



# ***European Network for Novel Accelerators (EuroNNAc) - Report from WP5***

ARIES Yearly Meeting 2021, 21 Apr 2021, Remote

Ralph W. Aßmann (DESY & INFN)

Also on behalf of other task conveners: M. Ferrario (INFN), B. Holzer (CERN),  
P. Nghiem (CEA), A. Specka (CNRS), R. Walczak (Oxford)

# Website: <https://www.euonnac.eu>

## EUROPEAN NETWORK FOR NOVEL ACCELERATORS



supported by EU via ARIES

[Home](#)[Members/Facilities](#)[Achievements](#)[Contact/Org](#)[ARIES](#)[EuroNNac Award](#)

**EAAC 2019**, 4th Europ. Advanced Acc. Workshop,

Elba, Italy

15.-21.09.2019

[Link](#)

**LPAW 2019** - Int. Conf. on Laser Plasma Acc.,

Split, Croatia

5.-10.05.2019

[Link](#)

**2019 CAS** on Plasma Acceleration,

Sesimbra, Portugal

11.-22.03.2019

[Link](#)

2018 **yearly EuroNNac meeting**, Frascati, Italy

23.11.2018

[Link](#)

**EAAC 2017**, 3rd Europ. Advanced Acc. Workshop,

Elba, Italy

24.-30.09.2017

[Link](#)

2017 **yearly EuroNNac meeting**, Elba, Italy

30.09.2017

[Link](#)

2016 **yearly EuroNNac meeting**, Pisa, Italy

01.07.2016

[Link](#)

**EAAC 2015**, 2nd Europ. Advanced Acc. Workshop,

### What is EuroNNac?

The European Network for Novel Accelerators EuroNNac brings together more than 60 institutes and aims at federating the significant European and international efforts in plasma-based accelerators. Goal is to prepare a roadmap for an efficient use of this novel technology in full-scale accelerators.

### Simon van der Meer Early Career Award in Novel Accelerators

The Simon van der Meer Award is being established in 2019 to recognize outstanding early career contributions (theoretical, experimental, computational or technical) in novel accelerator science. It is sponsored by the European Network for Novel Accelerators (EuroNNac) which is part of the EU project ARIES.

[Read more](#)

# EuroNNAc3 in 2021

> 65 institutes

EUROPEAN NETWORK FOR NOVEL ACCELERATORS

## EuroNNAc<sub>3</sub>

supported by EU via ARIES

**Armenia**  
CANDLE

**China**  
Beijing National Laboratory IOP CAS  
IOP, Chinese Academy of Science  
Shanghai Jiao Tong University  
Tsinghua University

**Czech Republic**  
ELI Beams

**France**  
CEA/CNRS  
Ecole Polytechnique  
ENSTA Paris tech  
IN2P3  
LAL  
LPGP  
LULI  
PHLAM Université de Lille  
Soleil

**Germany**  
Deutsches Elektronen-Synchrotron (DESY)  
Ferdinand Braun Institut  
Forschungszentrum Jülich  
Fraunhofer ILT  
Gesellschaft für Schwerionenforschung (GSI)  
Helmholtz Institutes Jena  
Helmholtz-Zentrum Dresden-Rossendorf  
Karlsruhe Institute of Technology  
LMU University Munich  
Max-Planck-Institute for Quantum Optics  
Max-Planck-Institute for Physics  
TU Darmstadt  
University Düsseldorf  
University Erlangen  
University Hamburg  
University Jena

**Hungary**  
Wigner Research Center

**Italy**  
CNR, Istituto Nazionale di Ottica – Pisa  
INFN Frascati  
INFN Milano  
INFN Roma1  
University of Rome Tor Vergata  
University of Rome La Sapienza  
University of Pisa

**Japan**  
Kansai Photon Science Institute  
KEK  
Osaka University  
RIKEN Spring-8

**Netherlands**  
Eindhoven University of Technology

**Norway**  
University of Oslo

**Portugal**  
Instituto Superior Tecnico de Lisboa

**Russia**  
JIHT of Russian Academy of Sciences  
Budker Institute of Nuclear Physics  
Institute of Applied Physics RAS

**Sweden**  
Lund University

**Switzerland**  
University of Bern  
Paul Scherrer Institut

**UK**  
ASTeC  
Cockcroft Institute  
JAI - Imperial College  
Lancaster University  
Manchester University  
Oxford University  
Queen's University of Belfast  
STFC Rutherford Appleton Laboratory  
STFC Daresbury Laboratory  
University College London  
University of Liverpool  
University of Strathclyde

**USA**  
Brookhaven National Laboratory  
Fermi National Accelerator Laboratory  
Lawrence Berkely National Laboratory  
Lawrence Livermore National Laboratory  
SLAC National Accelerator Laboratory  
University of California Los Angeles

**International**  
European Organization for Nuclear Research (CERN)  
ELI Beamlines  
International Committee for Future Accelerators  
International Committee on Ultra High Intensity Lasers

