Yes	Yes

Table 1-2 Media Services

Media Storage Application Profile	Write Files (FSC)	Read Files (FSR)
Compact Disk – Recordable		
STD-GEN-CD	Yes	Yes
DVD – Recordable		
STD-GEN-DVD	Yes	Yes
STD-GEN-DVD-J2K	Yes	Yes
USB		
STD-GEN-USB-J2K	Yes	Yes

The *syngo*® RT Planning **Application Server** creates ISO files to be burnt by *syngo*® RT Planning **Client** local burning SW (if hardware and software are available). Therefore it is only possible to update DICOMDIRs before the burning process has been started. When selecting the 'Standard' profile from the export UI, the export job will be handled according to the STD-GEN-XXX profile; depending on which media has been selected. In case the 'Patient' profile is selected, the STD-GEN-XXX-J2K profile will be used, depending on which media or destination has been selected.

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3 INTRODUCTION

3.1 GENERAL

The Conformance Statement describes the DICOM interface for the Siemens *syngo*® RT Planning in terms of part 2 of [1].

3.2 AUDIENCE

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.3 REMARKS

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with Siemens and other vendors' medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [1]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity.
- Test procedures should be defined and tests should be performed by the user to validate the connectivity desired. DICOM itself and the conformance parts do not specify this.
- The standard will evolve to meet the users' future requirements. Siemens is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

Siemens reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens representative for the most recent product information.

3.4 ABBREVIATIONS

ACR	American College of Radiology
AE	DICOM Application Entity
ASCII	American Standard Code for Information Interchange
DB	Database
DCS	DICOM Conformance Statement
DSA	Digital Subtraction Angiography
IIDC	Image-Intensifier Distortion Correction
IOD	DICOM Information Object Definition
ISO	International Standard Organization
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
R	Required Key Attribute
RIS	Radiology Information System
SC	Storage Commitment
SCU	DICOM Service Class User
SCP	DICOM Service Class Provider
SOP	DICOM Service-Object Pair
SCS	Specific Character Set
U	Unique Key Attribute

3.5 REFERENCES

[1] Digital Imaging and Communications in Medicine (DICOM), PS 3.1-2009 – PS 3.18-2009, National Electrical Manufacturers Association (NEMA). The DICOM Standard is under continuous maintenance, the current official version is available at http://dicom.nema.org.

[2] IHE Radiology Technical Framework, Vol. I – IV, http://www.ihe.net/Technical_Framework.

3.6 SCOPE AND FIELD OF APPLICATION

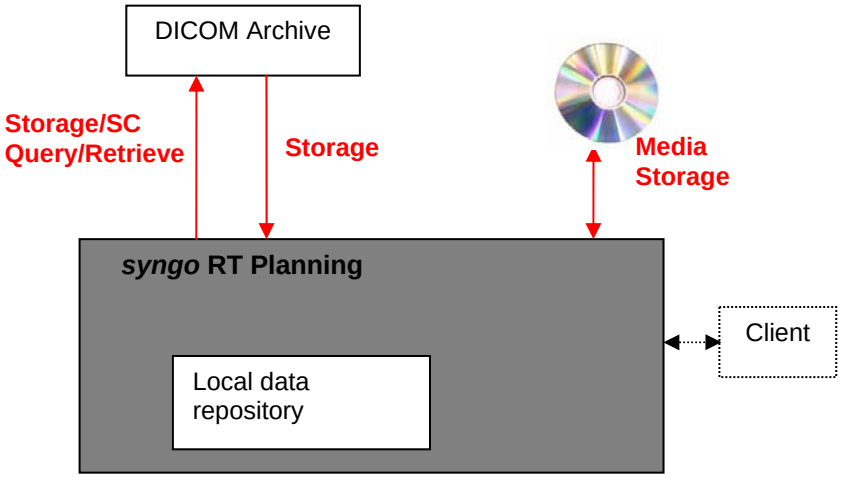


Figure 3.6-1: Overview of DICOM capabilities of *syngo*® RT Planning VC10 on *syngo*® VA11A

4 NETWORKING

4.1 IMPLEMENTATION MODEL

4.1.1 Application Data Flow

The Application Data Flow diagram in Figure 4.1-1 depicts the DICOM data flow to and from the individual applications within *syngo*® RT Planning.

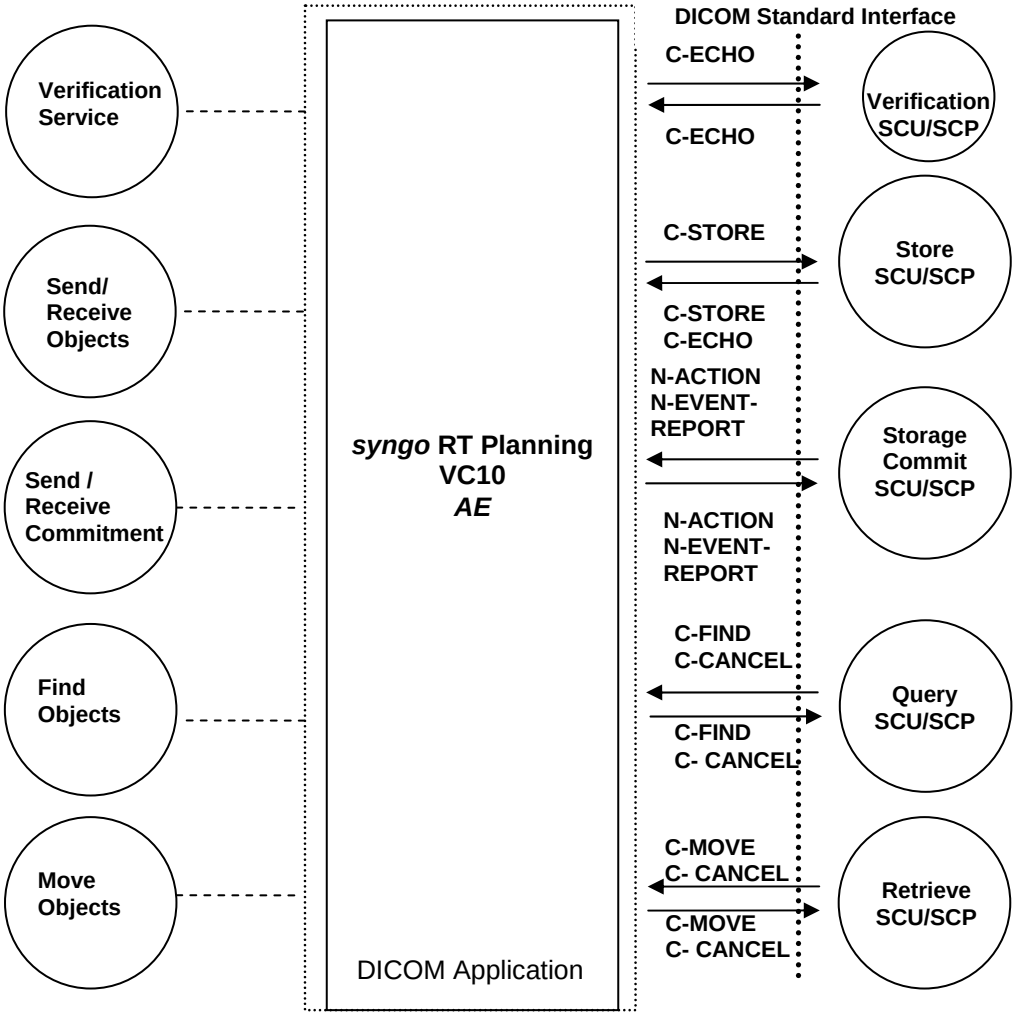


Figure 4.1-1: Application Data Flow Diagram

4.1.2 Functional Definition of AE's

The SCP components of the Application Entities of the *syngo*® RT Planning operate as background server processes. They exist as soon as the system is powered up and wait for association requests. Upon accepting an association with a negotiated Presentation Context they start to receive and process the requests described in the following sections.

The SCU components of the Application Entity are invoked upon requests from the user interface or indirect by trigger from internal processes.

4.1.2.1 Verification

Verification requests will be processed and responded by the *syngo*® RT Planning AE. The *syngo*® RT Planning AE can also initiate an association and request verification to a remote AE.

Verification as SCU is available for each service through the Networking pages of service configuration:

- Storage configuration
- Storage Commitment configuration
- Query/Retrieve configuration

4.1.2.2 Storage

The *syngo*® RT Planning Storage SCU is invoked either directly by the user, by an auto-archive trigger or internally by the Query/Retrieve Application Entity that is responsible for processing retrieve requests. The request consists of data describing the composite objects selected for storage and the destination AET. An association is negotiated with the destination AE and the image data is transferred using the DIMSE C-STORE -Service. The transfer status is reported to the initiator of the Storage request.

The *syngo*® RT Planning Storage SCP starts to receive the Composite Image Objects and import them into the database after accepting an association with a negotiated Presentation Context. The system can be configured in such a way, that Responses to the Storage Request are sent immediately after reception of the Data, or after persistent storage on the hard disc or after storage & indexing in the DB.

4.1.2.3 Storage Commitment

The *syngo*® RT Planning serves as a SCU for the DICOM Storage Commitment service. Upon successful completion of a storage job, the system uses the DIMSE N-ACTION Service to request storage commitment from a DICOM storage commitment SCP. This can either be the same as the storage destination or storage commitment can be requested from a different system depending on the system configuration.
Storage Commitment Request will be sent after a configurable delay of storing the objects. The Storage Commitment SCP will always send the N-EVENT-REPORT Request on a new association.

The *syngo*® RT Planning can also serve as a SCP for the DICOM Storage Commitment service. Additional to each successfully completed send job, modalities should trigger a Storage Commitment request for the safekeeping of the images sent to the *syngo*® RT Planning.

4.1.2.4 Query

The C-FIND request to the remote SCP is invoked directly by the user. The remote SCP returns a list of responses with defined data, which are displayed to the user. The user can decide to start retrieving any of the responses or to issue another query.

The *syngo*® RT Planning supports as SCU

- Study Root Query Model.
- Patient Root Query Model
- Patient/Study Only Query Model
- Furthermore the SCU services may issue relational queries, if supported by the SCP node and required by the querying Application.

The C-FIND SCP will perform a query on the local data repository and return the matching items.

The *syngo*® RT Planning supports as SCP

- Study Root Query Model.
- Patient Root Query Model
- Patient/Study Only Query Model
- Furthermore the C-Find SCP service supports and negotiates relational queries.

4.1.2.5 Retrieve

The *syngo*® RT Planning initiates a C-MOVE request to the remote Retrieve SCP. The remote Retrieve SCP in turn starts C-STORE sub operations to the *syngo*® RT Planning Storage SCP.

The syngo® RT Planning supports as SCU

- Study Root Retrieve Model.
- Patient Root Query Model in case relational queries are supported
- Patient/Study Only Query Model in case relational queries are supported

The *syngo*® RT Planning responds to C-MOVE requests from a remote SCU. C-MOVE requests involve the *syngo*® RT Planning DICOM Query/Retrieve SCP application to initiate a C-STORE sub-operation to send image objects to a remote Storage SCP.

The *syngo*® RT Planning supports as SCP

- Study Root Retrieve Model.
- Patient Root Retrieve Model
- Patient/Study Only Retrieve Model

4.1.3 Sequencing of Real-World Activities

Storage / Storage Commitment:

The communication between *syngo*® RT Planning and an external DICOM node in case of triggering the transfer of objects from *syngo*® RT Planning to the external node is depicted in Figure 4.1-2 in more detail.

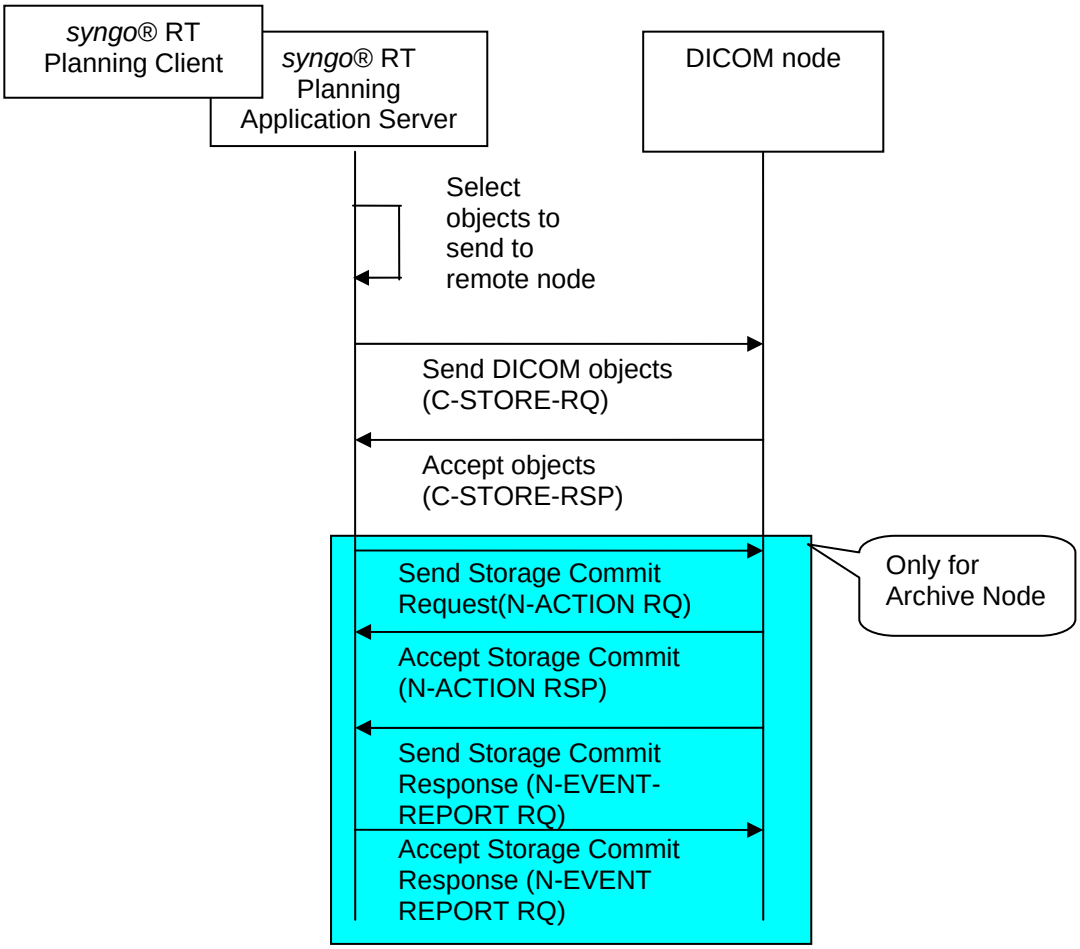


Figure 4.1-2: Sequence diagram – Storage / Storage Commitment

Query and Retrieval:

The communication between *syngo*® RT Planning and an external DICOM node in case of querying of objects from a remote DICOM node and retrieval to *syngo*® RT Planning is depicted in Figure 4.1-3 in more detail.

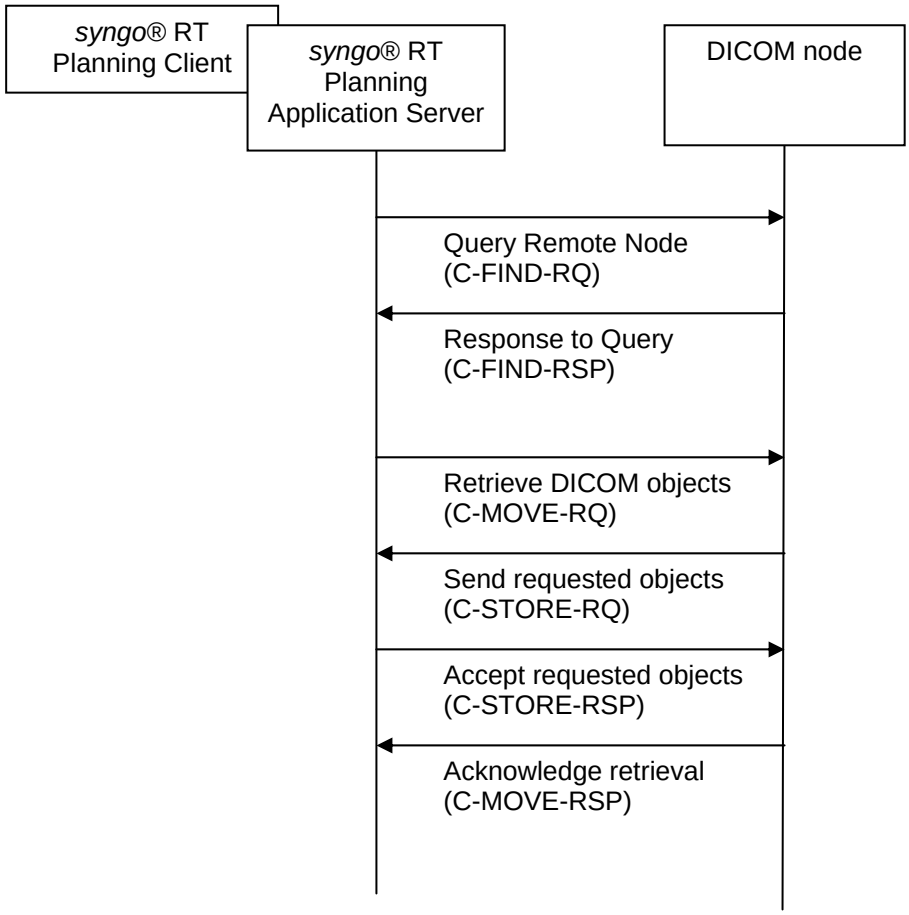


Figure 4.1-3: Sequence diagram – Query/Retrieve

4.2 AE SPECIFICATIONS

This section outlines the specifications for each of the Application Entities that are part of the *syngo*® RT Planning solution.

4.2.1 *syngo*® RT Planning AE

4.2.1.1 SOP Classes supported

This Application Entity provides Standard Conformance to the SOP Classes listed in Chapter 8 in Table 8-1 SOP CLASSES and Table 8-2: Supported Non-Storage SOP Classes

4.2.1.2 Association Establishment Policies

Table 4-1: Association Policies

Application Context Name	1.2.840.10008.3.1.1.1
PDU size	128 kB [1]
Maximum number of simultaneous associations as an association acceptor	12[1]
Maximum number of simultaneous associations as an association initiator	unlimited

The *syngo*® RT Planning AE contains a limitation of 512 kB for the maximum PDU size. By default, the maximum PDU size is set to 128kB.
The maximum number of simultaneous receiving associations (SCP) is configurable at run time, based on the system resources available. By default, the maximum number of associations is set to 12.
There is no inherent limit to the number of outgoing associations (SCU), other than limits imposed by the computer operating system. Nevertheless, transfer jobs to one distinct remote system (Send, Retrieve) will be run sequentially one after the other.

4.2.1.2.1 Asynchronous Nature

The *syngo*® RT Planning supports asynchronous communication (multiple outstanding transactions over a single association). On the SCU side the Window size proposed is infinite. On the SCP Side any non-infinite maximum size will be accepted.

Table 4-2: Asynchronous Nature as an Association Initiator

Maximum number of outstanding asynchronous transactions	Infinite

4.2.1.2.2 Implementation Identifying Information

Table 4-3: DICOM Implementation Class and Version

Implementation Class UID	1.3.12.2.1107.5.7.8.20120725
Implementation Version Name	syngo.via

[1] Default, the value is configurable

4.2.1.3 Association Initiation Policy

syngo® RT Planning initiates associations while processing the service operations and internal messages as shown below:

Table 4-4: Association initiation policies

Operation or Real-World Activity	Association for
Verification	C-ECHO
Send / Receive Instance	C-STORE
Storage Commitment	N-ACTION N-EVENT-REPORT
Querying a remote node	C-FIND
Retrieval of Instances	C-MOVE

4.2.1.3.1 Activity "Send To"

4.2.1.3.1.1 Description and Sequencing of Activities

Storage of DICOM object is either triggered internally in the *syngo*® RT Planning (either “Send to” from the UI or triggered by auto-archiving events; see also Figure 4.1-2) or by a C-MOVE request initiated by an external DICOM AE to *syngo*® RT Planning.

If an association to a remote Application Entity could successfully be established, each image will be transferred one after another via the same open association.

Automatic retry mechanism:
it is configurable, how many retry attempts are performed before the job goes to failed.

Retries are performed if:

- the network connection has been lost from SCU perspective. In this case retry is performed as soon as the network connection is available again
- the partner is not reachable for other reasons (e.g. partner node has broken down) that appear to be transient. The number of retries and the interval between the retries are configurable (the default of retries is 2 and the interval is 10 minutes)

In case the transfer fails for a permanent reason (rejection permanent reported by SCP, all Presentation Contexts refused, …) the transfer will not be retried.

4.2.1.3.1.2 Proposed Presentation Contexts

For all supported Transfer objects (see SOP Classes in Table 8-1) the following Transfer Syntaxes are supported:

Table 4-5: Proposed Presentation Contexts for Storage

UID value	Transfer Syntax
1.2.840.10008.1.2.1	Explicit Value Representation Little Endian native
1.2.840.10008.1.2	Implicit Value Representation Little Endian native
1.2.840.10008.1.2.4.70	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14) lossless compressed
1.2.840.10008.1.2.4.90	JPEG 2000 Image Compression (Lossless Only) compressed
1.2.840.10008.1.2.5	RLE Lossless compressed
1.2.840.10008.1.2.4.51	JPEG Extended (Process 2 & 4) lossy compressed
1.2.840.10008.1.2.4.50	JPEG Baseline (Process 1) lossy compressed
1.2.840.10008.1.2.4.91	JPEG 2000 Image Compression lossy compressed

Depending on the Configuration, the Storage SCU Service will choose a compressed or uncompressed Transfer Syntax among those accepted by the SCP. The Transfer Syntax chosen is the preferred one among the compressed and uncompressed ones. The preference order is the order of occurrence in the configuration. It is possible to configure for a specific node, which Transfer Syntax shall be used and which one shall be excluded. The configuration can even be extended, based on the combination of SOP Classes and supported Transfer Syntax. The configuration can be performed in the Service UI.
An instance will be JPEG lossless compressed only if it fulfills the following criteria:

- is an image and not already compressed
- Photometric Interpretation (0028,0004) is MONOCHROME or RGB or YBR_FULL or YBR_FULL_422
- Bits Allocated (0028,0100) equal to 16'D or 8'D
- Bits Stored (0028,0101) is >8
- High Bit (0028,0102) equal to Bits Stored (0028,0101) - 1
- Pixel Representation (0028,0103) equal to 0'D

An instance will be JPEG lossy compressed only if it fulfills the following criteria:

- is an image and not already compressed
- photometric interpretation (0028,0004) is MONOCHROME or RGB
- Bits Allocated (0028,0100) equal to 16'D or 8'D
- Bits Stored (0028,0101) equal to 12'D or 8'D
- High Bit (0028,0102) equal to Bits Stored (0028,0101) - 1
- Pixel Representation (0028,0103) equal to 0'D

An instance will be JPEG 2000 lossless compressed only if it fulfills the following criteria:

- is an image and not already compressed
- Photometric interpretation (0028,0004) not MONOCHROME or RGB or YBR_FULL or YBR_FULL_422
- Bits Allocated (0028,0100) not 16'D or 8'D

An instance will be JPEG 2000 lossy compressed only if it fulfills the following criteria:

- is an image and not already compressed
- Photometric interpretation (0028,0004) is MONOCHROME or RGB
- Bits Stored (0028,0101) equal to 12'D or 8'D

There is no extended negotiation as an SCU.

4.2.1.3.1.3 SOP Specific Conformance for SOP Classes

The *syngo*® RT Planning will not add or change private attributes by default, even in case objects are compressed or image header is updated according to IHE [2] Patient Information Reconciliation.
The behavior of *syngo*® RT Planning when encountering status codes in a C-STORE response is summarized in Table 4-6:

Table 4-6: DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Error	Duplicate SOP Instance UID: some of the instances sent to the SCP were already available there.	0x0111	Job is continued till the end and marked as Completed(!). A warning mentions that some images were already available on the remote node. These will not be overwritten.
Error	Out-Of-Resources: The remote node has run out of resources (storage resources for example)	0xA7XX	Job is continued till the end. An according message is shown to the user.
Error	Any other DIMSE Error Status	0xXXXX	Job is continued till the end. An according message is shown to the user. Error is logged in the system log.
Error	Sending partially or completely failed	Any none null Code	Failure reported to user (percentage of transferred instances is shown)
Success	Image is successfully stored on file system.	0000	Success reported to user

Table 4-7: DICOM Command Communication Failure Behavior

Exception	Behavior
Timeout	Failure reported to user (Timeout configurable; default 30s)
Association Aborted	Failure reported to user

4.2.1.3.2 Activity "Send Initial Storage Commitment"

4.2.1.3.2.1 Description and Sequencing of Activities

After sending Images to a configured Archive, the *syngo*® RT Planning will initiate a Storage Commitment request, if configured (see also Figure 4.1-2). The *syngo*® RT Planning initiates a new association in order to send the N-ACTION-RQ to the SCP.
The Storage Commitment Request will be sent after the storage, delayed by a configurable amount of time in order to make sure that the remote node had enough time to index correctly the instances received (default delay is 10 minutes).

syngo® RT Planning will accept the N-Event-Report-RQ in the same association when sent immediately after the N-ACTION-RSP but will not wait for it (association will be closed after 3 seconds).

The system may issue one N-ACTION-RQ for a complete set (bundle) of instances or issue one N-ACTION-RQ per instance. This behavior is configurable; the default value is "bundled".

4.2.1.3.2.2 Proposed Presentation Contexts

Table 4-8: Proposed Presentation Contexts for Storage Commitment

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.3.2.3 SOP specific Conformance for SOP classes

The behavior of *syngo*® RT Planning when encountering status codes in an N-ACTION response is summarized in Table 4-9:

Table 4-9: DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Error	Any failure that occurs	Any none null Code	Failure reported to user; corresponding object(s) will be marked as "Archived failed"
Success	All Instances are available on the remote node	0000	Success reported to user; in case failures exist, the corresponding instances will be marked as "Archived failed"

Table 4-10: DICOM Command Communication Failure Behavior

Exception	Behavior
Timeout	Failure reported to user (Timeout configurable; default 30s); the request will be retried
Association Aborted	Failure reported to user; the request will be retried

4.2.1.3.3 Activity "Send Reply to Commitment Requests on separate associations"

4.2.1.3.3.1 Description and Sequencing of Activities

In case the *syngo*® RT Planning has received a Storage Commitment request (N-ACTION-RQ) from an external node, the *syngo*® RT Planning initiates a new association in order to send the N-EVENT-REPORT-RQ to the SCU (Storage Commitment initiator).

4.2.1.3.3.2 Proposed Presentation Contexts

Table 4-11: Proposed Presentation Contexts for Storage Commitment

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.3.3.3 SOP specific Conformance for SOP classes

The behavior of *syngo*® RT Planning when encountering status codes in an N-EVENT-REPORT response is summarized in Table 4-12:

Table 4-12: DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Error	Storage Commitment Reply ignored.	Any none null Code	Storage Commitment will be repeated.
Success	Storage Commitment Reply noticed.	0000	Success reported to user.

syngo® RT Planning does not support the optional Storage Media File-Set ID and UID attributes in the N-ACTION.

4.2.1.3.4 Activity "Querying a Remote Node" for Instances

4.2.1.3.4.1 Description and Sequencing of Activities

The associated Real-World activity is a C-Find request initiated by the user (see also Figure 4.1-3). The user specifies some attributes and will send a C-Find request (according to the query model) and will then return the results to the initiating application.

4.2.1.3.4.2 Proposed Presentation Contexts

The ***syngo*® RT Planning** system will propose Presentation Contexts as shown in the following table:

Table 4-13: Proposed Presentation Contexts for Query

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	Yes
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/ Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	Yes
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Patient/Study Only Query/ Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Table 4-14: Extended Negotiation as an SCU

Name	UID	Extended Negotiation
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Relational Query will be negotiated if necessary as defined in DICOM PS3.4.
Study Root Query/ Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Relational Query will be negotiated if necessary as defined in DICOM PS3.4.

4.2.1.3.4.3 SOP Specific Conformance Statement to Query SOP classes

The *syngo*® RT Planning system checks for the following status codes in the Query SCP's C-FIND-Response:

Table 4-15: DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Error	e.g. Out of Resources; Cancellation; Identifier does not match SOP Class; Unable to process	Any none null Code	Failure reported to user
Pending	All optional keys are supported the same manner as Required Keys.	FE00	Pending state is indicated to user
	Matching Operation continues; some of the optional keys were not supported the same way as the required keys	FE01	Pending state is indicated to user
Success	Query has been performed successfully.	0000	Success reported to user

Table 4-16: DICOM Command Communication Failure Behavior

exception	Behavior
Timeout	Failure reported to user (Timeout configurable; default 30s)
Association Aborted	Failure reported to user

The *syngo*® RT Planning supports the following query levels:

- Patient
- Study
- Series
- Instances

Matching Keys on Series Level are not supported by *syngo*® RT Planning as SCU.

The following table lists the various attributes at Patient, Study, Series and Instance levels, which can be used for **relational** queries as well as return values for display. The display capabilities are highly configurable and "yes" indicates that it is possible to configure display of the data:
A "yes" in the **UI** column will indicate that the attribute may be visualized when browsing the Query results with the Browser. The Browser display is additionally influenced by the related Browser configuration

Table 4-17: Attributes supported for instance Query

Attribute name	Tag	Type	Matching	User input	UI
Patient Level [1]					
Patient Name	(0010,0010)	R	Wildcard[2]	enter value	yes
Patient ID	(0010,0020)	U	Wildcard[2]	enter value	yes
Issuer of Patient ID	(0010,0021)	O	Wildcard	-	no
Patient's Birth Date	(0010,0030)	O	universal (Null)	enter value	yes
Patient's Birth Time	(0010,0032)	O	universal (Null)	-	no
Patient's Sex	(0010,0040)	O	universal (Null)	enter value	yes
Other Patient IDs	(0010,1000)	O	universal (Null)	enter value	yes
Other Patient Names	(0010,1001)	O	universal (Null)	enter value	yes
Patient's Age	(0010,1010)	O	universal (Null)	enter value	yes
Patient's Size	(0010,1020)	O	universal (Null)	enter value	yes
Patient's Weight	(0010,1030)	O	universal (Null)	enter value	yes
Ethnic Group	(0010,2160)	O	universal (Null)	enter value	yes
Study Level					
Patient Name[3]	(0010,0010)	R	Wildcard[2]	enter value	yes
Patient ID	(0010,0020)	R	Wildcard[2]	enter value	yes
Issuer of Patient ID	(0010,0021)	O	Wildcard	enter value	yes
Patient's Birth Date	(0010,0030)	O	universal (Null)	enter value	yes
Patient's Birth Time	(0010,0032)	O	universal	-	no
Patient's Sex	(0010,0040)	O	universal (Null)	enter value	yes
Patient's Age	(0010,1010)	O	universal (Null)	-	yes
Patient's Size	(0010,1020)	O	universal (Null)	-	yes
Patient's Weight	(0010,1030)	O	universal (Null)	-	yes
Study Instance UID	(0020,000D)	U	universal (Null)	-	no
Study ID	(0020,0010)	R	universal (Null)	enter value	yes
Study Date	(0008,0020)	R	universal (Null)	enter value[4]	yes
Study Time	(0008,0030)	R	universal (Null)	-	yes

1 Patient Root Information Model only
2 Always a '*" is appended to the user-supplied string
3 Study Root Information Model only
4 Date range also possible

Attribute name	Tag	Type	Matching	User input	UI
Accession Number	(0008,0050)	R	universal (Null)	enter value	yes
Modalities in Study	(0008,0061)	O	universal (Null)	enter value	yes
Referring Physician's Name	(0008,0090)	O	universal (Null)	enter value	yes
Study Description	(0008,1030)	O	universal (Null)	enter value	yes
Name of Physician Reading Study	(0008,1060)	O	universal (Null)	enter value	yes
Series Level					
Series Instance UID	(0020,000E)	U	universal (Null)	-	no
Series Number	(0020,0011)	R	universal (Null)	-	yes
Series Date	(0008,0021)	O	universal (Null)	-	yes
Series Time	(0008,0031)	O	universal (Null)	-	yes
Modality	(0008,0060)	R	universal (Null)	enter value	yes
Series Description	(0008,103E)	O	universal (Null)	enter value	yes
Body Part Examined	(0018,0015)	O	universal (Null)	enter value	yes
Institution Name	(0008,0080)	O	universal (Null)	enter value	yes
Instance Level					
SOP Class UID	(0008,0016)	U	single value	-	No
SOP Instance UID	(0008,0018)	U	single value	-	No
Instance Number	(0020,0013)	R	universal (Null)	-	Yes

4.2.1.3.5 Activity "Move SCU"

4.2.1.3.5.1 Description and Sequencing of Activities

The C-MOVE-RQs are used to retrieve the referenced images. The Retrieve AE supports the query model Study Root.

4.2.1.3.5.2 Accepted Presentation Contexts

Table 4-18: Proposed Presentation Contexts for Retrieve and Activity "MOVE SCU"

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.3.5.3 SOP Specific Conformance Statement for Move SCU Classes

At association establishment time the C-MOVE presentation context shall be negotiated. When the C-MOVE-RQ is processed, the Move Destination attribute (receiver of images) is ignored. However the Move Destination AE must conform to the DICOM conventions (value representation AE).

The behavior of *syngo*® RT Planning when encountering status codes in a C-MOVE response is summarized in Table 4-19:

Table 4-19: DICOM Command Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Error	e.g. Out of Resources; Cancellation; Identifier does not match SOP Class; Unable to process	Any none null Code	Failure reported to user
Pending	Move Operation continues	FF00	Operation continues in background
Success	Move has been performed successfully.	0000	Success reported to user

Table 4-20: DICOM Command Communication Failure Behavior

exception	Behavior
Timeout	Failure reported to user (Timeout configurable; default 30s)
Association Aborted	Failure reported to user

4.2.1.4 Association Acceptance Policy

The *syngo*® RT Planning attempts to accept a new association for

- DIMSE C-STORE
- DIMSE N-ACTION (Storage Commitment)
- DIMSE C-MOVE
- DIMSE C-FIND

service operations.

Generally associations are accepted if all of the following conditions are true:

- The "called AET" matches one of the configured Application Entity Titles of the *syngo*® RT Planning .
- The "calling AET" is known (configured) at *syngo*® RT Planning . This check can be disabled.
- The maximum number of incoming associations is not reached.
- At least one Presentation Context with a minimum of one suitable transfer syntax has been proposed as defined by the "Presentation Context Tables" in the following subsections.
- The system has enough available resources to perform the service requested (e.g. enough free disk space, less than the max. number of associations are already in use)

4.2.1.4.1 Activity “Receive Instances”

4.2.1.4.1.1 Description and Sequencing of Activities

The *syngo*® RT Planning receiving process will accept an association, receive any objects transmitted on that association and store the objects on disk.

4.2.1.4.1.2 Accepted Presentation Contexts

For all supported Transfer objects (see SOP Classes in Table 8-1) the Transfer Syntaxes described in Table 4-5 are supported.

Generally all Presentation Contexts are accepted as long as they contain at least one suitable Transfer Syntax. All other Presentation Contexts are rejected.

If a Proposed Presentation Context contains more than one Transfer Syntax, the one in the following priority list is chosen (if applicable for the SOP class):

Table 4-21: Priority list of chosen Transfer Syntax

Order	Presentation Context
1	Explicit Value Representation Little Endian
2	Implicit Value Representation Little Endian
3	Explicit Value Representation Big Endian
4	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)
5	JPEG 2000 Image Compression (Lossless Only)
6	RLE Lossless
7	JPEG Extended (Process 2 & 4)
8	JPEG Baseline (Process 1)
9	JPEG 2000 Image Compression

There is no Extended Negotiation as an SCP

4.2.1.4.1.3 SOP-specific Conformance Statement for Storage SOP classes

The *syngo*® RT Planning conforms to the Full Storage Class at Level 2.

In case of a successful C-STORE operation, the image has successfully been written on disk either in Explicit Little Endian format or in the compression format received.

The Storage AE of the *syngo*® RT Planning returns the status “success” when the data is stored to disk and a minimal image header validation has been performed.

The following header attributes must be available and filled:

- Patient Name,
- Study Instance UID,
- Series Instance UID and
- SOP Instance UID.

Table 4-22: Storage C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
success	success	0x0000	Image received correctly (success notification is done after receiving, before indexing and storing)
failure	Out-of-resource	0xA700	Not resource left in the Short Term Storage
failure	Unable to Process	0xCxxx	Error during instance reception
failure	DataSet does not match SOP Class	0xA9xx	The DataSet is not conform to the SOP Class contained in the resource.

Restriction: successful operation does not guarantee storage of header data in the database.

4.2.1.4.1.4 Other SOP specific behavior

- If an image is received that is already stored in the database - identified by the SOP Instance UID - the new image will be ignored. The existing instance is not superseded.
- The Patient Quadruplet (Patient's Name, Patient ID, Date of Birth, Patient Sex) is internally used for unique identification. The Patient ID is specified as a "type 2" attribute by DICOM. Therefore the attribute must be in the message but it may be empty. If the Patient ID is missing one will be generated and inserted to the index by the *syngo*® RT Planning for internal purposes.

4.2.1.4.2 Activity “Receive Initial Storage Commitment Request”

4.2.1.4.2.1 Description and Sequencing of Activities

When receiving an initial Storage Commitment request (N-ACTION-RQ) the *syngo*® RT Planning will accept it with an N-ACTION-RSP and trigger a check in the database for the required instances.

The subsequently issued N-EVENT-REPORT-RQ will always be sent in a second association.

syngo® RT Planning will store SOP instances indefinitely unless the instances are manually deleted by a user or automatically by a watermark system, if the images have been routed to a PACS and the PACS committed the images back to *syngo*® RT Planning . The manual deletion may lead to deletion of acknowledged instances before archiving to PACS has happened.

4.2.1.4.2.2 Accepted Presentation Contexts

Table 4-23: Acceptable Presentation Contexts for Storage Commitment and Activity "Receive Commitment Request

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.4.2.3 SOP-Specific Conformance Statement for SC SOP classes

There are only 2 different return status codes for the commitment request itself. They indicate only whether the request was successfully received or not. The real response is sent via N-EVENT-REPORT-RQ either on the same or on a different association.

Success or failure of Storage Commitment will be signaled via the N-EVENT-REPORT primitive.

The SCU is responsible for creating a unique Transaction UID. The SCP will not check, whether the UID is already in use or not.

Table 4-24: Storage Commitment N-EVENT-REPORT Response Status

Service Status	Further Meaning	Error Codes	Reason
success	success	0x0000	Image received correctly (success notification is done after receiving, before indexing and storing)
failure	Unable to Process	0xCxxx	Error during instance reception
failure	DataSet does not match SOP Class	0xA9xx	The DataSet is not conform to the SOP Class contained in the resource.

4.2.1.4.3 Activity "Receive Instance Retrieve Requests"

4.2.1.4.3.1 Description and Sequencing of Activities

The *syngo*® RT Planning responds to requests issued by an SCU with the query model Patient Root, Study Root and Patient/Study Only.

Hierarchical and relational retrieve operations are both supported.

4.2.1.4.3.2 Accepted Presentation Contexts

syngo® RT Planning will accept Presentation Contexts as shown in Table 4-25.

Table 4-25: Acceptable Presentation Contexts Activity "Receive Instance Retrieve Request"

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Yes
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	Yes
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Patient/Study Only Query/ Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Table 4-26: Extended Negotiation as an SCP

SOP Class Name	SOP Class UID	Extended Negotiation
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Relational Query will be negotiated if necessary as defined in DICOM PS3.4
Study Root Query/ Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Relational Query will be negotiated if necessary as defined in DICOM PS3.4

4.2.1.4.3.3 SOP Specific Conformance Statement to Query SOP classes

The *syngo*® RT Planning Query AE supports all Query attributes of Table 4-17.

The query attribute contents will be treated case-sensitive except all PN attributes, which will always be treated case-insensitive. Wildcards (*, ?) will not replace trailing component separators (=).

The Query AE of the *syngo*® RT Planning does not return any Media File-Set ID or UID, they always return the Retrieve AET (0008,0054). Furthermore, "Instance Availability" (0008,0056) is always returned.

4.2.1.4.3.4 Hierarchical and Relational Queries

Independent of the negotiation for relational queries, each C-FIND request is treated as if it was a relational query. The SCP allows any combination of keys at or above the provided Query/Retrieve level in the hierarchy. Keys below Query/Retrieve level return an error.

But if for example a series level attribute is requested in a study level query, an error will be returned by *syngo*® RT Planning (code “0106”).

4.2.1.4.3.5 Return Codes

Table 4-27: Query C-FIND / C-CANCEL Response Status

Service Status	Further Meaning	Error Codes	Reason
Processing failure	Parsing or translation of the DICOM request failed. A response could not be generated. The response could not be sent to the SCU. The query of the database failed.	C001	Any error during Query in the DataBase
Success	Matching is complete - No final Identifier is supplied	0000	
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Further Items will be returned;
Pending	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Further Items will be returned; Some of Required Attributes are not present in the DataBase

The maximum number of matches returned can be configured. The status of the final response will always be SUCCESS whether the clipping occurred or not.

4.2.1.4.4 Activity "Move SCP"

4.2.1.4.4.1 Description and Sequencing of Activities

The Retrieve AE responds to retrieve requests of an SCU. The requests are used to retrieve the referenced images. The Retrieve AE supports the query model Study Root.

4.2.1.4.4.2 Accepted Presentation Contexts

Table 4-28: Acceptable Presentation Contexts for Retrieve and Activity "MOVE SCP"

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Patient/Study Only Query/ Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	No
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

4.2.1.4.4.3 SOP Specific Conformance Statement for Move SCP Classes

At association establishment time the C-MOVE presentation context shall be negotiated. When the C-MOVE-RQ is processed, the Move Destination attribute (receiver of images) is ignored. However the Move Destination AE must conform to the DICOM conventions (value representation AE).

The Retrieve AE sends continuously C-MOVE responses to indicate progress about the de-archiving of images. The C-MOVE-RSP contains the Service parameters listed in Table 4-29.

Table 4-29: C-MOVE-RSP Service Parameters

Attribute	Meaning
Number of Remaining Sub-Operation	Is sent if the C-MOVE-RSP has the status Pending. Indicates the number of images which have not yet been sent.
Number of Completed Sub-Operation	Indicates the number of images which were sent.
Number of Failed Sub-Operation	Number of failing images within the Sending Association (C-STORE)
Number of Warning Sub-Operation	Always 0.

The final C-MOVE-RSP is sent after all images have been de-archived either successfully or unsuccessfully. No C-STORE operations are done in series of a C-MOVE-RQ for the Retrieve AE.

4.2.1.4.4.4 Hierarchical and Relational Queries

Independent of the negotiation for relational queries, each C-FIND request is treated as if it was a relational query. The SCP allows any combination of keys at or above the provided Query/Retrieve level in the hierarchy. Keys below Query/Retrieve level return an error.

But if for example a series level attribute is requested in a study level query, an error will be returned by *syngo*® RT Planning (code “0106”).

4.2.1.4.4.5 Return Codes

Table 4-30: Retrieve C-MOVE Response Status

Service Status	Further Meaning	Error Code	Reason
success	success	0x0000	Image received correctly (success notification is done after receiving, before indexing and storing)
failure	Out-of-resource	0xA700	Not resource left in the Short Term Storage
failure	Unable to Process	0xCxxx	Error during instance reception
failure	DataSet does not match SOP Class	0xA9xx	The DataSet is not conforming to the SOP Class contained in the resource.

4.3 NETWORK INTERFACES

4.3.1 Physical Network Interface

The *syngo*® RT Planning provides DICOM 3.0 TCP/IP network communication support as defined in Part 8 of [1]. The network communication is independent from the physical medium over which TCP/IP executes; it inherits this from the Windows OS system upon which it executes.

4.3.2 Additional Protocols

none

4.3.3 IPv4 and IPv6 Support

IPv4 and IPv6 are supported. Regarding IPv6, please note that the complete networking infrastructure in the hospital (firewalls, DNS-Servers, etc.) must support IPv6 in order to get a functioning communication.

4.4 CONFIGURATION

4.4.1 AE Title/Presentation Address Mapping

AE Titles shall be unique within the hospital. A common way to achieve that is to use the hostname as part of the AE Titles. The string can be up to 16 characters and must not contain any extended characters. Only 7-bit ASCII characters (excluding Control Characters) are allowed according to DICOM [1].

4.4.1.1 Local AE Titles

The *syngo*® RT Planning allows to configure AETitles, Ports and Services in any wished way. Default delivery is that all services are using the same AE title and only one port number. In case the connected systems cannot handle this default, the customer service engineer is able to configure for each service its own AE title and Port number.

Parameter	Configurable	Default Value
Default AE title	Yes	hostname in uppercase characters; limited to 16 characters
Default Port	Yes	104

4.4.1.2 Remote AE Title/Presentation Address Mapping

4.4.1.2.1 Remote Association Initiators

All relevant remote applications that may setup DICOM associations towards ***syngo® RT Planning*** need to be configured in ***syngo® RT Planning***, before the association can be established. This behavior is configurable but it is recommended, not to change this behavior.

The mapping of external AE Titles to TCP/IP addresses and ports is configurable and initially set at the time of installation by Installation Personnel. Changes can later on also be performed by the local system administrator. The Application Entity Titles and supported transfer syntaxes need to be known for configuration.

To enable a fast and efficient configuration possibility Siemens will deliver templates for known configuration examples, so that the behavior (usage of one AE title, default port numbers, supported services) is determined already through the template.

Remote Application Entities can be configured without restarting the process.

4.4.1.2.2 Remote SCP's

For remote applications that shall be able to accept DICOM associations from ***syngo® RT Planning***, the following information needs to be available:

- Application Entity Title
- Host Name / IP address on which the remote application service runs
- Port number on which the remote application accepts association requests.

The remote system will be indicated in the UI of ***syngo® RT Planning*** with a logical name, that is also entered when configuring the node in the administration UI.

To enable a fast and efficient configuration possibility Siemens will deliver templates for known configuration examples, so that the behavior (usage of one AE title, default port numbers, supported services) is determined already through the template.

Remote Application Entities can be configured without restarting the process.

4.4.2 Parameters

The next table lists configuration parameters, which are true for all Application Entities.

