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High-power powder-flow target for radioactive ion beams production

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Worldwide several efforts are underway to increase the intensities of radioactive ion beams at an ISOL facility by several orders of magnitude. One of the approaches is based on increasing the power of the primary beam on target. For this, issues have to be solved on target design and target material, which should be capable of withstanding reliably high beam-power deposition over long periods of time. This becomes especially important at a facility such as ISOL@MYRRHA, since the scientific program of this envisaged facility is based exclusively on experiments requiring long periods of operation without interruption.

This presentation will discuss the concept developed at SCK•CEN for a high-power ISOL target for the production of radioactive ion beams at next-generation proton-based ISOL facilities. The concept is based on the flow of refractory-powder material under the continuous irradiation with a proton beam. Results of our feasibility study will be presented covering multiple aspects: particle-flow calculations, mass-flow rates, powder-density distribution, beam-power deposition, temperature profile, in-target production rates calculations, release-efficiency analysis, expected yields and overall expected performance of the system.

The main advantages of this concept, as concluded from the feasibility study, are: the possibility to increase the primary-beam power on target to unprecedented levels, faster release of the produced isotopes, the large variety of the produced RIBs since any refractory compounds can be used, and the expected long operation periods, increasing the overall RIB production at the facility and reducing the radioactive waste inventory.

EURISOL, with its high primary-beam intensities going to powers in the Megawatt range, is another interesting project to apply this target concept.

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