# Sponsored Schools & Workshops

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[Link](#)

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# EAAC 2019 – Elba, Italy, 15 – 21 Sep 2019

*Had to limit participation for the first time*



- Number of participants: 267 (> 70 applications not accepted)
- Number of countries: 17
- Male/Female: 84 % / 16 %



# Scientific Work EAAC 2019

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- Number of presentations: **301**
- Number of plenary talks: 28 (*86%/14 % male/female*)
- Simon van der Meer talk 1
- Number of WG's: 8
- Number of WG talks: 138 (160 in 2017)
- Number of posters: 121 (92 in 2017)
- Number various: 5

Program committee: 28 (*82%/18% male/female*)

# Proceedings: IOP Volume 1596

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Journal of Physics: Conference Series

Table of contents

**Volume 1596**  
**2020**

◀ Previous issue   Next issue ▶

**4th European Advanced Accelerator Concepts Workshop 15-20 September 2019, Isola d'Elba, Italy. Edited by A. Cianchi et al.**

Accepted papers received: 14 July 2020  
Published online: 18 September 2020

- Many thanks to Lead Editor A. Cianchi and the editor team
- **66 peer-reviewed publications, all open access**
- For many students the first peer-reviewed publication: important lesson in publishing

Papers

**OPEN ACCESS** 012001  
Summary of European Advanced Accelerator Workshop (EAAC) Working Group 1: Electron Beams from Plasma  
Sebastien Corde, Arie Irman and Marlene Turner  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012002  
Tunable and precise two-bunch generation at FLASHForward  
S Schröder, K Ludwig, A Aschikhin, R D'Arcy, M Dinter, P Gonzalez, S Karstensen, A Knetsch, V Libov, C A Lindström et al  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012003  
Towards experimental investigation of hosing instability mitigation at the PIZ facility  
G Loisch, M Gross, C Koschitzki, O Lishilin, A Martinez de la Ossa, J Osterhoff and F Stephan  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012004  
Angstrom wavelength FEL driven by 5 GeV LWFA beam with external injection  
A R Rossi, V Petrillo, A Bacci, E Chiodroni, A Cianchi, M Ferrario, A Giribono, M Rossetti Conti, L Serafini and C Vaccarezza  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012005  
Determination of the Charge per Micro-Bunch of a Self-Modulated Proton Bunch using a Streak Camera  
A.-M. Bachmann and P. Muggli  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012006  
Setup and Characteristics of a Timing Reference Signal with sub-ps Accuracy for AWAKE  
Fabian Batsch  
[+Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS** 012007  
Study of external electron beam injection into proton driven plasma wakefields for AWAKE Run2  
L. Verra, E. Gschwendtner and P. Muggli  
[+Open abstract](#) [View article](#) [PDF](#)



# Simon van der Meer Award: 1<sup>st</sup> Time

## Simon van der Meer Early Career Award in Novel Accelerators

Got permission of son of Simon van der Meer to use name for this award!

(sponsored by the European Network for Novel Accelerators through the EU project ARIES)

The Simon van der Meer Award is being established in 2019 to recognize outstanding early career contributions (theoretical, experimental, computational or technical) in novel accelerator science. It is sponsored by the European Network for Novel Accelerators (EuroNNAc) which is part of the EU project ARIES. EuroNNAc is coordinated by DESY, CERN, Ecole Polytechnique, University of Oxford, INFN Frascati and CEA.

The Simon van der Meer Award will be awarded every two years at the European Advanced Accelerator Concepts workshop (EAAC). Eligible candidates must be within 12 years of the completion of their first university degree or equivalent, excluding career breaks (e.g. maternity or paternity leave, adoption). There is no restriction as to nationality. The research recognized could be either a single piece of work, or the sum of contributions. The award recognizes one individual researcher and consists of a stipend of € 3000 and a certificate citing the contributions of the recipient.

The announcement of the Award Winner will be made at the EAAC19 workshop on Elba.

**Mr. Spencer Gessner (CERN)**





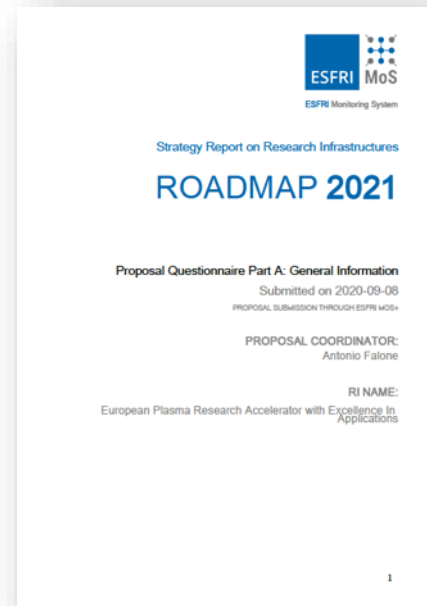
# EuPRAXIA Project – Outcome of EuroNNAc



