Title : Studies of preparation, characterisation and transport of low energy stable and radioactive ions for the ALTO low-energy beamlines

Abstract :

Over the last few decades, the study of neutron-rich exotic nuclei has been a major subject of investigation in nuclear physics, and the observations have had an impact on both nuclear structure studies and nuclear astrophysics. More recently, the Irène Joliot-Curie Laboratory (IJCLab) has recently supported the development of two experiments on the low-energy beamlines of the ALTO research platform (ALTO-LEB) : the MLLTRAP Penning Trap Mass Spectrometer (built at the Maier-Leibnitz laboratory in Germany) and LINO (Laser Induced Nuclear Orientation) for laser spectroscopy.

The intensities of low-energy radioactive ion beams delivered to experimental devices depend on the physical processes taking place in the target-ions source and the transport of ions along transfer lines to the physics experiments. To guarantee high intensities, a good selectivity and an optimized transport of the radioactive beams are required. It is crucial to manage the transmission efficiency from the production up to the last detector involved in the measurement of the observable of interest. To achieve this objective, all the instruments used to prepare beams for the experimental devices need to be made reliable, by taking into account the characteristics of the beams produced at the source. That implies measuring the emittance of the low-energy beam using precise diagnostics.

As part of the process of improving the reliability of the ALTO facility's beam lines and commissioning new lines, particularly the one serving MLLTRAP, studies were carried out on the characterisation of the source output and low-energy beam lines to optimise ion transport. To this end, electrostatic simulations of the target-ions source extraction and the ALTO-LEB transport lines were carried out and compared with the experimental results obtained during the emittance measurement campaigns and other beam diagnostics. The knowledge acquired during the beam studies at Orsay will be fundamental for the commissioning of the DESIR installation at GANIL-SPIRAL2, which is currently under construction.