Performance of Fast High-Resolution Muon Drift Tube Chambers for LHC Upgrades

Abstract

Monitored drift tube chambers are used as precision tracking detectors in the muon spectrometer of the ATLAS experiment at the LHC at CERN. These chambers provide a spatial resolution of 40 μm and a tracking efficiency of close to 100% up to background rates of 0.5 kHz/cm^2, the former being limited at higher rates mainly due to space charge effects and the latter due to the maximum drift time of 750 ns.

For LHC upgrades, a faster drift tube chamber have been developed, using drift tubes with a diameter of 15 mm instead of 30 mm. The increased channel density and shorter drift time of about 200 ns raise the rate capability to about 10 KHz/cm^2, while retaining the spatial resolution.

We present results of measurements with chamber prototypes at CERN at the Gamma Irradiation Facility (GIF) at high γ radiation rates, and at the H8 beam line with high momentum muons including the test of the first full-sized prototype chamber. Measurements of the response of the drift tubes to highly ionizing radiation such as neutrons and protons will also be discussed.