# Chapter IV.6

# JUAS during the period 2011–2016

*Louis Rinolfi*
CERN retired, Geneva, Switzerland

This chapter covers the period Louis Rinolfi was JUAS Director (i.e. between 2011 and 2016). It also includes the period 1994–2002, when Louis was teaching the "longitudinal beam dynamics" course. It also covers the transition, in 2010, between François Méot and Louis Rinolfi.

## IV.6.1 Teaching longitudinal beam dynamics, between 1994 and 2002

It was a wonderful and enriching experience to teach the longitudinal beam dynamics course to so many students over the nine years I oversaw this topic. The collaboration with two JUAS Directors, firstly with Marcelle Rey-Campagnolle and then with Joel le Duff, was extremely rewarding. In 2002, however, I decided to step down as a lecturer. I remember Joel's words, asking me to continue teaching, as this course was evaluated by the students as one of the best. But my answer was clear, based on two arguments: a) my CERN responsibilities and workload were too heavy at this time to continue giving lectures, tutorials, and examinations; and b) I felt that after many years of teaching, there was a risk of becoming less effective, and it was better to stop at the "top of the curve". In 2000, I wrote a CERN divisional report on the longitudinal beam dynamics course [1], which still remains a basic reference for JUAS students.

## IV.6.2 From September 2010 to December 2010

In 2010, the third Director of JUAS, François Méot, informed the JUAS committees meeting in Rome that he was planning to pursue his research in the USA, and that it would be necessary to find a new Director. He contacted me and asked me to consider putting my name forward for JUAS Director. A meeting was organised with François Méot and Manfred Buhler-Broglin, then ESI President, in September 2010 in Archamps. A constructive and friendly discussion took place, and I accepted the proposal to become the next JUAS Director. Manfred stipulated one condition: that a JUAS Director is engaged for a minimum period of three years. As CERN staff, I sought and obtained the support from my hierarchy, including the CERN Director General, Rolf Heuer. After receiving the green light from CERN management, Manfred Buhler-Broglin sent a letter [2] to both JUAS committees on 11 November 2010. At this time, there were two committees: a) the Advisory Committee, composed of 12 representatives from JUAS partner universities, as shown in Table IV.6.1; and b) the Program Committee, composed of seven

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experts selected *ad personam*, coming from various institutes (CERN, Oxford University, ESRF, and PSI), as shown in Table IV.6.2.

**Table IV.6.1:** Members of the Advisory Committee in 2010.

| University | Since | Members |
|---|---|---|
| Université Joseph Fourier (Grenoble) | 1994 | François Montanet |
| Technische Universität Darmstadt | 1994 | Joachim Enders |
| Karlsruhe Institut für Technologie (KIT) | 1994 | Anke Suzanne Müller |
| Universitat Politècnica de Catalunya | 1994 | Antoni Mendez |
| Universitat Autonoma de Barcelona | 1994 | Francisco Calvinõ |
| Institut polytechnique de Grenoble | 1994 | Elsa Merle-Lucotte |
| Università degli Studi di Napoli "Federico II" | 1994 | Vittorio Vaccaro |
| Università degli Studi di Roma "La Sapienza" | 1994 | Luigi Palumbo |
| Università degli Studi di Genova | 2002 | Marco Bozzo |
| Technische Universität Berlin | 2002 | Heino Henke |
| Universitat de València | 2002 | Angeles Faus-Golfe |
| Universität Heidelberg | 2007 | Carsten Welsch |

**Table IV.6.2:** Members of the Program Committee in 2010.

| | |
|---|---|
| Manfred Buhler-Broglin | ESI President |
| François Méot | JUAS Director |
| Roger Bailey<br>(Previously Daniel Brandt) | CAS Director |
| Bernhard Holzer<br>(Ex-DESY representative) | CERN Coordinator,<br>students and fellows |
| Chris Prior | University of Oxford |
| Jean-Luc Revol | ESRF |
| Lenny Rivkin | PSI |

### IV.6.3 Academics and university activities between 2011 and 2016

My time as JUAS Director lasted from January 2011 to July 2016, when I stepped down [3] after running six editions of the school. I had the pleasure of chairing my last Advisory Board meeting as JUAS Director in April 2016 in Naples, before passing the torch to Philippe Lebrun as the next Director.

I shall now mention some of what I consider to be the most salient outcomes of my mandate as Director.

a) I proposed merging the Program Committee and the Advisory Committee into a single body. This was approved at the JUAS annual meeting in Heidelberg in 2011. Since then, this unitary committee—the JUAS Advisory Board—has met each year in one of the partner universities. Figure IV.6.1 shows a session of the Advisory Board meeting held at Grenoble Institute of Technology (Grenoble INP) - Phelma, in 2014.

b) The team of lecturers has always been the key to the success of JUAS courses. In the case of a


**Fig. IV.6.1:** Some of the Advisory Board at a 2014 meeting in Grenoble.

lecturer stepping down or being replaced following the Advisory Board's recommendation, I established a procedure whereby the CVs of potential replacements were submitted to the Advisory Board. Whenever possible, I would meet with new lecturers over lunch or dinner to exchange ideas in depth, and to discuss pedagogy and the course contents.

c) I proposed and implemented an annual lecturers' meeting at CERN. This was obviously practical for lecturers working at CERN, but many others would also make the effort to come to CERN for this meeting. The sharing of experiences and ideas proved to be fruitful, and lecturers generally felt these meetings enhanced their pedagogy. Many other topics were also reviewed, such as students' behaviour, exam constraints, and so on.

d) I set up a selection committee to assess applications to attend JUAS. The committee met during September and December and was composed of me as JUAS Director, the Deputy Director, Elias Métral, and Marco Bozzo, the representative Genoa University.

e) Regarding the partner universities, one of my objectives was to "sign up" two major universities: Université Paris-Sud (today Université Paris-Saclay) and the University of Oxford. This was achieved in 2012 and 2014, respectively. On top of this, three new universities joined the JUAS partnership: Liverpool (2011), Rostock (2013), and Oslo (2016) (see Section IV.6.6). In 2016, there were 16 partner universities collaborating with JUAS.

f) Agreements with partner universities: 12 formal agreements between partner universities and JUAS were signed during my term. The signatories were the official representative of each university, Hans Hoffmann as ESI President, and the JUAS Director. The other universities were either undergoing organisational changes at the time or were still investigating the administrative process to formally join JUAS. ECTS credits were reviewed each year and updated with each university (see Section IV.6.5.3).

g) Computing support for JUAS: this was an important step for improving the students' learning ex-

perience. I reached out to Philippe Bloch, Head of the Physics Department at CERN, and Frédéric Hemmer, Head of the Information Technology Department at CERN, to discuss the possibility of establishing a remote connection between the existing ESI computers and terminals and the CERN network. The CERN Department leaders signed an agreement and nominated a CERN computer expert, Bruno Lenski, to implement the project and incorporate hands-on computing into the JUAS curriculum. This enabled ESI to have remote machines hosted and maintained at CERN, with flexible and expandable capacity in terms of memory, CPU, and disk usage. Each terminal at ESI was associated with one virtual machine at CERN, and this one-to-one mapping allowed each student to work independently. All software and applications were installed by JUAS lecturers. This new organisation was highly appreciated by faculty and students alike. Figure IV.6.2 shows students working from their individual terminals at ESI.


**Fig. IV.6.2:** JUAS students running particle accelerator programs under the supervision of lecturers.

h) A new website was created with the support of Tjitske Kehrer, an expert from CERN. In 2012, with the help of Guido Sterbini, we implemented the "Indico" tool as the JUAS learning platform. Each lecturer was able to upload their lectures and exercises to Indico, giving students access to all pedagogical documentation. Indico was also used as a secure support platform for Advisory Board documents.

i) From the new website, I introduced the link "Job opportunities", which was useful for students looking to pursue their careers within the particle accelerator community. JUAS was also the right place for students looking for an internship, a summer job, or a PhD position. This much-appreciated link still functions today.

j) International conferences: thanks to a strong and effective collaboration with the European Physical Society's Accelerator Group, and the support of Christine Petit-Jean-Genaz, JACoW manager, I was

able to send two JUAS students (instead of one) to participate to several international conferences (see Section IV.6.8).

k) Practical work for JUAS students: thanks to the collaboration with CERN colleagues, we were able to enhance existing practical work for all JUAS students, using hardware devices and experimental measurements. I also initiated the opportunity for students to spend a full day in a real control room, in agreement with Roberto Corsini. After having prepared a Machine Development study in collaboration with CERN experts, they would be ready to perform beam measurements on the accelerator (see Section IV.6.7). As in the past, we continued to organise visits to several small and large CERN accelerators, including the Linacs, Antiproton Collector, LEIR[1], PS[2], LHC[3], and the CMS[4] experiment.

l) Sponsorship: my policy was to contact as many potential contributors as possible, and to ask for a modest non-binding contribution. The range of contributions was between €1000 and €6000. In the best year, we succeeded in securing 23 sponsors, providing a budget of €53k for one year (see Section IV.6.10.2).

m) The organisation of the 20th anniversary of JUAS in Grenoble was a lot of work, but it went extremely well and had a large attendance. Senior officials from major accelerator laboratories made presentations in the morning and acted as moderators of roundtable discussions during the afternoon. This event was constructive for the future of JUAS.

It goes without saying that all of the above were successfully achieved thanks to the exceptional support from ESI staff, Advisory Board members, and all lecturers, assistants, and colleagues involved in the practical work. The excellent collaboration with European universities, the welcome contributions from sponsors, and the proactive support from CERN and many other laboratories mentioned in this chapter, are sincerely acknowledged.

## IV.6.4 Students and professors

### IV.6.4.1 Number of students trained

During the period described in this chapter, the number of students at each course was limited to a maximum of 40. The main reasons for this were the number of computers available and the idea to not overload the lecturers and their assistants during the tutorial sessions. However, due to strong demand, some years this number was exceeded, and we were obliged to find solutions to maintain excellent courses for all students. Table IV.6.3 shows the numbers of JUAS students trained within the different categories. It is interesting to note that almost every year, exams were taken by all master's and PhD students, and quite often by professionals too. More details are given in the general tables and graphs in Chapter **??**.

A group photo with all students, some lecturers and ESI staff was taken, each year:

[1]LEIR: Low Energy Ion Ring.
[2]PS: Proton Synchrotron.
[3]LHC: Large Hadron Collider.
[4]CMS: Compact Muon Solenoid.

**Table IV.6.3:** Numbers of JUAS students within the different categories between 2011 and 2016.

| | | JUAS students | | | | |
|---|---|---|---|---|---|---|
| | | **Master's** | **PhD** | **Professional** | **Total** | **Took exam** |
| 2011 | Course 1 | 22 | 8 | 2 | 32 | 27 |
| | Course 2 | 30 | 8 | 4 | 42 | 33 |
| 2012 | Course 1 | 20 | 4 | 13 | 37 | 25 |
| | Course 2 | 21 | 8 | 11 | 40 | 28 |
| 2013 | Course 1 | 13 | 20 | 12 | 45 | 30 |
| | Course 2 | 12 | 9 | 18 | 39 | 19 |
| 2014 | Course 1 | 12 | 19 | 3 | 34 | 30 |
| | Course 2 | 16 | 10 | 5 | 31 | 25 |
| 2015 | Course 1 | 13 | 11 | 12 | 36 | 24 |
| | Course 2 | 13 | 6 | 16 | 35 | 18 |
| 2016 | Course 1 | 12 | 22 | 6 | 40 | 26 |
| | Course 2 | 22 | 9 | 17 | 48 | 32 |

– Figure IV.6.3 shows the students of JUAS 2011 for Course 1.

**Fig. IV.6.3:** JUAS 2011 students.

– Figure IV.6.4 shows the JUAS students who followed Course 1 in January 2012. At this time, it was possible to initiate a snowball fight!

– Figure IV.6.5 shows the students who followed the JUAS 2012 Course 2. A real RF cavity was brought in for the photo.

– Figure IV.6.6 shows the JUAS students in February 2013, in the middle of the fog, in front of the Salève building, where JUAS lectures took place.

**Fig. IV.6.4:** JUAS 2012 students for Course 1.

**Fig. IV.6.5:** JUAS 2012 students for Course 2.

– Figure IV.6.7 shows the JUAS students in January 2014. The whole Institute, including all ESI schools, moved to the "Mont Blanc 1" building. The amphitheatre was larger than in the previous building, and several break-out rooms allowed students to work in small groups. A new dedicated computer room was also much appreciated by both the students and lecturers.
– Figure IV.6.8 shows the JUAS 2015 students who followed Course 1. They are standing underneath the ESI logo, which adorned the new building, alongside the JUAS roll-up, which was easily transportable for conferences and workshops at which JUAS was presented.
– Figure IV.6.9 shows the JUAS 2016 students. When the picture was taken, it was snowing.

