πE5 secondary beam line

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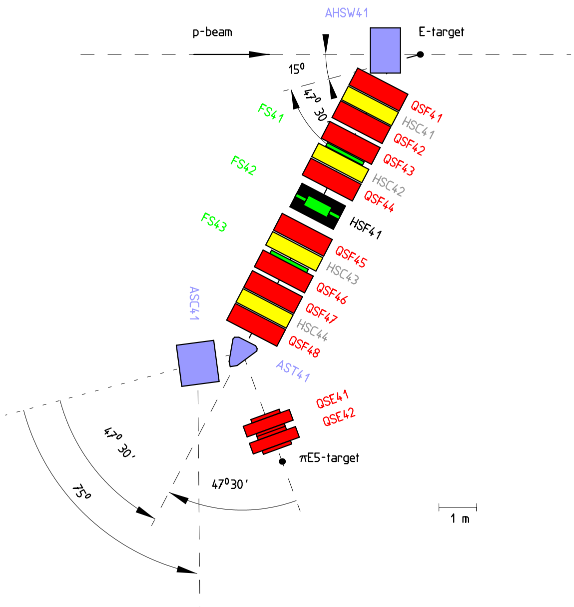
PSI jun 1996



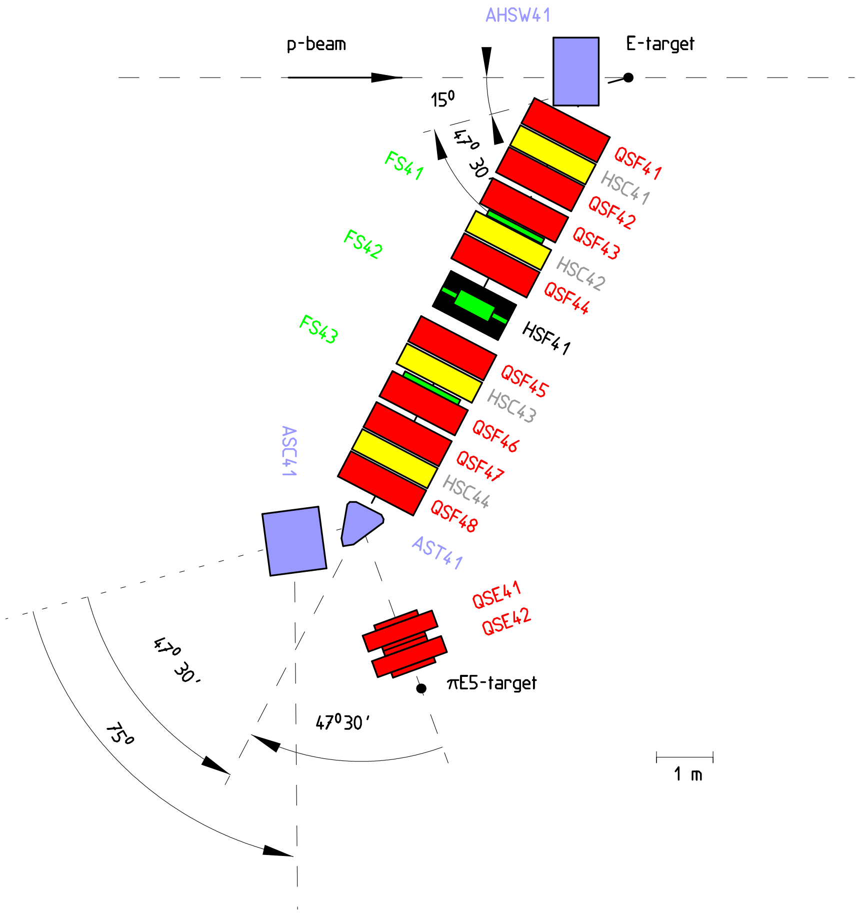


Figure 1: πE5 beam line

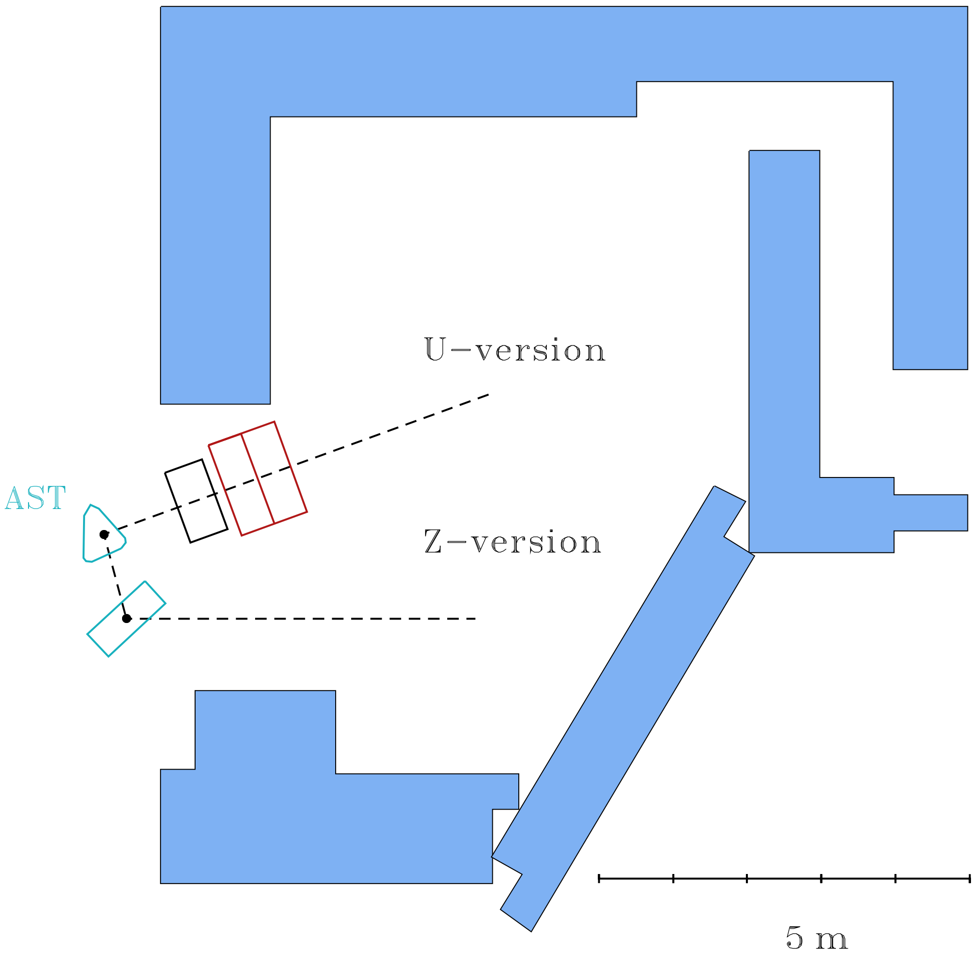


Figure 2: Lyout of the πE5 area

1 The πE5 beam line

The πE5 is a low energy (10-120 MeV/c) pion and muon beam line, viewing the thick target at 175^0 with respect to the primary proton beam. The main properties of the beam line are given in the following table . The beam line and a layout of the experimental area are shown in fig 1 and 2 respectively.

Main properties of πE5 beam line		
Solid angle		150 msr
Momentum range		10-120 MeV/c
Length		10.4 m
Momentun	acceptance (FWHM)	10%
	resolution (FWHM)	2%
Angular divergence (FWHM)	horizontal	450 mrad
	vertical	120 mrad
Spot size (FWHM)	horizontal	15 mm
	vertical	20 mm

The second bending magnet (AST) has a mirror symmetry with respect to z-axis, and by simply reversing the magnet field and setting the quadrupoles and sextupoles for the proper optics this will allow to serve alternatively two experiments at the location **U** and **Z** as indicated in the layout,within a short switching time.

In the middle of the beam line, where the momentum restricting slit system is located, the aberrations are rather big and because of this the momentum resolution is poor (2% FWHM). The situation is better at the final focus since the beam line is built up symmetrically and by this some abberations vanish at the end.
There are three sets of horizontal and one set of vertical slits, which restrict the momentum and/or the acceptance bite in the two versions of optics U and V.

A plot of the rates that can be expected at the final focus of πE5 is shown in fig. 3. The electron contamination is more or less independent from the momentum with a rate of 2×10^9 per second and mA proton current. Since there is no thick vacuum window there will be subsurface muons down to 10 MeV/c with a rate of 5×10^6 s$\times$ mA. In figure 4 the π and μ profiles are are shown.
In the region of the second bending magnet we have 150/cm$^2\times$sec$\times$mA hight energetic neutrons (kinetic enrgy larger than 120 MeV), and low energetic neutrons giving a radiation level of 5 rem/h$\times$mA.

