

A 500 MeV/c two stage separated kaon beam

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Abstract

A design is presented for a clean 500 MeV/c two stage separated kaon beam. The channel uses 1.2 m long crossed field separators with a voltage of 600 kV over a 12 cm vertical gap. Second order aberrations are corrected with 3 sextupoles. The beamline is 14.6 m long, including a 1.5 m long drift after the last quadrupole Q10. Two mass slits with 6 mm to 8 mm apertures remove 99.0 to 99.5 percent of the pions produced in the production target, the direct pions. The remaining 0.5 to 1.0 percent is removed by a fixed piece of beamblocker in Q8 at the cost of a few percent of kaon intensity. Cloud pions are sufficiently removed by the system of two mass slits. The muon contamination is negligible. The channel can also operate satisfactorily at 550 MeV/c. The channel has no octupoles. However, small octupole components built into Q2, Q3 and Q6 have been considered and give possibly useful results. That has to be studied further. The beamline is 14.6 m long. The survival rate is 2.0 percent for kaons and 59 percent for pions, a difference of a factor 30. If it is assumed arbitrarily that the production ratios at 120 GeV proton energy between 500 MeV/c pions and kaons is a factor 20, then at the end there will be 600 times as many pions as kaons. If a fraction of one tenth of a percent of the pions is transmitted that will correspond to 60 percent of the kaon beam.