**Fig. IV.6.6:** JUAS 2013 students, surrounded by fog.

**Fig. IV.6.7:** JUAS 2014 students, at the entrance of the new ESI building.


**Fig. IV.6.8:** JUAS 2015 students, beside the ESI building with a new JUAS poster.

**Fig. IV.6.9:** JUAS 2016 students under the snow between two ESI buildings.

### IV.6.4.2 Duration of a complete JUAS session

Each year, a complete JUAS session incorporates two courses between January and March. Typically, there is a total of 126 h of scheduled activities, including lectures, tutorials, practical work, and visits. Table IV.6.4 lists the complete contents of the 2016 JUAS school. For this year, there were 24 lecturers and assistants for Course 1, and exactly the same number for Course 2.

**Table IV.6.4:** Total numbers of hours for the various aspects of JUAS 2016.

| | **Course 1** | **Course 2** |
|---|---|---|
| Lectures | 65 | 63 |
| Tutorials + work at SOLEIL | 40 + 6 | 19 |
| Seminars | 7 | 6 |
| Visits (CERN, PSI, EPFL, HUG) | 8 | 17 |
| Practical work at CERN | | 14 |
| Practical work at Bergoz Instrumentation | | 7 |
| Grand totals | 126 | 126 |

### IV.6.4.3 Lectures and lecturers

A complete list of all those who contributed to the JUAS school, through lectures, seminars, and practical work was compiled for the years 1994 to 2016. Today, this list has been updated to 2024, and it is included in Chapter **??**.

Between 2011 and 2016, the main courses were generally taught by the same lecturer. When a lecturer did ask to step down, the policy was that they should propose at least one possible replacement. The proposed replacement was presented to—and in general approved by—the Advisory Board. As an example, Tables IV.6.5–IV.6.9 show the list of lectures and lecturers for the courses and seminars for the year 2016.

**Table IV.6.5:** Course 1: Lecturers in 2016.

| **Lecturer/Assistant** | **Lecture** | **Institution** |
|---|---|---|
| P. Bryant | Introduction to accelerators | Former CAS Director |
| H. Henke | Relativity & electromagnetism | University Berlin |
| J.M. De Conto | Particle optics | University J. Fourier |
| A. Latina/J. Resta Lopez | Transverse beam dynamics | CERN |
| G. Sterbini/D. Pelligrini | MADX | CERN |
| E. Métral/B. Salvant | Longitudinal beam dynamics | CERN |
| J.B. Lallement/V. Dimov | Linacs | CERN |
| Y. Papaphilippou/H. Bartosik | Linear imperfections and non-linear effects | CERN |
| M. Migliorati | Space charge, instabilities, and wakefields | Roma University |
| R. Bartolini | Synchrotron radiation | University of Oxford |
| F. Chautard | Cyclotrons | GANIL |
| T. Perron | Injection/extraction | ESRF |

**Table IV.6.6:** Course 1: Seminars in 2016.

| Lecturer | Seminar title | Institution |
|---|---|---|
| V. Vaccaro | History of particle accelerators | Naples University |
| M. Vretenar | European projects for collaborative accelerator R& D | CERN |
| F. Bordry | Future high-energy circular colliders | CERN |
| E. Prat | Free-electron lasers | PSI (Villigen) |
| R. Alemany | LHC injector chain | CERN |
| L. Rinolfi | Future high-energy linear colliders | CERN/JUAS |
| R. Assmann | Laser plasma acceleration | DESY (Hamburg) |

**Table IV.6.7:** Course 2: Lecturers in 2016.

| Lecturer/Assistant | Lecture | Institution |
|---|---|---|
| F. Caspers/M. Wendt | RF engineering including superconductivity | CERN |
| P. Chiggiato/R. Kersevan | Vacuum | CERN |
| D. Tommasini | Magnets design | CERN |
| T. Zickler/J. Bauche | Normal conducting magnets | CERN |
| M. Wilson/D. Schoerling | Superconducting magnets | Oxford/CERN |
| P. Forck | Beam instrumentation | GSI (Darmstadt) |
| T. Thuillier | Particle sources | LPSC (Grenoble) |
| E. Zimoch | Accelerator controls | PSI (Villigen) |
| W. Mondelears | Low-energy electron accelerators | Gent university |
| W. Kleeven | Accelerators for industrial and medical applications | IBA (Belgium) |
| S. Bousson | High-current proton linacs | IN2P3/IPNO (Orsay) |
| R. Miralbell | Radiation oncology | HUG (Geneva) |
| S. Meyroneinc | Life-cycle and reliability of particle accelerators | Institut Curie (Paris) |
| X. Queralt | Radiation safety | ISIS (Oxford) |

**Table IV.6.8:** Course 2: Seminars in 2016.

| Lecturer/Assistant | Seminar title | Institution |
|---|---|---|
| J.L. Biarrotte | Accelerator-driven systems | CNRS/IPNO (Orsay) |
| L. Rolland | Gravitational waves *(following discovery news)* | LAPP (Annecy-le-Vieux) |
| P. Lebrun | Performance & technology challenges of LHC | CERN |
| M. Schippers | Accelerators for hadron therapy | PSI (Villigen) |
| A. Seryi | From methodology of inventiveness to applications of plasma accelerators | JAI (Oxford) |
| J. Droz (+ I. Rongier) | Space projects: Arianne (ESIPAP seminar) | ESA |

I always insisted that lecturers be free to mix lectures and tutorials as they saw fit. If the timetable indicated a 3-h slot for a topic, that did not mean a 3-h lecture. It was important to insert tutorials into the lectures so that students could refocus their attention, working by themselves or in small groups with

**Table IV.6.9:** Course 2: Practical work in 2016.

| Lecturer | Activity | Site |
|---|---|---|
| F. Caspers + assistants | RF engineering measurements | CERN Prévessin: Building 864 |
| P. Chiggiato + assistants | Vacuum measurements | CERN: Buildings 30, 101, 113 |
| T. Zickler + assistants | Normal conducting magnet measurements | CERN ISR: Lab I8 |
| J. Fleiter + assistants | Superconducting magnet measurements | CERN: Building 163 + SM 18 |
| W. Farabolini + assistants | CTF3 beam measurements | CERN: Building 2008 |

help from the lecturer and/or their assistant.

## IV.6.5 Examination

### IV.6.5.1 Principle of examination

For many years, final exams were marked using a letter system ranging from A to F: A = Excellent (100–80), B = Very good (80–70), C = Good (70–60), D = Satisfactory (60–55), E = Sufficient (55–40), and F = Failed (< 40). Figure IV.6.10 shows histograms of the marks obtained for the years from 2003 to 2011.

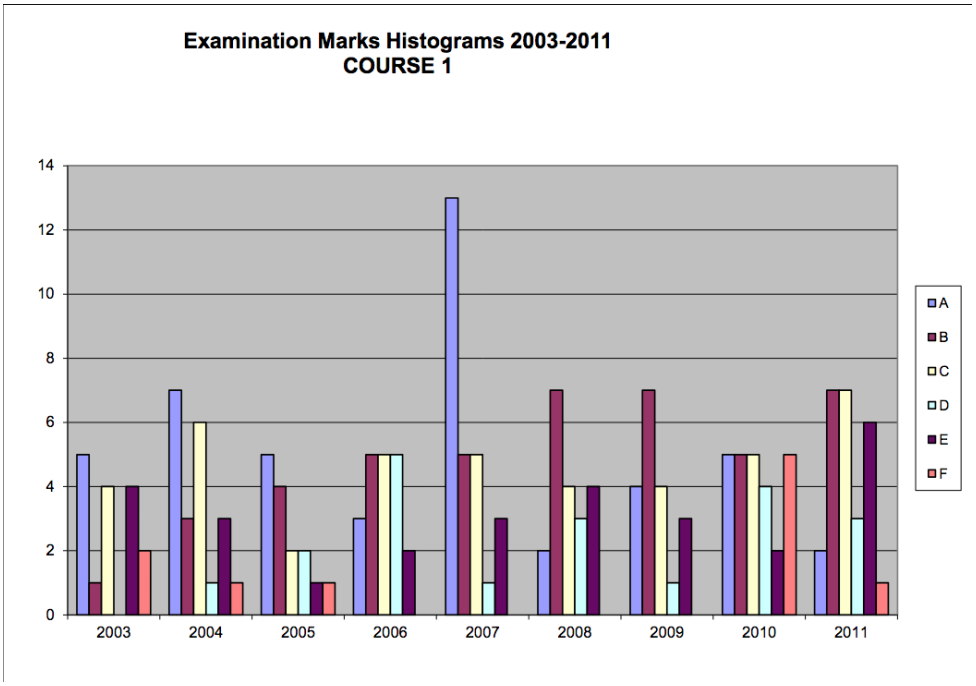


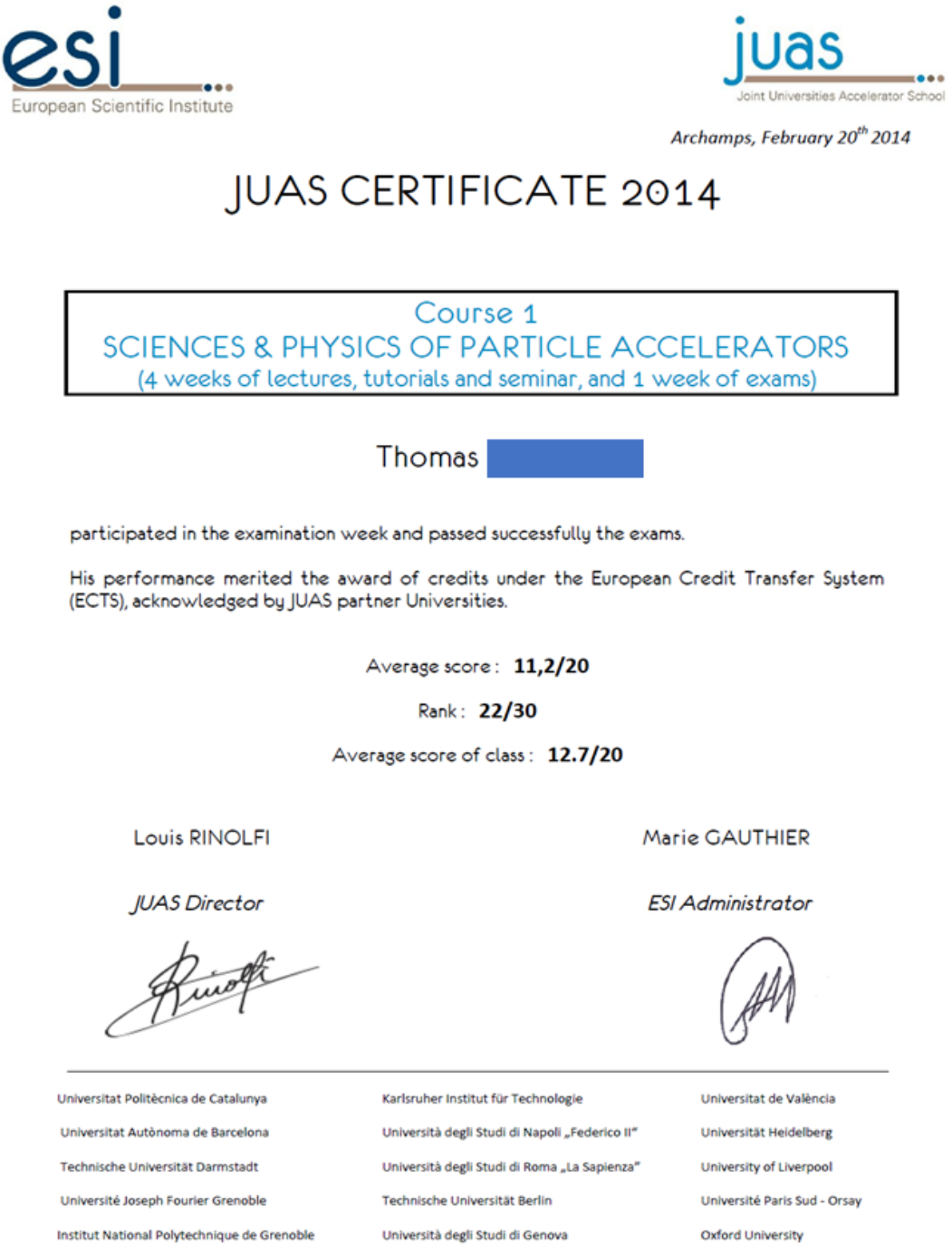

**Fig. IV.6.10:** Histograms of exam marks for the period 2003–2011.

For future JUAS schools, I proposed adopting the marking system used in French universities, i.e. from 0 to 20, with a pass mark being 10 or above. This was fully supported by the Advisory Board and implemented for the future JUAS schools. There was no change in policy regarding exam content. Each teacher had to propose a new problem, one that was not found in the books or elsewhere. Students were allowed to bring any documentation and books they wanted to have with them. Of course, they were

encouraged to use their own notes, along with documents distributed during the courses. The policy applied required three exams on core topics, which were announced at the beginning of the course, along with two additional exams that were announced during the penultimate week. For the Accelerator Physics course, the three main exams covered longitudinal beam dynamics, transverse beam dynamics, and synchrotron radiation. The other two exams were selected by the Director, in agreement with one of the lecturers of Course 1. For the Technologies and Applications of Particle Accelerators course, the three core topics were beam instrumentation, RF, and magnets. For the other two exams, as for Course 1, the JUAS Director selected the topics in agreement with one of the lecturers for Course 2. After the exam, each student, upon request, could ask for the detailed answers. In 2015, we gave two students who failed the exam in March the opportunity to re-sit an oral exam with the corresponding lecturers.

