EuPRAXIA Doctoral Network

>>> Newsletter

Latest developments in plasma accelerator research and training.

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Meet our EuPRAXIA Doctoral Network Fellows – Part 2

>>> Welcome

New EuPRAXIA leadership and training excellence

In this issue, we have the pleasure of welcoming Dr Pierluigi Campana as new EuPRAXIA Coordinator. At the same time, I would like to thank Dr Ralph Assmann, who has been a driving force behind EuPRAXIA from the beginning, for his outstanding contributions, leadership and friendship over the years. Ralph has taken on a new challenge in becoming Head of Accelerator Operations & Development at GSI/FAIR, Germany. We wish him every success in his new role!

A call for MSCA Networks has just been launched. To me, these are an ideal opportunity to think about the future of doctoral training, and how one can best tackle the many new challenges, from the role of AI in research, remote working and digital literacy. I was invited to talk about best practice in MSCA Network Coordination at an event jointly organized by the EC, UKRO and UUKi on 26 June 2024 in London, UK and will make sure I share our excellent results with the +250 event participants.

Prof Carsten P. Welsch
Coordinator

>>> Research Highlights

Coherence and superradiance from a quasi-particle accelerator

The active bending plasma device compared with a conventional bending magnet (Credit: INFN-LNF)

In a recently published paper in Physical Review Letters, Riccardo Pompili (INFN-LNF) and his colleagues present a novel method for deflecting and guiding relativistic electron beams along curved paths using magnetic fields generated within plasma-discharge capillaries. This pioneering approach promises to significantly mitigate the chromatic dispersion effects commonly encountered with conventional bending magnets, marking a substantial leap forward in the field.

The experimental results demonstrate that the guiding of electron beams through plasma-discharge capillaries is notably less influenced by chromatic dispersion, a phenomenon where particles of different energies follow slightly different paths, compared to traditional bending magnets. Enhanced numerical simulations support these findings, indicating that by increasing the discharge currents, the technique can be rendered nearly dispersionless.

According to Riccardo Pompili, head of the SPARC_LAB accelerator activities and leader of Plasma Area EuPRAXIA@SPARC_LAB project at INFN-LNF, “the results obtained at SPARC_LAB follow previous studies on (straight) active-plasma lenses and show that the same working principle can be applied to curved geometries with the goal to guide and bend relativistic particle beams by means of a plasma-based device. For this purpose, a high-current discharge flowing within a curved capillary simultaneously with the beam was used. Significant R&D was needed to develop the high-current discharge pulser that can reach 2.2 kA peak currents. The results show that the guiding was correctly obtained, and, unlike conventional bending magnets, it can be made achromatic (i.e., not affected by the beam energy spread) by tuning the discharge current.”

The study highlights the potential for this innovative method to pave the way for next-generation tabletop particle accelerator facilities. If compared to state-of-the-art bending magnets technology, its practical implementation would be very affordable in terms of size and costs.

Active-bending plasma represents therefore an innovative solution to develop ultracompact beam lines for existing or next-generation accelerator facilities. This development marks a promising step towards more compact, versatile, and economically feasible particle acceleration technologies.

Further reading:
R. Pompili et al. Phys. Rev. Lett. **132**, 215001 https://doi.org/10.1103/PhysRevLett.132.215001

EuPRAXIA^{DN}: Global Minds, Accelerating Tomorrow - A Film on the Future of Plasma Accelerators

EuPRAXIA^{DN} launched a short film "*EuPRAXIA-DN: Global Minds, Accelerating Tomorrow*" in January 2024, showcases a major leap forward in particle accelerator technology and its potential impact across various fields. Produced by the Fellows and partners of this new pan-European consortium, the film presents an immersive overview of the EuPRAXIA Doctoral Network (EuPRAXIA^{DN}).

EuPRAXIA: The Future of Compact Particle Accelerators

Particle accelerators have been instrumental in advancements across research, industry, medicine, and more. However, their widespread use is hindered by significant cost and size constraints, particularly affecting hospitals, universities, and small to medium-sized enterprises. The film dives into how these limitations could be overcome through the development of more compact, environmentally friendly, and cost-effective accelerator technologies.

EuPRAXIA is the first distributed research infrastructure based on innovative plasma accelerator technology. Recognized as a European priority on the ESFRI roadmap since June 2021, it offers a glimpse into a future of groundbreaking applications and innovations.

The film highlights EuPRAXIA^{DN}, a new 3.2M€ MSCA Doctoral Network funded by the EU and the UKRI guarantee fund, comprising 12 Fellows engaged in an interdisciplinary and cross-sector plasma accelerator research and training program. This network represents a backbone of the new EuPRAXIA research infrastructure, poised to transform the way we approach particle acceleration.

