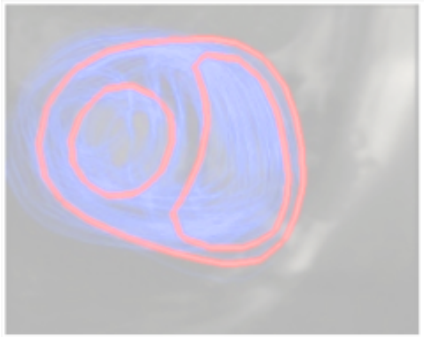
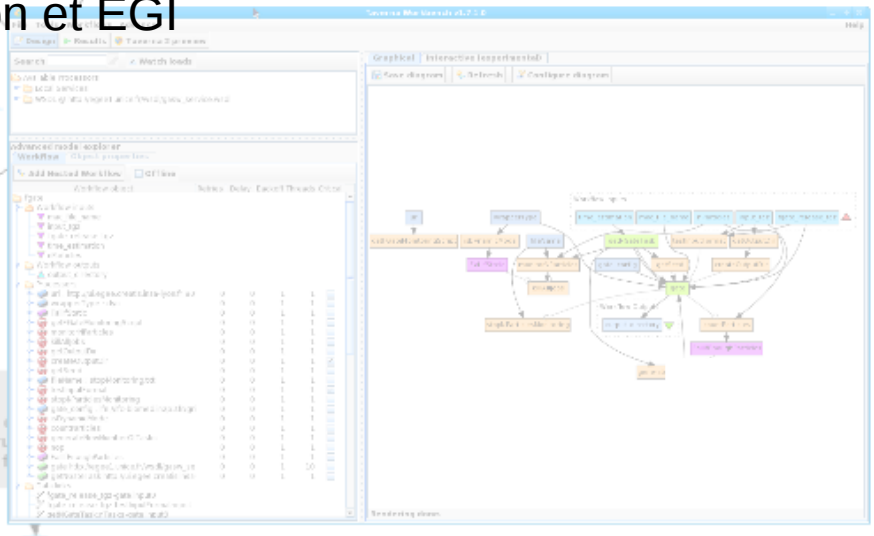


Grille pour l'imagerie médicale

Tristan Glatard
CNRS – CREATIS, Lyon

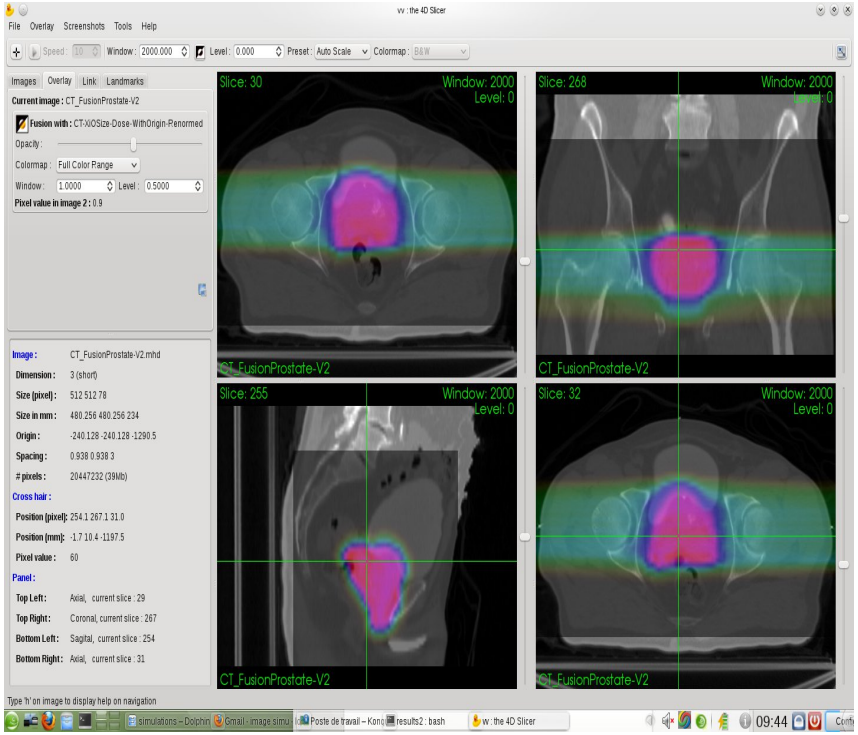
Journée grille de production et EGI
Lille, 17 mai 2011



http://www.creatis.insa-lyon.fr

Simulation

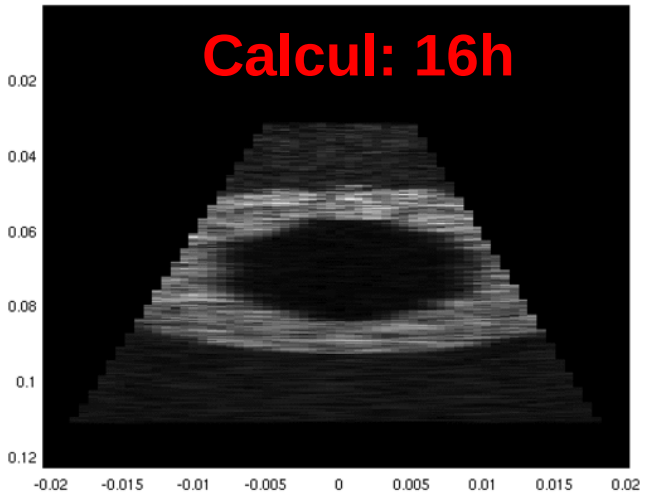
- **Traitement**



Exemple : plan de traitement de prostate en protonthérapie.
[L. Grevillot, D. Sarrut]

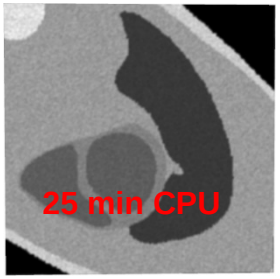
Calcul: 2 mois

- **Imagerie**

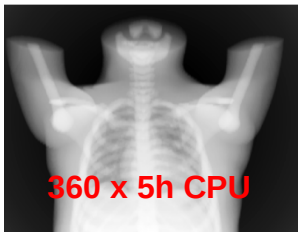


Exemple : simulation 2D+t ultrasons
[O. Bernard]

