THE MAGNETOM

✸FLASH✸

newsletter for SIEMENS MAGNETOM users • vol. 1 no. 2/1993

IN THIS ISSUE...

From the Editor

Christine Harris
Children's Hospital of Philadelphia

Firstly, I would like to thank all of you who have submitted material for this newsletter. We will be printing these pieces in upcoming issues as space permits. I would like to remind you that this is your newsletter. It will only work if everyone participates. Send your ideas, protocols, puzzles, interests, etc. We need your input. This one's for you. Keep it alive.

If anyone else has sent in any information, techniques, etc., the Editor apologizes if it does not appear in this issue. It seems that the Zip Code was incorrect (please make note of the correction under where to send correspondence) and all mail is just beginning to come in to the office.

Please note that there are some new sections in this issue. These include sections dedicated to interesting clinical protocols, educational applications materials and techs you can call upon for information and assistance.

The MAGNETOM FLASH

Published by:
Siemens Medical Systems, Inc.

Editor and Correspondence:
Christine Harris, R.T.
Children's Hospital of Philadelphia
P.O. Box 9264
Philadelphia, PA 19139

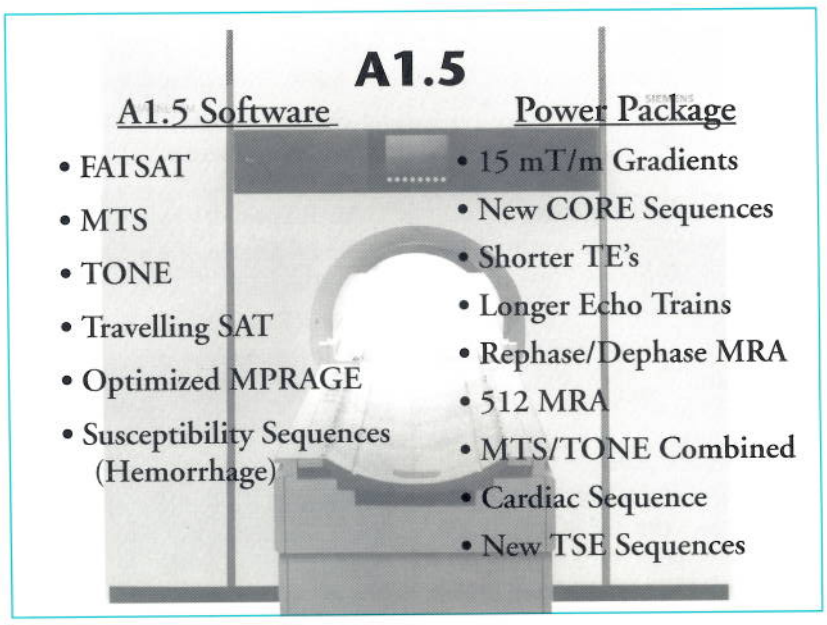
Produced by:
Medical Imaging
Consultants, Inc.
58 Notch Road
W. Paterson, NJ 07424

Introducing A1.5 Software

MR Division
Siemens Medical Systems, Inc.

❒ SP/SP4000
☑ Impact
❒ P8

Siemens Medical Systems is pleased to introduce software version A1.5 and the optional Power Package. A1.5 is the newly introduced software release for all Impact systems. The Power Package is an upgrade that enhances the gradient capabilities to 15 millitesla per meter with one-hundred percent duty cycle.



FATSAT

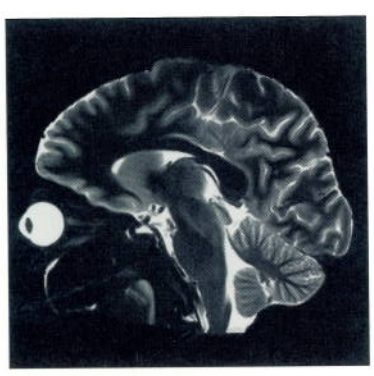
Some areas of the body can be difficult to visualize because they are obscured by the bright signal of fat. This is especially important when a contrast agent is used and enhancement may be obscured by the bright fat signal. But not with FATSAT - fat saturation sequences, new to the Magnetom Impact with software version A1.5, significantly improve visualization of areas which contain fatty tissues such as the liver or orbits. FATSAT sequences reduce the signal from fat by using a selective saturation pulse. There are a range of FATSAT applications to suit your clinical needs - Spin Echo and Turbo Spin Echo sequences, and gradient echo sequences for both 2D and 3D imaging.

Angiography

A1.5 brings you new features in MR angiography.

TONE, or Tilted Optimized Non-saturated Excitation, is a Siemens innovation which allows improved visualization of blood vessels throughout the volume. As blood flows through a volume, it becomes increasingly saturated and loses signal. TONE sequences use customized pulses to reduce the saturation of blood.

Also new with A1.5 are Traveling SAT sequences. Acquiring a stack of individual 2D images and moving a presaturation band parallel to the slice means you improve the saturation of signal from undesired vessels. The result? Clear visualization and differentiation of venous and carotid vessels.



Sagittal head image using Turbo IR.

With A1.5, you now have Magnetization Transfer Suppression for brain angiography. MTS pulses suppress the signal from static gray and white matter which improves visualization of slow-flowing blood and allows for improved small vessel conspicuity.

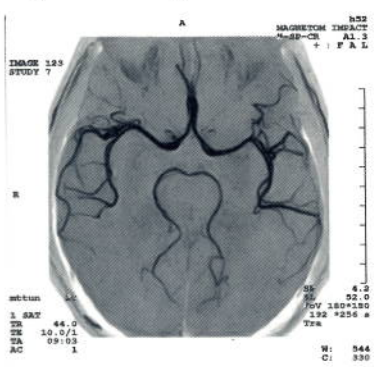
As always, Multi-slab MRA can be used in conjunction with the new angiography features to enhance your clinical images.

