



- ▶ **TELE-MED:** INTEGRATED SYSTEM FOR remote teleproctoring -telementoring in surgery and for the training of surgical specialist

CURRENT PROBLEMS

Figure 1

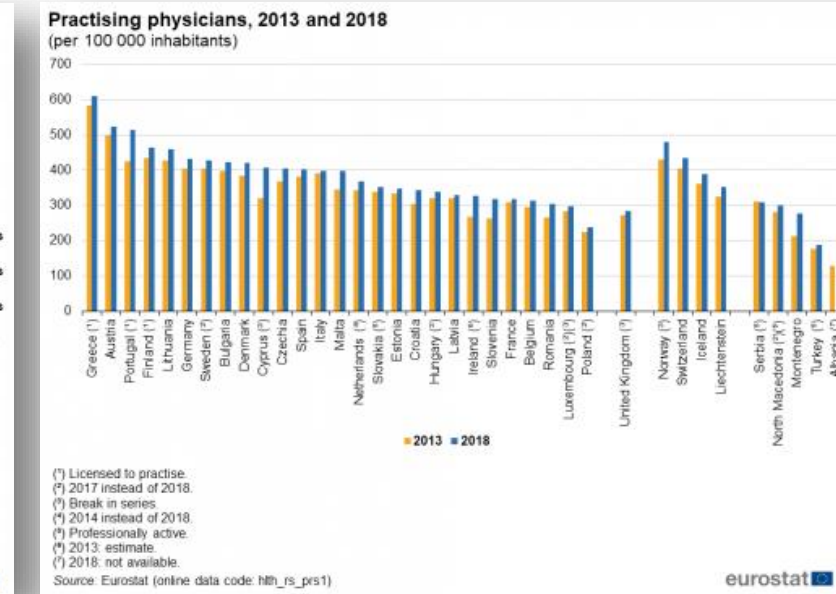
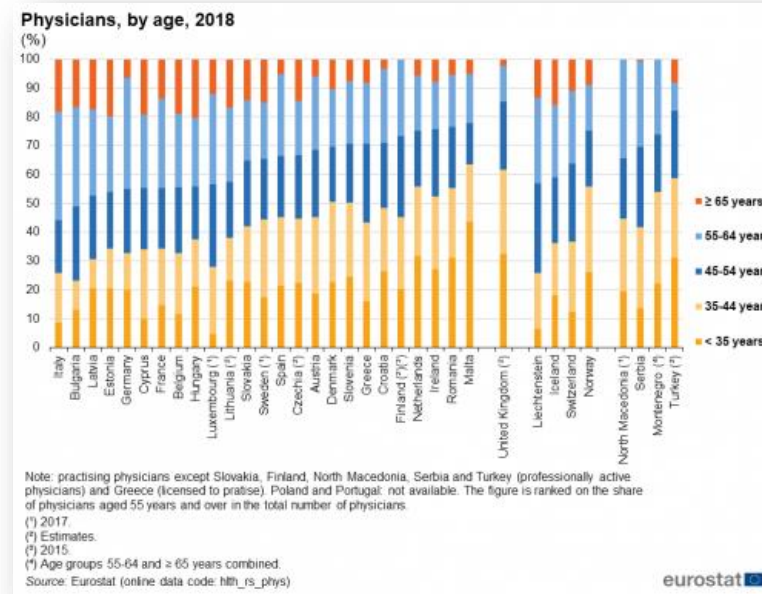
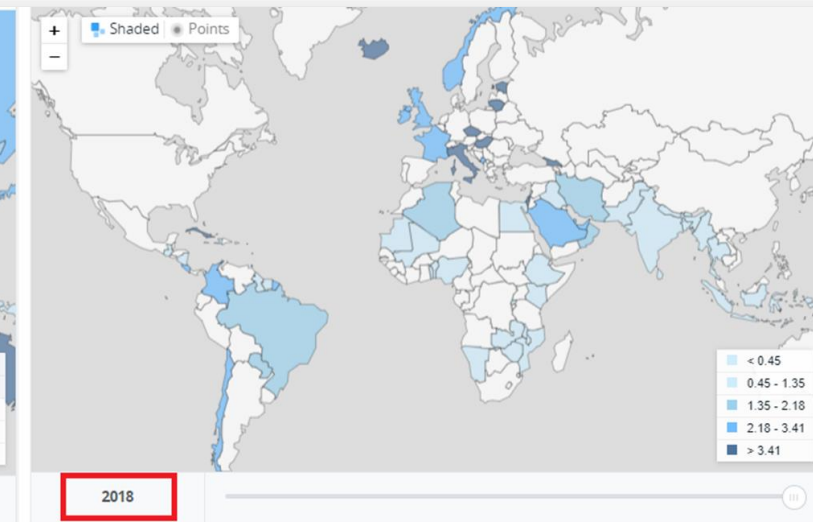
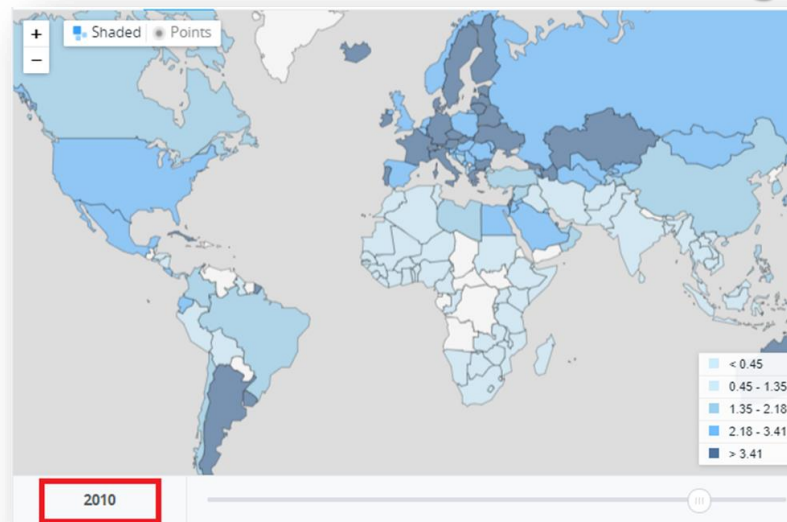


