

Recreating the experience maintaining the standards



Particle and photon beams are the quintessential probes of matter over a vast range of length and energy scales, from the dimensions of cancer cells, that they can destroy with exquisite precision, to fundamental phenomena a trillion times smaller, revealed in collisions at the LHC. Progress in many fields of science, technology and medicine is driven by the continuing construction, exploitation and improvement of particle accelerators, large and small, across the world.

JUAS has been meeting the need to train specialists in the physics, technology and applications of particle accelerators since 1994. Courses are given by experts from CERN and other major European accelerator laboratories. They are recognized for credits towards master's and PhD degrees in our network of Partner Universities.

Our alumni play key roles in research laboratories and technology companies throughout Europe and beyond.

For the second year running, JUAS 2022 took place in the shadow of the global pandemic, and it was once again decided not to risk bringing the students into residence at Archamps. Building on the 2021 online programme implemented under the coordination of John Jowett, several changes were made to take into account the feedback of students and lecturers.

These included preparatory videos on fundamentals, additional slots for core topics and new seminars and the use of a specialised platform to manage the exams.

The JUAS Advisory Board, meeting face-to-face in May at La Sapienza university in Rome, acknowledged the successful implementation of the school with final exam results very similar to previous years, confirming that academic standards were maintained, despite the remote format.

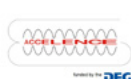
True to the ethos of the particle accelerator community, JUAS is a collaborative enterprise. Our heartfelt thanks go to the faculty, their assistants, and moderators, to the members of the Advisory Board and to the team at ESI. Colleagues at CERN, the ALICE experiment, ESRF, PSI, Synchrotron Soleil, Bergoz and HUG once again displayed remarkable ingenuity in recreating visits, seminars, and interactive laboratory work in an online format.

Dr. Elias Métral
JUAS DIRECTOR

- ● ● Course 1 - The Science of Particle Accelerators
- ● ● Course 2 - The Technology & Applications of Particle Accelerators

SPONSORS

JUAS would not be able to function without the financial and/or in-kind support it receives from a range of facilities, companies and research programmes.





The European Scientific Institute was founded as a French non-profit organisation in 1994 at the initiative of CERN-based physicists in order to develop high level training courses on technologies developed at CERN, the world's largest particle physics laboratory.

Located on the French-Geneva border, ESI organises thematic postgraduate schools with an extensive network of partner universities on the science, technology and applications of particle accelerators and detectors. More recently ESI has developed a series of summer schools in partnership with Université Grenoble-Alpes in the fast-moving area of digital health.

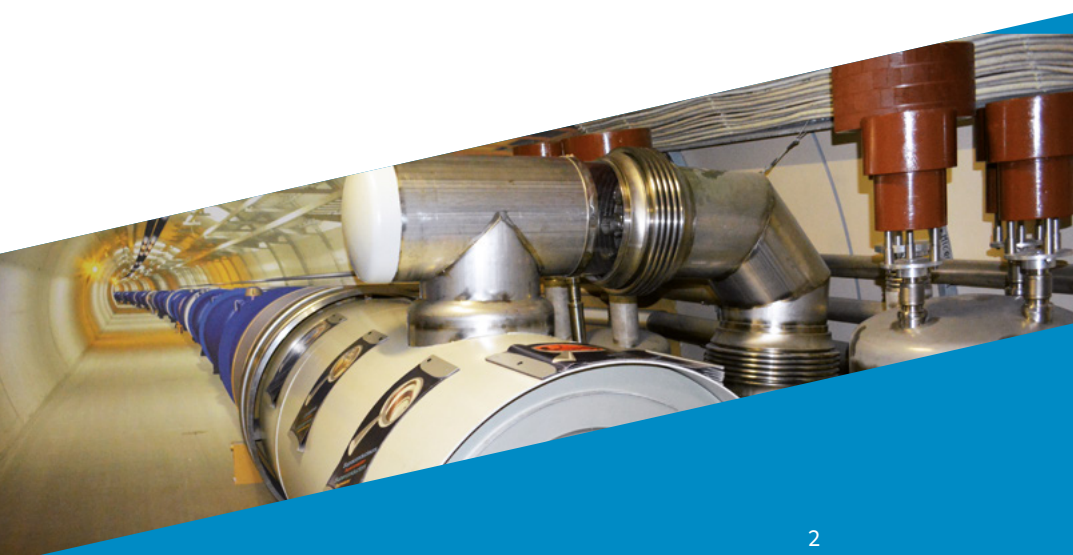
ESI's schools attract an international audience of post-graduate students and early-career professionals. Since its creation, ESI has delivered high level teaching and training to more than 3 000 young scientists from over 60 countries.

www.esi-archamps.eu

ESI IS SUPPORTED BY :



PARTNER UNIVERSITIES





Pre-requisite videos, including materials developed by the ARIES project, were posted on INDICO to be viewed prior to the start of the school. Mandatory topics covered Electromagnetism, Special relativity, Python and Hamiltonian formalism. Additional videos included introductions to particle accelerators and their applications, radiofrequencies, and applications of Hamiltonian formalism. Virtual visits of S-Dalinac, LEIR and the ALICE experiment at the CERN LHC were also made available. A “What to remember” session was scheduled during the first day. Core lectures were given by live video-conference including tutorials, practical exercises and quizzes. Most sessions involved a moderator in charge of managing questions and providing additional support to the lecturer.

