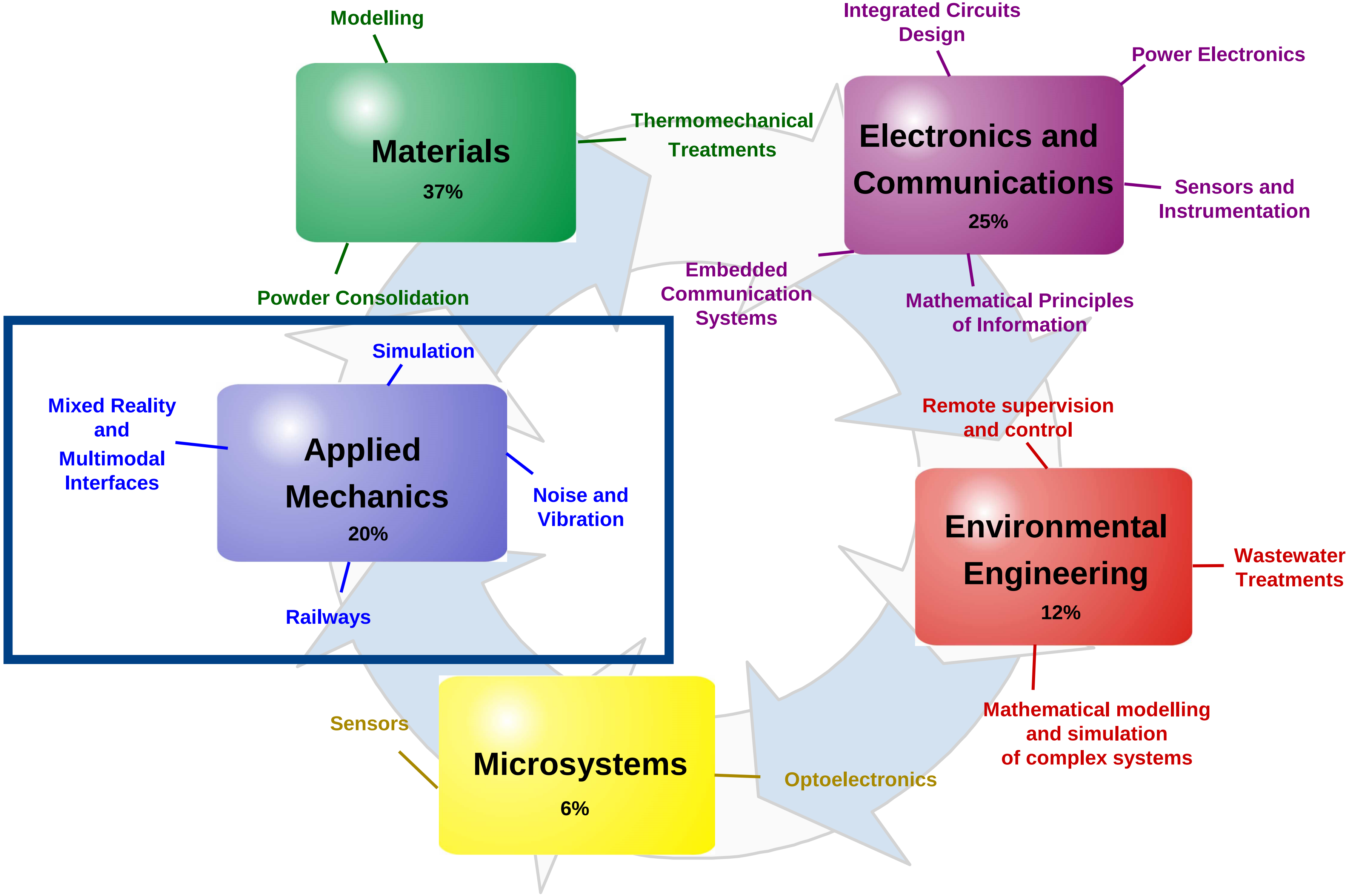
Álvaro Bertelsen

Javier Melo

CEIT's Profile

- **Founded in 1982 by the School of Engineering of the University of Navarra**
- **CEIT's mission is to serve society and industry by**
  - Developing research projects
  - Training young researchers
- **Independent private non-profit institution. Profit is re-invested in research**
- **Total Income in 2008: 14.2M €**
  - 50% from Industry
  - 20% From non-competitive public funding
  - 30% From competitive public funding

