WP 6 and Task 6.1 Leader: Massimo FERRARIO (INFN)

Task Leader: L. A. Gizzi (CNR-INO)

WP6 Deliverables and Milestones

Deliverables related to WP6	
D6.1: EAAC workshops and strategies. *Report on the EAAC workshops as strategic forums for international accelerator R&D and resulting strategies*	M42
D6.2: LASPLA Strategy. *Report on a strategy for laser drivers for plasma accelerators.* **ACTIVITY IN PROGRESS**	M46
D6.3: Electron acceleration experiments with new targets. *Report on electron acceleration with micro-scale target at a kHz repetition rate, and with long targets at the multi-Joule level.*	M24
D6.4: Improvement of the laser intensity stability on target. *Report showing the stability on two laser facilities before and after improvement.*	M36

6.2

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) √

6.2

MS22: LASPLA Workshop/School. Lead – CNR, M30, Report (Task 6.2) REPORT DELIVERED

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) √

Task 6.1 6th European Advanced Accelerator Concepts workshop

Held on 18-22 September 2023 at Elba, Italy

Workshop supported by EU via IFAST

EUROPEAN NETWORK FOR NOVEL ACCELERATORS
EuroNNAc4
NPACT supported by EU via I-FAST

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

Workshop hosted by:

Istituto Nazionale di Fisica Nucleare

	Monday 18th	Tuesday 19th	Wednesday 20th	Thursday 21st	Friday 22nd
09:00	*Opening remarks*	2023 AWAKE Run results (E. Gschwendtner)	Status and recent results of FLASHForward (F. Peña)	Probing strong-field QED in beam-plasma collisions (A. Matheron)	
09:20	Free electron lasers driven by plasma accelerators: status and near-term perspectives (M. Litos)	The EuPRAXIA ESFRI Preparatory Phase (R. Assmann)	High-quality 1 GeV electron beam with a 50 TW laser (C. Thaury)	Coherence and superradiance from a plasma-based quasiparticle accelerator (B. Malaca)	High average power, high rep rate lasers: Technological challenges towards multi-disciplinary applications (J. Collier)
10:00	New ideas for high beam quality from plasmas for FELs (B. Hidding)	EuPRAXIA@SPARC_LAB (A. Del Dotto)	Experimental Demonstration of Laser Guiding and Wakefield Acceleration in a Curved Plasma Channel (M. Chen)	Accelerator on a chip: Recent results and perspectives for applications (R. Shiloh)	Toward an Inertial Fusion Energy Future: Challenges and Opportunities in Science & Technology (Tammy Ma)
10:40	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00	Advancement in plasma sources towards high repetition rate operation (A. Alejo)	EuPRAXIA Second Site Options (A. Specka)	3D structure of microbunched plasma-wakefield-accelerated electron beams inferred by coherent optical transition radiation (M. Labarge)	Acceleration of polarized protons from laser-plasmas (L. Reichwein)	A hybrid, asymmetric, linear Higgs factory (HALHF) (C. A. Lindstrøm)
11:15		View from ELI-Beamlines (A. Molodozhentsev)			
11:25		View on EPAC (R. Pattathil)			
11:30	Modeling a novel laser-driven acceleration scheme using particle-in-cell simulations on exascale-class supercomputers (H. Vincenti)	View from CNR (L. A. Gizzi)	Temperature effects in plasma-based positron acceleration (S. Diederichs)	Ion acceleration activities at ELI NP with the acceleration of more than 100 MeV protons (D. Doria)	The plans to prepare the next European Strategy (R. Pattathil)
11:45		View on CLPU (M. Rodriguez Frias)			
11:55		View on Excellence Centers (M. Ferrario)			
12:00	On the Confluence of Data-Driven Techniques and Laser-Plasma Acceleration (A. Döpp)	EuPRAXIA Full Implementation: Round Table	FACET-II: Status of the first experiments and the road ahead (M. Hogan)	High energy proton acceleration at DRACO-PW and radiobiological applications (Josefine Metzkes-Ng)	Advanced Accelerator Concept activities at Snowmass (C. Geddes)
12:30	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
16:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
	Parallel Session	Parallel Session	Parallel Session	Parallel Session	Plenary Session
16:20 - 18:45	WG1: Plasma-based accelerators and ancillary components WG2: Laser technology (WP6 - Task2) WG3: Theory and simulations WG5: Applications	WG1: Plasma-based accelerators and ancillary components WG2: Laser technology (WP6 - Task2) WG4: High gradient vacuum structures WG6: Ion acceleration and developments towards fusion WG7: Beam diagnostics, instrumentation, Machine Learning	WG1: Plasma-based accelerators and ancillary components WG3: Theory and simulations WG5: Applications WG6: Ion acceleration and developments towards fusion WG8: Plasma sources and related diagnostics	WG1: Plasma-based accelerators and ancillary components WG2: Laser technology (WP6 - Task2) WG4: High gradient vacuum structures WG7: Beam diagnostics, instrumentation, Machine Learning WG10: ALEGRO towards colliders	16:20 Laser plasma accelerators: then and now through cutting-edge experiments (V. Malka) 17:00 Simon Van der Meer Award 17:45 Poster Prizes Ceremony and talks 18:30 *Closing remarks*
19:00	Poster Session	Poster Session	Poster Session		
20:30	Dinner	Dinner	Dinner	Social Dinner	Dinner

