

SCHOOL REPORT

(proposed structure, you can adapt it to your purpose, max 2 pages!)

School: HERCULES 2014 (HERCULES ANNUAL SESSION)

Specific Title: Neutrons and synchrotron radiation for science

Dates: 23/02 – 27/03/2014

Venue: GRENOBLE (France) – VILLIGEN (Switzerland) – SAINT AUBIN/SACLAY (France)

Organizer's Name: José Baruchel & European School Office (Joseph Fourier University)

Organizer's Affiliation: Joseph Fourier University (UJF), Grenoble Inp, ILL, ESRF, Paul Scherrer Institute, SOLEIL, laboratoire Léon Brillouin (CEA Saclay), CNRS, CEA Grenoble

Total budget: 111514,12 €

Maximum NMI3-II support: 27500

Scope The aim of the HERCULES is to train young European researchers (in particular PhD students and postdoctoral scientists) to optimally use the state-of-the-art instruments at the present and future Large Installations (LI) that deliver neutrons (n) or synchrotron radiation (SR) in Europe. Since its inception in 1991, the HERCULES annual sessions (HAS) have offered basic and advanced, theoretical and experimental know-how for a multidisciplinary audience composed of young biologists, chemists, physicists, geoscientists, and industrial scientists.

The HAS (HERCULES Annual Session) runs for four and a half weeks and trains 70-80 participants per year. **The great success of the HAS, which is shown by the demand always exceeding the available positions**, is mostly due to the coupling of practicals on high performance instruments (40% of the programme volume) carried out at partners LI (ESRF, ILL, LLB, SOLEIL, SLS) and participating laboratories (CNRS, CEA, IBS, UJF) with lectures and tutorials. The lectures are given by the best specialists selected at the international (mostly European) level. All the events (lectures, tutorials practicals) are evaluated by the participants.

The Hercules schools have also helped to build a European network of young researchers using n and SR for condensed matter studies and have greatly contributed to consolidate the communities of the two complementary investigational tools. It is a significant measure of the impact of HERCULES on the relevant community that, up to now, about 1910 participants have benefited from the HAS, out of more than 2700 applicants. A large fraction of these participants remains connected to LI.

Students

A large majority of the students attending the HERCULES Annual Session 2014, (February 23rd – March 27th) came from European countries. 73 participants attended the course, 69 full time and 4 part time participants. HERCULES always hosts, in addition to the participants originating from the European Union, participants from other European or emerging (Brasil, China, ...) countries.

They were selected out of more than 110 completed application forms, by taking, as criteria, the scientific excellence and the importance of neutrons and synchrotron radiation for the applicants research work.

For the practicals' and tutorials' hands-on training, the students were divided into 18 experimental groups (4 students per group) and carried out experiments and data analysis set up by about 70 local instructors. In this way, the students could establish contact with the scientists in charge in the large scale facilities, and therefore become familiar with the state-of-the-art instrumentation present there. Tutorials and specific practicals using beam were carried out at both International and National facilities: SLS (Villigen) and LLB (Saclay) for 20 full time participants and SOLEIL (St Aubin) for X-ray studies, and at ILL (Grenoble) and LLB (Saclay) for neutron experiments for 49 full time participants.

Concerning the NMI3-II financial support to HERCULES Annual Session 2014, we would like to point out the following information:

We have selected 28 eligible participants who benefited from NMI3-II support, all in agreement with the NMI3-II funding rules. They are mostly PhD students and post-docs, affiliated with a European scientific, academic or industrial institution.

Among the 28 eligible participants, 19 followed the one- week course in Paris (LLB and Soleil) and 9 participants followed the 3 days course at SLS (Villigen) and 1 day course at LLB for more intensive Neutron Scattering training.

