SPIRITnews

SPIRIT NEWS

SPIRIT'S PERFORMANCE EARNS PRAISE AT BRUSSELS MEETING

Prof. Dr. Wolfhard Möller, SPIRIT Coordinator

On 26th July 2011, the SPIRIT Coordinator met Teodora Rusu and Daniel Pasini from the Research Infrastructure Unit of DG Research and Innovation at Brussels. Both were highly complimentary about the performance of SPIRIT, which was documented by the very positive evaluation in the Midterm Report. They encouraged the SPIRIT team to continue their efforts and praised the networking, transnational access, and joint research activities that have been accomplished to date. They also recognised that SPIRIT was meeting its milestones and deliverables and in some areas was even exceeding expectations.

WORKSHOP: RESEARCH INFRASTRUCTURES FOR INDUSTRIAL INNOVATION

According to the main objectives of the new Programme Horizon 2020, the Research Infrastructure Programme should consider more closely the needs of industrial users to enlarge its focus on aspects of innovation. Therefore, on 20th October 2011, a workshop called "Research infrastructures for industrial innovation" took place in Brussels under the leadership of Hervé Péro, Head of Unit for Research Infrastructures within the Directorate General for Research within the European Commission (EC). Participants from many running Research Infrastructure (RI) projects discussed the following key questions:

- What additional measures need to be introduced in the RI programme to support better industry?
- What should be the scope and content of a future action on scientific instrumentation in the RI programme?
- Should Europe support a roadmap for industry oriented RIs (similar to the ESFRI Roadmap for scientific research)?

Andreas Kolitsch (SPIRIT Transnational Access Manager) had the opportunity to attend this meeting and was asked to present his experiences concerning the inclusion of industry within the framework of the SPIRIT Project. He determined from this meeting that as the rules of the EC concerning Transnational Access will not be changed in the future, strong national accompanying support programs have to be established to optimise the mutual benefits between Research Infrastructures and industry.

SPIRITnews

TWO NEW TNA PARTNERS IN SPIRIT

The SPIRIT project will add two new facilities as TNA providers*. The facilities are: RBI, Zagreb, Croatia (http://www.spirit-ion.eu/Partners/RBI.html); and UPMC, Paris, France (http://www.spirit-ion.eu/Partners/UPMC.html). Table A details the contributions to TNA of all the infrastructures within SPIRIT. (The table can be found here: http://www.spirit-ion.eu/TNA/Information.html)

SPIRIT TNA Areas of Activities		Materials																	Biomedical					Environment / Cultural Heritage		
		Ion Beam Analysis								Irradiation									Ion Beam Analysis			Irra-diation		Ion Beam Analysis		
		RBS, ERD, NRA incl.Channeling	High Depth Resolution	Hydrogen Profiling	3D Analysis,Tomography	External beam	Nanobeam	High-Resolution PIXE	Medium-Energy Ion Scattering	Implantation	Plasma Immersion Implantation	Very high energy	Radioactive Implantation	Ion Beam Lithography	Focused Ion Beam Irradiation	Multi-beam Irradiation.	Slow Highly Charged Ion Irrad.	Ion Beam Incuced Charge	In-situ structural analysis	IBA Tomography	External beam	nBeam Mapping	Radioactive Implantation	Targeted Irradiation	IBA Tomography	External beam	Nanobeam
WP4.1	HZDR	■	■	■						■	■				■	■	■										
WP4.2	CNRS				■	■	■													■		■		■	■	■	■
WP4.3	KUL	■	■							■			■										■				
WP4.4	JSI				■	■		■						■								■			■		
WP4.5	UBW		■	■	■		■																	■			
WP4.6	CEA											■				■			■								
WP4.7	SUR	■			■	■	■			■				■					■	■	■		■	■	■	■
WP4.8	UPMC	■	■	■					■																		
WP4.9	RBI	■		■			■	■						■	■	■		■							■		

Table A: SPIRIT TNA: Main fields of application, specific processes of ion-based materials analysis and modification, and contributions of the individual infrastructures

** The amendment to the Description of Work document will be signed by the EU shortly.*

SPIRIT EVENTS

Conferences

International Conference on Nuclear Microprobe Technology & Applications Lisbon, Portugal, 22-27July 2012

Since the first edition in 1988, ICNMTA has established itself to become a premier conference in microbeam technology. The conference fosters the gathering of scientists from all over the world to exchange ideas, share new knowledge and technical know-how in the relevant fields.