#### IV.6.5.2 JUAS certificates

Students who took the examinations received a certificate for each course indicating the average mark and class ranking of the student, along with the average mark for the class. Figures IV.6.11 and IV.6.12 show the Course 1 and 2 certificates for JUAS 2014. These certificates enabled the students' home universities to attribute ECTS or doctoral credits to their students. Finally, Fig. IV.6.13 shows the certificate of attendance given to students who did not take the exams and also to professionals requiring proof of participation.



esi
European Scientific Institute

juas
Joint Universities Accelerator School

*Archamps, February 20th 2014*

JUAS CERTIFICATE 2014

Course 1
SCIENCES & PHYSICS OF PARTICLE ACCELERATORS
(4 weeks of lectures, tutorials and seminar, and 1 week of exams)

Thomas [redacted]

participated in the examination week and passed successfully the exams.

His performance merited the award of credits under the European Credit Transfer System (ECTS), acknowledged by JUAS partner Universities.

Average score : **11,2/20**

Rank : **22/30**

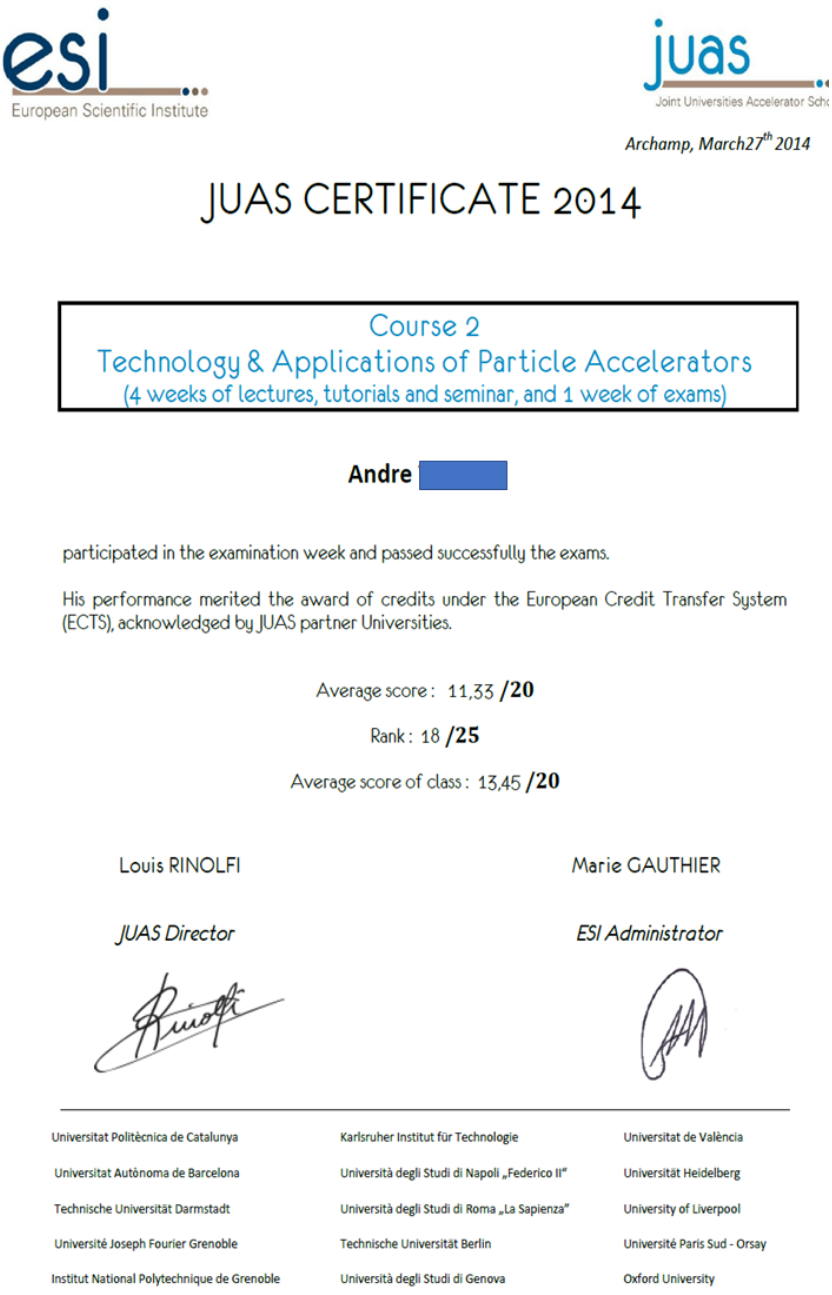
Average score of class : **12.7/20**

Louis RINOLFI
*JUAS Director*

Marie GAUTHIER
*ESI Administrator*

Universitat Politècnica de Catalunya
Universitat Autònoma de Barcelona
Technische Universität Darmstadt
Université Joseph Fourier Grenoble
Institut National Polytechnique de Grenoble
Karlsruher Institut für Technologie
Università degli Studi di Napoli „Federico II"
Università degli Studi di Roma „La Sapienza"
Technische Universität Berlin
Università degli Studi di Genova
Universitat de València
Universität Heidelberg
University of Liverpool
Université Paris Sud - Orsay
Oxford University

**Fig. IV.6.11:** Example of JUAS certificate delivered for Course 1.



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*Archamp, March27th 2014*

JUAS CERTIFICATE 2014

Course 2
Technology & Applications of Particle Accelerators
(4 weeks of lectures, tutorials and seminar, and 1 week of exams)

**Andre** [redacted]

participated in the examination week and passed successfully the exams.

His performance merited the award of credits under the European Credit Transfer System (ECTS), acknowledged by JUAS partner Universities.

Average score : 11,33 **/20**

Rank : 18 **/25**

Average score of class : 13,45 **/20**

Louis RINOLFI — *JUAS Director*

Marie GAUTHIER — *ESI Administrator*

Universitat Politècnica de Catalunya
Universitat Autònoma de Barcelona
Technische Universität Darmstadt
Université Joseph Fourier Grenoble
Institut National Polytechnique de Grenoble
Karlsruher Institut für Technologie
Università degli Studi di Napoli „Federico II"
Università degli Studi di Roma „La Sapienza"
Technische Universität Berlin
Università degli Studi di Genova
Universitat de València
Universität Heidelberg
University of Liverpool
Université Paris Sud - Orsay
Oxford University

**Fig. IV.6.12:** Example of JUAS certificate delivered for Course 2.

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**Joint Universities Accelerator School 2014**

*Archamps, 27th March 2014*

***CERTIFICATE OF ATTENDANCE***

*We, undersigned, certify that,*

**Thomas** [redacted]

*has registered as student for JUAS 2014 and*
*has followed 5 weeks of JUAS courses (lectures, tutorials and visits),*

Technology & Applications of Particle Accelerators
*(Course 2)*

*(from February 10th to March 13th in Archamps -France)*

This course consists of RF Engineering, Vacuum Systems, Electromagnetism, Normal Conducting Magnets, Superconducting Magnets, Superconducting RF Cavities, Beam Instrumentation, Particles Sources, Accelerator Control, Low Energy Electron Accelerators, Accelerators for Industrial & Medical Applications, High Current Proton Linac, Particle therapy and accelerators, Radiation safety.

*Organized by the European Scientific Institute (E.S.I.) in partnership with 15 European Universities.**

**Louis RINOLFI**
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Università degli Studi di Roma „La Sapienza"
Technische Universität Berlin
Università degli Studi di Genova
Universitat de València
Universität Heidelberg
University of Liverpool
Université Paris Sud - Orsay
Oxford University

**Fig. IV.6.13:** Example of JUAS certificate of attendance.

#### IV.6.5.3 ECTS credits

As from the beginning of JUAS, the credits were delivered by the partner universities to the students who passed the exams, i.e. those who obtained an average mark of 10 (or higher) out of 20 for all written tests. The number of ECTS credits varied from one university to another, typically between 6 and 10 credits per course. A survey was repeated each year to record the number of ECTS credits delivered by each university, an example of which is given in Table IV.6.10 for the year 2015. An empty box in this Table indicates that either there were no JUAS students from that university for that year, or that the university did not participate in ECTS.

**Table IV.6.10:** ECTS credits assigned by partner universities in 2015.

| **Joint university** | **ECTS credits** | | **Last name** | **Name** |
|---|---|---|---|---|
| | **Single course** | **Both courses** | | |
| Universitat Politècnica de Catalunya | 6 | 12 | Koubychine | Yuri |
| Universitat Autonoma de Barcelona | | | Mendez | Antoni |
| Technische Universität Darmstadt | 10 | 20 | Enders | Joachim |
| Université Joseph Fourier (Grenoble) | | | De Conto | Jean-Marie |
| Institut Polytéchnique de Grenoble (INPG) | 6 | 12 | Merle-Lucotte | Elsa |
| Karlsruhe Institut für Technologie (KIT) | 7 | 14 | Müller | Anke-Susanne |
| Università degli Studi di Napoli "Federico II" | | | Vaccaro | Vittorio |
| Università "La Sapienza" Roma | 6 | 12 | Migliorati | Mauro |
| Technische Universität Berlin | | | Henke | Hino |
| Università degli Studi di Genova | $< 10$ | $< 20$ | Bozzo | Marco |
| Universitat de València | 4 | 8 | Faus-Golfe | Angeles |
| University of Liverpool | | | Welsch | Carsten |
| Université Paris-Sud | 6 | 12 | Kazamias | Sophie |
| Universität Rostock | 10 | 20 | Van Rienen | Ursula |
| University of Oxford/JAI | | | Seryi | Andrei |

### IV.6.6 Partner universities

#### IV.6.6.1 Evolution

In 2011, there were 12 partner universities; however, Heidelberg University decided to leave the JUAS partnership due to a lack of students within the field of particle accelerator physics. One of my objectives was to "sign up" two new major universities: Université Paris-Sud and Oxford. I succeeded in this; an agreement was signed with the University of Oxford in 2014, and another was signed with Paris-Sud in 2012. Finally, in my last year as JUAS Director, there were 16 partner universities, as shown in Table IV.6.11, in which the last column indicates the date when the universities started their partnership with JUAS. Notably, the first eight universities joined in 1994, with Marcelle Rey-Campagnolle. In 2002, three new universities joined the partnership, with Joël Le Duff, and between 2011 and 2016, five new universities joined the JUAS partnership, during my period as Director.

Table IV.6.12 shows the status, in 2016, of partner universities who had signed a formal agreement between the official University representatives, Hans Hoffmann as ESI President, and the as JUAS Director. There were 12 universities subject to such an agreement at this time; the others assumed a partnership without signing a formal agreement or waiting for formal approval.