Organisation

The entire coordination and management of the project is carried out by HERCULES management with the support of the HERCULES Organising committee and the HERCULES assistants. It is based at the Maison des

Magistères (CNRS). The financial management of the HERCULES programme is mainly ensured by the financial office of Joseph Fourier University (UJF). The part of the project organized at Villigen, Saint Aubin and Saclay was governed by two sub-contracts between ESRF and Paul Scherrer Institute ; ESRF and Synchrotron SOLEIL (St- Aubin/Saclay).

HERCULES annual session included lectures (given by 60 lecturers, selected, as said before, because of their internationally recognised expertise in their field, and pedagogical skills), tutorials, practicals (about 40% of the time of the session), visits to laboratories and a poster session. It was structured into two parts:

- A general, common, part of a week and a half bringing together the multidisciplinary audience. The common lectures covered the various properties of neutrons and synchrotron radiation beams, and presented the most appropriate methods and instruments for the young scientists' needs in the future, i.e. basic notions on sources, detectors, optics, interaction of neutrons and X-rays with matter, powder and single crystal diffraction, small angle and diffuse scattering, inelastic scattering, absorption spectroscopy and imaging techniques.

The complementary nature of X-ray and neutron techniques was particularly pointed out.

- The application part (3 weeks) is split into 2 parallel specialised sessions:

Session A: Applications to physics and chemistry of condensed matter (45 full time & 3 part time participants).

Session B: Biomolecular structure and dynamics (24 full time & 1 part time participants).

This application part contains most of the experimental training with beam on instruments at the cutting edge of the technique during special days (as detailed below, and in the HERCULES 2014 Booklet, Annex I)

During the session, a one week programme program was organized at:

- Paul Scherrer Institute, SLS, Villigen for 20 participants (9 – 13 March 2014),

- Laboratoire Léon Brillouin, Saclay, for the same 20 participants (13 – 16 March 2014), for a reinforced neutron experimental programme

and a 1 week programme (8-16 March 2014) in parallel at:

- Laboratoire Léon Brillouin, Saclay, for a reinforced neutron experimental programme (practicals & tutorials),

- SOLEIL Synchrotron, St Aubin, for a training in applications of soft X-rays, ultraviolet and infrared radiation (lectures and practicals), challenging lectures on free electron lasers and ultra-fast x-ray science, and gas phase species interacting with the synchrotron radiation surface studies using synchrotron radiation techniques.

The HERCULES organization would like to point out the particular effort from the Laboratoire Léon Brillouin, devoting a full week for the school so that despite the ILL shutdown, all students could participate in hands-on neutron practicals.

Results

As a summary, we can say that, in addition to the training itself, considered as very important for their work by nearly all participants, an important added bonus of the HAS courses is that it helped to build a European network of young researchers using n and SR for condensed matter studies and has greatly contributed to consolidate the communities of the two complementary investigational tools. Setting up the HERCULES participants' interactive network on the web also contributed to creating links between the participants of this session as well as between the participants from previous and future sessions. An evaluation of the course was carried out by anonymous form by the HAS 2014 students, dealing with each lectures and tutorials, during the course.

It was done during the session by means of HERCULES web site evaluation forms for lectures, for practicals and tutorials, and at the end of the session for general evaluation.

Evaluation meetings were also organized for the participants to make remarks or discuss various points with the organizing committee. The results were analysed during two meetings (one per session), and we would like to say that the general evaluation of the session by the young researchers was highly positive and showed that HERCULES 2014 session was greatly appreciated by the participants.

During the session, contacts were facilitated between the scientific community of L.I. and the young researchers during the various activities of the course. The poster session was particularly successful with discussions around posters of high quality. This event has gathered the student but also many beamline scientists and instrument responsables, thus fostering the informal exchange of information with the teaching staff of HERCULES, and with the relevant Grenoble scientific community. This allowed the scientific discussion of possible complementary experiment on the large installations. Contact between young researchers and lecturers was also encouraged during the breaks (in the middle of lectures and at coffee break, during lunch) and after the lectures. During the practicals, the interaction was optimised between the group of four participants and the teacher (often a beamline scientist or instrument responsible).

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