Table 4-31: Parameter List

Parameter	Configurable	Default Value
max PDU size	Yes	131072 Bytes
time-out for accepting/rejecting an association request	Yes	30 s
time-out for responding to an association open/close request	Yes	30 s
time-out for accepting a message over network	Yes	30 s
time-out for waiting for data between TCP/IP-packets	Yes	5 s
time-outs for waiting for a Service Request/Response message from the remote node (Storage SCP/SCU)	Yes	30 s
time-outs for waiting for a Service Request/Response message from the remote node (Query/Retrieve SCP/SCU)	Yes	30 s
time-out for waiting for a C-MOVE-RSP	No	1200 s
number of image collection before saving to database	Yes	20
max matches query limit	Yes	100
max number of parallel receiving associations	Yes	10

5 MEDIA INTERCHANGE

5.1 IMPLEMENTATION MODELS

5.1.1 Application Data Flow Diagram

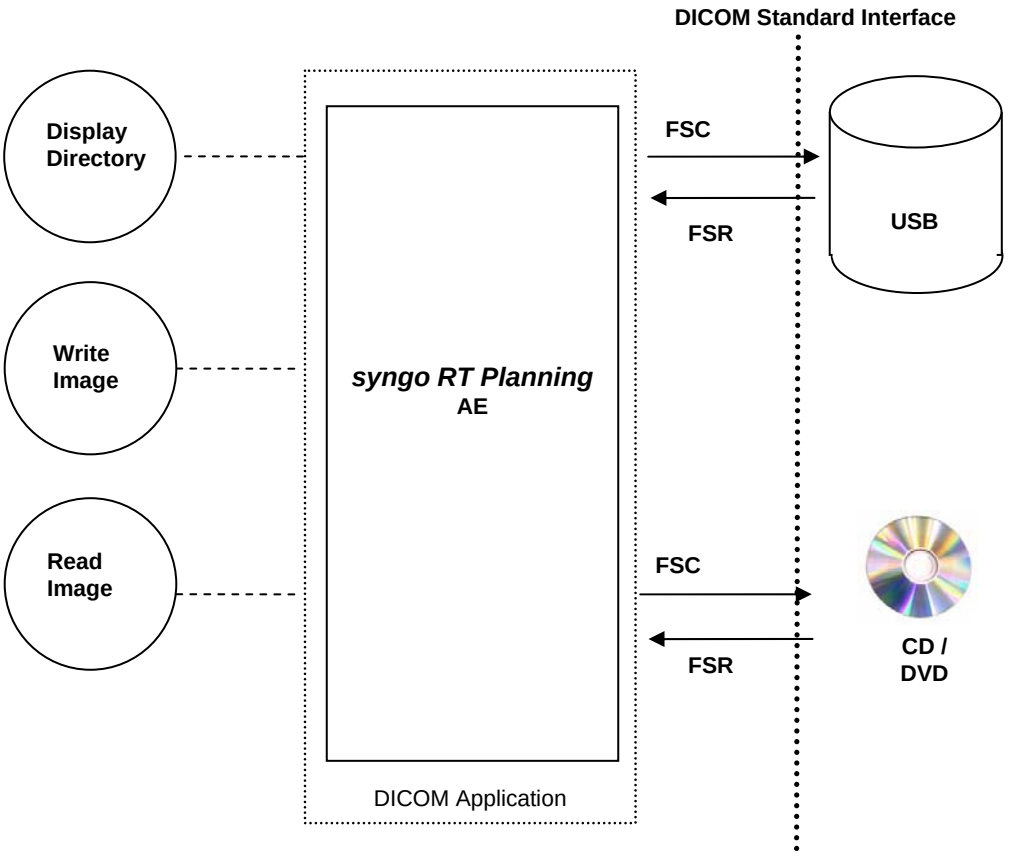


Figure 5.1-1: Media Interchange Application Data Flow Diagram

syngo® RT Planning provides the functionality to Import or Export DICOM Instances from and to the File System. During export, a DICOMDIR may also be generated (user selection). A complete ISO Image ready-to-burn can also be generated. All SOP Classes defined in Table 5-3 and Table 5-4 are supported for the Import/Export functionality.

5.1.2 Functional definitions of AEs

The syngo® RT Planning application is capable of

- creating a new File-set in the File System (Export to ...)
- importing SOP Instances from the medium onto local storage
- writing the File-sets DICOMDIR information into the file system and joining it to an ISO image.

5.1.3 Sequencing of Real-World Activities

Whenever data shall be written to an external media, ***syngo® RT Planning*** will create a DICOMDIR from the selected data and create an ISO image of the selected data on the local hard disk. Depending on the selected data and options (selected media size, with or without compression) either General Purpose CD profile or DVD-J2K profile is used.

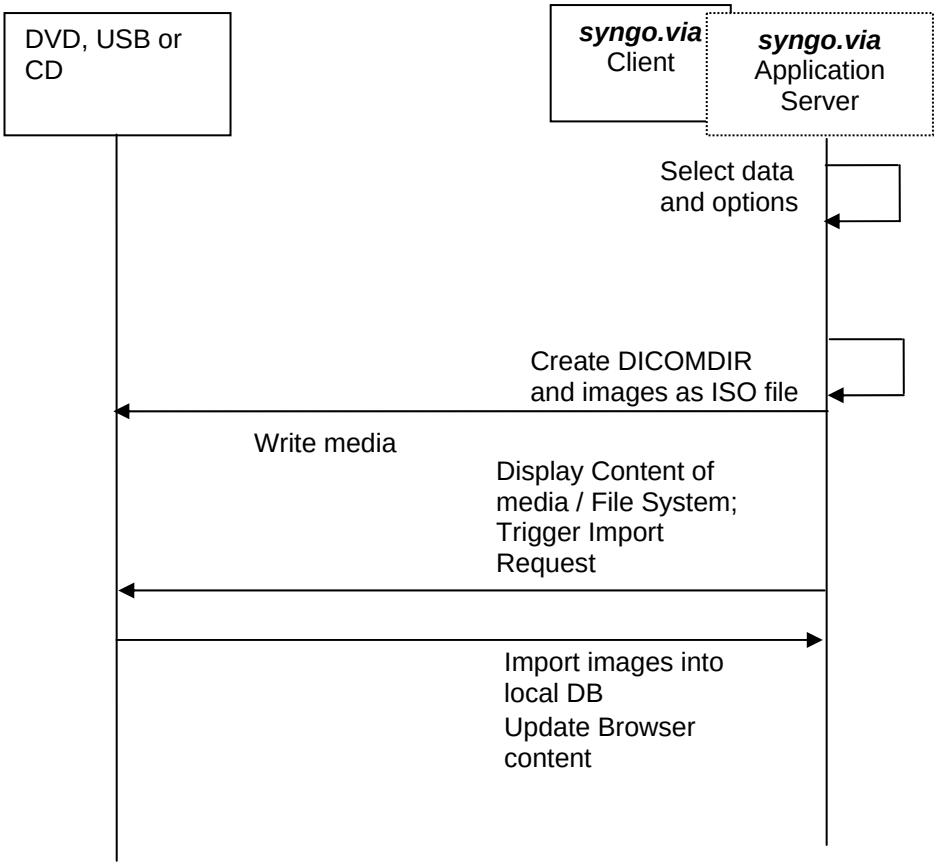


Figure 5.1-2: Sequence diagram – Media creation

5.1.4 File Meta Information for Implementation Class and Version

This section describes the values assigned to the File Meta Information attributes (see [1]part PS 3.10) that pertain to the Implementation Class and Version. The implementation Class UID and the Implementation Version name in the File Meta Header are the same as the values specified for networking.

Table 5-1: Implementation Class/Version Name - Media Interchange

File Meta Information Version	0x0001
Implementation Class UID	1.3.12.2.1107.5.99.3.20080101
Implementation Version Name	SIEMENS

5.2 AE SPECIFICATIONS

5.2.1 Media Storage AE – Specification

The ***syngo® RT Planning*** provides conformance to the following Application Profiles as an FSC as well as an FSU.

In addition augmented conformance is provided to store extra data attributes important for the full feature support of the *syngo*®-based products. Details are listed below:

Table 5-2: Media - Application Profiles and Real-World Activities

Application Profiles Supported	Real-World Activity	Role	Service Class Option
AUG-GEN-CD	Browse Directory Information Import into Application Export to local Archive Media	FSR FSC	Interchange
AUG-GEN-DVD			
AUG- GEN-DVD-J2K			
AUG- GEN-USB-J2K			
STD-GEN-CD	Browse Directory Information Import into Application Export to local Archive Media	FSR FSC	Interchange
STD-GEN-DVD			
STD-GEN-DVD-J2K			
STD-GEN-USB-J2K			

5.2.1.1 Real-World Activities

5.2.1.1.1 Activity “Browse Directory Information”

The ***syngo® RT Planning*** acts as FSR using the interchange option when requested to read the media directory.

The ***syngo® RT Planning*** will read the DICOMDIR and insert those directory entries that are valid for the application profiles supported, into a local database. The database then is used for browsing media contents.

Note: The “Icon Image Sequence” is also supported in DICOMDIR. But only those Icon Images with “Bits Allocated” (0028,0100) equal to 8 and size of 64x64 or 128x128 pixels are imported into database and are visible in the Browser.

5.2.1.1.1.1 Media Storage Application Profiles

See Table 5-2 for the Application Profiles listed that invoke this Application Entity for the Browse Directory Informatio.n

5.2.1.1.2 Activity “Import into Application”

The ***syngo® RT Planning*** application acts as FSR using the interchange option when requested to read SOP Instances from the medium into the application.

The SOP Instance selected from the media directory will be copied into the running Application. Only SOP Instances, that are valid for the application profile supported and supported by ***syngo® RT Planning*** (seeTable 8-1), can be retrieved from media.

5.2.1.1.3 Real-World Activity “Export to Local Archive Media”

The ***syngo® RT Planning*** application acts as FSU (for media with existing DICOM file-set) or FSC (media not initialized) using the interchange option when requested to copy SOP Instances from the local storage to local Archive Medium. The activity as FSU is only possible as long as the local burning SW of ***syngo® RT Planning*** **Client** has not already processed the generated ISO file.

The ***syngo® RT Planning*** application will receive a list of SOP Instances to be copied to the local archive medium. Depending on the profile selected (Standard: uncompressed, with DICOMDIR; Patient: compressed with DICOMDIR) the SOP Instances will be taken and an ISO file is being generated that includes the DICOMDIR and the corresponding objects.

It is then up to ***syngo® RT Planning*** **Client** local configuration (if equipped with a local media burner) to burn the ISO file to the appropriate media.

5.2.1.1.4 Media Storage Application Profiles

See Table 5-2 for the Application Profiles listed that invoke this Application Entity for the local Archive Media Real-World Activity.

5.2.1.2 SOP Classes and Transfer Syntaxes

These Application Profiles are based on the Media Storage Service Class with the Interchange Option. In the table below (Table 5-3) the Transfer Syntax UID “RLE Lossless “only applies for decompression.

Table 5-3: SOP Classes and Transfer Syntaxes for STD-GEN-DVD-J2K and STD-GEN-USB-J2K

Information Object Definition	SOP Class UID	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Color Softcopy Presentation State Storage (store &forward only)	1.2.840.10008.5.1.4.1.1.11.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
CR Image	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
CT image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

Information Object Definition	SOP Class UID	Transfer Syntax UID
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Enhanced Magnetic Resonance	1.2.840.10008.5.1.4.1.1.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Enhanced MR Color Image	1.2.840.10008.5.1.4.1.1.4.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1)

Information Object Definition	SOP Class UID	Transfer Syntax UID
		1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Multi-frame Single Bit SC Image	1.2.840.10008.5.1.4.1.1.7.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		RLE Lossless 1.2.840.10008.1.2.5

Information Object Definition	SOP Class UID	Transfer Syntax UID
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Raw Data	1.2.840.10008.5.1.4.1.1.66	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Ion Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.9	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended)

Information Object Definition	SOP Class UID	Transfer Syntax UID
		1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Ion Plan	1.2.840.10008.5.1.4.1.1.481.8	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90

Information Object Definition	SOP Class UID	Transfer Syntax UID
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Ultrasound Multi-frame (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

Information Object Definition	SOP Class UID	Transfer Syntax UID
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70
		Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
		JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51
		RLE Lossless 1.2.840.10008.1.2.5
		JPEG 2000 Lossless 1.2.840.10008.1.2.4.90
		JPEG 2000 Lossy 1.2.840.10008.1.2.4.91

Table 5-4: SOP Classes and Transfer Syntaxes for STD-GEN-CD and STD-GEN-DVD Profile

Information Object Definition	SOP Class UID	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Color Softcopy Presentation State Storage (store &forward only)	1.2.840.10008.5.1.4.1.1.11.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
CR Image	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
CT Image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Encapsulated PDF	1.2.840.10008.5.1.4.1.1.104.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Enhanced CT Image	1.2.840.10008.5.1.4.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Enhanced Magnetic Resonance	1.2.840.10008.5.1.4.1.1.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Enhanced MR Color Image	1.2.840.10008.5.1.4.1.1.4.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Enhanced Structured Report	1.2.840.10008.5.1.4.1.1.88.22	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
General ECG Waveform	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Hemodynamic Waveform	1.2.840.10008.5.1.4.1.1.9.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

Information Object Definition	SOP Class UID	Transfer Syntax UID
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Multi-frame Grayscale Byte SC Image	1.2.840.10008.5.1.4.1.1.7.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Multi-frame Grayscale Word SC Image	1.2.840.10008.5.1.4.1.1.7.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Multi-frame Single Bit SC Image	1.2.840.10008.5.1.4.1.1.7.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Multi-frame True Color SC Image	1.2.840.10008.5.1.4.1.1.7.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Procedure Log	1.2.840.10008.5.1.4.1.1.88.40	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Raw Data	1.2.840.10008.5.1.4.1.1.66	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Real World Value Mapping	1.2.840.10008.5.1.4.1.1.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Ion Beams Treatment Record	1.2.840.10008.5.1.4.1.1.481.9	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Ion Plan	1.2.840.10008.5.1.4.1.1.481.8	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Treatment Summary Record	1.2.840.10008.5.1.4.1.1.481.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Multi-frame (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

5.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

5.3.1 Augmented Application Profiles

With no private Siemens Non-Images stored onto Medium, the definitions of the STD-GEN-XXX Profiles are applicable to denote the augmentations for the STD-GEN-XXX Standard Profile.

Table 5-5: Private SOP Classes and Transfer Syntaxes for Augmented Media Profiles

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR
CSA Non-Image Storage	1.3.12.2.1107.5.9.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	O	M

The Siemens non-image is typically used for raw data and 3D private data.

5.4 MEDIA CONFIGURATION

none

6 SUPPORT OF CHARACTER SETS

6.1 CHARACTER SETS FOR syngo® RT Planning

The ***syngo® RT Planning*** DICOM application supports the following character sets as defined in the three tables below.

Table 6-1: Single-Byte Character Sets without Code Extension

Character Set Description	Defined Term	ISO registration number	Character Set
Default repertoire	none	ISO_IR 6	ISO 646:
Latin alphabet No. 1	ISO_IR 100	ISO_IR 100	Supplementary set
		ISO_IR 6	ISO 646:
Latin alphabet No. 2	ISO_IR 101	ISO_IR 101	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 3	ISO_IR 109	ISO_IR 109	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 4	ISO_IR 110	ISO_IR 110	Supplementary set
		ISO_IR 6	ISO 646
Cyrillic	ISO_IR 144	ISO_IR 144	Supplementary set
		ISO_IR 6	ISO 646
Arabic	ISO_IR 127	ISO_IR 127	Supplementary set
		ISO_IR 6	ISO 646
Greek	ISO_IR 126	ISO_IR 126	Supplementary set
		ISO_IR 6	ISO 646
Hebrew	ISO_IR 138	ISO_IR 138	Supplementary set
		ISO_IR 6	ISO 646
Latin alphabet No. 5	ISO_IR 148	ISO_IR 148	Supplementary set
		ISO_IR 6	ISO 646
Japanese	ISO_IR 13	ISO_IR 13	JIS X 0201: Katakana
		ISO_IR 14	JIS X 0201: Romaji
Thai	ISO_IR166	ISO_IR166	TIS 620-253 (1990)
		ISO_IR 6	ISO 646

Table 6-2: Single-Byte Characters Sets with Code Extension

Character Set Description	Defined Term	Standard for Code Extension	ESC sequence	ISO registration number	Character Set
Default repertoire	ISO 2022 IR 6	ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.1	ISO 2022 IR 100	ISO 2022	ESC 02/13 04/01	ISO-IR 100	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.2	ISO 2022 IR 101	ISO 2022	ESC 02/13 04/02	ISO-IR 101	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.3	ISO 2022 IR 109	ISO 2022	ESC 02/13 04/03	ISO-IR 109	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646
Latin alphabet No.4	ISO 2022 IR 110	ISO 2022	ESC 02/13 04/04	ISO-IR 110	Supplementary set
		ISO 2022	ESC 02/08 04/02	ISO-IR 6	ISO 646

Multi-Byte Character Sets without Code Extension

Table 6-3: Multi-Byte Character Sets without Code Extension

Character Set Description	Defined Term	ISO registration number	Character Set
Unicode	ISO_IR 192	ISO 10646	Unicode in UTF-8
Chinese	GB18030	GB18030	GB 18030-2000 (China Association for Standardization)

Table 6-4: Multi-Byte Character Sets with Code Extension

Character Set Description	Defined Term	Standard for Code Extension	ESC sequence	ISO registration number	Character Set
Japanese	ISO 2022 IR 159	ISO 2022	ESC 02/04 02/08 04/04	ISO-IR 159	JIS X 0212: Supplementary Kanji set
Korean	ISO 2022 IR 149	ISO 2022	ESC 02/04 02/09 04/03	ISO-IR 149	KS X 1001: Hangul and Hanja

All SCS listed above are supported for incoming Data. When creating new Instances, the system will use the default SCS (or SCS List) configured on the machine.

When there is a mismatch between the given character set in attribute (0008,0005) and the characters in an IOD received by the system, then the following measures are taken to make the characters DICOM conform:

- Convert each illegal character to a '?'.

There are now three categories of character sets which have to be differentiated because of their different encoding formats:

- Conventional ISO character sets: ISO_IR 6, ISO 2022 IR 6, ISO_IR 100, etc.
  → encoded in ISO 2022
- ISO_IR 192 → encoded in UTF-8
- GB18030 → encoded in GB18030

It is not possible to recognize the following mismatches automatically on receiving or importing:

- An attribute value is encoded in ISO_IR 192 ←→ (0008,0005) contains a conventional ISO character set as primary character set
- An attribute value is encoded in GB18030 ←→ (0008,0005) contains a conventional ISO character set as primary character set
- An attribute value is encoded in ISO 2022 ←→ (0008,0005) contains ISO_IR 192
- An attribute value is encoded in ISO 2022 ←→ (0008,0005) contains GB18030

An IOD that contains one of the above mentioned inconsistencies is not DICOM conform. As these kinds of inconsistencies cannot be recognized by the system, the IOD will not be rejected but the character data might be corrupted.

7 SECURITY

7.1 SECURITY PROFILES

Time Synchronization Profiles: ***syngo® RT Planning*** acts as an NTP Client in the Maintain Time Transaction.

7.2 ASSOCIATION LEVEL SECURITY

It is possible to configure whether the SCP will only answer to known AETs or to any AET.

7.3 APPLICATION LEVEL SECURITY

User must login with own password

For configuration and Maintenance, Service Technician must login with a separate password.

8 ANNEXES

8.1 SOP Classes supported

Table 8-1 SOP CLASSES for Storage

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Supported Storage SOP Classes			
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	YES	YES
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	YES	YES
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11	YES	YES
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	YES	YES
Color Softcopy Presentation State Storage (store &forward only)	1.2.840.10008.5.1.4.1.1.11.2	YES	YES
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	YES	YES
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	YES	YES
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2	YES	YES
Digital Mammography Image Storage for Presentation	1.2.840.10008.5.1.4.1.1.1.2	YES	YES
Digital Mammography Image Storage for Processing	1.2.840.10008.5.1.4.1.1.1.2.1	YES	YES
Digital X-Ray Image Storage- for Presentation	1.2.840.10008.5.1.4.1.1.1.1	YES	YES
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1	YES	YES
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1	YES	YES
Enhanced Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2.1	YES	YES
Enhanced Magnetic Resonance Storage	1.2.840.10008.5.1.4.1.1.4.1	YES	YES
Enhanced MR Color Image Storage	1.2.840.10008.5.1.4.1.1.4.3	YES	YES
Enhanced Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.22	YES	YES
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	YES	YES
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	YES	YES
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	YES	YES
Key Object Selection Document Storage	1.2.840.10008.5.1.4.1.1.88.59	YES	YES
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4	YES	YES
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	YES	YES
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	YES	YES
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	YES	YES
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	YES	YES
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	YES	YES
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	YES	YES
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	YES	YES

Procedure Log Storage	1.2.840.10008.5.1.4.1.1.88.40	YES	YES
Raw DataStorage	1.2.840.10008.5.1.4.1.1.66	YES	YES
Real World Value Mapping Storage	1.2.840.10008.5.1.4.1.1.67	YES	YES
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4	YES	YES
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	YES	YES
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	YES	YES
RT Ion Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.9	YES	YES
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	YES	YES
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	YES	YES
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	YES	YES
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7	YES	YES
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	YES	YES
Segmentation Storage	1.2.840.10008.5.1.4.1.1.66.4	YES	YES
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2	YES	YES
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	YES	YES
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	YES	YES
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	YES	YES
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	YES	YES
X-Ray Radiation Dose Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.67	YES	YES
X-Ray Radio-Fluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	YES	YES
Supported private Storage SOP Classes			
CSA Non-Image Storage	1.3.12.2.1107.5.9.1	YES	YES

Table 8-2: Supported Non-Storage SOP Classes

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Supported Verification SOP Classes			
Verification	1.2.840.10008.1.1	Yes	Yes
Supported Storage Commitment SOP Classes			
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	Yes
Storage Commitment Push Model well known SOP Instance	1.2.840.10008.1.20.1.1	Yes	Yes
Supported Query/Retrieve SOP Classes			
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	Yes
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	Yes
Patinet /Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	Yes

8.2 IOD CONTENTS

8.2.1 Created SOP Instance(s)

The applications of ***syngo® RT Planning*** create objects of the following SOP Classes during Post-Processing and Reading:

Table 8-3: List of created SOP Classes

SOP Class Name	SOP Class UID
Basic Text Structured Report Storage	1.2.840.10008.5.1.4.1.1.88.11
Encapsulated PDF Storage	1.2.840.10008.5.1.4.1.1.104.1
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
Spatial Fiducials Storage	1.2.840.10008.5.1.4.1.1.66.2
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1

8.2.2 Data Dictionary of Private Attributes

The following table Table 8-4: Private Data Element Dictionary lists all private attributes created by ***syngo® RT Planning***, which may be included in the generated instances. These private attributes may be deprecated or replaced with standard DICOM SOP Classes or attributes in the future.

Table 8-4: Private Data Element Dictionary

DICOM Tag	Name	VR	VM
(0027,SIEMENS SYNGO ENHANCED IDATASET API,01)	Business Unit Code	CS	1
(0027,SIEMENS SYNGO ENHANCED IDATASET API,02)	Application Type	LO	1
(0027,SIEMENS SYNGO ENHANCED IDATASET API,03)	Application Attributes Sequence	SQ	1
(0029,SIEMENS SYNGO FUNCTION ASSIGNMENT,01)	Data Reference	LO	1
(0009,SIEMENS SYNGO INDEX SERVICE,20)	Object Insertion Date	DA	1
(0009,SIEMENS SYNGO INDEX SERVICE,A0)	Sender System Device Name	LO	1
(0029,SIEMENS SYNGO VOLUME,12)	Slices	US	1
(0029,SIEMENS SYNGO VOLUME,14)	Volume Histogram	OB	1
(0029,SIEMENS SYNGO VOLUME,18)	Volume Level	IS	1
(0029,SIEMENS SYNGO VOLUME,30)	Voxel Spacing	DS	3
(0029,SIEMENS SYNGO VOLUME,32)	Volume Position (Patient)	DS	3
(0029,SIEMENS SYNGO VOLUME,37)	Volume Orientation (Patient)	DS	9
(0029,SIEMENS SYNGO VOLUME,40)	Resampling Flag	CS	1
(0029,SIEMENS SYNGO VOLUME,42)	Normalization Flag	CS	1
(0029,SIEMENS SYNGO VOLUME,44)	SubVolume Sequence	SQ	1-n
(0071,SIEMENS SYNGO REGISTRATION,20)	Registered Image Sequence	SQ	1
(0071,SIEMENS SYNGO REGISTRATION,21)	Registration Is Validated Flag	CS	1
(0071,SIEMENS SYNGO REGISTRATION,20)	Registered Image Sequence	SQ	1
(0071,SIEMENS SYNGO REGISTRATION,21)	Registration Is Validated Flag	CS	1
(7FDF,SIEMENS SYNGO DATA PADDING,FC)	Pixel Data Leading Padding	OB	1

8.2.3 Usage of Attributes from Received IODs

N/A

8.2.4 Coerced / Modified fields

N/A

8.3 CODED TERMINOLOGY AND TEMPLATES

See application specific annexes.

8.3.1 Context Groups

See application specific annexes.

8.3.2 Template Specifications

See application specific annexes.

8.3.3 Private Code definitions

See application specific annexes.

8.4 GRAYSCALE IMAGE CONSISTENCY

N/A

8.5 STANDARD EXTENDED / SPECIALIZED / PRIVATE SOP CLASSES

N/A

8.6 *syngo®* RT Planning

8.6.1 Definitions, Acronyms, and Abbreviations

Term	Definition
DCS	DICOM Conformance Statement
PT	Particle Therapy
RT	Radiation Therapy
syngo Classic	All syngo versions prior and equal to VE31B
(syngo) Singapore	All *syngo* version equal to and following “syngo VX02A enterprise platform”. Singapore is the working name. As a product name, it will be called *syngo.via*.
syngo RT	Short name for syngo Suite for Oncology.
syngo Suite for Oncology	New name for the COHERENCE product family after rebranding according to the Siemens MED wide naming concept.
TPS	Treatment Planning System

8.6.2 DICOM Interfaces

8.6.2.1 DICOM Data Transfer and Data Integrity

Patient data are transferred to and from the TPS via DICOM. Since neither DICOM nor the underlying protocol layers guarantee data integrity, the transfer of dosimetrically relevant data between the TPS and other DICOM devices as well as inside the TPS is protected via a checksum mechanism. This mechanism ensures that accidental or unwanted modifications of protected data is detected inside the TPS. Further processing of such data is blocked.

This mechanism applies to

- RT Ion Plans

- Fraction Sequences, being transferred as Structured Reports.

Please note that the mechanism does not detect if data gets corrupted on the way to the treatment delivery system (TDS), unless the TDS verifies the checksum before delivery.

8.6.2.2 Extensions to the DICOM Information Object Model

8.6.2.2.1 Additional Patient Information Studies

Typically, there is a set of information objects that globally apply to a patient, regardless of the location of the information in the DICOM data hierarchy. Inside the *syngo* RT system, such global information is stored in studies with Study Description (0008, 1030) “Additional Patient Information”.

Note that it is allowed to have multiple studies containing such global information as long as their description is named accordingly. This avoids introducing a global synchronization mechanism when initially creating such a study. Nevertheless, whenever such a study is known to already exist, it should be reused instead of creating a new one.

syngo RT Planning stores the following information object instances in this study:

- Fraction Sequence, see 8.6.2.2.3, together with Fraction Sequence pdf Reports stored as Encapsulated Document,
- Treatment Course, see 8.6.2.2.4.

Other instances stored in this study (e.g. Patient Headshot Photos, known to be added by a treatment delivery system) are ignored.

8.6.2.2.2 Other DICOM Studies and Series

Apart from the Additional Patient Information Studies, no application interfacing with the TPS should make any assumption about finding data to be grouped in specific studies and series.

Examples:

- An application working on verification plans should not expect to find the respective treatment plans in the same plan series as the verification plans.
- An application processing treatment summary records should not expect to find the respective plans in the same series as the summary records.

The intention is to reduce the number of interface constraints, allowing for easier interoperability.

8.6.2.2.3 Fraction Sequence

Inside the RT Fraction Scheme module of an RT (Ion) Plan, DICOM allows to group beams contained in the plan into fraction groups. For each fraction group, a statement can be made of how many treatment fractions of this group shall be applied. The concept allows to treat only a subset of beams within a given treatment session. The drawback of this concept is twofold:

- Potentially, not all beams that were planned and optimized together could be treated in a treatment session. In this case, the total effective dose would be unknown because of the non linear summation of individual effective doses contributed by the subset of beams irradiated.
- Only beams of a single plan can be grouped. It is not possible to involve beams from multiple plans, which is a must for combined treatments of RT Ion and RT Non Ion Plans.

To overcome this limitation, two decisions were made:

Inside the fraction group of a plan instance, no subsets of treatment beams are allowed. There must only be a single treatment fraction group, containing all treatment beams in the plan. Note that it is valid to have other fraction groups containing imaging and setup (motion) beams.

A new information object was introduced called Fraction Sequence or FxSequence for short that allows grouping multiple plans for treatment sessions and relating multiple treatment sessions to treatment days. A high level data model can be found in Figure 1. The object is implemented as a DICOM Structured Report; see [A-1], sheet “Fraction Sequence SR”. In particular, a Fraction Sequence can group both RT Ion and RT Non Ion Plans together, thus allowing for combined reviews and treatments.

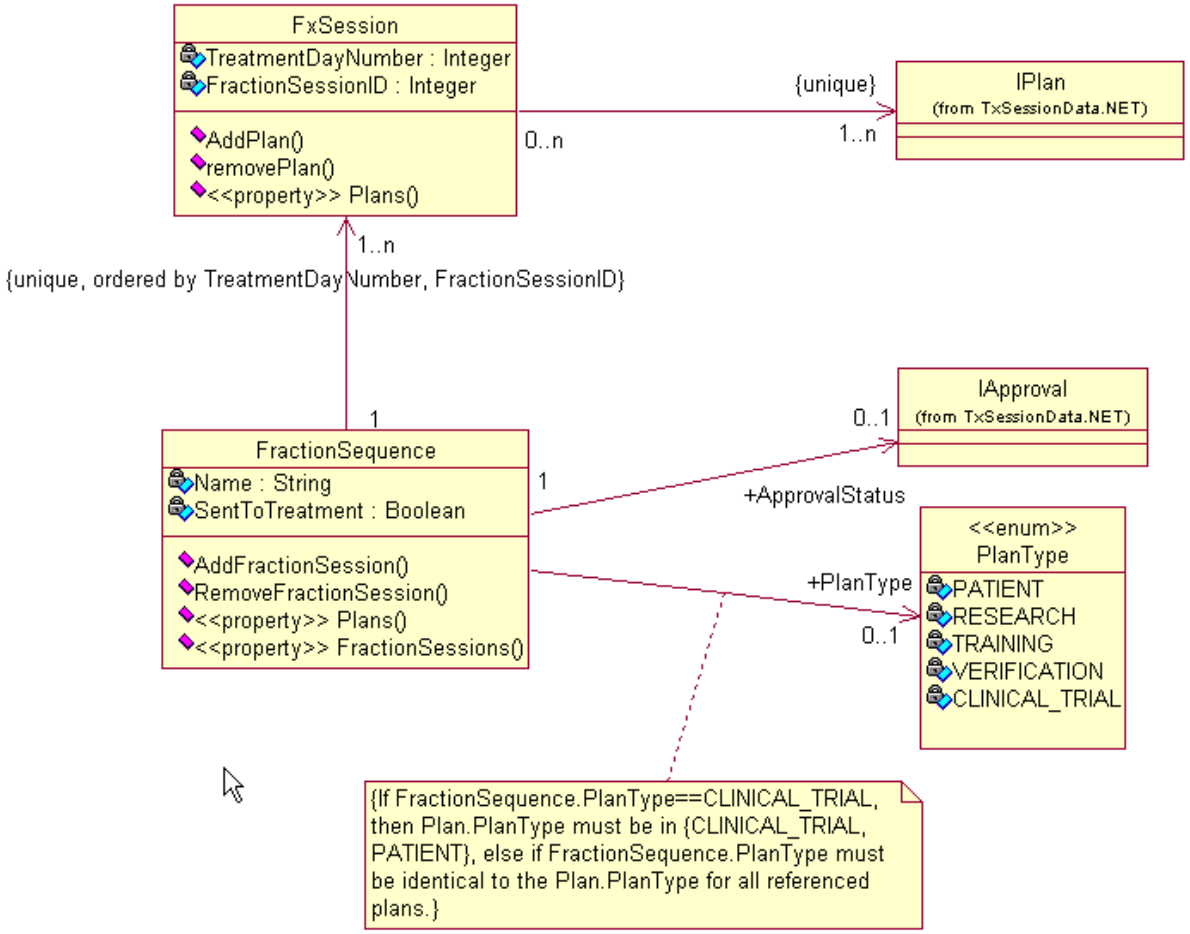


Figure 8.6-1: Fraction Sequence high level data model

The Fraction Sequence is a versioned SOP class. Versioning is implemented by the underlying Structured Report as specified in 9.15.1. Fraction sequence instances are stored in an Additional Patient Information study, see 8.6.2.2.1.

A Fraction Sequence must be approved before going into treatment delivery.

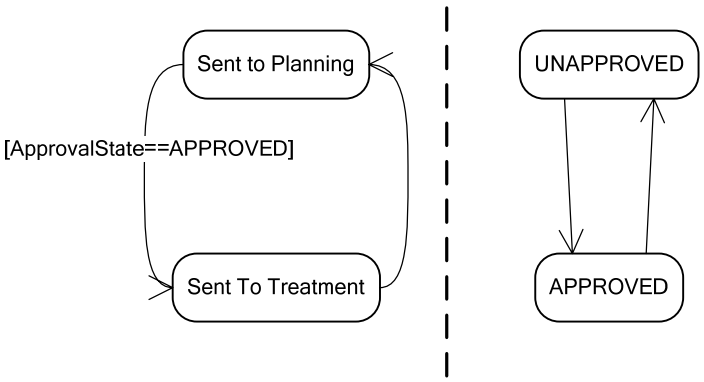


Figure 8.6-2: States of a Fraction Sequence

A Fraction Sequence which has gone into treatment delivery must never be changed by anybody except the delivery application or the planning application itself. As a treatment can be ongoing for several weeks, there is a risk that this constraint is not respected. In the absence of global data synchronization in the RT department, a state based locking mechanism has been introduced in the Fraction Sequence instance itself. Besides being approvable, a Fraction Sequence instance can be marked as *Sent to Treatment*. This is depicted in Figure 8.6-2: States of a Fraction Sequence.

A Fraction Sequence in state *Sent to Planning* must never be delivered by a treatment delivery application. Once the state is set to *Sent to Treatment* (typically by a planning system), no actor except the treatment delivery application or the planning system itself may create new versions of the Fraction Sequence. Only if in state *Sent to Treatment*, the Fraction Sequence may be delivered by the treatment delivery application. Once the treatment delivery application or the planning system has reset the state to *Sent to Planning*, a non treatment delivery application is free to create new versions of the Fraction Sequence. As Fraction Sequences in state APPROVED can not be modified, the user will first have to explicitly unapprove the Fraction Sequence before creating new versions.

As a global constraint on the entire patient data, there must only be a single latest instance version of a Fraction Sequence in state APPROVED and which is not yet completely delivered.

8.6.2.2.4 Treatment Course

In DICOM, there is no possibility to group data relevant for an ongoing treatment. The user has to know which data out of the overall data available for the patient is needed. In order to narrow down the focus to the subset of interest on the data, the *Treatment Course*, or TxCourse for short, was introduced. It is implemented as a DICOM Structured Report, see 9.15.2. The TxCourse is versioned based on date and time. In contrast to the Fraction Sequence (see 8.6.2.2.3), the versioning mechanism of the underlying Structured Report is not used. Treatment Course instances are stored in an Additional Patient Information study, see 8.6.2.2.1.

In contrast to the RT Course IOD defined in the DICOM RT 2.0 draft supplement 147, the TxCourse does not support the notion of “site” or “case”. If a patient again shows up after a completed treatment, the new patient data is added to an existing TxCourse without further structure or ordering. Yet, it is possible to hide content which is no longer of interest. For that purpose, the TxCourse contains two categories of content:

1. Positive content – a list of references to DICOM instances that may be visible inside a taskflow.

2. Negative content - a list of references to DICOM instances that may be hidden in a taskflow.

The following sections describe how TPS VC10 uses and provides the positive and negative content.

8.6.2.2.4.1 Workitem Startup in *syngo* RT Planning

All objects which are not in the negative content list are mapped into the taskflows. If some data referred by a mapped entity is outside the selected patient.(For example, VxPlan can refer to phantom dataset), the TPS retrieves the referenced data. The positive content is ignored during workitem startup.

8.6.2.2.4.2 Workitem Completion in *syngo* RT Planning

The following positive content is maintained as follows:

- Any existing content in the positive list is retained as is. This ensures backwards compatibility and avoids having to make assumptions about data added by other applications.
- Newly created instances or instance versions of FxSequences (Tx), plus the following content directly or indirectly referenced:
    - RT Ion Plans (Tx),
    - RT Non-Ion Plans (Tx),
    - RT Images referenced from plans inside the FxSequence ,
    - RT Structure Set referenced from plans inside the FxSequence,
    - the CTs referenced from the RT Structure Sets above.

In particular, RT Dose (Tx, grid based dose) and Encapsulated Documents (Planning Reports) are not added into the positive list, nor are recalculation plans.

- Newly created versions of FxSequences (Vx), plus the following content directly or indirectly referenced:
    - RT Ion Plans (Vx),
    - RT Non-Ion Plan (Vx),
    - RT Dose referenced from plans inside the FxSequence.

Note that in contrast to Tx Plans, RT Dose (Vx, point based dose) is added into the positive list.

The negative content of the TxCourse is updated with the instances that got removed during the execution of the workitem. Note that instances may be present both in positive and negative content.

8.6.2.2.5 Non Human Patients

In some contexts, we need DICOM data which is not associated with a human patient, but rather with some technical device like a water phantom. For such data, the patient last name should be suffixed with "_non_human". No application should assume that all non human patients are named in that way. If a patient is named that way, the application can decide to display the related data differently or even suppress it in some contexts.

8.6.2.2.6 Plan Type versus Treatment Intent

DICOM defines the attribute "RT General Plan::Treatment Intent (300A,000A)" (or "Plan Intent" starting with the DICOM standard 2009) to allow for a differentiation between different kinds of plans. Thus, the treatment intent defines a common semantics to the plans independent e.g. of the radiation type. However, the Siemens particle therapy solution requires an addition semantical differentiation of *ion plans* into the following plan types: PATIENT, CLINICAL_TRIAL, TRAINING, RESEARCH, VERIFICATION. This differentiation is implemented by the private attribute "RT General Plan::Plan Type (300B,xx10)" [5].

The following table shows the valid combinations between treatment intent and plan type. The value inside the table can be read as a *Derived Plan Type*.

Treatment Intent/ Plan Type	**CURATIVE**	**PALLIA-TIVE**	**PROPHYLACTIC**	**RESEARCH (DCM 2009)**	**VERIFI-CATION**	**RECALCU-LATION**	**empty/ not existent**	**unexpected value**
PATIENT	PATIENT	error	error	error	error	error	PATIENT	error
CLINICAL TRIAL	CLINICAL TRIAL	error	error	error	error	error	CLINICAL TRIAL	error
TRAINING	TRAINING	error	error	TRAINING	error	error	TRAINING	error
RESEARCH	RESEARCH	error	error	RESEARCH	error	error	RESEARCH	error
VERIFICATION	error	error	error	error	VERIFI-CATION	error	VERIFI-CATION	error
empty/not existent	PATIENT	PATIENT	PATIENT	RESEARCH	VERIFI-CATION	RECALCU-LATION	PATIENT	PATIENT
unexpected value	error	error	error	error	error	error	error	error

Table 8-5: Valid combinations between Treatment Intent and Plan Type

Legend:

- black = combination that can happen in real world.

[5] Note that the modeling chosen has flaws: the meanings of the two attributes are not independent of each other. This leads to many error enties in the table. The Derived Plan Type is an attempt to repair for that non-orthogonal modeling.

- orange = error case, but could theoretically be resolved in a reasonable way.
- red = error case, cannot be resolved in a reasonable way.

The following assumptions have been made for the specification of Table 8-5:

- Treatment intent CURATIVE implies always plan type PATIENT or CLINICAL_TRIAL.
- Treatment intent RESEARCH implies always plan type RESEARCH or TRAINING.
- If treatment intent and plan type are not available PATIENT is assumed.
- Treatment intent PALLIATIVE implies always plan type PATIENT or CLINICAL_TRIAL.
- Treatment intent PROPHYLACTIC implies always plan type PATIENT or CLINICAL_TRIAL.
- If treatment intent is RECALCULATION, always RECALCULATION is assumed, independent of the plan type.
- If treatment intent is VERIFICATION, the only valid plan type is VERIFICATION or empty
- If both plan type PATIENT or CLINICAL_TRIAL can be inferred, PATIENT is given preference.
- If both plan type RESEARCH or TRAINING can be inferred, RESEARCH is given preference.

The following table specifies the valid combinations between derived plan type from inside the table above, and patient type human and non human.

Derived Plan Type	Patient Type	
	human	**non human**
PATIENT	yes	yes
CLINICAL TRIAL	yes	yes
TRAINING RESEARCH	no	yes
VERIFICATION	Plan: human RT SS, CT: non human	Plan: non human RT SS, CT: non human
RECALCULATION	same patient type as referenced plan that is being recalculated	

Table 8-6: Valid combinations between Derived Plan Type and Patient Type

8.6.2.3 Spatial Registration and Registration Matrix Interpretation

The DICOM specification is not precise about the role of the registered items in general and about the registration matrix transformation direction in particular. Only IHE brings more clarity. We show here

- which registered item plays which role depending on the scenario,
- how we define registration matrices in a Spatial Registration IOD instance, at least for registrations created in the context of the Treatment Planning System.

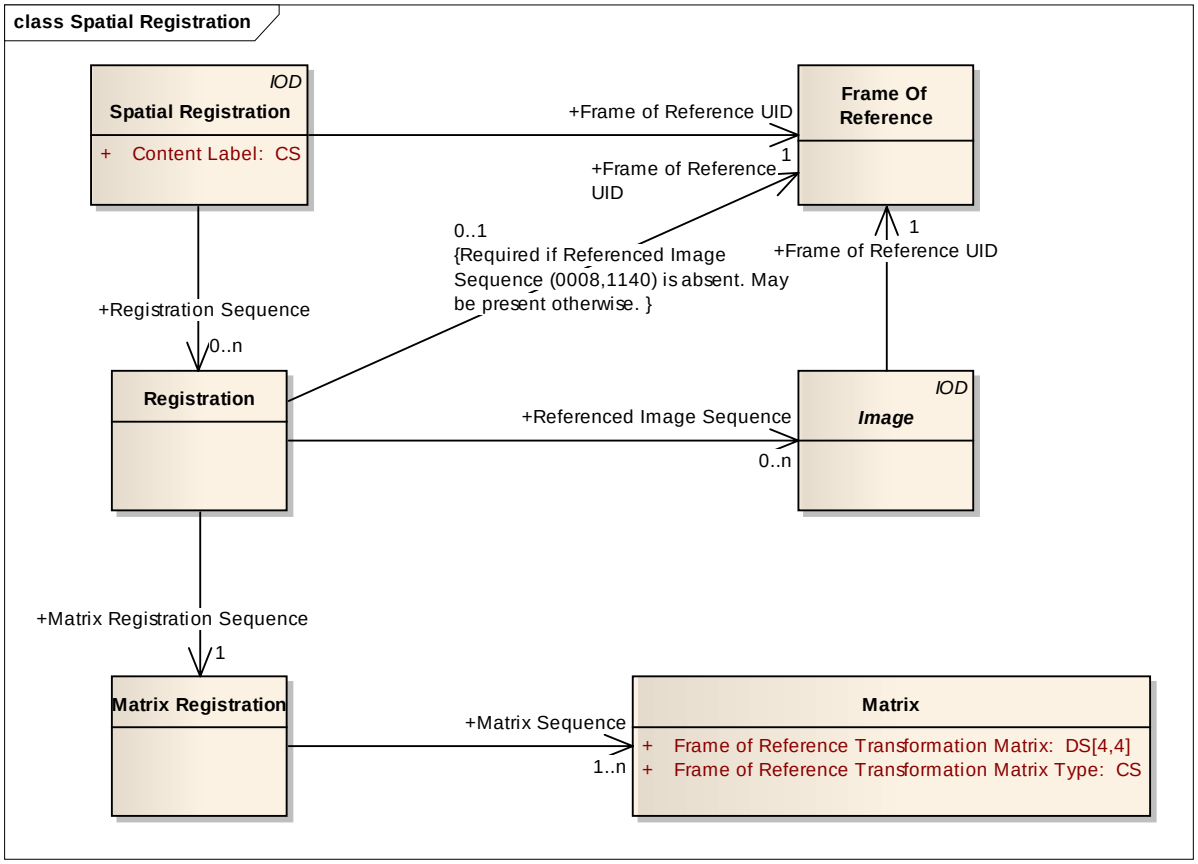


Figure 8.6-3: Spatial Registration in context with Frame Of Reference class diagram

Fehler! Verweisquelle konnte nicht gefunden werden. shows how DICOM defines the Spatial Registration. Additional constraints imposed by IHE are not shown. The following sections explain how the TPS approaches IHE on top of the DICOM standard.

8.6.2.3.1 Roles in Registration

For two coordinate systems resp. frames of reference being related to each other by a registration, two roles with multiple names are defined:

- the Reference, Registered or Primary frame of reference,
- the Model, Source or Secondary frame of reference.

In the following, the terms Reference and Model are used. Depending on the usage context, the roles are taken as specified in the next sections.

8.6.2.3.1.1 Stereotactic Registration

For a Spatial Registration encoding a stereotactic localization, the Content Label is set to “STX”. Yet, *syngo* RT Planning VC10 differs from earlier versions in the way how the registration roles are stored and interpreted.

When receiving a stereotactic Spatial Registration created by earlier versions of the TPS from the DICOM archive or any other external source, *syngo* RT Planning VC10 translates it into the VC10 format.

8.6.2.3.1.1.1 Stereotactic Registration from earlier syngo *RT Planning Versions*

The Reference role is denoted by the Frame of Reference UID (0020,0052) in the Frame of Reference Module of the Spatial Registration instance itself. This frame of reference denotes the abstraction of the coordinate system of the stereotactic frame in which the localization actually happens. There is no

Reference Image in this case. The Model role is denoted by the first item in the Registration Sequence. The frame of reference of the Model is given there. The Model Image having the same frame of reference is referenced as single item in the Referenced Image Sequence. The Matrix Registration Sequence (0070,0309) contains a single item, with a single registration matrix in the Matrix Sequence (0070,030A).

