

Precision Muon Tracking Detectors for High-Energy Hadron Colliders

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Small-diameter muon drift tube (sMDT) chambers are a cost-effective technology for high-precision muon tracking and trigger at the high background rates expected at future colliders. Chambers of this type are under construction for upgrades of the muon spectrometer of the ATLAS detector at high LHC luminosities. Several chambers have already been installed for LHC run II. The chamber design and construction procedures have been optimized for mass production while providing a precision of better than 10 micrometers in the sense wire positions and the mechanical stability required to cover large areas. The inherent mechanical precision allows for highly accurate monitoring of the absolute alignment of the chambers in the detector. The sMDT chamber design profits from the long experience with the MDT chambers in ATLAS and provides even higher reliability. The chambers are operated with a mixture of argon and CO₂ gas at 3 bar and are not susceptible to aging. The rate capability of the sMDT chambers has been extensively tested at the Gamma Irradiation Facility at CERN. It fulfills the requirements for the highest background regions in the ATLAS muon spectrometer at HL-LHC as well as over most of the acceptance of muon detectors at future high-energy hadron colliders. The optimization of the readout electronics to further increase the rate capability of the detectors will also be discussed as well as the use of the sMDT chambers in a highly selective first-level muon trigger as it is, for instance, planned for the upgrade of the ATLAS muon spectrometer at HL-LHC.