Test of the WASA Forward Proportional Chamber

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The Forward Proportional Chamber (FPC) is a tracking detector for charged particles [1]. It consists of 4 planes of straw tubes with 448 straws each. These planes are subdivided in two identical halves. After transportation to Jülich they were inspected for possible aging effects due to the long operation at the CELSIUS accelerator and for possible damage during transportation. A series of tests were performed and new front–end electronics were developed and tested.

The performance of each straw tube was investigated by inspecting the shape and amplitude of analog signals. During these tests the straws were flushed with a 80/20 mixture of Ar and C_2H_6, and a voltage of 1.4 kV was applied. Since all measured signal amplitudes were found to be identical there is no indication of strong local aging effects occured during previous operation. Moreover, the gas flow conditions of all chamber components are satisfactory.

During data taking with cosmic radiation prototype boards with CMP16 amplifier/discriminator chips [3] were connected to an FPC module. The main goal of this test was to check the interoperability of the prototype CMP16 chips with the chamber module. The test was based on a measurment of the time between the signal from a scintillation detector situated near the FPC and the signal from the FPC. The result is presented in fig.1. This time spectrum shows that the range of the drift time amounts approximately to 130 ns, a value which is in agreement with the maximum drift time of 150 ns. It was found that additional electric shielding of the straws is needed in order to reject pick–up of noise from external sources. Then it was possible to set the discriminator threshold to the very low level of about 30 fC.

In November one of the FPC modules was assembled at the WASA detector and tested under beam conditions. The main goal was to check the digital (F1) [2] and analog (CMP16) [3] electronic interoperability and all implemented functionalities. The collected data were used to test the acquisition system, to get experience in operation of the chamber and to establish working parameters. Results presented in fig.2 show that the range of the drift time is equal to 130 ns which is in agreement with the previous test performed with cosmic rays. In fig.2 one can notice background at a constant level which is likely to orginate from imperfect screening of the detector module.

During the November commissioning run also the prototype of the gas system has been checked. In the future an analog device will be used as a gas supply for the FPC detector. The individual components (Ar and C_2H_6) of the gas mixture are delivered by mass flow controllers. The flow is subdivided into separate branches for each FPC module and the flow is monitored with flow sensors.

The complete detector is going to be installed for the first production run in April 2007.

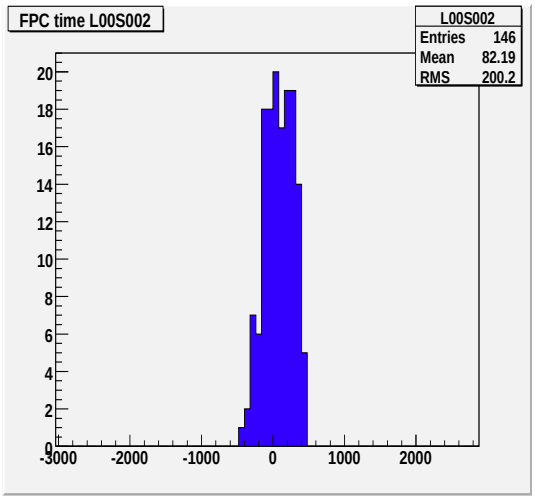

Fig. 1: Sample FPC spectrum received from the cosmic rays test. One channel corresponds to 130 ps.

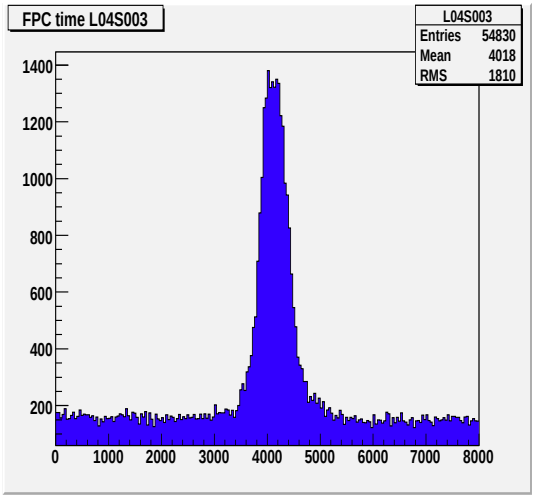

Fig. 2: Time spectra obtained during commissioning. One channel corresponds to 130 ps. The full width of the peak is equal to 130 ns.

References:

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