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Macro Pixel ASIC (MPA): The Readout ASIC for the Pixel-Strip (PS) module of the CMS Inner Tracker at HL-LHC

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The CMS tracker at HL-LHC is required to provide prompt information on high transverse momentum to the central level one trigger. The innermost part of the tracker is based on a combination of a pixelated sensor with a short strip sensor, the so-called Pixel-Strip module (PS). The readout of the sensors is carried out by two ASICs, the Strip Sensor ASIC (SSA) for the strip layer and the Macro Pixel ASIC (MPA) for the pixel layer. The processing of the data directly on the front-end module represents a design challenge due to the large data size (30720 pixels and 1920 strips per module) and the limited power budget. This is the reason why several studies have been carried out to find the best compromise between stub finding efficiency and power consumption.

This talk describes the current status of the ASIC development, focusing on the MPA chip development where the logic for the stub generation is implemented. An overview of the readout ASIC is presented with particular attention on the cluster reduction, position encoding and momentum discrimination logic. Concerning the testing, a software test bench capable of reading Monte-Carlo generated events has been developed and used to validate the MPA design and to evaluate the MPA performance. The obtained results will be reported and compared with the standard analysis software. In addition the first prototype of the MPA ASIC, namely the MPA-Light, will also be presented in the talk. The MPA-Light is scheduled for this year and will include the full analog functions and a part of the digital logic of the final version in order to qualify the chosen VLSI technology for the analog front-end, the module assembly and the low voltage digital supply.

Author: CERESA, Davide (CERN)

Co-authors: MARCHIORO, Alessandro (CERN); Dr TRAVERSI, Gianluca (University of Bergamo); KAPLON, Jan (CERN); KLOUKINAS, Kostas (CERN); RATTI, Lodovico (University of Pavia); GAIONI, Luigi (Università di Pavia); RE, Valerio (INFN); BIALAS, Wojciech (CERN)

Presenter: CERESA, Davide (CERN)