# Irradiation Response of Straw Drift Tubes

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Drift tubes filled with mixtures of $Ar/CF_4/CO_2$ were exposed to proton beams to study the radiation effects and operation characteristics expected for the COMPASS experiment at CERN. Stable operation is possible for charge accumulations on the anode wire up to 1.2 C/cm, in contrast to the aging effects that we observe for $Ar/CH_4$ mixtures. In addition to the aging characteristics, we also studied gas gains and spatial resolutions for various operation parameters.

**Summary of Talk:** The straw drifttime detectors of the COMPASS experiment at CERN consist of metallized kapton tubes of 6 or 10 mm diameter and 30 $\mu$m Au/W anode wires. We have studied the radiation effects and operation characteristics using 24 MeV proton beams from the Munich Tandem accelerator with broad and homogeneous profiles. Gas gains in the $10^4$ range were determined by comparing the measured integrated electrical currents and proton doses. Pulse height spectra for 5.89 keV photons from a $^{55}$Fe source allowed sensitive monitoring of gain variations. An $Ar/CH_4$ 70:30 gas mixture was used to demonstrate the sensitivity of our methods. A gain loss of 23% per C/cm was measured and the onset of Malter current was observed for accumulated charges below 0.1 C/cm. With a mixture of $Ar/CF_4/CO_2$ 74:20:6, considered for COMPASS operation, no significant loss of gain ($< 1\%$) was found up to an integrated current of 1.2 C/cm. Electron microscopy shows formation of a layer of fine grain of about 0.1 $\mu$m thickness. Some light element enrichment in the deposit are indicated in an Elastic Recoil Detection Analysis. The accumulated charge of 1.2 C/cm corresponds to about 20 (4) years of COMPASS (muon halo at 10 cm from beam axis) for a gas gain of $2{\cdot}10^4$ ($1{\cdot}10^5$).