Chapter IV.3

JUAS during the period 1994–2000

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This chapter covers how the JUAS came into being, the period Marcelle Rey-Campagnolle was JUAS Director (i.e. between 1994 and 2000).

As nuclear physicist, I had been a "user" of particle accelerators throughout my career, especially at CERN, where I arrived in 1981–1982. In the subsequent years, I saw how difficult it was for students to find a job after a PhD in nuclear or particle physics, and I began to see accelerator physics and technologies as more promising fields. Accelerators were advancing beyond research in medicine, industry, archaeology, and other areas, and the exacting requirements of pure science were pushing the limits of technology forward and stimulating developments in areas including superconductivity, cryogenics, vacuum, and geodesy.

In 1992, my home institute was ISN[1] in Grenoble, and Prof. J.P. Longequeue was the Director of one of the High Schools of INPG. He knew my professional path, and I naturally accepted his invitation to participate in the preparation of the "Archamps project" in September. I was involved in the discussions between the representatives of the four partner universities who fixed the frame of this foreseen special training of students outside their home university:

- Prof. J.P. Longequeue for INP Grenoble;
- Dr. H. Spalt for Technische Universität Darmstadt;
- Prof. D. Engelhardt for Universität (TH) Karlsruhe;
- Prof. F. Merchez for Université Joseph Fourier Grenoble.

The President of INPG endorsed the project (see his Letter Of Intent of December 1992 in Fig. IV.1.3 in Chapter IV.1). In his positive response of February 1993 (see Fig. IV.1.4 in Chapter IV.1), the CERN Director General C. Rubbia engaged the universities to present a detailed programme. This is how I was engaged in the adventure.

1994 is now long ago… big changes have occurred since then. The geographical environment is one example (see the view of Archamps in Fig. IV.3.1). More important for the school was the evolution

This chapter should be cited as: JUAS during the period 1994–2000, M. Rey-Campagnolle, DOI: 10.23730/CYRSP-2024-003.2239, in: Proceedings of the Joint Universities Accelerator School (JUAS): Courses and exercises, E. Métral (ed.), CERN Yellow Reports: School Proceedings, CERN-2024-003, DOI: 10.23730/CYRSP-2024-003, p. 2239.

[1]ISN: Institut des Sciences Nucléaires, now LPSC: Laboratoire de Physique Subatomique et de Cosmologie.

of the means of communication: we passed from a paper era to a digital one. The Internet was gradually expanding between research centres and computer companies, primarily in the US, when CERN established its connection to the outside world. The World Wide Web was invented at CERN in 1990, but 1994 was the "Year of the Web"[2].

Fig. IV.3.1: View of Archamps Business Park in 1994 with the Campus at the bottom right.

Unfortunately, at ESI, no records have been found of the early electronic communications from JUAS. However, when I retired from CNRS and left CERN in the early 2000s, I kept some of my JUAS memoirs on paper and floppy disks (another time!). It is from these documents that I could go back to the original information and write the following lines. Based on my memories, I believe that the first webpage was for the 1996 session: http://wwwjuas.cern.ch/juas. This was probably just an announcement—in any case, the first archived version is from 1997. The full information about JUAS was installed for the 1999 session when the Web extended outside the research laboratories (and... I knew enough about HTML language to do it). Its URL was http://www.cern.ch/Schools/JUAS. We then stopped editing the Information Bulletins (issued twice a year) on paper.

In 1994, no digital network yet existed to connect CUFRA to the outside world. The computing facilities started there slowly: PCs were available for certain tutorials in 1996, and the first email address for the JUAS secretariat at Archamps was established in 1999: bholland@cur-archamps.fr; this also indicates that independent administrative support for JUAS had not yet been fully established at ESI.

The posters, the first tools used for JUAS advertising, serve as valuable sources of information. Figures IV.3.2 to IV.3.4 show posters from the years 1995, 1998, and 2000. They evolved over time as progressively more information could be given on the website. We always tried to diversify the advertisements, aiming to attract more candidates and to promote this new and highly specialised school to universities that could not justify a full course at a local level. In the early years, not all students had an

[2]The First International World-Wide Web Conference was organised at CERN; see https://cds.cern.ch/record/278586.

email address, and most learned about JUAS through a professor or supervisor, with around 15% hearing of it through a poster and 10% via the Web. Word of mouth followed later!

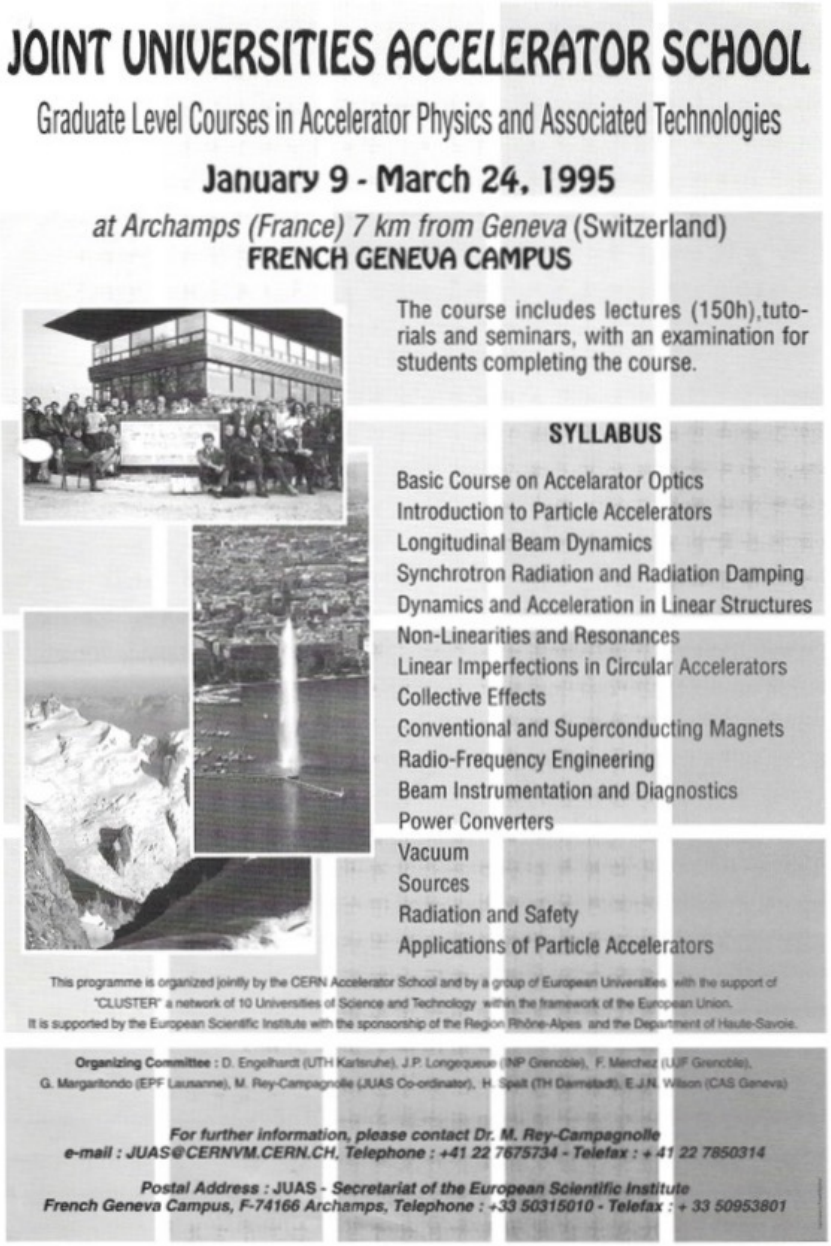


Fig. IV.3.2: Poster for JUAS 1995.

The present format of tuition was installed progressively, by successive adjustments, under the supervision of university representatives and accelerator specialists who volunteered to experiment with this new venture. In 1994, the academic cursus was not yet unified in Europe, and while the four university partners all agreed to ask for "university-style" courses at pre-PhD level for students having no preliminary knowledge of accelerators, the duration of the school was still a topic of discussion. Initially, it lasted eight weeks. The accelerator specialists had their professional constraints, and each could give up to 4 h of lectures per day due to the distant situation of Archamps from their home laboratory. They

Fig. IV.3.3: Poster for JUAS 1998.

recognised the value of having longer time to teach the students and thus providing them with a deeper level of knowledge than the seminar-style courses they were used to at CAS[3]. The examination ending each JUAS session were implemented from the very beginning, under the responsibility of one university (UJF in 1994), using its own system of marking. Harmonisation came slowly afterwards.

