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PRELIMINARY design of a LH2 target cooling system at LBL

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In order to study nuclear structure at the limits of stability through a program of targeted measurements at the Facility for Rare Isotope Beams (FRIB), a thick liquid-hydrogen target and vertex tracking detector system specifically optimized to be coupled to the Gamma-Ray Energy Tracking Array (GRETA) for fast beam measurements at FRIB is under development. The LH2 target-cell and windows will be made of thin Mylar. The target thickness is around 10˜15 cm with an effective diameter of order 50˜60 mm. A cryocooler-based hydrogen cooling system is under design to cool down the target, liquefy gas hydrogen, deliver and maintain liquid hydrogen in the target. The cooling system primarily consists of a cryocoole-cooled cryostat, a gas hydrogen and gas nitrogen storage and handling sub-system including safety devices, as well as instrument rack and PLC control system. The hydrogen is liquefied in the cryostat using a two-stage GM cryocooler at 20 K. The vaporized hydrogen is re-liquefied in the condenser attached to the second stage of the cold head and the liquefied hydrogen flows into the target through its gravity-driven thermos-syphon cooling circuit. A thermal radiation screen at around 30-40 K is mounted on the first stage of the cold head to protect the cold mass at 20 K from the 300K radiation. The safety design of the hydrogen cooling system is carefully taken into account. This paper presents the preliminary design of the LH2 target cooling system at LBL.

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