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LOW ENERGY SEPARATED BEAM AT THE CERN P.S.

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A two stage electrostatically separated beam has been built to provide 800 MeV/c K^+ and K^-. Lower energies are obtained by energy loss in an absorber at the end of the beam. The most interesting parameters are shown in the Table.

The layout of the beam in the experimental area on the inside of the proton synchrotron is shown in Figure 1. Figure 2 shows the path of the extreme rays in each plane, for the central momentum. Particles emerging from the target at 15° to the internal beam enter a special 0.5 meter magnet bending 14°, avoiding the fringing field of the next PS magnet and allowing the first quadrupole to be brought closer to the target than would otherwise be possible. The accelerator and separator vacua are isolated by mylar windows located 35 cm from the target. The vertical and horizontal collimators following the special magnet are adjustable from outside the vacuum. All the slits and collimator are tapered to fit the beam. The following quadrupole[1)] focuses horizontally, but all the vertical focusing required to make the beam parallel in the vertical plane in the first separator is provided by the one meter bending magnet, which bends 41°. The aberrations in this magnet have been reduced from $\sim$60 o/o to $\sim$ 1 o/o by shimming. After the next quadrupole there is a double focus at the first mass slit. To avoid the chromatic abberation which would be caused by the $\pm$ 1 o/o momentum band accepted, the slit is set at 45° to the beam, to lie along the locus of the vertical focus for varying momenta. This locus is

at a reasonable angle only because of the large momentum dispersion, 10 cm/1 o/o $\Delta P/_P$, which also makes it convenient to introduce a polyethylene wedge at this point to reduce the spread in momentum, to a calculated $\sim$4 MeV/c. This large dispersion makes it necessary to place the mass slit inside a field lens, acting in the horizontal plane, to avoid a loss in the second stage of particles at the extremes of the momenta accepted by the first slit. This lens refocuses the different momenta into the last quadrupole, where the horizontal excursions are largest.

The vertical focusing before the second separator is also provided by a one meter magnet bending 41°, but if the focusing were normal, there would be an abberation caused by the difference in the distance from the magnet to the different parts of the cocked mass slit. Since the beam has divergred very little horizontally at this point, this abberation was corrected by introducing a sextupole term in the focusing of the bending magnet in the course of the shimming. Final foci are made after the second separator by a quadrupole doublet.

The measurement of the final image width confirms the effectiveness of the correction of the aberration, since the target size and the chromatic abberation added in quadrature would give 3.3. mm.

The beam is now being used to provide 800 MeV/c K^+ for a heavy liquid bubble chamber. It is planned to do experiments with stopped K^-, and the $\bar{p}$ flux measurement shows that it may be useful for a stopping $\bar{p}$ beam.

Acknowledgements

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1) All the quadrupoles have a 20 cm. bore. The first four are 22 cm. long, the last is 100 cm.

Figure Captions

Fig. 1 - The layout of the beam in the Hall of the CERN PS.

Fig. 2 - The extreme rays in each plane, for the central momentum.

Table Captions - Beam Properties.

