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Ródenas Diago, J.; Tondeur, F.; Cechak, T.; Musilek, L.; Janssens, H.; Scherer, UW.; Hoyer, F.... (2019). CHERNE: prehistory and early days of the network. *Radiation Effects and Defects in Solids*. 174(11-12):954-964. <https://doi.org/10.1080/10420150.2019.1683834>



The final publication is available at

<https://doi.org/10.1080/10420150.2019.1683834>

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Additional Information

## **CHERNE: Prehistory and early days of the network**

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### **BIOGRAPHICAL NOTES**

J. Ródenas

José Ródenas, PhD in Nuclear Engineering, Full Professor in Nuclear Engineering at the Universitat Politècnica de València (UPV), is author of 2 textbooks in Spanish: Environmental Problems of Nuclear Energy and Radioactive Contamination Engineering. He has more than 100 publications in international journals (SCI/JCR) and organized IRRMA-9 at UPV from 6 to 11 July 2014 with 200 participants from 30 countries.

F. Tondeur

François Tondeur got a PhD in physics at Brussels Free University (ULB) in 1977. He joined the Institut Supérieur Industriel de Bruxelles (ISIB) in 1979 where he taught Nuclear Physics, Radiation Protection and related matters. His first research field was the theory of nuclear masses and fission barriers, but he later shifted towards the development of indoor radon mapping. He retired in 2012, continuing his research activity.

T. Čechák

Tomáš Čechák got a PhD in Experimental Physics (1980), Full Professor in Applied Physics at the Czech Technical University (2005) where he taught Application of Ionising Radiation, Radiation Protection and related matters. He has more than 85 publications in international journals (Web of Science). He took part on the project DIRAC in CERN (2001-15).

L. Musilek

Ladislav Musílek graduated in dosimetry and application of ionizing radiation at the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague in 1968. After a three-year job at the institute dealing with nuclear instrumentation, he returned to the faculty first as a researcher and then as a teacher. He was successively appointed associate professor and in 1996 professor. Since 1994, he was the dean of the Faculty for six years and then vice-rector of the University for ten years. He is currently teaching the fundamentals and applications of nuclear and radiation physics and researching applications of ionizing radiation.

H. Janssens

Herwig Janssens got a PhD in physical engineering at Ghent University in 1983. In 1985 he joined the Hogeschool Limburg (HL, later renamed XIOS, now Faculty of Engineering Technology at Hasselt University UH). He was associate professor Nuclear Technology with master courses in Nuclear Physics, Radiation Protection, Nuclear Measuring Techniques, Reactor Technology, Medical Nuclear Engineering. In 1997 he became the founder and coordinator of the Nuclear Technological Centre

NuTeC for research and for industrial services (radiological and non-nuclear industry, waste and recycling industry, medical nuclear techniques, ...). In 1999 he established a Postgraduate Course for Radiation Protection Officer RPO in medicine, and in 2001 the Postgraduate Course 'Radiation Protection Expert RPE', in collaboration with the Belgian nuclear research Centre SCK•CEN.

U.W. Scherer

Ulrich W. Scherer received a PhD chemistry at the University of Mainz (Germany) in 1989. After working as radiochemist in several research centers and as radiopharmacist in Nuclear Medicine he joined Aachen University of Applied Sciences in 1997 as professor for nuclear and radiochemistry. He introduced and directed the European Master in Nuclear Applications (EMiNA) program. In 2016 he was appointed chair in Physical Chemistry and Radiochemistry at Hochschule Mannheim where he continues his radiochemical research on radionuclide production and nuclear waste management.

F. Hoyler

Friedrich Hoyler got a PhD in physics at Tübingen University in 1982. He joined ILL Grenoble as an instrument responsible in the field of high-resolution gamma-spectrometry. From 1987 he pursued his research in nuclear spectroscopy at Tübingen University and obtained the German habilitation in 1994. From 1994 until his retirement in 2018 he taught physics and nuclear applications at Aachen University of Applied Sciences and shifted his main interest in the field of radiation protection.

