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1. Project

Production of radioactive ion beams and light exotic nuclei study at ACCULINNA-2 separator. Project is addressed to 1-2 students.

The goal of the exercise is to obtain basic knowledge on detection techniques used in the ACCULINNA and ACCULINNA-2 separators and radioactive beam production techniques in devices using the in-fligh separation. During the internship, students learn the principle of operation of in-flight separator, and perform a number of simulations using LISE++ software. The main task is to analyze data from experiments carried out at ACCULINNA-2 in 2018 and 2019. In addition, student will be able to familiarize themselves with the technique of detecting charged particles using an optical drift chamber with time projection, OTPC and experiments carried out at ACCULINNA.

2. Project description.

- Principles of separators using the in-flight separation method. ACCULINNA and ACCULINNA-2 construction. Methods of producing radioactive nuclei.
- Detection techniques and typical detectors used in ACCULINNA project – silicon detectors, scintillators (CsI(Tl) and stilbene crystals). Identification of reactions products at two dimensional energy and time of flight spectra (dE-TOF) and energy and full energy losses spectra (dE-E). Comparison with simulations obtained using the LISE++.
- Technique of detection of charged particles with the OTPC spectrometer.
- Calibration of silicone detectors with a radiation source (^{226}Ra).
- Analysis of experimental data from the first measurements carried out on the ACCULINNA-2 separator.

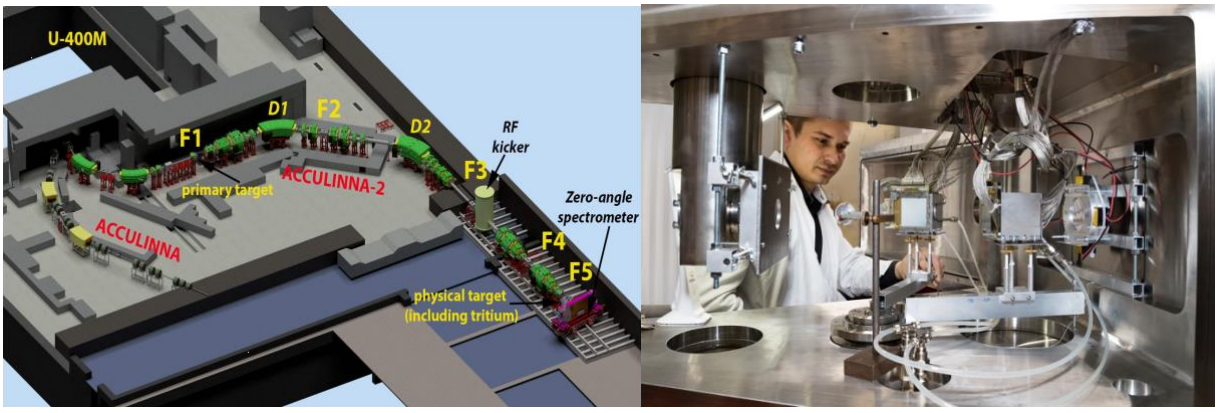

Fig. 1. Scheme of ACCULINNA and ACCULINNA-2 separators in the U400M cyclotron hall (left), charged particles detectors inside the reaction chamber (right).

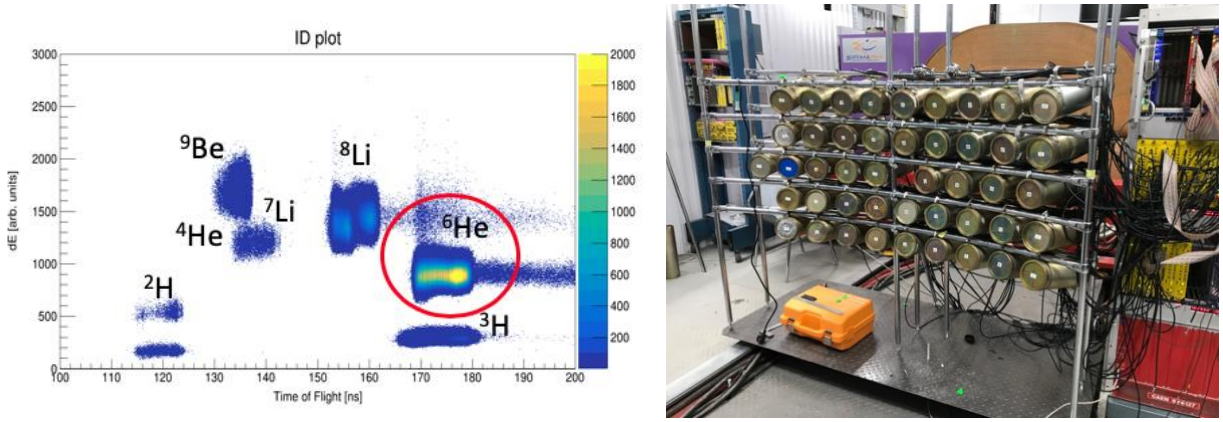

Fig. 2. An example of a 2D spectrum showing the dependence of energy loss and time of flight, dE-TOF (left), neutron detectors array based on the stilbene scintillators (right).

3. Requirements

- Interest to methods of experimental nuclear physics
- Interest to methods of detection of charged particles

Basic knowledge of nuclear physics and the basics of programming in C++ /knowledge of the ROOT environment (root.cern.ch) is nice seen.