

EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



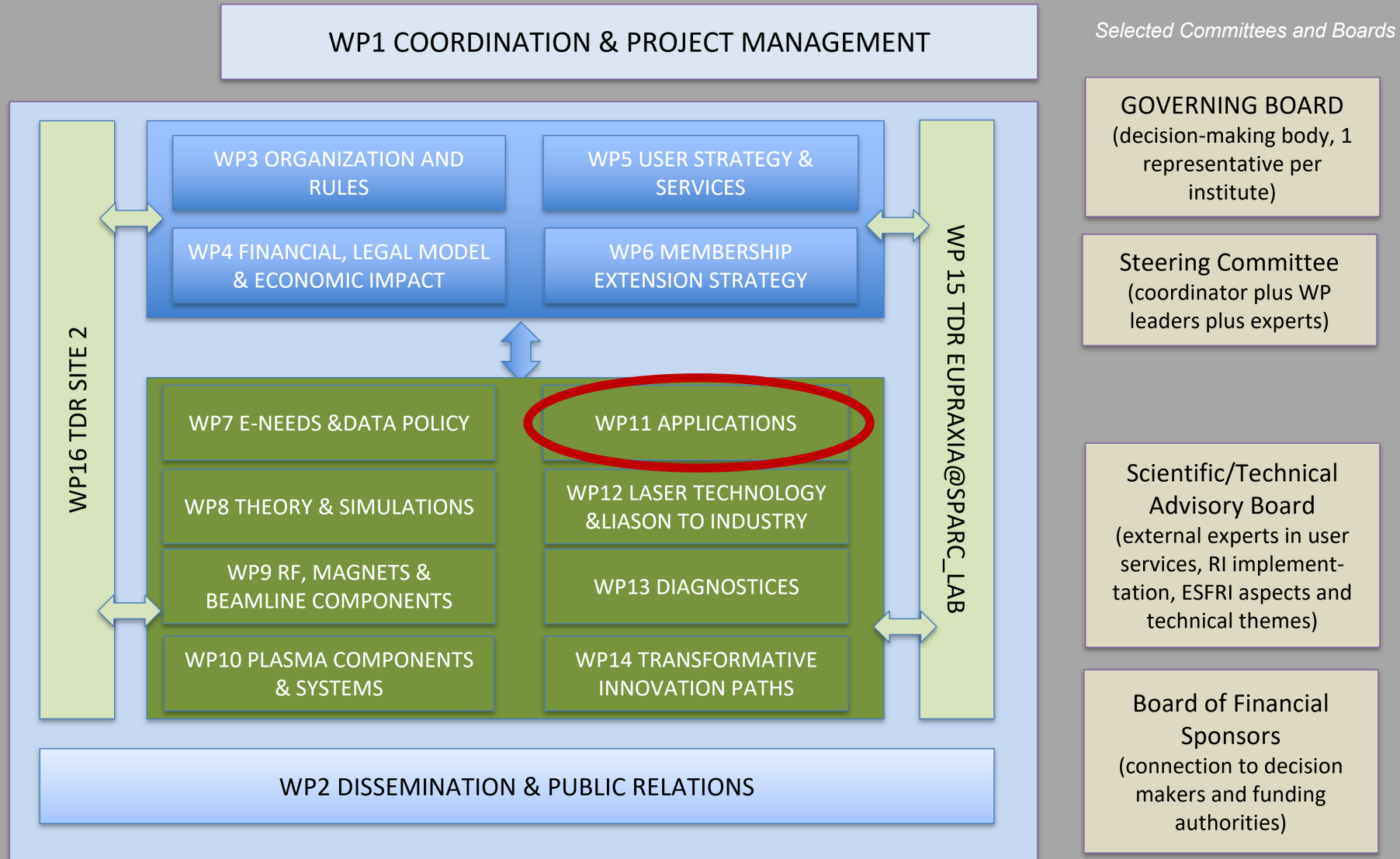
WP11: Applications

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Flagship Science Goals:

