



PROGRAMME
DE RECHERCHE
CALCUL HAUTE
PERFORMANCE



The NumPEEx Program

Co-directors: Dr J. Bobin (CEA), Pr M. Krajecki (CNRS), Dr J-Y. Berthou (INRIA)

Project leaders and co-leaders

ExaMa - Pr C. Prudhomme, U. de Strasbourg – Hélène Barucq (Inria)

ExaSoft - Pr R. Namyst, Inria/U. de Bordeaux - Alfredo Buttari, IRIT

ExaDost - Dr G. Antoniu, INRIA - Julien Bigot, CEA

ExaAtoW - Pr F. Bodin, U. de Rennes - Mark Asch, U. Picardie - Thierry Deutsch, CEA

ExaDIP - Dr J-P. Villette, DR CNRS - Valérie Brenner, CEA

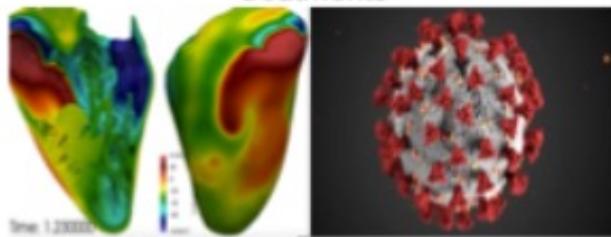
The French NumPEX Program

Exascale, what's at stake ?

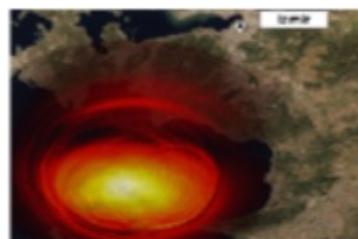
Exascale for scientific breakthrough, environmental sustainability, resilient society, and industrial competitiveness

Answering key scientific questions

Supporting the development of COVID-19 treatments



Weather and climate models

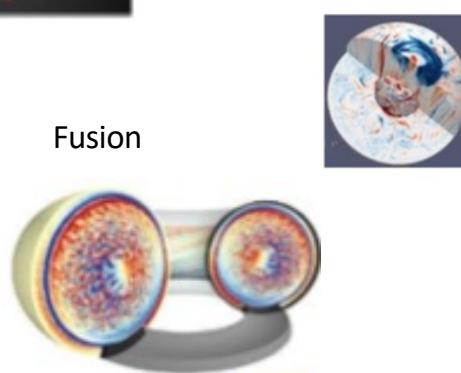


Earthquake simulation

Astrophysics



Fusion



Leading to engineering breakthrough





The French NumPEX Program Context and motivations

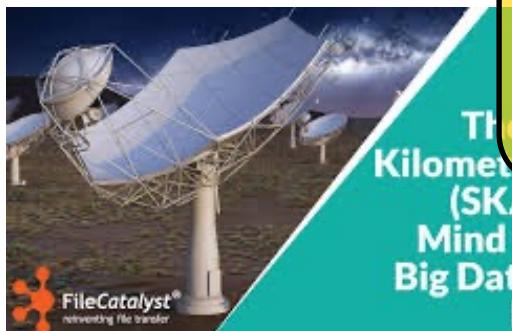


A technological breakthrough

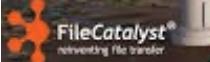
*Hybrid scalar/acc.
fewer memory/node
more concurrency*

