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Design of an 800 MeV/c separated beam II

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EP & S DIVISION TECHNICAL NOTE

No. 20

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DESIGN OF AN 800 MeV/c SEPARATED BEAM II

A previous paper[1] describes the design of a separated 800 MeV/c beam to be run in parallel with the 0^{o} pion beam from the S95 target in the slow external beam. Some modifications have been made in this design to accommodate the requirements of the 0^{o} beam, to allow cleaner separation of K's from π's and to utilize as far as possible existing magnets.

A layout of the modified beam is shown in Fig. 1. This is the same basic design as in I except that magnet Q3 has been eliminated. Magnets Q1 and Q2 are N8Q12's which will have to be specially ordered. Magnets Q3 and Q4 are Cosmotron 8Q12's and magnets Q5 and Q6 are 8Q24's. A special septum, denoted 10C20, and 2 standard 18D36 are also required. The limit on momentum is the 10C20. Design studies indicate that this magnet will permit this beam to be operated up to 1.0 GeV/c; higher momentum can be obtained only by going to higher production angles with corresponding degradation of the quality of the vertical image at the mass slit and loss of intensity. The other quadrupoles operate comfortably within their limits. A drawing of the front end of the beam is shown in Fig. 2., compared to the previous design the 10C20 has been moved downstream to permit better clearance for the 0^{o} pion beam. The central production angle remains at 10.5^{o}. The vertical images at the mass slit for 800 MeV K's and pions are shown in Fig. 3. This is a cleaner separation than was obtained in the earlier design. The intensity of the beam has been reduced. Acceptance is now ± 11 mrad vertically. Using

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the same production data as in I, we expect 1.5×10^5 K^+/pulse at the second focus for 10^{12} protons incident on a 1 interaction length target.

Several prospective users have expressed interest in the size of the horizontal image at the second focus. The proposed design as shown in Fig. 1 gives a momentum recombined image at the second focus with 0.7:1 magnification; the horizontal image size is shown in Fig. 4. This is about the smallest horizontal spot size that can be obtained and is achieved at the cost of having rather sharply converging rays (± 100 mrad for the off-momentum). Other possibilities for the design of the beam following the mass slit have been investigated and may prove more convenient for some experiments. One design has Q5 and Q6 in front of D3; D3 can then be used as a switching magnet so that two experiments can be set up at the same time. One beam will be partially momentum-recombined giving about 1" width spot while the other leg will be highly momentum-dispersed.

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FIG. 1 LAYOUT OF 800 Mev/c BEAM