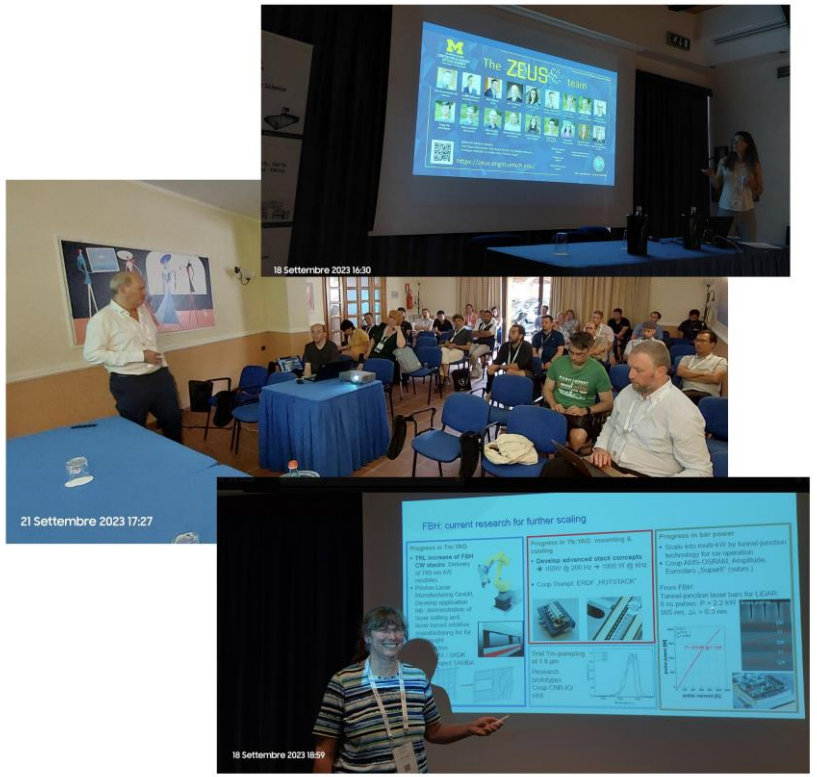
- EAAC Proceedings dead line post poned end of 2023.
- Next EuRONNAC meeting during the IFAST meeting in Paris, if possible

Task 6.2

LASPLA *Laser Technology* Workshop

Held on 19th, 20th and 22nd of September 2023 in the framework of the 6th EAAC 2023 at Elba, Italy

- Major progress on industrial scientific laser development;
- Robust industrial multi kW, thin disk laser technology + NL Pulse compression;
- Coherent combination of fibers aiming at few cycle, 100 Hz,
- OPCPA based on robust and high beam quality DPSSL pump lasers.
- Significant progress in the development of pump lasers for high average power Ti:Sa system
- Direct diode-pumping of Thulium-doped now in robust development phase and needs coordinated effort across labs for materials and architecture
- Strong impulse to diode laser developments for high average power, new wavelengths, high energy density, compactness



Dissemination of IFAST 6.2 activity

L.A.Gizzi, Novel high-intensity lasers for plasma acceleration, Invited talk at the 109 th Congress of
the Italian Physical Society, 11-15 Sept. 2023, Salerno, Italy
L.A.Gizzi, Laser and plasma studies at ILIL, Invited talk at the CMD30 and FISMAT 2023 Joint
conference, 4-8 September 2023, Milano, Italy
L.A.Gizzi, Science and Technology of laser drivers for plasma accelerators, Invited Lecture at the
INFN Erice Accelerator School, EMFCSC, 27 Jul – 2 Aug, 2023, Erice Italy
L.A. Gizzi, The EuPRAXIA Compact Plasma Accelerator Infrastructure and Perspectives for
Nuclear Applications, Invited talk at the International Conference on Applications of Nuclear
Technique, June 18-24, 2023, Crete, Greece

Summary

- Strong progress on laser driver developments:
  - Increasingly involving industrial partners
  - Infrastructure developments pushing industrial femtosecond Ti:Sa laser technology and diode lasers for pumping
  - Fiber and other laser schemes (Tm) with new materials and for direct diode pumping architectures markedly aiming at high efficiency
- Activity towards preparation of the LASPLA Strategy document D6.2 is ongoing
- Milestones and Deliverables on track