Advanced Numeric for Elm's : Models and Optimized Strategies (ANEMOS)

ANR-11-MONU-002

Oct. 2011 to Sep. 2015

Partners and Teams

- /JAD &INRIA **Nice Sophia-Antipolis** : 120 Months.
  B. Nkonga, A. Dervieux, H. Guillard, A. Sangam, ...
  A. Galligo, B. Mourain, ...

- /IRFM **Cadarache** : 70 Months
  M. Bécoulet, V. Grandgirard, G. Latu, C. Passeron, ...

- /BACCHUS **Bordeaux Sud-Ouest** : 35 Months
  P. Ramet, F. Pellegrini, ...

- /MDS **Ile de France Sud, Saclay** : 50 Months
  E. Audit, P. Kestener, D. Pomarede, B. Thooris, M. Mancip...

Goals for ANEMOS : Toward Elm's control.

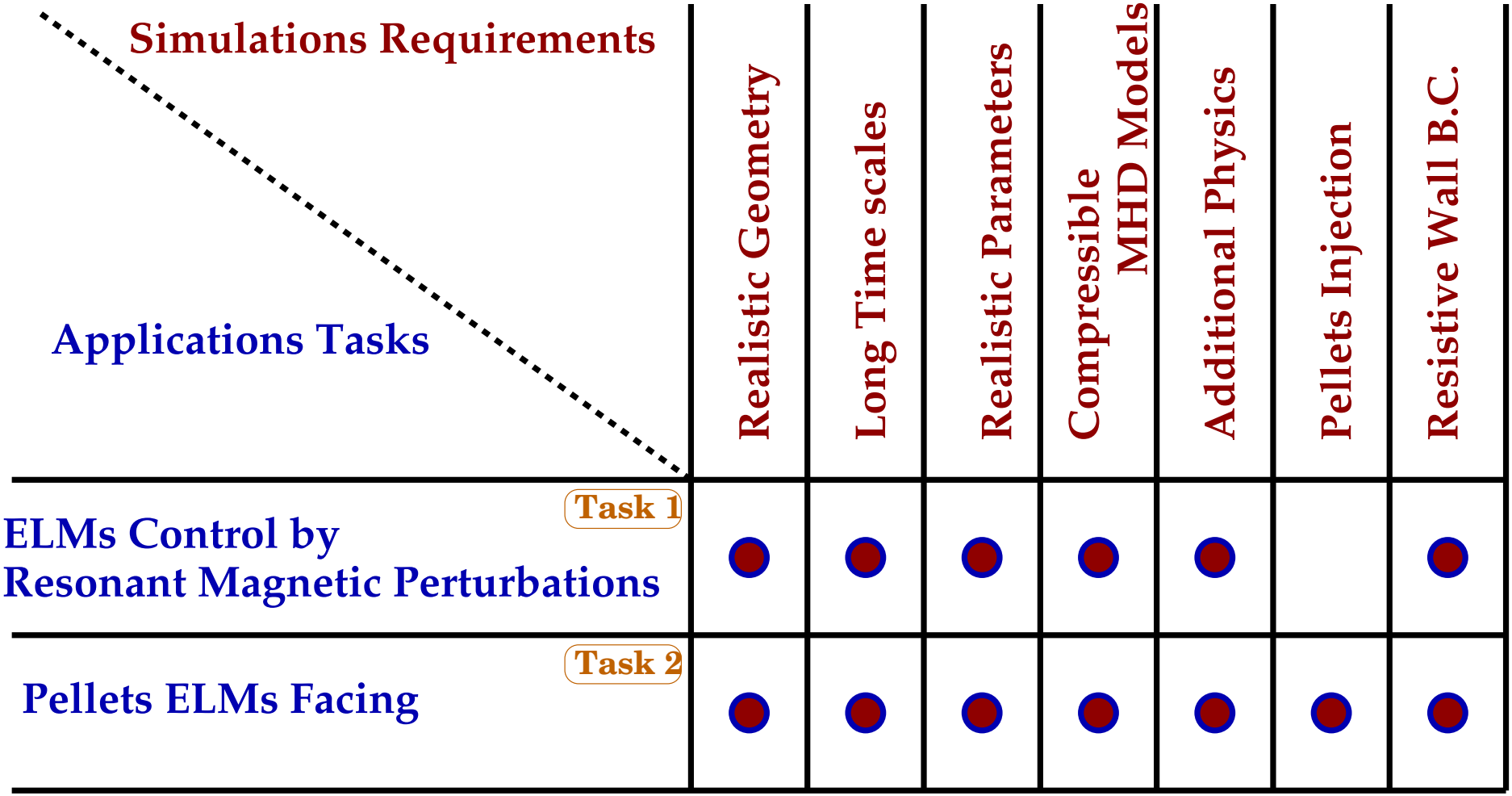
1. Developed and improved numerical tools (JorekX)
2. in order to simulate physical mechanisms of Elm's
3. and qualified some strategies for their control
4. Make them efficient on the most advanced computers available
5. to contribute to the science base underlying of proposed burning plasma
6. tokamak experiments such as ITER

