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Tracking studies with cosmic rays using the ATLAS ITk end-cap system test

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The new ATLAS Inner Tracker (ITk) detector is an all-silicon tracking detector replacing the currently installed Inner Detector (ID) for the high-luminosity phase of the LHC. The ITk detector design foresees a pixel and a strip sub-detector, both of which are subdivided into a barrel and end-cap sections. Focusing on the strip end-cap sections, the silicon microstrip sensors use a radial strip geometry that resembles a polar coordinate system and features an already defined stereo angle in the design. Detector modules, consisting of the active sensor, plus the directly glued on readout and power electronics, are grouped on larger local support structures, called petals. These are again arranged in discs out of which six of these are forming one end-cap in the global structure with a total number of 196 petals.
To demonstrate the full detector concept, the ITk strip detector collaboration is pursuing full system tests for the barrel and end-cap parts. Here, the latter is commissioned at DESY Hamburg and consists of a slice of the full detector structure which can be populated with up to 12 petals. Among several planned electrical characterisation measurements, it is also envisioned to take cosmic ray data with this setup to verify tracking and overall detector performance.
For this purpose, the end-cap system test is simulated within the simulation framework Allpix2 and tracking studies are performed within the track reconstruction framework Corryvreckan. As a first step, the implementation of the radial strip geometry was consolidated and the new feature of generating cosmic rays in the simulation was implemented. With this, first studies of the expected tracking performance of the system tests in various configurations were performed and will be compared to experimental test results in the actual lab setup.

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