EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS

Status of EuPRAXIA_PP

P. Campana (INFN-LNF)

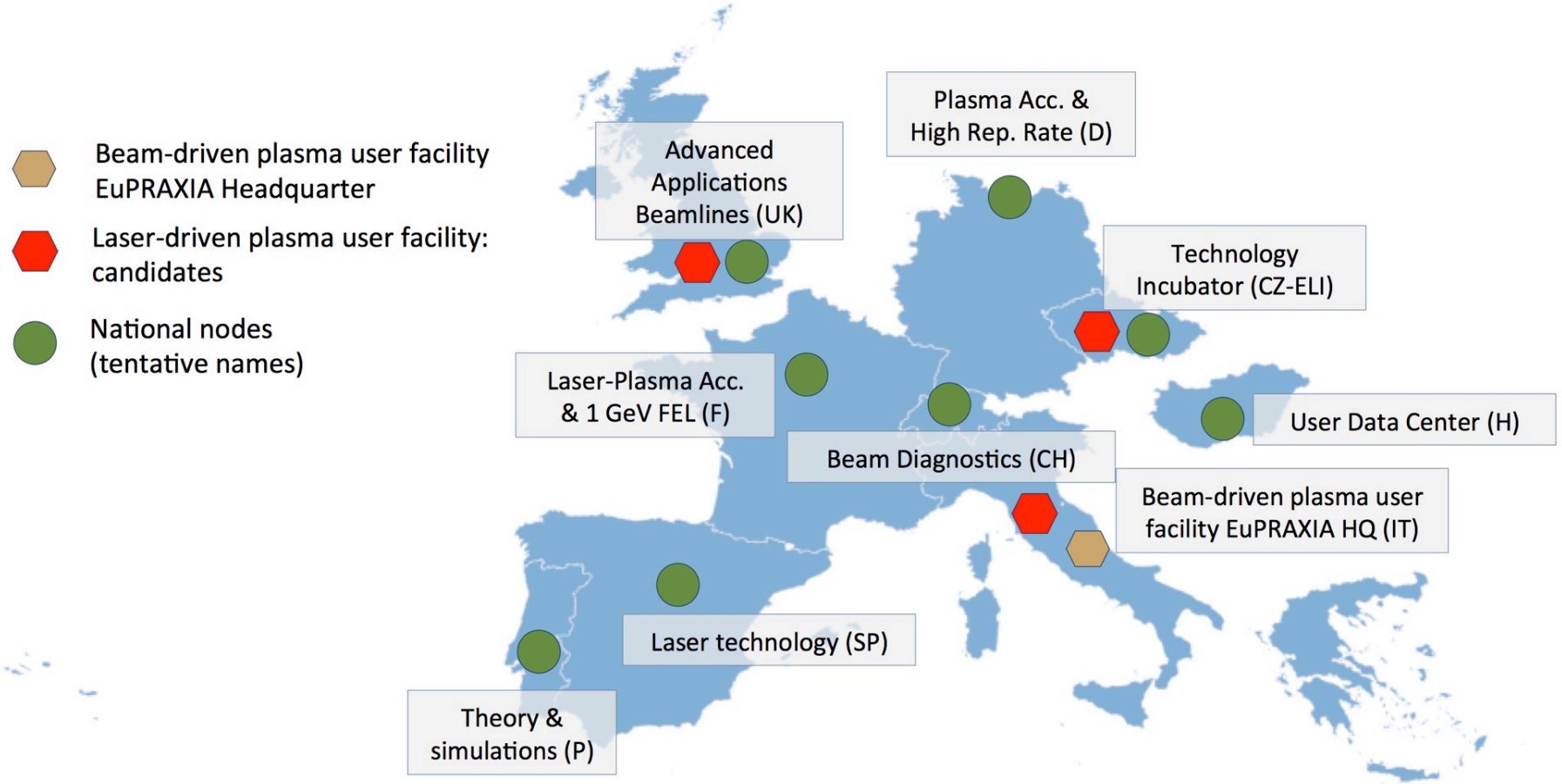
EuPRAXIA@SPARC_LAB Cost & Schedule Review, November 22, 2024

