

Sandwich Electromagnetic Calorimeter as Veto Counter for COMPASS

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The so-called Sandwich Counter (SC) was built in the MLL in Garching and installed in the COMPASS Experiment at CERN in order to detect charged and neutral particles outside of the spectrometer’s acceptance. As a veto detector, the SC in cooperation with a proton detector around the liquid-hydrogen target guarantees inert proton recoils from 190 GeV pion (or kaon or proton) induced reactions. Diffractive excitation of the beam particle or central meson production, both demanding an elastic proton vertex, are the focus of the COMPASS hadron programme. An enrichment factor of 3.2 was achieved for these events in the data recording of 2008 when the SC was turned on.

In principle, the SC is an electromagnetic calorimeter consisting of 5 scintillator layers and 5 steel-covered lead plates. A total of 768 scintillator plates (produced in Protvino, Russia) are arranged in 12 detector blocks, each read out by 208 optically active light guiding fibres (Fig.1). These are glued into groves running along the scintillator plates. The active area is about $2 \times 2 \text{ m}^2$ minus the central hole’s area of 0.24 m^2 (Fig.2). The detector was optimized for fast read out (6 ns signal FWHM), high rate capability ($\sim 1 \text{ MHz}$) and virtually complete trigger efficiency for minimum-ionizing particles. To demonstrate its proper operation, momentum distributions of events carrying the SC veto flag are compared with those of nonvetoed events (Fig.3). Target fragmentation events, characterized by a loss of momentum with respect to elastically scattered pions, dominate the flagged distribution (Fig.3, right). These are strongly suppressed in the nonveto distribution where the elastic peak shows up (Fig.3, left).



Fig. 2: View of complete detector with $2.5 \times 3 \text{ m}^2$ support frame during craning. The 12 photomultiplier rears are seen sticking out of the light shielding boxes covering the light-guides.



Fig. 1: View from above on the 5 upper detector blocks of the Sandwich Counter showing the bundles of 1 mm light guide fibres emerging from the 5 scintillator layers per block and ending in plastic cylinders for photomultiplier attachment. The scintillators (total thickness: 4cm) are stacked together with 7-mm steel-covered lead plates.

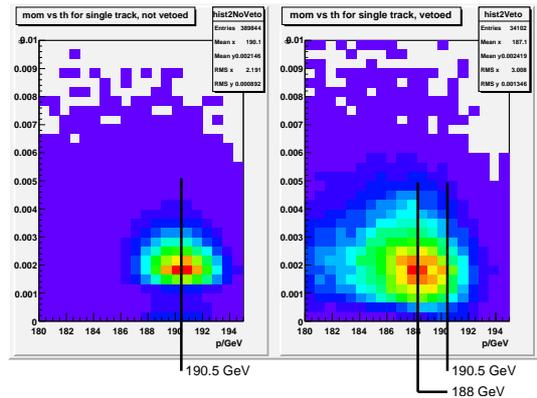


Fig. 3: Laboratory angle vs. total momentum for events with one outgoing charged pion from 190 GeV $\pi^- + p$ events recorded (a) without and (b) with Sandwich Veto flag.