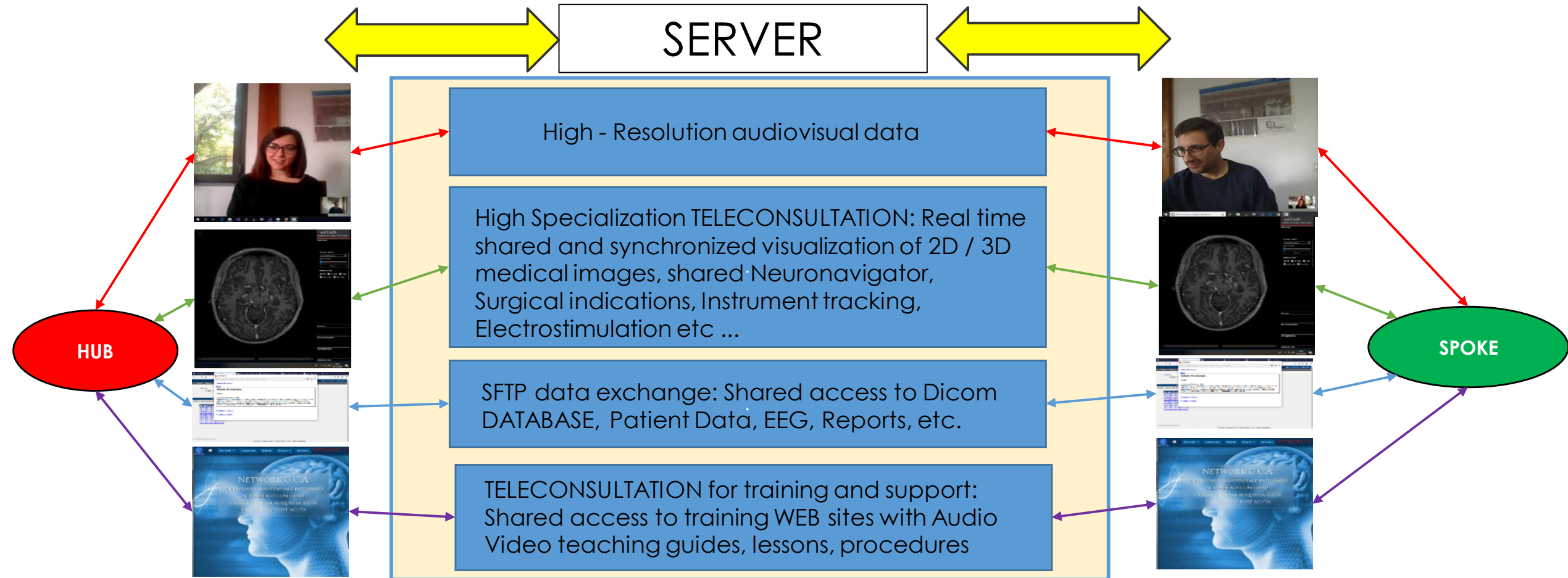
Figure 2



- **Aging** and **Shortage** of highly specialized surgeons (Figure 1)
- **Insufficient number** of new medical specialists in Europe and USA (Figure 2)
- The change in modern technique for general surgery **from traditional open procedures to minimally invasive techniques** has been driven by technological advances, which require effort to master on the part of trainee surgeons
- **RESTRICTIONS FOR COVID 19 PANDEMIC** which strongly limits the mobility of proctors, **significantly delaying clinical trials** and the introduction of new devices
- For the **training** of surgical specialists and the introduction of new technologies, **direct supervision** by an experienced physician is essential (by law): but there is shortage of such specialist
- Despite recent advances in telecommunications, **surgeons still have limited tools** to remotely help inexperienced surgeons

SOLUTION

TELEMED, a system that optimize current technology to improve **remote surgical collaboration and teleconsultation**: remote collaborators work side-by-side as if co-located