**Table IV.6.11:** Partner universities in 2016.

| University | Advisory board member | Since |
|---|---|---|
| Université Joseph Fourier (Grenoble) | Jean-Marie De Conto | 1994 |
| Technische Universität Darmstadt | Joachim Enders | 1994 |
| Karlsruher Institut für Technologie | Anke-Susanne Müller | 1994 |
| Universitat Politècnica de Catalunya | Youri Koubychine | 1994 |
| Universitat Autonoma de Barcelona | Caterina Biscari | 1994 |
| Institut polytechnique de Grenoble | Elsa Merle-Lucotte | 1994 |
| Università degli Studi di Napoli "Federico II" | Vittorio Vaccaro | 1994 |
| Università degli Studi di Roma "La Sapienza" | Mauro Migliorati | 1994 |
| Università degli Studi di Genova | Marco Bozzo | 2002 |
| Technische Universität Berlin | Heino Henke | 2002 |
| Universitat de València | Angeles Faus-Golfe | 2002 |
| University of Liverpool | Carsten Welsch | 2011 |
| Université Paris-Sud | Sophie Kazamias | 2012 |
| Universität Rostock | Ursula van Rienen | 2013 |
| University of Oxford | Andrei Seryi | 2014 |
| Universitetet i Oslo | Erik Adli | 2016 |

**Table IV.6.12:** Agreements signed by partner universities.

| University | Agreement |
|---|---|
| Université Joseph Fourier (Grenoble) | Moved to UGA |
| Institut polytechnique de Grenoble | Moved to UGA |
| Karlsruhe Institut für Technologie | Under discussion |
| Universitat Politècnica de Catalunya | 2015 |
| Universitat Autonoma de Barcelona | 2010 |
| Technische Universität Darmstadt | 2014 |
| Università degli Studi di Napoli "Federico II" | 2014 |
| Università degli Studi di Roma "La Sapienza" Master's | 2013 |
| Università degli Studi di Roma "La Sapienza" PhD | 2016 |
| Università degli Studi di Genova | 2013 |
| Technische Universität Berlin | Under discussion |
| Universitat de València | Under discussion |
| University of Liverpool | 2011 |
| Université Paris-Sud | 2012 |
| Universität Rostock | 2014 |
| University of Oxford | 2014 |
| Universitetet i Oslo | 2016 |

Many useful discussions were had with different universities, and many useful contacts were established. Table IV.6.13 lists those that were subject to preliminary discussions at the end of 2016. At the time of these discussions, they indicated a strong motivation to develop a partnership with JUAS. Unfortunately, some of the contacts retired, and new contacts had to be obtained.

**Table IV.6.13:** Universities and professors in preliminary discussions to start a partnership with JUAS.

| University | Contact |
|---|---|
| INSTN, Saclay | Guy Bonnaud |
| EPFL, Lausanne | Lenny Rivkin |
| Helmholtz University, Berlin | Meseck Atoosa |
| University Uppsala | Roger Ruber |
| Università di Milano | Gianluigi Arduini and Lucio Rossi |
| Università di Pisa | Kenichi Konishi |
| University Lund | Anders Karlsson |
| University Yerevan (CANDLE) | Tigran Vardanyan |
| "MEPhi" University, Moscow | Evgeny Savin |

#### IV.6.6.2 Universities that sent students

Most partner universities sent up to three students to JUAS (see Table IV.6.11), with some—such as La Sapienza (Roma), Institut polytechnique de Grenoble, Paris-Sud, and Darmstadt—sending up to ten students. Many other universities and laboratories around the world also sent students. Chapter **??** lists the large number of countries that have sent students to JUAS, along with an overview of all partner universities between 1994 and 2024.

### IV.6.7 Practical work

#### IV.6.7.1 Practical work in four CERN laboratories

Practical work is an important component of JUAS, and fruitful discussions and collaborations with CERN colleagues allowed the enhancement of the existing programme. The idea was that all JUAS students could participate in practical sessions, during which they were able to "turn knobs and push buttons" and perform hardware measurements. With this new approach, reports were written, each year, corresponding to the measurements performed in the different CERN laboratories. The four activities are illustrated in Fig. IV.6.14, with CERN coordinators giving explanations. We introduced a slot in the timetable during which the four CERN colleagues in charge of these sessions came to ESI to present the different topics. Each student could take part in two different experimental sessions, which meant spending two full days at CERN. Each student completed a table indicating their preferences, ranking their choices from 1 to 4. This worked perfectly well every year.

*RF measurements:* Fig. IV.6.15 shows the RF group conducting measurements using oscilloscopes and network analysers. This laboratory was at the CERN Prévessin site, and the sessions were run under the supervision of Fritz Caspers.

*Superconducting measurements:* Fig. IV.6.16 shows the Superconducting group conducting measurements. The laboratory was on the CERN Meyrin site. In collaboration with Amalia Ballarino, the session was run under the supervision of Jerome Fleiter.

*Magnet measurements:* Fig. IV.6.17 shows the Magnet group conducting electrical tests on a quadrupole magnet. One laboratory was on the CERN Meyrin site, and another was in the LHC hall. The sessions were run under the supervision Jérémie Bauché and Thomas Zickler.

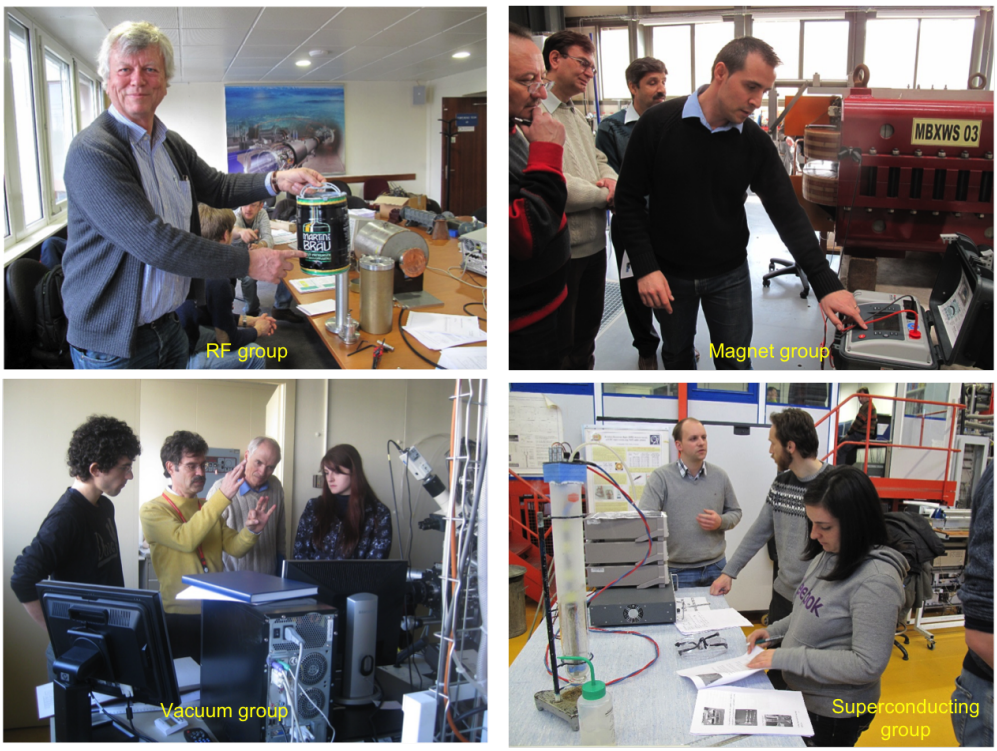



**Fig. IV.6.14:** The four practical-work groups with their corresponding supervisors.

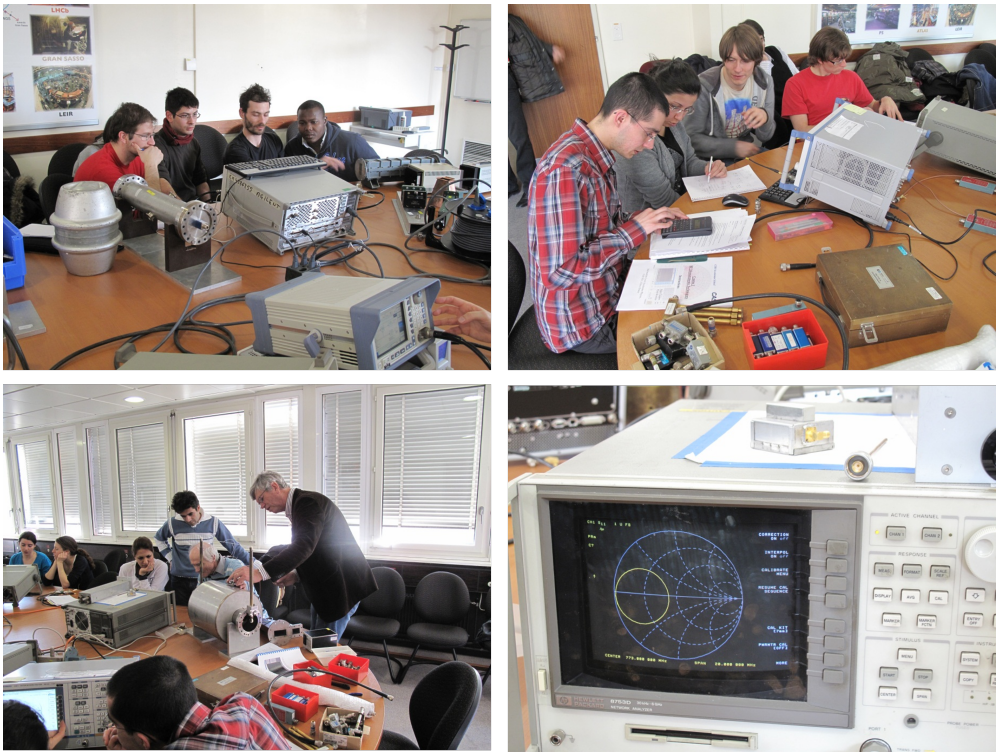


**Fig. IV.6.15:** Students performing RF measurements.

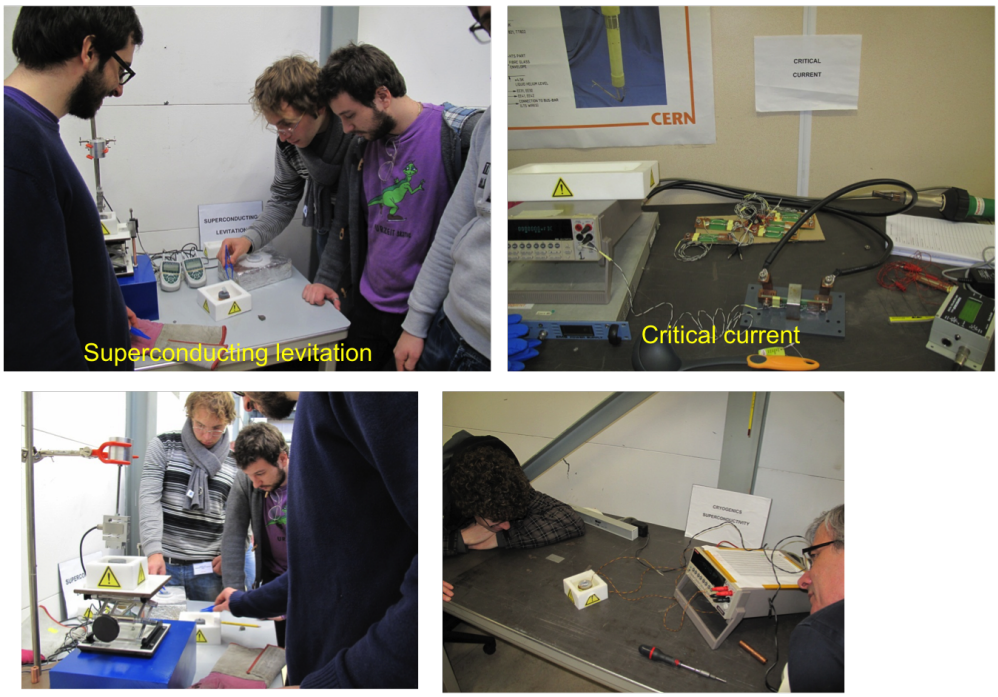
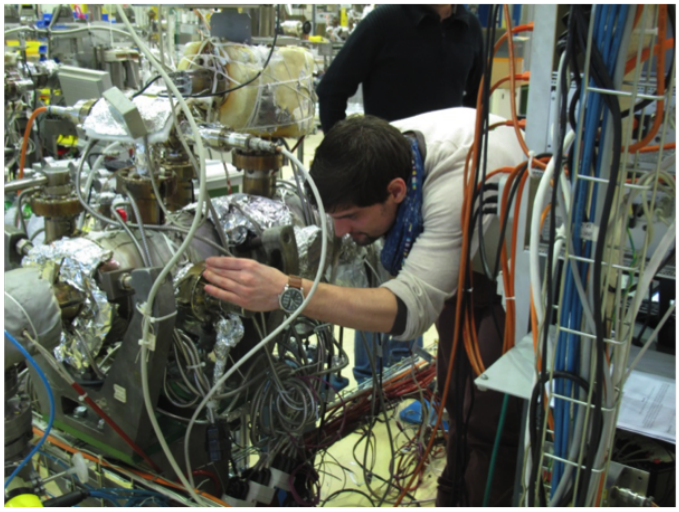
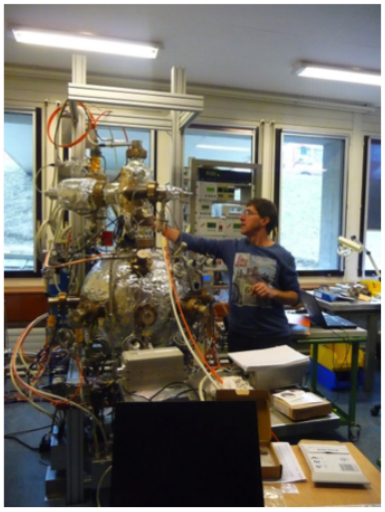