Flagship Science Goal 1: free-electron laser (FEL) X-rays

$10^9 - 10^{13}$ photons per pulse, 0.2 nm to 36 nm, 0.4 fs duration

Flagship Science Goal 2: betatron X-rays

10^{10} photons per pulse, energy of 5 –18 keV

Flagship Science Goal 3: low-energy positron beams

energies 0.5MeV - 10MeV, 10^6 positrons per pulse, 20–90 ps duration

Flagship Science Goal 4: electron and positron beams

energies 100MeV - 5 GeV for high-energy-physics-related R&D

Flagship Science Goal 5: Compton scattering (ICS) source

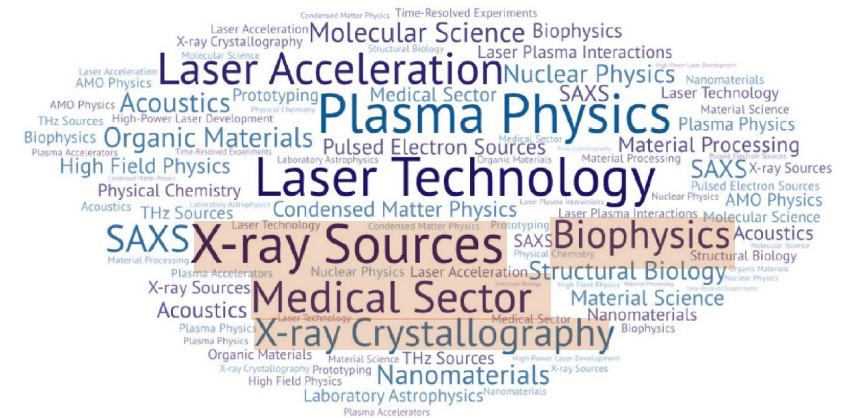
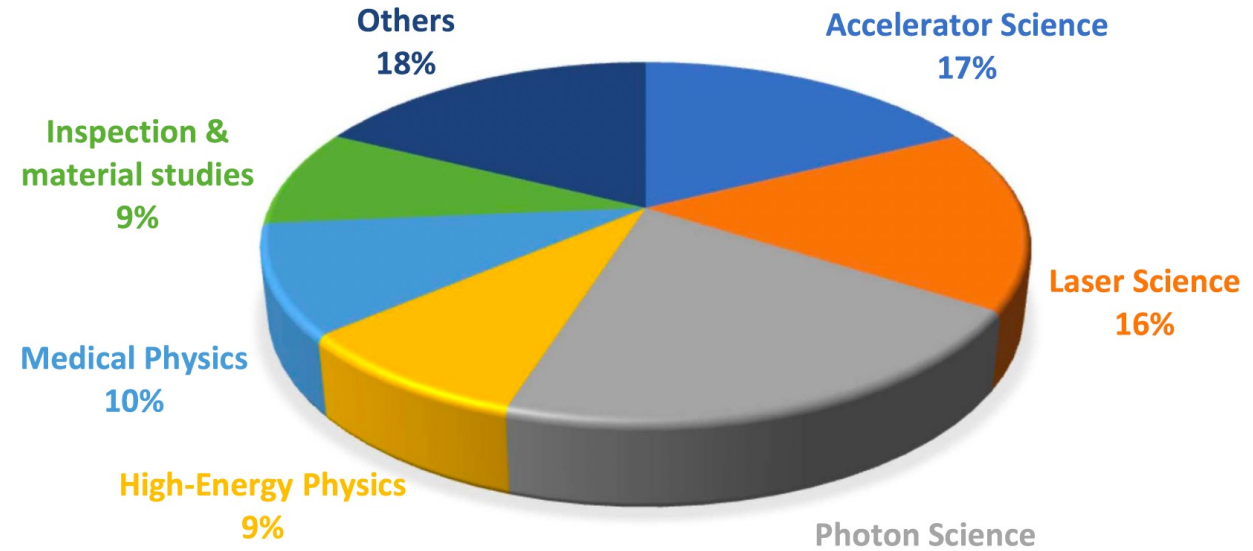
narrow-band spectrum for precision nuclear physics and highly penetrative radiography for users.

Flagship Science Goal 6: multi-stage high repetition-rate plasma accelerator

in the GeV range to users from accelerator science.

Flagship Science Goal 7: Novel schemes of pump probe configurations

and ultra-precise timing will be researched, feeding back into laser science



From the ESFRI hearing...

