

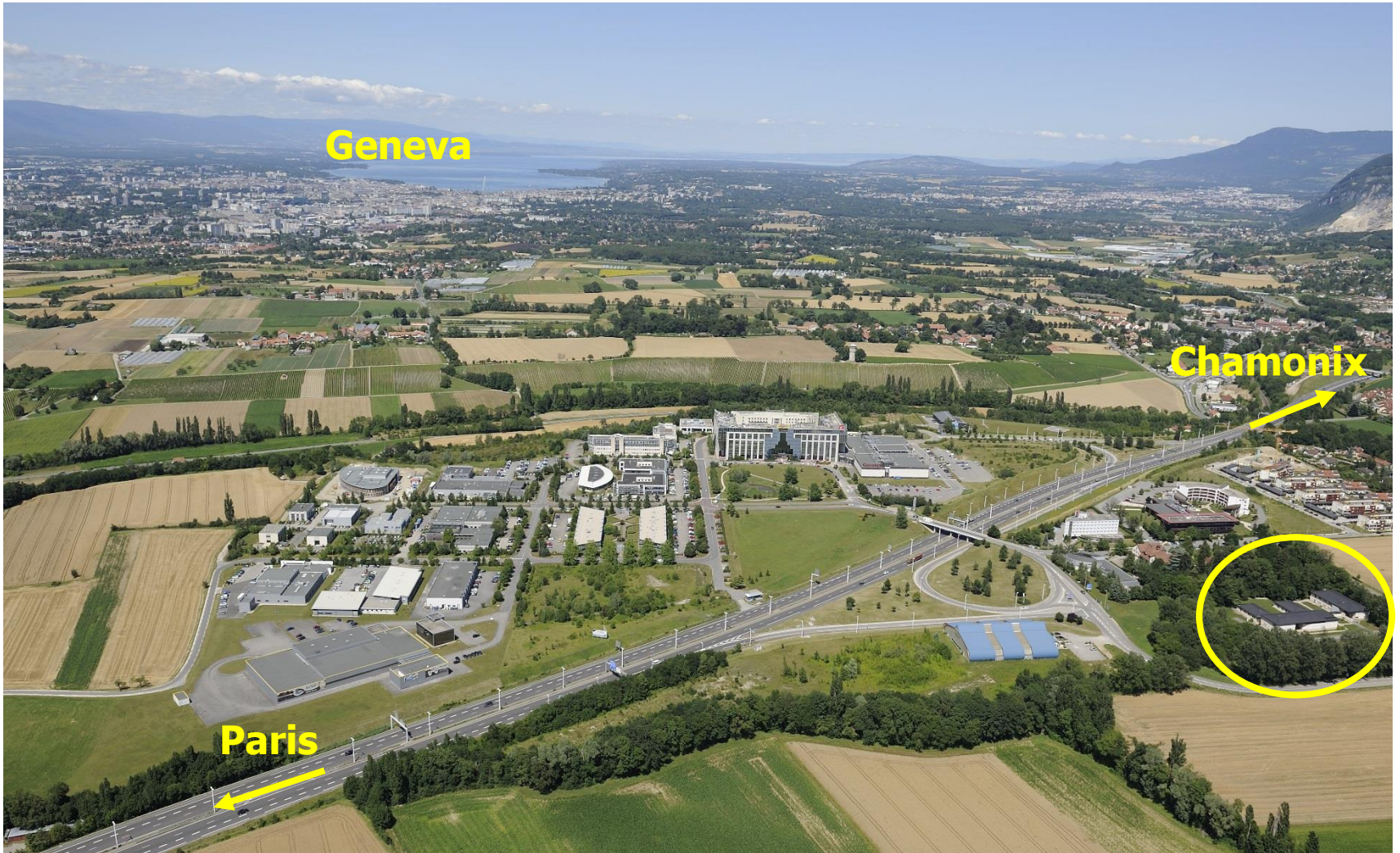
Welcome to JUAS 2019 Course 1

The science of particle accelerators

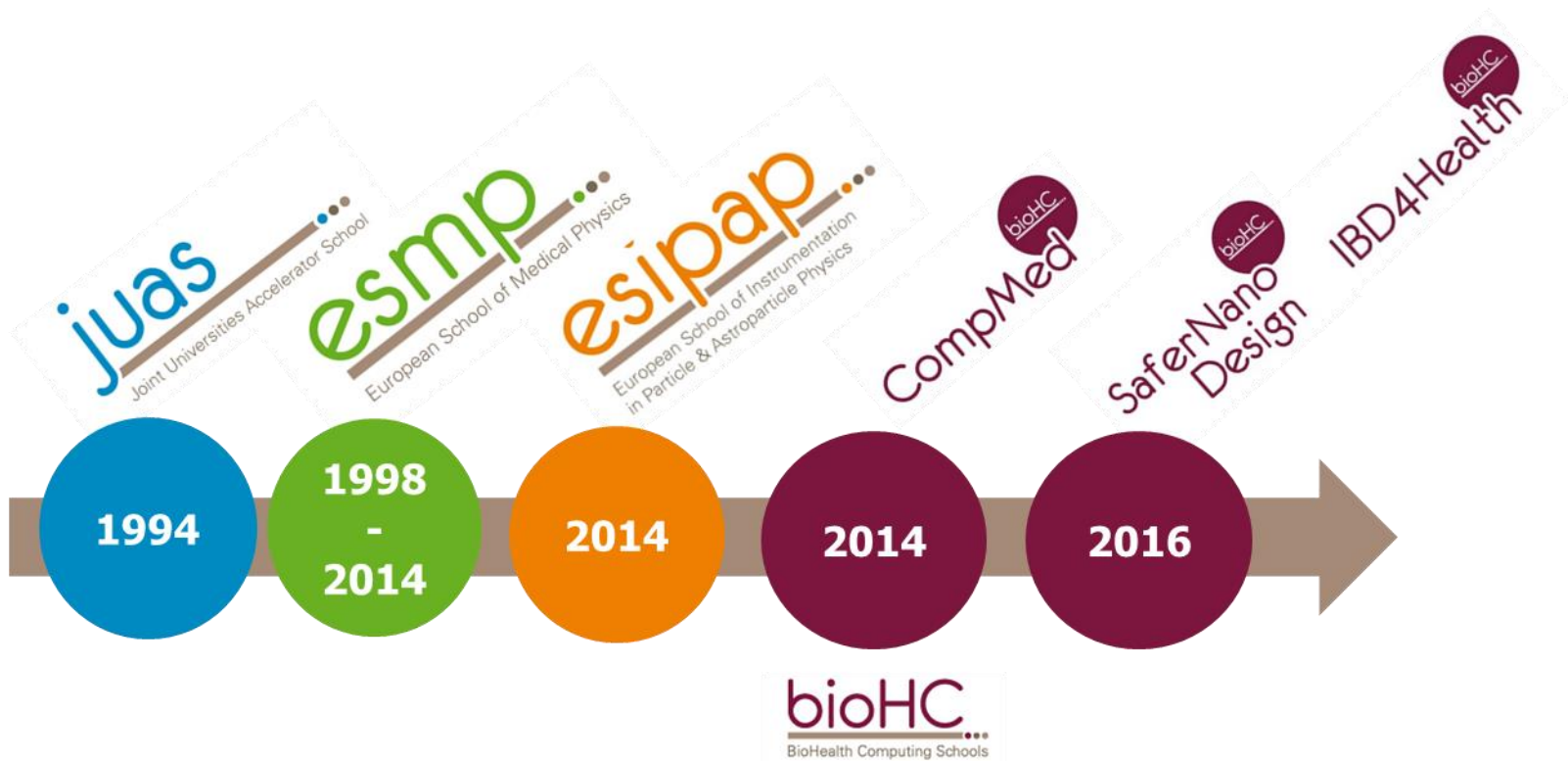
Philippe Lebrun
Director, JUAS

ESI Archamps Technopole
7 January 2019

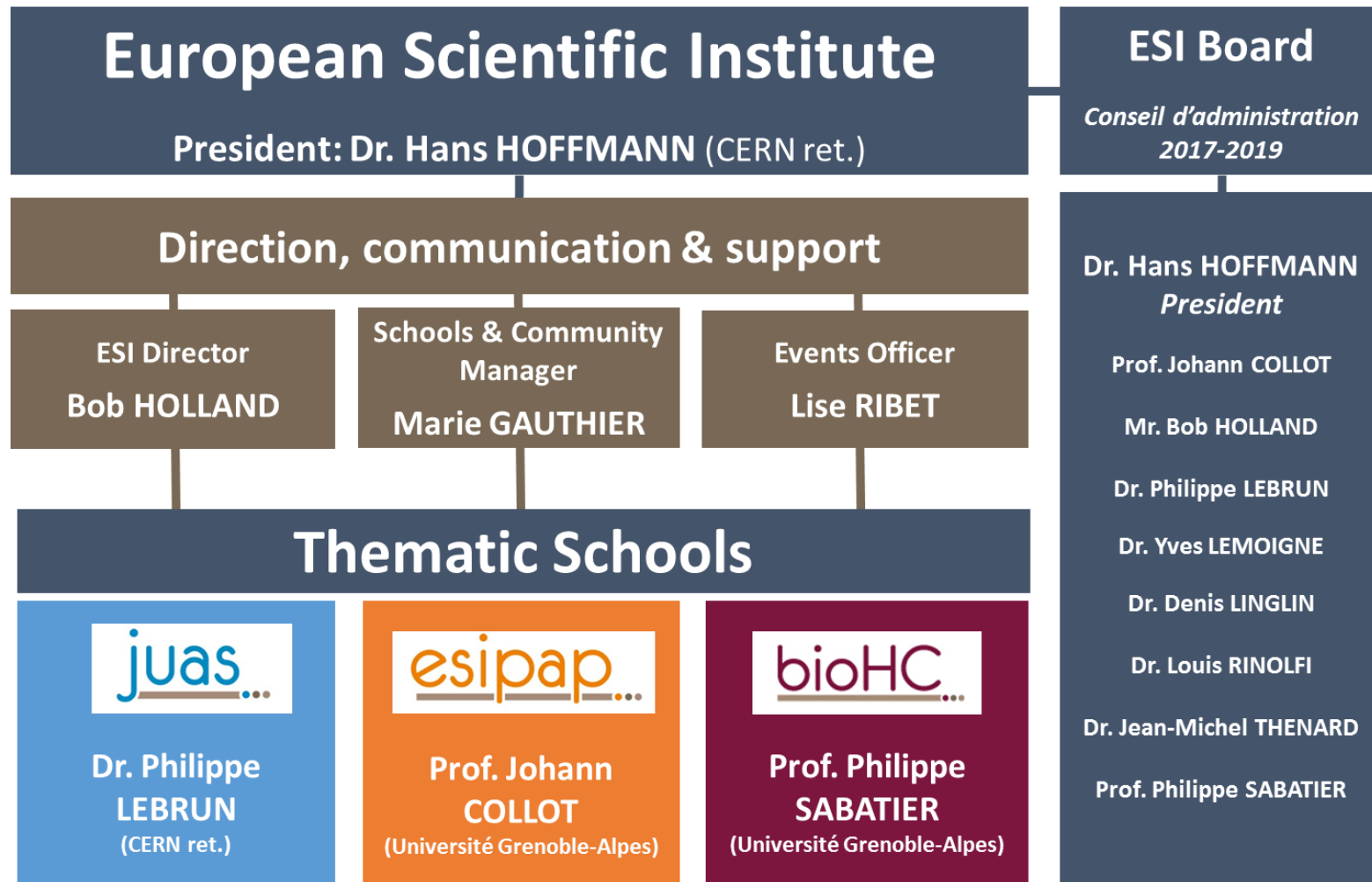
ESI Archamps Technopole, host of JUAS



ESI Scientific Schools



ESI Organization



JUAS mission

- Invented a century ago as instruments of basic science, particle accelerators have also become essential tools of applied science, engineering and medicine. There are today more than 30'000 particle accelerators in operation worldwide. Their design, construction and operation have developed into a specific domain of science and technology, resulting in a growing demand for training
- The mission of the Joint Universities Accelerator School (JUAS) is primarily to train graduate students from its Partner Universities in the science, technology and applications of particle accelerators
- For this purpose, JUAS holds two five-week courses yearly at the European Scientific Institute (ESI) in Archamps, taught by renowned experts from universities and laboratories and accredited by the Partner Universities:
 - A course on the Science of Particle Accelerators
 - A course on the Technology and Applications of Particle Accelerators
- Depending on the availability of places, JUAS also welcomes graduate students from other universities as well as professionals
- Additionally, JUAS contributes to knowledge dissemination and outreach in the field of particle accelerators

16 Partner Universities



24 Scientific and Industrial Partners



A brief history of JUAS

- Origins (1994)
 - Accelerator courses given by CERN staff at Université Joseph Fourier in Grenoble
 - Creation of ESI by Département de la Haute-Savoie (France)
- Previous directors
 - M. Rey-Campagnolle (founder)
 - J. Le Duff
 - F. Méot
 - L. Rinolfi
- More than 1000 students trained in 25 sessions of JUAS
- We have celebrated the 25th session of JUAS in 2018
- We celebrate the 25th anniversary of ESI in 2019