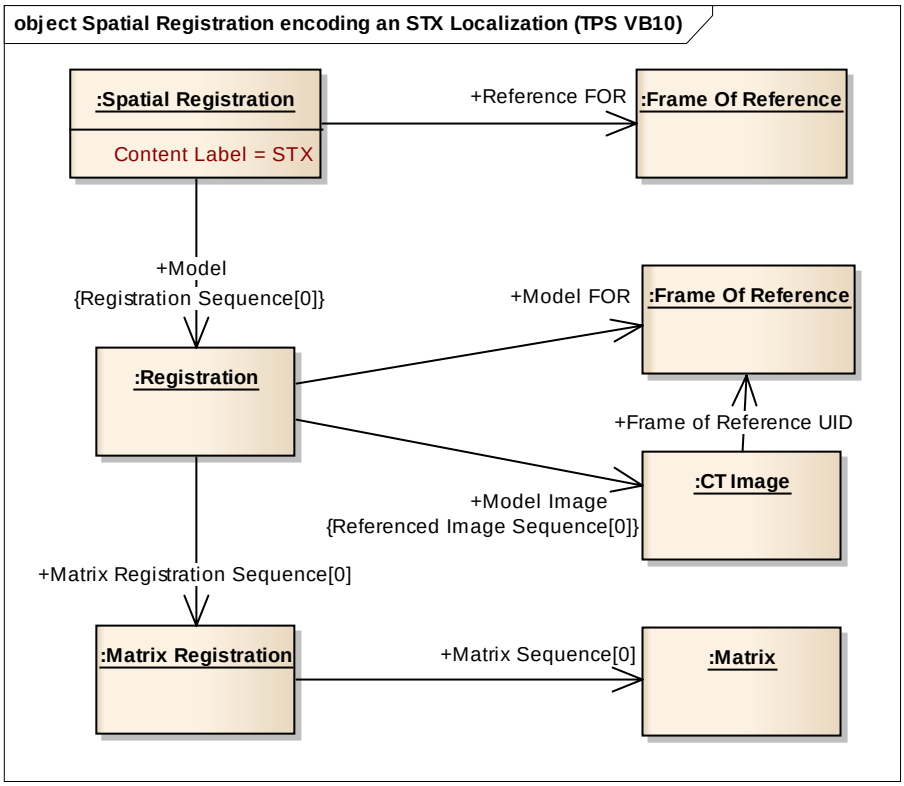


Figure 8.6-4: Spatial Registration encoding an STX Localization (*syngo* RT Planning VB10)

Note that this representation is not according to IHE, which does not yet make a statement for such kinds of registrations.

8.6.2.3.1.1.2 Stereotactic Registration from syngo *RT Planning VC10*

The first item in the Registration Sequence denotes the Reference role. The Frame of Reference UID (0020,0052) stands for the abstraction of the coordinate system of the stereotactic frame in which the localization actually happens. The Referenced Image Sequence (0008,1140) is empty. The Matrix Registration Sequence (0070,0309) contains the identity matrix as a single item. The second item in the Registration Sequence denotes the Model role. It references the Model Image both implicitly through the Frame of Reference UID (0020,0052) and explicitly as Referenced Image Sequence (0008,1140). The Model Matrix Registration Sequence (0070,0309) contains a single item, with a single registration matrix in the Matrix Sequence (0070,030A).

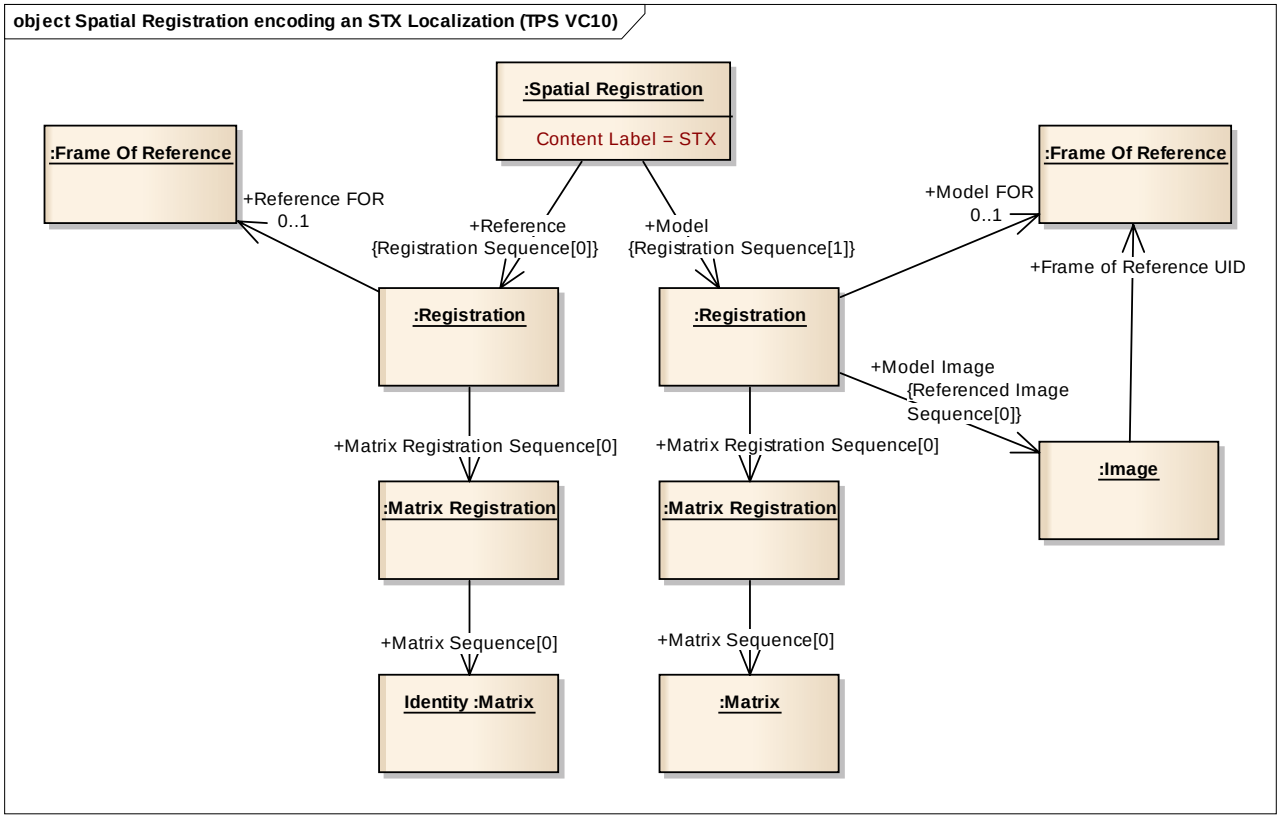


Figure 8.6-5: Spatial Registration encoding an STX Localization (*syngo* RT Planning VC10)

This format anticipates a future IHE definition for atlas based registrations.

8.6.2.3.1.2 Image to Image Registration

For a Spatial Registration encoding an image to image registration, we follow the IHE standard. The first item in the Registration Sequence denotes the Reference role. It references the Reference Image either implicitly through the Frame of Reference UID (0020,0052) or explicitly as Referenced Image Sequence (0008,1140). The Matrix Registration Sequence (0070,0309) contains a single item and denotes a self registration, typically containing the identity matrix. The second item in the Registration Sequence denotes the Model role. It references the Model Image both implicitly through the Frame of Reference UID (0020,0052) and explicitly as Referenced Image Sequence (0008,1140). The Model Matrix Registration Sequence (0070,0309) contains a single item, with a single registration matrix in the Matrix Sequence (0070,030A).

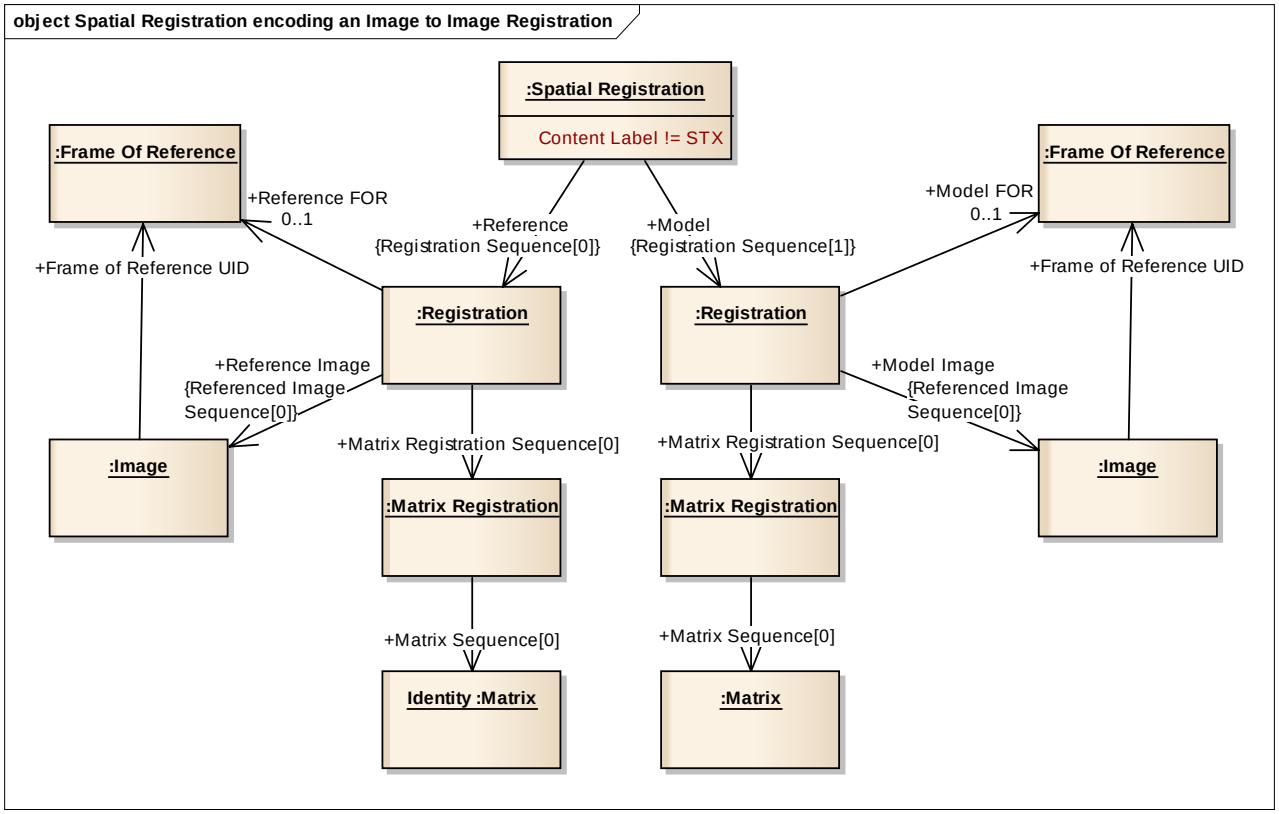


Figure 8.6-6: Spatial Registration encoding an Image to Image Registration

Note that multiple model images in one Spatial Registration instance are not supported. According to IHE, multiple Spatial Registration instances would be created in such a case.

8.6.2.3.2 Interpretation of Registration Matrices

DICOM allows multiple registration matrices in a single registration. Let $M_i, i = 1..n$ be the individual Frame of Registration Transformation Matrices (3006,00C6) in a Matrix Sequence (0070,030A). The resulting registration matrix is defined as

$$M = \Pi_{i=1}^{n} M_i$$

Let $\vec{x}_{model}$ be a point $\vec{x}$ expressed in coordinates of the Model (Source, Secondary) Frame of Reference, and $\vec{x}_{reference}$ the same point $\vec{x}$ expressed in coordinates of the Reference (Registered, Primary) Frame of Reference. We define the registration matrix such that

$$\vec{x}_{reference} = M \cdot \vec{x}_{model}$$

In Figure 8.6-7, an example sketch is given.

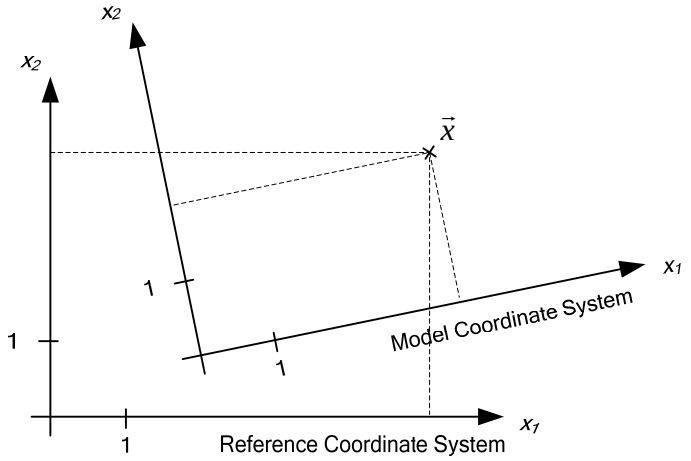


Figure 8.6-7: Example for Registration Matrix Transformation

The point $\vec{x}$ is located in two coordinate systems. In the model coordinate system, the point is specified by $\vec{x}_{\mathrm{model}} = (3.4,2.0)$, whereas in the reference coordinate system, the point is specified by $\vec{x}_{reference} = (5.0,3.5)$. The transformation matrix M would be defined such that

$$(5.0,3.5) = M \cdot (3.4,2.0)$$

8.6.2.4 RT Structure Set Interoperability

syngo RT Planning VC10 supports RT Structure Sets based on a single frame of reference as defined by the IHE-RO Technical Framework, Contourer 2007 for review purposes. RT Structure Sets based on multiple frames of reference are rejected.

syngo RT Planning VC10 allows to define treatment plans based on RT Structure Sets created by the following systems:

- *syngo* RT Dosimetrist 2.6
- *syngo* RT Dosimetrist 2.8
- *syngo* RT Dosimetrist 2.7 coming with *syngo* RT Planning VB10
- *syngo* RT Planning VB10
- *syngo* RT Planning VC10
- Oncentra MasterPlan 3.3 and later versions, provided the later version exports RT Structure Sets according to the same interface specified by IHE-RO Technical Framework, Contourer 2007. In order to be suitable for planning, these Structure Sets have to be loaded into the Patient Modeling workitem in *syngo* RT Planning VC10, and a new version has to be created.

RT Structure Sets from other systems have to be imported into the Patient Modeling workitem in *syngo* RT Planning VC10 in order to be usable for planning. In contrast to loading, importing does not create a new version. A new instance is created instead.

8.6.2.5 Reference Points

This section provides a summary about which kind of reference points are used with respect to clinical use cases and how the TPS application encodes them within the DICOM standard.

8.6.2.5.1 Reference Point (POI) types

In the context of treatment planning reference points with different semantics are used:

- Patient positioning POIs (see 8.6.2.5.2) (so called 'marked' reference points) are usually transferred to a laser system to create a marking on the patient skin. This marking is used to initially position the patient and zero the table before delivery. The final treatment isocenter position is obtained by shifting the table afterwards by a defined vector as calculated by the planning system.
- Dosimetric POIs (see 8.6.2.5.3) are used to define a dose prescription or normalization reference.
- Isocenters (see 8.6.2.5.4) define the target points of treatment beams.
- Other POIs (see 8.6.2.5.5) are any reference points without specific meaning. They can be used e.g. for measurements, as initial points for isocenter definitions, etc.

The following subsections describe how the various types are handled in *syngo* RT Planning VC10.

8.6.2.5.2 Patient Positioning POIs

Both, VSim (*syngo* RT Planning VB10) and PxModeling (*syngo* RT Planning VC10), store patient positioning POIs in the RT Structure Set. The patient coordinates of a marked reference point can be obtained by identifying the ROI in the RT Structure Set based on the name from (300A,01D0) and reading the coordinate values in the structure set. Table 4 shows how the relevant DICOM attributes are filled in the RT Structure Set and used in the RT Ion Plan.

IOD	Module	Attribute	Value
RT Structure Set	**Structure Set**	syngo RT Private Data (300B,xx17)	DosimetricPointType = NONE
	RT ROI Contour	Contour Geometric Type (3006,0042)	POINT
		Contour Data (3006,0050)	x\y\z
	RT ROI Observations	RT ROI Interpreted Type (3006,00A4)	MARKER
RT Ion Plan	**RT General Plan**	Treatment Intent (Plan Intent since DCM 2009) (300A,000A)	any
		RT Plan Geometry (300A,000C)	PATIENT
	RT Patient Setup	Setup Device Type (300A,01B6)	LASER_POINTER
		Setup Device Label (300A,01B8)	always empty
		Setup Device Parameter (300A,01BC)	always '0'
		Setup Reference Description (300A,01D0)	Name of the marked reference point used for aligning the patient as read from ROI Name (3006,0026) in RT Structure Set module
		Table Top Vertical Setup Displacement (300A,01D2)	Vertical displacement from the specified Marked Reference point to obtain the beam isocenter.
		~~Table Top Longitudinal Setup~~	~~Longitudinal displacement from the~~

		Displacement (300A,01D4)	specified Marked Reference point to obtain the beam isocenter.
		Table Top Lateral Setup Displacement (300A,01D6)	Lateral displacement from the specified Marked Reference point to obtain the beam isocenter.

Table 8-7: DICOM encoding of POIs for patient positioning

8.6.2.5.3 Dosimetric POIs

Dosimetric POIs are distinguished from other types by the private DICOM attribute (300B,xx17) in the RT Structure Set. These POIs are used for point dose prescriptions during plan definition.

IOD	Module	Attribute	Value
RT Structure Set	**Structure Set**	syngo RT Private Data (300B,xx17)	DosimetricPointType = ICRU
	RT ROI Contour	Contour Geometric Type (3006,0042)	POINT
		Contour Data (3006,0050)	x\y\z
	RT ROI Observations	RT ROI Interpreted Type (3006,00A4)	ISOCENTER
RT Ion Plan	**RT Prescription**	Dose Reference Structure Type (300A,0014)	POINT
		Referenced ROI Number (3006,0084)	reference to ROI of point as stored in the RT Structure Set
		Referenced Target ROI Number (300B,xx16)	Reference to structure which is selected in the 'Presc. to' combo in the prescription table (mandatory for POINT prescriptions referring a volume).
		Dose Reference Point Coordinates (300A,0018)	not used
	RT Fraction Scheme	Beam Dose Specification Point (300A,0082)	not used

Table 8-8: DICOM encoding of dosimetric POIs

8.6.2.5.4 Isocenters

Isocenter coordinates are directly stored in the beam as per **Fehler! Verweisquelle konnte nicht gefunden werden.**.

IOD	Module	Attribute	Value
RT Ion Plan	**RT General Plan**	Treatment Intent (Plan Intent since DCM 2009) (300A,000A)	any
		RT Plan Geometry (300A,000C)	PATIENT
	RT (Ion) Beam	Isocenter Position (300A,012C)	x/y/z

Table 8-9: DICOM encoding of isocenters

8.6.2.5.5 Other POIs

These POIs are only contained in a structure set. They can be used for initializing coordinates within a treatment plan, but no reference to the POI itself is stored in the plan. **Fehler! Verweisquelle konnte nicht gefunden werden.** shows how such points can be identified in an RT Structure Set.

IOD	Module	Attribute	Value
RT Structure Set	**Structure Set**	syngo RT Private Data (300B,xx17)	DosimetricPointType = NONE
	RT ROI Contour	Contour Geometric Type (3006,0042)	POINT
		Contour Data (3006,0050)	x\y\z
	RT ROI Obsersvations	RT ROI Interpreted Type (3006,00A4)	ISOCENTER

Table 8-10: DICOM encoding of general POIs

8.6.2.6 Number of Fractions Planned between RT (Ion) Plan and FxSequence

The number of fractions planned for a given RT (Ion) Plan is stored twice in the DICOM data the TPS creates along a complete planning workflow:

- In the RT (Ion) Plan, as “RT Fraction Scheme::Number of Fractions Planned” (300A,0078). This value determines how the prescribed, minimum and maximum dose values and constraints inside the RT Fraction Scheme of the plan scale down to individual fractions. It also determines the same for referenced RT Dose Instances of all dose summation types (see section 8.6.2.7 below). In summary, this is the number of fractions which is relevant during dose calculation and optimization, and the interpretation of the plan alone.
- In the private Fraction Sequence (see 8.6.2.2.3), via the fractionation patterns for all plans contained in the fraction sequence. The number of fractions planned for the individual plans determine how the individual plan doses sum up to the total dose of the fraction sequence across all fractions to be delivered. In summary, this is the number of fractions which should be finally delivered by the treatment delivery system.

For a given plan, the number of fractions planned stored in the plan and the one derived from the fractionation pattern in the fraction sequence may differ. Inside the TPS, a visual indication is given in this case (exclamation mark for the fraction sequence in the object browser). When such a fraction sequence is approved, a detailed warning is printed into the fraction sequence report.

The PT delivery system interprets the fraction sequence, giving the number of fractions planned derived from the fractionation pattern precedence over the potentially deviating number of fractions planned in a plan.

8.6.2.7 Dose Summation Type, Dose per Fraction and Dose for all Fractions

With *syngo* RT Planning VC10, the interpretation of an RT Dose instance according to the “RT Dose::Dose Summation Type” (3004,000A) has changed in order to align with the interpretation DICOM expects:

Dose Summation Type	*syngo* RT Planning VB10	*syngo* RT Planning VC10
PLAN	dose for all fractions planned	dose for all fractions planned
BEAM	dose per individual fraction	dose for all fractions planned
FRACTION	dose per individual fraction	not used
other dose summation types	not used	not used

The new interpretation applies to both treatment dose (dose cubes in RT Dose) and verification dose (point dose in RT Dose). Note that for verification plans created by the TPS, the number of fractions planned is always 1. Thus, the actual point dose values for plan verification do not change.

syngo RT Planning VC10 has built in logic to properly scale RT Dose instances created by *syngo* RT Planning VB10. *syngo* RT Planning VB10 is not able to correctly handle RT Dose instances created by *syngo* RT Planning VC10 with dose summation type other than PLAN.

8.6.2.8 Equivalent Treatment Rooms for RT Ion Plans

A common use case in radio therapy is to calculate a treatment plan based on the geometric and dosimetric properties of a selected treatment delivery machine, but deliver the plan on another geometrically and dosimetrically equivalent machine.

The TPS supports the ion treatment delivery system for this use case. For each beam, the TPS writes a list of alternative treatment machine names (i.e. beam line names) into the private attribute “RT Ion Beams::Alternative Treatment Machine Name Sequence” (300B,xx20). Based on the configured device data in the TPS Admin and Configuration subsystem, the TPS considers two treatment machines as alternatives if

- they have the same irradiation device type,
- they have the same motion device type (gantry or fixed),
- they have the same orthogonal transformation from the motion device into the treatment room.

In particular, the underlying assumption is that two treatment delivery machines are dosimetrically equivalent if they have the same type. If this property can not be guaranteed by the way how the machines are set up and commissioned, then the list of alternative treatment machine names is meaningless.

The TPS does not perform any further checks on the treatment machine nor on the beam modifying devices used in the beam. In particular:

- The TPS does not check if the beam modifying devices used in the beam are also available and configured in an identical or at least compatible manner for the alternative treatment machine.
- The TPS does not check if the beam modifying devices used in the beam can be considered dosimetrically equivalent across the alternative treatment machines.
- The TPS does not check if there is any alternative treatment room allowing to irradiate all beams of a plan on alternative treatment machines: the treatment delivery system may end up in a situation where for all beams, there is an alternative treatment machine, but the machines are distributed across different rooms.

It is up to the treatment delivery device to ensure that the latter points are properly considered before delivering the plan in an alternative room.

Note that this concept does not allow expressing the following scenarios:

- Provided the dosimetric properties match, a beam planned on a fixed beam line can be irradiated on a gantry beam line by setting the gantry to the angle of the fixed beam line.
- Provided the dosimetric properties match, a beam planned on a fixed beam line can be irradiated on another fixed beam line, even if the types of the two beam lines are different.

8.6.2.9 Patient and Image Orientation

TPS VC10 allows to create plans with non HFS patient orientation. In order to be interpretable in a safe manner, the image orientation has to match the planned patient position. Two DICOM attributes are used:

- General Series::Patient Position (0018,5100)
- Image Plane::Image Orientation (Patient) (0020,0037)

The following rules are applied:

- `if Patient Position = HFS and Image Orientation (Patient)= 1,0,0/0,1,0 then Patient Position = HFS`
- `if Patient Position = HFP and Image Orientation (Patient)= -1,0,0/0,-1,0 then Patient Position = HFP`
- `if Patient Position = FFS and Image Orientation (Patient)= -1,0,0/0,1,0 then Patient Position = FFS`
- `if Patient Position = FFP and Image Orientation (Patient)= 1,0,0/0,-1,0 then Patient Position = FFP`
- `if any of above combinations is not fulfilled or Patient Position = EMPTY then Patient Position is undefined.`

If no match is found between the Patient Position and the Image Orientation Patient, then the plan creation is rejected. 3rd party plans with non matching Patient Position and Image Orientation (Patient) can not be reviewed in order to prevent misinterpretations.

Note that these rules make the type 2C attribute General Series::Patient Position mandatory on CT image series to be used for planning.

8.7 Deviations from the DICOM Standard

The following deviations are known with respect to the DICOM Standard:

- In RT Dose instances created for verification plans, the attribute RT Dose::Dose Grid Scaling (3004,000E) is written, although this attribute is supposed to be empty for point based doses.
- For RT Ion position verification beams identified through Treatment Delivery Type (300A,00CE) = XA_IMAGING, the attribute Scan Spot Position Map (300A,0394) is set, although the attribute is only required if Scan Mode (300A,0308) is MODULATED.
- In the Patient Setup Sequence module for verification plans, both Patient Position (0018,5100) and Patient Additional Position (300A,0184) are set, although they are mutually exclusive.
- In the Structured Report instances implementing the Fraction Sequence 9.15.1 and the Treatment Course 9.15.2, the attribute Coding Scheme Designator (0008,0102) is written as "NA". This is an unrecognized defined term for this attribute.
- The series level attributes General Equipment::Manufacturer (0008,0070) and Manufacturer's Model Name (0008,1090) may differ between instances stored in the same series by the TPS.
- In RT Dose and RT Image instances, the Referenced RT Plan Sequence (300C,0002) may point to intermediate versions of RT Ion Plans that have not been published to the STS or DICOM archive. Yet, an RT Dose or RT Image instance referenced by an RT Ion Plan instance is garantueed to exist.

9 IODs

9.1 Basic Text SR IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			FxSeq (Tx)	Written
			FxSeq (Vx)	Written
Study	General Study	M	Rep (Tx)	Written
			Rep (Vx)	Written
			FxSeq (Tx)	Written
			FxSeq (Vx)	Written
Series	SR Document Series	M	Rep (Tx)	Written
			Rep (Vx)	Written
			FxSeq (Tx)	Written
			FxSeq (Vx)	Written
Equipment	General Equipment	M	Rep (Tx)	Written
			Rep (Vx)	Written
			FxSeq (Tx)	Written
			FxSeq (Vx)	Written
Document	SR Document General	M	Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Read
			FxSeq (Tx)	modified
			FxSeq (Vx)	modified
	SR Document Content	M	Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Read
			FxSeq (Tx)	modified
			FxSeq (Vx)	modified
	SOP Common	M	Rep (Tx)	Written
			Rep (Vx)	Written
			FxSeq (Tx)	Written
			FxSeq (Vx)	Written

9.2 Encapsulated PDF IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	Rep (Tx)	Read/Written
			Rep (Vx)	Read/Written
Study	General Study	M	Rep (Tx)	Read/Written
			Rep (Vx)	Read/Written
Series	Encapsulated Document Series	M	Rep (Tx)	Written
			Rep (Vx)	Written
Equipment	General Equipment	M	Rep (Tx)	Written
			Rep (Vx)	Written

IE	Module	Usage	Task	Task Usage
	SC Equipment	M	Rep (Tx)	Written
			Rep (Vx)	Written
Encapsulated Document	Encapsulated Document	M	Rep (Tx)	Read/Written
			Rep (Vx)	Read/Written
	SOP Common	M	Rep (Tx)	Read/Written
			Rep (Vx)	Read/Written

9.3 CT Image IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	PxM	Read
	Clinical Trial Subject	U	PxM	Not supported
Study	General Study	M	PxM	Read
	Patient Study	U	PxM	Not supported
	Clinical Trial Study	U	PxM	Not supported
Series	General Series	M	PxM	Read
	Clinical Trial Series	U	PxM	Not supported
Frame of Reference	Frame of Reference	M	PxM	Read
Equipment	General Equipment	M	PxM	Read
Image	General Image	M	PxM	Read
	Image Plane	M	PxM	Read
	Image Pixel	M	PxM	Read
	CT Image	M	PxM	Read
	SOP Common	M	PxM	Read

9.4 MR Image IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	PxM	Read
	Clinical Trial Subject	U	PxM	Not supported
Study	General Study	M	PxM	Read
	Patient Study	U	PxM	Not supported
	Clinical Trial Study	U	PxM	Not supported
Series	General Series	M	PxM	Read
	Clinical Trial Series	U	PxM	Not supported
Frame of Reference	Frame of Reference	M	PxM	Read
Equipment	General Equipment	M	PxM	Read
Image	General Image	M	PxM	Read
	Image Plane	M	PxM	Read
	Image Pixel	M	PxM	Read
	MR Image	M	PxM	Read
	SOP Common	M	PxM	Read

9.5 PET Image IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	PxM	Read
	Clinical Trial Subject	U	PxM	Not supported
Study	General Study	M	PxM	Read
	Patient Study	U	PxM	Not supported
	Clinical Trial Study	U	PxM	Not supported
Series	General Series	M	PxM	Read
	Clinical Trial Series	U	PxM	Not supported
	PET Series	M	PxM	Read
	PET Isotope	M	PxM	Read
	PET Multi-gated Acquisition	C - Required if Series Type (0054,1000) Value 1 is GATED.	PxM	Not supported
	NM/PET Patient Orientation	M	PxM	Read
Frame of Reference	Frame of Reference	M	PxM	Read
Equipment	General Equipment	M	PxM	Read
Image	General Image	M	PxM	Read
	Image Plane	M	PxM	Read
	Image Pixel	M	PxM	Read
	PET Image	M	PxM	Read
	SOP Common	M	PxM	Read

9.6 RT Dose IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	DCO	Written
			VxPlan	Written
Study	General Study	M	DCO	Written
			VxPlan	Written
Series	RT Series	M	DCO	Read/Written
			VxPlan	Read/Written
Frame of Reference	Frame of Reference	M	DCO	Written
			VxPlan	Written
Equipment	General Equipment	M	DCO	Written
			VxPlan	Written
Dose	General Image	C - Required if dose data contains grid-based doses.	DCO	Written
			VxPlan	Written
	Image Plane	C - Required if dose data contains grid-based doses.	DCO	Written
			VxPlan	Written
	Image Pixel	C - Required if dose data contains grid-based doses.	DCO	Written
			VxPlan	Written
	Multi-Frame	C - Required if dose data contains grid-based doses and pixel data is multi-frame data.	DCO	Written
			VxPlan	Written
	RT Dose	M	TxPlanDef	Read
			WS	Read
			DCO	Written

IE	Module	Usage	Task	Task Usage
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Written
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read
	Structure Set	C - Required if dose data contains dose points or isodose curves	DCO	Read
			VxPlan	Written
	ROI Contour	C - Required if dose data contains dose points or isodose curves	DCO	Read
			VxPlan	Written
	RT Dose ROI	C - Required if dose data contains dose points or isodose curves	DCO	Written
			VxPlan	Written
			FxSeq (Vx)	Read
	SOP Common	M	DCO	Written
			VxPlan	Written

9.7 RT Image IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	Rep (Tx)	Written
Study	General Study	M	Rep (Tx)	Written
Series	RT Series	M	Rep (Tx)	Written
Frame of Reference	Frame of Reference	U	Rep (Tx)	Written
Equipment	General Equipment	M	Rep (Tx)	Written
Image	General Image	M	Rep (Tx)	Written
	Image Pixel	M	Rep (Tx)	Written (value provided by Viewing Component)
	RT Image	M	Rep (Tx)	Written
	VOI LUT	U	Rep (Tx)	Written
	SOP Common	M	Rep (Tx)	Written

9.8 RT Ion Plan IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	TxPlanDef	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read Written
Study	General Study	M	TxPlanDef	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read Written
	Patient Study	U	TxPlanDef	Read
Series	RT Series	M	TxPlanDef	Written
			WS	Read
			DCO	Read
			VxPlan	Written
Frame of Reference	Frame of Reference	U – See Note	DCO	Read Written

IE	Module	Usage	Task	Task Usage
			VxPlan	Read Written
Equipment	General Equipment	M	TxPlanDef	Written
			DCO	Read Written
			Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Written
Plan	RT General Plan	M	TxPlanDef	Written
			WS	Read
			DCO	Modified
			Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Read Written
			STX	Read
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read
	RT Prescription	U	TxPlanDef	Written
			WS	Read
			DCO	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
	RT Ion Tolerance Tables	U	TxPlanDef	Written
			Rep (Tx)	Read
			Rep (Vx)	Read
	RT Patient Setup	U	TxPlanDef	Written
			WS	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
	RT Fraction Scheme	U	TxPlanDef	Written
			WS	Read
			DCO	Modified
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read Written
			FxSeq (Tx)	Read
	RT Ion Beams	C – Required if RT Fraction Scheme Module exists and Number of Beams @(300A,0080) is greater than zero for one or more fraction groups	TxPlanDef	Written
			WS	Read
			DCO	Modified
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read Written
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read

IE	Module	Usage	Task	Task Usage
	Approval	U	TxPlanDef	Written
			WS	Read
			DCO	Read
			Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Read
	SOP Common	M	TxPlanDef	Read Written
			WS	Read
			DCO	Read Written
			Rep (Tx)	Read Written
			Rep (Vx)	Read Written
			VxPlan	Read Written
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read
			PRC	Read

9.9 RT Plan IOD

IE	Module	Usage	Task	Task Usage
Series	RT Series	M	WS	Read
Plan	RT General Plan	M	WS	Read
			FxSeq (Tx)	Read
			PRC	Read
	RT Prescription	U	WS	Read
			PRC	Read
	RT Patient Setup	U	WS	Read
	RT Fraction Scheme	U	WS	Read
			FxSeq (Tx)	Read
			PRC	Read
	RT Beams	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups	WS	Read
			FxSeq (Tx)	Read
			PRC	Read
	Approval	U	WS	Read
	SOP Common	M	FxSeq (Tx)	Read
			PRC	Read

9.10 RT Structure Set IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	TxPlanDef	Read
			STX	Written
			PxM	Copied from Planning CT
	Clinical Trial Subject	U	PxM	No explicit support
Study	General Study	M	TxPlanDef	Read
			STX	Written
			PxM	Copied from Planning CT
	Patient Study	U	PxM	No explicit support
	Clinical Trial Study	U	PxM	No explicit support
Series	RT Series	M	TxPlanDef	Read
			WS	Read
			STX	Written
			PxM	Read;Written
	Clinical Trial Series	U	PxM	No explicit support
Equipment	General Equipment	M	TxPlanDef	Read
			STX	Written
			PxM	Read;Written
Structure Set	Structure Set	M	Comment	The Structure Set Module contains a private attribute for an XML based representation of private date inside the Structure Set IOD.
			TxPlanDef	Read
			WS	Read
			DCO	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read
			STX	modified
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read
			PxM	Read;Written
	ROI Contour	M	TxPlanDef	Read
			WS	Read
			DCO	Read
			VxPlan	Read
			STX	modified
			PxM	Read;Written
	RT ROI Observations	M	TxPlanDef	Read
			WS	Read
			DCO	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read
			STX	modified
			FxSeq (Tx)	Read

IE	Module	Usage	Task	Task Usage
			FxSeq (Vx)	Read
			PxM	Read;Written
	Approval	U	PxM	Read;Written
	SOP Common	M	TxPlanDef	Read
			WS	Read
			DCO	Read
			Rep (Tx)	Read
			Rep (Vx)	Read
			VxPlan	Read
			STX	Written
			FxSeq (Tx)	Read
			FxSeq (Vx)	Read
			PxM	Read;Written

9.11 RT Treatment Summary Record IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	Rep (Tx)	Read
			FxSeq (Tx)	Read
Study	General Study	M	Rep (Tx)	Read
			FxSeq (Tx)	Read
Series	RT Series	M	Rep (Tx)	Read
			FxSeq (Tx)	Read
Treatment Record	RT General Treatment Record	M	Rep (Tx)	Read
			FxSeq (Tx)	Read
	RT Treatment Summary Record	M	Rep (Tx)	Read
			FxSeq (Tx)	Read
	SOP Common	M	Rep (Tx)	Read
			FxSeq (Tx)	Read

9.12 Spatial Fiducial IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	STX	Written
Study	General Study	M	STX	Written
Series	General Series	M	STX	Written
	Spatial Fiducial Series	M	STX	Written
Equipment	General Equipment	M	STX	Written
Spatial Fiducials	Spatial Fiducials	M	STX	Read Written
	Common Instance Reference	M	STX	Written
	SOP Common	M	STX	Written

9.13 Spatial Registration IOD

IE	Module	Usage	Task	Task Usage
Patient	Patient	M	PxM	Copied from planning CT
			STX	Written
	Specimen Identification	U	PxM	Not supported
	Clinical Trial Subject	U	PxM	Not explicitly supported
Study	General Study	M	PxM	Copied from

IE	Module	Usage	Task	Task Usage
				planning CT
			STX	Written
	Patient Study	U	PxM	Not explicitly supported
	Clinical Trial Study	U	PxM	Not explicitly supported
Series	General Series	M	PxM	Copied from planning CT
			STX	Written
	Clinical Trial Series	U	PxM	Not explicitly supported
	Spatial Registration Series	M	PxM	Supported
			STX	Written
Frame of Reference	Frame of Reference	M	PxM	Copied from planning CT
			TxPlanDef	Read
			STX	Written
			PRC	Read
Equipment	General Equipment	M	PxM	Read; Written
			TxPlanDef	Read
			STX	Written
Spatial Registration	Spatial Registration	M	Comment	The Spatial Registration Module contains a private attribute for an XML based representation of private date inside the Spatial Registration IOD.
			PxM	Read; Written
			TxPlanDef	Read
			Rep (Tx)	Read
			STX	Read Written
			PRC	Read
	Common Instance Reference	M	PxM	Read; Written
			STX	Written
	SOP Common	M	PxM	Read; Written
			STX	Written

9.14 MODULEs

9.14.1 Approval Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Approval Status	(300E,0002)	1	Approval status at the time the SOP Instance was created. Enumerated Values: APPROVED Reviewer recorded that object met an implied criterion UNAPPROVED No review of object has been recorded REJECTED Reviewer recorded that object failed to meet an implied criterion	TxPlanDef	Written; New or copied plans are always set to UNAPPROVED Recalculation: set to UNAPPROVED
				WS	Read (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				VxPlan	Read
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PxM	Written; UNAPPROVED
Review Date	(300E,0004)	2C	Date on which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	TxPlanDef	Recalculation: removed
				WS	Read (ignored)
				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				PxM	Removed if present
Review Time	(300E,0005)	2C	Time at which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	TxPlanDef	Recalculation: removed
				WS	Read (ignored)
				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				PxM	Removed if present
Reviewer Name	(300E,0008)	2C	Name of person who reviewed object. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	TxPlanDef	Recalculation: removed
				WS	Read (ignored)
				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				PxM	Removed if present
Treatment Approval Sequence	(300B,xx90)	3	This sequence is used to encapsulate the treatment approval information. At most one item may be included in this list.	WS	Read (ignored)
				DCO	Read (BC)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
>Approval Status	(300E,0002)	1	Approval status at the time the SOP Instance was created. Enumerated Values: APPROVED Reviewer recorded that object met an implied criterion UNAPPROVED No review of object has been recorded REJECTED Reviewer recorded that object failed to meet an implied criterion	WS	Read (ignored)
				DCO	Read (BC)
>Review Date	(300E,0004)	2C	Date on which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	WS	Read (ignored)
>Review Time	(300E,0005)	2C	Time at which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	WS	Read (ignored)
>Reviewer Name	(300E,0008)	2C	Name of person who reviewed object. Required if Approval Status (300E,0002) is APPROVED or REJECTED.	WS	Read (ignored)

9.14.2 Common Instance Reference

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Include Series and Instance Reference Macro, Table 10-4.			Identifies all Series within the Study of which this Instance is a part, which Series contain Instances that are referenced elsewhere in this Instance.	STX	Written
				PxM	Supported; Typically only one series for reference image set, but 2 studies possible for hybrid scanner or rearranged data
Studies Containing Other Referenced Instances Sequence	‘(0008,1200)	1C	Sequence of items each identifying a Study other than the Study of which this Instance is a part, which Studies contain Instances that are referenced elsewhere in this Instance. One or more Items shall be present. Required if this Instance references Instances in other Studies.	PxM	Supported; Typically used for model image set
>Study Instance UID	‘(0020,000D)	1	Unique identifier of the Study containing the referenced Instances.	PxM	Supported; Typically used for model image set
>Include Series and Instance Reference Macro, Table 10-4.				PxM	Supported; Typically used for model image set

9.14.3 Contrast Bolus Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Contrast/Bolus Agent	(0018,0010)	2	Contrast or bolus agent	DCO	Read must not be present

9.14.4 CT Image Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.8.2.1.1.3 for specialization.	DCO	Read Has to be MONOCHROME2
KVP	(0018,0060)	2	Peak kilo voltage output of the x-ray generator used	DCO	Read Must be filled
Reconstruction Diameter	(0018,1100)	3	Diameter in mm of the region from within which data were used in creating the reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.	DCO	Read Must be filled
Exposure	(0018,1152)	3	The exposure expressed in mAs, for example calculated from Exposure Time and X-Ray Tube Current.	DCO	Read Must be filled
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data	DCO	Read Must be filled

9.14.5 Encapsulated Document Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Content Date	‘(0008,0023)	2	The date the document content creation was started.	Rep (Tx)	Written
				Rep (Vx)	Written
Content Time	‘(0008,0033)	2	The time the document content creation was started.	Rep (Tx)	Written
				Rep (Vx)	Written
Burned In Annotation	‘(0028,0301)	1	Indicates whether or not the encapsulated document contains sufficient burned in annotation to identify the patient and date the data was acquired. Enumerated Values: YES NO Identification of patient and date as text in an encapsulated document (e.g., in an XML attribute or element) is equivalent to “burned in annotation”. A de-	Rep (Tx)	Written. Value 'Yes'
				Rep (Vx)	Written. Value 'Yes'

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			identified document may use the value NO.		
Document Title	‘(0042,0010)	2	The title of the document. Note: In the case of a PDF encapsulated document, this may be the value of the “Title” entry in the “Document Information Directory” as encoded in the PDF data.	Rep (Tx)	Written. Value is FxSequenceName-Report
				Rep (Vx)	Written. Value is FxSequenceName-Report
MIME Type of Encapsulated Document	‘(0042,0012)	1	The type of the encapsulated document stream described using the MIME Media Type (see RFC 2046).	Rep (Tx)	written. Value application/pdf
				Rep (Vx)	written. Value application/pdf
Encapsulated Document	‘(0042,0011)	1	Encapsulated Document stream, containing a document encoded according to the MIME Type.	Rep (Tx)	Written
				Rep (Vx)	Written

9.14.6 Encapsulated Doc. Series Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	The modality appropriate for the encapsulated document. This Type definition shall override the definition in the SC Equipment Module. See section C.7.3.1.1.1 for Defined Terms. Note: SR may be an appropriate value for an Encapsulated CDA document with a structured XML Body.	Rep (Tx)	Written by TxSessionData for Encapsulated PDF as "OT"
				Rep (Vx)	Written by TxSessionData for Encapsulated PDF as "OT"
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.	Rep (Tx)	Written
				Rep (Vx)	Written
Series Number	(0020,0011)	1	A number that identifies the Series.	Rep (Tx)	Written
				Rep (Vx)	Written

9.14.7 Frame of Reference Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Frame of Reference UID	(0020,0052)	1	Uniquely identifies the frame of reference for a Series. See C.7.4.1.1.1 for further explanation.	TxPlanDef	Written (copied from referenced image series)
				DCO	written for RT Dose IOD; always the same as corresponding CT Series
				Rep (Tx)	Written (for RT Image; Read from plan and copied to RT image)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				VxPlan	written for RT Dose IOD; always the same as corresponding CT Series
				STX	Spatial Registration: newly created FOR which identifies the STX coordinate system
				FxSeq (Tx)	Written (for RT Image; Read from plan and copied to RT image)
				PRC	Read
Position Reference Indicator	(0020,1040)	2	Part of the patient's anatomy used as a reference, such as the iliac crest, orbitalmedial, sternal notch, symphysis pubis, xiphoid, lower coastal margin, external auditory meatus. See C.7.4.1.1.2 for further explanation.	TxPlanDef	Written (copied from referenced image series)
				Rep (Tx)	Written (for RT Image, always empty)
				FxSeq (Tx)	Written (for RT Image, always empty)

9.14.8 General Equipment Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances.	Comment	Previous implementations of TPS had written it as “Siemens AG, Healthcare Sector, Oncology Care Systems”.
				TxPlanDef	Written; Always “SIEMENS"
				DCO	Written; Always “SIEMENS"; CT Image: Read, has to be present
				Rep (Tx)	Read. Written by Session Data for RTImage ("SIEMENS")
				Rep (Vx)	Read Written by Session Data for RTImage ("SIEMENS")
				VxPlan	Written; Always “SIEMENS"
				STX	Written; Always “SIEMENS"
				FxSeq (Tx)	Written; Always “SIEMENS"

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				FxSeq (Vx)	Written; Always “SIEMENS"
				PxM	Written: SIEMENS Read: During provider classification (intern/extern)
Institution Name	(0008,0080)	3	N	Rep (Tx)	Read
				Rep (Vx)	Read
				PxM	Not supported
Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment that produced the composite instances is located.	Rep (Tx)	Read
				Rep (Vx)	Read
				PxM	Not supported
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the composite instances.	TxPlanDef	Written: <ServerMachineName> on stamping Plans.
				DCO	Read; Must be present if (0018,1000) is not present and vice versa. Written: <ServerMachineName> on stamping Plans.
				Rep (Tx)	Read Written: <ServerMachineName> on stamping Plans, Fraction Sequences and Fraction Sequence Reports.
				Rep (Vx)	Read Written: <ServerMachineName> on stamping Plans, Fraction Sequences and Fraction Sequence Reports
				VxPlan	Written: <ServerMachineName> on stamping Plans.
				STX	Written: <ServerMachineName> on stamping Structure Sets, Spatial Registrations and Spatial Fiducials.
				FxSeq (Tx)	Written: <ServerMachineName> on stamping Fraction Sequences.
				FxSeq (Vx)	Written: <ServerMachineName> on stamping Fraction Sequences.
				PxM	Written: <ServerMachineName> on stamping Structure Sets, and Spatial Registrations.
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that produced the	Rep (Tx)	Read
				Rep (Vx)	Read

