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Development and Construction of Muon Drift-Tube (sMDT) Chambers for Upgrades of the ATLAS Muon Spectrometer at High LHC Luminosities

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For the planned high-luminosity upgrades of the Large Hadron Collider (LHC)increasing background rates of neutrons and gamma rays are expected exceed the rate capability of the current ATLAS muon tracking detectors. Drift-tube chambers with a tube diameter of 15 mm have (sMDT chambers) been developed for upgrades of the ATLAS muon spectrometer. A full sMDT prototype chamber has been constructed and tested in a muon beam at CERN and at high gamma and proton irradiation rates.
The chamber design and construction procedures are discussed. The test results demonstrate the required track reconstruction efficiency and spatial resolution of the sMDT chambers at background rates far beyond the maximum expected values. The sense wire locations in the prototype chamber have been measured with few micron precision with cosmic rays confirming the required wire positioning accuracy of better than 20 microns. Currently sMDT chambers are under construction for installation in the ATLAS muon spectrometer in the 2013/14 LHC shutdown. Further sMDT chamber construction for subsequent upgrades are in the planning phase. New readout electronics for the chambers with higher bandwidth and better radiation hardness is also under development.

Summary

Muon drift-tube (sMDT) chambers
have been developed for high-luminosity upgrades of the ATLAS muon spectrometer. The chambers have demonstrated background rate capability far beyond the requirements. Several chambers are under construction for upcoming detector upgrades, others are in the planning phase.

Primary author: Dr KROHA, Hubert (Max-Planck-Institut für Physik (DE))

Co-authors: Dr ENGL, Albert (Ludwig-Maximilians University, Munich, Germany); Mr MANFREDINI, Alessandro (Max-Planck-Institut für Physik, Munich, Germany); Mr ZIBELL, Andre (Ludwig-Maximilians University, Munich, Germany); Mr BITTNER, Bernhard (Max-Planck-Institut fuer Physik, Munich, Germany); Mr ZANZI, Daniele (Max-Planck-Institut für Physik, Munich, Germany); Dr DUBBERT, Joerg (Max-Planck-Institut für Physik, Munich, Germany); Dr KORTNER, Oliver (Max-Planck-Institut für Physik, Munich, Germany); Prof. BIEBEL, Otmar (Ludwig-Maximilians University, Munich, Germany); Mr SCHWEGLER, Philipp (Max-Planck-Institut für Physik, Munich, Germany); Dr HERTENBERGER, Ralf (Ludwig-Maximilians University, Munich, Germany); Dr RICHTER, Robert (Max-Planck-Institut für Physik, Munich, Germany); Mr OTT, Sebastian (Max-Planck-Institut für Physik, Munich, Germany)

Presenter: Dr KROHA, Hubert (Max-Planck-Institut für Physik (DE))

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