



Student workshops and summer schools at the Heavy Ion Laboratory, University of Warsaw

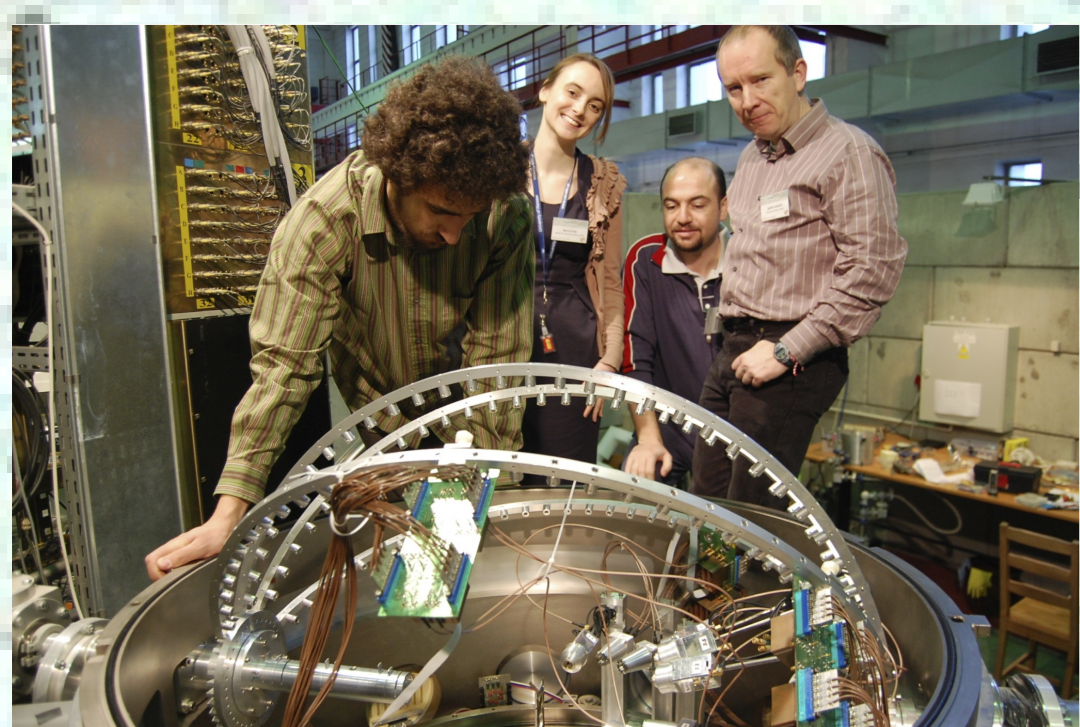


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Nuclear physics students, especially in countries where no accelerator facilities are available, have often quite limited possibilities of getting acquainted with modern scientific apparatus. Existing faculty physics laboratories usually offer only basic equipment and propose standard experimental tasks which do not stimulate independent thinking and creativity. As a response to these needs, Student Workshops and Summer Schools on Acceleration and Applications of Heavy Ions are organised every year at the Heavy Ion Laboratory of the University in Warsaw, giving students a unique opportunity to gain experience in methods of data acquisition and analysis, in operating the cyclotron including beam diagnostics measurements and in charged particle and gamma-ray detection techniques.



Participants work in small teams (2-4 people) to prepare and perform nuclear physics measurements using dedicated apparatus available in the Heavy Ion Laboratory. For this purpose, a week of cyclotron beamtime is allocated. These tasks provide them with a hands-on experience with modern scientific equipment (detectors and related electronics, vacuum systems) and offer a possibility to get acquainted with best practice rules of laboratory work (e.g. sources and target handling). The workshop is concluded by a session of student presentations in the form of 20 minute talks on each team's measurements and results.

Examples of experimental tasks include:

- Beam focusing in heavy ion acceleration,
- Target thickness and cross-section measurement in Rutherford scattering,
- Identification of excited bands in gamma-gamma coincidences,
- Fast-timing or TOF measurements using scintillation detectors,
- Experimental study of charged particle spectra in nuclear reactions,
- Identification of reaction products based on pulse shape analysis,
- Elemental analysis using X-ray fluorescence,
- Preparation of targets for nuclear physics studies,
- Gamma-ray spectroscopy of long-lived reaction products,
- Measurements of natural activity in environmental samples.