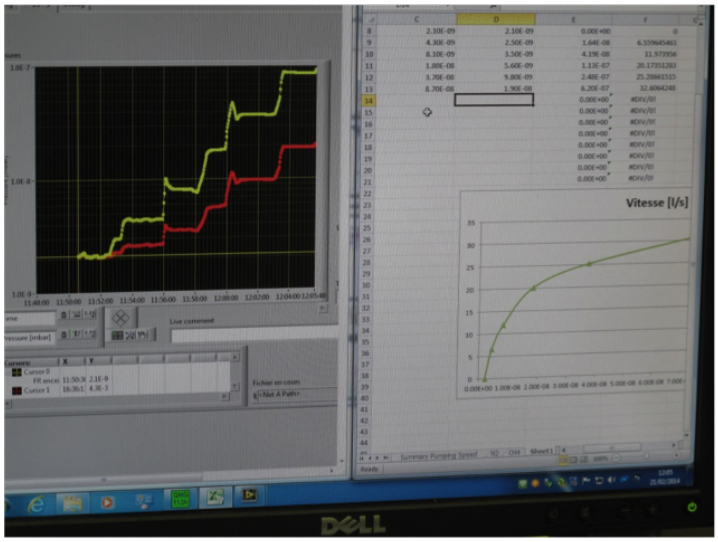

**Fig. IV.6.16:** Students performing superconducting measurements.


**Fig. IV.6.17:** Students performing magnetic measurements.

*Vacuum measurements:* Fig. IV.6.18 shows the Vacuum group conducting measurements and recording data. This laboratory was on the CERN Meyrin site. In collaboration with Paolo Chiggiato, several vacuum laboratories were made available for students. The different sessions were run under the supervision of Vincent Baglin, Berthold Jenninger, and Mauro Taborelli.








Pumping speed recorded by the JUAS students

**Fig. IV.6.18:** Students performing vacuum measurements.

### IV.6.7.2 Beam measurements from control rooms

#### *IV.6.7.2.1 At CERN*

Although the practical sessions at CERN were useful for JUAS students—in that they could perform measurements on RF systems, magnets, vacuum equipment, and superconducting devices—they were not able to "play" with real particle beams. Therefore, in 2014, I introduced the possibility for students, under the supervision of CERN experts, to perform real measurements on particle accelerators from a control room and manipulate real particle beams. The particle accelerator called CTF3 (CLIC Test Facility 3) was chosen for this (Fig. IV.6.19); it is a small machine at the human scale. This became the fifth option for the practical sessions, which now covered RF, magnets, superconductivity, vacuum, and beam measurements at CTF3. These efforts were reflected in a very high level of student satisfaction.

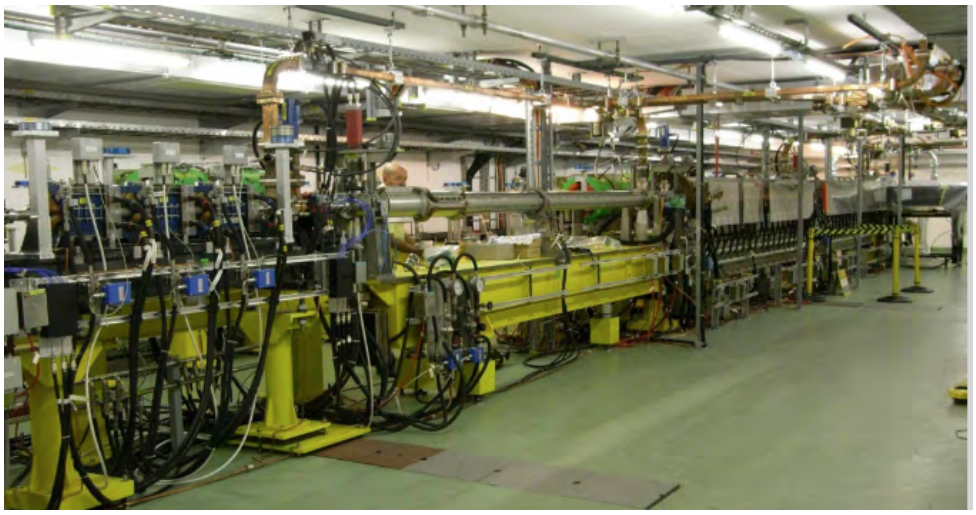


**Fig. IV.6.19:** The CTF3 accelerator.

Figure IV.6.20 shows the CTF3 control room, with JUAS students manipulating electron beams on the machine itself. After having prepared a study, under the supervision of Wilfrid Farabolini and Pierre Korysko, and recorded their own measurements with the electron beam, the students wrote reports presenting the experimental data and their analysis.

Figure IV.6.21 shows, as examples, the three first pages of reports written by students and submitted to the CERN experts. The first two were written by David Amorim and Felix Schliessmann on beam measurements performed on the CTF3 accelerator. The third was written by Mykola Zlygostiev on measurements performed on superconducting magnets during the practical days at CERN. The CERN experts provided feedback, comments, and suggested improvements for all the reports.

**Fig. IV.6.20:** The CTF3 control room with JUAS students at work.

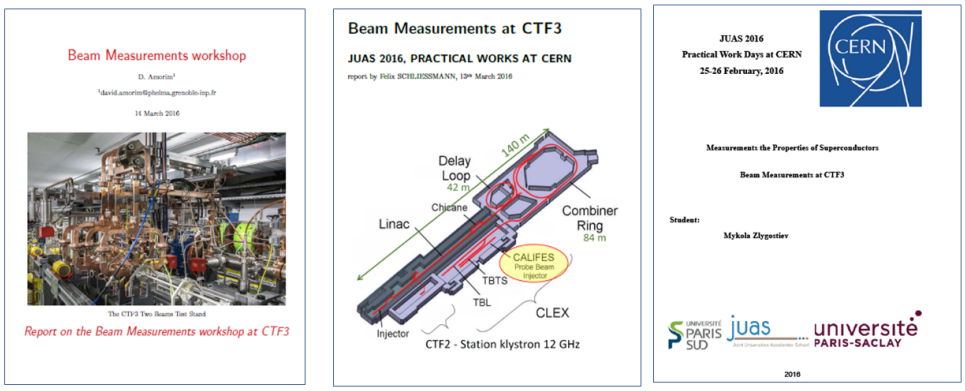



**Fig. IV.6.21:** Three reports written by JUAS students

#### *IV.6.7.2.2 At SOLEIL (Paris)*

Based on the enthusiasm from students for manipulating real particle beams and the success of the practicals, I got in touch with Laurent Nadolski, who was in charge of the SOLEIL machine studies. SOLEIL, an acronym for "Source Optimisée de Lumière d'Energie Intermédiaire du LURE[5]" is a research centre located on the Plateau de Saclay in Saint Aubin, Essonne (France). It is an electron-beam accelerator that produces synchrotron radiation, extremely powerful light that permits exploration of matter. In agreement with Amor Nadji, Director of the SOLEIL Accelerator Department, we were able to send a couple of JUAS students to perform beam measurements during one full day on this machine. These students travelled to Paris on Sunday and spent one night on the site (Fig. IV.6.22). They were ready on Monday morning to access the SOLEIL control room and work in collaboration with L. Nadolski and his colleagues. The machine studies were prepared in advance, in Archamps, to be ready to perform beam measurements for the full day on Monday.

**Fig. IV.6.22:** SOLEIL site in Saint Aubin, near Saclay, France.

#### *IV.6.7.2.3 At ESRF (Grenoble)*

A similar collaboration was introduced with the European Synchrotron Radiation Facility (ESRF) in Grenoble. The ESRF (Fig. IV.6.23) was conceived as a European collaboration for the advancement of X-ray science. In 1988, eleven European countries joined forces to build the world's highest performing and

[5]LURE: "Laboratoire d'Utilisation du Rayonnement Électromagnétique", the Laboratory for the Use of Electromagnetic Radiation was a pioneering laboratory in the field of synchrotron radiation. It was located in the premises of the Université d'Orsay, where research and development of the use of synchrotron radiation were cultivated on several machines (ACO: Orsay Collision Ring; DCI: Igloo Collision Machine; and SUPER ACO). SOLEIL has taken up the torch passed by LURE, which closed in 2003.

brightest “third-generation” light source. This visionary project has made an outstanding contribution to the excellence of European science. In collaboration with Jean-Luc Revol, who was in charge of the machine studies, and in agreement with Pantaleo Raimondi, Director of the Accelerator Department, a complete shift from the control room was planned for students. The machine studies were also prepared in advance, as for SOLEIL, to be ready to perform beam measurements in Grenoble.

**Fig. IV.6.23:** ESRF site in Grenoble, France.

### IV.6.7.3 Practical work at Bergoz Instrumentation

JUAS students spent a full day at Bergoz Instrumentation, a company based in Saint-Genis-Pouilly (France), 3 km from CERN. After a presentation of company activities and research areas, each student was given a kit of electronic components. The goal was to build an electronic device during the morning. Drawings were provided by Bergoz Instrumentation supervisors. After having finished the soldering and cabling, students were invited to check whether their devices were working as expected. All practical work was done under the supervisors listed in Fig. IV.6.24; this figure also shows JUAS students building Wi-Fi meters, soldering their components, and testing the performance of their devices using oscilloscopes and network analysers.

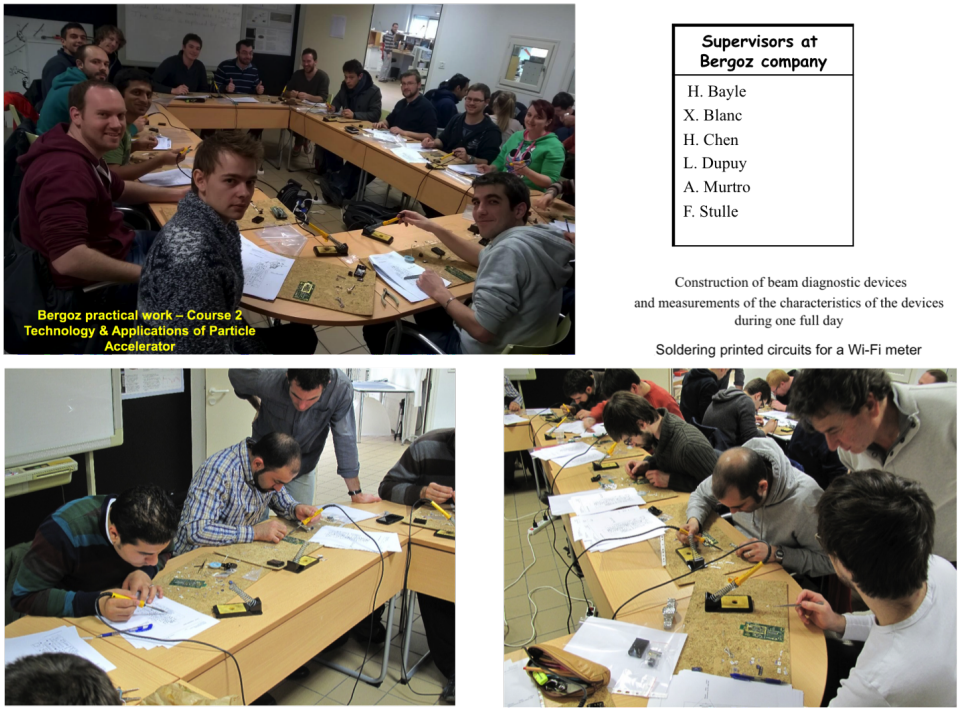



**Fig. IV.6.24:** Students soldering devices and performing measurements at Bergoz Instrumentation.

### IV.6.8 Students at the International Particle Accelerator Conference (IPAC)

Thanks to funding from the European Physical Society's Accelerator Group, the IPAC committee awarded a grant to one JUAS student from each year to attend the upcoming conference. The JUAS Director selected this student based on the overall exam results for Courses 1 and 2. In 2012, 2013, 2014, and 2015, I was able to secure two grants for JUAS students. Table IV.6.14 lists all those students who received a grant to go to IPAC between 2011 and 2016.

