



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

2nd Yearly Meeting, 19 – 21 April 2023, Trieste

Ralph Assmann, DESY & LNF/INFN

Massimo Ferrario, LNF/INFN



Tasks of WP6 – Novel Particle Accelerators Concepts and Technologies

- Task 1 (RA + M. Ferrario): **Novel Particle Accelerators Concepts and Technologies** (NPACT – EuroNNAc4) M1 – M48
*Sub-task leaders: **B. Holzer** (CERN), **P. Nghie** → **D. Minenna** (CEA), **A. Specka** (CNRS), **R. Walczak** (Oxford)*
- Task 2 (Leo Gizzi): **Lasers for Plasma Acceleration** (LASPLA) M1 – M48
- Task 3 (Cedric Thauray): **Multi-scale Innovative targets for laser-plasma accelerators** (MILPAT) M1 – M32
- Task 4 (Francois Mathieu): **Laser focal Spot Stabilization Systems** (L3S) M1 – M36

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Welcome to Damien from CEA

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WP6 Milestones

- MS21: Report on the novel accelerator landscape in Europe, facilities, projects and capabilities at the beginning of the 2020's. Lead – DESY, **M24**, Publication, website (task 6.1)
- MS22: LASPLA Workshop/School. Lead – CNR, **M30**, Report (task 6.2)
- MS23 Target manufacturing and characterization. Lead – CNRS, **M12** Report (task 6.3)
- MS24: Hypothesis on the causes of the instabilities of the focal spot profile. Lead – CNRS, **M24** Publication (task 6.4)

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

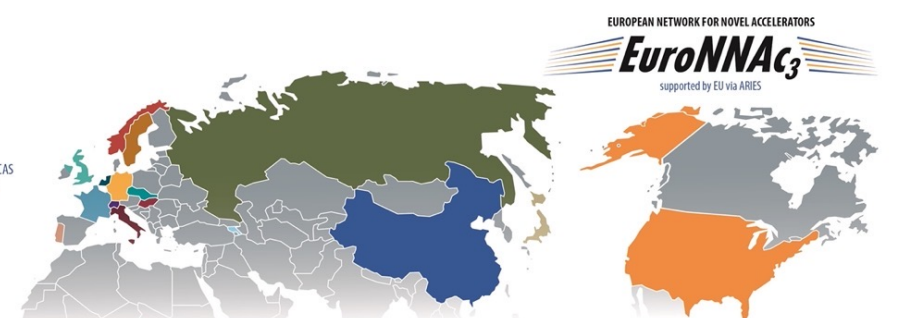
WP6 Milestones

April 2023

- MS21: Report on the **novel accelerator landscape in Europe, facilities, projects and capabilities** at the beginning of the 2020's. Lead – DESY, M24, Publication, website (task 6.1)
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EuroNNAc Special Topics Workshop: MS21

We founded network in 2011 at CERN, supported in EuCARD, EuCARD2, ARIES, I.FAST. More than 60 member institutes from around Europe, Asia, US. Includes **industry**.



EUROPEAN NETWORK FOR NOVEL ACCELERATORS
EuroNNAc₃
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
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Soleil
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Brookhaven National Laboratory
Fermi National Accelerator Laboratory
Lawrence Berkeley 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




**Russian institutes suspended*



EuroNNAc Special Topics Workshop: MS21

Overview

106

Registrations

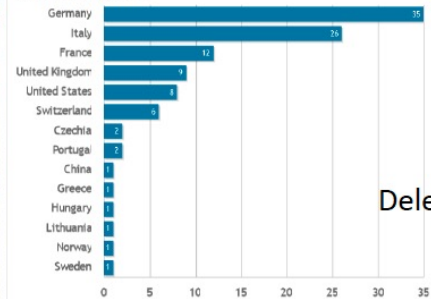
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14

Countries

Registrants per country



Delegates



Overview

42

Registrations

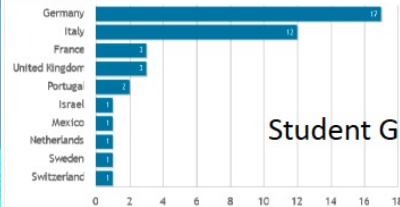
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Days left to register

