Demo on the use of the Grid to Boost Medical Imaging Processing

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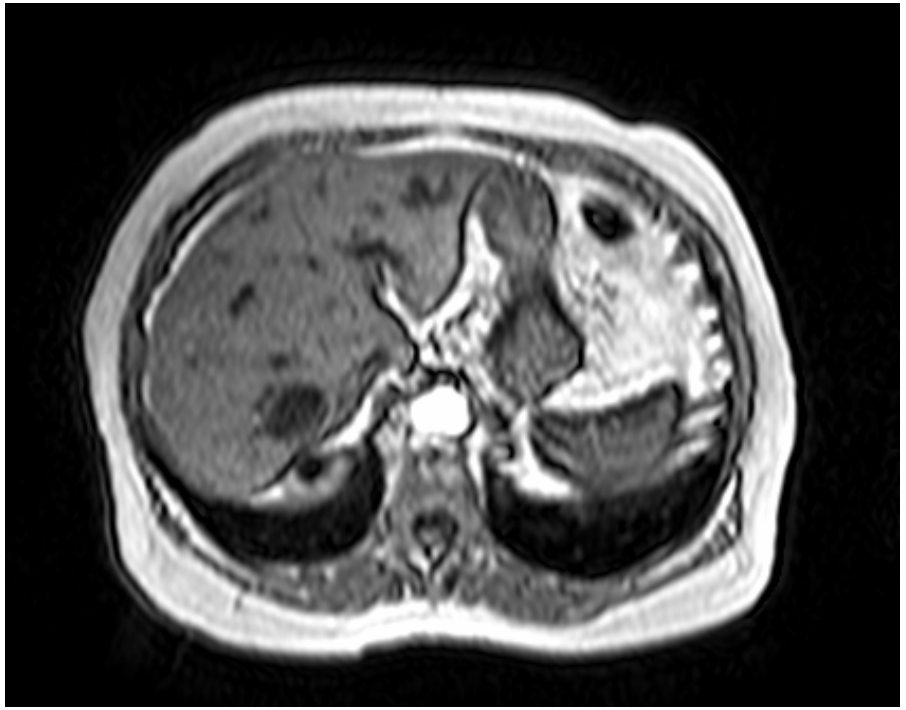
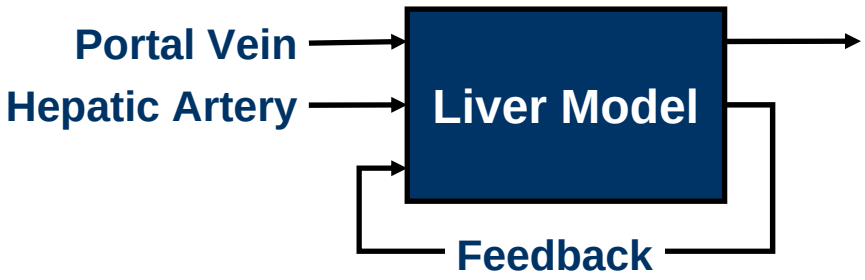
Analysing the Nature of Tumours

