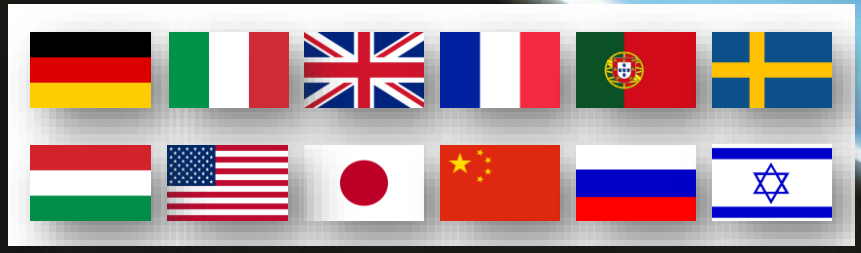
EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS

EuPRAXIA

10th Steering Committee Meeting

Ralph Aßmann



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

Agenda

7:45 – 8:00	**Coffee**
8:00 – 8:05	Welcome & administrative business: Approval of agenda
8:05 – 8:10	Welcome & administrative business: Approval of minutes from 9th Steering Meeting
8:10 – 8:20	Welcome & administrative business: Action items from 9th Steering Meeting and Collaboration Board Meeting
8:20 – 8:45	Round table (WP1-WP14): Short verbal report, no slides (round-table)
8:45 – 9:45	Discussion and decision on criteria and criteria weightings for prioritising EuPRAXIA technical options (M. Weikum et al)
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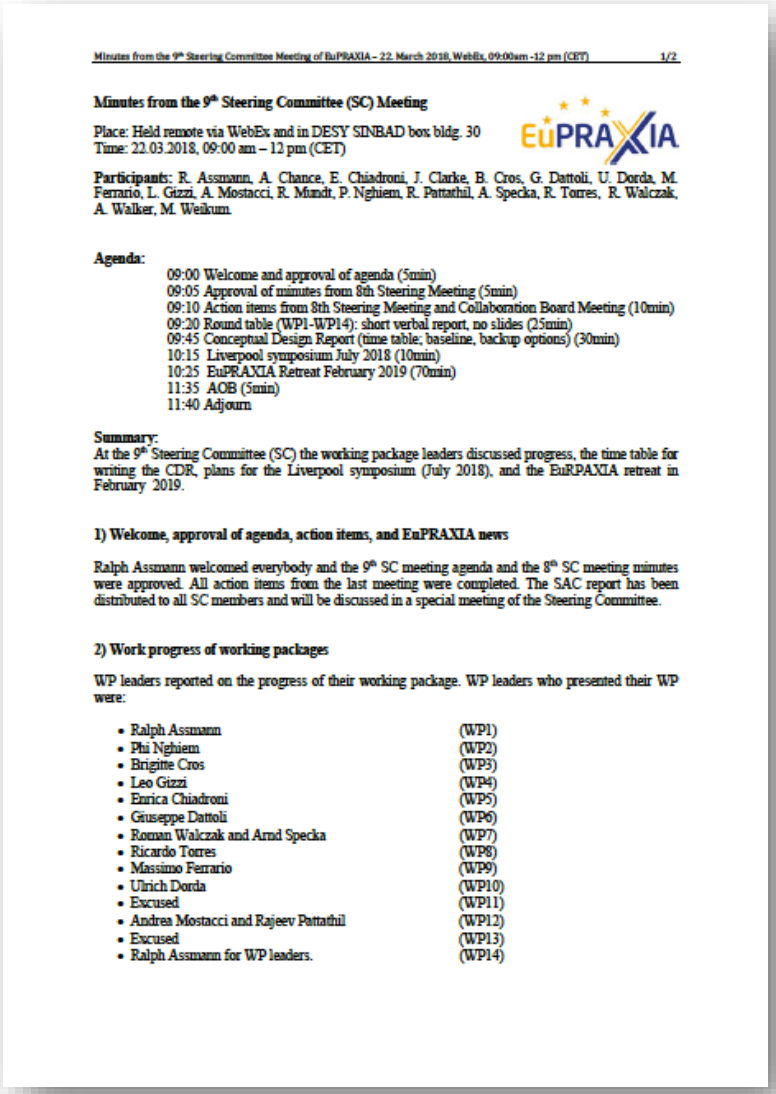
Follow-up 9th Meeting

Horizon 2020



Minutes from the 9th Steering Committee Meeting of EuPRAXIA – 22. March 2018, WebEx, 09:00am -12 pm (CET) 1/2

Minutes from the 9th Steering Committee (SC) Meeting

Place: Held remote via WebEx and in DESY SINBAD box bldg. 30
Time: 22.03.2018, 09:00 am – 12 pm (CET)

Participants: R. Assmann, A. Chance, E. Chiadroni, J. Clarke, B. Cros, G. Dattoli, U. Dorda, M. Ferrario, L. Gizzi, A. Mostacci, R. Mundt, P. Nghiem, R. Pattathil, A. Specka, R. Torres, R. Walczak, A. Walker, M. Weikum.

Agenda:

09:00 Welcome and approval of agenda (5min)
09:05 Approval of minutes from 8th Steering Meeting (5min)
09:10 Action items from 8th Steering Meeting and Collaboration Board Meeting (10min)
09:20 Round table (WP1-WP14): short verbal report, no slides (25min)
09:45 Conceptual Design Report (time table; baseline, backup options) (30min)
10:15 Liverpool symposium July 2018 (10min)
10:25 EuPRAXIA Retreat February 2019 (70min)
11:35 AOB (5min)
11:40 Adjourn

Summary:
At the 9th Steering Committee (SC) the working package leaders discussed progress, the time table for writing the CDR, plans for the Liverpool symposium (July 2018), and the EuRPAXIA retreat in February 2019.

1) Welcome, approval of agenda, action items, and EuPRAXIA news

Ralph Assmann welcomed everybody and the 9th SC meeting agenda and the 8th SC meeting minutes were approved. All action items from the last meeting were completed. The SAC report has been distributed to all SC members and will be discussed in a special meeting of the Steering Committee.

