



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No 101004730.

WP6: Novel Particle Accelerators Concepts and Technologies

Kick-Off iFAST, 4 May 2021, Zoom

Ralph Assmann, DESY



Tasks of WP6 – Novel Particle Accelerators Concepts and Technologies

- Task 1 (RA + M. Ferrario): **Novel Particle Accelerators Concepts and Technologies (NPACT) M1 – M48**
- Task 2 (Leo Gizzi): **Lasers for Plasma Acceleration (LASPLA) M1 – M48**
- Task 3 (Cedric Thaury): **Multi-scale Innovative targets for laser-plasma accelerators (MILPAT) M1 – M32**
- Task 4 (Francois Mathieu): **Laser focal Spot Stabilization Systems (L3S) M1 – M36**

The Theme of WP6

- This is the iFAST WP on **high gradient accelerators (> 1 GV/m)**, involving mainly **plasma-based** technology but also **dielectric** accelerators.
- This includes the development of **laser** features required for driving accelerators and **targets**.
- This WP: Promote and support the development of very high gradient, compact accelerators as a viable technology option!
- Towards HEP but also near-term applications.

WP6 Resources

Work package number		6	Lead beneficiary		DESY
Work package title		<i>Novel particle accelerators concepts and technologies</i>			
Participant	Person months per participant		Participant	Person months per participant	
1. CERN	3 + 0		22. CNR	10.5 + 6.5	
6. CEA	1.5 + 1.5		25. INFN	19.5 + 6	
7. CNRS	21.8 + 0		49. UOXF	0 + 3	
13. DESY	10 + 3				
Start month		1	End month		48

The other **WP6 Task 1** task leaders:

M. Ferrario (INFN), **B. Holzer** (CERN), **P. Nghie** (CEA), **A. Specka** (CNRS), **R. Walczak** (Oxford)

Tasks 2, 3 and 4: See talks by Leo Gizzi (Task 2), Cedric Thaury (Task 3) and Francois Mathieu (Task 4)

WP6 Deliverables

Deliverables related to WP6	
D6.1: EAAC workshops and strategies. <i>Report on the EAAC workshops as strategic forums for international accelerator R&D and resulting strategies</i>	M42
D6.2: LASPLA Strategy. <i>Report on a strategy for laser drivers for plasma accelerators.</i>	M46
D6.2: Electron acceleration experiments with new targets. <i>Report on electron acceleration with micro-scale target at a kHz repetition rate, and with long targets at the multi-Joule level.</i>	M24
D6.4: Improvement of the laser intensity stability on target. <i>Report showing the stability on two laser facilities before and after improvement.</i>	M36