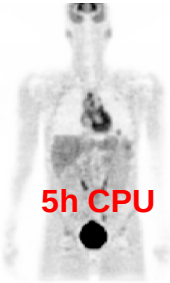
US



IRM



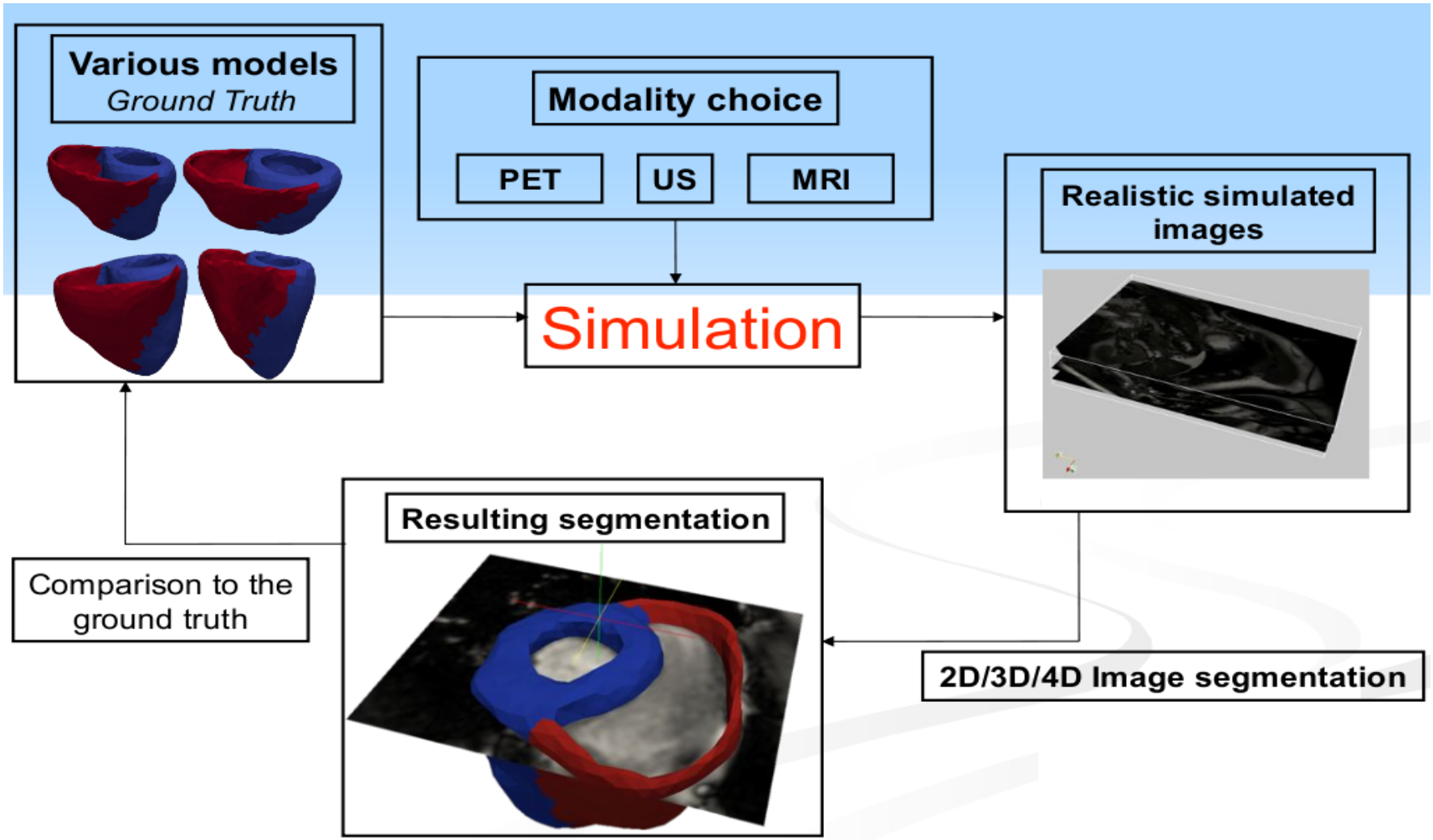
TDM X



TEP

Evaluation d'algorithmes

- **Evaluation de la segmentation**

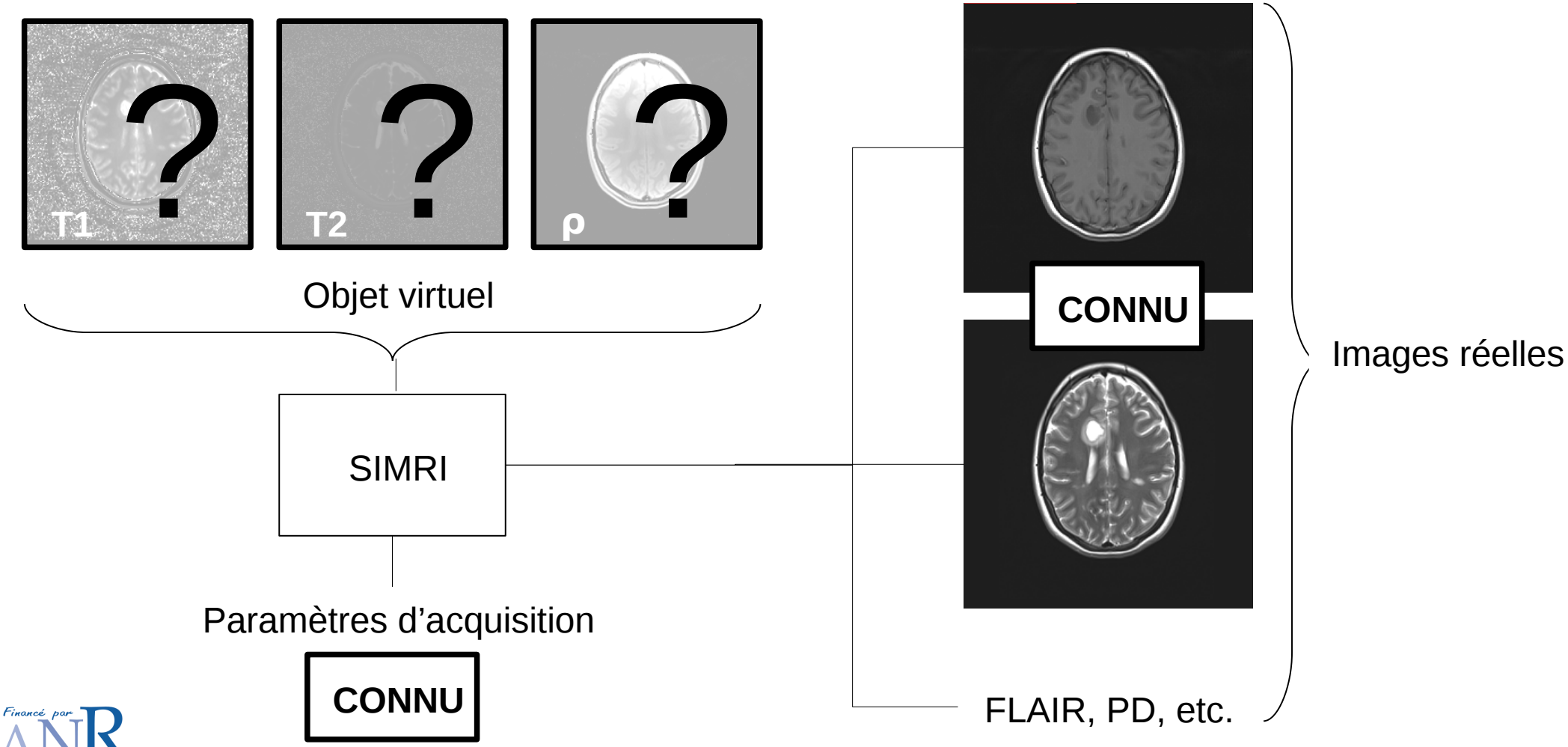


Financé par ANR

Modélisation du vivant

{INRIA Rennes Bretagne-Atlantique ; C. Barillot, O. Luong}

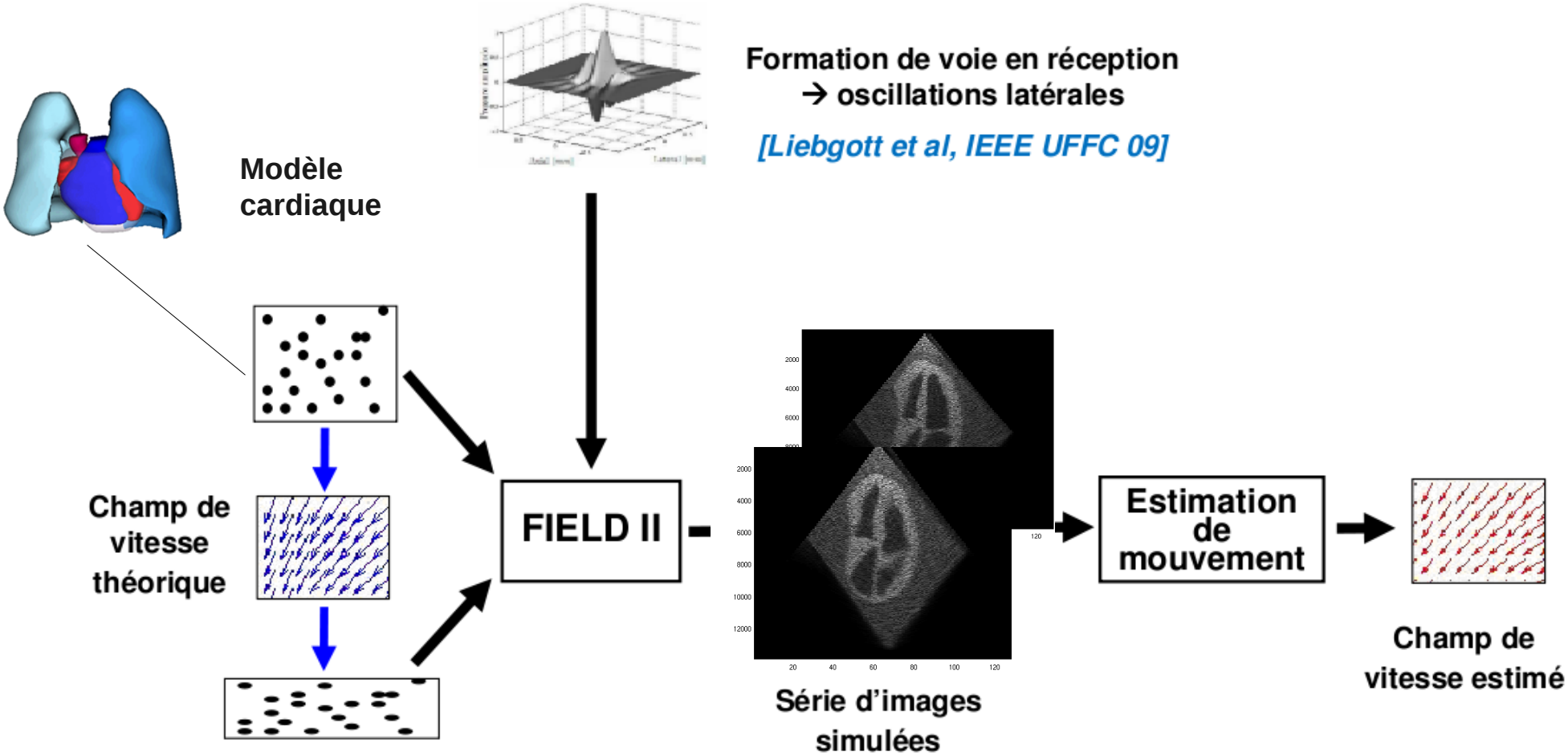
- **Modèle de cerveau inflammé (sclérose en plaques)**