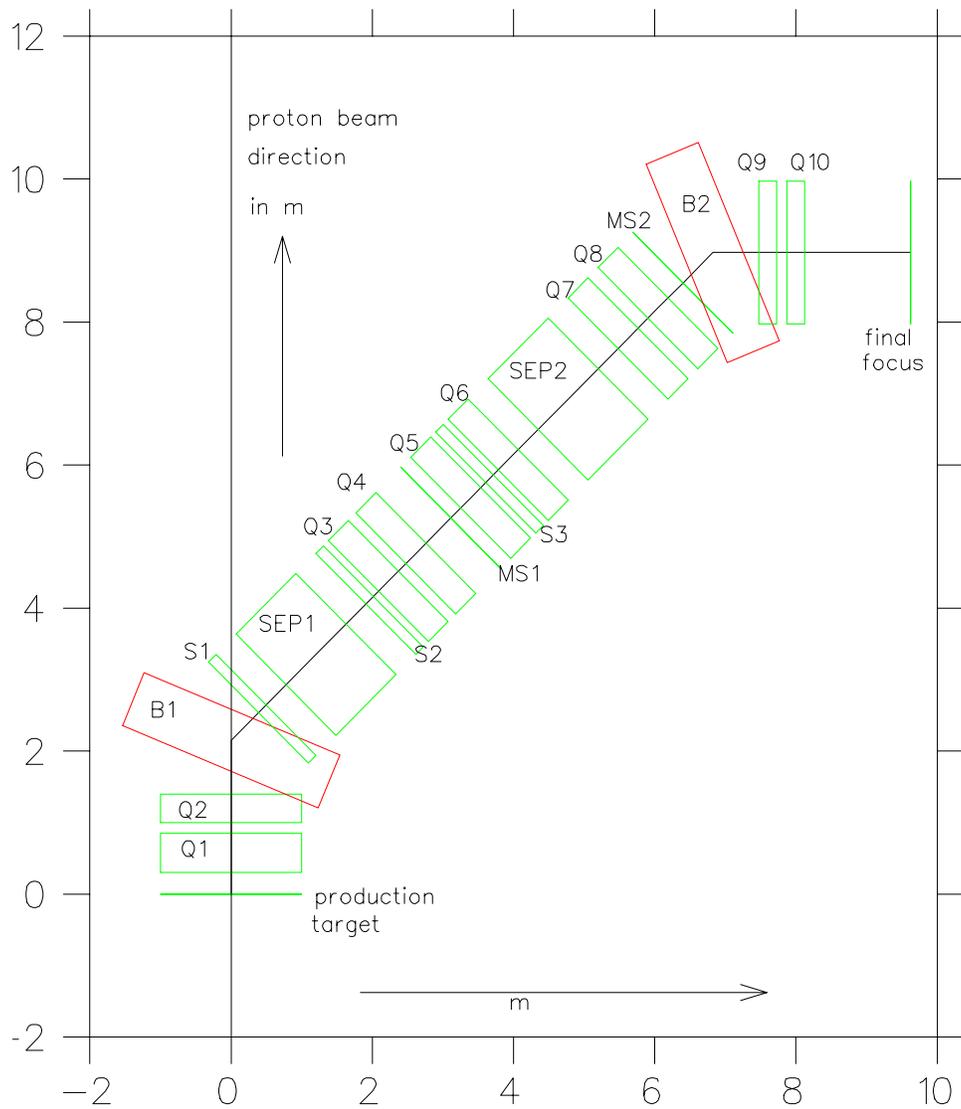


Figure 1: The beam line layout

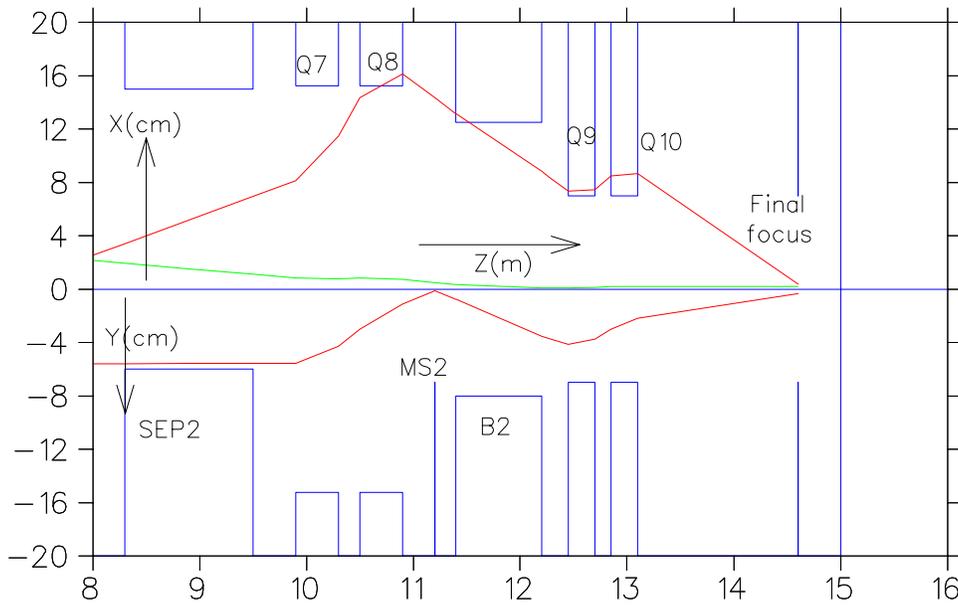
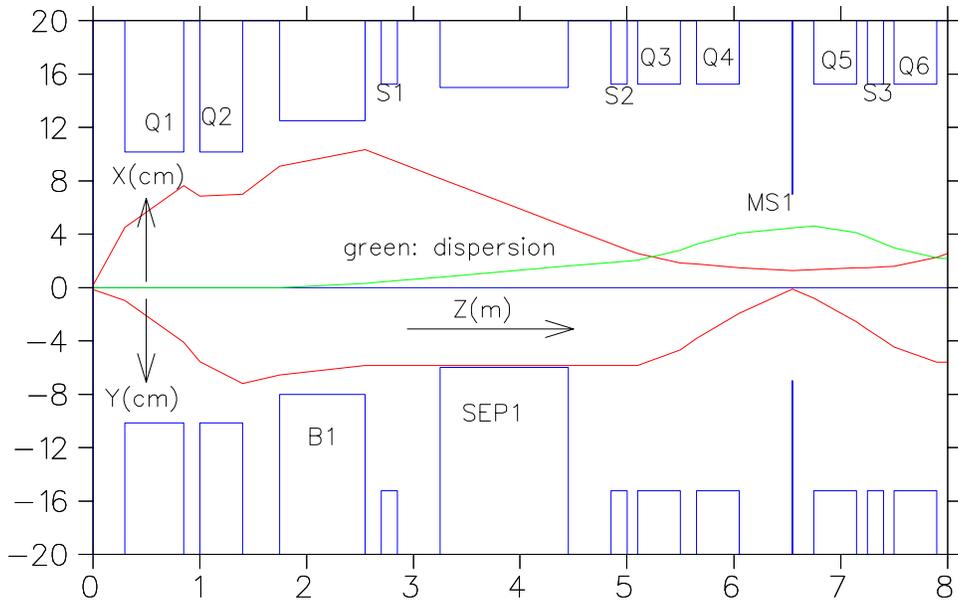