A Leap in Film Production: The Virtual Production Technique

The film's production with experts from Carbon Digital in Media City UK, Manchester is based on virtual production technique and thus marks a significant departure from conventional film-making methods. Network Coordinator Professor Carsten P Welsch comments on this innovative approach: "Utilizing virtual production has allowed us to vividly bring to life the complex world of particle accelerators. This technique not only enhances the visual storytelling but also significantly reduces production time and costs at much reduce environmental footprint, making it a game-changer in scientific film production."

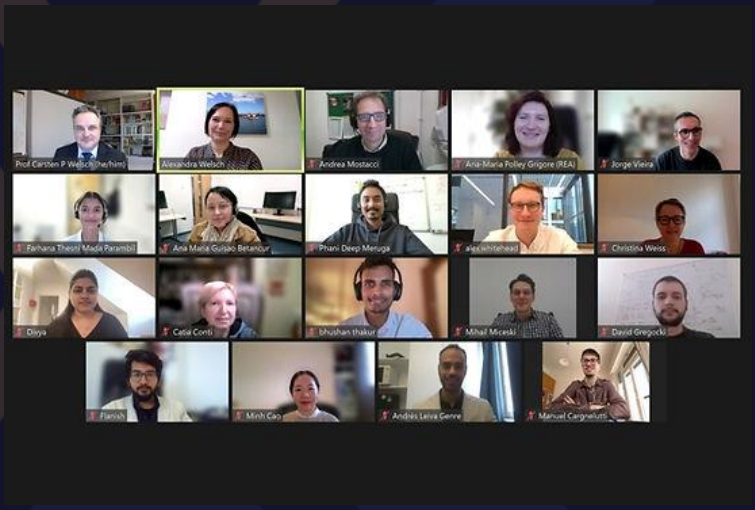
"The film is an invitation to explore the future of plasma technology and its potential to revolutionize our world. We encourage everyone with a curiosity in science and innovation to watch this film and join us on this exciting journey into the future."

The film can now be viewed on YouTube and includes subtitles in English, Italian, Spanish, French, German, Greek, Czech, Slovak, Finnish, Hindi, Telugu, Bengali, Chinese and Vietnamese.

Click on the link to watch now:

https://youtu.be/6NPgxCdffrE.

EuPRAXIA^{DN} Mid-term Review highlights



Participants at the EuPRAXIA^{DN} Mid-term Review Meeting.

On 5th February 2024, the Marie Skłodowska-Curie Actions (MSCA) EuPRAXIA Doctoral Network (EuPRAXIA^{DN}) met for a Mid-term Check to review and celebrate the project achievements and milestones.

The meeting kicked off with a welcome from the Network Coordinator Prof Carsten P. Welsch and an introduction by the Research Executive Agency (REA) Project Officer Dr Ana Maria Grigore. This was followed by a “tour de table” where all Fellows and representatives from project partners introduced themselves and their roles in the project.

Prior to the project update, Dr Grigore gave an informative presentation on the MSCA Doctoral Network initiative, reminding the Coordinator, the Fellows and all partners of the processes and obligations. Prof Welsch then presented an overview of progress made in research, training and networking, as well as aspects of the management of the contract. He spoke about the EuPRAXIA^{DN} training model, the events delivered so far, unique collaborations with other training initiatives and their impact on the fellows’ training. This approach was recognized as good practice in doctoral training by the European Commission. He also presented a summary of the project wide communication and significant outreach involvement that help raise the visibility of the EuPRAXIA^{DN} and the wider EuPRAXIA project, highlighting the EuPRAXIA^{DN} film produced by the Fellows during the Media Training week, project presentations at local outreach events as well as international conferences and meetings such as IPAC, APS, Physics of Star Wars. Prof Welsch concluded his presentation with a positive outlook as the project successfully met all deliverables and milestones thanks to joint effort of the Consortium.

The individual presentations of the EuPRAXIA^{DN} Fellows were a central part of the meeting. 10 of the 11 recruited Fellows were presented and delivered talks on their project progress in such aspects as research, training and dissemination, as well as their experiences in the network. One Fellow was unable to attend due to a schedule conflict with a training that is essential to his project. Recruitment of the final Fellow is being finalised and we look forward to having all 12 Fellows present at the next Network meeting.

The Fellows then met with the Project Officer to discuss their experiences and views on the project in more detail. Meanwhile the Consortium representatives gathered for a Supervisory Board meeting to discuss project reporting and plan future events.

The meeting finished with a brief summary by the Project Officer, who recognized a very good progress of the EuPRAXIA^{DN} project and congratulated all Fellows on their results and achievements within only one year from the project commencement.

EuPRAXIA^{DN} School on Plasma Accelerators held in Rome

The EuPRAXIA Doctoral Network (EuPRAXIA^{DN}) held a week-long international School on Plasma Accelerators between 22nd and 26th April 2024 in the beautiful Botanical Garden of Rome, Italy. The school were hosted in partnership with INFN and Sapienza University of Rome with strong support from the University of Liverpool/Cockcroft Institute.

