

A fast scintillating fibre detector for the Mu3e experiment

Monday, 16 September 2024 16:05 (1 hour)

We present a compact scintillating fibre timing detector developed for the Mu3e experiment. Mu3e is one of the flagship experiments of the Swiss particle physics scene, aiming to search for the charged lepton flavour violating “neutrinoless” muon decay ($\mu^+ \rightarrow e^+e^+e^-$). Mu3e is planned to start taking data in 2025 at the Paul Scherrer Institute (CH), using the world’s most intense continuous surface muon beam (10^8 muons per second).

Together with partners from ETH Zurich, at the University of Geneva, we are developing a scintillating fibre detector formed by staggering three layers of 250 μm scintillating fibres. The fibre ribbons are coupled at both ends to multi-channel silicon photo-multiplier arrays. These are read out with the MuTRiG ASIC, specifically developed for this experiment.

The presentation is going to be focused on the performances of the scintillating fibre detector, notably on the time resolution of ~ 250 ps, the efficiency of $\sim 97\%$, and spatial resolution of ~ 100 μm , including the time calibration of the detector. In this presentation, we also include the challenges overcome to build this very thin scintillating fibre detector, having a thickness smaller than 0.2% of the radiation length. Further, we discuss the operation and performance of the MuTRiG ASIC, used for reading out the ~ 3000 channels of the fibre detector.

Working Group

WG 4: Muon Physics

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Session Classification: Poster session

Track Classification: WG4: Muon Physics