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A liquid hydrogen target to fully characterize the new MEGII liquid xenon calorimeter

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The MEGII experiment searches for the μ+ ⟶ e+γ decay with a sensitivity of 6*10-14 at 90% C.L. The precise measurement of the kinematical variables of the two particles in the final state, generated by muons stopped in a thin target, is key in finding the signature of this process. A major upgrade has been carried out over the last years and a new Liquid Xenon (LXe) calorimeter has been introduced, equipped with both PMT and SiPM immersed in Xenon collecting the Xe scintillation light emitted in the Vacuum Ultra Violet region.
MEGII has successfully completed the eng. run and just started data taking.

The characterization of the 1000 L LXe calorimeter is a cardinal (and not trivial) task. To fully and precisely characterize the performances of this detector physical events in the μ ⟶ eγ signal region are desired.

The production at rest of π0, in the charge exchange reaction π− + p ⟶ π0 + n, matches this requirement. Gammas from the π0 decay have an energy spectrum flat in the interval 54.9 < Eγ < 82.9 MeV and one can easily select a 54.9 MeV γ detecting a coincident γ emitted in the opposite direction. An auxiliary detector, facing the LXe calorimeter, is therefore required to select the higher energy γ while the other is used for calibration. The method illustrated allows establishing the energy, position and time resolutions of the LXe calorimeter.

A core component of these measurements is a target with the right properties and able to work in the presence of a high magnetic field. Here we present the liquid hydrogen target designed, built and used for this purpose during the first data-taking period of MEGII.

Collaboration

MEGII

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