

EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



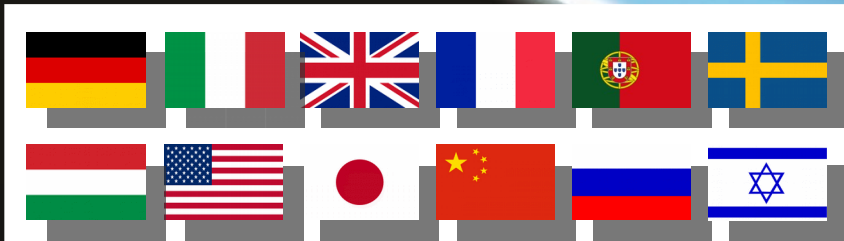
Horizon 2020 EuPRAXIA design study

Ulrich Dorda (DESY)

On behalf of the EuPRAXIA collaboration team

TIARA meeting

June 19th, 2017

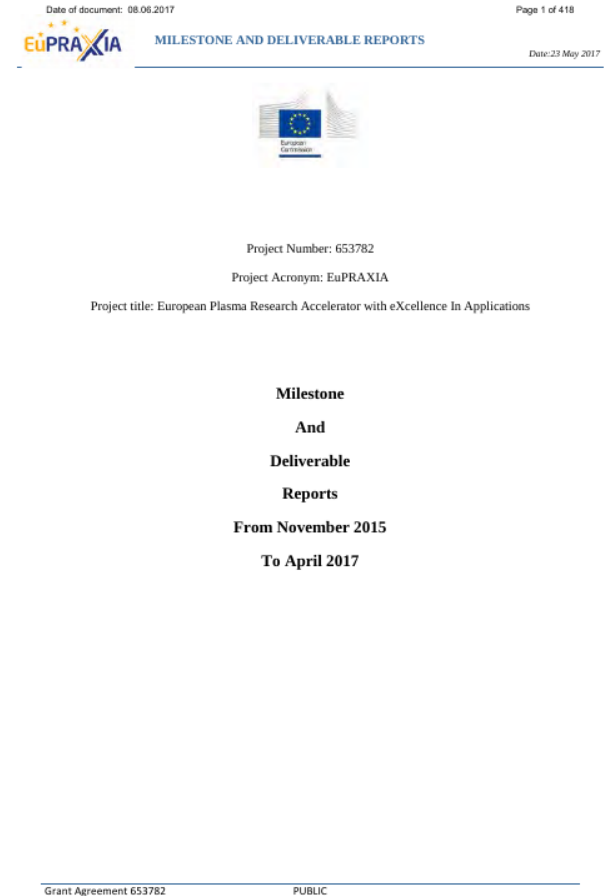


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

- EuPRAXIA is a **conceptual design study** for a **5 GeV electron plasma accelerator** as an European research infrastructure
- 125 scientists work in 38 international partners
 - 16 EU laboratories are beneficiaries
 - 22 associated partners contribute in-kind
- EuPRAXIA is an EU Horizon 2020 project
- Develop plasma technology for user readiness:
 - Incorporate established accelerator technology for optimal quality
 - Combine expertise from accelerator and laser labs, industry, and international partners



- Continue to deliver the milestone reports & workshops
- Collection available >400pages
- This year:
 - WP2 – Physics and simulation: Report designing baseline designs
 - W3 – High gradient laser plasma accelerator structure: “Design for an electron injector and a laser plasma stage proposed”
 - WP4 – Lasers: “Preliminary laser requirements table and tech survey”
 - WP7 – Applications: “HEP and Other Pilot Applications”
 - WP10 – other novel technologies: “Tests of ultra-cold electron bunch from an alternating current magneto-optical trap”



- Up to now, EuPRAXIA efforts were done in the kick-off meeting and scattered work-package meetings (<http://www.eupraxia-project.eu/events.html>)
- In order to reduce travel and enhance synergies & collaboration also between the WGs, the 1st EuPRAXIA week is starting right now.
- <https://indico.cern.ch/event/613622/overview>
- 79 participants
- Next EuPRAXIA week: Nov'17



EUROPEAN PLASMA RESEARCH ACCELERATOR WITH EXCELLENCE IN APPLICATIONS

Collaboration Week

19-23 June 2017
DESY Hamburg

ADVANCED TECHNOLOGIES
EuPRAXIA joins novel acceleration schemes with modern lasers, the latest correction technologies and large-scale user areas. The consortium offers unique training opportunities for researchers in a multidisciplinary field.

OPENING NEW HORIZONS
The project will bridge the gap between successful proof-of-principle experiments and ground-breaking, ultra-compact accelerators.
With a smaller size and improved efficiency, plasma-based technologies have the potential to revolutionize the world of particle accelerators multiplying their applications to medicine, industry and fundamental science.

