SM1 Module 0 test beam

Test beam measurements were performed at CERN in June 2016 at SPS HI experimental hall. A 180 GeV/c η beam with a rate between 1 kHz and 0.5 MHz (beam spot of about 1 cm²) was used. The experimental setup was a detector array composed by the SM1 Module 0 and five small dimension MM chambers, with X and Y coordinate readout, used as reference.

The purpose of the test beam was to certify the Module 0 prototype with respect to the project requirements. Both the quality of the single layer and the quality of layer assembly have been tested. The beam was centered on PCB3 (the middle one) and PCB5 (the largest) of Module 0, performing X and Y scanning on both chambers. Data have been collected at different HV amplification values (from 550 to 590 V). The HV drift baseline was set at 300 V but data have been collected also at 200 V and 400 V.

A measurement of the displacement of strips in the precision coordinates function of the second coordinate for the different layers of PCB5 and PCB3 has been performed. This kind of measurement is an indication of layer-to-layer rotation or strip pattern placement. Measurements are taken at different vertical positions along the strips (yellow spots). For each y-position, z-displacements are measured between layer i and layer (i-1) using reference tracks. The displacements are less than ±80 µm, indicating the presence of both shift and rotation within tolerances (±90 µm). These effects are under investigation at the construction site in Pavia using compact Charge-Coupled Devices (cCCDs). Twenty cCCDs are used to read twenty Rasnik masks located on the ten PCBs used for a RO panel, to establish the precise PCB coordinate and to control strip alignment and rotation.

SM1 Module 0 quadruplets

The INFN groups responsible for the construction of the SM1 quadruplets are: Pavia for the readout panels, Roma 1 for the drift panels, Roma Tre for the mesh stretching, Frascati for the quadruplet assembly while Cassino, Lecce and Napoli provide support. The mechanical precision represents a challenge in MM construction: alignments of the readout strips on each detection layer within 30 µm RMS in y and 80 µm RMS in Z are required.

In May 2016 the first full size SM1 prototype (Module 0) was constructed by the INFN consortium, and studied on a dedicated test beam at CERN in June. Further tests included mechanical studies for the detector assembly in the wheel and performance under deformation, as well as tests on high-voltage stability and ongoing checks using cosmic rays. To address issues that arose during Module 0 construction as well as to test the single layer prototype (Module 0.5) will be completed by the end of April 2017. Tests and studies of the performance of the new quadruplet will take place during Spring and Summer 2017.