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# Upgrade of the ATLAS Muon Drift Tube Front-end Electronics for HL-LHC Runs

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The ATLAS Muon Spectrometer is designed to provide Muon triggering, identification and momentum measurement. It consists of resistive plat chambers (RPCs) and thin gap chambers (TGCs) that are used as primary trigger detectors, while monitored drift tubes (MDTs) and cathode strip chambers (CSCs) are utilized for precision trackering. To improve the Muon transverse momentum (pT) resolution at L0 triggering for the future high-luminosity LHC (HL-LHC) run, MDT chamber data will be included at the first trigger level. The current MDT chambers (inner barrel) will be replaced by RPC and sMDT chambers to allow for 3-station RPC triggering. With the improved MDT triggering, roughly 75% low momentum muons (pT < 20GeV) can be rejected and the efficiency curve become much sharper. Additionally, coping with the much higher hit rates in HL-LHC, MDT readout electronics system face great challenges and much be upgraded. The main challenges are providing much higher data bandwidth, maintaining low power consumption, surviving in harsher radiation environment and complying with mechanical rule from legacy system.

This submission concerns the upgrade of front-end (FE) electronics for the MDT detector sub-system. The front-end (FE) system is made up of mezzanine cards and Chamber Service Modules (CSM) modules. For the new mezzanine card, it will operate in a trigger-less mode to handle the high collision rate compared to the detector trigger time. The ASD and TDC chips on the mezzanine are upgraded accordingly to provide higher readout bandwidth for the trigger-less operation. In total, roughly 80k ASDs and 22k TDCs will be produced for HL-LHC MDT detector. The new CSM module must handle both legacy and new mezzanines as there are some mezzanines cannot be accessed for replacement. The new CSM is based on the CERN LpGBT chipsets to take advantage of radiation-hard features. The latency of the CSM is fixed and the output bandwidth is up to 20Gbps. In total, roughly 1200 CSM modules will be delivered for installation eventually.

## Submitted on behalf of a Collaboration?

Yes

## Participate in poster competition?

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