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The Mu3e Experiment

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The Mu3e experiment searches for the charged lepton-flavour violating decay of a muon into two positrons and one electron. Due to the negligible Standard Model branching ratio, any observation would provide unequivocal evidence of new physics. A first phase of the experiment aims for a single-event sensitivity of one in $2 \cdot 10^{15}$ muon decays.

To reach this goal, the collaboration developed a low-mass pixel tracker based on high-voltage monolithic active pixel sensors, complemented by timing detectors, a system designed to fully reconstruct the kinematics of candidate $\mu^+ \rightarrow e^+e^+e^-$ events. A streaming data-acquisition system and online filter farm allow for the processing of over 10^8 muons on target per second.

The experimental apparatus is currently being commissioned at the $\pi E5$ secondary muon beamline at the Paul Scherrer Institute. In the June 2025 campaign the vertex detector, timing detectors, the data-acquisition system, and all slow control systems were integrated inside our 1T superconducting magnet, and operated at a beam rate of over $10^7 \mu/s$. Next year the outer layers of the pixel tracker will be added, which enables first physics data taking before the long HIPA shutdown.

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