

**Cliniques universitaires  
Saint-Luc in Brussels**

**Save 90 min  
of OR time by  
implementing**

A 6-step deep-brain  
stimulation workflow

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# Introduction

The Cliniques Universitaires Saint-Luc in Brussels offers approximately 1,000 beds in various specialties. Thanks to its highly specialized teams and continuous investment in state-of-the-art medical equipment, Saint-Luc is able to treat even the most complex conditions.

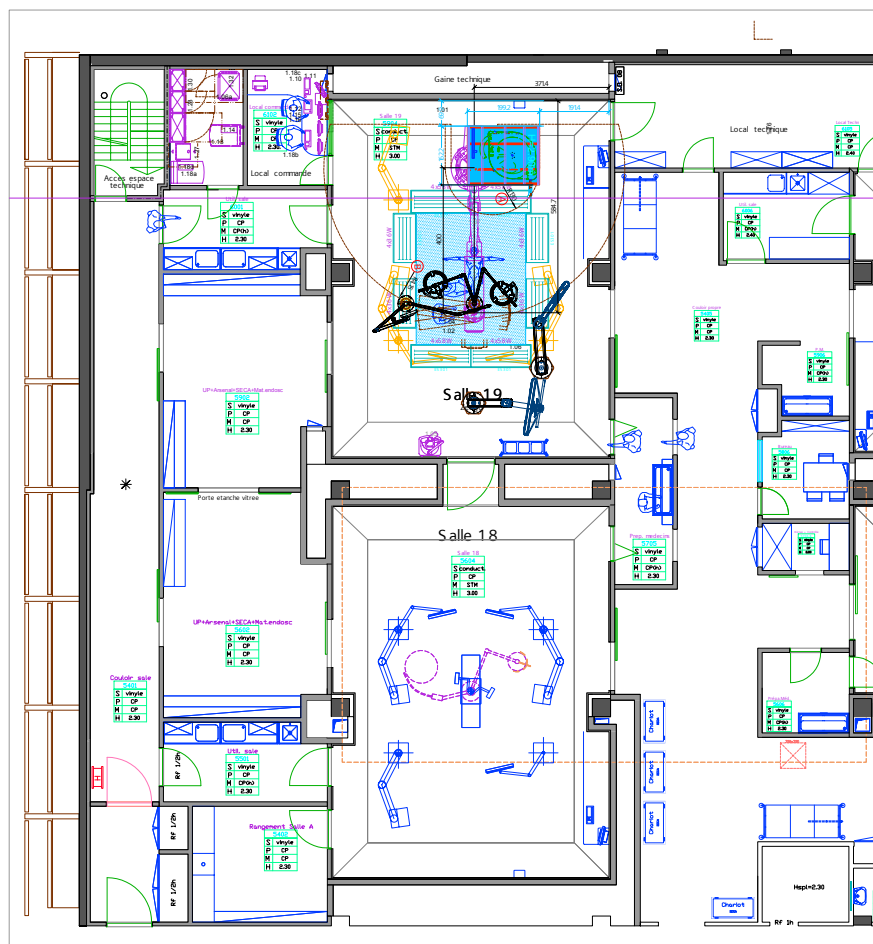
Prof. Christian Raftopoulos, the head of the Department of Neurosurgery at Saint-Luc's, is an international authority on neurosurgery including deep-brain stimulation, spine, and neurovascular.



# OR Setting

The Clinique Universitaires Saint-Luc has two robotic C-arms and three Hybrid ORs. The newest Hybrid OR was built in 2013 and is equipped with a robotic imaging system.

- The Hybrid OR: 74 m<sup>2</sup>
- Control room
- Siemens floor-mounted robotic C-arm Artis zeego with Q technology with PURE®
- Maquet Magnus OR table
- 2 anesthesia booms
- syngo X Workplace
- Large Display
- Laminar Air Flow
- syngo Image Fusion Package
- Intraoperative 3D Imaging with syngo DynaCT and syngo DynaCT 360