Task 1 – Novel Particle Accelerators Concepts and Technologies

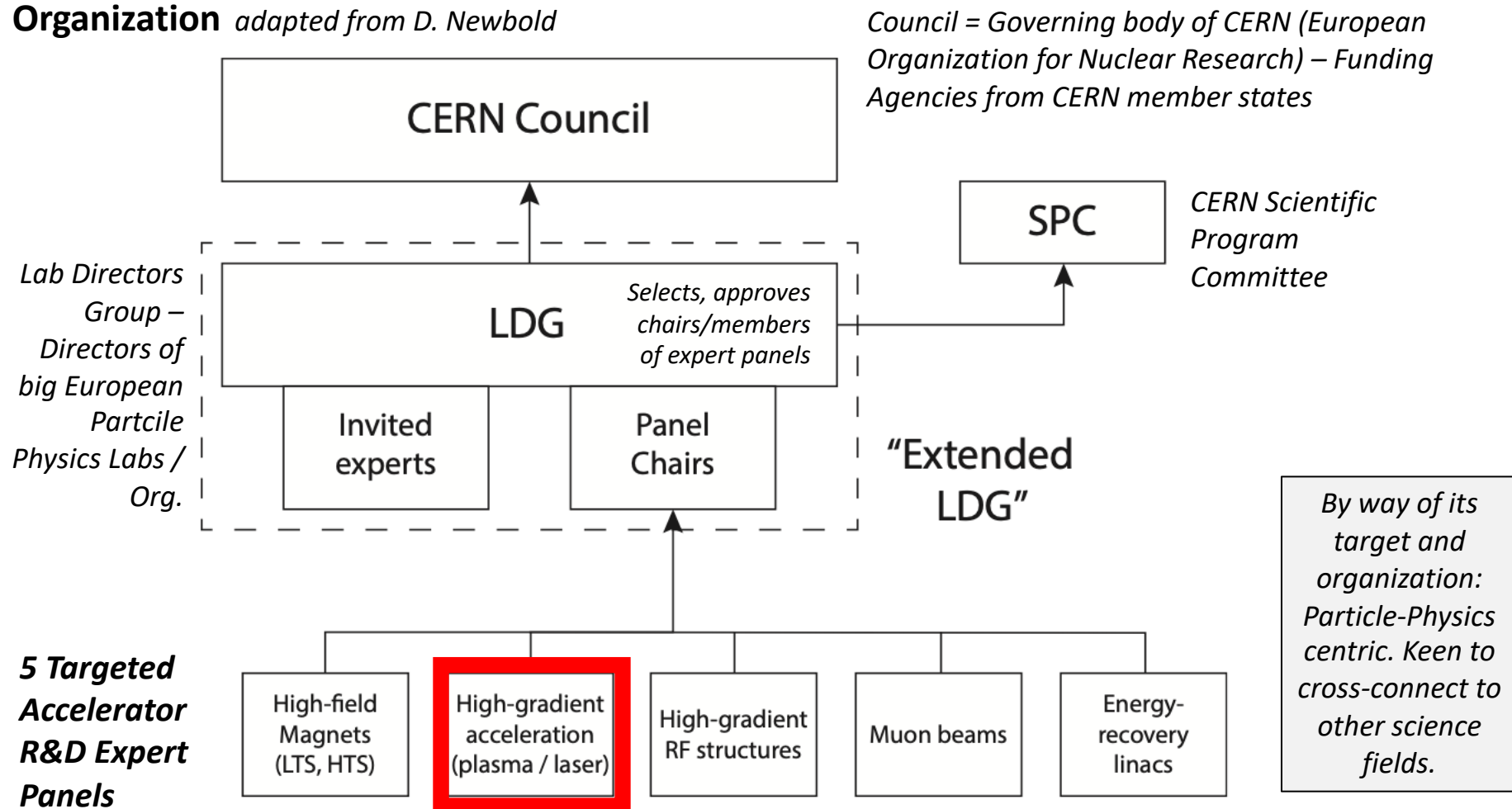
- Review the European landscape in novel, high-gradient accelerators and define a roadmap towards low-energy and high-energy physics applications.
- Provide a strategic forum to the research field of novel accelerators, organizing the biannual European Advanced Accelerator Concepts workshop (EAAC).
- Foster the connection with industry and with young scientists in the field of novel accelerators.

Task 1 – Novel Particle Accelerators Concepts and Technologies → **Sub-Task 1**

- **Review the European landscape in novel, high-gradient accelerators and define a roadmap towards low-energy and high-energy physics applications.**
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European Strategy for Particle Physics and Related Accelerator R&D

Organization *adapted from D. Newbold*



Expert Panel HGPL “High Gradient Acceleration (Plasma/Laser)”

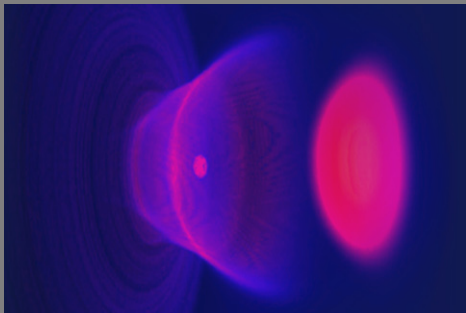
Panel Composition

Chair

R. Assmann DESY/INFN

Deputy Chair

E. Gschwendtner CERN



Kevin Cassou

IN2P3/IJCLab

Olle Lundh

Lund

Sebastian Corde

IP Paris

Patric Muggli

MPI Munich

Laura Corner

Liverpool

Phi Nghiem

CEA/IRFU

Brigitte Cros

CNRS UPSay

Jens Osterhoff

DESY

Massimo Ferrario

INFN

Tor Raubenheimer

SLAC

Simon Hooker

Oxford

Arnd Specka

IN2P3/LLR

Rasmus Ischebeck

PSI

Jorge Viera

IST

Andrea Latina

CERN

Matthew Wing

UCL

Expert Panel HGPL Scope

- Accelerator R&D Roadmap for **plasma and laser accelerators** (includes beam-driven options and **dielectric** structures).
- Roadmap to support establishing compact, high gradient accelerator technology (> 1 GV/m) as a **viable option for HEP**.
- Enable **intermediate HEP experiments** and on the longer-term a **compact, cost-effective plasma linear collider** design.