Figure 2: The beam envelopes

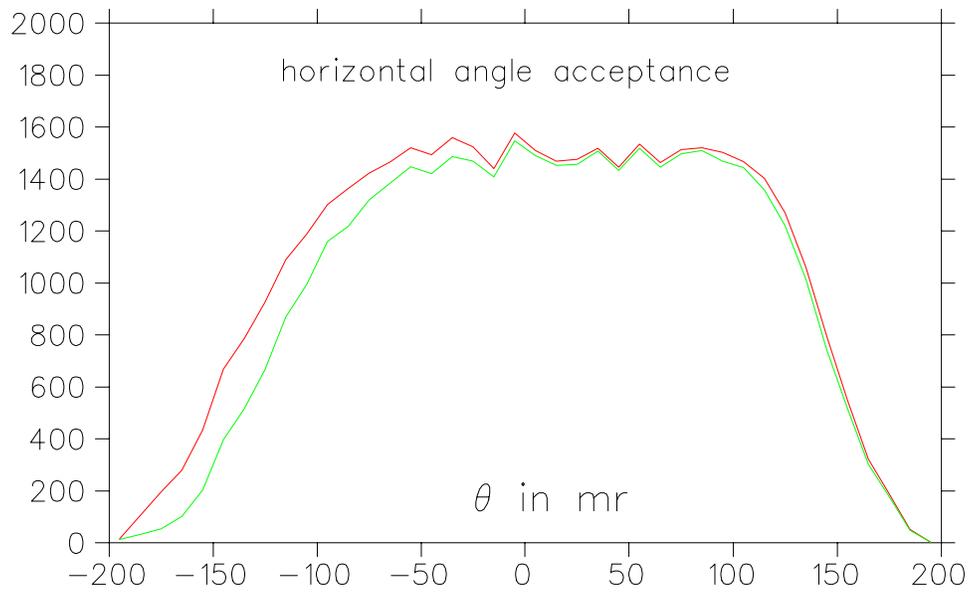
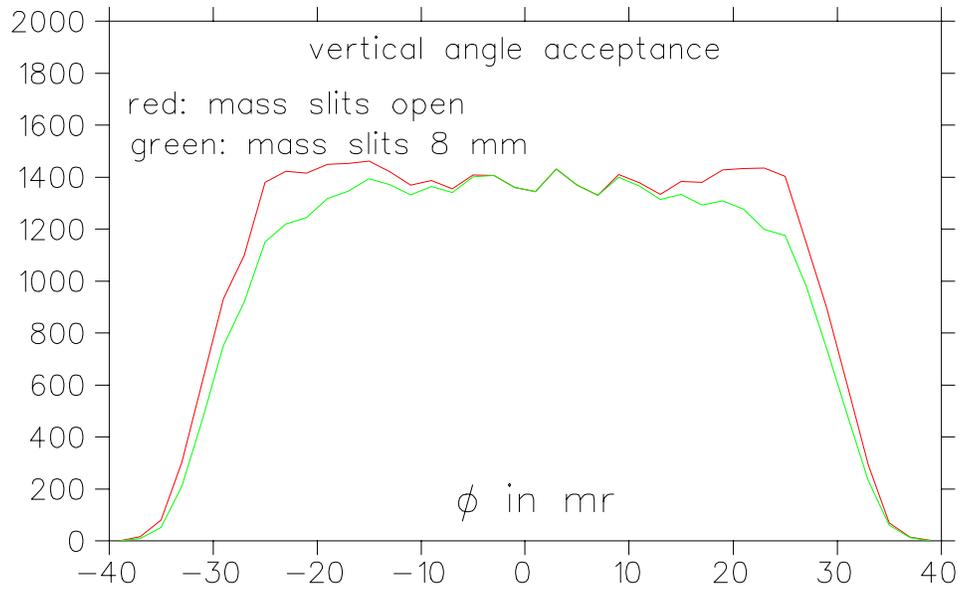


Figure 3: The horizontal and vertical angle acceptance averaged over the accepted momentum bite. MS1 and MS2 have 8 mm aperture

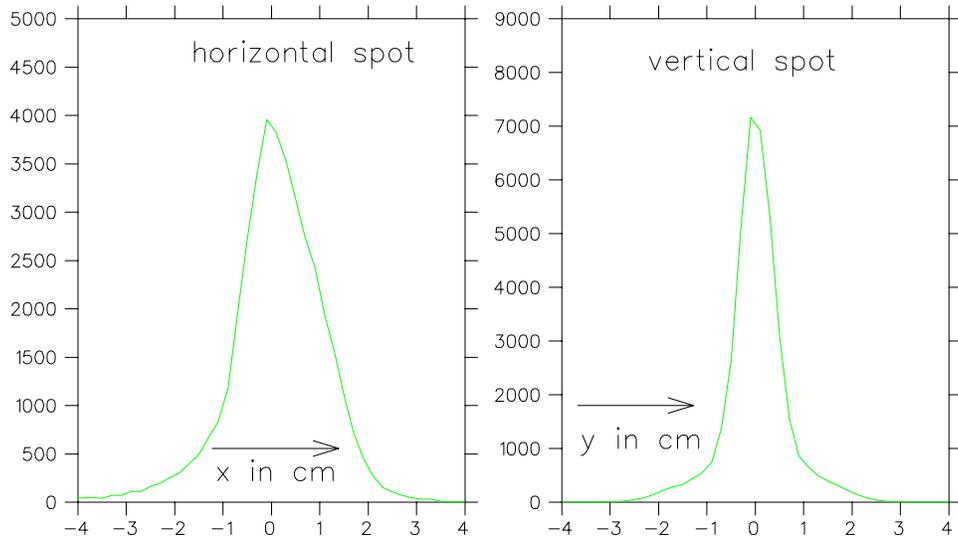
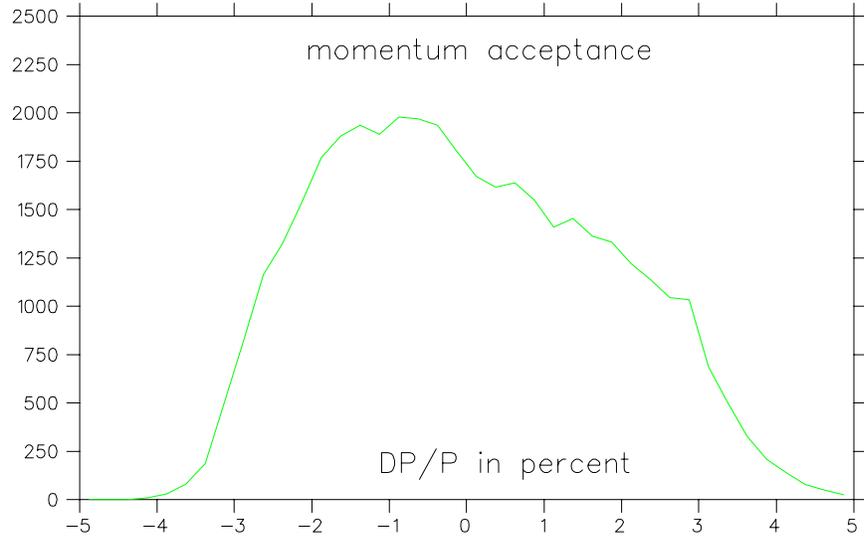