*In the digital continuum
Increased flux/volume
from the edge to the
HPC system*

*Convergence
HPC/HPDA/IA*



The Square Kilometer Array (SKA) & The Mind Blowing Big Data It Will Produce



Traditional
HPC
Systems

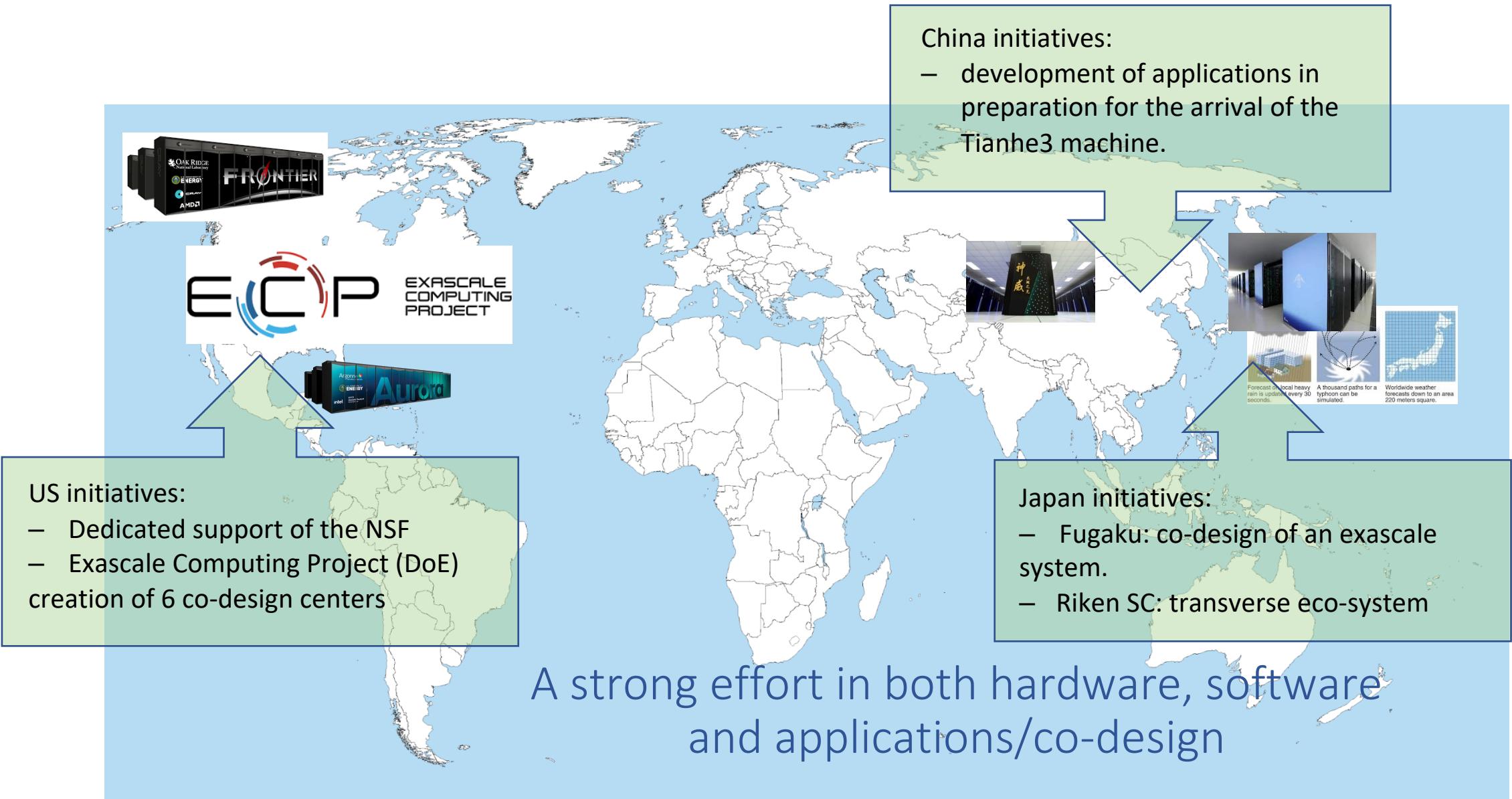
**Large-Scale
Numerical
Simulation**

**Scalable
Data Analytics**

**Deep
Learning**

**Capable
Exascale system**

Context - International initiatives pre-arrival of exascale computers



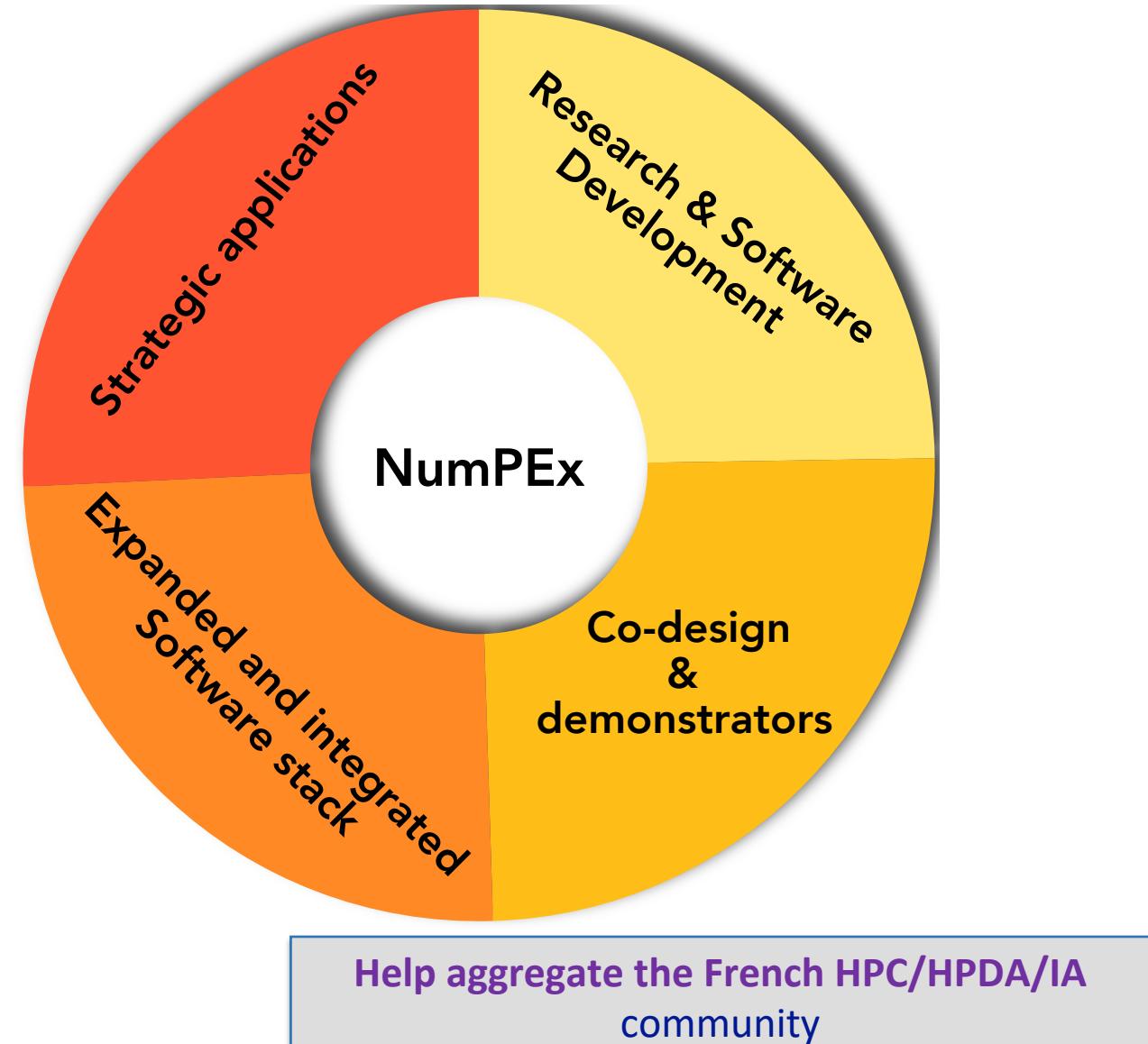
Context - European initiatives





The French NumPEx Program

Objectives



Contribute and accelerate the emergence of a European sovereign exascale software stack and strategic applications exascale capability in a coherent and multi-annual framework

Integrate and validate **co-designed** innovative methods, libraries and software stack with demonstrators of strategic applications.

