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T 244
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Addendum to proposal T244 (as presented at the TC meeting of 26/3/75)

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In view of the fact that a $\bar{p}p$ low energy study is already in progress (exp. T239) a first step towards the goal of the proposed experiment would be to get a similar exposure of $\bar{p}d$ with statistics that will enable both a correlation of $\bar{p}p$ and $\bar{p}d$ results and sufficient $P_s$ events for the study around the $\bar{N}N$ threshold region.

Therefore the request is scaled down to $5 \times 10^5$ pictures with the following conditions

Beam 650 MeV/c $\pm$ 0.5%

Field 5 KG

3 $\bar{p}$ per picture

These conditions will allow the beam to stop in the chamber giving a continuous study of the $\bar{p}d$ crossection.

This will give $1.5 \times 10^6$ $\bar{p}d$ interactions of which

$\sim 8.5 \times 10^5$ $\bar{p}p$

$\sim 6.5 \times 10^5$ $\bar{p}n$

There will be $\sim 2 \times 10^5$ $p_s$ events.

Advantages:

A direct comparison can be done of $\bar{p}p$ and $\bar{p}n$. For this purpose only a part of the available $\bar{p}d$ annihilations need be measured. The isotopic spin content of the S(1936) (if it exists) will be clarified, and the $\bar{N}N$ low energy crossection will be known from these two experiments with much better accuracy than it is now.

The number of $P_s$ events is sufficient for an exploration of the threshold behaviour of the $\bar{p}n$ crossection and there is no loss in accuracy.

The disavantage is in the low magnetic field which will limit the accuracy of measurement in the curvuture of the tracks. Thus the objective of section C will become more difficult but not impossible. The measurement of the average energy of the charged tracks does not require high statistics and a result can be obtained with 10,000 events per beam energy interval. If $\Delta p/p$ of the pions is of the order of 10%, and 20.000 tracks are used for the calculation of average energies the statistical error will not exceed 1%. For the average energy of the $\gamma$ rays all the electron pairs in the exposure ($\sim$ 40000) would be needed.

In this limited exposure there will also be 10000 $\bar{p}n \to \pi^+\pi^-\pi^-$ events. At some stage it may be of interest to study the energy dependence of the Dalitz plot of the reaction. The experiment[1] that produced Fig.1 had a 13KG field and a $\Delta p/p$ for non steep ($< 45°$) tracks better than 0.03. We have made some MONTE CARLO calculations to see how the depletion in the center of the plot (Fig.1) is affected by the accuracy of measurement. A .400$(GeV/c^2)^2$ diameter hole was imposed on the phase space of the three pions and a $\Delta p/p$ created with a gaussian distribution of the percentage quoted. In Figure 2 we show how the definition of the diameter changes for $\Delta p/p = 0.15$.

We conclude that the low magnetic field will not prohibit the study of this channel.

If the result of the above study is encouraging (i.e. there are a number of resonances about the $\bar{N}N$ threshold) we may request an additional number of pictures.

Reference:

1. Phys. Rev. Lett. 20 402 (1968).

7 April, 1975

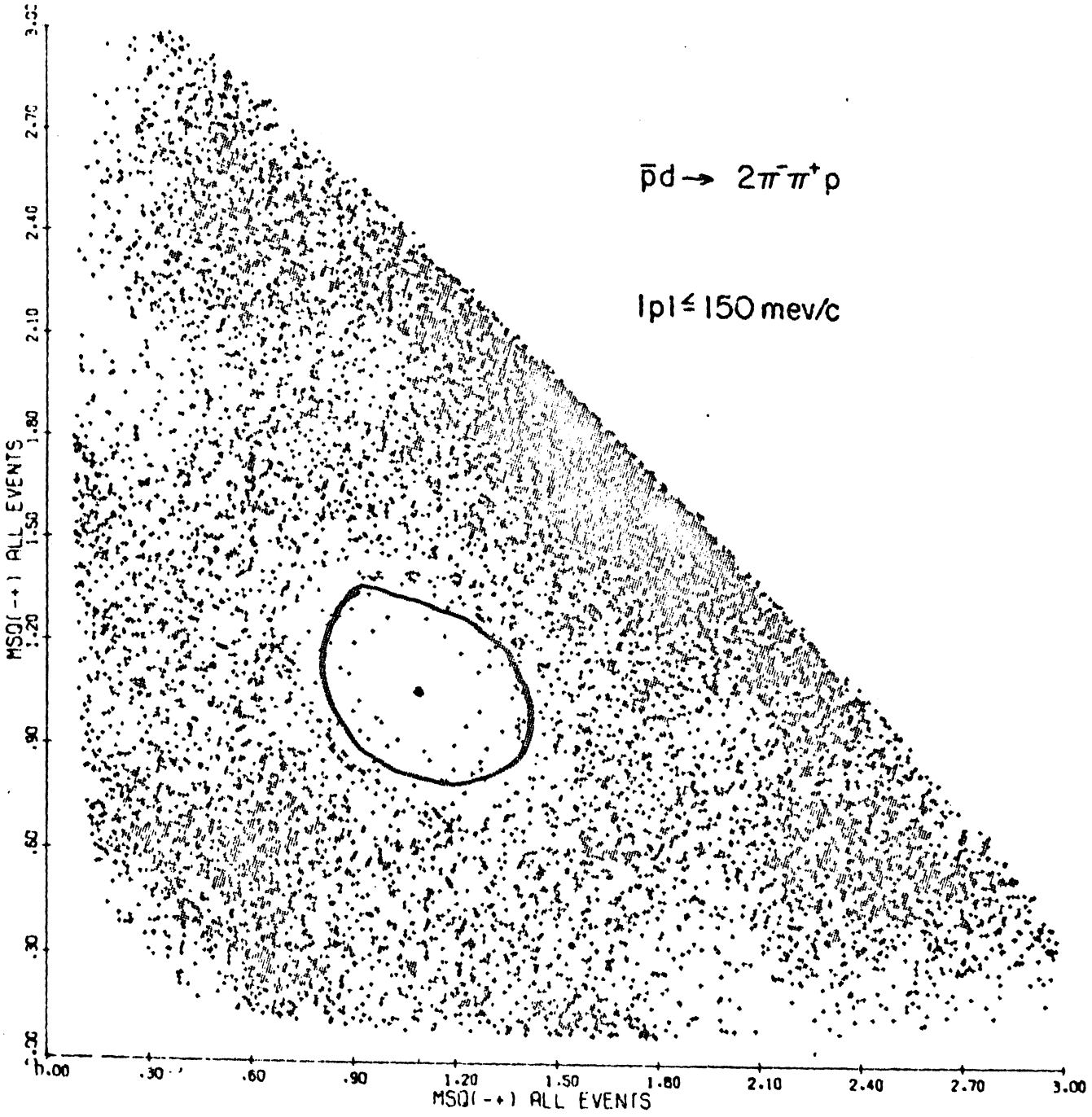
$\bar{p}d \rightarrow 2\pi^-\pi^+p$
$|p| \leq 150$ mev/c
MSQ(-+) ALL EVENTS
MSQ(-+) ALL EVENTS
.00
.30
.60
.90
1.20
1.50
1.80
2.10
2.40
2.70
3.00

