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Thermal, Mechanical and Fluid Flow Challenges of the FRIB Primary Beam Dump*

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The Facility for Rare Isotope Beams (FRIB) under construction at Michigan State University is based on a 400 kW heavy ion accelerator and uses in-flight production and separation to generate rare isotope beams. The first section of the fragment separator houses the rare isotope production target and a primary beam dump to absorb unreacted primary beam. FRIB will use ion beams from 18O to 238U with about 300 kW remaining beam power needing to be absorbed by the dump. Based on the results of extensive R&D, a rotating water-cooled thin-shell metal drum was chosen as the concept for the FRIB beam dump. The design foresees a 70-cm diameter drum made of titanium alloy with a shell thickness of 0.5 mm. Flowing water is used to both cool the beam dump shell and absorb the power of the beam penetrating the drum wall and being stopped in water. The volumetric flow rate and the drum rotation speed chosen are 60 gpm and 400 rpm, respectively. Titanium alloys have been identified as good candidates for the drum material due to the high strength, low density and good corrosion resistance. Extensive thermal, mechanical and fluid flow analyses have been carried out for the beam dump interior and the Ti alloy drum shell in order to evaluate the beam dump high-power density capability for different primary beams from oxygen to uranium. The results of these studies will be presented.
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