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Noise evaluation of silicon strip super-module with ABCN250 readout chips for ATLAS detector upgrade at high luminosity LHC

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Toward the High Luminosity LHC (HL-LHC) runs, the whole of ATLAS inner trackers will be replaced.
The SemiConductor Tracker (SCT) using silicon micro strip sensors for tracking of the charged particles willalso be fully replaced.
Dedicated readout chips, ABCN250, for the new SCT sensor are being developed for the HL-LHC.

The $10 \times 10 \text{ cm}^2$ strip sensors and the readout chips are integrated into a module.
The ABCN250 chips are mounted on hybrid.
The strips on the sensor and the readout channels of the chips are wire-bonded directly.
A block of these modules are integrated to be a larger structural and electrical unit.
The super-module is one of such concept of integration where double-side of the module form an unit, then, a block of double-side modules are mounted on a support frame.
We have assembled eight double-side modules equipped with more than 600 ABCN250 chips as a super-module prototype which has more than 80,000 channels of sensors.

When multiple sensors and readout chips are operated on a large structure simultaneously, crosstalk between the channels could increase the noise.
It is necessary to measure the noise on super-module prototype.
In order to readout and test the sensors with the ABCN250 chips on super-module prototype, we have developed a new data-acquisition system utilizing a readout board called SEABAS.
The SEABAS has FPGAs: one incorporates TCP/IP communication with PC in a firmware layer, the SiTCP technology, to communicate with PC, and the other, user-FPGA, to communicate with the user-specific hardware with user-specific firmware.
To detect unknown issue on bit stream from readout chips, firmware on user-FPGA for our system passes raw bit stream without processing.

With the new data-acquisition system, entire system of the super-module prototype was successfully readout and all the channels were tested simultaneously.
The distributions of the input noise and the accidental hit rate were evaluated.

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Session Classification: After dinner POSTER session, with drinks: (All presenters are requested/encouraged to attend their posters; All participants are requested to participate the session, with drinks!)

Track Classification: Strips