Contribution ID: **369** Type: **Poster**

The latest performance and refurbishment of the pixelated Timing Counter (pTC) in the MEG II physics data acquisition

Monday, 27 May 2024 09:56 (1 minute)

MEG II, the upgrade of the MEG experiment, has run physics data acquisition since 2021, collecting 7.3×10^{14} μ^+ on target during 42 weeks of DAQ live time. It searches for the Lepton Flavor Violating Decay $\mu^+ \to e^+\gamma$ with sensitivity improved by an order of magnitude from MEG that had set the current upper limit on the branching ratio $\mathcal{B}(\mu^+ \to e^+\gamma) < 4.2 \times 10^{-13}$ at 90% confidence level.

The pixelated Timing Counter (pTC) is responsible for providing precise timing information of positrons e^+. It is a time of flight detector devoted to reconstructing the decay time of μ^+ on target and to supplying efficient trigger information on the positron side. The detector consists of 512 fast plastic scintillator pixels ($120 \times 50(40) \times 5\ \mathrm{mm}^3$) readout by twin arrays of 6 series-connected SiPMs ($3 \times 3\ \mathrm{mm}^2$), glued on opposite sides of each pixel. Its goal is to achieve a resolution on the reconstructed time of 40 ps, by exploiting multiple-hits events where the detector overall resolution should improve with $1/\sqrt{N_{\mathrm{hit}}}$.

This contribution will show how the detector has degraded by increase of dark current due to irradiation damage on SiPMs, from the achieved performance in the 2021 run reaching 39 ps to the one in the 2023 run around 42 ps, for events with 8 hits corresponding to the average number of hits expected from Monte Carlo simulation for $\mu^+ \to e^+\gamma$ events. Therefore, we have been organizing the refurbishment of the detector using 1200 new SiPMs ($4 \times 4\ \mathrm{mm}^2$) and will report the estimation of time resolution recovery based on the selection of replacement pixels and the results of laboratory tests.

Collaboration

MEG II

Role of Submitter

The presenter will be selected later by the Collaboration

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Session Classification: Photo Detectors and Particle ID - Poster session

Track Classification: T2 - Photo Detectors and Particle ID