EuPRAXIA@SPARC_LAB Project Review, November 25, 2024

This project has received funding from the European Union´s Horizon Europe research and innovation programme under grant agreement No. 101079773

EuPRAXIA Consortium Networking

Funded by the European Union



A large collection of the best European know-hows in accelerators, lasers and plasma technologies

Network organization
- **Sites (PWFA/LWFA)**
- **National nodes**
- **Technology clusters**

3 candidates for LWFA:
- ~~CLPU, Salamanca~~
- CNR-INO, Pisa
- ELI ERIC, Prague
- EPAC-RAL, UK

EuPRAXIA Preparatory Phase

Horizon Europe

EuPRAXIA_PP Consortium & ancillary EU programs

Funded by the European Union

Recent membership entries (CB decision in March):
- **PSI** (associate), CH
- **GSI-FAIR** Darmstadt & **Uni. Dusseldorf**, DE
- **AMPLITUDE**, FR

Formal acceptance by EU-PO completed.
No further members foreseen.

Complemented by few institutes present in EuPRAXIA ESFRI consortium which did not sign the EuPRAXIA PP Grant Agreement, from FR, DE, PL, SE, UK, CN, JPN, US

EMPA*	CH
EPFL*	CH
PSI*	**CH**
DESY	DE
FBH Berlin	DE
FHG-ILT Aachen	DE
FZ Julich	DE
HZ Dresden	DE
LMU Muenchen	DE
HHU Dusseldorf	**DE**
GSI-FAIR Darmstadt	**DE**
ELI Beamline ERIC	CZ
CEA	FR
CNRS	FR
THALES	FR
AMPLITUDE	**FR**
IASA Athens	GR
WIGNER	HUN
Uni. Szeged	HUN
Uni. Pecs	HUN
* associate partners	

CERN	INT. ORG.
H. Univ. Jerusalem	ISR
CNR	IT
ELETTRA Trieste	IT
ENEA Frascati	IT
INFN	IT
U. Roma Sapienza	IT
U. Roma Tor Vergata	IT
IST Lisbon	P
ALBA Cells	SP
CLPU Salamanca	SP
IC London*	UK
QU Belfast*	UK
STFC*	UK
U. Liverpool*	UK
U. Oxford*	UK
U. Strathclyde*	UK
UCLA*	US

UJT Shanghai (observer)	CN
HZ Jena (observer)	DE
U. Cote d'Azur Nice (observe	FR
NTUA Athens (observer)	GR
U. Milano Bicocca (observer)	IT
U. Palermo (observer)	IT
NCBJ Otwock (observer)	PL
U. Manchester (observer)	UK

38 members, 8 observers

ANCILLARY PROGRAMS

- EuPRAXIA Doctoral Network

This project has received funding from the European Union´s Horizon Europe research and innovation programme under grant agreement no. 101073480 and the UKRI guarantee funds.

- EuAPS

This publication has been made with the co-funding of European Union Next Generation EU.

PACRI (recently approved, several references to EuPRAXIA) 10 ME

The world around us

- Recently, CERN started the process for the 2026 Update of the European Strategy for Particle Physics (ESPPU): a two-year process involving the whole community and aiming at **developing a common vision for the future of particle physics in Europe within the international context**. The process is expected to be concluded in June 2026, with the approval of the updated Strategy by the Council.