EuPRAXIA RI services fields of **Physical Sciences & Engineering** and **Food & Health**:

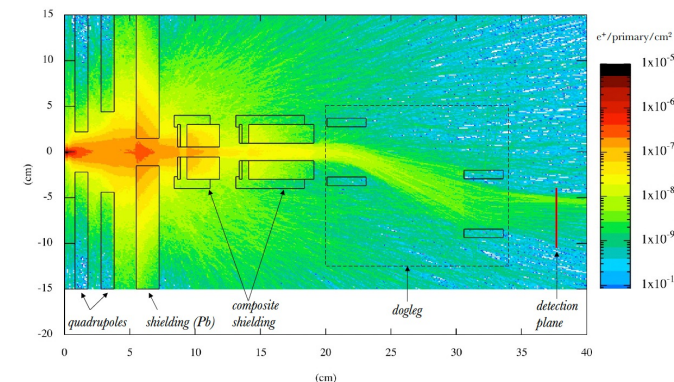
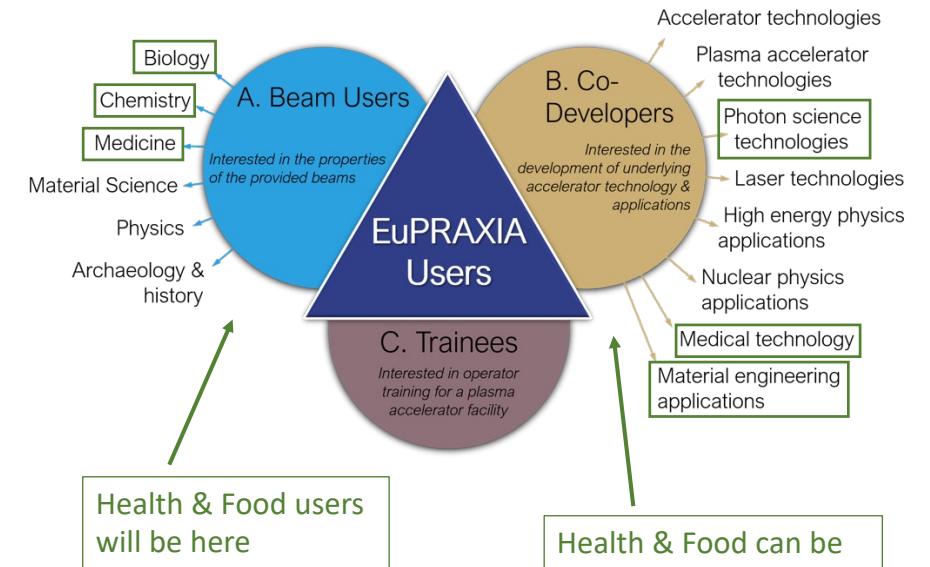
Compact and cost-efficient accelerator technology at scale of interest for industry, hospitals, universities (**longer-term VHEE radiation therapy**).

Compactified free electron laser facility for e.g. research on viruses and bacteria, rapid screening of biological tissues, **nanoparticles as pesticides**.

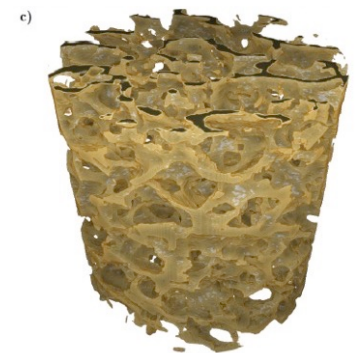
“Table-top” applications in **manufacturing industry** with **non-destructive testing methods** (compact X ray machine, deeply penetrating **positron annihilation spectroscopy**).

Point-like emission X ray source, e.g. for **material** studies or for identifying early onset of cancer at micron-scale (calcification).

Users with a range of research interests (including industry):



Positron sources for material scanning



Betatron tomography of bone tissue

Work package number	11	Lead beneficiary				QUB		
Work package title	Applications							
Participant number	2	5	8	16	19	20	23	26
Short name of part.	CNR	UNIROMA1	CNRS	USZ	QUB	STFC	ELIBL	IASA
Person months per part.:	0 (+2)	12 (+6)	2 (+2)	0 (+6)	24 (+12)	0 (+6)	0 (+6)	0 (+8)
Start month	1			End month	48			

Objectives

Application development. Beamlines and delivery into user areas. Develop required structures in detail (excellence centers, scientific programs, R&D). Specify required funding needs. Propose EuPRAXIA funding programs. Steer scientific and technical progress towards EuPRAXIA implementation. Define specific parameters and modes of operation for beams in the user areas of interest.

