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Development of AC-LGADs for large-scale high-precision time and position measurements

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We present here measurements on AC-LGADs that can be made with greater segmentation than the DC-coupled devices planned for the HL-LHC. The new devices maintain a 100 % fill factor for charge collection. This is achieved by employing un-segmented (p-type) gain layer and (n-type) N-layer separated from metal readout pads by a thin dielectric layer. The design allows great flexibility in the choice of the geometry of the metal readout pads, which can be sparsely located. High spatial precision can be achieved by using the information from multiple pads, exploiting the intrinsic signal sharing provided by the common N-layer. The sharing is determined by the pitch and size of the pads. Excellent time resolution, similar to the DC coupled LGADs at comparable gain, results from the gain layer. Using data collected with IR-laser scans we explore the dependence of the detector performance on some of the major sensor parameters: sheet resistance and termination resistance of the N-layer, thickness of the isolation dielectric, and pitch and size of the readout pads.

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