Just on time to face new challenges with NEC super-computer at Meteo-France

- Agenda of the procurement
- Presentation of the first phase
- Installation phase (power supply, air cooling)
- Use of a porting machine
- Performance results

* Many thanks for the help from NEC and Meteo-France team

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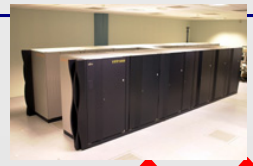
Evolution of main computer facilities at Météo-France



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Main date of the procurement (reminder)

- ***Publication (Joue, Boamp) Mid dec. 04***
- ***Selection of the candidates : end Jan. 05***
- ***Benchmarks : Feb. 05***
- ***Documents : march 05***
- ***First results : June 05***
- ***Second results : Sept 05***
- ***Visit to the vendors : oct. / nov. 05***
- ***Send of the final documents : dec. 05***
- ***Final offer : Jan. 06***
- ***Final decision : May, 15th 2006***
- ***Installation of the system : Sept. 14th***
- ***Acceptance tests (performance) : mid november 06***
- ***Acceptance tests (reliability) : dec 06***

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NEC SX Roadmap

SX-8 Enhancement

SX-6+

SX-8

SX-8R

SX-8X

8CPU/node
9GF-16GB/CPU
72GF/node
9TF/system

8CPU/node
16GF-16GB/CPU
128GF/node
65TF/system

Dec 2004

8CPU/node
35.2GF-32GB/CPU
281.6GF/node
143TF/system

Oct 2006

Next Generation

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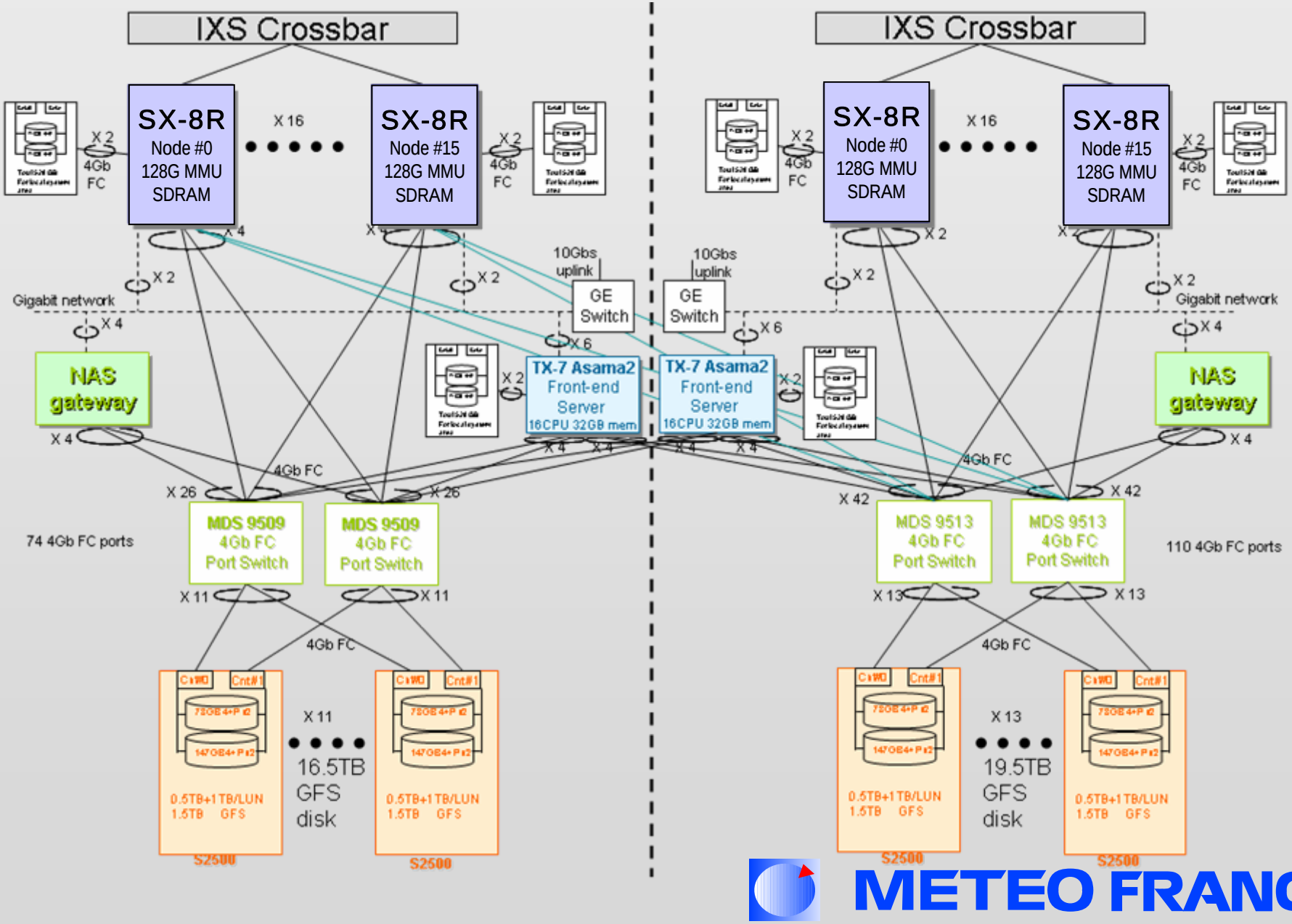
NEC : 1ère phase – sept. 2006