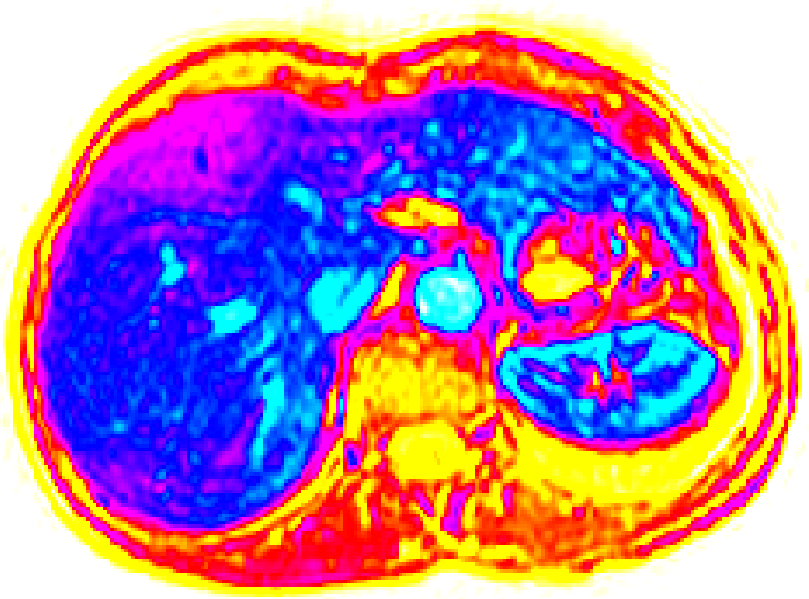
- A Lesion is Detected in an MRI Study of a Patient.
- Malignant and Benign Lesions have Similar Appearance in Medical Images and It is Difficult to Conclude with a Diagnosis with High Degree of Sensitively and Accuracy.
- The Final Analysis is the Biopsy.
- But Biopsy is Traumatic.
- This Delay in the Diagnosis Causes Patient Anxiety in Cases with Reasonable Uncertainity.



Alternative: Virtual Biopsy

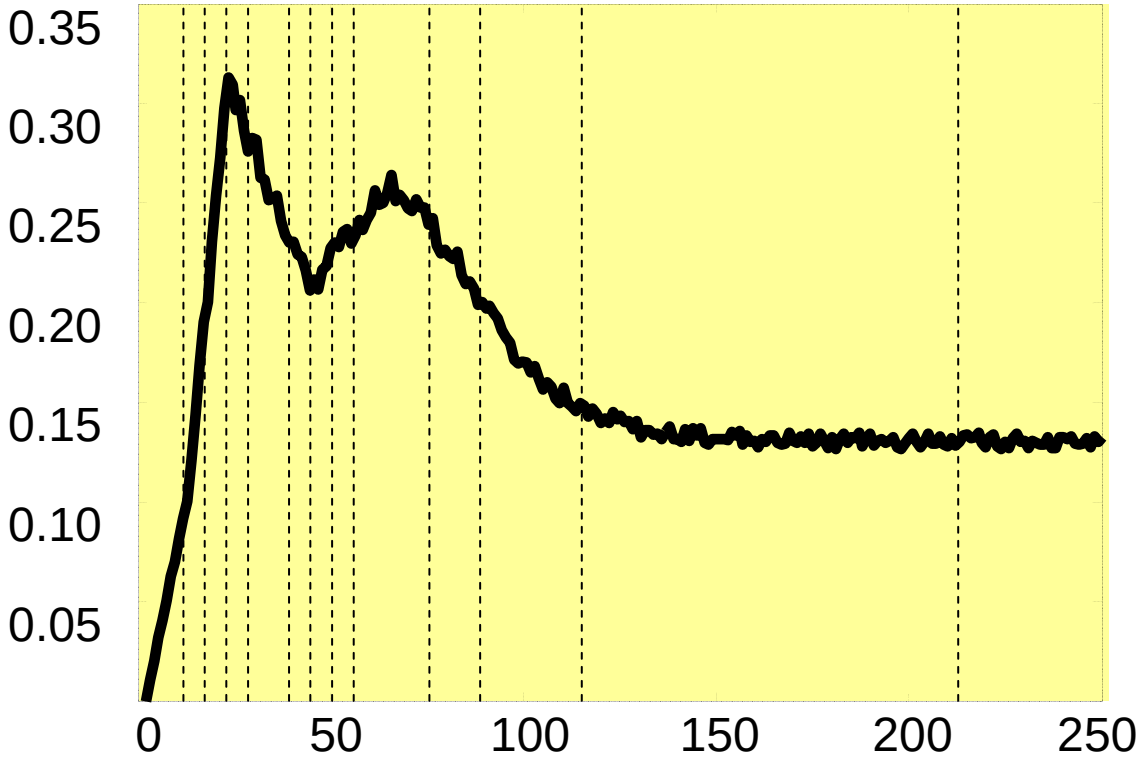
- Characterization of the Tissular Nature by the Analysis of the Evolution of Contrast in a Time Series.
- Tumours Generate the Growing of Vessels Around the Tumoural Mass.
- Different Tissues Define Different Constants for Recycling and Flow Rate of the Physical Models.
- Those Constants can be used for the Creation of Parametric Images.