JUAS pedagogy

- Two courses, each 4 weeks + 1 week exams
 - *The science of particle accelerators*
 - *The technology and applications of particle accelerators*
- Expert lecturers from universities, national labs and CERN
- Lectures + tutorials + seminars + workshops + practical work + lab visits
- Syllabus and appointment of lecturers submitted to Advisory Board
- Lecture slides are available in INDICO prior to the lectures/tutorials
- No distribution of paper documents, except lecture write-ups when available
- Students are required to have a computer/tablet, get USB stick with memory space to download material
- «Refresher» lecture and tutorial documents available to students well before the course for personal work
- Written exams
- Oral presentations by students on design workshops and practical work

Prerequisites to JUAS Courses

- The JUAS courses are of graduate level (Master or Doctoral) and the students are expected to have knowledge of general physics at the Bachelor's level
- Prerequisites include elementary knowledge of
 - Special relativity
 - Electromagnetism
 - Nuclear physics
 - Mathematical methods of physics (vector analysis, vector spaces and matrices, differential & partial differential equations, Laplace & Fourier transforms)
 - Some knowledge of signal theory could also be useful
- Refresher courses and tutorials are provided in some of these matters, and must be studied before the JUAS courses start

JUAS - TIMETABLE 2019 - WEEK 1

Schedule 2019	Monday Jan 7th	Tuesday Jan 8th	Wednesday Jan 9th	Thursday Jan 10th	Friday Jan 11th
09:00		Relativity lecture <i>H. Henke</i>	Electro-magnetism lecture <i>H. Henke</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	Intro. to the Mini-Workshop lecture <i>Ph. Bryant</i>
10:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:15		Relativity tutorial <i>H. Henke</i>	Electro-magnetism lecture <i>H. Henke</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	Intro. to the Mini-Workshop lecture <i>Ph. Bryant</i>
11:15		Relativity lecture <i>H. Henke</i>	Electro-magnetism tutorial <i>H. Henke</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	Bus leaves at 11:15 from JUAS (Lunch at CERN, R1, offered by ESI)
12:15	12:00 OFFICIAL OPENING (welcome & building visit)	BREAK	BREAK	BREAK	
14:00	13:00 WELCOME LUNCH	Relativity lecture <i>H. Henke</i>	Electro-magnetism lecture <i>H. Henke</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	13:30 Visit of LHC Magnets Test Hall
15:00	14:00 Presentation of JUAS & Introduction of students <i>P. Lebrun</i>	Particle optics lecture <i>J.M. De Conto</i>	Particle optics tutorial <i>J.M. De Conto</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	15:00 Introduction to CERN & its Accelerator Network Seminar - R. Alemany
16:00	History of particle accelerators Seminar <i>V. Vaccaro</i>	Coffee Break	Coffee Break	Coffee Break	16:30 Visit at CERN Control Center
16:15	CHECK-IN AT THE RESIDENCE & SHOPPING FOR GROCERIES	Particle optics lecture <i>J.M. De Conto</i>	Particle optics tutorial <i>J.M. De Conto</i>	Intro. to Accelerator Design lecture <i>Ph. Bryant</i>	Bus leaves at 17:30 from CERN
17:15		Particle optics lecture <i>J.M. De Conto</i>			
18:15		AFTER WORK AT ESI			

JUAS - TIMETABLE 2019 - WEEK 2

Schedule 2019	Monday Jan 14th	Tuesday Jan 15th	Wednesday Jan 16th	Thursday Jan 17th	Friday Jan 18th
09:00	Transverse Dynamics lecture <i>A. Latina</i>	Transverse Dynamics lecture <i>A. Latina</i>	Transverse Dynamics lecture <i>A. Latina</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons lecture <i>B. Jacquot</i>
10:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:15	Transverse Dynamics lecture <i>A. Latina</i>	Transverse Dynamics lecture <i>A. Latina</i>	Transverse Dynamics lecture <i>A. Latina</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons lecture <i>B. Jacquot</i>
11:15	Transverse Dynamics tutorial <i>A. Latina</i>	Transverse Dynamics tutorial <i>A. Latina</i>	Transverse Dynamics tutorial <i>A. Latina</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons tutorial <i>B. Jacquot</i>
12:15	WORKING LUNCH	BREAK	BREAK	BREAK	BREAK
14:00	Intro. to MAD-X <i>G. Sterbini</i>	Transverse Dynamics lecture <i>A. Latina</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons lecture <i>B. Jacquot</i>	Transverse Dynamics lecture <i>A. Latina</i>
15:00	MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>	MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons tutorial <i>B. Jacquot</i>	Transverse Dynamics lecture <i>A. Latina</i>
16:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
16:15	MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>	MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>	Linacs lecture <i>D. Alesini</i>	Cyclotrons lecture <i>B. Jacquot</i>	MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>
17:15			European Projects for Collaborative Accelerator R&D <i>M. Vretenar</i>		MADX <i>N. Fuster Martinez / H. Garcia Morales / A. Latina / G. Sterbini</i>
18:15			AFTER WORK AT ESI		

