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High power beam dumps of BigRIPS at RIBF

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At RIKEN RI Beam Factory (RIBF), heavy-ion beams such as 238U accelerated to 345 MeV/nucleon are utilized to produce a wide variety of short-lived nuclei through projectile fragmentation or in-flight fission reactions, induced when these beams impinge on a beryllium target. This target is placed at the entrance of the BigRIPS separator. Beam ions that do not undergo nuclear reactions at the target are intercepted by three water-cooled high-power beam dumps, positioned either inside or downstream of the first dipole magnet of BigRIPS.
Due to the limited range of heavy-ion beams in matter and the small beam spot size at the dumps, these components are subject to an intense heat flux exceeding 50 MW/m², corresponding to a volumetric heat density of over 10 GW/m³. The current BigRIPS beam dumps are designed to safely absorb beams with heat fluxes up to 100 MW/m². Operationally, beams with heat fluxes up to 50 MW/m² are routinely employed.

In this contribution, we present a comprehensive description of the BigRIPS beam dumps and report on operational experiences, including a recent incident in 2023 in which a molten mark was discovered on one of the dumps. Additionally, we discuss planned upgrades to the beam dumps to accommodate the increased beam power expected in future RIBF operations.

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