This interdisciplinary school brought together all research areas within EuPRAXIA^{DN} with lectures and topical talks from research leaders from both academia and industry. It attracted nearly 70 participants including EuPRAXIA^{DN} Fellows, invited lecturers and external participants from organizations across Europe and the UK.

The extensive program covered the basic principles of plasma accelerators, including the fundamentals of plasma physics, laser- and beam-driven acceleration, plasma injection schemes, plasma and beam diagnostics, particle-in-cell codes, as well as specific high impact projects such as EuPRAXIA and AWAKE.

One of the school highlights were three seminars given by world-leading experts after a series of intense lectures and discussions. These include a lecture on the 'History of Plasma Accelerators' by Professor Victor Malka on the first day of the school, covering the key developments and challenges of Plasma Accelerators. Another special lecture was given by 2023 Nobel Laureate Professor Anne L'Huillier from EuPRAXIA^{DN} partner Lund University. The inspiring lecture on 'Ultra-short Laser Pulse Generation and Applications' took participants through her research career from very early stages through many years of work behind the Nobel Prize. The third seminar was on 'the AWAKE Experiment at CERN' by the AWAKE project leader Dr Edda Gschwendtner. This is another important plasma wakefield acceleration research project that is included in the ESFRI strategic roadmap.

Throughout the week, participants had many opportunities to interact with invited lecturers and other participants. In the study session on the second day, participants were split into smaller groups to solve problems given by the lecturers. This exercise helped reinforce the content of the lectures they received. School participants also had a lively poster session on the fourth day where they presented their own research results and discussed them with other researchers. The participation of external participants in this event was crucial for promoting knowledge exchange and establishing links among researchers working on similar topics.

Invited speaker Nobel Laureate Prof Anne L'Huillier in dialogue with esteemed members of INFN and the University of Liverpool at the EuPRAXIA school. (Credit: QUASAR Group)

EuPRAXIA[DN] School on Plasma Accelerators Group Photo.
(Credit: QUASAR Group)

The school was complemented by a day excursion to the INFN National Laboratory of Frascati (INFN-LNF). The program of the day was dedicated to lectures by colleagues from INFN-LNF. Participants spent the afternoon learning about the history of INFN and were treated to a tour of the lab facilities at INFN-LNF.

were encouraged to explore and enjoy the beauty of the Botanical Garden in spring through a flower photo contest. Winner of the photo contest was Andrea Angella from Lund University with a fascinating capture of pink azalea and Rome in the background. This extra curriculum activity was seen as a fond memory for many participants.

The winning photograph of the flower photo contest.
(Credit: Andrea Angella)

Fruitful discussions at the school's poster session.
(Credit: QUASAR Group)

We would like to cordially thank all invited lecturers for their contribution. Special thanks go to Professor Andrea Mostacci, colleagues from INFN and the University of Liverpool's Project T.E.A.M. for their fantastic efforts in the organisation of the School.

For more information:
https://agenda.infn.it/event/38913

EuPRAXIA^{DN} Project launches Brochure at IPAC24

The EuPRAXIA^{DN} communication and public relations team has just released a comprehensive brochure highlighting the project's aims and activities, network Fellows, and partners.

The brochure offers a detailed overview of the EuPRAXIA^{DN} research objectives and the extensive network-wide training it provides. Each scientific work package is described in detail, explaining the targeted R&D and showcasing the respective Fellows.

Scheduled for distribution at prominent scientific conferences and workshops, the brochure aims to raise awareness within the broader scientific community about the groundbreaking research being conducted by the EuPRAXIA^{DN} Fellows. It has been designed to appeal to a very broad audience, its main target being policy makers, scientific and user communities, and European industry.

The brochure was first distributed during the 15th International Particle Accelerator Conference (IPAC24) in Nashville, Tennessee (USA) in May 2024. Being the world's largest conference on particle accelerator science and technology, IPAC24 provided an ideal platform to disseminate the brochure to a global audience. The University of Liverpool, as the network's communication lead, hosted an industry booth at the conference, fostering discussions and facilitating connections between the network's activities and the global accelerator community.

Download the brochure here:
https://www.eupraxia-pp.org/leaflet-and-brochure

>>> Fellows News

Meet our EuPRAXIA^{DN} Fellows – Part 2

EuPRAXIA^{DN} will train a cohort of 12 Fellows (ten Fellows will be funded from the HE-MSCA-DN funds, while two Fellows will be funded by the UKRI guarantee funds) between universities, research centers and industry that will carry out an interdisciplinary and cross-sector plasma accelerator research and training program for this new research infrastructure. The network focuses on scientific and technical innovations and on boosting the career prospects of its Fellows.

All Fellows have now been recruited to the EuPRAXIA Doctoral Network. Below we present those who recently started work in their host institutions, with other Fellows to be introduced in the upcoming issues.