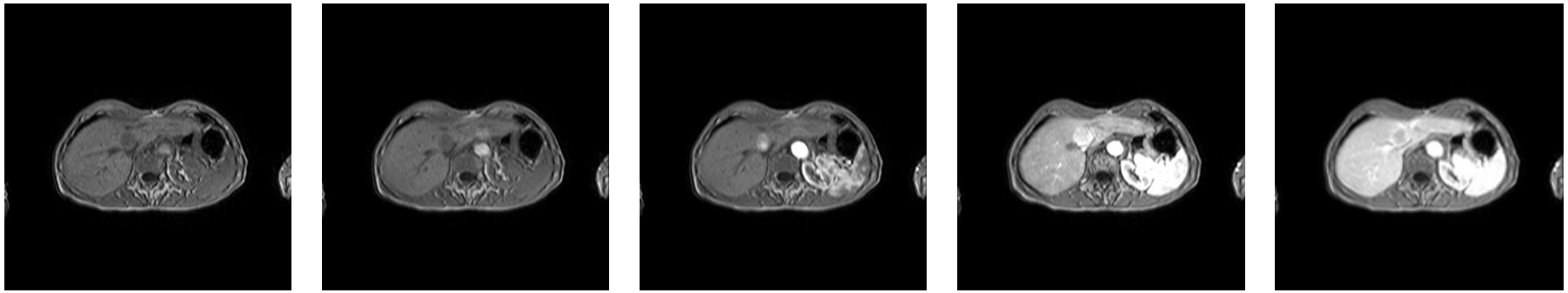
Pharmacokinetics: Problem

- **Description**
  - The Process Requires Obtaining a Sequence of MRI Volumetric Images.
  - Different Images are Obtained in Different Breath-holds.
  - The Movement of the Abdomen is Unavoidable and Relevant when Voxels have Sub-millimetrical Dimensions.
  - Before Analyzing the Variation of each voxel, Images Must be Co-registered to Minimize Deformation due to Different Breath Holds.



Pharmacokinetics: Problem II

- **The Area of the Abdomen Requires the use of Deformable Registration Methods.**
- **Much More Computationally Intensive than Rigid Affine Registration.**
- **Moreover, Registration Must be Very Accurate to Reduce the Artefacts on the Interpolation, Leading to Test Different Parameters.**

