Contribution ID: **553** Contribution code: **MOPB053** Type: **Poster Presentation**

Beam optics design of a prototype 20 kW conduction-cooled SRF accelerator for medical sterilization

Monday 26 August 2024 16:00 (2 hours)

Superconducting technology has significantly advanced the capabilities of particle accelerators, facilitating higher beam-power operations for fundamental research at a comparatively lower cost. However, the conventional implementation of superconducting technology introduces complexities in the form of cryogenic plants, cryogenic distribution systems and substantial construction and operational cost. In response to these challenges, recent research efforts at Fermilab have been dedicated to the development of a cryogen-free, conduction-cooled Nb3Sn-based superconducting technology. This paper outlines the beam optics design of a 20-kW conduction-cooled compact superconducting accelerator for medical sterilization. The paper reviews both the physics and practical constraints associated with high beam-power operation within the context of industrial applications. The focus is on providing insights into the potential of this innovative technology to overcome existing challenges and pave the way for more accessible and efficient industrial particle accelerators.

Footnotes

Funding Agency

This manuscript has been authored by Fermi Research Alliance, LLC under Contract No. DE-AC02-07CH11359 with the U.S. Department of Energy, Office of Science, Office of High Energy Physics

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Session Classification: Monday Poster Session

Track Classification: MC2: Electron Accelerators and Applications: MC2.5 Industrial and medical accelerators