D. Mostacci

Domiziano Mostacci earned a M.S. in Nuclear Engineering at the University of Bologna in 1981. Then a Ph.D. in Nuclear Engineering and Plasma Physics at the University of Arizona in 1985. He is with Bologna University since 1984 he is at present Associate Professor of radiation Protection and of Reactor Kinetics in the School of Energy and Nuclear Engineering. Research in Transport theory, radiation protection, natural radiation, medical applications of radiation, nuclear and radiation technologies, plasma physics. He is a Qualified Expert in radiation protection with the 3rd level, registered with the Italian Ministry of Welfare. Present teaching duties: Radiation protection; Mathematical methods for energy engineers; Neutron transport and Reactor kinetics.

## **CHERNE: Prehistory and early days of the network**

While the founding members of CHERNE gradually retire, the memory of the early steps of the network should not be lost. CHERNE (“Cooperation for Higher Education on Radiological and Nuclear Engineering”) is the product of a specific Erasmus activity possible in the early 2000’s: the intensive programmes (IP). The first step was a collaboration of three partners (Czech Technical University CTU, Institut Supérieur Industriel de Bruxelles ISIB, Universitat Politècnica de València UPV) organizing in 2002 the 3-year IP “PAN: Practical Approach to Nuclear techniques”, soon integrating two other partners (Aachen University of Applied Science AcUAS, XIOS Hogeschool Limburg). A second IP “SPERANSA: Stimulating Practical Expertise in RAdiation and Nuclear SAfety” was first organised without Erasmus support in 2005. A workshop was held in 2005 at UPV, including colleagues from other universities. Its main goal was to put in contact professors and researchers from European Institutions in order to share experiences in education and research in Radiation Protection and Nuclear Engineering. The creation of an informal group of universities to develop activities for the benefit of students was discussed. With the addition of Università degli Studi di Bologna (UniBo) to the initial group, the CHERNE network was created. It attracted rapidly more members (6 adhesions in 2006). CHERNE was conceived as a non-formal wide-scope open network, easily integrating new members, offering affordable activities to the students and mostly relying on Erasmus subsidies. The main goal was still the organisation of Erasmus IP’s based on practical activities, benefitting of the access to big experimental facilities offered by several partners, like reactors, accelerators, or a radiochemical laboratory. SPERANSA “Stimulating Practical Expertise in Radiological and Nuclear SAfety” was organised from 2006 to 2008, “JUNCSS: JÜlich Nuclear Chemistry Summer School” from 2007 to 2011 and “RAPIX-NOCOS: Radiation protection in non-conventional sectors” in 2007 and 2008 without Erasmus support. The annual workshops triggered exchanges between partners and attracted more institutions. The first workshops saw intense discussions about the network organisation and the types of activities that could be organised. A kind of maturity was reached from 2008.

Keywords: Erasmus, intensive programme, network, nuclear engineering, radiation protection

### **CHERNE: a child of Erasmus IP’s**

Already in the early steps of the Erasmus program, and until 2014 when it was changed into Erasmus+, one of the activities for which funds could be obtained was the Intensive Program

(IP), typically a 2-week specialised course with at least three academic partners of different countries, repeated during 3 years.

The organisation of an experimental IP was considered in 2000 in the discussions of new Erasmus exchanges between the Czech Technical University in Prague (CTU) and the Institut Supérieur Industriel de Bruxelles (ISIB). CTU could offer an access to unique experimental facilities, like the training nuclear reactor “Sparrow” (Fig.1), small particle accelerators (Van de Graaff, Microtron), industrial X-ray tomography, and many small-scale experimental devices, as well as very interesting visits to medical facilities (nuclear medicine, gamma-knife, radiotherapy Linac), to a nuclear research centre (reactor, Van de Graaff, cyclotron) and a nuclear power plant, and to the Czech Metrology Institute.

Participation in the partnership was offered to the Technical University of Dresden and Universitat Politècnica de València (UPV). Dresden could not participate, but Valencia confirmed its interest. The project was submitted in October 2000 for a first organisation during the academic year 2001-2002. The IP project received the name “PAN: Practical Approach to Nuclear techniques” and was approved by the Erasmus administration (still managing centrally the allocation of the budget for IP’s, later this decision was transferred to the national Erasmus agencies). PAN was designed for students of the second cycle in nuclear engineering, or in a related speciality. It was coordinated by ISIB. The central argument of the project was the possibility to share the access to facilities like a reactor and accelerators.