The first session of JUAS in 1994 was an experimental test: 135 h of lectures and tutorials were delivered over eight weeks by 24 specialists, a majority coming from CERN (60%), but there were also

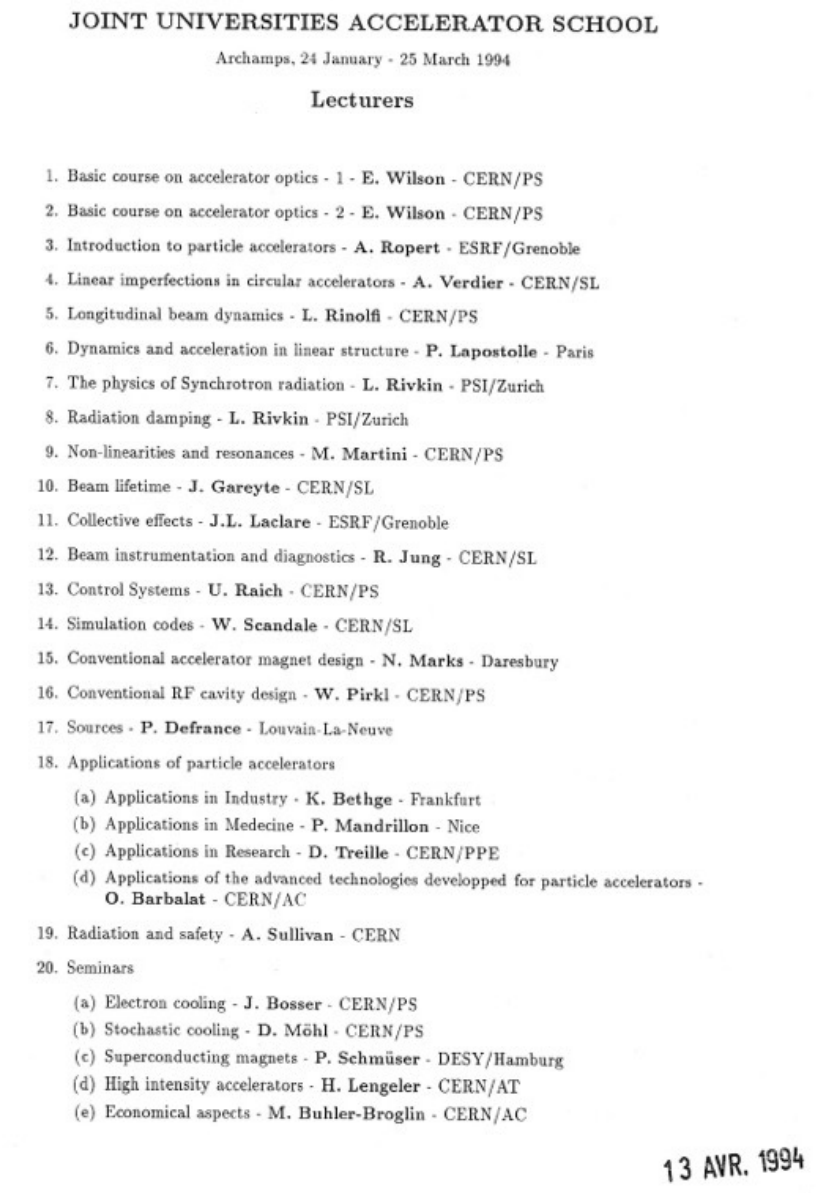
[3]CAS: CERN Accelerator School.

Fig. IV.3.4: Poster for JUAS 2000.

some from ESRF[4], PSI[5], DESY[6], Daresbury[7], Louvain-la-Neuve, and Paris. Three half-days of visits at CERN and ESRF were also organised, and seven half-days of practicals took place at CERN (six on computer codes, and one on beam instrumentation). Figure IV.3.5 shows the programme of lectures and the lecturers.

There were 29 enrolments: 16 students plus 13 postdocs and technical staff (six part-time) coming from ten universities/institutes and six European countries, all newcomers to the accelerator domain.

[4]ESRF: European Synchrotron Radiation Facility in Grenoble, France.
[5]PSI: Paul Scherrer Institute, Switzerland.
[6]DESY: Deutsches Elektronen Synchrotron, Germany.
[7]Daresbury: CLRC Daresbury Laboratory, UK.



JOINT UNIVERSITIES ACCELERATOR SCHOOL

Archamps, 24 January - 25 March 1994

Lecturers

1. Basic course on accelerator optics - 1 - **E. Wilson** - CERN/PS
2. Basic course on accelerator optics - 2 - **E. Wilson** - CERN/PS
3. Introduction to particle accelerators - **A. Ropert** - ESRF/Grenoble
4. Linear imperfections in circular accelerators - **A. Verdier** - CERN/SL
5. Longitudinal beam dynamics - **L. Rinolfi** - CERN/PS
6. Dynamics and acceleration in linear structure - **P. Lapostolle** - Paris
7. The physics of Synchrotron radiation - **L. Rivkin** - PSI/Zurich
8. Radiation damping - **L. Rivkin** - PSI/Zurich
9. Non-linearities and resonances - **M. Martini** - CERN/PS
10. Beam lifetime - **J. Gareyte** - CERN/SL
11. Collective effects - **J.L. Laclare** - ESRF/Grenoble
12. Beam instrumentation and diagnostics - **R. Jung** - CERN/SL
13. Control Systems - **U. Raich** - CERN/PS
14. Simulation codes - **W. Scandale** - CERN/SL
15. Conventional accelerator magnet design - **N. Marks** - Daresbury
16. Conventional RF cavity design - **W. Pirkl** - CERN/PS
17. Sources - **P. Defrance** - Louvain-La-Neuve
18. Applications of particle accelerators
    (a) Applications in Industry - **K. Bethge** - Frankfurt
    (b) Applications in Medecine - **P. Mandrillon** - Nice
    (c) Applications in Research - **D. Treille** - CERN/PPE
    (d) Applications of the advanced technologies developped for particle accelerators - **O. Barbalat** - CERN/AC
19. Radiation and safety - **A. Sullivan** - CERN
20. Seminars
    (a) Electron cooling - **J. Bosser** - CERN/PS
    (b) Stochastic cooling - **D. Möhl** - CERN/PS
    (c) Superconducting magnets - **P. Schmüser** - DESY/Hamburg
    (d) High intensity accelerators - **H. Lengeler** - CERN/AT
    (e) Economical aspects - **M. Buhler-Broglin** - CERN/AC

13 AVR. 1994

Fig. IV.3.5: Educational programme of the first session of JUAS in 1994.

The examination was composed of two 3-h written tests on eight subjects provided by the lecturers. This exam was compulsory for seven students, but 20 took it. The success rate was 18/20. At the end, we paid particular attention to the participant's comments, which were gathered on a special sheet: "STUDENTS' IMPRESSIONS". This enquiry was retained for the following years and, together with the impressions of the lecturers, it helped with improving the courses. At the evaluation meeting (14 April 1994), as a first attempt to organise this kind of course, everyone felt that it had been a great success with students, lecturers, and the university authorities, thanks to the involvement of CAS and accelerator scientists. The students maintained their enthusiasm and motivation up to the end of the course. They all completed the two months, and although they suggested adjustments for the following year, their reactions were extremely positive. Comments from representatives of the universities stressed the unique opportunity

offered by this school in bringing the students of many nations together. This created a more stimulating environment compared to the traditional binary exchange that was the common practice at the time. The examining bodies were pleasantly surprised to find that the results were in line with those from exams in their own institutions. This was particularly notable in view of the broad spectrum of experience among the students (diploma, doctoral, postdoctoral, and even academic staff). Figure IV.3.6 shows the picture of the group I took with my little Olympus "mju-1" film camera.

Fig. IV.3.6: Picture of the first JUAS students in 1994. Many of them are now distinguished accelerator engineers and scientists.