CEIT's Research Areas



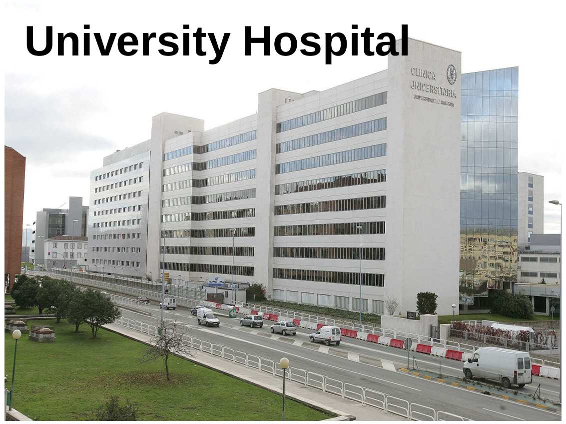
The Applied Mechanics Department has an extensive research experience. Its lines of work are the following

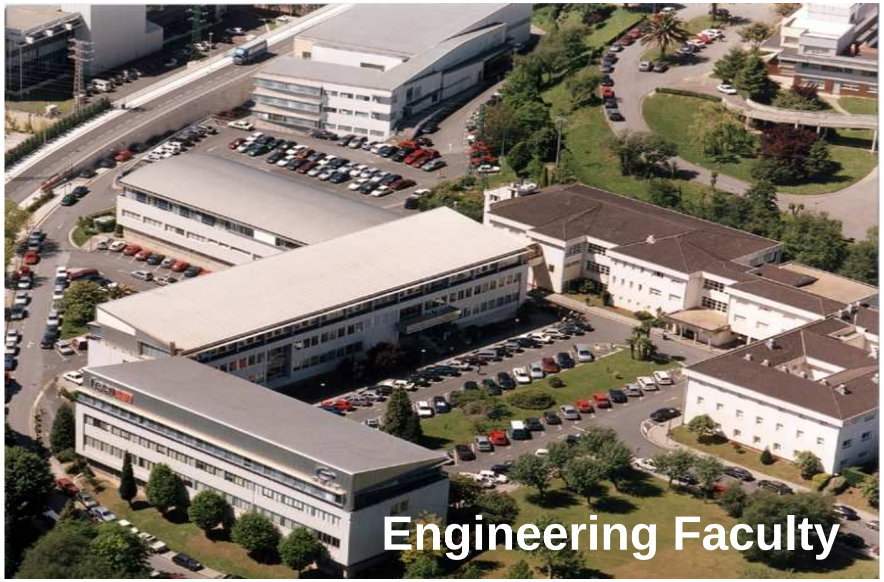
- **Biomechanics**
- **Training Simulators**
- **Railways**
- **Noise and vibration**
- **Haptics and Multimodal Interfaces**
- **Biorobotics & Surgical Simulation**

