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Development of Fast High-Resolution Muon Drift-Tube Chambers for SLHC Background Counting Rates

Pressurized drift-tube chambers are efficient detectors for precision tracking over large areas. The example of the monitored drift-tube (MDT) chambers of the muon spectrometer of the ATLAS detector at the Large Hadron Collider (LHC) shows that spatial chamber resolutions better than 40 μm and a tracking efficiency close to 100% can be achieved with 6 layers of 3 cm diameter drift tubes. The ATLAS MDT chambers, however, due to their relatively large maximum drift time of 700 ns can only cope with background counting rates of 1 kHz cm-2 which will be exceeded by about an order of magnitude in the forward region of the muon spectrometer at the high-luminosity upgrade of the LHC (SLHC). The high-rate limitation can be overcome by drift tubes of smaller diameter. Decreasing the drift-tube diameter to 1.5 cm decreases the maximum drift time to 200 ns with otherwise unchanged parameters and raises the rate limit to 10 kHz cm-2 . A prototype chamber consisting of 8 layers of 1 m long 1.5 cm diameter drift tubes was constructed with better than 16 μm anode wire positioning accuracy and operated at high background fluxes in the Gamma Irradiation Facility (GIF) at CERN. In the tests a spatial chamber resolution better than 45 μm and almost independent of the couting rate was achieved. The tracking efficiencies stayed above 97% up to the maximum available counting rate of 300 kHz per tube at the GIF.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

URL of the PDF document: ftp://www.mpp.mpg.de/outgoing/kortner/summary.pdf

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