

High-Voltage Pixel Sensors for ATLAS Upgrade

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The high-voltage (HV) CMOS pixel sensors offer several good properties: a fast charge collection by drift, the possibility to implement relatively complex CMOS in-pixel electronics and the compatibility with the commercial processes. The sensor element is a deep-n-well diode in a p-type substrate. The n-well contains CMOS pixel electronics.

The main charge collection mechanism is drift in a shallow-, high field region, which leads to a fast charge collection and a high radiation tolerance.

We are currently evaluating the use of the high-voltage detectors implemented in 180nm HV CMOS technology for the high-luminosity ATLAS upgrade. Our approach is replacing the existing pixel- and strip-sensors with the "intelligent" CMOS sensors while keeping the presently used readout ASICs. In this way we could benefit from the advantages of the HV sensor-technology such as lower cost, lower mass, lower operating voltage, smaller pitch, smaller clusters at high incidence angles all with comparable radiation hardness, without the need to develop new readout electronics.

In order to test the concept, we have designed two HV CMOS prototypes that can be readout in two ways: using pixel- and strip-readout chips. In the case of the pixel readout, the connection between HV CMOS-sensor and the readout ASIC can be established capacitively.

We will present measurement results performed on both prototypes, that include irradiations up to the fluence of 10^{16} neq/cm².

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