Expert Panel HGPL Meetings and Input

Meetings already organized:

- 5 expert panel meetings (see INDICO <https://indico.cern.ch/category/13717/>)
- 1 townhall TH meeting (30 Mar) – setting the scene (> 110 participants)

Upcoming meetings:

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

- Weekly panel meetings
- 2 TH meetings gathering **community input (21 May and 31 May)**
- 1 TH meeting **discussing roadmap** (23 Jun)

→ If you are a stakeholder in our domain, please register to email list and send input to townhall meetings!

Feasibility Issues and Questions to Community

Feasibility issues identified:

- emittance, tolerances, mitigation of instabilities
- efficiency including drive beam, laser issues
- energy spread
- IP issues, pile-up, background
- maximum bunch intensity / charge
- time structure of beam (rep rate)
- round or flat beams, beam shaping
- staging with in/outcoupling
- polarisation
- positrons
- test facilities
- simulation code development and outreach
- Hybrid, new or alternative schemes
- Low emittance beam sources, incl e+ sources
- Plasma stability / repeatability (incl. targetry)
- Synchronization systems, other support systems

*Discuss, group,
order, filter with
TH input* →

Questions to community (selected):

- Where do you see HEP applications of advanced accelerators in 30 years?
- What are the **important milestones for the next 10 years** to get there from today?
- What should be proposed as **deliverables until 2026**? Please list in order of priority.
- Is the R&D work ... already funded and, if not, what additional resources / support would be needed?
- What key R&D needs **can be achieved in existing R&D facilities**?
- What is the role of the already planned future facilities in Europe and world-wide?
- Is a completely new facility needed?
- Are additional structures needed beyond existing networks and projects, e.g. a design study for a collider or an advanced accelerator stage?

Roadmap Report Structure

- *40 page report*
- *Structure adopted in discussion with chair of expert panel HFM (PV)*
- *Focusing space-wise on challenges, program structure and deliverables for developing roadmap*
- *Embedding into larger context, including synergy (applications)*

• Executive Summary	2 p
• Abstract	0.5 p
• Motivation for a Plasma and Laser Accelerator R&D Program	1 p
• State of the Art	2 p
• Objectives of a Plasma and Laser Accelerator R&D Program	2 p
• Challenges of Plasma and Laser Accelerators	6 p
• Plasma and Laser Accelerator R&D Program Drivers	2 p
• Proposed Program Structure and Deliverables	12 p
• Roadmap, Work Plan and Timeline	4 p
• Impact of a Plasma and Laser Accelerator R&D Program	4 p
• Applications to Other Fields and Society	2 p
• Scenario of Engagement and Investments	2 p
• Sustainability	1 p

Register to HGPL Strategy Email List

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

It is important that you register:

1. Send an email (add only info below, otherwise blank) from your account to:

sympa@desy.de

2. Add following text into SUBJECT field (substitute your firstname and name):

subscribe expert-panel-plasma-laser-info@desy.de Firstname Name

Task 1 – Novel Particle Accelerators Concepts and Technologies → **Sub-Tasks 2 and 3**

- Review the European landscape in novel, high-gradient accelerators and define a roadmap towards low-energy and high-energy physics applications.
- **Provide a strategic forum to the research field of novel accelerators, organizing the biannual European Advanced Accelerator Concepts workshop (EAAC).**
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Continuing EAAC as THE European Discussion Forum for Advanced Accelerators

- Last: 2019
- Number of participants: 267 (> 70 applications not accepted)
- Number of countries: 17
- Male/Female: 84 % / 16 %



Next European Advanced Accelerator Concepts Workshop – Schedule impacted from COVID-19

- Rhythm constrained from AAC (American conference in this domain that takes place in 2020 – 2022 – 2024)...
- **EAAC September 2021:** Virtual (room reservation cancelled)
 - Simon van der Meer prize for early career scientist
- Sep/Okt 2022: Specialized European meeting on advanced accelerators (venue already reserved) → industry exhibition
- EAAC September 2023: Normal EAAC again
 - Simon van der Meer prize for early career scientist
 - Industry exhibition, student sponsoring, student prize

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