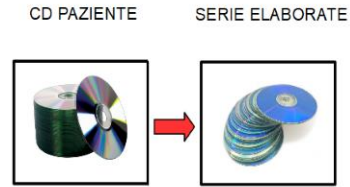


MAIN COMPONENTS OF THE TELE-MED SYSTEM

In addition to the integrated system for carrying out a remote teleconsultation and tele-assistance session in the pre, intra and post-operative phase for surgery (real time virtual presence in surgery), TELEMED also has the following essential components:

- 1) MEDICAL IMAGE PROCESSING E RENDERING (TC, MR, fMRI, FA, TRACTOGRAPHY, ECC)
- 2) NEURONAVIGATOR AND INSTRUMENT TRACKING
- 3) A POYNTING SYSTEM (SW) that indicates on the neuronavigator the path to follow to reach the target points in the brain or on the spine

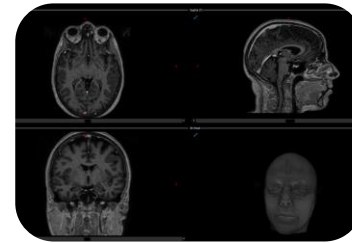
1: IMAGE PROCESSING E RENDERING



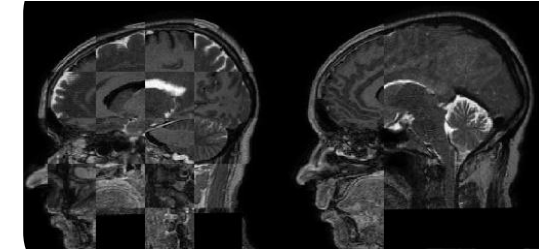
UNPACKING



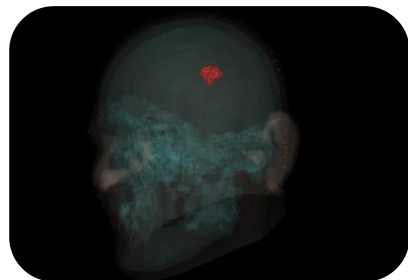
ANONYMIZATION



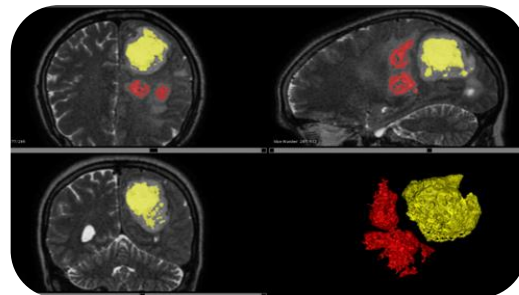
LOADING /DISPLAY



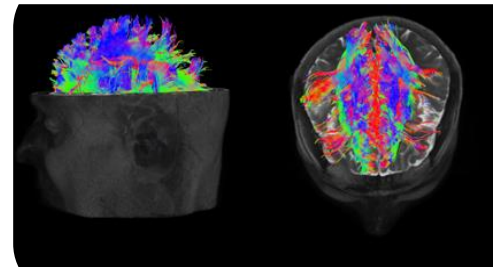
**MEDICAL
IMAGE
REGISTRATION**



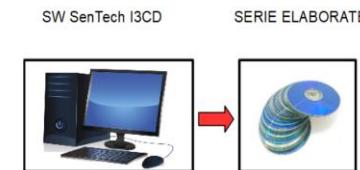
**3D SEGMENTATION
AND RENDERING**



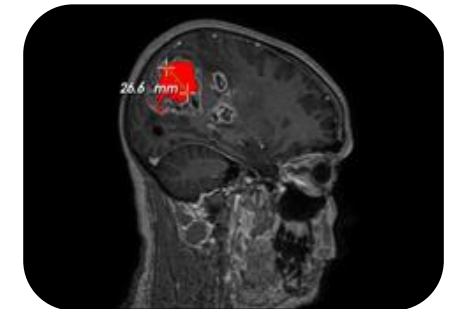
**DATA FUSION 2D-
3D**



**CALCULATION FA
AND TRACTOGRAPHY**



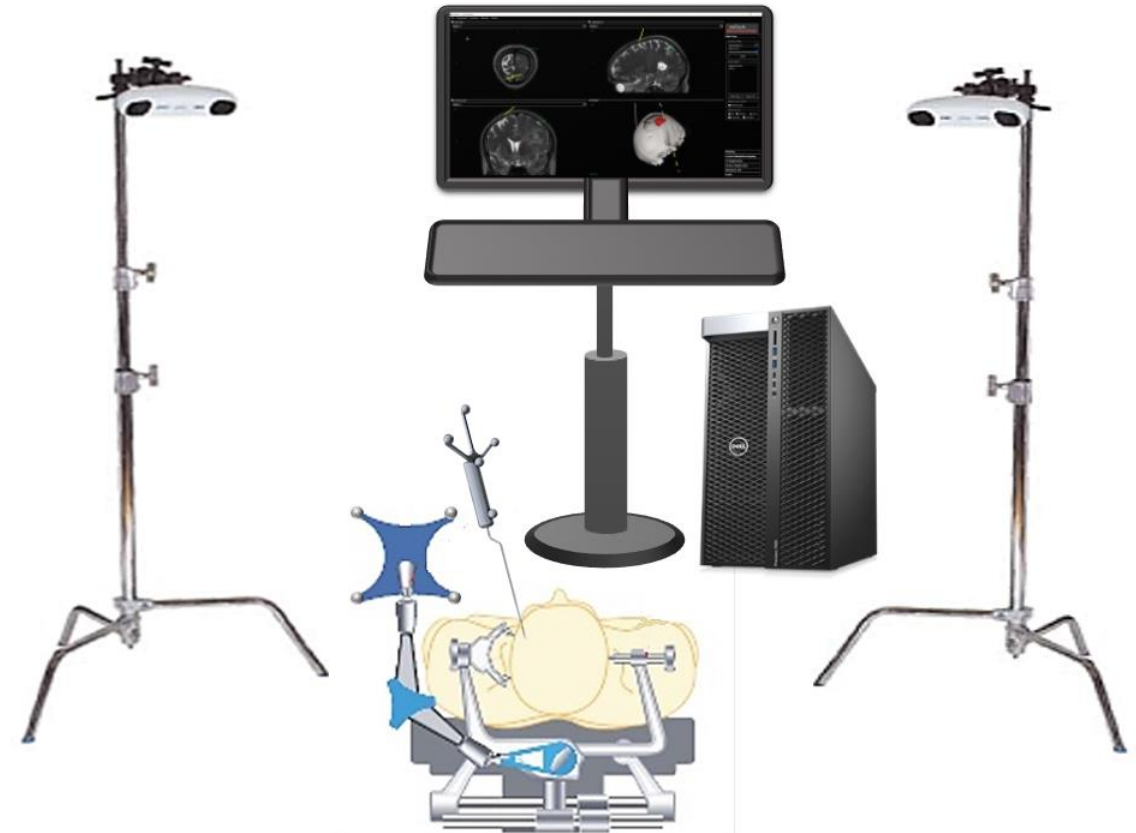
DATA SAVING



**MEASUREMENT
TOOLS**

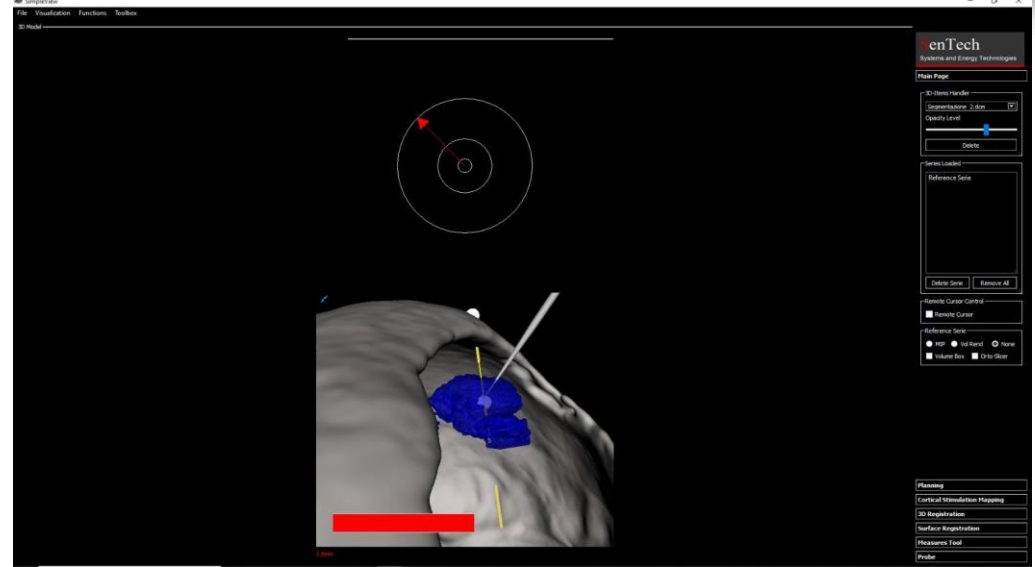
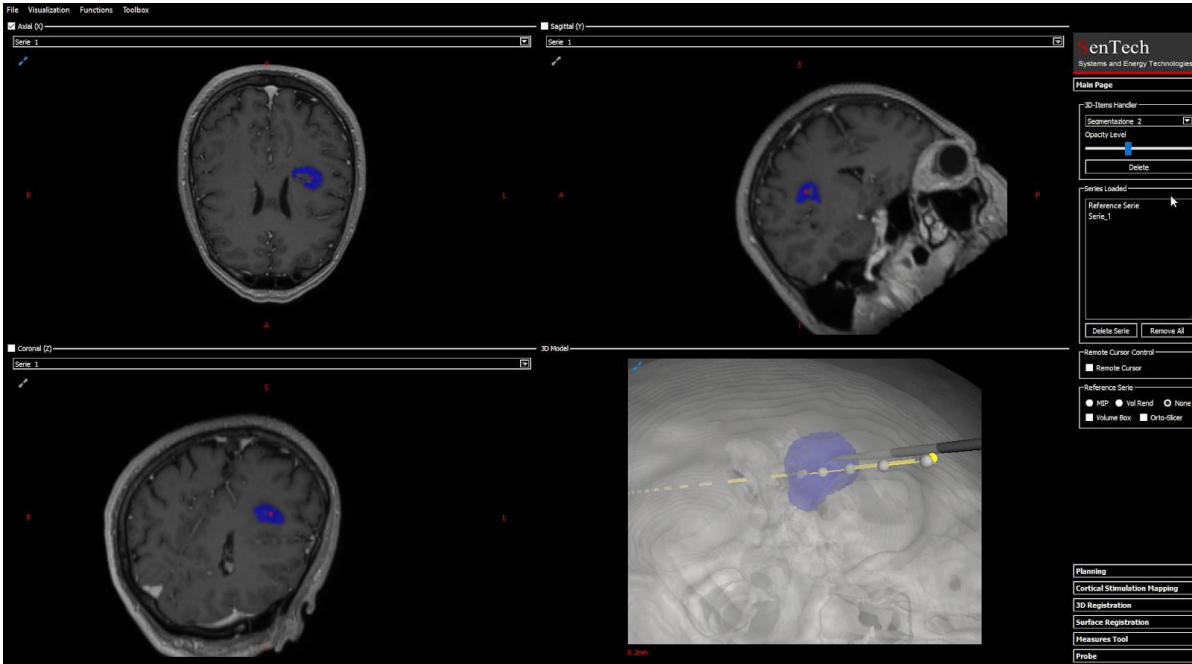
2: NEURONAVIGATOR

