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Prospects for the production of 100Sn ISOL beams at HIE-ISOLDE

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The region around doubly magic isotopes, such as 100Sn and 132Sn, has attracted a large interest in nuclear structure and physics studies, and for which intense and high quality beams are still required, as documented in the Long Range Plan published by NuPECC [1]. While 132Sn beams and beyond have been available at ISOL facilities for many years at low energy and as post-accelerated beams, 100Sn has shown to be much more challenging with only a few 101Sn/min being produced at GSI-ISOL [2]. Inflight beam fragmentation facilities at GANIL, GSI and RIKEN provide relativistic 100Sn beams at a rate comprised between less than one and a few ions per hour. In the future, up to a few ions/s is foreseen at FRIB [3]. ISOLDE has been limited so far to 104Sn, produced from LaCx targets and RILIS ionization, measured at a rate of 2000 ions/s in 2017.
The production of 100Sn beams by the ISOL technique has not been possible due to the lack of a suitable primary beam driver and target-ion source unit for any of the present-day facilities.
We review here the techniques suitable for the production of 100Sn beams at HIE-ISOLDE and propose an option based on a high power molten lanthanum target combined with molecular tin formation and a FEBIAD ion source. The envisaged options take into consideration upgrade scenarios of the primary beam at HIE-ISOLDE, going from a 1.4 GeV - 2 μA to a 2 GeV - 6 μA pulsed proton beam [4]. Details on achievable 100Sn beam intensities and purities will be provided, based on in-target production rates simulated with ABRABLA and FLUKA, tin release characteristics and molecular tin compound formation available from past experimental investigations. Progresses in the development of a high power molten metal target for the production of ISOL beams will finally be described and complete the set of data required to trigger the development of an ISOL beam of 100Sn [5].

References :

[1] NuPECC Long Range Plan 2017 Perspectives in nuclear physics, http://www.esf.org/fileadmin/user_upload/esf/Nupecc-LRP2017.pdf, accessed March 2018.
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Primary authors: STORA, Thierry (CERN); BOIX PAMIES, Ferran (Centro de Investigaciones Energéti cas Medioambientales y Tecno); CATHERALL, Richard (CERN); NEYENS, Gerda (KU Leuven (BE)); RAMOS, Joao Pedro (CERN); MALBRUNOT, Stephan (CERN); ROTHE, Sebastian (CERN)

Presenter: STORA, Thierry (CERN)

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