Farhana Thesni Mada Parambil

Farhana is from Kerala, India. She obtained her master's degree in Radiation Physics from the University of Calicut in 2023. Her thesis, titled 'Impact of nuclear reactions on proton therapy dose distribution' reflects her in-depth exploration into nuclear reaction calculation models, the utilization of a simulation toolkit based on C++ programming, and familiarity in data analysis tools. She complemented her studies with a one-year internship at a cancer center in Kerala during her master's program.

Now based at the Cockcroft Institute/University of Liverpool in the UK, Farhana investigates *Laser-driven Proton Beam Therapy* as a potential application with important health, economic and social impact. Farhana's research focuses on the concepts of using a laser to drive the creation of a large flux of protons or light ions which are captured and formed into a beam by strong-focusing plasma lenses. A laser-driven source allows protons and ions to be captured at energies significantly above those that pertain in conventional facilities, thus evading the current space-charge limit on the instantaneous dose rate that can be delivered. Beam physics and plasma simulation studies that target minimizing the beam's divergence, energy spread, and provide stable intensity pulse-to-pulse. Moreover, the project will explore the use of gas jet technology for characterizing charged particle beams.

Beyond her academic pursuits, Farhana finds solace in creative expressions during her free time. She likes to write poems, read books, and listen to soft music.

Phani Deep Meruga

Phani Deep Meruga graduated in Electronics Engineering from Sapienza University of Rome, Italy in 2023. He worked at CERN as a technical student mainly on the energy characterization of the Linac3 lead beam, with dedicated measurements in the Linac3 to LEIR transfer line, or by means of Schottky spectrumanalysis in LEIR.

He summarized the work at CERN within his master's thesis "Stripper foil characterization from beam energy measurement in the Low Energy Ion Ring at CERN". The outcome of his work has been published in the International Particle Accelerators Conferences proceedings in 2022 and 2023, marking his first contributions to the accelerator community.

Within EuPRAXIA^{DN}, Phani is based at I-Tech in Slovenia, working on the *Development and Validation of an X-band Low Level Radio Frequency (LLRF) prototype for EuPRAXIA*. He will develop a prototype for an X-band LLRF system, tailored to address the challenging requirements of the EuPRAXIA@SPARC_LAB application. Once confirmed on a real test-bench, the prototype will be used as a starting point for the industrialization into a commercial instrument.

Apart from academics, in leisure time Phani enjoys cooking and also loves travelling.

Alex Whitehead

Alex was born in Finland and grew up in France. He studied at the Université Paris-Saclay and is also a graduate from the GI-PLATO master's program. In his research, he performed charge measurements using a Turbointegrating current transformer during different experiments. He graduated in 2022 with a thesis on "Charge measurement tests of accelerated electron sources by laser-plasma interaction".

Alex works on the *Optimization of Final Laser Beam Focus for LWFA* at ELI-ERIC's ELI-Beamlines Facility in Dolní Břežany, Czech Republic. His project focuses on the study of laser-plasma Interaction in a high repetition rate regime. His research is divided between developing diagnostics on a high-power repetition rate OPCPA laser system and producing a set-up of controllable and repeatable plasma channel in the high repetition rate regime.

Alex likes to spend his free time on sport activities, in particular football. He also likes to spend time with his family and friends. He loves travelling to discover new cities and countries.

EuPRAXIA^{DN} Fellow reaches out as part of British Science Week

British Science Week ran from the 8th to 17th March this year and as ever many science outreach events were arranged to coincide with this. The Victoria Gallery and Museum, which is part of the University of Liverpool, organised an event on Saturday 16th of March aimed at the visitors who would normally visit at a weekend who are mainly family groups. Researchers from across the university were invited to display an activity about their research at this event.

EuPRAXIA^{DN} fellow Andrés Levia Genre, during his secondment in Liverpool, attended this outreach event along with University of Liverpool LIV.INNO student Qiyuan Xu to talk to the visitors about the 'Physics of Particle Accelerators'. They took lots of hands on demonstrations with them including the Surfatron, which shows how sub-atomic particles can be accelerated using electromagnetic waves, and the Gauss rifle which uses magnetic fields to accelerate a particle. Electromagnetic fields are used in real particle accelerators to both accelerate and steer the beam. Within EuPRAXIA^{DN}, Andrés studies "THz-driven Dielectric Accelerators (DLAs)" and is usually based at the University of Pécs in Hungary.

The event attracted almost 500 people over the course of the day with lots of positive feedback received from those who participated. Andrés and Qiyuan were also both very positive about their experience. Andrés said "It was a challenging yet rewarding experience. It was hard to communicate our goal to the youngsters. On the other hand, the children were very active and curious in their participation. As a scientist, it is heart-touching to see that the event attracted almost 500 people over the course of the day with lots of positive feedback received from those who participated."

Qiyuan (left) and Andrés (right) at the British Science Week event (Credit: Andrés Levia Genre)

>>> Partner Updates

High-power diode laser stacks with high duty cycle

High-power diode laser stack

Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH) has partnered with TRUMPF, LayTec and Finetech to develop innovative high-power diode laser stacks with both very high duty cycle and optical power as well as with low fabrication cost (high yield).