The lecturers found this new form of teaching (at least novel for CERN staff) very gratifying. They appreciated the opportunity to interact with a small group and found it professionally rewarding to re-examine their own basic understanding of the subject to present it effectively to the students. The JUAS course was quite different from, and complementary to, the usual CERN Accelerator School (seminar-style) course. It catered for a different kind of student, early in their professional learning, who chooses to follow an intensive course covering the whole subject. It was clear that more mature accelerator scientists would still find the shorter CAS courses suited to their schedules, and there was no doubt that the intensive course, coupled with an exam, was an excellent way to start.

It was proposed that the next school should last at least three months to qualify for support from the European Community, a duration that aligned with requests from both participants and lecturers. In June 1994, the Scientific Policy Committee of CERN approved the continuation of JUAS for two more years. In September 1994, JUAS became a School of ESI, the newly created European Scientific Institute, with a specific budget but it retained its independent pedagogic structure. I remained the Coordinator of the school and became the JUAS representative on the ESI Board.

JUAS 1995 and 1996: ten weeks. Everyone satisfied, but signs of weaknesses. A total of 138 h of lectures (138 slots of 50 min) and 47 h of tutorials, which were clearly separated and took place in the afternoon. They were delivered by 22 specialists (nine new ones, which reduced the contribution of CERN staff—the main concern of the new CERN management—to about 40%). The total number

of tuition hours was increased by 50%, with the additional time mainly devoted to the technology part. There was clear student interest in industrial and applied subjects. The oncology department of the Geneva Hospital (HUG) was added to the visits. The lecturers improved their oral presentations, and copies of their transparencies were distributed to all students. In turn, the students took on the task of writing up the tutorials (exercises with their solutions). The programme for JUAS 1996 can be seen in Fig. IV.3.7. Figures IV.3.8 and IV.3.9 show pictures of students from JUAS 1995 and JUAS 1996, respectively.

EDUCATIONAL PROGRAMME

The detailed syllabus is given on a separate document. It will be presented by twenty among the best European specialists in the field. Their name is given in the following table together with their corresponding subject, numbers of lectures (L) and tutorials (T). The seminars form a special category which are meant to give a 'window' beyond the course proper.

	Subject	L	T	Lecturers
0	Electro-magnetic theory for physicists	2		JP Longequeue /ENSP Grenoble
	Relativity for engineers	2		JP Longequeue /ENSP Grenoble.
1	Introduction to particle accelerators	8		E.J.N. Wilson /CERN-AC
2	Longitudinal beam dynamics	9	4	L. Rinolfi /CERN & SLAC
3.	Transverse beam dynamics	8	4	M. Martini /CERN-PS
4	RF linear accelerators	9	2	D. Tronc /GE Medical Systems
5	Cyclotrons	5	1+V	Th. Stammbach /PSI Villigen
6	Other low energy accelerators	2		S. Kapitza /IPP Moscow
7	Injection & extraction	2		G. Mülhaupt /ESRF Grenoble
8	Physics of synchrotron radiation	10	5	L. Rivkin /PSI Villigen
9	Space charge effects & instabilities	6	3	L. Palumbo /INFN Frascati
10	Linear imperfections in circ. accel.	8	3	A. Ropert /ESRF
11	Non-linearities and resonances	8	4	M. Martini /CERN-PS
12	Radio-frequency engineering	11	5	W. Pirkl /CERN-PS
13	Conventional accelerator magnets	8	5	N. Marks /DRS Daresbury
14	Superconducting magnets	6		M. Wilson /Oxford Inst.& CERN
15	Beam instrument. and diagnostics	7	V	P. Strehl /GSI Darmstadt
16	Vacuum systems	6	V	A. Poncet /CERN-MT
17	Sources of charged particles	4	V	K. Langbein /CERN-PS
18	Control systems	4	V	U. Raich /CERN-PS
19	Radiation and safety	4	2	P. Berkvens /ESRF Grenoble
20	Designing an accelerator together		4	H. Lengeler /CERN & KFA Jülich
21	Seminars			
	Applications of accelerators in basic and applied research	1		O. Barbalat /CERN-AC
	Industrial applications of accelerators	1		O. Barbalat /CERN-AC
	The accelerator industry	1		O. Barbalat /CERN-AC
	Applications of ion beams	2		H. Bernas /CSNSM Orsay
	Accelerator for spallation sources	2		P.J. Bryant /CERN-PS
	Accelerators for radiotherapy	2	V	R. Miralbell /HCU Geneva
	CLIC an linear collider for the future	2		L. Rinolfi /CERN & SLAC

JUAS Advisory Committee

Pr. P. Boyer - Université Joseph Fourier*, Grenoble
Pr. A. Donath - Hôpital Cantonal Universitaire, Genève
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Pr. JP. Longequeue - Institut National Polytechnique*, Grenoble
Dr. H. Spalt - Technische Hochschule Darmstadt*

JUAS Programme Committee

Dr B. Holzer - DESY Hamburg
Dr. W. Joho - PSI Zurich
Dr. A. Ropert - ESRF Grenoble
Dr. V.P. Suller - DRAL Daresbury
Pr. V.G. Vaccaro - Univ. di Napoli

Dr. E.J.N. Wilson - Head of the CERN Accelerator School
Dr. M. Rey-Campagnolle - JUAS Coordinator - IN2P3/CNRS

* JUAS-founder University

Fig. IV.3.7: Educational programme as it appears in Bulletin II of JUAS 1996.

The enrolments of graduate students decreased in 1996 and, at the evaluation meeting, the number

Fig. IV.3.8: Students of JUAS 1995.

Fig. IV.3.9: Students of JUAS 1996.

of attendees was considered to be too low for the effort invested. Last-minute cancellations (ten) showed that financial support for students had been absent. It was decided to act on several different levels to attract more candidates: 1) adapting the format of JUAS to cover a wider range of systems by making it more modular; 2) searching for possible grants; 3) increasing awareness of JUAS and its educational programme in universities and at specialised conferences such as EPAC. Thus, 1) the course was split into two consecutive parts of five weeks each: Accelerator physics (98 h) and Accelerator technologies and applications (98 h). As the basic knowledge of accelerators is rarely taught in academic programmes, we thought it important to pay attention to the needs of professionals who are new to the field, so we provided a modular structure appropriate for them. Each subject was covered within a week to accom-

modate part-time attendance. 2) Through INPG—a recognised university—I applied for the support of the European Commission (DG XXIII) within the SOCRATES Intensive Programmes. In the meantime, some local funds could be used to pay for the lodgings of EU students, and CERN could provide UNESCO grants to pay for the travel and lodging of students from outside the EU. 3) To promote JUAS, I specifically attended accelerator conferences, even though they were not directly related to my own research area. The lecturers were encouraged to make written notes, as these were essential for the students' understanding at the basic level; copies of transparencies were insufficient. Some of the lecturers in accelerator physics had already started to write extensive notes, and the first manuals were set out (see Fig. IV.3.10). Over the years, their numbers increased, in what would later be known as the "paper era".