The 13th ICNMTA includes plenary sessions, keynote lectures and several specialized sessions on different topics related to microbeam optics and instrumentation, imaging and tomography, cell irradiation and proton beam writing with relevant applications in Materials Science, Microelectronics, Biology, Biomedicine, Earth & Environment Sciences, and Archaeometry. The conference also includes tutorial talks, poster sessions and the Proton Beam Writing Workshop, which will be held at the conference venue. http://www.icnmta2012.itn.pt/index.html

SPIRITnews

SPIRIT Tutorial #4/ SPIRIT Workshop for New Users #3

The fourth SPIRIT tutorial and third SPIRIT workshop will be held on the days preceding the International Conference on Nuclear Microprobe Technology & Applications, Lisbon

Preliminary Program: SPIRIT Tutorial
"Live cell micro irradiation"
20.07 – 21. 07.2012, Lisbon, Portugal

Friday, 20.07.2012

G. Dollinger	09:00	Microirradiation of cells, tissue, animals, patients: a general overview
S. Girst	10:00	Interaction of ions with biological matter
	11:00	Coffee break
S. Incerti	11:30	Monte Carlo simulation of track structure in voxellized cellular phantom for microdosimetry in radiation biology
	12:30	Lunch
V. Hable	14:00	What do we need to perform microirradiation of living cells and tissue?
G. Dollinger	15:00	Ion sources, accelerators, phase space volume of a beam and its transformation, beam transport, pulsed beams
	16:00	Coffee break
C. Greubel	16:30	Focusing of ions, magnetic lenses, aberrations and their corrections
C. Greubel	17:30	Single ion preparation and irradiation, targeting and scanning

Saturday, 21.07.2012

V. Hable	09:00	Conditions for cell irradiation: exit window, cell culture at beam, vertical versus horizontal beam
T. Schmid	10:00	Cell and tissue handling, preparation, immuno staining, GFP-tagging
	11:00	Coffee break
V. Hable	11:30	Online optical microscopy for targeting and observation
	12.30	Lunch
Ph. Barberet – F. Vianna		
	14:00	Beam calibration/Cell recognition/Cell targeting
T. Schmid	15:00	DNA Repair
	16:00	Coffee break
H. Seznec – S. Bourret		
	16:30	Microirradiation: From cells to multicellular specimens
G. Dollinger and others		
	17:30	What do we need in future: improvements in microbeams, cell handling, optical microscopy to improve quality of actual and new experiments

Look for information about this tutorial and workshop on the SPIRIT website.

Workshops

Diamond Detector Workshop, Croatia, 6-9 May 2012

This Workshop, funded by a Croatian-Japanese bilateral project and the FP7 project PARTICLE DETECTOR at RBI, covers a subject that is part of the SPIRIT joint research activity (JRA WP6 KT12) involving detector development and should be of interest to anybody involved with this technology. Look for information about this workshop on the SPIRIT website.

SPIRITnews

Technical Meetings

MeV-SIMS Technical Meeting, Dubrovnik, Croatia, 21-25 May 2012

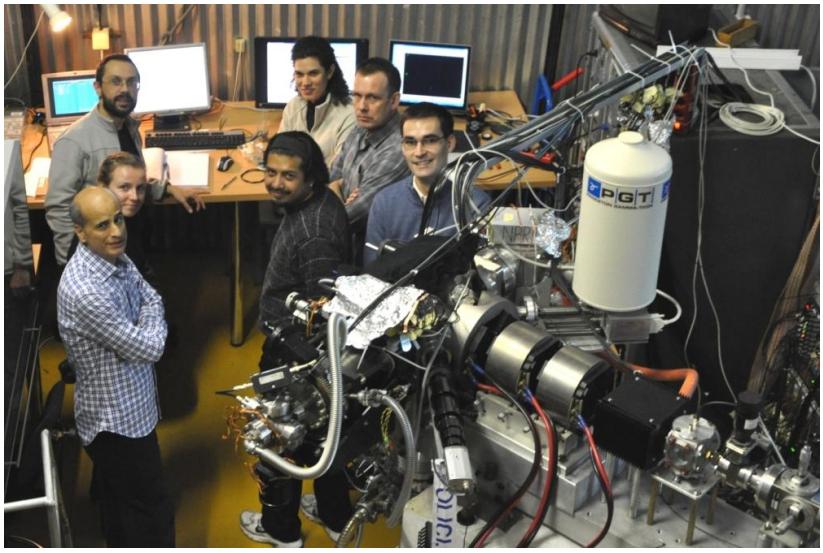
This meeting, the first of its kind, will be held at the Inter-University Centre Dubrovnik (IUC) (http://www.iuc.hr/). The meeting is scheduled for May 21-25 (Monday to Friday). Look for information about this workshop on the SPIRIT website.