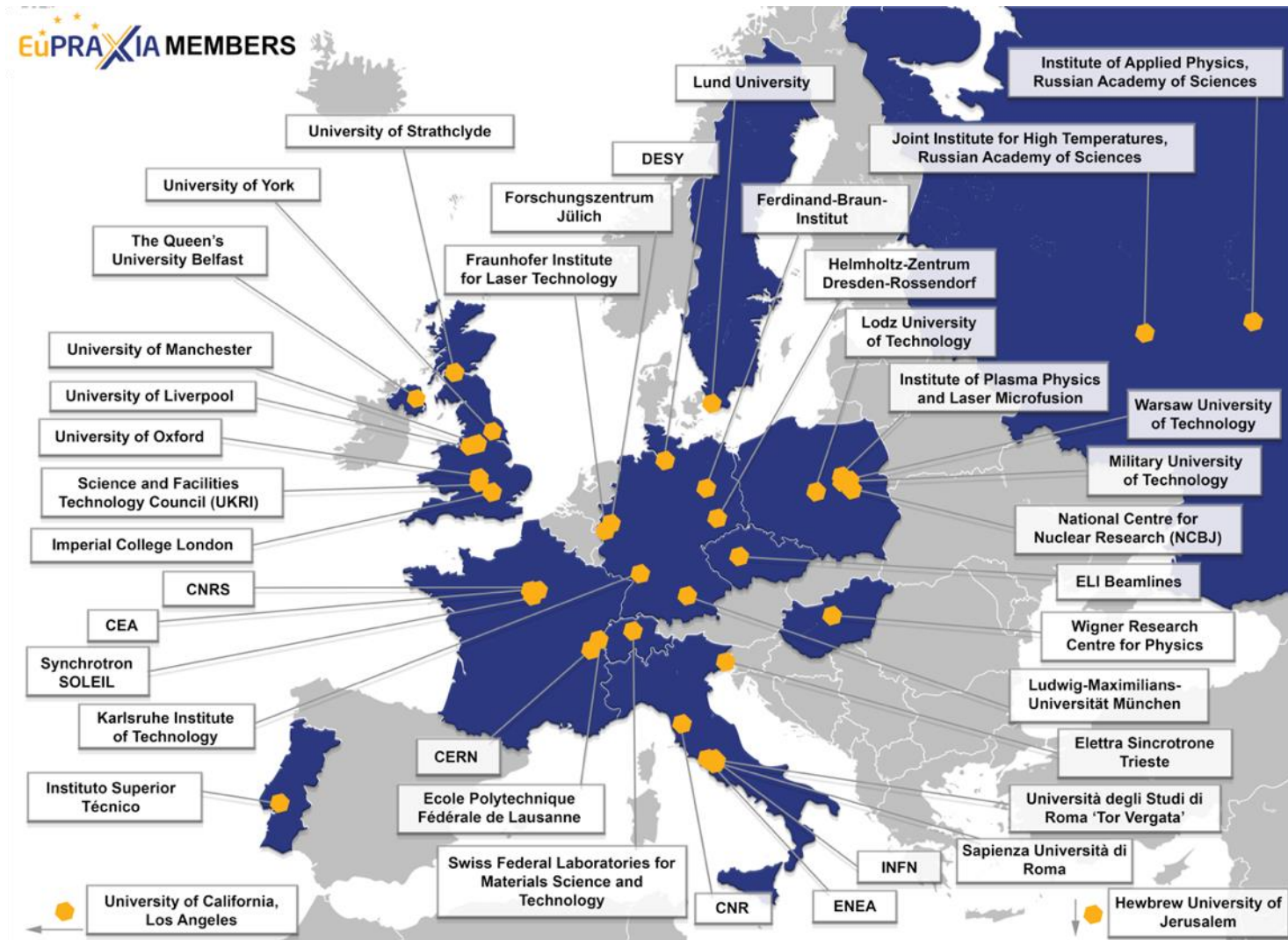
- First ever conceptual design of a plasma accelerator facility
- Funded by EU as Horizon2020 design study
- CDR published after peer review in European Physics Journal – Special Topics
  - 255 contributors, almost all also in EuroNNAc
  - > 650 pages
  - Two construction sites: beam-driven (Frascati) and laser-driven (ELI-Beamlines OR EPAC/Rutherford/STFC OR CNR Pisa)
- Cost of 570 M€ out of which 117 M€ have already been obtained.
- ESFRI application submitted, found eligible and defended last week in hearing. Decision in July.