Ratio = 5,33



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Configuration phase 1

- **Factor 5,33 based on 3 tests** :

1- AROME on a small case (Gard)
2- Forecast suite (ARPEGE+ALADIN+ Full-pos each 3 hours)
3- 4Dvar

- **Dimensionning test : AROME!**
- ➔ 2 clusters of 16 nodes (8 procs per node)

Each Pes : 35.2 Gflops = total : 9,1 Tflops (~ 2.3 Tflops sustained)
16 nodes HPC Linpack : 4,058 TFLOPS - 90,07 % peak performance
Communication intra nodes : 563.2 Gb/s
Communication inter node (IXS) : 16 Gb/s bi-directionnal
Cross-section bandwith : 256 Gb/s / Cluster
Memory : 4Tb
Disk space : 52 Tb (12 local)
File system : GFS managed by NAS head
Main access : scalar frontal Asama (16 cores Montecito)
3 Operational systems : Super UX, Linux Suse and one linux for NAS head
Cost : 3.8 Millions euros/ year (5 years)

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Infrastructure

Computer room : 600 m2

phase 1 : 110 m2, phase 2 roughly the same

With the other systems : just enough space!

1500 cables

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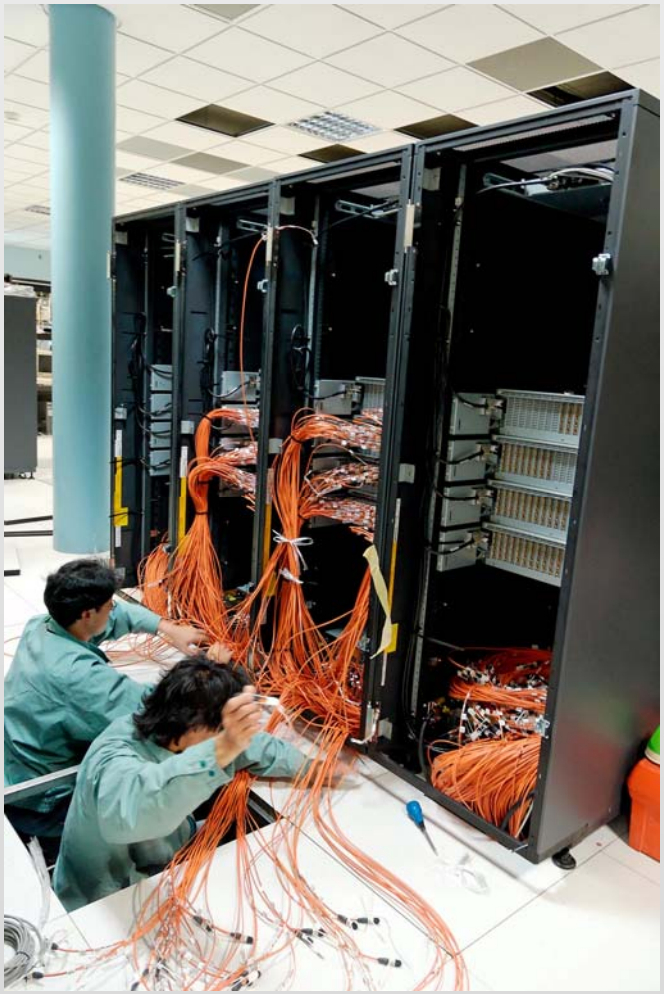