2) Work progress of working packages

WP leaders reported on the progress of their working package. WP leaders who presented their WP were:

- Ralph Assmann (WP1)
- Phi Nghiem (WP2)
- Brigitte Cros (WP3)
- Leo Gizzi (WP4)
- Enrica Chiadroni (WP5)
- Giuseppe Dattoli (WP6)
- Roman Walczak and Arnd Specka (WP7)
- Ricardo Torres (WP8)
- Massimo Ferrario (WP9)
- Ulrich Dorda (WP10)
- Excused (WP11)
- Andrea Mostacci and Rajeev Pattathil (WP12)
- Excused (WP13)
- Ralph Assmann for WP leaders. (WP14)

Approval Minutes 9th Steering Meeting

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Actions from 9th SC Meeting

1. A special SC meeting, in person and before July 2018, should be organized to discuss the CDR weighting of configurations and the SAC report. (Action: **M. Weikum**) ✓
2. Form a sub-group of EuPRAXIA scientists to follow up on ESFRI roadmap, with help from lab management. Organize meeting. (Action: **R. Assmann**)
3. Create highlight parameter table (sub-table from large table) for use with potential users. Distribute among WP leaders before use. (Action: **M.Weikum** with **R. Torres**). ✓
4. Send email to SC members with EuPRAXIA dates (Action: **R. Mundt**). Please review EuPRAXIA dates. (Action: **all**). ✓
5. B. Cros and R. Pattathil/A. Mostacci will set up a meeting to discuss access for experiments. (Action: **B. Cros** and **R. Pattathil/A. Mostacci**)
6. Add P. Nghiem to SC email list. (Action: **R. Mundt**). ✓
7. For the agenda of the next SC meeting: Discuss agenda of Yearly Meeting at INFN (Action: **A.Walker**)
8. Discussion to organize workshop with industries (Action: **R. Pattathil**)

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EuPRAXIA Deliverables

- EuPRAXIA: proposal for **site independent conceptual design study** for a European Research Infrastructure that
  - (a) can produce **high quality electron beams** from plasma accelerators
  - (b) advance several **applications for pilot users**.
- **Deliverables** in CDR:
  - (a) Technical concept(s) and major components of EuPRAXIA facility
  - (b) Cost
  - (c) Schedule
  - (d) Concept of usage
  - (e) Governance model
  - (f) Site studies
- We are free in what exactly we want to propose.

How to Get to EuPRAXIA Proposal

- Important **criteria** for a good/useful proposal:
  - **Reflect wishes, needs and ideas** of EuPRAXIA institutes
  - Be **convincing**: (a) Clear and easily explainable concept. (b) Technically feasible.
  - Be **ambitious**: (a) Extension of present state of the art. (b) Clear innovation potential. (c) Building on leadership of European laser industry.
  - **Maximize chance** for obtaining funding.
- The criteria and weightings will provide an important data basis for our work and we need to go through this exercise.
- However: No automatic algorithm will derive the best possible proposal for us. We will have to **form our proposal based on the info we get**!

Centers and Distribution Budget

- EuPRAXIA: **Build EuPRAXIA similar to a particle physics detector – many labs together build a central infrastructure**
- We need to collect interests and proposals. For example:
  - Who does prototyping, testing and building of EuPRAXIA laser(s)?
  - Who does prototyping, testing and building of RF injector/linac?
  - Who does prototyping, testing and building of plasma accelerator(s)?
  - Who does prototyping, testing and building of undulators?
  - Who does prototyping, testing and building of instrumentation?
  - Who does theory and simulation follow-up?
  - Who does project management?
- **Can and should be consortia of labs, using their local expertise and infrastructure**! Budget follows from responsibility!

EuPRAXIA Candidate Sites

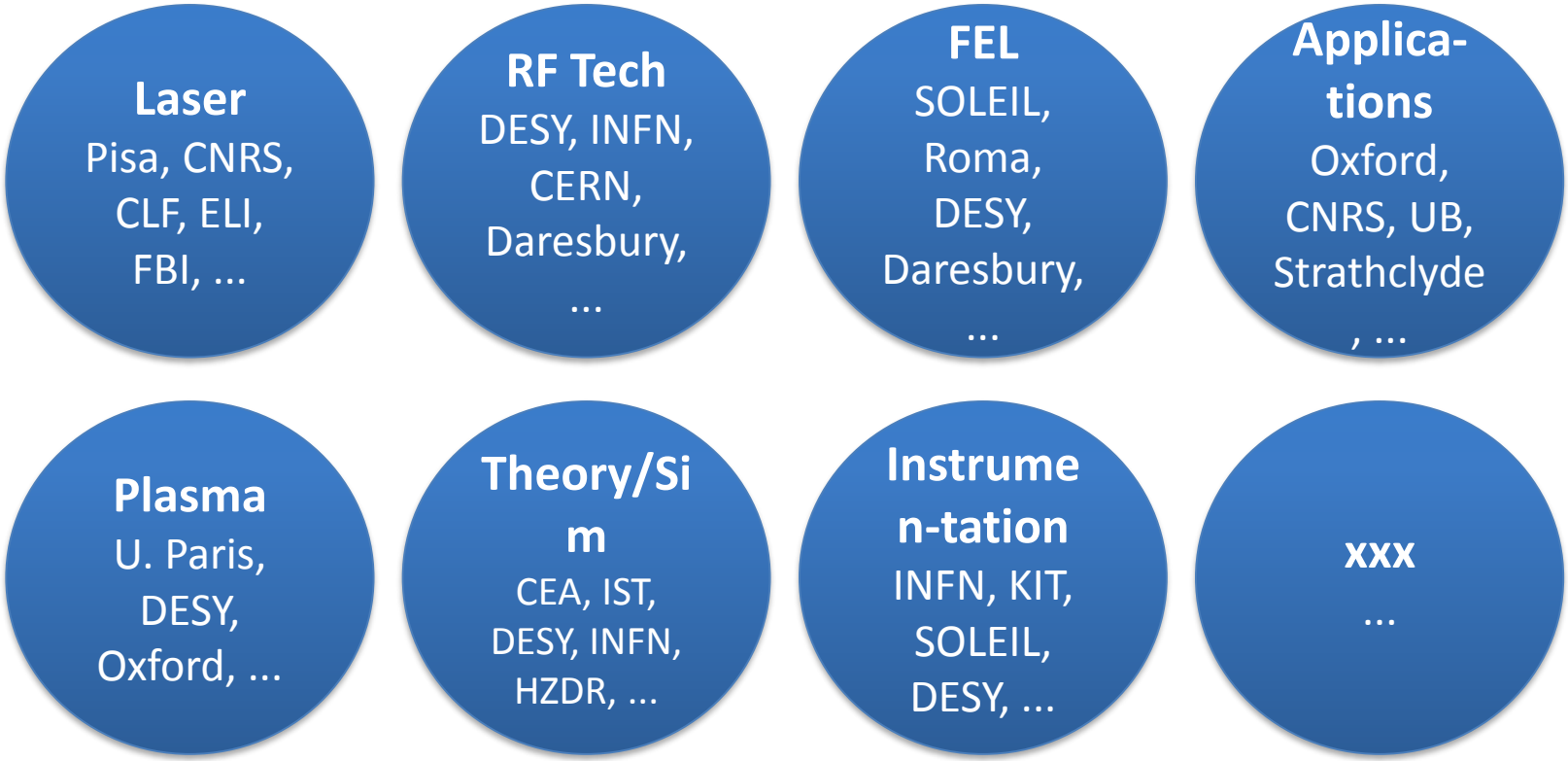
- **Possible sites** for EuPRAXIA research infrastructure being pushed strongly and clear site studies:
  - **Frascati, Italy** (first few M€, aiming for 50 M€ Italian project)
  - **DESY, Germany** (electron site for ATHENA a 30M€ invest laser plasma project)
- **Other possible sites** which have been discussed:
  - **CILEX, France** (political support not yet clear)
  - **CLF, UK** (impact from BREXIT unclear)
  - **ELI** (laser infrastructure with important milestones ahead – happy to connect to EuPRAXIA without being the EuPRAXIA site)
  - ... (?)
- In this situation, have been thinking about best way forward...