Accelerate science-driven and engineering-driven developers **training and software productivity**

Foster national and international collaborations to prepare for the Exascale and post-Exascale era

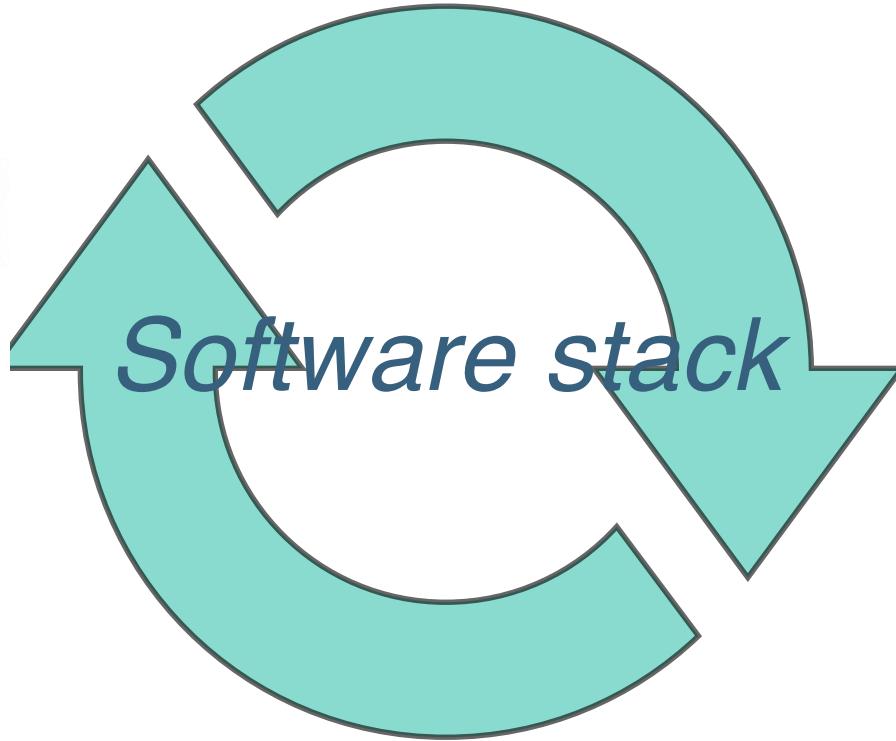


The French NumPEX Program

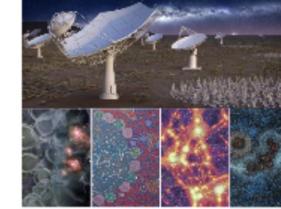
Objectives



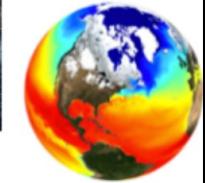
European Pre-Exascale system



Applications



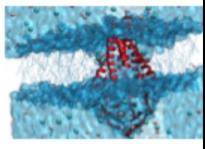
Astronomy & Astrophysics



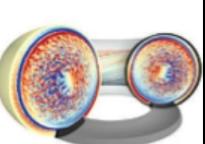
Climate



Earth system & environment



Plasmas physics and accelerators

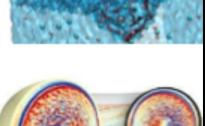


Particle physics

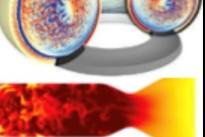


Quantum chemistry and materials

Energy



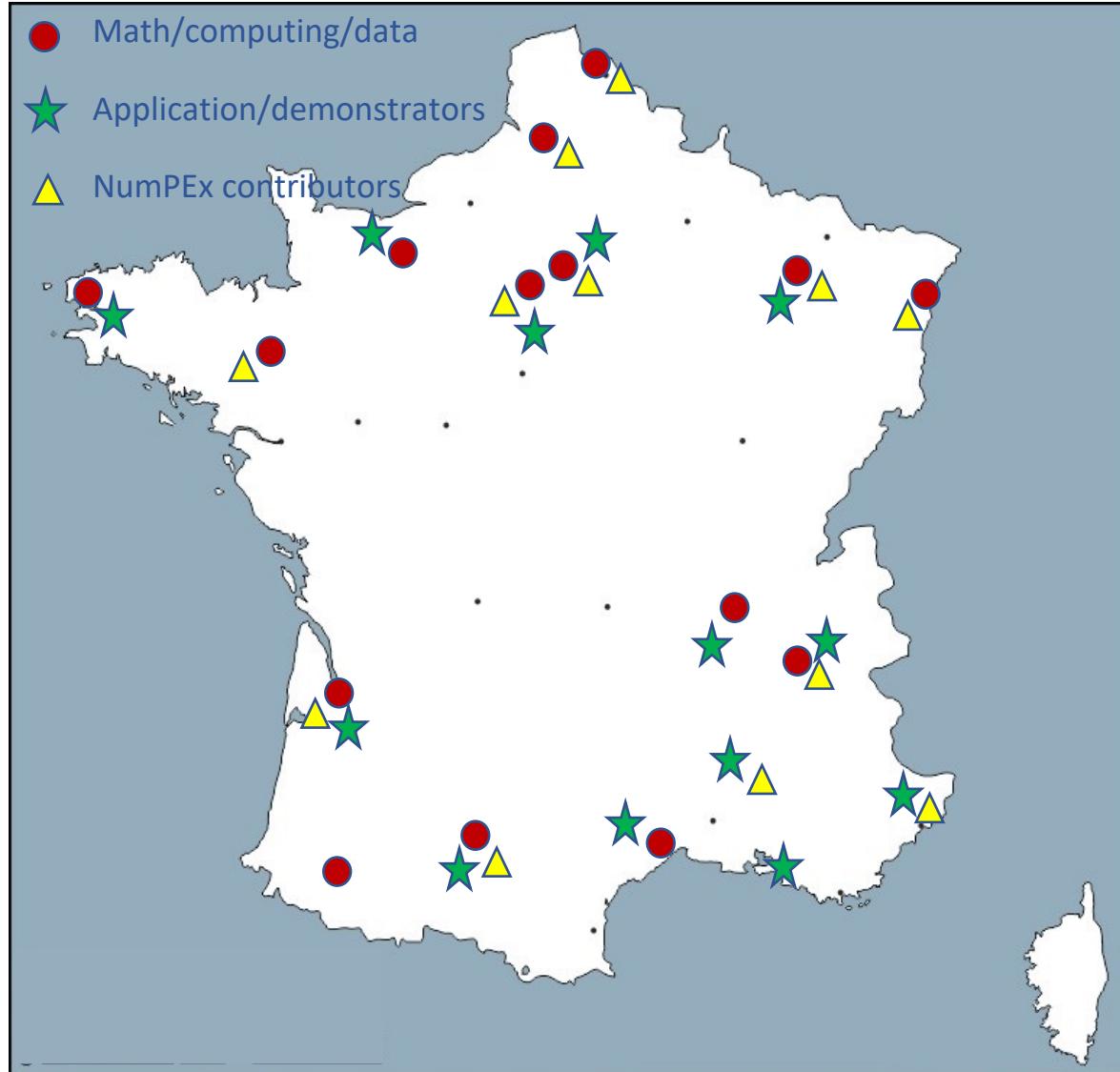
Biology and Health science



Industrial applications

