Status of the REX-ISOLDE project

D. Habs, O. Kester, T. Sieber, R. Rao, A. Kolbe, D. Rudolph, P. G. Thirolf, K. Rudolph, E. Nolte, S. Hegewisch, G. Bollen [a], F. Ames [a], P. Schmidt [a], H. L. Ravn [a], P. van Duppen [b], M. Huyse [b], R. v. Hahn [c], R. Repnow [c], D. Schwalm [c], H. Podlech [c], L. Liljeby [d], K. G. Rensfelt [d], U. Ratzinger [e], A. Schempp [f], G. Walter [g], A. Richter [h], and G. Shrieder [h]

[a] CERN, CH-1211 Geneva 23, Switzerland [b] Instituut voor Kern- en Stralingsfysica, B-3001 Leuven, Belgium
[c] Max-Planck-Institut für Kernphysik, D-69029 Heidelberg, Germany
[d] Manne Siegbahn Laboratory, S-10405 Stockholm, Sweden
[e] Gesellschaft für Schwerionenforschung, D-64220 Darmstadt, Germany
[f] J.W.Goethe-Universität Frankfurt, D-60325 Frankfurt am Main, Germany
[g] Universite Louis Pasteur, F-67037 Strasbourg, France
[h] Technische Universität Darmstadt, D-64289 Darmstadt, Germany

Several different projects of first generation radioactive ion beam (RIB) facilities are under construction throughout the world. In contrast to projects like SPIRAL at Ganil [1], where a complete RIB-facility is build up, REX-ISOLDE [2–4] is an experiment, which benefits from the already existing RIB-facility ISOLDE at CERN. There, a vast experience exists to produce radioactive ions with high energetic (1.2 GeV) proton beams. Besides the goal to perform first nuclear physics experiments for studying the structure of neutron-rich (N=20,N=28) nuclei by Coulomb excitation and neutron transfer reactions, the experiment will show the efficiency of a novel scheme for the post acceleration of radioactive ions from an online mass separator to energies at the Coulomb barrier.

The present lay-out of REX-ISOLDE is shown in fig.1. The 60 keV radioactive ions from the ISOLDE mass-separator are first injected into a Penning trap, where they are accumulated bunched and cooled. The REX-trap has been assembled and mounted on the high voltage platform in the middle of the year. In December the first injection and capture test of radioactive ions in the REX-trap have been carried out. Measurements of the cooling properties will follow soon. In a next step the ions will be extracted from the trap and injected into an electron beam ion source (EBIS), where the ions are bombarded by a 0.5 A, 6 keV electron beam with a current density of about 250 A/cm^2. In the EBIS the ions will be charge breeded to a charge to mass ratio between 0.22 and 0.34. The solenoid of the EBIS has been delivered to Stockholm in the middle of the year and first measurements of the magnetic field were done. Now the vacuum system is built and first electron beam tests will follow. The beam line between the EBIS and the LINAC consists of a mass separator [5] to separate the few highly-charged radioactive ions from the residual gas. Due to the potential depression of the electron beam of the EBIS, the extracted highly charged ions will have an energy spread, which can be handled by an achromatic system similar to a Nier spectrometer.

The front part of the LINAC consisting of an Radio Frequency Quadrupole (RFQ) accelerator [6], a matching section with a two gap quarter wave spiral buncher [7] and an interdigital-H-type (IH) structure [8], accelerates the radioactive ions from 5 keV/u to 1.1-1.2 MeV/u and is build by our group in Munich in collaboration with A. Schempp, university of Frankfurt. The three seven gap spiral resonators from the back part of the LINAC allow a variation of the final beam energy between 0.8 and 2.2 MeV/u [9] and are built by the MPI für Kernphysik in Heidelberg. Machining and copper plating of the REX-RFQ vacuum tank is finished, the quadrupole rods have been delivered and the stems are completed. The resonant structure is assembled for the first flatness measurements. The design of the buncher, which matches the longitudinal phase space of the beam out of the RFQ into the IH-structure is completed and the vacuum tank will be built in the beginning of 1998. The drawings of the vacuum tank of the IH-structure have been delivered to the company NTG Neue Technologien in October. The vacuum tank will be delivered in May 1998. Both power transmitters of RFQ and IH-structure have been ordered from BERTRONICS and will be delivered in April 1998 and December 1998 respectively. All structures will be assembled and tested (low level and power tests) at the tandem laboratory. Concerning the 7-gap resonators, the first tank and the first resonant structure have been completed [10]. The whole LINAC will be assembled at ISOLDE in the shut down period 1998/99. First beam is foreseen in spring 1999.