Description of work (where appropriate, broken down into tasks), lead partner and role of participants

The WP11 is following up on the following work items coordinated by QUB and UNIROMA1, supported by the collaborating institutes with their extensive experience and knowledge base.

Whenever possible, the WP will also encourage preliminary tests of the beamlines, subject to funding and facility access. The WP will then work towards developing stations for secondary sources to be generated in the dedicated target areas and, in consultation with the potential user community, will develop a suite of diagnostics to be installed in each user area for each foresought application.

Milestones:

- M11.1 Survey of Beam Parameters and identification of user applications (M12)
- M11.2 Survey of user facilities to test equipment and/or advanced concepts of beamlines (M18)
- MG.1 Update of concepts for EuPRAXIA, systems status report (M24)
- M11.3 Design and project of transport beamlines, focusing on the preservation of beam parameters (M30)

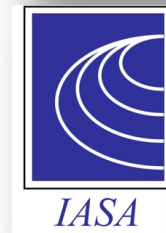
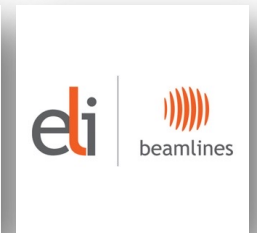
Deliverables (brief description and month of delivery)

- D11.1 Report on structures (centres, clusters) to be funded from national/bilateral/European levels (M12)
- D11.2 TRL report (M42)

Work Package Coordinators



Work Package Participants



1. Form a coherent and comprehensive structure of centres/initiatives to be funded at national/bilateral/European level

- *Are there other institutes interested in joining or that we should involve?* → Collaboration with WP6
- *What are the main current initiatives that could be integrated in WP11?*
- *What are the main existing facilities that we can use for R&D?*

2. Carry out more extensive and capillary surveys of potential user needs and beam requirements

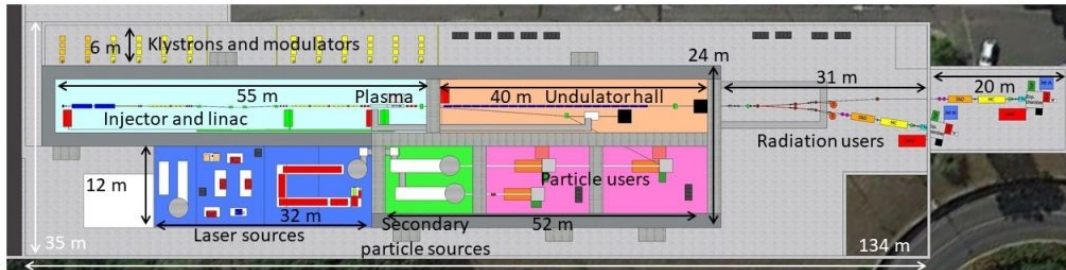
- *What photon/electron/positron (other..?) beam parameters would be most useful?* → Collaboration with WP5, 9, and 10
- *What would the end-stations look like?* → Collaboration with WP5, and 13
- *What diagnostics and experimental capability do we need to provide to the users?* → Collaboration with WP5, and 13

3. Preparation towards Eupraxia TDR

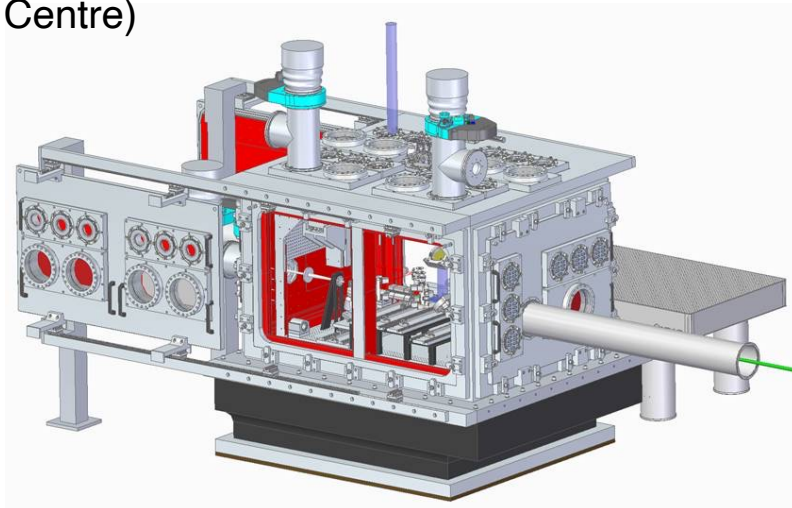
- *Design and project of transport beamlines* → Collaboration with WP8, 9, and 10
- *Design and project of end-stations* → Collaboration with WP5, 13 and 16
- *Beamline design for Eupraxia@Sparc-lab and for “Site 2”* → Collaboration with WP13 and 16