EuPRAXIA Candidate Sites

- Imagine original EuPRAXIA approach with competing sites:
  - Competing sites but **decision process after end of EuPRAXIA CDR unclear**.
  - EuPRAXIA message in October 2019 will be weaker: “we know what we want but we do not know where”
  - Large **potential for several years of delay**: “first decide site and then come to ask for budget”
- Possible risk:
  - Most strongly advanced site proposals move ahead without waiting for EuPRAXIA site selection process and form **independent European/international collaborations** around them.
  - E.g. an Italian and a German EuPRAXIA project moving in parallel.
  - Would **weaken our idea and reduce much the chance to obtain additional EU funding**!

EuPRAXIA Concept: Competence View

- Consortia address the relevant topics in design, construction and commissioning. Budget defined by responsibility...



Not complete, just examples...

Governance Model

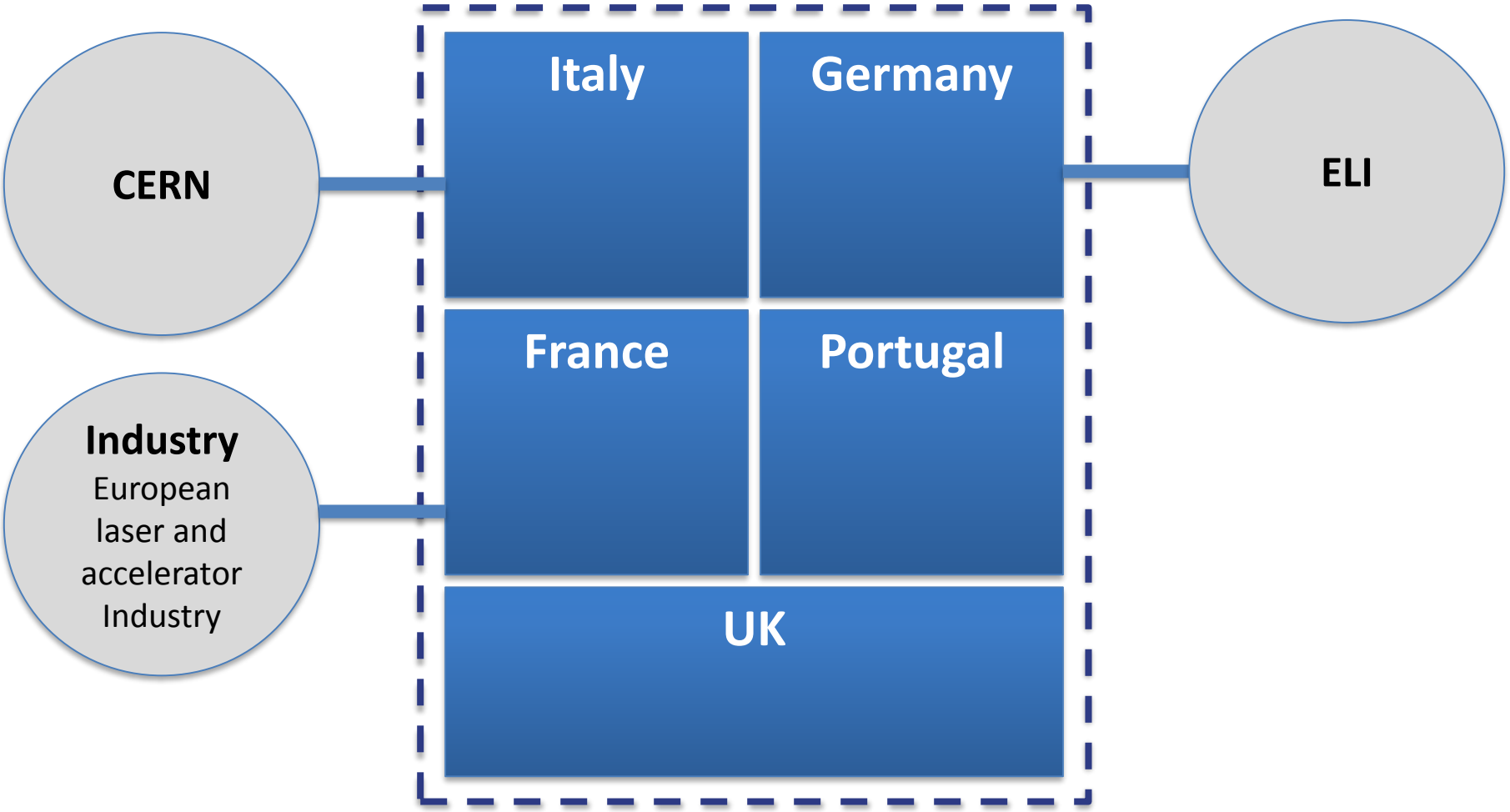
- We will also need to define a governance model of EuPRAXIA
- Proposal: **Model after high energy physics collaborations for constructing a big detector**.
- Have one of the agreements as model. For example:
  - Collaboration board as top executive body.
  - Agreements on part deliveries, responsibilities.
  - Publication policy.
  - Spokesperson elected.
  - …
- Comments and suggestions welcome. Volunteers to help are welcome.

