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The backscatter detector system of PERC

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The instrument PERC is currently under construction at the FRM II. It aims to measure the beta spectrum of neutron decay more precisely than its predecessors PERKEO II and PERKEO III, enabling the determination of several correlation coefficients in neutron beta decay with an improved precision by one order of magnitude. Of particular interest is the so-called beta asymmetry parameter A which describes the anisotropic emission of electrons in the decay of polarized neutrons. PERC aims to measure A with an unprecedented precision of $A = 4{\times}10^{-5}$ making it possible to determine the CKM matrix element V_{ud} most precisely and test the unitarity of the CKM matrix.
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 spectrum. The magnetic field guides backscattered electrons downstream, 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.
Using the Monte Carlo simulation tool Geant4 I compare different possible setups in their energy and spatial resolution to identify the optimal design. I present the results of these simulations and the status of the development of the detectors.

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