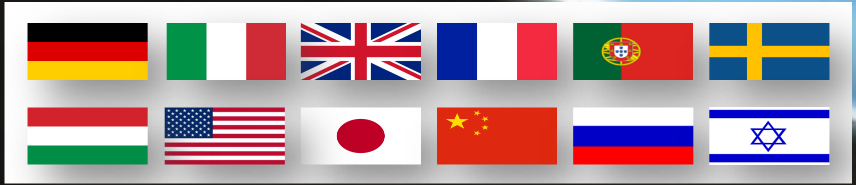
EuPRAXIA@SPARC_LAB user workshop, 14-15 October, 2021

EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS

EuPRAXIA

High Energy, High Power Lasers

Leonida Antonio GIZZI (CNR, Pisa, Italy)



http://eupraxia-project.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

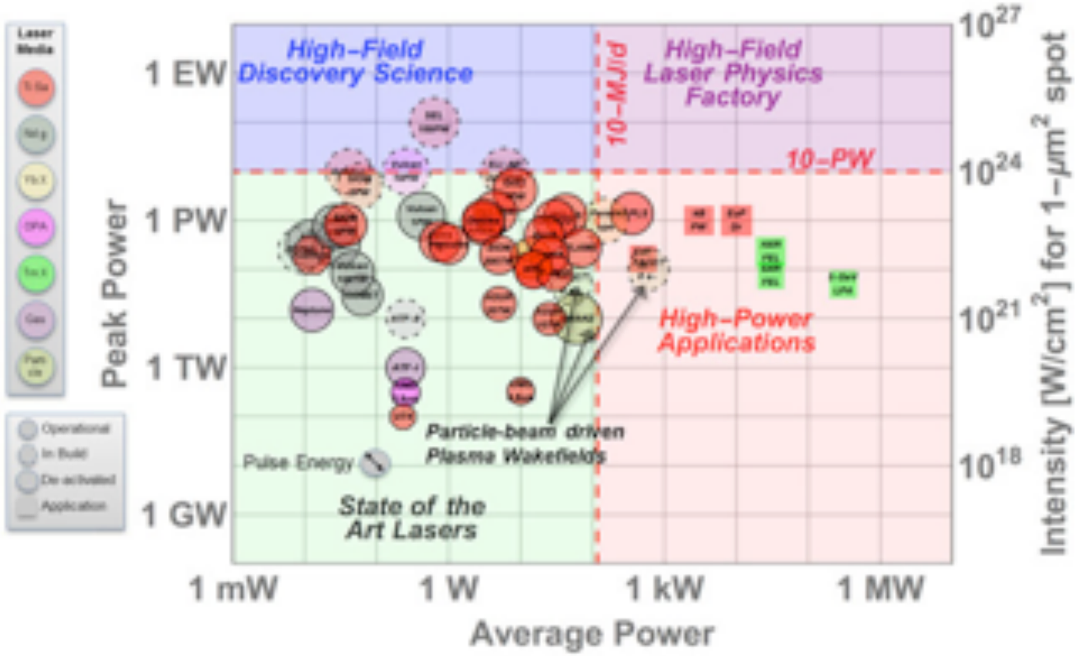
Outline

- Snapshot on high power lasers
- HPLasers and X-ray FELs for high energy density (HED)
- Main EuPRAXIA Laser driver specifications
- Forward look: HPLasers scalability
- Summary

Laser Parameters

- **Nanosecond-scale** laser pulses: ablation, high pressure shock generation, hot, dense plasma, … inertial fusion;

- **Picosecond and femtosecond** pulses: Laser-wakefield acceleration, Target-normal sheath acceleration, X-ray and gamma-rays secondary sources,THz generation, extreme fields and much, much more, incl. fusion ignition;



C. Siders et al., Instruments, 3, 44 (2019)

Intense laser development

ESFRI 2021

- Current laser technology development is mainly driven by **extreme intensity** applications;
- Laser-Plasma studies have developed along with progress in laser performance;
- Recent LWFA-FEL demonstration [1] **highlights the role of laser stability and control**;
- **Laser development** is now also focusing on the technology required to achieve high-repetition rate at multi-joule (≈100 TW) scale [2], with high quality and enhanced control and stability;
- **Key role of industry** to establish turn-key, high average/peak power ultrashort pulse technology;

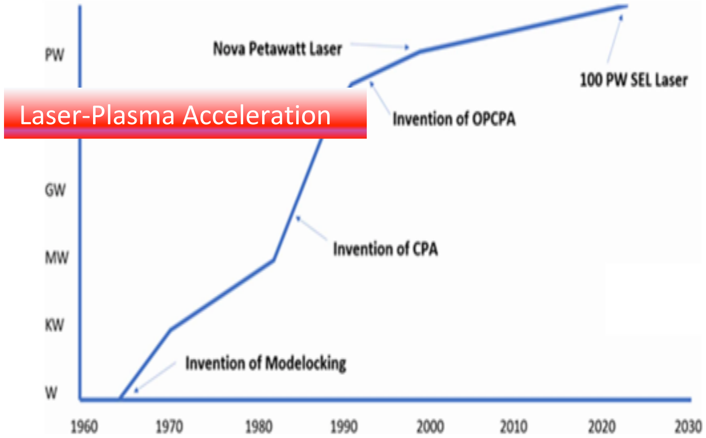


Figure 1. The historical journey to multi-petawatt ultra-short-pulse laser facilities.

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*W. Wang, K.Feng et al., Free-electron lasing at 27 nanometres based on a laser wakefield accelerator, *Nature* **595**, 516–520 (2021)
L.A. Gizzi et al., A viable laser driver for a user plasma accelerator, NIM **A 909 , 58 (2018); https://doi.org/10.1063/1.4984906

High power lasers at X-ray FELS

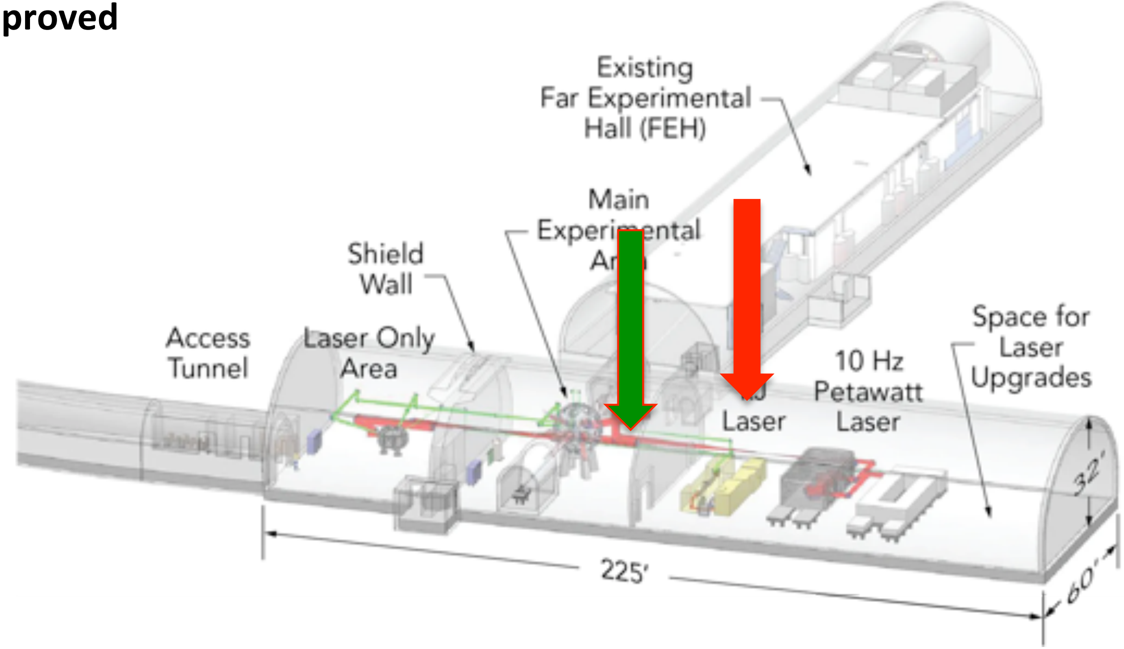
HPLasers are now established at most FEL facilities: including nanosecond-scale and TW femtosecond scale

SLAC Petawatt laser facility recently approved

" … today's petawatt lasers are **standalone facilities**, with limited ability to fully diagnose the conditions they produce"

"the first to combine these powerful lasers with an X-ray free-electron laser (XFEL) that can probe the extreme conditions they create as never before"

"… to dramatically improve our understanding of the conditions needed to produce fusion energy and to replicate a wide range of astrophysical phenomena here on Earth"



Interest in high energy density boosted by the recent 1.3 MJ Fusion Yield at the 2 MJ laser ignition facility (NIF)

[Linac Coherent Light Source (LCLS)](), the Matter in Extreme Conditions Upgrade

Convergence of scientific cases?