Transnational Access (TNA)

TNA activities at RBI begin in earnest

During November 2011, the first three TNA experiments have been performed at the Ruđer Bošković Institute (RBI) in Zagreb. The experiments involved two groups from Italy and one from France. In an experiment proposed by Domenico Torresi (Catania), the IBIC (Ion Beam Induced Charge) technique was used to test the response of interstrip regions of the 32 x 32 strip detectors used in nuclear physics experiments. IBIC imaging was performed using a series of energies of proton and Li microbeams to quantify the degradation of response at interstrip regions as a function of ion range. For the experiment the 5 x 5 cm^2 detector and the readout for all 32 x 32 strips was connected to an external data acquisition system.

Experiments proposed by Paolo Olivero (Torino) and Michal Pomorski (Saclay) involved microbeam irradiation of diamonds using carbon ions. High densities of defects were created at certain depths in diamond in order to create conductive channels or to perform etching for creation of differently shaped microstructures. High current microbeams (up to 5 nA) were obtained using a quintuplet microbeam configuration for ion energies between 750 keV and 18 MeV.



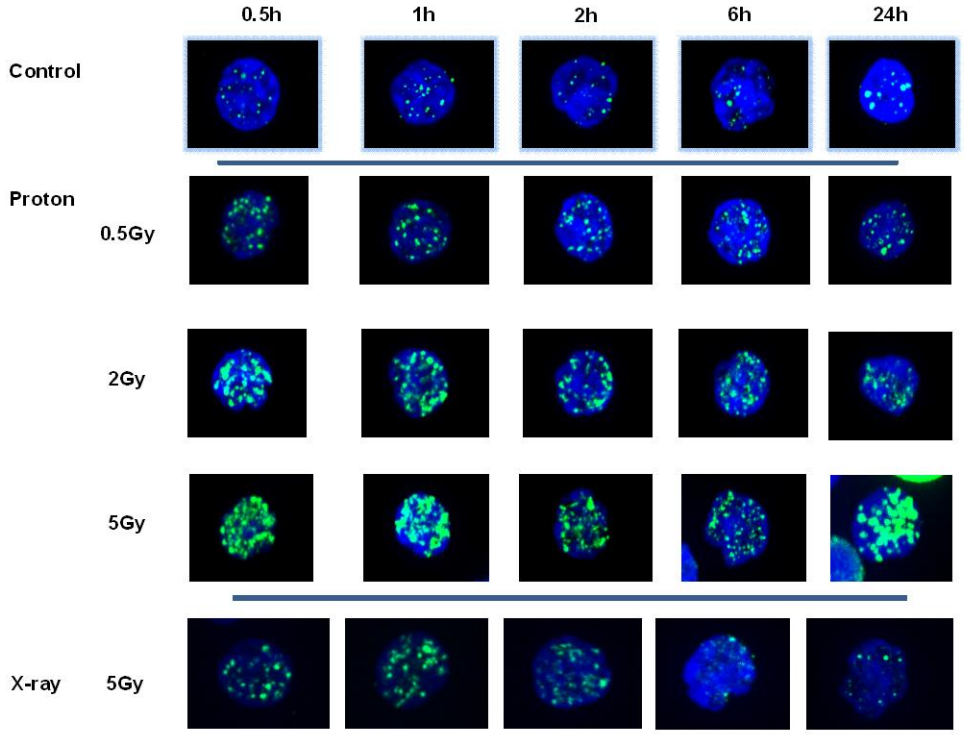
Researchers at RBI

In addition to the use of the heavy ion microprobe at RBI, several new proposals have been submitted to use the TOF ERDA setup. Its particular advantage is in its increased sensitivity for light elements such as hydrogen and helium. By using chlorine, iodine or gold ions in the energy range between 10 and 30 MeV, this TOF ERDA setup can be used for elemental depth profiling of layers near the sample surface. Another important application in the new proposals is connected with high energy ion irradiation of materials for production and ordering of metal nanoparticles in amorphous matrices.