Three-dimensional reconstruction of neuro-anatomical images (CT or MRI)



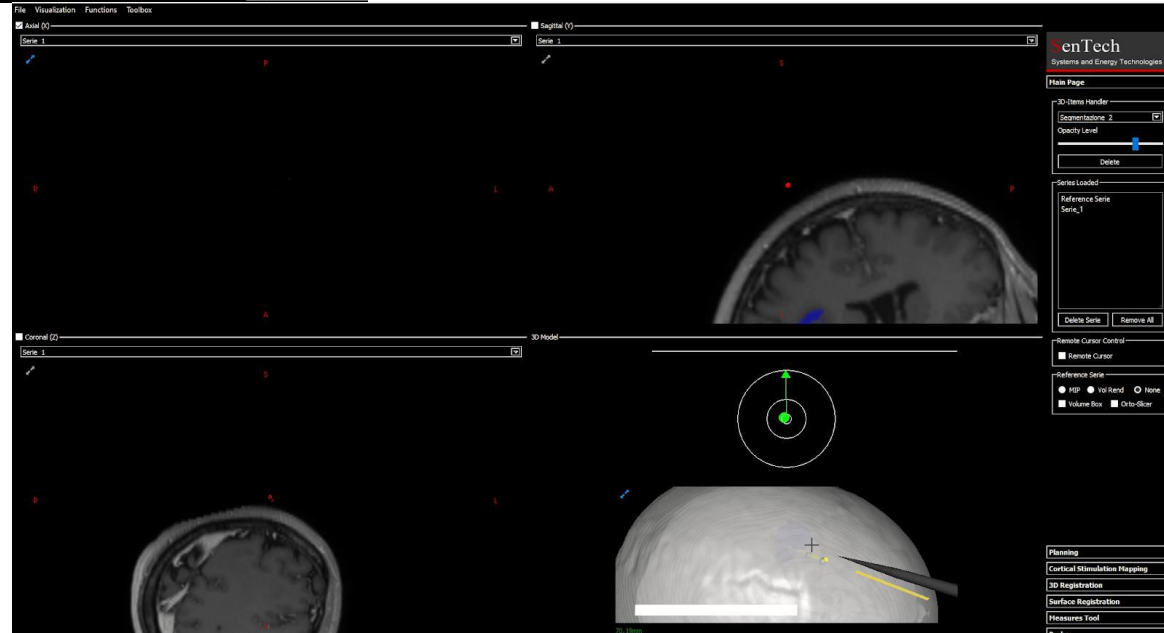
Real-time tracking of the position of the surgical instrument with respect to the anatomical structures of interest

3: POYNTING SYSTEM (SW)



