

FIDUCIALS MEASUREMENTS ON COLLEGE DE FRANCE
SPIRAL READER AND PARTIAL RESULTS ON π^- D EVENTS AT 9 GeV/c

M. Baubillier, M. C. Cousinou, M. Rivoal, L. De Billy.
 L.P.N.H.E. - Université Paris VI-FRANCE

1. Introduction

In order to examine the reaction $\pi^- d \rightarrow d\pi^+\pi^-$ at 9 GeV/c, we have measured 25,000 3 and 4 prong events on the CdF Spiral Reader. For this run optic titles had been derived from CERN HPD fiducial measurements and we treated a part of digitisations with them. Results were rather unsatisfactory and we hoped to improve them by measuring the fiducial marks on the L.S.D.

2. Analysis of fiducial measurements

A sample of about 60 frames, distributed over the whole run, was selected. In each view 30 fiducial marks were measured. We have made the average of these measurements in the following manner : for every frame we determined the linear transformation between the reference plane of a measured view and the reference plane of a " standard frame" which was fixed before. All fiducials of the view were transformed and deviations from the " standard " calculated. If more than 4 fiducials of a view showed large deviations, the view was rejected. Then the average of the accepted measurements was used as input for PYTHON. In order not to risk to work with a faulty " standard frame", we used 10 different "standard frames" and averaged the corresponding titles.

3. Comparison of different optic titles

We notice that the results of PYTHON differ very much according to formulae used to correct lens-distortions. We test the following two distortions formulae :

$$\left\{ \begin{array}{l} x = (1 + a_1x + a_2y + a_3r^2) x \\ y = (1 + a_1x + a_2y + a_3r^2) y + a_4x^2 \end{array} \right\} \quad \text{Danny formula}$$

$$\left\{ \begin{array}{l} x = x + a_1x^2 + a_2xy + a_3y^2 + a_4xr^2 \\ y = y + a_5x^2 + a_6xy + a_7y^2 + a_4yr^2 \end{array} \right\} \quad \text{Henry formula}$$

Fig. 1 shows the differences between the coordinates on the chamber and the reconstructed (x,y) coordinates on the 3 views for fiducial marks on plane 2 for these two formulae. It is clear that reconstruction is improved by using Henry formula. The 4 fiducial marks measured with each event determine a rectangle. On Fig. 2 one may see how the reconstruction of this rectangle varies according to the optic titles used. One may see that by using LSD titles the reconstruction is better.

Then we compared the results for 455 events geometrically reconstructed using the two sets of titles obtained and the last Cern version of the POOH program. The following table shows the main differences observed.

	DANNY	HENRY
measured events	455	455
good events	360 - 79,1 %	367 - 80,6%
number of tracks	2038	2038
lost tracks	102 - 5 %	95 - 4,7 %
doublet tracks	602 - 29,5%	422 - 20,7%
Mean Residual on beam	5,9 μ	5,6 μ
Mean Residual on tracks $p < 1 \text{ GeV}/c$	8,9 μ	7,5 μ
Mean Residual on tracks with $p > 1 \text{ GeV}/c$	7,3 μ	6,1 μ

This leads us to choose the titles fitted with "Henry" formula. Figure 3 shows the residual distributions of the tracks. On figure 4 we present the beam momentum LSD measurements obtained for 3 and 4 prongs events compared to the same quantity measured with conventional digitizing devices (IEP).

The deviation appears to be larger for the LSD data than for the IEP data. This is also true when one study the grind output. For instance figure 5 and 6 show squared missing masses for π^0 and neutrons.

4- Conclusion

It appears to be necessary to measure the fiducials marks, which are used to calculate geometry titles, on the Spiral Reader ; as, in that manner, much of the machine-dependent distortions are corrected. The previous results show, also, how important is the choice of the parametrization expression for the non linear distortions.

Nevertheless, it seems that the improvement is not sufficient and that the LSD output are more distorted than the IEP output.

