

3D sensors measurements with FEi4 read-out chips

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During the 2023-2024 shutdown, the Large Hadron Collider (LHC) will be upgraded to reach an instantaneous luminosity up to $7 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. This upgrade of the accelerator is called High-Luminosity LHC (HL-LHC). The ATLAS and CMS detectors will be replaced to meet the challenges of HL-LHC: an average of 200 pile-up events in every bunch crossing and an integrated luminosity of 3000 fb⁻¹ over ten years.

In order to have high resolution tracking performance, in such a challenging and dense environment, pixel cell size needs to be minimized. A new 65 nm Front-End is being developed by the RD53 collaboration with a readout cell size of $50 \times 50 \mu\text{m}^2$. The new front-end chip will be compatible with $50 \times 50 \mu\text{m}^2$ or $25 \times 100 \mu\text{m}^2$ pixel size sensors.

Italian groups are involved in the R&D effort on the design and production of new 3Ds sensors with thicknesses of 100 to 200 μm , 5 μm diameter columns and smaller pixel cells. A first batch of sensors have been produced by FBK Trento. As the new read-out chip with small pixel size is not available yet, sensors have been bump-bonded by Leonardo to FE-I4 chips, the read-out electronics used in the Pixel layer inserted in ATLAS in 2014. Although the read-out size is $50 \times 250 \mu\text{m}^2$, measurements of the new smaller size sensor pixel have been done.

In this talk we present an overview of these results including laboratory measurements such as IV curves, noise and charge collection using sources and laser setup and also preliminary measurements of efficiency and charge collection from a test beam at the Cern SPS.

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3D Sensors

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