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A PCI Express board for the upgrade of the ATLAS TDAQ read-out system

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During the next 5 years a great number of laboratories all around the world will be involved on the upgrading of the 4 principal experiments at CERN (ATLAS, CMS, LHCb, ALICE). The ATLAS Bologna group, which collaborates with the Pixel Detector's DAQ (Data AcQuisition), in the last 2 years has developed a prototype of a new board named PILUP (Pixel detector high Luminosity UPgrade); this board is a candidate for the re-design of the ATLAS DAQ required for HL-LHC (High Luminosity LHC) project. The main characteristics of this board are the embedded processor (Dual core ARM) and the large communication bandwidth (up to 60 Gb/s through optical fibers); these allow the board to manage complex systems and data transmissions suitable for the performance demanded for the next HEP (High Energy Physics) goals. The PILUP has already demonstrated the capability to manage the communication with the main board of the ATLAS DAQ upgrade, the FELIX, using different communication protocols (GBT and FullMode). This is the first result of the collaboration with the Felix group. Moreover, its features make it adaptable to be programmed as an emulator of several devices (front end electronic or read-out chips like the new RD53A). In conclusion, the experience gained by the Bologna team in the last 7 years collaborating the ATLAS Pixel Detector DAQ joined with the characteristics of this new board, open many directions for the use of the PILUP.

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