Co-design the exascale software stack
Preparing the applications for the Exascale era

NumPEX by numbers



**6 Years
41 M€***

2023-2028

* Funding 41M€=500 man.year non permanent staff
+ 170 man.year permanent staff
Total cost : 81 M€

Core Research Institutions

Core national Research Institutions:
CNRS, CEA, INRIA, Universities,
Engineer schools, Industry

3 Focus Area

Software stack development (PC 1-3)
Wide-area workflows and architecture (PC 4)
Integration and application development (PC 5)

**80 R&D teams
500 Researchers**

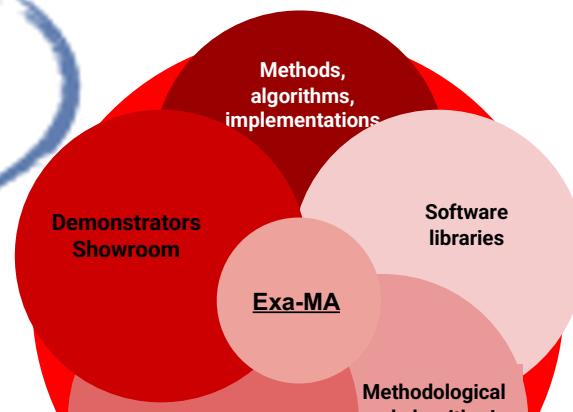
NumPEX - workplan



Applications



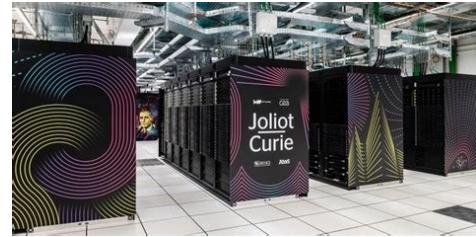
ExaMA
*Numerical methods
and solvers*
C.Prudhomme/H.Barucq



NumPEX - workplan

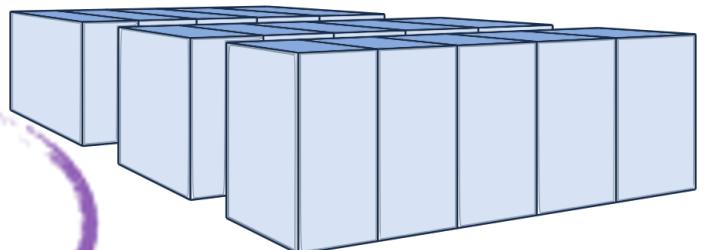
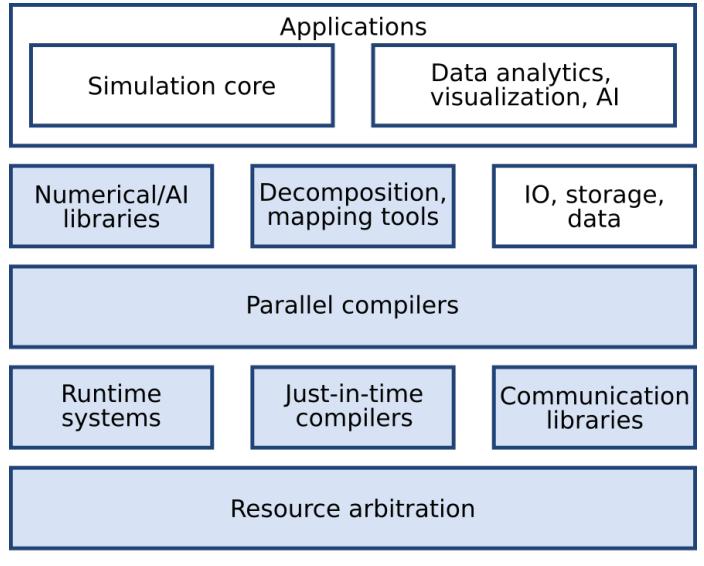