Financé par ANR

Mise au point de systèmes et séquences d'imagerie

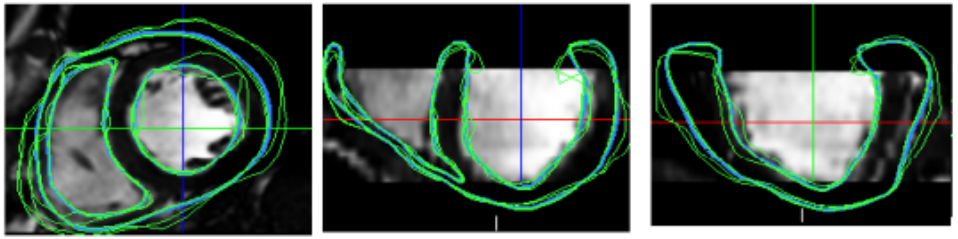
- **Mise au point d'une méthode "d'US-tagging" pour l'estimation de mouvement 2D**



Etudes de paramètres

- **Segmentation cardiaque**

Exemple : 972 segmentations IRM cardiaque 3D



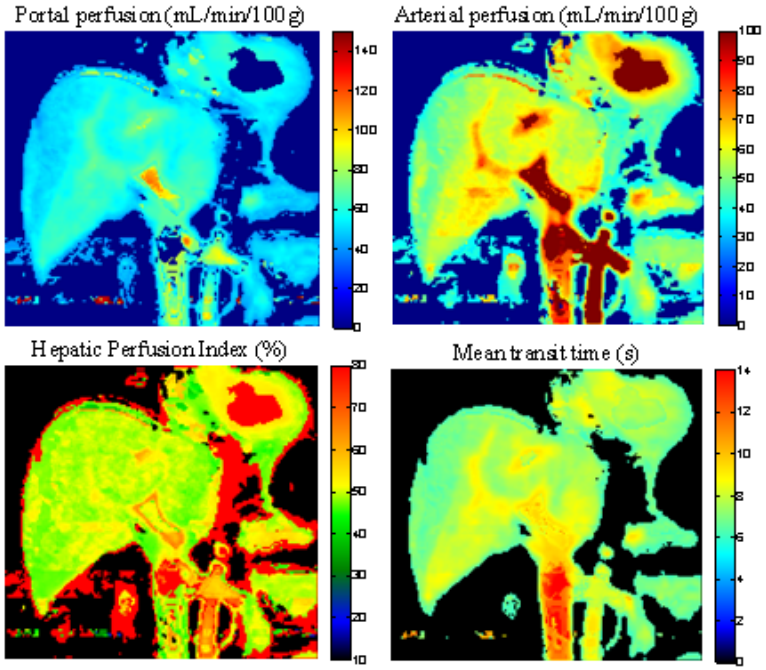
(a) C1, z=30 (b) C1, y=70 (c) C2, x=88

[S. Ben Fredj, P. Clarysse, C. Casta]

2.2 jours

- **Estimation de paramètres**

Exemple : paramètres de perfusion hépatique



18 jours / volume

[B. Leporq, F. Pilleul, O. Boeuf]

- **Paramètres du filtrage**

5.5 mois

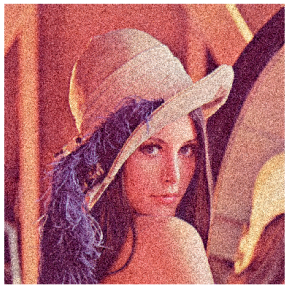
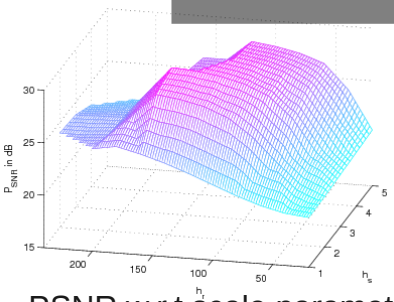


Image bruitée

Image restorée

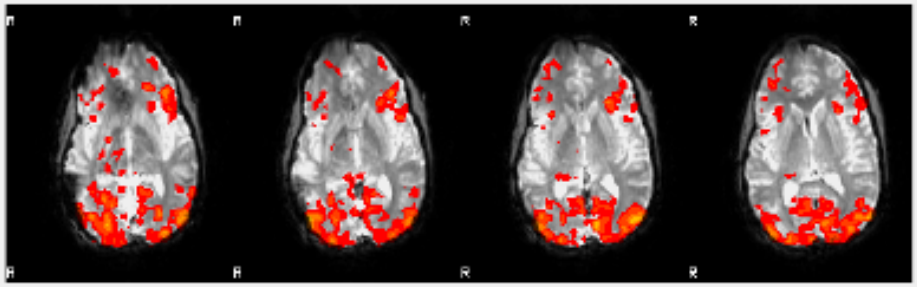


PSNR w.r.t scale parameters

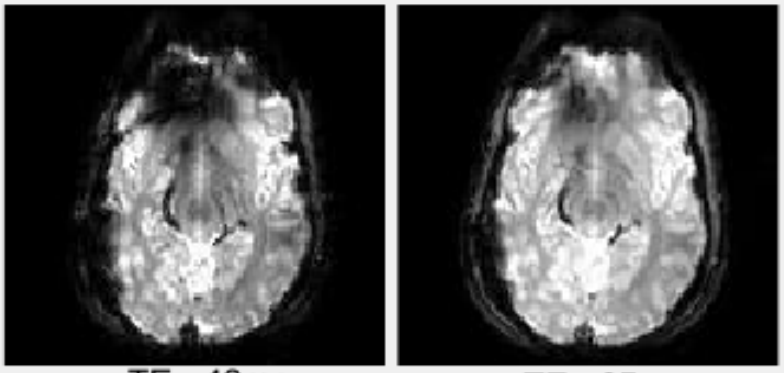
[miccai-G'08]