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			composite instances is located.	PxM	Not supported
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that produced the composite instances.	Comment	If the DICOM SOP instance is created within the context of a Singapore Clinical Task (=Subtask), then the name of the Clinical Task shall be written into this attribute. If it is created within the WS infrastructure, then "syngo RT WS" (syngo Classic) or "syngo RT WS.NET" (Singapore) shall be written into this attribute.
				TxPlanDef	Written: "syngo RT Define Treatment Plan"
				WS	Read
				DCO	Written: "syngo RT Optimize Treatment Plan"; CT Image: Read, has to be present
				Rep (Tx)	Read Written: "syngo RT Create Fraction Sequence Report" Written for RTImage by Session data("COHERENCE Dosimetrist Workspace")
				Rep (Vx)	Read Written: "syngo RT Create Fraction Sequence Report"
				VxPlan	Written: "syngo RT Create Verification Plan"
				STX	Written: "syngo RT Localize Stereotactic Markers" except for Structure Set IOD for which "COHERENCE Dosimetrist Workspace" is written to support the KONRAD workflow
				FxSeq (Tx)	Written: "syngo RT Manage Fraction Sequence"
				FxSeq (Vx)	Written: "syngo RT Manage Fraction Sequence"
				PxM	Read: During provider classification Written: Patient Modeling
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that produced the composite instances.	DCO	Read; Must be present if (0008,1010) is not present and vice versa

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Tx)	Read
				Rep (Vx)	Read
				PxM	Not supported
Software Versions	(0018,1020)	3	Manufacturer's designation of software version of the equipment that produced the composite instances.	Comment	The version of the software application, subsystem or component denoted by Manufacturer's Model Name (0008,1090).
				TxPlanDef	Written
				DCO	Written
				Rep (Tx)	Read Written for RTImage by Session data
				Rep (Vx)	Written
				VxPlan	Written
				STX	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
				PxM	Read: During provider classification Written: VC10
Pixel Padding Value	(0028,0120)	3	Value of pixels added to non-rectangular image to pad to rectangular format. Note: The Value Representation of this Attribute is determined by the value of Pixel Representation (0028,0103). Pixel Padding Value (0028,0120) is used to pad non-rectangular images to rectangle format. The native format of some images is not rectangular. It is common for devices with this format to pad the images to the rectangular format required by the DICOM Standard with a specific pixel value that is not contained in the native image. This attribute specifies the value of this padding value. Note: 1. When the relationship between pixel value and X-Ray Intensity is unknown, it is recommended that the following values be used to pad with black: 0 if Photometric Interpretation (0028,0004) is MONOCHROME2. 2**BitsStored minus 1 if Photometric Interpretation (0028,0004) is MONOCHROME1. 2. When the relationship between pixel value and X-Ray Intensity is known (for example as defined by Pixel Intensity Relationship (0028,1040) and Pi	DCO	Read

9.14.9 General Image Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Instance Number	(0020,0013)	2	A number that identifies this image. Note: This Attribute was named Image Number in earlier versions of this Standard.	Rep (Tx)	Written for RTImage (by Session Data)
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. Required if image does not require Image Orientation (Patient) (0020,0037) and Image Position (Patient) (0020,0032). Note: IOD's may have attributes other than Patient Orientation, Image Orientation, or Image Position (Patient) to describe orientation in which case this attribute will be zero length. The Patient Orientation (0020,0020) relative to the image plane shall be specified by two values that designate the anatomical direction of the positive row axis (left to right) and the positive column axis (top to bottom). The first entry is the direction of the rows, given by the direction of the last pixel in the first row from the first pixel in that row. The second entry is the direction of the columns, given by the direction of the last pixel in the first column from the first pixel in that column. Anatomical direction shall be designated by the capital letters: A (anterior), P (posterior), R (right), L (left), H (head), F (foot). Each value of the or	DCO	Read; Must be 1\0\0\0\1\0
				Rep (Tx)	Written (for RT image; value provided by viewing component)
Content Date	(0008,0023)	2C	The date the image pixel data creation started. Required if image is part of a series in which the images are temporally related. Note: This Attribute was formerly known as Image Date.	Rep (Tx)	Written for RTImage (by Session Data)
Content Time	(0008,0033)	2C	The time the image pixel data creation started. Required if image is part of a series in which the images are temporally related. Note: This attribute was formerly known as Image Time.	Rep (Tx)	Written for RTImage (by Session Data)
Source Image Sequence	(0008,2112)	3	A Sequence that identifies the set of Image SOP Class/Instance pairs of the Images that were used to derive this Image. Zero or more Items may be included in this Sequence. If an Image is identified to be a Derived image (compare Image Type), Source Image Sequence (0008,2112) is an optional list of Referenced SOP Class UID (0008,1150)/Referenced SOP Instance UID (0008,1150) pairs which identify the source images used to create the Derived image. It may be used whether or not there is a description of the way the image was derived in Derivation Description (0008,2111) or Derivation Code Sequence (0008,9215).	Comment	This attribute is used for maintaining the versioning relationship between images in the syngo RT context. Note that branching version chains is technically possible using this attribute, but it is forbidden in

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					syngo RT.
Image Comments	(0020,4000)	3	User-defined comments about the image.	Rep (Tx)	Written. DRR. (value provided by Viewing Component)

9.14.10 General Series Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. Defined Terms: AS - Angioscopy (retired) AU - Audio BI - Biomagnetic imaging CD - Color flow Doppler CF - Cinefluorography (retired) CP - Culposcopy (retired) CR - Computed Radiography CS - Cystoscopy (retired) CT - Computed Tomography DD - Duplex Doppler DF - Digital fluoroscopy (retired) DG - Diaphanography DM - Digital microscopy (retired) DS - Digital Subtraction Angiography (retired) DX - Digital Radiography IO - Intra-oral Radiography IVUS - Intravascular Ultrasound EC - Echocardiography (retired) ECG - Electrocardiography EPS - Cardiac Electrophysiology ES - Endoscopy FA - Fluorescein angiography (retired) FS - Fundoscopy (retired) HC - Hard Copy HD - Hemodynamic Waveform LP - Laparoscopy (retired) LS - Laser surface scan MA - Magnetic resonance angiography (retired) MR - Magnetic Resonance (incorporates the retired modalities MA and MS) MS - Magnetic resonance spectroscopy (retired) MG - Mammography NM - Nuclear Medicine OT - Other PR - Presentation State PT - Positron emission	TxPlanDef	Read
				WS	Read
				STX	written "REG" for registration series
				PxM	Written; REG for Spatial Registrations
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.	TxPlanDef	Read; if Modality (0008,0060) is CT: Displayed in image set selection combo for plan creation if Series

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Description (0008,103E) is not set
				Rep (Tx)	Written for RTImage (by Session Data)
				STX	Written
				PxM	Written
Series Number	(0020,0011)	2	A number that identifies this Series.	TxPlanDef	Read
				Rep (Tx)	Written for RTImage (by Session Data)
				PxM	Written
Series Date	(0008,0021)	3	Date the Series started.	WS	Read; (ignored)
				Rep (Tx)	Written for RTImage (by Session Data)
Series Time	(0008,0031)	3	Time the Series started.	WS	Read; (ignored)
				Rep (Tx)	Written for RTImage
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed. Note: This attribute conveys series-specific protocol identification and may or may not be identical to the one presented in the Performed Protocol Code Sequence (0040,0260).	WS	Read; (ignored)
				STX	written as "TPS_REGMATRIX_PROTOCOL"
Series Description	(0008,103E)	3	User provided description of the Series.	TxPlanDef	Read; if Modality (0008,0060) is CT: Displayed in image set selection combo for plan creation
				WS	Read; replaced by '???' if not present
				STX	written as "STX Spatial Registration Series"
Operators' Name	(0008,1070)	3	Names(s) of the operator(s) supporting the Series.	PxM	Written: User logged into RTC
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment. Defined Terms: HFP Head First-Prone HFS Head First-Supine HFDR Head First-Decubitus Right HFDL Head First-Decubitus Left FFDR Feet First-Decubitus Right FFDL Feet First-Decubitus Left FFP Feet First-Prone FFS Feet First-SupineRequired if CT or MR images; shall not be present if Patient Orientation Code Sequence (0054,0410) is present; may be present otherwise. Patient Position (0018,5100) specifies the position of the patient relative to the imaging equipment space. This attribute is intended for annotation purposes only. It does not provide an exact	Comment	For planning CT: HFS, HFP, FFS, FFP required for ION planning Patient Position Tag will be compared with Image Orientation (Patient) (0020,0037) vector for consistency, eg. HFS == (100,010)
				TxPlanDef	Read; Must be set for planning CT
				DCO	Read. Currently only HFS is supported.
				PxM	Read; Written: Copied from planning CT

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			mathematical relationship of the patient to the imaging equipment. When facing the front of the imaging equipment, Head First is defined as the patient's head being positioned toward the front of the imaging equipment. Feet First is defined as the patient's feet being positioned toward the front of the imaging equipment. Prone is defined as the patient's face being positioned in a downwards (gravity) directi		

9.14.11 General Study Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT
				WS	Read
				DCO	Read Written by SessionData for RTIonPlan, RTDose copied from Planning CT
				Rep (Tx)	Read Written by SessionData for RTIonPlan,RTImage copied from Planning CT for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				Rep (Vx)	Read Written by SessionData for RTIonPlan copied from Planning CT for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				VxPlan	Read Written by SessionData for RTIonPlan, RTDose copied from Planning CT
				STX	Read Written by SessionData for Spatial Registration and Structure Set copied

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					from Planning CT
				FxSeq (Tx)	Read Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				FxSeq (Vx)	Read Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				PRC	Read
				PXM	Written; Copied from Planning CT
Study Date	(0008,0020)	2	Date the Study started.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written by SessionData for RTIonPlan,RTImage copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				Rep (Vx)	Written by SessionData for RTIonPlan copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					and Structure Set copied from Planning CT if present
				FxSeq (Tx)	Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				FxSeq (Vx)	Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				PXM	Written; Copied from Planning CT
Study Time	(0008,0030)	2	Time the Study started.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written by SessionData for RTIonPlan,RTImage copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				Rep (Vx)	Written by SessionData for RTIonPlan copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				FxSeq (Tx)	Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				FxSeq (Vx)	Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise newly generated.
				PXM	Written; Copied from Planning CT
Referring Physician's Name	(0008,0090)	2	Patient's referring physician	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
Referring Physician Identification Sequence	(0008,0096)	3	Identification of the patient's referring physician. Only a single item shall be permitted in this sequence.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
>Include 'Person Identification Macro' from Table 10-1				PXM	Written; Copied from Planning CT
Study ID	(0020,0010)	2	User or equipment generated Study identifier.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
Accession Number	(0008,0050)	2	A RIS generated number which identifies the order for the Study.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
Study Description	(0008,1030)	3	Institution-generated description or classification of the Study (component) performed.	TxPlanDef	Read Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written by SessionData for RTIonPlan,RTImage copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				Rep (Vx)	Written by SessionData for RTIonPlan copied from Planning CT if present for FractionSequence SR, FractionSequenceReport EPDF copied from previous version of FractionSequence SR.
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				FxSeq (Tx)	Written by SessionData for FractionSequence

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise written as "Additional Patient Information"
				FxSeq (Vx)	Written by SessionData for FractionSequence SR, copied from previous version of FractionSequence SR or other Fraction Sequences if present otherwise written as "Additional Patient Information"
				PXM	Written; Copied from Planning CT
Physician(s) of Record	(0008,1048)	3	Name(s) of the physician(s) who are responsible for overall patient care at time of Study (see Section C.7.3.1 for Performing Physician) .	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
Physician(s) of Record Identification Sequence	(0008,1049)	3	Identification of the physician(s) who are responsible for overall patient care at time of Study. One or more items shall be included in this sequence. If more than one Item, the number and order shall correspond to the value of Physician(s) of Record (0008,1048), if present.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
>Include 'Person Identification Macro' from Table 10-1				PXM	Written; Copied from Planning CT
Name of Physician(s) Reading Study	(0008,1060)	3	Name(s) of the physician(s) reading the Study.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
Physician(s) Reading Study Identification Sequence	(0008,1062)	3	Identification of the physician(s) reading the Study. One or more items shall be included in this sequence. If more than one Item, the number and order shall correspond to the value of Name of Physician(s) Reading Study (0008,1060), if present.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
>Include 'Person Identification Macro' from Table 10-1				PXM	Written; Copied from Planning CT
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more Items.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written for RTIonPlan,RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Study Sequence (0008,1110) is sent.	PXM	Written; Copied from Planning CT
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Study Sequence (0008,1110) is sent.	PXM	Written; Copied from Planning CT
Procedure Code Sequence	(0008,1032)	3	A Sequence that conveys the type of procedure performed. One or more items may be included in this Sequence.	TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					present
				Rep (Tx)	Written for RTImage by SessionData; Copied from Planning CT if present
				Rep (Vx)	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration and Structure Set copied from Planning CT if present
				PXM	Written; Copied from Planning CT
>Include 'Code Sequence Macro' from Table 8.8-1				PXM	Written; Copied from Planning CT

9.14.12 Image Pixel Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. See C.7.6.3.1.1 for further explanation.	DCO	RT Dose: written
				VxPlan	RT Dose: written
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. Defined Terms: MONOCHROME1 MONOCHROME2 PALETTE COLOR RGB YBR_FULL YBR_FULL_422 YBR_PARTIAL_422 YBR_PARTIAL_420 YBR_RCT YBR_ICT See C.7.6.3.1.2 for further explanation.	DCO	RT Dose: written
				VxPlan	RT Dose: written
Rows	(0028,0010)	1	Number of rows in the image.	DCO	RT Dose: written
				Rep (Tx)	Written for RT Image (value provided by Viewing Component)
				VxPlan	RT Dose: written
Columns	(0028,0011)	1	Number of columns in the image	DCO	RT Dose: written
				Rep (Tx)	Written for RT Image (value provided by Viewing Component)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				VxPlan	RT Dose: written
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated Values: 0000H unsigned integer 0001H 2's complement	DCO	CT Image: Read, must be 0
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples that comprise the Image. See C.7.6.3.1.4 for further explanation.	Rep (Tx)	Written for RT Image (value provided by Viewing Component)

9.14.13 Image Plane Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. See C.7.6.2.1.1 for further explanation.	DCO	CT Image: Must be 1\0\0\0\1\0
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.	DCO	CT Image: Must be filled, value within [1,5]; Must be identical for all slices

9.14.14 Multi-Frame Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image. See C.7.6.6.1.1 for further explanation.	DCO	Written for Pixel based RT Dose
				VxPlan	Written for Pixel based RT Dose
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tag of the attribute that is used as the frame increment in Multi-frame pixel data. See C.7.6.6.1.2 for further explanation.	DCO	Written for Pixel based RT Dose
				VxPlan	Written for Pixel based RT Dose

9.14.15 Patient Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Patient's Name	(0010,0010)	2	The patient's full name.	TxPlanDef	Written copied from study
				Rep (Tx)	Written for Fraction Sequence, Fraction Sequence Report EPDF and RT Image copied from study
				Rep (Vx)	Written for Fraction Sequence, Fraction Sequence Report EPDF copied from study
				VxPlan	Written for RT Dose, RT Ion Plan copied from TxPlan Read for RT Ion Plan
				STX	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
				PxM	Written Copied from CT
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient.	TxPlanDef	Written copied from study
				Rep (Tx)	Written for Fraction Sequence, Fraction Sequence Report EPDF and RT Image copied from study
				Rep (Vx)	Written for Fraction Sequence, Fraction Sequence Report EPDF copied from study
				VxPlan	Written for RT Dose, RT Ion Plan copied from TxPlan Read for RT

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Ion Plan
				STX	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
				PxM	Written Copied from CT
Issuer of Patient ID	(0010,0021)	3	Identifier of the Assigning Authority that issued the Patient ID.	PxM	Written; Copied from Planning CT
Patient's Birth Date	(0010,0030)	2	Birth date of the patient.	TxPlanDef	Written copied from study
				Rep (Tx)	Written for Fraction Sequence, Fraction Sequence Report EPDF and RT Image copied from study
				Rep (Vx)	Written for Fraction Sequence, Fraction Sequence Report EPDF copied from study
				VxPlan	Written for RT Dose, RT Ion Plan copied from TxPlan Read for RT Ion Plan
				STX	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
				PxM	Written Copied from CT
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values: M = Male F = Female O = Other	TxPlanDef	Written copied from study
				Rep (Tx)	Written for Fraction Sequence, Fraction Sequence Report EPDF and RT Image copied from study
				Rep (Vx)	Written for Fraction Sequence, Fraction Sequence Report EPDF copied from

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					study
				VxPlan	Written for RT Dose, RT Ion Plan copied from TxPlan Read for RT Ion Plan
				STX	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
				PxM	Written Copied from CT
Referenced Patient Sequence	(0008,1120)	3	A sequence which provides reference to a Patient SOP Class/Instance pair. Only a single Item shall be permitted in this Sequence.	PxM	Written; Copied from Planning CT
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Patient Sequence (0008,1120) is sent.	PxM	Written; Copied from Planning CT
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Patient Sequence (0008,1120) is sent.	PxM	Written; Copied from Planning CT
Patient's Birth Time	(0010,0032)	3	Birth time of the Patient.	PxM	Written; Copied from Planning CT
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient.	PxM	Written; Copied from Planning CT
Other Patient Names	(0010,1001)	3	Other names used to identify the patient.	PxM	Written; Copied from Planning CT
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient.	PxM	Written; Copied from Planning CT
Patient Comments	(0010,4000)	3	User-defined additional information about the patient.	PxM	Written; Copied from Planning CT
Patient’s Telephone Numbers	(0010,2154)	3	Telephone numbers at which the patient can be reached	Comment	Attribute is taken from the patient demographic module and is not defined in the patient module.
				PxM	Written; Copied from Planning CT

9.14.16 Patient Study Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Patient's Age	‘(0010,1010)	3	Age of the Patient.	Comment	Study
				TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written by SessionData for RTIonPlan,RTImage copied from Planning CT if present
				Rep (Vx)	Written by SessionData for RTIonPlan copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration, Spatial Fiducial and Structure Set copied from Planning CT if present
Patient's Size	‘(0010,1020)	3	Length or size of the Patient, in meters.	Comment	Patient
Patient's Weight	‘(0010,1030)	3	Weight of the Patient, in kilograms.	Comment	Study
				TxPlanDef	Written for RTIonPlan by SessionData; Copied from Planning CT if present
				DCO	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				Rep (Tx)	Written by SessionData for RTIonPlan,RTImage copied from Planning CT if present

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Vx)	Written by SessionData for RTIonPlan copied from Planning CT if present
				VxPlan	Written for RTIonPlan, RTDose by SessionData; Copied from Planning CT if present
				STX	Written by SessionData for Spatial Registration, Spatial Fiducial and Structure Set copied from Planning CT if present

9.14.17 ROI Contour Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
ROI Contour Sequence	‘(3006,0039)	1	Introduces sequence of Contour Sequences defining ROIs. One or more items may be included in this sequence.	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	RT StructureSet: Read (BC) RT Dose: written
				VxPlan	Written for RT Dose IOD as one item per PinPointChamber
				STX	Modified
				PxM	Supported
>Referenced ROI Number	‘(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).	TxPlanDef	Read
				DCO	RT StructureSet: Read (BC) RT Dose: written
				VxPlan	Written
				STX	Read Written
				PxM	Read; Written
>ROI Display Color	‘(3006,002A)	3	RGB triplet color representation for ROI, specified using the range 0-255.	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	Read (BC)
				STX	Read Written
				PxM	Read; Written: User selected value;
>Contour Sequence	‘(3006,0040)	3	Introduces sequence of Contours defining ROI. One or more items may be included in this sequence.	TxPlanDef	Read
				STX	Modified For "STXFrame" VOI there can be zero or more contour sequences. For "STXOrigin" Reference Point, only one contour sequence is stored.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				PxM	Read; Written
>>Contour Number	‘(3006,0048)	3	Identification number of the contour. The value of Contour Number (3006,0048) shall be unique within the Contour Sequence (3006,0040) in which it is defined. No semantics or ordering shall be inferred from this attribute.	TxPlanDef	Read
				STX	Written
>>Contour Image Sequence	‘(3006,0016)	3	Introduces sequence of images containing the contour. One or more items may be included in this sequence.	TxPlanDef	Read
				STX	Written; Passed for every contour sequence. This is passed only for "STXFrame" VOI and NOT for "STXOrigin" reference point.
				PxM	Read; Written
>>>Include ‘Image SOP Instance Reference Macro’ Table 10-3				PxM	Read; Written: Reference SOP Class UID is always 1.2.840.10008.5.1.4.1.1.2 Reference SOP Instance UID provides the reference to the image on which the contour is defined
>>Contour Geometric Type	‘(3006,0042)	1C	Geometric type of contour. Required if Contour Sequence (3006,0040) is sent. See C.8.8.6.1. Enumerated Values: POINT = single point OPEN_PLANAR = open contour containing coplanar points OPEN_NONPLANAR = open contour containing non-coplanar points CLOSED_PLANAR = closed contour (polygon) containing coplanar points	TxPlanDef	Read
				WS	Read; (ignored)
				VxPlan	Written; always POINT
				STX	Written; For "STXOrigin" Reference Point, the value is “POINT”. For "STXFrame" VOI the value is always “CLOSED_PLANAR”
				PxM	Read; Written: For ROIs CLOSED_PLANAR For POIs POINT
>>Number of Contour Points	‘(3006,0046)	1C	Number of points (triplets) in Contour Data (3006,0050). Required if Contour Sequence (3006,0040) is sent.	TxPlanDef	Read
				VxPlan	Written; Always 1
				STX	Modified; Always 1 for Reference Point.
				PxM	Written; For ROIs: VM(Contour Data)/3 For POIs: 1
>>Contour Data	‘(3006,0050)	1C	Sequence of (x,y,z) triplets defining a contour in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required if Contour Sequence	TxPlanDef	Read
				WS	Read; (ignored) (if Contour Geometric Type = POINT)
				VxPlan	Written;

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			(3006,0040) is sent. See C.8.8.6.1 and C.8.8.6.3. Note: Contour Data may not be properly encoded if Explicit-VR transfer syntax is used and the VL of this attribute exceeds 65534 bytes.		the position of the corresponding PinPointChamber
				STX	Modified
				PxM	Read; Written

9.14.18 RT Beams Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Beam Sequence	‘(300A,00B0)	1	Introduces sequence of treatment beams for current RT Plan. One or more items may be included in this sequence.	WS	Read; (ignored)
>Beam Number	‘(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Plan in which it is created. See Note 1.	WS	Read; (ignored)
				PRC	Read
>Beam Name	‘(300A,00C2)	3	User-defined name for Beam. See Note 1.	WS	Read; (ignored)
				PRC	Read
>Beam Description	‘(300A,00C3)	3	User-defined description for Beam. See Note 1.	WS	Read; (ignored)
>Beam Type	‘(300A,00C4)	1	Motion characteristic of Beam. See Note 5. Enumerated Values: STATIC = All Control Point Sequence (300A,0111) attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). DYNAMIC = One or more Control Point Sequence (300A,0111) attributes change between one or more consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134).	WS	Read; (ignored)
>Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding treatment beam specified by Beam Number (300A,00C0) within Beam Sequence in RT (Ion) Beams Module within the RT (Ion) Plan referenced in Referenced RT Plan Sequence (300C,0002).	VxPlan	Written. This field is used for verification plans with Verification Method (300B,xx19) SEPARATE_BEAMS in order to link a treatment beam to the corresponding verification beam. FxSequence (Vx): Read
>Radiation Type	‘(300A,00C6)	2	Particle type of Beam. Defined Terms: PHOTON ELECTRON NEUTRON PROTON	WS	Read; (ignored)
>Treatment Machine Name	‘(300A,00B2)	2	User-defined name identifying treatment machine to be used for beam delivery. See Note 2.	WS	Read; (ignored)
>Primary Dosimeter Unit	‘(300A,00B3)	3	Measurement unit of machine dosimeter. See C.8.8.14.1. Enumerated Values: MU = Monitor Unit MINUTE = minute	WS	Read; (ignored)
>>RT Beam Limiting Device Type	‘(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction	Comment	Electron Planning: MLCX might be needed. If so, Pdef should write it.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction		
>>Source to Beam Limiting Device Distance	‘(300A,00BA)	3	Radiation source to beam limiting device (collimator) distance of the equipment that is to be used for beam delivery (mm).	Comment	Electron Planning: Pdef should write it.
>>Number of Leaf/Jaw Pairs	‘(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).	Comment	Electron Planning: Pdef should write it.
>>Leaf Position Boundaries	‘(300A,00BE)	2C	Boundaries of beam limiting device (collimator) leaves (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if Beam Limiting Device Sequence (300A,00B6) is sent and RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY. See Note 3.	Comment	Electron Planning: Pdef should write it.
>Referenced Patient Setup Number	‘(300C,006A)	3	Uniquely identifies Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.	Comment	Has to be written in the case that an isocenter is created.
>Planned Verification Image Sequence	‘(300A,00CA)	3	Introduces sequence of planned verification images to be acquired during current beam. One or more items may be included in this sequence. See C.8.8.14.2.	Comment	Electron Planning: Not used (no imaging beams with electron radiation possible)
>Treatment Delivery Type	‘(300A,00CE)	3	Delivery Type of treatment. Defined Terms: TREATMENT = normal patient treatment OPEN_PORTFILM = portal image acquisition with open field TRMT_PORTFILM = portal image acquisition with treatment port CONTINUATION = continuation of interrupted treatment SETUP no treatment beam is applied for this RT Beam. To be used for specifying the gantry, couch, and other machine positions where X-ray set-up images or measurements shall be taken.	Comment	Note that in "RT Ion Beams::Treatment Delivery Type", a private extension XA_Imaging exists. As of writing this comment (2008-04-17), TxSessionData.NET returns the same enum for both RT Beam and RT Ion Beam for sake of simplicity of the implementation. The private extension XA_Imaging should not be used inside RT Beams. In contrast, RT Ion Beams should be extended to allow for the same Imaging@Treatment modelling facilities as RT Beam does.
				PRC	Read
>>Block Number	‘(300A,00FC)	1C	Identification number of the Block. The value of Block Number (300A,00FC) shall be unique within the Beam in which	Comment	Session Data will create that number

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			it is created. Required if Block Sequence (300A,00F4) is sent.		
>>Block Name	‘(300A,00FE)	3	User-defined name for block.	Comment	Both for configured blocks and user defined blocks this is part of the config data.
>>Block Transmission	‘(300A,0102)	2C	Transmission through the block (between 0 and 1) at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). Required if Block Sequence (300A,00F4) is sent and Material ID (300A,00E1) is zero length. See C.8.8.14.4.	Comment	For Electron Planning the Block Transmission must not be filled.
>Number of Therapy Detectors	(300B,xxA3)	3	Number of Therapy Detectors associated with current beam.	Comment	Introduced this sequence in analogy to RT Ion Beams.
>>Therapy Detector Setup ID	(300B,xxA6)	1	User or machine supplied identifier for setup containing Therapy Detector.	Comment	This is the ID of the corresponding TherapyDetectorInPhantom instance in Admin&Config
>Number of Control Points	‘(300A,0110)	1	Number of control points in Beam.	WS	Read; (ignored) (TxBeams, only first CP)
>>>Beam Dose Point Depth	(300A,0088)	3	The depth (in mm) in the patient along a ray from the source to the referenced Dose Reference at the current Control Point. This value should be provided only if the referenced Dose Reference Structure Type (300A,0014) is COORDINATES. The depth shall take into account the stated Gantry Angle (300A,011E), Beam Limiting Device Angle (300A,0120), and Patient Support Angle (300A,0122) of the current Control Point.	Comment	PlanDef: Currently only POINT is used. -> This tag shall not be applied.
>>>Beam Dose Point Equivalent Depth	(300A,0089)	3	The radiological depth in mm (water-equivalent depth, taking tissue heterogeneity into account) in the patient along a ray from the source to the referenced Dose Reference at the current Control Point. This value should be provided only if the referenced Dose Reference Structure Type (300A,0014) is COORDINATES. The radiological depth shall take into account the stated Gantry Angle (300A,011E), Beam Limiting Device Angle (300A,0120), and Patient Support Angle (300A,0122) of the current Control Point.	Comment	PlanDef: Currently only POINT is used. -> This tag shall not be applied.
>>>Beam Dose Point SSD	(300A,008A)	3	Source to patient surface distance along a ray from the source to the referenced Dose Reference at the current Control Point. This value should be provided only if the referenced Dose Reference Structure Type (300A,0014) is COORDINATES. The Source to patient surface distance shall	Comment	PlanDef: Currently only POINT is used. -> This tag shall not be applied.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			take into account the stated Gantry Angle (300A,011E), Beam Limiting Device Angle (300A,0120), and Patient Support Angle (300A,0122) of the current Control Point.		
>>Nominal Beam Energy	‘(300A,0114)	3	Nominal Beam Energy at control point (MV/MeV).	WS	Read; (ignored) (TxBeams, only first CP)
>>Wedge Position Sequence	‘(300A,0116)	3	A Sequence of Items describing Wedge Positions for the current control point. Required for first item of Control Point Sequence if Number of Wedges (300A,00D0) is non-zero, and in subsequent control points if Wedge Position (300A,0118) changes during Beam. See C.8.8.14.5. The number of items in this sequence shall equal the value of Number of Wedges (300A,00D0).	Comment	Not needed for Electron Planning
>>>RT Beam Limiting Device Type	‘(300A,00B8)	1C	Type of beam limiting device (collimator). The value of this attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an item of Beam Limiting Device Sequence (300A,00B6). Required if Beam Limiting Device Position Sequence (300A,011A) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction	Comment	Electron planning: Only the following in principle is applicable: X, ASYMX, Y, ASYMY
>>Therapy Detector Settings Sequence	(300B,xxA7)	3	Introduces sequence of Therapy Detector settings for the current control point. One or more items may be included in this sequence. Required for first item of Control Point Sequence if Number of Therapy Detectors (300B, ..) is non-zero, or if Therapy Detector Setting (300B, ..) changes during Beam.	Comment	Introduced this sequence in analogy to RT Ion Beams.
				VxPlan	Only for VxPlans: Read Written
>>>Referenced Therapy Detector Number	(300B,xxA8)	1	Uniquely references Therapy Detector described by Therapy Detector Number (300B,xxA5) in Therapy Detector Sequence (300B,xxA4).	VxPlan	Only for VxPlans: Read Written
>>>Therapy Detector Position	(300B,xxA9)	1	Therapy Detector coordinates (x,y,z) in the patient based coordinate system described in C.7.6.2.1.1 (mm).	VxPlan	Only for VxPlans: Read Written
>>Gantry Angle	‘(300A,011E)	1C	Gantry angle of radiation source, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if	WS	Read; (ignored) (TxBeams)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Gantry Angle changes during Beam.		
>>Gantry Rotation Direction	‘(300A,011F)	1C	Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Rotation Direction changes during Beam. See C.8.8.14.8. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation	WS	Read; (ignored) (TxBeams)
>>Beam Limiting Device Angle	‘(300A,0120)	1C	Beam Limiting Device angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Beam Limiting Device Angle changes during Beam.	WS	Read; (ignored) (TxBeams, only first CP)
>>Patient Support Angle	‘(300A,0122)	1C	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Patient Support Angle changes during Beam.	WS	Read; (ignored) (TxBeams, only first CP)
>>Table Top Lateral Position	‘(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Lateral Position changes during Beam. See C.8.8.14.6.	WS	Read; (ignored) (TxBeams, only first CP)
>>Isocenter Position	‘(300A,012C)	2C	Isocenter coordinates (x,y,z) in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required for first item of Segment Control Point Sequence, or if Segment Isocenter Position changes during Beam.	WS	Read; (ignored) (TxBeams, only first CP)
> Referenced Target ROI Sequence	(300B,xx80)	3	Introduces a sequence of target ROIs associated with this beam. Required, if the beam only references a subset of ROIs in Structure Set Module. This tag is required (i.e. implicitly type '1') within TPS.	Comment	A beam may be restricted to a subset of target (!) ROIs. There are some limitations with respect to the applicable optimization algorithm, though! If no such SQ exists in the plan, we assume that all tagrets are assigned to this beam. In such a case, all expansion margins are taken to be 0.
				WS	Read; (ignored)
>> Referenced ROI Number	(3006,0084)	1	Uniquely identifies the ROIs representing targets for this beam, specified by ROI number in Structure Set ROI Sequence in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence in RT General Plan Module.	WS	Read; (ignored)
>> Target ROI lateral	(300B,xx82)	3	Specifies the lateral extension of	Comment	Introduced to have the

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
expansion margin			the target in mm within which beamspots may be placed. This value overrides a possible value stored in Target lateral expansion margin in sequence Target expansion sequence.		possibility to have individual expansion margins for each target of a beam.
> Display Color	(300B,xx9C)	3	Display color of the beam stored as 3 RGB values in the range of 0..255.	WS	Read; (ignored) (TxBeams)

9.14.19 RT Dose Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Samples per Pixel	(0028,0002)	1C	Number of samples (planes) in this image. See C.8.8.3.4.1 for specialization. Required if Pixel Data (7FE0,0010) is present.	DCO	Written
Photometric Interpretation	(0028,0004)	1C	Specifies the intended interpretation of the pixel data. See C.8.8.3.4.2 for specialization. Required if Pixel Data (7FE0,0010) is present.	DCO	Written
Bits Allocated	(0028,0100)	1C	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. See C.8.8.3.4.3 for specialization. Required Pixel Data (7FE0,0010) is present.	DCO	Written
Bits Stored	(0028,0101)	1C	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. See C.8.8.3.4.4 for specialization. Required if Pixel Data (7FE0,0010) is present.	DCO	Written
High Bit	(0028,0102)	1C	Most significant bit for each pixel sample. Each sample shall have the same high bit. See C.8.8.3.4.5 for specialization. Required if Pixel Data (7FE0,0010) is present.	DCO	Written
Pixel Representation	(0028,0103)	1C	Data representation of the pixel samples. Each sample shall have the same pixel representation. See C.8.8.3.4.6 for specialization. Required Pixel Data (7FE0,0010) is present.	DCO	Written
Dose Units	(3004,0002)	1	Units used to describe dose. Enumerated Values: GY = Gray RELATIVE = dose relative to implicit reference value	DCO	Written
				VxPlan	Written always GY
				PRC	Read
Dose Type	(3004,0004)	1	Type of dose. Defined Terms: PHYSICAL = physical dose EFFECTIVE = physical dose after correction for biological effect using user-defined modeling technique ERROR = difference between desired and planned dose	WS	Read (ignored)
				DCO	Written PHYSICAL or EFFECTIVE
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Written always PHYSICAL
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
Instance Number	(0020,0013)	3	A number that identifies this object instance.	DCO	Written
Dose Summation Type	(3004,000A)	1	Type of dose summation. Defined Terms:	WS	Read (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			PLAN = dose calculated for entire RT Plan FRACTION = dose calculated for a single Fraction Group within RT Plan BEAM = dose calculated for one or more Beams within RT Plan BRACHY = dose calculated for one or more Brachy Application Setups within RT Plan CONTROL_POINT = dose calculated for one or more Control Points within a Beam	DCO	Written: - BEAM - PLAN Dose for all fractions planned. FRACTION is no longer used
				VxPlan	Written always BEAM
				FxSeq (Tx)	Read Only PLAN, FRACTION and BEAM are considered
				FxSeq (Vx)	Read Only PLAN, FRACTION and BEAM are considered
				PRC	Read
Referenced RT Plan Sequence	(300C,0002)	1C	Introduces sequence of one Class/Instance pair describing RT Plan associated with dose. Required if Dose Summation Type (3004,000A) is PLAN, FRACTION, BEAM, BRACHY or CONTROL_POINT. Only a single item shall be permitted in this sequence. See Note 1.	TxPlanDef	Read
				WS	Read (ignored)
				DCO	Written
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	TxPlanDef	Read
				DCO	Written
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.	TxPlanDef	Read
				WS	Read (ignored)
				DCO	Written
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>Referenced Fraction Group Sequence	(300C,0020)	1C	Introduces sequence of one Fraction Group containing beams or brachy application setups contributing to dose. Required if Dose Summation Type (3004,000A) is FRACTION, BEAM,	DCO	Written
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			BRACHY or CONTROL_POINT. Only a single item shall be permitted in this sequence. See Note 1.	PRC	Read
>>Referenced Fraction Group Number	(300C,0022)	1C	Uniquely identifies Fraction Group specified by Fraction Group Number (300A,0071) in Fraction Group Sequence of RT Fraction Scheme Module within RT Plan referenced in Referenced RT Plan Sequence (300C,0002). Required if Referenced Fraction Group Sequence (300C,0020) is sent.	DCO	Written
				VxPlan	Written references the treatment fraction Group of the VxPlan
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>>Referenced Beam Sequence	(300C,0004)	1C	Introduces sequence of Beams in current Fraction Group contributing to dose. Required if Dose Summation Type (3004,000A) is BEAM or CONTROL_POINT. One or more items may be included in this sequence.	DCO	Written
				VxPlan	Written contains only one item
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>>>Referenced Beam Number	(300C,0006)	1C	Uniquely identifies Beam specified by Beam Number (300A,00C0) in Beam Sequence of RT Beams Module within RT Plan referenced in Referenced RT Plan Sequence (300C,0002). Required if Referenced Beam Sequence (300C,0004) is sent.	DCO	Written
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>>>Referenced Control Point Sequence	(300C,00F2)	1C	Sequence defining the Control Points in current Beam contributing to dose. Required if Dose Summation Type (3004,000A) is CONTROL_POINT. Only a single item shall be present in this sequence.	DCO	Written
>>>>Referenced Start Control Point Index	(300C,00F4)	1	Identifies Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006). This is the first of the two Control Points from which the Dose contribution to the Control Point can be calculated.	DCO	Written
>>>>Referenced Stop Control Point Index	(300C,00F6)	1	Identifies Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006). This is the second of the two Control Points from which the Dose contribution to the Control Point can be calculated. The Control Point Index (300A,0112) referenced by Referenced Stop Control Point Index (300C,00F6) shall be the Control Point Index (300A,0112) immediately following the Control Point Index (300A,0112) referenced by Referenced Start Control Point Index (300C,00F4) within the Referenced Beam Number (300C,0006).	DCO	Written
Grid Frame Offset Vector	(3004,000C)	1C	An array which contains the dose image plane offsets (in mm) of the dose image frames in a multi-frame dose. Required if multi-frame pixel data are present and Frame Increment Pointer (0028,0009) points to Grid Frame Offset Vector (3004,000C). See C.8.8.3.2.	DCO	Written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Dose Grid Scaling	(3004,000E)	1	Scaling factor that when multiplied by the dose grid data found in the Pixel Data (7FE0,0010) attribute of the Image Pixel Module, yields grid doses in the dose units as specified by Dose Units (3004,0002).	DCO	Written
				VxPlan	Written
Optimized dose type	(300B,xxD5)	3	Specifies from which kind of optimization the dose cube derives. Enumerated values PHYSICAL = physically optimized BIOLOGICAL = biologically optimized	Comment	This must not be confused with the RT Dose Module standard tag "dose type" (3004,0004). A "biological optimization" typically yields two dose distributions: a physical and an effective one. So both attributes need to be known.
				Rep (Tx)	Read (ignored)

9.14.20 RT Dose ROI

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
RT Dose ROI Sequence	(3004,0010)	1	Introduces sequence of items specifying dose levels for isodose curves or dose points described in the ROI module. One or more items may be included in this sequence. See C.8.8.7.1.	DCO	created
				VxPlan	Written; one item per PinPointChamber;
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI within the current RT Dose. See Note 1 and C.8.8.7.2.	DCO	created
				VxPlan	Written; references the ROI that corresponds to the PinPointChamber
>Dose Units	(3004,0002)	1	Units used for ROI Dose. Enumerated Values: GY = Gray RELATIVE = dose relative to implicit reference value	DCO	created
				VxPlan	Written; always GY
>Dose Value	(3004,0012)	1	Dose value for ROI, in units defined by Dose Units (3004,0002). See C.8.8.7.3.	DCO	created
				VxPlan	Written
>Confidence Measure Units	(300B,xxE7)	3	Units used for confidence measure. Defined Terms GYMM = Gray/mm for a dose gradient	Rep (Vx)	Read
				VxPlan	Read; Written
>Confidence Measure Value	(300B,xxE8)	3	Value of the confidence measure for the dose value, in units defined by Confidence Measure Units	Rep (Vx)	Read
				VxPlan	Read; Written

9.14.21 RT Fraction Scheme Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Fraction Group Sequence	(300A,0070)	1	Introduces sequence of Fraction Groups in current Fraction Scheme. One or more items may be included in this sequence.	TxPlanDef	Written Each fraction scheme contains exactly one Fraction Group (300B,xx76) = TREATMENT Additional groups of type IMAGING will be created: one for PV and one PV0 beams Recalculation: remove FxGroups of type IMAGING and MOTION
				WS	Read (ignored)
				Rep (Tx)	Read
				VxPlan	Read / Written
				FxSeq (Tx)	Read
>Fraction Group Number	(300A,0071)	1	Identification number of the Fraction Group. The value of Fraction Group Number (300A,0071) shall be unique within the RT Plan in which it is created.	TxPlanDef	Written
				WS	Read (ignored)
				Rep (Tx)	Read
				VxPlan	Read / Written
				FxSeq (Tx)	Read
>Fraction Group Description	(300A,0072)	3	The user defined description for the fraction group.	Rep (Tx)	Read (ignored)
>Fraction Group Code	(300B,xx76)	3	String Identification for the current fraction group. To easily identify Tx FG and Motion FG and other FGs. TREATMENT for Tx FG MOTION for motion FG IMAGING for imaging FG	TxPlanDef	Written TREATMENT and IMAGING
				WS	Read (ignored)
				Rep (Tx)	Read (ignored)
				VxPlan	Read: exactly one TREATMENT group is required; Written: always TREATMENT

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				FxSeq (Tx)	Read
				PRC	Read
>Referenced Treatment Beam Number	(300B,xx77)	3	Referenced Beam Number (300A,00C0) of Treatment Beam being verified by this imaging fraction group. Required if Fraction Group Code (300B,xx76) is IMAGING and this imaging fraction group verifies as specific treatment beam. If this imaging fraction group does not verify a specific treatment beam, but rather the overall setup, then this attribute is not sent.	TxPlanDef	Written: if Fraction Group Code (300B,xx76) is IMAGING and a specific treatment beam is verified by this imaging fraction group. Not written for PV0 imaging fraction group, and for non imaging fraction groups.
				Rep (Tx)	Read (ignored)
>Referenced Dose Reference Sequence	(300C,0050)	3	Introduces sequence of Dose References for the current Fraction Group. One or more items may be included in this sequence.	Comment	These are all the dose references from the prescription, but augmented with the calculated dose values.
				TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				DCO	Written (SC) if not present
>>Referenced Dose Reference Number	(300C,0051)	1	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) within Dose Reference Sequence (300A,0010) in RT Prescription Module. Required if Referenced Dose Reference Sequence (300C,0050) is sent.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				DCO	Written (SC) if not present
>>Fraction Dose to Dose Reference	(300B,xx78)	3	Dose per individual complete fraction delivered to this Dose Reference in this Fraction Group. Depending on Dose Type (3004,0004) in RT Prescription Module, this value is interpreted either as absorbed (in Gy) or effective (in GyE) Fraction Dose to Dose Reference.	TxPlanDef	Dose reset: removed Dose reference removal:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			If Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET, and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME, and Target Prescription Dose Type (300B,xx15) is MEAN/MEDIAN, then this is the calculated mean/median dose of the referenced volume. If Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET, and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is POINT, then this is the calculated dose in the referenced point. If Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK, then this is the calculated maximum dose in the referenced structure.		removed Recalculation: removed
				DCO	Written (SC) if not present
>>Constraint Weight	(300A,0021)	3	Relative importance of satisfying constraint, where high values represent more important constraints.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Delivery Warning Dose	(300A,0022)	3	The dose (in Gy) which when reached or exceeded should cause some action to be taken.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Delivery Maximum Dose	(300A,0023)	3	The maximum dose (in Gy) which can be delivered to the dose reference.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Target Minimum Dose	(300A,0025)	3	Minimum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Target Prescription Dose	(300A,0026)	3	Prescribed dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.	TxPlanDef	Dose reset: removed

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Dose reference removal: removed Recalculation: removed
>>Target Maximum Dose	(300A,0027)	3	Maximum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Target Underdose Volume Fraction	(300A,0028)	3	Maximum permitted fraction (in percent) of Target to receive less than the Target Prescription Dose (300A,0027) if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Organ at Risk Full-volume Dose	(300A,002A)	3	Maximum dose (in Gy) to entire Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Organ at Risk Limit Dose	(300A,002B)	3	Maximum permitted dose (in Gy) to any part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Organ at Risk Maximum Dose	(300A,002C)	3	Maximum dose (in Gy) to non-overdosed part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Organ at Risk Overdose Volume Fraction	(300A,002D)	3	Maximum permitted fraction (in percent) of Organ at Risk to receive more than the Organ at Risk Maximum Dose if Dose Reference Type (300A,0020) of referenced Dose Reference is	TxPlanDef	Dose reset: removed Dose

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.		reference removal: removed Recalculation: removed
>Number of Fractions Planned	(300A,0078)	2	Total number of treatments (Fractions) prescribed for current Fraction Group.	TxPlanDef	Written; Number of TxFx as defined in prescription (mandatory for subtask)
				WS	Read (ignored) (Tx FG)
				DCO	Read; Mandatory that this value is present and > 0
				VxPlan	Written; always 1
				FxSeq (Tx)	Read
				PRC	Read
>Number of Beams	(300A,0080)	1	Number of Beams in current Fraction Group. If Number of Beams is greater than zero, Number of Brachy Application Setups shall equal zero.	TxPlanDef	Written
				WS	Read (ignored) (Tx FG)
				VxPlan	Read / Written
>Referenced Beam Sequence	(300C,0004)	1C	Introduces sequence of treatment beams in current Fraction Group. Required if Number of Beams (300A,0080) is greater than zero. One or more items may be included in this sequence.	TxPlanDef	Written
				WS	Read (ignored) (Tx FG)
				VxPlan	Read / Written
>>Referenced Beam Number	(300C,0006)	1C	Uniquely identifies Beam specified by Beam Number (300A,00C0) within Beam Sequence (300A,00B0) in RT Beams Module. Required if Referenced Beam Sequence (300C,0004) is sent.	TxPlanDef	Written
				WS	Read (ignored) (Tx FG)
				VxPlan	Read / Written
>>Beam Dose	(300A,0084)	3	Dose (in Gy) at Beam Dose Specification Point (300A,0082) due to current Beam.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
>>Beam Meterset	(300A,0086)	3	Machine setting to be delivered for current Beam, specified in Monitor Units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3) (in RT Beams Module) for referenced Beam. Note:	Comment	For Ion TxBeams: Total ioncount cumulated across all