### **2002-2004 PAN, the first IP**

In January 2002, students from the three universities (CTU, ISIB, UPV) participated in the first edition of PAN in Prague. Two authors (José Ródenas and François Tondeur) accompanied the students coming from abroad. Many colleagues of CTU contributed to the course, supervised by Tomáš Čechák, with an essential contribution of Lenka Thinová to the organisation. The program, mixing lectures, practical exercises, visits and social activities (the course dinner),

beginning with the presentation of the partners and finishing with a global discussion, was adopted for all similar courses organised afterwards. The IP was a success, from the educational point of view - the experimental activities were greatly appreciated - as well as from the social point of view - the contact between students of different countries was rapidly established.

A sharp drop in the number of ISIB students led the partners to extend the partnership for the second edition in March 2003: Hogeschool Limburg (HL, later renamed XIOS, now part of the Hasselt University UH ) and Aachen University of Applied Sciences (AcUAS) joined the initial trio, with the active collaboration of three authors (Herwig Janssens, Ulrich W. Scherer, Friedrich Hoyler). With some adaptations in the scientific program, and a welcome party, the program of PAN-1 was repeated, again at CTU Prague, with the same success. The main change was the addition of a final presentation of results, i.e. an exercise of oral presentation in English by groups of students mixing the different nationalities.

Until then most of the workload was on the shoulders of the Czech colleagues, and it was decided that PAN-2004 would be organised in Belgium. In order to get exercises at the same level, ISIB sought the collaboration of the nuclear research centre SCK•CEN in Mol and of the University of Liège, while HL activated its good relations with JRC-IRMM in Geel, close to Mol. The first week was organised there, with exercises on the BR1 reactor, and on two accelerators at IRMM (Linac and Van de Graaff). There were also visits to Belgoprocess (radioactive waste treatment plant) and Hades (underground facility for studying radioactive waste disposal in clay). On Friday, the group first moved to the University of Liège, for a day of surface analysis with the cyclotron (PIXE) and with the Van de Graaff (RBS). We then went to Brussels for a second week of exercises at ISIB and in two hospitals (Radiotherapy dose measurement, nuclear medicine demos), and a visit to the public laboratory of environmental radioactivity.

With its third edition, PAN had reached the end of its 3 years, which are summarized in table 1. But the discussion had already been conducted for a second similar project, during a meeting in June 2003 at HL. The idea was to propose a very similar program, mainly changing the name and the presentation. The SPERANSA project, “Stimulating Practical Expertise in Radiological and Nuclear SAfety”, was submitted by ISIB for a first organisation in 2005 at CTU, but the project was not accepted. There were a few official reasons given by reviewers, but the unofficial reason was that there were too many Belgian projects! The partners decided to resubmit SPERANSA with minor changes as a Czech project coordinated by CTU, and it was accepted for 2006. SPERANSA-2005 was nevertheless organised in February in Prague without Erasmus support, and was the last activity of the prehistory of CHERNE.

The experience of PAN showed that, in addition to the benefit for the students, a very important outcome was the 2-week contact between the professors of the participating universities, that gave them excellent opportunities to discuss in detail the possible collaborations for teaching as well as for research, in particular the organisation of bilateral Erasmus exchanges of students and professors.

### **The birth of CHERNE 2005**

After the failure of the first submission of SPERANSA by ISIB and prior to the second submission by CTU, a meeting was organised in XIOS-HL on 22 October 2004 to prepare the proposal for the second submission. UPV could not participate in SPERANSA-2005 without financial support, but its representative (José Ródenas) proposed to organise a meeting in Valencia to discuss the situation and prepare other activities. The proposal was accepted and UPV started to prepare the meeting as a workshop.