Parameter sweep in fMRI

- Activation maps

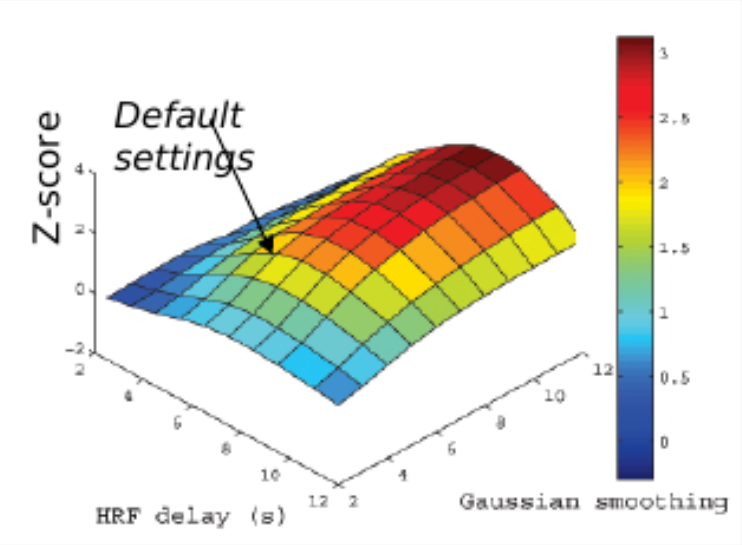


- Echo times comparison

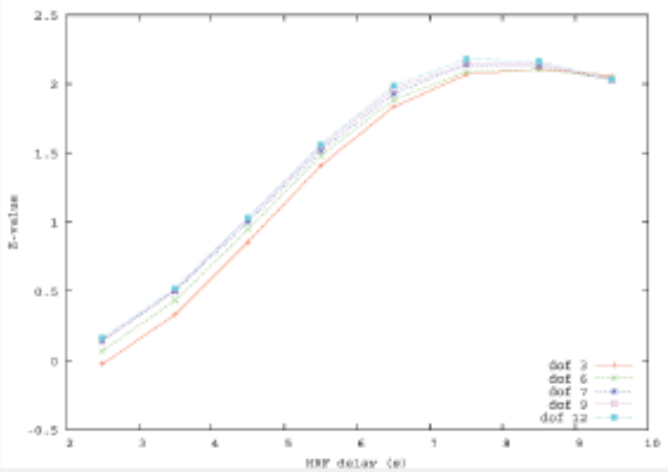


TE= 40ms TE= 25ms

- Smoothing and HRF optimization



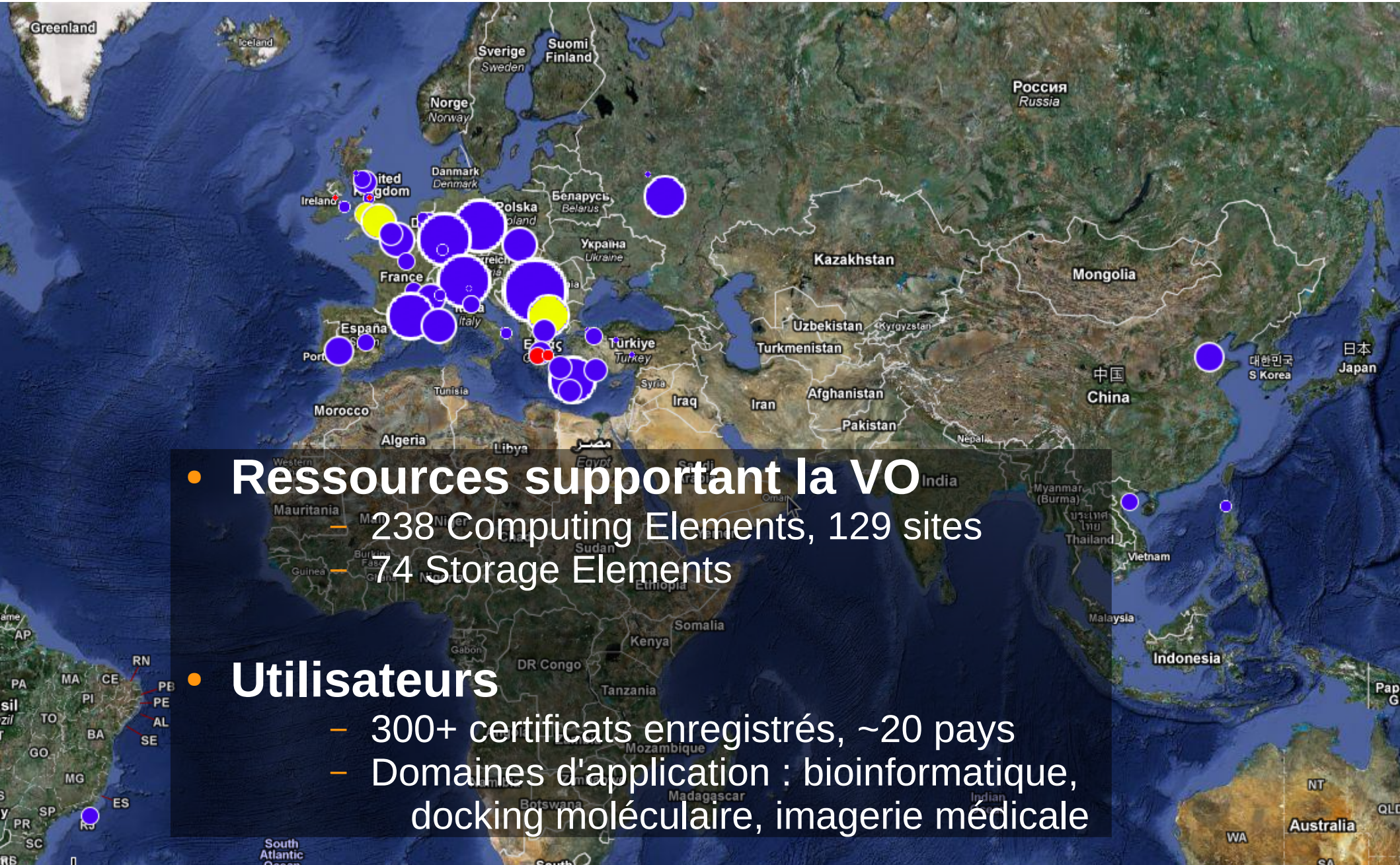
- Registration evaluation



- 10,000 jobs – 1 CPU year – 1 week elapsed time – 1.5 TB out

With R. Soleman and A. Nederveen

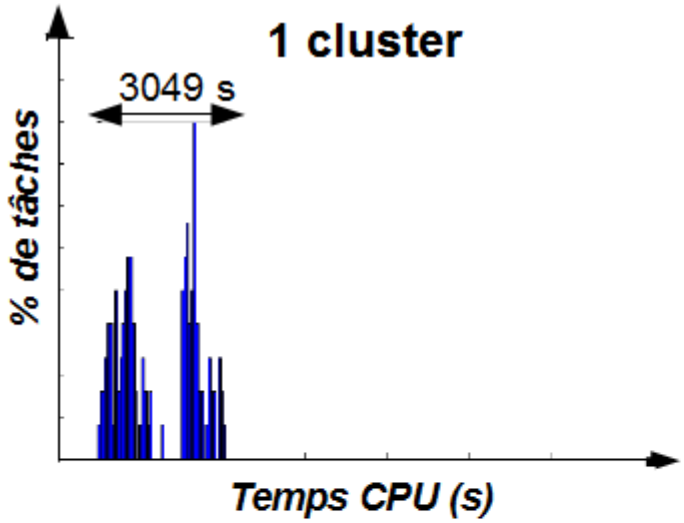
Organisation virtuelle biomed

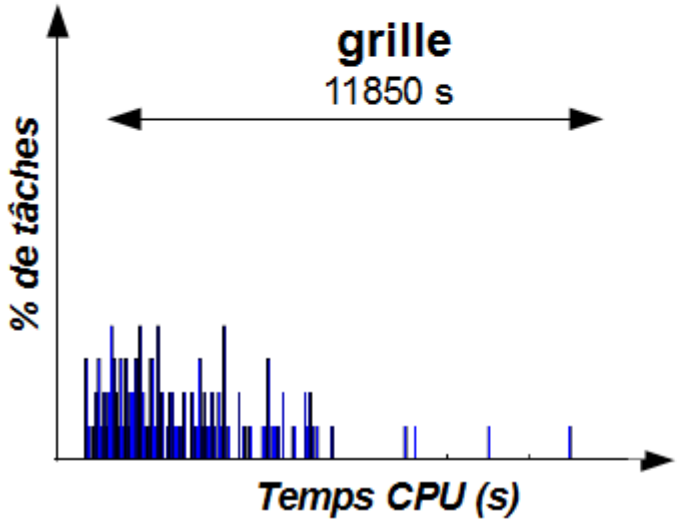


- **Ressources supportant la VO**
  - 238 Computing Elements, 129 sites
  - 74 Storage Elements
- **Utilisateurs**
  - 300+ certificats enregistrés, ~20 pays
  - Domaines d'application : bioinformatique, docking moléculaire, imagerie médicale