Investigation of extreme states of high energy density matter (HED) with light sources is also attracting the interest of the inertial fusion community

AN EVALUATION OF SUSTAINABILITY AND SOCIETAL IMPACT OF HIGH POWER LASER AND FUSION TECHNOLOGIES: A CASE FOR A NEW EUROPEAN RESEARCH INFRASTRUCTURE

S. Atzeni[1], D. Batani[2], C.N. Danson[3], L.A. Gizzi[4,], M. Perlado[5], M. Tatarakis[6], V. Tikhonchuk[2], L. Volpe[7]*

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[2] *CELIA, Université de Bordeaux–CNRS–CEA, UMR 5107, 33405 Talence, France*
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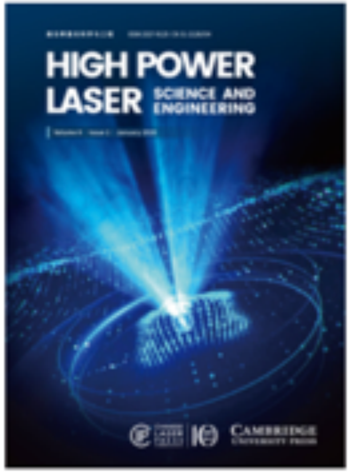
[7] *Laser-Plasma Chair at the University of Salamanca, Salamanca, Spain*

https://doi.org/10.1017/hpl.2021.41

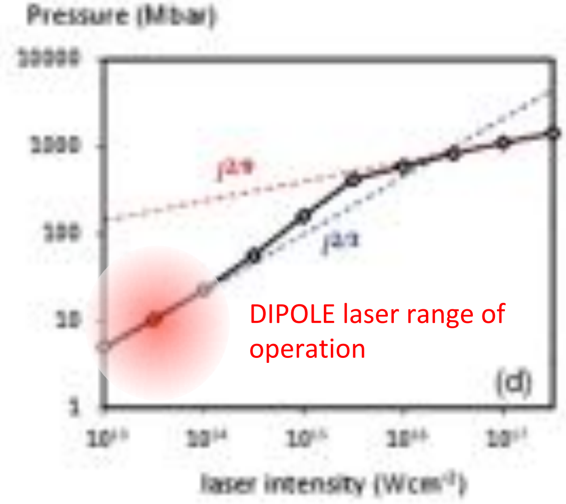


High Power Laser Science and Engineering

Laser driven shock

High power lasers enable dynamic high pressure by shock generation

- For tens of Mbars pressures, high energy lasers typically used: tens of Joules in ≈10-100 ns
- Higher pressures (≈100 Mbar to Gbar) accessible at large laser systems (Omega, NIF, LMJ)



DIPOLE laser range of operation

A.R. Bell and M. Tzoufras, PPCF 53, 045010 (2011).

PHYSICS OF PLASMAS 21, 032710 (2014)

Generation of high pressure shocks relevant to the shock-ignition intensity regime

D. Batani,[1] L. Antonelli,[1,2] S. Atzeni,[3] J. Badziak,[4] F. Baffigi,[5] T. Chodukowski,[4] F. Consoli,[6] G. Cristoforetti,[5] R. De Angelis,[6] R. Dudzak,[7] G. Folpini,[1] L. Giuffrida,[1] L. A. Gizzi,[5] Z. Kalinowska,[4] P. Koester,[5] E. Krousky,[7] M. Krus,[8,9] L. Labate,[5] T. Levato,[2,8] Y. Maheut,[1] G. Malka,[1] D. Margarone,[8] A. Marocchino,[3] J. Nejdl,[8] Ph. Nicolai,[1] T. O'Dell,[10] T. Pisarczyk,[4] O. Renner,[8] Y. J. Rhee,[11] X. Ribeyre,[1] M. Richetta,[2] M. Rosinski,[4] M. Sawicka,[8] A. Schiavi,[3] J. Skala,[7] M. Smid,[8,9] Ch. Spindloe,[10] J. Ullschmied,[7] A. Velyhan,[8] and T. Vinci[12]
[1]Université Bordeaux, CNRS, CEA, CELIA (Centre Lasers Intenses et Applications), UMR 5107, F-33405 Talence, France
[2]Università di Roma "Tor Vergata," Roma, Italy
[3]Dipartimento SBAI, Università di Roma "La Sapienza" and CNISM, Roma, Italy
[4]Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland
[5]Intense Laser Irradiation Laboratory, INO-CNR, Pisa, Italy
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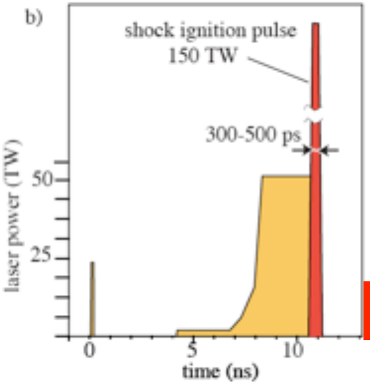
[7]Institute of Plasma Physics of the ASCR, PALS, Za Slovankou 3, 182 00 Prague, Czech Republic
[8]Institute of Physics of the ASCR, ELI-Beamlines/HiLASE/PALS, Na Slovance 2, 182 21 Prague, Czech Republic
[9]Czech Technical University, Prague, Czech Republic
[10]Scitech Precision Ltd, Rutherford Appleton Laboratory, Harwell Oxford, Didcot, Oxon, OX11 0QX, United Kingdom
[11]Korea Atomic Energy Research Institute, Daejeon 305-353, South Korea
[12]LULI, Ecole Polytechnique CNRS, Palaiseau, France

(Received 12 October 2013; accepted 10 March 2014; published online 31 March 2014)

An experiment was performed using the PALS laser to study laser-target coupling and laser-plasma interaction in an intensity regime ≤10^{16} W/cm^2, relevant for the "shock ignition" approach to Inertial Confinement Fusion. A first beam at low intensity was used to create an extended preformed plasma, and a second one to create a strong shock. Pressures up to 90 Megabars were inferred. Our results show the importance of the details of energy transport in the overdense region. © 2014 AIP Publishing LLC. [http://dx.doi.org/10.1063/1.4869715]



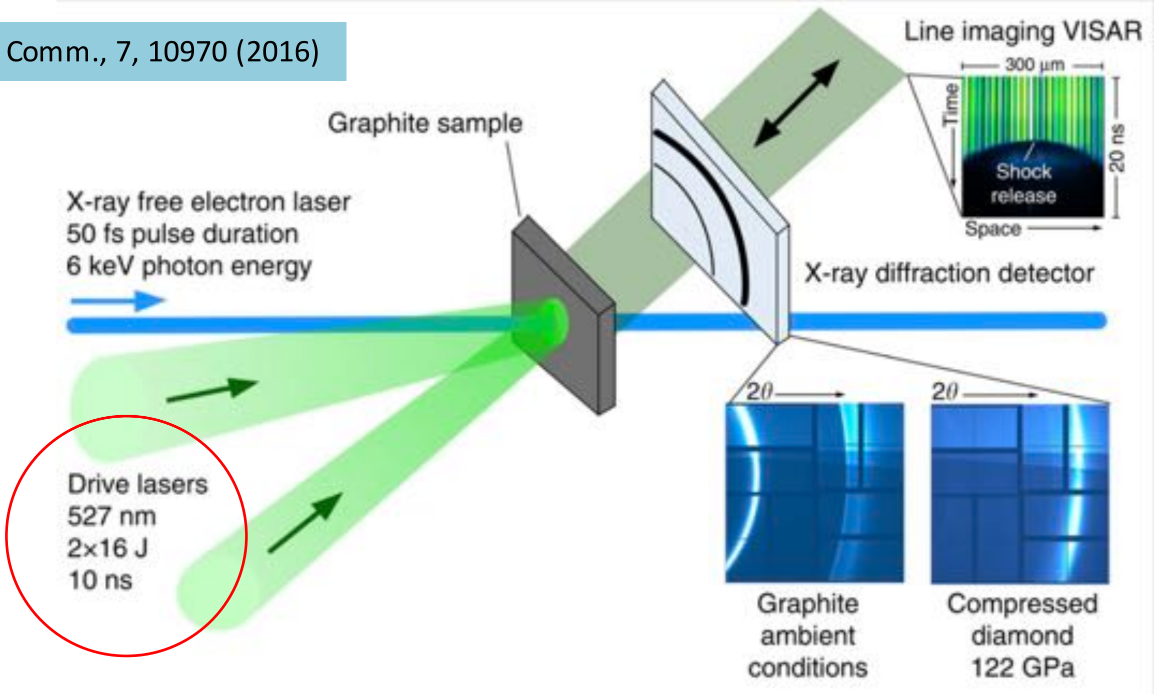
Active Eurofusion Collaboration project

Extensive study on shock generation on high intensity: D. Batani et al., Phys, Plasmas 21, 032710 (2014)

Probing matter in extreme conditions

Dynamic shock compression is used to investigate higher pressures and short time-scale phase transitions compared to static pressures