Applications



ExaMA
*Numerical methods
and solvers*
C.Prudhomme/H.Barucq

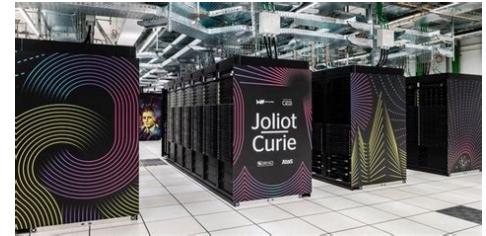
ExaSoft
Computing
R.Namyst/A.Butari



NumPEX - workplan

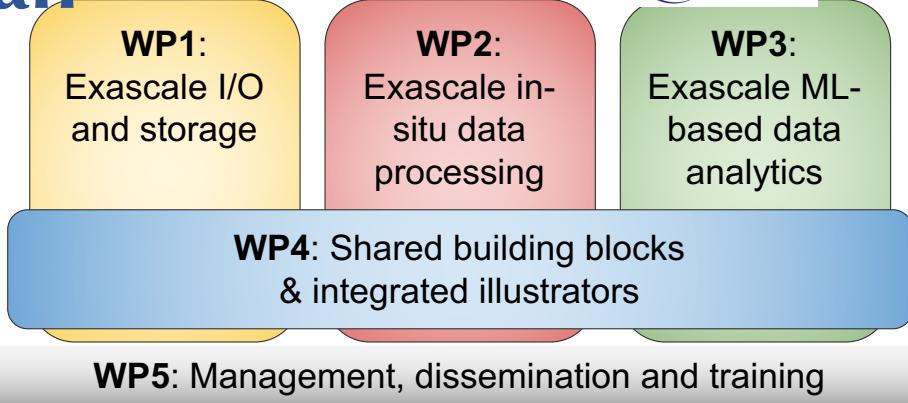


Applications



ExaMA
*Numerical methods
and solvers*
C.Prudhomme/H.Barucq

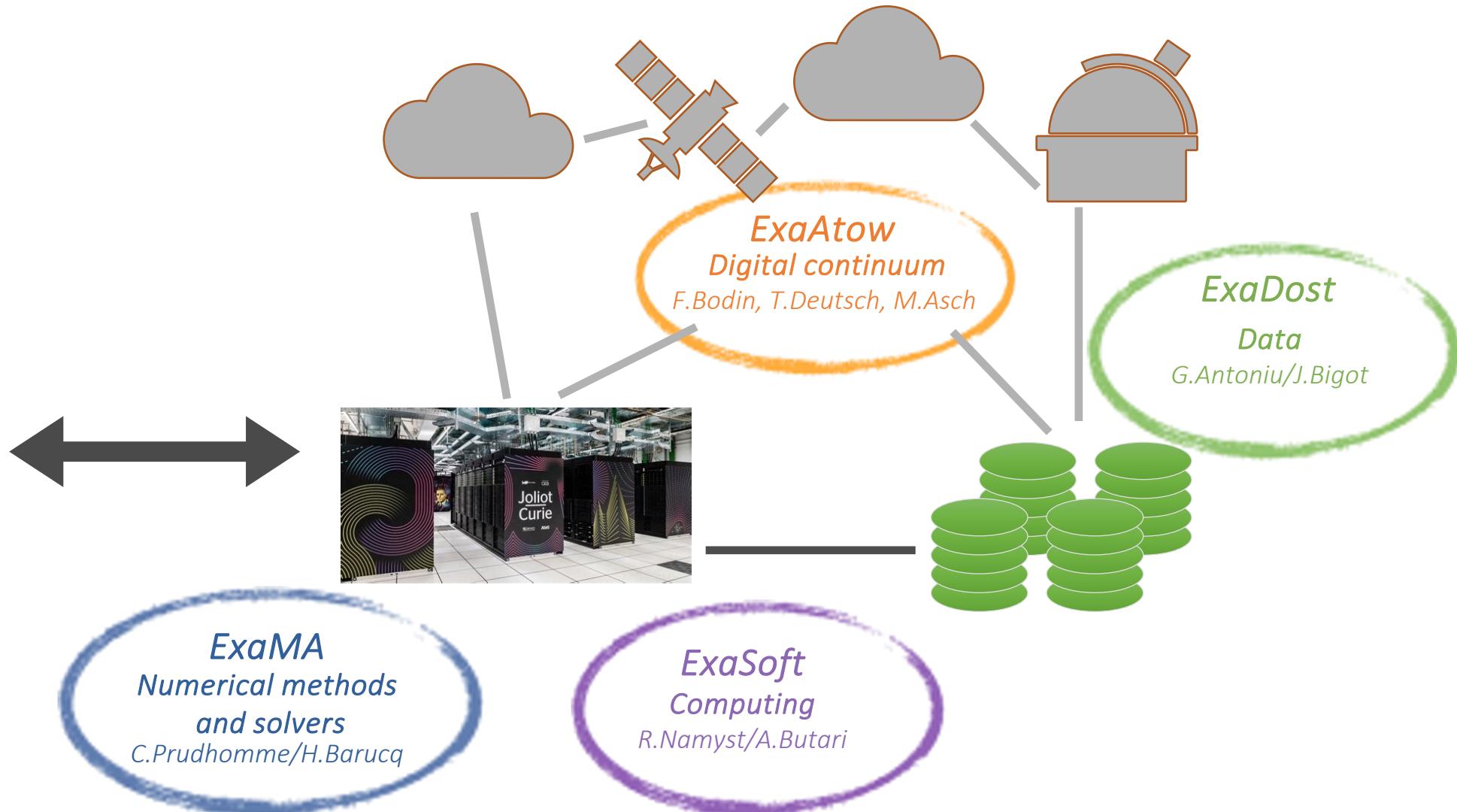
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Data
G.Antoniou/J.Bigot