Floor plan, Saint-Luc Hospital, Brussels, Belgium



Hybrid OR with the robotic C-arm



# Clinical Case

**History:** 70-year-old male patient, diagnosed with essential tremor 10 years ago

**Symptoms:** started on the right hand, progressed to left hand, head and voice

Refractory to different medication treatment scheme

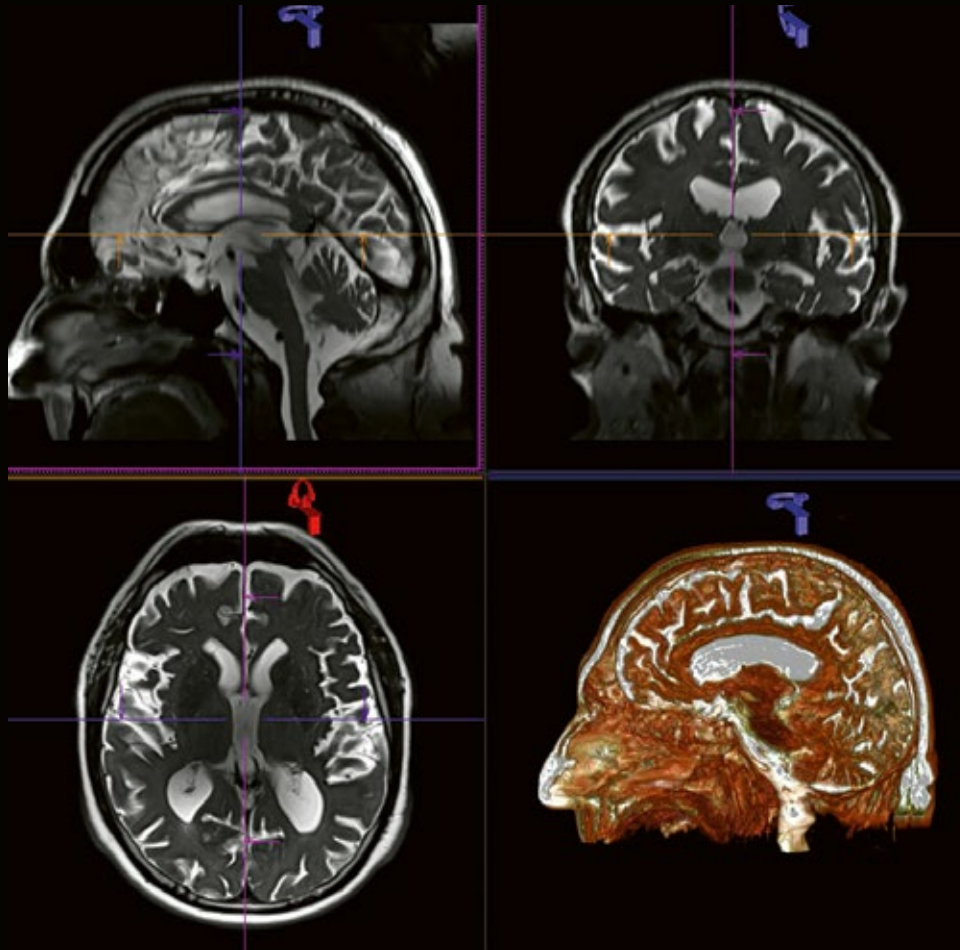
**Planned procedure:** deep-brain stimulation (DBS) of the VIM Nucleus, in 6 time-saving steps

**Preoperative planning:** A 3T magnetic resonance imaging (MRI) exam was performed under sedation 10 days prior to surgery, for intraoperative electrode planning and precise brain vessel evaluation

## Step 1

# Preoperative magnetic resonance imaging

An MRI is needed for intraoperative anatomic target visualization of the VIM nucleus



Stereotactic frame placement



Stereotactic frame placement



Stereotactic frame placement

## Step 2

# Stereotactic frame placement

The intraoperative stereotactic frame placement is necessary for exact intraoperative target guidance in the anatomic area during the entire procedure.

For the DBS procedure, the patient is positioned prone on the table with the head towards the robotic C-arm.

Under general anesthesia the neurosurgeon fixates the stereotactic four-pin fixation head ring, which, together with the target-centered arc, is part of the chosen stereotactic frame.

The stereotactic frame is necessary to guide the neurosurgeon to the anatomical targets through an 'x,y,z' coordinate setting.





Preparation for brain CT scan

### Step 3

## Brain CT scan outside the OR in the radiology department

After the head ring is attached, the patient is moved on a transport table from the Hybrid OR to the radiology department, where the computed tomography (CT) scanner is located.

This brain CT scan is important to correct any MRI distortions and helps the neurosurgeon locate the exact coordinates in the brain where the electrodes should be placed.



A profile incidence is memorized by the robotic C-arm.

While the patient is positioned on the table in the hybrid OR, the neurosurgeon uses a dedicated planning software to generate precise images of the target structures, enabling him to select the optimal approach.