10

Countries

Registrants per country



Student Grants

6 plenary sessions very well organised by the conveners
49 talks + 6 by remote

	Sept. Monday 19	Sept. Tuesday 20	Sept. Wednesday 21	Sept. Thursday 22	Sept. Friday 23	Sept. Saturday 24
Morning I 9:00 – 10:30	S-IN (RA&MF) News from field - 1 short talk per ST	S-ST1-b (EG&PM) Beam driven Plasma Accelerators with focus on proton-driven	S-ST3-b (LG&SK) Laser Technology and LWFA Results	S-ST4-b (EC&RP) Distributed Plasma Accelerator Landscape in Europe and Technical Progress towards Applications	S-ST5 (PM&CG&MH&MK &WL) International Landscape: Facilities, projects, initiatives	NPACT / EuroNNAc Yearly Meeting (RA&MF)
Coffee Break (20')						
Morning II 10:50 – 12:30	S-IN (RA&MF) News from field - 1 short talk per ST	S-ST2 (MT&JV) Simulation tools and roadmap,	S-ST3-b (LG&SK) Laser Technology and LWFA Results	S-ST4-b (EC&RP) Special sub-session (JO&aI) Particle physics plasma test facility	S-ST5 (PM&CG&MH&MK &WL) International Landscape: Facilities, projects, initiatives	NPACT / EuroNNAc Yearly Meeting (RA&MF)
Lunch Break (3h30')						
Afternoon I 16:00 – 17:30	S-ST1-a (EG&PM) Beam driven Plasma Accelerators with focus on proton-driven	S-ST3-a (LG&SK) Laser Technology and LWFA Results	S-ST4-a (EC&RP) Distributed Plasma Acc. Landscape in Europe and Technical Progress towards Appl.	S-SP (BH&RW) Student Talks - Prize Award Session	S-ST6 (RI&aI) Structure-based accelerators and advanced radiation generation schemes	
Coffee Break (20')						
Afternoon II 17:50 – 19:15	S-ST1-a: (EG&PM) Beam driven Plasma Accelerators with focus on proton-driven	S-ST3-a (LG&SK) Laser Technology and LWFA Results	Special sub-session (AI&aI) Talks and discussion on plasma-based FEL exp.	S-SP: (BH&RW) Student Talks - Prize Award Session	S-SU (RA&MF) Summary Report from discussions - input to IFAST/NPACT MS21	
Posters 19:15 - 20:15	Participants and student grantees	Participants and student grantees	Participants and student grantees			
Dinner 20:30				BANQUET		

EuroNNAc Special Topics Workshop: MS21



I.FAST

Innovation Fostering in Accelerator Science and Technology
Horizon 2020 Research Infrastructures GA n° 101004730

MILESTONE REPORT

Report on the Novel Accelerator Landscape in Europe: Facilities, Projects and Capabilities at the Beginning of the 2020's

MILESTONE: MS21

Document identifier:	IFAST-MS21
Due date of deliverable:	End of Month 24 (April 2023)
Report release date:	20/04/2023
Work package:	WP6: Novel Particle Accelerator Concepts & Technologies (NPACT)
Lead beneficiary:	DESY
Document status:	Final

ABSTRACT

The WP6 of IFAST brings together institutes and scientists developing novel accelerator concepts and technologies. This concerns in particular modern plasma accelerators, lasers, beam drivers and dielectric accelerators. WP6 organized a special in-person workshop in September 2022 in Elba in Italy, just after the end of the COVID-19 pandemic. This workshop discussed the novel accelerator landscape in Europe and beyond, the subject of this milestone report. The session organizers, leaders in their fields, have contributed the various chapters to this report.