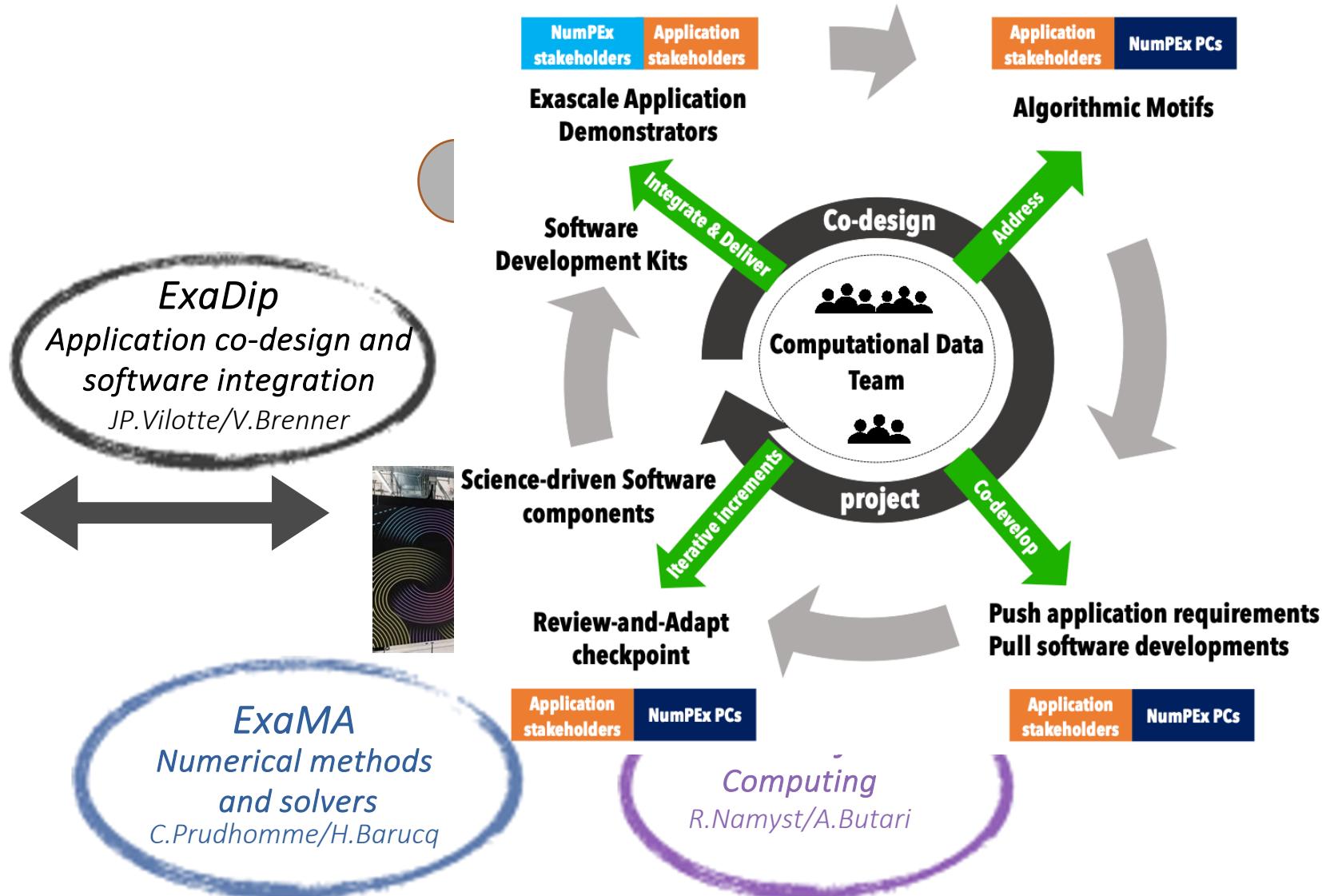
NumPEX - workplan



NumPEX - workplan



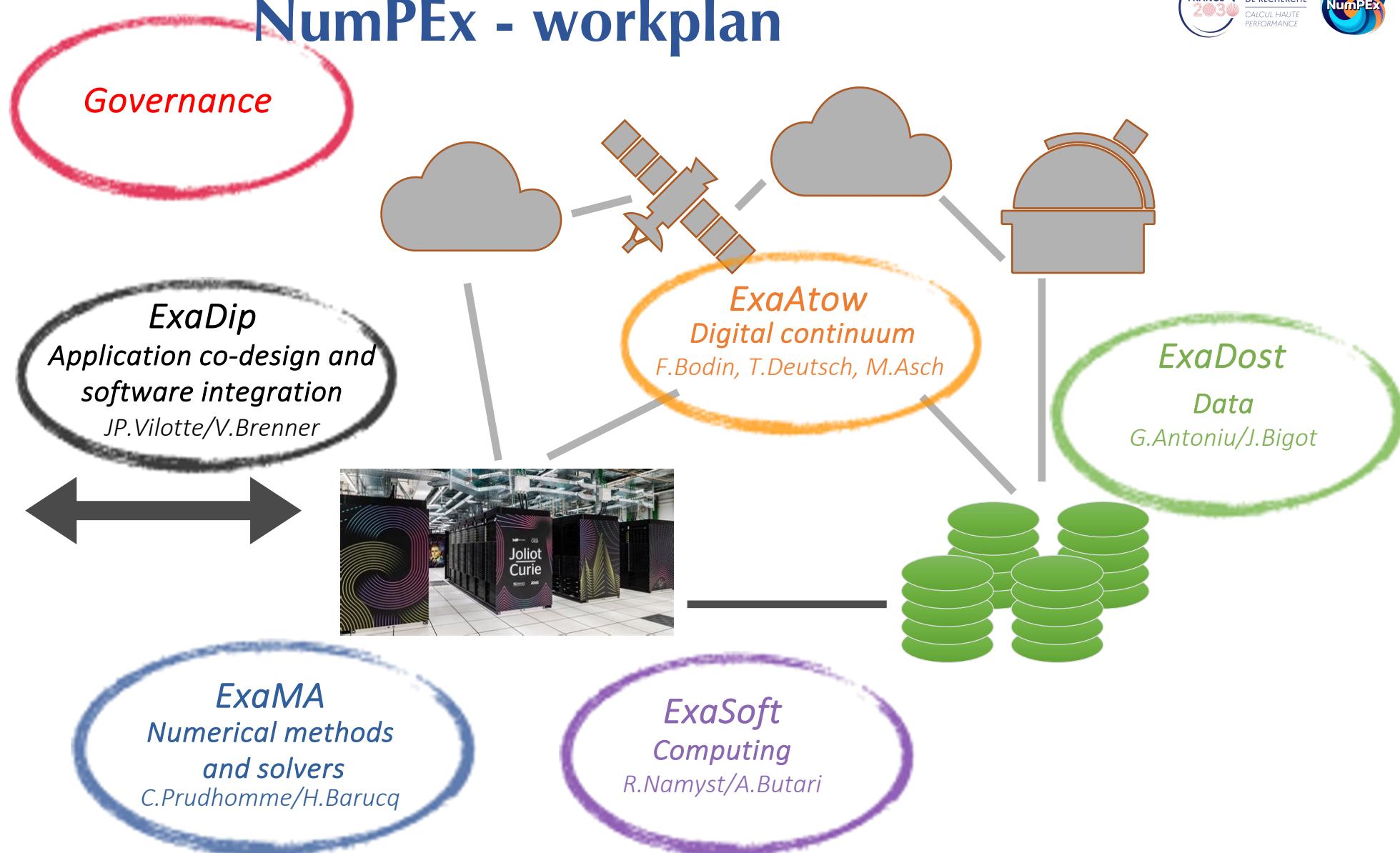
Applications



NumPEX - workplan



Applications





NumPEX – Transversal actions

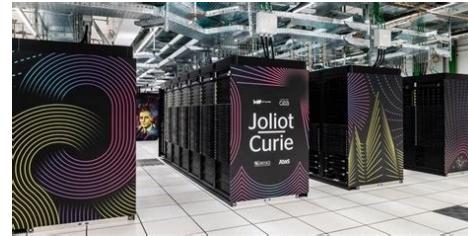
Resilience
L. Morin

*Software production &
Intégration*
B. Raffin

*Accelerator
prog.*
S. Thibault

HPC - IA
T. Moreau

Energy
G. Da Costa, A.
Guermouche



Applications

NumPEX – Transversal actions



Software production & Intégration
B. Raffin

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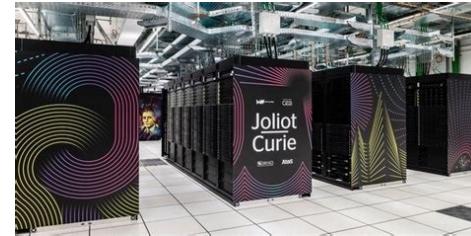
HPC - IA
T. Moreau

Energy
G. Da Costa, A. Guermouche