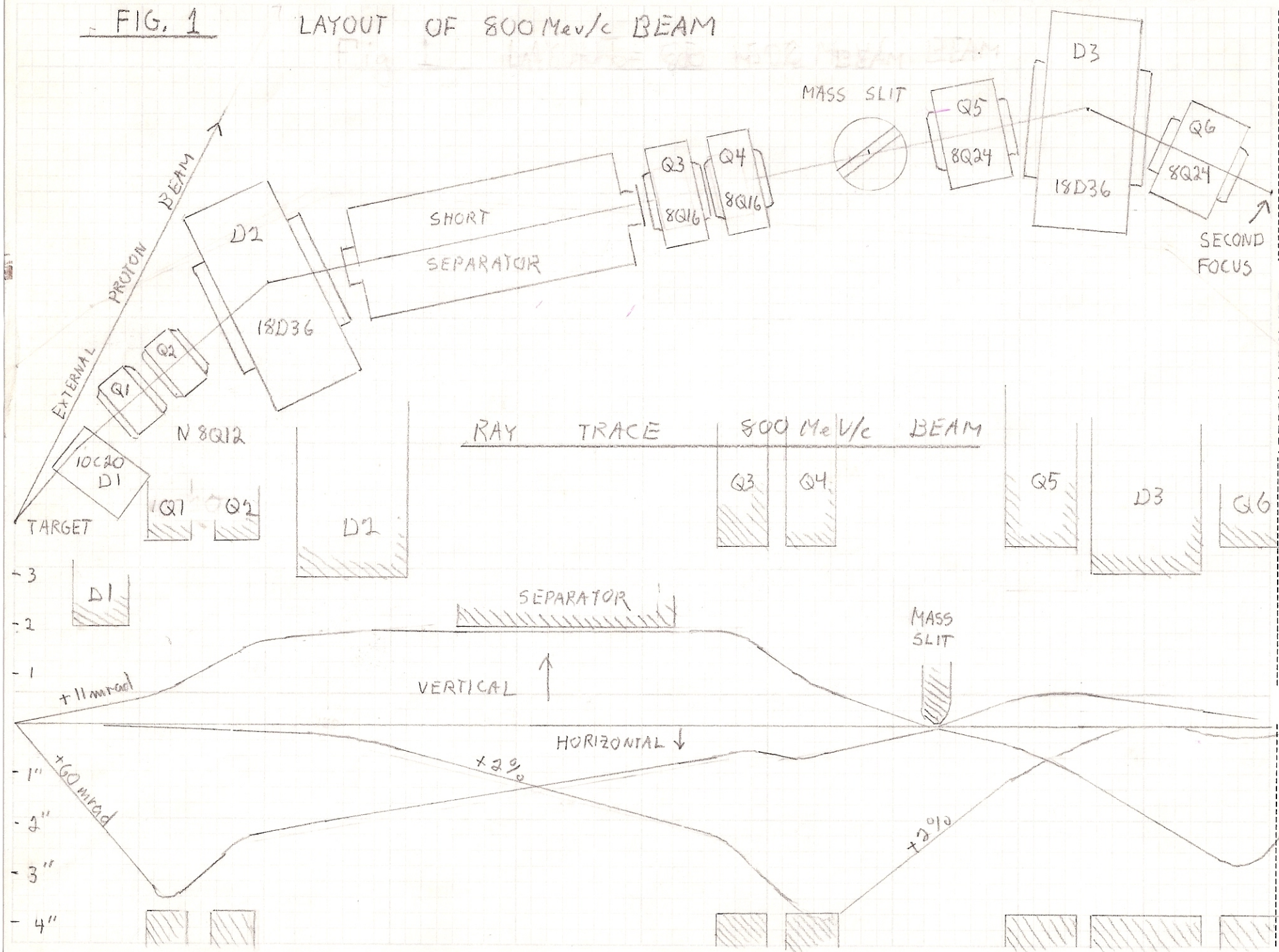

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FIGURE 2 FRONT END OF 800MEV/c BEAM

