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A liquid hydrogen target for the calibration of the MEG-II LXe calorimeter

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The MEG experiment has set the world's most stringent limit of 4.2×10^{-13} (90% C.L.) on the branching ratio of the charged lepton flavour violating decay mu+->e+ gamma at the Swiss intense continuous surface muon beam facility, the Paul Scherrer Institute. After an intense upgrade program, the MEG-II experiment started data taking in 2021. To achieve an order of magnitude sensitivity improvement with respect to MEG, the liquid XEnon Calorimeter (XEC) was upgraded to a 1000L liquid xenon C-shaped tank equipped with PMTs and SiPMs to collect the Vacuum UltraViolet scintillation light from the 52.8 MeV signal gamma.

Among the various calibration methods of the LXe calorimeter, we developed one that allows to extract the detector performance at an energy close to the signal gamma's. To do so, a beam of negative pions is sent towards a liquid hydrogen target in order to produce neutral pions via the charge exchange reaction π^- + p $\rightarrow \pi^0$ + n. Neutral pions decay into a pair of gammas with energies following a flat spectrum between 54.9 MeV and 82.9 MeV in the lab frame. The 54.9 MeV gammas are selected by requiring a back-to-back topology of the gammas using an auxiliary detector facing the XEC. This gamma source is used to extract the energy, position and timing resolutions of the detector. The liquid hydrogen (LH_2) target has stringent requirements in order to match MEG-II design, reach temperatures below 20K and allow fast liquefaction. The latest design of the liquid hydrogen target, its construction and its performances are presented here.

Collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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