	Name	Partner	Date
Authored by	R. Assmann, E. Chiadroni, M. Ferrario, C. Geddes, L. Gizzi, E. Gschwendtner, M. Hogan, B. Holzer, R. Ischebeck, A. Irman, M. Kando, S. Karsch, W. Lu, P. Muggli, P. Musumeci, J. Osterhoff, R. Pompili, M. Thévenet, J. Vieira, R. Walczak	DESY (lead), INFN (co-lead), CERN, CNR, HZDR, IST, LBNL, LMU, MPP, Oxford U., PSI, QST, Sapienza U., SLAC, Tsinghua U., UCLA	20.4.2023



EuroNNAc Special Topics Workshop: MS21

1	INTRODUCTION	4
2	NOVEL ACCELERATOR LANDSCAPE IN EUROPE: FACILITIES, PROJECTS AND CAPABILITIES AT THE BEGINNING OF THE 2020'S.....	5
2.1	BEAM-DRIVEN PLASMA ACCELERATORS WITH FOCUS ON PROTON-DRIVEN	5
2.2	SIMULATION TOOLS AND ROADMAP	6
2.3	LASER TECHNOLOGY AND LWFA RESULTS (E-, P+, ION)	8
2.4	DISTRIBUTED PLASMA ACCELERATOR LANDSCAPE IN EUROPE AND TECHNICAL PROGRESS TOWARDS APPLICATIONS (EUPRAXIA ESFRI AND OTHERS)	10
2.5	PLASMA-BASED FEL EXPERIMENTS	11
2.6	PARTICLE PHYSICS PLASMA TEST FACILITY (MULTI-STAGE, 10`S OF GeV).....	13
2.7	INTERNATIONAL LANDSCAPE: FACILITIES, PROJECTS, INITIATIVES	14
2.8	STRUCTURE-BASED ACCELERATORS (E.G. ACHIP) AND ADVANCED RADIATION GENERATION SCHEMES	16
3	STUDENT OUTREACH AND SUPPORT OF YOUNG SCIENTISTS.....	18
4	CONCLUSION	19

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2.1 BEAM-DRIVEN PLASMA ACCELERATORS WITH FOCUS ON PROTON-DRIVEN

Session organizers and summary prepared by: E. Gschwendtner (CERN), P. Muggli (MPP)



Fig. 1 Pictures of the AWAKE vapor/plasma source and diagnostics area (Courtesy CERN)

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2.2 SIMULATION TOOLS AND ROADMAP

Session organizers and summary prepared by: M. Thévenet (DESY), J. Vieira (IST)

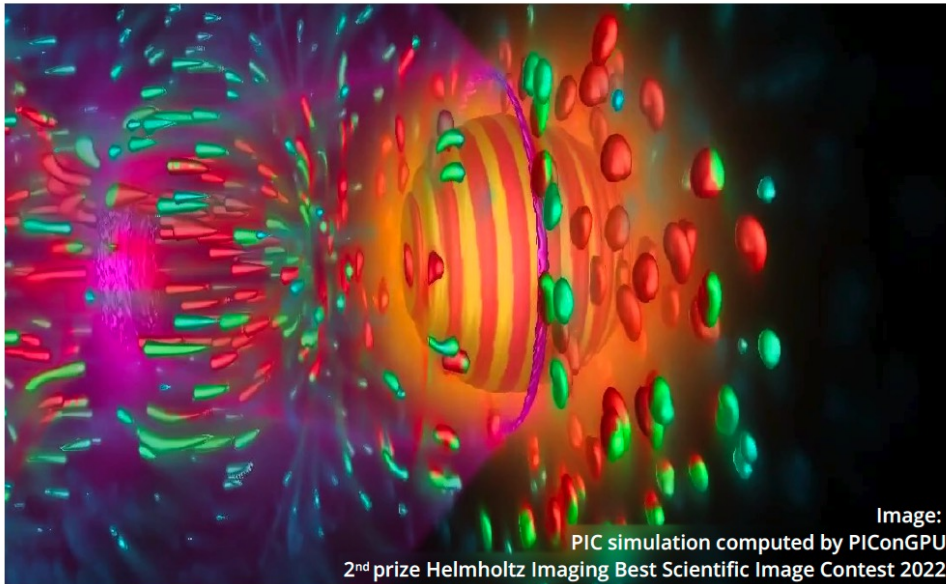


Fig. 2 Picture of a PIC simulation for a plasma wakefield, as computed by PICongGPU.

