Development and creation of coordinate detectors based on thin-walled drift tubes for the NA-64 experiment at CERN

Vasilieva Evgenia Vladimirovna, Volkov Petr Vladimirovich, Gusakov Yury Vasilievich, Enik Temur Lvovich, Zhukov Igor Alexeevich, Kekelidze Georgy Dmitrievich, Kramarenko Viktor Alexeevich, Lysan Viktor Mihailovich, Peshekhonov Dmitri Vladimirovich – from JINR, Solin AlexandrVladimirovich from the Research Institute for Nuclear Physics, Belorussia

ABSTRACT

This paper describes the properties and characteristics of tracking detectors developed at JINR using the straw tube technology for the NA64 experiment and obtaining the first physical results during runs at CERN SPS. To date, 12 double layer chambers made of 6 mm straw tubes and 2 double layer chambers made of 2 mm straw tubes have been produced and used in the experimental facility. For performing work on a muon beam of the NA64 project, 7 two-dimensional chambers with dimensions of 1200×600 mm have been developed and are being produced. The total number of straw tubes in the experiment is 3648.

A unique method of supplying a gas mixture through the side walls of a straw tube has been developed and implemented. The method was proposed and developed by the staff of the Laboratory. Experimental studies of the mechanical properties of straw tubes depending on the temperature and humidity of the environment have been conducted. Taking these results into account, new design and technological solutions have been proposed and implemented to improve the reliability and stability of the chambers.

The reconstruction of the beam tracks using the detectors of the facility was carried out. The ***r-t*** dependence for 6 mm straw tubes was obtained. The drift velocity for the gas mixture with 20% content of CO_2 has been estimated, which is in the range of (16.1 ± 0.5) ns/mm (62 mm/μs). The coordinate accuracy has been estimated, which is (100 - 450) μm depending on the distance of the track from the center of the tube.

The effect of aging of 6 mm straw tubes have been studied, the rate of change in the gas gain of 9.6% per C/cm has been estimated. A test bench has been constructed, which allows testing different types of detectors using cosmic radiation, as well as developing and studying DAQ systems and processing programs for various types of detectors in the NA64 experiment and experiments planned at the NICA accelerator complex.