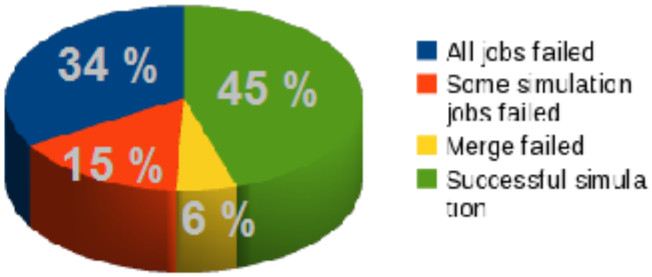
Enjeux

- **Hétérogénéité matérielle**



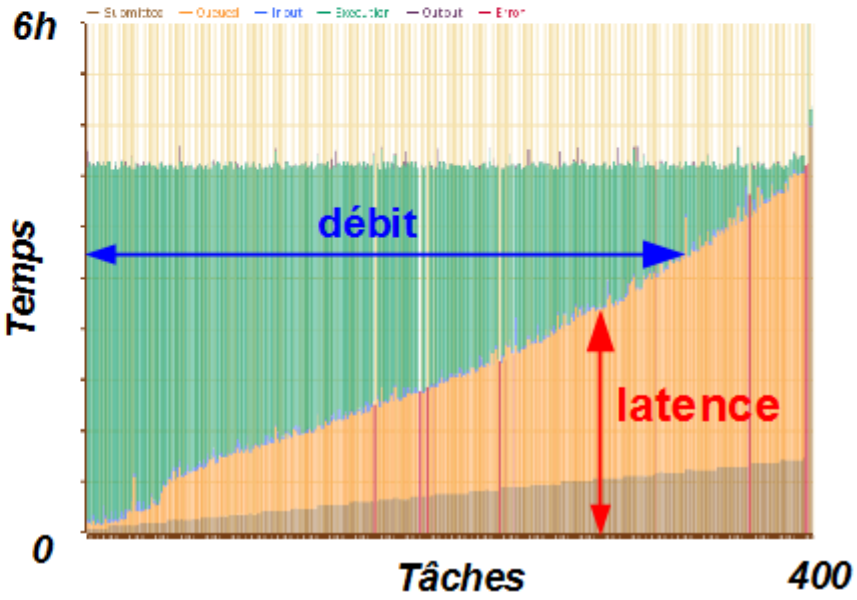


- **Hétérogénéité logicielle**

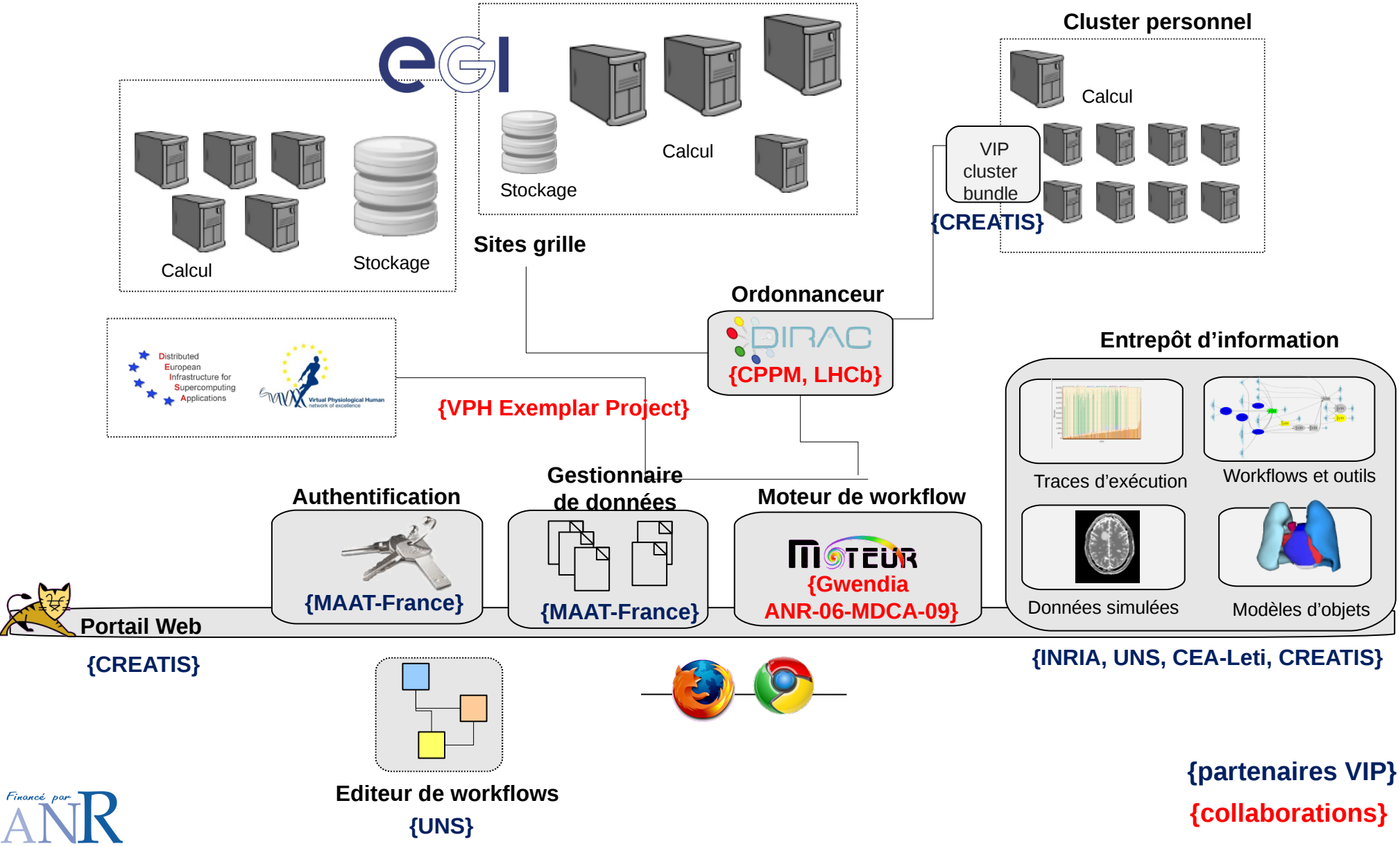


(total: 197 simulations, avril – septembre 2010)