SPIRITnews

Vertical Nanobeam at Surrey used to investigate DNA double strand breaks

A collaborative team including Susan Short (UCL) and Ayiguli Abulimiti (University of Munich) used the Vertical Nanobeam at the Surrey Ion Beam Centre to investigate if the induction and the repair of DNA double strand breaks following proton irradiation was different to photon irradiation in blood lymphocytes. It was found that the number of DNA breaks induced by protons in early periods after irradiation was significantly higher than that induced by X-rays. This reflects the much higher linear energy transfer of the radiation.



Images of nuclei from human white blood cells, irradiated with either X-rays or protons. The green dots indicate regions where the DNA of the cell has been damaged by the radiation

Investigation of XI-XIV Century Glass Jewellery

Iwona Szynkowska (Instytut Chemii Ogólnej i Ekologicznej Politechnika Łódzka) came to the Surrey Ion Beam Centre to analyze XI-XIV century glass found in cemeteries located in the north-western part of the Chelmińska Land (around Chelmno) on Polish territory.

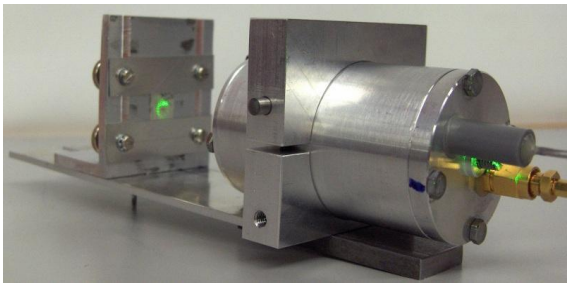
Various glass jewellery beads from this study

The elementary chemical composition was determined by PIXE-PIGE (Proton Induced X-ray Emission and Proton Induced Gamma ray Emission), and 26 elements have been quantified: Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, C, Ni, Cu, Zn, As, Br, Rb, Ag, Sn, Sb, Ba, Pb. The results obtained from the multivariate statistical analysis of compositional data of glass jewellery provide detailed information about technological aspects of glass used in an early medieval settlement complex in Kałdus of Chełmińska Land.

JOINT RESEARCH ACTIVITIES (JRA)

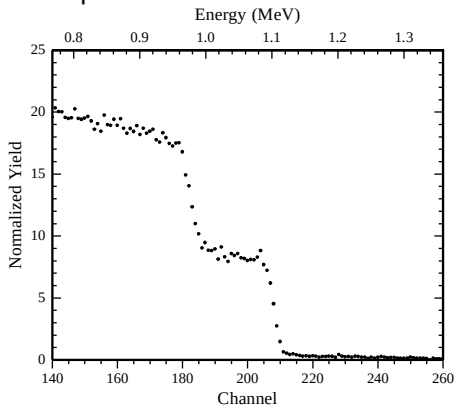
A new Compact Backscattering Gas Detector

A much more compact model of gas ionization chamber for Rutherford backscattering (RBS) and heavy ion backscattering (HIBS) has been developed at ETHZ. The so-called µ-HIBS detector is an in-line annular gas chamber with a similar geometry as the much bigger device developped at a very early stage of the SPIRIT project. However, it is downsized by about a factor of 4, has no Frisch grid and is constructed in a considerably simpler way. If mounted at the corresponding distance from a sample the solid angle is the same (3 msr). The basic assembly consists of an aluminum tube of 6 cm length and 4 cm diameter. On the front cap of the detector, eight silicon nitride entrance windows are arranged around the beam axis. The primary ion beam is guided through the centre of the device through a metal capillary with 1 mm bore hole. A cylindrical anode made of a 4 mm diameter copper tube surrounds the beam capillary.



Picture of the backside of the in-line µ-HIBS detector. A laser beam passing through the beam guiding capillary in the detector is used to adjust the position of the Al_2O_3 sample to the beam spot.

