A Long-term Aging Study of the Honeycomb Drift Tubes of HERA–B Using a Circulated and Purified CF_4–Gas Mixture

M. Capeáns, K. Dehmelt, M. Hohlmann, B. Schmidt

presented by **Klaus Dehmelt**

Deutsches Elektronensynchrotron (DESY), 22603 Hamburg, Germany

The Outer Tracker (OTR) of HERA–B uses a gas mixture containing CF_4 to obtain high electron drift velocities. The high cost of this gas makes it necessary to circulate the gas mixture which must then be purified to avoid accumulation of air and pollutants. However, any gas purifier presents the danger of outgassing pollutants into the gas stream. Furthermore, in this application the purifiers could be attacked chemically by the aggressive products from the cracking of CF_4 molecules in the plasma avalanches of the detector. This could potentially release further harmful pollutants into the gas stream. Consequently, a long–term irradiation study of about 3000 hours was carried out for the Honeycomb Drift Tubes that are used in the OTR. This provided a test of the long–term stability of the gas purifiers before putting them into operation for the full–size detector. We report on the experimental setup, procedures and obtained results.

Summary of Talk: In a small–scale setup built for simulating the OTR of HERA–B and its gas system as closely as possible, honeycomb test modules underwent long–term irradiation with 8.6 keV photons from an X–ray tube. The setup had two gas purifiers (a $3\overset{o}{A}$ molsieve for removing water and a copper–based catalyst for binding oxygen) running in series. These purifiers were chosen because the same types have been used successfully for years – albeit at much lower irradiation rates – in other track detectors, e.g. in the H1 and HERMES experiments. Special attention was paid to the choice of clean, non-outgassing materials for chamber and gas system construction. The aging test test was conducted with a gas mixture of $Ar/CF_4/CO_2$ 65:30:5 as used in the OTR. The development of gain in time as well as the gas composition and ambient parameters (temperature, pressure etc.) were monitored. A total charge of 2.3 C/cm was accumulated over $\sim$ 3000 hours of irradiation, which is equivalent to more than three years of nominal HERA–B operation in the hottest region of the OTR at 40 MHz interaction rate. All observed gain changes could be explained by changes in gas composition and/or ambient parameters. The results show the reliability of the gas purification scheme for at least three high–rate HERA–B years.