The software fuses 2D and 3D images of the pre operative MRI and perioperative CT to determine the microelectrode's targets as 'x,y,z' coordinates.



The head is fixated to the table with a clamp



Patient will be transferred from the transport table to the surgical table

#### Step 4

## Definition of coordinates

The MRI and the CT scans are fused to calculate and define x,y,z coordinates of the target area. The coordinates are sent to the OR for the team to start the procedure.

After the brain CT scan, the patient is transferred back to the Hybrid OR.

In the Hybrid OR, the patient is now positioned on the radiolucent surgical table where the head is fixated to the table with a clamp, for maximum stabilization.



## Step 5

# Trajectory placement

The calculated coordinates are used to precisely place the macro-electrodes in the target area.

The team adjusts the determined 'x,y,z' target coordinates to the head frame, which is then attached to the patient. A dimesized burr hole is made in the given direction. The electrodes are placed in the guide tubes and introduced into the brain.



Adjustment of the coordinates by the neurosurgeons

# Fluoroscopy-supported introduction of electrodes

2D fluoroscopy confirms immediate positioning of the macroelectrode before introducing the final stimulating electrode.

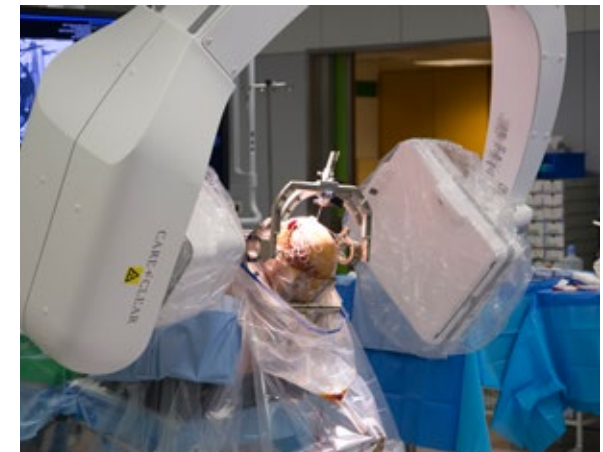
The precise, millimetric placement of the electrodes is done by combining the 'x,y,z' directions indicated by the coordinates together with the support of robotic C-arm fluoroscopy. The robotic C-arm moves into the surgical field in just a few seconds recalling the previously saved position. Direct visualization of the target structures allows the team to be assured that the target point of each electrode is as precise as planned.



Team operating with the robotic C-arm out of the operating field



2D fluoroscopy-supported introduction of electrodes



Widespace C-arm in lateral position.