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			The Meterset at a given Control Point (compare RT Beams Module) is equal to the Beam Meterset (300A,0086) multiplied by the Cumulative Meterset Weight (300A,0134) for the Control Point, divided by the Final Cumulative Meterset Weight (300A,010E).		spotmaps of this beam. This is exactly the same value as in "RT Ion Beams::Final Cumulative Meterset Weight" (300A,010E). For Non-TxBeams, Beam Meterset is not defined.
				TxPlanDef	Dose reset: removed
				WS	Read (ignored) (Tx FG)
				DCO	Written (SC) for TxBeams only.
				VxPlan	Written for TxBeams only.
>Number of Brachy Application Setups	(300A,00A0)	1	Number of Brachy Application Setups in current Fraction Group. If Number of Brachy Application Setups is greater then zero, Number of Beams (300A,0080) shall equal zero.	TxPlanDef	Written; always 0
				VxPlan	Written; always 0

9.14.22 RT General Plan Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Private Extensions for this module can be found in "RT General Plan::External Attributes"				TxPlanDef	Written; If a VA11 plan containing a patch plane is imported, the system renames this patch plane to 'PatchPlane'
RT Plan Label	(300A,0002)	1	User-defined label for treatment plan. Used as Plan Name.	Comment	RT Plan Label togehter with RT Plan Date (300A,0006) and RT Plan Time (300A,0007) is used for versioning 3rd party plans in the syngo RT context: any two plans with the same plan label are considered to be two related plan versions, ordered by date and time on the versioning chain. Note that branching version chains is not possible by construction. In addition, all syngo RT applications use the RT Plan Relationship (300A,0055) PREDECESSOR to indicate the versioning relationship. Note that branching version chains is technically possible, but is forbidden in syngo RT.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				TxPlanDef	Written; attribute is primarily used as 'Plan Name' in application Recalculation: updated
				WS	Read
				DCO	Read Written (during Save As)
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Read / Written
				STX	Read
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
RT Plan Name	(300A,0003)	3	User-defined name for treatment plan.	TxPlanDef	Written; set to the same string as plan label Read: if no value is set the RT Plan Label is used as plan name Recalculation: updated
				WS	Read; (ignored)
				DCO	Read (ignored)
				Rep (Tx)	Read (ignored)
				Rep (Vx)	Read (ignored)
				VxPlan	Read (required) Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
External Attributes	(0039,xx01)	3	RT General Plan private attributes encoded in an XML string.The XML instance format is defined in RTPlanExtensions.xsd	Comment	Specifies private attributes in an XML instance which are intended to be used as input to several applications.
				TxPlanDef	Ion plans: Written (Patch Plane Information) Conventional plans: not used Recalculation: updated: Patch Plane information removed
				DCO	Read (required)
				Rep (Tx)	Read (ignored)
Plan Type	(300B,xx10)	3	Type of treatment plan Defined Terms: PATIENT	Comment	PATIENT and CLINICAL_TRIAL are use for real patient

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			RESEARCH TRAINING VERIFICATION CLINICAL_TRIAL		treatments.VERIFICATION makes only sense if Treatment Intent (300A,000A) equals VERIFICATION.
				TxPlanDef	Ion Plans: Written If attribute is not present Treatment Intent is used for mapping (see (300A, 000A)) Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (required)
				Rep (Tx)	Read
				Rep (Vx)	Read
				VxPlan	Read (ignored): any type Written: always VERIFICATION
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
Verification Method	(300B,xx19)	3	Determines the verification method for a plan with Plan Type (300B,xx10) VERIFICATION. Defined Terms: ENTIRE_PLAN SEPARATE_BEAMS	Comment	A plan can either be verified beam by beam, typically with user interaction between the individual beams, or as entire plan without any user interaction. Note that also a beam by beam verification can be done without user interaction provided the delivery system supports repositioning of detectors and reset of measured dose through software. The two methods then only differ in the way how the measured dose is interpreted.
				Rep (Vx)	Read (mandatory if plan type = VERIFICATION)
				VxPlan	Read (required); must always be SEPARATE_BEAMS Written; always SEPARATE_BEAMS
RT Plan Description	(300A,0004)	3	User-defined description for treatment plan.	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Read (ignored) Written (during Save As)
				Rep (Tx)	Read (ignored)
				Rep (Vx)	Read
Checksum Encryption Code	(300B,xxA1)	3	A 128 bit encryption code generated by MD5 algorithm to verify the checksum.	Comment	The attributes used to calculate this checksum are marked in the column "Attribute Checksum Relevance" in each module page that is part RT Ion Plan and in the

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					column "Module Checksum Relevance" in the RT Ion Plan page. .
				TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Written
				Rep (Vx)	Written
Instance Number	(0020, 0013)	3	A number that identifies this object instance.	TxPlanDef	Written
				Rep (Tx)	Read (ignored)
				Rep (Vx)	Read (ignored)
Operator's Name	(0008,1070)	2	Name of operator(s) creating treatment plan.	TxPlanDef	Written
				WS	Read; (ignored)
				Rep (Tx)	Read (ignored)
				Rep (Vx)	Read (ignored)
RT Plan Date	(300A,0006)	2	Date treatment plan was last modified.	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Written
				Rep (Tx)	Read (ignored) Written
				Rep (Vx)	Read (ignored) Written
				VxPlan	Written; set to system date
RT Plan Time	(300A,0007)	2	Time treatment plan was last modified.	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Written
				Rep (Tx)	Read (ignored) Written
				Rep (Vx)	Read (ignored) Written
				VxPlan	Written; set to system time
Treatment Protocols	(300A,0009)	3	Planned treatment protocols.	Rep (Tx)	Read (ignored)
Plan Intent	(300A,000A)	3	Intent of this course of treatment. Defined Terms: CURATIVE = curative therapy on patient PALLIATIVE = palliative therapy on patient PROPHYLACTIC = preventative therapy on patient VERIFICATION = verification of patient plan using phantom MACHINE_QA= Quality assurance of the delivery machine (independently of a specific patient) RESEARCH = Research project SERVICE = Machine repair or maintenance operation	Comment	"RECALCULATION" is only used for plans that are recalculated by the TPS.
				TxPlanDef	Written: CURATIVE for Plan Type (300B,xx10) PATIENT or CLINICAL_TRIAL RESEARCH for Plan Type (300B,xx10) RESEARCH or TRAINING RECALCULATION for Recalculation plan Read (Ion plans): Only CURATIVE,

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			RECALCULATION = recalculation of another plan		RESEARCH, RECALCULATION or no value are supported. If no value is set CURATIVE is assumed. Read (Conventional plans): Plan Type (300B,xx10) is interpreted based on Treatment Intent (TI): - TI=RESEARCH and Patient Type = non-human then Plan Type=RESEARCH - TI=CURATIVE or RECALCULATION then Plan Type=PATIENT
				WS	Read; (ignored)
				Rep (Tx)	Read (ignored)
				VxPlan	Written; Always VERIFICATION
				PRC	Read: For checking whether it is VERIFICATION or not
RT Plan Geometry	(300A,000C)	1	Describes whether RT Plan is based on patient or treatment device geometry. Defined Terms: PATIENT RT Structure Set exists TREATMENT_DEVICE RT Structure Set does not exist	Comment	An RT Plan Geometry (300A,000C) of PATIENT shall signify that an RT Structure Set has been defined upon which the plan geometry is based, and this RT Structure Set shall be specified in the Referenced Structure Set Sequence (300C,0060). An RT Plan Geometry (300A,000C) of TREATMENT_DEVICE shall indicate that no patient geometry is available, and that the RT Plan is being defined with respect to the IEC FIXED Coordinate System.
				TxPlanDef	Written; Only “PATIENT” is supported. Plans with other plan geometry are refused.
				DCO	Read: PATIENT is assumed. If plan is not based on a structureset, DCO SC will throw an exception
				Rep (Tx)	Read
				VxPlan	Written; Always set to “PATIENT”
Referenced Structure Set Sequence	(300C,0060)	1C	Introduces sequence of one Class/Instance pair describing instance of RT Structure Set on which the RT Plan is based. Only a single item shall be permitted in this sequence. Required if RT Plan Geometry (300A,000C) is PATIENT.	TxPlanDef	Written; RT Structure Set information, based on which the plan is defined. Only one value is set in this sequence. Recalculation:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					updated
				WS	Read
				DCO	Read. Only first structureset in sequence is evaluated
				Rep (Tx)	Read Written: Update to latest version during unapproval
				VxPlan	Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Structure Set Sequence (300C,0060) is sent.	TxPlanDef	Written; SOP Class UID of structure set as defined in DICOM. Recalculation: updated
				Rep (Tx)	Read
				VxPlan	Written; SOP Class UID of corresponding phantom structure set
				STX	Read
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Structure Set Sequence (300C,0060) is sent.	TxPlanDef	Written; SOP Instance UID of the structure set used to defined the plan. Recalculation: updated
				WS	Read
				Rep (Tx)	Read
				VxPlan	Written; SOP Instance UID of corresponding phantom structure set
				STX	Read
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids and named/unnamed point doses). One or more items may be included in this sequence. Note: An RT Dose IOD referenced within	Comment	Note that an RT Dose instance referenced here is not required to refer to this plan. The RT Dose instance could also refer to a predecessor version of this plan.
				TxPlanDef	Written: if new plan versions are created

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			the Referenced Dose Sequence (300C,0080) can be used for storing grid-based (pixel) data, individual dose points (with optional dose point names), isodose curves, and DVH's.		forward references to still valid doses are set. Dose reset: removed Dose reference removal: removed Recalculation: removed
				WS	Read; (ignored)
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				Rep (Vx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				VxPlan	Written
				STX	Read
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Dose Sequence (300C,0080) is sent.	TxPlanDef	Written: if new plan versions are created forward references to still valid doses are set. Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				Rep (Vx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				VxPlan	Written
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Dose Sequence (300C,0080) is sent.	TxPlanDef	Written: if new plan versions are created forward references to still valid doses are set. Dose reset: removed Dose reference removal: removed Recalculation: removed

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				Rep (Vx)	Read Written (if new plan versions are created forward references to still valid doses are set)
				VxPlan	Written
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Plan. One or more items may be included in this sequence.	TxPlanDef	Written Recalculation: updated
				WS	Read; (ignored)
				DCO	Read (ignored) Written
				Rep (Tx)	Read Written
				VxPlan	Written; Used for versioning and for referencing the verified TxPlan
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	TxPlanDef	Written Recalculation: updated
				DCO	Read (ignored) Written
				Rep (Tx)	Read Written
				VxPlan	Written; a) Reference to the class UID of pevious VxPlan version (PREDECESSOR, see below). b) Reference to the class UID of verified TxPlan (VERIFIED_PLAN, see below).
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.	TxPlanDef	Written Recalculation: updated; original Tx plan is referenced for RECALCULATION relationship; additional recalculation plan versions are linked by the PREDECESSOR and will retain the original RECALCULATION relationship

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				WS	Read; (ignored)
				DCO	Read (ignored) Written
				Rep (Tx)	Read Written
				VxPlan	Written; a) Reference to the Instance UID of pevious VxPlan version (PREDECESSOR, see below). b) Reference to the Instance UID of verified TxPlan (VERIFIED_PLAN, see below).
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>RT Plan Relationship	(300A,0055)	1C	Relationship of referenced plan with respect to current plan. Defined Terms: PRIOR plan delivered prior to current Treatment ALTERNATIVE alternative plan prepared for current treatment PREDECESSOR plan used in derivation of current plan VERIFIED_PLAN plan which is verified using the current plan. This value shall only be used if Treatment Intent (300A,000A) is present and has a value of "VERIFICATION" RECALC_PLAN plan which is recalculated using the current plan. This value shall only be used if the Treatment Intent(300A,000A) is present and has a value of RECALCULATION Required if Referenced RT Plan Sequence (300C,0002) is sent.	Comment	This attribute is used for maintaining the versioning relationship between plans in the syngo RT context. Note that branching version chains is technically possible using this attribute, but it is forbidden in syngo RT.
				TxPlanDef	Written; Tx plans: only PREDECESSOR is supported. Other relationships are ignored. Recalculation: updated; RECALC_PLAN relationship for original Tx plan is created
				WS	Read; (ignored)
				DCO	Read (ignored) Written
				Rep (Tx)	Read Written
				VxPlan	Written; PREDECESSOR for previous VxPlan version; VERIFIED_PLAN for verified TxPlan
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
Beam Display Properties	(0039,xx76)	3	Private attribute to store beam number, beam color and beam group in the following format: BeamDisplayInfo ('#' BeamDisplayInfo)* BeamDisplayInfo = BeamNumber ',' BeamColor ',' BeamGroup BeamNumber = [0-9]+ BeamColor = [0-9]+	Comment	This attribute is deprecated and shall not be written any more!
				Rep (Tx)	Read (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			BeamGroup = [A-Za-z_0-9]+ Beam color is stored as Microsoft C++ COLORREF. Beams are grouped having common isocenter.		
Dose Calculation and Optimization Parameters	(300B,xxD6)	3	XML string containing dose calculation and optimization parameters.	TxPlanDef	Modified; removed when changing beam radiation type Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
Base Data Group Sequence	(300B,xxE0)	3	Introduces the sequence of base data group identifiers referencing the base data used in the calculation of this plan. Only a single item shall be permitted in this sequence.	Comment	The identifiers are the primary keys of the respective data base entries in ConfigDataSC. Identifiers are strings with a maximum length of 16 characters.
				TxPlanDef	Dose reset: removed Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Physics Base Data Group ID	(300B,xxE1)	1	Identifier of the physics base data group used in the dose calculation of this plan.	TxPlanDef	Dose reset: removed Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Biological Base Data Group ID	(300B,xxE2)	1	Identifier of the biological base data group used in the dose calculation of this plan.	TxPlanDef	Dose reset: removed Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Imaging Base Data Group ID	(300B,xxE3)	1	Identifier of the imaging base data group used in the dose calculation of this plan.	TxPlanDef	Dose reset: removed Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Dosimetric Base Data Group ID	(300B,xxE4)	1	Identifier of the dosimetric base data group used in the dose calculation of this plan.	TxPlanDef	Dose reset: removed Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
Dose Optimization Constraint Sequence	(300B,xxC0)	3	Introduces the sequence of dose optimization constraints. One or	TxPlanDef	Recalculation: removed

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			more items may be included in this sequence.	DCO	Modified
				Rep (Tx)	Read (ignored)
> Dose Constraint Status	(300B,xxD8)	3	Defines whether the constraint shall be taken into account during optimization. Enumerated values: ENABLED DISABLED If no value is sent, ENABLED is assumed.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Dose Reference Number	(300A,0012)	1	Identification number of the dose reference. The value of dose reference number shall be unique within RT plan in which it is created.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Dose Reference Structure Type	(300A,0014)	1	Structure type of the dose reference. Defined terms: POINT = dose reference point specified as ROI, VOLUME = dose reference volume specified as ROI, COORDINATES = point specified by dose reference point coordinates.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Dose Reference Description	(300A,0016)	3	User defined description of dose reference	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Referenced ROI Number	(3006,0084)	1C	Uniquely identifies ROI representing the reference specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within Structure Set in Referenced Structure Set Sequence (300C,0060) in General Plan Module. Required if dose reference structure type is POINT or VOLUME .	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Dose Reference Roint Coordinates	(300A,0018)	1C	Coordinates (x, y, z) of Reference Point in the patient based coordinate system. Required if dose reference structure type is COORDINATES.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Nominal Prior Dose	(300A,001A)	3	Dose from prior treatment to this dose reference.	TxPlanDef	Recalculation: removed
				Rep (Tx)	Read (ignored)
> Dose Reference Type	(300A,0020)	1	Type of dose reference. Defined terms are TARGET and ORGAN_AT_RISK.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Target Maximum Dose Constraint	(300B,xxC8)	3	Maximum dose to be applied to the target.	Comment	This field shall contain the total plan dose, not the fraction dose.
				TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
> Target Maximum Dose Constraint Weight	(300B,xxC9)	3	Constraint weight of the maximum target dose.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Target Minimum Dose Constraint	(300B,xxCA)	3	Minimum dose to be applied to the target.	Comment	This field shall contain the total plan dose, not the fraction dose.
				TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Target Minimum Dose Constraint Weight	(300B,xxCB)	3	Constraint weight of the minimum target dose.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Organ At Risk Maximum Dose Constraint	(300B,xxCC)	3	Maximum dose to be applied to an organ at risk.	Comment	In principle, this could be combined with the constraint on the target, but this way, the structure of the prescription module is copied. This field shall contain the total plan dose, not the fraction dose.
				TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Organ At Risk Maximum Dose Constraint Weight	(300B,xxCD)	3	Constraint weight of the maximum organ at risk dose.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Organ At Risk Minimum Dose Constraint	(300B,xxD9)	3	Minimum dose to be applied to an organ at risk.	Comment	The setting of minmum doses for OARs might seem nonsensical at first sight, but is actually used by the planner to drive the optimization process into a certain direction. This field shall contain the total plan dose, not the fraction dose.
				TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> Organ At Risk Minimum Dose Constraint Weight	(300B,xxDA)	3	Constraint weight of the minimum organ at risk dose.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
> DVH Constraint Sequence	(300B,xxCE)	3	Introduces a sequence of DVH constraints. One or more items may be included in this sequence	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
>> DVH Constraint Volume Limit	(300B,xxCF)	1	Volume value of the DVH constraint.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
>> DVH Constraint Volume Units	(300B,xxD0)	1	Volume axis units. Defined terms 'CM3' (cubic centimeters) and PERCENT. As of now, this tag shall always have the value 'PERCENT'.	TxPlanDef	Recalculation: removed
				DCO	Modified: always PERCENT
				Rep (Tx)	Read (ignored)
>> DVH Constraint Dose Limit	(300B,xxD1)	1	Dose value of the DVH constraint.	Comment	Dose values are always in absolute units and are given in Gy or GyE, depending on the "Dose Type" (3004,0004) in the RT Prescription Module. This field shall contain the total plan dose, not the fraction dose.
				TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
>> DVH Constraint Direction	(300B,xxD3)	1	Specifies whether the constraint corresponds to an upper or lower constraint for the DVH curve. Enumerated values: UPPER (curve shall pass below the point) and LOWER (curve shall pass above the point).	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
>> DVH Constraint Weight	(300B,xxD4)	1	Weigthing of the DVH constraint.	TxPlanDef	Recalculation: removed
				DCO	Modified
				Rep (Tx)	Read (ignored)
Applied Renormalization Factor	(300B,xxD7)	3	Renormalization factor which has been applied to all ion counts for each beam and all dose distributions attached to this plan. If no value is sent, then a default of 1 can be assumed.	TxPlanDef	Dose reset: removed
				DCO	Written
				Rep (Tx)	Read (ignored)
Configuration Baseline	(300B,xxE5)	3	Contains the configuration baseline the plan was generated with.	Comment	This attribute is evalutated in TxSD only. The Plan interface by TxSD will provide convenience methods only, that specify the validity of the baseline
				TxPlanDef	Written
				DCO	Written
				VxPlan	Written
Body Region	(300B,xxEB)	3	Identifies the Body Region for treatment.	Comment	The Body Region is used to set a proper initial position (a kind of zero'ed table position) for the treatment table in the room's eye view for treatments with relative positioning mode.
				TxPlanDef	Written
Dosimetric Checksum Encryption Code	(300B,xxED)	3	A 128 bit encryption code generated by MD5 algorithm on the Dosimetric and Safety relevant attributes.	Comment	The attributes used to calculate this checksum are marked in the column "DOSIMETRIC SAFETY

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Relevance".
				TxPlanDef	Written; removed on plan update
				DCO	Written
				Rep (Tx)	Read Written (checksum is cleared when structure set update happens during unapproval)
Referenced Report Sequence	(300B,xxEE)	3	Introduces sequence of related SOP Class/Instance pairs describing related report instances. Reports could be either DICOM Structured Report Document IOD or a DICOM Encapsulated PDF IOD. One or more items may be included in this sequence.	TxPlanDef	Written; removed when creating new plan version
				Rep (Tx)	Read

9.14.23 RT General Treatment Record

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Dose Type	(3004,0004)	3	Type of dose. Defined Terms: PHYSICAL = physical dose (Absorbed dose) EFFECTIVE = physical dose after correction for biological effect using userdefined modeling technique ERROR = difference between desired and planned dose.	Comment	ERROR is unused here
Referenced RT Plan Sequence	(300C,0002)	2	A sequence that provides reference to a RT Plan SOP Class/Instance pair. Only a single Item shall be permitted in this Sequence.	Rep (Tx)	Read
				FxSeq (Tx)	Read
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	Read
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	Read
Checksum Encryption Code	(300B,xxA1)	3	A 128 bit encryption code generated by MD5 algorithm to verify the checksum.	Comment	included attributes can be found in the column 'Module Checksum Relevance' of each IOD sheet and in the column 'Attribute Checksum Relevance' of each module sheet

9.14.24 RT Image Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. For RT Images, Samples per Pixel (0028,0002) shall have the Enumerated Value of 0001H	Rep (Tx)	Written (value provided by viewing component)
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. For RT Images, Photometric Interpretation (0028,0004) shall have the Enumerated Value of MONOCHROME2	Rep (Tx)	Written (value provided by viewing component)
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. For RT Images, Bits Allocated (0028,0100) shall have an Enumerated Value of 8 16 Each sample shall have the same number of bits allocated.	Rep (Tx)	Written (value provided by viewing component)
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Enumerated Values: 8 12 13 14 15 16 Each sample shall have the same number of bits stored. See C.8.8.2.6.4 for specialization.	Rep (Tx)	Written (value provided by viewing component)
High Bit	(0028,0102)	1	Most significant bit for each pixel sample. Each sample shall have the same high bit. See C.8.8.2.6.5 for specialization.	Rep (Tx)	Written (value provided by viewing component)
Pixel Representation	(0028,0103)	1	Data representation of the pixel samples. For RT Images, Pixel Representation (0028,0103) shall have the Enumerated Value of 0000H unsigned integer Each sample shall have the same pixel representation.	Rep (Tx)	Written (value provided by viewing component)
RT Image Label	(3002,0002)	1	User-defined label for RT Image.	Rep (Tx)	Written. Beam Number:BeamName If value would be longer than 16 chars: trunctaed after 13 characters and "…" appended
RT Image Name	(3002,0003)	3	User-defined name for RT Image.	Rep (Tx)	Written. The Beams Name
Image Type	(0008,0008)	1	Image identification characteristics (see Section C.7.6.1.1.2). RT Images shall use one of the following Defined Terms for	Rep (Tx)	Written. (by SessionData)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Value 3. RT Images shall use one of the following Defined Terms for Value 3: DRR digitally reconstructed radiograph PORTAL digital portal image or portal film image SIMULATOR conventional simulator image RADIOGRAPH radiographic image BLANK image pixels set to background value FLUENCE fluence map		
Conversion Type	(0008,0064)	2	Describes the kind of image conversion. Defined Terms: DV Digitized Video DI Digital Interface DF Digitized Film WSD Workstation	Rep (Tx)	Written. Only WSD
RT Image Plane	(3002,000C)	1	Describes whether or not image plane is normal to beam axis. Enumerated Values: NORMAL image plane normal to beam axis NON_NORMAL image plane non-normal to beam axis	Rep (Tx)	Written (value provided by viewing component)
X-Ray Image Receptor Angle	(3002,000E)	2	X-Ray Image Receptor Angle i.e. orientation of IEC X-RAY IMAGE RECEPTOR coordinate system with respect to IEC GANTRY coordinate system (degrees). See C.8.8.2.2.	Rep (Tx)	Written (value provided by viewing component - always null)
Image Plane Pixel Spacing	(3002,0011)	2	Physical distance (in mm) between the center of each image pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing. See C.8.8.2.3 and 10.7.1.3 for further explanation.	Rep (Tx)	Written (value provided by viewing component)
RT Image Position	(3002,0012)	2	The x and y coordinates (in mm) of the upper left hand corner of the image, in the IEC X-RAY IMAGE RECEPTOR coordinate system. This is the center of the first pixel transmitted.	Rep (Tx)	Written (value provided by viewing component)
Radiation Machine SAD	(3002,0022)	2	Radiation source to Gantry rotation axis distance of radiation machine used in acquiring or computing image (mm).	Rep (Tx)	Written (value provided by viewing component)
Radiation Machine SSD	(3002,0024)	3	Source to patient surface distance (in mm) of radiation machine used in acquiring or computing image.	Rep (Tx)	Written (value provided by viewing component)
RT Image SID	(3002,0026)	2	Distance from radiation machine source to image plane (in mm) along radiation beam axis. See C.8.8.2.3.	Rep (Tx)	Written (value provided by viewing component)
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of one Class/Instance pair describing RT Plan associated with image. Only a single item shall be permitted in this	Rep (Tx)	Written. (by SessionData) for RTImage

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			sequence.		
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Rep (Tx)	Written. (by SessionData) for RTImage
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Rep (Tx)	Written. (by SessionData) for RTImage
Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding segment treatment beam specified by Beam Number (300A,00C0) within Beam Sequence in RT Beams Module within the RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Rep (Tx)	Written. (by SessionData) for RTImage
Gantry Angle	(300A,011E)	3	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Comment	The Gantry Angle corresponds to the angle phi of the Gantry System as described in the ER Coordinate Systems.
Patient Support Angle	(300A,0122)	3	Patient Support angle, or table isocentric angle i.e. orientation of IEC PATIENT SUPPORT coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Comment	The Patient Support Angle corresponds to the isocentric rotation angle theta as defined for the Patient support system or the table top system, direct in the ER Coordinate Systems.
Table Top Vertical Position	(300A,0128)	3	Table Top Vertical position in IEC TABLE TOP coordinate system (mm).	Comment	The Table Top Vertical Position corresponds to the displacement delta_z of the Table Top System, direct (cf. ER Coordinate Systems)
				Rep (Tx)	Written (value provided by Viewing component: for relative or STX setup mode: value copied from (300A,01D2) - "Table Top Vertical Setup Displacement" of the patient setup which is referenced by the beam which is referenced by (300C,0002) and (300C,0006) --- for absolute setup mode: value copied from (300A,0128) - "Table Top Vertical Position" from the first control point of the beam which is referenced

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					by (300C,0002) and (300C,0006))
Table Top Longitudinal Position	(300A,0129)	3	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm).	Comment	The Table Top Longitudinal Position corresponds to the displacement delta_y of the Table Top System, direct (cf. ER Coordinate Systems)
				Rep (Tx)	Written (value provided by Viewing component: for relative or STX setup mode: value copied from (300A,01D4) - Table Top Longitudinal Setup Displacement of the patient setup which is referenced by the beam which is referenced by (300C,0002) and (300C,0006) --- for absolute setup mode: value copied from (300A,0129) - Table Top Longitudinal Position from the first control point of the beam which is referenced by (300C,0002) and (300C,0006))
Table Top Lateral Position	(300A,012A)	3	Table Top Lateral position in IEC TABLE TOP coordinate system (mm).	Comment	The Table Top Lateral Position corresponds to the displacement delta_x of the Table Top System, direct (cf. ER Coordinate Systems)
				Rep (Tx)	Written (value provided by Viewing component: for relative or STX setup mode: value copied from (300A,01D6) - Table Top Lateral Setup Displacement of the patient setup which is referenced by the beam which is referenced by (300C,0002) and (300C,0006) --- for absolute setup mode: value copied from (300A,012A) - Table

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Top Lateral Position from the first control point of the beam which is referenced by (300C,0002) and (300C,0006))
Table Top Pitch Angle	(300A,0140)	3	The Patient Support Pitch Angle, i.e. orientation of PITCHED PATIENT SUPPORT coordinate system with respect to IEC PATIENT SUPPORT coordinate system (degrees). Pitching is the rotation around IEC PATIENT SUPPORT X-axis. Required for first item of Control Point Sequence, or if Patient Support Pitch Angle changes during Beam.	Comment	The Patient Support Pitch Angle corresponds to the angle psi of the Pitched patient support system as described in the ER Coordinate Systems.
				Rep (Tx)	Written (value provided by Viewing component)
Table Top Roll Angle	(300A,0144)	3	Patient Support Roll Angle, i.e. orientation of ROLLED PATIENT SUPPORT coordinate system with respect to PITCHED PATIENT SUPPORT coordinate system (degrees). Rolling is the rotation around PITCHED PATIENT SUPPORT Y-axis. Required for first item of Control Point Sequence, or if Patient Support Roll Angle changes during Beam.	Comment	The Patient Support Roll Angle corresponds to the angle phi of the Rolled patient support system as described in the ER Coordinate Systems.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Angular Angle	(300B,xx24)	3	Angle describing the rotation of the OFF-PLANE coordinate system around the positive X-Axis direction of the imager center coordinate system (degrees). A positive angle corresponds to a clockwise rotation as viewed in the direction of the X-Axis.	Comment	The Imager Angular Angle corresponds to the angle psi of the Imager rotation system as described in the ER Coordinate Systems.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Angular Rotation Direction	(300B,xx29)	3	Direction of imager angular rotation. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	TPS uses only right-handed coordinate systems and -rotations. A positive angle value thus always means clock-wise rotation.CW rotation.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Iso-centric Angle	(300B,xx25)	3	Angle describing the rotation of the imager center coordinate system with respect to the IEC Fixed coordinate system (degrees). Required for first item of Control Point Sequence, or if the Isocentric Angle changes during the imager beam.	Comment	The Imager Iso-centric Angle corresponds to the angle theta of the Imager center system as described in the ER Coordinate Systems.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Isocentric Rotation Direction	(300B,xx2A)	3	Direction of imager isocentric rotation.	Comment	Always CW in our case.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Rep (Tx)	Written (value provided by Viewing component)
Imager Orbital Angle	(300B,xx2C)	3	Angle describing the rotation of the imager coordinate system with respect to the imager rotation system in degrees.	Comment	The Imager Orbital Angle corresponds to the angle phi of the Imager system as described in the ER Coordinate Systems. For a robot based system, this angle describes the rotation of the C-arm around the patient.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Orbital Rotation Direction	(300B,xx2F)	3	Direction of imager orbital rotation. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	Always CW in our case.
				Rep (Tx)	Written (value provided by Viewing component)
Imager Vertical Position	(300B,xx26)	3	Robot Imager Vertical position in coordinate system (mm).	Comment	The Imager Vertical Position corresponds to the displacement in delta_z of the Imager center system (cf. ER Coordinate Systems)
				Rep (Tx)	Written (value provided by Viewing component)
Imager Longitudinal Position	(300B,xx27)	3	Robot Imager Longitudinal position in coordinate system (mm).	Comment	The Imager Longitudinal Position corresponds to the displacement delta_y of the Imager center system (cf. ER Coordinate Systems)
				Rep (Tx)	Written (value provided by Viewing component)
Imager Lateral Position	(300B,xx28)	3	Robot Imager Lateral position in coordinate system (mm).	Comment	The Imager Lateral Position corresponds to the displacement delta_x of the Imager center system (cf. ER Coordinate Systems).
				Rep (Tx)	Written (value provided by Viewing component)
Patient Position	(0018,5100)	1C	Patient position descriptor relative to the	Rep (Tx)	Written. (The Patient positions is

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			patient support device. Required if Isocenter Position (300A,012C) is present. May be present otherwise. See Section C.8.8.12.1.2 for Defined Terms and further explanation. Note: The orientation of the patient relative to the patient support device is denoted in the same manner as in the RT Patient Setup module. It defines the relation of the patient-based DICOM coordinate system identified by the frame of reference module of the RT Image to the IEC coordinate system and together with the Isocenter Position (300A,012C) allows the RT Image to be placed into the patient frame of reference. It also allows a system using an RT Image to verify that the patient is setup in a similar position relative to the patient support device.		taken from Beams -> referenced patient setup)

9.14.25 RT Ion Beams Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Ion Beam Sequence	(300A,03A2)	1	Introduces sequence of setup and/or treatment beams for current RT Ion Plan. One or more items may be included in this sequence.	TxPlanDef	Written; Plans without beams are not supported. At least one beam module must exist under a plan. Recalculation: updated
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read / Written (only beams of type TREATMENT are copied)
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
>Beam Number	(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Ion Plan in which it is created. See note below.	TxPlanDef	Written; Unique number is automatically created by TxSD. Generated values are in the range 1 <= n < 2^31
				WS	Read; (ignored)
				Rep (Tx)	Read
				VxPlan	Read / Written
				FxSeq (Tx)	Read
				FxSeq (Vx)	Read
				PRC	Read
>Beam Name	(300A,00C2)	1	User-defined name for Beam.	TxPlanDef	Written; name must be unique within the plan (mandatory for subtask)
				WS	Read; (ignored)
				DCO	Read (BC)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
				PRC	Read
>Beam Description	(300A,00C3)	3	User-defined description for Beam.	TxPlanDef	Written
				WS	Read; (ignored)
				Rep (Tx)	Read (ignored)
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam. Enumerated Values: STATIC all beam parameters remain unchanged during delivery DYNAMIC one or more beam parameters changes during delivery	TxPlanDef	Written; Always STATIC.
				WS	Read; (ignored)
				Rep (Tx)	Read
				VxPlan	Written; Always STATIC.
>Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding treatment beam specified by Beam Number (300A,00C0) within Beam Sequence in RT (Ion) Beams Module within the RT (Ion) Plan referenced in Referenced RT Plan Sequence (300C,0002).	Rep (Tx)	Read (ignored)
				VxPlan	Only for VxPlans: Read Written This field is used for verification plans with Verification Method (300B,xx19) SEPARATE_BEAMS in order to link a treatment beam to the corresponding verification beam. FxSequence (Vx): Read
>Radiation Type	(300A,00C6)	1	Particle type of Beam. Defined Terms: PHOTON PROTON ION	TxPlanDef	Written; Tx Beams: ION or PROTON Imaging Beams: PHOTON
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Radiation Mass Number	(300A,0302)	1C	Mass number of radiation. Required if Radiation Type (300A,00C6) is ION	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Radiation Atomic Number	(300A,0304)	1C	Atomic number of radiation. Required if Radiation Type (300A,00C6) is ION	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Radiation Charge State	(300A,0306)	1C	Charge state of radiation. Required if Radiation Type (300A,00C6) is ION	TxPlanDef	Written
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					corresponding treatment beam
>Scan Mode	(300A,0308)	1	The method of beam scanning to be used during treatment. Defined Terms: NONE = No beam scanning is performed. UNIFORM = The beam is scanned between control points to create a uniform lateral fluence distribution across the field. MODULATED = The beam is scanned between control points to create a modulated lateral fluence distribution across the field.	TxPlanDef	Written Tx Beams: NONE Imaging and Motion Beams: NONE Dose reset: updated to NONE
				DCO	Written Tx Beams: MODULATED Scanspot reset: updated to NONE
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Treatment Machine Name	(300A,00B2)	2	User-defined name identifying treatment machine to be used for beam delivery.	Comment	In Ion context, the Treatment Machine Name denotes the BAMS (=beamline). It is possible to have more than one beamline in a treatment room, so it does not make sense to refer to the room here. At least in PT1.0, it shall not be possible to have plans with beamlines in different rooms. The name here is the name of an Irradiation-Device instance (IrradiationDevice.Name) in Admin&Config. The IrradiationDevice.Type is expected to be BeamLineType. TxSessionData.NET provides a method to directly navigate from the Beam to the IrradiationDevice instance in Admin&Config without explicitely going through the name.
				TxPlanDef	Written; Note: In TxPlanDefinition UI the Tx Room is selected. The application maps this to the respective irradiation device and writes the device name. (mandatory for subtask)
				WS	Read; (ignored)
				Rep (Tx)	Read
				VxPlan	Read Written: corresponding to the associated phantom / treatment room
>Alternative Treatment Machine Name Sequence	(300B,xx20)	3	Introduces sequence of treatment machines (treatment room) that may be used for treatment of the patient. One or more items may be included in this sequence.	TxPlanDef	Dose reset: removed
				Rep (Tx)	Read (ignored)
>>Treatment Machine Name	(300A,00B2)	2	User-defined name identifying alternative treatment machine to be used for beam delivery.	Comment	Please see comment for Treatment Machine Name above.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				TxPlanDef	Dose reset: removed
				Rep (Tx)	Read (ignored)
>Manufacturer	(0008,0070)	3	Manufacturer of the equipment to be used for beam delivery.	TxPlanDef	Written
				Rep (Tx)	Read (ignored)
>Institution Name	(0008,0080)	3	Institution where the equipment is located that is to be used for beam delivery.	Rep (Tx)	Read (ignored)
>Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment is located that is to be used for beam delivery.	Rep (Tx)	Read (ignored)
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located that is to be used for beam delivery.	Rep (Tx)	Read (ignored)
>Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that is to be used for beam delivery.	Rep (Tx)	Read (ignored)
>Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that is to be used for beam delivery.	Rep (Tx)	Read (ignored)
>Imager Organ Program	(300B,xx12)	3	Private attribute storing the organ program used to acquire the image at the AX system	TxPlanDef	Written value is read from A&C Recalculation: removed
				Rep (Tx)	Read (ignored)
>XA Image SID	(300B,xx13)	3	AX machine source to image plane distance (mm).	TxPlanDef	Written value is read from A&C Recalculation: removed
				Rep (Tx)	Read (ignored)
>XA Image Receptor Angle	(300B,xx14)	3	AX machine Image Receptor Angle i.e. the rotation angle of the image detector system around the z-axis relative to the supporting device in degrees.	Comment	The angle describes the rotation of the image detector around an axis perpendicular to the detector surface. In robot based imager systems this angle is not absolutely required as the respective degree of freedom is already covered by the motion variables of the robot. However, it would simplify things, if required. It thus has been decided to nevertheless keep this tag for future use and always have it set to '0' for now. See the ER Coordinate Systems for the definition of the 'image detector system'. For LINAC based installations, this system can be considered equivalent to the IEC X-Ray image receptor system.
				TxPlanDef	Written; Always 0. Recalculation: removed
				Rep (Tx)	Read (ignored)
>Primary Dosimeter Unit	(300A,00B3)	1	Measurement unit of machine dosimeter. Enumerated Values:	TxPlanDef	Written; TxBeams: NP

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			MU Monitor Unit MAMPSEC MilliAmp Seconds NP number of particles		Imaging beams: MU
				WS	Read; (ignored)
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Referenced Tolerance Table Number	(300C,00A0)	3	Uniquely identifies Tolerance Table specified by Tolerance Table Number (300A,0042) within Tolerance Table Sequence in RT Ion Tolerance Tables Module. These tolerances are to be used for verification of treatment machine settings.	TxPlanDef	Written
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: copied from corresponding treatment beam
>Virtual Source-Axis Distances	(300A,030A)	1	Distance (in mm) from virtual source position to gantry rotation axis or nominal isocenter position (fixed beam-lines) of the equipment to be used for beam delivery. Specified by a numeric pair - the VSAD in the IEC Gantry X direction (delimiter) the VSAD in the IEC Gantry Y direction. The VSAD is commonly used for designing apertures in contrast to the effective source-axis-distance (ESAD) that is commonly used with the inverse square law for calculating the dose decrease with distance. See section C.8.8.25.4.	Comment	Known as the beamsource-isocenter distance in the model of terms.
				TxPlanDef	Written; This information is read from the machine configuration.
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: corresponding to the associated phantom / treatment room
>Ion Beam Limiting Device Sequence	(300A,03A4)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) sets. One or more items may be included in this sequence.	TxPlanDef	not used within TPS
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X symmetric jaw pair in IEC X direction Y symmetric jaw pair in IEC Y direction ASYMX asymmetric jaw pair in IEC X direction ASYMY asymmetric pair in IEC Y direction MLCX multileaf (multi-element) jaw pair in IEC X direction MLCY multileaf (multi-element) jaw pair in IEC Y direction	TxPlanDef	not used within TPS
>>Isocenter to Beam Limiting Device Distance	(300A,00BB)	2	Isocenter to beam limiting device (collimator) distance (in mm) of the equipment that is to be used for beam delivery. See section C.8.8.25.4.	TxPlanDef	not used within TPS
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws).	TxPlanDef	not used within TPS
>>Leaf Position Boundaries	(300A,00BE)	1C	Boundaries of beam limiting device (collimator) leaves (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY. See section C.8.8.25.3.	TxPlanDef	not used within TPS
>Referenced	(300C,006A)	3	Uniquely identifies Patient Setup to be	TxPlanDef	Written;

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Patient Setup Number			used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module.		Patient setup number corresponding to the patient setup module containing the patient alignment information for all beams (including imaging beams). Recalculation: removed
				Rep (Tx)	Read (ignored)
>Referenced Reference Image Sequence	(300C,0042)	3	Introduces sequence of reference images used for validation of current beam. One or more items may be included in this sequence.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Read (ignored) Written (if new plan versions are created forward references to still valid images are set)
>>Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid images are set)
>>Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid images are set)
>>Reference Image Number	(300A,00C8)	1	Uniquely identifies Reference Image within Referenced Reference Image Sequence (300C,0042).	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				Rep (Tx)	Read Written (if new plan versions are created forward references to still valid images are set)
>Treatment Delivery Type	(300A,00CE)	1	Delivery Type of treatment. Defined Terms:	TxPlanDef	Written;

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			TREATMENT normal patient treatment OPEN_PORTFILM portal image acquisition with open field (the source of radiation is specified by Radiation Type (300A, 00C6)) TRMT_PORTFILM portal image acquisition with treatment port (the source of radiation is specified by Radiation Type (300A, 00C6)) CONTINUATION continuation of interrupted treatment SETUP no treatment beam is applied for this RT Beam. To be used for specifying the gantry, couch, and other machine positions where X-ray set-up images or measurements shall be taken. XA_IMAGING a beam to acquire a XA image.		TxBeams: TREATMENT Imaging beams: XA_IMAGING
				WS	Read; (ignored) (TxBeams)
				DCO	Read (only TxBeams are evaluated, others ignored)
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam (only beams of type TREATMENT are copied)
				FxSeq (Tx)	Read (only TxBeams are evaluated, others ignored)
				FxSeq (Vx)	Read (only TxBeams are evaluated, others ignored)
>Setup Type	(300B,xxA2)	3	This attribute provides a detailled information which kind of setup is denoted when Treatment Delivery Type (300A,00CE) is SETUP. Defined Terms: PICKUP a beam that used for picking up patient to the proper treatment/imaging position DROPOFF a beam that used to drop off patient from the treatment/imaging position. PARKIMAGER a beam to park imager	TxPlanDef	Recalculation: removed
				Rep (Tx)	Read (ignored)
>Imaging Technique	(300B,xx2E)	3	Imaging Technique to be used for Position Verification. Defined Terms: DBL XRAY C_ARM DBL XRAY GANTRY CBCT C_ARM CBCT GANTRY VOLUME CT	TxPlanDef	Written; TxBeams: not used Imaging beams: DBL_XRAY_C_ARM Recalculation: removed
				Rep (Tx)	Read (ignored)
>Requested Scanning Spot Size	(300B,xx2B)	3	The beam diameter (FWHM) in mm as requested by the user. The actual size of the beam depends on machine capabilities and is stored separately for each control point in attribute 'Scanning Spot Size' (300A,0398).	TxPlanDef	Written; TxBeams: set to FWHM value selected in beam setup tab Imaging beams: not used
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: copied from corresponding treatment beam
>Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids, isodose curves, and named/unnamed point doses). One or more items may be included in this sequence.	Comment	Note that an RT Dose instance referenced here is not required to refer to this beam in this plan. The RT Dose instance could also refer to the same beam in a predecessor version of this plan.
				TxPlanDef	Dose reset: removed

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Dose reference removal: removed Recalculation: removed
				DCO	Written (automatically by TxSessionData)
>>Referenced SOP Class UID	(0008,1150)	1	Uniquely identifies the referenced SOP Class.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				DCO	Written (automatically by TxSessionData)
>>Referenced SOP Instance UID	(0008,1155)	1	Uniquely identifies the referenced SOP Instance.	TxPlanDef	Dose reset: removed Dose reference removal: removed Recalculation: removed
				DCO	Written (automatically by TxSessionData)
>Number of Wedges	(300A,00D0)	1	Number of wedges associated with current beam.	TxPlanDef	Written; Always 0.
				DCO	ignored, 0 assumed
				Rep (Tx)	Read
				VxPlan	Read; always 0 Written: copied from corresponding treatment beam
>Number of Compensators	(300A,00E0)	1	Number of compensators associated with current Beam.	TxPlanDef	Written; Always 0.
				DCO	ignored, 0 assumed
				Rep (Tx)	Read
				VxPlan	Read; always 0 Written: copied from corresponding treatment beam
>Number of Boli	(300A,00ED)	1	Number of boli associated with current Beam.	TxPlanDef	Written; Always 0. Recalculation: updated to 0
				DCO	ignored, 0 assumed
				Rep (Tx)	Read
				VxPlan	Read; always 0 Written: copied from corresponding treatment beam
>Referenced Bolus Sequence	(300C,00B0)	1C	Introduces sequence of boli associated with Beam. Required if Number of Boli (300A,00ED) is non-zero. The number of items shall be identical to the value of Number of Boli (300A,00ED).	TxPlanDef	Recalculation: removed
>>Referenced	(3006,0084)	1	Uniquely identifies ROI representing the	TxPlanDef	Recalculation:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
ROI Number			Bolus specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module.		removed
>>Accessory Code	(300A,00F9)	3	An accessory identifier to be read by a device such as a bar code reader.	TxPlanDef	Recalculation: removed
>Number of Blocks	(300A,00F0)	1	Number of shielding blocks associated with Beam.	Comment	We do not have blocks in PT 1.0.
				TxPlanDef	Written; Always 0.
				DCO	ignored, 0 assumed
				Rep (Tx)	Read
				VxPlan	Read; always 0 Written: copied from corresponding treatment beam
>Snout Sequence	(300A,030C)	3	Introduces sequence of Snouts associated with Beam. Only a single item shall be permitted in this sequence.	Comment	We do not have snouts in PT1.0
>Number of Range Shifters	(300A,0312)	1	Number of range shifters associated with current beam.	TxPlanDef	Written; TxBeams: 0 or 1 Imaging beams: 0
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read; always 0 or 1 Written: copied from corresponding treatment beam
>Range Shifter Sequence	(300A,0314)	1C	Introduces sequence of range shifters associated with Beam. Required if Number of Range Shifters (300A,0312) is non-zero. The number of items shall be identical to the value of Number of Range Shifters (300A,0312).	TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Range Shifter Number	(300A,0316)	1	Identification number of the Range Shifter. The value of Range Shifter Number (300A,0316) shall be unique within the Beam in which it is created.	TxPlanDef	Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Range Shifter ID	(300A,0318)	1	User or machine supplied identifier for Range Shifter.	Comment	Identifier of a BeamModifierInTray instance in Admin&Config (BeamModifierInTray.Identifier). This instance in turn refers to a BeamModifier instance and to the (virtual) Accessory Tray in which the Range Shifter is mounted. The BeamModifier.Type is expected to be RangeShifterType. TxSessionData.NET provides a method to directly navigate from the Beam to the BeamModifierInTray instance in Admin&Config without explicitely going through the