The first issue was to get funds. Several sponsors were found: a grant from the Spanish Ministry of Science and Education was obtained as well as an important help from Vice

Rectorate of Research of UPV and from the ETSII (Escuela Técnica Superior de Ingenieros Industriales). The support of Bancaja and Cofrentes nuclear power plant (NPP) completed the budget. The title for the meeting was “Workshop on European Cooperation for Higher Education and Research in Nuclear Engineering and Radiological Protection”. It was held at UPV on 4-6 May 2005. The scientific program was fruitful as participants presented activities from their institutions and problems around teaching of nuclear engineering were discussed. The visit to Cofrentes NPP was highly interesting. There were in total 19 participants from 9 institutions: UPV, Universidad Politécnica de Madrid (UPM), Universitat Politècnica de Catalunya (UPC), ISIB, XIOS, AcUAS, CTU, Università degli Studi di Bologna (UniBo) plus Cofrentes NPP (Fig.2).

In the bus coming back from Cofrentes a list of subjects was established, to be discussed during the Final Round Table the next day. Among others: ERASMUS MUNDUS, sharing non-presence courses, collaboration in smaller groups for short periods of lectures, incorporation to the European Nuclear Education Network ENEN, opening a forum to continue discussion via web page or similar, and creation of an informal group. After two rounds of interventions, the last option was adopted, that is, to continue the collaboration by the organisation of an informal network whose main objectives would be:

- 1) To develop the collaboration on education, training and research between the partners.
- 2) To encourage bilateral ERASMUS agreements, in particular for staff exchanges.
- 3) To organise an annual meeting of the members during an annual workshop open to everybody.
- 4) In the 2006 meeting, partners should present proposals for activities to be organised.

With the addition of UniBo to the initial group (the five institutions of PAN), the network was created. No institution should be excluded, but the number of participants for activities had to remain manageable. On 9 June the name of the network was decided: **CHERNE** = Cooperation

for **H**igh Education on **R**adiological and **N**uclear **E**ngineering. A declaration was written and signed by partners. It is shown at the web page [www.upv.es/cherne](http://www.upv.es/cherne).

To some extent, the creation of CHERNE was a reaction to the development of another network, ENEN, European Nuclear Education Network, a structured network developed in the framework of EURATOM (European Atomic Energy Community) and strongly oriented towards the needs of the nuclear industry. CHERNE was instead conceived as a non-formal wide-scope open network with minimal administration (only a secretary), easily integrating new members, offering affordable educational activities to the students and mostly relying on Erasmus subsidies.

### **The growth of CHERNE 2006-2008**

The second CHERNE workshop was also held at UPV in March 2006, just before Las Fallas, the great festival in Valencia to give an opportunity to participants to know this feast and to enjoy it. In that second edition of the workshop, it was expected to consolidate and extend the network. Already in December 2005, Politecnico di Milano (PoliMi) joined the network and UPC did it in 2 March 2006. There were then 8 members of CHERNE. Invitations were sent to other groups and resulted in the participation of colleagues from Exeter and Surrey (UK), Kansas State University KSU (US), Namur (Belgium), Zittau and Dresden (Germany), Instituto Tecnológico e Nuclear ITN (Portugal), Nuclear Science Institute Vinča (Serbia). In total, 28 participants from 17 institutions, from 9 different countries.

The main objectives of the second edition of the workshop were:

- To maintain and enhance contacts established in the first edition.
- To establish new contacts.
- Analysis of the activities developed during the last year and of the attained goals.
- New proposals of collaboration in teaching as well as in research.

- In particular, proposals of intensive courses at master level for the students of the network.

Although the scope of the network is European it was interesting to count on the collaboration of professors from non-European institutions. Again, the workshop was sponsored by the Spanish Ministry of Science and Education, the Valencia Regional Government, UPV, ETSII and Cofrentes NPP. Cultural activities were included in the program: a concert by the Coràl Politècnica and the Mascletà at the Ayuntamiento square.

After this workshop, during 2006 Università degli Studi di Messina, KSU, Università degli Studi di Catania, Fachhochschule Zittau, and ITN, joined the network. Universidade de Coimbra did in 2007, reaching the number of 14 members in 2008.