MPRAGE

MPRAGE in software version A1.5 is optimized for high resolution 3D brain, spine and orthopedic imaging. Imaging time is shortened from nine to as little as four minutes for a complete 3D study.

Hemorrhagic Sequences

Also new with A1.5 software are double echo and variable echo time FLASH sequences. Because of their sensitivity to small variations in the magnetic field, these sequences are ideally suited for detecting hemorrhagic lesions.



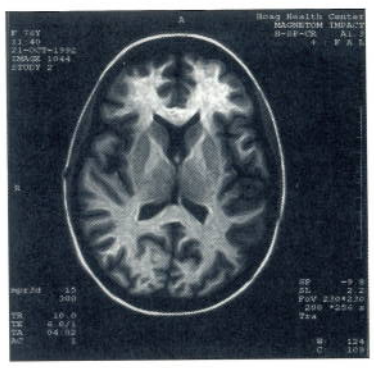
MTS/TONE MRA study utilizing 15 mT/m gradients.

Power Package

The optional Power Package, available with software version A1.5, provides exciting new features and enhancements to increase your system's performance and effectiveness. The Power Package is a hardware upgrade to fifteen millitesla per meter gradients. Many applications can be improved by using stronger gradients. These larger gradient capabilities mean sequences with shorter TE's, Turbo Spin Echo sequences with longer echo trains, possibilities for increased resolution as well as shorter acquisition times for many standard procedures.

But, the Power Package is much more! New Turbo Spin Echo sequences will provide the shortest echo spacing in the industry. That means 16-second breath-hold liver studies or 51-second complete head studies with full resolution and complete coverage!

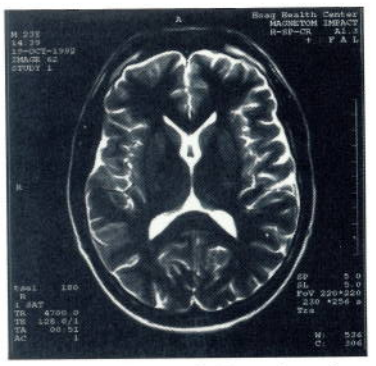
For MRA, the Power Package brings the Rephase/Dephase MRA sequences to the Siemens Magnetom Impact System! Two images are collected during a single acquisition. One rephases the blood signal, the second dephases it. The two images are automatically subtracted, and, as a result, only flowing blood is seen. Time of Flight MR Angiography is enhanced with 512 matrices, smaller fields of view and lower bandwidths. With the addition of Traveling SAT, MTS and TONE, you can make additional improvements to MRA imaging.



Optimized MPRAGE sequence using 15 mT/m gradients.

New Power Package CORE sequences – Clinically Optimized Regional Exams – provide improvements to a wide range of applications. For example, shorter TE's narrower bandwidths and smaller fields of view provide shorter acquisition times and better resolution to 512 spine studies with the CP spine coil. The Power Package's improved cardiac CORE sequences include a sequence with an MTS pulse to darken the myocardium. This increases the contrast between myocardium and blood. A new FISP sequence with a shorter echo time will reduce flow artifacts. DESS means Double Echo in a Steady-State. A new CORE DESS sequence is particularly appropriate for 3D imaging of the knee and other joints.

Software version A1.5 and the optional Power Package: the next stage in MR imaging for the Magnetom Impact Systems. If you have not already received the training video for A1.5 and the Power Package, please contact your local Siemens office.



51 second TurboSE head study using 15 mT/m gradients.

New Application Materials

This new section will list the library of new applications materials available to Magnetom users. Please contact your local Siemens representative to request additional copies of these items.

Introducing A2.5 Software for the MAGNETOM SP – Video
A 30 minute video introducing the technologist to the new applications and techniques in the A2.5 Software.
This video will be distributed to all MAGNETOM SP sites 2 weeks prior to the installation of A2.5 Software.

Introducing A1.5 Software and the Power Package for the MAGNETOM Impact – Video
A 40 minute video introducing the technologist to the new applications and techniques in A1.5 Software and the Power Package.
This video will be distributed to all MAGNETOM Impact sites 2 weeks prior to the installation of A1.5 Software.

Clinical Spectroscopy on the Siemens MAGNETOM – Video
A 20 minute video introducing the technologist to MR Spectroscopy in general and Single Voxel Proton Spectroscopy specifically.
This video has been distributed together with the Single Voxel Proton Spectroscopy Applications Update to all 1.5T sites.

Single Voxel Proton Spectroscopy – Applications Update
A step-by-step workbook for the technologist to make optimal use of the optional Single Voxel Proton Spectroscopy package on the MAGNETOM.
This applications update has been distributed together with the Clinical Spectroscopy Video to all 1.5T sites.

Multi-slab MR Angiography – Applications Update
A step-by-step workbook for the technologist to make optimal use of the Multi-slab MRA capabilities on the MAGNETOM SP/SP4000.
This applications update is being distributed to all MAGNETOM SP/SP4000 sites.

Cardiac Evaluation on the Siemens MAGNETOM – Video
A 20 minute video with a step-by-step introduction for the technologist to the optional Cardiac Evaluation Package on the MAGNETOM Impact.
This video will be distributed to all MAGNETOM Impact sites.

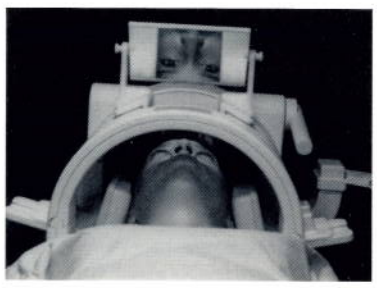
3D Display – Applications Update
A step-by-step workbook for the technologist to make optimal use of the 3D Surface Reconstruction capabilities (Voxelman) on the MAGNETOM SP/SP4000. This applications update is being distributed to all Magnetom SP/SP4000 sites.