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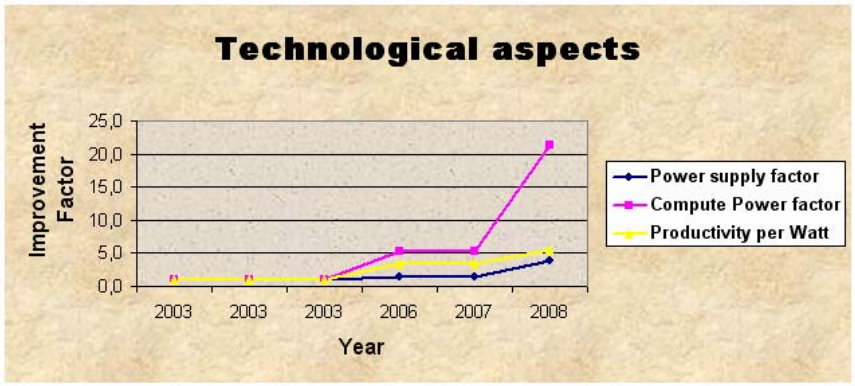
Infrastructure

- **Power supply** :

Announced 270 Kva for phase 1 + 180 Kva VPP5000

Don’t forget power supply for air cooling system!



Phase 2 : target <=700Kva , the limit of the site

If more than this, big work to do! (UPS change, …)

- **Air cooling :**

Phase 1 : from 80 000 m3/H to 230 000 m3/h (the limit of the computer room)

Total : # 650 K euros of work for phase 1 + an increase of electricty bill (more in phase 2!)

- **Power supply, electricity bills, air or water(???) cooling**

will become a big issue/constraint for the next procurement

+ **NOISE….**

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- **SX8R: very interesting architecture :**
  - Mix of scalar and vector processors
  - Balance of vector/scalar speed could be improved
  - Single name space with GFS
  - Mix parallel architecture (Shared memory – Message passing)
  - Peak efficiency
  - Ease of programming & porting
- **Nevertheless the scalar machine (ASAMA2) is used as a front-end system**
  - For batch jobs submission
  - As a files transfer agent with other machines (archiving, pre and post treatment)
  - As a cross-compilation server
- **Locality of files seems really important for direct access files: performance of GFS ???**

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Porting phase

- Access to a porting system (TX7+SX6- 8 procs) and first results (No tuning)
- Interesting to test 2 architectures : TX7 (SMP Itanium 2) and SX6
- Some codes are more efficient on scalar than on vector processors
- Some tests have been performed on both TX and SX!

Preliminary results on NEC

- Results on benchmarks :
  - AROME tests
  - ARPEGE-ALADIN + 2 post treatments (Full-Pos)
  - 4DVAR
- MOCAGE
- Wave applications

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Real Case

GARD flood 8-09-2002

Simulation parameters:

Size 192x192 points

Full Physique

Radiation called every 15'

Coupling every 3h with Aladin France

Begin at 12TU 8 September, end 00TU 9 Sept.

Time step 60s

Goal : As good as referenced mesoNH simulation

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The Arpege global spectral model

(September 2005 specifications)

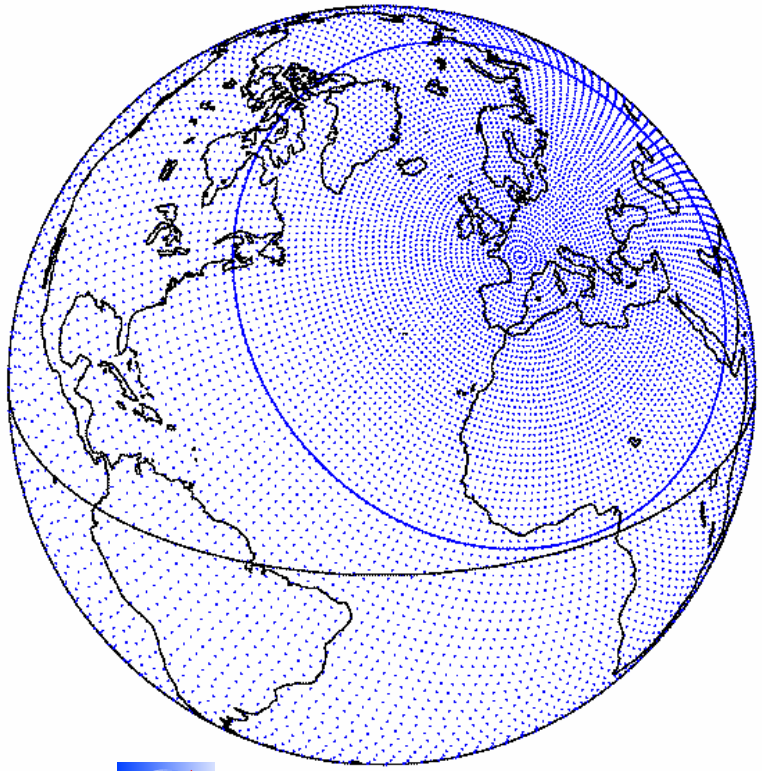
Spectral computation

TL511L41 (grid 720x360x41
- (moved from 41 to 46 levels)

