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Development of PANDA EMC Online High Level Trigger Algorithms

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The PANDA detector is a general purposed hadron spectrum planed to operate at the FAIR facility in Darmstadt, Germany. The PANDA EMC detector provides almost 4pi spatial coverage, good granularity and high energy resolution. A novel self-trigger data push data architecture for the PANDA data acquisition system requiring the data from EMC readout electronics to be processed on the fly to reconstruct electromagnetic shower. Features extracted from the electromagnetic shower combines with information from other detectors such as tracking and Cherenkov detectors in order to discriminate between photons, electron and hadrons. An EMC trigger and data acquisition scheme is proposed employing an FPGA based Compute Node (CN). The CN provides flexible connection with high bandwidth between processing modules, up to 10GByte DDR2 memory per board for data buffering and five high end FPGAs for sophisticated algorithm applications. A cluster finding algorithm is presented. The cluster finder also searches bumps in one cluster and distinguishes overlapped clusters which is essential for $\pi 0$ reconstruction in high momentum and high luminosity experiments. Its energy and spatial resolution is measured. The cluster finding efficiency is studied based on simulation data. Some electromagnetic shower feature extraction algorithms which are usually done in offline trigger and their computing power requirements for FPGA implementation are discussed. The algorithms partition strategy, based on the readout electronics layout and the Compute Node based processing architecture, is also coved in the last part.

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