

I.FAST

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DELIVERABLE REPORT

EAAC workshops and strategies

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ABSTRACT

We report here about the last two EAAC workshops that have been partially supported by the I.FAST funded European Network for Novel Accelerators (EuroNNAc4), and about the WP6 contributions to the elaboration of common strategies to support the development of novel acceleration techniques. The **European Advanced Accelerator Concepts Workshop** (EAAC) series has the mission to discuss and foster methods of beam acceleration with gradients beyond state of the art in operational facilities. Started in September 2013, in the premises of the Hotel Hermitage in the Biodola bay in the island of Elba in Italy, it has continued its mission with biennial cadence until the 6th edition in September 2023. The most cost effective and compact methods for generating high energy particle beams have been reviewed and assessed as a basis for elaborating strategies for the future R&D programs. Established since the 4th EAAC workshop in 2019, the “**Simon van der Meer Award**” has been also assigned to recognize outstanding early career contributions in novel accelerator science.

I.FAST Consortium, 2024

For more information on IFAST, its partners and contributors please see <https://ifast-project.eu/>

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Executive summary

We report here about the last two EAAC workshops that have been partially supported by the I.FAST funded European Network for Novel Accelerators (EuroNNAc4) and about the WP6 contributions to the elaboration of common strategies to support the development of novel acceleration techniques .

*The **European Advanced Accelerator Concepts Workshop (EAAC)** series has the mission to discuss and foster methods of beam acceleration with gradients beyond state of the art in operational facilities. Started in September 2013, in the premises of the Hotel Hermitage in the Biodola bay in the island of Elba in Italy, it has continued its mission with biennial cadence until the 6th edition in September 2023. The most cost effective and compact methods for generating high energy particle beams have been reviewed and assessed as a basis for elaborating strategies for the future R&D programs.*

*Established since the 4th EAAC workshop in 2019, the “**Simon van der Meer Award**” has been also assigned to recognize outstanding early career contributions in novel accelerator science.*

Contributions to the ESPP, ESFRI road map, Snowmass and EuRONNAC workshop are also reported.

1 Introduction

Task 6.1 “Novel Particle Accelerators Concepts and Technologies” (NPACT) brings together experts, institutions, and industry in the field of novel laser and plasma accelerators, including laser-driven dielectric accelerators. It also includes the European Network for Novel Accelerators (EuroNNAc4), a network of more than 60 institutes and universities established in the framework of I.FAST

The work is organized in 4 sub-tasks in a coordination shared between the Task 6.1 beneficiaries DESY, CEA, CERN, CNRS, INFN and Oxford:

- a. Strategic forum novel accelerator landscape in Europe, including the organization of the European Advanced Accelerator Concepts (EAAC) workshop, dedicated schools and young scientists` prizes
- b. Strategy High Gradient RF Accelerators in Lower Energy Applications
- c. Strategy Plasma Accelerators towards Applications and HEP
- d. Strategy Defining and Exploiting the Potential of Dielectric Accelerators

In the following paragraphs we report about the last two EAAC workshops that have been partially supported by EuroNNAc4 and about the WP6 contributions to the elaboration of common strategies to support the development of novel acceleration techniques.

2 European Advanced Accelerator Concepts (EAAC) Workshops

2.1 EAAC 2021

The 5th European Advanced Accelerator Concepts (EAAC) workshop was held from 20 to 23 September 2021 at the LNF-INFN laboratory at Frascati, Rome, Italy. Given the impact of the CoVID19 pandemic remote participation was allowed in a hybrid format and no program of student sponsoring has been. In total 255 experts registered from 20 countries. The program, assembled by a committee under the leadership of Laura Corner from University Liverpool, had 27 plenary presentations showing recent highlights in the field of advanced accelerators, in particular successful FEL lasing in Italy and in China.

At the occasion of EAAC2021 the yearly meeting of the Task 6.1 was held.