Variable resolution C2,4 with pole of interest over France

Code shared with ECMWF

Arpege grid



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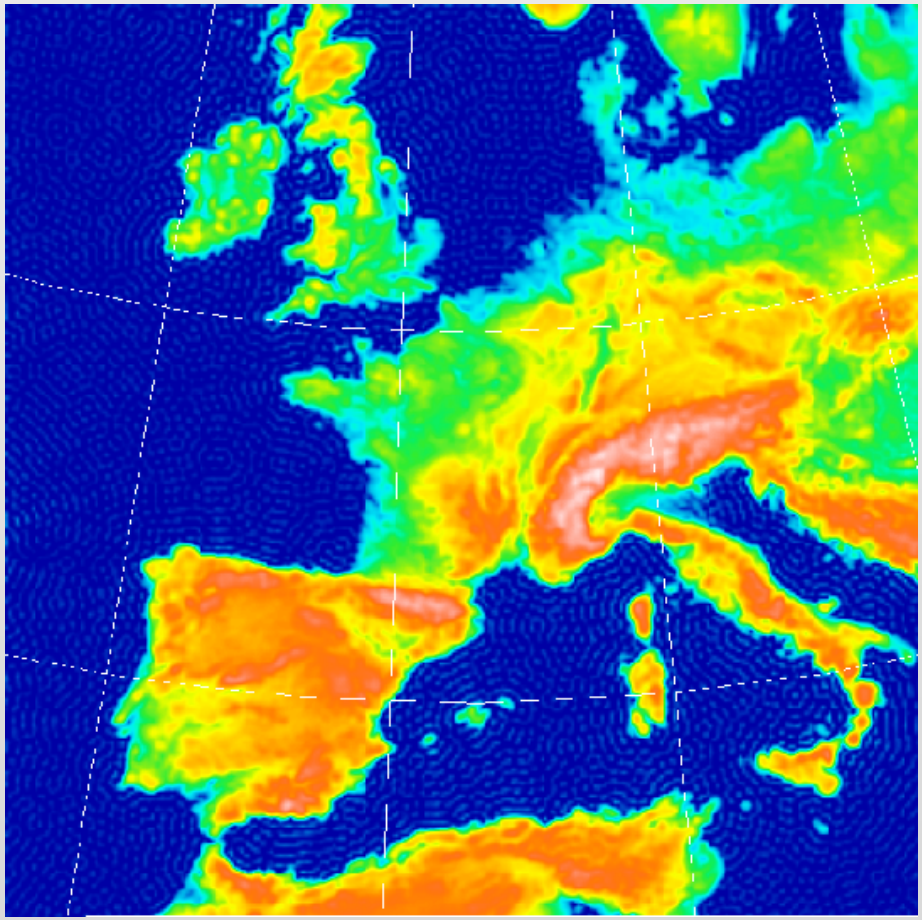
The Aladin-France limited area model



Representation of orography as it is taken into account in the Aladin-France model (Hor. Resol = 9km)

