

EUROPEAN
PLASMA
RESEARCH
ACCELERATOR
WITH
EXCELLENCE
IN
APPLICATIONS



Barna Imre Ferenc

a 2024 szeptemberi EuPRAXIA PP
meeting összefoglalója

Egy előadónál láttam:



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101079773

Beszámoló az alábbi eseményről:



EuPRAXIA_PP Annual Meeting 2024

2024. szept. 22–28.
Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy
Europe/Rome időzóna

Írd be a keresendő kifejezést

Összegzés

Ütemterv

Preliminary Agenda

Előadók listája

Absztraktok könyve

Committees

Regisztráció

Résztevők listája

PARTICIPANT
Registration Information

STUDENT Registration
Information

Accommodation
Information

Travel Information

INFN Privacy Policy

The EuPRAXIA Preparatory Phase (EuPRAXIA_PP) project, will hold its 2024 Annual Meeting at the Hermitage Hotel in Elba, Biodola bay, Italy, from Monday 23 to Friday 27 September 2024.

Fee Payment Dead-Line: July 31st, 2024



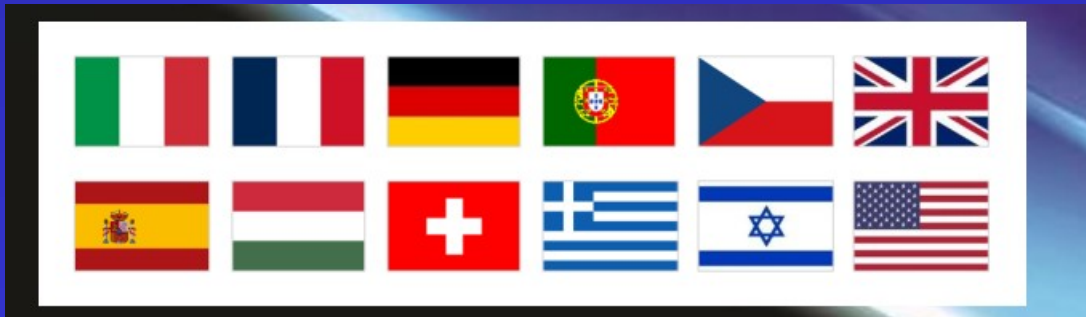
EuPRAXIA is the first European project that develops a dedicated particle accelerator research infrastructure based on novel plasma acceleration concepts driven by innovative laser and linac technologies.

EuPRAXIA-PP is a project designed to develop the organizational, legal, financial and technological aspects of the EuPRAXIA infrastructure, following the recommendations of the European Strategy Forum on Research Infrastructures (ESFRI), including the choice of the second EuPRAXIA Pillar (Laser

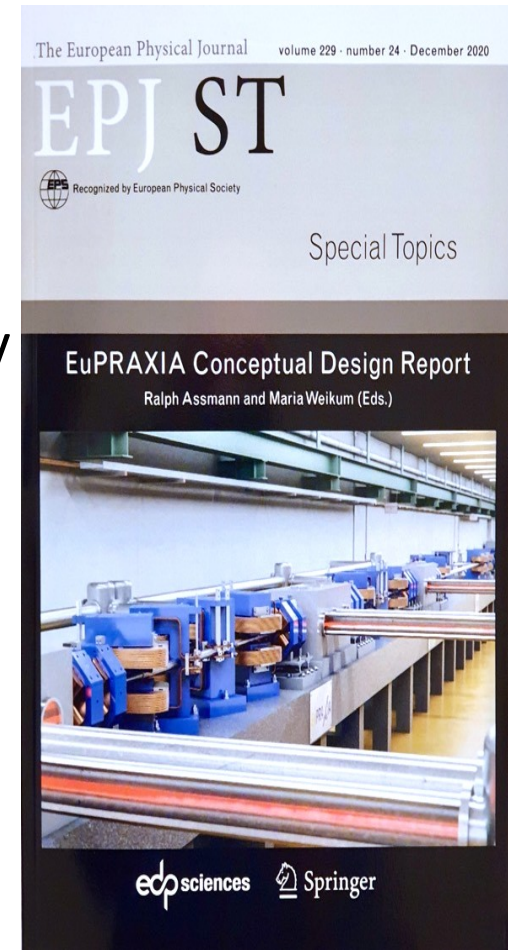
<https://agenda.infn.it/event/41613/>

Pár megjegyzés:

- Kb 50 ember volt, jóval kevesebb mint tavaly, csak 1 busz jött Rómából
- Maga a meeting csak 3 nap volt
- Csütörtök a frascatiban lévő EuPRAXIA_SPARC Lab update-ról szól
- Péntek pedig mindenféle EuPRAXIÁhoz csatlakozó dolog Outreach pl. további országok akik csatlakozni akarnak
- volt reggelente 1-1 Planary Lecture majd mentek sorba a Work Package-k némelyikhez csak 1-1 előadás volt, de néha 4-6 rövidebb
- ami fent volt: <https://agenda.infn.it/event/41613/> azokat letöltöttem, macerás mert sok van belőle
- Általában a deliverables és mile stones-zel kezdték mit mikorra kell megcsinálni
- nekem az volt az érzésem, hogy ez már sínen van, sok a társadalmi, gazdasági hatást elemző előadás stb. és a fizika háttérbe szorul...
- most ezekből próbálok szemezgetni



- First ever design of a **plasma accelerator facility**. <http://www.eupraxia-project.eu>
- **Conceptual Design Report for a distributed research infrastructure** funded by EU Horizon2020 program. Completed by 16+25 institutes.
- Challenges addressed by EuPRAXIA since 2015:
 - **Can plasma accelerators produce usable electron beams?**
 - **For what can we use those beams** while we increase the beam energy towards HEP and collider usages?



600+ page CDR, 240 scientists contributed



Coordinator

INFN
Istituto Nazionale di Fisica Nucleare

Consiglio Nazionale delle Ricerche

Elettra Sincrotrone Trieste

ENEA
Agenzia nazionale per la nuova tecnologia, l'energia e lo sviluppo economico sostenibile

SAPIENZA
UNIVERSITÀ DI ROMA

Università di Roma
Tor Vergata

Imperial College London

QUEEN'S UNIVERSITY BELFAST

UKRI
UK Research and Innovation

UNIVERSITY OF LIVERPOOL

UNIVERSITY OF OXFORD

University of Strathclyde Glasgow

DESY

Fritz-Haber-Berlin

Fraunhofer ILT

GSI

hhu
Heinrich Heine Universität Düsseldorf

HZDR
HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

JÜLICH
Forschungszentrum

LMU
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Amplitude

cea

cnrs

THALES

eli

IFT TÉCNICO LISBOA

ALBA

CLPU
CENTRO DE LASERES MALSADOS

Empa
Materials Science and Technology

EPFL

PSI
PAUL SCHERRER INSTITUT

THE HEBREW UNIVERSITY OF JERUSALEM

IASA



PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS

SZTE
UNIVERSITY OF SZEGED

Wigner

UNIVERSITY OF CALIFORNIA
UCLA

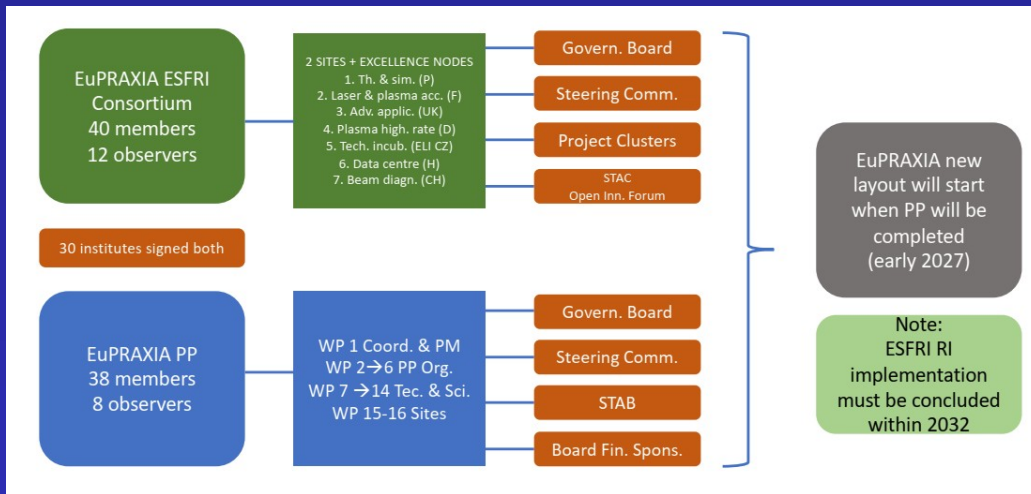
Hétfő délelőtt:

	Opening talk: Recoil dominated electron-photon beam collisions, a way towards novel radiation sources, advanced secondary beams and new phenomena in astrophysics <i>Luca Serafini</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	09:10 - 10:00
10:00	EuPraxia Status <i>Massimo Ferrario, Pierluigi Campana</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	10:00 - 10:40
	Coffee Break <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	10:40 - 11:00
11:00	WP2 - Dissemination and Public Relations <i>Carsten Peter Welsch et al.</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	11:00 - 11:50
12:00	WP3 - Organization and Rules <i>Andrea Ghigo, Arnd Specka</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	11:50 - 12:40

- Serafini
- Az inverz Compton szórás minden részecskét megállít, ez a fő kijelentés
255.5 keV photons can stop ANY relativistic electron
0.5 $m_p c^2$ photons can stop ANY relativistic m_p particle, ez egyben X-ray source
- Ez volt a Manhattan tervben is, kevés elektron volt de sok foton
- később ezt asztrofizikában is használták magyarázatra
- P.R Accel. Beams 24 080701 (2024)
- másodlagos müonokat is tudnak generálni
- Unruh sugárzás is elérhető lehet...