The collaboration takes place in the frame of the recently launched project HOTSTACK, a "ProFIT Innovation" project co-financed from 2023 - 2025 with funds from the European Fund for Regional Development (ERDF) Berlin.

The HOTSTACK project, coordinated by TRUMPF, addresses the need for stacked arrays of diode lasers to pump the new generation of pulsed solid-state lasers of the highest energy class.

The project will realize two types of high-power diode laser stacks as research prototypes. The development of “Type 1” stacks (industrial design) is aimed at the emerging secondary source industry and will realize an especially cost-effective and well-developed industrial design. Specifically, project partner TRUMPF targets increasing the average pump power per stack by a factor of around 20 compared to current systems, via higher pulse repetition frequency and the higher optical pulse power. Parallel research efforts by project partner Finetech into new die bonding technologies and production automation should also drastically reduce manufacturing costs.

In addition, “Type 2” stacks (research design) will be developed, supporting research into the next generation of innovative laser systems of the highest energy, like the ones required for the EuPRAXIA facility. The aim is to increase the average pump power by a factor of 100. The work on this will mainly take place at the Ferdinand-Braun-Institut.

Diode laser are needed in high volumes for high-energy-class laser systems, but are produced using complex manufacturing processes such as epitaxial growth, III-V wafer structuring and etching processes, and reliable process control is essential for understanding and controlling the manufacturing process. Therefore, project partner LayTec (in cooperation with the FBH) will develop innovative integrated optical analysis techniques for both III-V epitaxial growth and wafer process technology, that are intended to improve process understanding and control for such structures. The innovative control methods target greatly increased diode laser fabrication yield, and hence are anticipated to directly enable a highly-cost-effective diode laser fabrication, as needed to support large high energy laser systems.

Learn more about the project on the website: https://fbhlink.de/30kw

CAS40 - A look back at forty years CERN Accelerator School

Research infrastructures require the world to work together on the design, construction, operation and subsequent optimization of these facilities to fully exploit their discovery potential. Scientists and engineers are working together across country borders, research disciplines, building bridges also between cultures, genders and generations. Sharing knowledge enables collaborations among researchers, leading to the formation of new ideas and research projects.

The first CAS course in October 1983 "Antiprotons for colliding beam facilities" being introduced by Kjell Johnson, with Simon van der Meer in the front row. (Credit: CERN PhotoLab 300-10-83)

These are the ideas that brought up the first course of the CERN Accelerator School (CAS) forty year ago, in October 1983. Held at CERN, the course had the purpose of the communication of deep knowledge and the cultivation of teamwork during an era when significant progress could still be achieved by a single inventive scientist.

Four decades ago, the landscape of accelerator physics was vastly different from today's high-tech reality. Communication relied on telephones, faxes, and letters, with information primarily found in published books or conference proceedings.

Lectures at that time were based on hand-written transparencies, sometimes pictures and sketches, or transparency copies from books.

A key factor to the school's success has been its innovative educational approach and the flexibility to adapt to new learning processes. Participants attend lectures delivered by selected lecturers, including some of the world's foremost experts in accelerator physics, who willingly share their knowledge and insights in an engaging and accessible manner.

CERN celebrated this special anniversary with a special CAS40 Week in September 2023, which featured a diverse range of activities. The central point of engagement was the CAS stand, strategically positioned in Restaurant 1, which showcased the school's history, achievements, and its mission to advance accelerator technology education. This visual display was not only informative but also served as a conversation starter for attendees interested in the world of particle accelerators and their applications.

CAS40 Week aimed to create an atmosphere for professionals, researchers, and enthusiasts to exchange ideas and celebrate achievements in accelerator technology and education (Credit: CERN)

A particularly exciting highlight of CAS40 Week was a special concert, organized in collaboration with the CERN Music Club. (Credit: CERN/ Noemi Caraban)

A particularly exciting highlight of CAS40 Week was a special concert scheduled for the 14th of September during lunchtime. This concert, organised in collaboration with the CERN Music Club, promised to be a celebration of both the school's milestone and the power of networking within the CERN research community.

Another event in January 2024 honoured the dedicated lecturers, hands-on professionals and collaborators that come to CAS from CERN and from various institutes worldwide who have contributed all these years. A special award went to Piotr Kowina, from GSI and to Massimo Ferrario, from INFN.

Many of the current lecturers at CAS were once students and newcomers themselves. Now, they are recognised professors with successful careers and continue supporting the school and its specialised group of lecturers.

https://videos.cern.ch/record/2299491

Prof Carsten P Welsch, Head of the Accelerator Physics Cluster at the University of Liverpool, said: "I had the pleasure of joining several CAS at the start of my career, before becoming a CAS lecturer years later. The fantastic atmosphere found at each School made it much easier to learn the, at times very difficult, material. The schools were undoubtedly key for fascinating me for the world of accelerators. A number of the friendships I made at CAS have become excellent scientific collaborations and large-scale projects. Happy birthday, CAS!"