D. Kraus et al., Nat. Comm., 7, 10970 (2016)



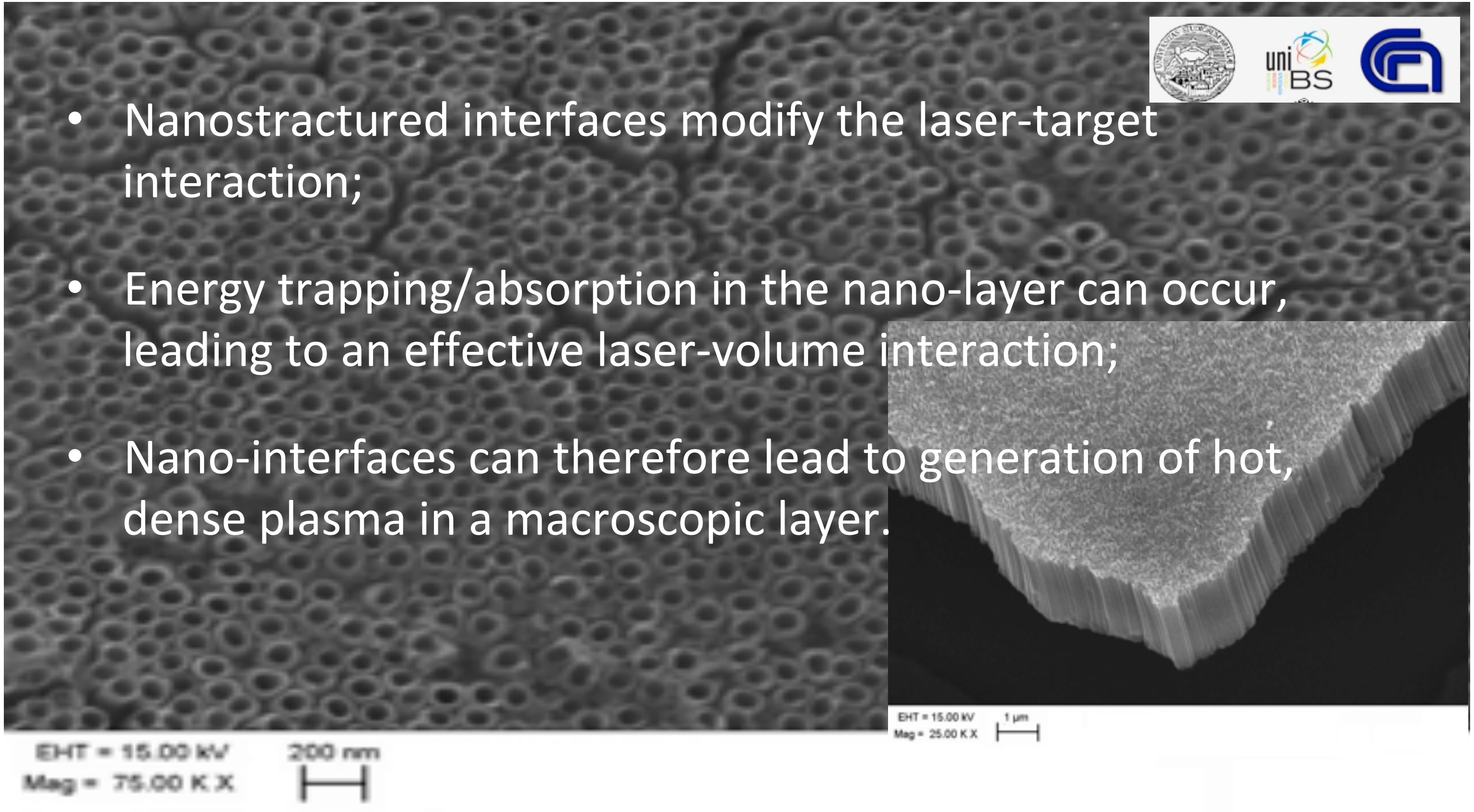
See also:

N. Booth et al., Nature Commun., **6**, 8742 (2015)
M. Santoro, et al., Nat. Commun. **4**, 1557 (2013)
M. Santoro, et al., Nature **441**, 857–860 (2006)

Combined laser-syncrotron/FEL investigations using compact lasers:

We can also use compact high intensity femtosecond lasers

Nanostructured target interface

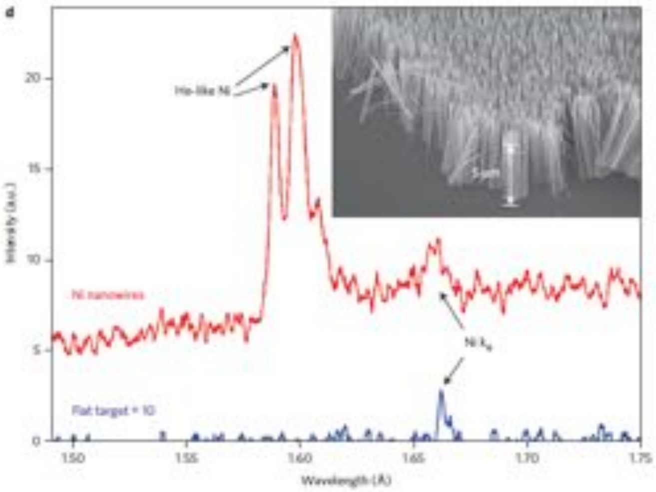


- Nanostructured interfaces modify the laser-target interaction;
- Energy trapping/absorption in the nano-layer can occur, leading to an effective laser-volume interaction;
- Nano-interfaces can therefore lead to generation of hot, dense plasma in a macroscopic layer.

V. Galstyan et al., J. Alloys and Compounds 536S, S488 (2012).

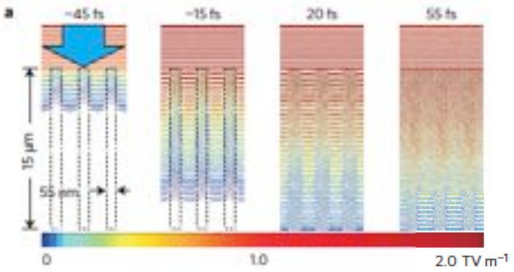
Large hot-dense plasma with fs pulses and nanostructures

- Laser interaction with nanostructured materials can provide an alternative for femtosecond driven Gbar pressure.

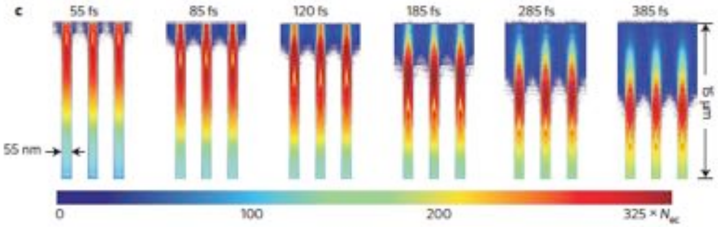


Evidence of hot (3keV) dense (1E23 cm-3) volume plasma

Laser field



Density



M. Purvis et al., Nat. Phot., 7(10), 796–800. doi:10.1038/nphoton.2013.217

High field plasmonics

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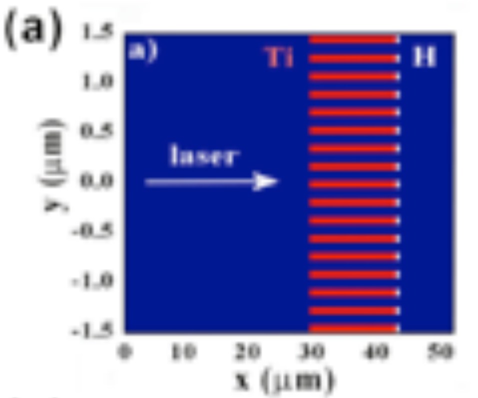
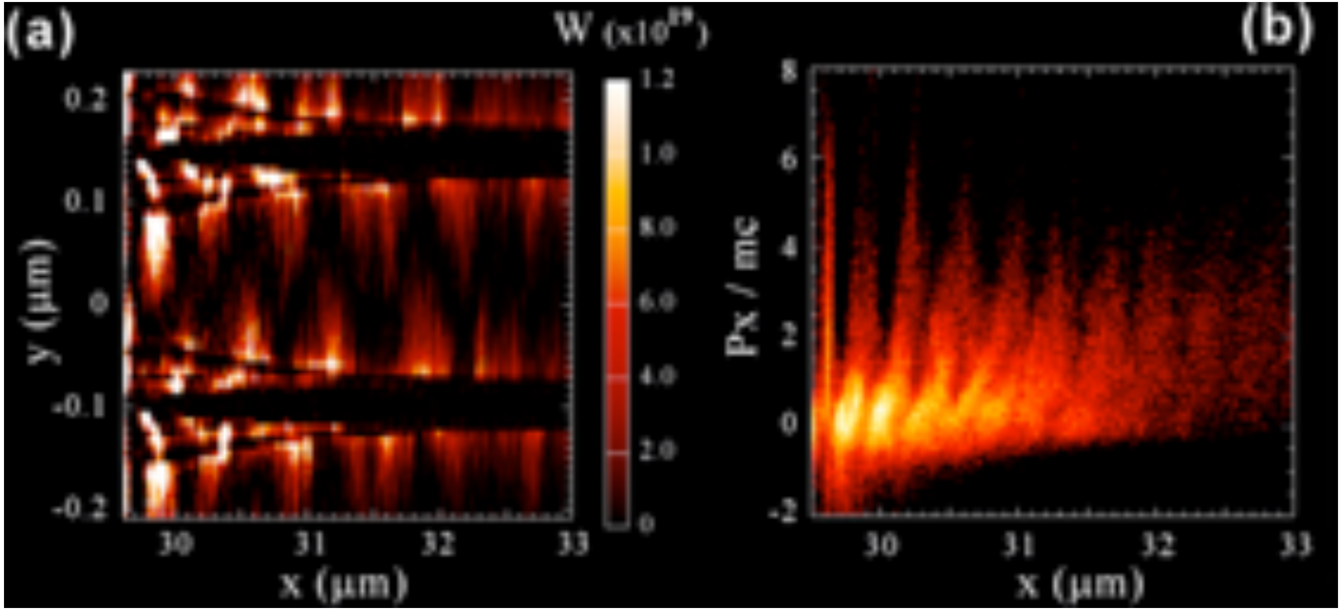
Propagation of an electromagnetic field in the subwavelength channels occurs via excitation of **surface plasmon polaritons** that travel in the channels down to the substrate surface, sustaining continuous and efficient electron acceleration





