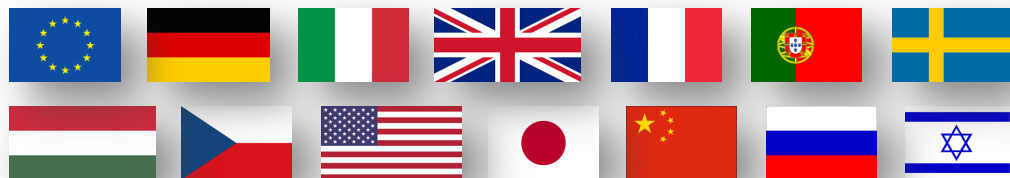




# EUROPEAN PLASMA RESEARCH ACCELERATOR WITH EXCELLENCE IN APPLICATIONS

## Report to TIARA

Ralph Assmann, DESY



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[EVENTS](#)
[CONTACT US](#)
[VACANCIES](#)
[INTRANET](#)

# EuPRAXIA

NOVEL FUNDAMENTAL RESEARCH  
 COMPACT EUROPEAN PLASMA  
 ACCELERATOR WITH SUPERIOR  
 BEAM QUALITY

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**OUR TECHNOLOGY**  
EuPRAXIA brings together novel acceleration schemes, modern lasers, the latest connection technologies and large-scale user areas.

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**PARTICIPANTS**  
A consortium of 16 laboratories and universities has formed to produce a conceptual design report.

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**WORK PACKAGES**  
The project is structured into 14 work packages of which 8 are included into the EU design study.

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**MANAGEMENT**  
The management bodies will organise, lead and control the project's activities and make sure that objectives are met.

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[www.eupraxia-project.eu](http://www.eupraxia-project.eu)



#EuPRAXIA  
 #plasma  
 #accelerator

**DESIGNING THE FUTURE**

The EuPRAXIA Consortium is preparing a conceptual design for the world's first multi-GeV plasma-based accelerator with industrial beam quality and dedicated user areas.

**ADVANCED TECHNOLOGIES**  
EuPRAXIA joins novel acceleration schemes with modern lasers, the latest connection technologies and large-scale user areas. The consortium offers ample training opportunities for researchers in a multi-labulatory 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 revolutionise the world of particle accelerators, involving their applications to medicine, industry and fundamental science.

**INTERNATIONAL COLLABORATION**  
EuPRAXIA brings together a consortium of 16 laboratories and universities from 12 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 collaboration, 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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**THE EuPRAXIA FILES**  
 ISSUE 1 - May 2016

**Forward**

Novel accelerators have seen strong advances not only in achievable beam energy but also in beam quality. This success story is still developing, as you can see from the publications that we collect in the first edition of "The EuPRAXIA Files". As many of you are aware, the Horizon2020 Design Study EuPRAXIA aims at a conceptual design for a European plasma accelerator with useful beams. Instead of another newsletter we will regularly provide you with summaries of recent publications, letting the science speak for itself. EuPRAXIA has meanwhile had an excellent project start and is gearing up to a workshop in Pisa at the end of June, organised together with the European Network for Novel Accelerators EUPRAXIA2 and EUCAR22. For further news on EuPRAXIA please visit our website or read regular updates in "Accelerating news". We wish you some inspirational science reading in the edition of "The EuPRAXIA Files", prepared by the EuPRAXIA outreach team in Liverpool with Ricardo Torres as lead editor.

**Research Highlights**

**Berkeley Lab Scientists Create the First-ever, 2-stage Laser-plasma Accelerator Powered by Independent Laser Pulses**

Researchers from the Lawrence Berkeley National Laboratory in the US have made an important breakthrough in the development of ultra-compact high-energy plasma-based accelerators.

In a paper recently published in *Nature*, they demonstrate for the first time the technique of "staging", or sequencing multiple plasma accelerators independently powered. Staging is critical for high-energy physics applications of laser-plasma accelerators, as it enables to achieve higher beam energies, while maintaining accelerating gradients orders of magnitude above conventional technology.

In these experiments, electrons from one laser-plasma accelerator were transported into a second laser-plasma accelerator, powered by a second laser pulse, and accelerated. What was particularly novel about the experiment is that a plasma-based lens was employed to shape the beam between stages and a plasma mirror was used to couple in the second laser pulse. These plasma-based components allowed the system to remain extremely compact.

With this result, one can envision scaling to beam energies of interest for high-energy physics applications in a compact footprint. However, these results are a first step toward the vision—requirements of higher beam energy, with higher efficiency and improved beam quality, will need to be performed to further develop plasma-based technology for next-generation colliders.

