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ATLASsilicon strip detector module Prototyping for phase II upgrade

Beginning in 2024, the HL-LHC will provide unprecedented pp luminosities to ATLAS, resulting in an additional integrated luminosity of around 2500 fb^{-1} over ten years. To withstand the much harsher radiation and occupancy conditions of the HL-LHC necessitates a complete replacement of the present ATLAS inner detector.

The biggest change to the current inner tracker is the replacement of the Transition Radiation Tracker (TRT) detector with long silicon strips. In order to improve the granularity, the number of strip modules and readout channels will be increased by one order of magnitude compared to current strip detector in this baseline design.

The second round of strip detector module prototyping is under development. We integrated the readout ASIC chip (ABC130) in 130nm CMOS process and n⁺-in-p type sensor radiation hard sensor in module prototyping. The first prototype of ABC130 readout chip has been designed with 128 readout channels. There are individual preamplifier, shaper, comparator, memorybanks for trigger latency and a derandomizer for each channel.

In order to improve the readout speed, the next version of “ABC-star” ASIC chip is under development with new “star” readout architecture.

In this round of module prototyping, the size of the hybrid, power consumption and the number of ASICs per module have been reduced, benefitting from the new feature of ABC130 readout chip. We also verify that the radiation hardness of this prototype ATLAS strip detector module fulfilling the requirements of HL-LHC operations.

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