EuroHPC and supercomputing

Dr. Giuliano Taffoni

INAF- OATs

HPC pillars in Europe

HPC resources from member countries

FET-HPC European Investment

PRACE

The HPC history by milestones

- Ancestor 2002 – DEISA Project
- First Ideas 2003 – HPC-Euro Interest Group
- Closing in 2006 – HPC in Europe Task Force (HET)
- ESFRI 2006 – HPC on the Roadmap
- PRACE MoU 2007
- PRACE Signature 2010
- PRACE II 2016

- FETHPC H2020 European Research

PRACE Role and Services

- Open access to leadership HPC systems for EU researchers.
- Peer Review at European level.
- Operation of a unified set of services.
- Architectural variety meeting all sorts of algorithmic needs.
- Training (Seasonal Schools, etc).
- Enabling Applications and support for Center of Excellence.

PRACE infrastructure

PRACE PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

PRACE | Tier-0 Systems 2018

MareNostrum: IBM
BSC, Barcelona, S
#25 Top 500

C50
gano, Switzerland
op 500

NEW ENTRY 2018/2019
SuperMUC NG : Lenovo cluster GAUSS @ LRZ, Garching, Germany #8 Top 500

Hazel Hen: Cray GAUSS/HLRS, Stuttgart, Germany #30 Top 500

MARCONI: Lenovo CINECA, Bologna, Italy #19 Top 500

EW ENTRY 2018
JOLIOT CURIE : Bull Sequana GENCI/CEA, Bruyères-le-Châtel, France #40 Top 500

Close to 110 Petaflops cumulated peak performance

Supported entirely by countries

Thomas Lippert ’19- Chair of the PRACE Council

From FET-HPC to EuroHPC: issues

EU has no top ranked supercomputers and depends on non-EU technology

- Weak integration of EU technology in HPC supercomputers
- Weak European Supply chain

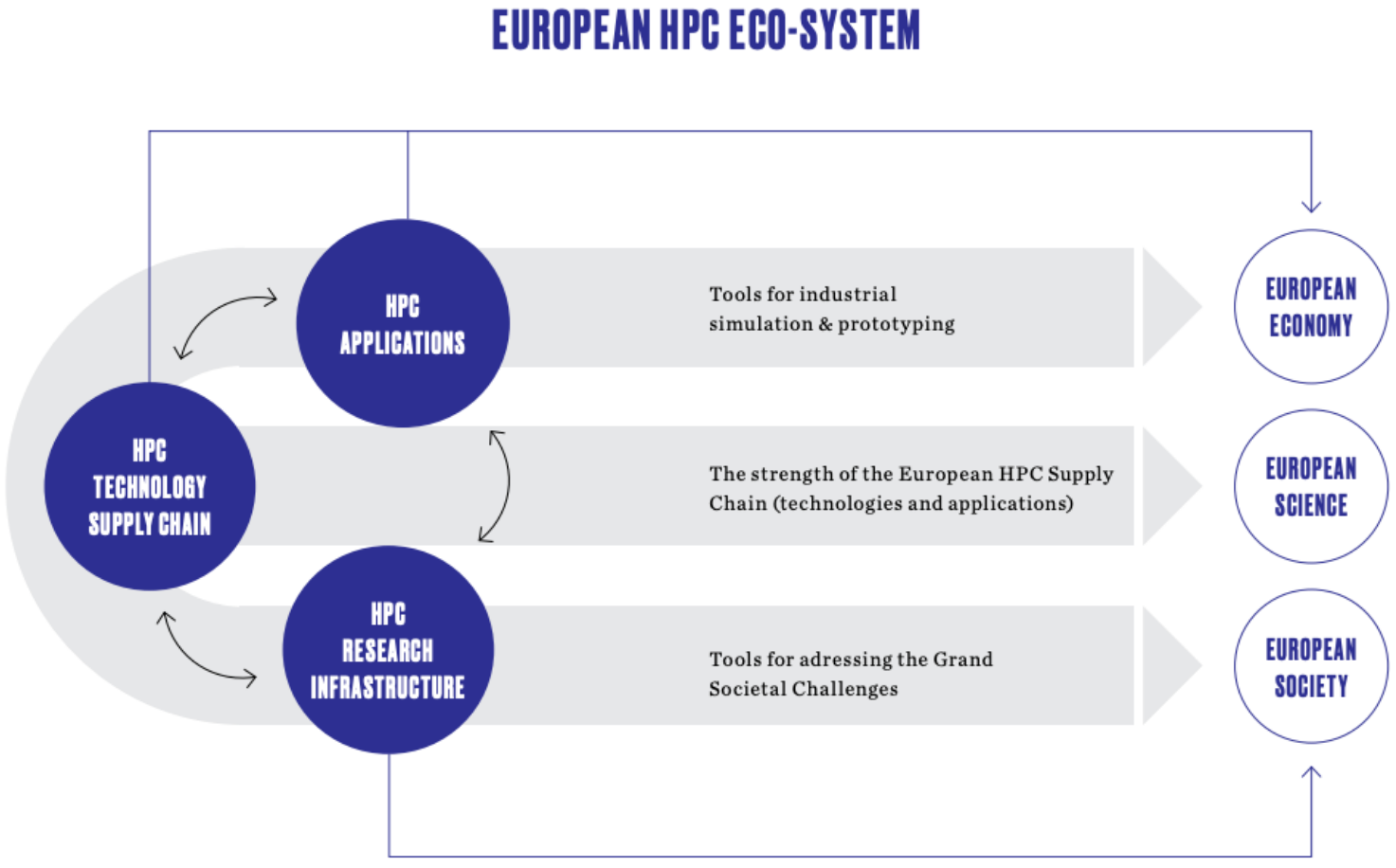
- Insufficient coordination of national investments
- Investments in skill and expertise are mandatory