MRI Ultraview

Added Patient Comfort for Your MAGNETOM

MRI Ultraview is the ultimate visual anti-claustrophobic device. This device is designed to easily attach to your current MAGNETOM head coil or cervical spine coil. MRI Ultraview will allow your patient to see the outside world at either end of the MAGNETOM bore simply by the technologist reversing the viewing angle. This device could significantly reduce the effects of claustrophobia when having an MRI exam. MRI Ultraview is available for many MAGNETOM configurations. For more information, contact:

A&E Specialty Fabricators
531 Campus View Drive
Riverside, CA 92507
(714) 784-6130



Head Coil Implementation

Neck Coil Implementation

Reminders

In this new section, reminders concerning the use of various features of the Magnetom software and hardware will be discussed.

Remember to properly use slice/series

Series = Interleaved
After using slice/auto/create with multi-slice multi-angle protocols, check that the series=interleaved. It defaults to ascending when creating these groups.

Series = Ascending
When trying to reduce the load time of sequential 2D angio protocols by reducing the number of slices to 1 and adjusting the receiver, it is better to change the number of slices to 3 to adjust the receiver. The time savings is less but the series and gap will not be affected.

Remember to Seq/load before RECFOV

If you want to use RECFOV for a post-Gado. scan and have to move the table to give the injection, run RECFOV only after a seq/load is performed. Remember, RECFOV will fail if an adjust/frequency is performed after RECFOV is setup. A sequence/load must be performed before RECFOV is run.

The procedure should be:
1.) Move patient back into magnet and tune coil
2.) Set up post_Gado. sequence
3.) Perform a sequence/load
4.) Run RECFOV
5.) Perform a sequence/measure

MAGNETOM Product Update

New Coils

Bilateral Breast Coil
Moveable CP Spine Coil
Head/Neck Coil

Software Deliveries in Progress

A2.5 for SP Systems
A1.5 for Impact Systems

Shoulder Coil Modification

As previously committed to at the SMRI, Siemens is beginning our Shoulder Coil Modification Program. This modification supports Siemens' commitment to providing our users with the highest quality equipment to achieve the best image quality possible. With the modified shoulder coils and new sequences which are in the latest software releases, signal-to-noise will increase by 40 percent and you will notice an overall improvement in your shoulder imaging.

The good news for you is that this modification is free of charge to all customers who previously purchased the shoulder coil. In the near future, your local Siemens service representative will be contacting you to send in your coil for modification. We have over 300 shoulder coils installed, so please be patient with us and enjoy your newly improved images.

Additional Applications Support

With the implementation of the 800 number for applications support (1-800-333-3137), we have also received requests for additional types of applications support. Namely, requests of names and telephone numbers of other technologists you can contact from other sites who may have expertise in a certain area. Technologists names, Site name, telephone number and area of expertise are listed below.

Name	Site	Tel Number	Area of Expertise
Clampitt, Mark	Univ. Hosp. of Cleveland	216/844-7750	SP - general
Greene, Robin	Univ. of Kentucky	606/287-8252	SP - cardiac, MRA, spectroscopy
Harris, Christine	Childrens Hosp. of Phila..	215/590-4120	SP - general, pediatrics, MRA, cardiac
Lanigan, Tim	Beth Israel Hosp.	617/735-2247	Impact - general
Lee, Ralph	UCSF/VAMC	415/750-6919	SP/Impact - MRA
McCurdy, Michael	Memorial Med. Ctr.	310/426-2928	SP - pediatrics, monitoring, MRA, breast imaging, contrast media
Stevens, Jeff	NYU	212/263-7195 (beeper 1501)	Impact - MRA difficult cases
Walling, Jim	Hoag Memorial Hosp.	714/760-2388	General
Shelley, Mindy	VA of Greater Dayton	513/461-1455	SP4000/Impact - pediatrics, general
Hodges, Mike	Radiology LTD	602/721-4337	Impact - general

SMRM Announcement

For the upcoming meeting of the SMRM, Siemens is proud to announce its status as a three year gold corporate member of the society.

Please note that funds normally earmarked for a marketing display were given to the society's educational program. Our goal is to encourage scientific forums which open communications to new ideas, better solutions, and effective applications.

We look forward to meeting all registered attendees at our luncheon on Monday, August 16 at 1:30 PM. Your ticket will be included in the meeting registration materials.

Magnetom...
the clinical innovation leader

Clinical Focus: Turbo Spin Echo

Principles and Clinical Applications

- ☑ SP/SP4000
- ☑ Impact
- ☑ P8

A.J. Martinez, M.D., Dir. of MRI – North Idaho Imaging – Coeur D'Alene, ID

The two major hurdles in clinical MRI are speed and motion. Faster scanning not only improves throughput but minimizes physiologic motion. Many approaches have been utilized in the quest for more rapid methods of obtaining clinically useful images. The scan time can be calculated by the following formula:

$$\text{Scan Time} = \frac{\text{TR x \# of phase encodings x \# of acquisitions}}{\text{Echo train length}}$$

From this formula, we can surmise the following choices for decreasing scan time:

1. We can reduce TR.
2. Reduce the number of phase encodes.
3. Reduce the number of acquisitions.
4. Increase the length of the echo train and combine the data.