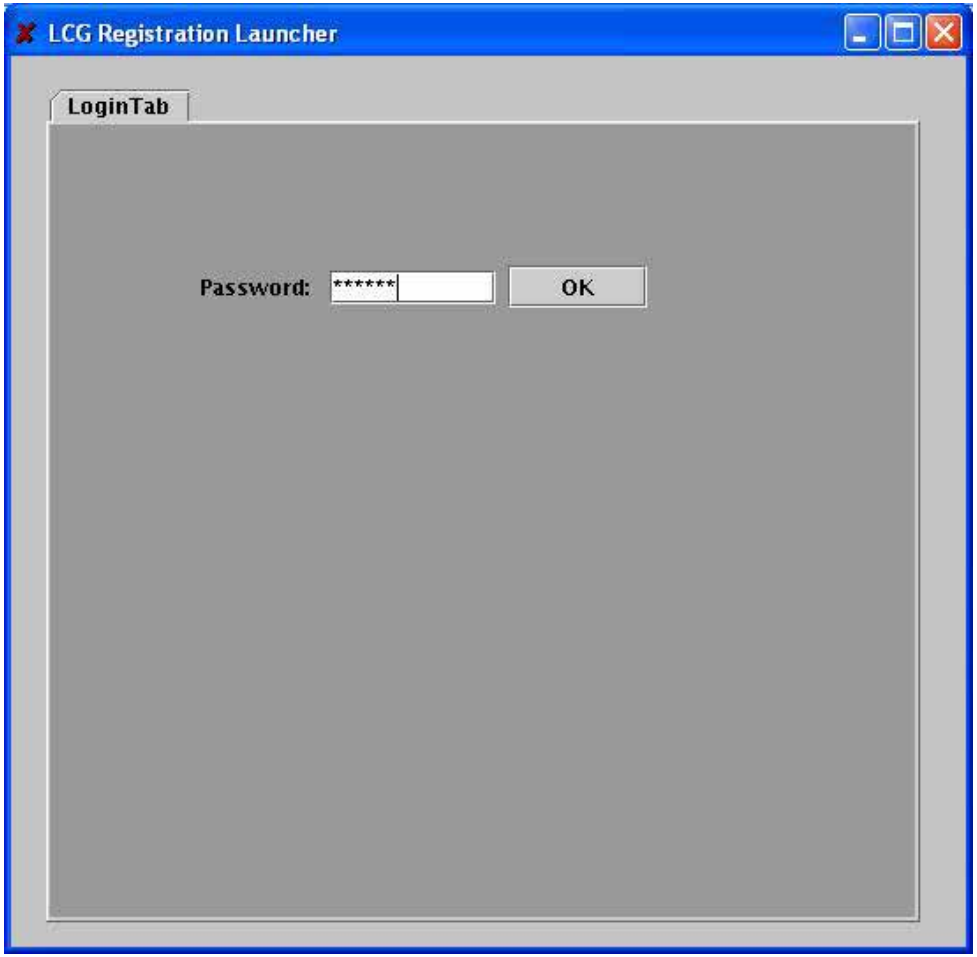


Pharmacokinetics: Process

- **Step 1: Entering in the System.**
- **Step 2: Uploading Data.**
- **Step 3: Creating the Jobs.**
- **Step 4: Submitting and Monitoring Jobs.**
- **Step 5: Retrieving the Output.**