European strategy: build an ecosystem

European Multi-annual
HPC Technology Roadmap

ETP 4 HPC — EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING

e-dci — European Extreme Data & Computing Initiative



INAF ISTITUTO NAZIONALE DI ASTROFISICA

From FET-HPC to EuroHPC: the Joint Undertaking

- It is not a new program: it is a joint initiative betwe…s, EU Commission and supporting countries.
- Build an ecosystem but also technolo…
- Develop and attract new engi…

- JU is a legal e…
- Pool f… untries and government.

New paradigm in supporting HPC in EU

EuroHPC JU objectives

- **Coordinate EC/MS activities**
- **Pool public and private resources at EU level**
- **Procure world-class infrastructure**
- **Close the chain from R&D to procurement**
- **Become lead Users**
- **Create a competitive supply industry**
- **Lead in Applications**

Co-invest on a leading HPC and data infrastructure

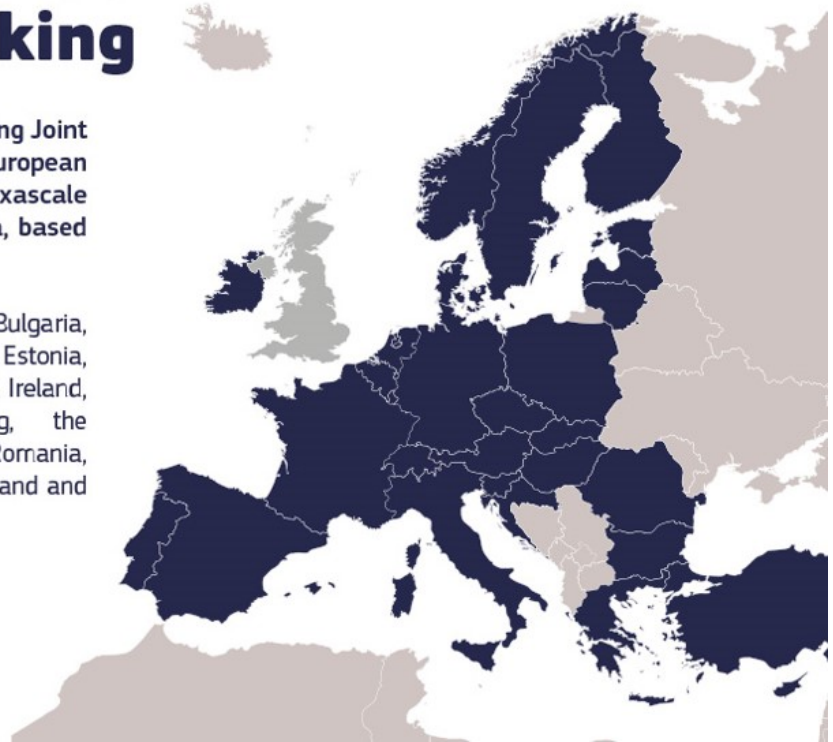
For our scientists, industry and the public sector and support the development of technologies and applications across a wide range of fields.

