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Modification of medium energy separated beam (MESB) B2

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Collider Accelerator Department

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MODIFICATION OF MEDIUM ENERGY SEPARATED BEAM (MESB) B2

J. D. Fox

A medium energy separated beam for the B target station was designed as part of the AGS Summer Studies by A.S. Carroll.[1] In this design momentum dispersion is provided by two septum magnets, giving a total of 4.6^{o} of bend, in front of the first quadrupole pair. Together with the production angle of 2.5^{o} this gives a beam line that is at an angle of 7.1^{o} with respect to the zero degree proton beam. This angle is uncomfortably small for accommodation of the zero degree unseparated beam from this target. An additional bending magnet would be desirable for the purpose of separating these two beams; it would also have the effect of orienting the MESB in such a direction that better use would be made of the available floor space in the East Experimental Building Addition (EEBA). However, in the Carroll design any additional bend would result in loss of particles at the end of the long line of electrostatic separators when the beam is operated at its maximum momentum acceptance, $\pm$ 3%. Even with only the two septum magnets, the dispersion at the end of this long straight section is so large that the particles will barely fit into a 12-in. quadrupole. The design proposed here is a modification of the Carroll design which will permit an additional bend to be introduced in front of the separators without having particles lost at the end of the separator chain. The proposed modification is shown in Figure 1.

The two septum magnets and the first two two quadrupoles are placed as in the Carroll design. The next element D3 is an 18C72 magnet which introduces an additional bend of 6.4°. The next element is a 12Q30 magnet, Q3, which is horizontally focusing; the gradient in this is rather weak, but it is sufficient to more than cancel the additional dispersion introduced by the 18C72 so that the horizontal beam is now contained in an 8-in. dia. pipe at the end of the separators. Figure 2 shows the images in horizontal phase space at this point. The horizontal rays are brought to a focus at this point, and,because this is a good dispersed image,it is proposed to put the sextupole at this point. The beam is brought to a focus at the mass slit by two 12Q60's and the rest of the beam is as in the Carroll proposal.

Figures 3 shows the vertical images at the mass slit for various momentum bites. These can be compared with the similar plots in the Carroll proposal. Because of magnet Q3, the vertical acceptance of this beam is increased from ± 2.3 mrad to ± 4 mrad an increase in solid angle of 74%. The larger vertical acceptance is desirable except in the case of very highest momenta, 5 GeV/c K or 8 GeV/c $\bar{p}$, for which magnet Q3 can be turned off. The beam will then revert to the Carroll design,but,because of the small momentum bite,the particles will still be contained at the end of the separator chain. Figure 4 shows the K-π separation with magnet Q3 off.

References

1. A.S. Carroll, AGS Summer Studies 1970.

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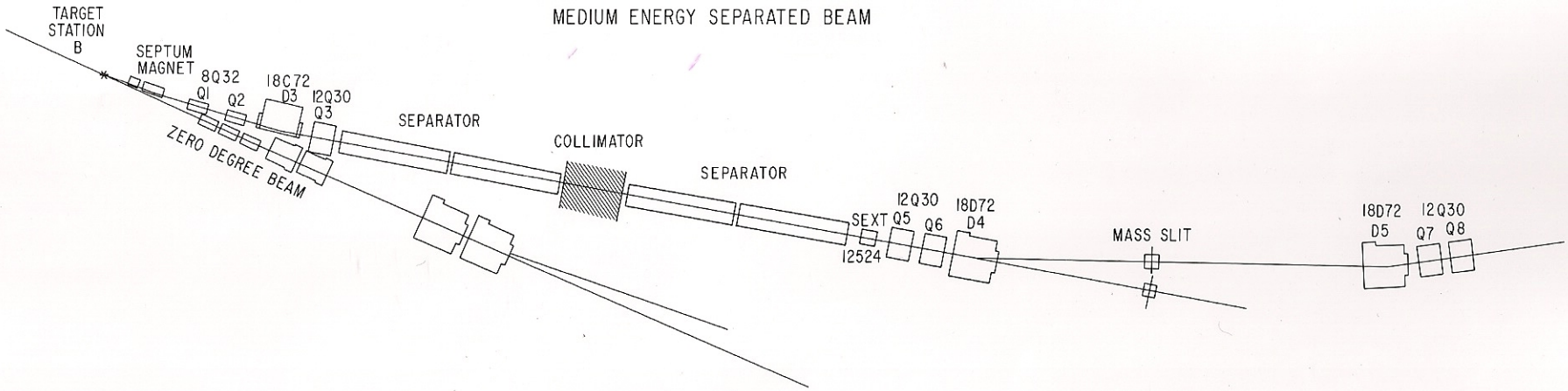
MEDIUM ENERGY SEPARATED BEAM
TARGET STATION B
SEPTUM MAGNET
8Q32
Q1
Q2
18C72
D3
12Q30
Q3
ZERO DEGREE BEAM
SEPARATOR
COLLIMATOR
SEPARATOR
SEXT
12524
12Q30
Q5
Q6
18D72
D4
MASS SLIT
18D72
D5
12Q30
Q7
Q8

