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Utilization of novel Silicon Photomultipliers with bulk integrated quench resistors in tracking applications for particle physics.

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Silicon Photomultipliers (SiPMs) are a promising candidate for replacing conventional photomultiplier tubes in many applications, thanks to ongoing developments and advances in their technology. A drawback of conventional SiPMs is their limited fill factor caused by the need for a high ohmic polysilicon quench resistor and its metal lines on the surface of the devices, which in turn limits the maximum photon detection efficiency. At the Semiconductor Laboratory of the Max-Planck Society (HLL) a novel detector concept was developed integrating the quench resistor directly into the silicon bulk of the device resulting in a free entrance window on the surface. The feasibility of the concept was already confirmed by simulation and extensive studies of first prototype productions.
Recently SiPMs were also considered as an attractive alternative for tracking applications in vertex detectors. The requirements for a fast response, simple design and high fill factor can all be met by SiPMs. In addition the increased trigger probability for an avalanche by minimum ionizing particles allows device operations at lower overbias voltages, resulting in a decreased noise contribution. The concept can be evolved further towards an imaging photo-detector.
A new design for an application of these SiPM devices as vertex detectors with active quenching developed by the HLL and DESY as well as first simulation results will be presented. Also, first measurements of the trigger efficiency as a function of the applied overbias voltage of SiPM devices will be shown.

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