INTERNATIONAL COLLABORATION
EuPRAXIA brings together a consortium of 16 laboratories and universities from 5 EU member states. The project, coordinated by DESY, is funded by the EU's Horizon 2020 programme.
The consortium holds open international events to strengthen collaborations, to connect to interested users from FELs, high-energy physics, medicine and industry, and to assess the development of the project.

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www.eupraxia-project.eu

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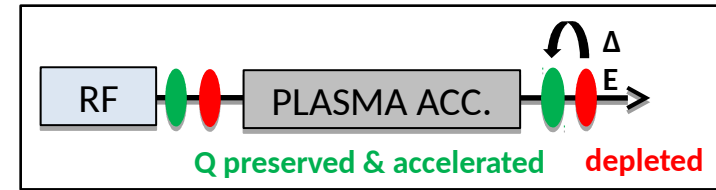
General sessions:

- Layout and major components of EuPRAXIA
- Injectors (RF and LP)
- Status of overall design (start to end simulations, LPA and LWFA)
- Diagnostics & correction devices, realistic imperfections and required redundancies
- Facility Access
- ESFRI Roadmap and funding discussion
 - A experienced person is being contracted to prepare the application EuPRAXIA will apply in 2019. Until then: prepare the required design report & get the support of a hosting country and get on its national roadmap
 - Continuing the efforts to attract additional funding to allow prototyping work to be done e.g. via LEAPS

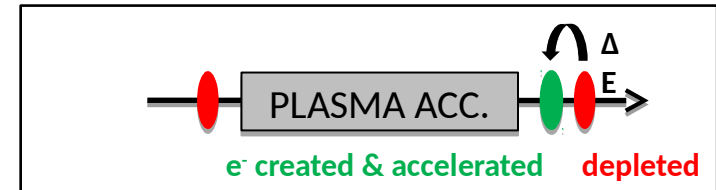
Individual WG sessions with objectives like:

- Prepare mid-term review
- Continue discussion of facility layout – incl. which options should be included
- Are start-to-end simulations working across WGs?
- Plan towards systematic electron simulated / experimental data comparison
- Narrow down design of plasma structure option
- Work towards a preliminary laser design (→ delivery report 4.2 in month 24)
- Is a longitudinal triangular shape (ideal for beam loading in the LPWFA) suitable for FEL operation

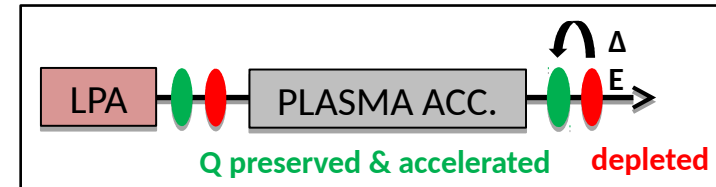
1) RF electron injector + laser plasma accelerator (LPA)
(LWFA with external injection from an RF accelerator)



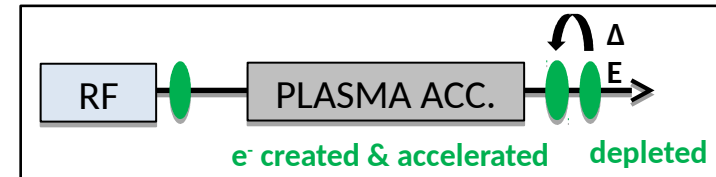
2) LPA with electron bunch created in plasma directly
(LWFA with internal injection)



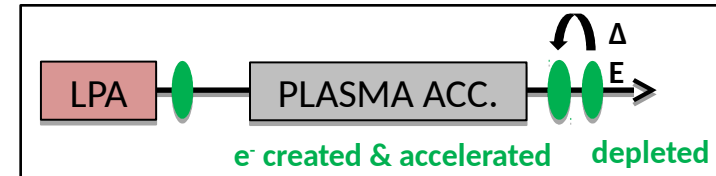
3) LPA electron injector + LPA
(LWFA with external injection from a LPA)



