ISOLDE RADIOACTIVE ION BEAM FACILITY

The On-Line Isotope Mass Separator ISOLDE is a facility dedicated to the production of a large variety of radioactive ion beams for a great number of different experiments, e.g. in the field of nuclear and atomic physics, solid-state physics, life sciences and material science. The facility, located at the Proton-Synchrotron Booster (PSB) of CERN, is operated by the ISOLDE Collaboration. In May 1998 ISOLDE acquired the status of a Large Scale Facility within the TMR programme of the European Commission. The current contract within the 6th framework trans-national programme of the EU project EURONS offers an increased support for external users.

At ISOLDE, radioactive nuclides are produced in thick high-temperature targets via spallation, fission or fragmentation reactions. The targets are placed in the external proton beam of the PSB, which has an energy of 1.0 or 1.4 GeV and an intensity of about 2 microA. The target and ion-source together represent a small chemical factory for converting the nuclear reaction products into a radioactive ion beam. An electric field accelerates the ions, which are mass separated and steered to the experiments. Until now more than 600 isotopes of more than 60 elements (Z=2 to 88) have been produced with half-lives down to milliseconds and intensities up to 10^{11} ions per second.

Through the advent of post-accelerated beams with the REX-ISOLDE charge breeder and linear accelerator, probing nuclear properties using transfer reactions and Coulomb excitation of exotic nuclear species is now possible. REX-ISOLDE currently provides beams of energy 3.1 MeV/u into the super-efficient, highly segmented gamma-ray MINIBALL array at the secondary target position. REX is operational and has already accelerated several species of radioactive ions, e.g. 10,000 ions/s of ^{29}Na; it has the capability to accelerate mass 200 ions and heavier with efficiency of a few percent of the ion source yield. In 2003 REX-ISOLDE was integrated into the standard operation of CERN facilities.

Physics at ISOLDE is pursued in several directions. The large variety of available species allows the systematic study of atomic and nuclear properties and exotic decays far from the line of stability. The results obtained have implications for the basic understanding of the atomic nucleus, but also for related fields like astrophysics and weak-interaction physics. The possibility of pure radioactive implants opens access to the investigation of problems in solid-state physics, in particular concerning impurities and defects in semiconductors. Biomedical studies using radioactive isotopes for diagnosis and therapy have introduced life-science into the research programme.

A laboratory portrait has been published as a special volume of Hyperfine Interactions: HFI 129 (2000) (please note that access to the document may not work for everybody as it is restricted by the publisher to subscribers of the journal).