Hétfő délelőtt:

- Campana EuPRAXIA status
- még van 650 nap Preparatory Phaseből
- van 15 workpackage



Spain	Rebeca Frías Antolín	Grandes Instalaciones Científicas - Ministerio de Ciencia, Innovación y Universidades
UK	John Collier	CLF Director and Executive Director of Laserlab Europe
Hungary	Peter Racsko	NRDIO officer

Beadódik egy Bid-Book (licit könyv most okt 25 körül ez alapján döntenek majd A 2. site-ról, 2025 első felében)

Hétfő délelőtt:

WP2: Dissemination and Public Relations

Carsten Welsch (Cockcroft Institute/University of Liverpool)

Susanna Bertelli (INFN)

Mindeféle társadalmi jelenlétért felel,
Doctoral network-öt szervezi, a honlapért felel, dokumentumokat deliverables rendbe tartja online, Eupraxiár témájú publikációkért felel,
Leaflet, brossure, szórólapot gyárt, az EuPRAXIA projektet képviseli konferenciákon, oktatási anyagokat csinál, youtube csatornát, social media
Jelenlét, facebook, twitter, instagram, style guide for EuPRAXIA előadásokhoz,
Big Science Business Forum 1-4 okt 2024 jelen van,
Nyílt napot szervez, 40 iskola meglátogatta nyugat angliából,
Physics of Star Wars... (mi hülyeségnek gyerekesnek tartjuk) de sok embert bevonz,
Tudomány népszerűsítés,
Sufatron online hullám modell a gyorsítóra, British science weekend
Van ilyen open day Farascatiban is

Hétfő délelőtt:

Status of the first site

Massimo Ferrario

> 130 M Euro, Frascati 2029-re elkészül, 54 intézet 18 ország
alakul a plazma csatorna, további 3-4 olasz intézet van benne,

Minden technikai részletet

PI ilyen vizsgálati módszereket akarnak alkalmazni:

Photoemission Spectroscopy,

Photoelectron Circular Dichroism,

Raman spectroscopy,

Photo-fragmentation of molecules

Time of Flight Spectroscopy

-

- **Electrons**
(0.1-5 GeV, 30 pC)
- **Positrons**
(0.5-10 MeV, 10^6)
- **Positrons** (GeV source)
- **Lasers**
(100 J, 50 fs, 10-100 Hz)
- **X-band RF Linac**
(60 MV/m, up to 400 Hz)
- **Plasma Targets**
- **Betatron X rays**
(1-10 keV, 10^{10})
- **FEL light**
(0.2-36 nm, 10^9 - 10^{13})

Hétfő délelőtt:

Update on the status of the 2nd site selection procedure WP 3

Giancarlo Gatti (CLPU, Salamanca)

Leo Gizzi (CNR, Pisa)

Alexander Molodozhentsev (ELI BL,
Prague)

Rajeev Pattathil (EPAC, Rutherford Lab,
Didcot)

	Laser-driven
Baseline scenario of original proposal	
• Phase 1: laser-driven 1 GeV plasma FEL (20 Hz, 30 pC) as requirement for initial operation:	Phase 1 ✓ FEL beamline to 1 GeV + user area 1 ✓ Ultracompact positron source beamline + positron user area
• Phase 2: Upgrade plan to 100 Hz, to 5 GeV FEL	Phase 2 ✓ X-ray imaging beamline + user area ✓ Table-top test beams user area ✓ FEL user area 2 ✓ FEL to 5 GeV
• Beneficial in review: Additional applications & user beamlines (time plan & resource needs), test plan for 2 stage plasma acceleration	Phase 3 ✓ High-field physics beamline / user area ✓ Other future developments

Bid-book (licit könyv megírása beadása csomó egyéb paraméterrel, infrastructure, operation, budget, FEL user parameters, electron beam,) 20 dec 2024 beadás
Jan-febr 2025 bid book evaluation

Felelősök:

Giancarlo Gatti (CLPU, Salamanca)

Leo Gizzi (CNR, Pisa)

Alexander Molodozhentsev (ELI BL, Prague)

Rajeev Pattathil (EPAC, Rutherford Lab, Didcot)

Hétfő délután:

WP4 - Legal Framework, Financial Model and Socio-economic impact	<i>Antonio Falone</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:20 - 17:10
WP5 - User Strategy and Services	<i>Dr Emiliano Principi, Francesco Stellato</i>
WP6 - Membership Extension Strategy	<i>Andrea Mostacci, Brigitte CROS</i>
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	18:00 - 18:50

WP4 kidolgozni, hogy milyen modelben működjön pl: CERN –IGO, EUXFEL – GmbH Hub és node és national excellence cnete hogyan működjön együtt, Pl ELI ERIC Association International sans but lucrative – AISBL előny hátrány, gyengeség Hogyan legyenek a boardok, funding model

WP5 E. Stellato documents How to get beam time, how many proposals can run per year, Industrial users, how many how many to pay, user services, is there cantine, hostels, Vannak hasonló nagy berendezések synchrotron, XFEL, ezek működése alapján kell Ezeket kidolgozni

Hétfő délután:

WP5 E. Principi Survey of the Scientific Community: Key Findings and Insights,
Érdekes előadás, mit is akarnak a userek kb 10 év múlva ezt kell felmérni 500 usert
megkérdeztek

- Fundamental Constituents of Matter illetve Condensed Matter Physics user
plasma atomfizika, elektron .prop. Biologica phys.
- 48 % a potenciális usereknek már ismeri az EUPRAXIAT rézben, 36% semennyire nem
- rep ráta 100 -10000 Hz (36%)
- Xray sources több érdeklődő van 33% EUV, 47% soft X-ray, 20 % hard X-ray > 7 KeV
- Intenzitás fluktuáció 1-5 % (55% user)
- -pulse duration 1-10 fs
- 49 % user akar majd ultrafast fenomenat vizsgálni, 40% anyagot akar vizsgálni 33
imaging, non-linear phenomena 32 %
- Absorption spectroscopy (66%), Photoelectron spectroscopy (45%)
Emission spectroscopy (40%), Bragg diffraction (36%)
- Sample delivery, cristal, liquid jet, fixed target, self-tanding foil
- 66 % akar detektort is 64 % teljes kísérleti setup ot akar készen
- kell-e extra STM, AFM, kell-e data storage

Ezeket pontosan fel kell mérni

Hétfő délután:

WP 6 Hoisting and outreach

L. Gizzi Attractivity for users in the inertial fusion field

a lézeres cite-on el kell gondolkodni, hogy milyen fúziós kísérletet lenne érdemes csinálni

B. Cross membership extension strategy , pl African School of Physics, Latin American Synchrotron bevonása, developing countries bevonása, a pénteni napot reklámozta

R. Pattathil Incorporating PWASC EuPRAXIA into EPAC az angol cite bemutatása , technikai részletek, szerintem fontos hogy ott van neutron központ is

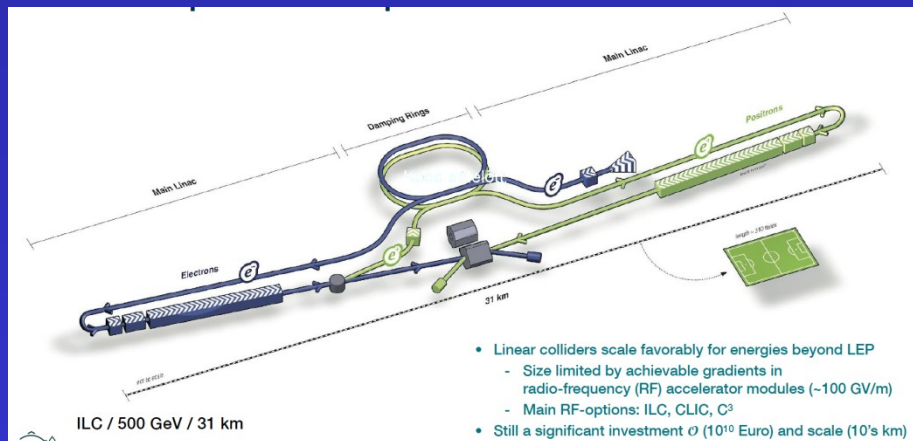
A. Molodzhentsev LPA-FEL ELI-Beamline Vision eddig 100 M euró, plusz 25 kell még

phase 2 2-5 GeV e^-

Kedd délelőtt:

09:00	Overview of Plasma based Linear Collider efforts <i>Jens Osterhoff</i>	09:00 - 09:50
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	
10:00	WP7 - E-Needs and Data Policy <i>Ricardo Fonseca, Stefano Pioli</i>	09:50 - 10:40
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	
	Coffee Break <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	10:40 - 11:00
11:00	WP8 - Theory & Simulation <i>Henri Vincenti, Jorge Vieira</i>	11:00 - 11:50
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	
12:00	WP9 - RF, Magnets & Beamline Components <i>Federico Nguyen, Sergey Antipov</i>	11:50 - 12:40
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	

J. Osterhoff a Berklex-ben már plazmás colideren gondolkodnak, lineárisan



- az elektront lehet plazmával gyorsítani, a pozitront nem igazán, ezért aszimmetrikus design

- ILC 31 km 50 GeV, gradiens $> 1 \text{ GeV/m}$

- a circular collider globális CO2 nyoma nagyobb

Kedd délelőtt:

W7 Richardo Fontesa (portugál plazmás), ez fontos WP a Wigner számára
Open Science Challenges for EuPRAXIA