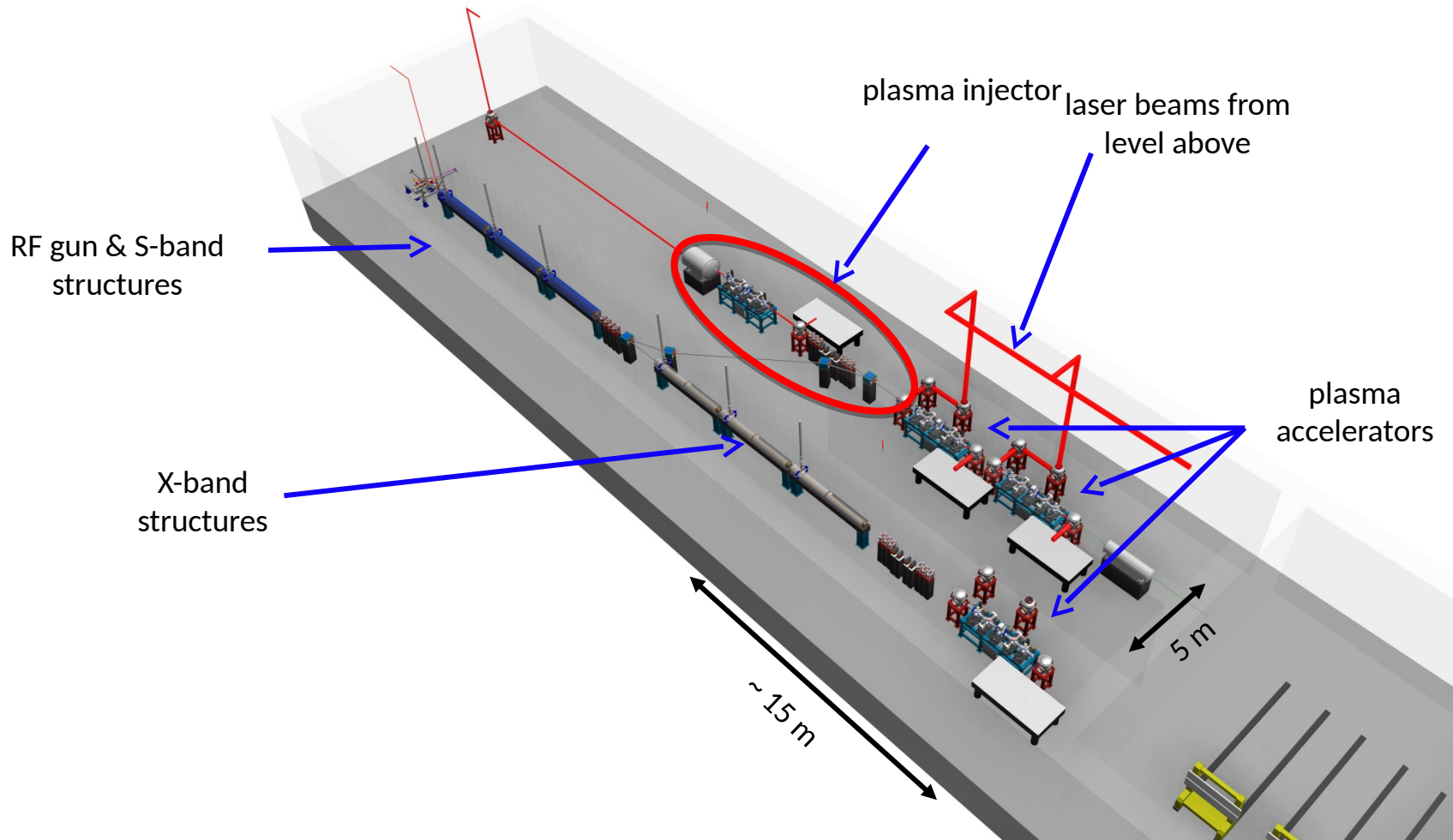
4) RF electron bunch as beam driver in LPA
(PWFA with an RF electron beam)



5) RF electron bunch as driver in a hybrid stage
(PWFA with LWFA produced electron beam or Trojan Horse scheme)