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G. Cristoforetti et al., Plasma Phys. Control. Fusion **62**, 114001 (2020)

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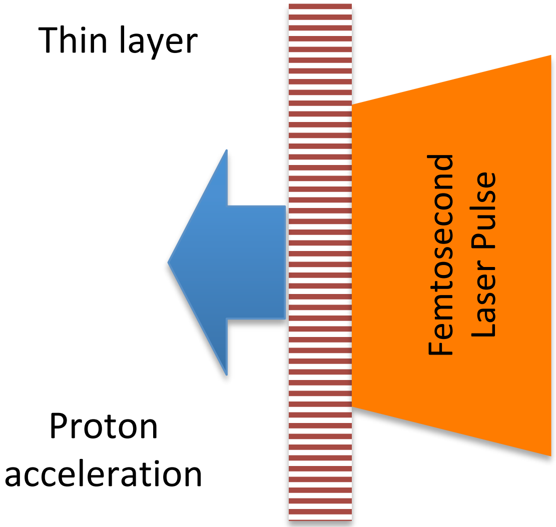
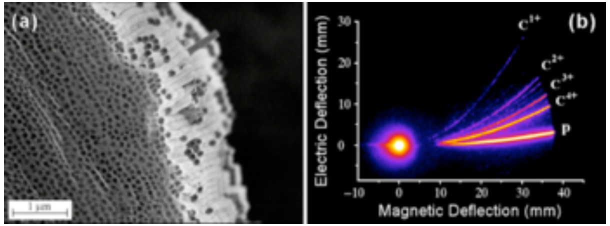
Light ion acceleration

Enhanced electron acceleration boosts acceleration of protons via the target normal sheath acceleration mechanism

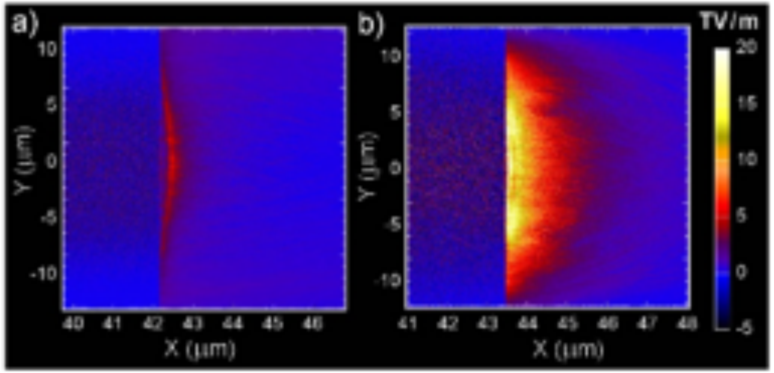

Thin layer

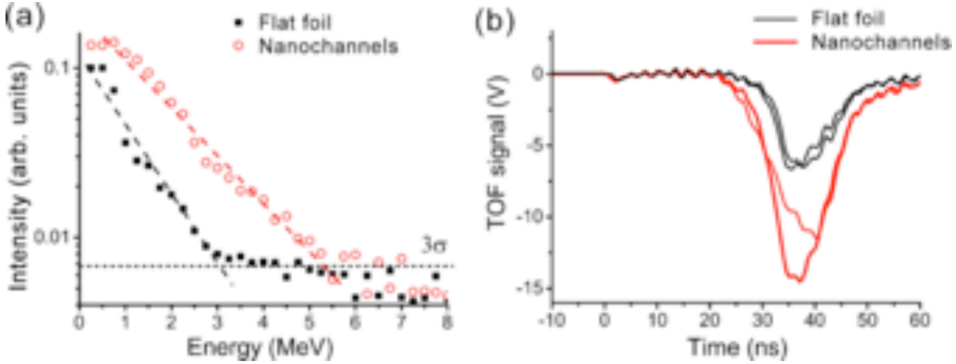
Femtosecond Laser Pulse

Proton acceleration



TNSA FIELD





L. A. Gizzi et al., Phys. Rev. Research **2**, 033451 (2020)

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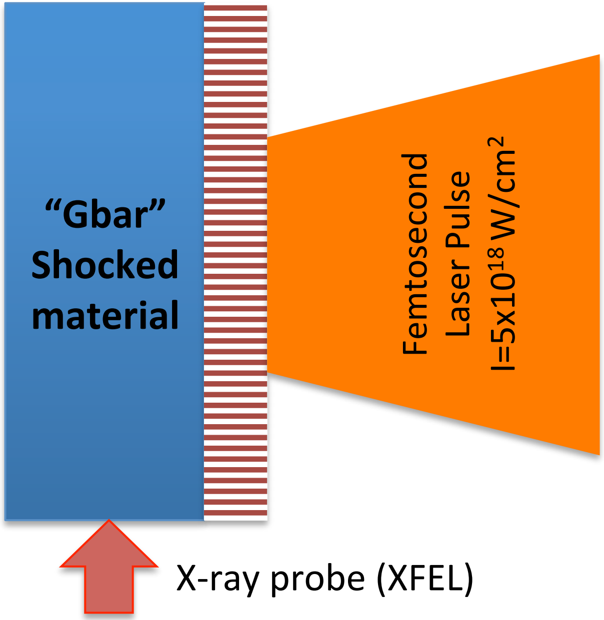
Gbar shock with femtosecond pulses

Laser interaction with nanostructured materials can provide an alternative for femtosecond driven Gbar pressure.

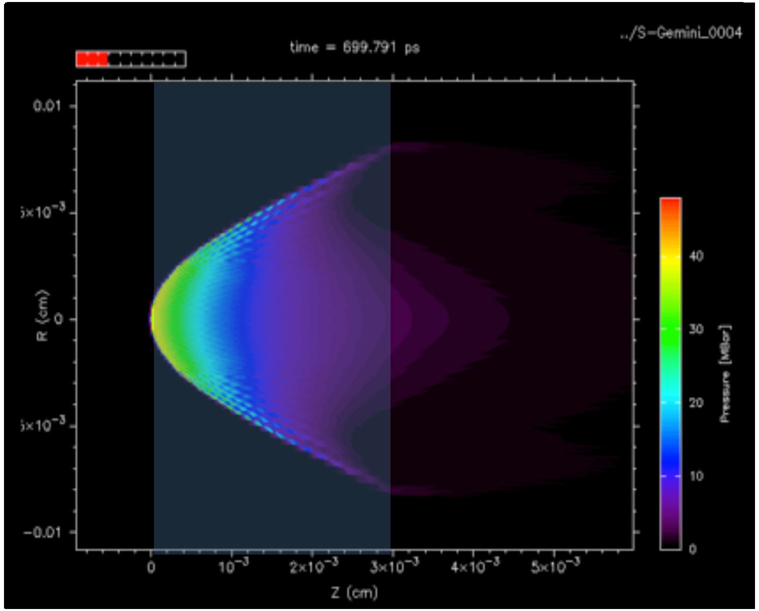


"Gbar" Shocked material

Femtosecond Laser Pulse $I=5\times10^{18}$ W/cm^2

X-ray probe (XFEL)

HED plasma from isocoric heating of the nanostructured layer



Dued hydro-simulations by S. Atzeni, U. Roma, La Sapienza

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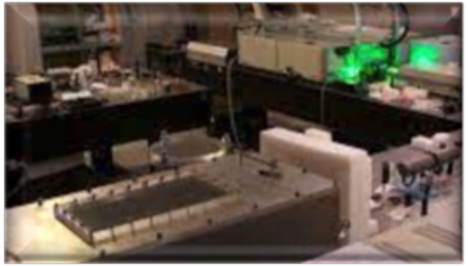
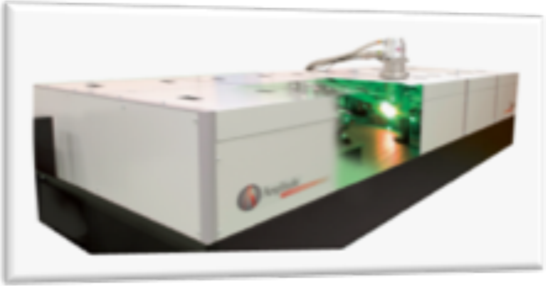
What laser driver for EuPRAXIA?

Current laboratory LPAs are mostly driven by Ti:Sa lasers, established technology for ultrashort pulse lasers*

Custom systems

Industrial systems





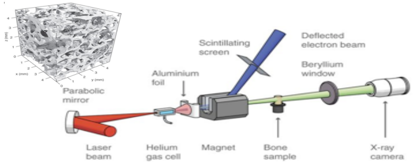
Mainly driven by extreme fields physics: high peak power, low repetition rate, tens of W average power

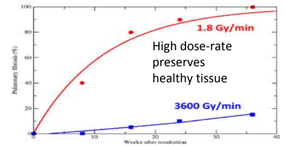
*Colin N. Danson et al., *Petawatt and exawatt class lasers worldwide*, High Power Laser Sci. and Eng. **7**, e54 (2019); https://doi.org/10.1017/hpl.2019.36

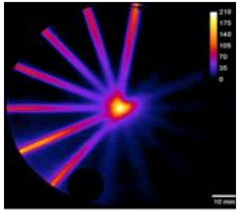
Motivating further industrial development

Further industrial development towards high repetition rate, high average power, motivated by key societal applications:

- **X-ray imaging** for compact, high resolution (phase contrast imaging[1]) bio-medical diagnostics;
  - Address some of the needs of large SR facility users
- **Laser-driven VHEE electrons[2] and hadron beams** can provide ultra-high dose-rate to meet requirements of future "FLASH[3]" radiotherapy, currently unaddressed:
  - Unique working point for beam readio-therapy
- **γ-rays or neutron sources[4]** for industry and security
  - Leading to dedicated centers (e.g EPAC)
- …







Inspection for failure modes in very dense and heavy metals such as steel.