- **Design of new surgical simulators**
  - Surgery planning and evaluation
    - Virtual reality + simulation
  - Surgery trainer
    - Virtual reality + simulation + haptics

- **Design of new surgery assistance tools**
  - Instrumentation for surgical procedures
  - Cobots (COllaborative roBOTS)
  - Teleoperated systems

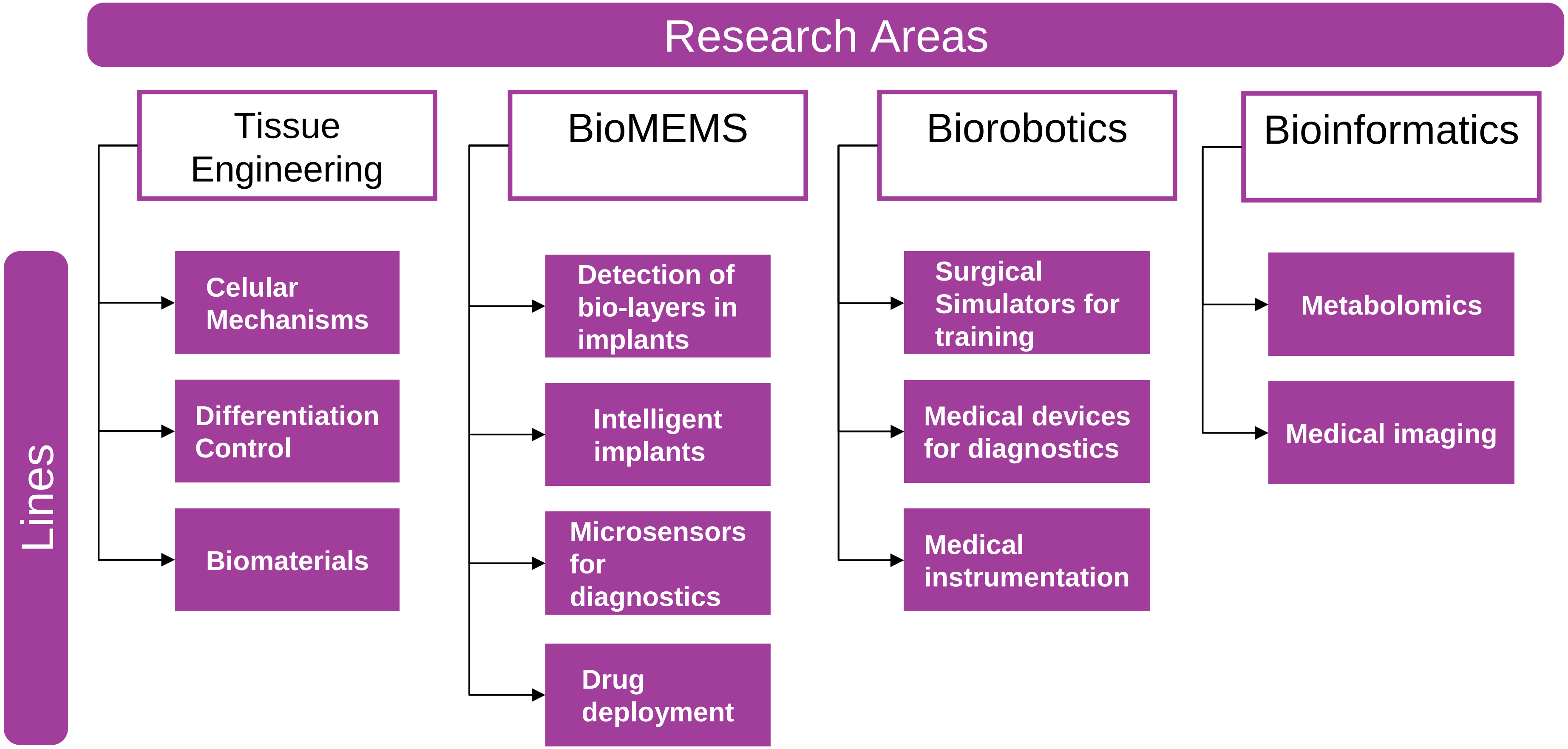
New Centre for Bioengineering (CBIO)