# EuPRAXIA – Towards ESFRI

- Sep 2020 Submitted
- Nov 2020 Found eligible for ESFRI Roadmap  
Detailed assessment through  
ESFRI panels
- 30 Mar 2021 Critical questions received
- 6 Apr 2021 Dry run with INFN president plus  
Italian representatives
- 12 Apr 2021 Additional support letters on  
financial side submitted  
(CNRS, STFC, Queen's University)
- 15 Apr 2021 ESFRI Hearing (last week)
- July 2021 Announcement of decision



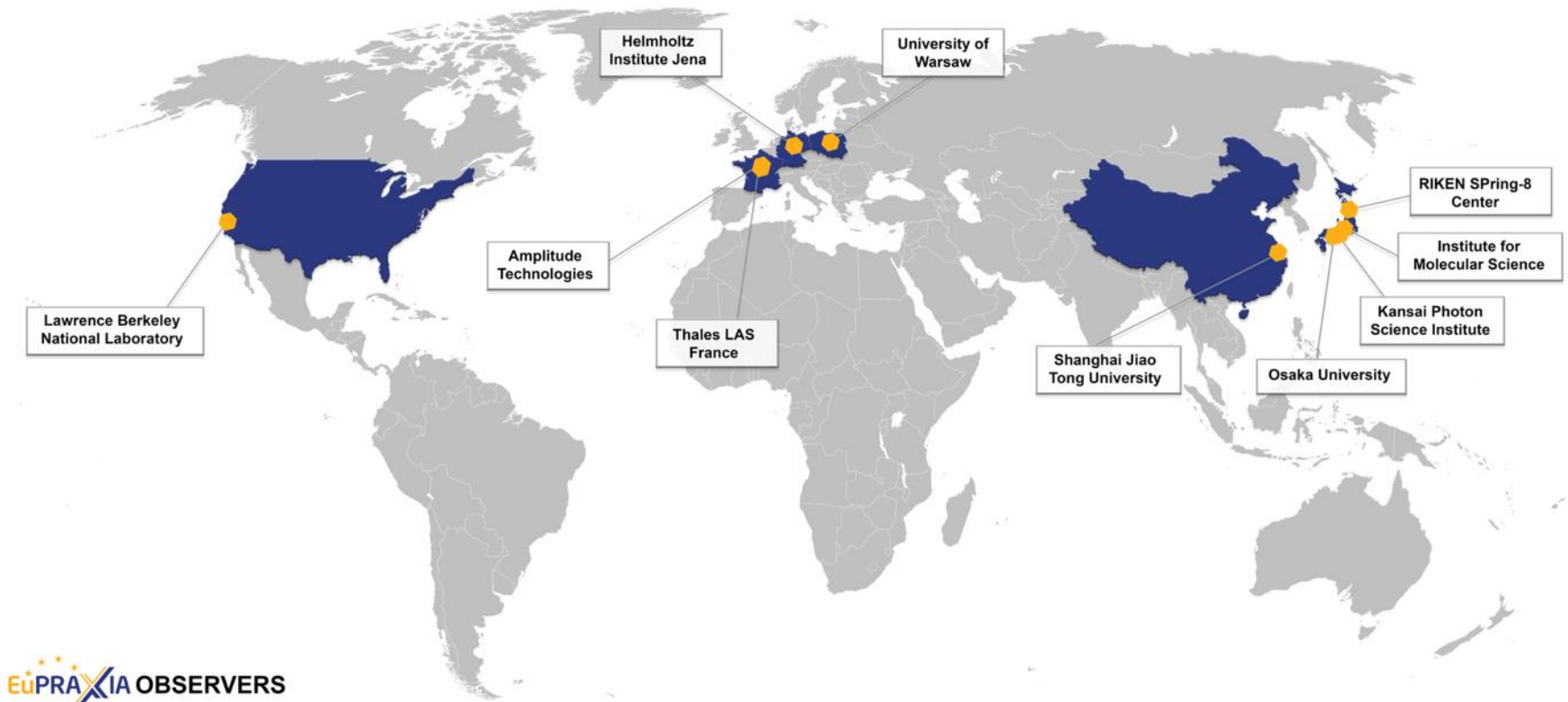
# EuPRAXIA – Consortium Preparatory Phase



