



Contribution ID: 339

Type: Oral Presentation

Heavy Ion Beam Dynamics in Continuous Wave Superconducting Linacs

Thursday, 22 August 2019 12:30 (30 minutes)

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The Facility for Rare Isotope Beams in Michigan State University includes a continuous wave (CW) superconducting (SC) driver linac capable to accelerate any ion beam from oxygen to uranium above 200 MeV/u. The first segment of the FRIB linac, composed of 15 cryomodules, was successfully commissioned with beam. Detailed study of the beam parameters demonstrated good consistency with the original design parameters. Four ion beam species, Ne, Ar, Kr and Xe, were accelerated up to 20.3 MeV/u with 100% transmission and no detectable beam losses. High-power equivalent beams were delivered to the beam dump in two modes: pulsed and CW. In pulsed mode, the peak intensity of argon beam was 14.8 pA at 3% duty factor which constitutes 30% of the FRIB design intensity for this particular ion beam. A CW argon beam was accelerated, demonstrating that the FRIB linac in its current configuration is the highest energy CW SC hadron linac in the world.

*Work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661, the State of Michigan and Michigan State University.

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Session Classification: Workshop on Physics of Exotic Nuclei