How to characterize exotic ion beams?

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In a paper that has just been published researchers from CERN, the Cockcroft Institute and the University of Liverpool present how to optimize the design of this important monitor on the example of monitor that was successfully developed for an exotic ion beam project at CERN.

A crucial parameter needed for the operation of an accelerator of charged particles is the beam intensity, i.e. the number of charges crossing a certain area per unit time. For low energy, low intensity ion beams the most common detection instrument is a Faraday cup. This is a device that can be placed in front of the beam to collect its charges, i.e. it essentially stops the beam. The beam intensity is then determined by means of a sensitive current detector attached to it. The design of the internal parts of a FC typically obeys certain aspect ratios in their geometries in order to ensure the accurate collection of beam charges.

To fulfil the beam diagnostics requirements for the HIE-ISOLDE project at CERN a specially tailored FC was needed as the longitudinal space available for instrumentation was severely limited and typical geometries could not be used. The task was tackled using a threefold approach combining theoretical and experimental developments with computer (electrostatic fields and particle tracking) simulations. After several tests with two prototypes, a final design successfully achieved all the specifications and was therefore accepted for the series production of monitors for HIE-ISOLDE. They will be used for determining absolute total beam intensities; combined with other devices transverse beam profiles will also be acquired.

Lessons learned during the design campaign including details of theoretical analysis, computer simulations, and validation results in experiments with beams performed with both REX-ISOLDE (CERN) and ISAC-II (TRIMUF) accelerators are discussed in a journal article just published in Nuclear Instruments and Methods A. It presents several rules of thumb, and highlights the do's and don'ts, as well as some general considerations on how to build (from scratch) compact beam current monitors. We recommend the article not only to instrumentation specialists but also for colleagues from the wider particle accelerator community.

More information: E.D. Cantero et al. Design of a compact Faraday cup for low energy, low intensity ion beams, *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* (2015). DOI: 10.1016/j.nima.2015.09.096

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