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					identifiers.
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: corresponding to the associated phantom / treatment room / treatment machine
>>Range Shifter Type	(300A,0320)	1	Type of Range Shifter. Defined Terms: ANALOG Device is variable thickness and is composed of opposing sliding wedges, water column or similar mechanism. BINARY Device is composed of different thickness materials that can be moved in or out of the beam in various stepped combinations.	TxPlanDef	Written; Always BINARY.
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read; always BINARY Written: copied from corresponding treatment beam
>Number of Lateral Spreading Devices	(300A,0330)	1	Number of lateral spreading devices associated with current beam.	Comment	We do not have lateral spreading devices in PT1.0
				TxPlanDef	Written; Always 0.
				DCO	ignored, 0 assumed
				Rep (Tx)	Read
				VxPlan	Read; always 0 Written: copied from corresponding treatment beam
>Number of Range Modulators	(300A,0340)	1	Number of range modulators associated with current beam.	TxPlanDef	Written; TxBeams: 0 or 1 Imaging beams: 0
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read; always 0 or 1 Written: copied from corresponding treatment beam
>Range Modulator Sequence	(300A,0342)	1C	Introduces sequence of range modulators associated with Beam. Required if Number of Range Modulators (300A,0340) is non-zero. The number of items shall be identical to the value of Number of Range Modulators (300A,0340).	Comment	Note that Ripple Filters are a specific kind of Range Modulators.
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Range Modulator Number	(300A,0344)	1	Identification number of the Range Modulator. The value of Range Modulator Number (300A,0344) shall be unique within the Beam in which it is created.	TxPlanDef	Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Range Modulator ID	(300A,0346)	1	User or machine supplied identifier for Range Modulator.	Comment	Identifier of a BeamModifierInTray instance in Admin&Config

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					(BeamModifierInTray.Identifier). This instance in turn refers to a BeamModifier instance and to the (virtual) Accessory Tray in which the Range Modulator is mounted. The BeamModifier.Type is expected to be RangeModulatorType (or more specifically: RippleFilterType). TxSessionData.NET provides a method to directly navigate from the Beam to the BeamModifierInTray instance in Admin&Config without explicitely going through the identifiers.
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: corresponding to the associated phantom / treatment room / treatment machine
>>Range Modulator Type	(300A,0348)	1	Type of Range Modulator. Defined Terms: FIXED fixed modulation width and weights using ridge filter or constant speed wheel with constant beam current WHL_FIXEDWEIGHTS selected wheel/track (Range Modulator ID) is spinning at constant speed. Modulation width is adjusted by switching constant beam current on and off at wheel steps indicated by Range Modulator Gating Values WHL_MODWEIGHTS selected wheel/track (Range Modulator ID) is spinning at constant speed. Weight per wheel step is adjusted by modulating beam current according to selected Beam Current Modulation ID (300A,034C). Only one item in the Range Modulator Sequence (300A,0342) can have a Range Modulator Type (300A,0348) of WHL_MODWEIGHTS.	TxPlanDef	Written; Always FIXED.
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read; always FIXED Written: copied from corresponding treatment beam
>Number of Therapy Detectors	(300B,xxA3)	3	Number of Therapy Detectors associated with current beam.	WS	Read; (ignored)
				Rep (Vx)	Read (mandatory if plan type=VERIFICATION)
				VxPlan	Only for VxPlans: Read Written
>Therapy Detector Sequence	(300B,xxA4)	3	Introduces sequence of Therapy Detectors associated with Beam. Required if Number of Therapy Detectors (300B,xxA3) is non-zero. The number of items shall be identical to the value of Number of Therapy Detectors (300B,xxA3).	Rep (Vx)	Read (mandatory if plan type=VERIFICATION)
				VxPlan	Only for VxPlans: Read Written
>>Therapy Detector Number	(300B,xxA5)	1	Identification number of the Therapy Detector. The value of Therapy Detector Number (300B,xxA5) shall be unique within the Beam in which it is created.	Rep (Vx)	Read (mandatory if plan type=VERIFICATION)
				VxPlan	Only for VxPlans:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Read Written
>>Therapy Detector Setup ID	(300B,xxA6)	1	User or machine supplied identifier for setup containing Therapy Detector.	Comment	This is the ID of the corresponding TherapyDetectorInPhantom instance in Admin&Config
				Rep (Vx)	Read (mandatory if plan type=VERIFICATION)
				VxPlan	Only for VxPlans: Read Written
>Patient Support Type	(300A,0350)	1	Defined terms: TABLE Treatment delivery system table CHAIR Treatment delivery system chair	TxPlanDef	Written; Always TABLE.
				Rep (Tx)	Read
				VxPlan	Read; always TABLE Written: copied from corresponding treatment beam
>Patient Support ID	(300A,0352)	3	User-specified identifier for manufacturer specific patient support devices.	TxPlanDef	Written; ID of patient support that is selected for the plan
>Final Cumulative Meterset Weight	(300A,010E)	1C	Value of Cumulative Meterset Weight (300A,0134) for final Control Point in Ion Control Point Sequence (300A,03A8). Required if Cumulative Meterset Weight is non-null in Control Points specified within Ion Control Point Sequence.	Comment	Sum of all ioncounts of all beamspots of all controlpoints of this beam.
				TxPlanDef	Dose reset: removed
				DCO	txBeams: Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Number of Control Points	(300A,0110)	1	Number of control points in Beam. Value shall be greater than or equal to 2.	TxPlanDef	Written; Always 2. Dose reset: updated as 2
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	txBeams: Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>Ion Control Point Sequence	(300A,03A8)	1	Introduces sequence of machine configurations describing Ion treatment beam. The number of items shall be identical to the value of Number of Control Points (300A,0110).	Comment	If the TPS just calculates a beam's dose, all beam modifier parameters are only read by the DCO SC. If a plan optimization is done, the DCO SC will copy all these parameters from CP0 into all the other CP which it creates.
				TxPlanDef	Written; For new beam, contains exactly 2 control points. All Control Point parameters are set for 1st control point. 2nd control point contains only Control Point index Dose reset:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					updated
				DCO	txBeams: Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Control Point Index	(300A,0112)	1	Index of current Control Point, starting at 0 for first Control Point.	TxPlanDef	Written; 0 for 1st control point and 1 for 2nd control point. Dose reset: updated
				DCO	txBeams: Written
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Cumulative Meterset Weight	(300A,0134)	2	Cumulative weight to current control point. Cumulative Meterset Weight for the first item in Control Point Sequence shall always be zero. Cumulative Meterset Weight for the final item in Ion Control Point Sequence shall always be equal to Final Cumulative Meterset Weight.	Comment	Sum of all ioncounts of all controlpoints up to but not including the current one. Example for 2 segments (4 control points): CP0 contains 0, CP1 contains SummedIonCounts(First spotmap), CP2 contains SummedIonCounts(First spotmap), CP3 contains SummedIonCounts(First spotmap+Second spotmap)
				TxPlanDef	Dose reset: removed
				DCO	txBeams: Written. Note that in a segment made up of two control points C1, C2, the difference C2.CMW-C1.CMW is exactly the sum of all ion counts in the beam spot map. The beam is not switched off when being scanned from one position to the next, the ions shot while scanning are missing in the current or in the next point and are "smeared" while scanning.
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Referenced Dose Reference Sequence	(300C,0050)	3	Introduces a sequence of Dose References for current Beam. One or more items may be included in this sequence.	TxPlanDef	Dose reset: removed Recalculation: removed
>>>Referenced Dose Reference Number	(300C,0051)	1	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module.	TxPlanDef	Dose reset: removed Recalculation: removed
>>>Cumulative	(300A,010C)	2	Coefficient used to calculate cumulative	TxPlanDef	Dose reset:

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Dose Reference Coefficient			dose contribution from this Beam to the referenced Dose Reference at the current Control Point.		removed Recalculation: removed
>>Nominal Beam Energy	(300A,0114)	1C	Nominal Beam Energy at control point in MeV per nucleon. Defined at nozzle entrance before all Beam Modifiers. Required for first item of Control Point Sequence, or if Nominal Beam Energy changes during Beam, and KVp (0018,0060) is not present.	Comment	First controlpoint of each segment must contain energy of the iso-energy slice.
				TxPlanDef	Written; Always 0. Dose reset: updated as 0
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	txBeams: Written, in MeV
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>KVp	(0018,0060)	1C	Peak kilo voltage output of the setup X-Ray generator to be used. Required for first item of Control Point Sequence, or if KVp changes during setup, and Nominal Beam Energy (300A,0114) is not present.	Rep (Tx)	Read
>>Ion Wedge Position Sequence	(300A,03AC)	1C	Introduces sequence of Wedge positions for current control point. Required for first item of Ion Control Point Sequence if Number of Wedges (300A,00D0) is non-zero, and in subsequent control points if Wedge Position (300A,0118) or Wedge Thin Edge Position (300A,00DB) changes during beam. The number of items shall be identical to the value of Number of Wedges (300A,00D0).	Comment	We do not have wedges in PT1.0
				TxPlanDef	Dose reset: removed
>>>Referenced Wedge Number	(300C,00C0)	1	Uniquely references Wedge described by Wedge Number (300A,00D2) in Wedge Sequence (300A,00D1).	TxPlanDef	Dose reset: removed
>>>Wedge Position	(300A,0118)	1	Position of Wedge at current Control Point. Enumerated Values: IN OUT	TxPlanDef	Dose reset: removed
>>>Wedge Thin Edge Position	(300A,00DB)	1C	Closest distance from the central axis of the beam along a wedge axis to the thin edge as projected to the machine isocentric plane (mm). Value is positive is the wedge does not cover the central axis, negative if it does. Required if Wedge Type (300A,00D3) of the wedge referenced by Referenced Wedge Number (300C,00C0) is PARTIAL_STANDARD or PARTIAL_MOTORIZ.	TxPlanDef	Dose reset: removed
>>Range Shifter Settings Sequence	(300A,0360)	1C	Introduces sequence of Range Shifter settings for the current control point. One or more items may be included in this sequence. Required for first item of Control Point Sequence if Number of Range Shifters (300A,0312) is non-	TxPlanDef	Written
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			zero, or if Range Shifter Setting (300A,0362) changes during Beam.	Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>>Referenced Range Shifter Number	(300C,0100)	1	Uniquely references Range Shifter described by Range Shifter Number (300A,0316) in Range Shifter Sequence (300A,0314).	TxPlanDef	Written
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>>Range Shifter Setting	(300A,0362)	1	Machine specific setting attribute for the range shifter. The specific encoding of this value should be documented in a Conformance Statement.	TxPlanDef	Written
				DCO	Read. Must be same in all CP! Is simply copied from CP0 if Dosecalc optimizes the beam
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>>Isocenter to Range Shifter Distance	(300A,0364)	3	Distance from Isocenter to downstream edge of range shifter (mm) at current control point	Comment	At RTT-PT, the exact value of the Isocenter to Range Shifter Distance is taken from the last created Ion Beam Treatement Record.
				TxPlanDef	Written
				DCO	Read
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: corresponding to the associated phantom / treatment room and the desired air gap
>>>Range Shifter Water Equivalent Thickness	(300A,0366)	3	Water equivalent thickness (in mm) of the range shifter at the central axis for the beam energy incident upon the device.	DCO	Read
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: copied from corresponding treatment beam
>>Range Modulator Settings Sequence	(300A,0380)	1C	Introduces sequence of Range Modulator Settings for current control point. One or more items may be included in this sequence. Required for first item of Control Point Sequence if Number of Range Modulators (300A,0340) is non-zero, or if Range Modulator Setting changes during Beam.	Comment	Ripple Filters are Range Modulators
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>>Referenced Range Modulator Number	(300C,0104)	1	Uniquely references Range Modulator described by Range Modulator Number (300A,0344) in Range Modulator Sequence (300A,0342).	TxPlanDef	Written
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Read Written: copied from

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					corresponding treatment beam
>>>Isocenter to Range Modulator Distance	(300A,038A)	3	Isocenter to downstream edge of range modulator (mm) at current control point. See section C.8.8.25.4	DCO	Read
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: corresponding to the associated phantom / treatment room
>>Therapy Detector Settings Sequence	(300B,xxA7)	3	Introduces sequence of Therapy Detector settings for the current control point. One or more items may be included in this sequence. Required for first item of Control Point Sequence if Number of Therapy Detectors (300B, ..) is non-zero, or if Therapy Detector Setting (300B, ..) changes during Beam.	Rep (Vx)	Read (mandatory if plan type=VERIFICATION
				VxPlan	Only for VxPlans: Read Written
>>>Referenced Therapy Detector Number	(300B,xxA8)	1	Uniquely references Therapy Detector described by Therapy Detector Number (300B,xxA5) in Therapy Detector Sequence (300B,xxA4).	Rep (Vx)	Read (mandatory if plan type=VERIFICATION
				VxPlan	Only for VxPlans: Read Written
>>>Therapy Detector Position	(300B,xxA9)	1	Therapy Detector coordinates (x,y,z) in the Therapy Detector coordinate system described in 90.001442_ER_CoordinateSystems.doc (mm).	Rep (Vx)	Read (mandatory if plan type=VERIFICATION
				VxPlan	Only for VxPlans: Read Written
>>Gantry Angle	(300A,011E)	1C	Gantry angle of radiation source, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry Angle changes during Beam.	Comment	The Gantry Angle corresponds to the angle phi of the Gantry System as described in the ER Coordinate Systems.
				TxPlanDef	Written; TxBeam: angle of the Tx gantry PV Imaging beam: gantry/fixed beamline angle of the corresponding TxBeam PV0 Imaging beam: the default Tx gantry/fixed beamline angle
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Written: set to 90°
>>Gantry Rotation Direction	(300A,011F)	1C	Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Rotation Direction changes during Beam. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	TxPlanDef	Written; NONE
				Rep (Tx)	Read
				VxPlan	Written; NONE (fixed beamline)
>>Imager Angular Angle	(300B,xx24)	3	Angle describing the rotation of the OFF-PLANE coordinate system around the positive X-Axis direction of the imager center coordinate system (degrees). A positive angle corresponds to a clockwise rotation as viewed in the direction of the X-Axis.	Comment	The Imager Angular Angle corresponds to the angle psi of the Imager rotation system as described in the ER Coordinate Systems.
				TxPlanDef	Written (only PV/PV0)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Tx)	Read (ignored)
>>Imager Angular Rotation Direction	(300B,xx29)	3	Direction of imager angular rotation. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	TPS uses only right-handed coordinate systems and -rotations. A positive angle value thus always means clock-wise rotation.CW rotation.
				TxPlanDef	Written (only PV/PV0); NONE
				Rep (Tx)	Read (ignored)
>>Imager Iso-centric Angle	(300B,xx25)	3	Angle describing the rotation of the imager center coordinate system with respect to the IEC FIXED coordinate system (degrees). Required for first item of Control Point Sequence, or if the Isocentric Angle changes during the imager beam.	Comment	The Imager Iso-centric Angle corresponds to the angle theta of the Imager center system as described in the ER Coordinate Systems.
				TxPlanDef	Written (only PV/PV0)
				Rep (Tx)	Read (ignored)
>>Imager Isocentric Rotation Direction	(300B,xx2A)	3	Direction of imager isocentric rotation. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	Always CW in our case.
				TxPlanDef	Written; (only PV/PV0) NONE
				Rep (Tx)	Read (ignored)
>> Imager Orbital Angle	(300B,xx2C)	3	Angle describing the rotation of the imager coordinate system with respect to the imager rotation system in degrees.	Comment	The Imager Orbital Angle corresponds to the angle phi of the Imager system as described in the ER Coordinate Systems. For a robot based system, this angle describes the rotation of the C-arm around the patient.
				TxPlanDef	Written (only PV/PV0)
				Rep (Tx)	Read (ignored)
>> Imager Orbital Rotation Direction	(300B,xx2F)	3	Direction of imager orbital rotation. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	Always CW in our case.
				TxPlanDef	Written; (only PV/PV0) NONE
				Rep (Tx)	Read (ignored)
>>Imager Vertical Position	(300B,xx26)	3	Robot Imager Vertical position in the IEC FIXED coordinate system (mm).	Comment	The Imager Vertical Position corresponds to the displacement in delta_z of the Imager center system (cf. ER Coordinate Systems)
				Rep (Tx)	Read (ignored)
>>Imager Longitudinal Position	(300B,xx27)	3	Robot Imager Longitudinal position in the IEC FIXED coordinate system (mm).	Comment	The Imager Longitudinal Position corresponds to the displacement delta_y of the Imager center system (cf. ER Coordinate Systems)
				Rep (Tx)	Read (ignored)
>>Imager Lateral Position	(300B,xx28)	3	Robot Imager Lateral position in the IEC FIXED coordinate system (mm).	Comment	The Imager Lateral Position corresponds to the displacement delta_x of the Imager center system (cf. ER Coordinate Systems).
				Rep (Tx)	Read (ignored)
>>Gantry Pitch	(300A,014A)	2C	Gantry Pitch Angle of the radiation	Comment	The Source-off plane Angle

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Angle			source, i.e. the rotation of the IEC GANTRY coordinate system about the X-axis of the IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry Pitch Rotation Angle changes during Beam. See C.8.8.25.6.5.		corresponds to the angle psi of the Gantry off-plane coordinate system (cf. ER Coordinate Systems). The PT gantry does not support OFF_PLANE rotation in PT1.0. For now, 0 is written.
				TxPlanDef	Written for first control point; always empty
>>Gantry Pitch Rotation Direction	(300A,014C)	2C	Direction of Gantry Pitch Angle when viewing along the positive X-axis of the IEC GANTRY coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Pitch Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.25.6.5. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation	TxPlanDef	Written for first control point; always NONE
>>Beam Limiting Device Angle	(300A,0120)	1C	Beam Limiting Device angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Beam Limiting Device Angle changes during Beam.	Comment	For the TPS this angle is defined relative to the Gantry off-plane coordinate system, which exists as a suggestion for extension of IEC 61217 but not yet for DICOM. However, this slightly different definition would only hurt in the case of 3 non-planar beam lines - which is not foreseen.
				TxPlanDef	Written for first control point; always 0
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	Direction of Beam Limiting Device Rotation when viewing beam limiting device (collimator) from radiation source, for segment following Control Point. Required for first item of Control Point Sequence, or if Beam Limiting Device Rotation Direction changes during Beam. See section C.8.8.14.8. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	TxPlanDef	Written for first control point; always NONE
>>Scan Spot Tune ID	(300A,0390)	1C	User-supplied or machine code identifier for machine configuration to produce beam spot. This may be the nominal spot size or some other machine specific value. Required if Scan Mode (300A,0308) is MODULATED.	Comment	In syngo RT context, this attribute shall contain the the nominal spot size in mm.
				TxPlanDef	Dose reset: removed
				DCO	Written; same as Scanning Spot Size (300A,0398) but rounded to two decimal places
				Rep (Tx)	Read
>>Number of Scan Spot Positions	(300A,0392)	1C	Number of spot positions used to specify scanning pattern for current segment beginning at control point. Required if Scan Mode (300A,0308) is MODULATED.	TxPlanDef	Dose reset: removed
				WS	Read; (ignored) (TxBeams)
				DCO	Written: optimization Result

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Scan Spot Position Map	(300A,0394)	1C	The x and y coordinates of the scan spots are defined as projected onto the machine isocentric plane in the IEC GANTRY coordinate system (mm). Required if Scan Mode (300A,0308) is MODULATED. Contains 2N values where N is the Number of Scan Spot Positions (300A,0392).	Comment	Scan Spot Positions are stored in the order as determined by the scan path optimization algorithm. Scan Spot Positions with a weight of '0' are removed. These positions are stored in both ControlPoints of each segment.
				TxPlanDef	Dose reset: removed
				DCO	Written: optimization Result
				VxPlan	Read Written: copied from corresponding treatment beam
>>Scan Spot Meterset Weights	(300A,0396)	1C	A data set of meterset weights corresponding to scan spot positions. The order of weights matches the positions in Scan Spot Positions (300A,0394). The sum contained in all meterset weights must match the difference of the cumulative meterset weight of the current control point to the following control point. Required if Scan Mode (300A,0308) is MODULATED.	Comment	Ioncounts are stored in the same order as above. Note that they are only stored in the first ControlPoint of each segment, they contain only 0s for the second ControlPoint.
				TxPlanDef	Dose reset: removed
				DCO	Written: optimization Result
				VxPlan	Read Written: copied from corresponding treatment beam
>>Scanning Spot Size	(300A,0398)	3	The Scanning Spot Size as calculated using the Full Width Half Maximum (FWHM). Specified by a numeric pair - the size measured in air at isocenter in IEC GANTRY X direction (delimiter) the size in the IEC GANTRY Y direction (mm).	TxPlanDef	Dose reset: removed
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Written: Calculated from single value which user selects and which is stored in Requested Scanning Spot Size, (300B,xx2B)
				Rep (Tx)	Read (ignored)
				VxPlan	Read Written: copied from corresponding treatment beam
>>Number of Paintings	(300A,039A)	1C	The number of times the scan pattern given by Scan Spot Position Map (300A,0394) and Scan Spot Meterset Weights (300A,0396) shall be applied at the current control point. To obtain the meterset weight per painting, the values in the Scan Spot Meterset Weights (300A,0396) should be divided by the value of this attribute. Required if Scan Mode (300A,0308) is MODULATED.	TxPlanDef	Dose reset: removed
				DCO	Written: Always 1
				Rep (Tx)	Read
				VxPlan	Read Written: copied from corresponding treatment beam
>>Patient Support Angle	(300A,0122)	1C	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Patient Support Angle changes during Beam.	Comment	The Patient Support Angle corresponds to the isocentric rotation angle theta as defined for the Patient support system or the table top system, direct in the ER Coordinate Systems.
				TxPlanDef	Written
				WS	Read; (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					(TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Written
>>Patient Support Rotation Direction	(300A,0123)	1C	Direction of Patient Support Rotation when viewing table from above, for segment following Control Point. Required for first item of Control Point Sequence, or if Patient Support Rotation Direction changes during Beam. See section C.8.8.14.8. Enumerated Values: CW clockwise CC counter-clockwise NONE no rotation	Comment	Always CW in our case.
				TxPlanDef	Written; NONE
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Pitch Angle	(300A,0140)	2C	Table Top Pitch Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the X-axis of the IEC TABLE TOP coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Pitch Angle changes during Beam. See section C.8.8.25.6.2.	Comment	The Patient support pitch angle corresponds to the angle psi as defined for the Pitched patient support system in the ER Coordinate Systems.
				TxPlanDef	Written
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Pitch Rotation Direction	(300A,0142)	2C	Direction of Table Top Pitch Rotation when viewing the table along the positive X-axis of the IEC TABLE TOP coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Pitch Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.25.6.2. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation	Comment	Always CW in our case.
				TxPlanDef	Written; NONE
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Roll Angle	(300A,0144)	2C	Table Top Roll Angle, i.e. the rotation of the IEC TABLE TOP coordinate system about the Y-axis of the IEC TABLE TOP coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Roll Angle changes during Beam. See section C.8.8.25.6.2.	Comment	The Patient support roll angle corresponds to the angle phi as defined for the Rolled patient support system in the ER Coordinate Systems.
				TxPlanDef	Written
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Roll Rotation Direction	(300A,0146)	2C	Direction of Table Top Roll Rotation when viewing the table along the positive Y-axis of the IEC TABLE TOP coordinate system, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Roll Rotation Direction changes during Beam. See C.8.8.14.8 and C.8.8.25.6.2. Enumerated Values:	Comment	Always CW in our case.
				TxPlanDef	Written; NONE
				Rep (Tx)	Read
				VxPlan	Written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			CW = clockwise CC = counter-clockwise NONE = no rotation		
>>Table Top Vertical Position	(300A,0128)	2C	Table Top Vertical position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Vertical Position changes during Beam.	Comment	The Table Top Vertical Position corresponds to the negative vertical displacement of the Table Top System, direct (i.e. -delta_z, cf. ER Coordinate Systems). See comment for table top lateral position.
				TxPlanDef	Written; Table top vertical position set if beam is not relative Recalculation: updated as empty value
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Longitudinal Position	(300A,0129)	2C	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Longitudinal Position changes during Beam.	Comment	The Table Top Longitudinal Position corresponds to the negative longitudinal displacement of the Table Top System, direct (i.e. -delta_y cf. ER Coordinate Systems). See comment for table top lateral position.
				TxPlanDef	Written; Table top longitudinal position is set if beam is not relative. Recalculation: updated as empty value
				Rep (Tx)	Read
				VxPlan	Written
>>Table Top Lateral Position	(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Lateral Position changes during Beam.	Comment	The Table Top Lateral Position corresponds to the negative lateral displacement of the Table Top System, direct (i.e. -delta_x cf. ER Coordinate Systems). Please note that the translation vector in table top coordinates as used in the ER Coordinate Systems points from the origin of the table top system to the origin of the IEC fixed system. The Table Top Lateral/Longitudinal/Vertical positions form a translation vector from the origin of the IEC fixed system to the origin of the Table Top System (expressed in the - potentially rotated - table top system). The values here are thus exactly the negative of the values of the translation vector as used in the ER.
				TxPlanDef	Written; Table top lateral position is set if beam is not relative Recalculation: updated as empty value
				WS	Read; (ignored) (TxBeams,

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					only first CP)
				Rep (Tx)	Read
				VxPlan	Written
>>Snout Position	(300A,030D)	2C	Axial position of the snout (in mm) measured from isocenter to the downstream side of the snout (without consideration of variable length elements such as blocks, MLC and/or compensators). Required for first item in Control Point Sequence, or if Snout Position changes during Beam.	Comment	no snouts in PT1.0
				TxPlanDef	Written for first control point; empty value
>>Isocenter Position	(300A,012C)	2C	Isocenter coordinates (x,y,z) in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required for first item of Segment Control Point Sequence, or if Segment Isocenter Position changes during Beam.	TxPlanDef	Written Recalculation: updated
				WS	Read; (ignored) (TxBeams, only first CP)
				DCO	Read
				Rep (Tx)	Read
				VxPlan	Written
>>Surface Entry Point	(300A,012E)	3	Patient surface entry point coordinates (x,y,z), along the central axis of the beam, in the patient based coordinate system described in C.7.6.2.1.1 (mm).	TxPlanDef	Written; Set if external ROI is present along the beam axis. Recalculation: updated
				VxPlan	Written; Set if external ROI is present along the beam axis.
>>Maintain Checksum Compatibility	(300B,xxEF)	3	Attribute that is created in each Ion Control Point which ensures that a private creator code is always created within the Ion Control Point	Comment	This atribute is automatically created whenever an Ion Plan with Ion control points are created. This is needed in order to maintain a backwards compatibility to the delivery checksum generated on an RTT-PT edited plan. Refer to charm OCS_00075200 for further description of the problem.
				TxPlanDef	Written (always empty)
				DCO	Written (always empty)
> Referenced Target ROI Sequence	(300B,xx80)	3	Introduces a sequence of target ROIs associated with this beam. Required if the beam only references a subset of ROIs in Structure Set Module.	Comment	A beam may be restricted to a subset of target (!) ROIs. There are some limitations with respect to the applicable optimization algorithm, though! If no such SQ exists in the plan, we assume that all targets are assigned to this beam. In such a case, all expansion margins are taken to be 0.
				TxPlanDef	Written (mandatory for subtask) Recalculation: removed
				WS	Read; (ignored) (TxBeams)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				DCO	Read
				Rep (Tx)	Read (ignored)
				FxSeq (Tx)	Read
>> Referenced ROI Number	(3006,0084)	1	Uniquely identifies the ROIs representing targets for this beam, specified by ROI number in Structure Set ROI Sequence in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence in RT General Plan Module.	TxPlanDef	Written (mandatory for subtask) Recalculation: removed
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read (ignored)
				FxSeq (Tx)	Read
>> Target ROI lateral expansion margin	(300B,xx82)	3	Specifies the lateral extension of the target in mm within which beamspots may be placed. This value overrides a possible value stored in Target lateral expansion margin in sequence Target expansion sequence.	Comment	Introduced to have the possibility to have individual expansion margins for each target of a beam.
				TxPlanDef	Recalculation: removed
				DCO	Read
				Rep (Tx)	Read (ignored)
>> Target ROI distal expansion margin	(300B,xx83)	3	Specifies the extension of the distal boundary of the target volume in mm within which beamspots may still be placed. This value overrides a possible value stored in Target lateral expansion margin in sequence Target expansion sequence.	TxPlanDef	Recalculation: removed
				DCO	Read
				Rep (Tx)	Read (ignored)
>> Target ROI proximal expansion margin	(300B,xx84)	3	Specifies the extension of the proximal boundary of the target volume in mm within which beamspots may still be placed. This value overrides a possible value stored in Target lateral expansion margin in sequence Target expansion sequence.	TxPlanDef	Recalculation: removed
				DCO	Read
				Rep (Tx)	Read (ignored)
> Beam Weight	(300B,xx87)	3	Relative beam weight wrt the other beams in the plan. If the value is not present or null, a default of 1 is assumed.	Comment	Before being applied for dose optimization, the relative beam weights of all beams in a plan are scaled such that they sum up to 100%. We can not use scaling through cumulative meterset weight because in case of carbon, effective doses to not add in a linear way.
				TxPlanDef	Written; default is set to 1.0
				DCO	Read
				Rep (Tx)	Read (ignored)
> Display Color	(300B,xx9C)	3	Display color of the beam stored as 3 RGB values in the range of 0..255.	TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				Rep (Tx)	Read (ignored)
> Scan grid lateral distance	(300B,xx85)	3	The lateral resolution of the scan grid in mm. Specified by a numeric pair - the distance at isocenter in IEC Gantry X and IEC Gantry Y direction.	Comment	It is preferred to have two shadow attributes, lateral and longitudinal grid distance, instead of specifying the complete scan spot position map with each beam. This measure can still be used in

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					the case of complex scan grid geometries - which we do not plan for right now. Same as for the range step/ripple filter: when the user selects a FWHM value, the system automatically sets the appropriate lateral grid size in the UI (the scaling factor is defined in Admin&Config), but not vice versa.
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams, only first value)
				DCO	Read
				Rep (Tx)	Read (ignored)
> Scan grid longitudinal distance	(300B,xx86)	3	Longitudinal distance of energy planes in mm.	Comment	s.a.
				TxPlanDef	Written
				WS	Read; (ignored) (TxBeams)
				DCO	Read
				Rep (Tx)	Read (ignored)
> Beam Group Name	(300B,xx9D)	3	Name of the beam group this beam belongs to. Beams are grouped having common isocenter.	TxPlanDef	Written; TxPlanDef for (user-defined) grouped treatment beams RcPlanDef for Recalculation beams SplitGroupfor Sub-beams of a compound beam Not used for PV/PV0 beams. Notes: 1. If a treatment beam is imported (e.g. from VA11) which has a group name other than one of the defined names above, Tx Plan Definition sets this string to TxPlanDef when creating a new plan version. 2. Only one user defined Tx beam group can be available in a plan. This group is used to move the isocenter while maintaining the spatial relationship between all group isocenters.
				Rep (Tx)	Read (ignored)

9.14.26 RT Ion Tolerance Tables Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Ion Tolerance Table Sequence	(300A,03A0)	1	Introduces sequence of ion tolerance tables to be used for delivery of treatment plan. One or more items may be included. See Note below.	Comment	Tolerance Tables values will not be written into the RT ION Tolerance Table Module. We do not consider 3.rd party communication for PT1.0.
				TxPlanDef	Written
				Rep (Tx)	Read
>Tolerance Table	(300A,0042)	1	Identification number of the	TxPlanDef	Written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Number			Tolerance Table. The value of Tolerance Table Number (300A,0042) shall be unique within the RT Ion Plan in which it is created.	Rep (Tx)	Read
>Tolerance Table Label	(300A,0043)	3	User-defined label for Tolerance Table.	Comment	In PT context, the Tolerance Table Label is the identifier of a tolerance table in Admin&Config (ToleranceTable.Identifier).
				TxPlanDef	Written
				Rep (Tx)	Read (ignored)

9.14.27 RT Patient Setup Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Patient Setup Sequence	(300A,0180)	1	Introduces sequence of patient setup data for current plan. One or more items may be included in this sequence.	TxPlanDef	Written; Patient setup information for the following kinds of beams in the RT General Plan/RT Ion Plan is stored: Relative (includes SSD based relative beams) and absolute TxBeams (including SSD based beams) AND PV/PV0 Imaging Beams. Recalculation: removed Notes: - PV beams will always use the same setup as the assigned TxBeams - PV0 beams will always have a separate patient setup although the same values may be available for a TxBeam
				Rep (Tx)	Read
				VxPlan	Written; contains only 1 patient setup which is referenced by all beams
>Patient Setup Number	(300A,0182)	1	Identification number of the Patient Setup. The value of Patient Setup Number (300A,0182) shall be unique within the RT Plan in which it is created.	TxPlanDef	Written; Number that is unique within a plan. Beams under the plan refer to this number for patient setup information (marked reference point and table position information).

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Recalculation: removed
				Rep (Tx)	Read
				VxPlan	Written
>Referenced Setup Image Sequence	(300A,0401)	3	Introduces sequence of setup verification images for this patient setup. One or more items may be included in this sequence.	Comment	Images with modality SC or VL serve as visible light photos for visual setup control. Images with modality RTIMAGE serve as reference images on plan level. RT Images present in this sequence shall not be referenced in the Referenced Reference Image Sequence (300C,0042) of the RT Beams module.
>Patient Position	(0018,5100)	1C	Patient position descriptor relative to the equipment. Required if Patient Additional Position (300A,0184) is not present.	TxPlanDef	Written; Patient position information as set in the CT series used to create the structure set. Recalculation: removed
				Rep (Tx)	Read (ignored)
				VxPlan	Written; Patient position information as set in the CT series used to create the structure set
>Patient Additional Position	(300A,0184)	1C	User-defined additional description of patient position. Required if Patient Position (0018,5100) is not present.	Rep (Tx)	Read (ignored)
>Fixation Device Sequence	(300A,0190)	3	Introduces sequence of Fixation Devices used in Patient Setup. One or more items may be included in this sequence.	Rep (Tx)	Read (ignored)
>Setup Technique	(300A,01B0)	3	Setup Technique used in Patient Setup. Defined Terms: ISOCENTRIC FIXED_SSD TBI BREAST_BRIDGE SKIN_APPOSITION	TxPlanDef	Written; always ISOCENTRIC Recalculation: removed
>Setup Device Sequence	(300A,01B4)	3	Introduces sequence of devices used for patient alignment in Patient Setup. One or more items may be included in this sequence.	TxPlanDef	Written; Used to store the patient alignment information.This SQ attribute is filled if and only if the patient setup module under the plan is referenced by one or more Relative (or Relative-SSD)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					beams under the plan. PDef optimizes on the number of patient setup modules referenced by beams under a plan by keeping only one patient setup module for beams based on the same reference point and table position. Note: This is filled only for relative beams. Recalculation: removed
				Rep (Tx)	Read (ignored)
>>Setup Device Type	(300A,01B6)	1	Type of Setup Device used for Patient alignment. Defined Terms: LASER_POINTER DISTANCE_METER TABLE_HEIGHT MECHANICAL_PTR ARC	TxPlanDef	Written; Always LASER_POINTER. Recalculation: removed
				Rep (Tx)	Read (ignored)
>>Setup Device Label	(300A,01B8)	2	User-defined label for Setup Device used for patient alignment.	TxPlanDef	Written; empty value Recalculation: removed
				Rep (Tx)	Read (ignored)
>>Setup Device Description	(300A,01BA)	3	User-defined description for Setup Device used for patient alignment.	Rep (Tx)	Read (ignored)
>>Setup Device Parameter	(300A,01BC)	2	Setup Parameter for Setup Device in appropriate IEC 61217 coordinate system. Units shall be mm for distances and angles for degrees.	TxPlanDef	Written; always 0 Recalculation: removed
				Rep (Tx)	Read (ignored)
>>Setup Reference Description	(300A,01D0)	3	User-defined description of Setup Reference used for patient alignment.	TxPlanDef	Written; ROI Name (3006,0026) as defined in RT Structure Set of the marked reference point which is used for aligning the patient is stored Recalculation: removed
				Rep (Tx)	Read (ignored)
>Table Top Vertical Setup Displacement	(300A,01D2)	3	Vertical Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. vertical offset between patient positioning performed using setup and	TxPlanDef	Written; Table top vertical displacement from the specified Marked Reference

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			treatment position.		point to obtain the beam isocenter. Note: This is filled only for relative beams. Recalculation: removed
				Rep (Tx)	Read
>Table Top Longitudinal Setup Displacement	(300A,01D4)	3	Longitudinal Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. longitudinal offset between patient positioning performed using setup and treatment position.	TxPlanDef	Written; Table top longitudinal displacement from the specified Marked Reference point to obtain the beam isocenter. Note: This is filled only for relative beams. Recalculation: removed
				Rep (Tx)	Read
>Table Top Lateral Setup Displacement	(300A,01D6)	3	Lateral Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. lateral offset between patient positioning performed using setup and treatment position.	TxPlanDef	Written; Table top lateral displacement from the specified Marked Reference point to obtain the beam isocenter. Note: This is filled only for relative beams. Recalculation: removed
				Rep (Tx)	Read
>Motion Synchronization Sequence	(300A,0410)	3	Introduces sequence of Motion Synchronization. One or more items may be included in this sequence.	TxPlanDef	RT Ion plans: Written, if gating option is enabled for the treatment plan.
>>Respiratory Motion Compensation Technique	(0018,9170)	1	Technique applied to reduce respiratory motion artifacts. Defined Terms: NONE BREATH_HOLD REALTIME = image acquisition shorter than respiratory cycle GATING = Prospective gating TRACKING = prospective throughplane or in-plane motion tracking PHASE_ORDERING = prospective phase ordering PHASE_RESCANNING = prospective techniques, such as real-time averaging,	TxPlanDef	RT Ion plans: Written; always GATING

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			diminishing variance and motion adaptive gating RETROSPECTIVE = retrospective gating CORRECTION = retrospective image correction UNKNOWN = technique not known		
>>Respiratory Signal Source	(0018,9171)	1	Signal source from which respiratory motion is derived. Defined Terms: NONE BELT NASAL_PROBE CO2_SENSOR NAVIGATOR = MR navigator and organ edge detection MR_PHASE = phase (of center k-space line) ECG = baseline demodulation of the ECG SPIROMETER = Signal derived from flow sensor EXTERNAL_MARKER = Signal determined from external motion surrogate INTERNAL_MARKER = Signal determined from internal motion surrogate IMAGE = Signal derived from an image UNKNOWN = Signal source not known	TxPlanDef	RT Ion plans: Written; always BELT

9.14.28 RT Prescription Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Prescription Description	(300A,000E)	3	User-defined description of treatment prescription.	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
Dose Type	(3004,0004)	3	Type of dose. Defined Terms: PHYSICAL = physical dose (Absorbed dose) EFFECTIVE = physical dose after correction for biological effect using userdefined modeling technique ERROR = difference between desired and planned dose.	Comment	ERROR is unused here
				TxPlanDef	Written (mandatory for subtask): PHYSICAL or EFFECTIVE
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read
Dose Reference Sequence	(300A,0010)	3	Introduces sequence of Dose References. One or more items may be included in this sequence.	TxPlanDef	Written; at least one target prescription is mandatory for the subtask

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Dose Reference Number	(300A,0012)	1C	Identification number of the Dose Reference. The value of Dose Reference Number (300A,0012) shall be unique within the RT Plan in which it is created. Required if Dose Reference Sequence (300A, 0012) is sent.	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Dose Reference UID	(300A,0013)	3	A unique identifier for a Dose Reference that can be used to link the same entity across multiple RT Plan objects.	TxPlanDef	Recalculation: removed
>Dose Reference Structure Type	(300A,0014)	1C	Structure type of Dose Reference. Defined Terms: POINT dose reference point specified as ROI VOLUME dose reference volume specified as ROI COORDINATES point specified by Dose Reference Point Coordinates (300A,0018) SITE dose reference clinical site Required if Dose Reference Sequence (300A,0010) is sent.	TxPlanDef	Read: VOLUME and POINT are supported; types COORDINATES and SITE are ignored Written; VOLUME or POINT Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Dose Reference Description	(300A,0016)	3	User-defined description of Dose Reference. Uniquely identifies the treatment site name. Used for Named Dose References.	TxPlanDef	Written Recalculation: removed
				Rep (Tx)	Read (ignored)
>Referenced ROI Number	(3006,0084)	1C	Uniquely identifies ROI representing the dose reference specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module. Required if Dose Reference Structure Type (300A,0014) is POINT or VOLUME and Dose Reference Sequence (300A,0010) is sent.	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Referenced Target ROI Number	(300B,xx16)	3	Uniquely identifies an additional target ROI representing the dose reference specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module. This additional target ROI shall be of RT ROI Interpreted Type (3006,00A4) PTV, CTV or GTV. Used if Dose Reference Structure	Comment	In case of a dose reference of structure type POINT which references a target ROI of type POINT it is impossible to find the corresponding target ROI of type VOLUME the dose reference point

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Type (300A,0014) is POINT and Dose Reference Type (300A,0020) is TARGET to identify the referenced target volume.		refers to. Due to missing DICOM attributes the relationship between an ICRU dose reference point and a target volume is not supported. Although it can be argued that the reference should be established in the Structure Set IOD instance, we decided to put it into the prescription. This allows to use 3rd party structure sets and establish the association between the dose reference point and the target volume nevertheless.
				TxPlanDef	Written; Reference to the structure which is selected in the 'Presc. to' combo in the prescription table (mandatory for POINT prescriptions referring a volume). Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Dose Reference Point Coordinates	(300A,0018)	1C	Coordinates (x, y, z) of Reference Point in the patient based coordinate system described in C76211 (mm). Required if Dose Reference Structure Type (300A,0014) is COORDINATES and Dose Reference Sequence (300A,0010) is sent.	DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Nominal Prior Dose	(300A,001A)	3	Dose (in Gy) from prior treatment to this Dose Reference (e.g. from a previous course of treatment).	TxPlanDef	Written Recalculation: removed
				Rep (Tx)	Read (ignored)
>Dose Reference Type	(300A,0020)	1C	Type of Dose Reference. Required if Dose Reference Sequence (300A,0010) is sent. Defined Terms: TARGET treatment target (corresponding to GTV, PTV, or CTV in ICRU50) ORGAN_AT_RISK Organ at Risk (as defined in ICRU50)	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Constraint Weight	(300A,0021)	3	Relative importance of satisfying constraint, where high values	TxPlanDef	Written; set to 1.0 as

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			represent more important constraints.		default Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
>Delivery Warning Dose	(300A,0022)	3	The dose (in Gy) which when reached or exceeded should cause some action to be taken.	Comment	Proposed wording: The dose (in Gy) cumulated over all fractions delivered which when reached or exceeded should cause some action to be taken.
				TxPlanDef	Written As entered in the prescription pane. If nothing is entered, then Target Prescription Dose (300A,0025) + 5% is sent. Recalculation: removed
				Rep (Tx)	Read (ignored)
>Delivery Warning Dose Comment	(300B,xx11)	3	Description of action to be taken when Delivery Warning Dose level is exceeded.	TxPlanDef	Written; Always "Delivery Warning Dose reached or exceeded". Recalculation: removed
				Rep (Tx)	Read (ignored)
>Delivery Maximum Dose	(300A,0023)	3	The maximum dose (in Gy) which can be delivered to the dose reference.	Comment	Proposed wording: The maximum dose (in Gy) which can be delivered by all fractions to the dose reference.
				TxPlanDef	Written Recalculation: removed
				Rep (Tx)	Read (ignored)
>Target Minimum Dose	(300A,0025)	3	Minimum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET.	Comment	Proposed wording: Minimum permitted dose (in Gy) of all fractions planned to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.
				TxPlanDef	Written Recalculation: removed

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Target Prescription Dose	(300A,0026)	3	Prescribed dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET.	Comment	Proposed wording: Prescribed dose (in Gy) of all fractions planned to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.
				TxPlanDef	Read (mandatory for subtask) Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
				PRC	Read
> Target Prescription Dose Type	(300B,xx15)	3	Type of Target Prescription Dose (300A,0026) if Dose Reference Type (300A,0020) is TARGET and Dose Reference Structure Type (300A,0014) is VOLUME. It indicates how the Target Prescription Dose is to be interpreted in the referenced target volume. Defined Terms: MEAN MEDIAN	TxPlanDef	Written; As entered in the 'Presc. to' column in the prescription table in plan dialog. Set as MEAN per default. Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Target Maximum Dose	(300A,0027)	3	Maximum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET.	Comment	Proposed wording: Maximum permitted dose (in Gy) of all fractions planned to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET.
				TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Target Underdose Volume Fraction	(300A,0028)	3	Maximum permitted fraction (in percent) of Target to receive less than the Target Prescription Dose if Dose Reference Type (300A,0020) is TARGET and Dose Reference Structure Type (300A,0014) is	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			VOLUME.XSee Target Underdose Volume Fraction.	DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Organ at Risk Full-volume Dose	(300A,002A)	3	Maximum dose (in Gy) to entire Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME.	Comment	Proposed wording: Maximum dose (in Gy) of all fractions planned to entire Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.
				TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Organ at Risk Limit Dose	(300A,002B)	3	Maximum permitted dose (in Gy) to any part of Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME.	Comment	Proposed wording: Maximum permitted dose (in Gy) of all fractions planned to any part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME.
				TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Organ at Risk Maximum Dose	(300A,002C)	3	Maximum dose (in Gy) to non-overdosed part of Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME.	Comment	Proposed wording: Maximum dose (in Gy) of all fractions planned to non-overdosed part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					(300A,0014) of referenced Dose Reference is VOLUME.
				TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
>Organ at Risk Overdose Volume Fraction	(300A,002D)	3	Maximum permitted fraction (in percent) of the Organ at Risk to receive more than the Organ at Risk Maximum Dose if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME.	TxPlanDef	Written Recalculation: removed
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)