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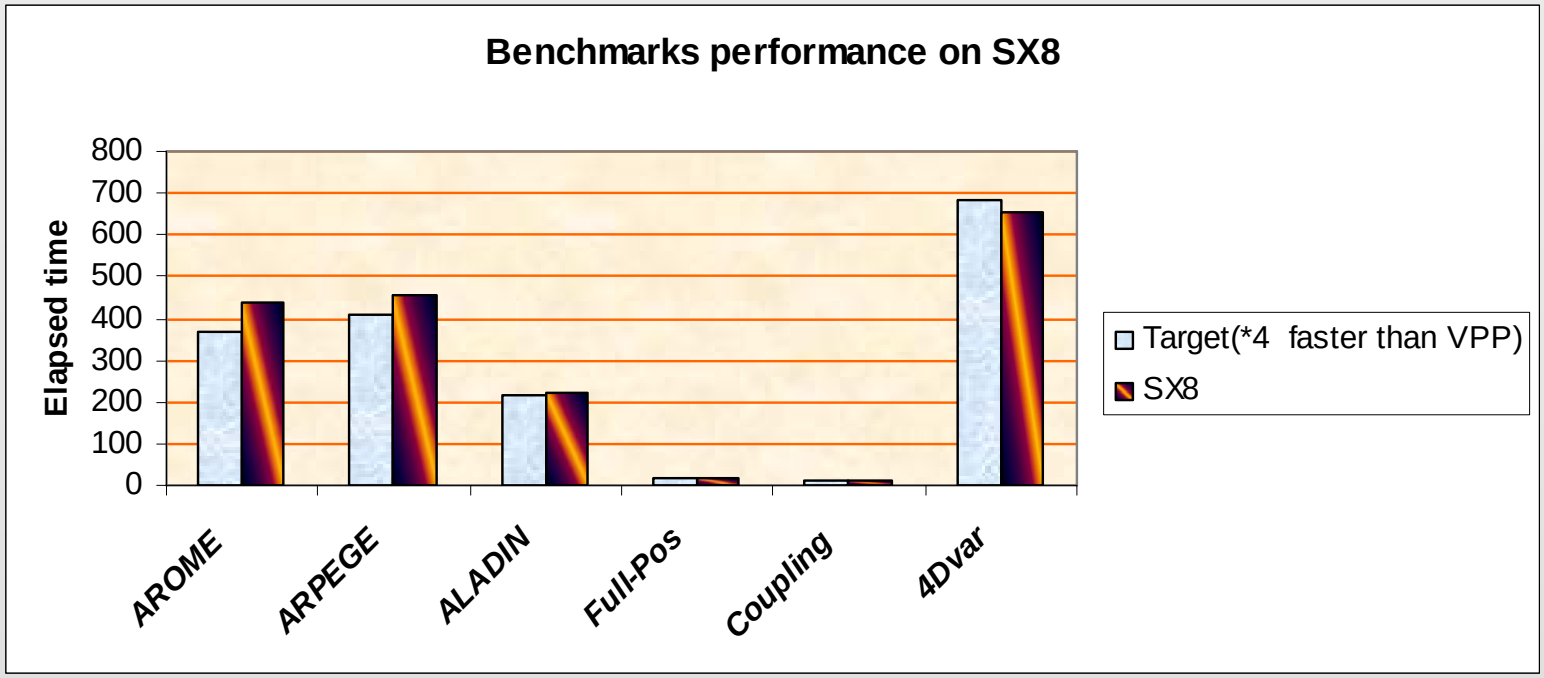

- Results obtained during the benchmarks phase on SX8
- Factor 4 achieved
- On the new machine (SX8R), we'll expect factor 5.33 (and 8 on 4Dvar)

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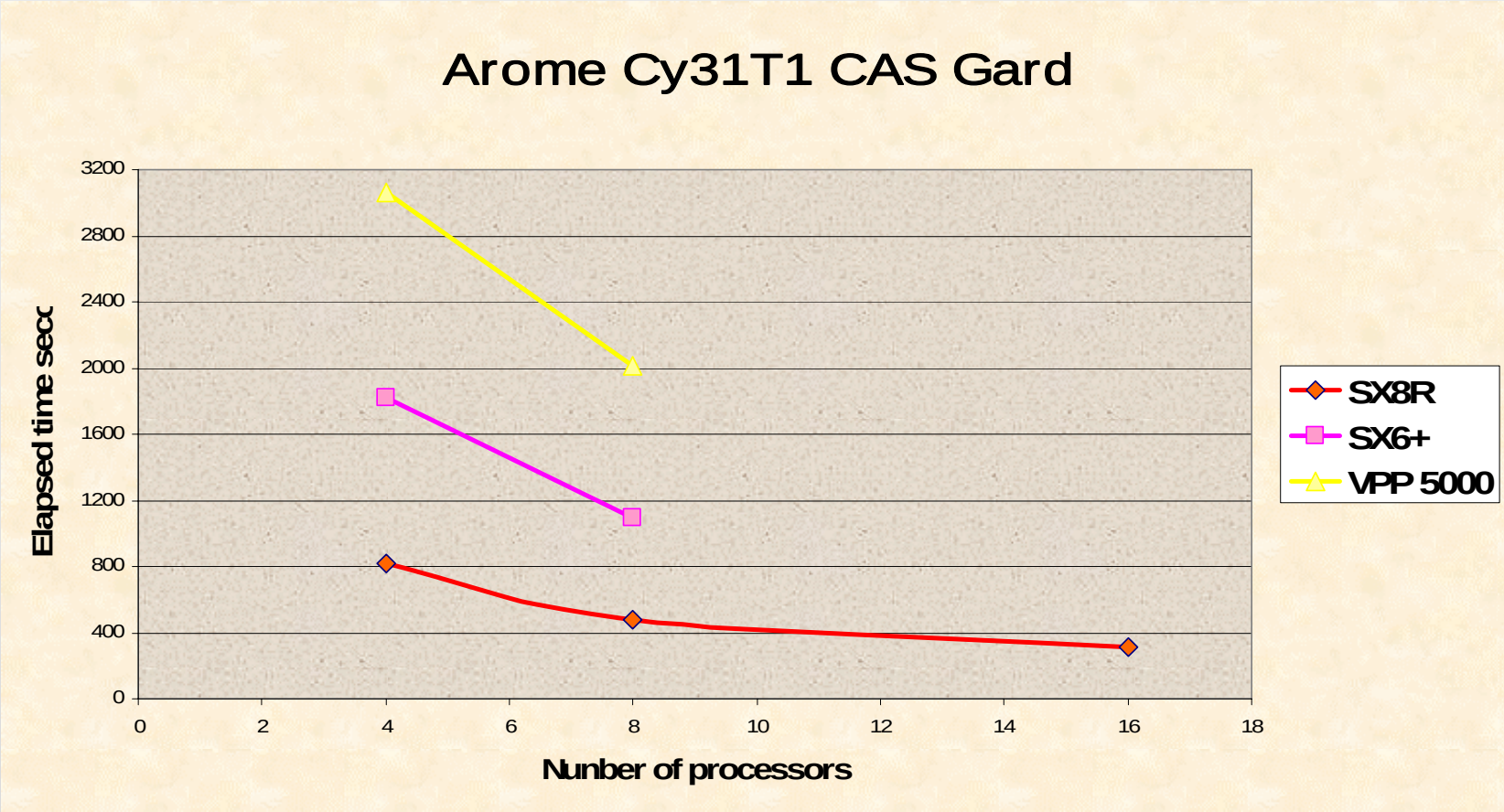