Figure 4: The final spot size and the momentum acceptance. MS1 and MS2 have 8 mm aperture.

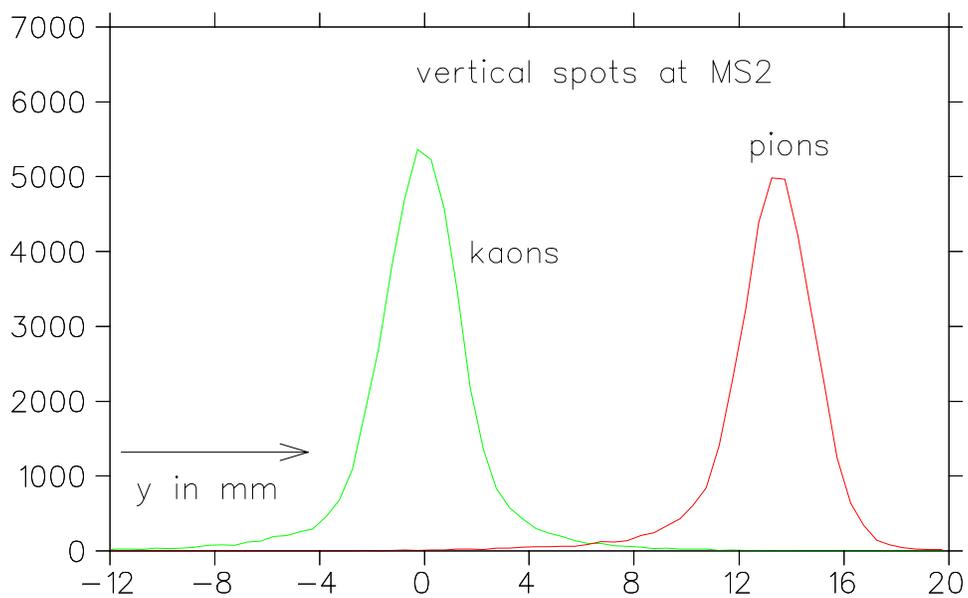
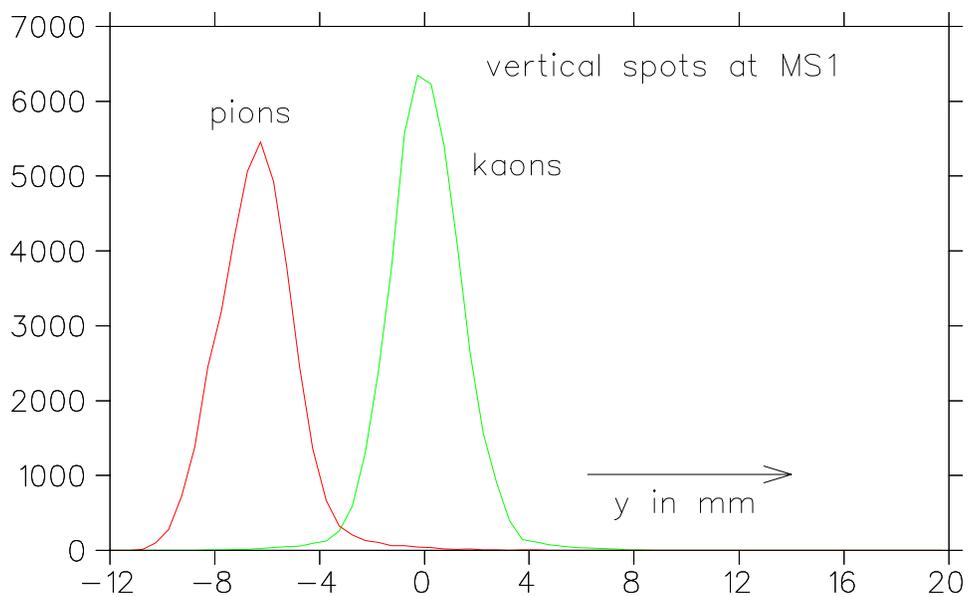


Figure 5: Vertical kaon and pion spots at the mass slits. For kaons at MS1 FWHM is 3.1 mm, FWQM is 4.4 mm. At MS2 FWHM is 3.3 mm, FWQM is 4.7 mm.

