THE LEBIT PROJECT

M. Baird, G. Bollen, D. Lawton, P. Lofy, D. Morrissey, J. Ottarson, R. Ringle, P. Schury, S. Schwarz, T. Sun;
V. Varentsov (St Petersburg)

The employment of high-precision nuclear and atomic physics techniques at low-energy beam ISOL-type facilities has turned out to be a very successful and complementary approach in the investigation of the structure of nuclei far from stability. Extending the applicability of these experimental techniques to exotic beams produced in fragmentation reactions will allow to explore isotopes of elements not accessible at these facilities and to study more exotic and short-lived nuclides. In order to bridge the gap between the beam properties as provided by fragment separators (i.e. highly energetic, large emittance) and the requirements of trap-type and other low-energy beam experiments the beam has to be manipulated accordingly. This is a task of the low-energy-beam and ion-trap (LEBIT) project. The set-up of LEBIT is sketched in fig. 1. The goal of this project is to stop the fragmentation products from the A1900 in a gas cell and use radio-frequency ion-guide techniques to form a low-energy (bunched) ion beam with excellent beam properties.

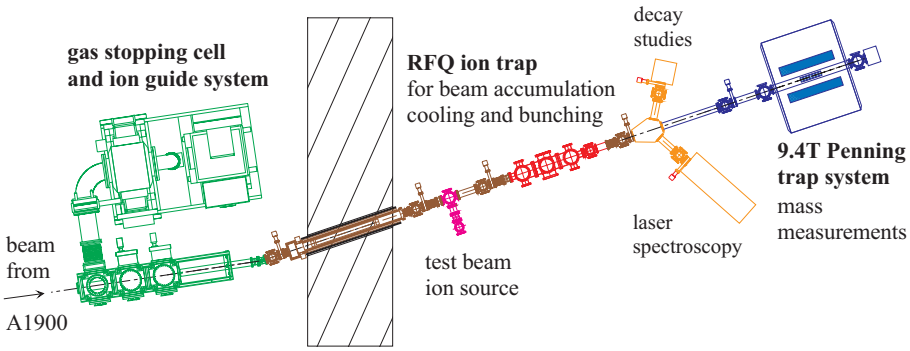

Figure 1: Conceptual layout of the LEBIT-project

A key part of the project is the gas stopping station. A solid degrader and a gas cell containing helium gas at a pressure of ≈ 1 bar are used to slow down, stop, and thermalize the high-energy beam. The ions will be extracted from the cell through a supersonic nozzle by a combination of electric potentials and gas flow. Differential pumping and RFQ-ion guiding will be used to transport the ions into high vacuum and to form a continuous low-energy ion beam, which is transported into the experimental area by an electrostatic beam transport system.

A test beam ion source will be installed at a 4-way beam switch for optimization and calibration of the downstream equipment.

The ion accumulator and buncher in the LEBIT project is a linear RFQ trap system designed to accept the continuous beam from the gas cell and convert it into cooled low-energy pulsed beams with the help of helium buffer gas cooling. Compared to systems used elsewhere, the LEBIT buncher uses novel wedge-type cylindrical DC electrodes and can be operated at LN_2-temperature. This will lead to a higher efficiency and a better beam quality.

A 3-way switch-yard is foreseen for the delivery of the beam to experimental stations after the buncher.

The first major experminental installation at LEBIT will be a 9.4 T Penning trap system for high-precision mass measurements of very short-lived isotopes.