JUAS - TIMETABLE 2019 - WEEK 3

Schedule 2019	Monday Jan 21st	Tuesday Jan 22nd	Wednesday Jan 23rd	Thursday Jan 24th	Friday Jan 25th
09:00	<p><i>Bus leaves at 07:30 from JUAS</i></p> <p><i>(2 hours of travel by bus)</i></p> <p>VISIT AT ESRF</p> <p><i>(Lunch offered by ESRF)</i></p>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Non-linear effects lecture <i>H. Bartosik</i>
10:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:15		Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Non-linear effects lecture <i>H. Bartosik</i>
11:15		Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Non-linear effects lecture <i>H. Bartosik</i>
12:15		BREAK	BREAK	BREAK	BREAK
14:00	<p>14:00 - 16:00 Injection / Extraction lecture <i>Thomas Perron</i></p>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Longitudinal Dynamics lecture <i>E. Métral/B. Salvant</i>	Non-linear effects lecture <i>H. Bartosik</i>
15:00		Linear imperfections lecture <i>H. Bartosik</i>	Linear imperfections lecture <i>H. Bartosik</i>	Linear imperfections lecture <i>H. Bartosik</i>	Non-linear effects lecture <i>H. Bartosik</i>
16:00	<p><i>Bus leaves at 17:00 from ESRF</i></p>	Coffee Break	Coffee Break	Coffee Break	Coffee Break
16:15		Linear imperfections lecture <i>H. Bartosik</i>	Linear imperfections lecture <i>H. Bartosik</i>	Linear imperfections lecture <i>H. Bartosik</i>	Non-linear effects lecture <i>H. Bartosik</i>
17:15		Free-Electron Lasers Seminar <i>E. Prat</i>		LHC & Future High-Energy Circular Collider Seminar <i>O. Bruning</i>	
18:15				AFTER WORK AT ESI	

JUAS - TIMETABLE 2019 - WEEK 4

Schedule 2019	Monday Jan 28th	Tuesday Jan 29th	Wednesday Jan 30th	Thursday Jan 31st	Friday Feb 1st
09:00	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Presentation of Accelerator Design <i>Students</i>
10:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:15	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Presentation of Accelerator Design <i>Students</i>
11:15	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Presentation of Accelerator Design <i>Students</i>
12:15	WORKING LUNCH	BREAK	BREAK	BREAK	BREAK
14:00	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Instabilities lecture <i>M. Migliorati</i>
15:00	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Instabilities lecture <i>M. Migliorati</i>
16:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
16:15	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Synchrotron Radiation lecture <i>R. Ischebeck</i>	Space charge lecture <i>M. Migliorati</i>	Mini-workshop Accelerator Design <i>Ph. Bryant</i>	Instabilities lecture <i>M. Migliorati</i>
17:15			Novel High Gradient Particle Accelerators Seminar <i>R. Assmann</i>	Future High-Energy Linear Colliders Seminar <i>L. Rinolfi</i>	
18:15			AFTER WORK AT ESI		

JUAS - TIMETABLE 2019 - WEEK 5

Schedule 2019	Monday Feb 4th	Tuesday Feb 5th	Wednesday Feb 6th	Thursday Feb 7th	Friday Feb 8th
09:00	Free for preparation of examinations	EXAMINATION Synchrotron Radiation <i>Written session</i>	EXAMINATION Longitudinal beam dynamics <i>Written session</i>	EXAMINATION Transverse beam dynamics <i>Written session</i>	
10:30 11:00		Coffee Break	Coffee Break	Coffee Break	
12:30		EXAMINATION topic to be announced <i>Written session</i>	EXAMINATION topic to be announced <i>Written session</i>	DISCUSSION SUMMARY OF JUAS LECTURES	
14:00	WORKING LUNCH	BREAK	BREAK	JUAS CLOSING COURSE 1 LUNCH OFFERED BY ESI	
15:00 16:00 16:15	Free for preparation of examinations				
17:15					

