The large-scale coordinate-tracking detector TREK for registration of near-horizontal muon flux generated by ultrahigh energy cosmic rays is being developed in MEPhI. Detector is based on the multihit drift chambers from the neutrino experiment at the HEP U-70 accelerator. Their key advantages are a large effective area (1.85 m²), good coordinate and angular resolution with a small number of measuring channels. Detector will be operated as a part of the Experimental complex NEVOD, in particular, in the framework of the neutrino detector CHERENkov-OER (DECOR). This type of large detector (CTUDC) representing two coordinate planes, crosswise to the effective sides of the chambers, which has been developed and has been mounted on the opposite sides of the CWD. It has the same principle of joint operation with NEVOD-DECOR triggering them and the same drift chambers alignment, so main features of the detector TREK will be examined. Results of a cross-calibration of the CTUDC and coordinate-tracking detector DECOR and a joint work with NEVOD-DECOR complex are presented.

CTUDC

Coordinate-tracking detector CTUDC is designed for joint operation with complex NEVOD triggering system (TS). Triggering system has a rather fast data handling; the period between the passage of a particle through the working volume of CWD and the time moment of its output is about 500 ns. On the other side, the maximum drift time of the electrons in the chamber is 6 μs, so registration system and logic of CTUDC cannot be directly integrated into NEVOD TS and should be implemented separately. Primary processing of signals from sense wires of drift chambers is carried out by 4-channel signal-processing amplifiers (mounted in the rear face of the DC) with a single adjustable threshold for all channels. It forms 15 ns LIVOS pulses that pass through several commutation blocks to a 128-ch time-to-digital converter EM-4. There are 64 channels in 16 chambers and single TDC can handle all of them, so after the expansion of the drift chamber setup to the TREK, CTUDC channels can be included into its registration system. Trigger signal of NEVOD TS acts as the time mark for TDC; it is produced with implementation of any trigger condition of CWD or DECOR (configured separately for each detector).

After the generation of the trigger signal in the triggering system, it transmits all its data to NEVOD central computer that starts (via Ethernet) to gather all amplitude information from CWD and configuration of triggered DECOR streamers. Simultaneously NEVOD central computer sends network packet to CTUDC that contains main information about the event number and the time out of the event, types of CWD and DECOR inner trigger signals, the number of hit CTUs counters. Network packet contains also a bit mask that indicates all the time intervals of the detector which are required of transferred to the NEVOD-DECOR complex. All these data are required by the CTUDC system for further data transfers, later these events will be offline joined with events saved at the NEVOD central computer by means of time marks and event numbers.

Conclusion

The unique coordinate-tracking detector CTUDC based on drift chambers from HEP neutrino experiment is developed in MEPhI. Detector operates jointly with other systems of the experimental complex NEVOD and is aimed at registration of near-horizontal flux of muons generated by ultrahigh energy primary cosmic rays. Currently the detector is at the calibration stage. It has been already cross-calibrated with the coordinate detector DECOR and gamma jet water. First results of this work showed a good performance of the detector.

Registration system

Figure shows the distribution in the mean track earth angle estimates according to CTUDC and DECOR reconstruction. Taking into account the scanning of the muon in 28 m of water and 1.2 m concrete, as well as errors in the reconstruction of the angle of CWD and DECOR modules and drift chambers, the 7° RMS scatterer can be considered as a successful proof of the efficiency of the coordinate-tracking detector CTUDC.