Goals for ANEMOS : Toward Elm's control.

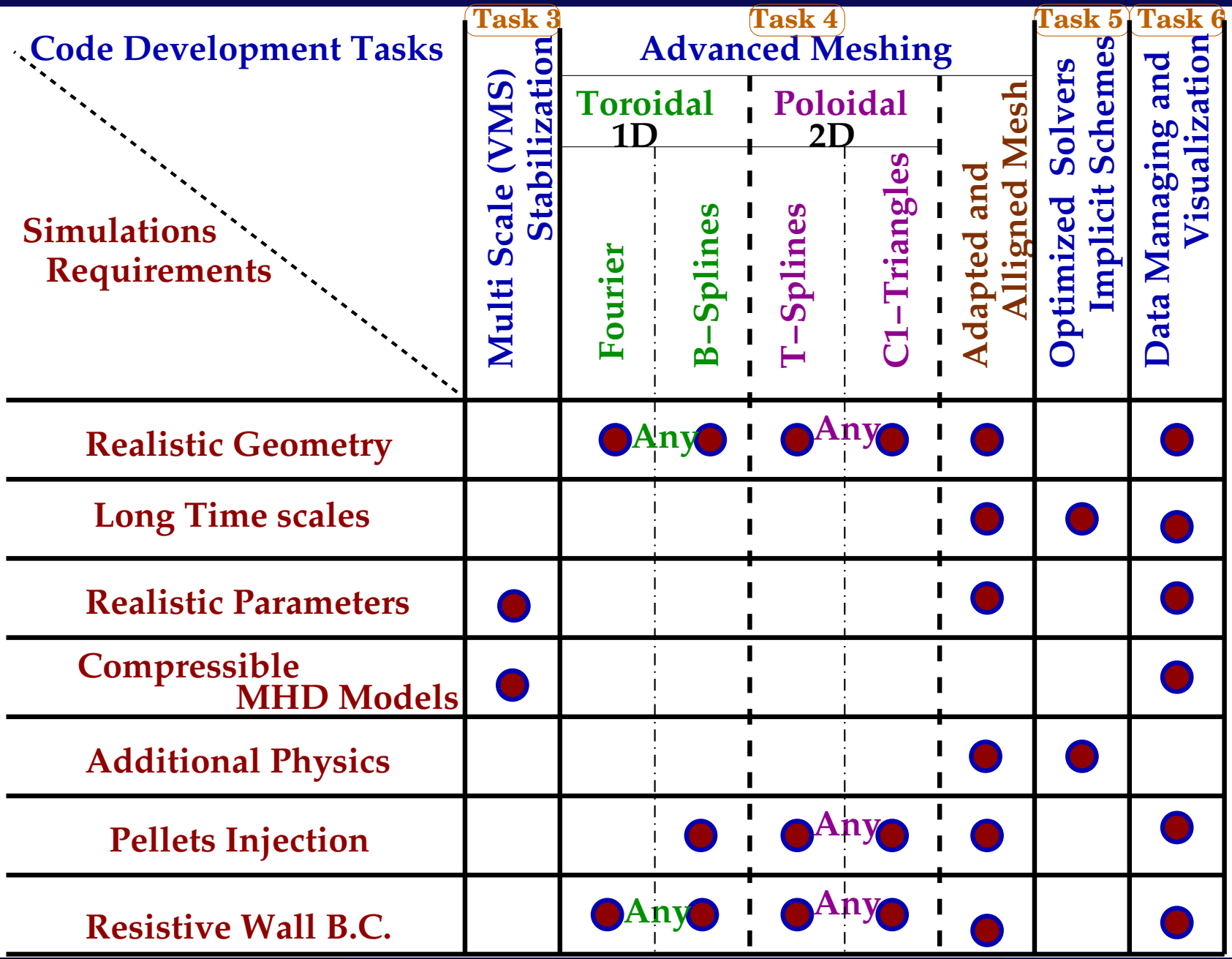
Main tasks for 4 -1 = 3 years research investigations.