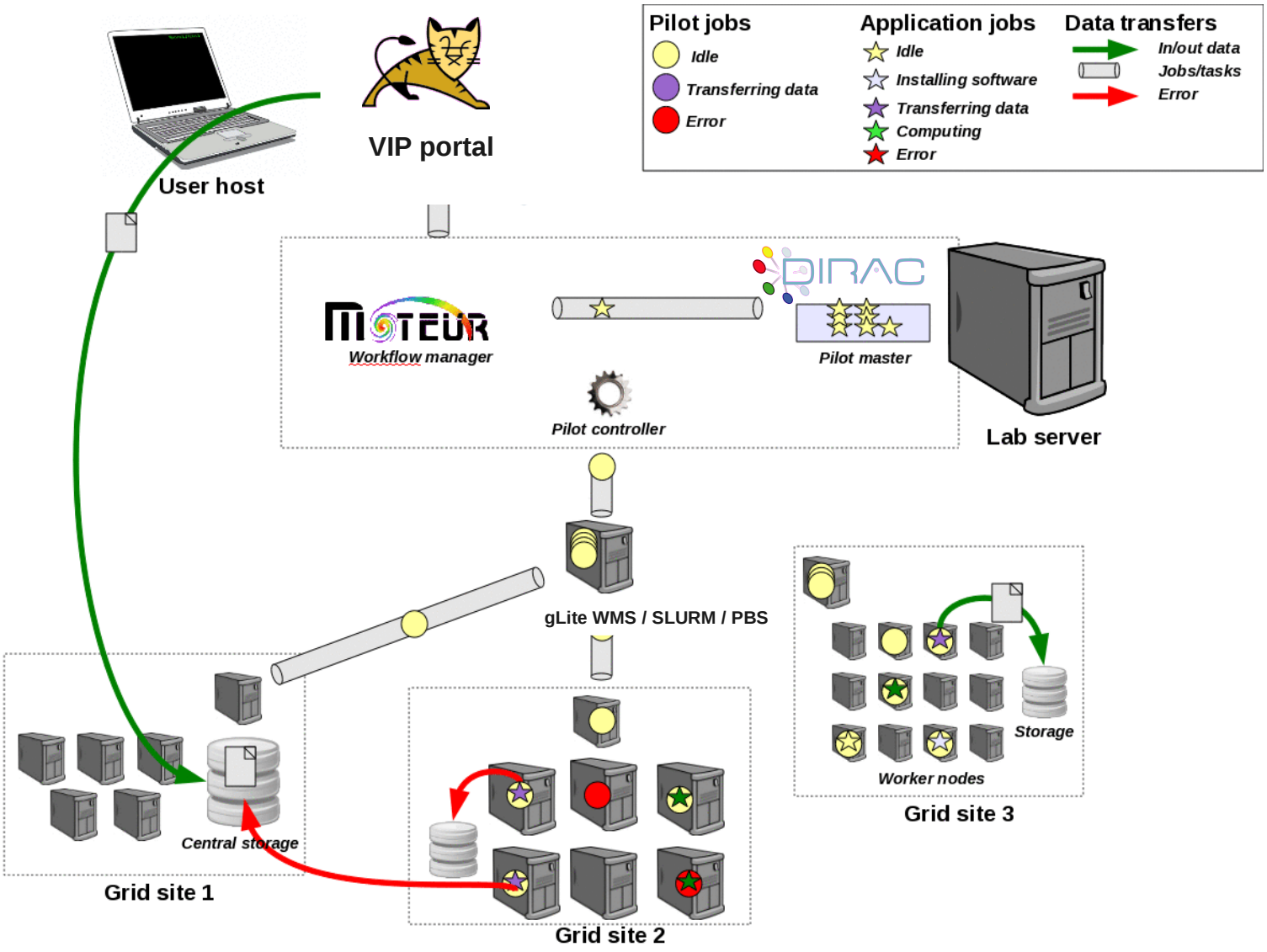
- **Débit VS latence**



Architecture logicielle

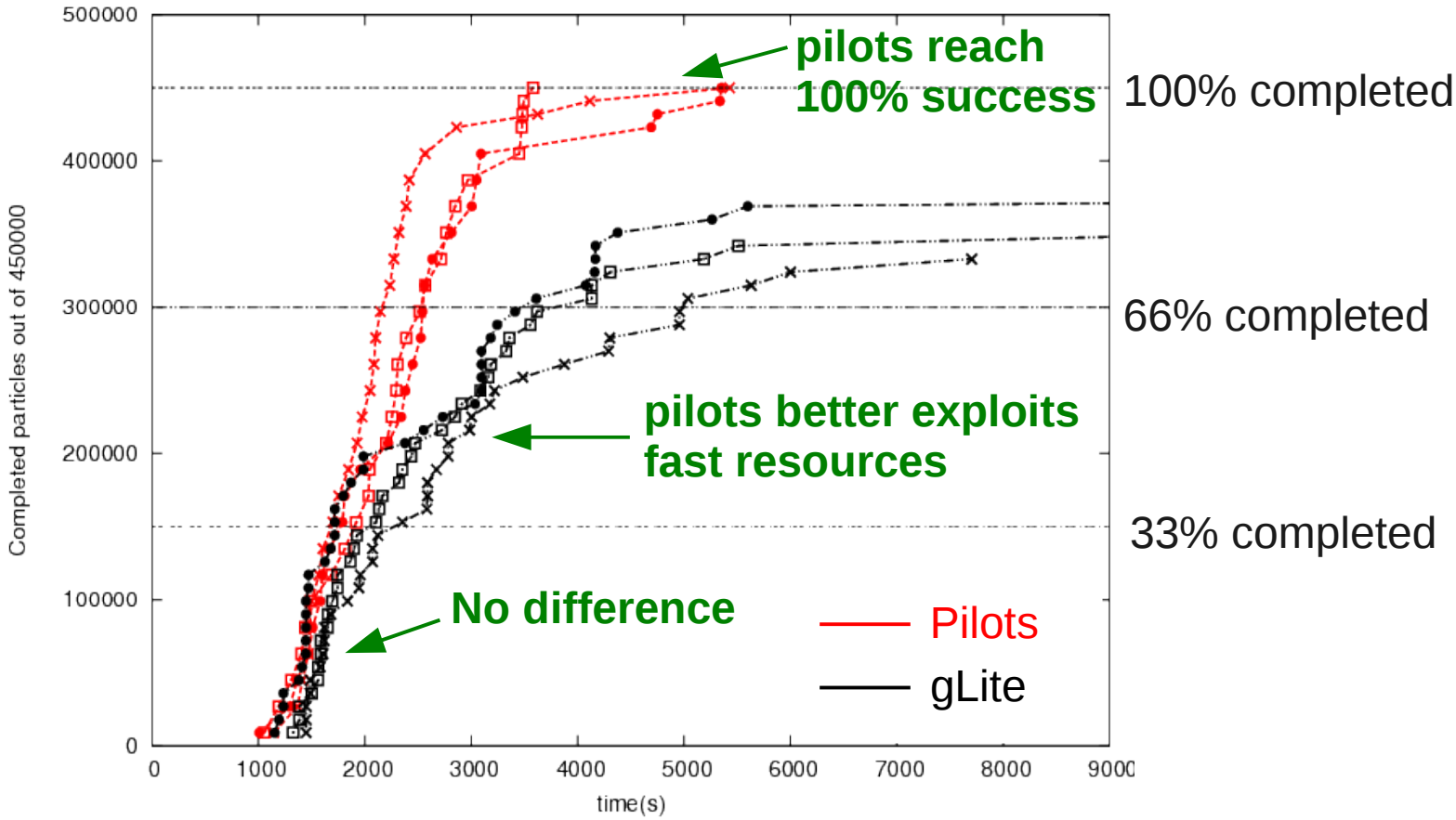


Exécution par tâches pilotes

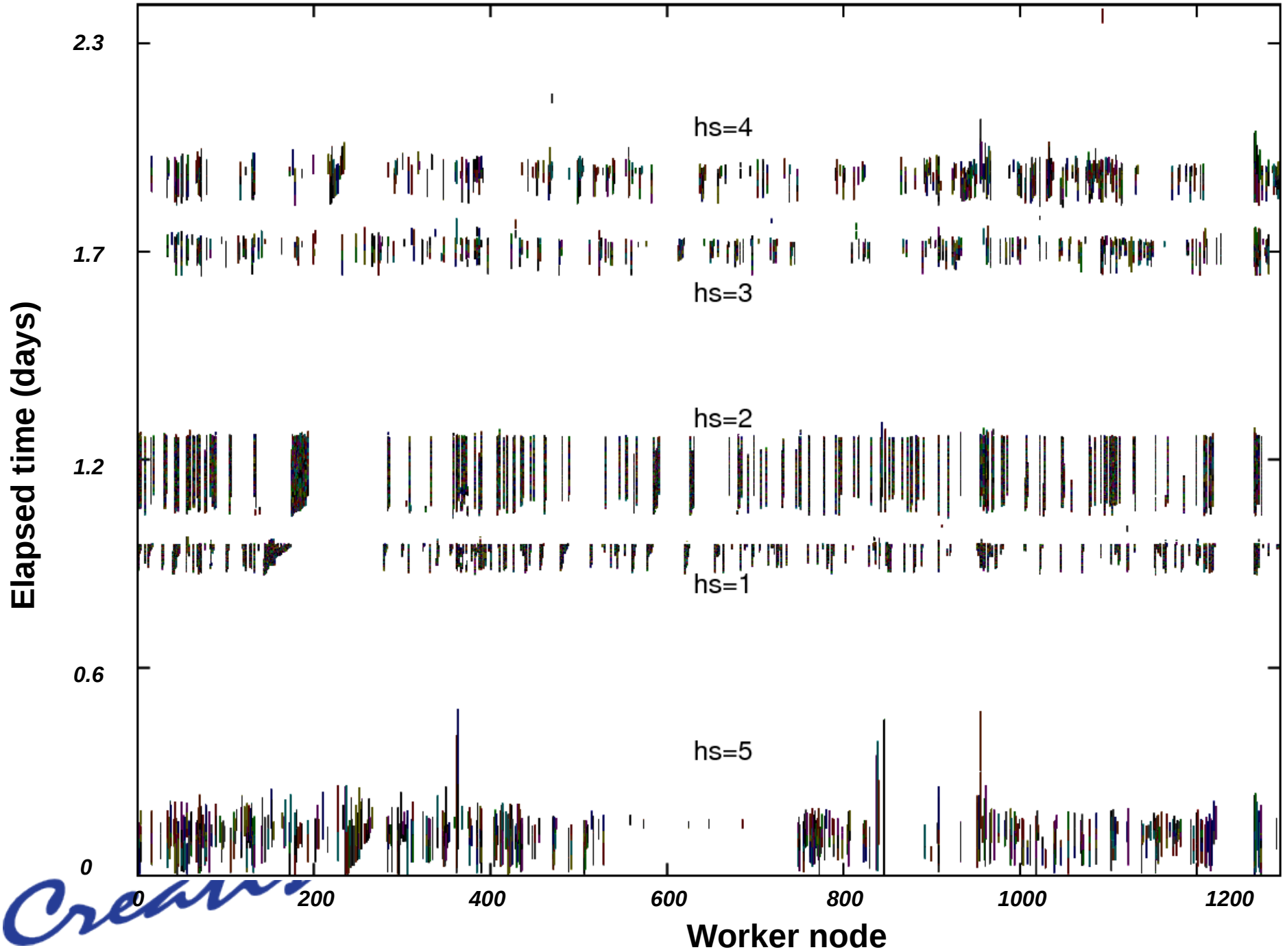


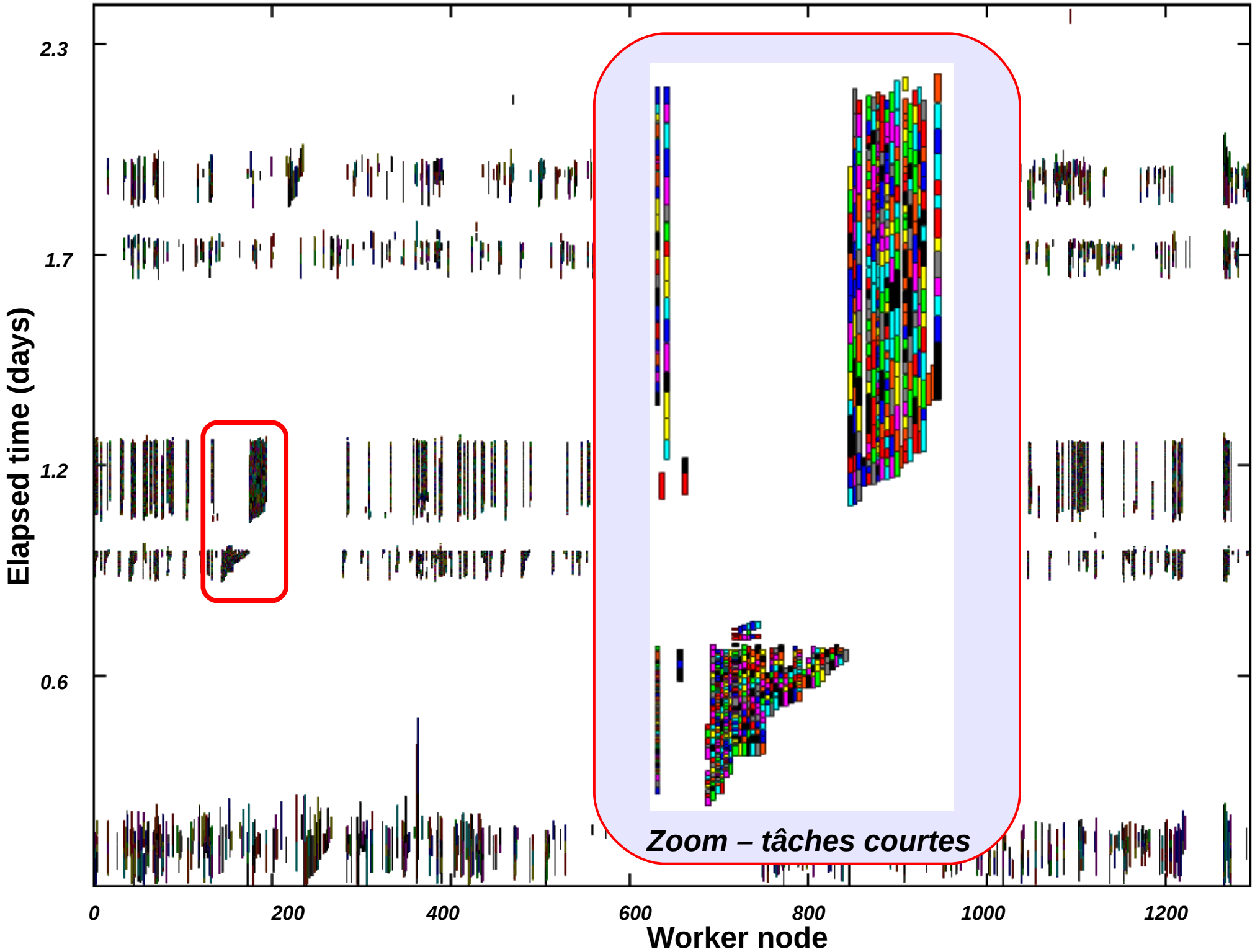
Tâches pilotes : performance

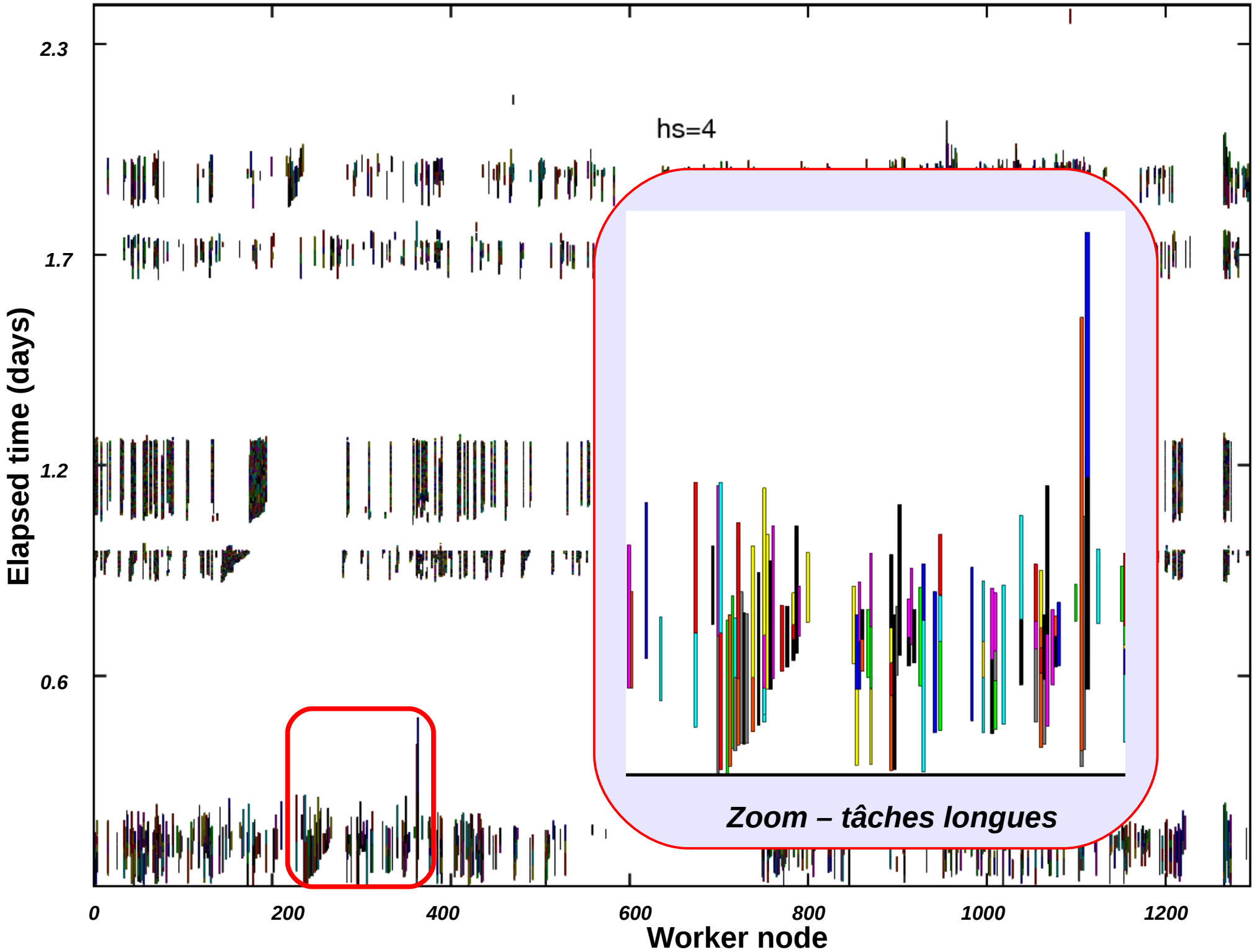