The annual workshop was held in CTU Prague in 2007, during the SPERANSA intensive program, giving the opportunity to the new partners to have a close look to this kind of activity. The workshop was still fully devoted to the organisation of the network, the presentation of the new partners, and the possible common educational activities.

In 2008, the workshop was organised by UniBo, in Favignana, a small island close to Sicily, with the support of the universities of Catania and Messina, and introduced two innovations: a session devoted to research activities, with publication of the research communications in a special issue of a scientific journal (*I*), and the participation of a few students involved in the exchanges between the partners (Fig.3).

In 2006 and 2007, many discussions were needed before the partners reached a consensus on the CHERNE membership, like the rights and duties of full members, the definition of associate members, and the possibility to accept research centres, companies and individuals in the network. The financial question was also a recurrent debate, but the majority always discarded the idea of seeking subsidies and sponsorship for the network itself, which

would not be easily compatible with its very informal organisation. Of course, the partners organizing a CHERNE activity can benefit of sponsorship or subsidies when this is possible.

### **SPERANSA 2005-2008**

Organising SPERANSA-2005 without financial support was possible thanks to contributions of the institutions of origin of the students, and a small fee was asked to the students. The consequence was that there were only 13 students from abroad and no participation of UPV. The welcome party and course dinner were not organised. Despite the financial constraints, the 2-week formula was kept. The program was similar to PAN-2003, with a few modifications, in particular the visit to the Tokamak of the Institute of Plasma Physics, and to the Asterix Laser System, instead of the Czech Metrology Institute. The number of exercises was a bit reduced, in accordance with the lower number of student groups, leaving two free afternoons. The lesson of SPERANSA-2005 was that it is possible to organise such an activity without external support, at least in Prague where the cost of accommodation and subsistence was low.

The formula adopted for SPERANSA-2006 was original, the course being organised in two countries: Belgium and Germany. The first week was spent in Mol at SCK•CEN and JRC-IRMM, much like PAN-2004, with more focus on safety aspects: work with the hot cells and simulation of a radioactive transport accident. The second week was at AcUAS in Jülich, with various laboratory experiments, and a visit to TEXTOR, the Tokamak of the Research Centre. A new initiative was the organisation of a round table on ethical aspects of radiological and nuclear safety, with the participation of SCK•CEN. Of course, thanks to the Erasmus grant, the social activities could be organised again, as well as a cultural activity. SPERANSA-2006 was submitted before the founding workshop of CHERNE and was thus limited to the group of five partners established for PAN-2003.

Still with the same partners, SPERANSA-2007 came again in Prague. The work program was similar to 2005, but new round tables, in addition to the one devoted to ethical

aspects, replaced the visit to the Nuclear Research Centre in Rez. These round tables were devoted to the future of nuclear fission in Europe, and to topical questions in radiation protection. The one on fission was prepared in advance by the students in their university of origin, who had to present their contribution orally, and to provide a text formatted as a scientific publication, published on the Web site of the course.

For the last edition of the SPERANSA series, the course was organised in Belgium, in Mol and Brussels. There were now six partners, with the incorporation of PoliMi, a first consequence of the new cooperation within CHERNE. The number of students from each institution was now strictly limited to four, for a total of 24 students. The week in Mol was similar to 2006, including the round table on ethics, with an additional half-day at IRMM. The second week in Brussels was much like PAN-2004, but the list of laboratory exercises was shortened, to include the second round table on nuclear techniques and sustainable development, and a full day allocated to the preparation of the final presentations. This round table was prepared by the students before the course, each national group contributing with a specific chapter. The evolution of the SPERANSA courses is summarized in table 2.

Meanwhile, the selection of IP projects had been transferred to the national agencies, and SPERANSA was finally managed by the Czech agency. During SPERANSA-2008, that was organised early in the year (February-March) before the submission deadline for the next academic year, the partners met in Brussels with other members of CHERNE to define a next project and choose the country where to submit it. Italy was chosen, and the coordination was entrusted to PoliMi. The partnership was again extended, including the universities of Catania, Bologna and Coimbra, and UPC Barcelona. ICARO, Intensive Course on Accelerator and Reactor Operation and applications, was really the product of the cooperation within CHERNE, open to the students of most of the network members. Its organisation also relied on the new

partners: it was organised in Portugal (ITN) in 2009 and 2011 and in Italy (Catania and Palermo) in 2010.