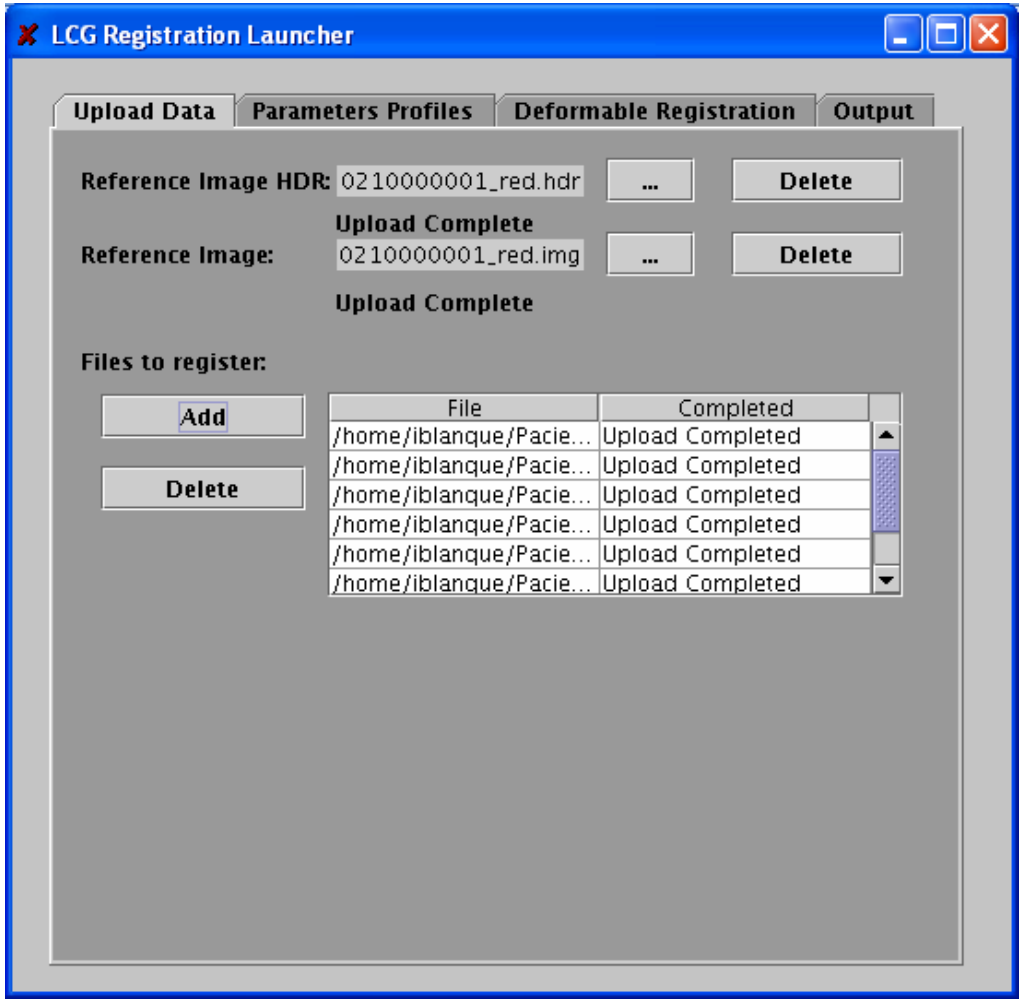
Step 1: Entering in the System

- **Password for accessing a pre-loaded**



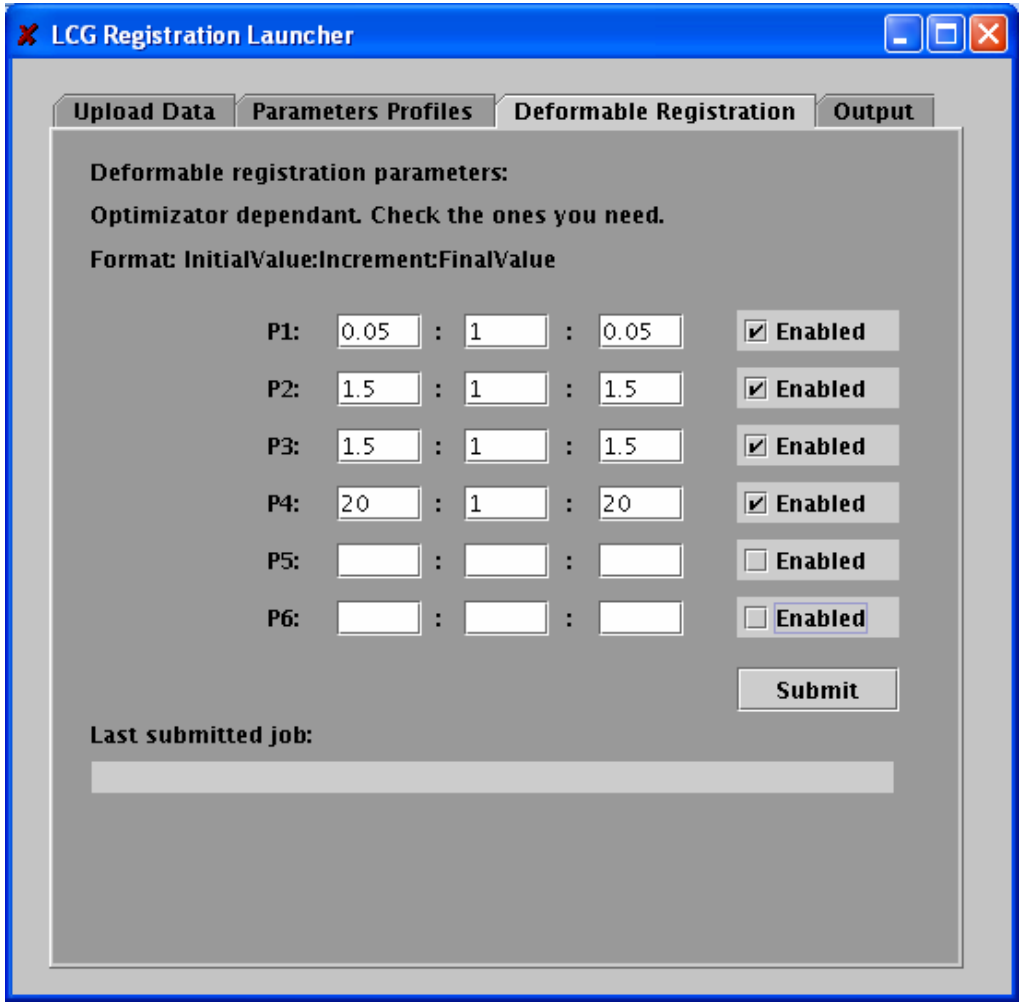
Step 2: Uploading Data

- **Uploading Reference and Deformable Medical Studies in Analyze Format.**
- **Register the Files on the Grid and Stores the LFN for the Scripts Creating the Jobs.**