Figure Captions

1. Differences between coordinates of fiducial marks of the chamber window (plane 2) and reconstructed (x,y) coordinates from measurements of fiducial marks on the three views.
2. Comparison between theoretical and reconstructed coordinates of fiducial marks.
3. Tracks residuals (24 master points)
4. Beam momentum
5. (missing mass)²
6. " "

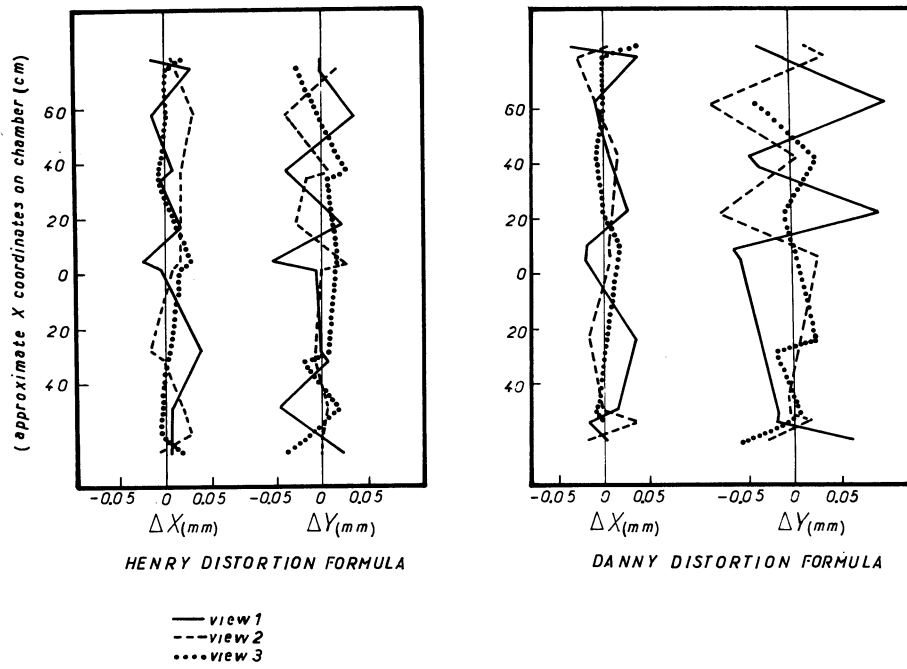


Fig. 1

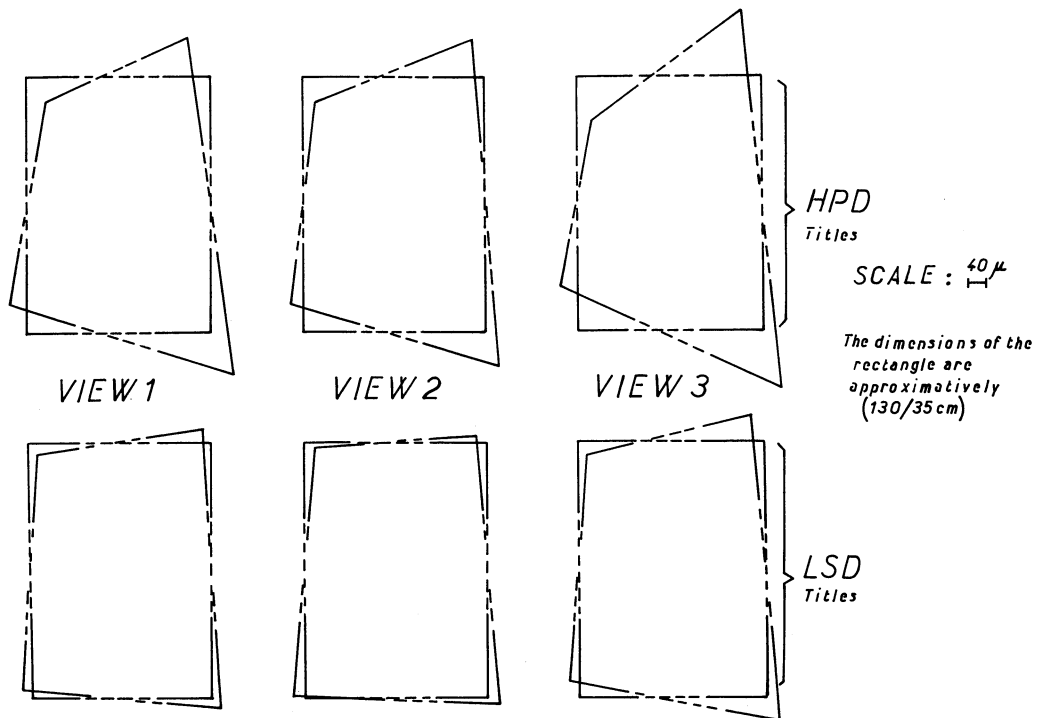