Penetrating beams for fast throughput monitoring and testing of critical components in extreme performance conditions.

Inspection of battery components, full-scale systems and fuel cells for micron-scale defects with micro CT.

Ultra high contrast, high resolution and high throughput biological micro CT imaging.

Fast scan time for CT imaging of large metallic additively manufactured parts and in-build imaging inspection for quality assurance and validation.

Inspection for quality assurance and detection of micron-level cracks and defects in extreme performance composite materials.

The Extreme Photonics Applications Centre (EPAC), CLF, UK

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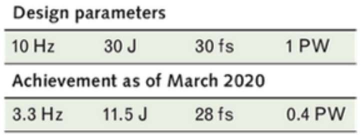
[1] J.M.Cole et al., Sci. Rep. **5**, 13244 (2015); [3] L. Labate et al., Scientific Reports **10**, 17307 (2020); [2] V. Favadoun et al., Sci. Transl. Med. 245ra93 (2014); [4] C. M. Brenner et al, PPCF, 58 014039, (2015)

Recent advances for high average power at ELI

Diode-pumping technology for Ti:Sa pump lasers established



Design parameters			
10 Hz	30 J	30 fs	1 PW
Achievement as of March 2020			
3.3 Hz	11.5 J	28 fs	0.4 PW

Latest (April 2021)
0.5 Petawatt (PW)
13.3 Joules (J)
27.3 Femtoseconds (fs),
3.3 Hertz (Hz) repetition rate
44 Watts average power.

The L3-HAPLS at ELI Beamlines Research Center in the Czech Republic. Credit: ELI Beamlines*

*L. Koubíková, LaserFocusWorld, 2020

New EU Infrastructures

ESFRI 2021

ESFRI

New RIs for Roadmap 2021 announced

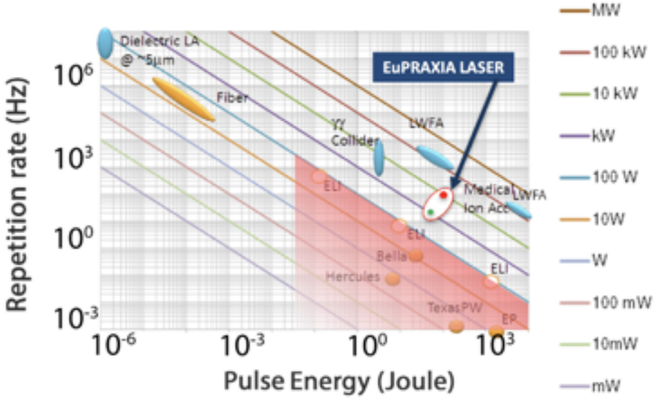
Strategy Report on Research Infrastructures

ROADMAP **2021**

Roadmap on LPA Laser Driver technology

Laser-driven plasma acceleration needs ultrashort, high power lasers with high average power

- **Current technology: ≈ Ti:Sa technology, pumped by flash-lamp pumped lasers**
  - Robust, reliable industrial technology
- **Mature technology: ≈ Ti:Sa technology, pumped by diode-pumped lasers**
  - Strong R&D effort in place (e.g HAPLS@ELI)
  - ≈ 3-5 years to go to first industrial LWFA demonstrator (e.g. Eupraxia) [1]



- **Beyond TiSA: targeting higher wall-plug efficiency and rep. rate, kHz and beyond, stability, control (space, time, spectral)**;
  - **5-10 yrs for first efficient**, multi-kW-scale demonstrator,
  - A strategy is needed to steer effort in the LPA laser driver direction: LASPLA

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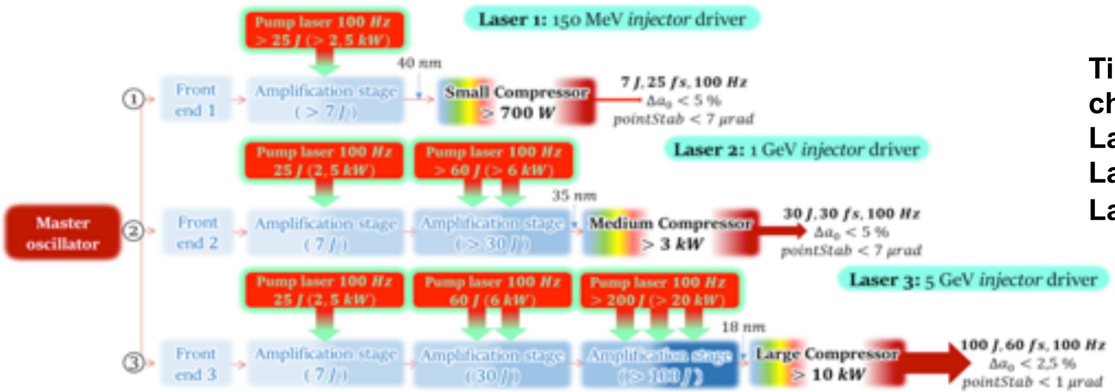
[1] R. Assmann et al., EuPRAXIA Conceptual Design Report, The European Physical Journal Special Topics **229**, 3675–4284 (2020)

[2] C. Danson et al., Petawatt and exawatt class lasers worldwide High Power Laser Sci. and Eng. **7**, e54 (2019)

EuPRAXIA: Baseline System Design

The current EuPRAXIA laser design relies on Titanium Sapphire technology to address average and peak power as required by the project.



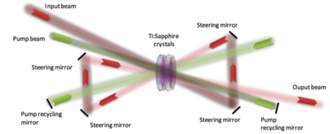
EuPRAXIA baseline laser systems:

Ti:Sapphire based amplification chains
Laser 1 : to drive a 150 MeV injector
Laser 2 : to drive a 1 GeV injector
Laser 3 : to drive a 5 GeV accelerator

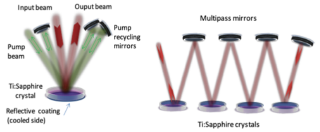
MAIN CHALLENGES

Pumping technology:
High rep. rate, high energy
Gain media:
Bandwidth, Size, Thermal load, Cooling
Grating technology
Size, LIDT, Thermal load, Cooling
Pointing stability
Transport

Amplifier geometries (needs TDR)



Pro: More efficient (double-side) cooling and reduced complexity;
Con: propagation through flowing cooling liquid



Pro: Well established concept with no propagation through cooling fluid
Con: limited cooling (single face), to be modelled

Strong synergy

Ti:Sa amplifier (EPAC 30J, 30fs @ 10Hz)
Gas cooled Ti:Sa amplifier
50J @ 10Hz with 100+nm bandwidth – installation commences Q3 2022
Full 3D Ti:Sa amplification model developed
Spatial, temporal, polarization & spectral dependencies
ASE mitigation strategies, delayed pulse pumping etc.
Developing solid-state Ti:Sa cladding solution for ASE suppression

UKRI Science and Technology Facilities Council

central laser facility

Nanosecond (kW) and femtosecond PW beamlines available.

- L.A. Gizzi, et al., A viable laser driver for a user plasma accelerator, NIMA **909** , 58 (2018); https://doi.org/10.1063/1.4984906
- R. Assmann et al., EuPRAXIA Conceptual Design Report, The European Physical Journal Special Topics **229**, 3675–4284 (2020); https://doi.org/10.1140/epjst/e2020-000127-8
- Water cooled Ti:Sa amplifier under development at ELI-HU (After V. Cvhykov *et al.* , Opt. Lett, **41,** 3017, 2016)
- Fluid (D_2O) cooled Nd:YAG laser, 20 kW CW pump power, D_2O (After X. Fu *et al.* , Opt. Express, **22**, 18421 (2014)
- Fluid (Siloxane) cooled Nd:YLF laser, 5 kW CW pump power (After Z. Ye *et al.* , Opt. Express, **24**, 1758 (2016)