2.3 LASER TECHNOLOGY AND LWFA RESULTS (E-, P+, ION)

Session organizers and summary prepared by: L. Gizzi (CNR), S. Karsch (LMU)

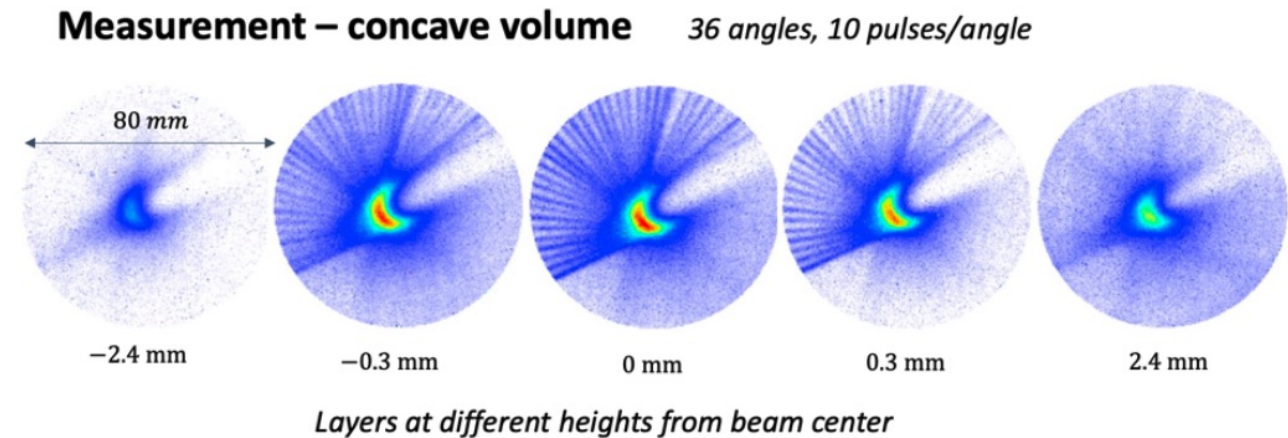


Fig. 4 Measurement of LWFA VHEE focused on a phantom, showing fine control of dose deposition (O. Lundh).

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2.4 DISTRIBUTED PLASMA ACCELERATOR LANDSCAPE IN EUROPE AND TECHNICAL PROGRESS TOWARDS APPLICATIONS (EuPRAXIA ESFRI AND OTHERS)

Session organizers and summary prepared by: Enrica Chiadroni (Sapienza University Rome),
Riccardo Pompili (INFN)

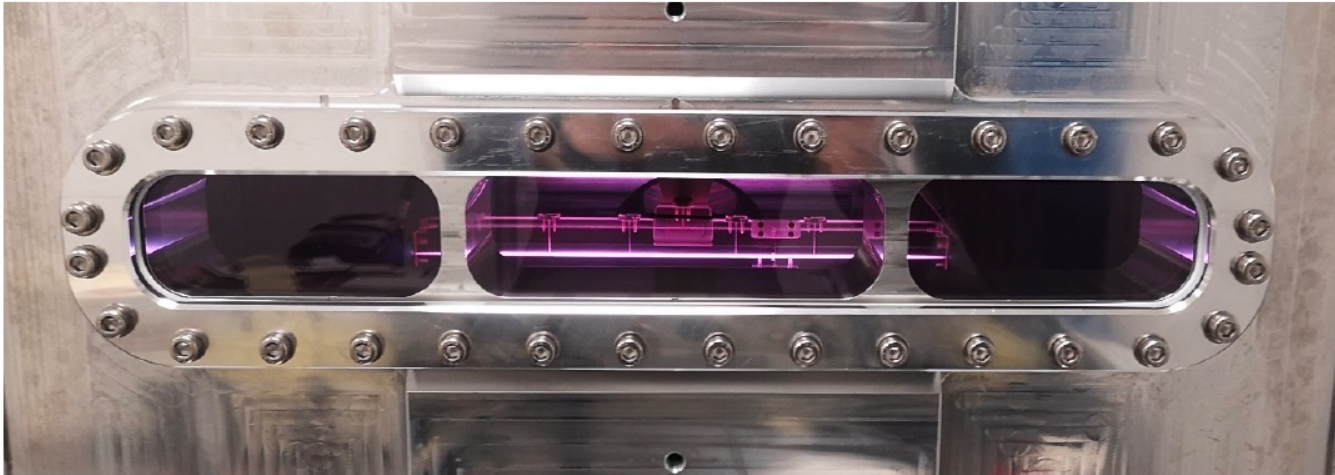


Fig. 5 Prototype of discharge capillary as the one that will be implemented in the EuPRAXIA beam-driven facility.