Fig. 1

HORIZONTAL PHASE SPACE AT END OF SEPARATOR CHAIN

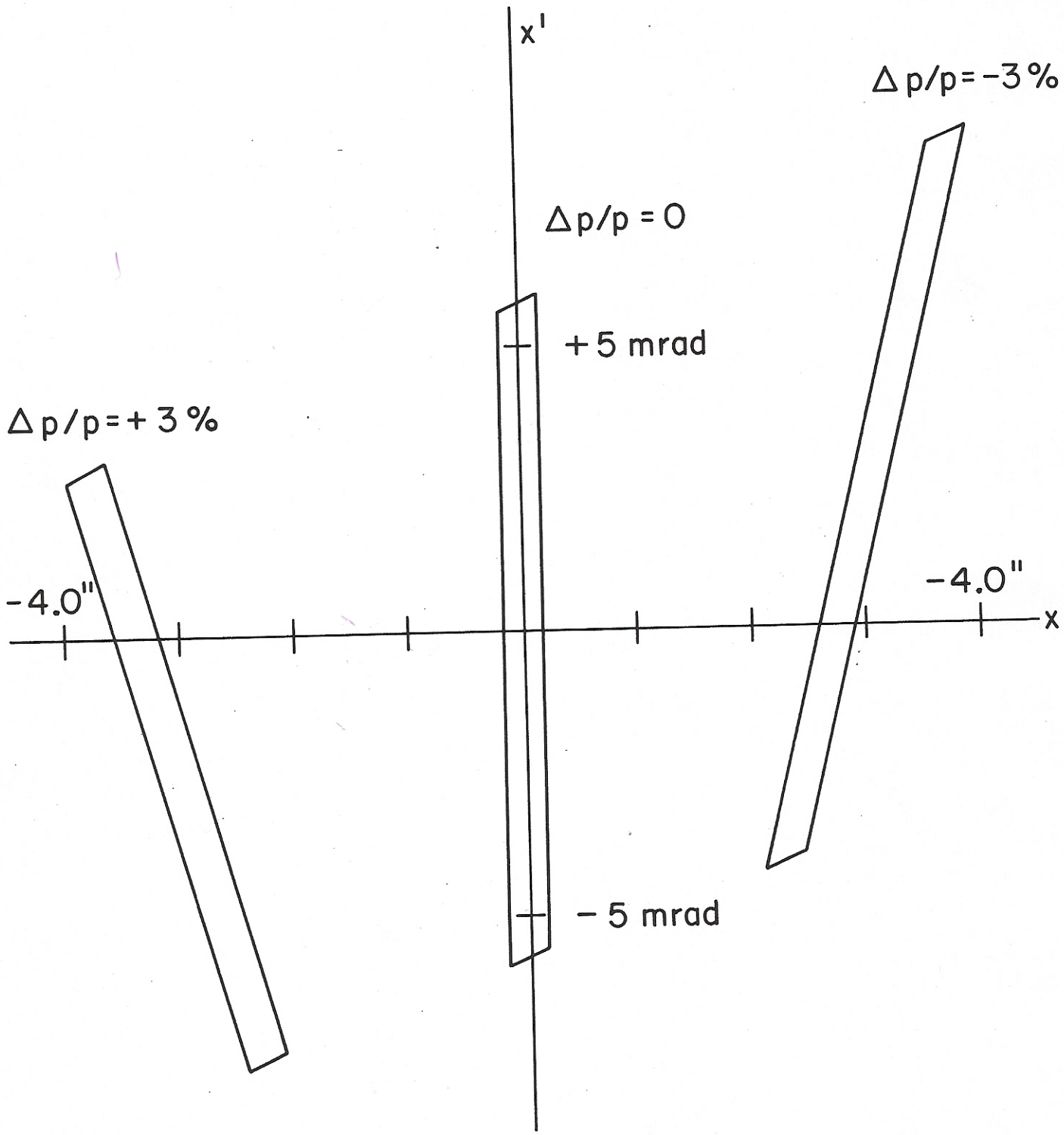

Figure 2

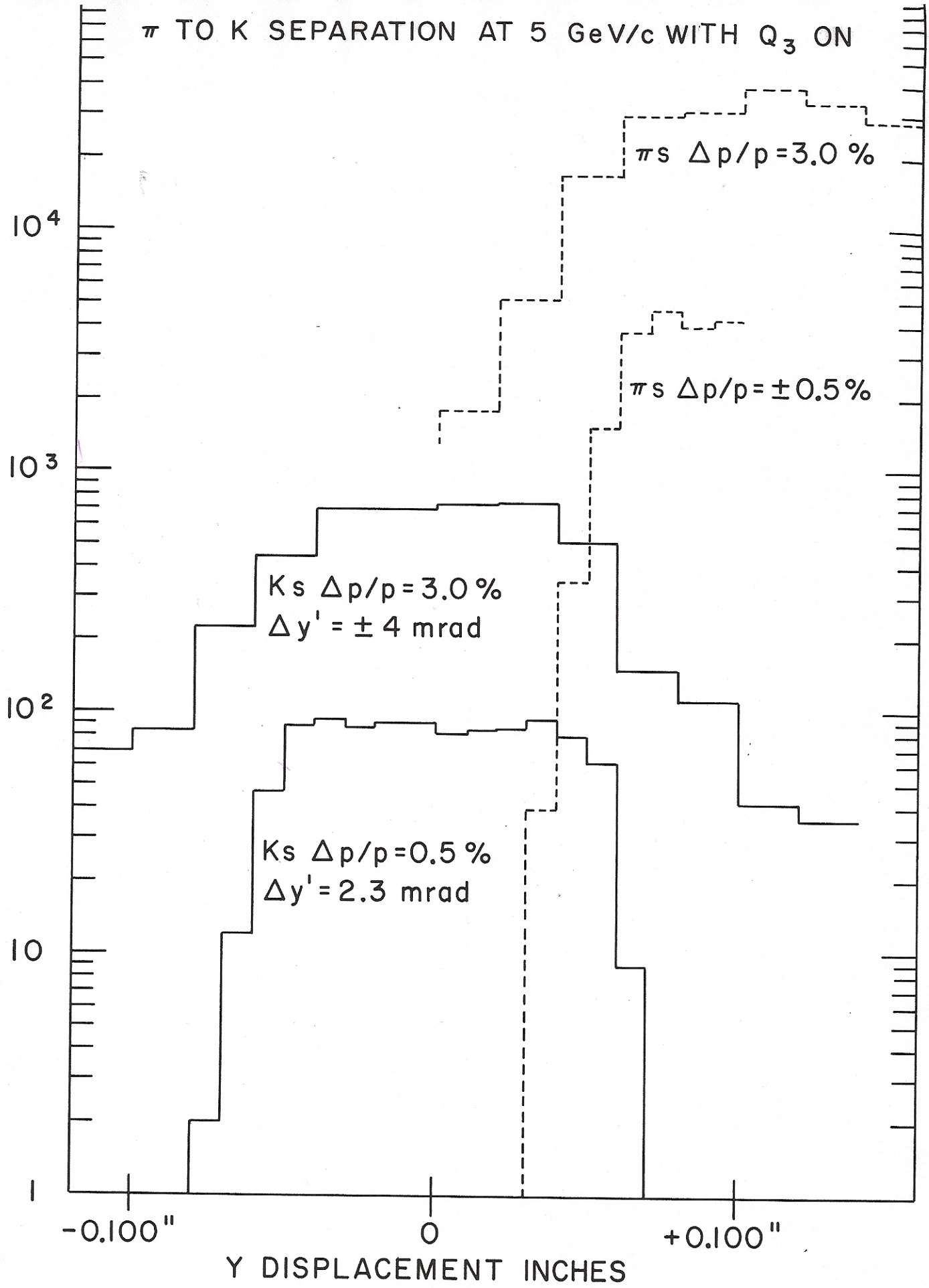
π TO K SEPARATION AT 5 GeV/c WITH Q_3 ON
πs Δp/p=3.0 %
πs Δp/p=±0.5%
Ks Δp/p=3.0 %
Δy' = ± 4 mrad
Ks Δp/p=0.5 %
Δy' = 2.3 mrad
10^4
10^3
10^2
10
1
-0.100"
0
+0.100"
Y DISPLACEMENT INCHES

