

High-Rate Performance of New Fast 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 Large Hadron Collider (LHC) at CERN. The chambers provide a spatial resolution of $40\ \mu\text{m}$ and a tracking efficiency of close to 100% up to background rates of $0.5\ \text{kHz}/\text{cm}^2$. At high rates it deteriorates due to space-charge effects and the latter due high occupancy for the drift time of 700 ns.

For LHC high-luminosity upgrades, faster drift tube chambers have been developed using drift tubes with a diameter of 15 mm instead of 30 mm. The high granularity and shorter drift time of about 200 ns raise the rate capability to more than $10\ \text{kHz}/\text{cm}^2$ while retaining the spatial resolution up to high counting rates.

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