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Characterization of supersonic gas jets in ion catchers

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The High Areal Orthogonal Extraction Cryogenic Stopping Cell (HADO-CSC) represents a state of the art ion catcher design, used for the formation of radioactive ion beams (RIBs). It has a two-chamber design, leading to a faster estimated extraction when compared to existing ion catchers[1]. It uses Helium at cryogenic temperatures to freeze out the impurities and strong DC fields are used to further decrease the travel time through the stopping gas. Close to the top wall, an ion transport device (RF Carpet) will catch the incoming ions and drift them towards the center. There, a sub-mm nozzle will form, due to the difference in pressure of two orders of magnitude, a supersonic jet. These jets are used as a guiding mechanism to drag the ions from one chamber to the next.
The HADO-CSC collaboration extends to several institutes and Universities around the world: GSI and Giessen University (Germany), where it was firstly proposed, as an upgrade to the existing longitudinal extraction cryogenic stopping cell[2], ELI-NP (Romania), Soreq (Israel), JYFL (Finland).
As a very challenging and complex scientific setup, which does not exist anywhere in the world, multiple aspects can be treated separately and in detail, e.g. supersonic jet optimizations, testing different RF Carpet designs etc. As such, at ELI-NP different test-units have been considered that describe and test different aspects of the HADO-CSC. Two such examples are represented by the RF Carpet Test Unit and the Supersonic Test Unit (STU). The latter, represents the main focus of the poster which covers different aspects revolving around the formation and properties of the used supersonic jets.
The STU is a setup designed and constructed in-house, to characterize supersonic gas jets with different invasive and non-invasive techniques. These methods combine the Schlieren imaging technique, gas jet fluorescence, Pitot tube measurements. The results are then applicable to the HADO-CSC in terms of optimizing the ion transport and designing the gas system.
References
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