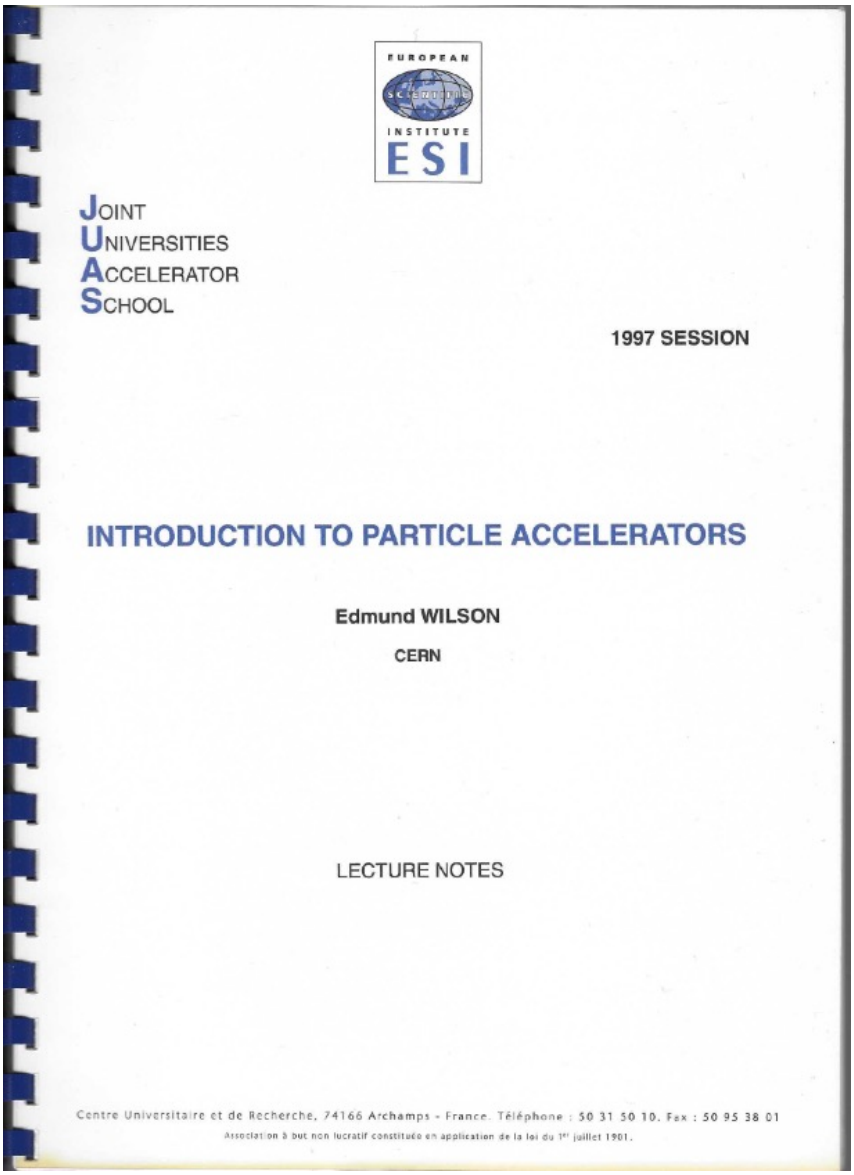
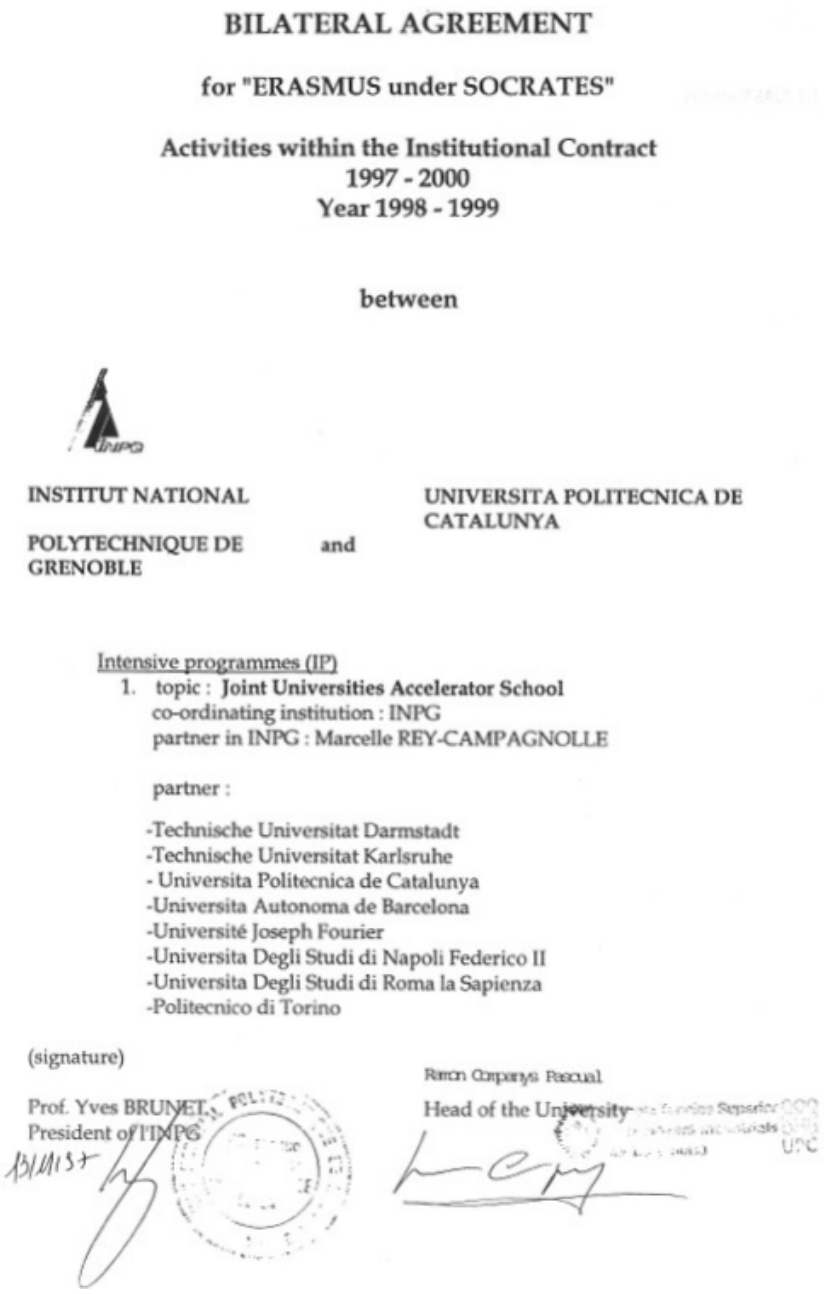


Fig. IV.3.10: One of the first manuals of lecture notes.

JUAS 1997–2000: two × five weeks. Helm righted, success confirmed, the end of the pioneer

period. In 1997, the number of university partners increased: five new European universities[8] joined the four initiators and solidified their partnership through the Socrates Intensive Programme JUAS (see Fig. IV.3.11).



BILATERAL AGREEMENT

for "ERASMUS under SOCRATES"

Activities within the Institutional Contract
1997 - 2000
Year 1998 - 1999

between

INSTITUT NATIONAL POLYTECHNIQUE DE GRENOBLE

and

UNIVERSITA POLITECNICA DE CATALUNYA

Intensive programmes (IP)

1. topic : **Joint Universities Accelerator School**
   co-ordinating institution : INPG
   partner in INPG : Marcelle REY-CAMPAGNOLLE

   partner :

   -Technische Universitat Darmstadt
   -Technische Universitat Karlsruhe
   - Universita Politecnica de Catalunya
   -Universita Autonoma de Barcelona
   -Université Joseph Fourier
   -Universita Degli Studi di Napoli Federico II
   -Universita Degli Studi di Roma la Sapienza
   -Politecnico di Torino

(signature)

Prof. Yves BRUNET
President of INPG

Ramon Companys Pascual
Head of the University

Fig. IV.3.11: One of the bilateral agreements for the JUAS programme under Socrates.

JUAS was then split in two courses: Course 1, on Accelerator Physics, and Course 2, on the Technologies and Applications of Particle Accelerators. A farewell ceremony for the 1997 class was organised to present this novel format, with attendees including personalities from ESI, CERN, and local authorities. The overall programme was slightly modified; a few courses were shortened to make room

[8] UA de Barcelona, UP de Catalunya, TU Darmstadt, UJF and INP Grenoble, TU Karlsruhe, U. Federico II di Napoli, U. La Sapienza di Roma, and Politecnico di Torino.

for new lectures (RF quadrupoles, superconducting cavities, and accelerators dedicated to applications). Despite these changes, the programme remained within 90 h of lectures and tutorials. The timetable stabilised to contain three 50-min lectures in the morning, two 50-min tutorials in the afternoon, with visits and demonstrations always included, taking place at CERN, PSI, ESRF, and HUG. Tutorials were clearly separated from lectures, and in 1999, guided studies were introduced to assist students with their homework. A few assistants were available to help with this task.

Figures IV.3.12–IV.3.15 show the educational programmes in 1998 and 1999 and the renewal of lecturers. A total of 25 to 30 lecturers shared the tuition tasks, with around 30% to 40% of them coming from CERN; the remainder came from other laboratories in nearby areas of Europe. With time, the computer support improved in Archamps (PCs became available for tutorials in 1997), and all the information about the school, the programme, and the schedule became available on the webpages of JUAS from 1999 on.