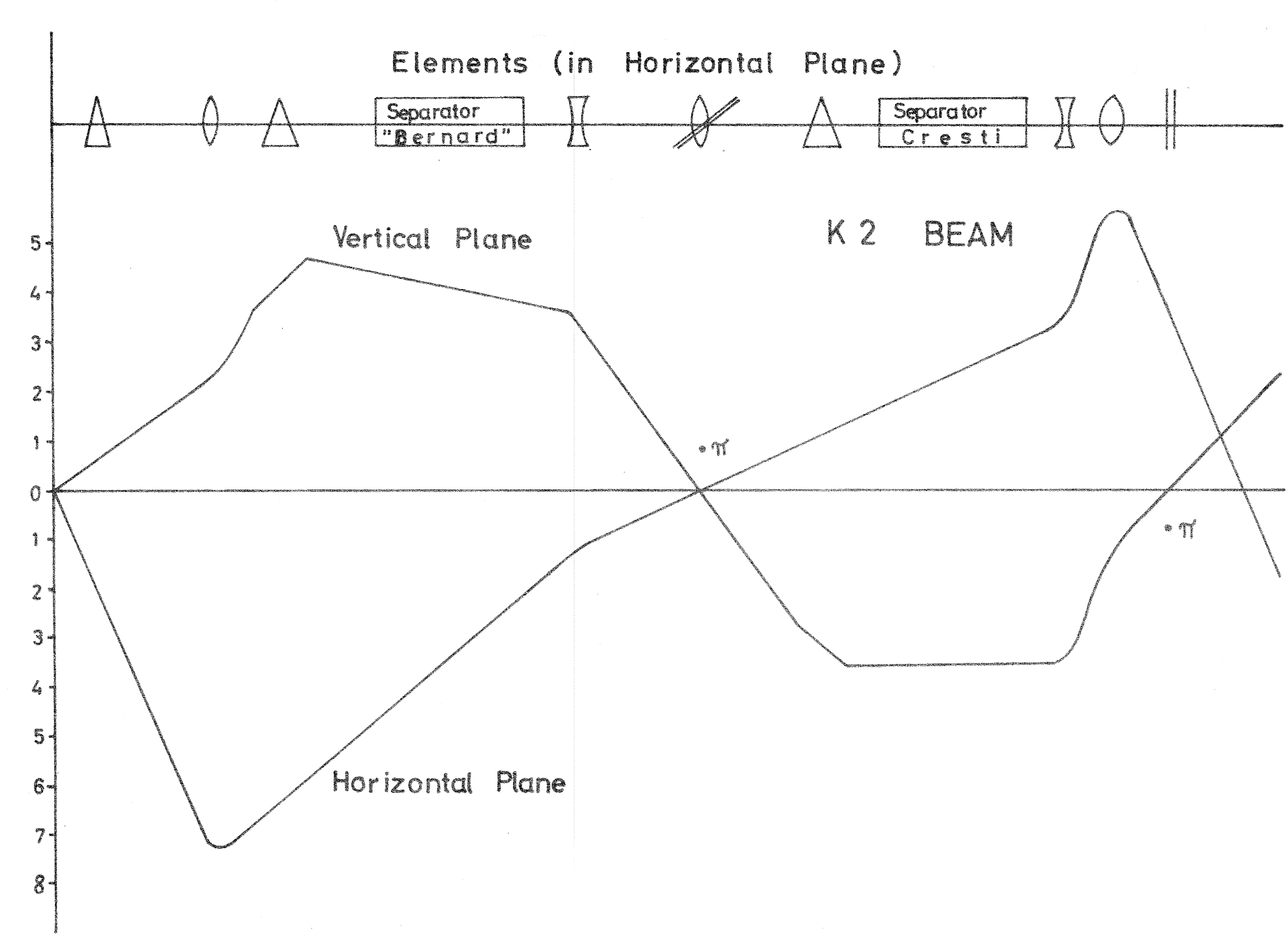
Table - Beam Properties

1. Momentum, p = 800 MeV/c
2. Δ p = 15 MeV/c
3. Ω = 0.6 x 10^{-3} str. maximum, performance figures are given for 0.45 x 10^{-3} str.
4. Length = 22 m. Decay factor = 1.65 for π, 39.7 for K
5. Target = 2 (high) x 4 (wide) x 38 mm Be.
6. Rejection ratio of $\pi + \mu$ when set for K $\sim$ 1 - 2 x 10^4
7. Flux after second mass slit, per 10" protons of 19 GeV/c, measured with a slow burst:

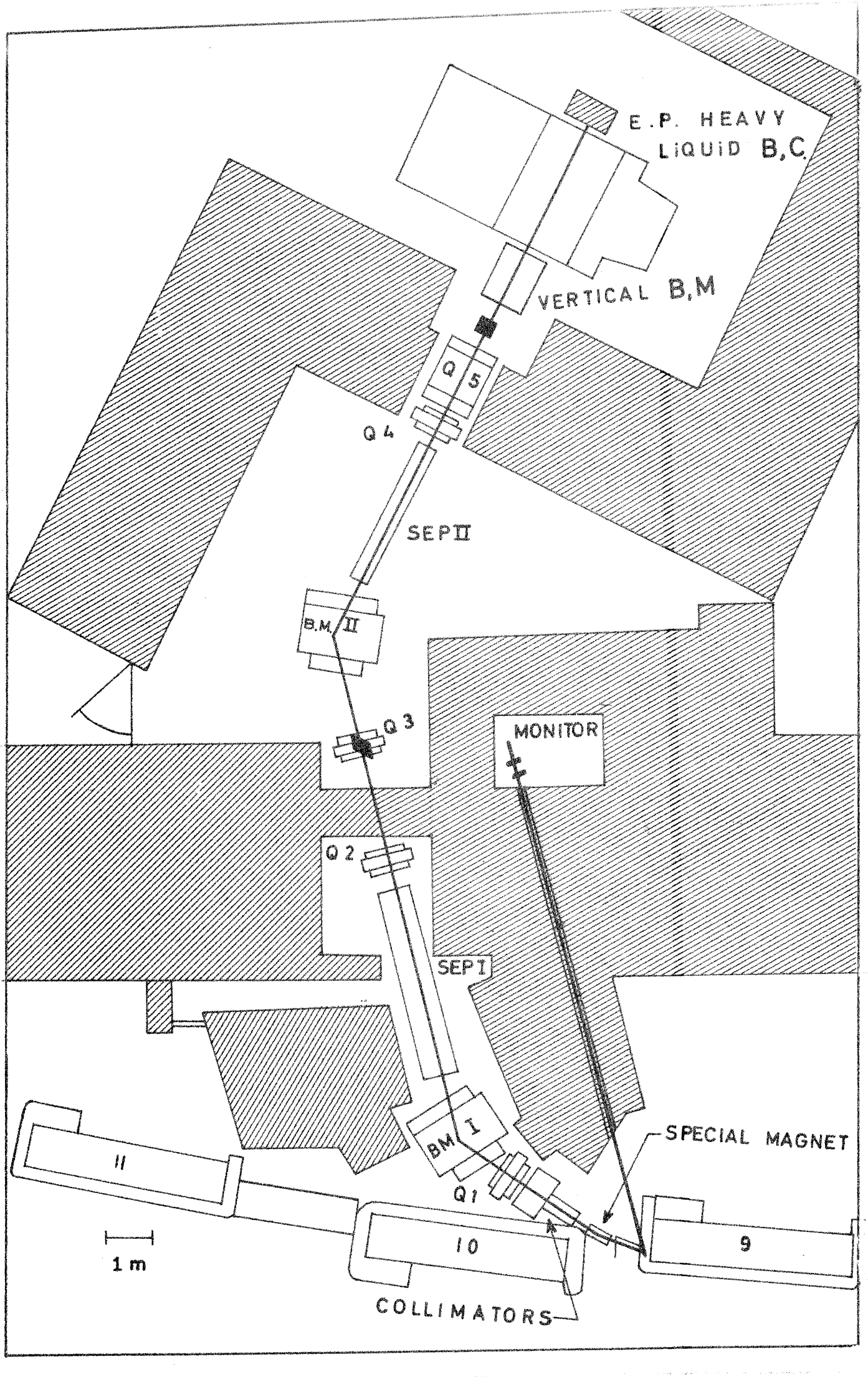
$\pi^{\pm}$	K^+	K^-	$\bar{p}$
0.36 x 10^5 (corresponds to 0.6 x 10^5 at target)	57	21	$\sim$5

8. Geometrical parameters:

Parameter	1st stage	2nd stage
Separator Plate Length	3 m	3 m
Separator Gap	10 cm	6 cm (for Ω=0.45x10^{-3} str)
Separator Voltage	460 KV	240 KV
Horizontal Magnification	4.9	0.19 (0.9 overall)
Vertical Magnification	0.54	1.33 (0.72 overall)
Vertical Image of Target (calculated)	1.1 mm	1.4 mm
Measured Vertical Image Size	< 3 mm	< 2.3 mm
K - π separation	8 mm	8 mm
Momentum Dispersion	10 cm/1 o/o $\frac{\Delta p}{p}$	0.4 cm/1 o/o $\frac{\Delta p}{p}$


Elements (in Horizontal Plane)
Separator "Bernard"
Separator Cresti
Vertical Plane
K 2 BEAM
Horizontal Plane
• π
• π
5
4
3
2
1
0
1
2
3
4
5
6
7
8

PS/3381


E.P. HEAVY
LIQUID B,C.
VERTICAL B,M
Q 5
Q 4
SEP II
B.M. II
Q 3
MONITOR
Q 2
SEP I
BM 1
Q 1
SPECIAL MAGNET
11
10
9
1 m
COLLIMATORS