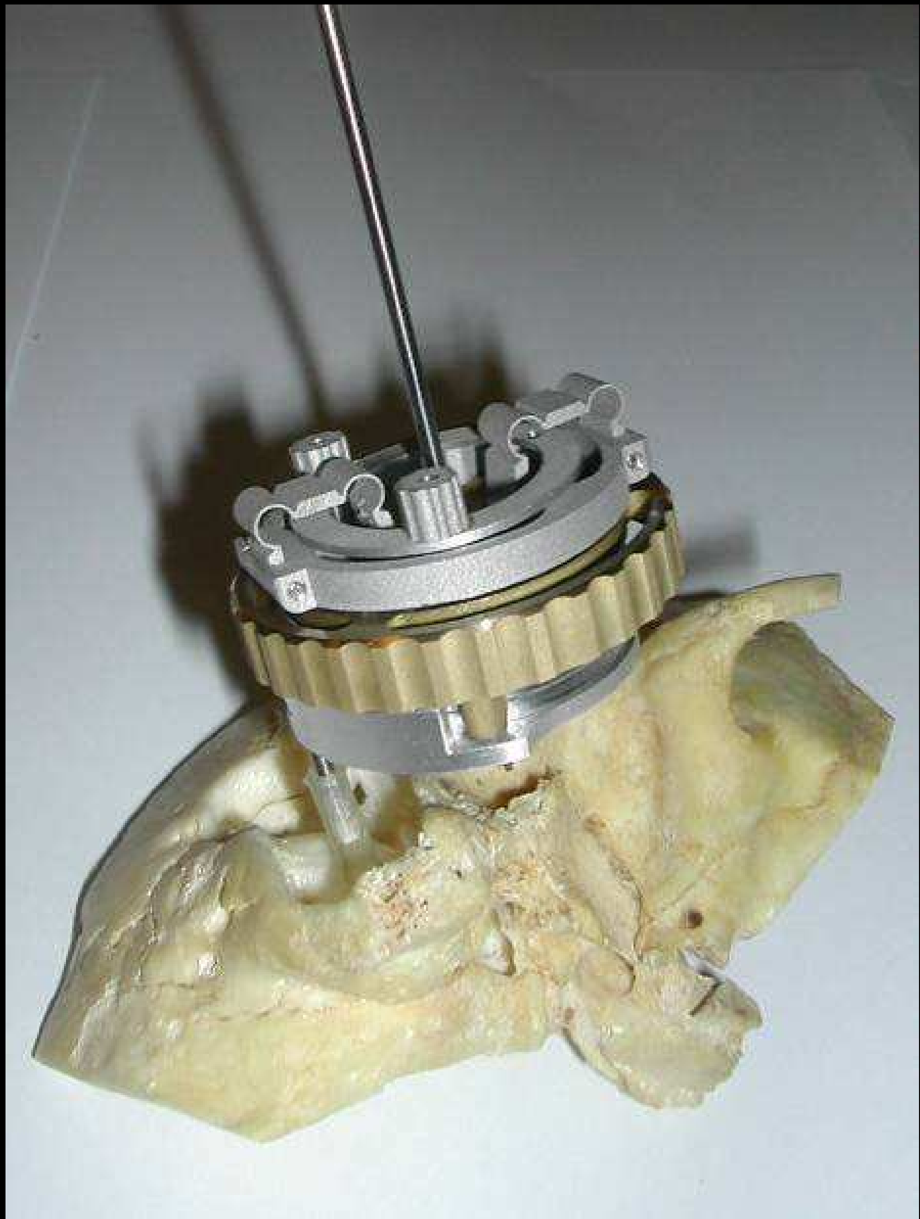


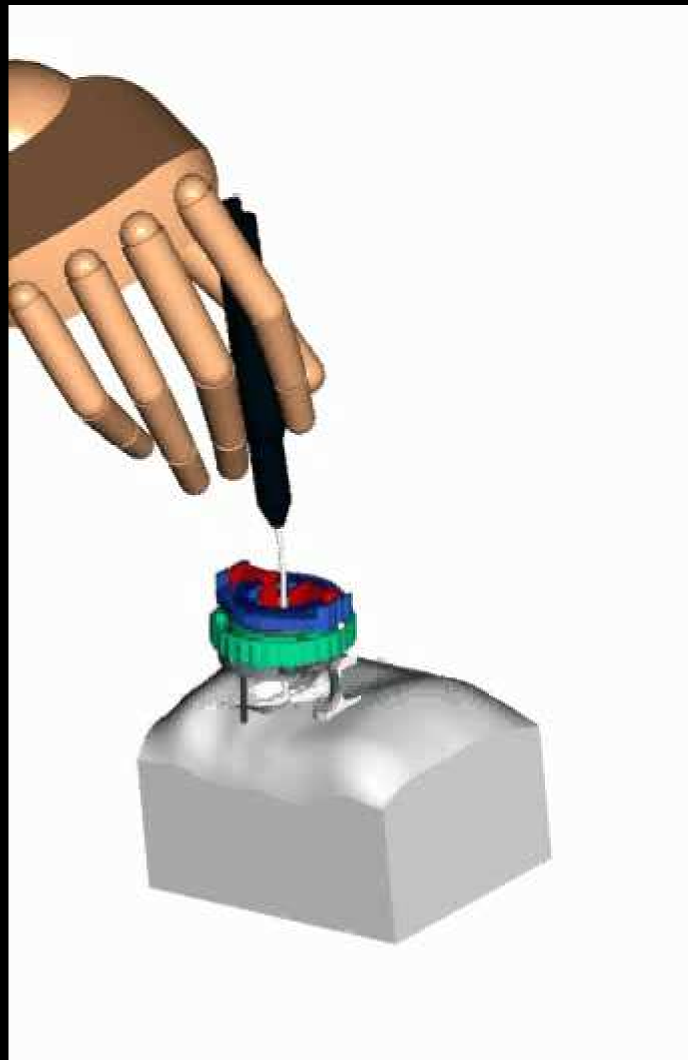
CENTRO DE BIOINGENIERÍA
UNIVERSIDAD DE NAVARRA

CBIO’s will have four main research areas, each one having its own different lines