National level

LNF is developing a beam-driven source towards an FEL (Eupraxia@Sparc_Lab) and betatron sources

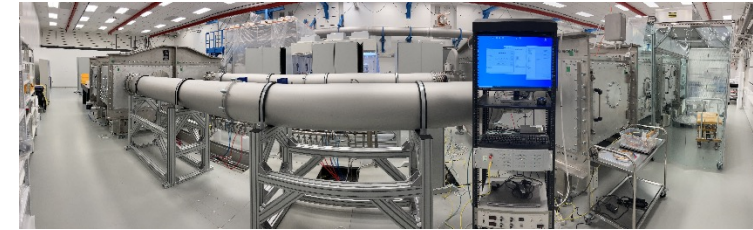


Building on the experience of CLF, the UK has started the construction of EPAC (Extreme Photonics Application Centre)

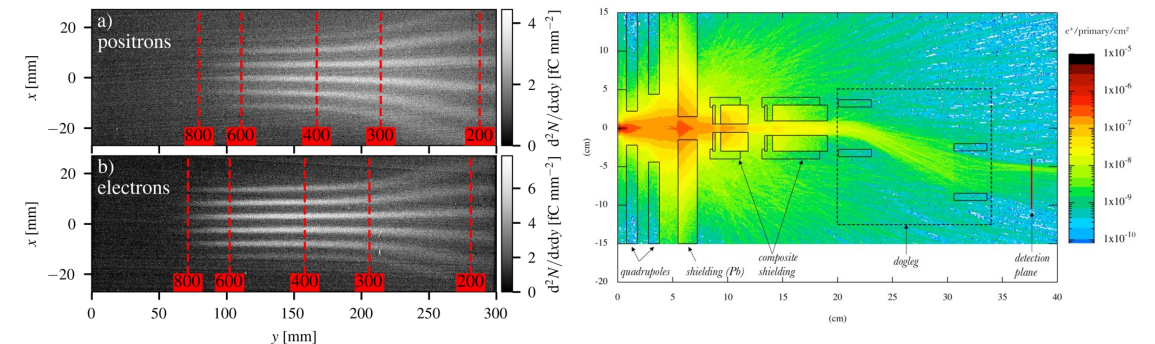


Institutional level

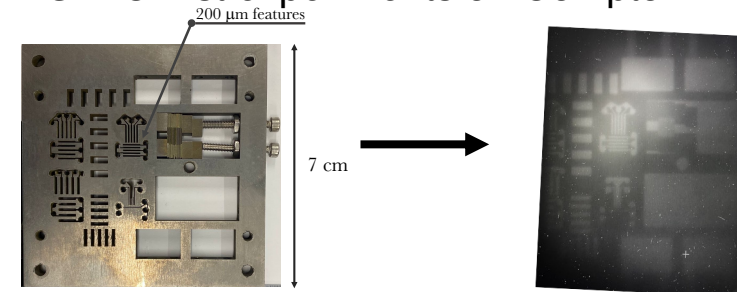
ELI_Elba at ELI-BL has been commissioned at low power



High- and low- energy laser-driven positron sources have been designed and built at QUB



QUB/STFC first experiments on Compton imaging



- **November kick-off**
 - This is our first meeting for the Preparatory Phase, an excellent chance to start discussions!
 - First step would be to establish a structure of initiatives and of centres involved
 - Start procedures for funding applications both at national and international level
- **Steering committee every 3 months**
- **Dedicated workshop: „EuPRAXIA WP`s and Excellence Centers“**
- **Feedback very welcome: workshop when, meetings required, ...**

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Thank you for your attention!

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