Contribution ID: **71** Type: **Poster (including Speed Talk)**

Diagnostics, monitoring and analysis of high-energy proton beams

Thursday 26 June 2025 11:03 (3 minutes)

The HZB Cyclotron provides proton beams for ocular therapy and various experiments. A continuous effort to enhance the diagnostic capabilities of the facility aims to improve the accuracy and available beam time for its irradiation campaigns. Four systems are presented here, developed to measure the transverse and longitudinal beam properties in vacuum and in air. A cost-efficient optical beam profile monitor from ZnS has been implemented to visualize low intensities of high-energy beams in vacuum (patent pending). For the visualization of the transverse profile of intensities down to 0.1 pA in air, a lightweight camera system has been developed and tested. Regarding the longitudinal beam properties, an optical system has been invented to depict the Bragg peak of ions in air together with the integrated transverse profile of the beam (patent pending). Moreover, the multi-leaf faraday-cup technology developed at HZB for verifying the proton range has been transferred to a commercial company, which has integrated it into a certified medical product.

Summary

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Session Classification: Beam Diagnostics

Track Classification: Beam diagnostics