In a first backscattering experiment the 2 MeV RBS spectrum of a 150 nm thick Al_2O_3 layer was acquired. The obtained performance is very promising, showing an energy resolution of 17 keV at the Al edge. Tests with heavier projectiles are in preparation. Similar results as with the original, much larger and more complex model are expected.



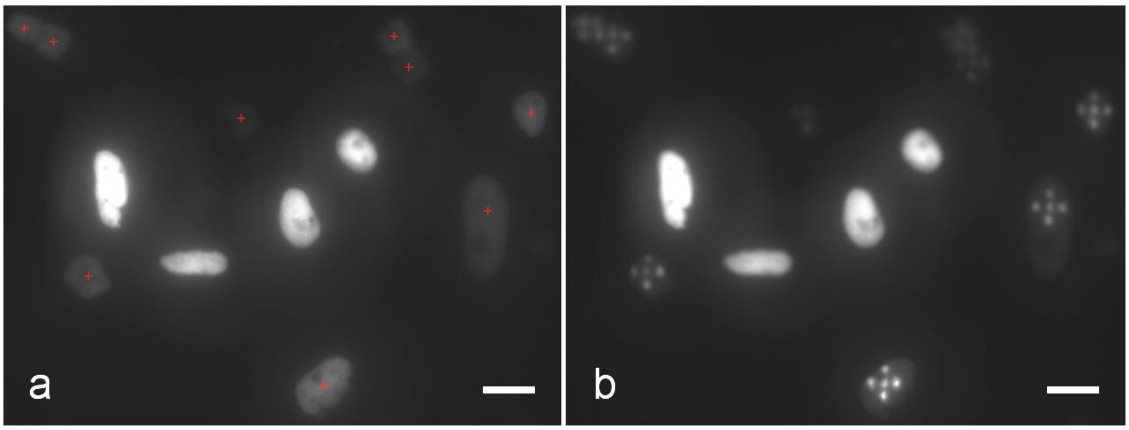
2 MeV ^{4}He RBS spectrum of a 150 nm thick Al_2O_3 layer on aluminum backing.

SPIRITnews

Commissioning of the micro-irradiation beamline at AIFIRA, Bordeaux: first targeted irradiation of living cells

A second generation micro-irradiation end-station has been commissioned at the AIFIRA facility. This setup allows for the targeted irradiation of living cells with protons and alpha particles up to 3 MeV. Compared to the previously used setup, major improvements have been done:

- The beam is positioned on the target cells by means of electrostatic deflection, providing thus a higher irradiation throughput
- The online microscope is used to perform video-microscopy
- A complete control software has been designed to handle the beam calibration process, image processing and automatic cell recognition, cell irradiation and video-microscopy acquisition.



a: HeLa cell nuclei transiently expressing XRCC1-GFP. The targeted nuclei were automatically localized by image processing. The irradiated nuclei are marked with a red cross. The four bright nuclei were not targeted.
b: The same cells observed online 90 seconds after irradiation. The irradiation was performed with 3 MeV alpha particles distributed on a cross pattern (5 µm between each point of the cross). About 650 particles were delivered on each point. Scale bar: 20 µm

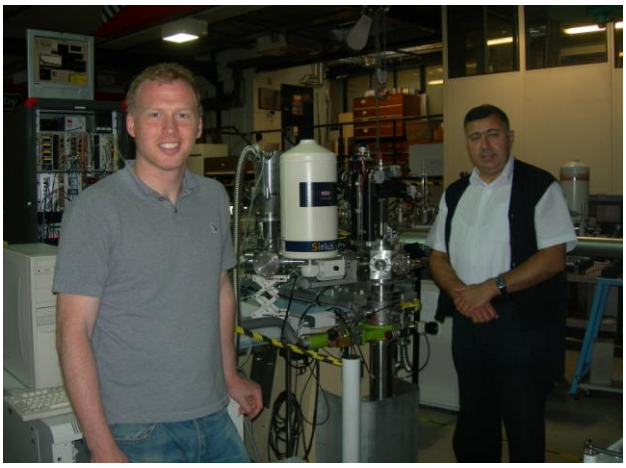
The first targeted irradiation of cells was performed in November 2011 and allowed to visualize DNA damage in-vivo. By comparing the position of the targeted point with the actual damages appearing in the cell nuclei after irradiation, the targeting accuracy was estimated to be 2.0 ± 0.7 µm.