Over CAS' 40 year-long history, more than 6000 accelerator students and professionals have been trained, over a hundred accelerator schools have been held, and over forty publications have been carefully and rigorously compiled. Many of its alumni have gone on to play crucial roles in the development, construction, and operation of particle accelerators around the world.

Today, any new accelerator is the result of international collaborations featuring many individual contributions. CAS promotes this development concept by fostering collaboration right from the start of the initial courses, ensuring that students engage in teamwork and maintain the connections forged during the courses throughout their careers.

More information can be found here:

https://cerncourier.com/a/40-years-of-accelerating-knowledge/

https://acceleratingnews.eu/news/issue-46/communication-outreach-aco/ramping-cern-accelerator-school

Pierluigi Campana new coordinator of the EuPRAXIA ESFRI and PP projects

EuPRAXIA is the first European project that develops a dedicated particle accelerator research infrastructure based on novel plasma acceleration concepts and laser technology. The preparational phase project EuPRAXIA-PP will serve a central role in the overall implementation plan of EuPRAXIA as a truly European Research Infrastructure.

Dr Pierluigi Campana (Credit: INFN-LNF)

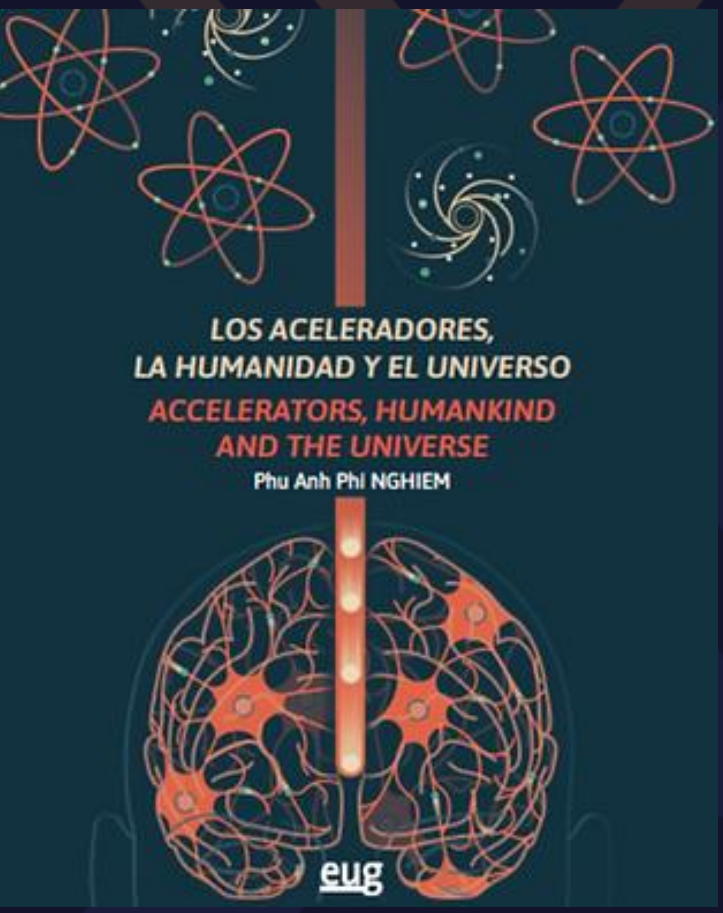
Dr Pierluigi Campana takes over the coordinator roles from Dr Ralph Assmann, who has been leading the EuPRAXIA idea and collaborations since 2013, when the concept for such a European advanced accelerator facility was conceived at the 1st European Advanced Accelerator Workshop at Elba, Italy. Dr Assmann developed the idea into an EU funded Design Study (EuPRAXIA-DS) which ran from 2015 to 2019, delivering the conceptual design report of the EuPRAXIA facility. Subsequently he prepared and led the successful application to the government-endorsed roadmap of the European Strategy Forum of Research Infrastructures (ESFRI) and for a Preparatory Phase project (EuPRAXIA-PP). Ralph Assmann says: “It has been a privilege to promote and to develop the EuPRAXIA idea together with all our supporters in Europe and internationally over the last decade. Now it is time for me to move on to a new leadership position in German science at GSI/FAIR but I will remain connected scientifically to EuPRAXIA. I have known Dr Campana from years of intense collaboration, and it is excellent to see our project in the hands of such an outstanding scientist and leader.”

Dr Pierluigi Campana is an experimental high-energy physicist with extensive experience in the field of particle detectors. His research career began at Frascati National Laboratory of INFN. He participated in the ALEPH experiment at the CERN LEP accelerator and later in the KLOE experiment at DAFNE at LNF. Since 2002, he has been a member of the LHCb collaboration at the CERN Large Hadron Collider and served as the spokesperson from 2011 to 2014. In 2015, he was appointed Director of the National Laboratories of Frascati, a position he held until 2020 when he was appointed as a member of the Ministry of University and Research in the INFN Executive Board, a position held until the end of 2023.