CORE TOPICS

(84 HOURS)

Special Relativity,
electromagnetism, classical
and quantum mechanics:
What to remember for particle
accelerators

Elias Métral
(CERN)

Transverse Beam Dynamics
(Exam subject)

Bernhard HOLZER
(CERN)

Longitudinal Beam Dynamics
(Exam subject)

Alexandre LASHEEN
(CERN)

MADX

(Intro & Workshop)
Nuria FUSTER MARTINEZ
(CERN)

PyHeadTail

(Intro & Workshop)
Benoît SALVANT
(CERN)

Transverse Linear Imperfections
(Exam subject)

Hannes BARTOSIK
(CERN)

Linacs
(Exam subject)

David ALESINI (INFN)

Synchrotron Radiation
(Exam subject)

Rasmus ISCHEBECK (PSI)

Transverse Nonlinear Effects
(Exam subject)

Hannes BARTOSIK
(CERN)

Accelerator Design
& Design Workshop

Bastian HÄRER (KIT)
& Adrian OEFTIGER (GSI)

Collective Effects (mainly Space
Charge & Instabilities)

Mauro MIGLIORATI
(UNI. ROME LA SAPIENZA)

Cyclotrons & FFAs

Bertrand JACQUOT
(GANIL)

Injection / Extraction

Nicola CARMIGNANI
(ESRF)

“ JUAS enabled me to have
contact with many accelerator
specialists, which gave me
a great overview of these
machines at a general level.
This is so important for
someone like me who intends
to make my career in particle
accelerators ”

Cristóbal Miguel
García Jaimes
PHD, EPFL (SWITZERLAND)

“ JUAS allowed me to enter my
PhD without any gaps and with
a high level of preparation. The
lectures, although online, were
carried out in an excellent way
with teachers who were able to
make us passionate about the
subjects ”

Enrico Manosperti
PHD, UNIVERSITAT POLITÈCNICA
DE CATALUNYA (SPAIN)

Course 1

An essential part of JUAS is the programme of specialist seminars, traditionally given by invited speakers at the end of the school day or during visits of accelerator facilities. Course 1 seminars aim to give participants an opportunity to broaden their vision of large-scale accelerators as they exist today and how they may look tomorrow.

SEMINARS (8H15)

Particle Accelerators in the 21st Century

Maurizio VRETENAR
(CERN)

CERN & its Accelerator Complex

Reyes ALEMANY FERNANDEZ
(CERN)

Colliders

Elias MÉTRAL, Oliver BRÜNING, Massimo GIOVANNNOZZI, Louis RINOLFI, Daniel SCHULTE, Frank ZIMMERMANN (CERN) & Todd Satogata (JEFFERSON LAB)

Transverse nonlinear manipulations

Massimo GIOVANNNOZZI (CERN)

Nuclear collisions at the LHC

John JOWETT (CERN)

Beam-based impedance measurements

Nicolo BIANCACCI
(CERN)

Novel High-gradient Particle Accelerators

Ralph ASSMANN
(DESY)

CERN Liu Project/ Beam dynamics aspects & solutions

Giovanni RUMOLO (CERN)

Free-electron Lasers

Eduard PRAT(PSI)

“ As a student with a background in electronic engineering, it was a great experience to learn all about accelerator physics. The course covers all the fundamentals as well as real-life applications in the field. The highlight for me was the accelerator design workshop. ”

Adnan Kurtulus

PHD, ETHZ (SWITZERLAND)

VIRTUALS VISITS (3H45)

One of the particular challenges of the remote format was to maintain the highly popular visits of accelerator facilities.

Participants were appreciative of the efforts deployed by their virtual tour guides, despite occasional technical glitches such as poor connectivity in an accelerator tunnel.