Figure 3

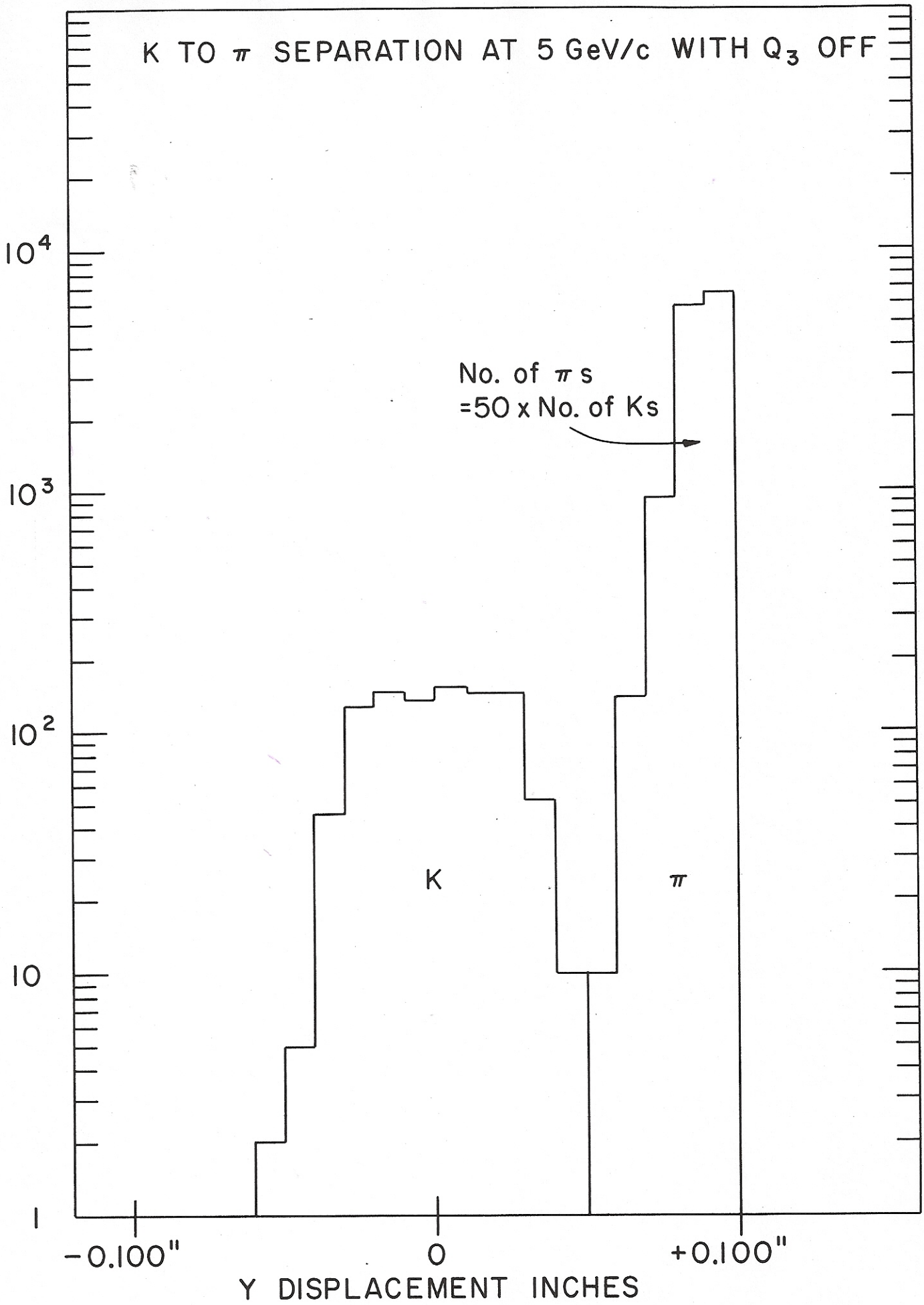
K TO π SEPARATION AT 5 GeV/c WITH Q3 OFF
No. of π s
=50 x No. of Ks
10^4
10^3
10^2
10
1
K
π
-0.100"
0
+0.100"
Y DISPLACEMENT INCHES

Figure 4