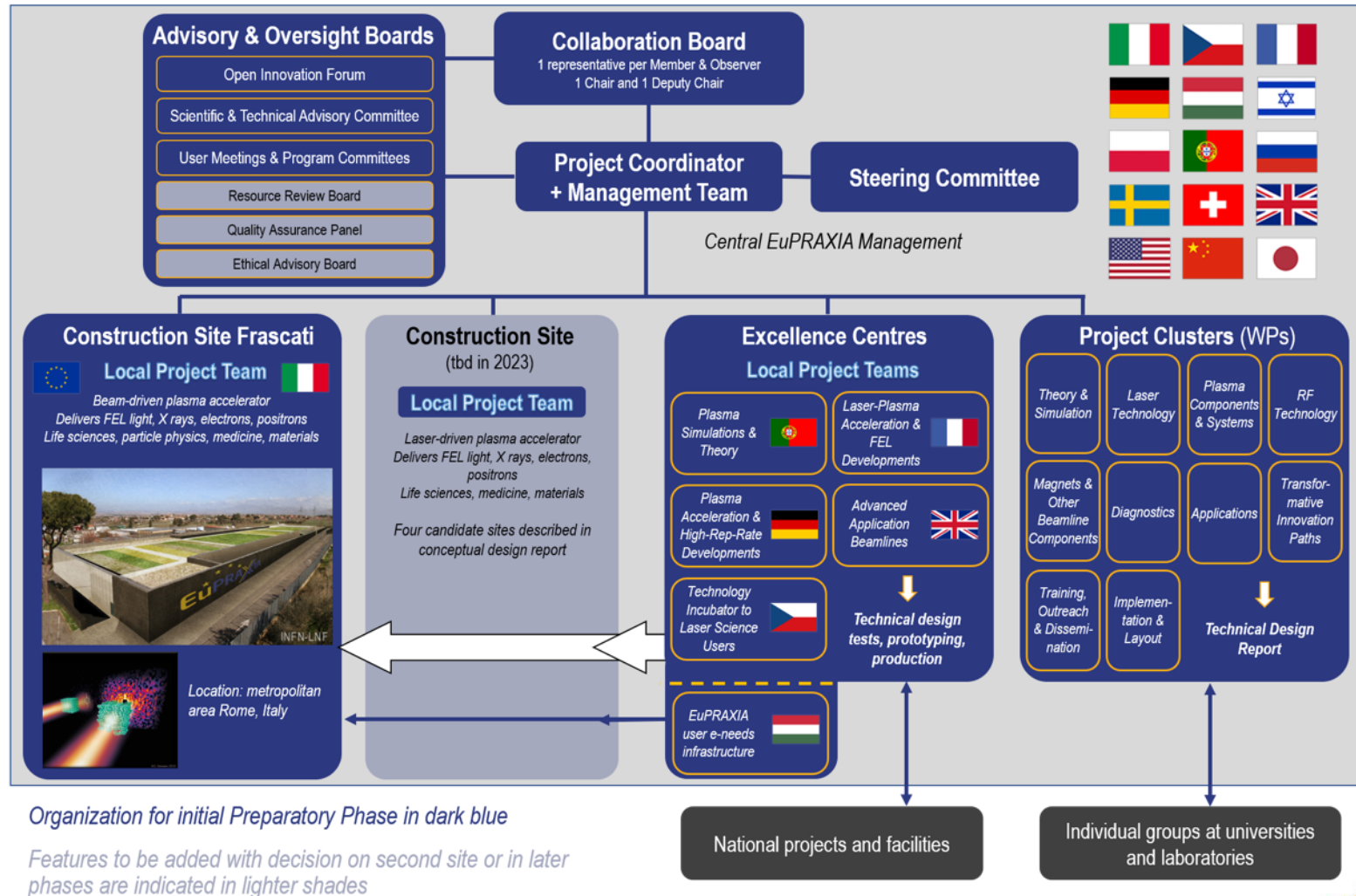
*Grown from 16 members (2015) to 40 members (2021)*



# EuPRAXIA – Consortium Preparatory Phase



# EuPRAXIA Organigramm



# Strategic Input to the Science Community

## Input 2018 European strategy for Particle Physics



Statement from the European Network for Novel Accelerators (EuroNNAc)  
to the European Strategy Preparatory Group (ESPG)

### On the Prospect and Vision of Ultra-High Gradient Plasma Accelerators for High Energy Physics

- Update to our 2012 Statement to the ESGP, list of Institutes and Names at the End of Document -

#### Abstract

Plasma accelerators generate accelerating fields that are up to 1,000 times higher than fundamentally possible in RF accelerators. They therefore offer a promising alternative path to the high-energy frontier. In 2012 the European Strategy Preparatory Group received for the first time detailed input about the prospects and promise of plasma accelerators, a 15 page report provided by the EU-funded European Network for Novel Accelerators (EuroNNAc). The network published a 31 page report on a European strategy for plasma accelerators in 2017. Here we provide a short update on the prospect of plasma accelerators for high energy physics. We propose that the next European strategy for particle physics should explicitly list ultra-high gradient plasma acceleration and, if possible, its supporting international projects as essential R&D towards a compact alternative for future colliders.

