

Status of the Mu3e experiment at PSI

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The Mu3e experiment at the Paul Scherrer Institute (PSI) will search for the charged lepton flavour violating decay $\mu^+ \rightarrow e^+ e^- e^+$, improving the current best limit set by the SINDRUM experiment by four orders of magnitude.

Mu3e will be conducted in two phases. Phase I, currently under construction at the $\pi E5$ beamline at PSI, will utilise an intense DC surface muon beam of $10^8 \mu^+/s$ to reach a single event sensitivity of 2×10^{-15} . Phase II will exploit the future High-Intensity Muon Beam to push the sensitivity further to the 10^{-16} level.

Such an improvement in sensitivity is enabled by several key aspects of the experiment design: the availability of high-intensity muon beams, a low-material-budget tracking system consisting of the ultra-thin HV-MAPS silicon pixel detectors combined with scintillating fibre and tile detectors providing sub-ns timing resolution to reduce multiple scattering, and a high-rate data acquisition system capable of handling the large data volume produced by the detector at high beam rates. The detector system, specifically optimised for the $\mu^+ \rightarrow e^+ e^- e^+$ signature, operates under a 1 T solenoidal magnetic field, enabling precise reconstruction of the decay vertex and invariant mass of the three final-state particles.

Preparations for Phase I data-taking are actively ongoing at the PSI $\pi E5$ beamline. A recent beamtime campaign in June 2025 validated key detector components - including vertex, scintillating fibre, and tile modules - and their integration with the high-intensity muon beamline under a 1 T magnetic field, marking a significant milestone in commissioning.

This contribution will present the status of the experiment, the first results from the recent beamtime campaign at PSI, and future prospects.

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