### **Other early activities 2007-2008**

#### ***JUNCSS 2007-2011***

After having participated in many previous courses and having been a co-organizer of SPERANSA 2006, AcUAS decided to organize a course on handling of open radionuclides and radiochemistry. It was named Jülich Nuclear Chemistry Summer School, or in brief, JUNCSS. The application was submitted through CTU as we believed to have a higher chance of acceptance, and it was indeed accepted. The students were again accommodated in the visitor's residence of Jülich Research Centre. The first week started with experiments on radiation detection and measurement in the Nuclear Physics Laboratory. In the second week the students extensively performed radiochemical experiments in the Radiochemistry Laboratories. We followed the proven schedule of previous CHERNE courses by preparing the students with brief lectures in the morning covering the relevant topics. In addition, visits were organized to institutes of Jülich Research Centre e.g. the fusion experiment TEXTOR, the radionuclide production, or the decommissioning site of the High-Temperature Reactor HTR. During the weekend touristic tours were organized with visits to Aachen and Cologne besides of the historical sites in Jülich. In the first year 2007, we had 10 students, 16 in 2008, 13 in 2009. It was decided to maintain the course even when the grant had expired. So, we had sequels in 2010 and 2011 with 14 and 15 students, respectively.

#### ***RPIX-NOCOS 2007-2008***

In 2007 and 2008, XIOS and ISIB proposed another possible formula for the international courses of CHERNE. The principle was to organise a 2-week course integrated in the curriculum of their students and in the organisation by the two institutes, and to open it to the

students of other CHERNE partners with a small fee (<100 €) covering the accommodation in a youth hostel and local transport, but not the travel to Belgium and the food. About 50% of the expenses were paid by sponsors: Federal Agency of Nuclear Control, Belgian Association of Radiation Protection, Canberra, Institute of Radioelements. In 2007, 5 students from the network joined 11 Belgian students, for a total limited to 16, but in 2008 only one student came from abroad. The course was devoted to Radiation Protection in non-conventional sectors (natural radiation, radon, NORM) with roughly 50% lectures and 50% practice including in-field measurements, and a few visits. In 2009 its name and scope were changed to XIMER, XIOS-ISIB course on Measurement of Environmental Radioactivity, with two full-day field trips.

A similar approach was followed later by UPV. Some 1-week courses in the frame of its Master on Industrial Safety and Environmental were offered to students of CHERNE partners without any fee, and with a possibility of low-cost accommodation. Furthermore, professors of CHERNE institutions were invited to give some of these courses.

### **Maturity 2009-2014**

The years that followed cannot anymore be considered as “early days”. The network was now fully established, and the variety of activities increased. The workshop was organised every year (in Jülich, Coimbra, Brussels, Athens, Salamanca, Thessaloniki), and new members joined the network. Several Erasmus IP’s were organised (ICARO, JUNCSS, SARA, MANTRA) as well as many other 1-week or 2-week courses, and a few visits (Tchernobyl, Zwentendorf). CHERNE continued to trigger many bilateral exchanges between its members: mainly student exchanges and professor exchanges supported by the Erasmus program, but also several research collaborations.

In 2014, Erasmus became Erasmus+, which did not anymore support the independent IP's that were the backbone of the network. A new chapter was open, the development of strategic partnerships.

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Table 1. Summary of the organisation of PAN Intensive Programmes