Contact: Ralph Assmann (ralph.assmann@desy.de)

December 18<sup>th</sup>, 2018

1



# Input 2018 European strategy for Particle Physics

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## New Major Plasma Acceleration Projects since the last European Strategy Update:

Important new projects were funded since the last strategy update in Europe and beyond. These include the Horizon2020 EU Design Study for a “European Research Plasma Accelerator with eXcellence In Applications” **EuPRAXIA** involving 41 institutes [3], the international **AWAKE** experiment [4] at CERN involving 18 institutes and the international **ALEGRO** study [5] on a possible future plasma linear collider. New national activities in Europe since 2012 are the Plasma Wakefield Accelerator Steering Committee (PWASC) in the UK [6], the multi-institutional laser plasma acceleration project **ATHENA** [7] in the Helmholtz Association in Germany, the ELBE center at HZDR, CILEX in France, CLARA and SCAPA in the UK, **EuPRAXIA@SPARC\_LAB** at INFN-LNF in Italy [8], Lund in Sweden, JuSPARC at FZJ and **FLASHForward** and **SINBAD** at DESY. There are strong activities with new funding on plasma acceleration in Japan (**ImPACT**), in China (Synergetic Extreme Condition User Facility **SECUF**) and in the US (**FACET-II**, **BELLA**).

## Our Proposal for the Strategy Update:

The next European strategy for particle physics should **explicitly list ultra-high gradient plasma acceleration** and, if possible, its supporting international projects (see above in bold) as **essential R&D towards a compact alternative for future colliders**.

→ **Followed up with various talks, e.g. in ECFA seminar and newsletter late 2019**

# Outcome Strategy

## 3 | !

### High-priority future initiatives

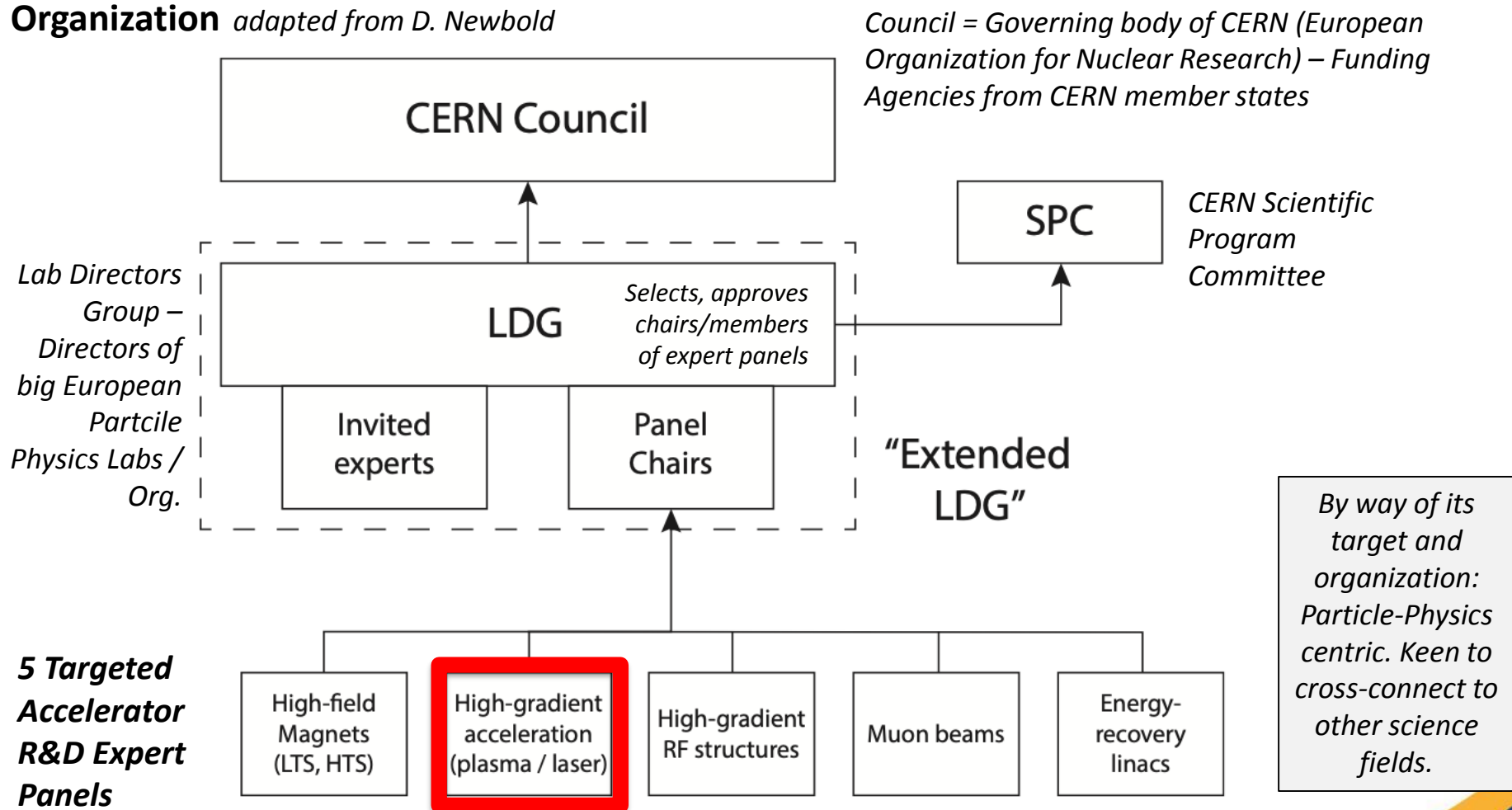


B. Innovative accelerator technology underpins the physics reach of high-energy and high-intensity colliders. It is also a powerful driver for many accelerator-based fields of science and industry. The technologies under consideration include high-field magnets, high-temperature superconductors, plasma wakefield acceleration and other high-gradient accelerating structures, bright muon beams, energy recovery linacs.