Can we define a proposal for THE easily explainable EuPRAXIA that we want budget for as soon as possible?

- Thought about a possibility.
- The following is just for discussion – need to collect ideas and proposals how to have it best balanced.
- But must remain easy and convincing...

EuPRAXIA Concept: Alternative Site View?

- Define future approach now, reflecting national approaches?



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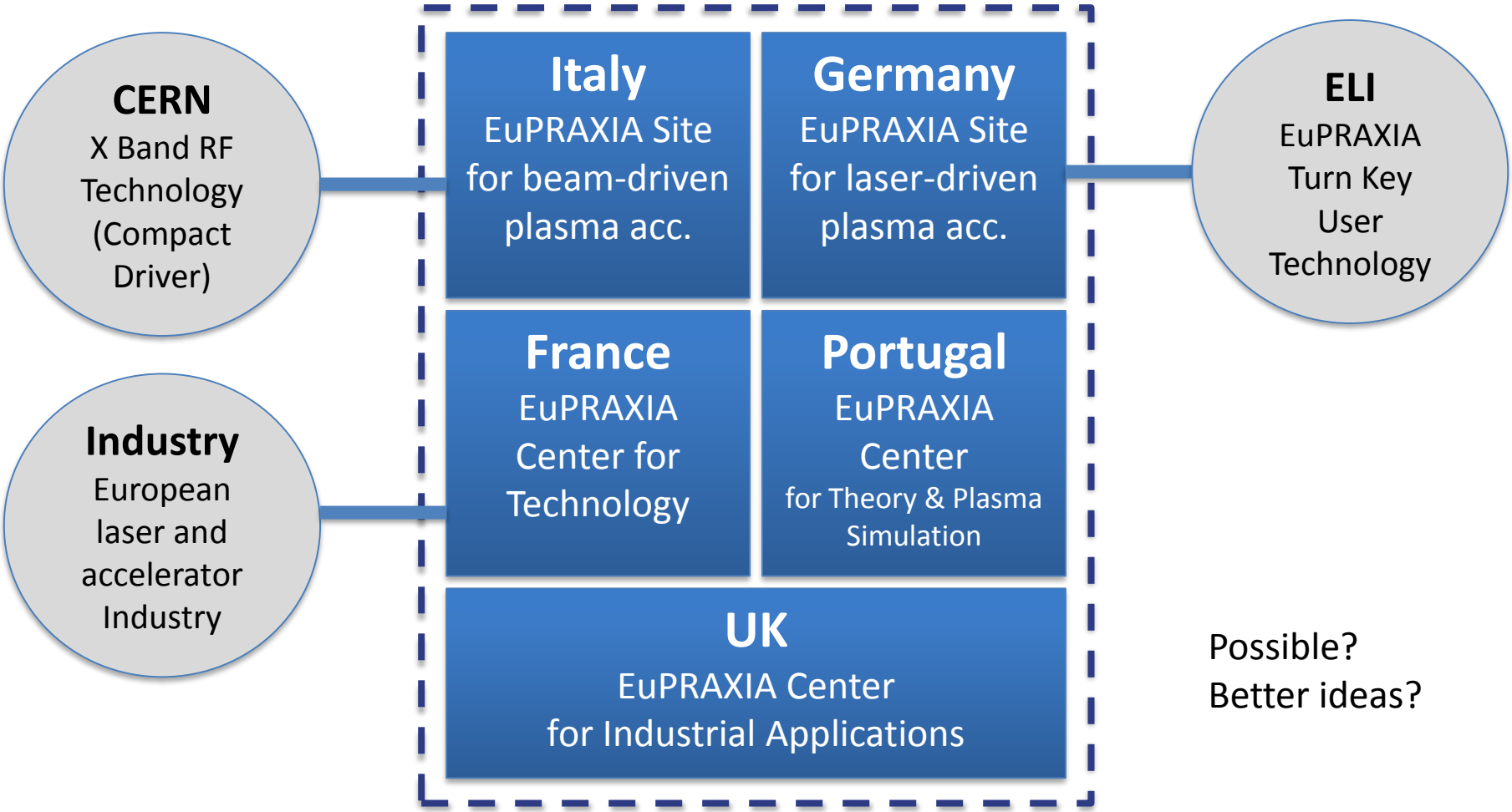
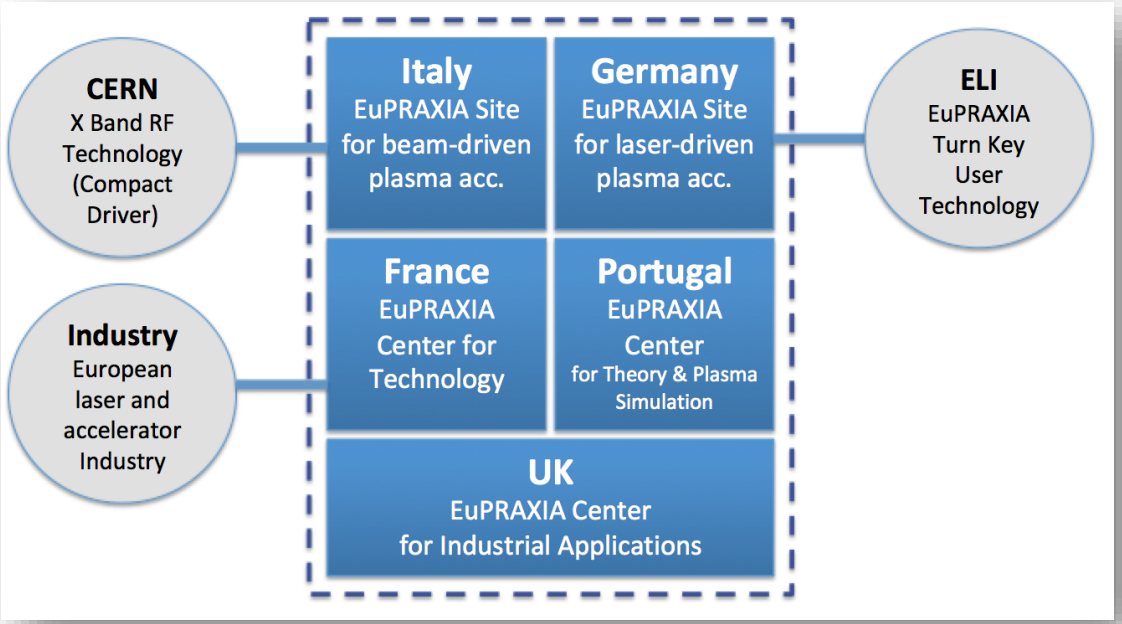


