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Development and testing of a FEBIAD ion-source for the LERIB project

Radioactive Ion Beams (RIBs) play an important role in advancing nuclear physics by offering unique insights into nuclear reactions. The interdisciplinary nature of RIBs research, along with its potential impact on fundamental and medical physics, positions RIBs facilities as essential drivers for enhancing our understanding of nuclear phenomena. Two methods are commonly used for radioactive isotope production: in-flight and ISOL (Isotope Separation On-Line) techniques [1]. After production of a nuclide, it has to be separated from unwanted by-products and transported away from the harsh production environment.

The ISOL techniques, uses an ion source to further separate the unwanted by-products, and produce a radioactive ion beam. The ion-sources dedicated to the production of Radioactive Ion Beams (RIB) have to be highly efficient, selective (to reduce the isobar contamination) and fast (to limit the decay losses of short-lived isotopes). An offline test-facility needed to the development of a Forced Electron Beam Induced Arc Discharge (FEBIAD) ion-source. The FEBIAD ion-source is a type of plasma ion-source that has the advantage of being able to ionize most elements on the periodic table through electron impact ionization, based on the Forced Electron Beam Induced Arc Discharge design [2].

The future aim of the LERIB project at iThemba LABS is of the production of radionuclide isotopes such as Terbium and Actinium, which are used in medical therapy or/and diagnosis. Through the combination of element-sensitive ion source and mass separation (magnetic dipole) would in principle allow the extraction of a pure beam, only containing the isotope of interest.

[1] O. Kofoed-Hansen, K. Nielsen, Short-lived krypton isotopes and their daughter substances, Physical Review Journals 82 (96) (1951) 499. doi:10.1103/PhysRev.82.96.2.

[2] R. Kirchner, E. Roeckl, Investigation of small-volume gaseous discharge ion sources for isotope separation on-line, Nuclear Instruments and Methods 131 (2) (1975) 371–374. doi:10.1016/0029-554X(75)90342-0.

Notes

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