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Ion optics test stand: generating ML training data sets for ion optics optimization

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Transfer maps of different ion optical elements are usually obtained via ray tracing methods without taking into account the imperfections and misalignments of the optics. Normally beam profile monitors do not measure the full 6D phase-space, but only a portion of it. To verify the beam phase-space, we have constructed an Ion Optics Test Stand (IOTS) that is located at the Low Energy Branch (LEB) of the Jozef Stefan Institute in Ljubljana, Slovenia [1]. The IOTS consists of two Allison emittance scanners (AES) [2] with an electrode sandwiched between them, and is supplied by the LEB with a variety of ion beams with energies up to 20 keV. This allows us to automatically measure the 6D beam phase-space before and after the electrode and determine the electrodes transfer map. We will discuss the status of the IOTS, the emittance scanners, electrode transfer map measurements with them, and describe an example of AES–Einzel lens–AES test configuration. We will also show how the phase-space measurements performed with the IOTS can be used as a training ground of Machine Learning (ML) tools designed for ion optics optimization with respect to a preferred transport metric.

Footnotes

[1] Z. Brencic et. al, Development of Low Energy Branch at Micro Analytical Centre, Ljubljana, IPAC 23

[2] P. Allison et. al, An Emittance scanner for intense Low-Energy Ion beams, IEEE Trans. On Nuc. Sci. 30, 2204 (1983)

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