- **75 tâches gLite VS 75 pilotes et 75 tâches**



Equilibrage de charge



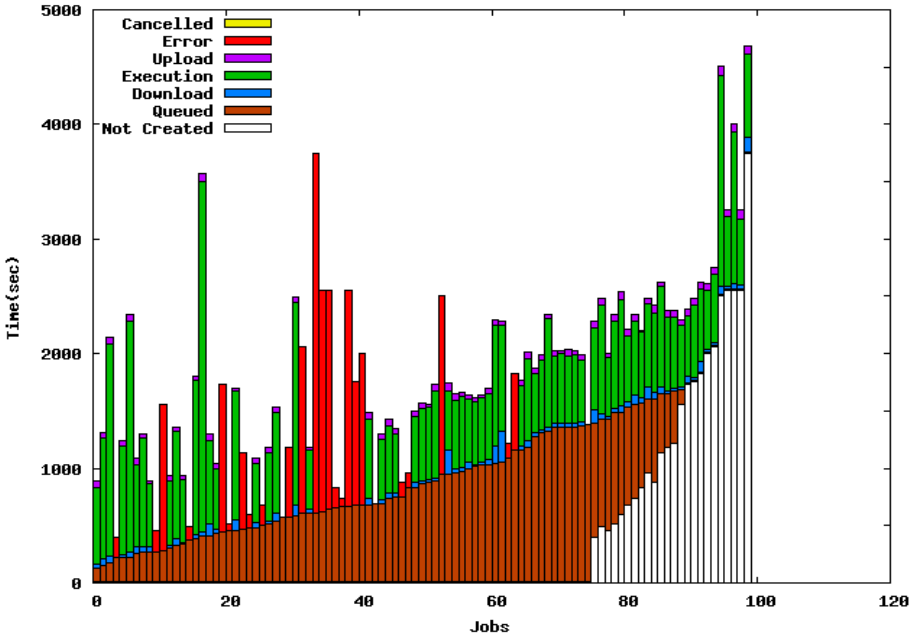

Elapsed time (days)
2.3
1.7
1.2
0.6
0
200
400
600
800
1000
1200
Worker node
Zoom – tâches courtes


hs=4
Zoom – tâches longues
Elapsed time (days)
2.3
1.7
1.2
0.6
0
200
400
600
800
1000
1200
Worker node