2.6 PARTICLE PHYSICS PLASMA TEST FACILITY (MULTI-STAGE, 10`s OF GeV)

Session organizers and summary prepared by: J. Osterhoff (DESY)

EuroNNAc Special Topics Workshop: MS21

2.5 PLASMA-BASED FEL EXPERIMENTS

Session organizer and summary prepared by: Arie Irman, HZDR

	SIOM-CAS	COXINEL-HZDR	SPARC_LAB-INFN
Driver-beam	LWFA 200TW system, 6mm gas jet, shock injection	LWFA 100TW system, 2.5 mm gas jet, STII	PWFA Photo-injector, driver-witness ($\Delta t=1.21\text{ps}$), 3 cm cap.discharge
Mean energy [MeV]	490	189	93.9(W)
Rel. Energy spread [%]	0.5-rms	6.3-rms	0.3-rms
Charge [pC]	30	100-FWHM	200 (D),20(W)
Charge density [pC/MeV]	12	6.3-FWHM	97
Divergence [mrad]	0.2-rms	0.8-rms (plasma lens)	
Emittance [mm-mrad]	-	1-rms	2.7 (x),1.3(y)-rms
Undulator	1.5m (3x), 10mm gap, 25mm length, K=1.41	4.3mm gap,20mm (97periods), K=2.47	2.15m(6x), 28mm(77 periods), K=1.4
FEL wavelength [nm]	27	275	830
FEL operation modes	SASE	Decompression, Seeding (269nm)	SASE, Seeding (800nm)
Rep. Rate [Hz]	1-5	0.1 -1	

Injector

Fig. 6 Experimental parameters of proof-of-principle experiment of FEL lasing driven by plasma accelerators.

EuroNNAc Special Topics Workshop: MS21

2.7 INTERNATIONAL LANDSCAPE: FACILITIES, PROJECTS, INITIATIVES

Session organizers and summary prepared by: P. Musumeci (UCLA), C. Geddes (LBNL), M. Hogan (SLAC), M. Kando (QST), W. Lu (Tsinghua)



Beam Test Facilities at DOE Laboratories provide unique and world-leading capabilities for research on Advanced Accelerator Concepts fueled by collaboration with University groups

Figure 7. Main test facilities in the US for advanced accelerator research. These facilities have recently formed a Test Facility Council to coordinate efforts, strengthen collaboration and enhance complementarity in their scientific programs.

