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Commissioning Procedures and Software for the CMS Silicon Strip Tracker

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The CMS silicon strip tracker (SST), comprising a sensitive area of over 200m2 and 10M readout channels, is unprecedented in its size and complexity. The readout system is based on a 128-channel analogue front-end ASIC, optical readout and an off-detector VME board, using FPGA technology, that performs digitization, zero suppression and data formatting before forwarding the detector data to the CMS online computing farm. Commissioning such a large-scale readout system requires sophisticated procedures that can optimally configure and synchronize the entire readout system and provide calibration parameters that are used by both hardware and the CMS reconstruction software. The software implementation for the commissioning procedures is divided between the CMS online and offline frameworks, known as XDAQ and CMSSW, respectively. Data acquisition loops for each of the commissioning tasks have been implemented within the XDAQ framework. These loops configure and control the readout system hardware and local trigger system, and perform event building using tools provided by the CMS TriDAS group. The data analysis modules, which receive the event data stream and calculate optimized hardware configurations and calibration constants, have been implemented within CMSSW. This design, using both the online and offline frameworks, ensures that the commissioning software is sufficiently flexible for online operation using either the local DAQ resources allocated to each sub-detector or the global resources of the online computing farm. The latter option offers significant improvements in detector readout speeds and CPU processing power, thus reducing turn-around times between physics runs. We present an overview of the SST data acquisition system, focusing on the commissioning procedures and their software implementations within the online and offline frameworks. Results and performance studies will also be presented, based on experiences gained when commissioning a complete slice of the SST readout system and during integration activities of the final silicon strip tracker.

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