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Construction and Test of a Full Prototype Drift-Tube Chamber for the Upgrade 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) background rates of neutrons and gamma rays of up to 14 kHz/cm^2 are expected which exceed the rate capability of the current ATLAS precision muon tracking detectors, the Monitored Drift Tube (MDT) chambers, with a drift tube diameter of 30 mm. So called sMDT chambers with a drift tube diameter of 15 mm have 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 with cosmic muons at high gamma irradiation rates of up to 23 kHz/cm^2. The chamber design and construction procedures will be discussed. The test results demonstrate the required track reconstruction efficiency and spatial resolution of the sMDT chambers at background rates well beyond the maximum expected value. The sense wire locations in the prototype chamber have been measured with few micron precision with cosmic rays using precise reference chambers and confirm a wire positioning accuracy of better than the 20 microns required.

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