*Gender/Equity/
Diversity*
Anne-Laure Pelé &
Virginie Grandgirard

Training
M. Krajecki, R. Namyst, C.
Prudhomme

*Int.
Collaborations*
JY Berthou, E. Jeannot



Take-away messages

NumPEX is an ambitious programme to:

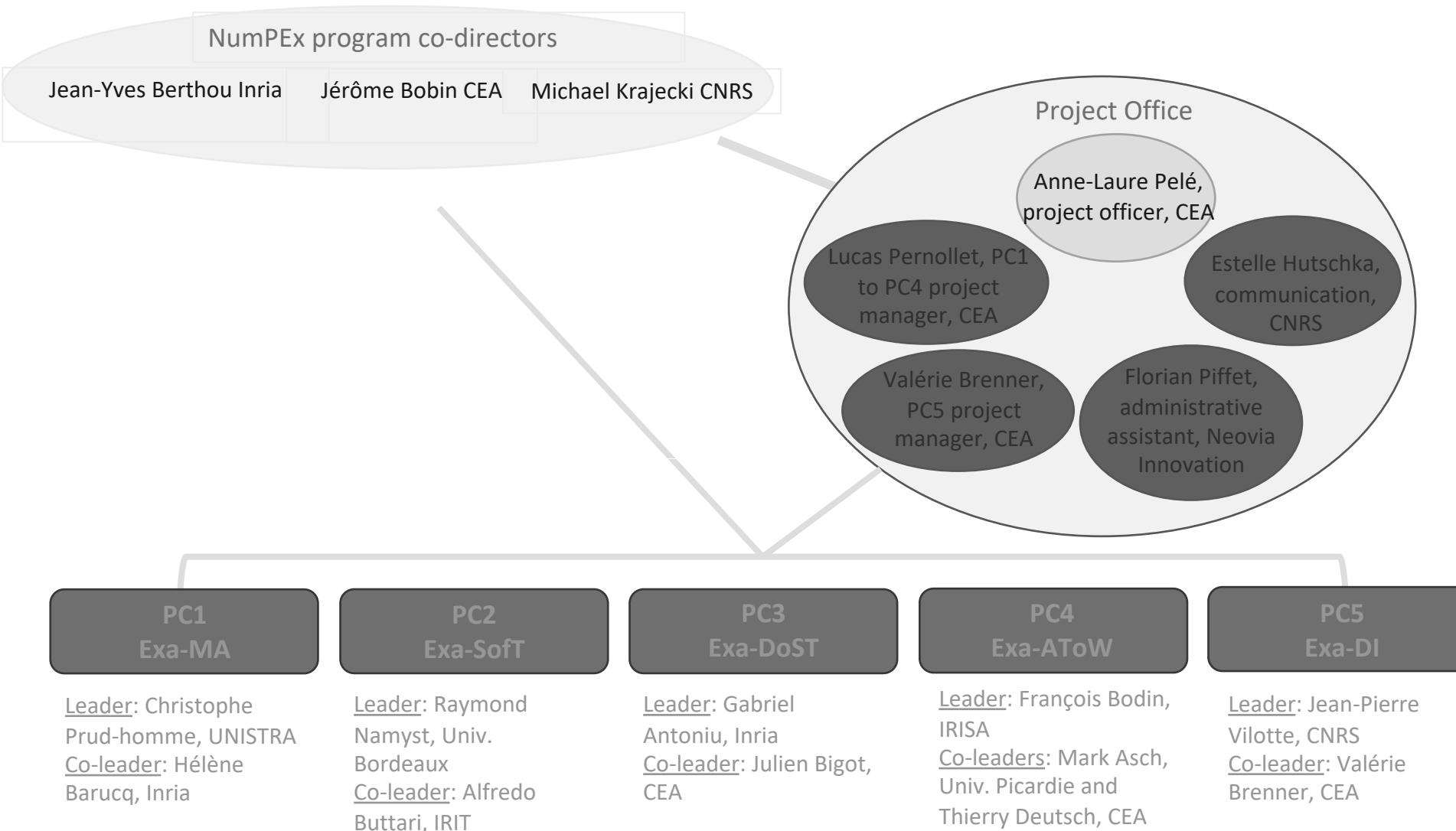
- *contribute to the European Exascale software*
- *help preparing scientific and industrial applications to the Exascale*
- *bridge the gap between the computer science/application communities*
- *help building a French community for advanced scientific software development*
- *Foster national and international collaborations (e.g. other PEPRs, CoEs, etc)*