CERN LEIR Accelerator

Nicolo Biancacci (INFN)

ALICE Experiment at the CERN LHC

John Jowett (CERN)

European Synchrotron Radiation Facility

Jean-Luc REVOL (ESRF)

“ My experience at JUAS course 1 was really positive. I had the chance to learn from really well-prepared professors who were always available for insights/extra explanations. Despite the remote format, the school gave me the possibility to know other realities in the accelerator world and to meet many interesting people with similar aspirations ”

Angelica De Gregorio,

PHD, UNIVERSITÀ DI ROMA LA SAPIENZA (ITALY)

Course 1 in figures

5
INTENSIVE
weeks

13 lectures - 3 workshops
9 seminars - 3 virtual visits

27
faculty
members

from 8 Universities / Institutions

34
Participants

27
MALES

8 Master students
21 PhD students
5 Professionals

7
FEMALES

14
nationalities

from 21 different
Universities /
Institutions

(27 took the exams)

IPAC prize

IPAC is the leading international event for the worldwide accelerator community and industry. IPAC'22 took place in Bangkok in June, following two online editions due to the COVID pandemic. It is a unique opportunity to meet, interact and network with accelerator scientists, engineers, students and companies. Thanks to a long-standing agreement between JUAS and the conference organisers, each year the JUAS-IPAC award is attributed to the first-ranked student of Course 1. The award takes the form of a bursary which covers conference fees, travel and accommodation.

Thanks to the organisers' generosity, it was not one but two JUAS laureates who were able to travel to Bangkok: Pablo Martinez Reviriego, PhD student from Universitat de Valencia (who was ranked best student at JUAS 2021) and his JUAS 2022 counterpart, Philipp Niedermayer, PhD at Goethe Universität Frankfurt and GSI Darmstadt.

Pablo and Philipp joined the director of JUAS, Elias Métral, to help him in promoting Europe's leading particle accelerator school during this event.

“ JUAS has played a crucial role in my training as a particle accelerator researcher. As well as providing me with a solid background in physics and engineering, it also put me in contact with many experts from different fields and colleagues I may work with in the future. In addition, thanks to JUAS I had the opportunity to attend IPAC 2022 in Bangkok, where I presented a poster on my work and listened to many fascinating talks. Besides, I was also able to visit an amazing country with a very interesting culture. ”

Pablo MARTINEZ REVIRIEGO

PHD AT INSTITUT DE FISICA CORPUSCULAR « IFIC » / UNIVERSITAT DE VALENCIA (SPAIN)



From left to right :
Elias Métral,
Philipp Neidermayer,
Pablo Martinez Reviriego



Course 2

The Technology & Applications of Particle Accelerators

14 FEBRUARY - 18 MARCH

In Course 2, on top of the full lecture programme, participants worked in groups to deliver reports on normal-conducting magnets workshops as well as giving an oral presentation on the CERN practical days. Both were marked and contributed to the final grade.

“ It was a one-of-a-kind experience, even though online. The people at ESI made us feel very welcome and went above and beyond to make it an exciting 5 weeks. A wide range of topics were covered and as a master student I was able to decide what field I wanted to pursue in future. ”

Abhishek Panchal

MASTER, INSTITUT POLYTECHNIQUE DE PARIS (FRANCE)

CORE TOPICS

(75 HOURS)

Introduction to CERN

Practical days

Jérémie BAUCHE, Vincent BAGLIN,
Fritz CASPERS (CERN)

Introduction to RF

Andrea Mostacci (LA SAPIENZA)

Normal conducting magnets (Exam subject) & Workshop

Thomas ZICKLER & Jérémie BAUCHE
(CERN)

Radio-Frequency (RF) engineering (Exam subject)

Christine VOLLINGER & Manfred WENDT
(CERN)

Superconductivity (intro) : RF vs. Magnets

Claire Antoine (CEA)

Cryogenics for superconducting devices

Philippe LEBRUN (CERN RET.)

PSI Accelerators Controls

Elke ZIMOCH (PSI)

Superconducting RF cavities

Fritz CASPERS (CERN RET.)

Vacuum systems (Exam subject)

Vincent BAGLIN & Roberto KERSEVAN
(CERN)

Superconducting magnets (Exam subject) & Workshop

Paolo FERRACIN (LBL)

Beam instrumentation (Exam subject)

Peter FORCK (GSI)

Particle sources (Exam subject)

Thomas THUILLIER (CNRS-IN2P3)

Accelerators for medical & industrial applications

Erik VANDERKRAAIJ &
Jérôme MANDRILLON (IBA)

PSI ProScan Introduction

Jacobus Maarten SCHIPPERS (PSI)

Low energy electron accelerators

Wim MONDELAERS (GHENT UNIVERSITY)

Survey & Alignment of Accelerators

Jean-Christophe GAYDE
(CERN)

High power proton linacs

Sébastien BOUSSON (CNRS-IN2P3)

Radiation safety

Xavier QUERALT (STFC)

Life cycle & operability of particle accelerators

Samuel MEYRONEINC (INSTITUT CURIE)

“ With experts and professors from CERN and universities all over Europe presenting their fields, densely but passionately, there is no better way of starting a career in particle accelerators in my opinion. ”

Ruben Heine

MASTER STUDENT, TU BERLIN
(GERMANY)

Course 2

Key features of Course 2 include visits of CERN and PSI and the two-day practical technology sessions organised at CERN and the half-day spent at the bench at Bergoz Instrumentation.