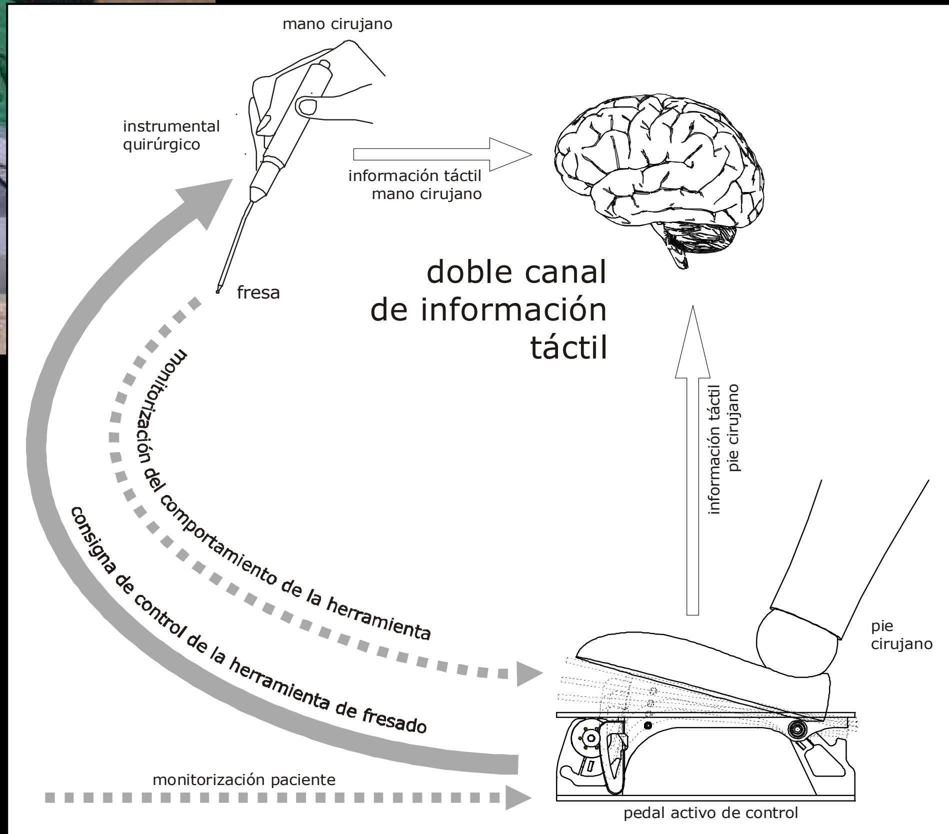


Tool holder for cochlear interventions



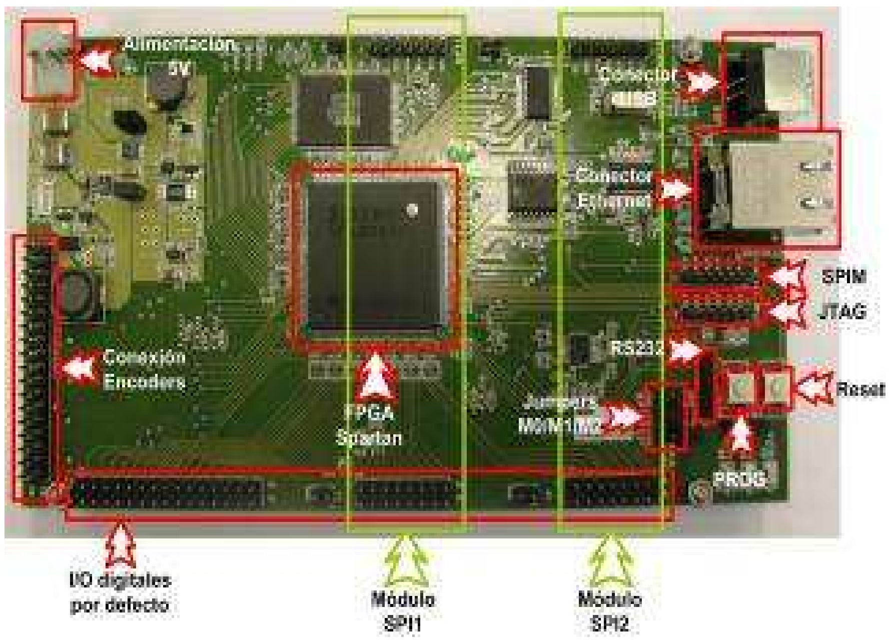


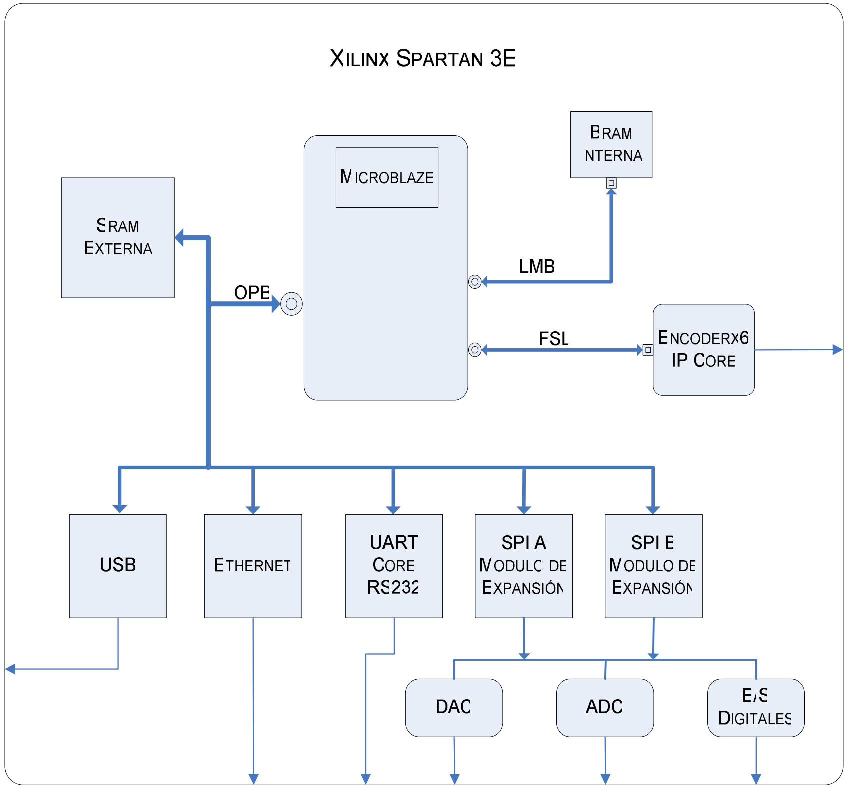
The haptic pedal



Haptics Control Board

The EOS Control board is a electronic device based on FPGA technology, designed to control haptic interfaces.