The examinations remained the responsibility of INPG up to 1999, and they then became the responsibility of TU Darmstadt. Detailed results were given to every student, who could later negotiate equivalence in his/her university system. In Europe, the credit system was slowly implemented as the academic organisation in semesters was expanding. In 2000, following the recommendations of the Advisory Committee, the JUAS examination procedure was slightly modified to be as close as possible to most European systems. Therefore, in each course, all subjects were examined: for core subjects, there was continuous assessment and a written test (4 h) at the end, with documents; for other subjects, there was a list of written questions to answer within 1 h without documents. Lecturers marked all the tests using a detailed marking system with a range of 0–100. Each successful candidate—those who obtained a final mark of at least 50—received an examination certificate[9] from the partner university responsible for the examination (see Figs. IV.3.16 and IV.3.17). A conversion table for the JUAS marking system into the ECTS grades was proposed.

On average, the enrolments increased in each successive year (see JUAS statistics), with attendees coming, each year, from at least a tenth of European countries, and a few coming from other continents (Africa, Asia, and North America). Most of the students were supported by scholarships. In 1997, they came from local funds, UNESCO grants through CERN and French foreign affairs. For the three subsequent years, 1998–2000, the scholarships came mainly from the European Commission. In the final survey conducted each year, the students expressed a high level of general satisfaction: “excellent”, “very good”, and “perfect” were adjectives commonly used for the quality of lectures and organisation. They were still enthusiastic about their multicultural origins, but they also requested “real lecture notes written by the lecturers”, which were difficult to provide for those lecturers teaching at JUAS for only a few sessions and for whom teaching was an occasional activity. CAS proceedings, available for free, were not much used; they seemed inappropriate for beginners in the field.

By the end of 1999, the administrative situation of JUAS had improved thanks to its three main supports, namely the ESI, CERN, and the partner universities. At ESI, its recognition by CERN as a “collaborating institute” facilitated contacts, and the increase in logistic support (personnel and materiel) allowed for the consolidation of the programme. At CERN, the attribution of a small budget to JUAS

[9]This was different from the attestation, which recognised attendance at the course.

JUAS PROGRAMME SUMMARY
5 May 1997

ACCELERATOR PHYSICS
13 January - 14 February 1997

	Subject	L +T	Lecturer
0	What is an accelerator?	2 + V	M. Rey-Campagnolle /IN2P3-CNRS
1	Relativity for engineers	2	JP. Longequeue /ENSP Grenoble.
2	Electro-magnetic theory for physicists	2	JP. Longequeue /ENSP Grenoble
3	Introduction to particle accelerators	8	E.J.N. Wilson /CERN Genève
4	Longitudinal beam dynamics	8 + 4	L. Rinolfi /CERN Genève
5	Transverse beam dynamics	8 + 4	M. Martini /CERN Genève
6	Physics of synchrotron radiation	8 + 5	L. Rivkin /PSI Villigen
7	Cyclotrons	5 + V	Th. Stammbach /PSI Villigen
8	Injection & extraction	2	G. Mülhaupt /PSI Villigen
9	Linear imperfections in circ. accel.	6 + 3	A. Ropert /ESRF Grenoble
10	Space charge effects & instabilities	6 + 3	L. Palumbo /Univ. & INFN Frascati
11	Non-linearities and resonances	6 + 3	M. Martini /CERN Genève
12	Designing an accelerator together	3	H. Lengeler /ESS Jülich
	Student seminar	2	

ACCELERATOR TECHNOLOGIES
17 February - 21 March 1997

	Subject	L + T	Lecturer
1	Radio-frequency engineering	11 + 5	W. Pirkl /CERN Genève
2	Design of instruments based on RF linear accel.	6	D. Tronc /GE Medical Systems
3	RF Quadrupoles	2	A. Lombardi /CERN Genève
4	Superconducting cavities	2	E. Palmieri /INFN Legnaro
5	Conventional accelerator magnets	6 + 6	N. Marks /DRS Daresbury
6	Superconducting magnets	6 + 3+V	M. Wilson /Oxford Inst.
7	Radiation and safety	6 + 3	P. Berkvens /ESRF Grenoble
8	Beam instrumentation and diagnostics	7 + V	P. Strehl /GSI Darmstadt
9	Cyclotrons for medicine	5	Y. Jongen /IBA Louvain-la-Neuve
10	Control systems	4 + V	U. Raich /CERN Genève
11	Sources of charged particles	4	K. Langbein /CERN Genève
12	Vacuum systems	4 + V	A. Poncet /CERN Genève
13	Combining technologies in accelerator	3	H. Lengeler /ESS Jülich
	Seminars:		
	Accelerators applied to Art & Archeology	2	JC. Dran /LRMF Paris
	Accelerator Mass spectrometry	2	F. Yiou /CSNSM Orsay

Fig. IV.3.12: Educational programme of JUAS 1997. L: number of lecture slots; T: number of tutorial slots.

opened some internal facilities, and the visit service was responsible for the weekly visits of JUAS students. The CERN Bulletin 11/99-15.3.99 presented the JUAS students visiting CERN as the "Next generation of accelerator engineers and physicists" (see Figs. IV.3.18 and IV.3.19).

The partner universities initiated an official request for their representation on the governing board of ESI and accepted the proposition to hold a rotative annual meeting. Previous meetings took place at CERN or in Archamps. TU Darmstadt agreed to assume responsibility for the examinations, which had previously been overseen by INPG. Another positive development was that the Interdivisional Group on Accelerators of the European Physical Society offered grants to attend EPAC conferences to the top

DEA officiel ne pas séparer 140 h (annuel!)

JUAS PROGRAMME SUMMARY
10 March 1998

CERN 60h ~ 33%
ESRF 20h ~ 11%
PSI 5h ~ 3%

ACCELERATOR PHYSICS
12 January - 13 February 1998

	Subject	L +T	Lecturer
0	Presentation of the course	2	M. Rey-Campagnolle /ISN & CERN
1	Relativity for engineers (refresher)	2	JP. Longequeue /ENSP Grenoble.
2	Electro-magnetism for physicists (refr.)	2	JP. Longequeue /ENSP Grenoble
3	Introduction to particle accelerators	8	E.J.N. Wilson /CERN Genève
4	Longitudinal beam dynamics	8 + 4	L. Rinolfi /CERN Genève
5	Transverse beam dynamics	8 + 4	M. Martini /CERN Genève
6	Physics of synchrotron radiation	8 + 4	K. Wille /Univ. Dortmund
7	Linear accelerators	5 + 2	J. LeDuff /LAL Orsay
8	Cyclotrons	5	Th. Stammbach /PSI Villigen
9	Injection & extraction	2	JM. Filhol /ESRF Grenoble
10	Linear imperfections in circ. accel.	6 + 3	A. Ropert /ESRF Grenoble
11	Space charge effects & instabilities	6 + 3	L. Palumbo /Univ. Roma & LNF-INFN
12	Summing up	6	H. Lengeler /Genève

ACCELERATOR TECHNOLOGIES AND APPLICATIONS
16 February - 20 March 1998

		Subject	L + T	Lecturer
0		Presentation of the course	2	M. Rey-Campagnolle /ISN & CERN
1		Radio-frequency engineering	11 + 5	W. Pirkl /CERN Genève
2		Superconducting RF cavities	4	E. Palmieri /INFN Legnaro
3		RF Quadrupoles	2	A. Lombardi /CERN Genève
4		Charged particle optics	5	JM. Deconto /ISN Grenoble
5		Conventional accelerator magnets	6 + 5	N. Marks /DRS Daresbury
6		Superconducting magnets	6 + 4	M. Wilson /Oxford Inst.
7		Radiation and safety	6 + 3	P. Berkvens /ESRF Grenoble
8		Beam instrumentation and diagnostics	7	P. Strehl /GSI Darmstadt
9		Sources of charged particles	4	K. Langbein /CERN Genève
10		Vacuum systems	4	A. Poncet /CERN Genève
11		Summing up	3	H. Lengeler /Genève
12		Applications:		
	12.1	Accelerators in industry	3	W. Mondelaers /Univ. Gent
	12.2	High intensity accelerators	3	JM. Lagniel /CEN Saclay
	12.3	Accelerators in medicine		
		Production of medical isotopes	2	GJ. Beyer /HUGenève
		Therapeutic applications	2	R. Miralbell /HUGenève
		Accelerators for hadron therapy	2	P. Mandrillon / CAL Nice & CERN
13		The challenges of designing and building accel. for industrial and medical appl.	2	Y. Jongen /IBA Louvain-la-Neuve

Fig. IV.3.13: Educational programme for JUAS 1998.

three students of JUAS over a two-year period[10]. It was also a pleasure to announce that a well-known accelerator specialist, Joël Le Duff from Orsay and already lecturing at the school would take over as the Head of JUAS after the 2000 sessions once a dedicated administration team was stabilised to help with the management of the school. I involved him at the beginning of 2000 to ensure a smooth transition.

