Development of spin-polarized radioactive ion beams at RIBRAS

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The RIBRAS (Radioactive Ion Beams in Brasil) facility [1–4] is a beamline of the Pelletron accelerator at the Laboratório Aberto de Física Nuclear e Aplicações (LAFNA) of the Universidade de São Paulo, responsible for conducting experiments involving radioactive secondary beams. This system generates radioactive nuclei through reactions induced by the collision of the primary Pelletron beam with a production target, and subsequently selects the specific radioactive species of interest via the in-flight method, employing two superconducting solenoids as focusing lenses. For over 20 years, experiments at RIBRAS have primarily focused on collisions involving radioactive nuclei to investigate reaction dynamics and nuclear structure. To expand the facility's scientific reach, a new ongoing project aims to produce and utilize polarized secondary beams. This upgrade will enable advanced investigations into the dynamics of reactions induced by polarized radioactive nuclei, as well as open new avenues for applied material science via beta-detected Nuclear Magnetic Resonance (β-NMR) [5].

The project currently follows two development lines. The first focuses on the design and implementation of a β-decay asymmetry polarimeter, which leverages the anisotropic angular distribution of beta emissions, exhibiting a preferential orientation along the polarization axis, to determine the asymmetry parameter. This device is essential both for diagnosing the secondary beam's initial polarization and for future β-NMR applications. The second development line addresses the implementation of an effective beam polarization method. Two techniques are being evaluated due to their compatibility with the RIBRAS system: the Tilted Foil Technique [6] and polarization via transfer reactions [7]. This presentation will outline the core concepts, detail the technical developments achieved to date, and highlight our most recent preliminary results.

References

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