-vele beszéltem is, kéne velük vmikor online meegingelni,

-a hosszú távú adat tárolás érdekli őket most,

- data policy, data management kidolgozás fontos, gondolkodni, hogy hogyan lehet

Ez 10 év múlva, 5- 10 PB per year,

-hogyan lesz a real time data processing,

-EuPRAXIA integrálása a PANOSC-be photon and neutron open science cloud

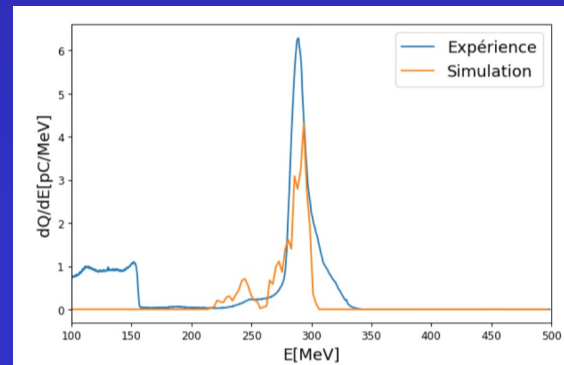
- megvan a milestone report kb 50 oldal

W8 Theory and simulation start-to-end simulations, pl WarpX open source PIC

100 contributor, rajta van github-on

COMSOL - HYQUP. plasma fluid dynamics

Element in chain	Code/algorithm	Input
Laser	GSA algorithm	Laser fluence
Conventional beam lines	Several codes: TraceWin, Trace 3D, MADX, Astra, GPT, Elegant, G4BL ...	6D phase-space (e.g., from PIC)
Gas jet	TBD	TBD
Plasma profile	Openfoam, Ansys/Fluent	none identified
Plasma accelerator	Osiris, Smiley, FBPIC, EPOCH	6D beam phase-space, laser e.m. profile, gas jet and plasma profile
Free electron laser	Osiris, Genesis, Simplex	6D beam phase-space from PIC



Kedd délelőtt:

W8 Viera tetszőleges időbeli formájú lézerimpulzusok bevétele az OSIRIS PIC Kódba, tetszőleges Lorentz boosts, tetszőleges polarizációs állapotok, Szög alatti belövés, túl a parallaxiális közelítésen

W9 Magnets beamline components

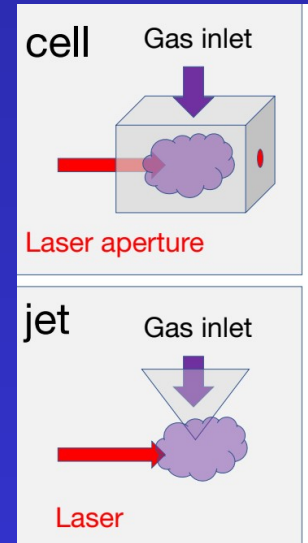
Undulator, beamline, RF components mindhez van 5-6 fős nemzetközi együttműködés
RF S-band 2.8 GHz, X-band 11.9 GHz, 60 MeV/m ami 16 TW 0.9 méterenként

Kedd délután

16:00	Coffee Break <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:00 - 16:20
	WP10 - Plasma Components & Systems <i>Kevin Cassou, Dr Rob Shaloo</i>	
17:00	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:20 - 17:10
	WP11 - Applications <i>Enrica Chiadroni, Gianluca Sarri</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	17:10 - 18:00
18:00	WP12 - Laser Technology and Liaison to Industry <i>Dr Leonida Antonio Gizzi, Paul Crump</i>	
	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	18:00 - 18:50

W10 8 intézet dolgozik rajta, jan 24-25 2025 lesz egy meeting a DEYS-ben

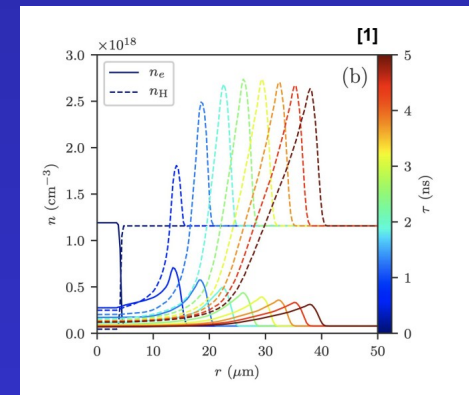
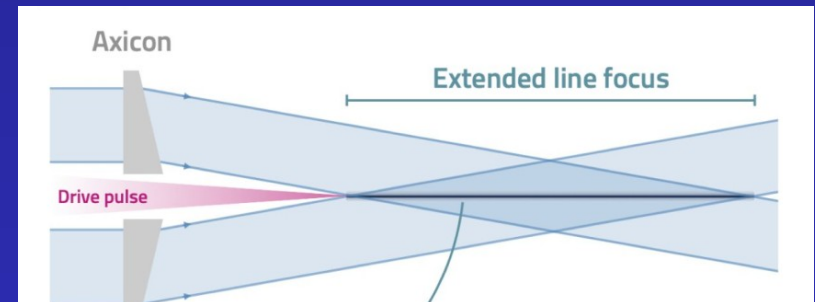
- 3 -féle probléma Gas cell and gas jet for laser-plasma e- source, discharged based plasma, Plasma waveguide channels
- 2 -féle megoldás gas cell vagy jet megoldás előnyök hátrányok
- már volt 5000 lövés, 1Hz 28 – 61 pC, 250- 300 MeV, 7% energy spread
- discharge: $3 \cdot 10^{17} \text{ cm}^{-3}$ sűrűség 1GeV/m gradients 13 keV, 500 A van aktív plasma lens, (Pinch hatás)
- Low-Density Hydrodynamic optical Field Ionized Plasma Waveguide (HOFI)



Kedd délután

W10

- Low-Density Hydrodynamic optical Field Ionized Plasma Waveguide (HOFI) ahogyan tellik az idő úgy bezárja jobban a plazmát



Kedd délután

W11 applicatioion

Specka High energy detector testing with EuPRAXIA,

Ez releváns Wigner-nek, beszéltem is vele személyesen,

kéne küldeni neki Hamar Gergőéktől cikket, hogy pontosan milyen detektore fejlesztés van nálunk,

náluk 0.5 - 5 GeV, rep ráta 1Hz, 10000 fs bunchg length

- Chiadroni XFEL beamline aplication to EuPRAXIA Frascati (itt említik a pécsi egyeteme lesz két FEL beamline

Parameter	Value
Wavelength	50-180 nm
Photons/pulse	$10^{13} - 10^{14}$
Pulse duration	20/200 fs
Repetition rate*	10 - 100 Hz

Parameter	Value
Wavelength	~4-10 nm
Photons/pulse	$10^{10} - 10^{11}$
Pulse duration	< 50 fs
Repetition rate*	10 - 100 Hz

L. Labate, érdekes előadás, radiobiológia alkalmazások az EuPRAXIAban

Ötlet: ugye 10 Gy a prompt halálos röntgen adag, ultra-high rate flash radiotherapy

Elnyelt dózis > 10 Gy de besugárzási idő < 200 ms,

Kedd délután

WP11 applicatioion

J. Sari secondary particles and photon sources in EuPRAXIA

- Novel schemes for the generation and applications of betatron radiation
X-ray (Betatron radiation) Gamma rays (Compton)
- Single-shot x-ray absorption spectroscopy
- Demonstration of laser-driven high-quality narrow-band positron beams
Low energy high energy
- Femtosecond-scale electron beams allow accessing a novel regime of radiobiology

WP12 laser techn. and liaison to industry

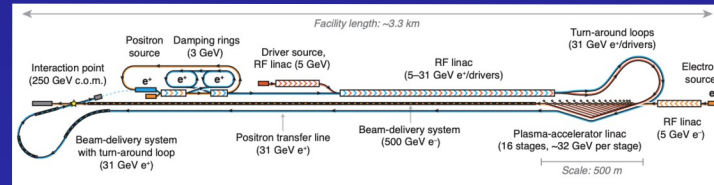
N. Lobo Poch Diode Pump lasers for advanced accelerators, high power, high rep rate is needed, Yb:YAG 940 nm, Nd:YAG 870 nm,

- De. Vito, STFC (Central Laser Facility UK) update
- A. Courjard kex tchnologieg at Amplitude for compact accelerators, dióda pumpa ézerekről beszélt
- A. Maier Laser development at DESY, 50 ember dolgozik ezen, KALDERA Laser Phase 3 100 TW, 1 kHz (30 fs)

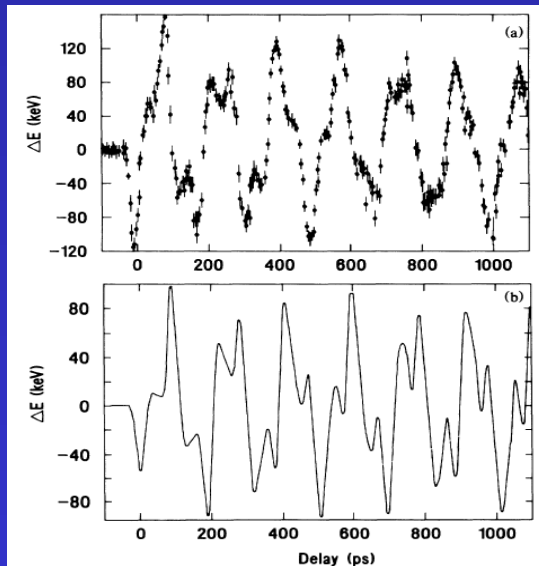
Szerda délelőtt:

09:00	Dielectric wakefield acceleration: application to linear colliders	James Rosenzweig
	Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	09:00 - 09:50
10:00	WP13 - Diagnostics	Prof. Alessandro Cianchi, Rasmus Ischebeck
	Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	09:50 - 10:40
	Coffee Break	
	Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	10:40 - 11:00
11:00	WP14 - Transformative Innovation Paths	Bernhard Hidding és mtsai.
	Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	11:00 - 11:50
12:00	WP15 - TDR EuPRAXIA @SPARC_LAB (beam-driven plasma)	Cristina Vaccarezza, Dr Riccardo Pompili
	Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	11:50 - 12:40

Rosenzweig: - van 1 tervezett lineáris Collider HIGGS factory, USA



- 31 GeV e^+ és 500 GeV e^-
- Van THz source 1 Joule
- Waveguide leírás létezik TM_{0n} módusokra
- 1 GeV /m gradiens elektronra és pozitronra is a cél
- Argonne kísérlet 1988