Fig. 2

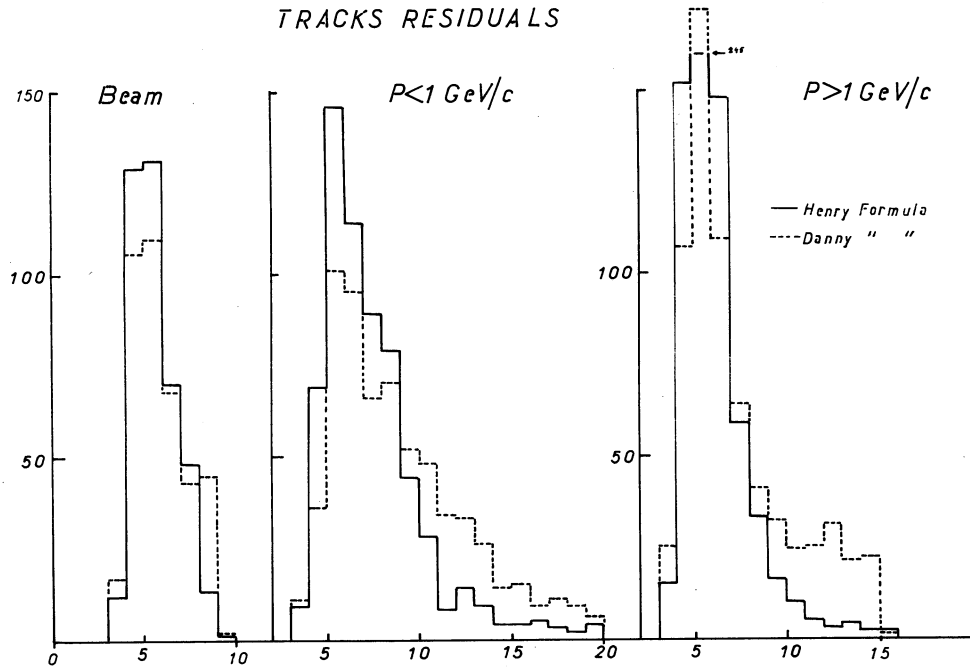


Fig. 3

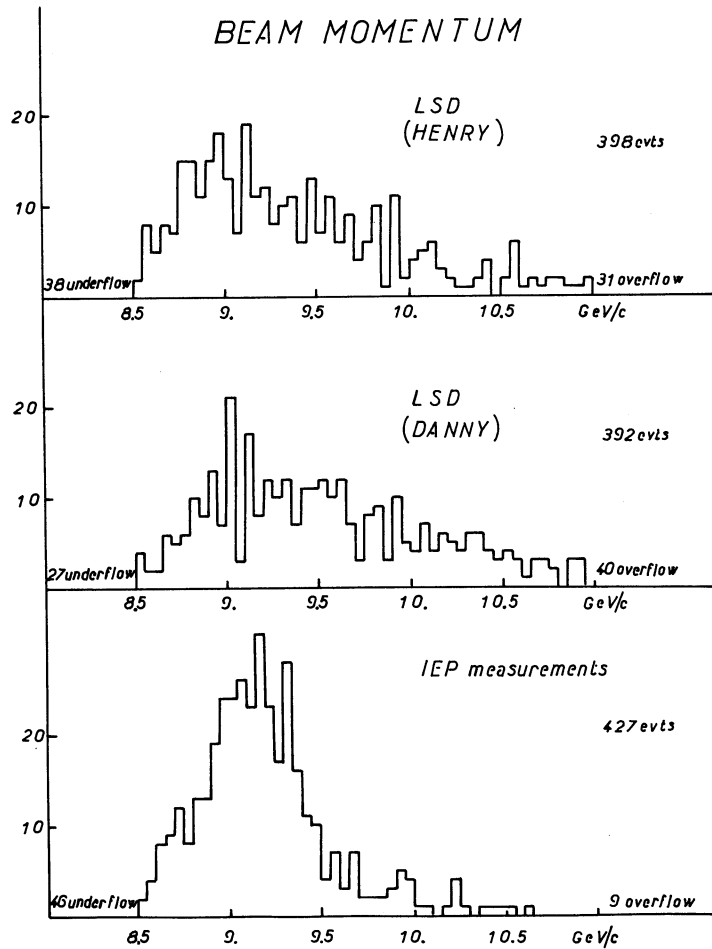


Fig. 4

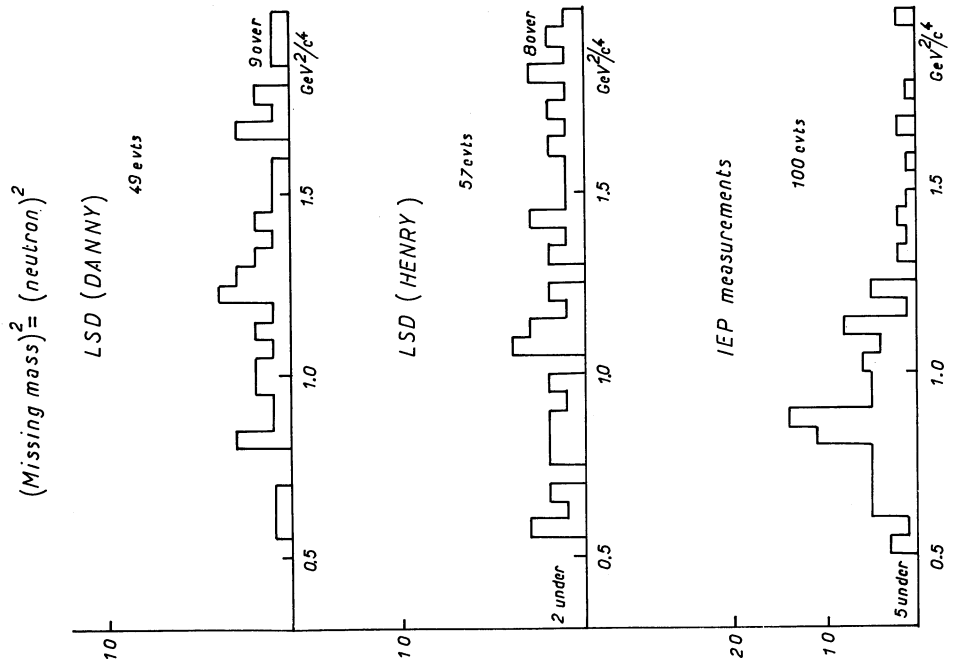


Fig. 6

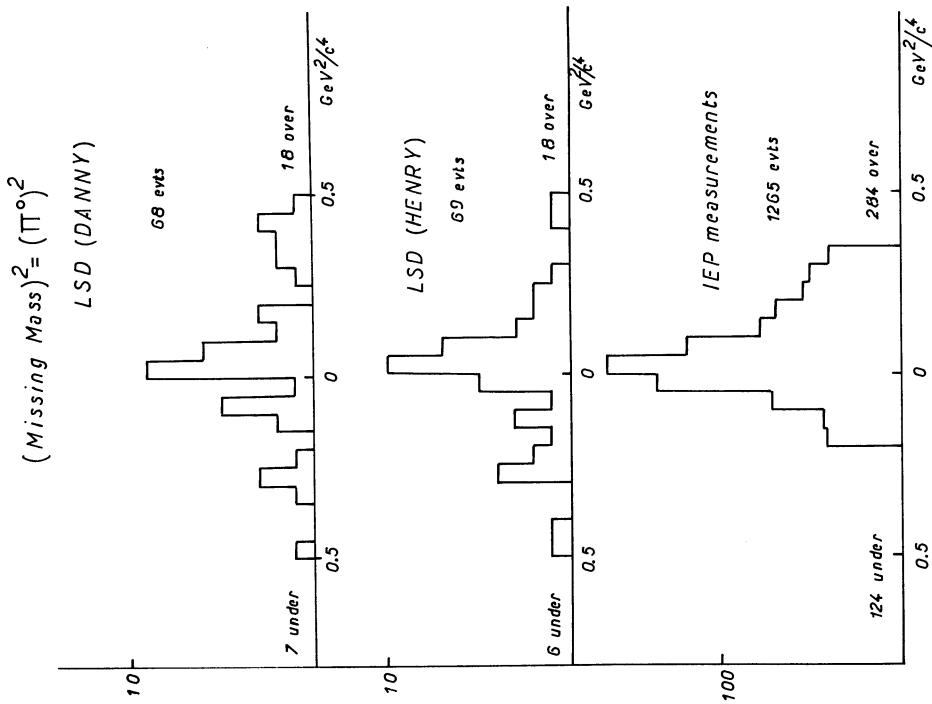


Fig. 5