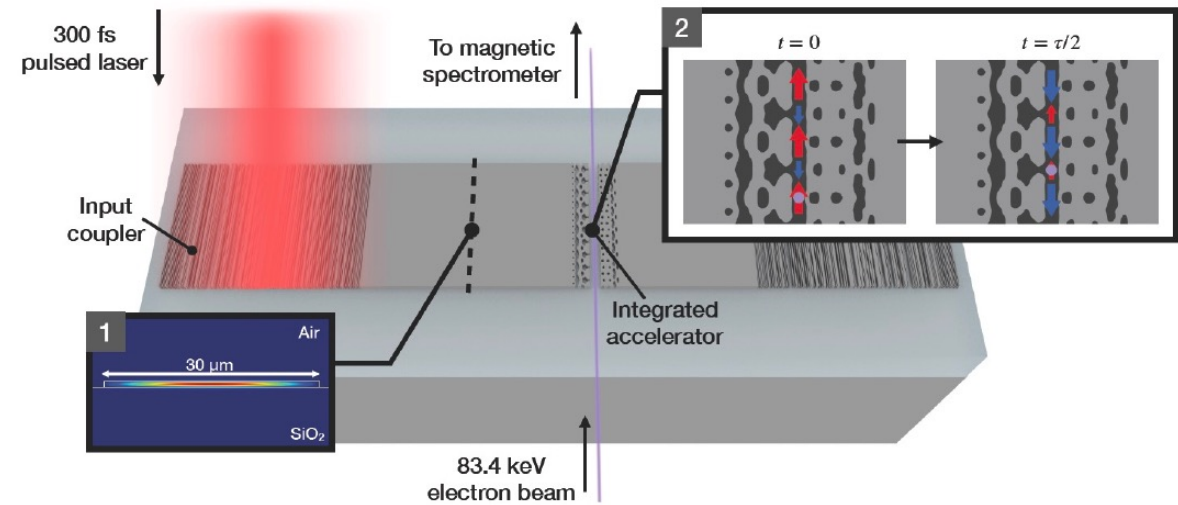


Fig. 8 Inverse design of a dielectric laser accelerator. Figure reproduced from: N. Saprà, et al., "On-chip laser driven particle acceleration through inverse design," Science 367 (6473), 79 (2020)

2.8 STRUCTURE-BASED ACCELERATORS (E.G. ACHIP) AND ADVANCED RADIATION GENERATION SCHEMES

Session organizer and summary prepared by: R. Ischebeck (PSI)



EuroNNAc Special Topics Workshop: MS21

3 Student Outreach and Support of Young Scientists

Session organizers and summary prepared by: B. Holzer (CERN) / R. Walczak (Oxford)

The three posters that have been chosen for this poster award were:

- *Resonant Wakefield Excitation Observed in Long Plasma Channels*, **Aimee Ross** (Oxford university and John Adams Institute)
- *Alternating Phase Focusing and Approaching Large Net Energy Gain in Photonic Chip Based Particle Acceleration*, **Stephanie Krauss** (Friedrich Alexander University, Nürnberg)
- *Early dynamics of the self-modulation instability growth rate* **Mariana Moreira**, (Instituto Superior Técnico, Lisbon)

A special session during the EuroNNAc special topics workshop in September 2022 had been dedicated to the contributions of young colleagues, that presented their work in form of posters. Close to 60 contributions - 42 from students - were received - representing an impressive amount of information. Three contributions were selected for a special poster prize, chosen by an international selection committee and ranked on quality of the poster, the student's own contribution and the impact of the chosen topic to the field.

Last but not least, and following already a certain tradition, the workshop was the right moment and location to present the winner of the 2021 Simon vander Meer prize. This prize is awarded by the European Network for Novel Accelerators to recognise outstanding early career contributions in novel accelerator science. Following the recommendation of an international selection committee, the 2021 SvdM prize was awarded to **Dr. Carl Lindstrøm**,

“... for his numerous outstanding experimental and theoretical contributions to the field of beam-driven plasma accelerators - including the demonstration^[1]_{SEP} of beam-quality preservation and efficient acceleration, study of advanced beam transport concepts and the invention of self-stabilising multi-stage acceleration. “

WP6 Deliverables

Nov 2024

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
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EAAC

Workshop

2021

Hybrid

European

Advanced

Accelerator

Concepts

Workshop

5th Edition



5th European Advanced Accelerator Concepts Workshop

20–23 Sep 2021
INFN LNF
Europe/Rome timezone



Overview

Committees

Timetable

Scientific Program - Indico
Style

My Conference

My Contributions

5th EAAC - Group photo

Participant List

INFN Privacy Policy

WIFI Internet Access

How to get LNF and
general info

Previous Editions

Support

✉ eaac2021@lists.lnf.infn.it

5th European Advanced Accelerator Concepts Workshop

REGISTRATION IS CLOSED

The workshop will take place at LNF-INFN from the 20th to the 22nd of September 2021 in a hybrid format, followed by a EuroNNAC meeting on the 23rd of September.

Under present rules most of the workshop will take place in a virtual and reduced format, allowing an expectation of maximum of **40 people** to attend in-person at the LNF-INFN, in Frascati (Rome, Italy).

For those participants who will be notified as "in presence", it will be requested to show EU covid-19 green pass or covid-19 certificate at the entrance of the LNF area and/or Bruno Touschek Auditorium due to the new Italian law issued on July 22, 2021. Here some useful information about travelling to Italy: [link](#).