Cas des simulations Monte-Carlo

Statique

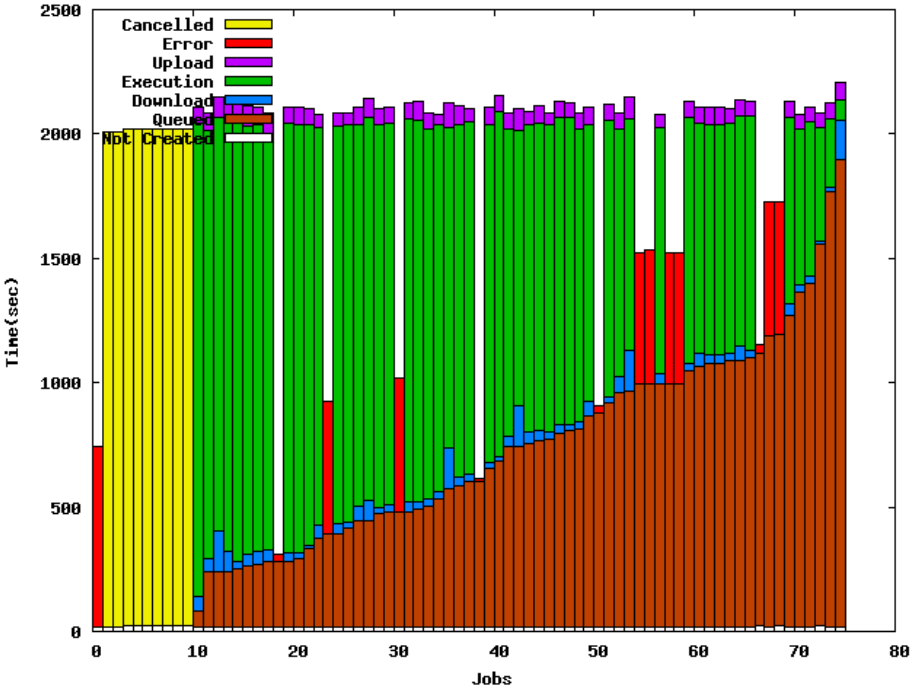
Worker:
Simule P/n particules



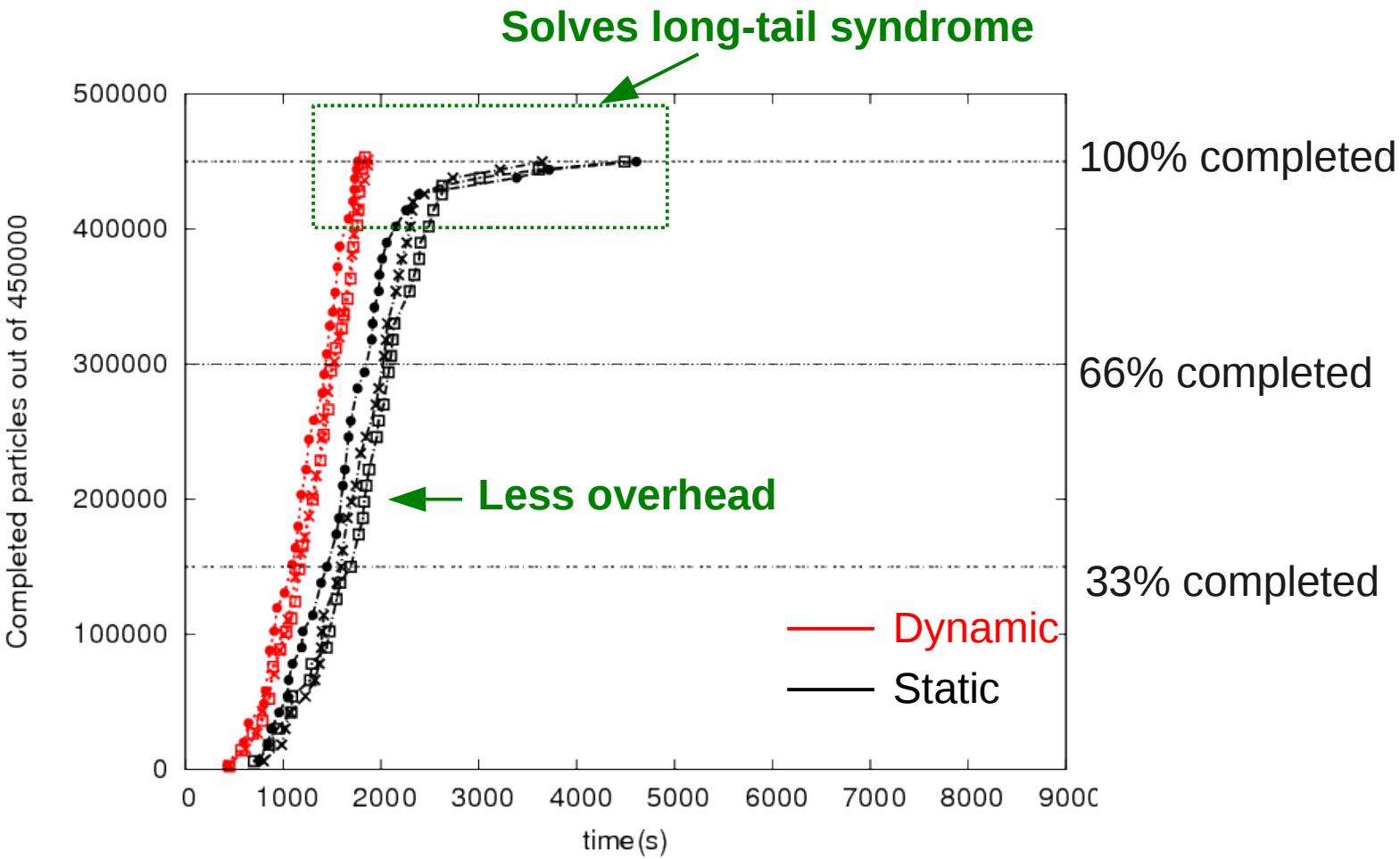
Dynamique

Worker:
Tant que “stop” non reçu:
Simule 1 particule
Fin tant que

Master:
Tant que p ≠ P
p ← # particules simulées
Fin tant que
Stoppe tous les workers

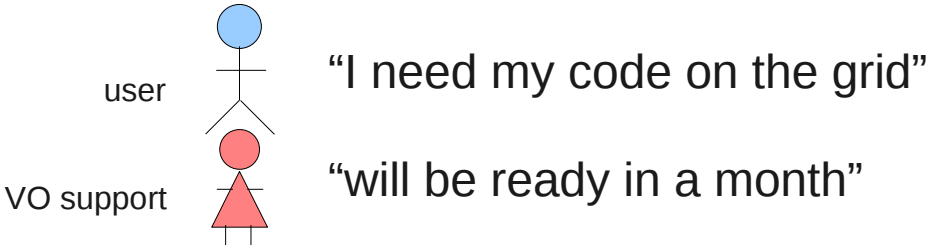


Mode dynamique : performance

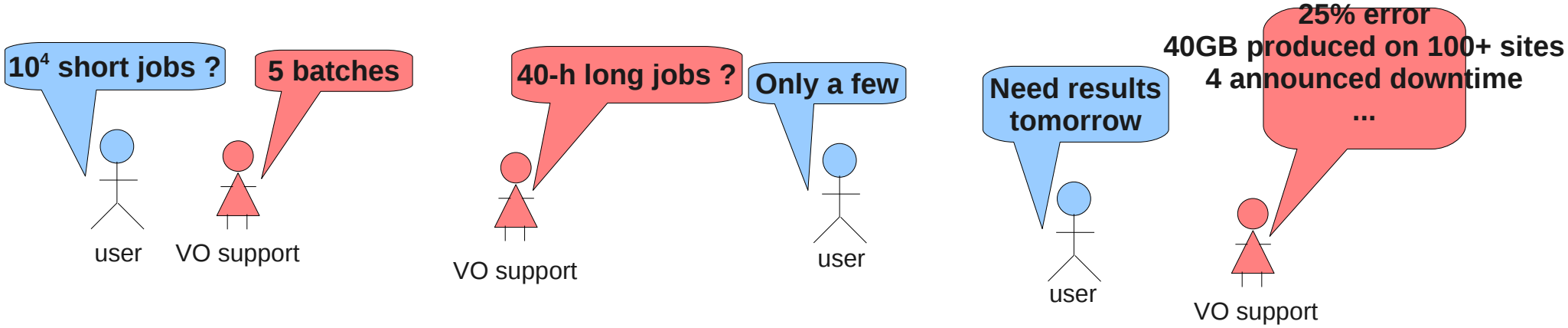


La grille comme un outil quotidien ?

- **Portage d'applications**

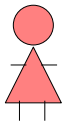


- **Planification des expériences**



La grille comme un outil quotidien ?

- **Ordonnancement robuste**

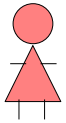


VO support

“99% of your experiment has completed ; the last 3 jobs will be available in 12 hours”

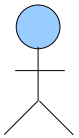
- **Fiabilité**

VO/user support



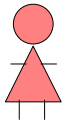
“The server hosting your experiment had to reboot: your workflow was killed”

user



“It had been running for 3 days and was 53% complete...”

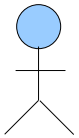
- **Gestion de données**



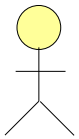
VO/user support

“Jobs are failing due to file transfer issues”

“The file I have uploaded to the grid in December is not available”



user



site admin

“Storage Element is full / being decommissioned ; please organize migration”

Plus d'information...

- **Organisation Virtuelle biomed**
  - https://voms-biomed.in2p3.fr:8443/voms/biomed/
  - http://wiki.healthgrid.org/LSVRC:Biomed

- **Life-Science Grid Community**
  - 4 VOs: biomed, lsgrid, vlemed, pneumogrid
  - 5 NGIs: France, Pays-Bas, Suisse, Italie, Espagne
  - http://wiki.healthgrid.org/LSVRC:Index

Remerciements

FR National projects
Radiotherapy simulation: hGATE (2010-2012)
Image simulation: VIP (2010-2012)

France-Grilles

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Johan Montagnat ; CNRS I3S

Pilot jobs
Jakub T. Moscicki ; *CERN*
A. Tsaregorodtsev, V. Hammar ; *CPPM*

EGI grid support
https://gus.fzk.de