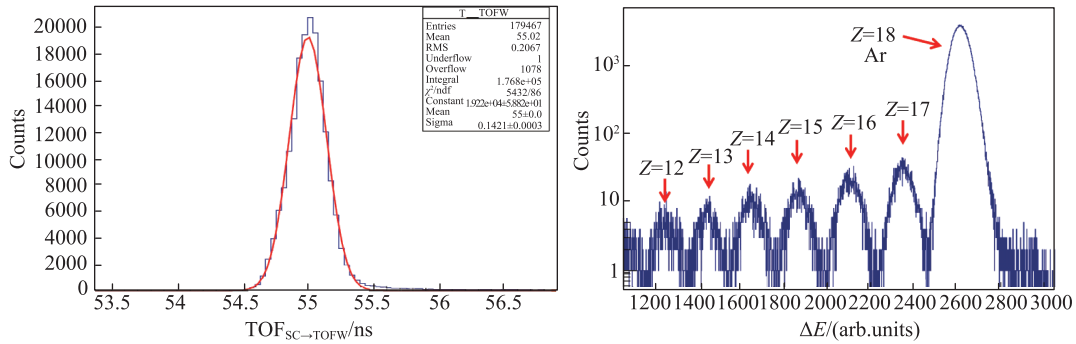

Fig. 3 (color online) Some results from the in-beam test for ETF detectors.

5 - 2 Pattern Recognition Algorithm for MWDCs in ETF

Sun Yazhou

Multi Wire Drift Chambers (MWDCs) in External Target Facility (ETF) are in their first commissioning since fabrication. Six MWDCs are arranged to form two 3-MWDC arrays to trace particles flying in straight trajectories in air and in absence of magnetic field. Each of the MWDCs is of cubic shape (800 mm×600 mm×130 mm) with six layers of sense wires installed in three different orientations. The tracking program is supposed to reconstruct all 3-D tracks passing through the MWDC arrays to the designed spatial resolution of 200 μm. A Monte Carlo event generator was written according to the geometrical specifications of the objective MWDCs to help develop and evaluate a feasible pattern recognition program.

The pattern recognition algorithm recognizes different projections of tracks from hit sense wires in different orientations (step 1). A 3-D track is confirmed by matching three of its projections from those obtained above (step 2). To simplify step 1, a coordinate system rotation is implemented so that one of the three axes is parallel to the concerned sense wire orientation. The rotation would be recovered after step 1 to get the function of the projecting plane.

In an attempt to maximize tracking efficiency under the given detecting efficiency of each sense wire layer, a variety of hit sense wire combinations are accepted as being reconstructable in step 1. The standard is that for a candidate track projection, there should be at least three hit sense wires involved, each of which from different MWDCs; or that at least four hit sense wires belonging to one track projection are present, with each two of them from the same MWDC. Meanwhile, possible combinations of hit sense wires from different sense wire layers are exhausted to include every eligible track projection candidates. The estimated efficiency is 99.96% with the efficiencies of the six sense wire layers involved being 93.71%, 97.99%, 97.48%, 96.84%, 84.62%, 85.69% respectively, according to the data analysis of a beam test. Test using simulation data yields consistent results. Thanks to the noise reduction effect of step 2, a significant part of spurious track projections are ruled out in the process of track projection matching. As a result, the purity of the eventual recognized 3-D tracks is almost insusceptible to the decrease of detecting efficiencies of sense wire layers, as is indicated by simulation test (see Fig. 1).

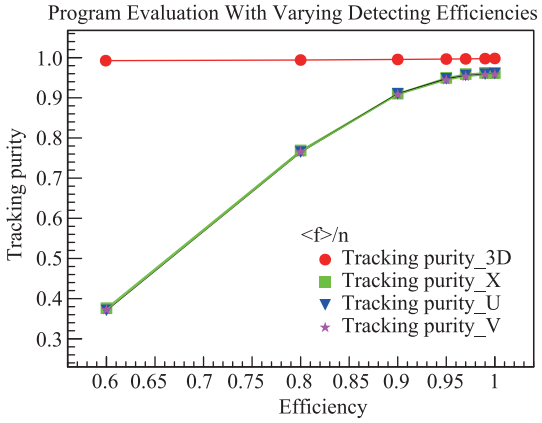

Fig. 1 (color online) Tracking purity v.s. detecting efficiency. Circled dots represents experimental configurations.