LNF-INFN decline all responsibility for any quarantines/isolations that may occur in the event of a positive COVID-19 case during the meeting.

The focus this year will be on 18 plenary talks and a one day event on the accelerator R&D roadmap discussions ongoing in Europe and the US.

The poster session and the usual parallel sessions of working groups cannot take place.

The **European Advanced Accelerator Concepts Workshop (EAAC2021)** has the mission to discuss and foster methods of beam acceleration with gradients beyond state of the art in operational

EAAC

Workshop

2021 Hybrid

European
Advanced
Accelerator
Concepts
Workshop
5th Edition



5th European Advanced Accelerator Concepts Workshop 20 Sep - 23 Sep

Created by Maria Rita Ferrazza (maria.rita.ferrazza@infn.it) from event on 15 Sep 2019

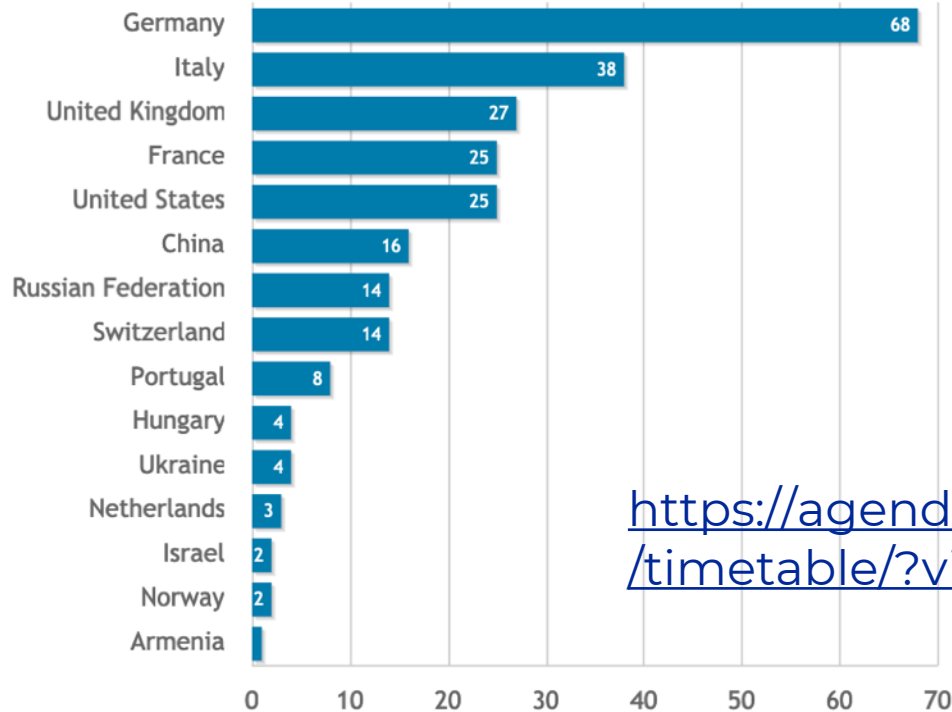
Registration

Stats for "5th EAAC21 Pre-registration form"