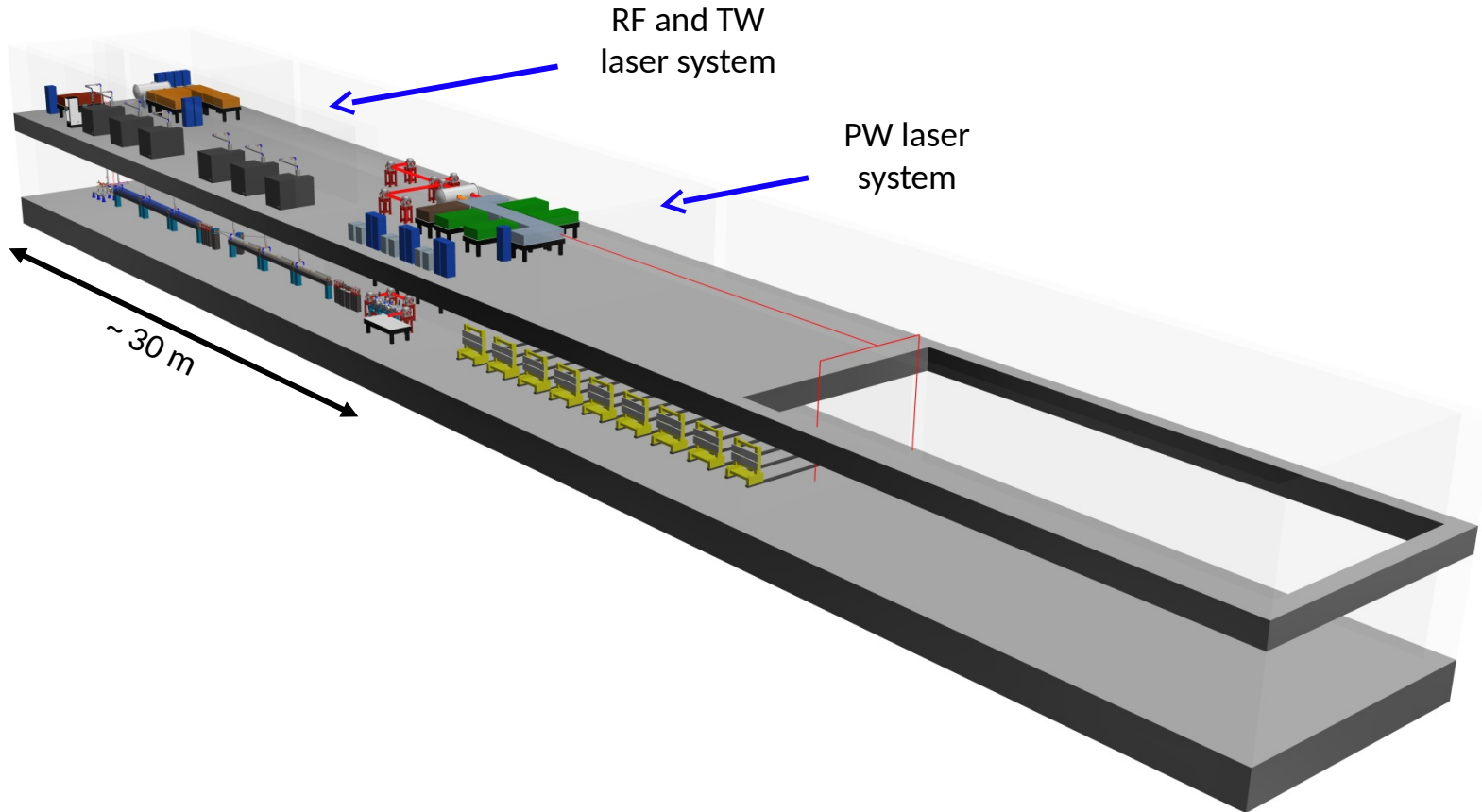


● Laser beam ● Electron beam



3D design by P.A. Walker (DESY) and Dariusz Kocoń (ELI-Beams)

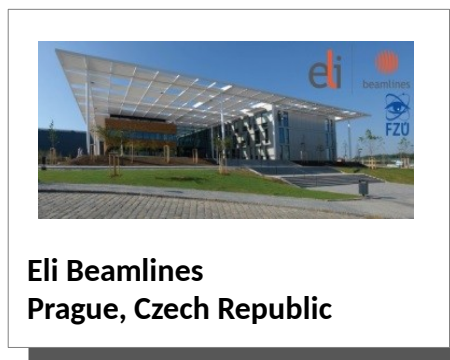
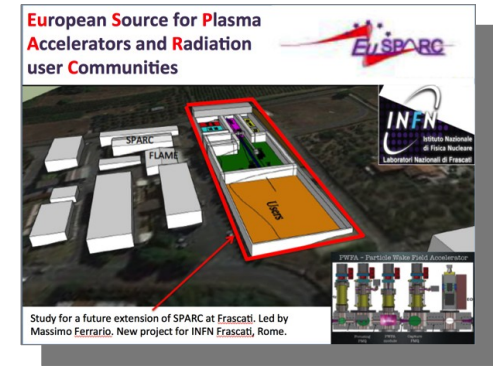
See IPAC paper: P.A.Walker et al., 'Layout and space considerations for EuPRAXIA', IPAC'17, **TUPIK012**



Acc. tunnel + infrastructure **about 300 - 600 m² for 5 GeV** (depending on conf.)

3D design by P.A. Walker (DESY) and Dariusz Kocoń (ELI-Beams)

- EuPRAXIA design study is site independent
- Five possible sites have been discussed so far
- We invite the suggestions of additional sites



The EuPRAXIA team

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www.eupraxia-project.eu

3rd European Advanced Accelerator Concepts workshop
 Supported by EU/ARIES via EuroNNAc3
 24-30 September 2017, La Biodola - Isola d'Elba - Italy

Laser technology for advanced accelerators
 Dielectric structures and other novel technologies
 Advanced and novel accelerators for High Energy Physics
 High gradient and multibunch acceleration in metallic structures
 (C-X-band and beyond) with innovative power generation schemes
 Plasma accelerators driven by: modern lasers, electron beams, proton beams
 Computations for Accelerator Physics Advanced beam diagnostics for beams and plasma
 Novel schemes using advanced technologies (table-top FEL, medical imaging ...)

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