FIGURE 1

MONTE-CARLO SCATTERGRAM

```
 7
SCAT   1
       HORIZONTAL  PLACE   3  WEIGTTWOPI      ..............................
         VERTICAL, PLACE   4    WEIGHTS  NEXT      ........  ........  ...
                   WEIGHT  3
```

Plot contains 2000 equivalent events. Highest bin (circled) contains 26 events

```
          I                  I                  I                  I                  I
        5 24 30 55 28 40 28 36 33 38 31 38 44  9 21 21 16 28 30 48
1.5000-
        0 22 16 28 28 19 19 24 34 23  7 26 24 33 22 18  6 17 21 43
1.4500-
        5 50 20 23 32 38 23 32 34 27 31 48 42 19 18 75 36 87 31 50
1.4000-
       18 21 25 21 25 63 33 64 39 17 37 56 24 44 25 49 37 23  9 34
1.3500-
       46 61 36 38 48 25 23 60 42 27 42 32 19 29 65 73 37 13  6 44
1.3000-
       11 41 39 62 49 82 80 33 27 11 44 27 18 35 53 37 45 23 41 14
1.2500-
       16 40 22 38 55 61 41 48 37 21 32 11 15 33 75 29 33 48 62 29
1.2000-
       11 17 61 33 79 36 44 17 26  9  5  4 17 18  8 22 12 32 16 41
1.1500-
       22 48 68 65 48 75 37  8  7  3  3  4  3 12 13 21 27 41 39 43
1.1000-
       20 51 30 43 47 66 38 13  6  1  0  3 12 18 13 58 53 41 47 69
1.0500-
       18 25 36 29 35 17 47 21  1  1  9  5  7  8 36 33 17 35 35 34
1.0000-
       18 23 32 32 34 17 25 15 36  6  5  8 12 15 32 46 63 37 26 22
0.9500-
       23 41 33 74 43 58 36 24 20 24 19 24 30 32 45 30 26 11 21 25
0.9000-
       15 34 29 (99) 48 56 23 28 60 37 29 42 41 19 30 70 54 23 31 18
0.8500-
       16 29 31 57 74 39 48 51 30 25 34 31 26 31 48 46 45 23 17 83
0.8000-
       20 28 60 33 46 25 33 52 71 37 79 54 35 71 26 38 27 13 21 74
0.7500-
        8 20 25 70 34 51 59 31 46 39 39 65 41 55 32 48 34 49 45 46
0.7000-
       13 26 23 33 62 47 55 39 50 29 42 26  9 56 29 54 16 26 31 33
0.6500-
        5 19 49 75 17 24 19 40 39 22 60 48 42 28 39 18 41 29  2 21
0.6000-
        8 15 16 11 10 17  7 13  6 12  5 18 14 11 24 28 11 19 22  6
          I                  I                  I                  I                  I
        0.600000           0.850000           1.100000           1.350000           1.600000

                                        MSQ(+)
```

MSQ(+)

$\frac{\Delta p}{p}$ = .15 for each pion.
The cross outlines the imposed circle assuming $\frac{\Delta p}{p}$ = 0. (see text)

FIGURE 2