Overview



Registrants per country

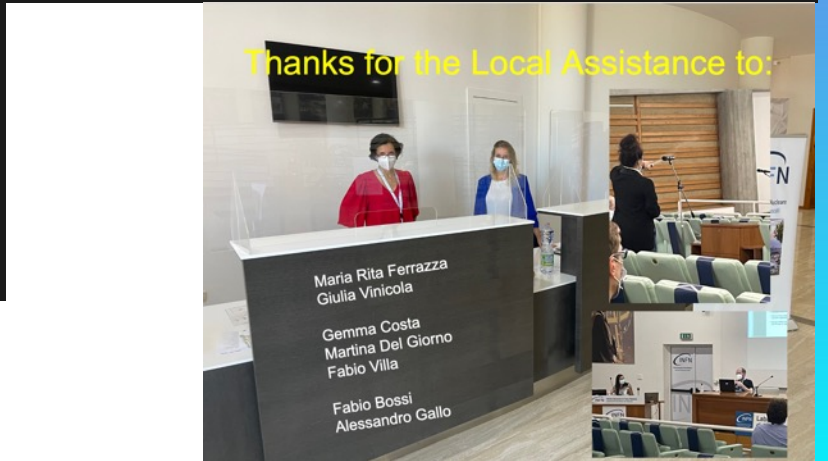
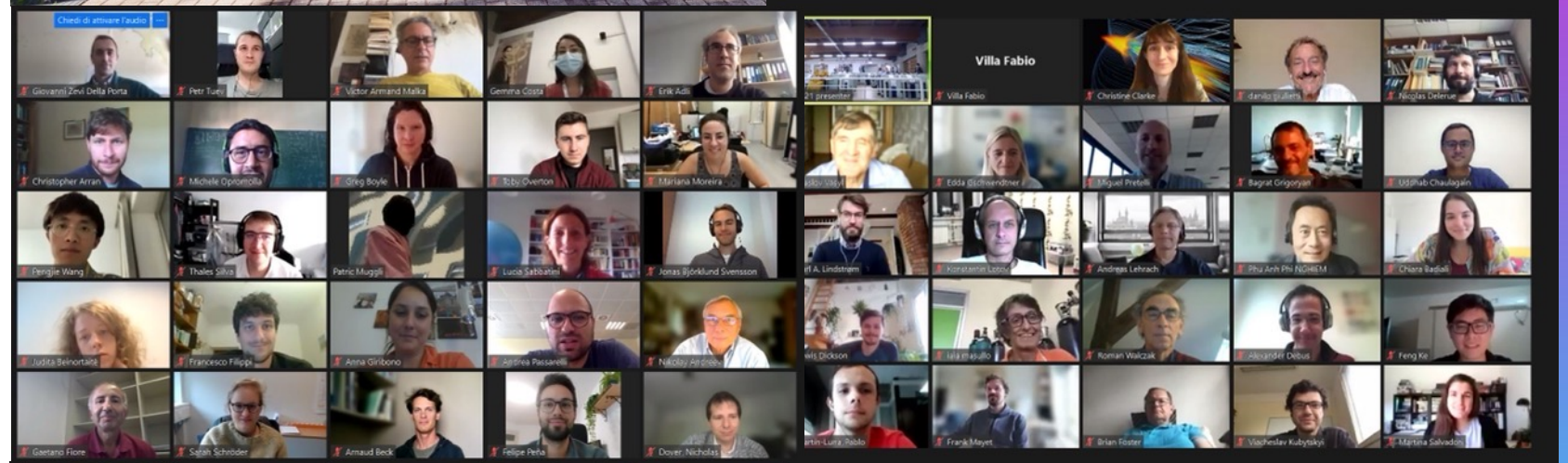


<https://agenda.infn.it/event/24374/timetable/?view=standard>

EAAC Workshop

2021 Hybrid

European
Advanced
Accelerator
Concepts
Workshop
5th Edition



EAAC

Workshop

2021 *Hybrid*

European
Advanced
Accelerator
Concepts
Workshop
5th Edition



EAAC 2023



See you at the next EAAC 2023,
17-23 September 2023

Organizing Committee:

Massimo Ferrario, (*INFN - LNF, Italy*)
Ralph Assmann, (*DESY, Germany and INFN-LNF, Italy*), **co-Chairs**

Enrica Chiadroni, (*University of Roma, La Sapienza*), **SPC Chair**

Bernhard Holzer, (*CERN, Switzerland*)
Arnd Specka, (*Ecole Polytechnique, France*)
Roman Walczak, (*JAI, United Kingdom*)

Damien Minenna (CEA, France), **Proc. co-Editor**
Rasmus Ischebeck (PSI, Switzerland), **Proc. co-Editor**

Conclusion

- WP6 and its task 1 so far on track: Leo will explain tasks 2 – 4.
- MS21 report (R&D landscape) authored after 1 week meeting by 20 experts from 16 labs
- EAAC`21 successfully organized, EAAC`23 being organized
- Other outreach coming:
 - CERN Courier feature article on EuPRAXIA ESFRI project
 - Nature photonic review article on plasma-based FEL`s



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