JUAS 2017 Course 1 Examination

- Written examination
- 5 topics, each allocated one and a half hours
 - Transverse beam dynamics (coefficient 12)
 - Longitudinal beam dynamics (coefficient 12)
 - Synchrotron radiation (coefficient 12)
 - Remaining two topics (each coefficient 6) announced in week 4 (i.e. one week before examination)
- Students have access to paper documents and computer/tablet with USB stick
- WIFI and wire connections disabled in exam room
- No cell phone or connected electronic device allowed

Attendance Certificates & Grade Sheets Master and Doctoral students

- Are asked at beginning of course if they **opt for taking the exams**, with the following conditions
- **If no**, they get
 - **Certificate of Attendance (type A1)** with mention «has opted not to take the examinations»
- **If yes**, they get
 - **Certificate of Attendance (type A2)** with
 - Overall grade of student
 - Overall class average grade
 - Rank of student
 - **Grade Sheet (type G1)** with, for each subject
 - Student grade
 - Class average grade
- **Class average grades and ranking** are based only on results of Master and Doctoral students
- All grades out of 20

Attendance Certificates & Grade Sheets Professional students

- Are asked at beginning of course if they **opt for taking the exams**, with the following conditions
- **If no**, they get
 - **Certificate of Attendance (type A3)**, bearing no mention relative to examinations
- **If yes**, they get
 - **Certificate of Attendance (type A3)**, bearing no mention relative to examinations
 - **Grade Sheet (type G2)** with, for each subject
 - Student grade
- Grades of Professional students are **not included in class averages**
- Professional students are **not ranked**
- All grades out of 20

Evaluation of lectures and seminars by students

- The students are asked (anonymously) to evaluate the lectures and seminars, on the basis of several criteria:
 - Fulfilment of personal learning expectations
 - Quality of slides and written documents
 - Level of treatment of the subject
 - Quality of oral presentation
 - Guidance during lectures and tutorials
- The students are also asked for possible improvements to the course
- Evaluation is done on-line using Google Forms
- Evaluation results are communicated
 - Individually to the lecturers
 - Statistically to the JUAS Advisory Board

Possibility of practical work on the SOLEIL synchrotron

- The SOLEIL Synchrotron in Saclay, offers the possibility to **two JUAS students** to take part in a Machine Development (MD) session at their premises
- This requires some preparation work and the writing of a short report
- The date of the MD is **Monday 4 February morning**
 - In view of the early start, the students will travel to Paris on Sunday 3 February, spend the night in Saclay and return on Monday evening
 - Transport will be arranged and paid by ESI
 - Accommodation will be arranged and paid by SOLEIL
- **Candidates should declare their interest to participate by Monday 14 January to the JUAS director**
- The selection of students will be made by the JUAS director

IPAC Prize for JUAS Student

- A JUAS student is allotted a prize by the IPAC Committee for **attending the IPAC conference**
- The proposal is made by the JUAS director to the IPAC Conference Coordinator, based on the following **criteria**
 - To obtain the best mark at the examination of Course 1
 - To continue his/her career in the field of particle accelerators
 - To present his/her work at the Conference
 - To serve as required at the Conference (e.g. scientific secretary of session, man the JUAS booth,...)



10TH INTERNATIONAL PARTICLE ACCELERATOR CONFERENCE
19 - 24 MAY 2019
 Hosted by ANSTO's Australian Synchrotron at the Melbourne Convention & Exhibition Centre