9.14.29 RT ROI Observation Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
RT ROI Observations Sequence	(3006,0080)	1	Introduces sequence of observations related to ROIs defined in the ROI Module. One or more items may be included in this sequence.	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	RT StructureSet: Read (BC) RT Dose: written
				Rep (Tx)	Read
				STX	Read Written
				PxM	Supported
>Observation Number	(3006,0082)	1	Identification number of the Observation. The value of Observation Number (3006,0082) shall be unique within the RT ROI Observations Sequence (3006,0080).	TxPlanDef	Read
				STX	Written; Set equal to the Reference ROI Number (3006,0084) because, as of the current version, only one Observation is supported per ROI.
				PxM	Written
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	RT StructureSet: Read (BC) RT Dose: written
				STX	Written
				PxM	Read; Written
>ROI Observation Label	(3006,0085)	3	User-defined label for ROI Observation.	STX	Written; Name of the ROI/Reference Point (truncated to 16 characters) as set in the ROI Name(3006,0026) attribute of Structure Set ROI Sequence under RT Structure Set.
				PxM	Not supported
>ROI Observation Description	(3006,0088)	3	User-defined description for ROI Observation.	PxM	Not supported

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
>RT Related ROI Sequence	(3006,0030)	3	Introduces sequence of significantly related ROIs, e.g. CTVs contained within a PTV. One or more items may be included in this sequence.	PxM	Not supported
>RT ROI Identification Code Sequence	(3006,0086)	3	Introduces sequence containing Code used to identify ROI. If this sequence is included, only one item shall be present. Baseline Context ID Number = 96. See Section 53 for further explanation.	PxM	Not supported
>Related RT ROI Observations Sequence	(3006,00A0)	3	Introduces sequence of related ROI Observations. One or more items may be included in this sequence.	PxM	Not supported
>RT ROI Interpreted Type	(3006,00A4)	2	Type of ROI. Defined Terms: * EXTERNAL = external patient contour * PTV = Planning Target Volume (as defined in ICRU50) * CTV = Clinical Target Volume (as defined in ICRU50) * GTV = Gross Tumor Volume (as defined in ICRU50) * TREATED_VOLUME = Treated Volume (as defined in ICRU50) * IRRAD_VOLUME = Irradiated Volume (as defined in ICRU50) * BOLUS = patient bolus to be used for external beam therapy * AVOIDANCE = region in which dose is to be minimized * ORGAN = patient organ * MARKER = patient marker or marker on localizer * REGISTRATION = registration ROI * ISOCENTER = treatment isocenter to be used for external beam therapy * CONTRAST_AGENT = volume into which a contrast agent has been injected * CAVITY = patient anatomical cavity * BRACHY_CHANNEL = brachytherapy channel * BRACHY_ACCESSORY = brachytherapy accessory device * BRACHY_SRC_APP = brachytherapy source applicator * BRACHY_CHNL_SHLD = brachytherapy channel shield * SUPPORT = external patient support device * FIXATION = external patient fixation or immobilisation device * DOSE_REGION = ROI to be used as a dose reference * CONTROL = ROI to be used in control of dose optimization and calculation See RT ROI Interpreted Type.	TxPlanDef	Read; Structure Set conditions checked: 1. exactly one ROI of type EXTERNAL 2. at least one target of type PTV, CTV or GTV 3. at least one reference point of type MARKER required for relative positioning mode
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read
				STX	Written; FIXATION for "STXFrame" VOI MARKER for "STXOrigin" reference point
				PxM	Read; Written: For ROIs: External PTV CTV GTV BOLUS AVOIDANCE ORGAN FIXATION For POIs MARKER ISOCENTER
>ROI Interpreter	(3006,00A6)	2	Name of person performing the interpretation.	PxM	Written: user assigning the value
>Material ID	(300A,00E1)	3	User-supplied identifier for ROI material.	DCO	DCO: Read
				STX	Written for external

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					contours (plates with fiducial markers); always "Air"
				PxM	Read; Written
>ROI Physical Properties Sequence	(3006,00B0)	3	Introduces sequence describing physical properties associated with current ROI interpretation. One or more items may be included in this sequence.	STX	Written; singe item only
				PxM	Read; Written Additional information as part of private xml in syngo RT Private Data#PrivCreatorSyngoRT
>>ROI Physical Property	(3006,00B2)	1C	Physical property specified by ROI Physical Property Value (3006,00B4). Defined Terms: * REL_MASS_DENSITY = mass density relative to water * REL_ELEC_DENSITY = electron density relative to water * EFFECTIVE_Z = effective atomic number * EFF_Z_PER_A = ratio of effective atomic number to mass (AMU power -1) * REL_STOP_RATIO = linear stopping power ratio relative to water Required if ROI Physical Properties Sequence (3006,00B0) is sent.	DCO	DCO: Read only REL_ELEC_DENSITY is supported
				STX	Written for external contours (plates with fiducial markers); always "REL_ELEC_DENSITY"
				PxM	Read; Written Only REL_ELEC_DENSITY supported
>>ROI Physical Property Value	(3006,00B4)	1C	User-assigned value for physical property. Required if ROI Physical Properties Sequence (3006,00B0) is sent.	DCO	DCO: Read
				STX	Written for external contours (plates with fiducial markers); relative electron density value for air.
				PxM	Read; Written Configured value for material

9.14.30 RT Series Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. Enumerated Values: RTIMAGE=RT Image RTDOSE=RT Dose RTSTRUCT=RT Structure Set RTPLAN=RT Plan RTRECORD=RT Treatment Record The Enumerated Value for Modality (0008,0060) shall determined by the IOD: RTIMAGE if RT Image IOD, RTDOSE if RT Dose IOD, RTSTRUCT if RT Structure Set IOD, RTPLAN if RT Plan IOD. RTRECORD if RT Beams Treatment Record IOD, RT Brachy Treatment Record IOD, or RT Treatment Summary Record IOD. Note: DICOM specifies that a given series shall contain objects of only	TxPlanDef	Written; RTPLAN
				WS	Read
				DCO	Written RTPLAN, RTDOSE
				Rep (Tx)	RTIMAGE OT (For EncapsulatedPDFSeries)
				Rep (Vx)	OT (For EncapsulatedPDFSeries)
				VxPlan	Written; RTPLAN, RTDOSE
				STX	Written "RTSTRUCT"
				FxSeq (Tx)	Written RTRECORD (Only when manual entry of Tx Records are expected)
				PxM	Written;

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			one Modality, and shall be created by a single device (described in the General Equipment Module). However, in general there may be many series defined for a given modality/device pair. Note that a radiotherapy series is generally created over an extended time interval (unlike in radiology, where all images in an image series are generally created together).		RTSTRUCT for RT Structure Sets
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.	Comment	Ion plans are placed in one series, conventional ones in another.
				TxPlanDef	Written
				DCO	Written
				Rep (Tx)	Written
				Rep (Vx)	Written
				VxPlan	Written
				STX	Written
				FxSeq (Tx)	written (Only when manual entry of Tx Records are expected)
				PxM	Written
Series Number	(0020,0011)	2	A number that identifies this Series.	TxPlanDef	Written
				DCO	Written
				Rep (Tx)	Written
				Rep (Vx)	Written
				VxPlan	Written
				STX	Written
				FxSeq (Tx)	written (Only when manual entry of Tx Records are expected)
				PxM	Written
Series Description	(0008,103E)	3	User provided description of the Series.	TxPlanDef	Written; RT Ion Plan Series
				DCO	Written
				Rep (Tx)	read. written for RTImage
				VxPlan	Written
				STX	Written
				FxSeq (Tx)	written (Only when manual entry of Tx Records are expected)
				PxM	Written
Operators' Name	(008,1070)	2	Name(s) of the operator(s) supporting the Series.	PxM	Written; Name of logged into RTC

9.14.31 RT Treatment Summary Record

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Current Treatment Status	(3008,0200)	1	Status of the Treatment at the time the Treatment Summary was created. Enumerated Values: NOT_STARTED ON_TREATMENT ON_BREAK SUSPENDED STOPPED COMPLETED	FxSeq (Tx)	Read. Written (Only when Manual Entry is expected). Can only be ON_TREATMENT, COMPLETED.
Fraction Group Summary Sequence	(3008,0220)	3	Introduces sequence describing current state of planned vs. delivered fraction groups. The sequence may contain one or more items.	Rep (Tx)	Read
				FxSeq (Tx)	read. Written. Contains all the fraction groups that have been delivered. This is filled only when manual entry is expected
>Referenced Fraction Group Number	(300C,0022)	3	References Fraction Group Number (300A,0071) in Fraction Group Sequence (300A,0070) in the referenced RT Plan.	Rep (Tx)	Read
				FxSeq (Tx)	read/written(Only when Manual entry is expected)
>Number of Fractions Delivered	(3008,005A)	2C	Number of fractions delivered as of Treatment Summary Report. Required if Fraction Group Summary Sequence (3008,0220) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	read/written (Only when Manual Entry is expected).
>Fraction Status Summary Sequence	(3008,0240)	3	Introduces sequence describing status of fractions in Fraction Group. The sequence may contain one or more items.	Rep (Tx)	Read
				FxSeq (Tx)	read Written (Only when Manual Entry is expected). Contains all the fractions of this fraction group that have been delivered
>>Referenced Fraction Number	(3008,0223)	1C	Identifies fraction. Required if Fraction Status Summary Sequence (3008,0240) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	read. Written (Only when Manual Entry is expected).
>>Treatment Date	(3008,0250)	2C	Date when fraction was delivered. Required if Fraction Status Summary Sequence (3008,0240) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	read/written (Only when Manual Entry is expected).
>>Treatment Time	(3008,0251)	2C	Time when fraction was delivered. Required if Fraction Status Summary Sequence (3008,0240) is sent.	Rep (Tx)	Read
				FxSeq (Tx)	read/written (Only when Manual Entry is expected).
>>Treatment Termination Status	(3008,002A)	2C	Conditions under which treatment was terminated. Required if Fraction Status Summary Sequence (3008,0240) is sent. Enumerated Values: NORMAL treatment terminated normally OPERATOR operator terminated treatment MACHINE machine terminated treatment for other than NORMAL condition UNKNOWN status at termination unknown	FxSeq (Tx)	read. Written (Only when Manual Entry is expected). Only NORMAL is written

9.14.32 SC Equipment Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Conversion Type	(0008,0064)	1	Describes the kind of image conversion. Defined Terms : DV = Digitized Video DI = Digital Interface DF = Digitized Film WSD = Workstation SD = Scanned Document SI = Scanned Image DRW = Drawing SYN = Synthetic Image	Rep (Tx)	Written by TxSessionData for Encapsulated PDF as "WSD"
				Rep (Vx)	Written by TxSessionData for Encapsulated PDF as "WSD"

9.14.33 SOP Common

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. See C.12.1.1.1 for further explanation. See also PS 3.4.	PxM	Supported
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance. See C.12.1.1.1 for further explanation. See also PS 3.4.	PxM	Supported
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used. See C.12.1.1.2 for Defined Terms.	PxM	Supported (when written based on configuration)
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.	PxM	Written
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.	PxM	Written
Timezone Offset From UTC	(0008,0201)	3	Contains the offset from UTC to the timezone for all DA and TM Attributes present in this SOP Instance, and for all DT Attributes present in this SOP Instance that do not contain an explicitly encoded timezone offset. Encoded as an ASCII string in the format “&ZZXX”. The components of this string, from left to right, are & = “+” or “-”, and ZZ = Hours and XX = Minutes of offset. Leading space characters shall not be present. The offset for UTC shall be +0000; -0000 shall not be used. Notes: 1. This encoding is the same as described in PS 3.5 for the offset component of the DT Value Representation. 2. This Attribute does not apply to values with a DT Value Representation, that contains an explicitly encoded timezone offset. 3. The corrected time may cross a 24 hour boundary. For example, if Local Time = 1.00 a.m. and Offset = +0200, then UTC = 11.00 p.m. (23.00) the day before. 4. The “+” sign may not be omitted. Time earlier than UTC is expressed as a negative offset. Note: For example: UTC = 5.00 a.m. Local Time = 3.00 a.m. Offset = -0200 The local timezone offset is undefined if this Attribute is absent.	PxM	Written

9.14.34 Spatial Fiducials Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Content Date	(0008,0023)	1	The date the content creation started.	STX	Written
Content Time	(0008,0033)	1	The time the content creation started.	STX	Written
Instance Number	(0020,0013)	1	A number that identifies this instance	STX	Written
Content Label	(0070,0080)	1	A label that is used to identify this registration	STX	Written "STX FIDUCIALS"
Fiducial Set Sequence	(0070,031C)	1	A sequence of one or more items, each of which is a fiducial set.	STX	Read Written (one sequence)
>Frame of Reference UID	(0020,0052)	1C	Identifies a Frame of Reference that may or may not be an image set (e.g. an atlas or physical space). See C.7.4.1.1.1 for further explanation. Required if Referenced Image Sequence (0008,1140) is absent. May be present otherwise.	STX	written FOR UID of the image set for which fiducials are created.
>Fiducial Sequence	(0070,031E)	1	A sequence that specifies one or more fiducials, one item per fiducial.	STX	Read Written (one item per image slice for which fiducials are created)
>>Fiducial Identifier	(0070,0310)	1	A fiducial assignment identifier that is unique within this Fiducial Sequence item but may match the fiducial identifier of an equivalent feature in another item.	STX	Written STXFiducial_n, where n starts from 0
>>Fiducial UID	(0070,031A)	3	Globally unique identifier for the fiducial instance of this fiducial assignment.	STX	Read Written (UID creaed by STX task)
>>Shape Type	(0070,0306)	1	Shape Type (0070,0306) defines the geometric interpretation of the Contour Data (3006,0050) and Graphic Data (0070,0022). A point is defined as a triplet (x,y,z) in the case of spatial data or a pair (x,y) in the case of graphic data. Defined Terms are: POINT = a single point designating a single fiducial point. Note: A point may be the epicenter of a more complex shape such as sphere. LINE = two points that specify a line or axis such as the inter-orbital line. The point locations have no significance other than identifying the line, i.e. they are not line segment end points. PLANE = three points that	STX	Written always SHAPE

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			identify a plane such as the laterality plane SURFACE = three or more points (usually many) that reside on, or near, a region of a curved surface. The surface may be flat or curved, closed or open. The point order has no significance. RULER = two or more evenly spaced collinear points ordered sequentially along the line, such as a physical ruler placed in the imaging field. L_SHAPE = three points of two perpendicular line segments, AB and BC, having a common end point B. The order of the points is: ABC. May represent an L-shaped marker placed in the imaging field. T_SHAPE = three points of two perpendicular line segments AB and CD, such that C bisects AB. The order is ABD. SHAPE = three or more points that specify the shape of a well-known fiducial type. The term in the Fiducial Identifier Code Sequence (0070,0311) defines the shape and the order of the points that represent it.		
>>Number of Contour Points	(3006,0046)	1C	Number of points (triplets) in Contour Data (3006,0050). Required if Contour Data is present.	STX	Written number of fiducials of one image slice e.g. 12 if 4 Localizers are used 9 if 3 Localizers are used
>>Contour Data	(3006,0050)	1C	Specifies the coordinates of this item's fiducial. One triplet (x,y,z) shall be present for each point in the fiducial. See C.21.2.1.2 for further explanation. Required if Frame of Reference UID (0020,0052) is present in this item of the Fiducial Set Sequence (0070,031C). Shall not be present otherwise. Note: Contour Data may not be properly encoded if Explicit-VR transfer syntax is used and the VL of this attribute exceeds 65534 bytes. Contour Data (3006,0050) is an ordered set of triplets that defines a shape. The triplets (x,y,z) denote points in the Reference Coordinate System of the Registration Instance. Note: Contours may associate observational data with a set of	STX	Read Written DICOM patient coordinates of fiducial markers are stored

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			Image features or specify coordinates that are input data for a measurement.		

9.14.35 Spatial Fiducials Series

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	Modality type. Enumerated Value: FID	STX	Written

9.14.36 Spatial Registration Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Content Date	‘(0008,0023)	1	The date the content creation started.	STX	Read Written
				PxM	Written: Date when alignment was created/modified
Content Time	‘(0008,0033)	1	The time the content creation started.	STX	Read Written
				PxM	Written: Time when alignment was created/modified
Instance Number	‘(0020,0013)	1	A number that identifies this instance	STX	Written
				PxM	Written
Content Label	‘(0070,0080)	1	A label that is used to identify this registration.	STX	Read Written as "STX"
				PRC	Read whether it is STX or not
				PxM	Written: SYNGOBASE
Content Description	‘(0070,0081)	2	A description of this registration.	STX	Written as "STX Registration"
				PxM	Written: User defined label for registration
Content Creator’s Name	‘(0070,0084)	2	Name of operator performing the registration (such as a technologist or physician).	PxM	Written: Name of user logged into RTC
Registration Sequence	‘(0070,0308)	1	A sequence of one or more registration items. Each item defines a spatial registration to the referenced images in that item. All referenced images are in the same spatial frame of reference or atlas.	TxPlanDef	Read
				Rep (Tx)	Read
				STX	Read Written Item0 : GRM information Item 1-n: LRM information where 1-n is for image 1-n in the series
				PxM	Supported
>Frame of Reference UID	‘(0020,0052)	1C	Identifies a Frame of Reference that may or may not be an image set (e.g. atlas or physical space). See C.7.4.1.1.1 for further explanation. Required if Referenced Image Sequence (0008,1140) is absent. May be present otherwise.	STX	Read Written FOR of localized image set (only for first item which is GRM) <empty> for subsequent items (LRMs)
				PxM	Read; Written: Copied from alignment image set
>Referenced Image Sequence	‘(0008,1140)	1C	Identifies the set of images registered in this sequence item. One or more items shall be present. Required if Frame of Reference UID (0020,0052) is absent. May be present	WS	Read
				STX	Read Written <empty> for first item (GRM)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			otherwise.		Image SOP Instance Reference (n) of localized image (n) for subsequent items.
				PxM	Read; Written: Lists all images used during alignment
>>Include 'Image SOP Instance Reference Macro' Table 10-3				PxM	Read and Written
>Matrix Registration Sequence	‘(0070,0309)	1	A sequence that specifies one spatial registration. Exactly one item shall be present	TxPlanDef	Read
				Rep (Tx)	Read
				STX	Read Written
				PxM	Supported
>>Frame of Reference Transformation Comment	‘(3006,00C8)	3	User description or comments about the registration.	TxPlanDef	Read
				Rep (Tx)	Read
				STX	Read Written "GRM" if used for saving GRM else "LRM_z" where z is z-coordinate of image origin
>>Registration Type Code Sequence	‘(0070,030D)	2	Describes the information input into the registration process. Only one item may be present.	PxM	Supported
>>>Include ‘Code Sequence Macro’ Table 8.8-1			Baseline Context ID is 7100	PxM	>>>Code Value (0008,0100) 125021 for first item in registration sequence 125025 for second item in registration sequence >>>Coding Scheme Designator (0008,0102) DCM >>>Code Meaning (0008,0104) Frame of Reference Identity for first item in registration sequence Visual Alignment for second item in registration sequence
>>Matrix Sequence	‘(0070,030A)	1	One or more items shall be present. Each item specifies a transformation. The item order is significant and corresponds to matrix multiplication order. See C.20.2.1.1.	TxPlanDef	Read
				Rep (Tx)	Read
				STX	Read Written Exactly one item is present
				PxM	Supported
>>>Frame of Reference Transformation Matrix	‘(3006,00C6)	1	A 4x4 homogeneous transformation matrix that registers the referenced images to the local RCS. Matrix elements shall be listed in row-major order. See C.20.2.1.1.	Comment	Note that DICOM stores the transformation matrix as Model-> Reference
				TxPlanDef	Read
				Rep (Tx)	Read
				STX	Read Written Transformation matrix FROM image set TO stereotactic space
				PRC	Read
				PxM	Read; Written: Transformation matrix from model to reference
>>>Frame of	‘(0070,030C)	1	Type of Frame of Reference	STX	written

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Reference Transformation Matrix Type			Transformation Matrix (3006,00C6). Defined terms: RIGID RIGID_SCALE AFFINE RIGID_PROJECTIVE See C.20.2.1.2		"RIGID" for CT/MRI/PET localization "RIGID_PROJECTIVE" for DSA localization
				PxM	Read; Written; Only RIGID is supported
>Used Fiducials Sequence	‘(0070,0314)	3	The fiducials used to determine the Frame of Reference Transformation Matrix. One or more Items may be present.	STX	Read Written
				PxM	Not supported
>>Include 'SOP Instance Reference Macro'			Reference to the Spatial Fiducial SOP Instance identifying the Used Fiducial(s)	STX	Read Written
>>Fiducial UID	‘(0070,031A)	1	The UID that identifies the fiducial used as registration input.	STX	Read Written
Referenced Siemens Non Image Sequence	(300B,xx18)	3	References the instance of the Siemens Non Image IOD which mirrors this Spatial Registration IOD instance into the syngo Classic world. At most one item shall be present in the sequence.	Comment	For details of this mapping, please refer to ClearCase: /DOCS/SWDS/ArcH&Comps/TxSessionData/SiemensNonImageIODSpatialRegistrationIODMapping.xls. Note that this private data is not implemented in the XML based attribute below in order to allow infrastructural components to follow the reference without having to parse the XML data.
				STX	Written
				PxM	Not supported
syngo RT Private Data	(300B,xx17)	3	This tag contains private data for a Spatial Registration IOD as an instance of SpatialRegistrationExtensions.xsd	STX	Written
				PxM	Not supported

9.14.37 Spatial Registration Series

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	Modality type. Enumerated Value: REG	STX	Written
				PxM	Written

9.14.38 SR Document Content

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Include Document Content Macro Table C.17-5. with a Value Type (0040,A040) of CONTAINER				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				VxPlan	Read
				FxSeq (Tx)	read / written
				FxSeq (Vx)	read / written
Include Document Relationship Macro Table C.17-6.				Rep (Tx)	Read Written
				Rep (Vx)	Read

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
					Written
				VxPlan	Read
				FxSeq (Tx)	read / written
				FxSeq (Vx)	read / written

9.14.39 SR Document General

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Instance Number	(0020,0013)	1	A number that identifies the SR Document.	Rep (Tx)	Written
				Rep (Vx)	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
Completion Flag	(0040,A491)	1	The estimated degree of completeness of this SR Document with respect to externally defined criteria in a manner specified in the Conformance Statement.Note: It may be desirable to make thesecriteria adaptable to local policies or user decisions. Enumerated Values: PARTIAL Partial content. COMPLETE Complete content.	Rep (Tx)	Written COMPLETE for unofficial/official Report
				Rep (Vx)	Written COMPLETE for unofficial/official Report
				FxSeq (Tx)	written; always COMPLETE
				FxSeq (Vx)	written; always COMPLETE
Verification Flag	(0040,A493)	1	Indicates whether this SR Document is Verified. Enumerated Values: UNVERIFIED Not attested to. VERIFIED Attested to by a Verifying Observer Name (0040,A075) who is accountable for its content. Note: The intent of this specification is that the""prevailing final versio"" of an SR Document is the version having the most recent Verification DateTime (0040,A030), Completion Flag (0040,A491) of COMPLETE and Verification Flag (0040,A493) of VERIFIED.	Rep (Tx)	Written UNVERIFIED for unapproved FxSequence VERIFIED for approved FxSequence VERIFIED for official Report
				Rep (Vx)	Written UNVERIFIED for unapproved FxSequence VERIFIED for approved FxSequence VERIFIED for official Report
				FxSeq (Tx)	written; always UNVERIFIED
				FxSeq (Vx)	written; always UNVERIFIED
Content Date	(0008,0023)	1	The date the document content creation started.	Rep (Tx)	Read Written
				Rep (Vx)	Read Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
Content Time	(0008,0033)	1	The time the document content creation	Rep (Tx)	Read

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
			started.		Written
				Rep (Vx)	Read Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
Verifying Observer Sequence	(0040,A073)	1C	The person or persons authorized to verify documents of this type and accept responsibility for the content of this document. One or more Items may be included in this sequence. Required if Verification Flag (0040,A493) is VERIFIED.	Rep (Tx)	Read Written
				Rep (Vx)	Read Written
>Verifying Observer Name	(0040,A075)	1	The person authorized by the Verifying Organization (0040,A027) to verify documents of this type and who accepts responsibility for the content of this document	Rep (Tx)	Read Written
				Rep (Vx)	Read Written
>Verifying Organization	(0040,A027)	1	Organization to which the Verifying Observer Name (0040,A075) is accountable for this document in the current interpretation procedure.	Rep (Tx)	Read Written
				Rep (Vx)	Read Written
>Verification DateTime	(0040,A030)	1	Date and Time of verification by the Verifying Observer Name (0040,A075).	Rep (Tx)	Read Written
				Rep (Vx)	Read Written
Predecessor Documents Sequence	(0040,A360)	1C	Shall refer to SR SOP Instances (for example prior or provisional reports) whose content has been wholly or partially included in this document with or without modification. One or more Items may be included in this sequence. Required if this document includes content from other documents. Note: The amendment process of an existing SR Document is not explicitly described, but several approaches may be considered; one may choose, for example, to create a new SR Document that includes the original content with any amendments applied or included; the structure of this amended SR Document may or may not reflect what was amended; however, the use of the Predecessor Document Sequence allows tracing back to the input SR Document, which in this case is the previous version.	Comment	This attribute is used for maintaining the versioning relationship between structure sets in the syngo RT context. Note that branching version chains is technically possible using this attribute, but it is forbidden in syngo RT.
				Rep (Tx)	Read Written
				Rep (Vx)	Read Written
Dosimetric Checksum Encryption Code	(300B,xxED)	3	A 128 bit encryption code generated by MD5 algorithm on the Dosimetric and Safety relevant attributes.This attribute is only created for Structured Reports that are Fraction Sequences.	Comment	The attributes used to calculate this checksum are marked in the column "DOSIMETRIC Relevance" and "SAFETY Relevance" in page Fraction Sequence SR

9.14.40 SR Document Series Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Modality	(0008,0060)	1	Modality type. Enumerated Values: SR SR Document	Rep (Tx)	Written
				Rep (Vx)	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. Note: No SR-specific semantics are specified.	Rep (Tx)	Written
				Rep (Vx)	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written
Series Number	(0020,0011)	1	A number that identifies the Series. Note: No SR-specific semantics are specified.	Rep (Tx)	Written
				Rep (Vx)	Written
				FxSeq (Tx)	Written
				FxSeq (Vx)	Written

9.14.41 Structure Set Module

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Structure Set Label	(3006,0002)	1	User-defined label for Structure Set.	VxPlan	written; always "VxPlanStructSet" for point based RT Dose
				STX	Written "STX" only if SS is newly created else existing label is retained
				PxM	Read; Written according to user input Default value is PxM RTSS
Structure Set Name	(3006,0004)	3	User-defined name for Structure Set.	STX	Written "Frame Contours" only when SS is created else existing Name is retained
				PxM	Not supported
Structure Set Description	(3006,0006)	3	User-defined description for Structure Set.	STX	Written "Frame Contour Structureset" only when SS is created else existing description is retained
				PxM	Not supported
Instance Number	(0020,0013)	3	A number that identifies this object instance.	STX	Written
				PxM	Written;
Structure Set Date	(3006,0008)	2	Date at which Structure Set was last modified.	TxPlanDef	Read
				WS	Read; (ignored)
				VxPlan	writtten; always set to system date for point based RT Dose
				STX	Written
				PxM	Read; Written with system date during workitem completion
Structure Set Time	(3006,0009)	2	Time at which Structure Set was last modified.	TxPlanDef	Read
				WS	Read; (ignored)

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				VxPlan	writtten; always set to system time for point based RT Dose
				STX	Written
				PxM	Read; Written with system time during workitem completion
Structure Set Predecessor	(0039,xx76)	3	SOP instance UID of predecessor version of this structure set.	Comment	This attribute is used for maintaining the versioning relationship between structure sets in the syngo RT context. Note that branching version chains is technically possible using this attribute, but it is forbidden in syngo RT.
				TxPlanDef	Read
				STX	Written
				PxM	Read; Written
Referenced Frame of Reference Sequence	(3006,0010)	3	Introduces sequence of items describing Frames of Reference in which the ROIs are defined. One or more items may be included in this sequence. See C.8.8.5.1.	TxPlanDef	Read
				STX	Written;
				PRC	Read
				PxM	Read; Written with planning CT information
>Frame of Reference UID	(0020,0052)	1C	Uniquely identifies Frame of Reference within Structure Set. Required if Referenced Frame of Reference Sequence (3006,0010) is sent.	TxPlanDef	Read
				STX	Written; Frame of Reference UID of the CT series used to define the structures and ROIs.
				PRC	Read
				PxM	Read; Written with planning CT information
>Frame of Reference Relationship Sequence	(3006,00C0)	3	Introduces sequence of transforms that relate other Frames of Reference to this Frame of Reference.	STX	Not supported
				PxM	Not supported
>>Related Frame of Reference UID	(3006,00C2)	1C	Frame of Reference Coordinate System to be transformed to the current Frame of Reference. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent.	STX	Not supported
				PxM	Not supported
>>Frame of Reference Transformation Type	(3006,00C4)	1C	Type of Transformation. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent. Defined Terms: HOMOGENEOUS	STX	Not supported
				PxM	Not supported
>>Frame of Reference Transformation Matrix	(3006,00C6)	1C	Four-by-four transformation Matrix from Related Frame of Reference to current Frame of Reference. Matrix elements shall be listed in row-major order. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent. See C.8.8.5.2.	STX	Not supported
				PxM	Not supported
>>Frame of Reference	(3006,00C8)	3	Comment regarding the transformation between the related	STX	Not supported
				PxM	Not supported

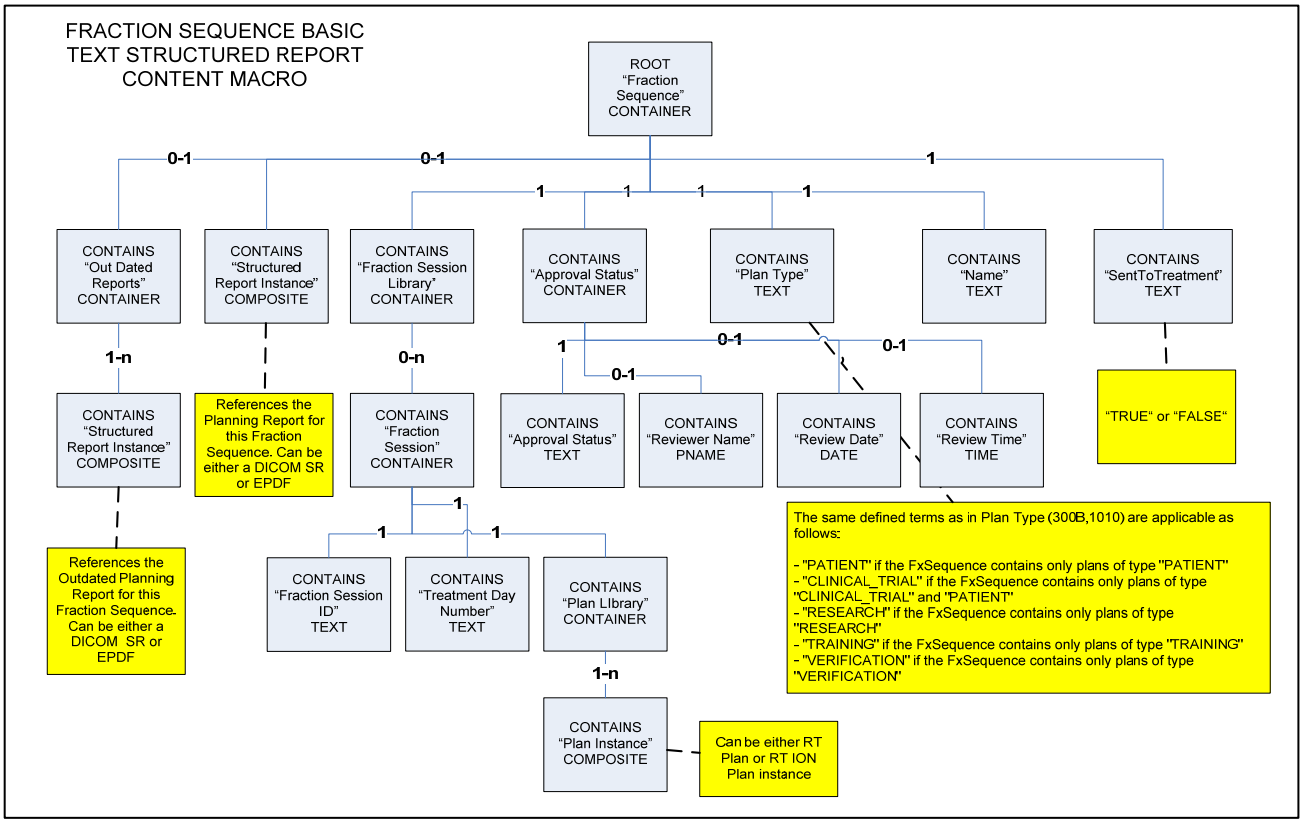
Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Transformation Comment			and current Frames of Reference		
>RT Referenced Study Sequence	(3006,0012)	3	Introduces sequence of Studies containing series to be referenced. One or more items may be included in this sequence.	VxPlan	Written; Reference to study to which CT series belongs. Only one sequence is populated for point based RT Dose Required for Siemens and non-Siemens RT objects.
				STX	Written; Reference to study to which CT series belongs. Only one sequence is populated.
				FxSeq (Tx)	Read
				PxM	Read; Written with planning CT study information
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if RT Referenced Study Sequence (3006,0012) is sent.	STX	Written
				PxM	Written: Only 1.2.840.10008.5.1.4.1.1.2
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if RT Referenced Study Sequence (3006,0012) is sent.	STX	Written
				PxM	Written;
>>RT Referenced Series Sequence	(3006,0014)	1C	Introduces sequence of items describing series of images within the referenced study which are used in defining the Structure Set. Required if RT Referenced Study Sequence (3006,0012) is sent. One or more items may be included in this sequence.	STX	Written; Reference to CT series to which the CT images belong. Only one sequence is populated. Note: There is exactly one RT Structure Set referencing a CT image Series.
				FxSeq (Tx)	Read
				PxM	Read; Written with planning CT series information
>>>Series Instance UID	(0020,000E)	1C	Unique identifier for the series containing the images. Required if RT Referenced Series Sequence (3006,0014) is sent.	STX	Written
				FxSeq (Tx)	Read
				PxM	Written;
>>>Contour Image Sequence	(3006,0016)	1C	Introduces sequence of items describing images in a given series used in defining the Structure Set (typically CT or MR images). Required if RT Referenced Series Sequence (3006,0014) is sent. One or more items may be included in this sequence.	STX	Written
				PxM	Read; Written;
>>>>Include 'Image SOP Instance Reference Macro' Table 10-3				PxM	Read; Written: SOP Class UID:The image class UID duplicated from the image data set as transferred via DICOM. SOP Instance UID: The instance UID duplicated from the image instance for the contour as transferred via DICOM.

Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
Structure Set ROI Sequence	(3006,0020)	3	Introduces sequence of ROIs for current Structure Set. One or more items may be included in this sequence.	Comment	RTT-PT and MTS always expect the items in RT Dose ROI Sequence to be sorted according to their PinPointChamberIds, hence this sequence has to be sorted according to the ROIName as the ROIName corresponds to the PinPointChamberId.
				TxPlanDef	Read
				WS	Read; (ignored)
				DCO	Read
				VxPlan	Written for RT Dose IOD as one item per PinPointChamber; Items in this sequence are written after sorting them by ascending ROIName
				STX	Written
				FxSeq (Tx)	Read
				PxM	Supported
>ROI Number	(3006,0022)	1C	Identification number of the ROI. The value of ROI Number (3006,0022) shall be unique within the Structure Set in which it is created. Required if Structure Set ROI Sequence (3006,0020) is sent.	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	Read
				VxPlan	Written; Used to uniquely identify the corresponding ROI Contour
				STX	Written; Used to uniquely identify the corresponding ROI Contour and RT ROI Observations modules under a structure set.
				FxSeq (Tx)	Read
				PxM	Unique number for ROI within structure set
>Referenced Frame of Reference UID	(3006,0024)	1C	Uniquely identifies Frame of Reference in which ROI is defined, specified by Frame of Reference UID (0020,0052) in Referenced Frame of Reference Sequence (3006,0010). Required if Structure Set ROI Sequence (3006,0020) is sent.	TxPlanDef	Read
				VxPlan	Written as Frame of Reference UID of the phantom CT series
				STX	Written
				PxM	Same as in >Frame of Reference UID above
>ROI Name	(3006,0026)	2C	User-defined name for ROI. Required if Structure Set ROI Sequence (3006,0020) is sent.	TxPlanDef	Read
				WS	Read; (ignored)
				DCO	Read (BC)
				Rep (Tx)	Read (ignored)
				VxPlan	Written; always the name of the corresponding PinPointChamber
				STX	Written; "STXFrame" for STX frame VOI "STXOrigin" for STX origin reference point
				FxSeq (Tx)	Read

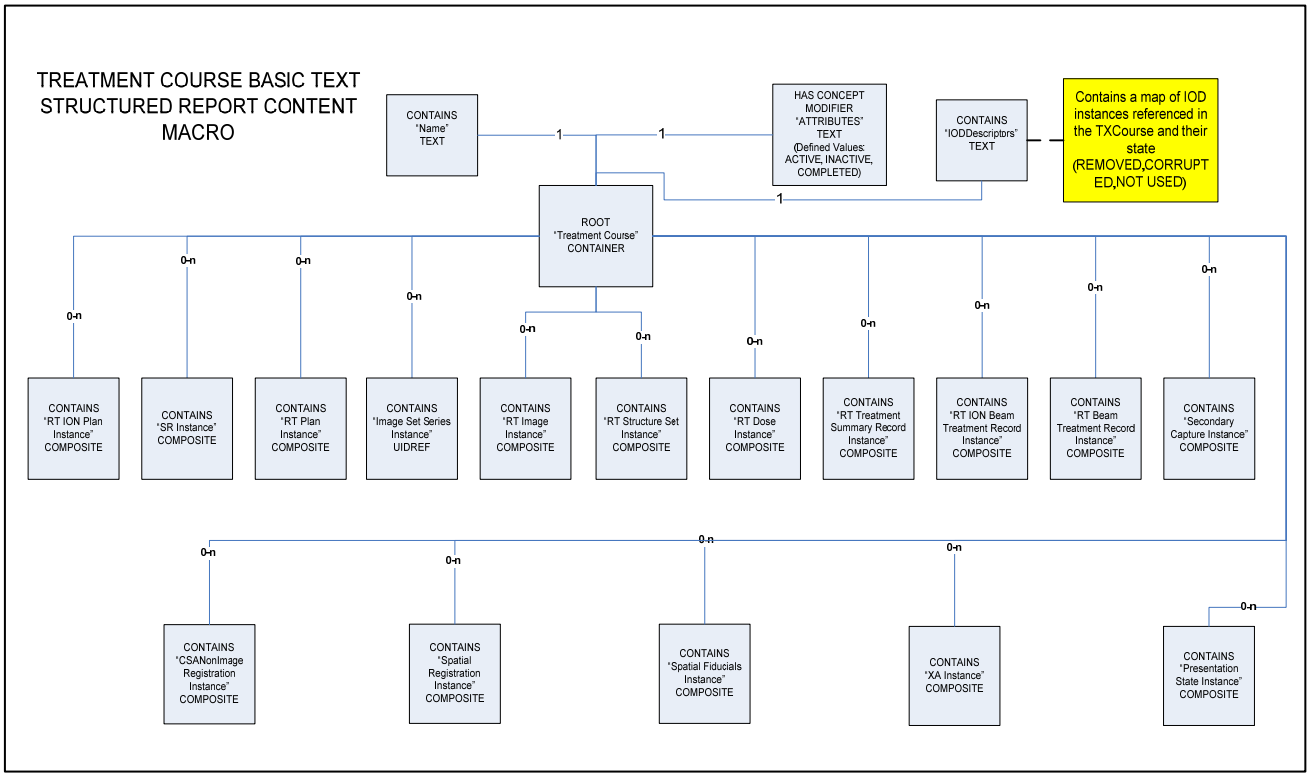
Attribute Name	Tag	Type	Description / Notes	Task	Task Usage
				PxM	User provided ROI name
>ROI Description	(3006,0028)	3	User-defined description for ROI.	WS	Read; (ignored)
				PxM	Not supported
>ROI Volume	(3006,002C)	3	Volume of ROI (cubic centimeters).	WS	Read; (ignored)
				PxM	Only written
>ROI Generation Algorithm	(3006,0036)	2C	Type of algorithm used to generate ROI. Required if Structure Set ROI Sequence (3006,0020) is sent. Defined Terms: AUTOMATIC = calculated ROI SEMIAUTOMATIC = ROI calculated with user assistance MANUAL = user-entered ROI	WS	Read; (ignored)
				VxPlan	Written; Always MANUAL
				STX	Written; Always SEMIAUTOMATIC
				PxM	Written: MANUAL or SEMIAUTOMATIC
>ROI Generation Description	(3006,0038)	3	User-defined description of technique used to generate ROI.	PxM	Not supported
syngo RT Private Data	(300B,xx17)	3	This tag contains private data for a Structure Set IOD as an instance of RTStructureSetExtensions.xsd	TxPlanDef	Read; ICRU reference points used for POINT prescription
				WS	Read; (ignored)
				DCO	Read
				Rep (Tx)	Read (ignored)
				STX	Written Identifier of AIR will be written for "STXFrame" VOI
				PxM	Read; Written: Used to store material overrides and RP types

9.15 Structured Reports With Special Meaning

9.15.1 Fraction Sequence SR



9.15.2 Treatment Course SR



9.16 Private Creator Codes

Attribute Name	Tag	Type	Task	Task Usage
SIEMENS MED SYNGO RT	(300B,00XX)	1	Comment	Creator code for private attributes defined for syngo RT in context of PT-RTT and PT-TPS. Specifies that all private attributes based on this code have a tag in the following format: (300B,XXyy)
SIEMENS MED OCS SS VERSION INFO	(0039,00XX)	1	Comment	Creator code for structure set versioning.
SIEMENS MED OCS PUBLIC RT PLAN ATTRIBUTES	(0039,00XX)	1	Comment	Creator code for XML instance with private content in RT General Plan

9.17 Private Data Element Dictionary (used by *syngo*® RT Planning)

Attribute Name	Tag	Type	VR, VM	Creator Code Used
External Attributes	(0039,xx01)	3	UT 1	SIEMENS MED OCS PUBLIC RT PLAN ATTRIBUTES
Structure Set Predecessor	(0039,xx76)	3	LO 1	SIEMENS MED OCS SS VERSION INFO
Plan Type	(300B,xx10)	3	CS 1	SIEMENS MED SYNGO RT
Delivery Warning Dose Comment	(300B,xx11)	3	LT 1	SIEMENS MED SYNGO RT
Imager Organ Program	(300B,xx12)	3	LO 1	SIEMENS MED SYNGO RT
XA Image SID	(300B,xx13)	3	DS 1	SIEMENS MED SYNGO RT
XA Image Receptor Angle	(300B,xx14)	3	DS 1	SIEMENS MED SYNGO RT
Target Prescription Dose Type	(300B,xx15)	3	CS1	SIEMENS MED SYNGO RT
Referenced Target ROI Number	(300B,xx16)	3	IS 1	SIEMENS MED SYNGO RT
syngo RT Private Data	(300B,xx17)	3	UT 1	SIEMENS MED SYNGO RT
Referenced Siemens Non Image Sequence	(300B,xx18)	3	SQ 1	SIEMENS MED SYNGO RT
Verification Method	(300B,xx19)	3	CS 1	SIEMENS MED SYNGO RT
Alternative Treatment Machine Name Sequence	(300B,xx20)	3	SQ 1	SIEMENS MED SYNGO RT
Imager Angular Angle	(300B,xx24)	3	DS 1	SIEMENS MED SYNGO RT
Imager Iso-centric Angle	(300B,xx25)	3	DS 1	SIEMENS MED SYNGO RT
Imager Vertical Position	(300B,xx26)	3	DS 1	SIEMENS MED SYNGO RT
Imager Longitudinal Position	(300B,xx27)	3	DS 1	SIEMENS MED SYNGO RT
Imager Lateral Position	(300B,xx28)	3	DS 1	SIEMENS MED SYNGO RT
Imager Angular Rotation Direction	(300B,xx29)	3	CS 1	SIEMENS MED SYNGO RT
Imager Isocentric Rotation Direction	(300B,xx2A)	3	CS 1	SIEMENS MED SYNGO RT
Requested Scanning Spot Size	(300B,xx2B)	3	DS 1	SIEMENS MED SYNGO RT
Imager Orbital Angle	(300B,xx2C)	3	DS 1	SIEMENS MED SYNGO RT
Imaging Technique	(300B,xx2E)	3	CS 1	SIEMENS MED SYNGO RT
Imager Orbital Rotation Direction	(300B,xx2F)	3	CS 1	SIEMENS MED SYNGO RT
Patient Barcode	(300B,xx30)	3	LO 1	SIEMENS MED SYNGO RT
Ordered Referenced Beam Numbers	(300B,xx60)	3	IS 1-n	SIEMENS MED SYNGO RT
Fraction Group Code	(300B,xx76)	3	CS 1	SIEMENS MED SYNGO RT
Referenced Treatment Beam Number	(300B,xx77)	3	IS 1	SIEMENS MED SYNGO RT
Fraction Dose to Dose Reference	(300B,xx78)	3	DS 1	SIEMENS MED SYNGO RT
Referenced Target ROI Sequence	(300B,xx80)	3	SQ 1	SIEMENS MED SYNGO RT
Target ROI lateral expansion margin	(300B,xx82)	3	DS 1	SIEMENS MED SYNGO RT
Target ROI distal expansion	(300B,xx83)	3	DS 1	SIEMENS MED SYNGO RT