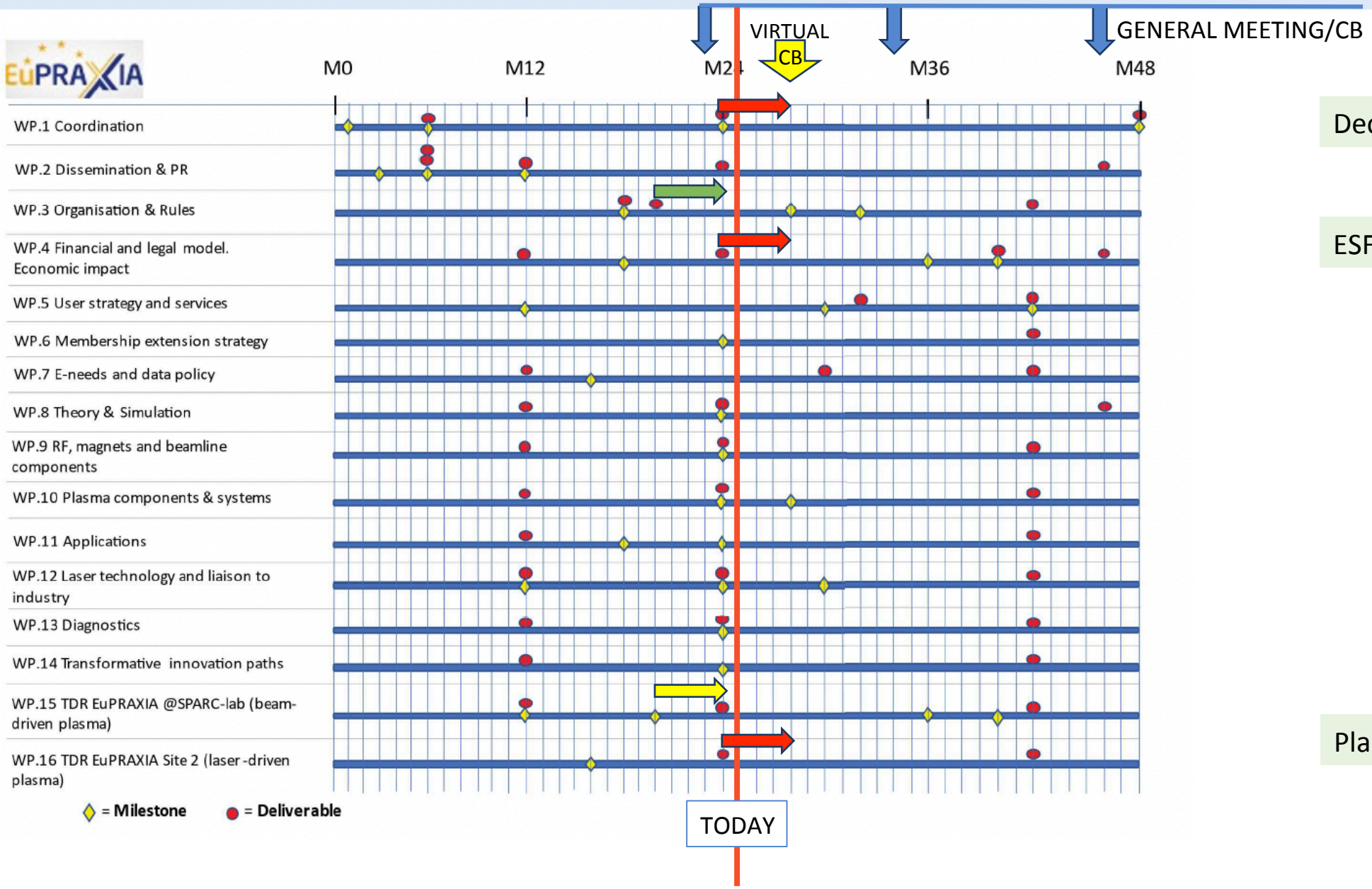
- The process will not only address the issue of what will be the next large machine to be built at CERN, but also plan identify the strategic technologies to be supported at CERN and in Member States' Laboratories: High Field Magnets, high gradient RF structures, **plasma-based accelerators**, energy recovery linacs, etc…

- A similar program ("The 2022 Snowmass process", finalized in the P5 2023 report) has been developed by DOE within the US HEP community for an R&D strategy for future colliders