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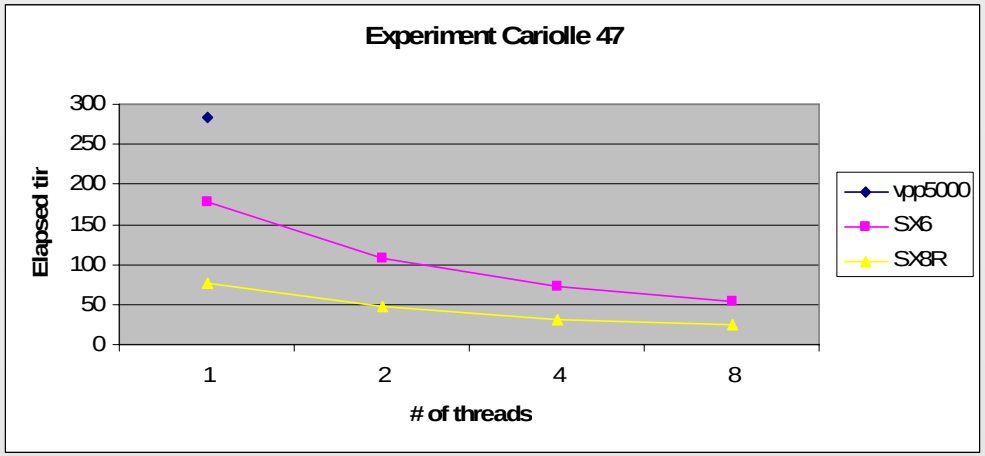