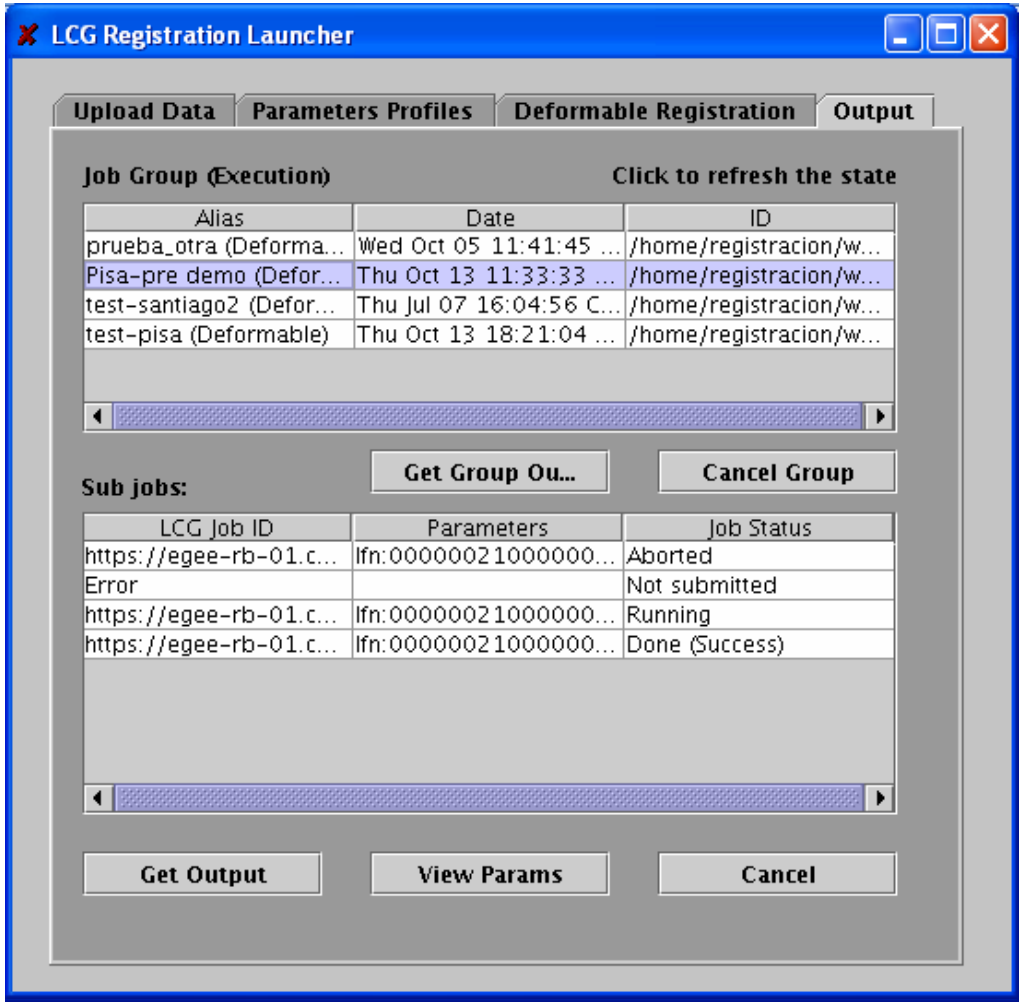
Step 3: Creating the Jobs

- **Both the JDL Files and the Necessary Scripts to Copy Locally the Input Data and Start the Co-registration.**
- **Create All the Instances Necessary for the Combination of Parameters.**
- **The Executable File is Easily Upgradeable to Test Different Methods.**



