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Upgrade of the CMD-3 trigger system.

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In 2017, the luminosity at the VEPP-2000 collider at the Budker Institute of Nuclear Physics SB RAS, Novosibirsk, has increased. In this regard, it was decided to upgrade the trigger system of the CMD-3 detector. For this, the development of a device called the "Final Decision Block"was started. In this paper, we consider the designing and debugging process of the created block, as well as its implementation in the Data Acquisition System of the CMD-3 detector. The test results are presented both at the test bench and directly as part of the Data Acquisition System on the detector.

Summary (500 words)

he VEPP-2000 is an electron-positron collider located at Budker Institute of Nuclear Physics SB RAS. The collider is designed to provide luminosity up to 10ˆ32 cmˆ(-2)sˆ(-1) at the maximum center of-mass energy sqrt(s) = 2 GeV. The Cryogenic Magnetic Detector (CMD-3) is installed in the interaction regions of the collider VEPP-2000. The CMD-3 is an electrophysical installation designed for accurate measurements of charged particles and photons.

The Data Acquisition system (DAQ) is one of the most important parts of the CMD-3 detector. Its task is to collect and record data from the detector, synchronize the operation of all units, and monitor the parameters of the detector subsystems. Thus, the CMD-3 DAQ automates the process of conducting the experiment and processes the received data. It consists of about 6500 measuring channels, the signals from which are processed by several types of electronic modules.

The CMD-3 DAQ includes blocks of the front-end electronics, the L-1 trigger, the Module for synCHronization of System (MChS), the General Interface Board for Data Delivery (GIBDD), and the Event Builder.

The L-1 trigger system consists of interface blocks (IFLT, ADAM) and solver blocks (ClusterFinder (CF) and Trackfinder (TF)). The IFLT and ADAM units prepare data from the front-end electronics and send them to the TF and CF, respectively. Operation of triggering electronics is based on the pipeline algorithm of data processing. Based on the received data, the solver blocks form logical arguments and, comparing them with masks, issue a decision on the registration of the current event. At the moment, there are two trigger signals: Charged Trigger (Trackfinder) and Neutral Trigger (ClusterFinder).

When designing the trigger system of the CMD-3 detector, it was planned that the start of the event digitization cycle would be carried out by a device called the Final Decision Block (FDB). The following signals should be proceeded as inputs: Charged trigger and signs of tracks, Neutral trigger and signs of clusters, which are formed in TF and CF respectively. Based on the arguments received, the FDB was obliged to make a final decision on the registration of the current event and, in the case of a positive decision, to generate the L-1 trigger signal.

In 2017, the VEPP-2000 collider luminosity was increased, thus it was decided to upgrade the trigger system of the CMD-3 detector. Upgrade will be carried out in two stages. The first stage is creation of the FDB with a Mixed trigger, which will allow the selection of events on the basis of joint data from the Charged and Neutral triggers. The second stage is creation of the second version of the block, which will combine the Charged, Neutral and Mixed trigger.

In this paper, we present the designed block and tests carried out with it, as well as its integration in the Data Acquisition System of the CMD-3 detector. The test results are presented both at the test bench and directly as a part of the Data Acquisition System of the detector.

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