	PAN 2002	PAN 2003	PAN 2004
Where?	Prague	Prague	Mol-Liège-Brussels
Students	19	23	24
Partners	CTU,ISIB,UPV	CTU,ISIB,UPV,AcUAS,HL	CTU,ISIB,UPV,AcUAS,HL
Reactor exercises	Sparrow	Sparrow	BR1
Accelerator exercises	Microtron, Van de Graaff	Microtron, Van de Graaff	LINAC, Van de Graaff, cyclotron
Lectures (~1h)	9	11	8
Lab. exercises	5	6	6
Visits , many with demos	Radiotherapy, Nuclear medicine, gamma knife Research centre Rez: reactor, cyclotron. Czech metrology institute, NPP Temelin	Radiotherapy, Nuclear medicine, $\gamma$ knife, Positron tomography. Research centre Rez: reactor, cyclotron. Czech metrology institute	Radiotherapy, Nuclear medicine, Positron tomography. Radwaste treatment & geological disposal. Environmental radioactivity lab.
Oral presentation	no	yes	yes, 1/2 day preparation
Social events	1	2	3
Accommodation	CTU hotel	CTU residence	Holiday resort + youth hostel
Free time	weekend	weekend	Weekend + 1 afternoon

Table 2. Summary of the organisation of the SPERANSA Intensive Programmes

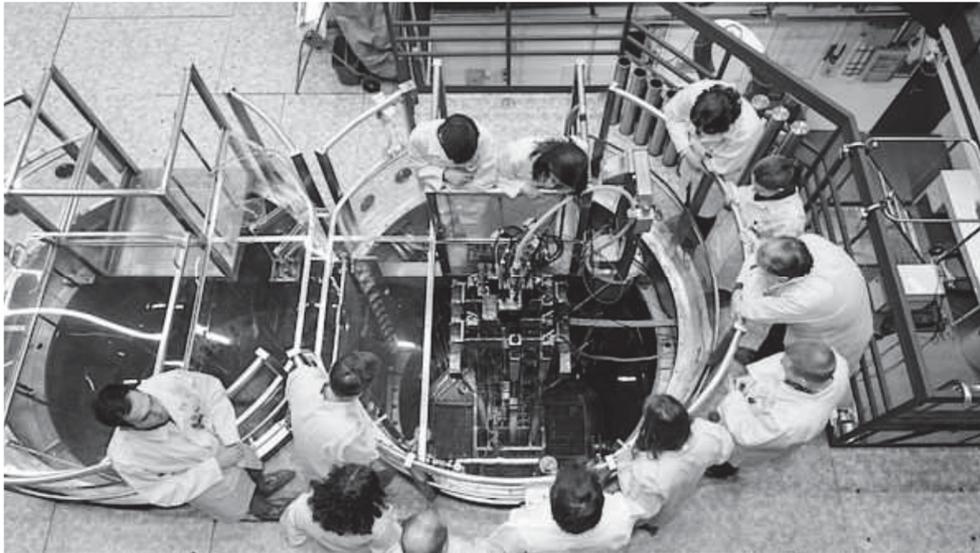
	<b>SPERANSA 2006</b>	<b>SPERANSA 2007</b>	<b>SPERANSA 2008</b>
Where?	Mol - Jülich	Prague	Mol - Brussels
Students	23	23	24
Partners	CTU,ISIB,UPV,AcUAS,HL	CTU,ISIB,UPV,AcUAS,HL	Same + PoliMi
Reactor exercises	BR1	Sparrow	BR1
Accelerator exercises	LINAC – Van de Graaff	Van de Graaff	LINAC – Van de Graaff
New exercises	Work with hot cells Simulation of transport accident		Same as 2006
New activity	Round table on ethical aspects	3 round tables: ethics, future of nuclear fission, radiation protection	2 round tables: nuclear energy & sustainable development, ethics.
Visits	Tokamak, radwaste processing, geological disposal	Tokamak, Laser system Radiotherapy, Positron tomography	Environmental radioactivity lab., radwaste processing, geological disposal, nuclear medicine, radiotherapy,
Social activities	3	3	4
Cultural visits	Guided tour of Aachen		Guided tour of Brussels Visit of traditional brewery

Figure 1. Students at the Sparrow reactor (CTU)

Figure 2. Participants into the founding workshop

Figure 3. Student presentation at the 2008 workshop in Favignana

Figure 4. Work in radiochemical cells during JUNCSS



*Figure 1. Students at the Sparrow reactor (CTU)*



*Figure 2. Participants into the founding workshop*



*Figure 3. Student presentation at the 2008 workshop in Favignana*



*Figure 4. Work in radiochemical cells during JUNCSS*