The program and slides are available at the EAAC2021 website: <https://agenda.infn.it/event/24374/> and a group photo is shown in Fig. 1.



Fig. 1 Group picture of the hybrid EAAC2021 workshop in September 2021.

2.2 EAAC 2023

More than 200 scientists from all over the world gathered from Sep 17 – 23, 2023 at the 6th European Advanced Accelerator Concept Workshop (EAAC) on the Island of Elba in Italy, see Fig. 2. Specialists from accelerator physics, RF technology, plasma physics, instrumentation and the laser field discussed ideas and directions towards a new generation of ultra compact and cost effective accelerators with ground-breaking applications in science, medicine and industry. At the EAAC

senior scientists from various specialties mix with junior experts and a large community of young students, attracted by the promise and success of compact particle accelerators. In 2023 about 35 PhD students presented their work at the EAAC. Besides the reports on scientific achievements the large diversity in gender, age distribution and nationalities made the EAAC 2023 a special event and a great success for the accelerator field.



Fig. 2 Group photo of the EAAC 2023 attendants

Enrica Chiadroni (University of Roma “La Sapienza”), Chair of Program Committee, has organized an outstanding program. In addition to the many excellent presentations at EAAC2023, soon published in the proceedings, special sessions have been devoted to:

- the EuPRAXIA ESFRI project developments with particular emphasis to the presentation of the 4 institutes candidates to host the second EuPRAXIA site (being the first INFN Frascati),
- the ongoing activities in the framework of the European Strategy for Particle Physics,
- the Laser Technologies progress, as part of the LASPLA activities in IFAST. In addition to complete the advanced laser technology landscape there has been also an overview of the opportunities offered by the recent advanced in the Inertial Fusion R&D with possible cross fertilization with the LWFA community.

Another important event took place at EAAC 2023: the “Simon van der Meer Award” ceremony to recognize outstanding early career contributions in novel accelerator science. The price has been sponsored by the European Network for Novel Accelerators (EuroNNAc). It recognizes one individual researcher and consists of a stipend of € 3000 and a certificate citing the contributions of the recipient. The Award Winner in 2023, selected by an international committee, was Marlene Turner (CERN) for her outstanding contribution to the development of proton driven wakefield beam self-modulation and acceleration of electrons, stability of laser driven wakefield acceleration and concepts for future colliders, which has been also the subject of her outstanding workshop closing talk.

At the occasion of EAAC2023 the yearly meeting of the IFAST Task 6.1 was also held. The program and slides are available at the EAAC2023 website: <https://agenda.infn.it/event/35577/overview>.

3 Strategies

3.1 CONTRIBUTION TO ESPP

Several coordinators of the I.FAST WP6.1 were invited to lead and to contribute to the expert panel for “High Gradient Laser and Plasma Accelerators”, set up as part of the European Strategy for Particle Physics. The panel had various meetings and outreach events with the European and world-wide community (centred on the I.FAST contacts) in 2021 and up to February 2022. At this time the work culminated by the publication of the European strategy for accelerator R&D with a dedicated chapter on advanced accelerators (see: <https://arxiv.org/pdf/2201.07895>). An optimized R&D strategy is described in this report for plasma and dielectric accelerators and this strategy will serve as a firm basis for further strategic discussions.

3.2 CONTRIBUTION TO 2021 ESFRI ROADMAP

The NPACT community and its European network for Novel Accelerators (EuroNNAc) has been driving for several years the preparation of a European Research Infrastructure based on the plasma accelerator technology, namely the EuPRAXIA project (<https://www.eupraxia-facility.org/>). It is a success of the continuing WP6.1 work that the EuPARXIA, after its publication of the CDR, has received sufficient government support and readiness to be placed on the 2021 update of the ESFRI roadmap.

