

Test of the Scintillating Fiber Tracker Prototype for MICE

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The international ionization cooling experiment (MICE) will be carried out from 2007 to verify the effect of ionization cooling with muon beam from ISIS of the Rutherford Appleton Laboratory. In addition to the cooling channel composed with liquid-hydrogen absorbers and high-gradient RF cavities, particle detectors are also necessary to measure the beam emittance before and after the cooling channel. The tracker based on 350 μm scintillating fiber doped with 3HF dye will be used in MICE. Due to the low light yield from such fine fibers, the photo detector, VLPC, with quantum efficiency higher than 80% is employed.

The beam test at KEK-PS $\pi 2$ beam line was performed in 2005 to test the prototype tracker. The purpose of the experiment is to check the ability of construction of the MICE SciFi tracker, to check the alignment and light yields with high-momentum pions injected, and to demonstrate tracking in 1-Tesla solenoid magnetic field with low momentum muons. Figure 1 shows photographs of the tracker prototype and the cryostat for 2048-channel VLPC prepared for the beam test. The tracker has 4 stations of scintillating fiber plane, and clear fibers are attached to the stations to extract scintillation light to VLPC. The newly-developed cryostat cooled by a cryocooler worked to cool VLPC down to 7 K quite stably in the test period over one month.

The beam momentum was successfully measured with the tracker prototype embedded in the 1-Tesla solenoid magnetic field. The reconstructed transverse and longitudinal momentum distributions are shown in Fig.2. The measured distributions are well reproduced by the simulation, and the results will be fed back to the modeling of MICE SciFi tracker.



Figure 1: Pictures of the tracker prototype (left) and the cryostat for 2048-channel VLPC (right).

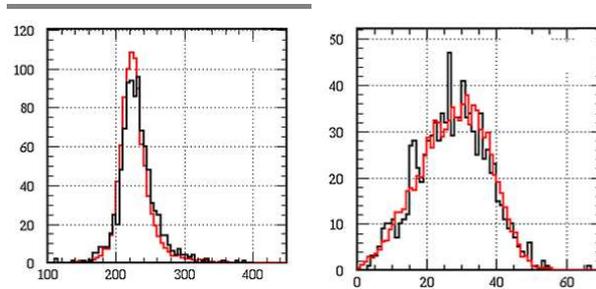


Figure 2: Distributions of reconstructed longitudinal (left) and transverse (right) momentum of the 250 MeV/c muon beam at KEK-PS $\pi 2$ beam line. The horizontal axes indicate momentum in MeV/c. The red histograms is MC and the black is DATA.