JUAS 2000 went smoothly. In each course, four weeks of tuition were followed by a week for the examinations, with a steady number of students. The 30% increase in the total number of hours concerned mainly the guided studies to help students assimilate the contents of lectures. At the evaluation meeting

[10]These grants were the first of those introduced later from 2006 and reported in the statistics. The students rewarded were Uli Laier (Institute für Kernphysik Darmstadt & JUAS 1998), Yun Luo (Institute of High Energy Physics, Beijing & JUAS 1999), Antonio Maffucci (Università di Napoli & JUAS 1999), and Erik Brambrink (TU Darmstadt & JUAS 2000). They each attended EPAC 2000 and/or EPAC 2002.

accelerator physics 11 Jan.- 12 Feb. 1999

LECTURES		LECTURERS
Revision of relativity & electro-magnetism	4	J-P. Longequeue / IN2P3 Grenoble
Introduction to accelerators	4	E.J.N. Wilson / CERN Genève
Longitudinal beam dynamics	8+4	L. Rinolfi / CERN Genève
Transverse beam dynamics	8+4	M. Martini / CERN Genève
Charged particle optics	4	J-M. Deconto / ISN Grenoble
Synchrotron radiation	8+4	K. Wille / Univ. Dortmund
Building a synchrotron radiation source	2	H. Lengeler / Genève
Linear accelerators	5+2	J. LeDuff / LAL Orsay
Cyclotrons	5+1	Th. Stammbach / PSI Villigen
Injection & extraction	3	J-M. Filhol / ESRF Grenoble
Imperfections	5+3	A. Ropert / ESRF Grenoble
Space charge & instabilities	6+3	L. Palumbo / Univ. & INFN Roma
Summing up	4	E.J.N. Wilson / CERN Genève
SEMINARS		
Future accelerator projects	1	K. Hübner / CERN Genève
Applications of the synchrotron radiation	1	D. Cornuejols / ESRF

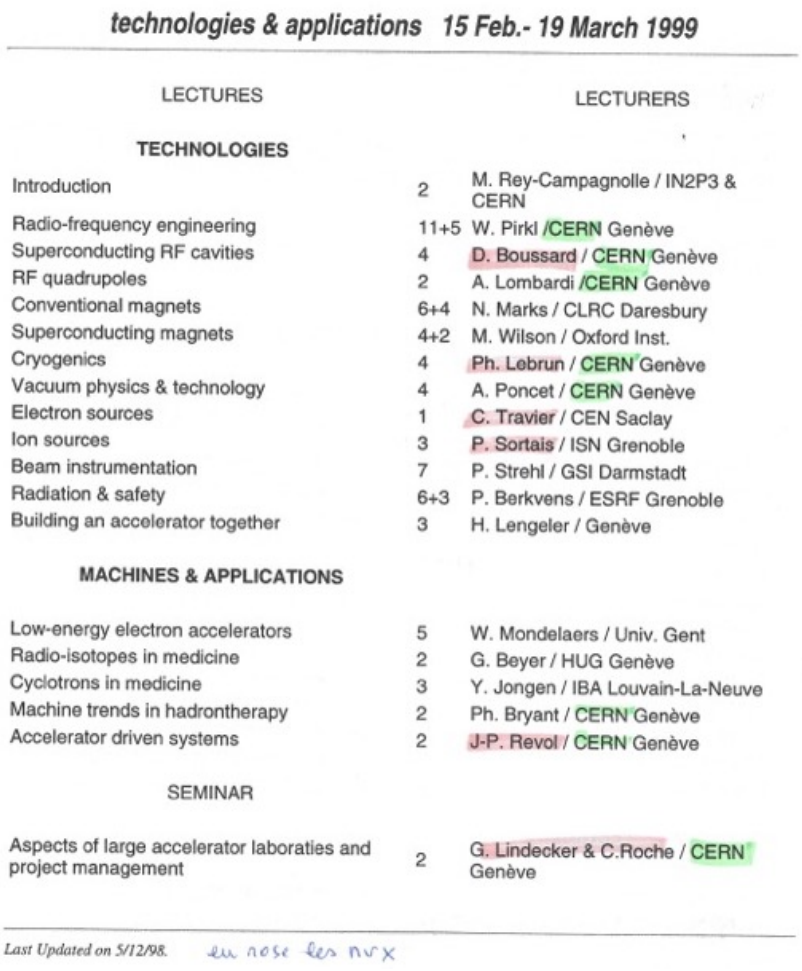
Last Updated on 9/01/99.

Fig. IV.3.14: Educational programme for JUAS 1999 Course 1.

in Darmstadt, despite satisfying exam results, the programme was considered to be too heavy would be reduced while keeping the guided study timing.

During these pioneer years, I was Coordinator and then Director of JUAS, but primarily "the kingpin" of this school without real administrative support. I would like to thank Valérie Guichet who, in addition to her responsibilities at the Business Park, helped with "all tasks" during the running periods of the school in Archamps from 1994 to 1997; and Bob Holland, who took over in 1998 and 1999, and whose mother tongue and character were an invaluable help. I am very grateful for their assistance. In 2000, an ESI staff was established with dedicated administrator and secretary.

Before closing this chapter, I would like to underline the success of the modular structure of the JUAS school among both university students and professionals. To the former, it provides choices, and to the latter, it offers an opportunity to update their knowledge, with the best accelerator scientists in the world. The interest in this unique school has been gradually growing, and it is now a great reward to see its evolution over the years. Thanks to all who trusted and agreed to engage in this venture. I express a personal acknowledgment to Prof. Vittorio Vaccaro and Ted Wilson for their continuous active support. Figures IV.3.20–IV.3.22, together with Fig. IV.3.18, show pictures of the JUAS students from 1997 to 2000.