#EuroHPC *(high performance computing)*
Joint Undertaking

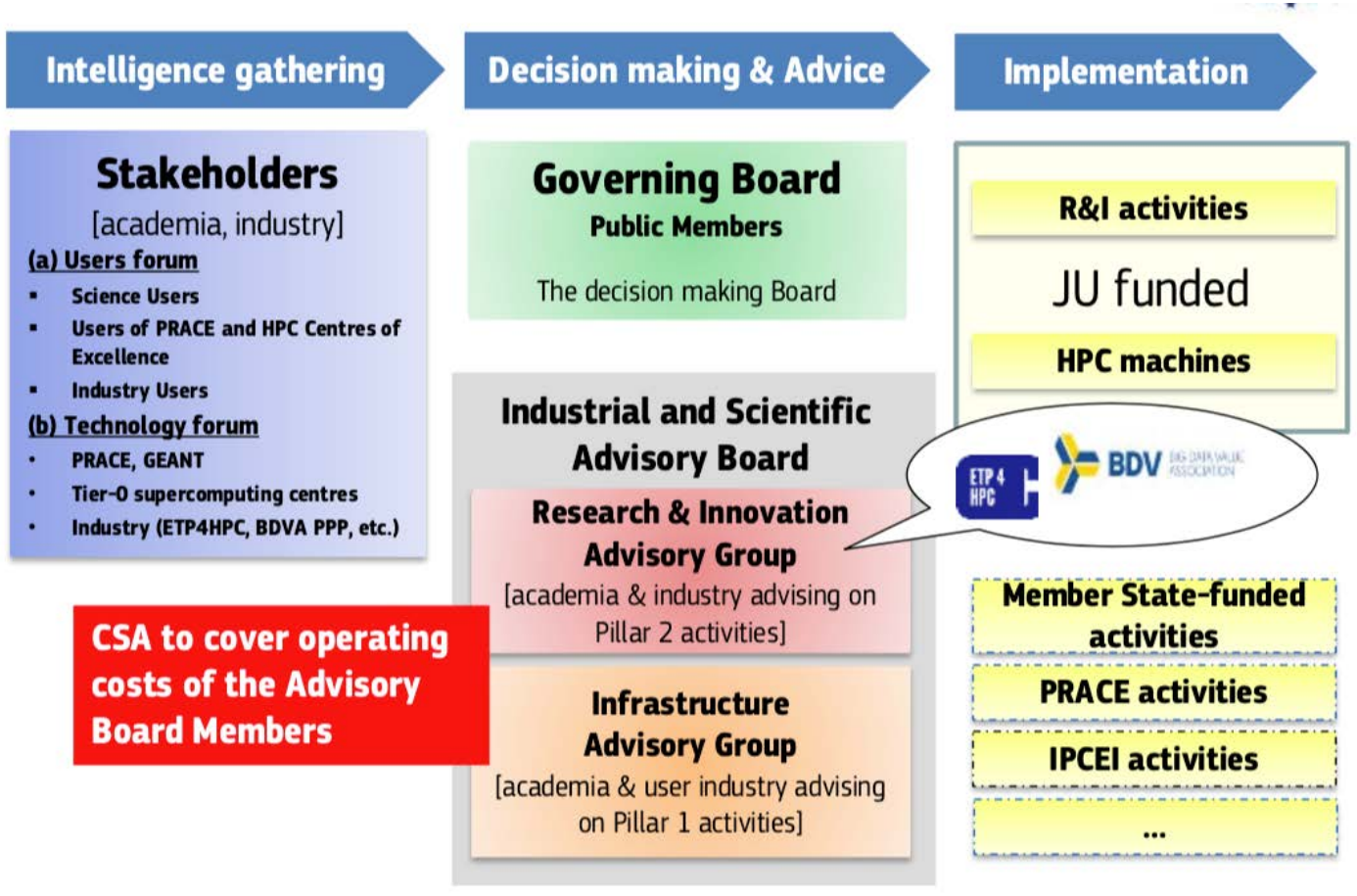
The European High Perfomance Computing Joint Undertaking (EuroHPC JU) will pool European resources to develop top-of-the-range exascale supercomputers for processing big data, based on competitive European technology.