- The plasma beam driven technology is identified **as one of the main component** for stage 2 future linear colliders (HAHLF proposal): there are plans to set-up a common facility for multi-stage plasma studies. Other large international projects (Petra IV, DESY; CEPC, China) plan to build plasma-based injectors to operate large electron machines complex

- The EuPRAXIA community should make any effort to be involved in the scientific discussion, as the ESFRI RI will represent the first worldwide TANGIBLE example of plasma-based facility

The tasks of the Preparatory Phase



Decision on 2nd site

ESFRI RI cost update

Plans for selected site 2

Status of Preparatory Phase Activities

Funded by the European Union

- 16 Milestones & deliverables of October 2024: **done**

- Several crucial ones to be concluded in the next few months:
  - D3.2 *Report on the decision on the second site* (Jun 24 → Oct 24) → **done in September**
  - D1.2 *Description of updated implementation scheme after site decision* (Oct 24 → Feb 25) **idem**
  - D4.2 *Cost implementation and service preliminary assessment* (Oct 24 → Feb 25) **idem**
  - D16.1 *Update on EuPRAXIA plans for selected site 2* (Oct 24→ Feb 25) **linked to decision on 2nd site**

- Define procedures toward 2nd site identification (see later)
- Define procedures toward governance model (see later)
- Activation of Scientific and Technical Advisory Board (1st meeting held in September)
- Activation of Board of Financial Sponsors (1st meeting on February 6, 2025)
- Work on realization/start-up of National Nodes/Technical Clusters (to the benefit of two PWFA/LWFA sites)
  > first contacts with CNRS (they are preparing a Roadmap on LWFA activities, to be ready by mid 2025)

Scientific and Technical Advisory Board

Committee formed by high level scientists, belonging to the area of particle physics, accelerators, plasma and laser technologies, with high expertise in governance of large programs / science policy

The goal is to provide advise to EuPRAXIA for the operation of the Consortium, both in the Preparatory Phase and in the (most important) Implementation Phase. They will have access to General Meetings material, and will be allowed to follow the CB, to get insights in the project

First, **introductory meeting done on Sep. 12**; presentations on advancement of Preparatory Phase, technical aspects of beam and laser driven technologies, status of 2nd site choice, preparation of governance scheme

A second meeting is foreseen by early next year, with a more specific list of questions to which the Consortium will be asked to answer

→ Scientific strategy, technical choices, 2nd site, governance, funding, long term sustainability: the main items that will be discussed by STAB

- **Final list of members:**

* Lenny Rivkin - Chair	PSI/LEAPS
* Mike Dunne	SLAC
* Ursula Bassler	CNRS
* Sandro de Silvestri	Politecnico Torino
* László Veisz	UMU Sweden
* Fernando Ferroni	INFN
* Thomas Tschentscher	Eu. XFEL
* Hagen Zimer	Trumpf Laser CEO
* Roland Sauerbrey	ex HZDR director, retired

Board of Financial Sponsors

Funded by the European Union

Committee formed by representatives from Funding Agencies of countries present in EuPRAXIA to advise/support/endorse/control the operation of the Consortium, both in the Preparatory Phase and in the (most important) Implementation Phase

BoFS is expected to ratify 2nd site choice, legal framework, governance, funding scheme (in-kind & cash), together with general EuPRAXIA layout and operation (sites + national nodes + technical clusters).
Quite inhomogeneous National Funding Schemes: National Institutes (IT, FR, UK), Ministerial levels, CERN IGO, ELI-ERIC, etc… Difficult recollection of concerned people