Haptics Control Board

6 Inputs Diferential Encoders.

8 Digital I/O by Default.

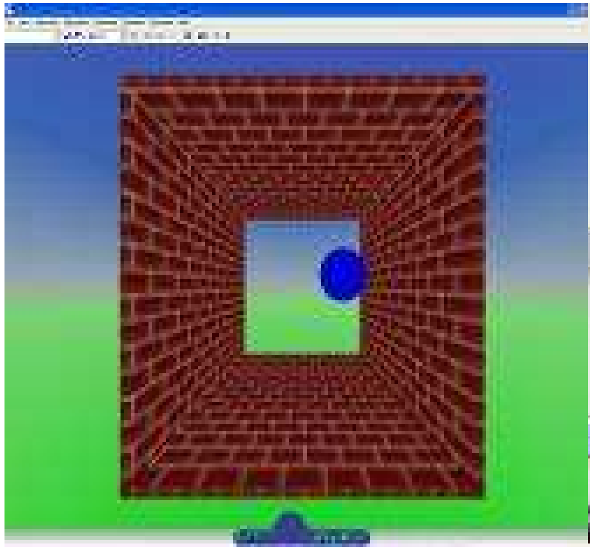
Module 6 DAC ±10V output.

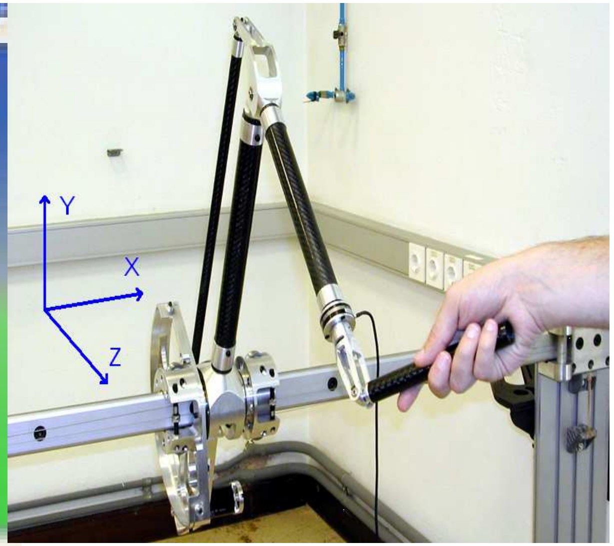
Module 8 ADC ±10V input.

Ethernet

USB.

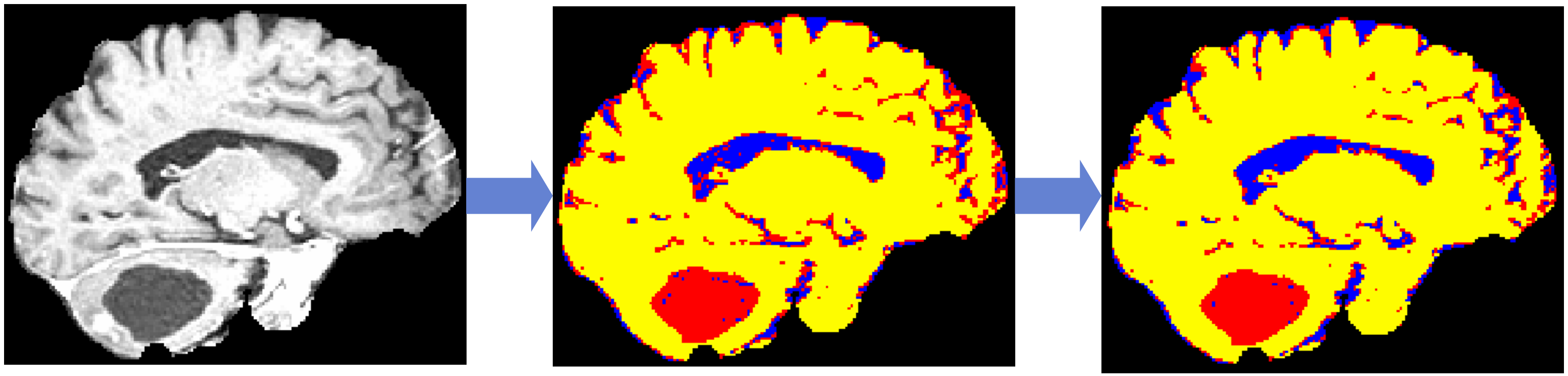
RS232.





