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A tracker for the novel mu3e experiment based on high voltage monolithic active pixel sensors

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The proposed mu3e experiment will study the lepton flavor violating decay $\mu \rightarrow e e e$ which is strongly (10^4 -50) suppressed in the standard model, but enhanced to observable levels in many models for new physics. In order to achieve the proposed branching ratio sensitivity of 10^{-16} the detector has to have high rate capability and good background suppression, which in turn requires excellent momentum and vertex resolution.

The mu3e detector consists of two double layers of high voltage monolithic active pixel sensors (HV-MAPS) around a target double cone. To minimize multiple scattering of the low energetic decay electrons (<53 MeV), an ultralight layer design is proposed, with HV-MAPS thinned to 50 μm . With on-sensor pre-amplification, discrimination and zero-suppression a separate read-out chip can be omitted, which further reduces the material budget. The detector design will be discussed and results from the characterization of the HV-MAPS prototype in 180 nm technology will be shown.

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