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The IGISOL Facility at ELI-NP

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A project for the implementation of an IGISOL beamline for the production and study of exotic neutron-rich nuclei at the Extreme Light Infrastructure – Nuclear Physics (ELI-NP) facility has been initiated. The latest developments in the simulation and design of its first component, a cryogenic gas cell, are presented. We report on the construction of a demonstrator unit for this device and on simulations of the diverse physical processes with various software packages.

KEYWORDS: ELI-NP, photo-fission, IGISOL, gas cell, radioactive ion beam

1. Introduction

The upcoming advancement of the ELI-NP project [1][2] into its operational phase will offer to the nuclear physics community access to two new photon installations: a high-intensity laser system [3] and a high-brilliance gamma beam system [4]. Among the many nuclear physics programs proposed at the gamma beam system, an IGISOL beamline will generate a Radioactive Isotope Beam (RIB) via photo-fission in a stack of actinide targets placed at the center of a gas cell filled with He [5]. The High Areal Density with Orthogonal extraction Cryogenic Stopping Cell (HADO-CSC) proposed in Ref. [6], featuring ion extraction orthogonal to the primary beamline, is considered. It is designed in collaboration with GSI Darmstadt and Gießen University. The photo-fission fragments extracted from this CSC will be formed into a RIB by a Radio-Frequency Quadrupole (RFQ) device. The exotic neutron-rich nuclei will be separated, and their mass measured, by a high-resolution Multiple-Reflection Time-of-Flight (MR ToF) mass spectrometer. The isomerically pure RIBs will be measured by a β-decay tape station and a collinear laser spectroscopy station.

Section 2 of this paper reports on the development of a small scale CSC demonstrator unit. Section 3 presents the latest simulation studies. These are a continuation of the work