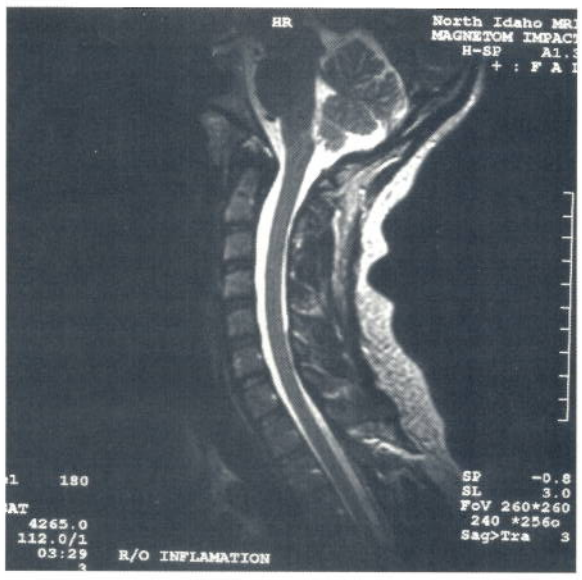
Turbo Spin Echo

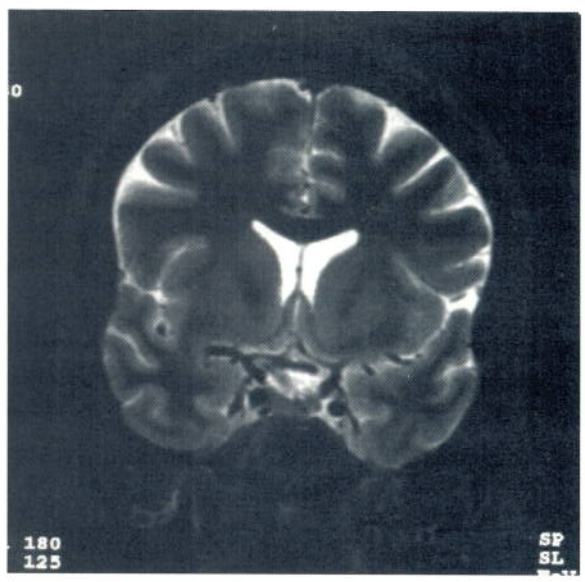
This family of sequences was first described by Hennig as RARE (Rapid Acquisition with Relaxation Enhancement). The Siemens version of the product goes by the name of Turbo Spin Echo (TSE). The basic principle of TSE is to obtain multiple individually phase encoded echoes in a single TR. The information from these echoes is then combined to form either a single effective echo or a double effective echo (i.e. proton density and T2). The image or k-space map is thus completed in a fraction of the time that would have been required for a conventional spin echo sequence (CSE). This fraction is determined by the length of the echo train. Thus, for a given TR, if an echo train of 16 is used, imaging time would be reduced by a factor of 16 from the comparable conventional spin echo sequence.

Echo train lengths (ETL) usually vary from 3 to 16. Realistically, time savings in TSE tend to be less than 16 because adequate coverage often requires shorter ETL's. Double echo sequences also pose limitations in the ETL. Some or all of the additional time savings obtained with TSE can be traded for additional SNR by using more acquisitions. The time savings may also be traded in for the increased spatial resolution of a large matrix such as a 512 x 512 matrix.

Before prescribing a TSE sequence, several factors should be known. One should know how many slices are necessary for coverage of the anatomy under study and the acceptable TR range. This usually severely limits the ETL which can be used. The acceptable SNR, and whether a single or double echo sequence is desired, further limit the choice of sequence. Additionally, the need for GMR and its direction should be ascertained. These factors will narrow the choice of sequences significantly. At this point, the sequence which meets these criteria and offers the longest ETL will provide the maximum time savings.

The images obtained with TSE are almost exactly the same as those obtained with CSE albeit a few notable differences. Fat signal is brighter in TSE images. The brighter fat can serve to highlight bone marrow metastases on TSE T1 weighted images but significantly hinders detection of bone marrow pathology on T2 weighted images. These factors can be altered by the inter-echo spacing. This parameter has been optimized by Siemens scientists and is not offered as an operator controlled parameter. Brighter fat can be useful in assessing the neural foramina in the spine on T2 weighted images. In cases where brighter fat poses a problem, fat suppression schemes can be applied.





Left: TurboSE image of the sagittal cervical spine with GMR. Note the absence of flow artifact from CSF pulsation.

Right: High resolution Turbo Inversion Recovery with excellent fat suppression.

The Turbo family of data acquisition has allowed for the development of Turbo-IRABS (IRABS TurboSE) sequences. IRABS images have long been known to provide exquisite sensitivity to pathologic processes resulting in T1 and T2 prolongation. Additionally, IRABS provides homogeneous suppres- sion of fat when the appropriate TI is used. These properties have made IRABS the sequence of choice in assessing bone marrow pathology. Prior to the development of Turbo-IRABS, the IRABS sequences were hampered by low SNR, long acquisition times and motion artifacts. With the advent of Turbo-IRABS, acquisition time has been markedly shortened allowing for decreased motion artifacts. SNR can be significantly augmented by doubling or tripling the acquisitions while keeping imaging time short.

The Nuts and Bolts

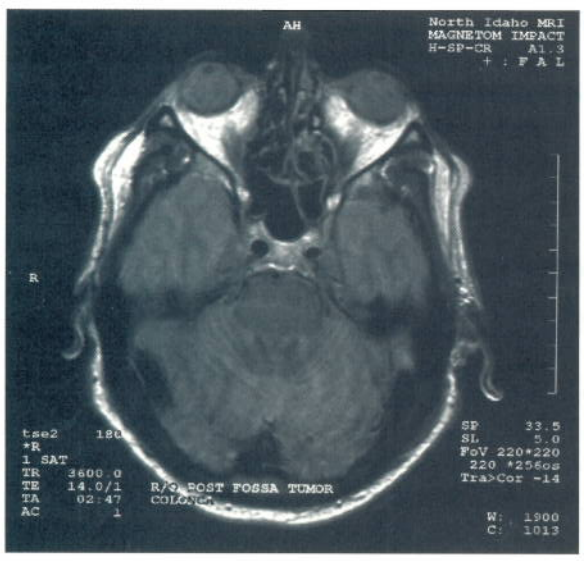
In order to better understand TSE some concepts need to be defined. These include the concept of k-space, the design of the TSE sequences, the echo train length, inter-echo spacing, symmetric versus asymmetric k-space data collection schemes and shared echoes.