the incorrect position of the pointer with respect to the established trajectory

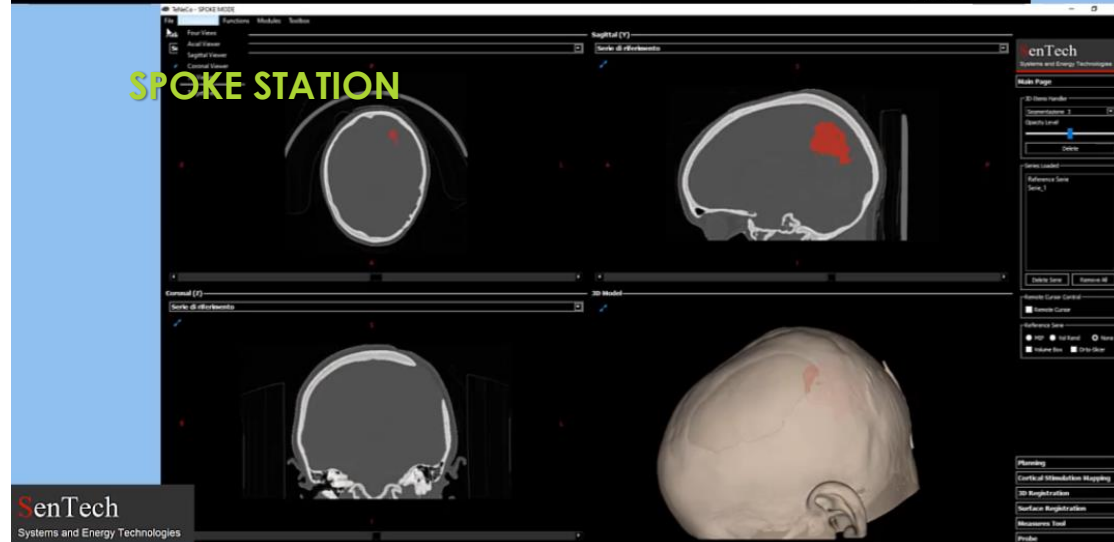
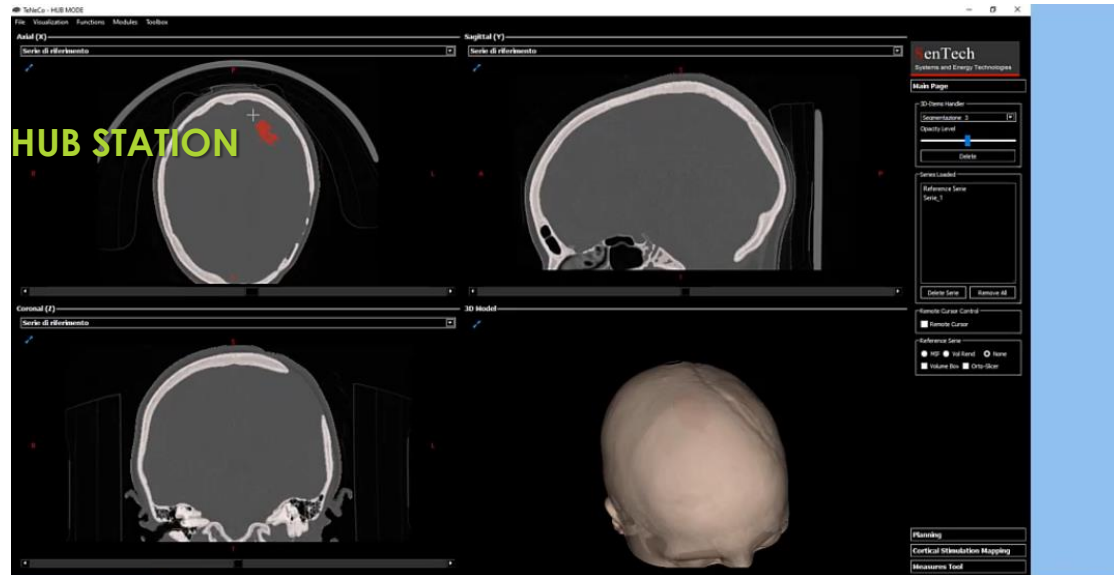
In sagittal, coronal and transversal scans, the red dot indicates the tip of the instrument that has reached the target



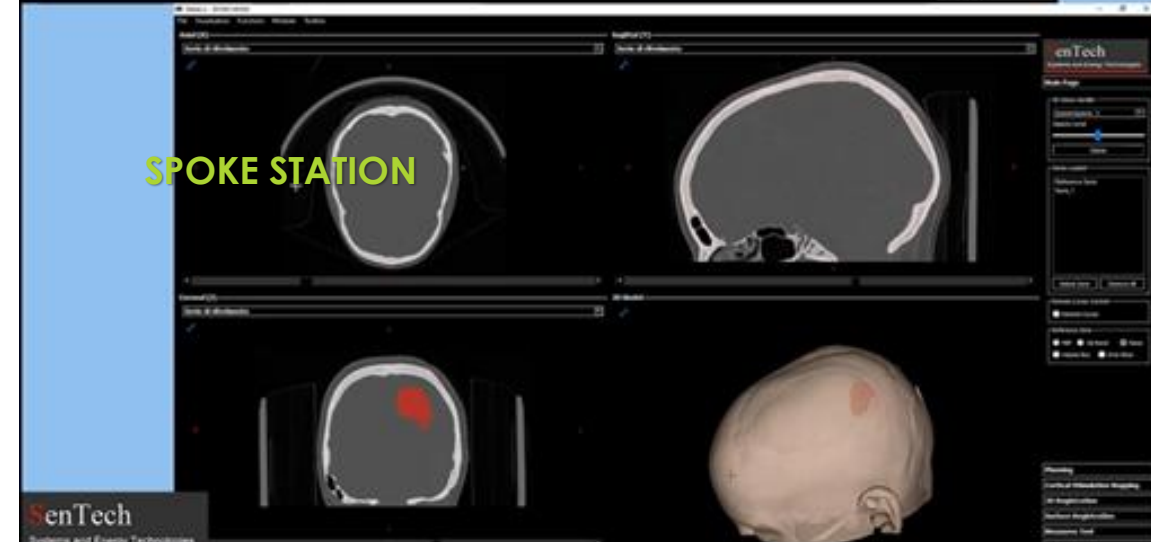
Correct positioning of the instrument and centering of the entry point as confirmed by the green crosshair.