Country	Name	other info
CERN	Steinar Stapnes	CERN
Czech Rep	Radka Wildova	Director General for Higher Education, Science and Research section
	Marek Vysinka	Research Infrastructures Department
France	Antoine Rousse	CNRS - LOA
	Catalin Miron	CEA - Research Infrastructures
Germany	Andreas Maier	interim from DESY
Greece	Emmanuel Varvarigos	Vice-Rector of NTUA
Hungary	Peter Racsko	NRDIO officier
Italy	Sandra Malvezzi	INFN Executive Board
	Roberto Cimino	Italian Research and University Ministry
Portugal	Marta Fajardo	Instituto Superior Tecnico
Spain	Rebeca Frías Antolín	Grandes Instalaciones Científicas - Ministerio de Ciencia, Innovación y Universidades
UK	John Collier	CLF Director and Executive Director of Laserlab Europe

Second site choice (WP1, WP3, WP4, WP15, WP16)

Funded by the European Union

- 3 candidates: CNR Pisa, ELI-ERIC Prague, ~~CLPU Salamanca~~, EPAC RAL
- Milestone 16.1 finalized: candidacy overview (text provided by sites, according to structure template):

  - *Existing infrastructure towards delivering the LPA-based EuPRAXIA pillar (Phase1)*
  - *Technology readiness for LPA-based EuPRAXIA pillar (Phase1)*
  - *Existing Safety and Control Systems*
  - *Teaming and Management*
  - *User-oriented operation experience*
  - *Identification of pre-investment relevant for the EuPRAXIA development*
  - *Identification of required funding to accomplish EuPRAXIA LPA-pillar Phase1*
  - *Strategy to implement the EuPRAXIA LPA-pillar Phase-2*
  - *Collaboration needed (wish-list from each candidate)*

- Internal Selection Panel setup. Preparation of template for site bid-book (representing D3.2 *Report on the decision on the second site)*
- Bid-book scheme approved by CB on next Sept. 25th, call opened (deadline Dec. 20th)
  (*informal support from respective Funding Agency expected as key element*)
- Evaluation by panel (working in Jan./Feb., Information provided to STAB & BoFS)
- Proposal for a collegial choice, to be submitted for approval in a special CB in March 2025
  → important: site choice & EuPRAXIA governance must be aligned

Governance and Funding

Key inputs to the EuPRAXIA Consortium operation:

- Cooperative-oriented consortium with light legal framework (currently considering AISBL) to be agreed by Funding Agencies & ESFRI
- Flexible legal scheme (minimal bureaucracy) and based on MoUs (or Service agreements)
- Capable of accounting in-kind contributions and fresh resources (assets remains to stakeholder)
- Operating coherently as a Network + 2 sites + several Nodes/Clusters (on specific technologies)
- Coordinated external user access to EuPRAXIA facilities, following ESFRI regulation (OA, FAIR, etc…)
- Centralized capability to participate to EU calls as “EuPRAXIA”
- Sites funding: based on in-kind contributions from National/Regional funding + EU calls
- Operational costs: relying on host Institution (other schemes possible, although difficult)
- National nodes/ technology clusters: based on in-kind contributions from institutes/country + regional funding + EU calls. They are expected to contribute to specific technical parts of sites

- … (plus any other further request from partners)

Effects from ESFRI “seal of excellence”: funding

Funded by the European Union

Funding Sources (EuPRAXIA Preparatory Phase Consortium members)				
Country	EU Funding	EU matching funds	National Funding	TOTAL
Italy	4'228'313		140'400'000	144'628'313
France	3'918'060		2'500'000	6'418'060
United Kingdom	2'376'590	1'116'000		3'492'590
Germany	2'380'328			2'380'328
Switzerland		1'670'880		1'670'880
Czech Republic	1'626'052			1'626'052
Portugal	808'103			808'103
CERN	450'500			450'500
Spain	401'000			401'000
Hungary	270'348			270'348
Israel	10'000			10'000
Greece	10'000			10'000
TOTAL	16'479'294	2'786'880	142'900'000	162'166'174

EU grants: Design Phase (2015-19), Preparatory Phase (2022-26), Doctoral Network (2022-26), PACRI (2024-28)