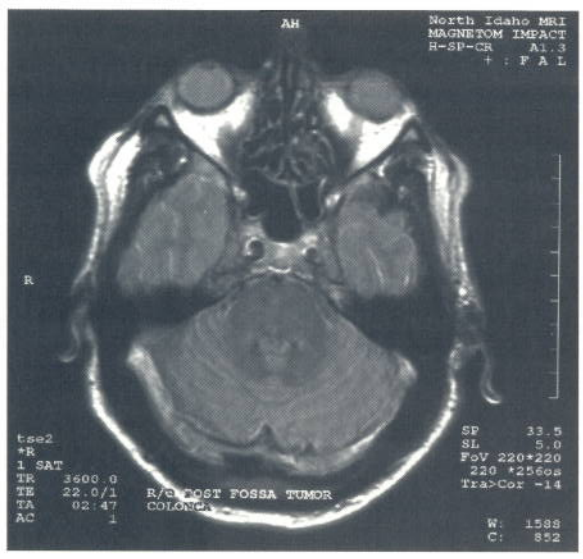
k-space: The information acquired through the application of an MR sequence is detected as an rf signal which has encoded contrast and spatial information. The sum of the information necessary for construction of a slice is called a k-space map. The k-space map contains this information as a complex mixture of frequencies which, when unraveled through a mathematical computation (Fourier transformation), results in the familiar image that we see and film.

An interesting feature of k-space is that the central 20% (low frequency) phase encode lines provide the vast majority of the contrast whereas the peripheral 80% (high frequency) phase-encode lines add almost nothing to contrast but provide most of the edge detail or sharpness. The contrast of the image is determined by obtaining the central phase encodings at the time TE at which the desired contrast occurs, this being the effective TE. The remainder of the edge detail information can be filled from phase encoding obtained at somewhat shorter or longer TE's.

The scheme of k-space ordering could involve either a symmetric ordering scheme or an asymmetric ordering scheme. In the case of asymmetric ordering, the phase encodings from the first echo would precede the phase encodings from the second echo and so forth. The contrast would be determined by the echo in the middle of the echo train as it would represent the central, low frequency, phase encodings. In the case of symmetric ordering, the data from each echo is split to symmetrically fill the positive and the negative phase encoding lines in a mirror image type of fashion. The last echo placed in the center of k-space to provide the desired contrast.

The inter-echo spacing (IES) is the time between echoes. This is limited by the time necessary to apply encoding gradients and GMR. In the present configuration, with the present hardware, the minimum inter-echo spacing is in the neighborhood of 12 msec. when no GMR is used and 22 msec. when GMR is applied. The IES impacts on the contrast and the quality of the image. As a general rule, most of the effects of shortening the IES are helpful. Shorter IES allows less time for dephasing effects to occur between echoes. This results in less magnetic susceptibility effects. With a shorter IES, the echoes can be clustered closer to the effective TE, thus reducing the degree of edge enhancement artifact. More slices can be obtained for a given TR. Shorter IES also reduces blurring, motion and truncation artifacts.





Left: TurboSE proton density weighted image of the head. No Gradient Motion Rephasing (GMR) was used. Note the presence of flow artifacts.

Right: TurboSE proton density weighted image of the head. Gradient Motion Rephasing (GMR) has been included. Note the absence of flow artifacts.

CLINICAL FOCUS: TURBO SPIN ECHO

THE INTRICACIES EXPLAINED

☑ SP/SP4000
☑ Impact
☑ P8

Dean Kaufman, Siemens Medical Systems, Inc.

It has been said that "fast spin echo is not just *fast* spin echo" when making reference to the difference between Turbo Spin Echo (TurboSE or TSE) and just running a faster Spin Echo sequence. TurboSE is much more complex than conventional Spin Echo in many ways. In the discussion that follows, you will find a discussion of the similarities and differences between conventional Spin Echo and TurboSE and clarification of how the TurboSE parameters affect image contrast and signal-to-noise.

Both conventional Spin Echo and TurboSE refocus the echo with the use of RF pulses. This is why they are both called Spin Echo sequences. There are new parameters specific to TurboSE sequences. They are the echo train length, echo spacing and echo ordering. These parameters exist because TurboSE sequences acquire data as a train of echoes within the time allowed by the TR period, and because the raw data map of one image is actually filled with data from this series of separately acquired echoes occurring at different echo times. This differs from conventional Spin Echo imaging where the raw data from one image is filled with data acquired at only one echo time.

Because of the need to optimize these parameters within the timing of the imaging sequence, these new parameters cannot be changed by the user. This is why Siemens provides a large number of imaging sequences with various echo train lengths and effective echo times, while always attempting to minimize the interecho spacing. Selecting a sequence with a longer echo train increases the time savings, but eventually this positive effect is offset by the appearance of image artifacts.

The echo train in TurboSE also changes how the number of imaging slices are calculated. With conventional Spin Echo the maximum number of available slices is equal to TR/TE. With the TurboSE sequences the maximum number of slices is equal to the TR/the longest TE in the echo train. Therefore, as the echo train length gets longer , the number of slices per TR decreases. As with conventional Spin Echo, increasing the repetition time (TR) increases the number of potential slices one can acquire and improves the T2 contrast. TRs for TurboSE can be much longer (3000 to 5000 msec) than for conventional SE sequences to allow for good slice coverage. Echo train lengths are usually 4-15 echoes long, and provide a good compromise between scan time reduction and slice coverage for the desired range of TR values.

