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LH₂ Target Design & Position Survey Techniques for the MUSE experiment for Precise Proton Radius Measurement LUC LE POTTIER, PRYIASHEE ROY, WOLFGANG LORENZON, RICHARD RAYMOND, NOAH STEINBERG, ERICK ROSSI DE LA FUENTE, Univ of Michigan - Ann Arbor, MUSE (MUON PROTON SCATTERING EXPERIMENT) COLLABORATION — The proton radius puzzle is a currently unresolved problem which has intrigued the scientific community, dealing with a 7σ discrepancy between the proton radii determined from muonic hydrogen spectroscopy and electron scattering measurements. The MUon Scattering Experiment (MUSE) aims to resolve this puzzle by performing the first simultaneous elastic scattering measurements of both electrons and muons on the proton, which will allow the comparison of the radii from the two interactions with reduced systematic uncertainties. The data from this experiment is expected to provide the best test of lepton universality to date. The experiment will take place at the Paul Scherrer Institute in Switzerland in 2018. An essential component of the experiment is a liquid hydrogen (LH₂) cryotarget system. Our group at the University of Michigan is responsible for the design, fabrication and installation of this system. Here we present our LH₂ target cell design and fabrication techniques for successful operation at 20 K and 1 atm, and our computer vision-based target position survey system which will determine the position of the target, installed inside a vacuum chamber, with 0.01 mm or better precision at the height of the liquid hydrogen target and along the beam direction during the experiment.

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