**Table IV.6.14:** The nine students selected for IPAC grants between 2011 and 2016.

| JUAS year | Student | University | IPAC | Place | Dates |
|---|---|---|---|---|---|
| 2011 | Yan Dutheil | Joseph-Fourier (Grenoble) | 2012 | New Orleans | 20–25 May |
| 2012 | Robert Stegmann | TU Darmstadt | 2012 | New Orleans | 20–25 May |
| 2013 | Jorge Giner Navarro | Valencia | 2013 | Shanghai | 12–17 May |
| 2013 | Alessio Mereghetti | Manchester | 2013 | Shanghai | 12–17 May |
| 2014 | Michele Carla | Barcelona | 2014 | Dresden | 15–20 June |
| 2014 | Nikolai Schmitt | TU Darmstadt | 2014 | Dresden | 15–20 June |
| 2015 | Philipp Dijkstal | TU Darmstadt | 2015 | Richmond | 3–8 May |
| 2015 | Giovanna Campogiani | La Sapienza (Roma) | 2015 | Richmond | 3–8 May |
| 2016 | David Amorim | Institut polytechnique de Grenoble | 2016 | Busan | 8–13 May |

### IV.6.9 Visits

Visits to laboratories were organised each year and for each course.

#### IV.6.9.1 CERN visit

In Course 1, a talk was given presenting CERN and its many particle accelerators. There followed visits to the linacs, the Antiproton Decelerator, and LEIR, as shown in Fig. IV.6.25. For Course 2, there were also talks presenting CERN, followed by visits to different accelerators. Students who followed both JUAS courses always visited different accelerators and laboratories (RF, magnets, etc.).

The CTF3 (Fig. IV.6.26) is a small electron beam accelerator used to test the two-beam concept for the future Compact Linear Collider (CLIC); it is well suited to JUAS students using it to perform beam measurements.

At a very different scale, students were always impressed by the visit to the huge LHC detectors. One of these detectors, the Compact Muon Solenoid (CMS), is shown in Fig. IV.6.27. We were lucky to have Marco Bozzo, from Genoa University, a member of the CMS collaboration, who always arranged visits with small groups of students. These were conducted close to the detector, and students enjoyed discovering such a big device.


**Fig. IV.6.25:** Linac 2, Linac 3, AD, and LEIR.

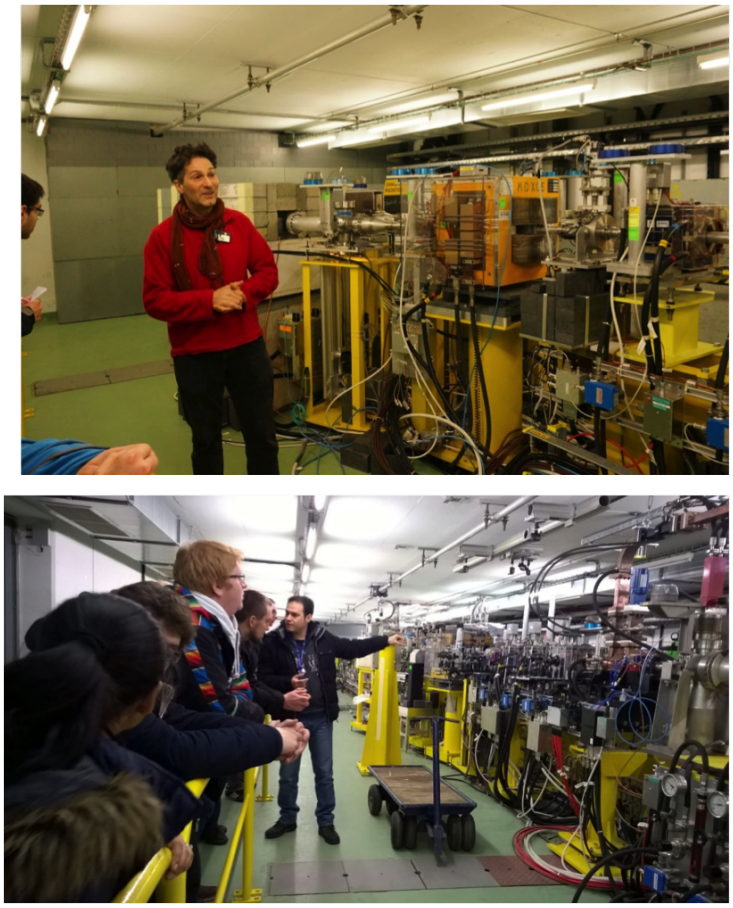


**Fig. IV.6.26:** CTF3 with the Probe Beam accelerator. Top: W. Farabolini; bottom: JUAS students.


**Fig. IV.6.27:** CMS detector on the LHC accelerator.

### IV.6.9.2 ESRF visit

The ESRF visit took place during Course 1. A full day was spent inside the laboratory. In general, this day was planned in January, when the machine was in shutdown. At the beginning of the day, presentations were given by the Visit Service, followed by presentations about the ESRF accelerator complex. The visits, in situ, to the Linac, Booster, and Storage Ring, as seen in Fig. IV.6.28, were always very valuable.


**Fig. IV.6.28:** ESRF presentation and inside the storage ring.

### IV.6.9.3 PSI visit

The PSI visit took place during Course 2. Initially, this visit was foreseen as lasting for one day; however, given the distance between Archamps and Villigen, I decided to organise this visit to span two full days. The students spent one night on the PSI site, and on the following day, they continued to visit several particle accelerators on the site. On top of that, on-site seminars were organised, avoiding the need for PSI experts to come to Archamps for 1-h seminars. This allowed the creation of a friendly atmosphere among students, the JUAS leadership, and the ESI staff. Figure IV.6.29 gives an overview of this visit.


**Fig. IV.6.29:** PSI site and particle accelerators in Villigen.

#### IV.6.9.4 Hôpitaux Universitaires de Genève (HUG) visit

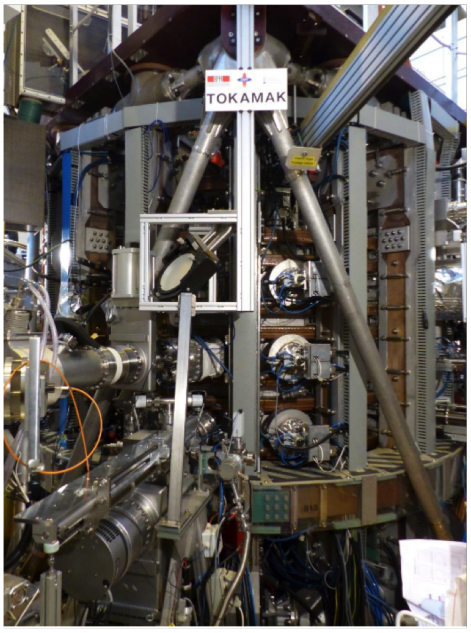
The visit to the HUG department of Radiation Oncology in the HUG took place during a full afternoon during Course 2. Following a talk from the department head, Prof. Raymond Miralbell, students visited the installations in small groups, as shown in Fig. IV.6.30. This needed to be organised carefully so that students did not disturb the patients waiting for treatment.


**Fig. IV.6.30:** HUG visit.

#### IV.6.9.5 EPFL tokamak visit

When the ESRF machine was not available to receive students (due to upgrades preventing access inside the tunnels), students visited the tokamak facility at EPFL (École Polytechnique Fédérale de Lausanne). Excellent presentations about tokamaks were arranged by Prof. Quang Tran (Fig. IV.6.31), followed by visits on site, as shown in Fig. IV.6.32.


**Fig. IV.6.31:** Tokamaks presented by Prof. Quang Tran.



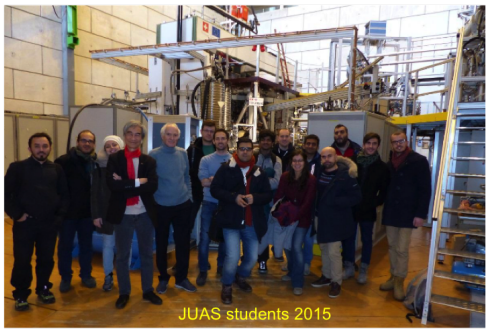




**Fig. IV.6.32:** EPFL tokamak in Lausanne.

#### IV.6.9.6 Visit and practical session at Bergoz Instrumentation

The visit to Bergoz Instrumentation took place during Course 2. Figure IV.6.33 shows the Goubau line developed by Frank Stulle. The full day spent inside the Bergoz Instrumentation company is described in Section IV.6.7.3 above.

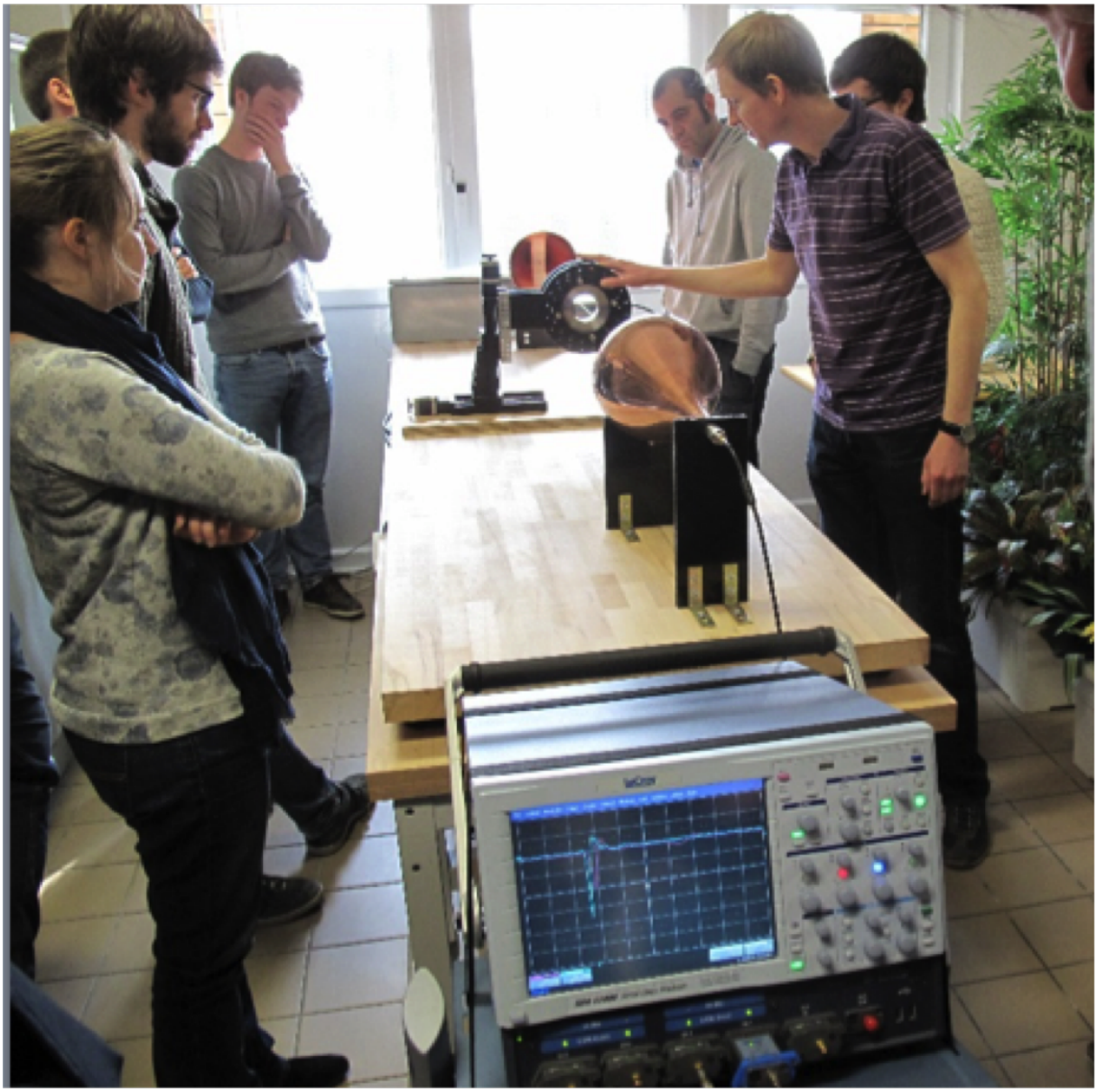


**Fig. IV.6.33:** Visit and demonstration, by Frank Stulle, at Bergoz Instrumentation.

## IV.6.10 Administrative matters

### IV.6.10.1 Advisory Boards

- The Advisory Board 2011 was held at Heidelberg University, hosted by Carsten Welsch.
- The Advisory Board 2012 was held at Genoa University, hosted by Marco Bozzo.
- The Advisory Board 2013 was held at Berlin University, hosted by Heino Henke.
- The Advisory Board 2014 was held at Grenoble University, hosted by Elsa Merle-Lucotte.
- The Advisory Board 2015 was held at Liverpool University, again hosted by Carsten Welsch, who had taken up a position there. Figure IV.6.34 shows the members of the Advisory Board who attended this meeting.
- The Advisory Board 2016 was held at Naples University, hosted by Vittorio Vaccaro. As an example for this year, Table IV.6.15 shows the representatives of the 16 partner universities as members of the Advisory Board. Table IV.6.16 shows the ten members of the Advisory Board selected *ad personam* as particle accelerator experts.

