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VMM3a, an ASIC for tracking detectors

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The VMM3a is a System on Chip (SoC) custom Application Specific Integrated Circuit (ASIC). It will be used as the front ASIC for both Micromegas and sTGC detectors of the ATLAS Muon New Small Wheels upgrade at CERN. Due to its highly configurable parameters, it has been proposed a variety of tracking detectors and another experiments. It is fabricated in the 130nm Global Foundries 8RF-DM process. The ASIC integrates 64 independently configurable channels each providing amplitude and timing measurements, in digital or analog format. The design aspects and performance of the VMM3a as a production ASIC will be presented.

Summary

The VMM front-end ASIC is being developed since 2012 by Brookhaven National Laboratory for the upgrade of the ATLAS Muon Spectrometer. The 4th version, VMM3a, has been validated to fulfill the upgrade requirements for both sTGC and resistive MicroMegas detectors of the New Small Wheel upgrade which is a 2.4 Million channel system featuring two detector technologies providing trigger and tracking data. ATLAS has submitted the production of 70,000 chips for the upgrade of its Muon Spectrometer. The ASIC features an amplifier which can operate with a wide range of input capacitances, has adjustable polarity, gain and peaking time. It features 64 channels with 160,000 Mosfets each, providing charge amplification, discrimination, neighbour logic, analog-to-digital conversions, and either direct output for trigger or multiplexed readout within a data-driven readout system. Three readout modes have been developed allowing the ASIC to be used in several applications. The ASIC has been tested with resistive MicroMegas and sTGC production modules as well as prototypes in test beam campaigns at CERN. The architecture of the ASIC will be presented along with its performance. Results with detectors from the test beam campaigns will be presented along with results from the production. Moreover highlights of the integration of a 2.4 Million channel system upgrade will be shown.

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