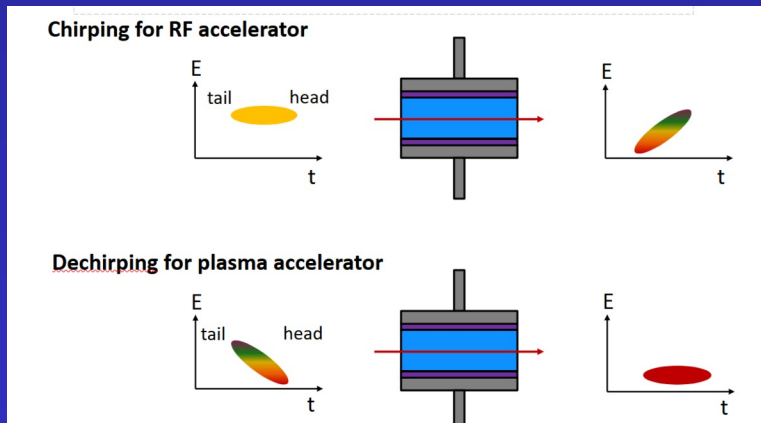


Szerda délelőtt:

WP 13 Diagnostics A. Chianchi beam diagnostics and photon diagnostics
PWFA & LWFA same problem not so critical
shot to shot instability usual FEL methods can be use
PSI excellence center for diagnostics

E. Ericson

Reduction of Projected Energy Spread with a Dielectric Wake Field Structure



Addesa Progress on Wire Scanners Manufactured by
Photolithography Si_3N_4 wire,



Szerda délelőtt:

WP14 S. Karsch Transformative Innovation Paths

New partners Uni Düsseldorf Pukhov simulation,
Helmholz Rossendorf, Drezda,

Uni Strathclyde Glasgow, Univ. Oxford, Tor Vergata Roma, Imperial Collage London,
Uni Szeged

14.1: Hybrid laser-
particle driven
wakefield
acceleration
(LWFA→PWFA)

14.2: Multipulse-
driven P-MoPA for
harnessing
accessible high-
repetition rate
laser technology

14.3: Plasma
photocathode
injectors and
ultracold beams

14.4: High-
brightness
prototyping for
light sources, QED
and HEP

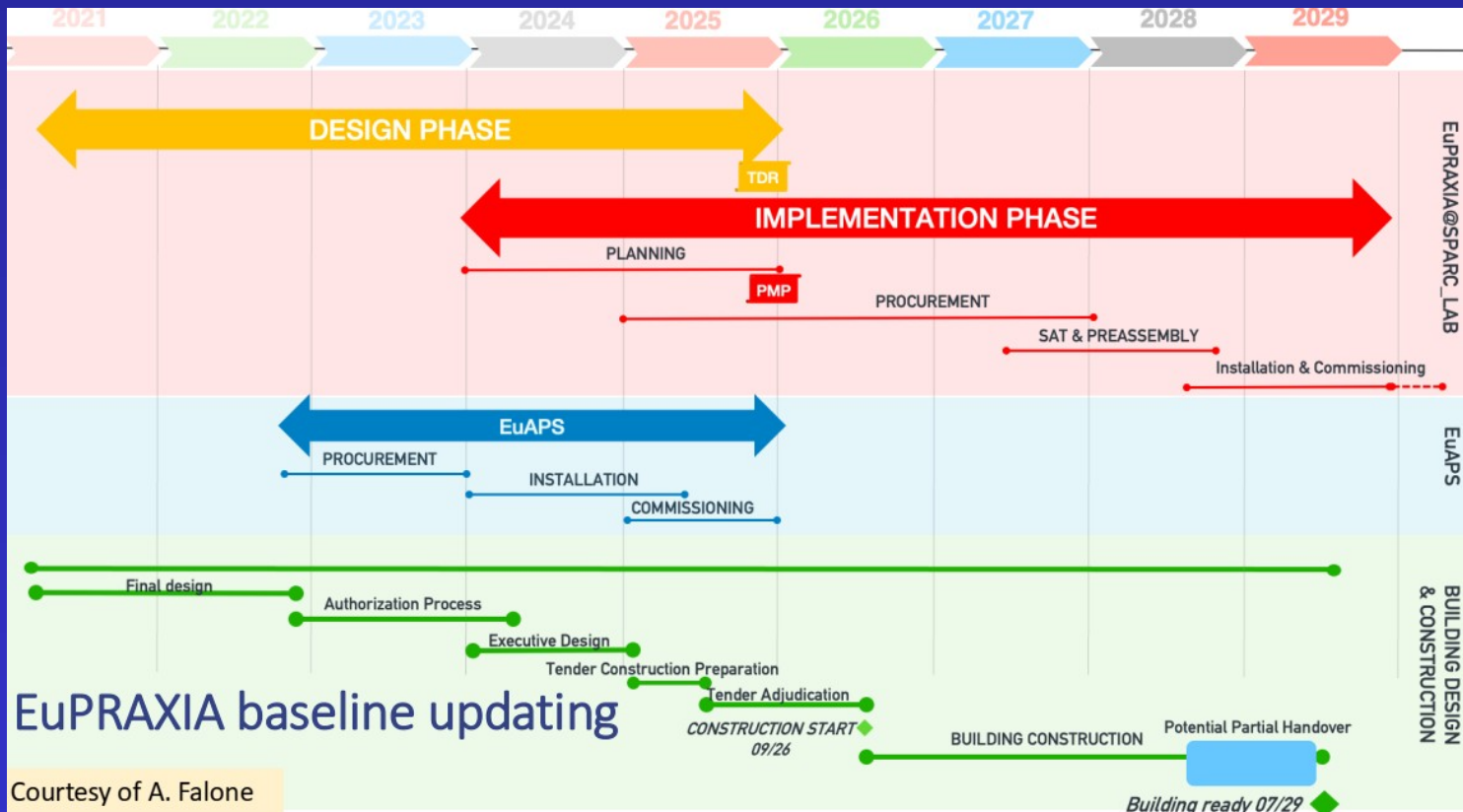
14.5: Plasma
targetry and
diagnostics for
ultrabright, high
rep-rate beams

Partners:



Szerda délelőtt:

WP15 R. Pompili Status report of EuPRAXIA Spac Lab, TDR Elmondja, hogy hogyan halad a Frascati site-on az építkezés, Minden technikai részlettel C. Vaccarezza TDR első fele



Szerda délután:

16:00	Coffee Break <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:00 - 16:20
	WP16 - TDR EuPRAXIA Site 2 (laser-driven plasma) <i>Dr Alexander Molodzhentsev, Rajeev Pattathil</i>	
17:00	<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:20 - 17:10
	Beyond EuPRAXIA_PP: the PACRI Project <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	Gerardo D'Auria 
	Final Discussion <i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	17:10 - 17:40
18:00	Collaboration Board	17:40 - 18:00

WP16 prágai, oxfordi, pisai, salamancai site2 hogyan halad

M16 – Milestone report: Review of candidates sites proposals

→ DONE

D16.1 - Update on EuPRAXIA plans for selected 2nd site (LD-based EuPRAXIA)

→ Feb.2025

D16.2 - Report on TDR status for the 2nd site (LD-based EuPRAXIA)

→ Apr.2026

G. Gatti Salamanca, épül az épület, múlva indul a földmunka, EMP-t vizsgálnak, ANSYS optical thermal stress analysis, amplifiers thermo/mechanical analysis, post compression analysis, time spectral analysis of the laser pulse, Dioda pumpált lézer, 100 mJ, 100 fs, 100 Hz,

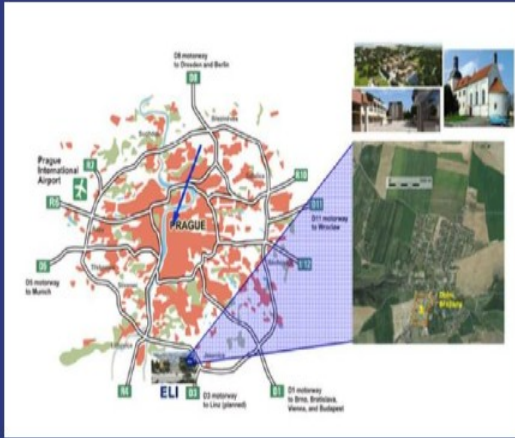
Szerda délután:

WP16 Molodozhentsev ELI beamlines,

Pump Laser and OPCPA	Status	Expected completion
Cryogenic system	Defects found after initial installation repaired and full system tests currently underway.	09/2024
Pump laser front end	Seed laser and regenerative amplifier complete , booster pre-amplifier running at 100 <u>mJ</u> , currently ramping up to 0.5 J	10/2024
Commissioning of pump laser	Pump laser pre-aligned ; now awaiting finalized cryo-cooling	11/2024
OPCPA pre-alignment	All components installed , pre-alignment of pump telescopes and signal path underway	12/2024
OPCPA amplification	Amplification possible after pump laser and BBFE complete	03/2025
Broadband front end (BBFE)	Status	Expected completion
Seed available	NIR OPCPA to be completed and passed through pre-aligned stretcher	11/2024
Mid-IR output	Work on this set aside to prioritize main amplifier seed branch.	12/2024
Compressor	Status	Expected completion
Optics	Most delivered , some still in production	12/2024
Alignment and first compression	Possible after OPCPA completion (03/2025) and arrival/installation of all compressor optics	08/2025

Overview of existing facility

Location: near Prague (CZ)



ELI Beamlines explores the interaction of light with matter at intensities 10 times higher than previously achievable.

