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ATLAS ITk-Pixel DAQ system

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During the ATLAS High-Luminosity Large Hadron Collider (HL-LHC) upgrade, the current inner detector is going to be replaced by an all-silicon Inner Tracker (ITk). The pixel detector, located in the innermost part of the ITk, comprises of 9716 modules arranged in 5 layers around the beam line. The ITk-Pixel DAQ system basic read-out chain includes the YARR software, communicating with the FELIX PCIe board acting as an interface connected through lpGBT transceivers to the on-detector front-end (FE) chips ITkPix. The FEs are grouped in triplet (3-FE) and mostly quad modules (4-FE, QM) that are installed on local supports, which are integral parts of the ITk structure. The FELIX system is also used for performing Quality Control (QC) tests during integration. The work describes the development steps and corresponding testing and read-out chain validation results. A representative read-out sub-system will be used to develop and validate the different aspects of the read-out chain. This subsystem can be a Loaded Local Support (LLS) comprising few tens of ITkPix QMs with serial powering (SP) and opto-box connection. In order to have the readout chain validated, developments on trigger and command sending and data reading of YARR FelixClient controller were consequently required to validate the read-out chain, achieved first on a lab setup with a couple of ITkPix single chip cards (SCCs) and QMs. This step has been carried out successfully, paving the road to the next LLS sub-system readout test.

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