Contribution ID: **1189** Contribution code: **TUPS035** Type: **Poster Presentation**

TURBO –Enabling fast energy switching for hadron therapy with constant magnetic fields

Tuesday 3 June 2025 16:00 (2 hours)

The energy layer switching time is a limiting factor for hadron therapy, precluding fast beam delivery and reducing treatment efficacy. For rapid energy switching the beam delivery system must be achromatic with zero dispersion over a large energy range. At the University of Melbourne, the TURBO project will utilise Fixed Field Accelerator techniques to demonstrate transport of a ±42% momentum spread beam around a 30° bend, with constant magnetic fields to eliminate the energy switching bottleneck. This will be demonstrated with an electrostatic Pelletron accelerator. A fast-switching energy degrader with thin diamond films has been designed to quickly change proton beam energies in the range 0.5-3.0MeV, covering the full clinical range when scaled up. A new design technique using nonlinear magnetic fields for energy-dependent focusing has been developed to minimise delivered beam variations. A novel method has been found to produce nonlinear permanent magnet arrays without custom magnets, enabling fast prototyping and reuse of magnets. With these innovations, the TURBO project will demonstrate rapid energy switching for hadron therapy to enable improvements in patient outcomes.

Footnotes

Paper preparation format

LaTeX

Region represented

Asia

Funding Agency

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Session Classification: Tuesday Poster Session

Track Classification: MC8: Applications of Accelerators, and Engagement for Industry and Society: MC8.U01 Health & Biology