

# Image-based gesture guidance for auditory neuroprosthetic implantation

PhD project supported by the LABEX CAMI, <http://cami-labex.fr/>

**Location:** LIRMM Lab. (University of Montpellier) / LATIM Lab. (University of Brest)

**Supervisors :**

Nabil Zemiti and Philippe Poignet, LIRMM (University of Montpellier, France)

Guillaume Dardenne, LATIM (University of Brest, France)

**Collaboration:** Frédéric Venail (PU-PH), ENT department of the Hospitals of Montpellier

Rémi Marianowski, (PU-PH) ENT department of the Hospitals of Brest

**Starting date:** Oct 2021.

**Duration:** 36 months

**Keywords:** US/CT registration, Image segmentation, Image-based guidance, auditory neuroprosthetic implant.

## 1. The CAMI context

Medical interventions (surgery, interventional radiology, radiotherapy) can benefit from a significant boost for progress in terms of patient-specific optimal planning and performance. To fulfil the patient's demands for quality, senior operators demand to see beyond the immediately visible, to be assisted in their real-time vital decisions and to provide access to enhanced dexterity, while junior operators need to "learn to fly" before being left alone, and public health authorities and companies require demonstrations of the medical benefit of innovations.

The Computer Assisted Medical Interventions LABEX (CAMI LABEX) strategic vision is that an integrated approach of medical interventions will result in breakthroughs in terms of quality of medical interventions, demonstrated in terms of medical benefits and degree of penetration of CAMI technology in routine clinical practice.

Among the different actions undertaken in the scope of the CAMI LABEX, 6 to 10 theses starting yearly are to be financed. Subjects dealing with themes within LABEXs scientific field and resulting from collaboration between different CAMI partners will be favored. The following thesis proposal falls within this framework.

## 2. Context and objectives

Cochlear implant is the first functional implantable neuroprosthetic device in human. It restores the auditory perception in people with severe to profound deafness. The implantation of such a device requires the insertion into the cochlea of an electrode array allowing electrical stimulation of auditory nerve end fibers. However, this insertion is a critical point of the surgery since the surgeon cannot visually control the trajectory of the electrode array and has to rely on its tactile feedback.

This is responsible in many cases of damages of the cochlear structures and of the loss of residual hearing, thus preventing the extension of cochlear implant to people with milder hearing loss.

The ultimate goal of this PhD project is to combine intra-operative ultrasound (US) imaging with pre-operative CT imaging to enhance the visualization of cochlear structures and help cochlear electrode arrays' insertion. To this aim, a new US-probe dedicated to cochlear navigation has been developed.

The scientific objectives of this position are to develop 3D-US image reconstruction tools and to propose new algorithms for US/CT image co-registration and electrode segmentation and tracking dedicated to the developed probe for cochlear imaging.

### 3. PhD planned program

As part of the LABEX CAMI, the primary goal of this work is to translate research from the lab-bench to the clinic and involves two research laboratories: the LIRMM (University of Montpellier, CNRS, France) and the LATIM (University of Brest, Inserm, IMT Atlantique, France) labs, as well as the ENT departments of the Hospitals of Montpellier and Brest.

The recruited candidate will be expected to:

- develop a new algorithm for US/CT image co-registration for cochlear imaging,
- design software for structure and electrode segmentation,
- create software designed for the surgical navigation and real-time rendering of co-registered US-CT imaging,
- validate the developments on ex-vivo experimental platforms and cadavers.
- work within the operating room environment.

The PhD student will be administratively registered at the University of Montpellier (UM). Several meetings between LIRMM and LATIM will take place during the first months in order to better define and adjust the proposed objectives as well as create a detailed work program (including bibliography study, specifications and requirements, etc.). A close clinical collaboration between the candidate and surgeons in both Montpellier and Brest will be held.

### 4. Qualifications:

The position is for 36 months. The candidate must have received an engineering/master degree in medical image processing or related disciplines.

A previous experience in image-guided surgery instrumentation and processing/visualization of data could be also highly appreciated.

The skill sets for this project require experience with programming languages and environments. LINUX/UNIX, C++ and/or Python, Insight Toolkit (ITK) and Visualization ToolKit (VTK) are essential. Good writing and communication skills are also required.

**Expected starting date:** October 2021

**Close Date:** Until filled

#### **Laboratories / Teams:**

- LIRMM Lab., Robotics department, Dexter team, medical robotics group
- LATIM Lab, Imagine team, Computer Assisted Surgery group.

#### **Application:**

Please send your CV, a cover letter, and 2 references to the below email addresses.  
Philippe.Poignet@lirmm.fr, Nabil.Zemiti@lirmm.fr and guillaume.dardenne@univ-brest.fr