**Fig. IV.6.34:** Advisory Board members at Liverpool University in April 2015.

**Table IV.6.15:** University representatives on the Advisory Board at Naples University in April 2016.

| **JUAS University** | **Advisory Board member** |
|---|---|
| Université Joseph Fourier Grenoble | Jean-Marie De Conto |
| Technische Universität Darmstadt | Joachim Enders |
| Karlsruher Institut für Technologie | Anke-Susanne Müller |
| Universitat Politècnica de Catalunya | Youri Koubychine |
| Universitat Autonoma de Barcelona | Caterina Biscari |
| Institut polytechnique de Grenoble | Elsa Merle-Lucotte |
| Università degli Studi di Napoli "Federico II" | Vittorio Vaccaro |
| Università degli Studi di Roma "La Sapienza" | Mauro Migliorati |
| Università degli Studi di Genova | Marco Bozzo |
| Technische Universität Berlin | Heino Henke |
| Universitat de València | Angeles Faus-Golfe |
| University of Liverpool | Carsten Welsch |
| Université Paris-Sud Orsay | Sophie Kazamias |
| Universität Rostock | Ursula van Rienen |
| University of Oxford | Andrei Seryi |
| Universitetet i Oslo | Erik Adli |

**Table IV.6.16:** Expert members of the Advisory Board at Naples University in April 2016.

| **Advisory Board member** | **Affiliation** |
|---|---|
| Hans Hofmann | ESI President |
| Louis Rinolfi | JUAS Director |
| Philippe Lebrun | JUAS Deputy Director |
| Bernhard Holzer | CERN |
| Chris Prior | University of Oxford |
| Jean-Luc Revol | ESRF |
| Terry Garvey | PSI |
| Peter Forck | GSI |
| Winfried Decking | DESY |
| François Méot | BNL |

### IV.6.10.2 Sponsors and collaborative institutes

The logos of the 23 institutes, laboratories, and sponsors who supported JUAS between 2011 and 2016 are shown in Fig. IV.6.35. From France, there were six institutes and laboratories. From Germany, there were five laboratories. From Italy, there was one institute and one laboratory. From Spain, there was one institute and one laboratory. From Sweden, there was one laboratory. From Switzerland, there were two laboratories with an important contribution from CERN, one European programme and one private company. Finally, from the UK, there were two laboratories and one European programme.


**Fig. IV.6.35:** Logos of the 23 sponsors who supported JUAS between 2011 and 2016.

### IV.6.10.3 JUAS logos

The JUAS logo has changed three times over its 30 years. The different versions are shown in Fig. IV.6.36.

At the beginning of the JUAS school, Marcelle Rey-Campagnolle, with limited tools, designed the first logo. In 2011, when I took charge of the JUAS school, a new logo was designed; this showed the Salève building where JUAS lectures took place on the left, the JUAS students inside the amphitheatre on the right, and the LHC magnet in the middle. In 2014, the year of the 20th anniversary of JUAS, a new, more modern and stylised logo was introduced. The same type of stylised logo is now used for all ESI schools.


1994 - 2011 M. Rey-Campagnolle / ISN


2012- 2013 T. Kehrer / CERN


2014 - 2016 V. Guyony /Indélébile Création

**Fig. IV.6.36:** JUAS logos between 1994 and 2016 (the latter is still being used in 2024).

### IV.6.10.4 JUAS flyers and posters

Each year, the JUAS school was announced through various channels using, in particular, flyers and posters. Figure IV.6.37 shows the recto of a flyer with three columns: on the left, some photos about the two schools JUAS and ESMP; in the middle, the ESI coordinates; on the right, some text giving a brief history. Figure IV.6.38 shows the verso of the same flyer, also with three columns, giving more details


**Fig. IV.6.37:** Recto of JUAS flyer used to announce ESI schools.

about the two existing schools at this time.

Figure IV.6.39 shows the poster developed by Marie Gauthier and Tjiske Kehrer to promote and announce the 2012 JUAS school. For the first time, a background using the LHC accelerator was used. Partner universities and sponsors were also mentioned. Figure IV.6.40 shows the poster announcing JUAS 2014. Partner universities and sponsors now appeared with their respective logos.

ESMP

The Medical Physics includes Medical Imaging (PET Cameras, Ultrasound, MRI, scanners) to scan inside patient's bodies and survey their functioning, as well as treatment techniques such as radiotherapy (with X-Rays or Hadrons) and brachytherapy (where sources are implanted inside tumours). Use of these techniques requires sophisticated training for highly qualified staff and a training which has to follow the rapid development of the discipline.

ESMP, the European School of Medical Physics, organizes training courses for medical physicists and university students wishing to enter this field. ESMP has been established in partnership between the ESI-Archamps and EFOMP, the European Federation of Medical Physicists where 35 European countries are represented. ESMP, the school of EFOMP, is segmented into weeks, each dealing with one or two techniques of medical physics that can be grouped as follows:
- Two weeks of medical imaging
- One week of medical informatics
- Two weeks of radiotherapy and brachytherapy.
- One week on radiation protection in medical physics.

Each week is followed by approximately 35-40 students who are individually provided with a computer for practical exercises (modelling, simulation). In 2010 about 100 students come from 25 countries to follow the courses delivered by sixty teachers, who are experts in their field and were coming from 14 countries (Europe, USA) and CERN. Since its foundation more than 1,200 students came to ESMP in Archamps. They have appreciated the ease of contacts with teachers due to deliberately limited number of participants (maximum 40), the permanent teacher availability, and a friendly atmosphere despite (or because) the diversity of origins.

Among the unqualified support to ESMP we have to mention:
- EFOMP *European Federation of Organisations in Medical Physics*
- CERN and University Hospital of Geneva (Switzerland)
- IAEA, Vienna (Austria)
- Centre Léon Bérard, Lyon (France)
- Royal Marsden Hospital & King's College, London (UK)
- Hôpital Pitié-Salpetrière, Curie Institute & CEA-SHFJ, Paris (France)
- DKFZ Heidelberg & PTW Freiburg (Germany)
- University Federico II (Napoli) and TERA (Novara, Italy)
- Trinity College, St James' Hospital (Dublin, Ireland)
- Holycross Cancer Centre (Kielce, Pl)

http://www.cur-archamps.fr/esi

EUROPEAN SCIENTIFIC INSTITUTE ESI

European Scientific Institute

**Premises and equipment**

In the Saleve building, the Institute has at its disposal a 76-seat amphitheater, a large computer room and 190 m2 of office space for staff and faculty.

The computer room is equipped with 40 personal computers with specialized software to adapt the lessons to the needs of research laboratories, hospital techniques and industrial applications in physics. The students are thus immersed in the professional world. Practical exercises are also held at CERN and the Cantonal Hospital of Geneva.

**The ESI Team**

Manfred BUHLER-BROGLIN (ESI President )
Marie GAUTHIER (ESI Administrator)
Filiz DEMOLIS (ESI Assistant)
Yves LEMOIGNE (ESMP Director)
Louis RINOLFI (JUAS Director)

http://www.esi.cur-archamps.fr

JOINT UNIVERSITIES ACCELERATOR SCHOOL

The JUAS school provides a training of university style in collaboration with the consortium "CLUSTER" (fourteen European Universities) and CERN. The courses last for ten weeks: five weeks are devoted to physics of accelerators, five weeks to technologies of accelerators. Classes are taught by the best specialists in these fields.
In 2012, 37 participants have followed the course 1 and 40 participants the course 2, from 22 different countries.
Since its beginning in 1994, JUAS has welcomed 800 students.
For the partner universities of JUAS, the teachings of the two JUAS courses are part of their Master curriculum.
Each course is followed by an exam allowing the acquisition of 10 ECTS (European Credit Transfer System) issued by the home institutions of students.
All the 32 JUAS teachers arise partly from universities, CERN and research laboratories. Students are living 10 weeks in a multicultural community sharing an atmosphere favourable to international work.
They appreciated a direct contact with teachers who are acquainted with the latest developments of these technologies.

**The 14 partner universities are:**
- Universitat Politècnica de Catalunya
- Universitat Autònoma de Barcelona
- Technische Universität Darmstadt
- Université Joseph Fourier Grenoble
- Institut National Polytechnique de Grenoble
- Karlsruher Institut für Technologie
- Università degli Studi di Napoli « Federico II »
- Università degli Studi di Roma « La Sapienza »
- Technische Universität Berlin
- Università degli Studi di Genova
- Universitat de València
- Universität Heidelberg
- University of Liverpool
- Université Paris Sud - Orsay

**The Sponsors Laboratories are:**
Bergoz Instrumentation (F), CEA Saclay (F), CERN (CH), CNRS-IN2P3 (F), CPAN (E), DESY (D), ESRF (F), GSI (D), HIC for FAIR (D), HZB (D), INFN (IT), OPAC (UK), PSI (CH), SOLEIL (F).

www.cern.ch/juas

**Fig. IV.6.38:** Verso of JUAS flyer used to announce ESI schools.


**Fig. IV.6.39:** Poster for JUAS 2012 distributed in the European universities, laboratories, and institutes.


**Fig. IV.6.40:** Poster for JUAS 2014 distributed in the European universities, laboratories, and institutes.

### IV.6.10.5 JUAS and ESI structure

Between 2011 and 2016, several changes occurred within ESI. Figure IV.6.41 shows the ESI organisational chart in 2011, with Manfred Buhler-Broglin as ESI President, and Tamara Barberan and Filiz Demolis providing administrative and logistical support for the two schools, JUAS and ESMP (with Yves Lemoigne as Director).

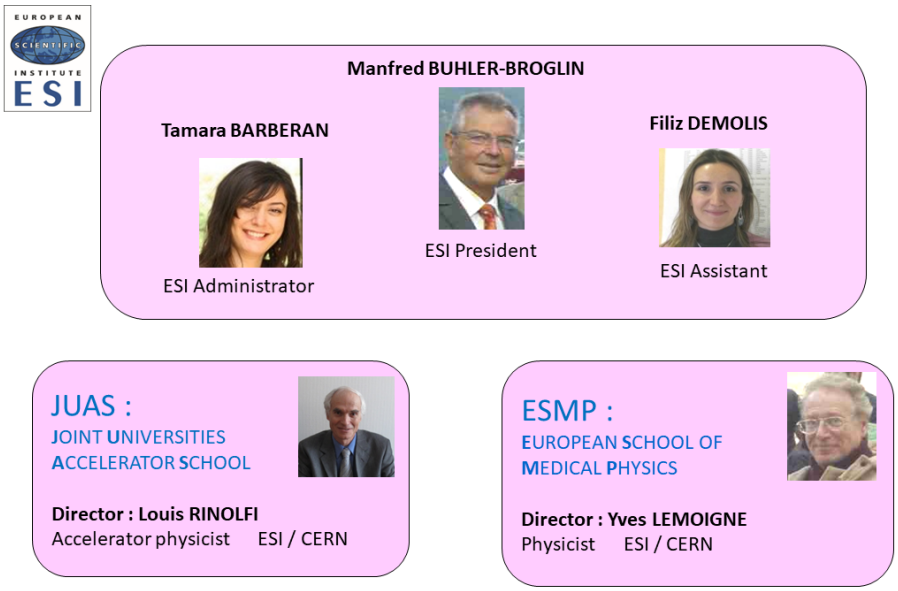



**Fig. IV.6.41:** ESI staff and two school Directors in 2011.

At the end of 2011, the team was hastily reorganised following Tamara's resignation and Filiz's departure on maternity leave. Fortunately, Sébastien Rinolfi, an engineer from ENSIMAG in Grenoble, agreed to provide support to the ESI schools, and we were lucky to recruit Marie Gauthier as the new administrator. Figure IV.6.42 shows the organisational chart in 2012.