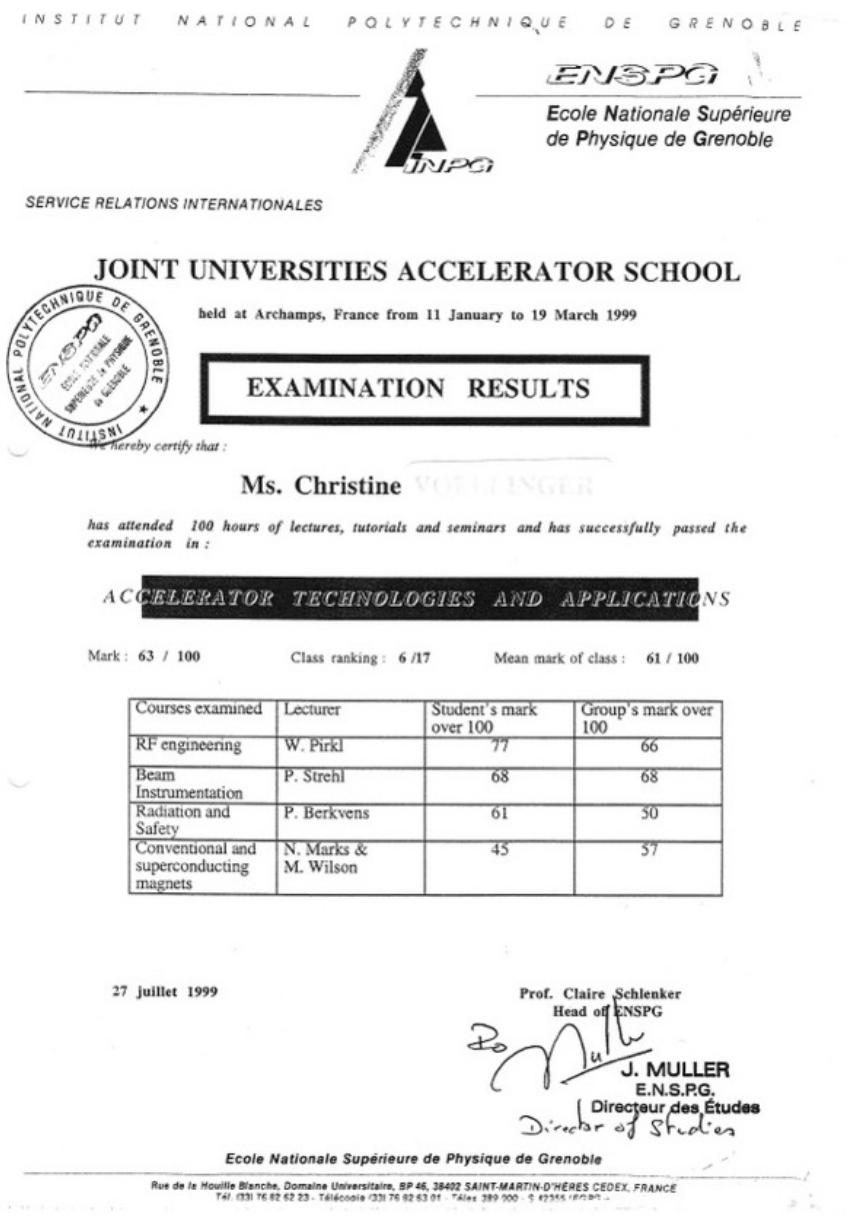


technologies & applications 15 Feb.- 19 March 1999

LECTURES		LECTURERS
TECHNOLOGIES		
Introduction	2	M. Rey-Campagnolle / IN2P3 & CERN
Radio-frequency engineering	11+5	W. Pirkl /CERN Genève
Superconducting RF cavities	4	D. Boussard / CERN Genève
RF quadrupoles	2	A. Lombardi /CERN Genève
Conventional magnets	6+4	N. Marks / CLRC Daresbury
Superconducting magnets	4+2	M. Wilson / Oxford Inst.
Cryogenics	4	Ph. Lebrun / CERN Genève
Vacuum physics & technology	4	A. Poncet / CERN Genève
Electron sources	1	C. Travier / CEN Saclay
Ion sources	3	P. Sortais / ISN Grenoble
Beam instrumentation	7	P. Strehl / GSI Darmstadt
Radiation & safety	6+3	P. Berkvens / ESRF Grenoble
Building an accelerator together	3	H. Lengeler / Genève
MACHINES & APPLICATIONS		
Low-energy electron accelerators	5	W. Mondelaers / Univ. Gent
Radio-isotopes in medicine	2	G. Beyer / HUG Genève
Cyclotrons in medicine	3	Y. Jongen / IBA Louvain-La-Neuve
Machine trends in hadrontherapy	2	Ph. Bryant / CERN Genève
Accelerator driven systems	2	J-P. Revol / CERN Genève
SEMINAR		
Aspects of large accelerator laboraties and project management	2	G. Lindecker & C.Roche / CERN Genève

Last Updated on 5/12/98. eu nose les nrx

Fig. IV.3.15: Educational programme for JUAS 1999 Course 2.



INSTITUT NATIONAL POLYTECHNIQUE DE GRENOBLE

ENSPG

Ecole Nationale Supérieure de Physique de Grenoble

SERVICE RELATIONS INTERNATIONALES

JOINT UNIVERSITIES ACCELERATOR SCHOOL

held at Archamps, France from 11 January to 19 March 1999

EXAMINATION RESULTS

We hereby certify that :

Ms. Christine VOELLINGER

has attended 100 hours of lectures, tutorials and seminars and has successfully passed the examination in :

ACCELERATOR TECHNOLOGIES AND APPLICATIONS

Mark : 63 / 100 Class ranking : 6 /17 Mean mark of class : 61 / 100

Courses examined	Lecturer	Student's mark over 100	Group's mark over 100
RF engineering	W. Pirkl	77	66
Beam Instrumentation	P. Strehl	68	68
Radiation and Safety	P. Berkvens	61	50
Conventional and superconducting magnets	N. Marks & M. Wilson	45	57

27 juillet 1999

Prof. Claire Schlenker
Head of ENSPG

J. MULLER
E.N.S.P.G.
Directeur des Études
Director of Studies

Ecole Nationale Supérieure de Physique de Grenoble

Rue de la Houille Blanche, Domaine Universitaire, BP 46, 38402 SAINT-MARTIN-D'HERES CEDEX, FRANCE

Fig. IV.3.16: Examination certificate delivered by the responsible university.

Joint
Universities
Accelerator
School

EUROPEAN SCIENTIFIC INSTITUTE ESI

ATTESTATION
CERTIFICATE

Nous, soussignés, certifions que,
We, undersigned, certify that,

Ecole Nationale Supérieure de Physique de Grenoble

a suivi **200** heures de cours et travaux dirigés de la formation,
*has followed **200** hours of lectures and tutorials on,*

Accelerator Physics
Accelerator Technologies & Applications

Archamps, 10 January – 18th March 2000.

organisée par un groupe d'Universités Européennes* avec le concours du CERN (Laboratoire Européen pour la Physique des Particules) et parrainée par l'Institut Scientifique Européen (ESI).
organised by a group of European Universities and the CERN Accelerator School, with the support of the European Scientific Institute (ESI).*

Giorgio BRIANTI
ESI Chairman

Marcelle REY-CAMPAGNOLLE
Head of JUAS.

*
Institut National Polytechnique de Grenoble
Universitat Politècnica de Catalunya
Universität Karlsruhe (TH)
Politecnico di Torino
Universitat Autonoma de Barcelona
Università Degli Studi di Roma la Sapienza
Université Joseph Fourier, Grenoble
Università Degli Studi di Napoli Federico II
Technische Universität Darmstadt

Fig. IV.3.17: Attestation delivered for attending JUAS courses.

La prochaine génération d'ingénieurs et physiciens «accélérateurs»

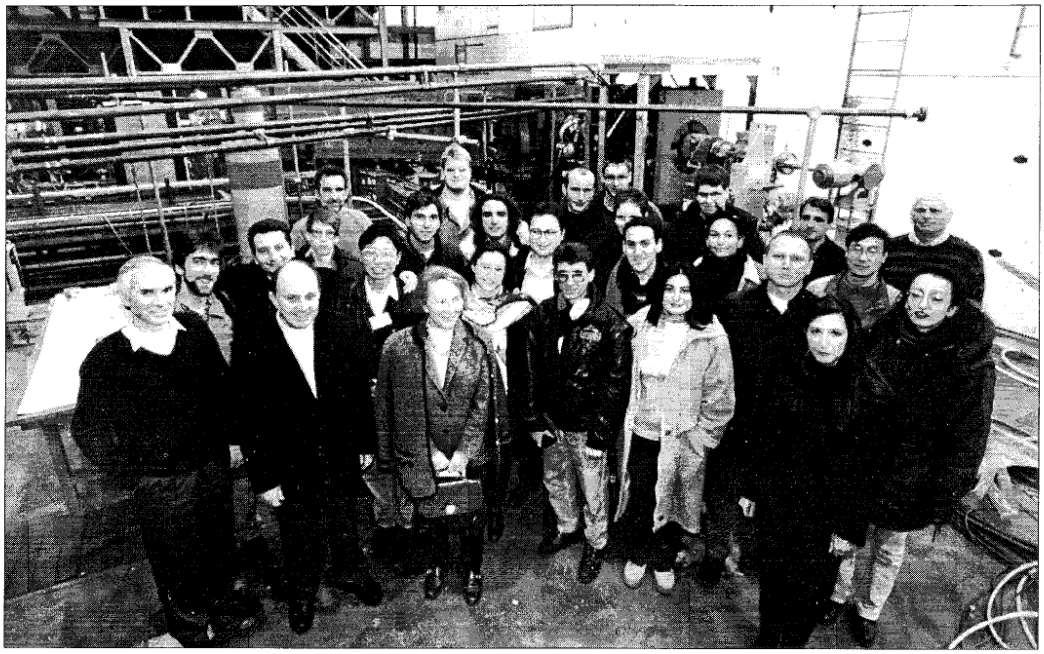
Comme chaque année depuis 1994, les étudiants de la Joint Universities Accelerator School (JUAS) viennent visiter le CERN et plus particulièrement les accélérateurs profitant ainsi de leur arrêt hivernal. Ils ont la chance d'avoir pour guides des experts dans chacun des secteurs visités (complexe PS, instrumentation de faisceau, cryogénie, cavités RF et aimants supraconducteurs). Des spécialistes du CERN participent également à l'enseignement contribuant ainsi directement à la formation des futurs ingénieurs et physiciens appelés un jour à les remplacer et plus généralement à l' initiation des étudiants aux technologies de pointe développées au Laboratoire.