Since 2021, Dr Campana is the Italian Delegate in ESFRI and in January 2024 he was appointed as chair of the International Committee for Future Accelerators (ICFA). Dr Massimo Ferrario, Deputy Project Coordinator, said: “Pierluigi Campana knows the EuPRAXIA project from the inside out since its start. He has accompanied it in his various roles, has attended many of our meetings and is one of our strongest supporters. In the view of both of us he is an excellent candidate and will be an outstanding coordinator, bringing in his knowledge of EuPRAXIA, his senior management experience and his international standing.”

“With EuPRAXIA we are trying to activate a strong network among the most important European Labs active in accelerators, high power lasers and plasma advanced technologies, not only to foster R&D in the field, but also to cooperate in building two European sites devoted, respectively, to plasma acceleration with beams and with lasers, and a series of nodes of excellence in specific technologies.” points out Dr Campana, “Entering the ESFRI 2021 Roadmap is rapidly stimulating this integration process, making EuPRAXIA a pivotal example of a distributed research infrastructure in the field of novel technologies, in strong connection with European high-tech companies. I’m honoured to take the lead from Ralph Assmann, who conceived the program in 2015.”

Accelerators, Humankind and the Universe



Accelerators are wonderful tools at the service of science and society and they deserve to be better known by the general public. This is what inspired Phu Anh Phi Nghiem to write the book "Accelerators, humankind and the Universe" which contains, in the words of the author, "a reflection on the physics of accelerators… and the nature of Nature."

The book gives an overview of the science and applications of particle accelerators, with an accessible language and engaging style.

Phu Anh Phi Nghiem is a distinguished scientist from the EuPRAXIA collaboration at Commissariat à l'énergie atomique et aux énergies alternatives (CEA), where he conducts scientific research in the fields of plasma physics, astrophysics and accelerator physics.

The book, originally published in French by EDP-Sciences in 2023, has now been translated into Spanish and English. The bilingual English – Spanish version has just been published by Editorial Universidad de Granada – Spain.

Phi says, "Particle accelerators deserve to be better known by each one of us, citizens, and protagonists of the future of our countries and our societies. And this can only be achieved by striving to go beyond scientific language -which is universal, but flooded with a jargon that only specialists can understand- to get as close as possible to common, local and, therefore, polysemic speech, a speech that is nevertheless understood by a greater number of people and even capable of making them "feel". Hence the importance of reporting scientific achievements in the vernacular of each country."

In eleven short chapters, beautifully illustrated by Mara-Flore Dubois, the book gives an overview of the science and applications of particle accelerators, with an accessible language and engaging style. In this book, Phi does not shy away from dwelling into the most personal and human aspects of scientific research, trying to provide an answer to perhaps the most profound question that a layperson can ask a scientist, "Why do you do what you do?"

The book can be accessed here:

https://www.eupraxia-pp.org/_files/ugd/3693ce_458dfb910f454884b1ab26530782c919.pdf

Reference:
Los aceleradores, la humanidad y el Universo – Accelerators, humankind, and the Universe. Phu Anh Phi Nghiem. Editorial Universidad de Granada, Spain (2024)

»»Selected Publications

FLASH Radiotherapy: Expectations, Challenges, and Current Knowledge

A. Borghini, Andrea; L. Labate; S. Piccinini; C. M. V, Panaino; M. G. Andreassi and L. A. Gizzi.

Int. J. Mol. Sci. 2024, *25*(5), 2546

https://doi.org/10.3390/ijms25052546

Abstract: Major strides have been made in the development of FLASH radiotherapy (FLASH RT) in the last ten years, but there are still many obstacles to overcome for transfer to the clinic to become a reality. Although preclinical and first-in-human clinical evidence suggests that ultra-high dose rates (UHDRs) induce a sparing effect in normal tissue without modifying the therapeutic effect on the tumor, successful clinical translation of FLASH-RT depends on a better understanding of the biological mechanisms underpinning the sparing effect. Suitable in vitro studies are required to fully understand the radiobiological mechanisms associated with UHDRs. From a technical point of view, it is also crucial to develop optimal technologies in terms of beam irradiation parameters for producing FLASH conditions. This review provides an overview of the research progress of FLASH RT and discusses the potential challenges to be faced before its clinical application. We critically summarize the preclinical evidence and in vitro studies on DNA damage following UHDR irradiation. We also highlight the ongoing developments of technologies for delivering FLASH-compliant beams, with a focus on laser-driven plasma accelerators suitable for performing basic radiobiological research on the UHDR effects.

