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Charge collection and annealing studies on 800 MeV proton irradiated AMS H18 HV-CMOS sensors.

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With the upcoming HL-LHC upgrade, there is ongoing investigations on the viability of HV-CMOS sensors for the upgrade of the ATLAS pixel detector. The HV-CMOS technology is showing great promise, however, a drawback in the standard process is the use of low resistivity silicon (10 - 20 Ωcm) wafers, as this commonly only provides a rather small depletion region before breakdown voltage is reached. This is usually circumvented by using high resistivity (˜1k Ωcm) silicon. On the other hand, after NIEL irradiation above 1e15 neq/cm2 fluences low and medium resistivity sensors show somewhat higher charge collection compared to high resistivity silicon. This makes the low and medium resistivity HV-CMOS highly interesting if close to 100% efficiency can be guaranteed below this fluence.

In this study 10 Ωcm AMS H18 test chips have been irradiated with 800 MeV protons at LANSCE up to 1.3e16 neq/cm2 to closer mimic the average energy of the simulated proton background radiation in HL-LHC ATLAS. Edge-TCT was used to investigate the change in charge collection, and an annealing study was carried out to confirm the signal behaviour over time.

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