Complémentaire de l'Ecole d'Accélérateurs du CERN (CAS), «JUAS» est maintenant un programme intensif d'enseignement supérieur de 3 ème cycle dans le cadre des programmes SOCRATES de la Commission Européenne.

Next generation of accelerator engineers and physicists

As they have been doing each year since 1994, the students of the Joint Universities Accelerator School (JUAS) are making the most of the winter shut-down to visit CERN installations and in particular the accelerators. They are lucky to have as their guides experts in each of the sectors visited (PS complex, beam instrumentation, cryogenics, RF cavities and super-conducting magnets). Specialists from CERN likewise teach at JUAS, thereby contributing directly to the training of the next generation of CERN's engineers and physicists as well more generally exposing the students to the cutting edge technologies being developed at the Laboratory.

Complementary to CAS (CERN Accelerator School), JUAS now enjoys the status of an Intensive Programme of higher education within the framework of the Socrates programmes of the European Commission. JUAS is a



C'est un programme qu'une seule université ne peut offrir et qui est le fruit d'une collaboration entre neuf grandes universités en Europe, l'Institut Scientifique Européen et le CERN avec la participation des divisions «accélérateurs» de l'ESRF à Grenoble et de l'Institut Paul Scherrer à Villigen, ainsi que de celle du département nucléaire de l'hôpital universitaire de Genève.

En effet la proximité de ces quatre grands établissements permet de présenter l'état de l'art de ce vaste domaine qu'est celui des accélérateurs tant du point de vue de ses machines de base (RFQ, linac, synchrotron, accélérateur électrostatique, cyclotron, etc.) que de leurs modes d'utilisation (injecteur, accélérateur, collisionneur, anneau d'accumulation, etc.) de leurs applications (source de lumière synchrotron, sources de neutrons de spallation, production

programme which no single university could set up on its own and indeed results from the active collaboration of 9 major European Universities, the European Scientific Institute and CERN with the participation of the "accelerator" divisions of ESRF in Grenoble and the Paul Scherrer Institute in Villigen, as well as the department of nuclear medicine at the University Hospital of Geneva.

The close proximity of these four establishments enables JUAS to offer its students an insight into the complete spectrum of what has today become a vast field, from the basic machines (RFQs, linacs, synchrotrons, electrostatic accelerators, cyclotrons ...) to their uses (as injectors, accelerators, colliders, storage rings ...), from their applications (synchrotron light sources, neutron spallation

Fig. IV.3.18: JUAS in CERN Bulletin no. 11/99: Part 1/2.

de radio-isotopes médicaux, etc.) et des techniques de pointe qui ont été développées sous son impulsion (ultravide, cryogénie, radiofréquence supraconductrice, etc.).

De janvier à mars, 200 h de cours et travaux dirigés sont ainsi donnés au Centre Universitaire de Formation et de Recherche d'Archamps par des spécialistes renommés des plus grands laboratoires européens, (environ 1/3 environ du corps enseignant est cernois). A ces cours s'ajoutent 9 demi-journées de visites et démonstrations sur les sites (5 sont au CERN). Pour ce programme intensif le nombre d'étudiants est limité à environ 30 et les coûts minimisés car ces étudiants, en général dans leur 5e année d'université, n'ont pas de laboratoire d'accueil pour les aider. Environ la moitié d'entre eux vient des universités partenaires et est soutenue financièrement par le programme SOCRATES, – venant de pays moins riches est soutenu par des bourses UNESCO offertes par la CAS ; les autres étudiants européens peuvent recevoir une aide ponctuelle de l'ESI. Les cours sont bien sûr ouverts à tout professionnel désireux de parfaire sa formation ainsi qu'aux étudiants des programmes éducatifs du CERN, «doctorants» ou «étudiants techniques». Leur présentation modulaire permet un suivi à temps partiel compatible avec le travail au Laboratoire et des jeunes professionnels étudient ainsi le programme complet en plusieurs années. Certains des étudiants cernois les plus motivés viennent après leur stage «pratique» au CERN, suivre l'ensemble des cours d'Archamps et compléter ainsi leur formation.

De style universitaire, les cours s'achèvent par des examens obligatoires pour les étudiants des universités partenaires, et ceux qui les passent avec succès reçoivent un certain nombre de crédits de leur université d'origine. Pratiquement tous les étudiants plein temps se soumettent aux épreuves, pour tester leur assimilation de ces nouvelles connaissances, et l' ambiance est particulièrement studieuse pendant toute la durée des cours. Logés sur le même site, pouvant partager le même appartement ils ont aussi l'occasion de rencontres avec d'autres cultures ou modes de vie. La cuisine et les sorties se font le plus souvent en groupe. Pour la majorité d'entre eux ce sont les premiers échanges internationaux et les comptes rendus qu'ils en donnent sont très positifs.

Cette année ils sont trente sept étudiants et jeunes professionnels issus de quinze pays de l'Union Européenne, Europe de l'Est et Chine à bénéficier de cet enseignement unique délivré par vingt neuf spécialistes. Candidats enseignants, guides, démonstrateurs, et bien sûr étudiants ou simple curieux, vous trouverez plus d'informations sur les pages WEB à l'adresse

http://www.cern.ch /Schools/JUAS/

sources, production of medical isotopes ...) to the cutting edge technologies developed in their wake (ultra-high vacuum, cryogenics, superconducting RF ...).

From January to March, 200 hours of lectures and tutorials are delivered at the Centre Universitaire de Formation et de Recherche d'Archamps by acknowledged experts drawn from Europe's major laboratories (approximately 1/3 of them from CERN). In addition to the lecture programme there are 9 half-days of visits and demonstrations on-site (including 5 visits to CERN). The number of students participating at any one time in the intensive programme is limited to around 30 and costs are intentionally reduced to a minimum to take into account the fact that the majority of the students are in their 5th year of higher education and do not have support from a laboratory. Around half of the students come from the collaborating universities and are able to obtain some financial support via the European Commission's SOCRATES grant to JUAS ; a quarter come from less rich countries and are supported by UNESCO scholarships awarded through CAS; other European students not falling into either of these two categories are eligible for limited support from ESI. JUAS is of course open to all professionals seeking to complement or perfect their technical knowledge as well as to students of CERN Students Programmes. The modular structure of the JUAS programme enables part-time study compatible with the responsibilities of laboratory work and, indeed, young professionals can follow the complete course over a period of several years. Particularly motivated are those students who have just completed a period of professional work experience at CERN and who come to Archamps for the entire course thereby rounding off their training.

University-style examinations complete the lecture and tutorial programmes. These exams are compulsory only for students from the partner universities and successful candidates are awarded credits in their home universities. In practice, however, virtually all full-time participants take the examinations in order to assess the extent of their new-found knowledge, and the atmosphere throughout the School is one of hard work. Most students also appreciate being lodged on site in shared accommodation thereby giving them the opportunity to know a variety of people from other countries and cultures. Students often get together for cooking and outings. For the majority, it is their first experience of international exchange and their feedback on this aspect of the School is extremely positive.

This year 37 students and young professionals from 15 countries of the EU and Eastern Europe as well as China are following this unique programme taught by 29 leading specialists. Potential lecturers, guides, demonstrators, and of course students are welcome to have a look at the WEB pages:

http://www.cern.ch /Schools/JUAS/

Fig. IV.3.19: JUAS in CERN Bulletin no. 11/99: Part 2/2.

Fig. IV.3.20: JUAS 1997 classes: Course 1 (top) and Course 2 (bottom).

Fig. IV.3.21: JUAS 1998 classes: Course 1 (top) and Course 2 (bottom).

Fig. IV.3.22: Farewell party for JUAS 2000 students.