Its member countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and Turkey.

EuroHPC
Joint Undertaking



EuroHPC Governance



from Dr. Gustav Kalbe presentation at EuroHPC info day

(Interim Executive Director EuroHPC Joint Undertking)

EuroHPC Actions: building the infrastructure

Precursors to exascale

At least 2 Precursors to exascale

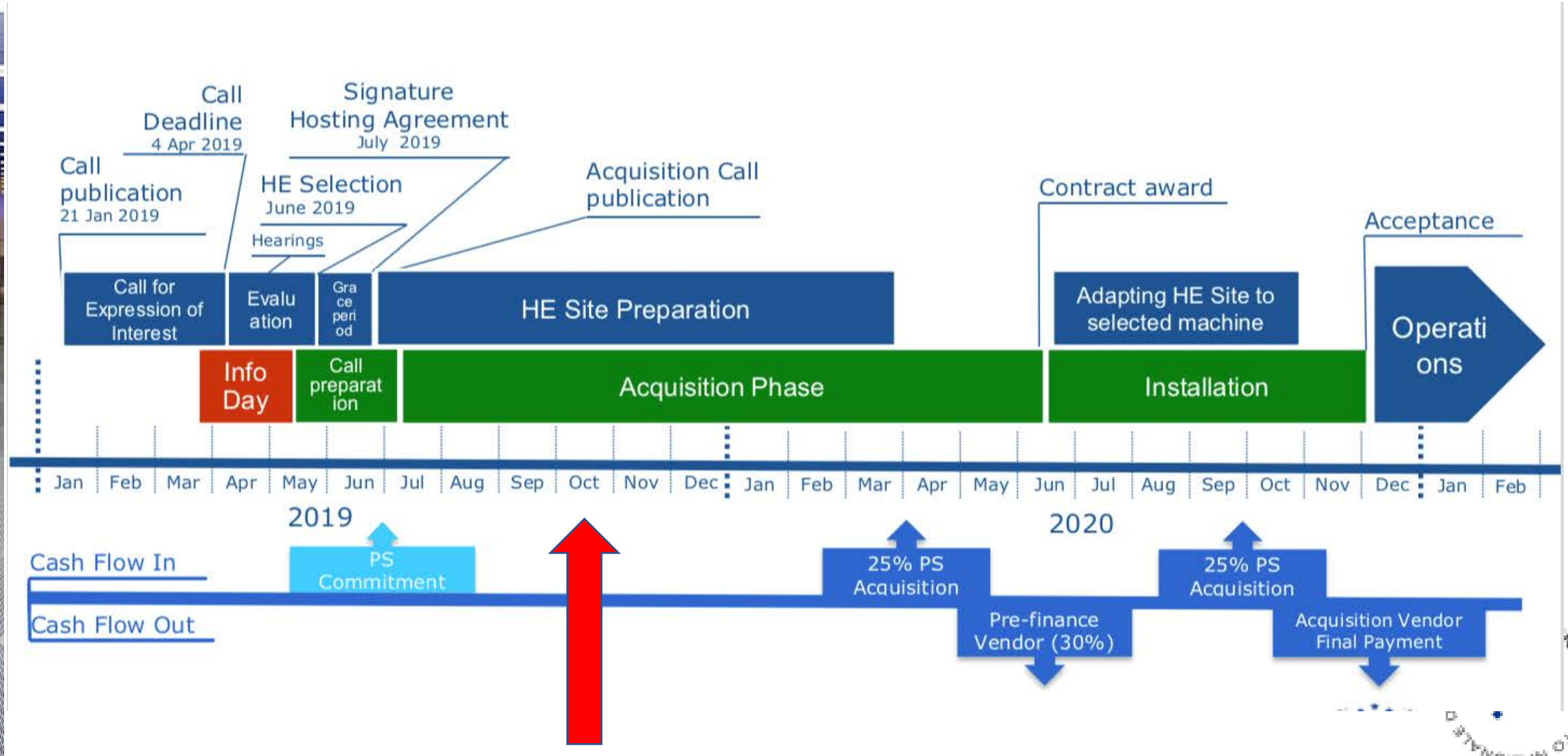
EU contribution:
≤50% of CAPEX and ≤50% of OPEX
MAX EU budget: 250 M€