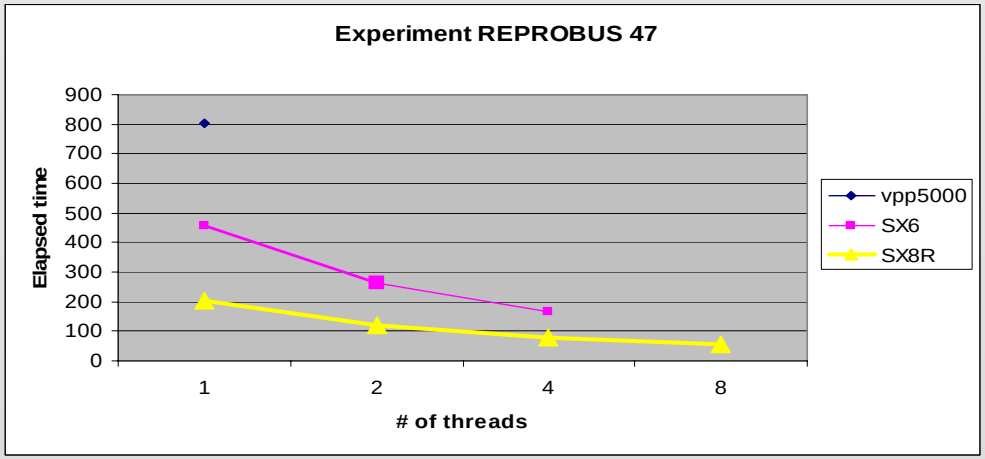

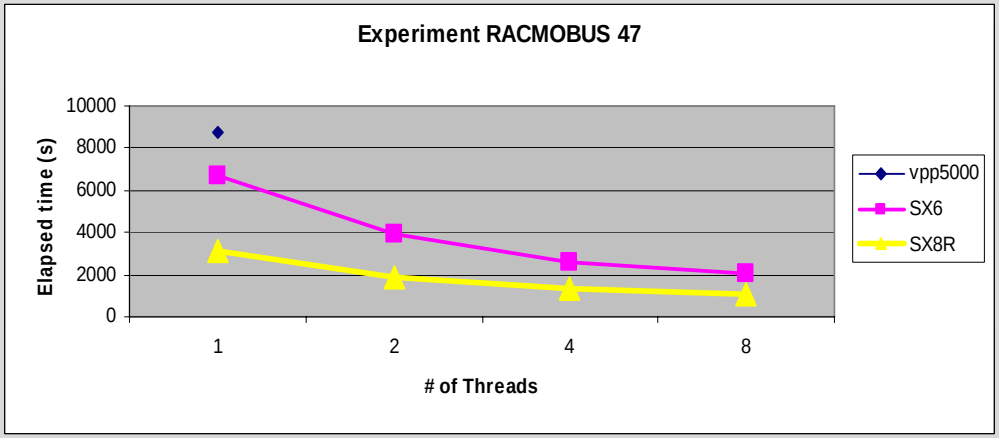

MOCAGE

Chemical transport model

Good ratio betwen SX8R and VPP

- (3.6, 4 and 2.8)

Scalability :

- ~2,5 for 4 threads
- ~3.3 for 8 threads for SX6
- a little bit less for SX8R

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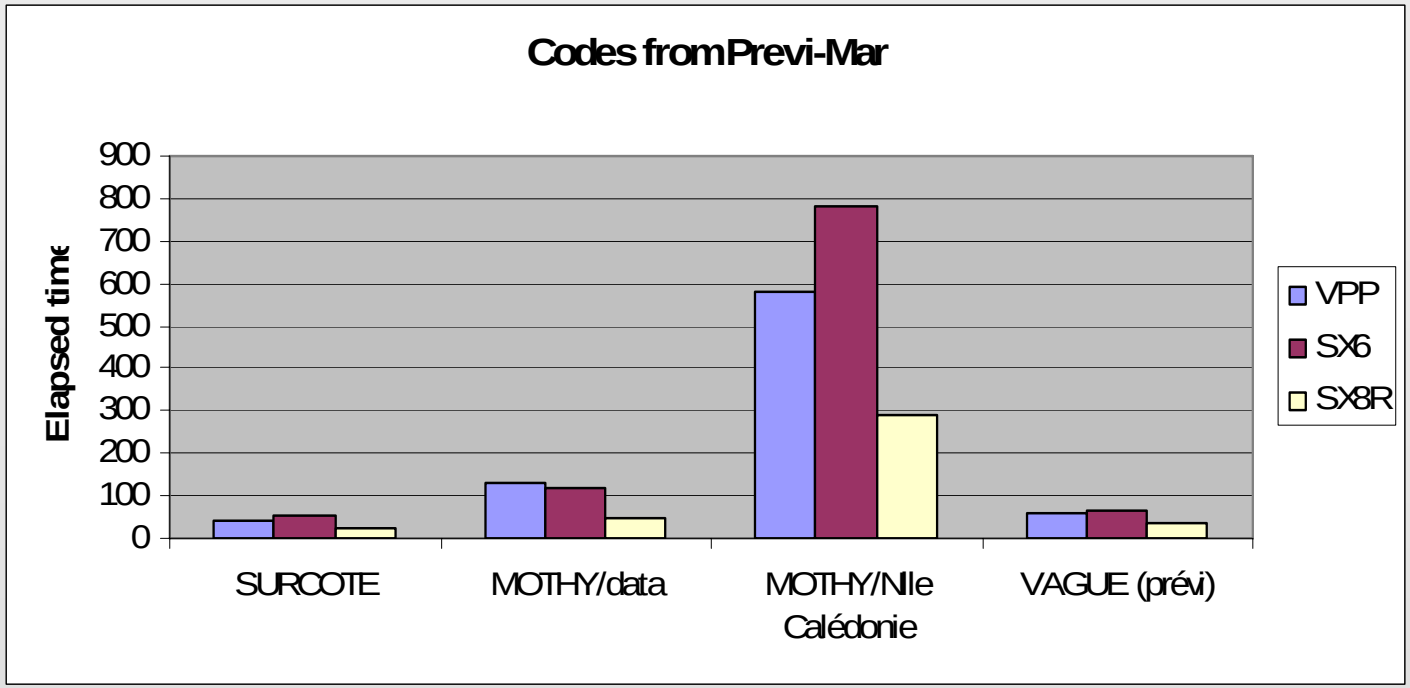

