Progress Towards a Fixed Field Beamline in Melbourne

A.F. Steinberg [a, b, c], H.X.Q. Norman [a, b, c], J.S.L. Yap [b], R.B. Appleby [b, c] and S.L. Sheehy [a, d]

[a] *School of Physics, University of Melbourne, Melbourne, Victoria 3010, Australia.*

[b] *Department of Physics and Astronomy, University of Manchester, Manchester, M13 9PL, United Kingdom.*

[c] *Cockcroft Institute, Daresbury, WA4 4AD, United Kingdom*

[d] *Australian Nuclear Science and Technology Organisation (ANSTO), Lucas Heights, NSW 2234, Australia*

A design study is currently underway at the University of Melbourne to build a fixed field beamline that will demonstrate technologies enabling rapid depth scanning for hadron therapy [1, 2]. We hope to achieve simultaneous beam transport for a wide energy range through a nontrivial bending angle, which will be vital for incorporating fixed field optics in accelerators and transfer lines: this arc must have trajectories for all energies entering the beamline at a single point, before dispersing out to a maximum excursion halfway through the bend, and returning to zero dispersion at the end. In addition, an energy degrader must be created to allow for fast energy variation, and beam matching structures may be required to integrate all sections. We have designed these components to transport protons from 0.5-3.5MeV, using the beam produced by the Pelletron at the University of Melbourne: the study has included measurements of the beam current and transverse distribution; prototyping of magnets using commercially available materials in 3D-printed holders; and simulations of transport through the arc with both simplified and realistic fieldmaps. Further investigations are currently ongoing, including the impact of the nonlinear fields on the beam profile and future applications for particle therapy facilities.

[1] J.S.L. Yap, E. Higgins and S.L. Sheehy (2021). 'Preliminary Study of a Large Energy Acceptance FFA Beam Delivery System for Particle Therapy'. Proceedings of the 12th International Particle Accelerator Conference (IPAC'21).

[2] J.S.L. Yap, A.F. Steinberg, H.X.Q. Norman, R. B. Appleby and S. L. Sheehy (2022). 'TURBO: A Novel Beam Delivery System Enabling Rapid Depth Scanning for Charged Particle Therapy'. Journal of Physics: Conference Series, 13th International Particle Accelerator Conference.