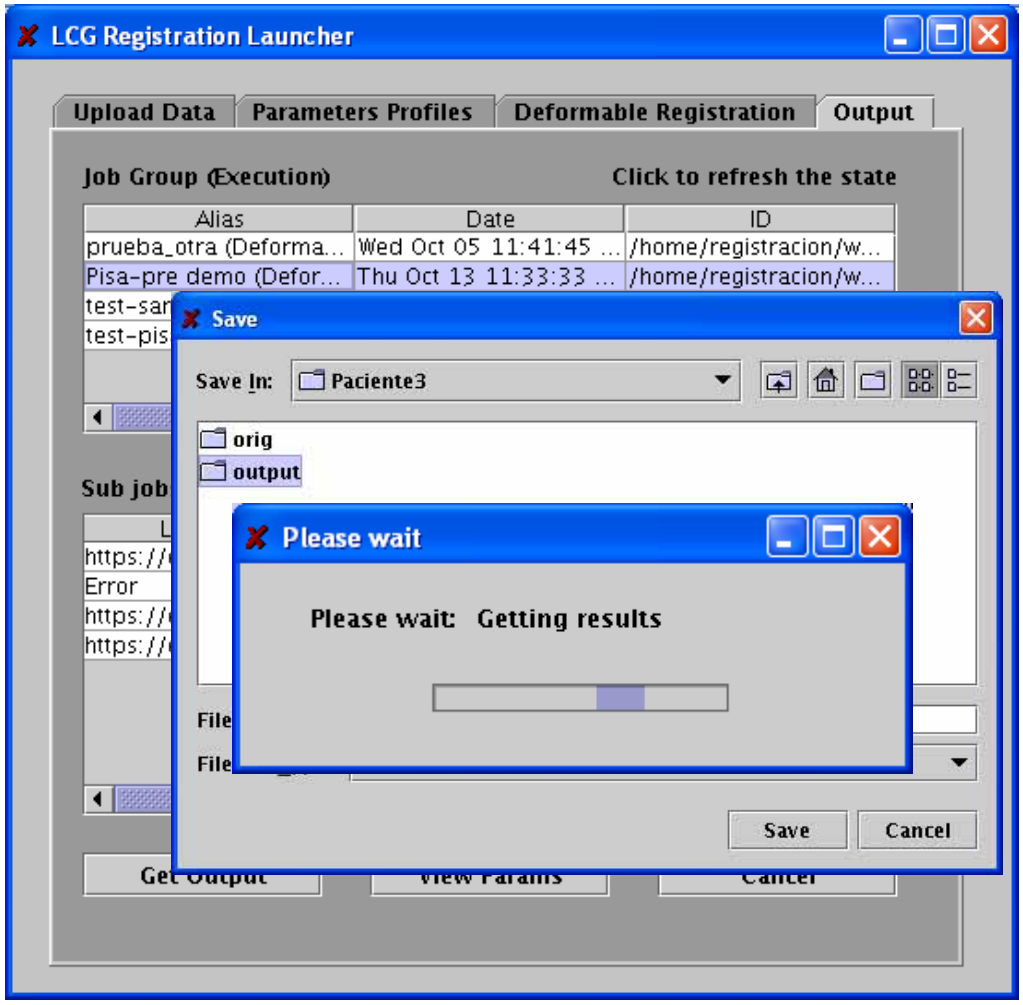
Step 4: Submitting and Monitoring Jobs

- **Submit all the JDLs Instances Through the RB and Monitoring the Jobs.**
- **Use a High-Level Name Identifier for the Jobs of a Group.**



