Creatis contribution in NA4 (Medical applications), EGEE2

Scientific Contributors:

F. Bellet

H. Benoit-Cattin, deputy

P. Clarysse

L. Guigues

C. Lartizien

I. Magnin, supervisor

C. Pera

PhD students: B. Delhay, J. Schaerer

CREATIS, UMR CNRS #5515, U630 Inserm,
INSA Lyon, UCB Lyon
www.creatis.insa-lyon.fr

- **CREATIS**
  - Research and application center in medical image and signal processing
  - Research Unit of the French National Center of Scientific Research (CNRS) and National Health Institute (INSERM)
  - Common to INSA Lyon Engineering School and UCB Lyon University
  - 40 researchers (10 Medical doctors), 70 PhD and master students, 15 technicians
  - 12 persons (3.1 etp) involved in EGEE2

- **CREATIS applications in EGEE2**
  - *SIMRI*: MRI Simulator (H. Benoit-Cattin)
  - *PETSIM*: Simulation of 3D PET images (C. Lartizien)
  - *CAVIAR*: Cardio-Vascular image analysis on grid (P. Clarysse)
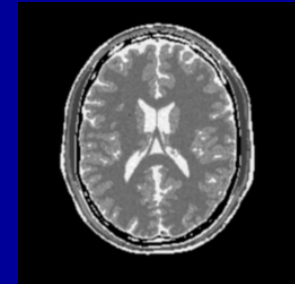 - *ThIS*: Therapeutic irradiation simulator (L. Guigues)
- **Participation to *MDM*: Medical Data Management (J. Montagnat, I3S, Nice)**

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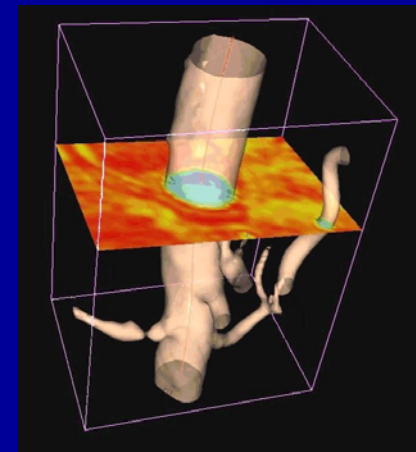
SIMRI: 3D Magnetic Resonance Simulator

- **Aims**

  – Study MR sequences in silico

  – Study MR artifacts

  – Ground truth for image processing algorithm evaluation

  – Core or image processing based artifact correction method

- **Method**

  – Virtual objects defined by a MR physical parameters dataset

  – MR device simulated through electro-magnetism model (Bloch equation)

- **Main facts**

  – June 2002 : MPI based parallelization of the simulation kernel

  – Nov. 2003 : 1^{rst} Grid deployment

  – June 2005: *SIMRI@Web* Simulation service through a web portal

  – Nov 2005: *SIMRI* code distributed under CECILL free licence

- **Perspectives**

  – Global MPI testing: inter-clusters communication, synchronizing execution tasks

  – Web portal V2: Pgrade or Genius or specific solution

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SIMRI: Pre-production test

- **Test protocol**
  - 9th March 06 / 20 March 06
  - 10 jobs per day (request of 10 to 32 nodes)
  - 512x512 image simulation : 8 h CPU

- **Results**
  - Only 62 % of jobs correctly achieved !
  - Saturation of some clusters
  - Still clusters with bad MPI configuration

- **Questions**
  - Is EGEE grid adapted to run such type of MPI jobs ?
  - Are the VO biomed ressources sufficient for such applications ?

				(Failed)
20Mars14h30-214-32Noeuds-19	grid10.lal.in2p3.fr:2119/jobmanager-pbs-biomed	2006-03-25	Done (Success)	H
20Mars14h30-214-32Noeuds-19	grid10.lal.in2p3.fr:2119/jobmanager-pbs-biomed	2006-03-21	Done (Failed)	H
20Mars14h30-214-32Noeuds-18	ce1.egee.fr.cgg.com:2119/jobmanager-pbs-biomed	2006-03-23	Done (Success)	H D
20Mars14h30-214-32Noeuds-17	mu6.matrix.sara.nl:2119/jobmanager-pbs-medium	2006-03-21	Done (Failed)	H
20Mars14h30-214-32Noeuds-16	mu6.matrix.sara.nl:2119/jobmanager-pbs-short	2006-03-25	Done (Success)	H D
20Mars14h30-214-32Noeuds-15	mu6.matrix.sara.nl:2119/jobmanager-pbs-short	2006-03-21	Done (Failed)	H

eGee
Enabling Grids
for E-sciencE

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PETSIM: Simulation of 3D PET images

- ## Aims

  - Demonstrate the feasibility to simulate realistic 3D and 4D (3D+time) Positron Emission Tomography (PET) images with the GATE Monte Carlo simulation platform

  - Generate 3D and 4D PET databases of cardiac and small animal images for evaluation of image processing techniques such as segmentation and automatic detection

- ## Methods

  - Use the developments of accelerating techniques of GATE simulations and implementation on Egee grid performed by the GATE collaboration

  - Define realistic imaging protocols based on numerical phantoms and modelling of evolving tracers biodistributions