- 4 PW class laser systems, 4 support lasers
- 7 Secondary sources – EUV - X-rays, Electron and Ion Accelerators
- 10 User stations

- 350 international staff
- Area 31,000 m²
- Structural Dynamics
- Particle Acceleration and Applications
- HED Physics and ICF
- High Field Physics

ELI-Beamlines (ELI-ERIC)

PRE-INVESTED BUDGET

... no personal cost

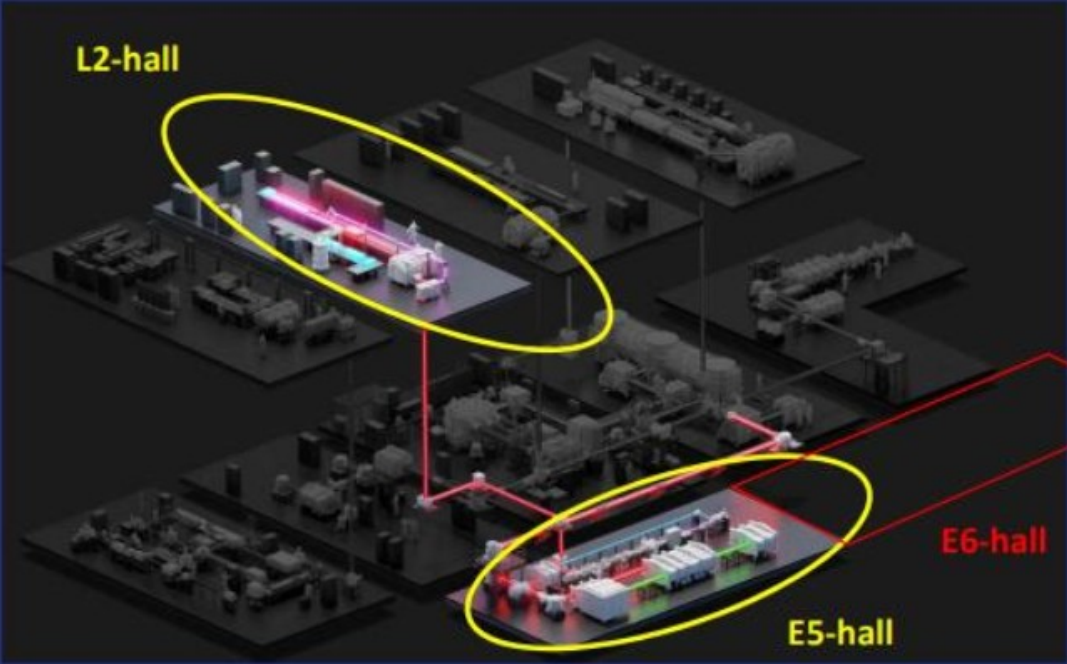
ELI-beamlines building (offices, labs, halls)	Total: ~ 100 MEur
L2-LUIS technology	
L2-laser hall (including relevant technology)	~ 5 MEur
L2-DUHA laser	~ 5.5 MEur
L2-to-E5 laser beam transport	~ 1.5 MEur
E5 experimental hall @ Local Control Room (including vacuum, cooling, cabling, gases, compressed air, CS, MSI, PSS, Radiation-MS)	~ 10 MEur
E5 LUIS technology	~ 2.5 MEur
(L2-Hall) + (E5-Hall) + (L2-Laser) + (L2-BT) + LUIS	~ 25 MEur

L2-hall and DUHA-Laser

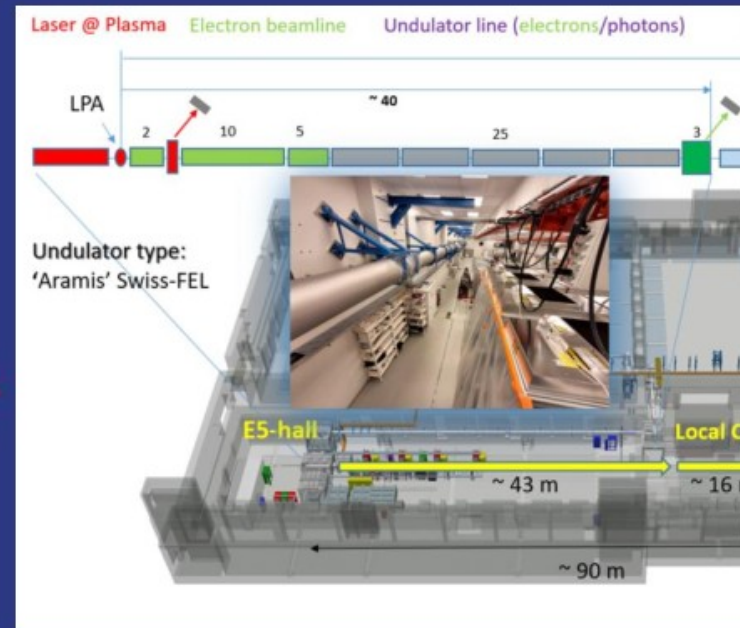
E5-hall and LUIS

Presented: EuPRAXIA CoE workshop / June 5-7, 2023

Possible usage of the existing ELI-Beamlines infrastructure for LPA-based FEL (EuPRAXIA/Phase#1 – 1GeV)



Integration of the L2-DUHA laser with the E5-LUIS experimental setup



1GeV LPA-based FEL

Presented: EuPRAXIA CoE workshop

Szerda délután:

WP16 R. Pattahill Oxfordi site

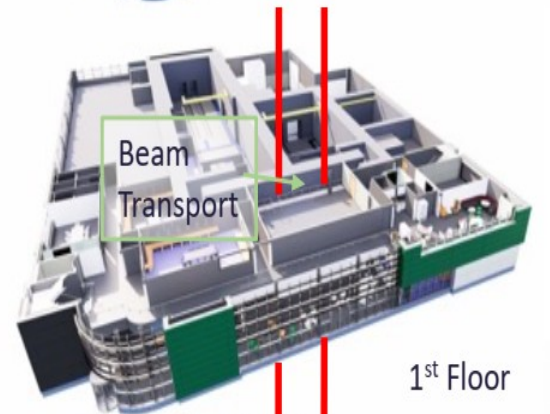
100J pump laser system elfogadták, a fő Ti:Sapphire erősítőt beépítették,
Kompressor kamrát beépítették, a nyaláb transzportáló rész épül,
A lézer plazmás kamra készül, az optikákat megrendelték,
parabola decemberben lesz ott

Top floor houses

- 1 PW@ 10Hz Laser areas and laser control room.
- Space for the addition of new laser systems: 2nd and 3rd synched beamlines
- Office space on 2nd and 1st floors

Ground Floor houses three double height radiologically shielded experimental areas

- Experimental area 1 (EA1) ~38 m x 9 m,
- Experimental area 2 (EA2) ~18 m x 10 m
- Future experimental area (EA3)
- Control rooms and auxiliary labs and future cleanroom space and development laser labs

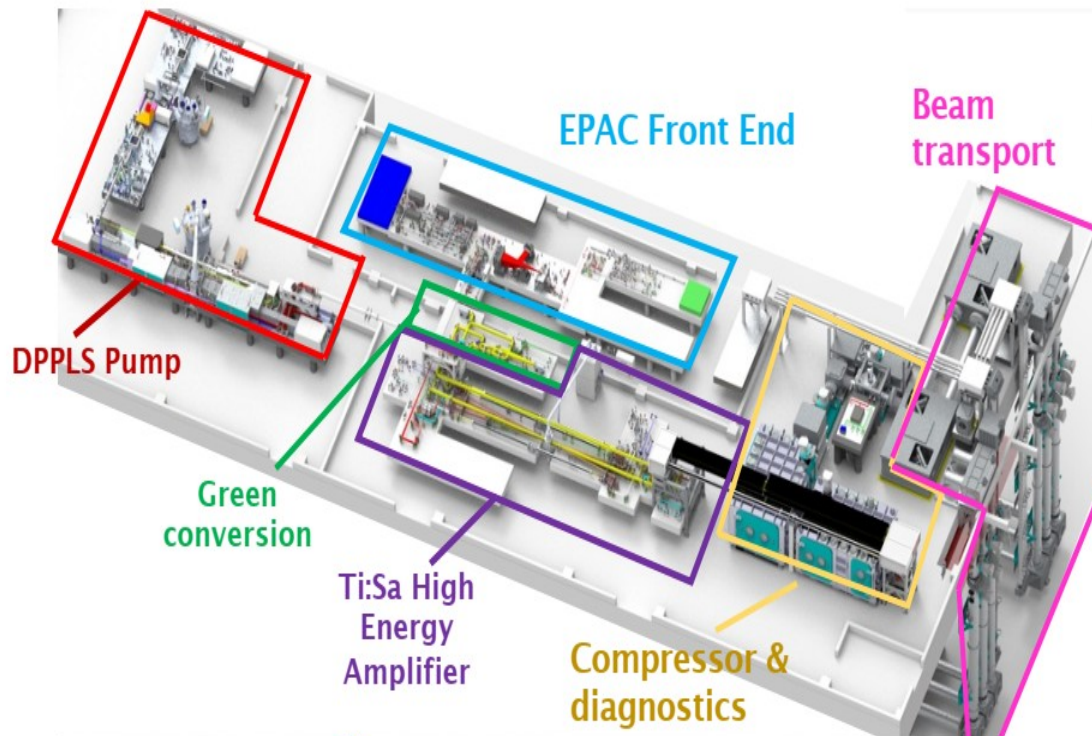




EPAC Laser system

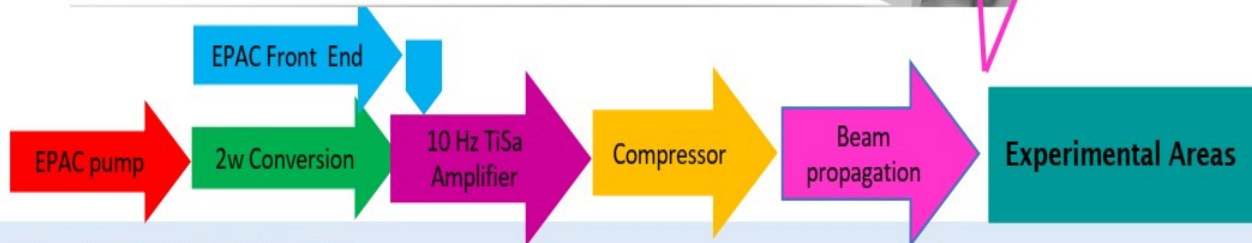


Funded by the European Union



1PW@10Hz

- Output Energy 30 J
- Pulse duration ≤ 30 fs
- Repetition rate 10 Hz, 1 Hz, Shot on Demand
- Pump for Ti:S is CLF developed 100J DiPOLE system.
- Additional space for future laser and experimental areas (eg. a 100Hz system under development)