IPAC19

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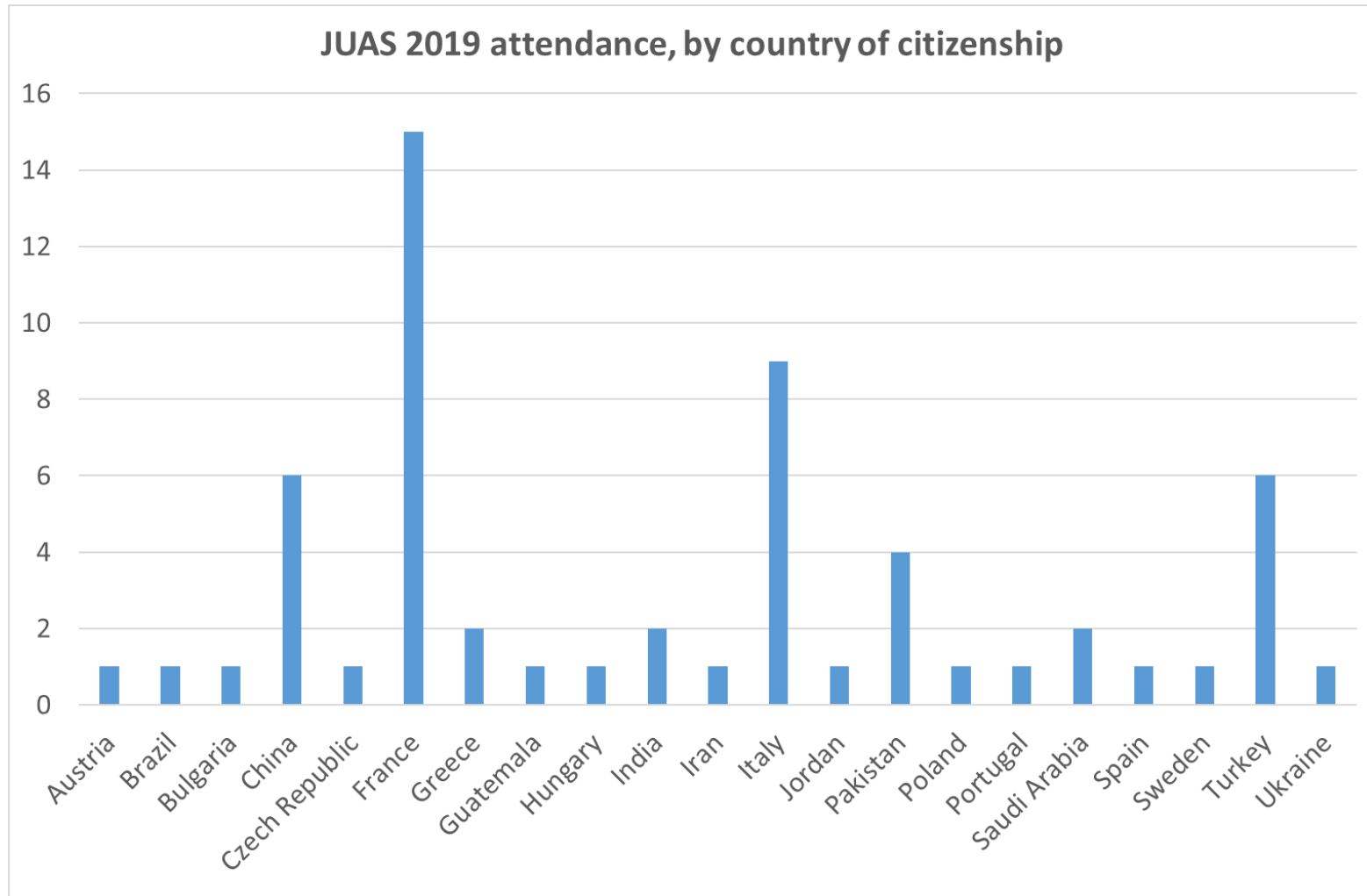
Registration & abstract submission opens October 2018