***The European particle physics community must intensify accelerator R&D and sustain it with adequate resources. A roadmap should prioritise the technology, taking into account synergies with international partners and other communities such as photon and neutron sources, fusion energy and industry. Deliverables for this decade should be defined in a timely fashion and coordinated among CERN and national laboratories and institutes.***

# Expert Panel: High Gradient Acceleration Plasma and Laser

**Organization** *adapted from D. Newbold*





# Expert Panel: High Gradient Acceleration Plasma and Laser

## Panel Composition

Chair  
R. Assmann DESY/INFN

Deputy Chair  
E. Gschwendtner CERN

Kevin Cassou	IN2P3/IJCLab
Sebastian Corde	IP Paris
Laura Corner	Liverpool
Brigitte Cros	CNRS UPSay
Massimo Ferrario	INFN
Simon Hooker	Oxford
Rasmus Ischebeck	PSI
Andrea Latina	CERN

Olle Lundh	Lund
Patric Muggli	MPI Munich
Phi Nghiem	CEA/IRFU
Jens Osterhoff	DESY
Tor Raubenheimer	SLAC
Arnd Specka	IN2P3/LLR
Jorge Viera	IST
Matthew Wing	UCL

Given the success of our field and the large effort outside Particle Physics, not all advanced accelerator groups are represented in this panel. Committed to an open process  
→ **Please give us input – there will be plenty of opportunity...**

*Associated members  
added case by case*

## Panel mandate I

*Five tasks. Based on European Strategy and discussions inside panel and with LDG*

1) Develop **long-term roadmap for the next 30 years** towards a HEP collider, other HEP applications.

*Q: Where do you see HEP applications of advanced accelerators in 30 years?*

2) Develop **milestones for next 10 years** taking into account the plans/needs in related scientific fields as well as the capabilities and interests of the stakeholders.

*Q: What are the important milestones for the next 10 years to get there from today?*

*Q: What is the synergy with related fields?*

*Q: What is the role of your work here?*

R. Assmann, E. Gschwendtner

## Panel mandate II

*Five tasks. Based on European Strategy and discussions inside panel and with LDG*

3) Establish **key R&D needs** matched to the existing and planned **R&D facilities**.

*Q: What key R&D needs can be achieved in existing R&D facilities?*

*Q: What is the role of the already planned future facilities in Europe and world-wide?*

*Q: Is a completely new facility needed?*

4) Give **options and scenarios** for European activity level and investment.

*Q: What can be done with the existing and planned funding base?*

*Q: In case additional support is needed for a milestone: What is required?*



## Panel mandate III

*Five tasks. Based on European Strategy and discussions inside panel and with LDG*

5) Define **deliverables and required resources** to be achieved until next European strategy process in **2026**, in order to enable as best as possible critical decisions for R&D lines for HEP.

*Q: What should be propose as deliverables until 2026? Please list in order of priority.*

*Q: Is the R&D work for each of those deliverables already funded and, if not, what additional resources / support would be needed?*

*Q: Are additional structures needed beyond existing networks and projects, e.g. a design study for a collider or an advanced accelerator stage?*

R. Assmann, E. Gschwendtner

# Expert Panel: High Gradient Acceleration Plasma and Laser

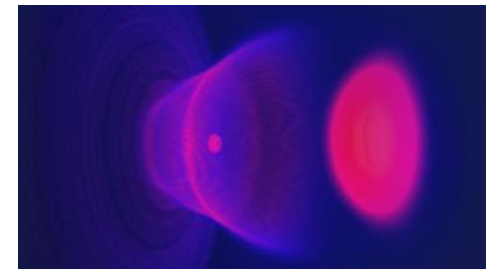
Every 2 weeks	Expert panel meeting
5 March	Common convener meeting advanced accelerators with Snowmass AF6
30 March 21 May 31 May 23 June	1 <sup>st</sup> TH – Setting the scene 2 <sup>nd</sup> TH – Expert input I 3 <sup>rd</sup> TH – Expert input II 4 <sup>th</sup> TH – Skeleton R&D Roadmap Discussion
June/July	4 page interim report – bullet list R&D roadmap – iterations
Aug/Sep	Writing of 30-40p strategy document. Discussion at EAAC in September.
November	Submission strategy document LDG