In November 2012, Manfred Buhler-Broglin stepped down as ESI President, replaced by Hans Hoffmann. Filiz Demolis took extended parental leave, and Coline Creton was recruited as a new assistant. Figure IV.6.43 shows the new organisation at ESI. Furthermore, for the first time, a JUAS Deputy Director was nominated in the person of Michel Martini, who had been a JUAS lecturer for many years. In 2014, further changes occurred. Elias Métral replaced Michel Martini as JUAS Deputy Director, a new school (ESIPAP) was launched by ESI, and there was a change in the management of ESMP. Marjorie Romand replaced Coline Creton as administrative assistant. Figure IV.6.44 shows the new JUAS team inside the ESI structure in 2014, at the time of the 20th anniversary of JUAS. This organisation chart remained the same until July 2016, when I stepped down as JUAS Director.

To give students the opportunity to discover the local region and take a break from particle accelerators, ESI organised two Saturday day trips during each course. For Course 1, students had the opportunity to visit Annecy and Lausanne, and for Course 2, excursions were organised to Lyon and Chamonix. These trips were optional, with ESI organising the transport and students paying a small contribution to offset some of the cost. Figure IV.6.45 shows pictures of the four places visited by the students.

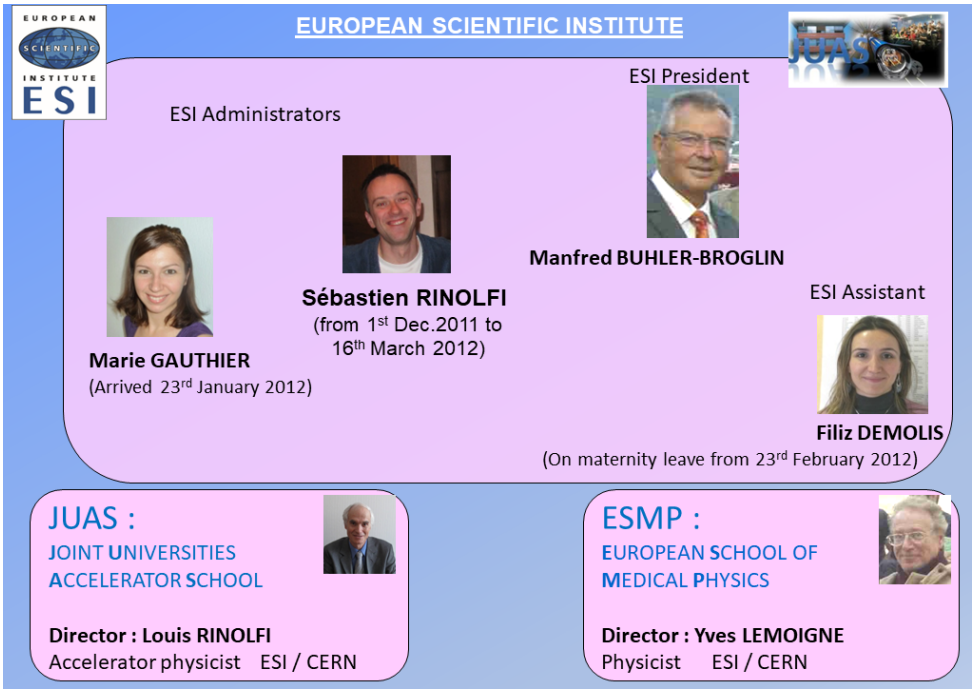



**Fig. IV.6.42:** ESI staff and two school Directors in 2012.

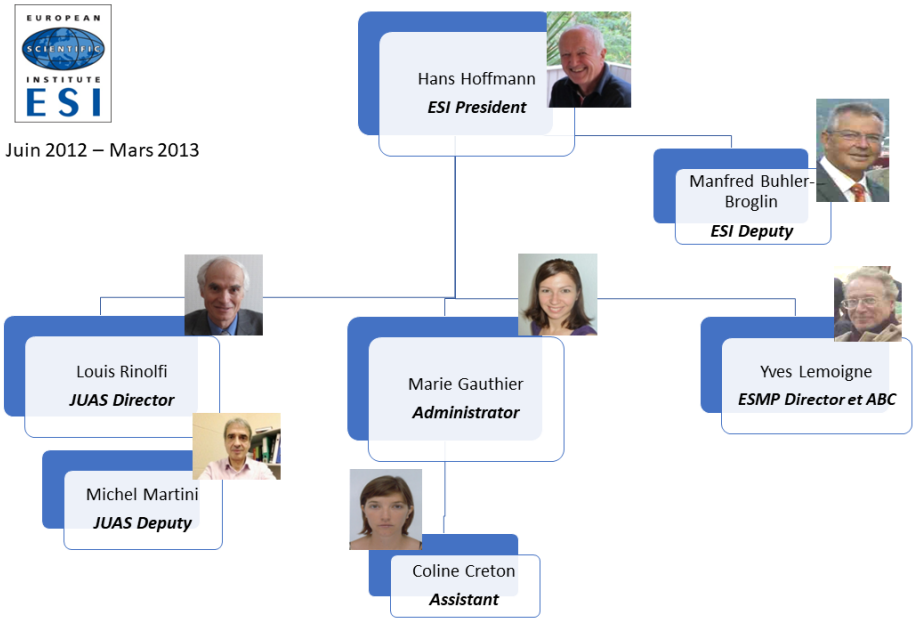



**Fig. IV.6.43:** ESI staff and JUAS team in 2013.

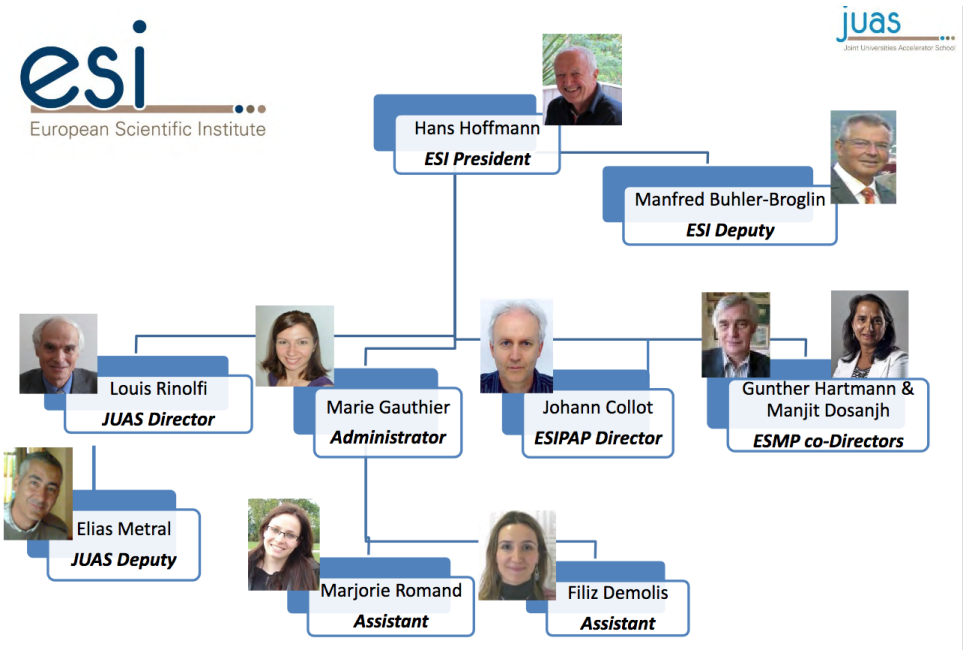



**Fig. IV.6.44:** ESI staff and JUAS team in 2014.


**Fig. IV.6.45:** The four places offered to students for touristic visits.

### IV.6.11 20th anniversary of JUAS

For the 20th anniversary of JUAS, a brochure of eight pages was published describing the history of JUAS, the partnerships with 15 European universities, the strong collaboration with CERN, and the laboratories and institutes supporting JUAS and sending lecturers to teach at the school. Figure IV.6.46 shows the first page of this brochure.


**Fig. IV.6.46:** Brochure for the 20th anniversary of JUAS.

The celebration of the 20th anniversary of JUAS was held on 25 April 2014, in Grenoble, where JUAS had its origins. Today, the name Joseph Fourier University has disappeared, and now it is called LPSC (Laboratoire de Physique Subatomique et de Cosmologie). The celebration was held at the LPSC laboratory following the Advisory Board at Grenoble INP (Institut National Polytechnique). An invitation letter (Fig. IV.6.47) was sent to the French "Ministre de l'Enseignement Supérieur et de la Recherche", Geneviève Fioraso. She answered positively, but the day before the meeting, the French President François Hollande asked her to remain in Paris for an urgent issue.

The event brought together more than 100 scientists, lecturers, students, and institutional partners, all present to share a special day dedicated to the school (Fig. IV.6.48). This was an opportunity to look back over the past 20 years and debate the future. In the morning, presentations were given as follows: Alex Mueller, “Specificity of the Benodet school for technicians”; Steve Myers, “Needs for special training on accelerators for medical applications”; Luigi Palumbo, “Role of universities in training related to particle accelerators”; Phil Burrows, “Overview of the needs in Europe in light of the TIARA survey”; Pantaleo Raimondi, “Difficulty in finding right skills for new projects”; Hans Hoffmann, “Role of ESI to organise several schools and support transfer technology”; and Louis Rinolfi, “How JUAS responds to evolving training needs?”.

In the afternoon, there was a roundtable discussion. Figure IV.6.49 shows the moderators who animated the fruitful discussions with participants in the LPSC amphitheatre. An article was published in the CERN Courier [4] relating to this captivating event for JUAS in Grenoble.

LPSC Grenoble
Laboratoire de Physique Subatomique et de Cosmologie

Madame Geneviève FIORASO
Ministre de l'Enseignement Supérieur et de la Recherche
1 rue Descartes
75231 Paris cedex 05

Grenoble, le 12 décembre 2013

**Objet** : Invitation au 20ème anniversaire du JUAS,
le 25 avril 2014 à Grenoble

Madame la Ministre,

Les 23 et 24 avril 2014, se tiendra à Grenoble la réunion annuelle du JUAS (Joint Universities Accelerator School), référence européenne en matière d'enseignement sur les accélérateurs de particules.

Dans ce cadre, le Laboratoire de Physique Subatomique et de Cosmologie de Grenoble a le plaisir d'accueillir, en ses murs le 25 avril, le vingtième anniversaire de cette prestigieuse école, en présence de représentants d'institutions et de laboratoires européens partenaires, et avec le soutien de l'ESI (European Scientific Institut).

L'évènement revêt un caractère particulier puisque Grenoble s'avère être le lieu de naissance du JUAS. De plus, cette école participe au rayonnement de notre ville car elle dispense aujourd'hui un enseignement et des cours pratiques de très haut niveau à de jeunes physiciens de toute l'Europe et ceci en lien avec les formations de l'Université de Grenoble et la participation de personnels du site.

Cet anniversaire se déroulera en présence du professeur Rolf Heuer, Directeur Général du CERN. Ce dernier présidera une table ronde sur l'avenir des accélérateurs de particules et d'éminents physiciens européens donneront un ensemble de conférences sur le sujet.

Monsieur Louis Rinolfi, Directeur du JUAS, se joint à moi afin de vous inviter à prendre part à cette célébration, sous la forme qui vous apparaitra la plus adaptée. Nous vous adresserons pour cela la liste complète des conférenciers ainsi que le programme précis de cet événement lorsqu'il sera mieux établi.

Nous vous remercions de bien vouloir considérer cette demande, en espérant que votre agenda vous permettra de nous honorer de votre présence.

Dans l'attente de votre réponse, nous vous prions de croire, **Madame la Ministre**, en l'assurance de notre très haute considération.

Serge KOX,
Directeur du LPSC

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**Fig. IV.6.47:** Invitation letter sent to the French Minister for the 20th anniversary of JUAS.


**Fig. IV.6.48:** Participants in the 20th anniversary of JUAS.

**Fig. IV.6.49:** Roundtable for 20th anniversary of JUAS. From left to right: Luigi Palumbo (Director of Department of Applied Sciences for Engineering/Sapienza University/Rome), Phil Burrows (Professor at University of Oxford/Chairman Education and Training group (Eucard2)), Steve Myers (Former Director of CERN Accelerators Department), Pantaleo Raimondi (Director of ESRF Accelerators), Frédérick Bordry (Director of CERN Accelerators and Technology, representing the CERN DG, chairman), Hans Hoffmann (President of ESI), and Louis Rinolfi (JUAS Director).

## Acknowledgements

My thanks to Elias Métral, Marco Bozzo, and Jens Vigen for their help in reading and rebuilding some tables, and to Bob Holland for reading through the draft and suggesting some rewording for the sake of clarity.

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