3.3 CONTRIBUTION TO SNOWMASS ACCELERATOR FRONTIER (AF6)

The Snowmass meeting is a community effort that takes place in the US every 5-7 years. It collects statements of interests from the accelerator R&D community, discusses a future strategy and prepares a report to implementation committees (see <https://arxiv.org/abs/2209.14136>). The IFAST WP6.1 leadership and members helped in the coordination of the Accelerator Frontier 6, concerned with advanced accelerators. WP6.1 participated to meetings, presented the European perspective and joined in report writing. This effort spent will support a coordinated approach between EU and US activities, of course subject to decisions by the funding agencies involved.

3.4 ORGANISATION OF THE EURONNAC-NPACT-IFAST WORKSHOP

The COVID-19 pandemic had a major impact on in-person meetings in the field of advanced accelerators, as in all scientific areas. While work has been advanced as much as possible in remote meetings (the European Strategy for accelerator R&D was prepared fully in remote) other meetings went into hybrid mode to keep a minimum personal exchange active. However, especially students and young researchers, never having met their peers in real life, were strongly hampered in collaborative research. Therefore, the WP6.1 management, together with IFAST decided to hold a special topics EuroNNAc-NPACT-IFAST workshop as in-presence meeting, see Fig. 3 (one baby was born during the workshop to delegates, not included in the picture). The meeting discussed six

special topics in advanced accelerators and took place 18 - 24 September 2022 on the island of Elba in Italy, bringing together 148 registered participants from 17 countries, close to the allowed 150 maximum attendance. 42 students from 10 countries attended, supported by the WP6.1 budget foreseen for this. Plenary talks were complemented by poster sessions.

The meeting website is available at <https://agenda.infn.it/event/28376/>. The six special topics in advanced accelerators, including sub-topics, and their coordinators are listed in:

<https://agenda.infn.it/event/28376/attachments/91646/130988/TimeTableEURONNAC.v0.pdf>

and included the following:

- S-ST1: Beam-driven Plasma Accelerators with focus on proton-driven (AWAKE, ...)
- S-ST2: Simulation tools and roadmap
- S-ST3: Laser Technology and LWFA Results (e-, p+, ion)
- S-ST4: Distributed Plasma Accelerator Landscape in Europe and Technical Progress towards Applications (EuPRAXIA ESFRI and others)
 - Special sub-session: Talks and discussion on plasma-based FEL experiments
 - Special sub-session: Particle physics plasma test facility (multi-stage, 10`s of GeV)
- S-SP: Student Talks - Prize Award Session
- S-ST5: International Landscape: Facilities, projects, initiatives
- S-ST6: Structure-based accelerators (e.g. ACHIP) and advanced radiation generation schemes

The biennial Simon van der Meer Award, established by EuroNNAc in 2019 to recognize outstanding early career contributions (theoretical, experimental, computational or technical) in novel accelerator science, could not be awarded in 2021 and was awarded at the meeting to Dr. Carl A. Lindstrom. The EuroNNAc poster prizes for the best three posters from students were awarded to Mrs. Aimee Ross from Oxford University (UK), to Mrs. Stefanie Kraus from the Friedrich-Alexander-Universität in Erlangen-Nürnberg (Germany) and to Mrs. Mariana Moreira from IST in Lisbon (Portugal).

The workshop was followed on Saturday 24.09.2022 by the yearly meeting of WP6.1.



Fig. 3 Group photo of the EuroNNAc-NPACT-IFAST workshop attendants

4 Conclusions

The networking activity supported by WP6 via NPACT and EuRONNAC4 has been highly successful and it will be worth to preserve it and the activities that it sponsors: for example EAAC, Simon van der Meer prize, contributions to the discussion of strategies relevant for the development of novel acceleration techniques. Possible extension of the mission should be also considered including for example topics related to novel hadron beams or plasma based linear colliders.

Certainly one of the main achievement of this community has been to launch the EuPRAXIA initiative and to continuously support its program offering a solid background to keep alive the discussion and the integration of the EuPRAXIA project with the advanced accelerator community.