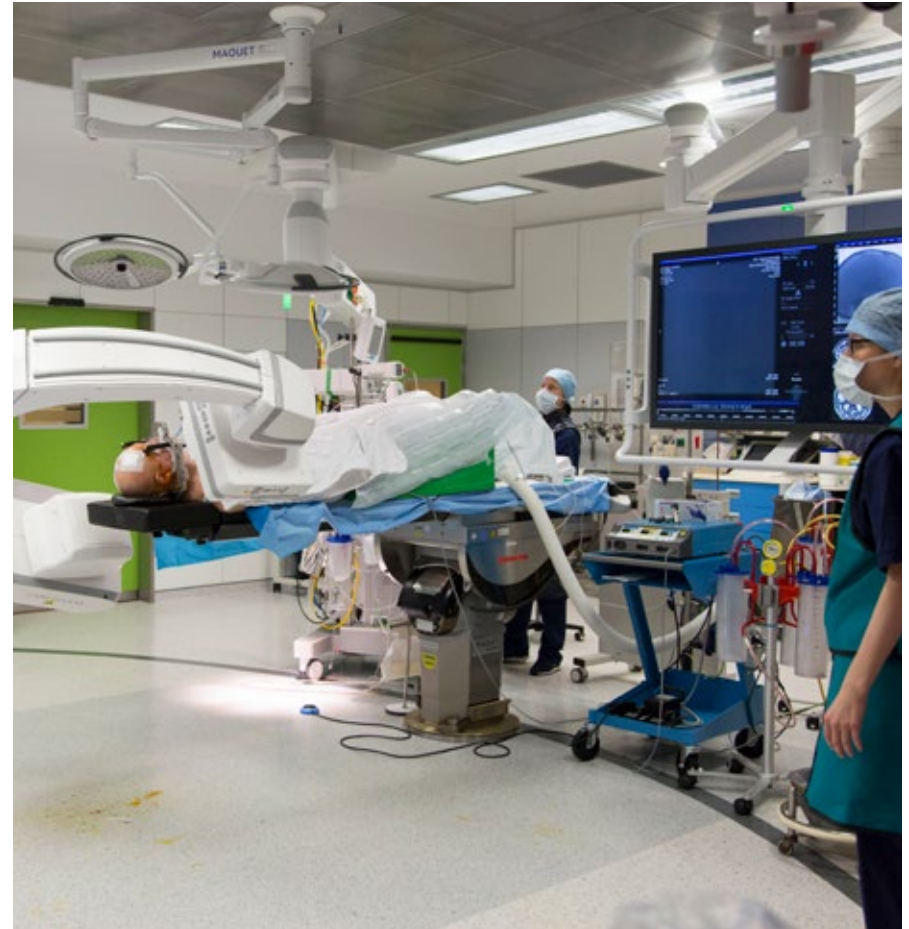
## Step 6

# Intraoperative quality control with robotic-assisted 3D imaging

A 6-second syngo DynaCT is performed directly in the OR.

The introduction of each electrode needs to be milli-metrically correct. The recommended post-operative control of precise electrode placement would routinely take place in the radiology department. The patient would need to be moved back to the transporting table and taken to the radiology department for either a CT scan or an MRI.

Instead, the team has significantly sped up the work-flow by avoiding all further patient transfer and performing the post-operative control inside the Hybrid OR using the image fusion capabilities of the robotic C-arm.

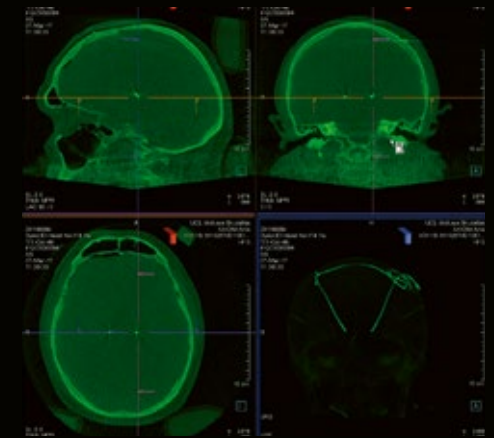


Post-operative quality control with syngo DynaCT in the operating room

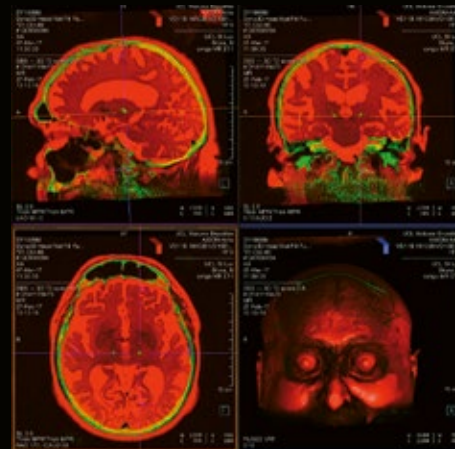
# Intraoperative quality control with image fusion

The preoperative MRI can be fused intraoperatively using the *syngo* DynaCT Fusion Package to immediately check the result and ensure precise positioning of the final stimulating electrodes.

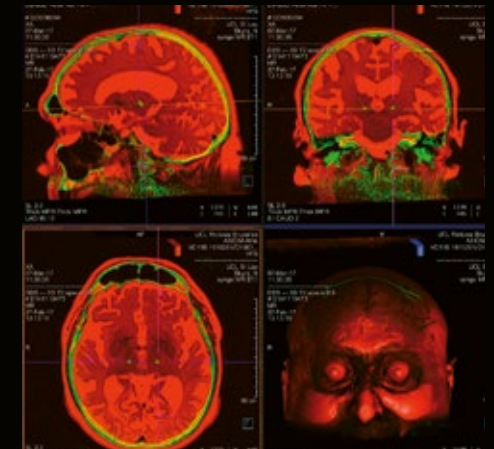
The control *syngo* DynaCT without any patient repositioning is acquired in only 6 seconds. This native 3D fluoroscopic acquisition is then fused automatically with the preoperative MRI using the *syngo* Fusion Package to show the precise lead position in 'x,y,z' views.