- *Surcote code is more efficient on VPP than SX-6 (exception but the smallest one)*
- *Ratio of 2.7 between VPP and SX8R on Mothy data*
- *Ratio around 1,9 for the other cases*

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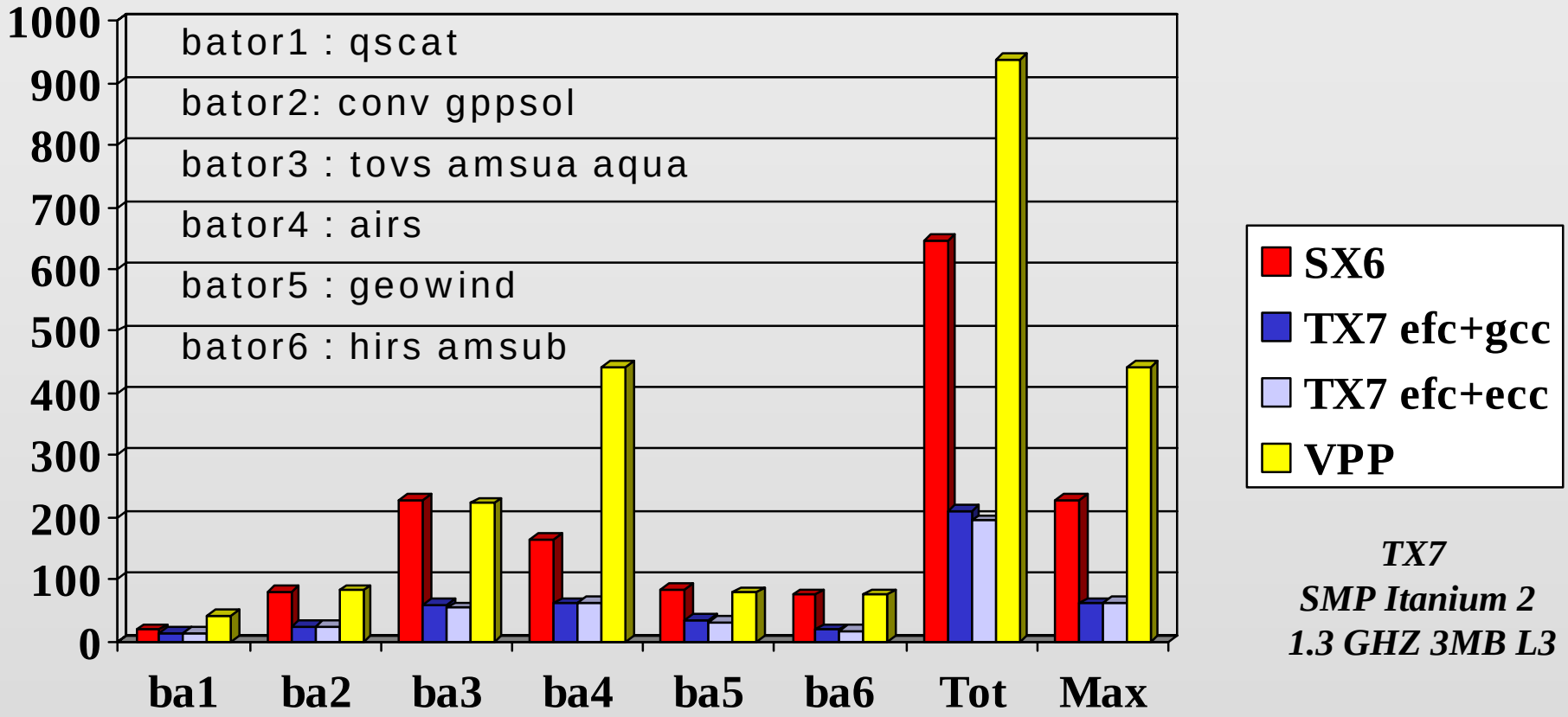
Tests bator-odb



TX7
SMP Itanium 2
1.3 GHZ 3MB L3

Real cases (oper) ran by *Guillaume Beffrey(GCO)*

Efc : scalar fortran compiler from NEC, ecc : C compiler C from NEC

With C compiler gcc, : ratio 1,3 to 4,1 and with ecc (NEC) ratio from 1,6 to 4,5

Bator Sequential run Bator : ratio 3,1 to 3,3.
Bator parallel run ratio from 3,7 to 3,8

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Conclusions

- On schedule to implement the operational suite on NEC
- Acceptance tests will start mid-november
- Excellent results of the SX-8R with Mocage
- Hybrid architecture (mix of scalar and/or vector processors)?
- Infrastructure challenge in phase 2
- Future issues : power supply, space, air (or water) cooling for 2010

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