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Magnetic field control in the MedAustron synchrotron

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MedAustron, a synchrotron-based ion therapy centre in Austria, is focused on enhancing cancer treatment performance. A key improvement opportunity lies in the regulation of the main ring bending dipoles, which currently require time-consuming procedures to ensure reproducibility and reliability of the associated magnetic fields (B-Fields). Other therapy centres globally address this through a traditional B-train or similar systems to regulate on the B-Field and mitigate parasitic effects. In contrast to that, we propose a novel approach utilising a single Hall probe measurement inside a reference magnet, fused with a magnet model to provide real-time, high accuracy estimates of the integral B-Field for regulation. This technique, combined with a tailored controller, is evaluated under typical therapy cycling conditions. The system's performance is demonstrated through metrological analysis and beam property comparisons. Most importantly, the results show the possibility of significant improvements in treatment time reduction. Ultimately, the already achievable beam position accuracy, and spill structure in the treatment rooms, enable the start of commissioning in 2025.

Footnotes

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Author: MARGREITER, Thomas (EBG MedAustron GmbH)

Co-authors: PLASSARD, Fabien (EBG MedAustron GmbH); PROKOPOVICH, Dale (EBG MedAustron GmbH); WOLF, Markus (EBG MedAustron GmbH); ADLER, Laurids (EBG MedAustron GmbH); PELLETIER, Sebastien (EBG MedAustron GmbH); GFALL, Immanuel (EBG MedAustron GmbH); BENEDIKT, Michael (European Organization for Nuclear Research)

Presenter: MARGREITER, Thomas (EBG MedAustron GmbH)

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