Possible?
Better ideas?

EuPRAXIA Concept: Alternative Site View?

- Reflects ambitions known to us but integrates all into a common project.
- Two sites reflect two driver technologies – minimal duplications due to common project work!
- Use of existing sites use pre-invest and make sure OP costs are covered.
- Very visible roles to France, Portugal and UK without the need to propose a site.
- Connects to European industry, ELI and CERN.



- Simplifies discussion of radiation protection, safety, ...: labs take care of it through existing structures.
- Easy to explain to people not interested in technical details.

For discussion...

Today

- No decision
- Just discussion and start of collecting ideas and proposals
- In any case need to collect the possible contributions (competence view) and budget requests
- In parallel discuss country/side view
- Keep both possibilities (decide one site later – two possible sites plus centers) until we decide a solution

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SAC Report – WP1

Rec1. Re-communicate goals of EuPRAXIA. To get on the ESFRI roadmap, EuPRAXIA must provide the perspective of a **transformative change** of accelerator that benefits applications with high societal impact – don't fall short on innovation.

- User facility/FEL vs technology demonstrator vs competitive accelerator!
- Some WPs are mainly working on a very modest extension of today's S&T.

Attention should be given to develop a **compelling** set of applications that goes beyond the FELs.

Rec2. Integration across WPs to develop the CDR will be most challenging. It will take time to transition EuPRAXIA from present status to CDR finalization, and mature the design(s). Sensitize work package leaders and find out where help is needed. Develop and communicate **process** to establish CDR.

- **Homogenize** the requirement space across work packages
- Identify **frontrunner** approaches, **technical gaps** and request comprehensive technology development **roadmaps** from WP leaders.

Agree on a **down-selection matrix**; keep other approaches as backup solutions or future opportunities in the back pocket

Rec3. Establish **crisper** communication between WP leaders to support the CDR integration:

- define **interface requirements** between WPs more clearly
- identify technical gaps, showstoppers, risks and mitigations and resulting priorities for R&D.
- consider using Technical Readiness Levels to assess maturity of various approaches.

SAC Report – WP1

Rec4. Repetition rate, average brightness and flux are important to making a convincing argument for wakefield accelerators. The stated repetition rates, which the WP leaders are working against, were inconsistent with each other and spanned from “not considered yet” to 100Hz, away from the original goal of 1 kHz. In general, average power effects and high repetition rate aspects are lacking attention; partially because expertise on average power effects in the area of

- Lasers, Targets (still extrapolation from existing solutions)
- Plasma – dissipation of heat, lifetime, rep rate – fundamental to the success of the project and to convince sponsors

is missing in the WP. We recommend considering adding Subject Matter Expertise to the project to address this gap.

SAC Report – WP2

Rec5. SAC recommends to define a time-line for starting this down selection process that should lead to a CDR with identified solutions for the low energy case (1 GeV) and the high-energy case (5 GeV) in one year from now.

Rec6. SAC recommends reinforcing the coordination with the above WP and considering opening up the design space if showstoppers are identified by any of the WPs, e.g. a mitigation of the high average power could be achieved by scaling the process of instability formation, with a longer driver wavelength.

Rec7. SAC recommends carrying on an analysis of the stability of the solutions under investigation and including the stability parameter as an element in the down selection process; deepening the analysis of the effects associated to non-ideal conditions, such as density fluctuations in the plasma target, quality of transverse laser mode, and, in the cases of external injection, the injection process with realistic laser temporal profiles and plasma densities. The latter should be investigated to understand the role of the beam energy in the external injection and could be an important element of selection.

Rec8. If additional effort in simulations is required, SAC recommends ensuring additional computer resources in institutes.

SAC Report – WP3

Rec10.SAC recommends detailed evaluation of plasma & laser diagnostics, laser beam/electron beam alignment and synchronization for the CDR.

Rec11. SAC recommends performing a thermal study of the plasma cell considering the significant increase of laser average power and to prototype the plasma cell according to final design for any activity following the design study.

SAC Report – WP4

Rec12. Broaden the dialogue to other WPs (e.g. WP2, WP5, WP14) to inform their and your design space, specifically on critical parameters (e.g. a0 vs power/focal area).
Rec13. Explore **feasibility** of **timing precision and jitter** requirements provided by WP2 and WP3, and how it can be verified at the target.
Rec14. Develop a better understanding of pointing requirements and metrics, specifically how they are coupled to the facility.
Rec15. Develop a strategic technology **roadmap** that supports the overarching performance goals of EuPRAXIA. Get guidance on technology demonstrator vs science facility. Maintain perspective of technologies that can scale.
Rec16. Given the timescales on how much technology development is required, how long does it take, and when construction of a system could start, identify risk reduction experiments that **add credibility** to the feasibility of certain technologies.
Rec17. Develop a **crisp risk matrix** for each technology approach, identify bottlenecks and areas where risk reduction experiments are needed. Identify synergetic efforts between technology paths.
Rec18. Use **technical readiness levels** for the integrated laser system concepts (not individual components) to assess and compare maturity of each solution.

SAC Report – WP5

Rec20. SAC recommends analysing the expected effects of electron scattering in the gas, the effect on the emittance growth and the resulting dose irradiated.