www.ipac19.org

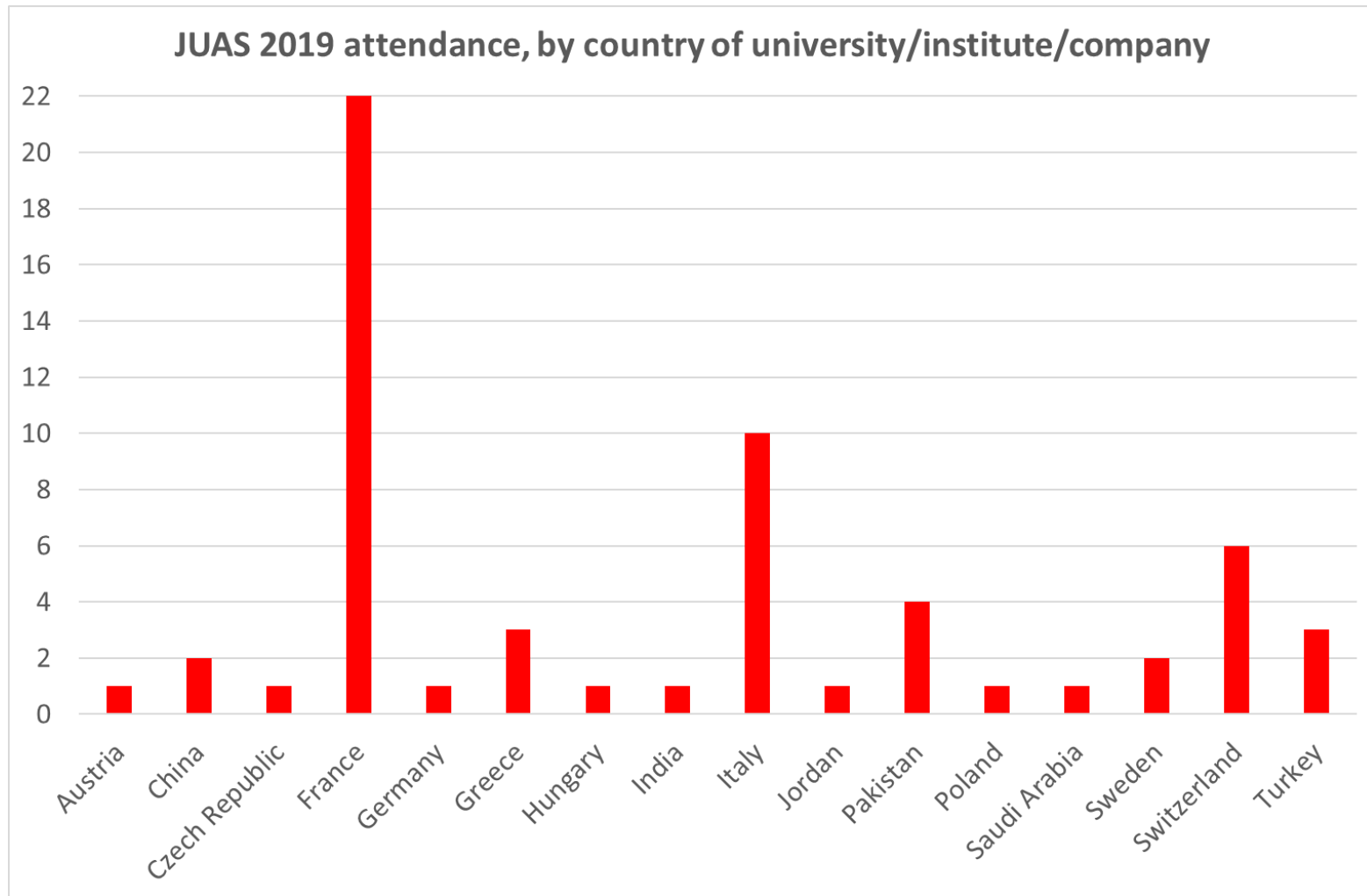
Artwork: "In Unity" by Kelly Seylon



Origin of JUAS 2019 students



Origin of JUAS 2019 students



JUAS code of conduct [1/2]

- **Mutual respect**

- Freedom of opinion and of belief
- Cultural diversity
- Gender equality

⇒ Constitution of France, Article 1

- *La France... assure l'égalité devant la loi sans distinction d'origine, de race ou de religion. Elle respecte toutes les croyances*
- *France... shall ensure the equality before the law, without distinction of origin, race or religion. It shall respect all beliefs*

- **No dress code, but**

⇒ Loi du 11 octobre 2010 interdisant la dissimulation du visage dans l'espace public

- *Nul ne peut, dans l'espace public, porter une tenue destinée à dissimuler son visage*
- *Nobody may, in public space, wear a dress hiding his/her face*

JUAS code of conduct [2/2]

- **Behaviour**

- **Arrive on time** at the lectures
- **Individual and collective behaviour**, in particular during visits, must not impair the good reputation of JUAS... but rather improve it further!

- **Examinations**

- Respect the ban on cell phones and connected electronic devices
- Cheating will result in immediate exclusion

Job opportunities

- Studying at JUAS is a good opportunity to find a position
 - Internship in national or international laboratory
 - Summer job
 - PhD grant
 - Post doctoral
 - ...
- Do not hesitate to
 - Talk to the lecturers during coffee and lunch breaks
 - Talk to the people you will meet during laboratory visits

- Consult our updated job opportunity web site

<http://www.esi-archamps.eu/Thematic-Schools/JUAS/Job-opportunities>

Developing the JUAS network

- CV Yearbook
 - We publish a CV (curriculum vitae) Yearbook
 - Introducing JUAS,
 - Containing the curriculum vitae of each JUAS 2019 student (with his/her agreement)
 - Distributed to our partner universities and industrial sponsors
- Alumni network
 - Build up the JUAS Alumni network using social media
- More information will be communicated to you on these matters during the Course

Have a pleasant and fruitful time at JUAS!