MeV SIMS used to analyse artwork

At the Surrey Ion Beam Centre in July 2011, thanks to a proposal submitted by Dr. Tonči Tadić (Laboratory for Ion Beam Interactions, "Ruđer Bošković" Institute, Croatia), MeV-SIMS was used to map the molecular composition of various samples relating to art and archaeology. This analysis, a first of its kind, exploits the simultaneous molecular (from MeV-SIMS) and elemental (from PIXE and RBS) data generated by this new technique. Several reference samples were measured and compared to a cross-section taken of a Croatian painting to determine whether the binders and pigments could be identified.

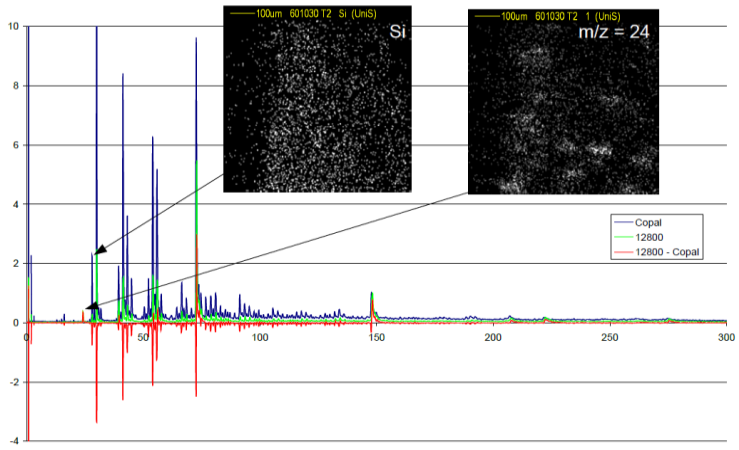
Many fatty acids commonly found in binder material could be identified and this helped to identify possible candidates for binders used in the unknown sample. The figure below demonstrates a set of MeV-SIMS measurements, taken with 4 MeV O^{3+} primary ions, used to compare the normalized

unknown sample (12800) spectrum with a normalized reference spectrum. This figure also demonstrates MeV-SIMS's ability to map the distribution of the secondary ion peaks.



Brian Jones (SUR) and Tonči Tadić (RBI) with the newly developed MeV SIMS equipment in Surrey

This technique is continuing to be developed by several groups across Europe (SUR, JSI, RBI) and SUR is working to bring their MeV-SIMS technique out into atmospheric pressure by late 2012.



Normalized resin (Copal) reference and unknown (12800) spectra. The red spectrum shows the result of subtracting these two spectra. Maps of the Si distribution and the m/z = 24 distribution across the sample shown.

NETWORKING AND EVENTS

Foresight Study in 2012

As part of the SPIRIT project, the consortium will produce a Foresight Review, which sets out the opportunities and pathways towards developments and applications where ion beams can really make a difference in the future. Here is a link to the Foresight Study on the SPIRIT website.

SPIRITnews

The second SPIRIT Tutorial “Ion Beam Surface Analysis” held June 20/21, 2011 at ETH, Zurich

22 participants attended the course, 9 of which obtained financial support by SPIRIT and 5 came from SPIRIT partner institutions. On the first day, 7 lectures on the basic principles of Ion Beam Analysis were held by the ETHZ team. Then samples were prepared for the RBS/PIXE measurement planned for the following day.

Tutorial group photograph, Zurich

All participants and the ETHZ team spent the evening in downtown Zurich to stimulate social contact among the young people from 13 nations. In the morning of the second day, participants formed 4 groups and carried out RBS/PIXE experiments at the accelerator lab, partly on a collection of standard samples, partly on samples of their own research projects. The laboratory work alternated with a practical course in SRIM calculation. The RBS/PIXE data taken in the morning were then analysed by the participants in the afternoon with support of the local team. All attendees were strongly motivated by the challenge of solving the given tasks. Many of them even skipped the afternoon coffee break to finish their analysis.

A student is mounting samples on the RBS/PIXE target holder. Some participants brought specimens from their own research projects.