SAC Report – WP6

Rec21. SAC suggest that the FEL application drives more strongly the definition of the important parameters that need to be taken into account for the accelerator.

SAC Report – WP7

Rec22. SAC recommends strengthening the identification of compelling applications and focus on determining the advantage in terms of overall performances, costs and portability with respect to available techniques with similar beam production capacities.

SAC Report – WP8

Rec23. SAC though **considers that realistic expectations** on medical applications, eg. hadron therapy, shall be presented.
SAC notes with pleasure the future planned activities in featuring articles in general media and an outreach symposium.
Rec24. SAC **supports the activities to further foster EuPRAXIA** in different conferences, especially at laser conferences to stimulate the interest for laser challenges.
Rec25. SAC **recommends to add outreach** in social media such as Facebook, Twitter, etc.…and **considers that STEM disciplines** for girls are important to be further promoted within the EuPRAXIA outreach efforts.

SAC Report – WP9

Rec26. The e-beam driven plasma acceleration scheme is a complementary approach. Hence, SAC recommends a detailed analysis of e-beam driven plasma acceleration aiming the same FEL parameters than the laser-based design. It should include a one-on-one evaluation between both technologies. A final statement whether e-beam driven plasma acceleration could be a realistic alternative to the laser-based approach is highly appreciated. SAC would be pleased to see the accomplishment of the one-on-one evaluation by the foreseen deadline of May 2018.
Rec27. In addition, risk-reduction experiments to explore average power loading of a plasma accelerator structure should be considered.
Rec28. Finally, the approach should be considered to explore average power and lifetime aspects of the plasma wakefield structure.

SAC Report – WP10

Rec29. An evaluation of the dielectric accelerator structures including future prospects, challenges and a rough time-line when this technology might be available for a FEL application would be desirable as part of the CDR.

SAC Report – WP11

Rec30. SAC recommends to define and fund an experimental program to support any EuPRAXIA-related activity (TDR, prototyping, de-risking) between current design study and construction phase and to secure the required access to the few already existing facilities needed to achieve it.

SAC Report – WP12

Rec31. To overcome the situation, SAC **recommends dedicated EuPRAXIA test slots** in the experimental facilities. To make it easier getting started in these facilities, **‘parasitic' measurements** with already other approved experiments are proposed.
Rec32. SAC also **considers that some budget** could be cleared from the project to cover possible costs of beam-time.
Rec33. SAC notes that WP12 is an in-kind contribution with **only very limited person power.** In order to coordinate the tests of the different WPs in experimental facilities, SAC **proposes to setup a panel** to coordinate the measurements as well as to ensure that the tests will be performed within the dedicated schedule.

SAC Report – WP13

Rec34. EuPRAXIA collaboration could exploit the opportunity for development of diagnostics for beam transport, radiation coherence measurements and measurement of the correlation beam/radiation of the facility.

SAC Report – WP14

Rec35. Communicate idea to other WP leaders more broadly and establish peer review of the idea within EuPRAXIA to gain support.
Rec36. Develop clear understanding of bottlenecks and risks, specifically which challenges have to be overcome to establish this idea at eye-height with the other approaches.
Rec37. Establish a clear understanding of laser and interface requirements.
Rec38. Continue to build trust in the approach by experimental and modeling effort – request support from EuPRAXIA leadership on gaining timely access to user facilities.

Agenda

7:45 – 8:00	**Coffee**
8:00 – 8:05	Welcome & administrative business: Approval of agenda
8:05 – 8:10	Welcome & administrative business: Approval of minutes from 9th Steering Meeting
8:10 – 8:20	Welcome & administrative business: Action items from 9th Steering Meeting and Collaboration Board Meeting
8:20 – 8:45	Round table (WP1-WP14): Short verbal report, no slides (round-table)
8:45 – 9:45	Discussion and decision on criteria and criteria weightings for prioritising EuPRAXIA technical options (M. Weikum et al)
9:45 – 10:45	Discussion on EuPRAXIA concept for CDR: sites, centres, distribution budget requests, … (R. Assmann et al)
10:45 – 11:00	Coffee break
11:00 – 11:45	Discussion on simulation results and directions (P. Nghiem et al)
11:45 – 12:30	Prioritising EuPRAXIA technical options (round-table)
12:30 – 13:30	Lunch
13:30 – 15:00	Discussion on SAC report (R. Assmann and round-table)
15:00 – 15:15	Calendar Management and towards CDR completion (M. Weikum et al)
15:15 – 15:25	AOB
15:25 – 15:30	Adjourn – End of Meeting