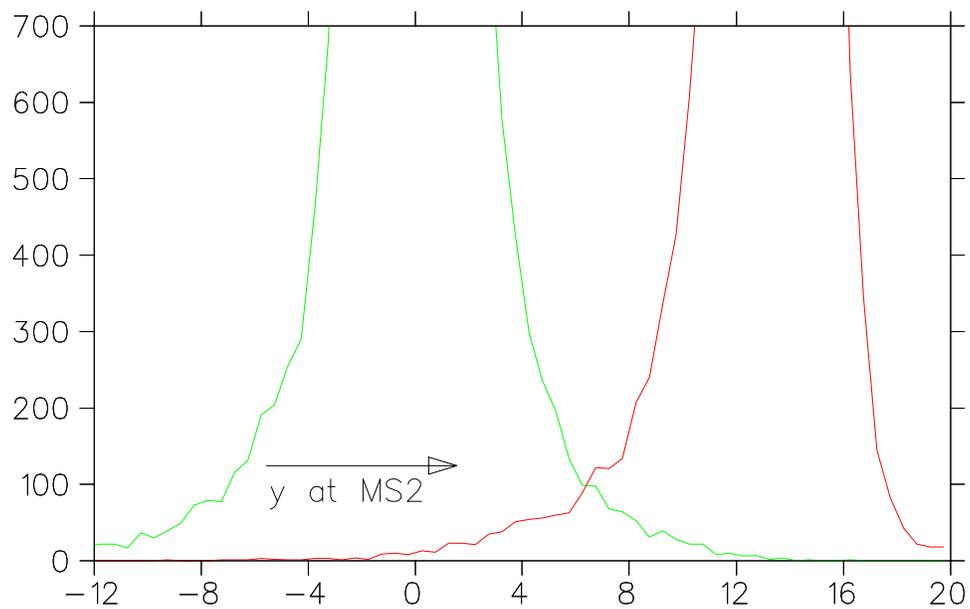
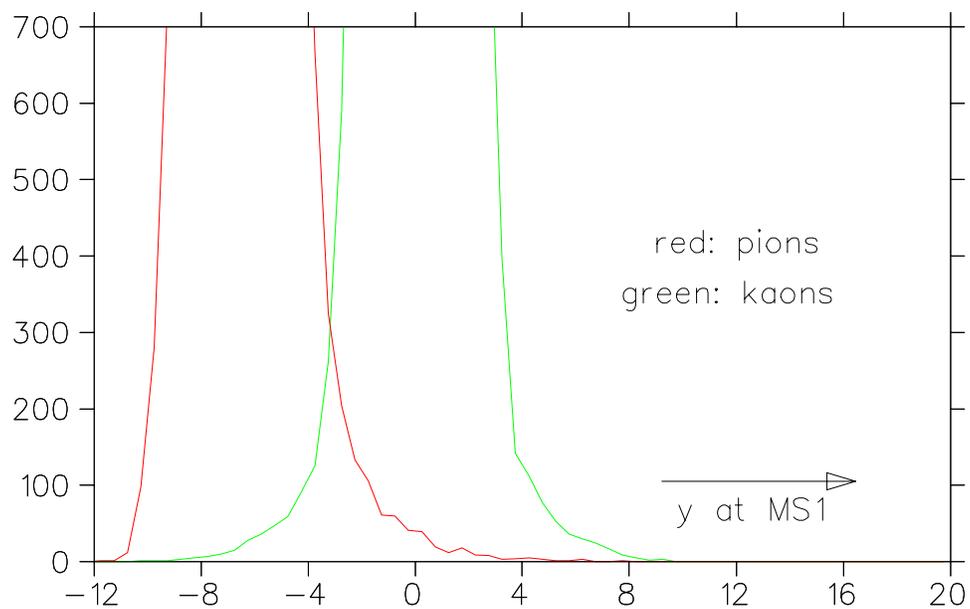


Figure 6: Vertical kaon and pion spots at the mass slits. Same as previous plot but vertical scale factor 10 different to show the tails.