Stay tuned

www.numplex.fr

 #NumPEX

Project office & Operational committee



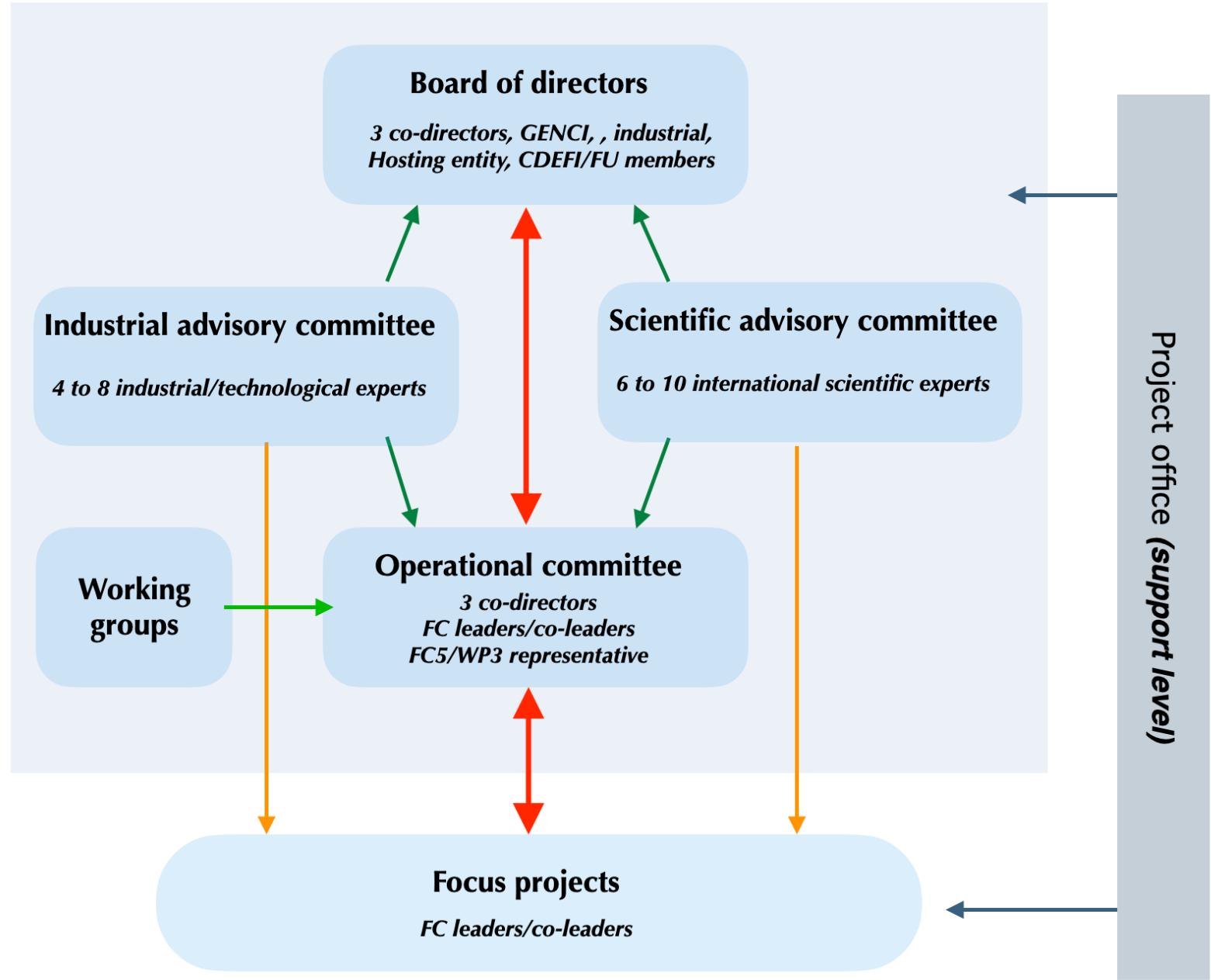
Coordination 

Evaluate 

Advise 

Support 

Report 



NumPEX consortium

National Research Organisation

CEA, CNRS, Inria

IFPEn

Onera

Industry

Atos

DataDirect networks – DDN

Airbus

Sipearl

Fermat

Intel

En discussion : Safran, EDF, Total, Thales, ...

Engineering school

Bordeaux INP

Institut Polytechnique de Paris/Ecole
Polytechnique, Télécom Sud Paris

University

Université de Bordeaux

Université Paris 1 Panthéon-Sorbonne

Université de Lorraine

Université de Strasbourg

Université Clermont-Auvergne

Université de Toulouse 3

Université Gustave Eiffel

Université de Lille

Université de Pau

Université de Picardie

Sorbonne Université

Université Paris Saclay

Université de Rennes

Observatoire de Paris

Observatoire de la Côte d'Azur

Université de Grenoble