Research Plans in Simulation

- **First stage: Automatic Segmentation Tools**
  - Tissue classification: fluid, cerebral matter and tumor
  - Based on previous works by Kaus [1], Bach-Cuadra [2] and Clatz [3]
  - Will be followed by simulations of tumor growth and atlas warping



[1] Kaus O. et al. Radiology 2001. 218(2). 586-591

[2] Bach-Cuadra M. et al. IEEE Trans Med Imag. 2004. 23(10). 1301-1314

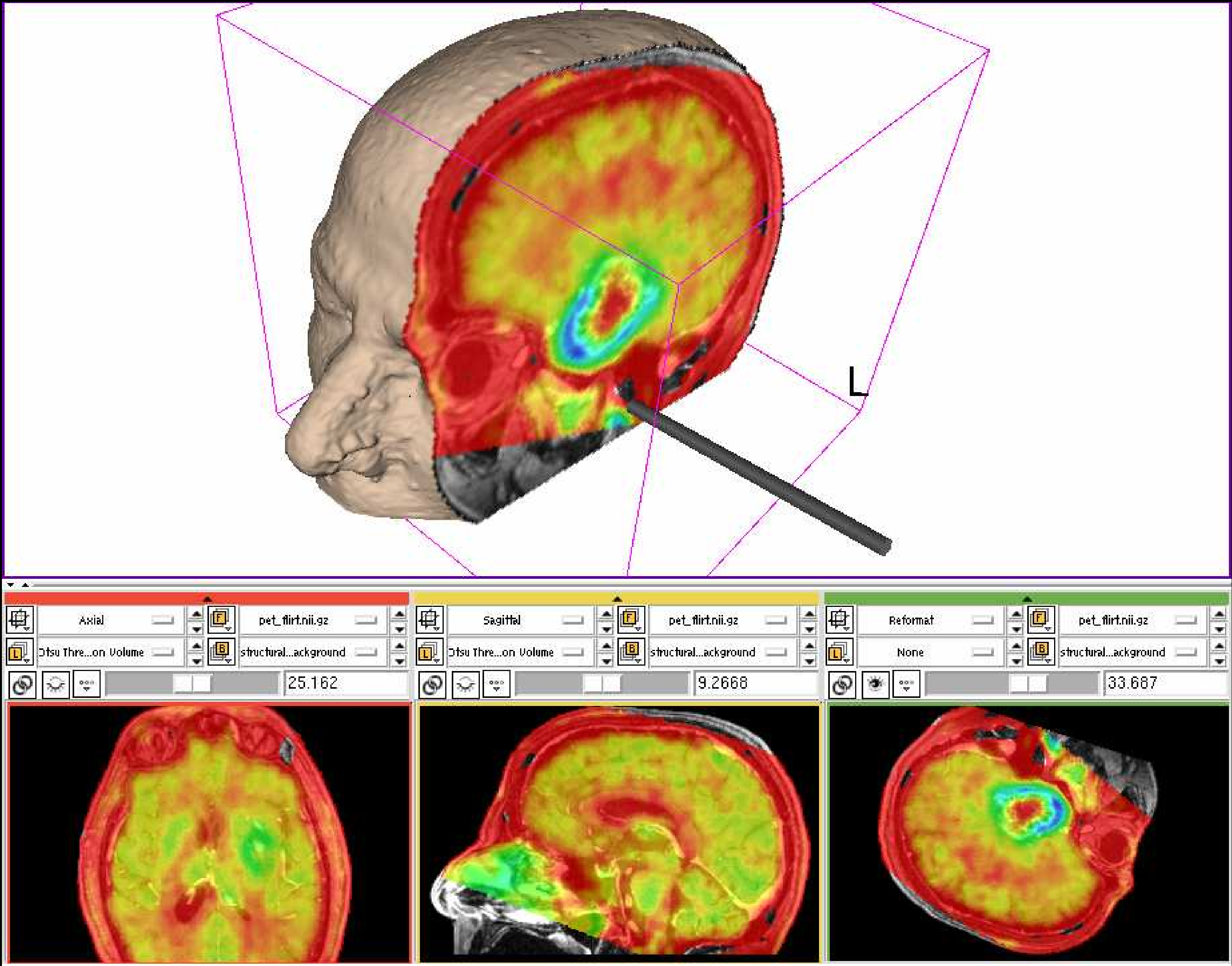
[3] Clatz et al. INRIA Research Report. 2004. 5187

Research Plans

- **Second stage: Image Fusion**
  - Warped atlas, CT, PET, DTI and/or fMRI

- **Thrid stage: Path Planning**
  - Design of minimum risk paths for the interventions
  - Usable by simulators and robots