Parameter	Advantage	Disadvantage
Increased TR	Incr. Contrast Incr. S/N Incr. # of slices	Incr. Acq. Time Incr. Motion Artifacts
Increased TE	Incr. Contrast Decr. Edge Enhancement	Decr. S/N Incr. Mag. Suscept.
Increased Echo Train	Incr. Contrast Decr. Scan Time Incr. Range of TE's Decr. Scan Time/Slice	Decr.S/N Incr. Blurring Decr. # of slices/TR Incr. Truncation Artifact Incr. Edge Enhancement

Due to the sequence construction and spin echo reordering specific to TurboSE, there are a number of image artifacts which can manifest themselves in TurboSE. Some of these artifacts can also be seen in conventional spin echo and gradient echo images. The blurring and edge enhancement artifacts are a result of the echo reordering which must be performed with TurboSE image data. This reordering is necessary because TurboSE images are created with data from different echo times. This is the major difference between TurboSE and conventional Spin Echo. It is important to understand why these artifacts are formed in TurboSE images so they can be minimized by choosing the best possible scan parameters.

These artifacts include:

- **Blurring**
- **Truncation Artifact**
- **Motion Artifact**
- **Edge Enhancement**
- **Magnetic Susceptibility**

BLURRING

This artifact can easily be confused with motion artifact ghosts. Blurring worsens with increased echo spacing. It is caused by changes in tissue T2 during the echo train and affects tissues which have a short T2 time such as muscle, liver, and vertebral bodies. This results in the artifact getting worse when data from early echoes in the echo train are used to define the contrast.

EDGE ENHANCEMENT

This artifact is attributed to T2 decay during data collection and is manifest as increased signal at the edges of anatomic structures. This is due to data from various short echo times being used to fill the raw data which define the edges of image features.

TRUNCATION "EDGE RINGING" ARTIFACT

As in conventional Spin Echo, truncation artifact appears where there is high contrast between bright and dark anatomical structures. This artifact gets worse as the echo train length increases, and results in the acquisition of very late echoes. It is due to T2 relaxation processes occurring during the various echo acquisitions. This artifact will not be apparent with either conventional Spin Echo or TurboSE if high resolution matrices are used.

MOTION ARTIFACT

TurboSE sequences benefit from GMR (Gradient Motion Rephasing) similarly to conventional Spin Echo sequences. This is why many of the TurboSE sequences available on Siemens systems have GMR built into the sequence. It is very important to select a sequence with GMR when imaging regions which include physiological motion. When this guideline is followed, motion artifacts will not be a problem. Regions such as the spine, and body can only be successfully imaged if CSF, blood flow, and respiratory artifacts are eliminated.

MAGNETIC SUSCEPTIBILITY

This artifact is due to the dephasing of transverse magnetization. This is the very same reason magnetic susceptibility is a factor in conventional spin echo imaging. This artifact is no more of a problem with TurboSE sequences.

Above is a table summarizing the positive and negative affects of manipulating TR, TE, Echo Spacing, and Echo Train. As with most other aspects of MRI parameter optimization, there are advantages and disadvantages to manipulating each of these parameters. Gaining a thorough understanding of these tradeoffs should be a goal of anyone working with TurboSE. It is only through such an understanding that the full benefits of TurboSE can be put to use clinically.

Seminars and Announcements

Following are Siemens users meetings and national meetings for the remainder of 1993. A total of 7 Siemens-sponsored users meetings are offered in 1993 alone! These meetings enable you to meet other Siemens users, exchange ideas and remain informed in this rapidly evolving field. For information concerning any of the following meetings, please contact the MR product group at 908-321-3270.

August 14-20	SMRM Annual Meeting New York Hilton New York, NY
August 15	Magnetom Users Meeting SMRM New York Hilton
August 16	Siemens luncheon SMRM annual meeting New York Hilton
September 18	Seattle Users Meeting Embassy Suites Hotel Bellevue, WA
September 23-25	Fall MR Tech. Seminar Sheraton El Conquistador Tucson, AZ
Nov. 28 - Dec. 3	RSNA Annual Meeting McCormick Place Chicago, IL

Fundamentals of MRI For Technologists

Hyatt Regency New Brunswick

New Brunswick, N J

Remaining course dates for this year:

August 30 - Sept. 2

October 18 - 22

More dates will be announced shortly for 1994.

Protocols

This is a new regular section of the FLASH newsletter. If you have interesting or unique protocols that you wish to share with other Siemens users, please submit them.

Cardiac Gating Made Easy

Sent by Ken Lockhart
Maxum Health Corp.
Parkersburg, W.Va.

As many of you can testify, cardiac gating on some systems is difficult to set up and often not worth the effort. Not so with the Impact system. Try this technique to evaluate a mediastinal mass. It is quick and easy. The results have been very impressive at our site.

The leads must be attached to the patient's back: never to the front of the chest. Make sure the wires are separated and do not cross each other. Triggering can be done on every beat, but we have found that the scan quality is improved if you trigger on 2. Our radiologists want only T1 axials and coronals, so the total exam time is still very reasonable.

The matrix size and FOV may have to be adjusted for large variances in patient size. But, we have found that the above parameters work well for most average size patients while minimizing scan times.

SE_15b_130_ufa
TR = 600
TE = 15
No. = 12 slices
Thick. = 5mm
FOV = 400
Dist. Factor = .25
Matrix = 160 x 256
Acq. = 4
Ekg Triggering on
Trig. Pulses = 2
Filter = on
Free Sat = 2
Swap Re/Ph = no
Time is greater than 12 minutes 54 seconds

L-Spine Imaging TurboSE PD/T2 Sagittal

TSE3_21B130_103B130
TR = 3000
TE = 21/103
FOV = 500
Matrix = 384x512,o
No. = 11
Thick. = 4
Dist. Factor = 0.2
Acq. = 1
Swap Re/Ph = no
Filter = off
RECFOV

2 PRESATS (1 superior & 1 coronal obliqued to be parallel and below sacrum), MAG 1.8.

Knee Imaging

Sentby Stan Gray RT
Tanya Paulette RT
Randall Shortt RT
Lynchburg General MRI
Lynchburg Va.

