Contribution ID: **36** Type: **Poster**

High intensity ISOL ion source for long-term irradiation

Friday 27 November 2020 11:45 (5 minutes)

The **MYRRHA** project (Multi-purpose hYbrid Research Reactor for High-tech Applications) is the first prototype of a subcritical lead-bismuth cooled reactors driven by a particle accelerator (˜ 100-600 MeV proton). In parallel to the reactor, **ISOL@MYRRHA** will extract part of the proton beam coming from the accelerator and use it to produce Radioactive Ion Beams (RIBs) with the Isotope Separation On-Line (ISOL) technique for experiments which require long beam times without interruption, high-precision measurements or to perform experiments which hunt very rare phenomena. Those experiments have different needs from already existing ISOL: an **isotope production increase** by using **higher intensity** primary beams on a **longer period of time without losing** the radioisotope **beam quality**.

One part of this ISOL system, which will be affected by this higher input, will be the ion source, and we will need to **create an ion source adapted to this new input before the start of the new accelerator at SCK-CEN**. We choose to work on Surface Ion Source [SIS] because they are reliable and usually of a simple design. Only a few attempts to modify these sources have been made on materials and cavity sizes, by Kirchner 2 for example. But there are other parameters to explore. There is also a lack of research on the physical processes inside the ionisation cavity and their impact on the performance of the source. To identify the relevant parameters which will affect our ion source at higher intensity, we need to understand through theoretical studies and numerical simulation analysis how those parameters affect the output parameters, like the total efficiency. First using Thermal-Electric simulations with ANSYS 1 then with Plasma simulations with Starfish 4. To start our simulation, we need first to validate our model and simulation conditions with already existing experimental results. That is why we tried, as a starting point, to reproduce the results coming of a heating system of an ion source & its transfer-line from a study 3 from the Selective Production of Exotic Species (SPES) project. Then with this simulation model, which was validated by experimental results, we can start modifying this ion source and see what the thermal-electric response: Insulate electrically (& Thermally) or Add a second feed through for a better control on the electrical flow and so of the heating of the ionizer tube. Those new ion source heating systems need to be tested, improved and validated through numerical simulations and in the future with experimental results for the creation of the best ion source for the day-1 operation at **ISOL@MYRRHA**. A heating test stand has thus been designed and commissioned at **SCK-CEN** to test the prototype ion sources.

Reference:

1 ANSYS. www.ansys.com
2 R. Kirchner. "On the thermoionization in hot cavities". In: Nuclear Instruments and Methods in Physics Research Section A 292 (July 1990). pp. 203–208. doi.org/10.1016/0168-9002(90)90377-I
3 M. Manzolaro et al. "The SPES surface ionization source". In: Review of Scientific Instruments 88, 093302 (Sept. 2017). doi.org/10.1063/1.4998246
4 Starfish. www.particleincell.com/starfish

Author: HURIER, Sophie (KU Leuven, SCK-CEN)

Co-authors: COCOLIOS, Thomas Elias (KU Leuven - IKS); RIJPSTRA, Kim (SCK-CEN)

Presenter: HURIER, Sophie (KU Leuven, SCK-CEN)

Session Classification: Posters Presentations