The experimental part of the workshop is accompanied by a series of lectures on subjects related to heavy ion physics. The lectures take place every day in the morning and offer introductions to subjects such as target preparation, ion optics, presentation of various experimental techniques as well as applications of nuclear methods in other fields, such as medicine and nuclear energy.

The Polish edition of the workshop has been organised every year since 2005 and is currently intended for students starting their third year of studies. As the Bologna process has been implemented in most Polish universities, this is the moment when students start thinking about their future specialisation area and possible BSc projects. We hope that participation in the workshop will encourage them to choose a subject for their thesis in the domain of nuclear physics.

The number of participants has been increasing every year, reaching nineteen (which is the maximum we are able to accept) in 2008. Following the success of the first editions, we usually receive over twice as many applications as the number of places available. It should be also noted that almost every year new institutions join the list of universities interested in sending their students to the workshop. The participants are often willing to continue the collaboration with HIL in the form of a summer internship or at the MSc stage. So far three MSc theses prepared at HIL by former workshop participants have been defended: one in 2008 at the Adam Mickiewicz University in Poznań and two in 2009 at the University of Silesia in Katowice.



Three international editions of the Workshop on Acceleration and Applications of Heavy Ions were organised jointly by HIL, University of Huelva (Spain), St. Kliment Ohridski University in Sofia (Bulgaria) and Akdeniz University (Antalya, Turkey) as Erasmus Intensive Programmes (IP) in years 2011-2013. The received EU funding from the LLP Erasmus programme made it possible to extend the workshop to two full weeks. The first week was used for setting up the experimental apparatus and in-beam measurements. During the second week of the workshop, participants analysed the collected data, performed additional off-beam measurements (if needed) and prepared final presentations. The offer of lectures was also much broadened as compared to the one-week Polish edition thanks to complementarity of partner institutions' areas of competence and important contribution of numerous scientists from other research centres in Poland and abroad (the Henryk Niewodniczański Institute for Nuclear Physics, Kraków; National Centre for Nuclear Research, Świerk; Jagiellonian University, Kraków; Maria Curie-Skłodowska University, Lublin; University of Szczecin; CEA Saclay, France; Florida State University, Tallahassee, USA; Smith College, Northampton, USA)



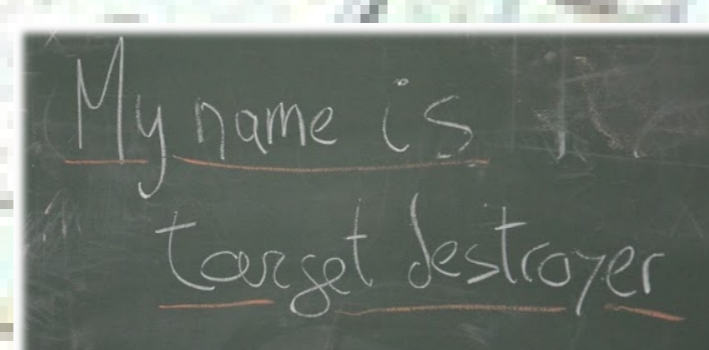
The funding from the LLP Erasmus Programme cannot be extended beyond three years and thus an effort has been made to preserve this initiative beyond the period of support. The first edition of the Summer School on Acceleration and Applications of Heavy Ions was organised in July 2012: 11 students from Armenia, Belgium, Croatia, Italy, Poland, Russia, Spain and the UK took part in lectures and experimental projects supervised by researchers from HIL, KU Leuven, CEA Saclay and University of Ioannina. The school was very well received by the participants and became a part of the regular teaching offer at HIL: it will be organised every year in the first half of July.

More information about student training programmes at HIL can be found at:

http://www.slcj.uw.edu.pl/student_workshops



Participants of the international student workshop in 2012



Student training programmes similar to those offered by HIL Warsaw are rarely organised by European accelerator centers. Existing training programmes and summer schools do not provide accelerator beam time and sophisticated equipment for teaching purposes only: common practice is to incorporate students in research groups and assign them routine and sometimes unskilled tasks. In this aspect, our project is unique and innovative: it offers a real hands-on experience with modern equipment and an opportunity to work in an international group on an open problem.

Until now more than 200 students benefited from this form of training at HIL.