Attribute Name	Tag	Type	VR, VM	Creator Code Used
margin				
Target ROI proximal expansion margin	(300B,xx84)	3	DS 1	SIEMENS MED SYNGO RT
Scan grid lateral distance	(300B,xx85)	3	DS 2	SIEMENS MED SYNGO RT
Scan grid longitudinal distance	(300B,xx86)	3	DS 1	SIEMENS MED SYNGO RT
Beam Weight	(300B,xx87)	3	DS 1	SIEMENS MED SYNGO RT
Treatment Approval Sequence	(300B,xx90)	3	SQ 1	SIEMENS MED SYNGO RT
Display Color	(300B,xx9C)	3	IS 3	SIEMENS MED SYNGO RT
Beam Group Name	(300B,xx9D)	3	SH 1	SIEMENS MED SYNGO RT
Checksum Encryption Code	(300B,xxA1)	3	OB 1	SIEMENS MED SYNGO RT
Setup Type	(300B,xxA2)	3	CS 1	SIEMENS MED SYNGO RT
Number of Therapy Detectors	(300B,xxA3)	3	IS 1	SIEMENS MED SYNGO RT
Therapy Detector Sequence	(300B,xxA4)	3	SQ 1	SIEMENS MED SYNGO RT
Therapy Detector Number	(300B,xxA5)	1	IS 1	SIEMENS MED SYNGO RT
Therapy Detector Setup ID	(300B,xxA6)	1	SH 1	SIEMENS MED SYNGO RT
Therapy Detector Settings Sequence	(300B,xxA7)	3	SQ 1	SIEMENS MED SYNGO RT
Referenced Therapy Detector Number	(300B,xxA8)	1	IS 1	SIEMENS MED SYNGO RT
Therapy Detector Position	(300B,xxA9)	1	DS 3	SIEMENS MED SYNGO RT
Dose Optimization Constraint Sequence	(300B,xxC0)	3	SQ 1	SIEMENS MED SYNGO RT
Target Maximum Dose Constraint	(300B,xxC8)	3	DS 1	SIEMENS MED SYNGO RT
Target Maximum Dose Constraint Weight	(300B,xxC9)	3	DS 1	SIEMENS MED SYNGO RT
Target Minimum Dose Constraint	(300B,xxCA)	3	DS 1	SIEMENS MED SYNGO RT
Target Minimum Dose Constraint Weight	(300B,xxCB)	3	DS 1	SIEMENS MED SYNGO RT
Organ At Risk Maximum Dose Constraint	(300B,xxCC)	3	DS 1	SIEMENS MED SYNGO RT
Organ At Risk Maximum Dose Constraint Weight	(300B,xxCD)	3	DS 1	SIEMENS MED SYNGO RT
DVH Constraint Sequence	(300B,xxCE)	3	SQ 1	SIEMENS MED SYNGO RT
DVH Constraint Volume Limit	(300B,xxCF)	1	DS 1	SIEMENS MED SYNGO RT
DVH Constraint Volume Units	(300B,xxD0)	1	CS 1	SIEMENS MED SYNGO RT
DVH Constraint Dose Limit	(300B,xxD1)	1	DS 1	SIEMENS MED SYNGO RT
DVH Constraint Direction	(300B,xxD3)	1	CS 1	SIEMENS MED SYNGO RT
DVH Constraint Weight	(300B,xxD4)	1	DS 1	SIEMENS MED SYNGO RT
Optimized dose type	(300B,xxD5)	3	CS 1	SIEMENS MED SYNGO RT
Dose Calculation and Optimization Parameters	(300B,xxD6)	3	UT 1	SIEMENS MED SYNGO RT
Applied Renormalization Factor	(300B,xxD7)	3	DS 1	SIEMENS MED SYNGO RT
Dose Constraint Status	(300B,xxD8)	3	CS 1	SIEMENS MED SYNGO RT
Organ At Risk Minimum Dose	(300B,xxD9)	3	DS 1	SIEMENS MED SYNGO RT

Attribute Name	Tag	Type	VR, VM	Creator Code Used
Constraint				
Organ At Risk Minimum Dose Constraint Weight	(300B,xxDA)	3	DS 1	SIEMENS MED SYNGO RT
Base Data Group Sequence	(300B,xxE0)	3	SQ 1	SIEMENS MED SYNGO RT
Physics Base Data Group ID	(300B,xxE1)	1	CS 1	SIEMENS MED SYNGO RT
Biological Base Data Group ID	(300B,xxE2)	1	CS 1	SIEMENS MED SYNGO RT
Imaging Base Data Group ID	(300B,xxE3)	1	CS 1	SIEMENS MED SYNGO RT
Dosimetric Base Data Group ID	(300B,xxE4)	1	CS 1	SIEMENS MED SYNGO RT
Configuration Baseline	(300B,xxE5)	3	OB 1	SIEMENS MED SYNGO RT
Confidence Measure Units	(300B,xxE7)	3	CS 1	SIEMENS MED SYNGO RT
Confidence Measure Value	(300B,xxE8)	3	DS1	SIEMENS MED SYNGO RT
Body Region	(300B,xxEB)	3	CS 1	SIEMENS MED SYNGO RT
Dosimetric Checksum Encryption Code	(300B,xxED)	3	OB 1	SIEMENS MED SYNGO RT
Referenced Report Sequence	(300B,xxEE)	3	SQ 1	SIEMENS MED SYNGO RT
Maintain Checksum Compatibility	(300B,xxEF)	3	CS 1	SIEMENS MED SYNGO RT

9.18 XSD Schemas

9.18.1 Common

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  elementFormDefault="qualified"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.siemens.com/med/ocs/syngoRT/Common"
  xmlns="http://www.siemens.com/med/ocs/syngoRT/Common">
  <xs:annotation>
    <xs:documentation>
      A collection of type definitions used across the syngo RT XML based extensions.
    </xs:documentation>
  </xs:annotation>
  <xs:simpleType name="DICOMDateTime">
    <xs:annotation>
      <xs:documentation>
        The DICOM Date Time common data type. Indicates a concatenated date-time ASCII string in
the format:
        YYYYMMDDHHMMSS.FFFFFF&amp;amp;ZZZZ. The components of this string, from left to right, are
        YYYY = Year,
        MM = Month,
        DD = Day,
        HH = Hour,
        MM = Minute,
        SS = Second,
        &amp;amp; = “+” or “-”,
        FFFFFF = Fractional Second,
        ZZZZ = Hours and Minutes of offset. &amp;amp;ZZZZ is an optional suffix for plus/minus offset
```

```
      from Coordinated Universal Time.
      (taken from the DICOM standard 2007, Part 5, Value Representation)
    </xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:pattern value="[0-9]{14}.[0-9]{6}([-+][0-9]{4})?" />
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="OrientationType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="OBVERSE">
      <xs:annotation>
        <xs:documentation>
          Obverse side of reference structure
        </xs:documentation>
      </xs:annotation>
    </xs:enumeration>
    <xs:enumeration value="REVERSE">
      <xs:annotation>
        <xs:documentation>
          Reverse side of reference structure
        </xs:documentation>
      </xs:annotation>
    </xs:enumeration>
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="Vector3DType">
  <xs:sequence>
    <xs:element name="X" type="xs:double" />
    <xs:element name="Y" type="xs:double" />
```

```
    <xs:element name="Z" type="xs:double" />
   </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RGBColorType">
   <xs:sequence>
    <xs:element name="R" type="xs:unsignedByte" />
    <xs:element name="G" type="xs:unsignedByte" />
    <xs:element name="B" type="xs:unsignedByte" />
   </xs:sequence>
  </xs:complexType>
  <xs:simpleType name="NameType">
   <xs:restriction base="xs:token">
    <xs:length value="1" />
   </xs:restriction>
  </xs:simpleType>
</xs:schema>
```

9.18.2 PhantomDetectorMeasurements

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns:i="http://www.w3.org/2001/XMLSchema-instance"
  targetNamespace="http://schemas.datacontract.org/2004/07/syngo.RT.Services.TxSessionDataSC.
ModelFactoryBO.Core"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:annotation>
   <xs:documentation>
    Instances of this schema are written into a private DICOM tag
     "RT Ion Beam Session Record::Phantom Detector Measurements" (300B,xxB1).
   </xs:documentation>
  </xs:annotation>
```

```
  <xs:element name="PhantomDetectorMeasurements">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="DetectorArrayLateralPosition" type="xs:decimal" />
        <xs:element name="DetectorArrayLongitudinalPosition" type="xs:decimal" />
        <xs:element name="DetectorArrayVerticalPosition" type="xs:decimal" />
        <xs:element name="DetectorPointMeasuredDoses" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="DetectorPointMeasuredDose" type="xs:decimal" />
              <xs:element name="AirDensityCorrectionFactor" type="xs:decimal" />
              <xs:element name="Dose2WaterRadiationCorrectionFactor" type="xs:decimal" />
              <xs:element name="ElectrometerCorrectionFactor" type="xs:decimal" />
              <xs:element name="HumidityCorrectionFactor" type="xs:decimal" />
              <xs:element name="IonRecombinationCorrectionFactor" type="xs:decimal" />
              <xs:element name="IonSpeciesCorrectionFactor" type="xs:decimal" />
              <xs:element name="PolarityCorrectionFactor" type="xs:decimal" />
              <xs:element name="UserCorrectionFactor" type="xs:decimal" />
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

9.18.3 RTPlanActionStatus

```
<?xml version="1.0" encoding="utf-8"?>

<xs:schema attributeFormDefault="unqualified" elementFormDefault="qualified"
xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="RT_Plan_Action_Status_SR_Document">

    <xs:complexType>

      <xs:sequence>

        <xs:element name="Referenced_Plan" minOccurs="1" maxOccurs="1">

          <xs:complexType>

            <xs:sequence>

              <xs:element name="Plan_Label" type="xs:string" minOccurs="1" maxOccurs="1"/>

              <xs:element name="Referenced_Plan_Version_UID" type="xs:string" minOccurs="1"
maxOccurs="1"/>

            </xs:sequence>

          </xs:complexType>

        </xs:element>

        <xs:element name="Dose_Alert_Acknowledgements" minOccurs="0" maxOccurs="1">

          <xs:complexType>

            <xs:sequence>

              <xs:element name="Dose_Reference" minOccurs="1" maxOccurs="1">

                <xs:complexType>

                  <xs:sequence>

                    <xs:element name="Lead_Dose_Alert_Acknowledgements"

                                minOccurs="0" maxOccurs="unbounded">

                      <xs:complexType>

                        <xs:sequence>

                          <xs:element name="Dose_Alert_Acknowledgment_Container"

                                type="Dose_Acknowledgement_Container_Type"

                                minOccurs="1" maxOccurs="unbounded"/>
```

```
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="Warning_Dose_Alert_Acknowledgements"
                minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Dose_Alert_Acknowledgment_Container"
                      type="Dose_Acknowledgement_Container_Type"
                      minOccurs="1" maxOccurs="unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="Dose_Reference_Number" type="xs:string"
                minOccurs="1" maxOccurs="1"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="Patient_Treatment_Chart_Status" minOccurs="0" maxOccurs="1">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Last_Printer_Configuration_Change" type="xs:string"
              minOccurs="1" maxOccurs="1"/>
      <xs:element name="Start_Row_Number" type="xs:unsignedByte"
              minOccurs="1" maxOccurs="1"/>
      <xs:element name="Start_Page_Number" type="xs:unsignedByte"
              minOccurs="1" maxOccurs="1"/>
```

```
            <xs:element name="Report_Template_Last_Modification_Date_Time" type="xs:string"
                    minOccurs="1" maxOccurs="1"/>
            <xs:element name="Tx_Chart_First_Print_Date_Time" type="xs:string"
                    minOccurs="1" maxOccurs="1"/>
            <xs:element name="Tx_Chart_Last_Print_Date_Time" type="xs:string"
                    minOccurs="1" maxOccurs="1"/>
            <xs:element name="Tx_Chart_Start_Date_Time" type="xs:string"
                    minOccurs="1" maxOccurs="1"/>
            <xs:element name="Report_Template_Name" type="xs:string"
                    minOccurs="1" maxOccurs="1"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:complexType name="Dose_Acknowledgement_Container_Type">
  <xs:sequence>
    <xs:element name="Dose_Level" type="xs:string"
            minOccurs="1" maxOccurs="1"/>
    <xs:element name="Acknowledgement_Date_Time" type="xs:string"
            minOccurs="1" maxOccurs="1"/>
    <xs:element name="Acknowledging_User" type="xs:string"
            minOccurs="1" maxOccurs="1"/>
  </xs:sequence>
 </xs:complexType>
</xs:schema>
```

9.18.4 RTPlanExtensions

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.siemens.com/med/ocs/syngoRT/RTPlanExtensions"
  xmlns="http://www.siemens.com/med/ocs/syngoRT/RTPlanExtensions"
  xmlns:uinf="http://www.siemens.com/med/ocs/usageInformation"
  xmlns:syngoRT="http://www.siemens.com/med/ocs/syngoRT/Common"
  xmlns:NS="http://www.siemens.com/med/ocs/syngoRT/RTPlanExtensions"
  version="1.1">
  <xs:import
    namespace="http://www.siemens.com/med/ocs/syngoRT/Common"
    schemaLocation="Common.xsd" />
  <xs:import
    namespace="http://www.siemens.com/med/ocs/usageInformation"
    schemaLocation="usageInformation.xsd" />
  <xs:annotation>
    <xs:documentation>
      This schema defines the content of the private DICOM tag "SIEMENS MED OCS PUBLIC RT
PLAN ATTRIBUTES".
    </xs:documentation>
  </xs:annotation>
  <xs:simpleType name="Lead_Dose_Type">
    <xs:restriction base="xs:double">
      <xs:minInclusive value="0"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:simpleType name="Fraction_Time_Interval_Type">
```

```
   <xs:restriction base="xs:double">
    <xs:minInclusive value="0"/>
   </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="RT_Tolerance_Table_Shadow_Attribute_Schema">
   <xs:sequence>
    <xs:element name="RT_Tolerance_Table" maxOccurs="unbounded">
     <xs:complexType>
      <xs:all>
       <xs:element name="RT_Tolerance_Table_Creation_Date_Time" type="xs:string"
minOccurs="0" maxOccurs="1"/>
       <xs:element name="SID_Tolerance" type="xs:long" minOccurs="0" maxOccurs="1"/>
       <xs:element name="FlatPanel_LateralPos_Tolerance" type="xs:long" minOccurs="0"
maxOccurs="1"/>
       <xs:element name="FlatPanel_LongitudinalPos_Tolerance" type="xs:long" minOccurs="0"
maxOccurs="1"/>
       <xs:element name="KV_SID_Tolerance" type="xs:long" minOccurs="0" maxOccurs="1"/>
       <xs:element name="KV_FlatPanel_LateralPos_Tolerance" type="xs:long" minOccurs="0"
maxOccurs="1"/>
      </xs:all>
      <xs:attribute name="Tolerance_Table_Number" type="xs:long" use="required"/>
     </xs:complexType>
    </xs:element>
   </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RT_Prescription_Shadow_Attribute_Schema">
   <xs:sequence>
    <xs:element name="RT_Prescription" maxOccurs="unbounded">
     <xs:complexType>
      <xs:all>
       <xs:element name="RT_Prescription_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
```

```
        <xs:element name="Lead_Dose" type="Lead_Dose_Type" minOccurs="0"/>
        <xs:element name="Delivery_Warning_Dose_Description" type="xs:string" minOccurs="0"/>
       </xs:all>
       <xs:attribute name="Dose_Reference_Number" type="xs:long" use="required"/>
      </xs:complexType>
    </xs:element>
   </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RT_Patient_Setup_Shadow_Attribute_Schema">
   <xs:sequence>
    <xs:element name="RT_Patient_Setup" maxOccurs="unbounded">
     <xs:complexType>
      <xs:sequence>
       <xs:element name="RT_Patient_Setup_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
       <xs:element name="Patient_Setup_Name" type="xs:string"/>
       <xs:element name="Additional_Setup_Instructions" type="xs:string"/>
       <xs:element name="Referenced_Setup_Image_Sequence" minOccurs="0">
        <xs:complexType>
         <xs:sequence>
          <xs:element name="Setup_Image" minOccurs="1">
           <xs:complexType>
            <xs:sequence>
             <xs:element name="Setup_Image_Description" type="xs:string"/>
             <xs:element name="Referenced_SOP_Class_UID" type="xs:string"/>
             <xs:element name="Referenced_SOP_Instance_UID" type="xs:string"/>
            </xs:sequence>
           </xs:complexType>
          </xs:element>
         </xs:sequence>
```

```
          </xs:complexType>
         </xs:element>
        </xs:sequence>
        <xs:attribute name="Patient_Setup_Number" type="xs:long" use="required"/>
       </xs:complexType>
     </xs:element>
   </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RT_Fraction_Group_Shadow_Attribute_Schema">
   <xs:sequence>
    <xs:element name="RT_Fraction_Group" maxOccurs="unbounded">
     <xs:complexType>
      <xs:all>
       <xs:element name="RT_Fraction_Group_Creation_Date_Time" type="xs:string"
minOccurs="0" maxOccurs="1"/>
       <xs:element name="Fraction_Group_Name" type="xs:string"/>
       <xs:element name="Fraction_Time_Interval" type="Fraction_Time_Interval_Type"
minOccurs="0"/>
       <xs:element name="Fractions_Per_Week" type="xs:long"/>
      </xs:all>
      <xs:attribute name="Fraction_Group_Number" type="xs:long" use="required"/>
     </xs:complexType>
    </xs:element>
   </xs:sequence>
  </xs:complexType>
  <xs:complexType name="CompoundBeamType">
   <xs:annotation>
    <xs:documentation>
     This declaration contains compound beam information related attributes.
    </xs:documentation>
   </xs:annotation>
```

```
    <xs:sequence>
      <xs:element name="Name" type="xs:string">
        <xs:annotation>
          <xs:documentation>
            Name of the compound beam. The name of Compound Beam should be unique inside a plan.
          </xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="SplitPlaneSequence" minOccurs="0">
        <xs:annotation>
          <xs:documentation>
            Introduces an optional list of Split planes.
            Note that split planes are not part of a single beam, they group beams from the beam
sequence.
          </xs:documentation>
          <xs:appinfo uinf:app="TPS" uinf:usage="WRITTEN"/>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element name="SplitPlane" type="SplitPlaneType" minOccurs="1"
maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name ="RTPlaneType">
    <xs:annotation>
      <xs:documentation>
        The information in this structure describe a plane type.
        This type can be enriched with the obverse and reverse dose type.
```

```
    </xs:documentation>
   </xs:annotation>
   <xs:sequence>
    <xs:element name="PlaneName" type="xs:string">
     <xs:annotation>
      <xs:documentation>
       Name of the patch plane.
      </xs:documentation>
     </xs:annotation>
    </xs:element>
    <xs:element name="PointOnPlane" type="syngoRT:Vector3DType">
     <xs:annotation>
      <xs:documentation>
       Defines the plane's position. Patch planes are defined in the CT coordinate system.
      </xs:documentation>
     </xs:annotation>
    </xs:element>
    <xs:element name="NormVectorOfPlane" type="syngoRT:Vector3DType">
     <xs:annotation>
      <xs:documentation>
       Defines the plane's orientation. Points in Obverse direction.
      </xs:documentation>
     </xs:annotation>
    </xs:element>
    <xs:element name="RowVectorOfPlane" type="syngoRT:Vector3DType" minOccurs="0"
maxOccurs="1">
     <xs:annotation>
      <xs:documentation>
       Defines the plane's row direction vector for aligning the plane in the image segments.
      </xs:documentation>
```

```
      </xs:annotation>
    </xs:element>
    <xs:element name="ColumnVectorOfPlane" type="syngoRT:Vector3DType" minOccurs="0"
maxOccurs="1">
      <xs:annotation>
        <xs:documentation>
          Defines the plane's column direction vector for aligning the plane in the image segments.
        </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="PlaneThickness" type="xs:double">
      <xs:annotation>
        <xs:documentation>
          Width of overlap area, in mm.
        </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="ObverseDosePercent" type="xs:double">
      <xs:annotation>
        <xs:documentation>
          Defines the gradient of the overlap, together with ReverseDosePercent.
          Percent of max dose which all beams on the obverse side of the plane must add up to.
        </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="ReverseDosePercent" type="xs:double">
      <xs:annotation>
        <xs:documentation>
          Defines the gradient of the overlap, together with ObverseDosePercent.
          Percent of max dose which all beams on the reverse side of the plane must add up to.
```

```
        </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="DisplayColor" type="syngoRT:RGBColorType">
      <xs:annotation>
        <xs:documentation>
          Display color of the plane stored as 3 RGB values in the range of 0..255.
        </xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="BeamInPlane">
  <xs:sequence>
    <xs:element name="Orientation" type="syngoRT:OrientationType">
      <xs:annotation>
        <xs:documentation>
          Defines to which side of the patch plane the beam is linked.
          Obverse or reverse are defined with respect to the norm vector of the plane.
          Enumerated Values:
          OBVERSE: beam is associated to the obverse side of the plane
          REVERSE: beam is associated with the reverse side of the plane
        </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="ReferencedBeamNumber" type="xs:integer">
      <xs:annotation>
        <xs:documentation>
          References a beam in the beam sequence belonging to the patch plane.
          The beam is identified by the attribute "RT Ion Beams::Beam Number" (300A,00C0).
```

```
        </xs:documentation>
       </xs:annotation>
     </xs:element>
   </xs:sequence>
 </xs:complexType>
 <xs:complexType name="PatchPlaneType">
   <xs:annotation>
     <xs:documentation>
       The information in this structure describe a patch plane.
       Patch planes are used to define an overlap area between 2 or
       more beams coming from different directions.
     </xs:documentation>
   </xs:annotation>
   <xs:complexContent>
     <xs:extension base="RTPlaneType">
       <xs:sequence>
         <xs:element name="PatchBeam" type="BeamInPlane" minOccurs="2"
maxOccurs="unbounded">
           <xs:annotation>
             <xs:documentation>
               Defines the list of beams linked to this patch plane.
               The list must contain at least 2 entries.
             </xs:documentation>
           </xs:annotation>
         </xs:element>
       </xs:sequence>
     </xs:extension>
   </xs:complexContent>
 </xs:complexType>
 <xs:complexType name="SplitPlaneType">
```

```
  <xs:annotation>
   <xs:documentation>
    The information in this structure describe a split plane.
    Split planes are used to define an overlap area between 2 or
    more beams coming from different directions.
   </xs:documentation>
  </xs:annotation>
  <xs:complexContent>
   <xs:extension base="RTPlaneType">
    <xs:sequence>
     <xs:element name="SplitBeam" type="BeamInPlane" minOccurs="2" maxOccurs="2">
      <xs:annotation>
       <xs:documentation>
        Defines the list of beams linked to this split plane.
        The list must contain at least 2 entries.
       </xs:documentation>
      </xs:annotation>
     </xs:element>
    </xs:sequence>
   </xs:extension>
  </xs:complexContent>
 </xs:complexType>
 <xs:complexType name="RTBeamCommonSchema">
  <xs:annotation>
   <xs:documentation>
    This declaration contains the parts which are common to the RT Beam and RT Ion Beam.
   </xs:documentation>
  </xs:annotation>
  <xs:all>
  </xs:all>
```

```
  </xs:complexType>
  <xs:complexType name="RTBeamSchema">
    <xs:annotation>
      <xs:documentation>
        This declaration contains the parts which are specific for the RT Beam.
      </xs:documentation>
    </xs:annotation>
    <xs:complexContent>
      <xs:extension base="RTBeamCommonSchema">
        <xs:all>
          <xs:element name="RT_Beam_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
          <xs:element name="Bolus_Description" type="xs:string" minOccurs="0"/>
          <xs:element name="Gated_Delivery" type="xs:boolean" minOccurs="0"/>
          <xs:element name="Treatment_Pause" type="xs:long" minOccurs="0"/>
          <xs:element name="Treatment_Pause_Comment" type="xs:string" minOccurs="0"/>
          <xs:element name="Gantry_Table_Movement_Order" type="xs:long" minOccurs="0"/>
          <xs:element name="Beam_Delta" type="xs:long" minOccurs="0"/>
          <xs:element name="Gantry_Direction_To_Next_Beam" type="xs:long" minOccurs="0"/>
          <xs:element name="Port_Only_Set" type="xs:boolean" minOccurs="0"/>
          <xs:element name="KV_Beam_Energy" type="xs:double" minOccurs="0"/>
          <xs:element name="KV_Beam_Exposure" type="xs:double" minOccurs="0"/>
          <xs:element name="Beam_Setup_Instructions" type="xs:string"  minOccurs="0"/>
        </xs:all>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <xs:complexType name="RTIonBeamSchema">
    <xs:annotation>
      <xs:documentation>
```

```
      This declaration contains the parts which are specific for the RT Ion Beam.

    </xs:documentation>

  </xs:annotation>

  <xs:complexContent>

    <xs:extension base="RTBeamCommonSchema">

    </xs:extension>

  </xs:complexContent>

 </xs:complexType>

 <xs:complexType name="RTBeamsCommonSchema">

  <xs:annotation>

    <xs:documentation>

      This declaration contains the parts which are common to the RT Beam and RT Ion Beam
Sequence.

      It would be nice to already introduce an RTBeamCommonSchema element here, which would be

      refined to RTBeamSchema and RTIonBeamSchema in the derived types RTBeamsSchema and
RTIonBeamsSchema.

      Unfortunately, XML Schema does not allow for such covariance.

    </xs:documentation>

  </xs:annotation>

  <xs:sequence>

    <xs:element name="PatchPlaneSequence" minOccurs="0">

      <xs:annotation>

        <xs:documentation>

          Introduces an optional list of patch planes.

          Note that patch planes are not part of a single beam, they group beams from the beam
sequence.

        </xs:documentation>

        <xs:appinfo uinf:app="VSim" uinf:usage="WRITTEN"/>

      </xs:annotation>

      <xs:complexType>

        <xs:sequence>
```

```
        <xs:element name="PatchPlane" type="PatchPlaneType" minOccurs="1"
maxOccurs="unbounded"/>

       </xs:sequence>

      </xs:complexType>

    </xs:element>

    <xs:element name="CompoundBeamSequence" minOccurs="0">

      <xs:annotation>

        <xs:documentation>

          Introduces an optional list of Compound beam sequence.

        </xs:documentation>

        <xs:appinfo uinf:app="TPS" uinf:usage="WRITTEN"/>

      </xs:annotation>

      <xs:complexType>

        <xs:sequence>

          <xs:element name="CompoundBeam" type="CompoundBeamType" minOccurs="1"
maxOccurs="unbounded"/>

        </xs:sequence>

      </xs:complexType>

    </xs:element>

  </xs:sequence>

 </xs:complexType>

 <xs:complexType name="RTBeamsSchema">

  <xs:annotation>

    <xs:documentation>

      This declaration contains the parts which are specific for the RT Beam Sequence.

    </xs:documentation>

  </xs:annotation>

  <xs:complexContent>

    <xs:extension base="RTBeamsCommonSchema">

      <xs:sequence>

        <xs:element name="RT_Beam" type="RTBeamSchema" maxOccurs="unbounded"/>
```

```
      </xs:sequence>
      <xs:attribute name="Beam_Name" type="xs:string"  use="required"/>
    </xs:extension>
  </xs:complexContent>
 </xs:complexType>
 <xs:complexType name="RTIonBeamsSchema">
  <xs:annotation>
   <xs:documentation>
    This declaration contains the parts which are specific for the RT Ion Beam Sequence.
   </xs:documentation>
  </xs:annotation>
  <xs:complexContent>
   <xs:extension base="RTBeamsCommonSchema">
    <xs:sequence>
     <xs:element name="RTIonBeam" type="RTIonBeamSchema" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
   </xs:extension>
  </xs:complexContent>
 </xs:complexType>
 <xs:complexType name="RT_Approval_Shadow_Attribute_Schema">
  <xs:all>
   <xs:element name="APPROVAL_STATUS" type="xs:string" minOccurs="0"/>
   <xs:element name="APPROVAL_REVIEWER_NAME" type="xs:string" minOccurs="0"/>
   <xs:element name="APPROVAL_REVIEW_DATE" type="xs:string" minOccurs="0"/>
   <xs:element name="APPROVAL_REVIEW_TIME" type="xs:string" minOccurs="0"/>
  </xs:all>
 </xs:complexType>
 <xs:complexType name="RT_Plan_Type">
  <xs:sequence>
```

```
    <xs:element name="RT_Tolerance_Table_Sequence"
type="RT_Tolerance_Table_Shadow_Attribute_Schema" minOccurs="0">

      <xs:key name="Tolerance_Table_ID">

        <xs:selector xpath=".//NS:Tolerance_Table"/>

        <xs:field xpath="@Tolerance_Table_Number"/>

      </xs:key>

    </xs:element>

    <xs:element name="RT_Prescription_Sequence"
type="RT_Prescription_Shadow_Attribute_Schema" minOccurs="0">

      <xs:key name="Dose_Reference_ID">

        <xs:selector xpath=".//NS:Dose_Reference"/>

        <xs:field xpath="@Dose_Reference_Number"/>

      </xs:key>

    </xs:element>

    <xs:element name="RT_Patient_Setup_Sequence"
type="RT_Patient_Setup_Shadow_Attribute_Schema" minOccurs="0">

      <xs:key name="Patient_Setup_ID">

        <xs:selector xpath=".//NS:Patient_Setup"/>

        <xs:field xpath="@Patient_Setup_Number"/>

      </xs:key>

    </xs:element>

    <xs:element name="RT_Fraction_Group_Sequence"
type="RT_Fraction_Group_Shadow_Attribute_Schema" minOccurs="0">

      <xs:key name="Fraction_Group_ID">

        <xs:selector xpath=".//NS:Fraction_Group"/>

        <xs:field xpath="@Fraction_Group_Number"/>

      </xs:key>

    </xs:element>

    <xs:element name="RT_Beam_Sequence" type="RTBeamsSchema" minOccurs="0">

      <xs:annotation>

        <xs:documentation>

          If RT_Beam_Sequence occurs, then RTIonBeamSequence must not occur.
```

```
        </xs:documentation>
       </xs:annotation>
       <xs:key name="Beam_ID">
        <xs:selector xpath=".//NS:RT_Beam"/>
        <xs:field xpath="@Beam_Name"/>
       </xs:key>
      </xs:element>
      <xs:element name="RTIonBeamSequence" type="RTIonBeamsSchema" minOccurs="0">
       <xs:annotation>
        <xs:documentation>
         If RTIonBeamSequence occurs, then RT_Beam_Sequence must not occur.
        </xs:documentation>
       </xs:annotation>
      </xs:element>
      <xs:element name="RT_BEAMS_APPROVAL" type="RT_Approval_Shadow_Attribute_Schema"
minOccurs="0"/>
      <xs:element name="RT_SITE_APPROVAL" type="RT_Approval_Shadow_Attribute_Schema"
minOccurs="0"/>
      <xs:element name="RT_QA_APPROVAL" type="RT_Approval_Shadow_Attribute_Schema"
minOccurs="0"/>
      <xs:element name="RT_Plan_Checksum" type="xs:string" minOccurs="0"/>
      <xs:element name="Completed_Plan" type="xs:boolean" minOccurs="0"/>
      <xs:element name="OIS_Plan" type="xs:boolean" minOccurs="0"/>
      <xs:element name="OIS_Transferred" type="xs:boolean" minOccurs="0"/>
      <xs:element name="RT_Plan_Late_Resumption_Notification" type="xs:string"
default="LR_NOTIFY_USER" minOccurs="0"/>
      <xs:element name="RT_Plan_Rx_Description" type="xs:string" minOccurs="0"/>
     </xs:sequence>
     <xs:attribute name="Plan_UID" type="xs:string" use="required"/>
    </xs:complexType>
    <xs:element name="RT_Plan" type="RT_Plan_Type"/>
</xs:schema>
```

9.18.5 RTStructureSetExtensions

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.siemens.com/med/ocs/syngoRT/RTStructureSetExtensions"
  xmlns="http://www.siemens.com/med/ocs/syngoRT/RTStructureSetExtensions"
  xmlns:uinf="http://www.siemens.com/med/ocs/usageInformation"
  xmlns:syngoRTExt="http://www.siemens.com/med/ocs/syngoRT/Common">
  <xs:import
    namespace="http://www.siemens.com/med/ocs/syngoRT/Common"
    schemaLocation="Common.xsd" />
  <xs:import
    namespace="http://www.siemens.com/med/ocs/usageInformation"
    schemaLocation="usageInformation.xsd" />
  <xs:element name="RTStructureSet">
    <xs:annotation>
      <xs:documentation>
        Extensions for the RT Structure Set IOD
      </xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="StructureSet" type="StructureSetExtensionsType" minOccurs="0"
maxOccurs="1" />
        <xs:element name="RTROIObservation" type="RTROIObservationExtensionsType"
minOccurs="0" maxOccurs="1" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
```

```
<xs:complexType name="RTROIObservationExtensionsType">
 <xs:annotation>
  <xs:documentation>
   Extensions for the RT ROI Observation Module
  </xs:documentation>
 </xs:annotation>
 <xs:sequence>
  <xs:element name="RTROIObservations" minOccurs="0" maxOccurs="unbounded">
   <xs:annotation>
    <xs:documentation>
     Extensions for the Structure Set::RT ROI Observations Sequence
    </xs:documentation>
   </xs:annotation>
   <xs:complexType>
    <xs:sequence>
     <xs:element name="ROINumber" type="xs:integer" minOccurs="1" maxOccurs="1">
      <xs:annotation>
       <xs:documentation>
        Uniquely identifies the referenced ROI described in the
        "Structure Set::Structure Set ROI Sequence" for which the private information
        applies.
       </xs:documentation>
      </xs:annotation>
     </xs:element>
     <xs:element name="DosimetricPointType" minOccurs="0" maxOccurs="1">
      <xs:annotation>
       <xs:documentation>
        Assigns a dosimetric point type to structures of "RT ROI Interpreted type" (3006,00A4)
        ISOCENTER or MARKER which have a dosimetric type assigned.
       </xs:documentation>
```

```
    <xs:appinfo uinf:app="WS" uinf:usage="READ" />
    <xs:appinfo uinf:app="DCOpt" uinf:usage="READ" />
    <xs:appinfo uinf:app="VSIM" uinf:usage="WRITTEN" />
   </xs:annotation>
   <xs:simpleType>
    <xs:restriction base="xs:string">
     <xs:enumeration value="ICRU">
      <xs:annotation>
       <xs:documentation>
        ICRU dosimetric point
       </xs:documentation>
      </xs:annotation>
     </xs:enumeration>
     <xs:enumeration value="PRIMARY">
      <xs:annotation>
       <xs:documentation>
        primary dosimetric point
       </xs:documentation>
      </xs:annotation>
     </xs:enumeration>
     <xs:enumeration value="MEASURING">
      <xs:annotation>
       <xs:documentation>
        measuring dosimetric point
       </xs:documentation>
      </xs:annotation>
     </xs:enumeration>
    </xs:restriction>
   </xs:simpleType>
  </xs:element>
```

```
        </xs:sequence>
       </xs:complexType>
     </xs:element>
   </xs:sequence>
 </xs:complexType>
 <xs:complexType name="StructureSetExtensionsType">
   <xs:annotation>
     <xs:documentation>
       Extensions for the Structure Set Module
     </xs:documentation>
   </xs:annotation>
   <xs:sequence>
     <xs:element name="StructureSetROI" minOccurs="0" maxOccurs="unbounded">
       <xs:annotation>
         <xs:documentation>
           Extensions for the Structure Set::Structure Set ROI Sequence
         </xs:documentation>
       </xs:annotation>
       <xs:complexType>
         <xs:sequence>
           <xs:element name="ROINumber" type="xs:integer" minOccurs="1" maxOccurs="1">
             <xs:annotation>
               <xs:documentation>
                 Uniquely identifies the ROI in the "Structure Set::Structure Set ROI Sequence"
                 for which the private information applies.
               </xs:documentation>
             </xs:annotation>
           </xs:element>
           <xs:element name="ROIBiologicalCellIdentifier" type="xs:string" minOccurs="0"
maxOccurs="1">
```

```
          <xs:annotation>
            <xs:documentation>
              Name of the biological cell type associated with this ROI.The name
              is the primary key of the respective item in the ConfigDataSC database.
              ConfigDataSC identifiers are strings with a maximum length of 16 characters.
              If cell parameters are required for a calculation, the cell type of the
              external structure is used as default and is thus mandatory.
            </xs:documentation>
            <xs:appinfo uinf:app="WS" uinf:usage="READ" />
            <xs:appinfo uinf:app="DCOpt" uinf:usage="READ" />
            <xs:appinfo uinf:app="VSIM" uinf:usage="WRITTEN" />
          </xs:annotation>
        </xs:element>
        <xs:element name="ROIMaterialIdentifier" type="xs:string" minOccurs="0" maxOccurs="1">
          <xs:annotation>
            <xs:documentation>
              Name of the physics material associated with this ROI. The name
               is the primary key of the respective item in the ConfigDataSC database.
              This attribute is only sent, if a specific material is applied to a ROI.
            </xs:documentation>
            <xs:appinfo uinf:app="WS" uinf:usage="READ" />
            <xs:appinfo uinf:app="DCOpt" uinf:usage="READ" />
            <xs:appinfo uinf:app="VSIM" uinf:usage="WRITTEN" />
          </xs:annotation>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:schema>
```

9.18.6 SpatialRegistrationExtensions

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.siemens.com/med/ocs/syngoRT/SpatialRegistrationExtensions"
  xmlns="http://www.siemens.com/med/ocs/syngoRT/SpatialRegistrationExtensions"
  xmlns:uinf="http://www.siemens.com/med/ocs/usageInformation"
  xmlns:syngoRT="http://www.siemens.com/med/ocs/syngoRT/Common">
  <xs:import
    namespace="http://www.siemens.com/med/ocs/syngoRT/Common"
    schemaLocation="Common.xsd" />
  <xs:import
    namespace="http://www.siemens.com/med/ocs/usageInformation"
    schemaLocation="usageInformation.xsd" />
  <xs:element name="SpatialRegistration">
    <xs:annotation>
      <xs:documentation>
        Extensions for the Spatial Registration IOD
      </xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="SpatialRegistration" type="SpatialRegistrationExtensionType"
minOccurs="0" maxOccurs="1"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:complexType name="SpatialRegistrationExtensionType">
    <xs:annotation>
```

```
      <xs:documentation>
        Extensions for the Spatial Registration Module to store result from STX localization
      </xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element name="Registration" type="RegistrationExtensionType" minOccurs="0"
maxOccurs="1"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RegistrationExtensionType">
    <xs:annotation>
      <xs:documentation>
        Extensions for the Registration Sequence within the Spatial Registration Module
      </xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element name="MatrixRegistration" type="MatrixRegistrationExtensionType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="Settings" type="SettingsType" minOccurs="1" maxOccurs="1" />
      <xs:element name="Frame" type="FrameType" minOccurs="1" maxOccurs="1" />
      <xs:element name="SliceInfo" type="SliceInfoType" minOccurs="1" maxOccurs="1" />
      <xs:element name="SliceDistance" type="SliceDistanceType" minOccurs="1"
maxOccurs="unbounded" />
      <xs:element name="Angles" type="AngleType" minOccurs="1" maxOccurs="1" />
      <xs:element name="RegressionCoefficients" type="RegressionCoefficientsType" minOccurs="3"
maxOccurs="3" />
      <xs:element name="ResultsTable" type="ResultsTableType" minOccurs="1"
maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="MatrixRegistrationExtensionType">
    <xs:annotation>
```

```
    <xs:documentation>
      Extensions for Matrix Registration sequence
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="QI" type="ResultType" minOccurs="1" maxOccurs="1" />
    <xs:element name="Matrix" type="MatrixType" />
    <xs:element name="ImageUIDRef" type="xs:string" />
  </xs:sequence>
</xs:complexType>
<xs:complexType name="ResultType">
  <xs:annotation>
    <xs:documentation>
      Defines the min and max quality index (QI) for the given matrix
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="QImean" type="xs:float" />
    <xs:element name="QImax" type="xs:float" />
  </xs:sequence>
</xs:complexType>
<xs:complexType name="FrameType">
  <xs:annotation>
    <xs:documentation>
      Defines the name and ID of the frame used for localization
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="Name" type="xs:string" />
    <xs:element name="ID" type="xs:string" />
```

```
  </xs:sequence>
 </xs:complexType>
 <xs:complexType name="SliceInfoType">
  <xs:annotation>
   <xs:documentation>
    Defines the information about slices used for localization
   </xs:documentation>
  </xs:annotation>
  <xs:sequence>
   <xs:element name="NumberOfLocalizedSlices" type="xs:integer" />
   <xs:element name="NumberOfExcludedSlices" type="xs:integer" />
   <xs:element name="NumberOfNonLocalizedSlices" type="xs:integer" />
   <xs:element name="NumberOfBadLocalizedSlices" type="xs:integer" />
  </xs:sequence>
 </xs:complexType>
 <xs:complexType name="AngleType">
  <xs:annotation>
   <xs:documentation>
    Angles (between DICOM FOR and STX FOR) resulting from STX localization
   </xs:documentation>
  </xs:annotation>
  <xs:sequence>
   <xs:element name="Alpha" type="xs:double" />
   <xs:element name="Beta" type="xs:double" />
   <xs:element name="Gamma" type="xs:double" />
  </xs:sequence>
 </xs:complexType>
 <xs:complexType name="SettingsType">
  <xs:annotation>
   <xs:documentation>
```

```
      Settings used for STX localization
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="Threshold" type="xs:integer" />
    <xs:element name="SearchRadius" type="xs:double" />
    <xs:element name="QILimit" type="xs:double" />
  </xs:sequence>
</xs:complexType>
<xs:complexType name="SliceDistanceType">
  <xs:annotation>
    <xs:documentation>
      Slice distances calculated from STX matrix
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="NumberOfSlices" type="xs:integer" />
    <xs:element name="ReferenceDistance" type="xs:double" />
    <xs:element name="MeanDistance" type="xs:double" />
    <xs:element name="MaxDistance" type="xs:double" />
    <xs:element name="StandardDeviation" type="xs:double" />
  </xs:sequence>
</xs:complexType>
<xs:complexType name="RegressionCoefficientsType">
  <xs:annotation>
    <xs:documentation>
      Regression coefficients for LRMs
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
```

```
    <xs:element name="a" type="xs:double" />
    <xs:element name="b" type="xs:double" />
    <xs:element name="r" type="xs:double" />
    <xs:element name="d" type="xs:double" />
  </xs:sequence>
 </xs:complexType>
 <xs:complexType name="ResultsTableType">
  <xs:annotation>
   <xs:documentation>
    Complete Result table (image center of each slice  is transformed to STX coordinates)
    Regression coefficients are calculated based on this table
   </xs:documentation>
  </xs:annotation>
  <xs:sequence>
   <xs:element name="z_pcs" type="xs:double" />
   <xs:element name="x_stx" type="xs:double" />
   <xs:element name="y_stx" type="xs:double" />
   <xs:element name="z_stx" type="xs:double" />
   <xs:element name="x_res" type="xs:double" />
   <xs:element name="y_res" type="xs:double" />
   <xs:element name="z_res" type="xs:double" />
   <xs:element name="ImageUIDRef" type="xs:string" />
  </xs:sequence>
 </xs:complexType>
 <xs:simpleType name="MatrixType">
  <xs:annotation>
   <xs:documentation>
    Defines the matrix type (GRM: global registration matrix, LRM: local registration matrix)
   </xs:documentation>
  </xs:annotation>
```

```
    <xs:restriction base="xs:string">
      <xs:enumeration value="GRM" />
      <xs:enumeration value="LRM" />
    </xs:restriction>
  </xs:simpleType>
</xs:schema>
```

9.18.7 usageInformation

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.siemens.com/med/ocs/usageInformation"
  xmlns="http://www.siemens.com/med/ocs/usageInformation">
  <xs:annotation>
    <xs:documentation>
      This namespace defines infrastructure to document application usage of individual elements.
    </xs:documentation>
  </xs:annotation>
  <xs:simpleType name="UsageType">
    <xs:annotation>
      <xs:documentation>
        This enumeration type is used in the appinfo-tag in order to specify
        the usage of some piece of information through some application.
      </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
      <xs:enumeration value="WRITTEN">
        <xs:annotation>
          <xs:documentation>
```

Application does not expect any value for the attribute, either initially fills or overwrites the attribute.

```
        </xs:documentation>
       </xs:annotation>
     </xs:enumeration>
     <xs:enumeration value="READ">
       <xs:annotation>
         <xs:documentation>
           Application expects some value to be present which is not modified.
         </xs:documentation>
       </xs:annotation>
     </xs:enumeration>
     <xs:enumeration value="MODIFIED">
       <xs:annotation>
         <xs:documentation>
           Application expects some value to be present which is read, modified and written
         </xs:documentation>
       </xs:annotation>
     </xs:enumeration>
   </xs:restriction>
 </xs:simpleType>
 <xs:attribute name="app" type="xs:string">
   <xs:annotation>
     <xs:documentation>
       Attribute specifying the name of an application using some piece of information.
     </xs:documentation>
   </xs:annotation>
 </xs:attribute>
 <xs:attribute name="usage" type="UsageType">
   <xs:annotation>
```

```
      <xs:documentation>
        Attribute specifying the usage of some piece of information through some application.
      </xs:documentation>
    </xs:annotation>
  </xs:attribute>
  <xs:complexType name="usageInfo">
    <xs:sequence />
    <xs:attribute ref="usage" />
    <xs:attribute ref="app" />
  </xs:complexType>
</xs:schema>
```

9.18.8 IODDescriptor

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema elementFormDefault="qualified" xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="IODDescriptors" nillable="true" type="IODDescriptorContainer" />
  <xs:complexType name="IODDescriptorContainer">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="1" name="IODS" type="ArrayOfIODDescriptor" />
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="ArrayOfIODDescriptor">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" name="IOD" nillable="true"
type="IODDescriptor" />
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="IODDescriptor" abstract="true">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="1" name="ReferencedSopClassUid" type="xs:string" />
```

```
    <xs:element minOccurs="0" maxOccurs="1" name="ReferencedSopInstanceUid" type="xs:string"
/>

    <xs:element minOccurs="0" maxOccurs="1" name="STATUS" type="TxCourseStatus"
nillable="true"/>

   </xs:sequence>

  </xs:complexType>

  <xs:simpleType name="TxCourseStatus">

   <xs:restriction base="xs:string">

    <xs:enumeration value="UNDEFINED" />

    <xs:enumeration value="REMOVED" />

    <xs:enumeration value="CORRUPTED" />

    <xs:enumeration value="NOTUSED" />

   </xs:restriction>

  </xs:simpleType>

  <xs:complexType name="IODDescriptorOfIStructureSet">

   <xs:complexContent mixed="false">

    <xs:extension base="IODDescriptor" />

   </xs:complexContent>

  </xs:complexType>

  <xs:complexType name="StructureSetDescriptor">

   <xs:complexContent mixed="false">

    <xs:extension base="IODDescriptorOfIStructureSet">

     <xs:sequence>

      <xs:element minOccurs="0" maxOccurs="1" name="RemovedROIS" type="ArrayOfInt" />

     </xs:sequence>

    </xs:extension>

   </xs:complexContent>

  </xs:complexType>

  <xs:complexType name="ArrayOfInt">

   <xs:sequence>

    <xs:element minOccurs="0" maxOccurs="unbounded" name="RemovedROI" type="xs:int" />
```

```
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="IODDescriptorOfIIOD">
    <xs:complexContent mixed="false">
      <xs:extension base="IODDescriptor" />
    </xs:complexContent>
  </xs:complexType>
  <xs:complexType name="DefaultIODDescriptor">
    <xs:complexContent mixed="false">
      <xs:extension base="IODDescriptorOfIIOD" />
    </xs:complexContent>
  </xs:complexType>
</xs:schema>
```