

Study of the multiwire proportional chamber cathode samples of the LHC experimental facilities

The motivation of the present studies is creation of the spontaneous self-supporting currents commonly denoted as Malter effect (ME) in multiwire proportional chambers used at Large Hadron Collider (LHC) beam experiments in European Organization for Nuclear Research (CERN).

Search for reasons of the origin and analysis of the nature of this effect are necessary for development of procedures meant to decrease ME-current which is 100 times higher than ionization current at detector during collider processing. The importance of these studies is growing while collecting the charge running through the proportional chambers during processing at LHC. Another reason is planning increase of LHC luminosity by about 10 times, from $L = 7 \cdot 10^{33} \text{ sec}^{-1} \cdot \text{cm}^{-2}$ (2012) to $L = 5 \cdot 10^{34} \text{ sec}^{-1} \cdot \text{cm}^{-2}$.

For the study of detector degradation processes under its irradiation life tests of two proportional chamber prototype detectors of the muon CSC (Cathode Strip Chamber) system were carried out. After 90-Sr β -source irradiation the first prototype collected 1.39 Coulomb/cm charge, the second one collected 0.39 Coulomb/cm charge. The next studies of prototype detector cathode samples have shown that the reason of creation of ME spontaneous currents is plasmochemical influence of gaseous charge products at cathode copper surface and radiation damage [1].

In the present work the results of complex structure-element analysis of cathode samples derived from multiwire proportional chamber are shown. This chamber had been working in LHC physical experiment for about 10 years and was influenced by repeated origins of spontaneous ME-current. Comparative analysis of obtained results and data from life tests of radiation resistance of prototype detectors is made, possible reasons for ME creation are discussed.

[1] M.E.Buzoveria, N.V.Zavyalov, I.A.Karpov, M.I.Tkachenko, A.A.Dziuba, G.E.Gavrilov, S.A.Nasybulin, M.V.Grechkina. Investigation of the Cathode Plane Radiation Damage in the Prototypes of Multiwire Proportional Chamber from the CMS Experiment // Physics of Atomic Nuclei 2019, Vol. 82, No. 9 pp. 1–11

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