Petascale

At least 2 Petascale

EU contribution:
≤35% of CAPEX
MAX EU budget: 30 M€

Pre-exascale timeline (indicative)



Status of the Infrastructure

8 hosting sites has been selected: Sofia (Bulgaria), Ostrava (Czechia), **Kajaani (Finland), Bologna (Italy),** Bissen (Luxembourg), Minho (Portugal), Maribor (Slovenia), **and Barcelona (Spain).**

CINECA will host the Leonardo super computer at the Tecnopolo

Total cost: 240 Meuro (co-finaced by MIUR and European commission)

Computing Power: 270 petaflops

Tecnopolo in Bologna

- INFN – Tier0
- CINECA
- **European Centre for Medium-Range Weather Forecasts**

and

- **INAF computing center**

Leonardo Supercomputer

Booster
- 3500
- Low Ram/core
- 4GPUs

General Purpose
- 1000
- CPU computing

Data centric
- 500
- High RAM/core
- Fast IO

Storage (scratch and work space)	**Capacity: 150 PB, bandwidth: 1 TB/s**
Storage (high IOPS tier and home space)	Capacity: 5 PB, bandwidth: 1 TB/s
HPL Targeted Performance (peak)	150-180 PFlops (210-250 PFlops); Top 3
HPCG Targeted Performance	2.8-3.3 PFlops; Top 3

Leonardo Supercomputer: partitioning

Italian Community

EuroHPC & PRACE

EuroHPC Research and Innovation calls

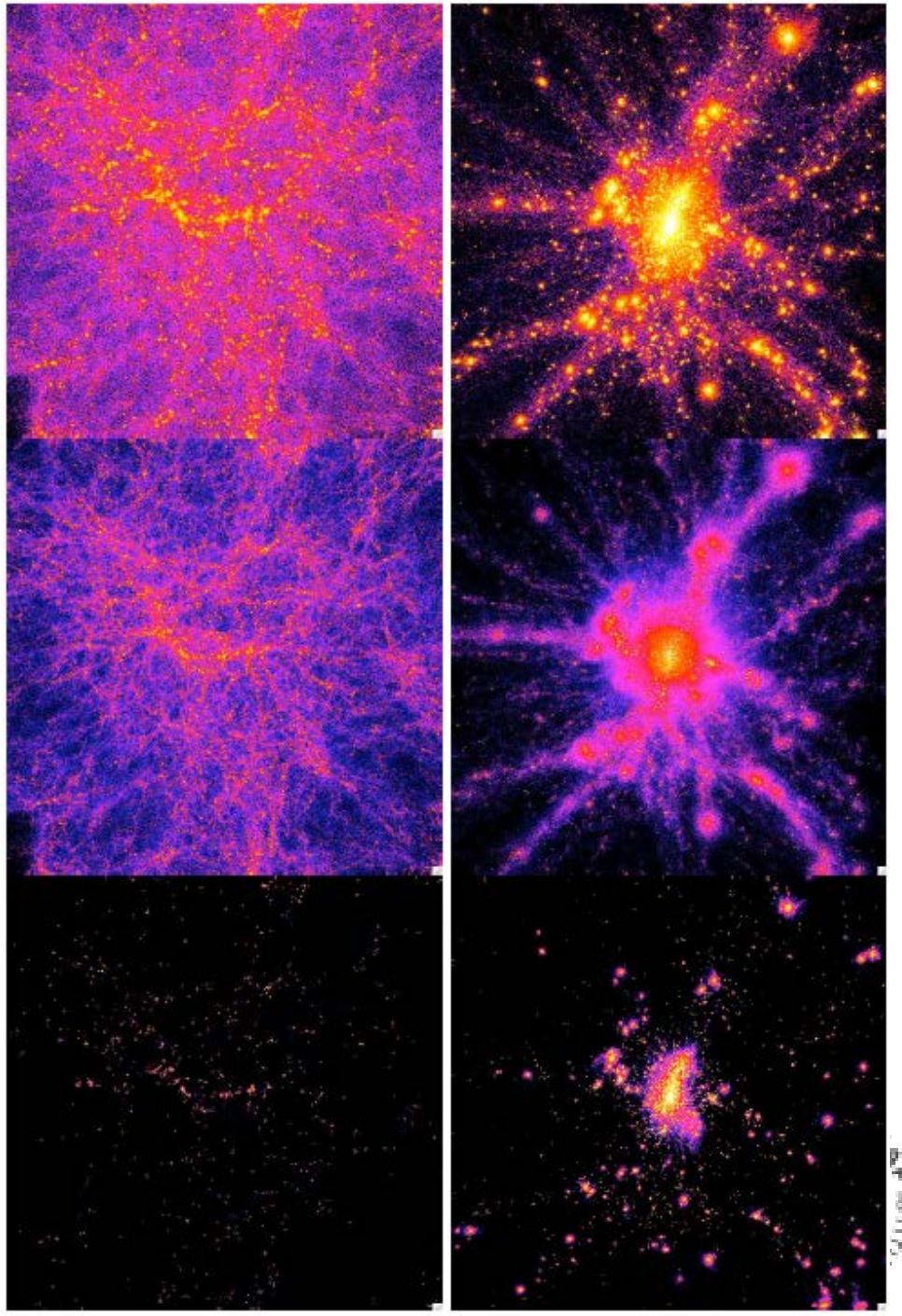
- Towards Extreme Scale Technologies and Applicatio
  - Extreme scale computing and data driven techno
  - HPC and data centric environments and a ns
  - Industrial software codes for extre ng environments and applications