TELERADIOLOGY

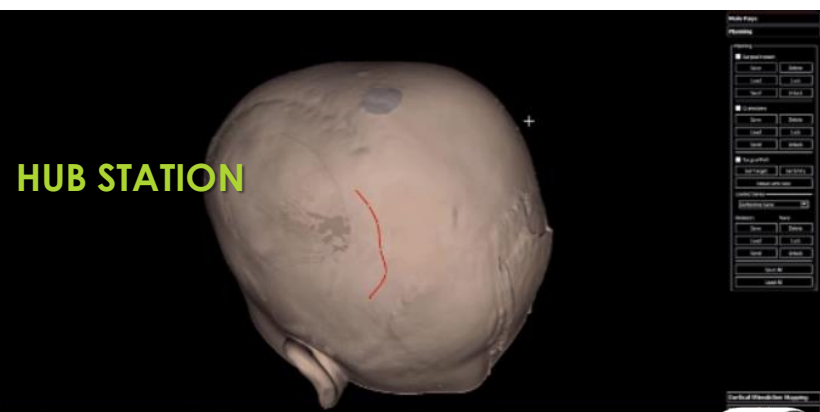
Before synchronization each station works standalone



After synchronization views and interactions are shared between stations

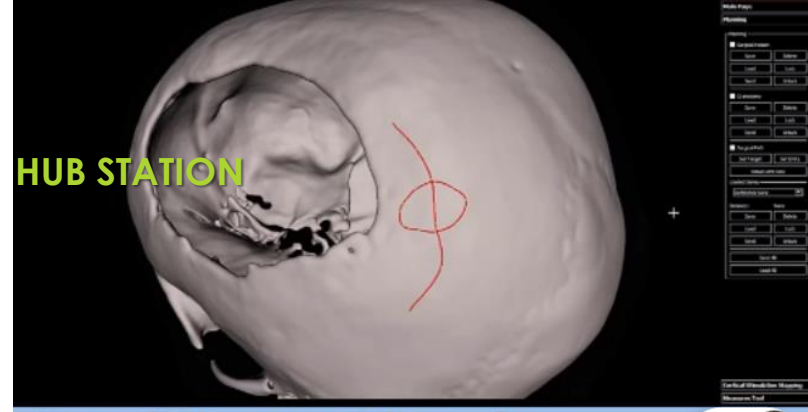


SURGICAL PLANNING IN TELECONSULTATION



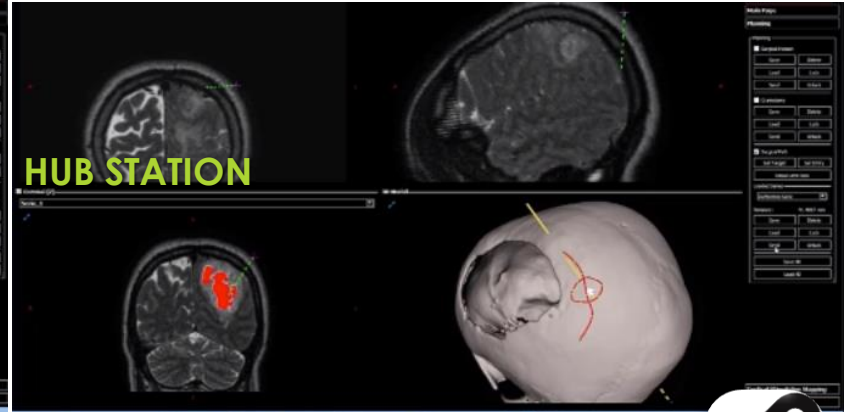
HUB STATION

Surgical Incision Planning



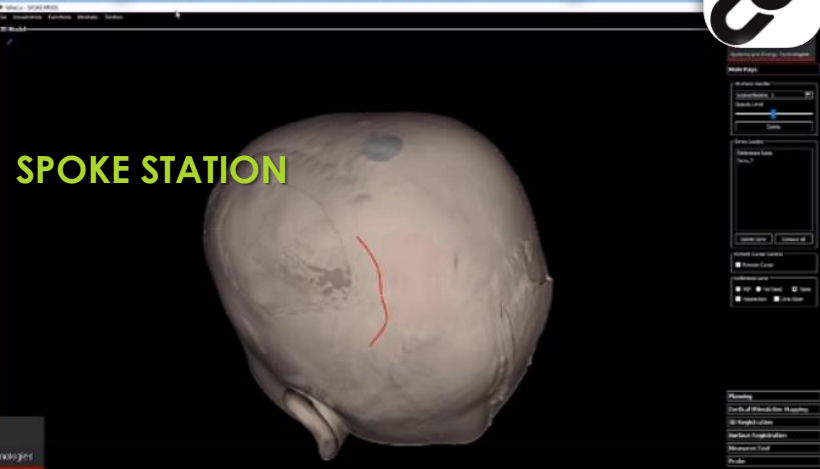
HUB STATION

Craniotomy Planning



HUB STATION

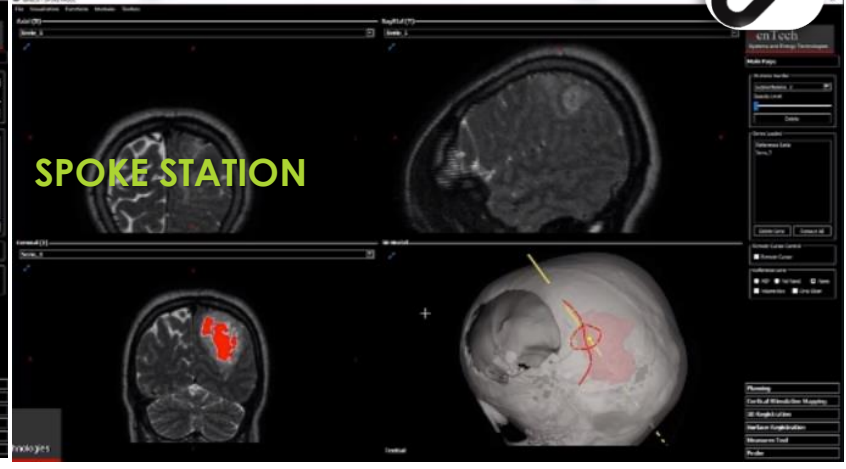
Surgical Path Planning



SPOKE STATION

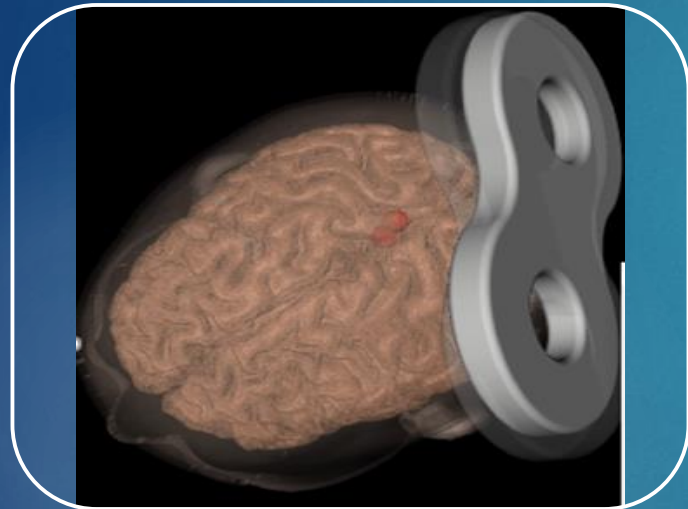


SPOKE STATION