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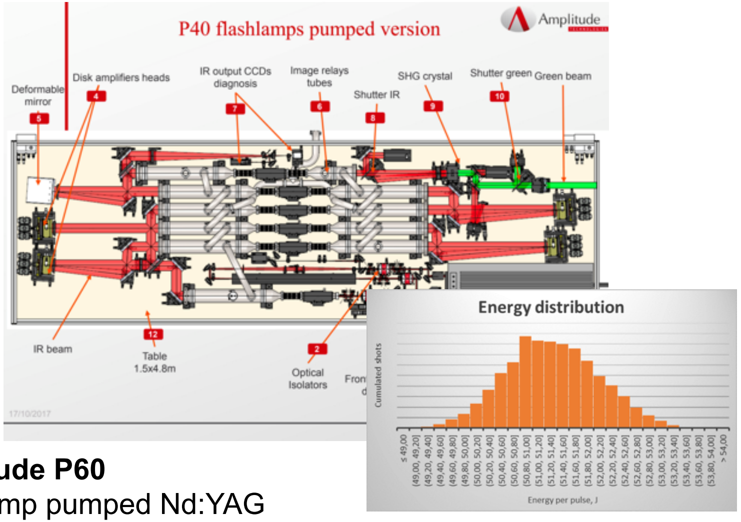
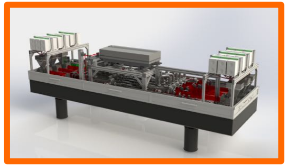
EuPRAXIA Laser Driver: pump lasers

kW, up to 100 Hz nanosecond scale lasers with 100 J scale energy per pulse



Amplitude P60
Flashlamp pumped Nd:YAG
Design: 60 J @ 10 Hz, 532 nm

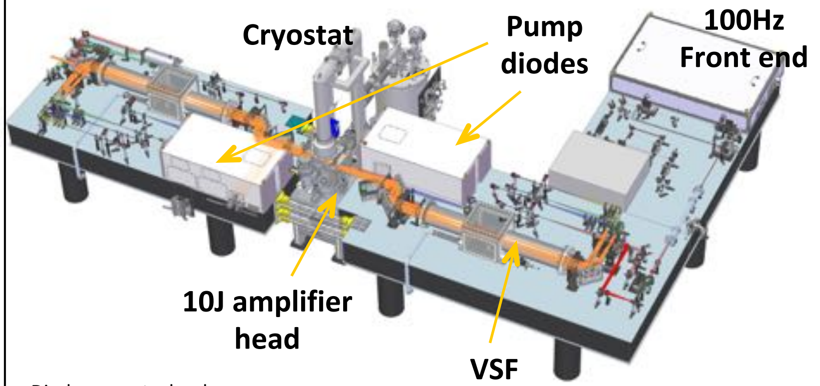


Conversion to diode pumping fully designed - **Premiumlight**

Expected specs: **100 Hz – 10 kW** (100 J/pulse @ 1μm)
Cost of diode still an issue currently 5x compared to flash-lamps. expected to decrease. Maintenance free operation for 25-30 yrs.

Amplitude *Courtesy of F. Falcoz*

Schematic of DiPOLE 100Hz



Diode pump technology
100J @ 10Hz

Summer 2019 demonstrated 60J @ 10Hz, 515nm in LBO with 66% efficiency (91J @ 1030nm)
Commissioning of DiPOLE100 @ XFEL commenced Q1 2020 – completion end 2021
Energy scaling 145J @ 10Hz, 1030nm@ HiLASE in January 2021 10J @ 100Hz
Build @ CLF near completion – commissioning Q4 2021

central laser facility UKRI Science and Technology Facilities Council *Courtesy of P. Mason*

Specs are ideal as pump lasers to drive HED for FEL probe

CNR-INO ISTITUTO NAZIONALE DI OTTICA CONSIGLIO NAZIONALE DELLE RICERCHE

What laser driver specs for future LPA

Rapidly evolving scenario for laser technologies relevant for plasma acceleration towards multi-stage accelerators design:

Pillars for a STRATEGY for laser drivers for plasma accelerators:

- Ultrashort pulses (large bandwidth <50 fs)
- High Repetition rate (100 Hz – 15 kHz)
- High average power (kW -10 kW)
- High wall-plug efficiency (>30%)

→ **Beyond TiSA**

L.A Gizzi, F. Mathieu, P. Mason, P P Rajeev, *Laser drivers for Plasma Accelerators*, in Félicie Albert et al, *2020 roadmap on plasma accelerators*, 2021 New J. Phys. 23 031101, https://doi.org/10.1088/1367-2630/abcc62

Several options under development

- **Fiber laser technology** offers the best WPE >50% in CW mode and coherent combination is being developed (FSU Jena-Fraunhofer IOF and Ecole Polytechnique-Thales in France).
  - Suited for moderate energy per pulse/high rep-rate (10s of kHz);
  - Now 96 fibers delivering 23 mJ and 674 W in a 235 fs pulse
- **Direct Chirped Pulse Amplification** with lasing media pumped directly by diodes is ideal for higher efficiency and higher rep-rate;
  - several materials under consideration, Yb:CaF2, Tm:YLF, Tm:Lu2O3 …
  - PENELOPE (Jena) 150 J, 1 Hz, at 1030 nm
- **OPCPA** optical parametric amplification within large-aperture lithium triborate (LBO) crystals;
  - ELI-Beamlines facility, L1 ALLEGRA (100 mJ at 1 kHz) and L2 AMOS (100 TW, 2 to 5 J between 10 and 50 Hz), and the Shenguang II Multi-PW beamline(SIOM, China) …

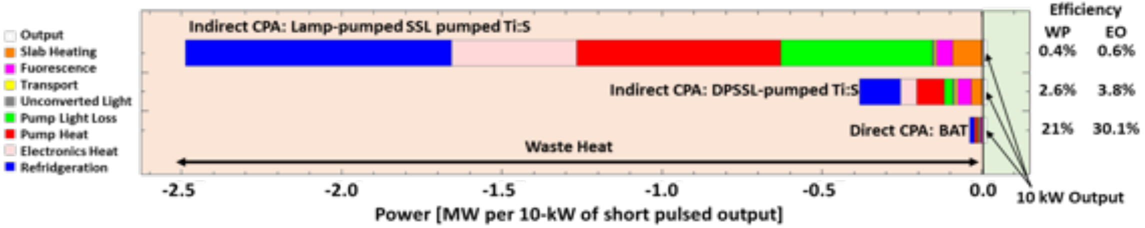
L.A Gizzi, F. Mathieu, P. Mason, P P Rajeev, *Laser drivers for Plasma Accelerators*, in Félicie Albert et al, *2020 roadmap on plasma accelerators*, 2021 New J. Phys. 23 031101, https://doi.org/10.1088/1367-2630/abcc62

Efficiency Path: scalability

TiSa technology is **prompt** and will demonstrate repetitive operation 24/7 and stability, but not scalable with poor efficiency (% level) due to the indirect pumping architecture:

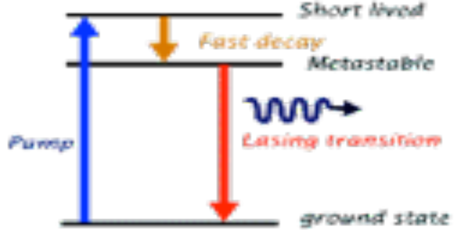
Direct CPA is the solution for wall-plug (WP) efficiency and high rep-rate.

From flashlamp to indirect to direct diode pumping



C. Siders et al., EAAC 2017

Quantum defect



WP Efficiency > 30% possible:
e.g. Yb-doped medium

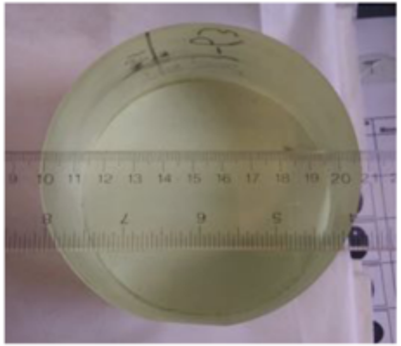
We need a **gain medium** that can support amplification on a large bandwidth, has a **low quantum defect**, or alternative efficiency boost (e.g. cross-relaxation) and can be pumped **directly** with diode lasers: **endless quest for the perfect laser medium!!**

Beyond Ti:Sa – the Thulium option

Diode-pumped thin disk Tm-based amplifiers for ultrashort pulse J-scale kW driver

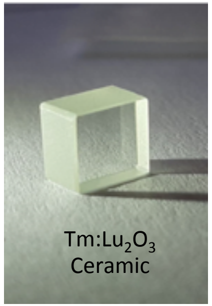
- Ultrashort pulses (large bandwidth <50 fs)
- High Repetition rate (100 Hz – 15 kHz)
- High average power (kW -10 kW)
- **High wall-plug efficiency**

Needs



Tm:YLF crystal recently procured by LLNL: Diameter ~10cm

- Power scalable system using direct diode pumping [1];
- Choice of active medium mainly guided by availability of broad amplificati bandwidth (<50 fs)[2];
- Ceramic material available;
- >2µm wavelength: also effective LPA driver
- Thin disk architecture
- Active mirror configuration
- Edge pumping



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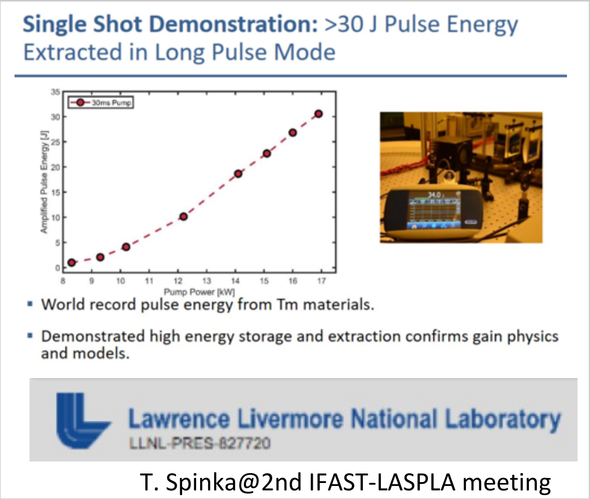
[1] J. Vetrovec, et al., "Wide-Bandwidth Ceramic Tm:Lu2O3 Amplifier", Proc. SPIE 9834, 983407 (2016); doi:10.1117/ 12.2224411