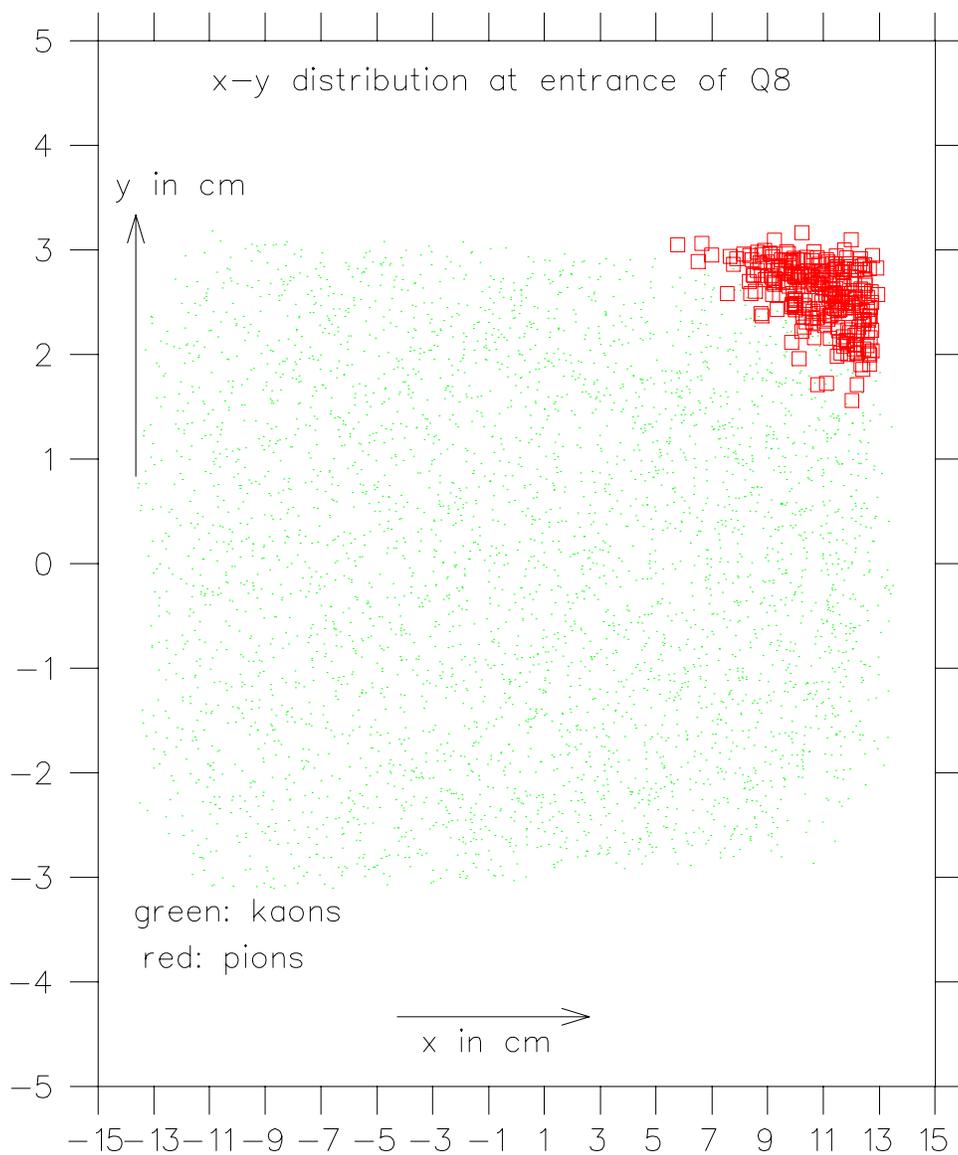


Figure 7: Kaon and pion scatter plot at the entrance of Q8 for those particles transmitted through the mass slits when their apertures are 8 mm. This is a crucially important picture!