Rajeev Pattathil EuPRAXIA PP - 2024

- The LHC in CERN was $> 7 \cdot 10^9$ (billion) euro 2010
- The European Spallation Sources was $< 2 \cdot 10^9$ (billion) euro -
green field investment with a 1km long LINAC
1GeV proton 2022
- ELI-ALPS Hungary was about 300 million Euro -
green field investment 2020
- EuPRAXIA Beam Driven site in Italy -
“development on a site”
> 130 million Euro
- EuPRAXIA laser driven ELI Beamlines/ELI-ERIC (Prag) -
20-25 million Euro
- EPAC (Oxford) -
60 – 80 millio Euro








Csütörtök délelőtt

EuPRAXIA@SPARC_LAB status

EuPRAXIA@SPARC_LAB status short	<i>Cristina Vaccarezza és mtsai.</i>
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	09:00 - 09:10
Beam Driven Acceleration Scheme to 5 GeV Energy for EuPRAXIA@SPARC_LAB	<i>Anna Giribono</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	09:10 - 09:40
EuPRAXIA@SPARC_LAB energy boosting to 5 GeV by LWFA and external injection	<i>Andrea Renato Rossi</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	09:40 - 10:10
Plasma-Based Solutions for Beam Handling and Driver Extraction	<i>Martina Carillo</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	10:10 - 10:40
Coffee Break	
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	10:40 - 11:00
Stable Beam driven wakefield in structured plasmas	<i>Alexander Pukhov</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	11:00 - 11:30
Towards 400 Hz RF system for EuPRAXIA@SPARC_LAB	<i>Fabio Cardelli</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	11:30 - 12:00
High repetition rate C-band Photoinjector	<i>Gilles Jacopo Silvi</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	12:00 - 12:30

Csütörtök délután

EuPRAXIA@SPARC_LAB status

High Repetition rate Plasma sources	<i>Lucio Crincoli</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:00 - 16:30
Fully synchronized high repetition rate Petawatt laser driver for betatron beamline on EuPRAXIA@SparcLab machine	
<i>Antoine Courjaud</i>	
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	16:30 - 17:00
WP14 physics progress	<i>Prof. Stefan Karsch</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	17:00 - 17:30
Coffee Break	
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	17:30 - 18:00
VUV Applications at EuPRAXIA@SPARC_LAB	<i>Francesco Stellato</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	18:00 - 18:30
Theory and simulations for high K/γ regimes in undulator and ion channel devices	<i>Andrea Frazzitta</i> 
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	18:30 - 19:00
Closing Remarks & Discussion	<i>Cristina Vaccarezza és mtsai.</i>
<i>Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy</i>	19:00 - 19:30

Csütörtök délután
EuPRAXIA@SPARC_LAB status

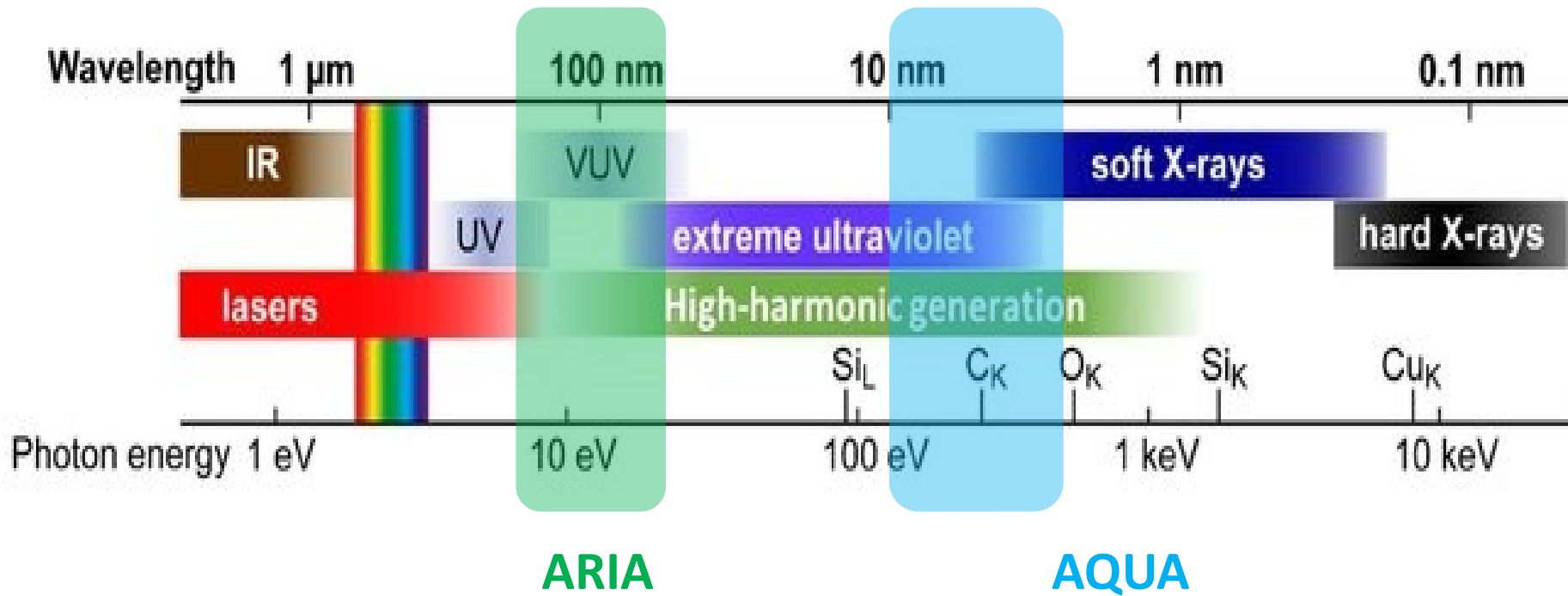
Épül Frascatiban 2 free electron beamline
ARIA és AQUA

ARIA will be complementary to the other
EuPRAXIA@SPARC_LAB FEL beamline, **AQUA**

AQUA is a soft-X-ray SASE FEL beamline that will
deliver photons in the region between 4 and 10 nm

Parameter	Value
Wavelength	4-10 nm
Photons/pulse	$10^{10} - 10^{11}$
Pulse duration	< 50 fs
Repetition rate	100 Hz

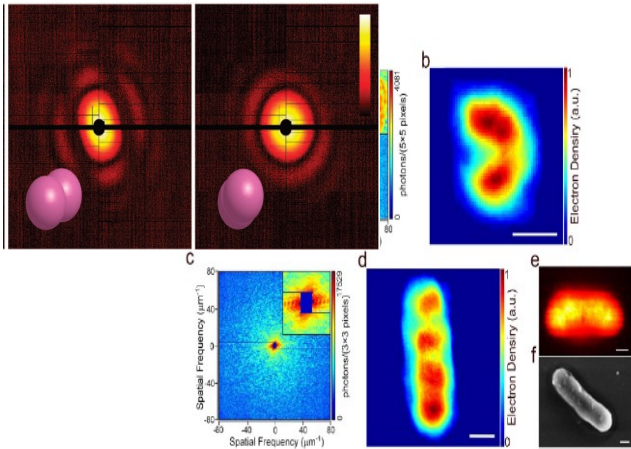
What is **ARIA**?



Science @ AQUA in a nutshell

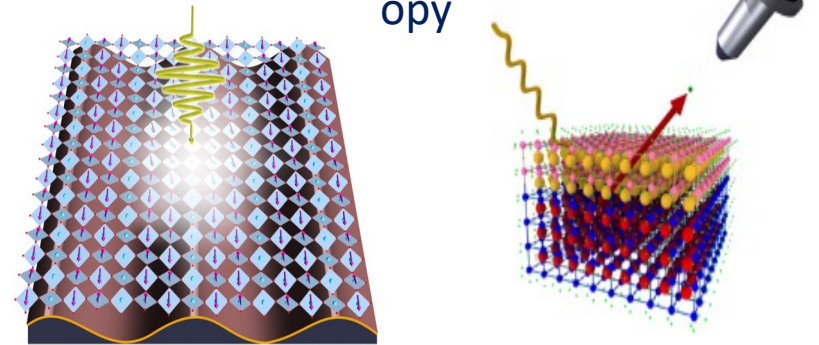
Mire lesz jó?

Coherent imaging in the water window,
including stereoimaging schemes



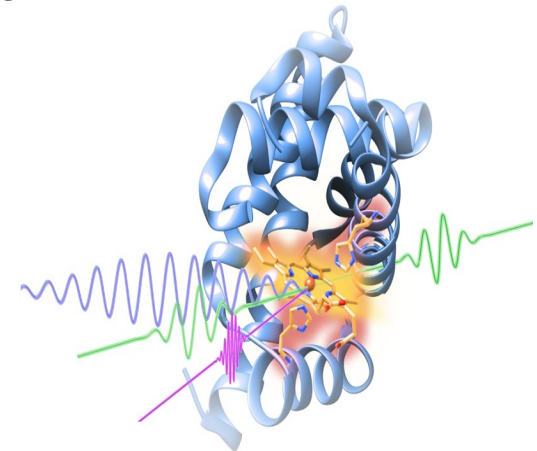
Hydrated environment measurements
on bacteria, viruses, nanoparticles,
ashes...

