



MAISON DE LA SIMULATION





Stakes for HPC

Simulation has become *third pillar of science* together with theory and experiment

Computational science has become the third pillar of the scientific enterprise, a peer alongside theory and physical experiment.

Rapport PITAC 2005

- Upcoming grand challenges or HPC are shared by a wide scientific community
 - Visualization of very large data sets
 - Massive parallelism, emerging technologies (GPU, many-core,...)
 - Linear algebra
 - Fault tolerance
 - ...

- Be creative on technical aspects, and stay focused on science
- Be able to adapt and react rapidly

- Need for building multi-disciplinary teams and develop partnerships

- Need for mutualization of human resources
 - economies of scale
 - diffusion of relevant skills





- ❑ Created in January 2011 :
 - Joint project CEA/CNRS/INRIA/UPS/UVSQ
 - MdS is a « Unité de Service et de Recherche CNRS »
 - Steering Committee and Scientific Advisory Board
 - Located on plateau de Saclay (Bât. Digitéo / CEA)

Accompany, support and stimulate scientific communities so as to best use available high-end computing facilities

- Multidisciplinary research laboratory around numerical simulation
- Service Unit opened to communities, offering high level expertise and support to high end software development
- Teaching and training center for





Multidisciplinary research center in the field of simulation

Creation within a unique lab of multidisciplinary teams able to address HPC challenges

Staff researchers : mainly on transversal topics (applied math., computer sciences, algorithmics,..) and in a few fields where HPC is a major issue.

- Close link with their scientific community
- Responsible of multidisciplinary projects
- Knowledge transfer

Researcher hosted on long term projects (competitive calls)

HPC engineers : design, creation and spreading of numerical tools

Contribute to the development and use of high-end innovative software for the large computing facilities at the national (GENCI) and European level (PRACE)





Community support

Provide the community with an expertise and back-up for code development and for the efficient use of supercomputers such as provided by Genci and Prace-RI

- ❑ **Host researcher and/or teams and provided them with support for :**
 - Code development and optimization
 - Preparing, running and process very large simulations

- ❑ **Global support of the HPC community in particular through doctoral and post-doctoral fellowship.**

- ❑ **Strong collaboration with GENCI and the national computing centers**
- ❑ **Animation of national network of similar initiatives**





Teaching and training

Initial training:

Contribute to HPC masters on Plateau de Saclay

M2S :

- Partner organization
- Hosting of web site
- Hosting of courses, teaching in 4 courses

MIHPS



Continuous training:

Train engineers and scientists to optimal use of computing facilities

PRACE Advanced Training Center (PATC) :

- 6 centers in Europe
- French network coordinated by Maison de la Simulation (3 national computing centers and Inria)
- 15 courses / year

Coordinate training and scientific animation of Equip@Meso project (Genci





Staff

- Management team: E. Audit, A. Bui et M. Kern
- 7 permanent staff : 1 secretary, 6 engineers / researchers
- 12 doctoral students: Applied maths., Fusion, Geosciences, Astrophysics, Life sciences ...
- 3 post-docs
- 3 HPC engineers on short term contracts\
- 2 contracts for PRACE support **to be filled**



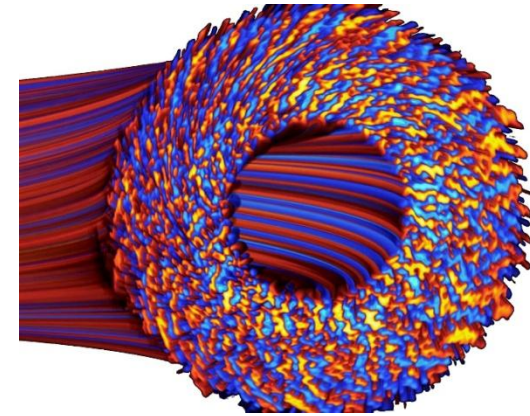


Scientific highlights

Maison de la Simulation is open for all communities.

Fusion : Gysela

- 5D gyrokinetics code for fusion plasma (ITER, CEA/Inria)
- $\geq 450\,000$ cores (1.8M tasks) on Juqueen, 91% efficiency



Astrophysics : Ramses-GPU

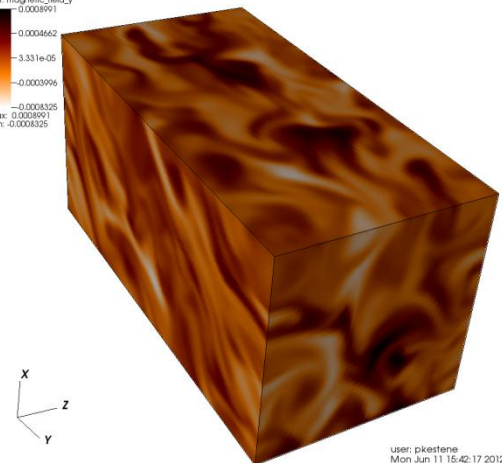
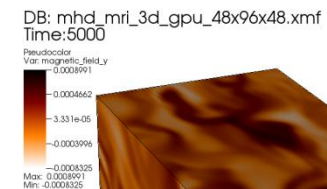
- High resolution magneto-hydrodynamics simulations
- Turbulence in accretion disks: $800 \times 1660 \times 800$ on 256 GPUs on Curie