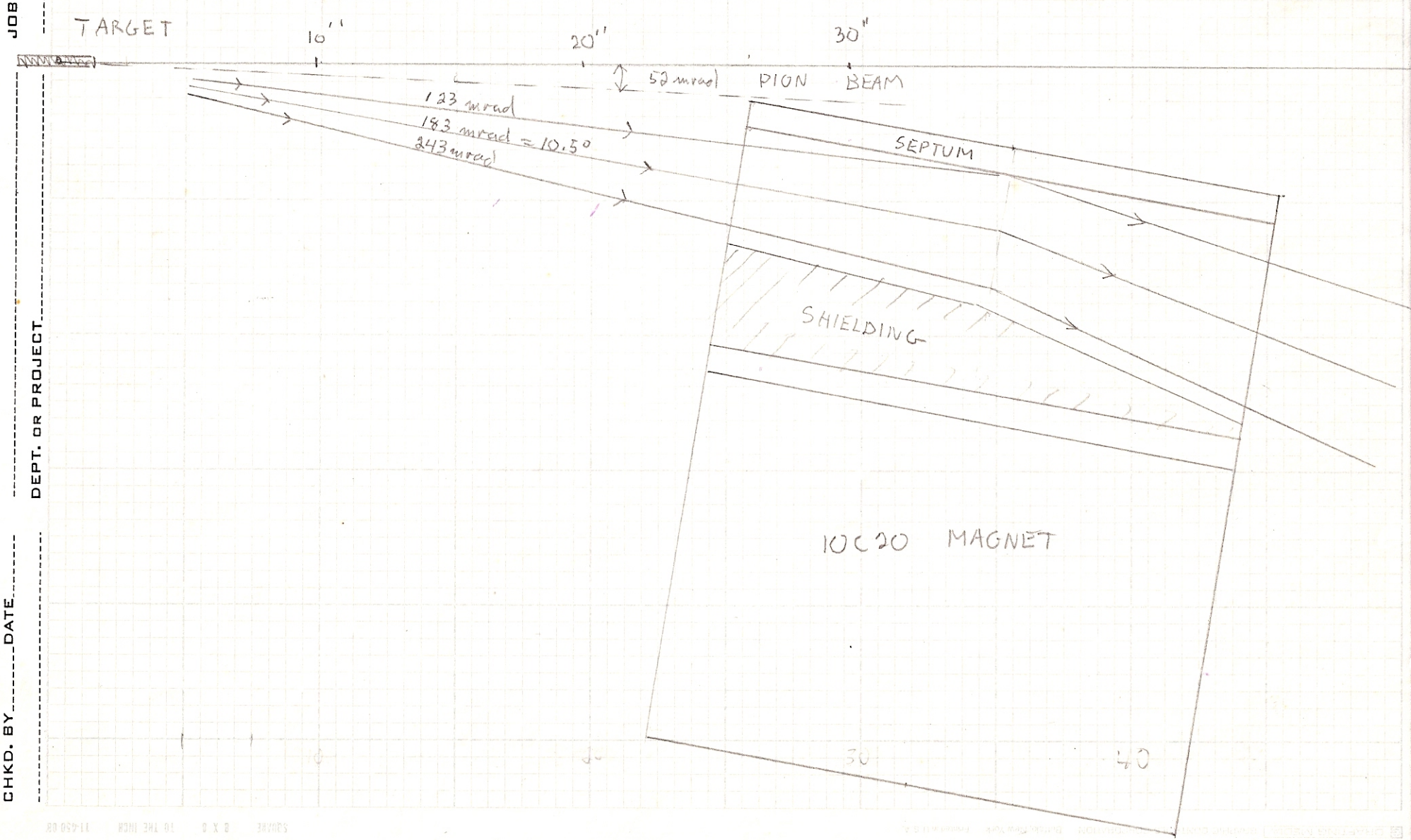

FIGURE 3

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VERTICAL IMAGE AT MASS SLIT, EQUAL POPULATIONS OF K AND π

P = 800 MeV/c V = 500 KV ACROSS 4"

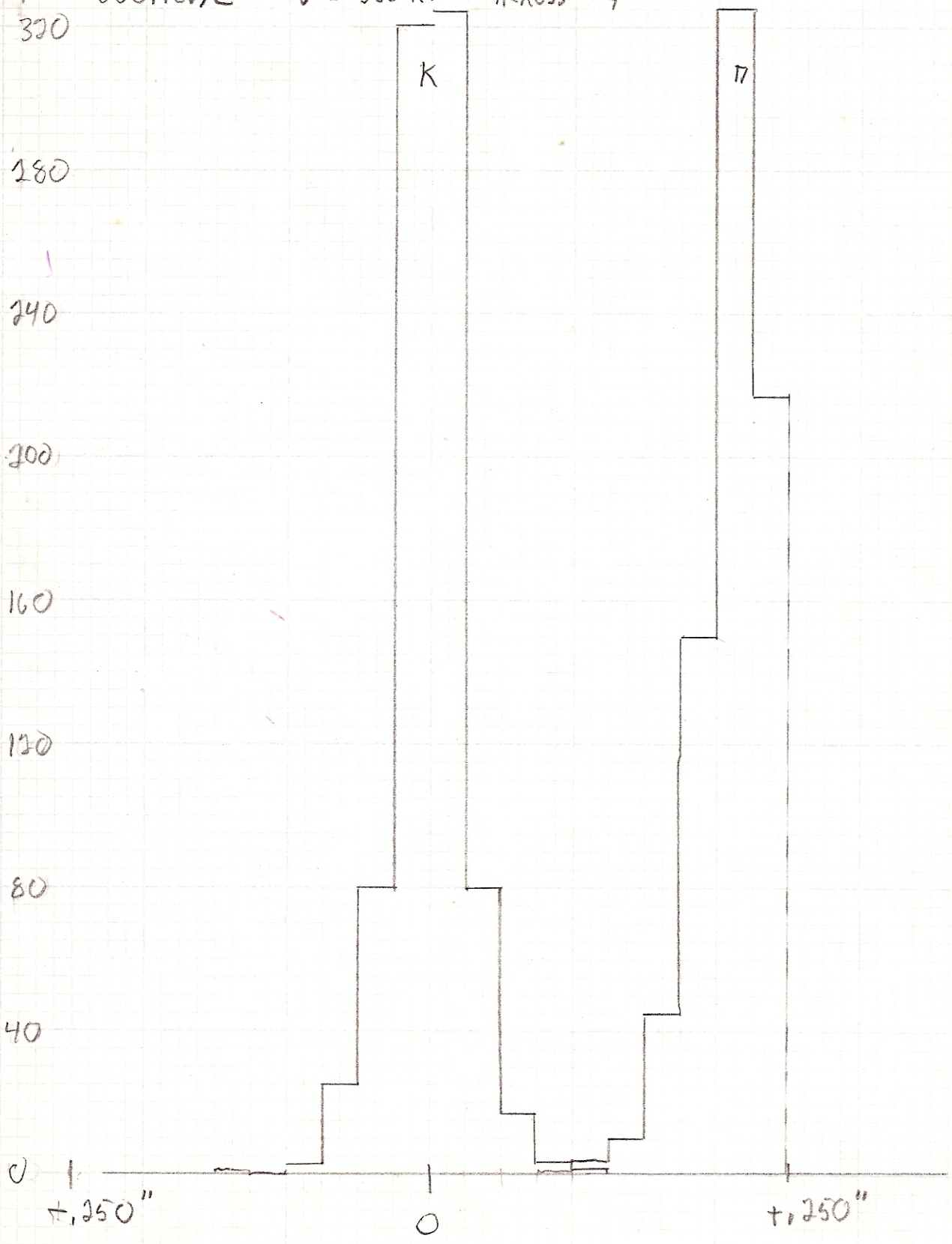

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FIG 4 HORIZONTAL PROFILE AT SECOND FOCUS