Operation of Negative Ion Sources at the cooler synchrotron COSY/ Jülich

O. Felden, R. Gebel, R. Maier

Forschungszentrum Jülich GmbH, IKP, 52425 Jülich, Germany
Jülich Center for Hadron Physics (JCHP)

e-mail: r.gebel@fz-juelich.de

The institute for nuclear physics at the Forschungszentrum Jülich is dedicated to fundamental research in the field of hadron, particle, and nuclear physics. The aim is to study the properties and behavior of hadrons in an energy range that resides between the nuclear and the high energy regime. Main activities are the development of the HESR (HESR) synchrotron, part of the GSI FAIR (FAIR) project, the 3.7 GeV/c Cooler Synchrotron COSY-Jülich (COSY) with the injector cyclotron JULIC, as well as the design, preparation, and operation of experimental facilities at this large scale facility, and theoretical investigations accompanying the scientific research program.

The HESR synchrotron, part of the GSI FAIR project, is dedicated to the field of high energy antiproton physics with high quality beams over the broad momentum range from 1.5 to 15 GeV/c to explore the research areas of hadron structure and quark-gluon dynamics. An important feature of the new facility is the combination of phase space cooled beams with internal targets which opens new capabilities for high precision experiments. The tools to reach the required quality are tested at COSY. The cooler synchrotron COSY offers excellent research opportunities for hadron physics experiments and for essential preparatory studies for the machine development of HESR. A 2 MeV electron cooler is under construction, Detector tests for PANDA and polarization buildup studies for PAX are performed.

The operation and development of the accelerator facility COSY is based upon the availability and performance of the isochronous cyclotron JULIC as the pre-accelerator and its ion sources. Since 1996 the cyclotron delivers negative light ions for charge exchange injection into the synchrotron. The injector shows availability for synchrotron operation in excess of 7000 hours a year, averaged over the last decade. Beam times for experiments at COSY have been delivered successfully for over 90 % of the scheduled periods.

Two filament driven volume sources deliver unpolarized H^- or D^- alternately. A charge exchange colliding beams source provides polarized H^- or D^-. For the ion sources uninterrupted operation in the order of 4 weeks is standard and short swap is realized by providing two operational ion sources. Beam losses for the 4.5 keV/u ion beam from source extraction to first acceleration of the ions have been investigated. As a consequence e.g. ion optical elements have been modified and the vacuum condition in the low energy beam line has been improved significantly. This enables a change from polarized to unpolarized ions from one synchrotron injection to another on a second time scale. This feature is essential for precision experiments with polarized particles, which need a real unpolarized reference, not available from a polarized source.

A brief overview of activities, performance, new or improved installations will be presented.