They write that they use the same positioning as Dr. Brian Murphy of Doctor's Hospital of Coral Gables (see Flash Vol 1,Page 2), but they will do a straight coronal to localize the ACL and they position their slices parallel to the ACL ,with the following technique:

Se_15B130
Tr = 500
Matrix = 256x256 h,o
ACQ = 5
Slices =11
Thick. = 2mm
FOV = 170
Dist. = .2
Measurement time : 5:44

They note that the thinner slices really make a big improvement in visualization of both the ACL and PCL

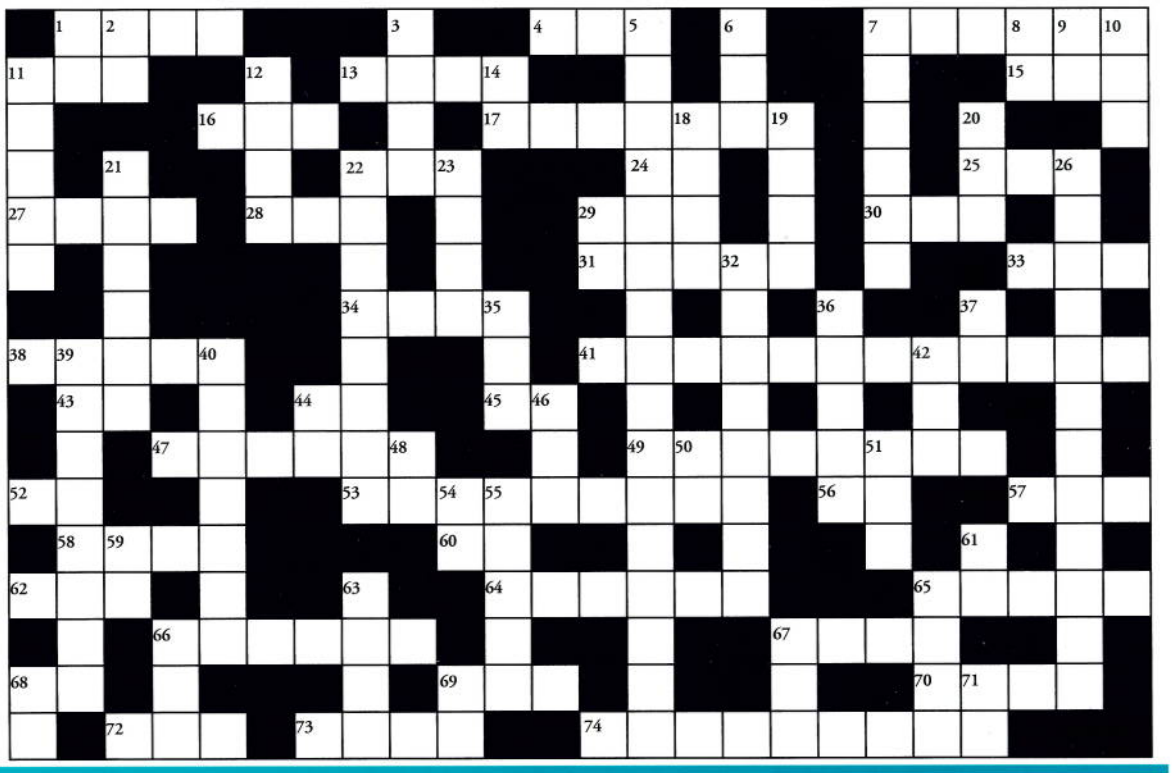
C-Spine Imaging

This sequence can be used in the C-spine to improve image sharpness. The shorter echo train improves sharpness and soft tissue detail, and increases marrow and fat signal. Notice the suggested large FOV and 512 matrix combination which must be used when phase/frequency are swapped.

TSE7_103B130
TR = 3000
TE = 103,
FOV = 450
Matrix = 511x512,o
No. = 11
Thick. = 4
Dist. Factor = 0.2
Acq. = 2
Swap Re/Ph = no
Filter = off
No RECFOV

2 PRESATS (1 superior & 1 coronal obliqued to cover breathing motion of chest) MAG 1.8.

If you find the protocols in this section helpful, please let us know. Also, if you have tried other methods, we would love to have your input. It is in this way that we can all learn from each other's experiences.



Across
1 Medical aptitude test.
4 Variable flip angle spin echo sequence.
7 Hydrocephalic babies get silastic _ _ _ _ _ _.
11 Federal agency certifies safety and efficacy.
13 Technologist registry.
15 Can generate a metal artifact.
16 Managed care genre.
17 Name of Siemens' MRI software.
22 Software that reformats additional image planes.
24 High freq. is to HF as low freq. is to _ _.
25 Biomagnetic analog of the EEG.
27 Technologist professional society.
28 MRI of the vasculature.
29 3D angiographic reconstruction software.
30 This older term was replaced by "MRI".
31 MRI can detect disease at an early _ _ _ _ _.
33 Brainstem view contains acoustic pathologies.
34 Establishes equipment manufacturers' standards.
38 Siemens' computerized service network.
41 Weakly attracted to a magnetic field.
43 Technologist degree.
44 Lateral aspect opposite left (abbrev).
45 Most sites run QA procedures in the _ _.
47 Siemens' software for non-square imaging.
49 Requires 90° and 180° RF pulses.
52 Siemens' new shielded magnet design (abbrev).
53 Alternative to time-of-flight.
56 _ _ 4000 MRI system.
57 Off-resonance MRA enhancement technique.
58 RF pulse containing a slice profile 'ramp'.
60 Physician's degree.
62 Calculation that limits RF power.
64 Siemens' 1.0T MRI system.
65 The role of applications specialists.
66 City of Siemens' USA headquarters.
67 Professional neuro society.
68 Phase encoding (abbrev).
69 Limb containing the knee.
70 MRI signal.
72 Vascular anomaly (abbrev).
73 Unspoiled gradient echo sequence.
74 Siemens USA headquarters' state.

