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A Silicon Pixel Tracker for Future μ SR Experiments

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Muon spin rotation (μ SR) is a long existing baseline technique in condensed matter research, facilitating the exploration of magnetic and superconducting phenomena. Traditional reliance on scintillator-based detectors, limited in rate and spatial resolution, hinders the investigation of novel quantum materials. The use of ultra-thin silicon pixel sensors for precise track reconstruction has the potential to revolutionize μ SR spectrometry.

A first prototype of a silicon-based μ SR spectrometer has been constructed, using a telescope setup with four layers of quad modules made from MuPix11 sensors and a central μ SR sample. Initial studies were conducted at a polarized muon beamline at PSI.

The testbeam analysis framework Corryvreckan is used to efficiently track the incoming muons and emitted decay positrons.

First results demonstrate muon spin precession measurements comparable to traditional methods, while eliminating accidental background and enabling resolution of details on a 1 mm scale on the sample.

This technology shows great potential for efficient, high-rate investigations of multi

Authors: MANDOK, Lukas (Heidelberg University (DE)); MANDOK, Lukas (University of Heidelberg)

Presenters: MANDOK, Lukas (Heidelberg University (DE)); MANDOK, Lukas (University of Heidelberg)

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