SPIRITnews

A group of attendees tries to interpret experimental spectra during data taking

At the end of the tutorial, participants were asked to fill in detailed feedback forms, evaluating the quality of the tutorial administration and performance as well as the level and benefit of the lectures and the hands-on work. On the average the quality of the event was rated with 4.5 points in a range from 1 to 5 points. For a large majority of participants the level of the presented material was "just right". Of all aspects of the course the practical work was judged most positively.

After the measurements at the accelerator lab, participants are analyzing the RBS/PIXE data. They are asked to answer a number of questions on the composition of samples.

SPIRIT TUTORIAL & WORKSHOP ON HIGH RESOLUTION DEPTH PROFILING

A SPIRIT Tutorial of two days and a SPIRIT Workshop on High Resolution Depth Profiling were held at the Université de Pierre et Marie Curie in Paris from June 25 to June 30, 2011.

The Tutorial was held over the weekend preceding the High Resolution Depth Profiling workshop HRDP6. The Tutorial attracted 27 participants from SPIRIT and other European labs, but also from

Russia, the Ukraine, South Africa, Romania, and Japan. SPIRIT was able to offer travel and accommodation bursaries to 15 participants. The placing of the Tutorial immediately before HRDP meant that it was easy to attract high-level international experts already coming to HRDP6, to give lectures on high energy resolution ion beam production, high resolution electrostatic and magnetic detectors, and applications of MEIS and high resolution ERDA. The tutorial included a hands-on session on the SAFIR narrow resonance profiling system, with a two-hour experimental session for each of three groups of ten participants, and a communal 2 1/2 hour data interpretation session. The participants appreciated the chance to meet the high level experts, and were invited to the opening cocktails of HRDP6 where they appreciated the opportunity to meet many more experts in high resolution depth profiling. Some of the Tutorial participants stayed in for the HRDP6 Workshop.

Tutorial Participants, Paris

HRDP6 was attended by 74 registered participants coming from North America, South America, Asia, and Europe. Twelve Invited Speakers introduced sessions in which 34 Oral presentations were made, and 24 Poster presentations were displayed for the duration of the Workshop. The Invited Speakers, being at the cutting edge of their respective fields, were offered one of a limited series of hand-made ‘Laguiole’ pockets knives in appreciation of their contributions. A special effort was made to showcase high resolution ion beam depth profiling techniques and applications, and at the same time a selection of new or complementary high resolution depth profiling techniques were presented. In particular, there was an invited talk on the Atom Probe, and one on the use of surface diffraction of grazing incidence He beams for monitoring MBE layer-by-layer growth – a kind of ion beam analogue of RHEED. The latest developments in high depth resolution SIMS were also presented in an invited talk. Participants were able to relax and ‘network’ during the outings organised in central Paris, and during the Gala Dinner, which was held on a Bateau Mouche dinner cruise along the Seine River.

SPIRITnews

SPIRIT on exhibit

SPIRIT was exhibited at the 18th International Conference on Secondary Ion Mass Spectrometry (SIMS XVIII) held in Riva del Garda, Italy from 18-23 September 2011. The conference provided a forum for scientists from academia and industry to exchange results and new ideas on Secondary Ion Mass Spectrometry and related techniques. The conference also covered advancements of scientific knowledge from fundamentals to applications.

The SPIRIT exhibit at SIMS XVIII, Italy

SPIRIT was also featured prominently during the Open Day at the Advanced Technology Institute held at the University of Surrey. This event, which took place 20th June 2011, focused on the impact of the research carried out at the ATI (part of the Surrey Ion Beam Centre), the essential role of partnerships, and on recent scientific highlights. Professor Roger Webb, in his talk “The Ion Beam Centre: Support for Public and Industrial Research Using Ion Beam Technology”, highlighted the SPIRIT project to the audience.

SPIRIT presented at the ATI Open Day, Surrey, UK

SPIRIT was exhibited at S2K 2011 in June at the University of Surrey, UK. This event saw over 100 attendees discussing future manufacturing processes designed to enable the next generation of electronics. Since its inception in 2000, S2K has established itself as one of Europe’s leading conferences for the Semiconductor, Nanotechnology and MEMS.

Job Opportunities

Please visit http://www.spirit-ion.eu/Jobs.html for links to job opportunities in SPIRIT.