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High Power Capability of the Primary Beam Dump Drum for FRIB – Simulation and Experimental Study

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The Facility for Rare Isotope Beams (FRIB) is presently under construction at Michigan State University. It is based on heavy ion accelerator which produces the primary ion beams from 16O to 238U with up to 400 kW power. For the rare isotope production the in-flight technique and fragment separation is used with over 300 kW of unreacted primary beam needing to be absorbed in the beam dump. The basic concept of the beam dump for FRIB assumes a rotating thin-wall drum filled with water. Flowing water is used to both cool down the wall and stop the beam penetrating this 0.5 mm thick wall made of Ti-6Al-4V alloy. Under the extreme operational conditions the effects of high power density are significant and need detailed study, so the extensive thermal, mechanical and fluid flow analysis was performed taking into account the beam power deposited both in water and drum wall. It appears that an intense water cooling is required to dissipate the power deposited in the wall, which for the heaviest 238U beam can reach 70 kW.
The results of tests and simulations will be discussed in this paper.
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