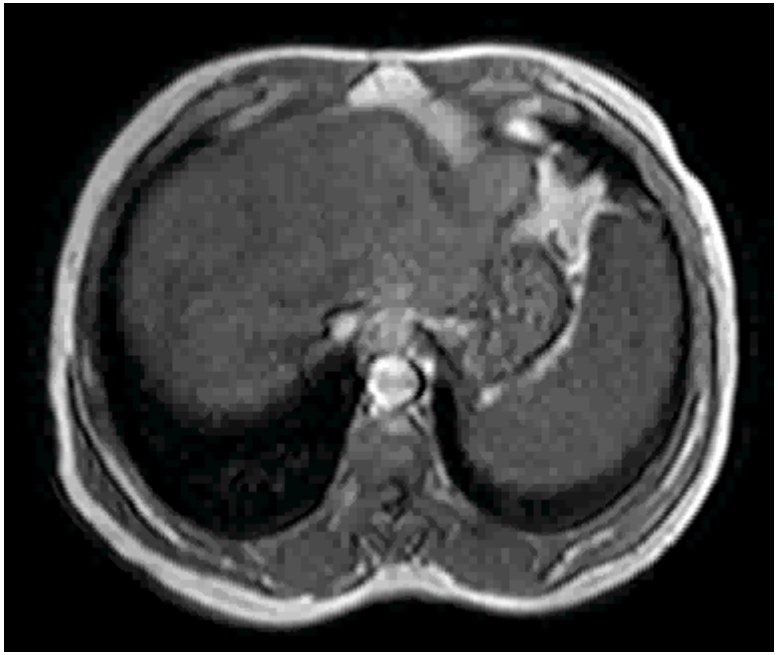
Step 5: Retrieving the Output

- **Retrieve the Output Files from a Group of Jobs.**

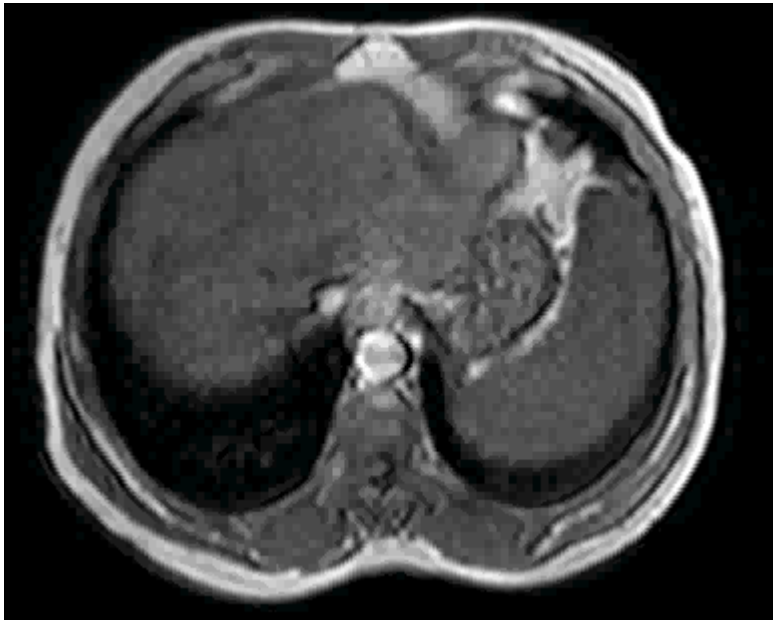


Checking the Results

Before Co-registration



After Co-registration



Conclusions

- **Execution Comparison (1 patient)**
  - 12 Co-registrations for Each Patient in Production
  - More in Testing (Argument Tuning).
  - Time Consumed:
    - Sequentially not in the Grid:15h 17m.
    - In the GRID: 4h 23m. (Duration of the Longest Job).
- **Easy to Use Interface.**
- **No Need for Grid Knowledge.**

Work in Progress

- **Improvement of the Selection of Resources**
  - "Black-List" and Automatic Relaunching.
- **Direct Support of DICOM**
  - No Need for pre- and post-processing for Converting Data into Analyze and DICOM.
- **Migration of the Parametric Image Generation.**
  - Complete Solution for the Whole Problem of Contrast Kinetics Characterization.