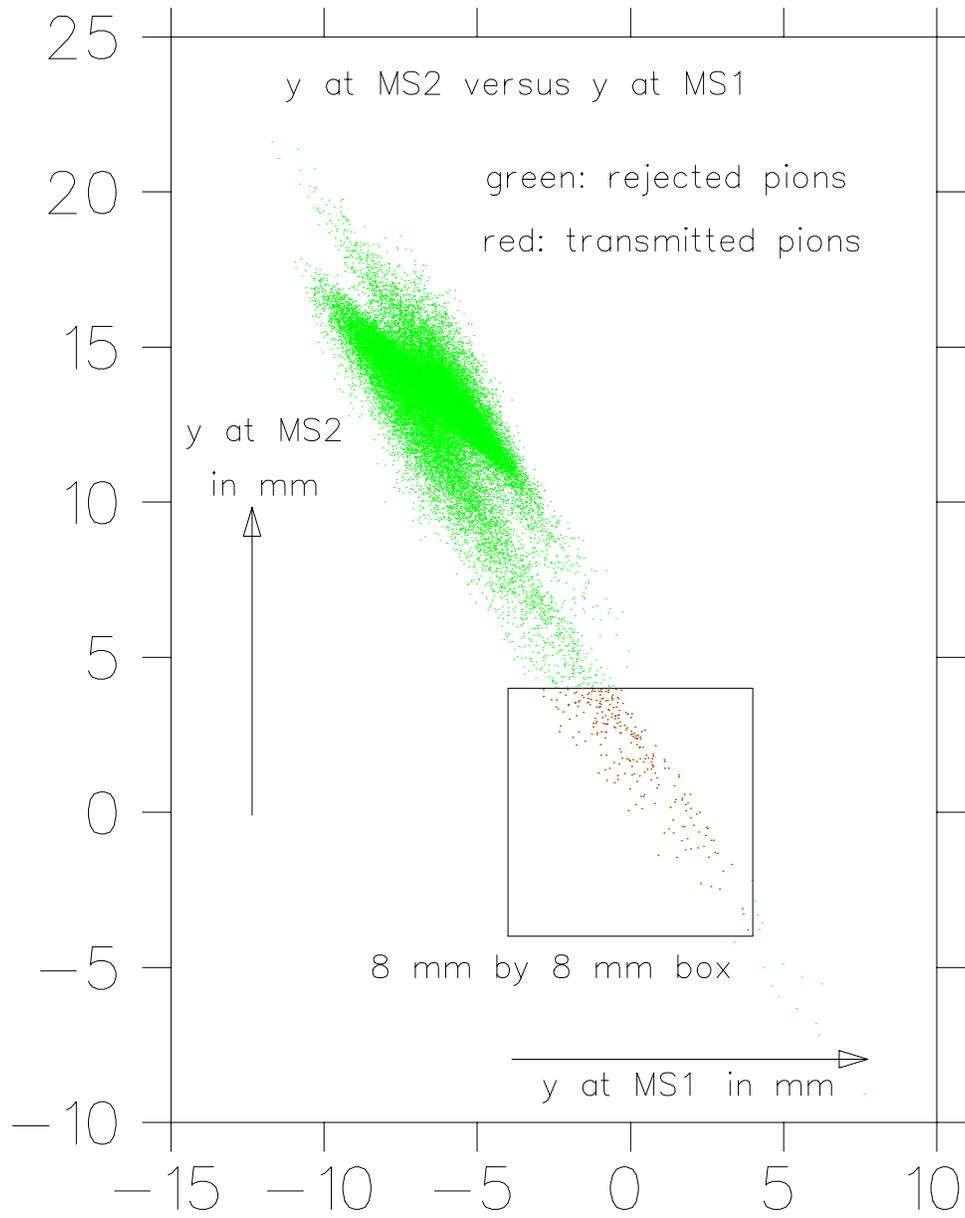


Figure 8: Y at MS2 versus y at MS1 for pions. The transmitted pions are in red.