X-ray & Photoemission pump-probe
scopy



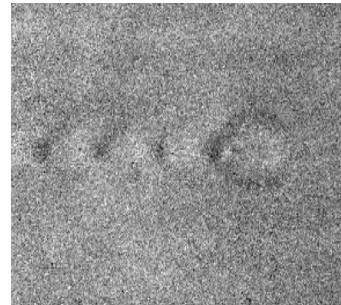
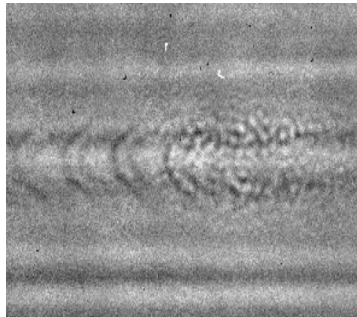
Ultrafast studies on hydrocarbons,
aminoacids, alloys, warm-dense matter,
cuprates, catalysts, batteries

Ultrafast
Raman spectroscopy
on metalloproteins
and organometallic
molecules



- how do we achieve ultracold electron beams for future wakefield accelerators and compact light sources?
- how can we study basic PWFA physics with high accessibility in a scalable toy model?

Idea: Drive a PWFA with electrons from an LWFA



First experimental clues (ca. 2010):

Hybrid accelerator & plasma

Strong drivers: nC LWFA electron

Plasma waves driven by LWFA

Driver-witness pairs: Dual bunches

Hybrid proof-of-concept: External

Towards cold beams: Internal injection

High stability and beam quality from hybrid accelerator

Energy (MeV)
650
500
350
200
190
150
110
70

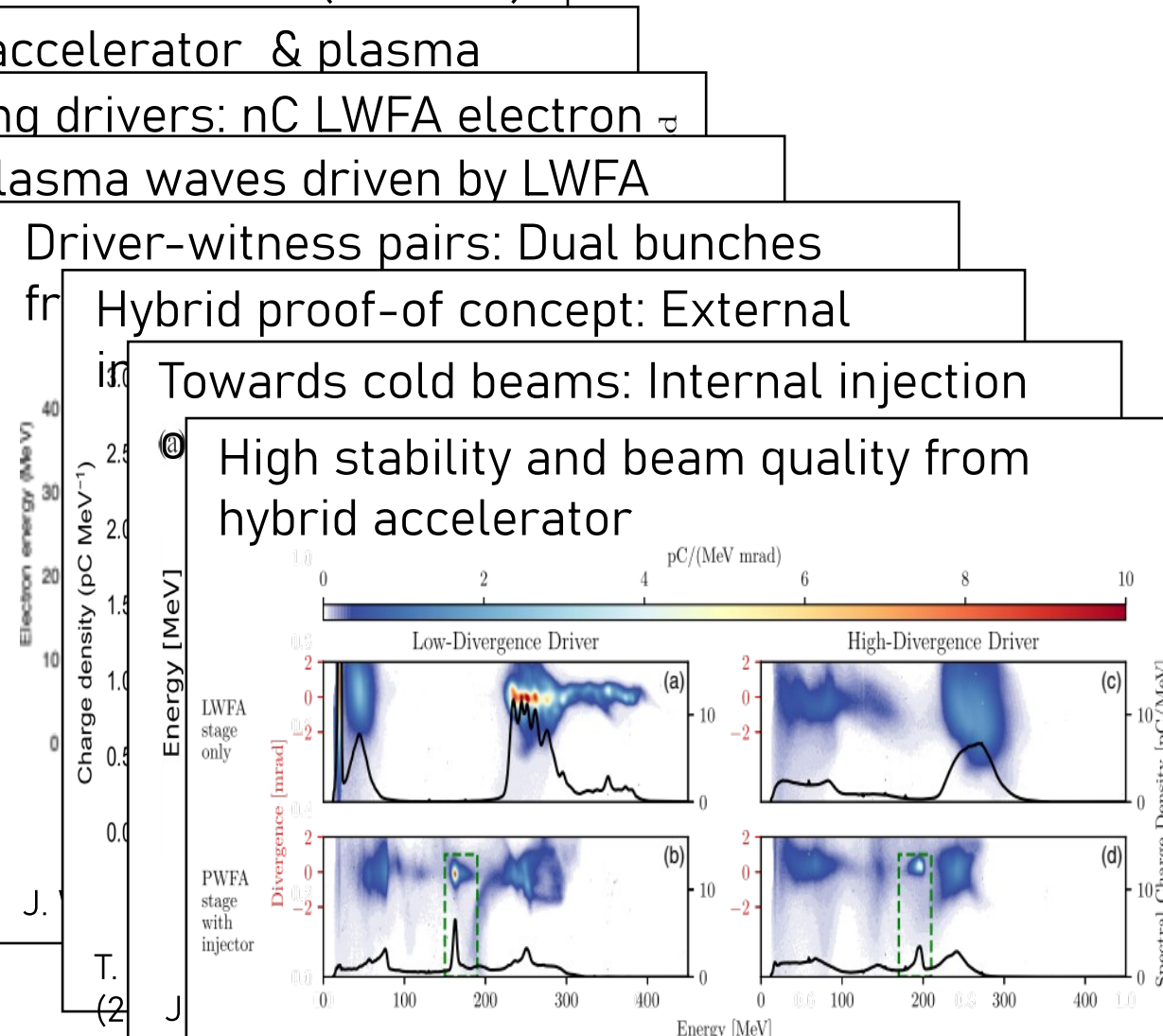
Pressure (mbar)
190
150
110
70

1st
incident laser
LWFA
SMLWFA

Mo
10
Co
Let

Charge Density [mrad]
Position [μm]
Electron energy (MeV)
Charge density (pC MeV⁻¹)
Energy [MeV]
Spectral Charge Density [pC/MeV]

J. (20)
M. (20)
S. J.
T. (20)
J.



M. Foerster et al. Phys.Rev.X **12**, 041016 (2022)

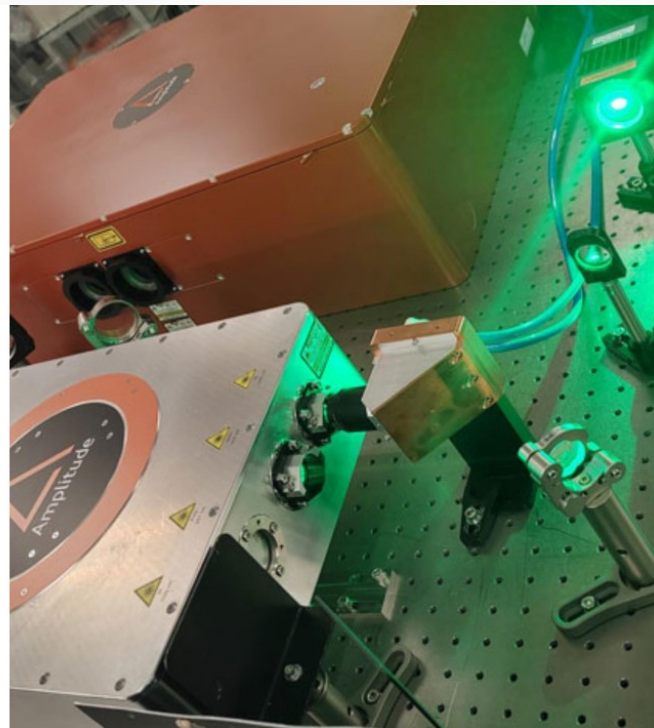
Hybrid collaboration (since



Fully synchronized Petawatt
 laser driver for betatron
 beamline on
 EUPRAXIA@SparcLab
 machine

26th of Sept 2024
 Antoine COURJAUD

A Laser Bright Future 



Péntek délelőtt EuPRAXIA Framework

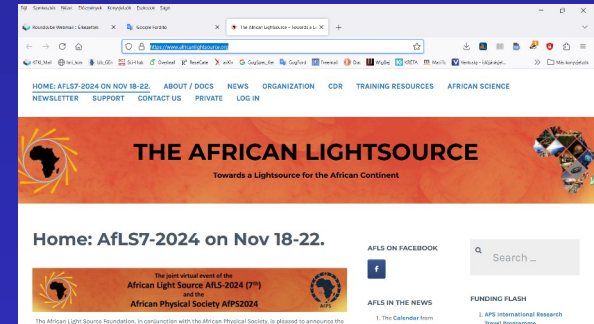
Presentation of Eupraxia	
Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	09:00 - 10:00
Potential links in countries not yet represented in EuPRAXIA	
Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	10:00 - 10:30
Coffee Break	
Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	10:40 - 11:00
Potential links in countries not yet represented in EuPRAXIA	
Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy	11:00 - 12:30

Christine Darve Research Initiatives in Developing
Communities and
Potential Opportunities for EuPRAXIA
African Light Source Conceptual Design Report (CDR)
<https://www.africanlightsource.org/>

(megszólított és homályos utalást tett arra, hogy Somogyvári
Zoliékkal és a tanuló algoritmusukkal tudna együttműködni, még nem derítettem ki a
pontos részleteket...)