[2] J. Vetrovec, et al., "2-micron lasing in Tm:Lu2O3 ceramic:initial operation", Proc. SPIE 10511, 1051103 (2018); doi:10.1117/ 12.2291380

Latest developments on Tm: lasers

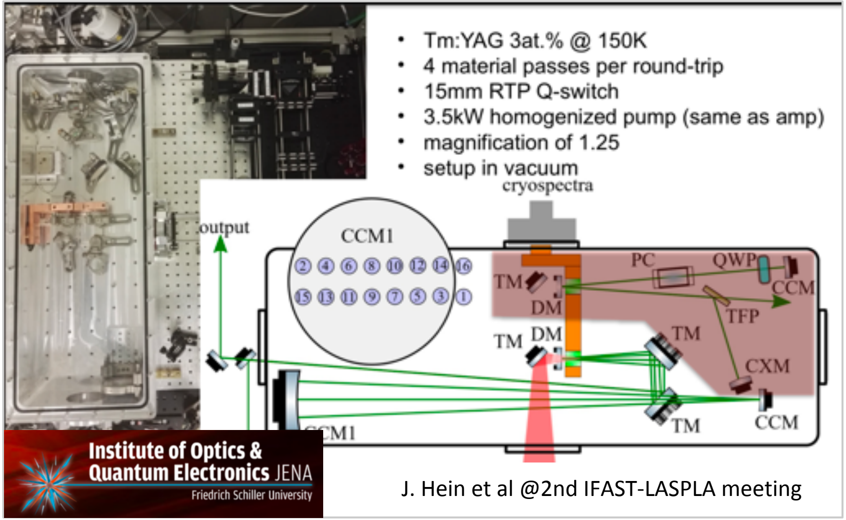


Single Shot Demonstration: >30 J Pulse Energy Extracted in Long Pulse Mode

- World record pulse energy from Tm materials.
- Demonstrated high energy storage and extraction confirms gain physics and models.

Lawrence Livermore National Laboratory
LLNL-PRES-827720

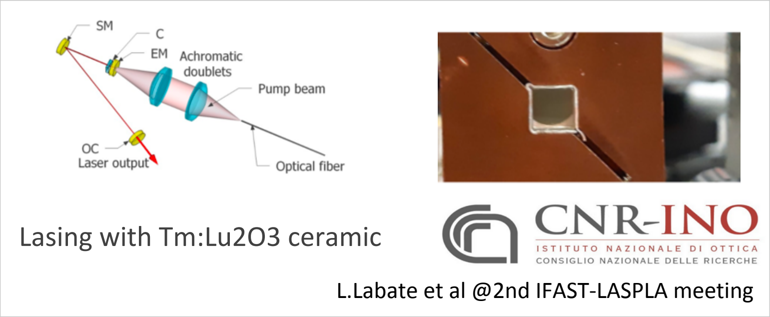
T. Spinka@2nd IFAST-LASPLA meeting



- Tm:YAG 3at.% @ 150K
- 4 material passes per round-trip
- 15mm RTP Q-switch
- 3.5kW homogenized pump (same as amp)
- magnification of 1.25
- setup in vacuum

Institute of Optics & Quantum Electronics JENA
Friedrich Schiller University

J. Hein et al @2nd IFAST-LASPLA meeting



Lasing with Tm:Lu2O3 ceramic

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L.Labate et al @2nd IFAST-LASPLA meeting

Among the most exciting results presented at the 2nd IFAST-LASPLA Technical meeting on Lasers for Plasma Acceleration

Leonida A. Gizzi, EuPRAXIA@SPARC_LAB user workshop, 14-15 October, 2021

About I.FAST - Horizon 2020 (Research Innovation Action)

The Large Hadron Collider tunnel during Long-Shutdown 2 (image: CERN).

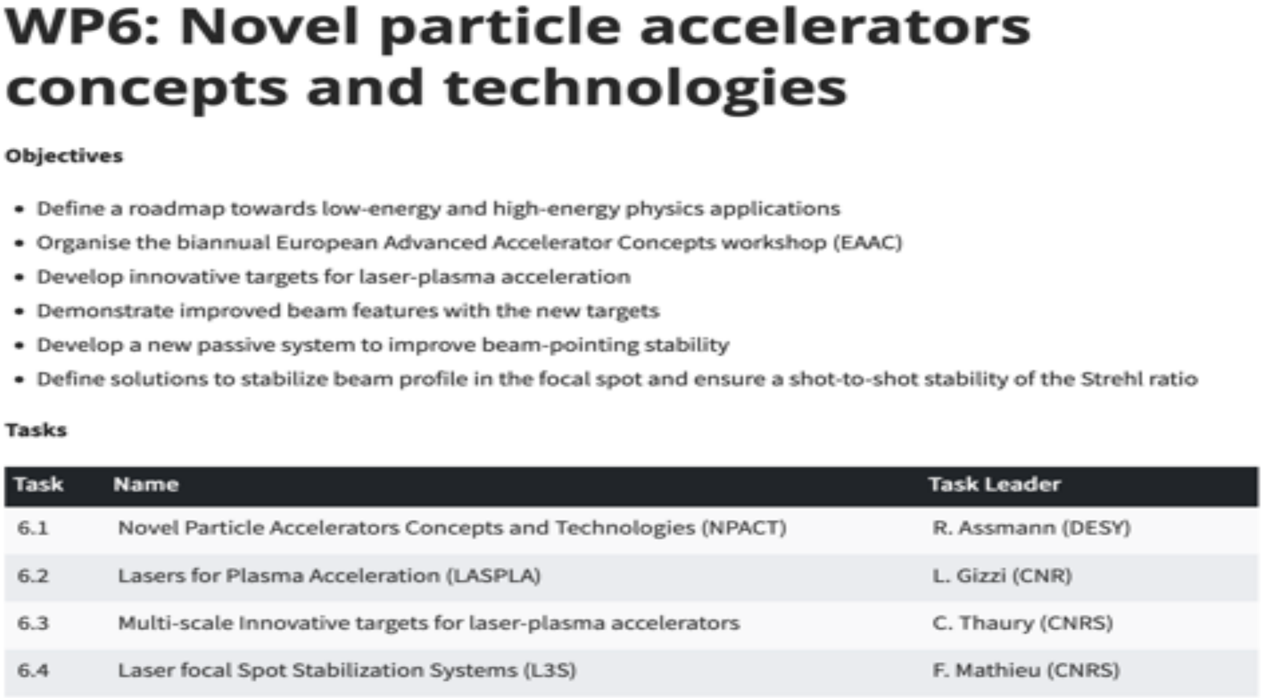
Innovation Fostering in Accelerator Science and Technology (I.FAST)

Particle accelerators currently face critical challenges related to the size and performance of future facilities for fundamental research, to the increasing demands coming from accelerators for applied science, and to the growing applications in medicine and industry.

I.FAST aims to enhance innovation in the particle accelerator community, mapping out and facilitating the development of breakthrough technologies common to multiple accelerator platforms. The project involves 49 partners, including 17 companies as co-innovation partners, to explore new alternative accelerator concepts and advanced prototyping of key technologies. These include, among others, new accelerator designs and concepts, advanced superconducting technologies for magnets and cavities, techniques to increase brightness of synchrotron light sources, strategies and technology to improve energy efficiency, and new societal applications of accelerators.

https://ifast-project.eu/

About I.FAST - Horizon 2020 (Research Innovation Action)



WP6: Novel particle accelerators concepts and technologies

Objectives

- Define a roadmap towards low-energy and high-energy physics applications
- Organise the biannual European Advanced Accelerator Concepts workshop (EAAC)
- Develop innovative targets for laser-plasma acceleration
- Demonstrate improved beam features with the new targets
- Develop a new passive system to improve beam-pointing stability
- Define solutions to stabilize beam profile in the focal spot and ensure a shot-to-shot stability of the Strehl ratio

Tasks

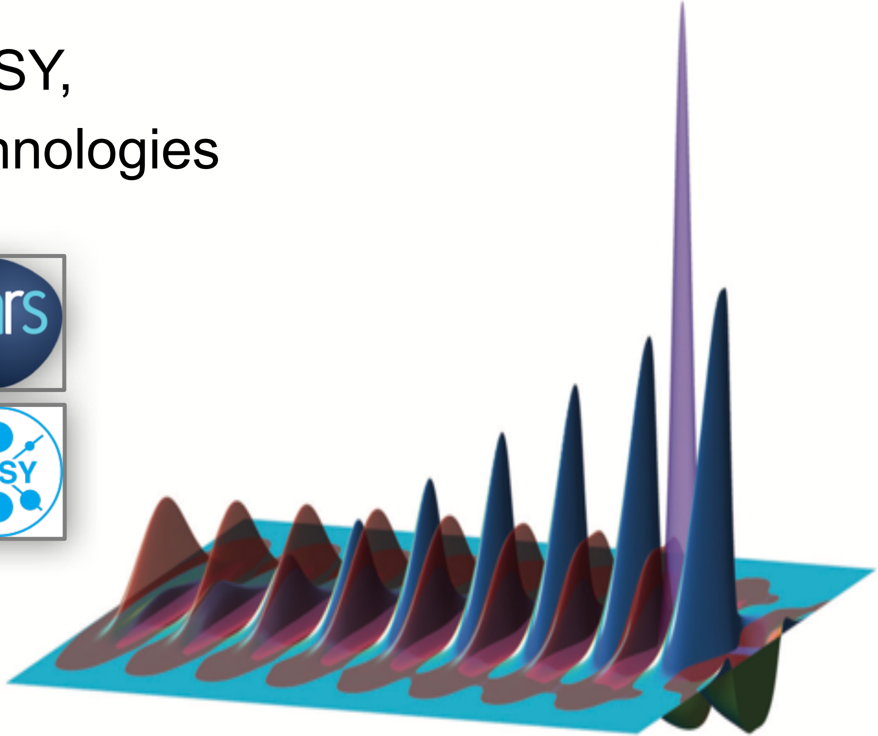
Task	Name	Task Leader
6.1	Novel Particle Accelerators Concepts and Technologies (NPACT)	R. Assmann (DESY)
6.2	Lasers for Plasma Acceleration (LASPLA)	L. Gizzi (CNR)
6.3	Multi-scale Innovative targets for laser-plasma accelerators	C. Thaury (CNRS)
6.4	Laser focal Spot Stabilization Systems (L3S)	F. Mathieu (CNRS)

https://ifast-project.eu/

Task 6.2 LASers for Plasma Acceleration

- CNR, CERN, INFN, CNRS, DESY,
- THALES and AMPLITUDE Technologies

LASPLA team
L.A.Gizzi (CNR)
F. Mathieu (CNRS),
F. Falcoz (AT),
C. Simon Boisson (Thales)
D. Giove, (INFN-MI)
M.P.Anania (INFN-LNF)
...



