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System simulations for the ALICE ITS detector upgrade

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The ALICE experiment at the CERN LHC will feature several upgrades for run 3, one of which is a new inner tracking system (ITS). The ITS upgrade is currently under development and commissioning. The new ITS will be installed during the ongoing long shutdown 2.

The specification for the ITS upgrade calls for event rates of up to 100 kHz for Pb-Pb, and 400 kHz pp, which is two orders of magnitude higher than the existing system. The seven layers of ALPIDE pixel sensor chips significantly improve tracking with a total of 24120 pixel chips. This is a vast improvement over the existing inner tracker with six layers, of which only the two innermost layers were pixel sensors.

A number of factors will have an impact on the performance and readout efficiency of the upgraded ITS in run 3. While these factors are not limited to operating conditions such as run type and event rates, there are also a number of sensor configuration parameters that will have an effect. For instance the strobe length and the choice of sensor operating mode; triggered or continuous.

To that end we have developed a simplified simulation model of the readout hardware in the ALPIDE and ITS, using the SystemC library for system level modeling in C++. This simulation model is three orders of magnitude faster than a normal HDL simulation of the chip, and facilitates simulations of an increased number of events for a large portion of the detector.

In this paper we present simulation results where we have been able to quantify detector performance under different running conditions. The results are used for system configuration as well as ongoing development of the readout electronics.

Consider for promotion

No

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