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Charge collection and laser measurements on double-sided 3D strip sensors irradiated up to 2*10^16 n_eq/cm^2

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Although 3D silicon sensors are characterized by higher capacitance (thus higher noise), lower spatial uniformity and more fabrication process complexity than standard sensors, the higher radiation hardness motivates the investigation of this layout in view of the LHC upgrade. In between the different 3D layouts, the double-sided represent the most attractive but also the most mechanically challenging.
We performed charge collection (with a beta source) and laser studies on irradiated (up to 2*10^16 n_eq/cm^2), p-type, 3D double-sided strip sensors from the ATLAS Insertable B-Layer (IBL) production wafers, fabricated at FBK (Trento). We compared the results with the one obtained before irradiation and with simulations performed with TCAD.
While the charge collection reflect the expectation from simulation and show the relatively high radiation hardness, being significant also at relatively low bias voltages (e.g. at 25 V for 5*10^15 n_eq/cm^2), laser measurements shows that the most effective regions are located and grows with the bias voltage dependently on the irradiation fluence (showing unexpected high collection close to the p+ columns).

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