Climate:

- Optimisation of OASIS coupler to make it conservative

Mathématiques appliquées :

- Design and analysis of Finite Volume schemes that remain accurate at low Mach numbers





- Scientific tool: **Computer+ Applications**
- Build French community of *Sciences for and by Simulation* (Computational sciences)
- Maison de la Simulation is a place for sharing expertise that researchers and laboratories must make best use of its resources



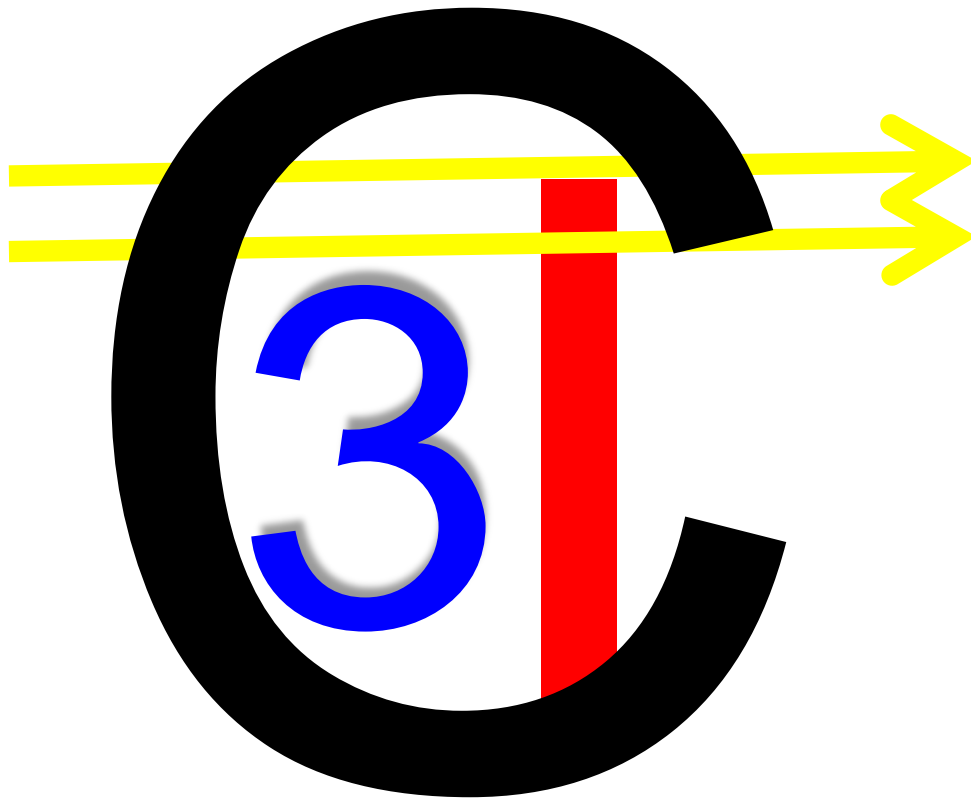
Nouvelles du C3I



**Conférence
des présidents
d'université**



MAISON DE LA SIMULATION



Lauréats récents

Prenom	Nom	Titre
David	Beaujouan	Simulation des matériaux magnétiques à base Cobalt par Dynamique Moléculaire Magnétique
Fabien	Castanié	Approches numérique et théorique du microscope à force atomique : interaction, dynamique et imagerie
Elena	Collado Morata	Impact of the unsteady aerothermal environment on the turbine blades temperature.
Xavier	Garnaud	Modes, transient dynamics and forced response of circular jets
Patrice	Linel	Méthodes de décomposition de domaines en temps et en espace pour la résolution de systèmes d'EDO non-linéaires
Marc	Wolff	Analyse mathématique et numérique du système de la magnétohydrodynamique résistive avec termes de champ magnétique auto-généré
Imen	Chakroun	Algorithmes Branch and Bound parallèles hétérogènes pour environnements multi-coeurs et multi-GPU

Prénom	Nom	Intitulé de la thèse
Gabriel	Noaje	Un environnement parallèle de développement haut niveau pour les accélérateurs graphiques : mise en œuvre à l'aide d' OpenMP et MPI
Vincent	Visseq	Calcul haute performance en dynamique des contacts via deux familles de décomposition de domaine
Francky	Luddens	Analyse théorique et numérique des équations de la magnétohydrodynamique : application à l'effet dynamo
Forian	Pantillon	Transition extra-tropicale d'ouragans en Atlantique Nord et impact sur la prévisibilité d'événements extrêmes en Méditerranée
Benoit	Fabrege	Une méthode de prolongement régulier pour la simulation d'écoulements fluide/particules
Pascal	Tremblin	Ionization impact on molecular clouds and star formation. Numerical simulations and observations
Benjamin	Pajot	Analyse et prévision de l'ozone issues d'une assimilation de données satellitaires à haute résolution

3 dossiers refusés

Précisions sur critères d'attribution

Description explicite des apports originaux au calcul intensif.

Préciser les parties de la thèse spécifiquement concernées et fournir tous les éléments concrets

- **techniques utilisées,**
- **amélioration de performances sur différentes machines cibles,**
- ...

permettant au jury de l'évaluer.