Thanks to all those who devoted time and energy to organising live-stream visits and virtual practicals, with the indelible memory of Rasmus ISCHEBECK conducting a Zoom session from his bike as he crossed the river Aare to enter the tunnel for a detailed explanation of the structure and workings of PSI's state-of-the-art facility.

SEMINARS (6H45)

Particle Accelerators, Instruments of Discovery in Physics

Philippe LEBRUN (CERN RET.)

Materials for SCRF Cavities : Beyond Niobium

Sergio CALATRONI (CERN)

Muon Colliders

Daniel SCHULTE (CERN)

Bench-impedance measurements & materials characterization

Nicolo BIANCACCI (CERN)

Energy Recovery Linacs

Michaela ARNOLD (TU DARMSTADT)

Radiation Oncology: Biology, Physics & Clinical

André DURHAM (HUG)

Accelerator-Driven Systems

Frederic BOULY (IN2P3)

Machine Learning

Jochem SNUVERINK (PSI)

Dielectric Laser Accelerators

Benedikt HERMANN (PSI)



I am very satisfied with the courses I followed and have already started to see the effect of them on the quality on my PhD work.

Lorenzo Crescimbeni

PHD, GOETHE UNIVERSITY FRANKFURT (GERMANY)

VIRTUALS VISITS & WORKSHOPS (15 HOURS)

CERN : AD ELENA, LINAC4, Thin-film coating facilities

Christian CARLI, Alessandra LOMBARDI, Jean-Baptiste LALLEMENT, Pedro COSTA PINTO & Wilhelmus VOLLENBERG

Paul Scherrer Institute

Rasmus ISCHEBECK, et al. (PSI)

Bergoz Instrumentation

Etienne TOUZAIN (BERGOZ)

Practical sessions at CERN (RF, Vacuum, Magnets)

Andrea MOSTACCI, Fritz CASPERS, Jérémie BAUCHE, Lucio FISCARELLI, Roberto KERSEVAN, Marton ADY, Berthold JENNINGER, Sophie MEUNIER (CERN)

JUAS opened new horizons for me in the world of particle accelerators, with amazing insights into their applications and also to virtually access the most important accelerator facilities in the world.

Lucio Crincoli

PHD, UNIVERSITÀ DI ROMA LA SAPIENZA (ITALY)

Course 2 in figures

5
INTENSIVE
weeks

19 lectures - 1 workshop
9 seminars - 5 virtual visits

36
faculty
members

from 13 Universities / Institutions

30
Participants

23
MALES

13 MSc students
12 PhD students
5 Professionals

7
FEMALES

11
nationalities

from 17 different
Universities /
Institutions

(22 took the exams)

juas ADVISORY BOARD

With the lifting of travel restrictions due to the COVID pandemic, the JUAS Advisory Board was able to meet face-to-face in Rome on 5 and 6 May with certain members connected by video conference over two half-days. In spite of the remote format, JUAS 2022 was considered to be a very successful edition with many improvements implemented including the prerequisite videos additional slots for certain topics and seminars, two exams already in the 3rd week and the specialised platforms used for the exams.

However, everybody is looking forward to a hoped-for return to face-to-face teaching for JUAS 2023 followed by the Advisory Board meeting at the University of Oxford, **on 17-18 April 2023**.



SAPIENZA
UNIVERSITÀ DI ROMA



UNIVERSITY OF
OXFORD

juas IN EUROPEAN PROGRAMMES

JUAS figures in two European Commission funded programmes.

Firstly as one of the year-2 electives in the Erasmus Mundus Joint Master LASCALA (Large Scale Accelerators and Lasers) : a two-year international master's programme, created by the universities of Paris-Saclay, Rome La Sapienza, Lund and Szeged, aimed at **training experts in the most advanced experimental and theoretical tools and concepts in accelerators physics, high power lasers, laser plasma interaction at high intensity**, as well as in **their applications related to new sources of energy, health, and security diagnostics**.



 **Lascala**
Erasmus Mundus Master

Secondly, in the H2020 project **I.Fast (Innovation Fostering in Accelerator Science and Technology)**, as one of the inspirations of the I.Fast Challenge Based Initiative **on "Particle Accelerators for the Environment "**, which was held at ESI-Archamps **from 26 July to 4 August 2022**.



SAVE THE DATE !

9 JANUARY TO 17 MARCH 2023



Course 1

The Science of Particle Accelerators

9 JANUARY – 10 FEBRUARY 2023



Course 2

The Technology & Applications of Particle Accelerators

13 FEBRUARY – 17 MARCH 2023