- Innovating ap e HPC use and skills base
  - **HPC ence!**

New paradigm: 50% co-funded

Th role of computing infrastructure

- to capture the complexity of the formation of cosmic structures
- as interpretative framework for the “tsunami” of observational data
- to optimize the design and operation of such large facilities
- to prepare methods and tools of analysis



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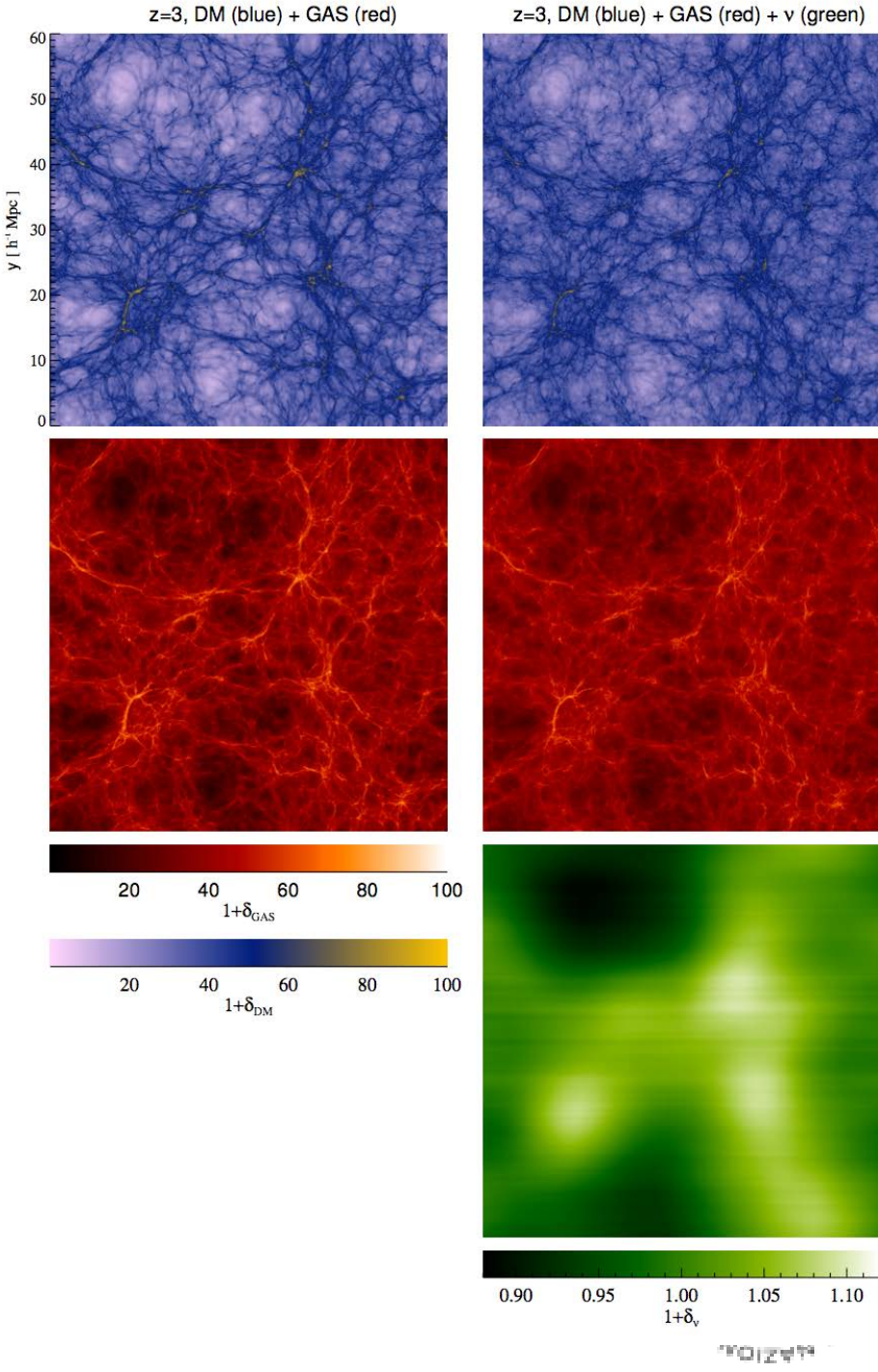