- ## Perspectives

  - Simulation of 3D and 4D TEP images of small animal
  - Simulation of 3D and 4D TEP cardiac images of human

Simulated 3D PET acquisition of the MOBY mouse phantom

Video Thorax.avi
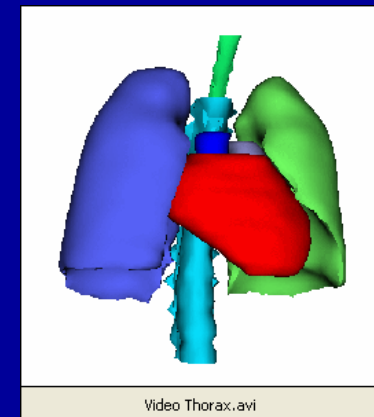
4D model of a breathing human heart and thorax

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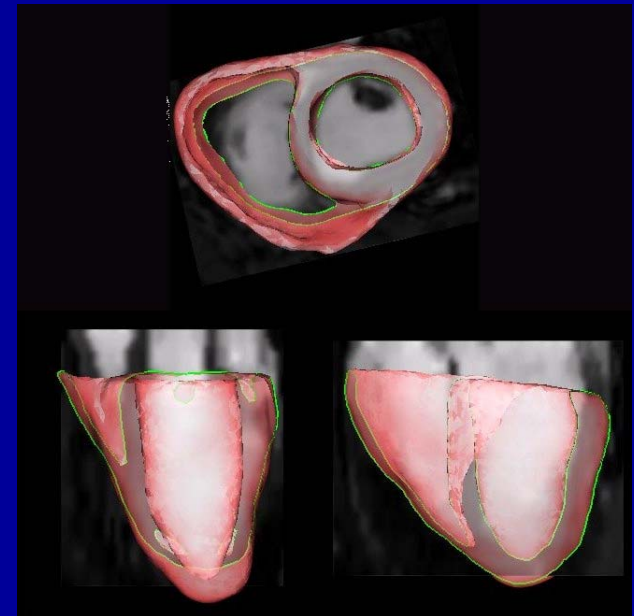# *CAVIAR*: CArdio-Vascular Image Analysis on gRid

- **Aims**
  - Exploit the huge computing power of grid architectures in time consuming cardio-vascular imaging applications
  - Grid aided Cardio-Vascular Diseases diagnosis and treatment
  - Allow for large distributed studies on patients with CVDs

- **Methods**
  - Analysis of 3D+time image sequences

    - Cardio-vascular structure segmentation with physically based deformable models

    - Motion tracking from time constrained registrations

- **Perspectives**
  - MPI based application deployment on the grid
  - Development of a web portal (image registration) based on the SIMRI web portal solution

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CAVIAR: CArdio-Vascular Image Analysis on gRid

MR Image sequence   **Estimated motion field**

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ThIS : Therapeutic Irradiation Simulator

ThIS is a Geant4-based simulator of the treatment of cancer by irradiation of a patient with beams of photons, protons or light ions (hadrontherapy).

In the context of the ETOILE project (http://www.projet-etoile.fr/sommaire.html)

- **Aims**
  - Offer an open platform for researchers for optimization of Monte Carlo simulations (fast navigation algorithms, parallelization, hybrid simulations...)

  - Offer a fast and reliable simulation tool for researches in medical physics (treatment planning) and medical imaging for treatment control.

  - Produce a reference dataset (energy deposit, positron emitters distributions, ...) for non-conventional therapies (hadrontherapy).

- **Perspectives**
  - application deployment on the grid
  - Collaboration with the Gate consortium
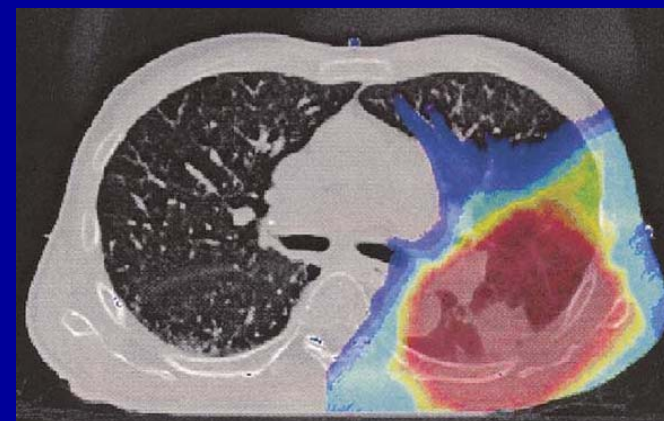
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Contacts

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F. Bellet   fabrice.bellet@creatis.insa-lyon.fr

H. Benoit-Cattin   hugues.benoit-cattin@creatis.insa-lyon.fr

P. Clarysse   patrick.clarysse@creatis.insa-lyon.fr

L. Guigues   laurent.guigues@creatis.insa-lyon.fr

C. Lartizien   carole.lartizien@creatis.insa-lyon.fr

I. Magnin   Isabelle.magnin@creatis.insa-lyon.fr

C. Pera   christophe.pera@creatis.insa-lyon.fr

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- **Perspectives**
  - application deployment
  - Dec. 07 : Web portal

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