EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS

EuPRAXIA 9th Steering Committee Meeting, 22 March 2018

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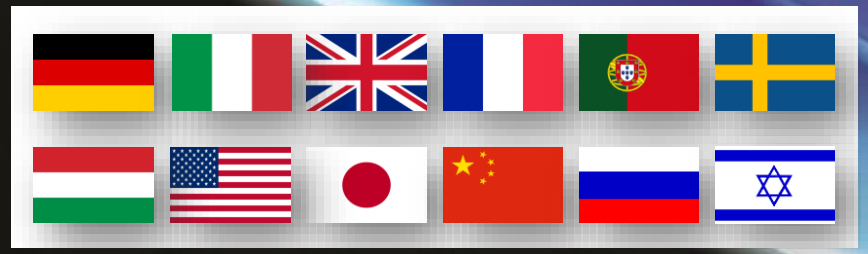

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

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, not included backup options)	(30min)
• 10:15	ESFRI Roadmap Application	(20min)
• 10:35	Liverpool symposium July 2018	(10min)
• 10:45	EuPRAXIA Retreat February 2019	(30min)
• 11:15	Calendar Management	(10min)
• 11:25	AOB	(5min)
• 11:30	Adjourn	

Action Items

1. **Distribute SAC slides to SC (Action: R. Mundt).**
   → done on 15. Dec 2017. SAC report sent yesterday by A. Walker.
2. **Send short email to SAC after they send us their written report (Action: R. Assmann).**
   → done. Many thanks and invited to next SAC.
3. **Re-check date of future SC meetings to make sure they are still convenient for our WP leaders (Action: R. Mundt)**
   → done
4. **Ask new associated partners to sign letters of EuPRAXIA rules (Action: R. Mundt)**
   → done
5. **Check if all members received new PPT template (Action: R. Mundt)**
   → done

Action Items

5. **One poster of job announcements could be displayed at IPAC (Action: R. Assmann)**
   → Maria Weikum followup.
6. **Send new agenda of Liverpool symposium to SC (Action: R. Torres)**
   → reported today
7. **Assign name for each EuPRAXIA case (Action: P. Nghiem/A.Walker)**
   → done by Phi
8. **Everybody who wants to request beam-time, please contact Brigitte Cros** who organizes this in the context of ARIES (Action: all and B. Cros).
   → to be reported

Recommendations SAC Report

Final SAC report received on Feb. 11 at start of my vacation → therefore late redistribution.

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

Recommendations SAC Report: WP1

WP1 continued

- **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.

- **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.

Recommendations SAC Report: WP2

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.
- The continuation of the analysis and convergence of the parameters should be ensured with a proper coordination with the other working package leaders, in particular with WP4 (laser systems), WP5 (beam handling and diagnostics) and WP6 (FEL requirements). The input from WP6 is for example essential in reducing the number of configurations analysed, narrowing the spectrum of configurations to the ones ensuring e.g., a minimum acceptable charge or a maximum acceptable energy spread. The space of laser parameters varies widely from tens of TW to PW with extremely tight specifications (e.g. synchronization). SAC notes that the analysis does not consider so far the implications associated to the 100 Hz drive beam, which should deliver an average power of 10 kW in the interaction region. These implications should be considered on both the diagnostics (WP5) and the plasma target, analysing the relaxation times, the heat removal from plasma (this work package). A mitigation of the average power could be achieved analysing the scaling parameters of the process of instability formation, as e.g. the driver wavelength.

Recommendations SAC Report: WP2

WP2 continued

- **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.
  - SAC learns from the WP2 leader that the different codes used were benchmarked one another on similar physical situations leading to compatible results. Despite this, it was pointed out a poor stability of the solutions analysed leading to a high sensitivity to the input parameters.
- **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.

Recommendations SAC Report: WP3

WP3

- **Rec9.** SAC recommends decreasing this number in the short term with appropriate metric and thereafter to perform tolerance studies for the main parameters.
- SAC considers that interactions between WP3 and other WPs needs to be reinforced in particular for the definition of laser parameters requirements to avoid over-specification or under-specification (Example 1: pointing stability requirement described more appropriately by distance shift of focal spot than an angle. Example 2: temporal contrast which seems to be over specified considering a gas medium for the interaction).
- **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.

Recommendations SAC Report: WP4

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.

Recommendations SAC Report: WP5 & 6

WP5

- **Rec19.** SAC recommends including the diagnostics for the pre-acceleration injection of the beam in the overall analysis. These diagnostics could be the subject of experimental investigation at one of the two facilities proposed for external injection, at Flash Forward or at SPARC.
- **Rec20.** SAC recommends analysing the expected effects of electron scattering in the gas, the effect on the emittance growth and the resulting dose irradiated.

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.

Recommendations SAC Report: WP7 & 8

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.

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.

Recommendations SAC Report: WP9

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.

Recommendations SAC Report: WP10, 11, & 12

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.

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.

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.

Recommendations SAC Report: WP13 & 14

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.

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.