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The MUSE Experiment and Proton Radius Puzzle: Design and Status of LH₂ Cryotarget¹ PRIYASHREE ROY, NOAH STEINBERG, LUC LEPOTTIER, RICHARD RAYMOND, WOLFGANG LORENZON, University of Michigan, MUSE COLLABORATION — A fundamental challenge faced by the scientific community is to resolve the proton radius puzzle: the 7σ discrepancy observed between muon spectroscopy and atomic measurements of the proton radius. The discrepancy, if real, could point to interesting new physics. The MUon Scattering Experiment (MUSE), which will take place at the Paul Scherrer Institute in Switzerland, will play an instrumental role towards resolving this puzzle since it will be the first muon elastic scattering experiment at low Q^2 of about $0.0016 - 0.08 \text{ GeV}^2$ and the first to perform simultaneous elastic scattering measurements using both muons and electrons. This will allow a direct comparison of the proton radius from the two leptonic probes to a sub-percent level. An essential and arguably the most complex part of MUSE is the liquid hydrogen (LH₂) cryotarget system. Dictated by physics needs, the cryotarget system needs to satisfy many requirements, including a vertically movable target ladder consisting of three more targets in addition to the LH₂ target housed inside a vacuum chamber and large vacuum windows on both sides of the beamline. Here we report on the design and status of the MUSE cryotarget system, and our technique to fabricate the LH₂ target cell.

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