The γ-rays from Coulomb excitation and transfer reactions will be detected with the 4π Ge-detector array called MINIBALL [11]. A first prototype of the MINIBALL cluster detector has been delivered and tested [12] in Munich. Measurements with collimated sources have shown that measured and predicted energy resolution and position resolution are in good agreement. An investigation of the Doppler-broardening of incident γ-rays via the ^{32}S+^{24}Mg fusion reaction at 130 MeV has been carried out at the tandem laboratory.

References

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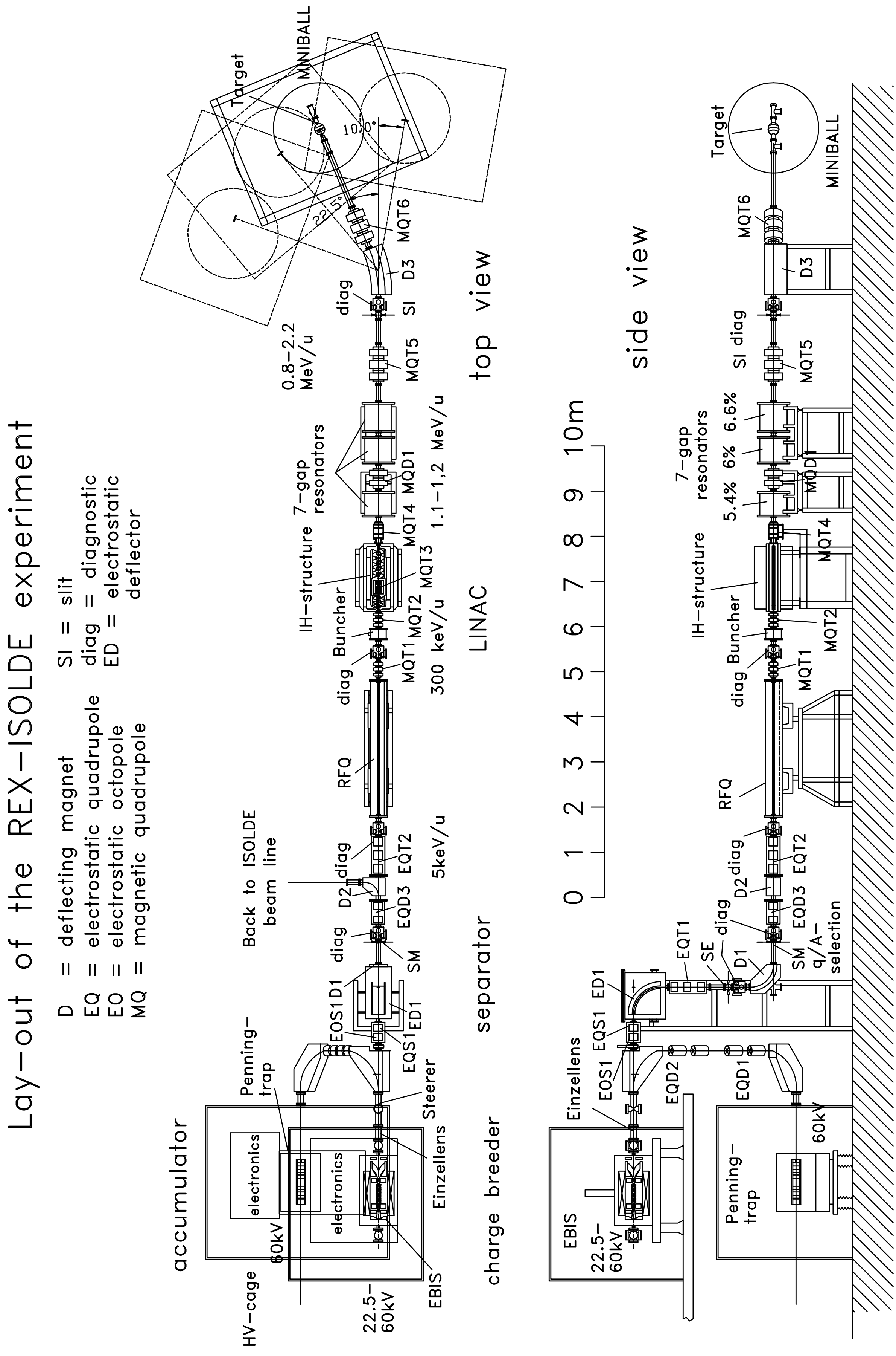

Fig. 1: Layout of the REX-ISOLDE experiment