The REX-ISOLDE Project

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REX-ISOLDE [1,2] is an experiment at ISOLDE/CERN with two aims: (i) to demonstrate a novel efficient scheme for the acceleration of radioactive ions from the online mass separator ISOLDE to energies around the Coulomb barrier, and (ii) to perform first nuclear physics experiments by studying the structure of neutron-rich ($N = 20, N = 28$) nuclei by Coulomb excitation and neutron transfer reactions.

The general layout of the REX-ISOLDE experiment in the experimental hall of ISOLDE is shown in fig.1. The isotope production of ISOLDE takes place in the heavily shielded target area of ISOLDE using the 1 GeV proton beam. ISOLDE delivers mass separated radioactive beams of singly-charged ions with 60 keV energy. The 1^+ beams are injected into an EBIS for breeding of higher charge states. To match the continuous and rather low energetic radioactive 1^+ beam from ISOLDE to the acceptance of the EBIS a large Penning trap will for the first time be used as an accumulator. By buffer gas cooling the 1^+ beam is bunched and cooled before transfer. The Penning trap is presently being set up in the ISOLDE hall by the group of G. Bollen (Mainz,CERN) and first test experiments will start in Feb. 1997. The EBIS is built by the group of L. Liljeby at the MSI in Stokholm; its delivery to CERN is scheduled for the end of 1997. Typical times for charge state breeding are 10 ms, resulting in equivalent accumulation times of the Penning trap. The EBIS is followed by a high resolution mass-separator [3] to separate the few highly-charged radioactive ions from other more intense highly-charged ions which are also produced in the EBIS by ionisation of the residual gas. The radioactive ions are then accelerated in a linear accelerator (LINAC), consisting of a radio frequency quadrupole (RFQ)-structure, an interdigital H-type (IH) structure and three 7-gap resonators. The separator [3] and the front part of the LINAC consisting of the RFQ-structure [4], a buncher [5] and the IH-structure [6] are developed by our group in Munich while the 7-gap resonators are built by R. von Hahn (MPI,Heidelberg).

At the target the reactions with the weak radioactive beams have to be detected with very efficient detector arrays. The γ-rays from Coulomb excitation and transfer reactions are measured with a dedicated 4π Ge-detector array called MINIBALL [7]. Simultaneously, the scattered target and projectile nuclei are detected in position sensitive semiconductor counters to perform proper Doppler corrections of the γ-energies. These highly segmented double-sided strip detectors, consisting of 4 quadrants with 16 annular and 24 sector strips each, are developed by the group of A. Shotter (Edinburgh). With this detector arrangement the deexitation γ-rays spectra and the $B(E2)$-values of very neutron-rich Na, Mg, K and Ca nuclei will be investigated. For some of these nuclei one expects large deformations and neutron skins.

First experiments are planned for the end of 1998.

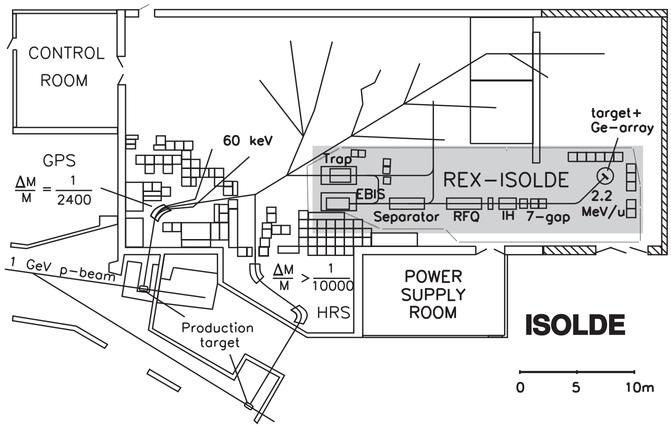

Fig. 1: Lay-out of the REX-ISOLDE experiment in the experimental hall of ISOLDE/CERN.

References

[1] D. Habs et al., "Radioactive beam Experiment at ISOLDE: Coulomb exitation and neutron transfer reactions of exotic nuclei", Proposal to the ISOLDE Committee, CERN-ISC94-25 (1994)

[2] D. Habs et al., The REX-ISOLDE Project, in EMIS13, Bad Dürkheim, 1996, to be published in NIMB

[3] O. Kester et al., this report p. 81

[4] O. Kester et al., this report p. 82

[5] K. Rudolph et al., this report p. 83

[6] B. Keil et al., this report p. 84

[7] P. G. Thirolf et al., this report p. 102