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Consortium

Horizon 2020

16 Participants

24 Associated Partners

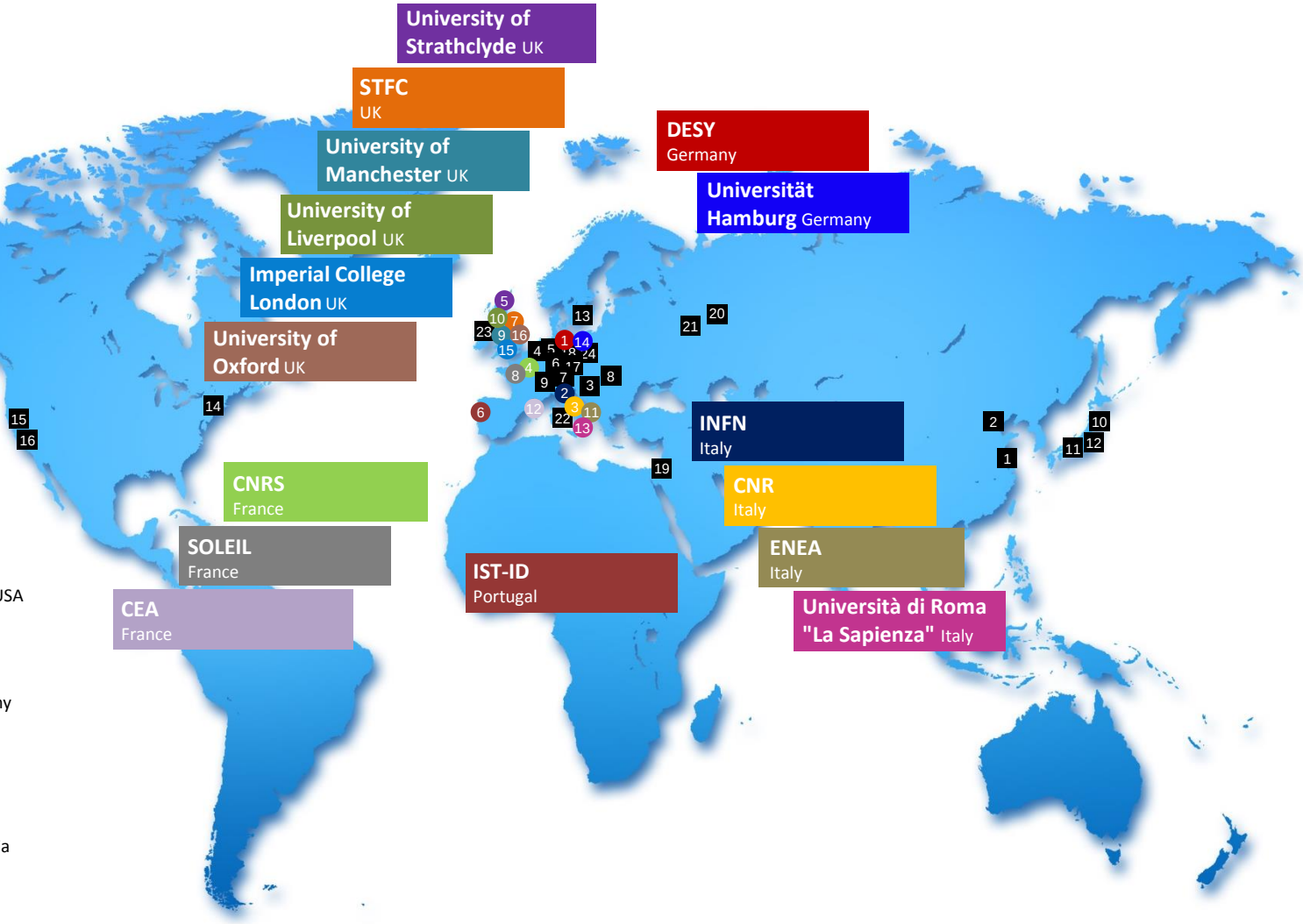
(as of December 2017)

Participating Institutions

Horizon 2020

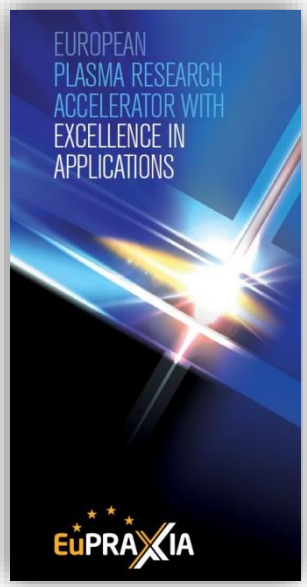
Associated Partners
(as of December 2017)

1. **Shanghai Jiao Tong-University**, China
2. **Tsinghua University Beijing**, China
3. **ELI Beamlines**, International
4. **PHLAM, Université de Lille,** France
5. **Helmholtz-Institut Jena**, Germany
6. **HZDR (Helmholtz)**, Germany
7. **LMU München**, Germany
8. **Wigner Fizikai Kutatóközpont**, Hungary
9. **CERN**, International
10. **Kansai Photon Science Institute**, Japan
11. **Osaka University**, Japan
12. **RIKEN SPring-8**, Japan
13. **Lunds Universitet**, Sweden
14. **Stony Brook University & Brookhaven NL**, USA
15. **LBNL**, USA
16. **UCLA**, USA
17. **Karlsruher Institut für Technologie**, Germany
18. **Forschungszentrum Jülich**, Germany
19. **Hebrew University of Jerusalem**, Israel
20. **Institute of Applied Physics**, Russia
21. **Joint Institute for High Temperatures**, Russia
22. **Università di Roma 'Tor Vergata'**, Italy
23. **Queen's University Belfast**, UK
24. **Ferdinand-Braun-Institut**, Germany