Surgeon's planning tools using 3DSlicer



MRE Technique

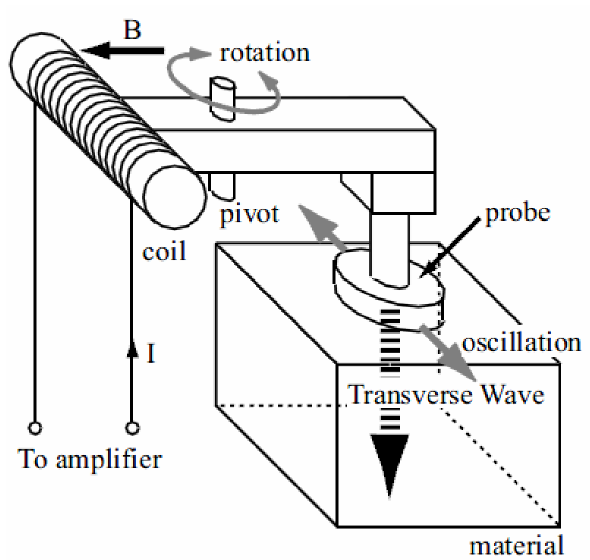
Magnetic resonance elastography (MRE) is a method for quantitatively imaging the mechanical properties of tissue, using modified phasecontrast MRI to visualize applied shear waves [1].

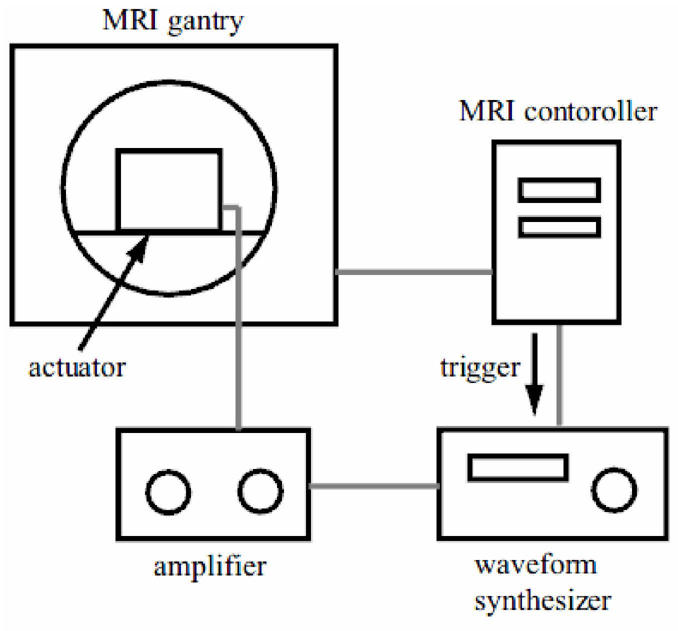
Many diseases cause significant changes in the underlying mechanical structure of tissue, providing high contrast for the elasticity images generated by MRE and related elastographic methods.

[1] R. Muthupillai.

MRE Technique

Using an external force oscillator which synchronizes to the MRE pulse sequence, we can acquire MRE images.

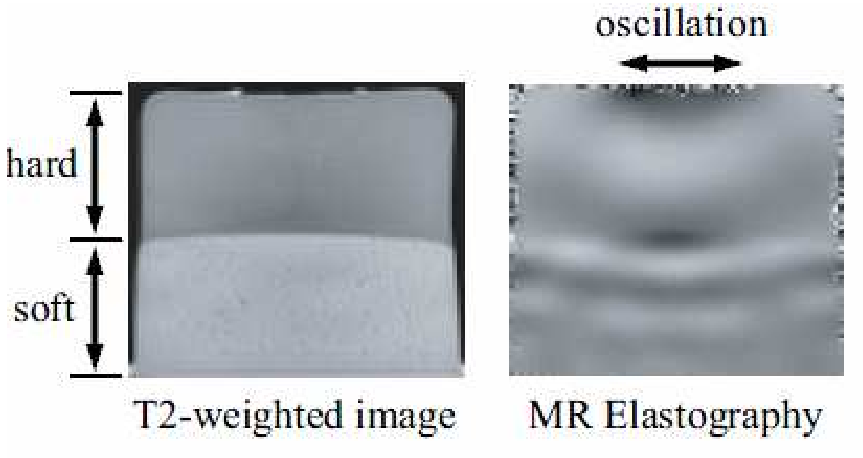




MRE Technique

This actuator makes transverse waves, and we can calculate shear moduli from the acquired image representing the propagating transverse wave.

Young's moduli can be acquired with application of propagating longitudinal wave, if the oscillator produces several oscillations perpendicular to the top surface of a material.



Brain MRE

Actuators must be compatible with MRI.

Acustic windows of the skull make possible to transmit the waves to the brain.

Short amplitude and low frecuency (125 Hz)