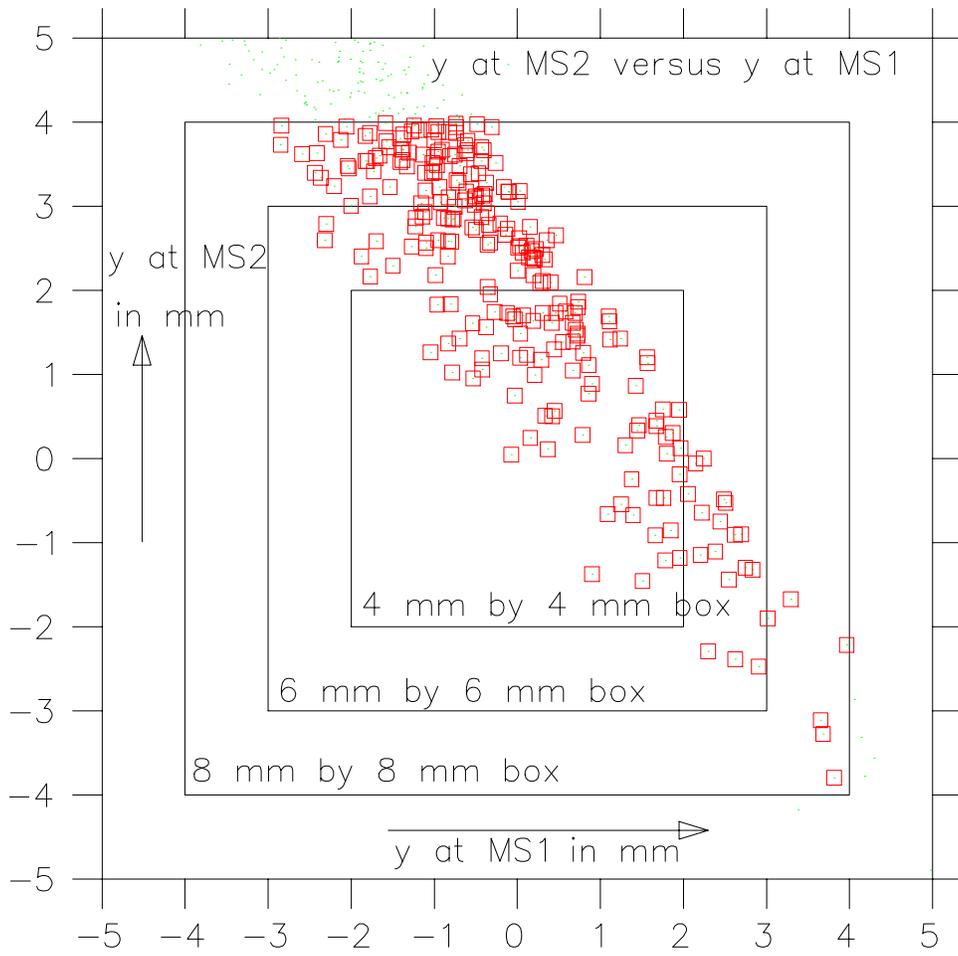


Figure 9: Y at MS2 versus y at MS1 for pions. Blow up of detail of previous plot.

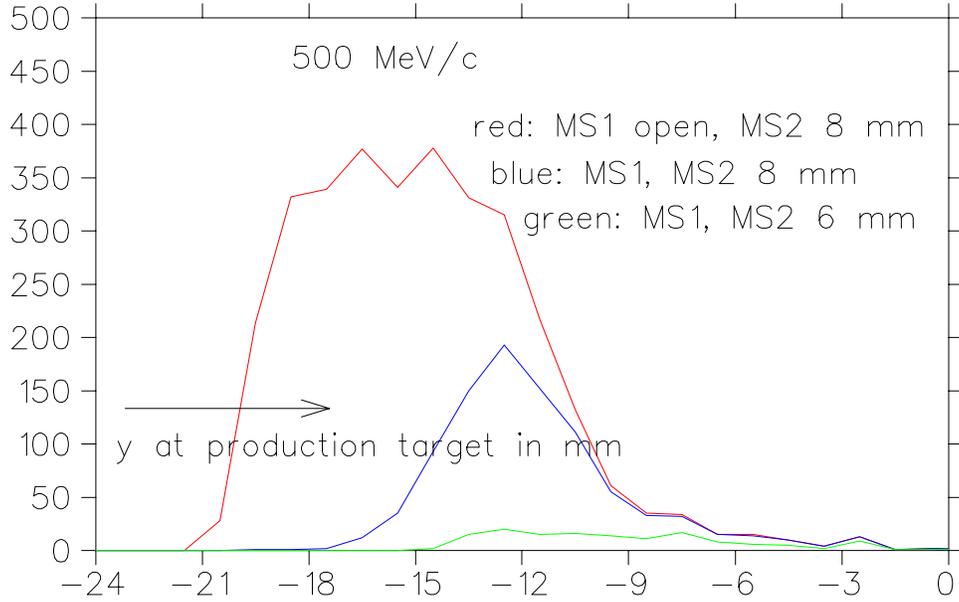
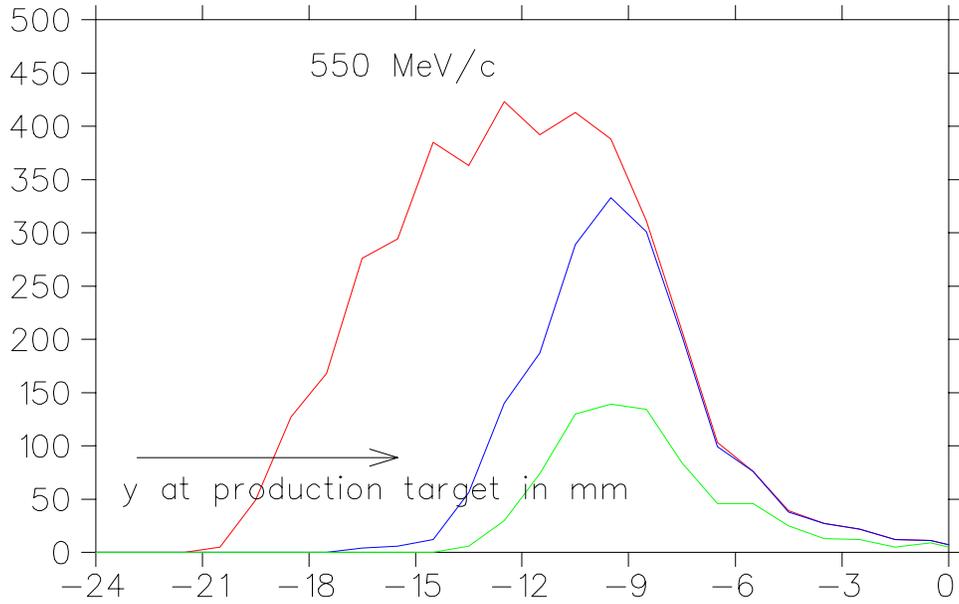


Figure 10: The vertical area at the production target from which accepted cloud pions originate for various mass slit settings.