



GEMSS

Grid-enabled Medical Simulation Services

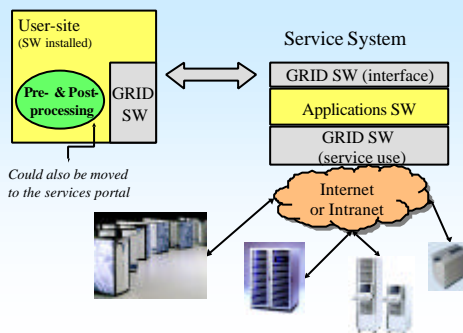
(project period: September 2002 until February 2005)



Objective

The central objective of the GEMSS project is to demonstrate that the Grid can be used to provide medical practitioners and researchers with access to advanced simulation and image processing services for improved pre-operative planning and near real-time surgical support for specific time-critical applications. The GEMSS will build on existing Grid technologies, maintaining compliance with standards thereby ensuring future extensibility and interoperability, to provide support for sophisticated authorisation, workflow, security, error detection and recovery.

Medical simulation service Portal + networked compute resources



The GEMSS System Design:

Generic GRID-services:

build on existing GRID and WEB technologies (like OGSA, Web services, Jini, Corba), service interaction models, protocols & interfaces, QoS (time critical services), security, medical GRID protals, PSEs, application servers.

Collaborative tools:

tele-support,
tele-consulting.

Medical service applications:

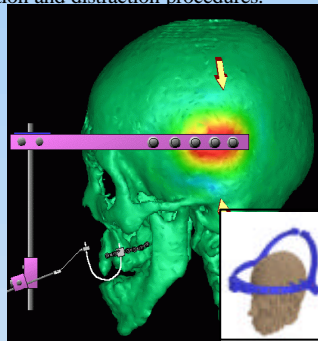
Numerical modelling, based on existing software packages such as CFX and EASA, High Performance Computing (HPC) simulation, Advanced image processing.

GEMSS Test-bed Applications

- (1) Maxillo-facial surgery simulation.
- (2) Neuro-surgery support.
- (3) Radio-surgery simulation.
- (4) Inhaled drug-delivery simulation.
- (5) Cardio-vascular system simulation.
- (6) Advanced image reconstruction for SPECT.

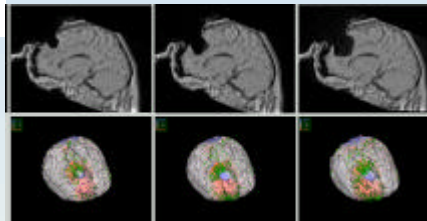
1. Maxillo-facial Surgery Support

During maxillo-facial surgery a steel device is tightly fixed to the head by special screws. These screws deform the skull which becomes clearly visible as a result of our parallel finite element analysis. The goal is to provide a virtual planning space for the optimisation the fixation and distraction procedures.



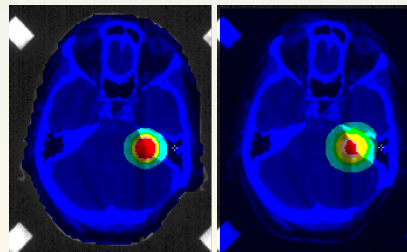
2. Neurosurgery Support

Prediction of the brain shift during neurosurgery is important to provide co-ordinates for the surgical navigation. In GEMSS a robust and precise approach based on non-linear image registration will be implemented in a Grid environment.



Brain displacements during neurosurgery.

3. Radiotherapy Planning



Conventional

RAPT

Revised treatment plan simulated
- different beam weighting and orientation
RAPT simulation now shows better coverage
- differs from conventional treatment analysis
New treatment more likely to be successful.

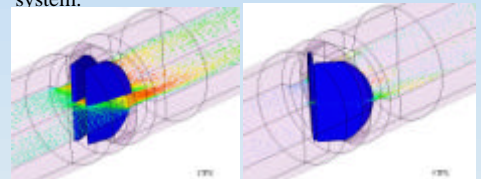
4. Inhaled Drug Delivery

Take-up of the Cophit project - A combination of computational fluid dynamics and 1-dim. models to optimise delivery of inhaled drug to the lung.



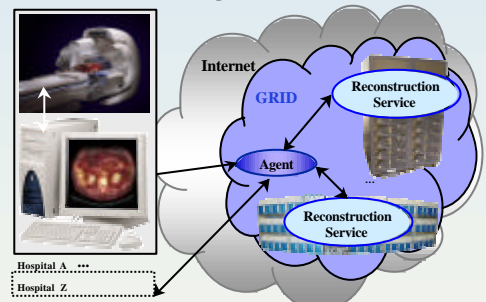
5. Cardio Vascular System

A compartmental approach and coupled structural mechanics and fluid dynamics will be applied to simulate the entire cardio-vascular system.



Heart-valve example provided by the BLOODSIM project.

6. Advanced Image Reconstruction



The medical image reconstruction system is based on a service oriented architecture to provide clients with advanced fully 3D image reconstruction services running transparently on remote parallel computers.

The GEMSS Consortium

- NEC C&C Research Labs, St. Augustin
- MPI of Cognitive Neuroscience Leipzig
- AEA Technology Engineering Software
- CRID, Uni. of Namur
- IT Innovation, Uni. of Southampton
- The University of Sheffield
- Inst. f. Softwarewissenschaft, Uni. Wien
- Inst. f. Biomed. Technik u. Physik, Uni. Wien
- IDAC Ireland Ltd.
- ASD Advanced Simulation & Design GmbH

<http://www.gemss.de>