OPEN  
PROCESS

*Connect to US/Snowmass & coordinate efforts/outputs*

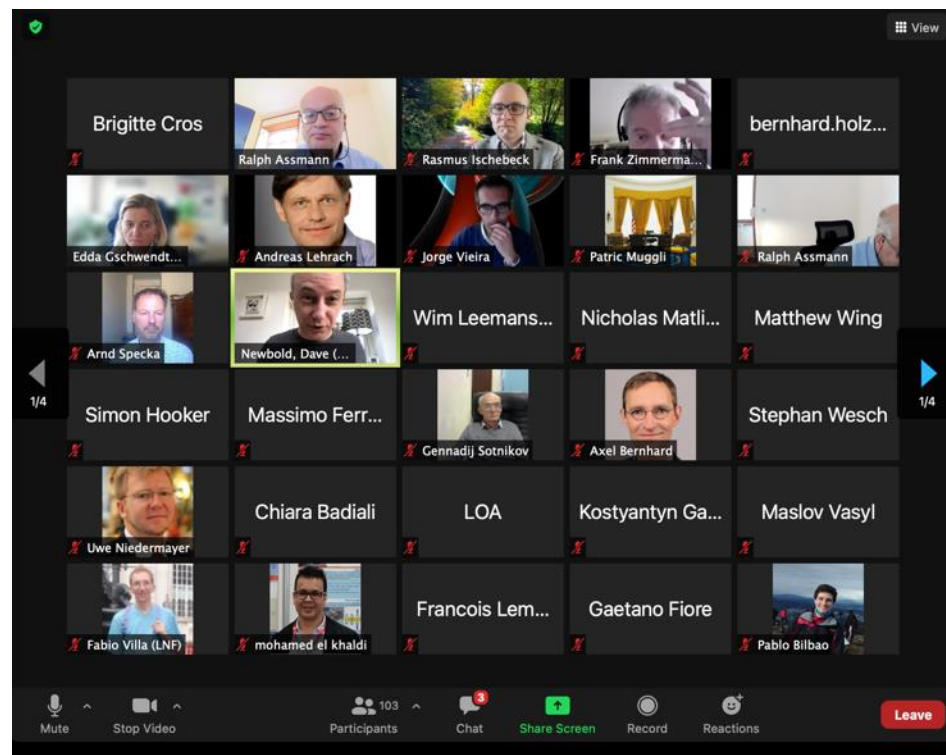
*Connect to the community and provide **opportunity to submit external input** (we will define format of input)*

*Connect to other panels, e.g. to high gradient RF*



# Expert Panel: High Gradient Acceleration Plasma and Laser

- Created email info list for community: more than 200 colleagues registered
- First townhall meeting 30 MAR: Setting the scene
  - More than 110 participants
  - Very informative presentations and discussions
- Next large meetings:
  - 21 MAY: TH2
  - 31 MAY: TH3
  - 23 JUN: TH4



<https://indico.cern.ch/event/1017117/>

# Join the expert panel email list

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All Communication will be done through a new and dedicated email list (not through our network, project and conference email lists as for first announcement):

[expert-panel-plasma-laser-info@desy.de](mailto:expert-panel-plasma-laser-info@desy.de)

It is important that you register:

1. Send an email (add only info below, otherwise blank) from your account to:  
[sympa@desy.de](mailto:sympa@desy.de)
2. Add following text into SUBJECT field (substitute your firstname and name):  
**subscribe [expert-panel-plasma-laser-info@desy.de](mailto:expert-panel-plasma-laser-info@desy.de) Firstname Name**



# WP5 Deliverables: Done

(Milestones: All Done)

## List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D5.1	Specialized school on Novel Accelerators for young scientists	1 - CERN	Report	Public	36
D5.2	Final EuroNNAc and EAAC Report	9 - DESY	Report	Public	46

## Description of deliverables

D5.1 : Specialized school on Novel Accelerators for young scientists [36]

Organization of a topical lecture series, report to summarize presentations and attendance (Task 5.5)

D5.2 : Final EuroNNAc and EAAC Report [46]

Final report to summarize the outcome of the work progress in tasks, including the status of European strategies for plasma accelerators and dielectric accelerators (Task 5.1, 5.2, 5.3)

**All DONE.**



# Conclusion

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- ARIES, WP5 and EuroNNAc played an important role in the European and international development of novel accelerators.
- In the last 4 years of ARIES:
  - Novel accelerators became a much bigger activity, visible by large workshops, important publications and “big” proposals (e.g. EuPRAXIA on ESFRI?)
  - Several major efforts ongoing in Europe: EuPRAXIA, AWAKE, ALEGRO, ...
  - ARIES/EuroNNAc-sponsored EAAC as a central discussion forum for this field
  - Many good young scientists and students involved and supported
  - First explicit mentioning of plasma and laser accelerators in the 2020 update of the European strategy for particle physics
  - Forming of a European expert panel for defining an accelerator R&D roadmap
- Thanks for the good collaboration and support from all the other ARIES WP's and the ARIES management!