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A prototype for the backscatter detector system of PERC

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The instrument PERC is currently under construction at the FRM II. Like its predecessors PERKEO II and PERKEO III, it will measure the beta spectra of neutron decay and determine several of its correlation coefficients. It aims to improve the precision by up to one order of magnitude over current best values. This enables testing the Standard Model and search for new physics via effective couplings.

PERC will observe neutron decay in an 8 m long neutron guide and a high magnetic field will guide the charged decay products to the main detector, positioned downstream of the experiment. In order to achieve the targeted precision, it is important to identify backscattering events, in which the electron only deposits a part of its energy in the detector, as this would otherwise alter the measured spectra. The magnetic field guides backscattered electrons upstream, where a detector system will identify the backscattering events by the coincidence time. The backscatter detectors will consist of two scintillation detectors and SiPM arrays on the backside for readout. Due to the high background in the area of the backscatter detector system, spatial resolution is necessary to avoid random coincidences.

Following a comparison of different possible setups via simulations with the Monte Carlo simulation tool Geant4, I determined the design most suitable for its purpose and built a prototype. We present first results of its characterization.

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