Setting-up EuPRAXIA network

EuPRAXIA Network is built on the following elements:

- **sites** (beam driven, laser driven): they operate as main EuPRAXIA facilities to users
- **national nodes**: they collect national technological interests, lobbying respective funding agengies to get support for EuPRAXIA, locally and to the sites
- **technical clusters**: they collect specific technological interests from different groups (even in different countries) to support the sites. Logically linked to current WP organization

Next important activity: **develop national nodes** with dedicated meeting with national communities and – hopefully – representatives from funding agencies, explaining EuPRAXIA vision and perspectives
(this would also be very useful for first BoFS meeting)

Quite different situations in various countries: some with many/several institutes, from different Funding Agencies, others with 1 or 2 groups.
A challenging step, although necessary for EuPRAXIA future & development

Trying to build an **EuPRAXIA Collaboration** (including a collaborators' list), to work together on the project, especially when PP grant will be over: need to set solid foundations **NOW** !

Non-INFN activities on EuPRAXIA@SPARC_LAB

Funded by the European Union

INJECTOR & X-BAND – CERN, PSI, Rome Sapienza Univ.

DIAGNOSTICS – PSI, Rome Tor Vergata Univ.

UNDULATOR – ENEA, FERMILAB (SCU prototype)

PHOTON BEAM LINES & USERS - ELETTRA, CNR, Rome Tor Vergata Univ., ESRF (under discussion)

SIMULATION – IST Lisbon (under discussion)

Outstanding efforts to increase this spectrum of activities with other collaborators, internal and external to EuPRAXIA Consortium. Quite complex to get support from outside institutions.
This is one of the main challenges of the entire EuPRAXIA program

Summary

EuPRAXIA is a challenging and fascinating ESFRI European Research Infrastructure with several “non standards” aspects:

- Effort to merge three very different communities: accelerators, plasma, lasers experts
- Network with real sites, nodes and clusters: HEP-style collaboration guidance
- Effort to have nodes/clusters contributing to sites
- Un-conventional way of funding (multi-actors: EU, FA, Universities, etc…), large use of in-kind (HW and personnel)

A little more than 2 years to conclude EuPRAXIA_PP and several challenging tasks ahead of us: 2nd site choice, governance, legal model, interactions with Fas, …

EuPRAXIA-PP Consortium

Coordinator

INFN
Istituto Nazionale di Fisica Nucleare

Consiglio Nazionale delle Ricerche

Elettra Sincrotrone Trieste

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

SAPIENZA
Università di Roma

Università di Roma Tor Vergata

Imperial College London

QUEEN'S UNIVERSITY BELFAST

UK Research and Innovation

UNIVERSITY OF LIVERPOOL

UNIVERSITY OF OXFORD

University of Strathclyde Glasgow

CERN

DESY.

Leibniz Ferdinand Braun Institut

Fraunhofer ILT

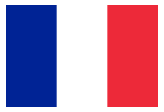
GSI

hhu Heinrich Heine Universität Düsseldorf

HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

JÜLICH Forschungszentrum

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN



Amplitude

cea

cnrs

THALES

eli

IFT TÉCNICO LISBOA

ALBA

CLPU CENTRO DE LÁSERES PULSADOS

Empa
Materials Science and Technology

EPFL

PAUL SCHERRER INSTITUT PSI

THE HEBREW UNIVERSITY OF JERUSALEM

IASA

PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS

SZTE
UNIVERSITY OF SZEGED

Wigner

THE UNIVERSITY OF CALIFORNIA UCLA

Acknowledgements

Funded by the European Union

- EuPRAXIA Preparatory Phase

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101079773. It is supported by in-kind contributions by its partners and by additional funding from UK and Switzerland.

- EuPRAXIA Doctoral Network

This project has received funding from the European Union´s Horizon Europe research and innovation programme under grant agreement no. 101073480 and the UKRI guarantee funds.

- EuAPS

This publication has been made with the co-funding of European Union Next Generation EU.