1. Elm's control by Resonant Magnetic Perturbations.
2. Modeling of pellets Elm's pacing.
3. Numerical algorithm optimizations and parallel scaling.
4. Higher-order-of-continuity advanced meshing.
5. VMS stabilization for compressible MHD models.
6. Visualization, data management and code integration.

Applications Tasks versus Simulations Requirements



Simulations Requirements versus Code Development tasks.



Man power Funding :: **16 Years $\simeq$ 4 Mens/Year**

	JAD/INRIA	CEA/IRFM	INRIA/BACCHUS	CNRS/MDS
PhD's	J. Costa	F. Orain	X. Lacoste	J. Vides
Post. Doc.	M. Wu 12	A. Ratnani W. Haverkort		36
Master		6	2	4

	JAD/INRIA	CEA/IRFM	INRIA/BACCHUS	CNRS/MDS
RMP		Yes		
Pellets	Yes			Yes
VMS	Yes			Yes
A. Mesh	Yes	Yes		
Op. Linag	Yes	Yes	Yes	
Data/Vis.			Yes	Yes

Schedule 48 months : 01/09/11 to 30/08/15

[redacted]	18 24	30 36	40 48
report	Report&show	Report	Final Report

[redacted] Task 1 : Elm's control by Resonant Magnetic Perturbations.

Extended fluid models neo-classical viscosity.	Implementation of RPM physics and validations with more relevant parameters: JET size tokamak.	
Neoclassical Equilibrium for JET and ITER.	Nonlinear simulations of Elm's interactions with RMPs : ITER-size machine	

[redacted] Task 2 : Modeling of pellets ELMs pacing.

Numerical tools for 3D curvilinear Beziers patches.	Numerical implementation of the code version using 3D curvilinear Beziers patches.	
Applications to Pellets Elm's Pacing:by mass source term and latter by a simple model for pellet dynamic		

[redacted] Task 3 : Numerical algorithm optimizations and parallel scaling.

Reduce memory footprint	Optimize & load balance. Improve time-stepping scheme	
Investigate alternative sparse solvers		

Schedule 48 months : 01/09/11 to 30/08/15

6 12	18 24	30 36	40 48
??	Report&show	Report	Final Report

Task 4 : Higher order of continuity Advanced Meshing.

Global analysis, strategies for the resolution.	Implementations and Validations for MHD simulations.	
Development of automatic mesh aligned C1-Splines for general quadrangular subdivisions.	Development of automatic C1-Splines for triangular meshes.	

Task 5 : VMS stabilization for compressible MHD models.

Global analysis for MHD Models.	Code development for full MHD models: Improvement.	
Code development for reduced MHD. Numerical Validations.	Upgrade of VMS Stabilized Version of Jorek.	

Task 6 : Visualization, data management and code integration.

Analysis of existing software and graphical libraries	Formation to production of scientific pictures &movies. CEMRACS'14	
Visualization tool for quadrangular and curvilinear meshes.	Visualization techniques for high order resolution fields.	

Report T0+18 :: Contributions before 15 March 2013

ste. Louise

1. Elm's control by Resonant Magnetic Perturbations (10H30-11H15)
   - Extended fluid models neoclassical viscosity.
   - Neoclassical Equilibrium for JET and ITER.
2. Modeling of pellets ELMs pacing (11H15-12H00).
   - Numerical tools for 3D curvilinear Beziers patches.
3. Higher order of continuity Advanced Meshing (14H00-15H00).
   - Global analysis, strategies for the resolution.
   - Automatic mesh aligned C1-Splines
4. VMS stabilization for compressible MHD models (15H00-17H00).
   - Global analysis for MHD Models.
   - Code development for reduced MHD and Numerical Validations.
5. Numerical algorithm optimizations and parallel scaling 9H00-11H00.
   - Reduce memory footprint
   - Investigate alternative : Multigrid and deflation strategies.
6. Visualization, data management and code integration.
   - Analysis of existing software and graphical libraries.
   - Visualization tool for quadrangular and curvilinear meshes.

Program

ste. Louise