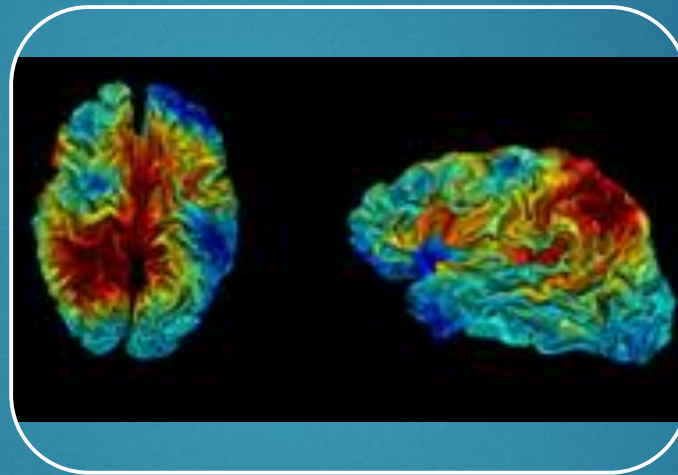


SPOKE STATION

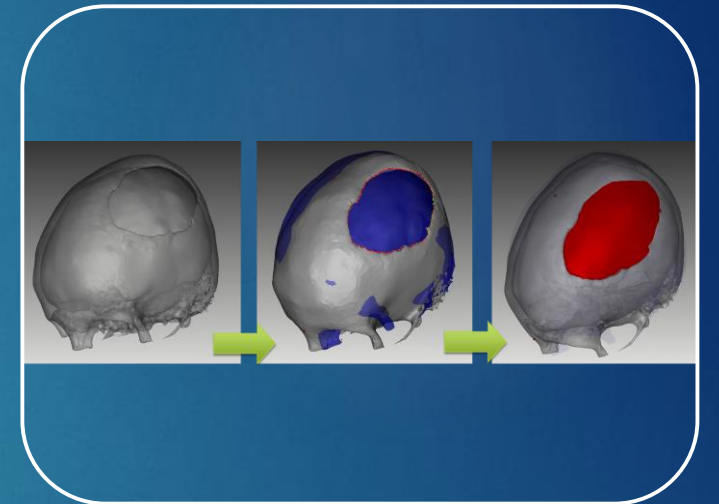
Additional functions integrated into TELEMED



Intracranial neuronavigation system to be used during TMS therapy, with cortical activation localization system based on EEG source reconstruction



System for localization of cortical EEG sources and real-time visualization of activation areas



Design software for Cranioplasty Implant, starting from the patient's diagnostic images in DICOM format, with tools for high specialized remote consultation for checking final 3D model;