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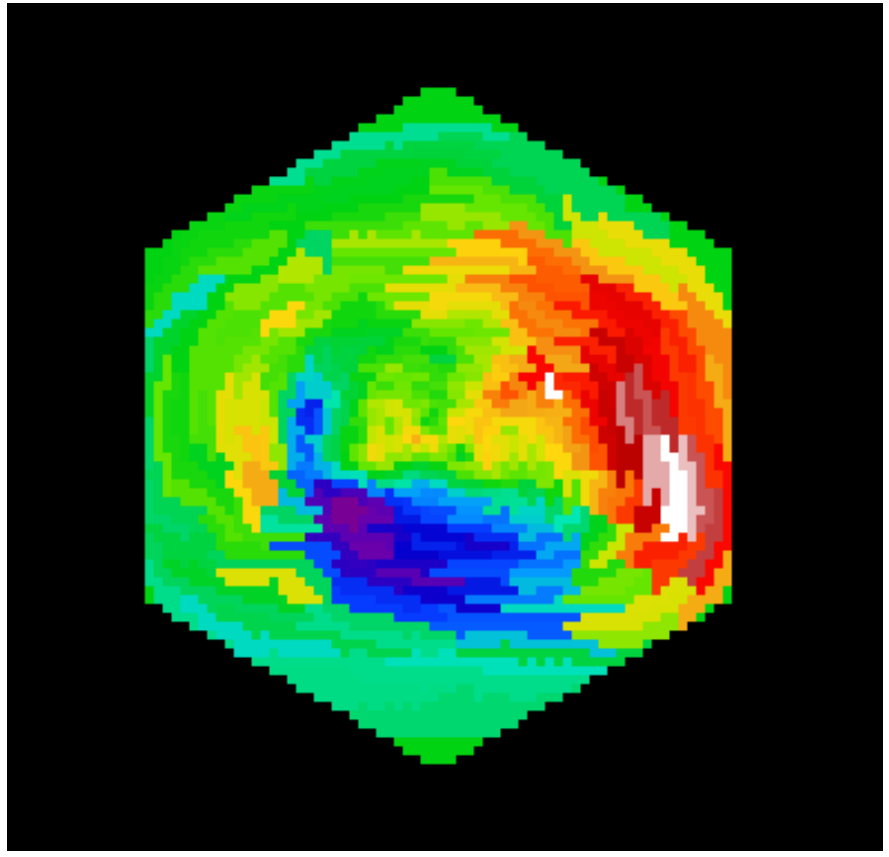