Dissemination

Horizon 2020



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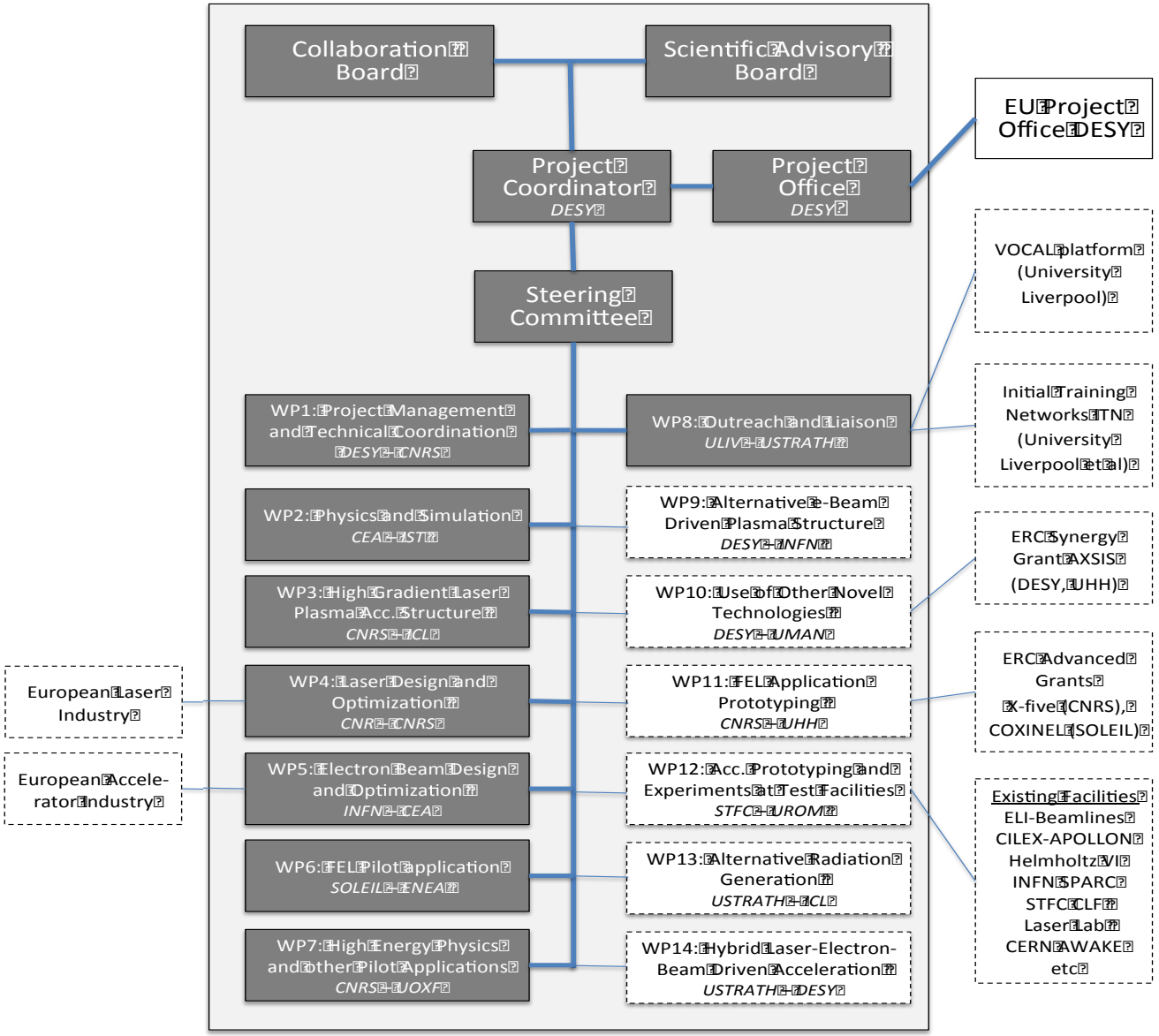
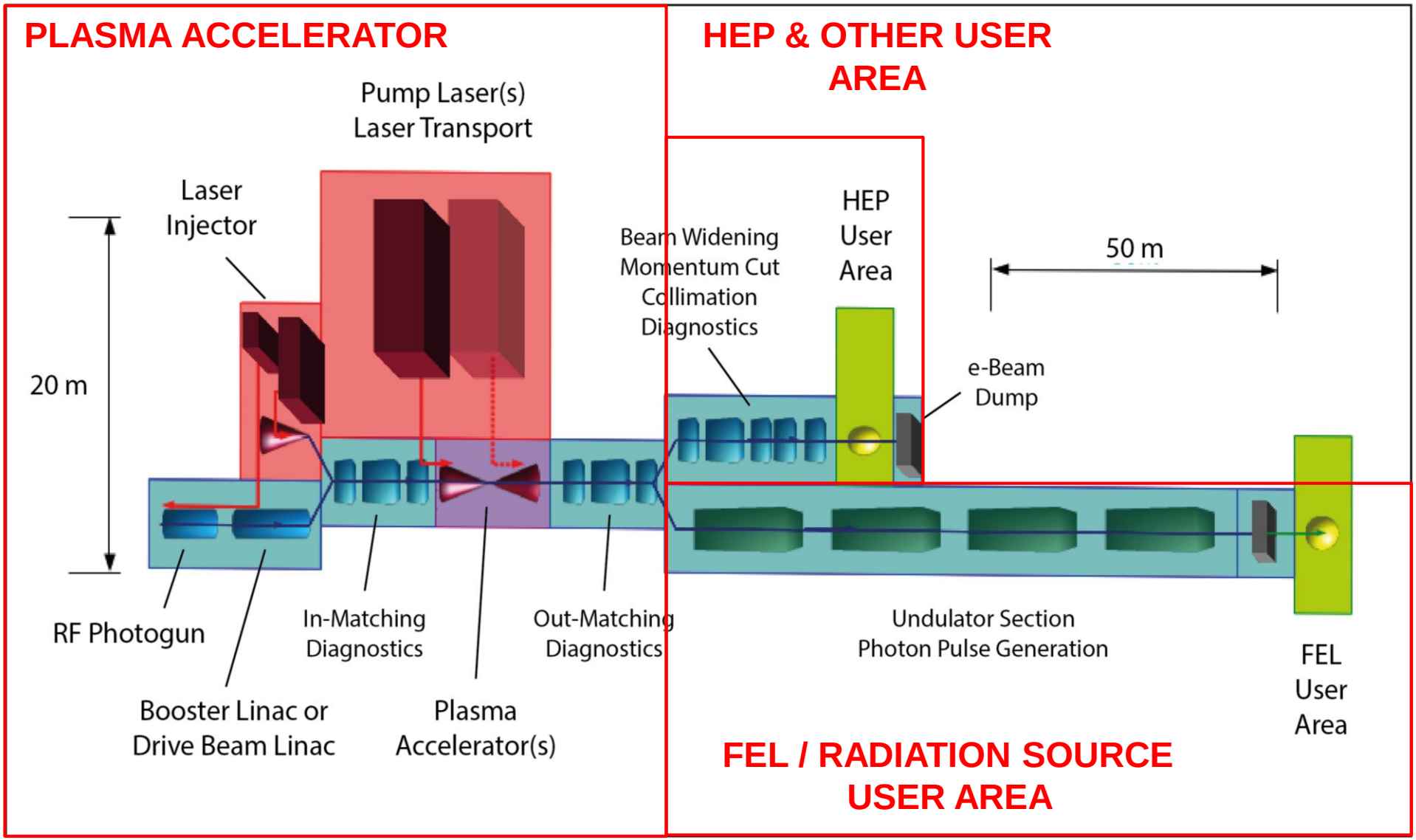
#EuPRAXIA
#plasma
#accelerator

Work Breakdown Structure




PLASMA ACCELERATOR
HEP & OTHER USER AREA
Pump Laser(s)
Laser Transport
Laser Injector
20 m
Beam Widening
Momentum Cut
Collimation
Diagnostics
HEP User Area
50 m
e-Beam Dump
RF Photogun
In-Matching Diagnostics
Out-Matching Diagnostics
Undulator Section
Photon Pulse Generation
FEL User Area
Booster Linac or Drive Beam Linac
Plasma Accelerator(s)
FEL / RADIATION SOURCE USER AREA