G Violini, Bogota
The Latin American Synchrotron in the Greater Caribbean
<https://arxiv.org/abs/2109.11979>

vannak voltak nagy teleszkópok latin Amerikában, Maxikóban van 43000 PhD hallgató 2018



Péntek délelőtt
EuPRAXIA Framework

R. Pattahil

Possible collaboration in India

nature
physics

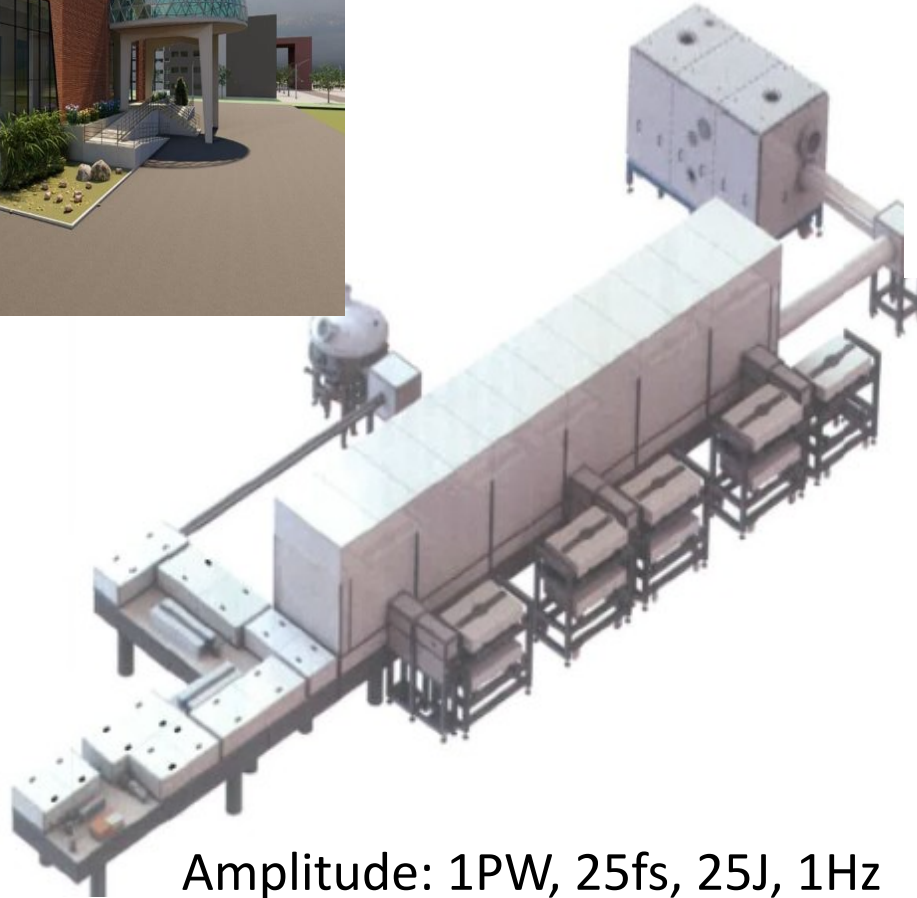
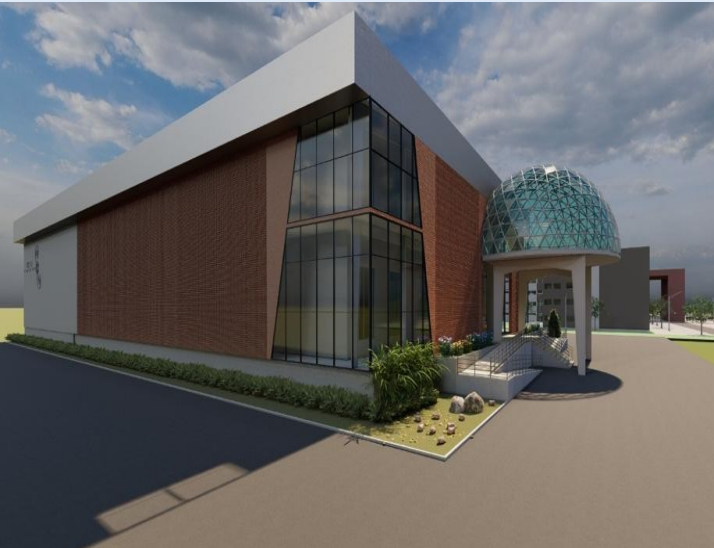
ARTICLES

PUBLISHED ONLINE: 27 JANUARY 2013 | DOI: 10.1038/NPHYS2526

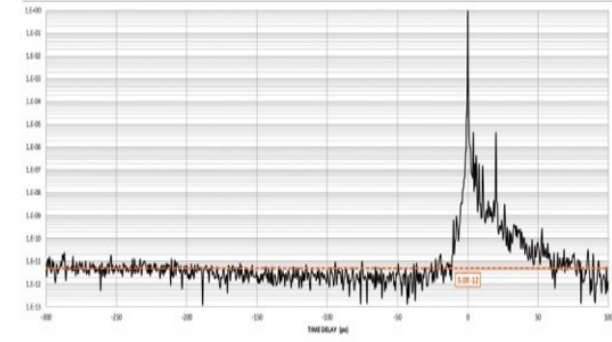
A compact laser-driven plasma accelerator for megaelectronvolt-energy neutral atoms

R. Rajeev, T. Madhu Trivikram, K. P. M. Rishad, V. Narayanan, E. Krishnakumar
and M. Krishnamurthy*

Benne vannak a CERN-ben, ITER-ben,
Van TOKAMA-juk Aditya and SST



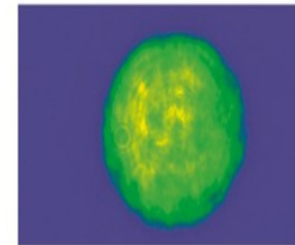
Amplitude: 1PW, 25fs, 25J, 1Hz



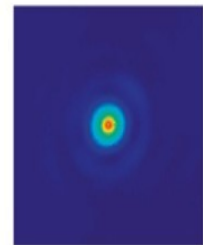
Pulsar 500 HR Sequoia
HD contrast measurement

Pulsar PW

Ultra intense ultrafast laser



Pulsar 500 HR typical
Near Field beam profile



Pulsar 1000 HR typical
Far Field beam profile



- > Up to 25 J
- > Highest contrast ratio better than $10^{10} : 1$
- > Up to 5 Hz repetition rate
- > Ultra-short sub-20 fs pulses
- > Advanced Monitoring System

Péntek délután

EuPRAXIA Framework

EuPRAXIA framework for R&D

Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy

16:00 - 17:40

Coffee Break

Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy

17:40 - 18:00

Training and young researcher education

Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy

18:00 - 18:40

Discussion/Round table - Strategy for linking Eupraxia to other worldwide similar accelerator activities (convener: B. Cros)



Andrea Lausi és mtsai.

Hotel Hermitage, La Biodola Bay, Isola d'Elba, Italy

18:40 - 19:30



The African School of Fundamental Physics and Applications

a.k.a. the African School of Physics (ASP)

Mounia Laassiri

On behalf of the ASP-IOC

<https://www.africanschoolofphysics.org>

ASP-IOC@CERN.CH

ACP-IOC@CERN.CH

X f i @BrookhavenLab

EuPRAXIA_PP Annual Meeting 2024
September 27, 2024



Extreme Light Infrastructure-Nuclear Physics
(ELI-NP) - Phase II



Nuclear physics in plasma at EuPRAXIA (a view of what's happening at ELI Nuclear Physics that might be on interest for EuPRAXIA)

Paolo Tomassini, Domenico Doria, Vojtech Horny, Paul Constantin, Andi Cocuanes, Dan Stutman

Extreme Light Infrastructure (ELI-NP), Str. Reactorului no.30, P.O. box MG-6, Bucharest - Magurele, Romania

Cautionary note 1:
PT is not a nuclear physicist

Cautionary note 2:
PT was one of the proponents of the EUROGAMMAS consortium

EuPRAXIA meeting, La Biodola, 27/09/2024

Paolo Tomassini

Towards Societal Applications: Laser-driven radioisotope production



- **The full chain of radioisotope production with lasers has never been demonstrated.** Small laser (hundreds of TW) systems have the greatest potential.
- Several studies (review: Z.Sun AIP Adv. 2021) shown isotope production based on single/few shots events, and then extrapolated to hours beamtime.
- 2 examples: ^{11}C with proton beams via $^{11}\text{B}(p,n)^{11}\text{C}$ and ^{62}Cu with gamma beams via $^{63}\text{Cu}(\gamma,n)^{62}\text{Cu}$:

Ref. ^{11}C prod.	E [J]	Pulse T [fs]	Rep. [Hz]	Activ [MBq]	Obs.
Tayyab et al. 2019	2.4	25	1	9	7-10 shots (2-3 min) meas. Cu,Al, Ni foils
Singth et al. 2018	3	30	1	7.6	Spectrum meas. Al foils, analysys in Penas et al.
Penas et al. 2024	25	250	1	21.7	174 shots at 0.1 Hz meas., Al foils
ELI-NP estim.	8	23	1	30	PIC + TENDL21 CS, water-leaf tg.
Ref. ^{62}Cu prod.	E [J]	Pulse T [fs]	Rep. [Hz]	Activ [MBq]	Obs.
Ma et al. 2019	11.5	33	1	180	PIC + Geant4, Varlamov CS
Lobok et al. 2022	4	30	1	87	PIC + Geant4
ELI-NP estim.	2.3	23	1	35	PIC + Geant4, TENDL21 CS.

Plasma based positron sources for testing positron acceleration at EuPRAXIA

Gianluca Sarri

g.sarri@qub.ac.uk

School of Mathematics and Physics, The Queen's University of Belfast

Összefoglaló a lehetséges jövőbeli Wigneres együttműködésekről

WP 7 Ricardo Fontesa Data Storage & Data Acquisition

Szerveződik egy online megbeszélés vele és a Wigner között,
Barnaföldi-Kacskovics illetve Kiss Tivadar

Nem igazán tudunk semmi konkrétat, szerintem Ricardo sem,
Tervezünk küldeni neki egy pár oldalas összefoglalót az online
megbeszélés előtt, ő nagyon nyitott erre

WP 11 Arnd Specka Applications

HEP detektor tesztelést emlegetnek 5 GeV körül

Hamar Gergővel már beszéltem, gáz töltésű detektor fejlesztés van
a Wignerben

Arnd is kért egy összefoglalót, amit majd küldünk neki,
(Ricardó összefogottabb optimistább volt...)

WP 15? Christina Darve ESS, érdekesnek találja Somogyvári Zoltán

néhány tanuló algoritmusos cikkét és ezt illetően szeretne
együttműködni, itt is le kéne ülni egy online meetingre...

Köszönöm a figyelmet!