Guiding of Charged Particle Beams in Curved Plasma-Discharge Capillaries

R. Pompili; M. P. Anania; A. Biagioni, M. Carillo; E. Chiadroni; A. Cianchi; G. Costa; A. Curcio; L. Crincoli; A. Del Dotto; M. Del Giorno; F. Demurtas; A. Frazzitta; M. Galletti; A. Giribono; V. Lollo; M. Opromolla; G. Parise; D. Pellegrini; G. Di Pirro; S. Romeo; A. R. Rossi; G. J. Silvi; L. Verra; F. Villa; A. Zigler and M. Ferrario.

Phys. Rev. Lett. 132, 215001

https://doi.org/10.1103/PhysRevLett.132.215001

Abstract: We present a new approach that demonstrates the deflection and guiding of relativistic electron beams over curved paths by means of the magnetic field generated in a plasma-discharge capillary. We experimentally prove that the guiding is much less affected by the beam chromatic dispersion with respect to a conventional bending magnet and, with the support of numerical simulations, we show that it can even be made dispersionless by employing larger discharge currents. This proof-of-principle experiment extends the use of plasma-based devices, that revolutionized the field of particle accelerators enabling the generation of GeV beams in few centimeters. Compared to state-of-the-art technology based on conventional bending magnets and quadrupole lenses, these results provide a compact and affordable solution for the development of next-generation tabletop facilities.

Filamentation of a relativistic proton bunch in plasma

L. Verra et al. (AWAKE Collaboration)

Phys. Rev. E 109, 055203

https://doi.org/10.1103/PhysRevE.109.055203

Abstract: We show in experiments that a long, underdense, relativistic proton bunch propagating in plasma undergoes the oblique instability, which we observe as filamentation. We determine a threshold value for the ratio between the bunch transverse size and plasma skin depth for the instability to occur. At the threshold, the outcome of the experiment alternates between filamentation and self-modulation instability (evidenced by longitudinal modulation into microbunches). Time-resolved images of the bunch density distribution reveal that filamentation grows to an observable level late along the bunch, confirming the spatiotemporal nature of the instability. We provide a rough estimate of the amplitude of the magnetic field generated in the plasma by the instability and show that the associated magnetic energy increases with plasma density.

The EuPRAXIA Files

The EuPRAXIA Files is a collection of publicly available abstracts of published articles that are relevant to the EuPRAXIA project. Putting together the latest research in plasma accelerators, the aim is to facilitate the work of the many researchers involved in EuPRAXIA and to highlight the scientific outcomes of the various projects supporting the initiative.

The latest EuPRAXIA Files Issue 12 and previous issues can be accessed here: https://www.eupraxia-pp.org/research-resources


THE EuPRAXIA FILES

ISSUE 12 - May 2024

FOREWORD FROM THE COORDINATOR

A new issue of the EuPRAXIA Files is presented here, collecting the most relevant books and papers recently appeared in literature about accelerators, lasers and plasma science and strictly correlated with technologies that will be used at EuPRAXIA. I present the Files with particular pleasure, as in March, the EuPRAXIA Collaboration Board choose me as the new EuPRAXIA ESFRI Preparatory Phase Project Coordinator, succeeding to Ralph Assmann, which has lead the Collaboration since the early Design Study in 2015, moved to a prestigious position at GSI-FAIR Laboratory. To Ralph we convey all our gratitude for the nearly 10 years of effective and high-level running of the EuPRAXIA dream.

Together with him, I share this dream, to setup a network of brilliant people across Europe, to foster an ESFRI infrastructure for advanced particle acceleration, in the field of accelerators, lasers and plasma technology, based on two "physical" pillars (two beam-driven and laser-driven FELs) and on a set of clusters of excellence around the most important European Laboratories.

The EuPRAXIA files is an intelligent and clever way to make this network effective, looking after the many successes and new ideas in the field. A big thanks to the authors.

I wish you a fruitful reading,

Pierluigi Campana

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⋙ Job Opportunities

Open positions at the University of Liverpool/The Cockcroft Institute:

MSCA Doctoral Fellowships

These Fellowships enhance the creative and innovative potential of researchers holding a PhD and who wish to acquire new skills through advanced training, international, interdisciplinary and inter-sectoral mobility. MSCA Postdoctoral Fellowships will be open to excellent researchers of any nationality.

The scheme also encourages researchers to work on research and innovation projects in the non-academic sector and is open to researchers wishing to reintegrate in Europe, to those who are displaced by conflict, as well as to researchers with high potential who are seeking to restart their careers in research.

Application deadline 11th September 2024. For further information, please contact Prof Carsten P. Welsch (carsten.welsch@cockcroft.ac.uk).

>>> Notice Board

EuPRAXIA Doctoral Network

Selection of Events	
23 – 27 Sept 2024	EuPRAXIA Workshop, Isola d'Elba, Italy
March/April 2025	EuPRAXIA^{DN} Camp I – Technologies, Pisa, Italy
June/July 2025	EuPRAXIA^{DN} Camp II – Science, Lisbon, Portugal

Help us communicate interesting events, updates and latest R&D in plasma accelerator physics and send us your news and updates.

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