Down
1 Physician's degree.
2 Carcinoma (abbrev).
3 _ _ _ _ around artifact.
5 Daily performance test.
6 Name of our field.
7 Pathology involving an enlarged spinal canal.
8 H _ _ (abbrev. for "slipped disk").
9 An inversion recovery sequence parameter.
10 Important image quality parameter.
11 Spoiled gradient echo sequence.
12 MRI trade show.
14 Hillary Rodham's husband's runningmate's state.
18 Main transmitter amplifier.
19 An important attribute of an MRI exam.
20 Motion rephasing technique.
21 Gad. has revitalized the imaging of this body part.
22 Siemens' MRI product name.
23 Quick magnification feature.
26 Signal refocussed without an RF pulse.
29 Pathology showing demyelination in neural tissue.
32 Linearly varying magnetic field.
35 American Hospital Association.
36 The heart TRIGGERS and the lung _ _ _ _ _.
37 It cools the magnet to supercon. temperature.
39 Best imaged with the endorectal coil.
40 First company to offer an MRA package.
42 Federal life science institute in Bethesda.
44 Type of energy specified by flip angle.
46 New functional imaging based on biomagnetism.
48 Federal hospital chain.
50 Long TR, short TE.
51 Billing codes for each examination.
54 Popular MRI contrast agent.
55 Low signal-to-noise can be due to high _ _ _ _ _.
59 Operating room.
61 Timing parameter controls amount of dephasing.
63 This puzzle's author's company (abbrev).
65 MIP allows you to view the vascular _ _ _ _.
66 Major brain vasculature.
67 Vertebral disks dehydrate with _ _ _.
68 Siemens' 0.2T MRI product.
69 Alternative to circularly polarized.
71 County (abbrev).

By: Philip A. Femano, Ph.D., President, Medical Imaging Consultants, Inc.
CONTEST: Please fax your completed puzzle to the author at (201)812-9199. The first five correct submissions will receive a MAGNETOM tote bag from Siemens. Because of the number of submissions, only winners will be acknowledged. Answers to this puzzle will be published in the next issue of the MAGNETOM FLASH.

Questions & Answers

From: Arthur R Montes, R.T. (R) ARRT
Dallas V.A. Medical Center/MRI Dept., Dallas ,TX

I recently found your newsletter (The Magnetom "FLASH") in the Medical Center where I work. I found it to be be very informative and would like to subscribe to it.

We are currently using the Siemens SP(with the new A2.5 software upgrade) at our site and I have attended the Siemen's Magnetom users school in New Brunswick, NJ. If you can't help me could you direct me to someone who can. Any help is greatly appreciated.

Response:

Thanks for your interest in our newsletter. We appreciate your input and look forward to hearing from you regarding future issues. Your name has been added to our mailing list.

Michele Kessler, MR Applications Manager

Application Tips

Apps Tip 1

FATSAT

- ☑ SP/SP4000
- ☐ Impact
- ☐ P8

Once the FATSAT frequency for a certain anatomical region is calculated and saved, do you have to set the frequency each time a FATSAT sequence is run for that region or does the frequency change hold for the next measurement?

When you set a certain FATSAT frequency on the SPs with A2.5 using either the FSFIX or FSTUNE programs, then that particular frequency is kept in a reference file until it is changed (either with FSFIX or FSTUNE). Changing the FATSAT sequence, moving the table, or performing any other function will not change the FATSAT frequency. Even if FATSAT is not used for a month this frequency would still remain unchanged in the reference file.

Apps Tip 2

MTS/TONE

- ☑ SP/SP4000
- ☑ Impact
- ☐ P8

Is it OK to run an MTS/TONE ICV angiography sequence after giving Gadolinium? What will be the effect on my MR angiograms and is there any advantage to doing my MRA exams this way?

There is no harm using these types of sequences, or any angio sequence after contrast is given. Since the contrast agent shortens the T1 of fluid (blood), smaller vessels and vessels with slower flow could be better visualized. The Gadolinium, however, will also shorten the T1 of the brain parenchyma, so the background tissue may not be as dark had the Gado. not been given. So, it is not worthwhile at this time to give contrast for the sole purpose of improving the quality of the angio scan.

Apps Tip 3

RECFOV

- ☑ SP/SP4000
- ☐ Impact
- ☐ P8

Reports of RECFOV not working even after following all the proper steps for running RECFOV.

It was recently found when a new protocol is chosen immediately after RECFOV is run and Seq/Measure performed, RECFOV can fail. The next protocol should not be selected until the currently loading sequence has started and the console says: 'Measurement in Progress'. There are many experienced technologists who move very quickly from 1.) Running RECFOV, to 2.) Loading, and then 3.) Selecting the next protocol. If you are experiencing this problem try to slow down between step 2 & step 3.

Apps Tip 4

GMR

- ☑ SP/SP4000
- ☑ Impact
- ☑ P8

Imaging sequences with the letter 'R' in their name have Gradient Motion Rephasing (GMR) in both the read-out and the slice selection direction. Having GMR along two axes results in significant reduction in motion artifacts independent of the direction of motion. Ultimately, it would be best to have GMR along all three axes, but this is seldom practical. This situation can push the gradients to their maximum when used in sequences which utilize high gradient amplitudes.

Rephasing along only one axis – RR along the read-out only and RS along the slice selection axis – provides a number of benefits. Primarily it relaxes the sequence timing and gives you the option of smaller FOVs, thinner slices and higher matrices (512 for example).

Now, when would you choose one versus the other? In the spine, CSF pulsation occurs along the long axis of the body. When using a sagittal orientation without the phase/frequence swapped, use the sequence with GMR in read-out direction only. If you're using a transverse orientation, make sure the sequence has GMR in the slice selection direction.

Swapping on a sagittal scan would not help since motion is along the z direction which is now phase encoding.

THE MAGNETOM

✸ FLASH ✸

newsletter for SIEMENS MAGNETOM users • vol. 1 no. 2/1993

Siemens Medical Systems, Inc.
186 Wood Avenue South
Iselin, NJ 08830