Read more at: <https://www.nature.com/2016/05/01/12-stage-laser-plasma-accelerator/>

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Page | 1

EUROPEAN PLASMA RESEARCH ACCELERATOR WITH EXCELLENCE IN APPLICATIONS



**Associated Partners**  
*(as of October 2016)*

- |              |            |
|--------------|------------|
| 1 JUS        | 12 RSC     |
| 2 TUB        | 13 LU      |
| 3 ELI-B      | 14 CASE    |
| 4 PHLAM      | 15 LBNL    |
| 5 HIJ        | 16 UCLA    |
| 6 HZDR       | 17 KIT     |
| 7 LMU        | 18 FZJ     |
| 8 WIGNER     | 19 HUJI    |
| 9 CERN       | 20 IAP RAS |
| 10 KPSI/JAEA | 21 JIHT    |
| 11 OU        | 22 URTV    |

6 institutes joined as associated partners in October 2016, after completion of formal procedure

- Manpower list: **119 scientists in our list**
  - Working members
  - Committees
  - From students to post-docs to staff to directors...
- October 2016: Technical tables of 1<sup>st</sup> study version published
  - About 20 pages of tables.
  - Colleagues now working on start-to-end simulations
- Several EuPRAXIA meetings happening at various places in Europe

Working package #	Time	Place
WP4 workshop	18.05.2016	Soleil, France
WP10 meeting	19.05.2016	WebEx
PISA workshop	29.6.-1.7.2016	Pisa, Italy
WP1&8	30.06.2016	Pisa, Italy
WP3&4&10	30.06.2016	Pisa, Italy
WP2&5&6&7&9&11&13	30.06.2016	Pisa, Italy
WP6&7&11&12&13	30.06.2016	Pisa, Italy
WP9&10&14	30.06.2016	Pisa, Italy
WP2&3&4	30.06.2016	Pisa, Italy
WP2&5&9	01.07.2016	Pisa, Italy
WP6&11	01.07.2016	Pisa, Italy
WP5 meeting	25.07.2016	WebEx
WP14 meeting	27.07.2016	DESY, Germany
WP10 meeting	01.09.2016	WebEx
WP9 workshop	3.-4.10.2016	Frascati, Italy
WP5 workshop	5.-6.10.2016	Frascati, Italy
WP7 workshop	11.-13.10.2016	Paris, France
WP3 workshop	26.10.2016	Paris, France
WP2 workshop	26.10.2016	Paris, France
Yearly Meeting	26.-28.10.2016	Paris, France
WP14 meeting	20.11.2016	DESY, Germany
WP2 meeting	20.01.2017	Lisbon, Portugal
WP5 meeting	25.01.2017	DESY, Germany
WP9 meeting	26.-27.1.2017	DESY, Germany

Plus steering meetings all 3 months and future funding discussion in December 2016

- Major meetings planned up to end of project
  - 2 **collaboration weeks** in 2017 at DESY
  - Symposium in Liverpool 2018
  - ...
- Strong industry participation in advisory board
- Plenary talk at HEDS conference in Japan in April 2017
  - Exchange with CSTI (Council for Science, Technology and Innovation under the Cabinet Office), MEXT (Ministry of Education, Culture, Sports, Science and Technology) and JST (Japan Science and Technology Agency) being discussed by Dr. Sano (project manager of ImPACT program in Japan)
- Contributed talk at IPAC 2017 by Dr. A. Walker (DESY Post-Doc) on EuPRAXIA
- **Special session at EAAC 2017 workshop**

- Applying to **2018 ESFRI roadmap?**
  - INFN strongly supporting
  - Industry pushing (F, GER)
  - France: first national roadmap
  - Germany: ministry thinking but this is on high priority, Helmholtz – among 7 top priorities on president’s agenda
  - Probably getting tight!?
- Applying to **2020 ESFRI roadmap:**
  - Must do this for sure, our baseline plan.
- Offer from external consultant for ESFRI roadmap application being considered

- EuPRAXIA: **3M€ total for 4 years, 38 institutes. CDR ONLY!**
- Collecting funding needs to move ahead and build a serious accelerator
- Thanks to Roy and DESY EU office for December discussion
- Survey from 38 institutes (EU, Russia, Israel only)
  - 18 institutes provided requests (2018 – 2022)
  - At the moment: 50-60 M€ total for four years → about 15 M€/year
- Investigating possible sources
  - Talk again to EU DG research
  - TIARA
  - LEAPS (photon science)
- Unique chance for Europe here: **we work out the option to make a quantum leap for accelerator technology** – needs sufficient funding from some source



## 16 Participants



## 22 Associated Partners

(as of October 2016)

