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DESIR Needs Fission: A quantitative reassessment under today's GANIL constraints

The commissioning of the DESIR hall, equipped at its entrance with world-class beam purification and radioactive-ion preparation devices, opens outstanding opportunities for low-energy, trap-based, laser-based, and β-delayed studies. However, the full scientific potential of DESIR, commensurate with the efforts invested in its realization, will remain constrained over the coming decade by an overly narrow portfolio of beams and by the limited diversity of driver sources able to feed the hall in the short to medium term.

DESIR was originally conceived in the framework of a SPIRAL2 program that included an ISOL fission-fragment capability, a component that was de-scoped long ago. The scientific consequence is well identified: without intense beams of neutron-rich intermediate-mass nuclei, which fission uniquely provides with competitive yields, the DESIR physics case risks remaining artificially restricted. It is therefore timely to formulate concrete, technically realistic options that can be implemented within the present GANIL/SPIRAL2 accelerator and operational constraints.

Paradoxically, the time elapsed since the original SPIRAL2 fission concept has also been an opportunity. Over the past two decades, substantial experimental benchmarks and modeling efforts have clarified achievable fission rates, spatial production profiles, and release characteristics associated with different actinide excitation regimes, benefiting from the long operational feedback of major ISOL facilities such as ISOLDE and TRIUMF, as well as from more recent, smaller-scale implementations such as ALTO. In this context, the start of DESIR provides a natural occasion for a comprehensive reassessment of fission-based production schemes optimized for ISOL performance rather than for raw fission yield alone.

Within the scope of this LoI, and with the aim of strengthening the DESIR scientific program, we examine three distinct approaches to inducing fission in uranium-carbide targets from a unified perspective. The comparison is framed using the figure of merit that matters for very neutron-rich ISOL beams: fission selectivity against parasitic reaction channels, spatial localization of fragment creation, excitation-energy regime, power density, and the resulting impact on release efficiency and effective delivered beam intensity. The objective is not to advocate a single, one-size-fits-all solution, but to establish, on the basis of experimental reference points and quantitative estimates, the respective strengths and limitations of each approach in the specific context of existing GANIL/SPIRAL2 capabilities. This comparative analysis is intended to support an original and competitive physics program at DESIR, enabled by the availability of fission-fragment beams produced in a moderate (few kW) power, operationally realistic ISOL mode.

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