ICM bulk velocities of a simulated Perseus-like clusters with a 100 ksec exposure with Athena

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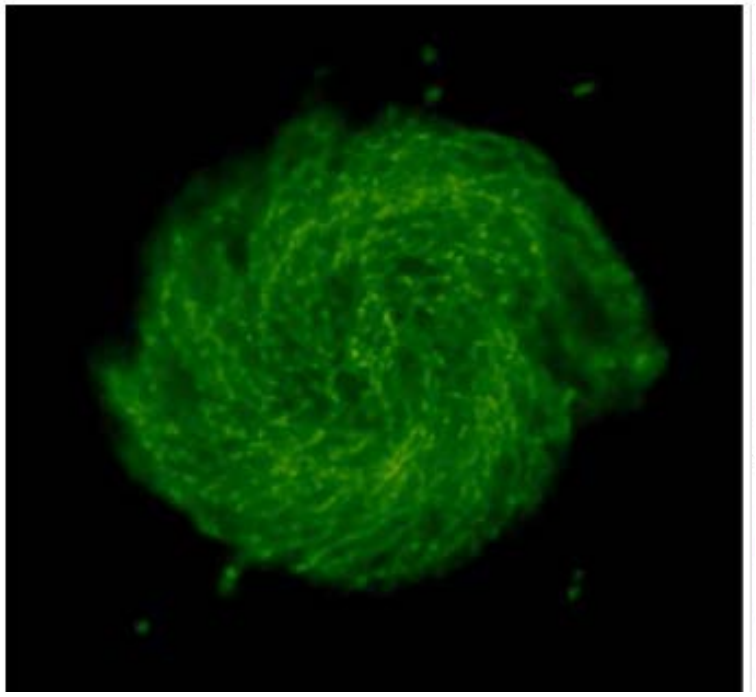

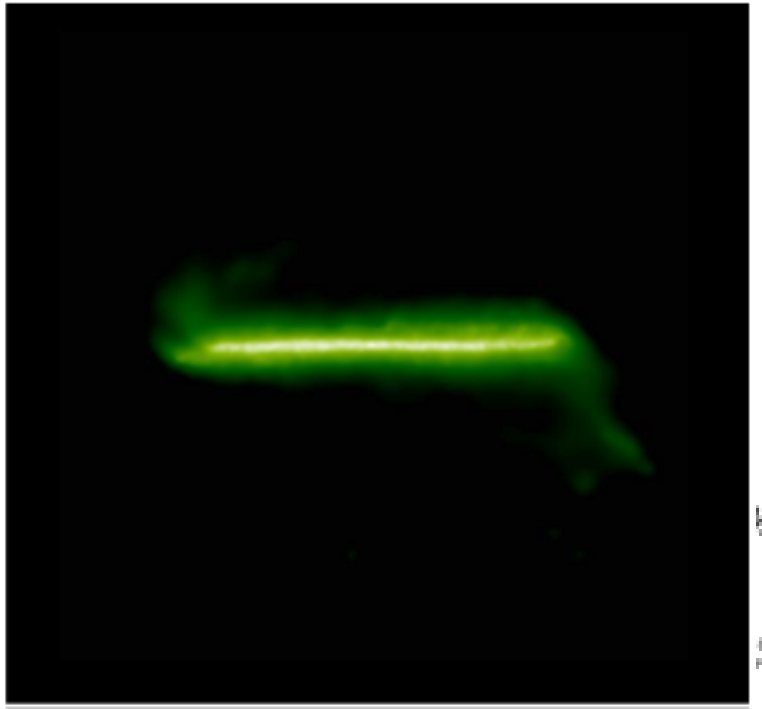

Facilities are not only ”telescopes”

New exascale capable laboratories allow to increase dramatically the dynamical range (from cosmological scales down into galaxies)

Crucial for scientific exploitation
of a variety of observational data !!!!!

New experiments require new exascale capable laboratories!

Are Astrophysical (HPC) codes ready for that?

Conclusion

- New projects and facilities requires HPC and HPDA resources
- Codes for data analysis and reductions will approach HPC, also in interactive way
- We should be able to use the new resources
- EuroHPC is an opportunity
- We should become actors and not users