P. Tomassini et al., Plasma Physics and Contr. Fusion, **62**, 014010 (2020); https://doi.org/10.1088/1361-6587/ab45c5
R. Assmann et al., EuPRAXIA Conceptual Design Report, EPJST, **229**, 3675–4284 (2020); https://doi.org/10.1140/epjst/e2020-000127-8

LASPLA Technical meetings

IFAST WP6 - NPACT-Novel particle accelerators concepts and technologies

Task 6.2 - LASPLA

1st Technical Meeting – 23rd June 2021

10.00 - "Introduction about IFAST/LASPLA" - Leo GIZZI/CNR, Italy

10.20 - "Overview of Laser Technology Developments @ CLF" - Paul MASON/STFC, UK

10.40 - "First acceleration experiments on Apollon" - Francois MATHIEU/CNRSApollon, France

11.00 - "Overview of laser technology developments @ Thales" - Christophe SIMON BOISSON/THALES, France

11.20 - "New materials for pulse amplification at 1 and 2 microns" - Guido TOCI/CNR-INO, Italy

11.40 - "Tm:Lu2O3 amplifier design issues" - Luca LABATE/CNR-INO, Italy

12.00 - "Challenges for diode laser pump sources: high intensity & high repetition rate & efficient & low €/W" - Paul CRUMP/FB, Germany

12.20 - Discussion and next meeting/conference - All

12.30 - Close

iFAST

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

LASPLA Technical meetings

IFAST WP6 - NPACT-Novel particle accelerators concepts and technologies

Task 6.2 - LASPLA

2nd Technical Meeting – 7th October 2021

Session 1 (Convenor, L. GIZZI, CNR)

15.00 – Leonida A GIZZI, INO-CNR, Pisa, Italy, "Overview and motivation of the IFAST project"

15.15 - Georgia ADRIANAKI, HMU, Greece,"Experiencing the development of the ZEUS laser facility at IPPL for particle acceleration optimization experiments"

15.30 - Thomas M. SPINKA, LLNL, USA, - "Demonstration of a compact, multi-joule, diode-pumped Tm:YLF laser",

15.45 – Roman WALCZAK, Clarendon Laboratory, Oxford, UK – "High-repetition-rate, GeV-scale accelerators driven by plasma-modulated laser pulses"

16.00 - Joachim HEIN, Jena University, Germany, "Prospects of high energy Tm lasers and first tests"

Session 2 (Chair Paul CRUMP, FBH)

16.30 – Luca LABATE, CNR-INO, Pisa, Italy, "Tm laser development for the ELITE infrastructure at CNR"

16.45 - Luis ROSO, CLPU, Salamanca, Spain, "Petawatt Lasers: High Repetition Rate Challenges"

17.00 - Victor MALKA, Weizmann Institute, Israel - "What about very high energy electrons radiotherapy (VHEE-RT) with compact laser plasma accelerators?"

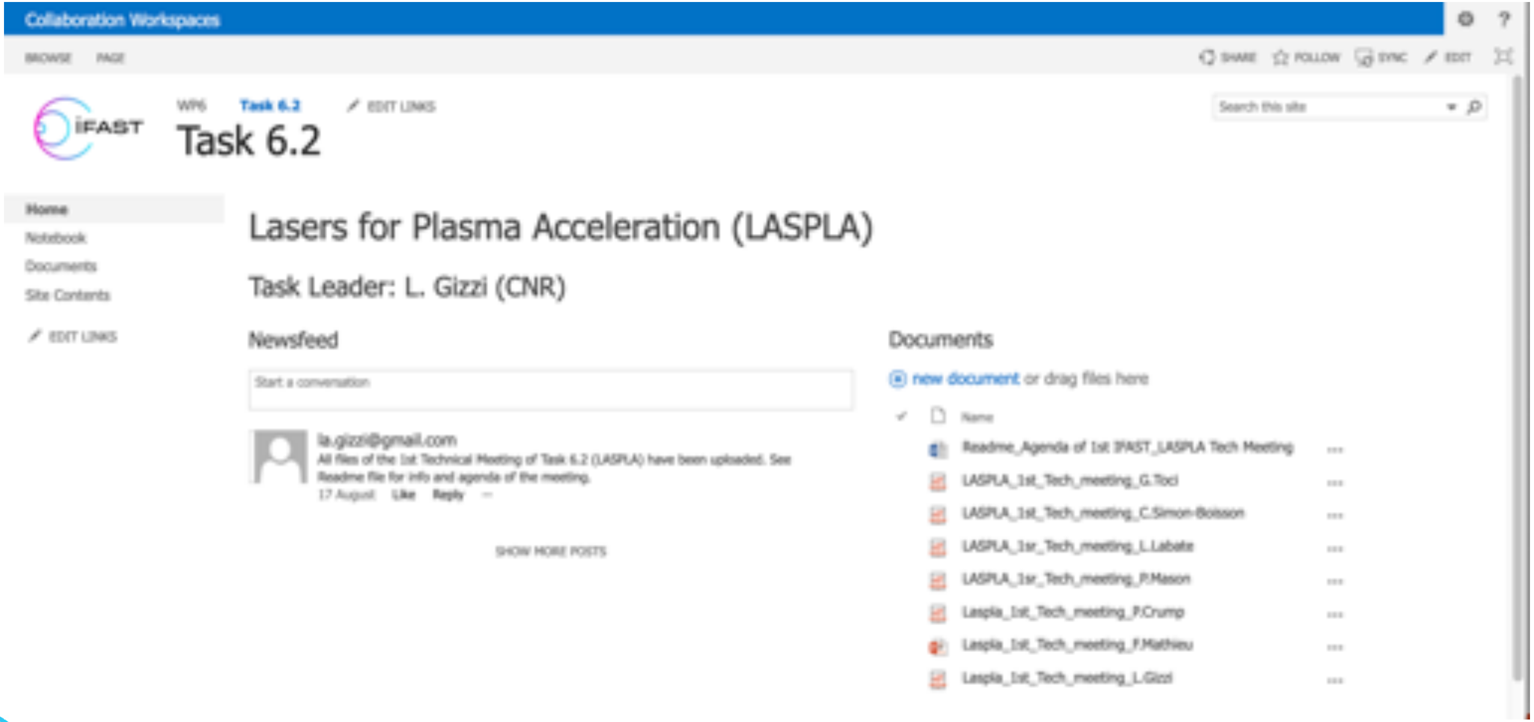
17.15 - Andreas R. MAIER, Hamburg University, Germany - "High Average Power Laser-Plasma Acceleration"

17.30 – Conclusions/Next meeting (All)

iFAST

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

Collaborative space for participants



Task 6.2

Lasers for Plasma Acceleration (LASPLA)

Task Leader: L. Gizzi (CNR)

Newsfeed

Start a conversation

la.gizzi@gmail.com
All files of the 1st Technical Meeting of Task 6.2 (LASPLA) have been uploaded. See Readme file for info and agenda of the meeting.
17 August

Documents

- Readme_Agenda of 1st IFAST_LASPLA Tech Meeting
- LASPLA_1st_Tech_meeting_G.Toci
- LASPLA_1st_Tech_meeting_C.Simon-Boisson
- LASPLA_1sr_Tech_meeting_L.Labate
- LASPLA_1sr_Tech_meeting_P.Mason
- Laspla_1st_Tech_meeting_P.Crump
- Laspla_1st_Tech_meeting_F.Mathieu
- Laspla_1st_Tech_meeting_L.Gizzi

https://espace.cern.ch/project-IFAST-Intranet/_layouts/15/start.aspx#/

Summary

- High energy, high power lasers are crucial for science at FEL sources;
- They enable convergence of laser, plasma and photon science, with a focus on high energy density and matter under extreme conditions;
- EuPRAXIA has such tools at its core as drivers for LPA, with major advances at the horizon;
- Current laser design based on a Ti:Sa CPA architecture carries a full range of laser parameters for pump and probe experiments;
- Looking even further, scalability to higher performance and repetition rate is strongly emerging from direct CPA laser technology using novel lasing materials;
- Growing community, with HPLasers and Plasmas, and Photon Science community coming together.