SLAC-PUB-5084
SCIPP 89/52
November 1989
(I)

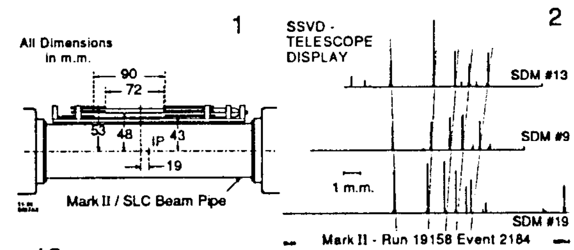
A SILICON STRIP DETECTOR TELESCOPE IN THE MARK II DETECTOR AT THE SLC*

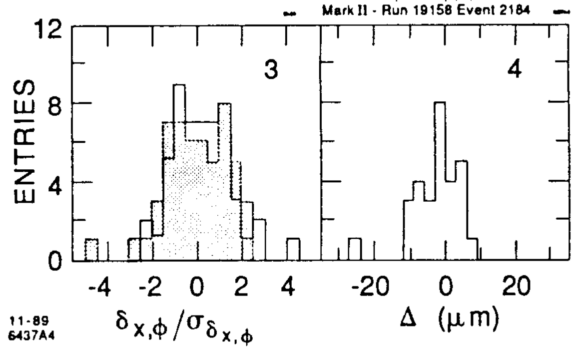
L. Labarga[1], C. Adolphsen[1], B. Barnett[2], A. Breakstone[3], P. Dauncey[2], D. Drewer[2], G. Gratta[1], R.Jacobsen[4], A. Litke[1], V. Lüth[4], J. Matthews[2], S. Parker[3], A. Schwarz[1], M. Turala[1], C. Zaccardelli[1]

(1)Univ. of California, Santa Cruz, California 95064; (2)Johns Hopkins Univ., Baltimore, Maryland 21218; (3)Univ. of Hawaii, Honolulu, Hawaii 96822; (4)Stanford Linear Accelerator Center, Stanford, California 94309

In this paper we report on the performance of a telescope made of three Silicon Detector Modules placed inside the Mark II detector at the SLC. We study occupancies, telescope - Mark II Central Drift Chamber (CDC) track matching and spatial resolution.

To gain operational experience prior to the running of the MARK II Silicon Strip Vertex Detector (SSVD)[1] at the SLC, we have placed inside the Mark II a telescope made of three Silicon Detector Modules. Figure 1 shows the telescope layout and its location on the beam pipe. It covers 1.3 % of the total solid angle and is mounted inside a 3.3 mm thick lucite rectangular box. The relative alignment of the modules was determined with a collimated X-ray beam.[2] 100 tracks from the decay of the 350 Z^0's produced during the six months of data taking crossed the telescope. An event display with five tracks is shown in Figure 2 . The occupancy measured for random beam crossing events was $0.6 \pm 0.2\%$.





A given telescope track was matched to the CDC track which minimizes the differences in their positions and angles. Figure 3 shows the distributions after matching for $\frac{\delta_X}{\sigma_{\delta_X}} = \frac{X_{CDC}-X_{TEL}}{\sigma_{\delta_X}}$ (shaded) and $\frac{\delta_\phi}{\sigma_{\delta_\phi}} = \frac{\phi_{CDC}-\phi_{TEL}}{\sigma_{\delta_\phi}}$ (solid line) where X is in the $r\Phi$ direction along the outer module and $\sigma_{\delta_{X,\phi}}$ are the expected measurement errors. Their widths are 1.4 ± 0.1 and 1.3 ± 0.1 respectively. They approach the expected value of one when demanding high quality in the reconstruction of the CDC track.

To study spatial resolution we use the quantity Δ: for a given track, Δ is the difference between the position of the hit in the middle module and the expected value from the straight line formed with the positions in the inner and outer modules. Figure 4 shows the Δ distribution obtained for $p > 1$ GeV tracks after internal alignment corrections. The event in the left tail is consistent with a background hit distorting one of the true track hits. Ignoring that event the distribution is centered at $\bar{\Delta} = -1.9 \pm 1.0\ \mu m$ with a width $\sigma_\Delta = 5.1 \pm 0.7\ \mu m$. The spatial resolution of the individual modules, σ_{x_M}, derived from σ_Δ and the telescope geometry, is $\sigma_{x_M} = \sqrt{2/3}\sigma_\Delta = 4.2 \pm 0.6\ \mu m$.

REFERENCES

1. C. Adolphsen et al., IEEE Trans. Nucl. Sci. NS-35 (1988) 424
2. C. Adolphsen et al., SLAC-PUB-4961, Apr. 1989; Presented at European Symp. on Semiconductor Detectors, Munich, Feb. 1989

Presented at the International Europhysics Conference High-Energy Physics, Madrid, Spain, September 6–13, 1989

* Work supported by Department of Energy contracts DE-AM03-76SF00010 (UCSC), DE-AC03-83ER40103 (Hawaii), and DE-AC03-76SF00515 (SLAC), and by the National Science Foundation (Johns Hopkins).