Post-operative *syngo* DynaCT



Pre-operative MRI



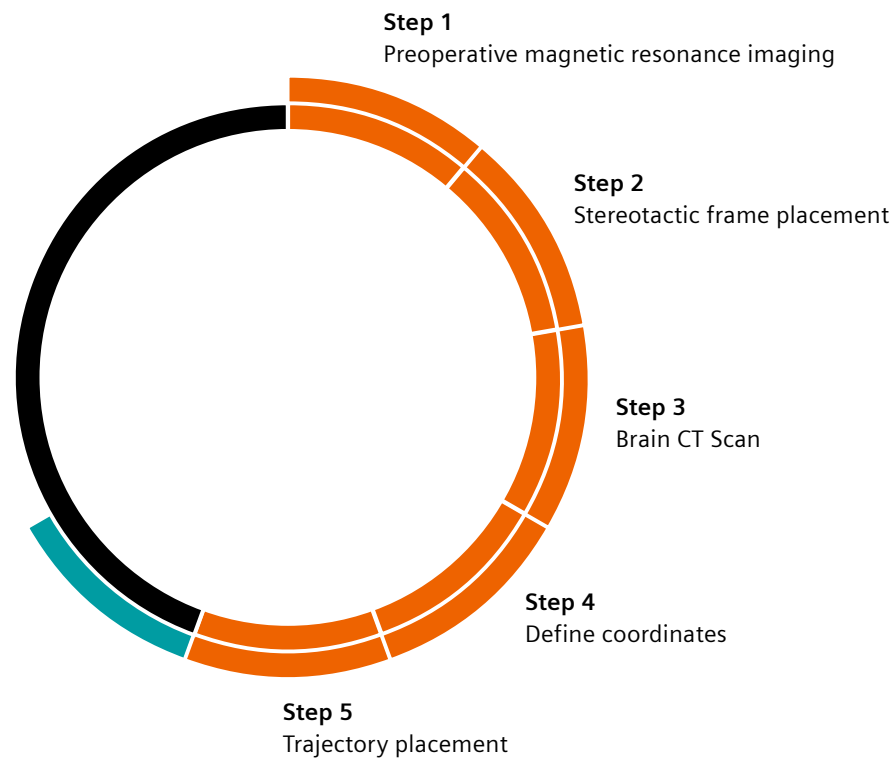
*syngo* DynaCT Fusion image

# Comparison of workflows

Time savings approx. 90 minutes per procedure

**Step 6 without robotic C-arm**  
Transfer to the CT, positioning on the CT table, reconstruction, transfer back to the OR, repositioning on the OR table.

**Step 6 with robotic C-arm**  
Intraoperative quality control with robotic-assisted 3D imaging



*"Saving up to 90 min of procedural time using the robotic C-arm for deep-brain stimulation in a Hybrid OR setting makes our department highly productive."*

Prof. Christian Raftopoulos, Head of Neurosurgery,  
Cliniques Universitaires Saint-Luc, Brussels, Belgium

- Step 1-5
- Step 6 **with** robotic-arm
- Step 6 **without** robotic-arm



# Higher utilization increases the efficiency of the Hybrid OR

After assuring the correct positioning of the electrodes, an internal pulse generator was implanted and the procedure was successfully completed.

*"No loss of precision"*

The robotic C-arm and its image fusion capabilities allowed the post-operative control of the lead implants without moving the patient, saving substantial OR time

*"An average procedure now takes 4 hours"*

Due to the implemented workflow settings and especially due to the fast post-procedural check using the robotic C-arm, the team is now able to perform a second surgery on the same day, increasing OR utilization dramatically.

*"Cost reduction due to fewer resources and higher utilization of the Hybrid OR"*

Prof. Christian Raftopoulos



Artis zeego used in this workflow has been discontinued and is no longer available. Artis zeego has been replaced by ARTIS pheno. For further information, please see [siemens.com/artis-pheno](https://www.siemens.com/artis-pheno) or contact your local sales representative.





# Benefit of the Robotic C-arm in the Hybrid OR

1. Precise targeting and automatic image fusion using pre-operative MRI and *syngo* DynaCT with *syngo* Fusion Package
2. Intraoperative image control with *syngo* DynaCT without patient transfer, saving a significant amount of time
3. Increased procedural success by using intraoperative 3D imaging for quality control
4. Less radiation dose compared to workflows that include perioperative CT
5. Increased patient safety by reducing patient transfer and anesthesia times
6. Financial benefits for the hospital through optimized resources and higher utilization of the Hybrid OR

More information



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*The clinical overlay on title image is not that of the individual pictured.  
It was modified for better visualization.*

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