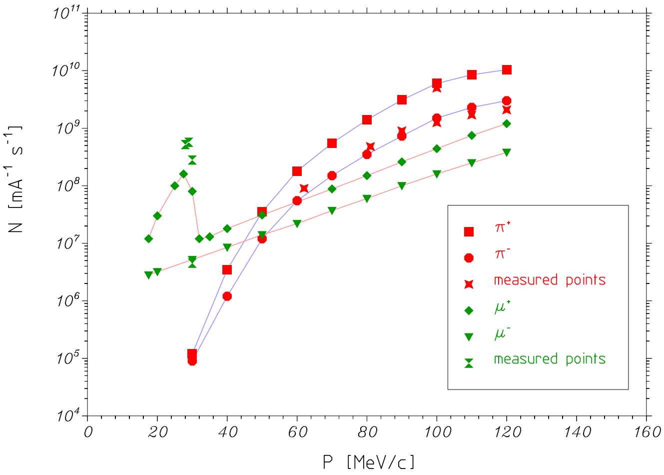


Figure 3: Particles fluxes in πE5 beam line

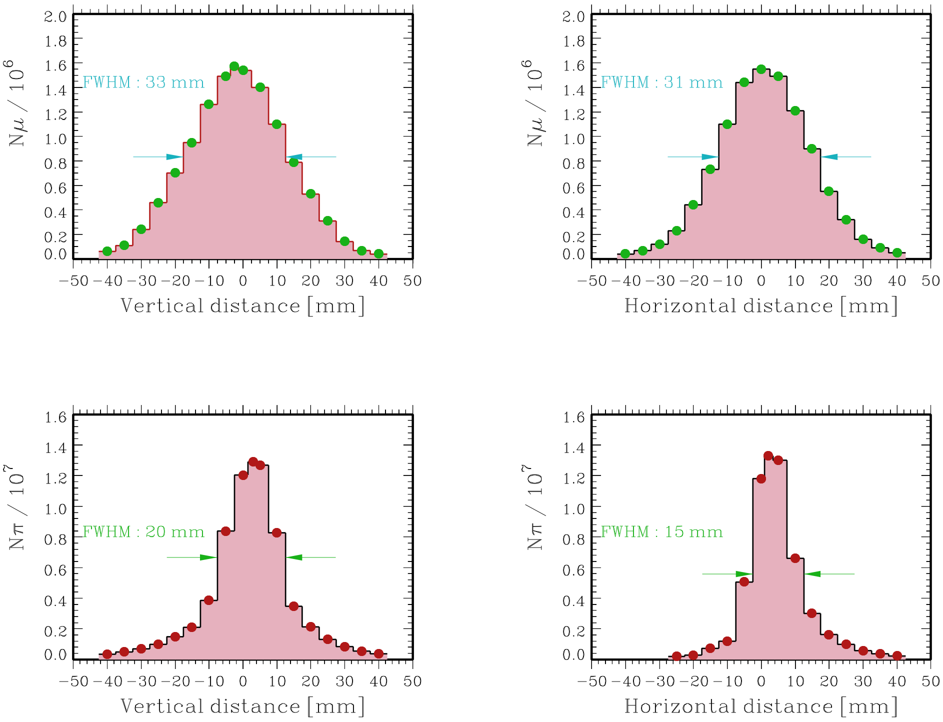
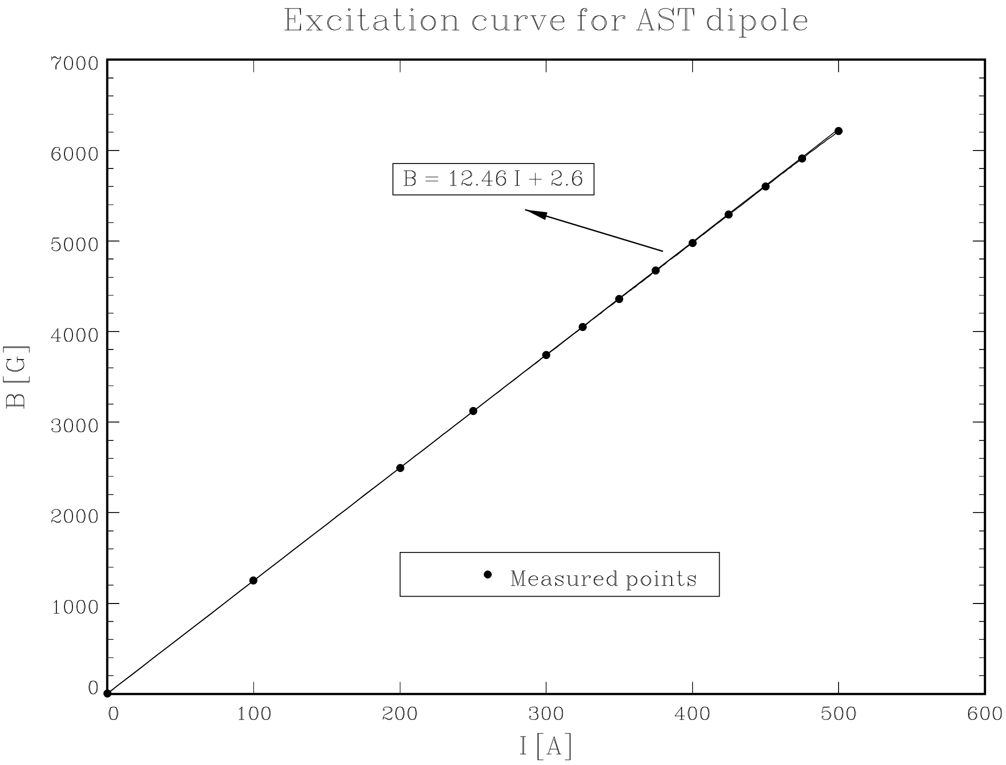
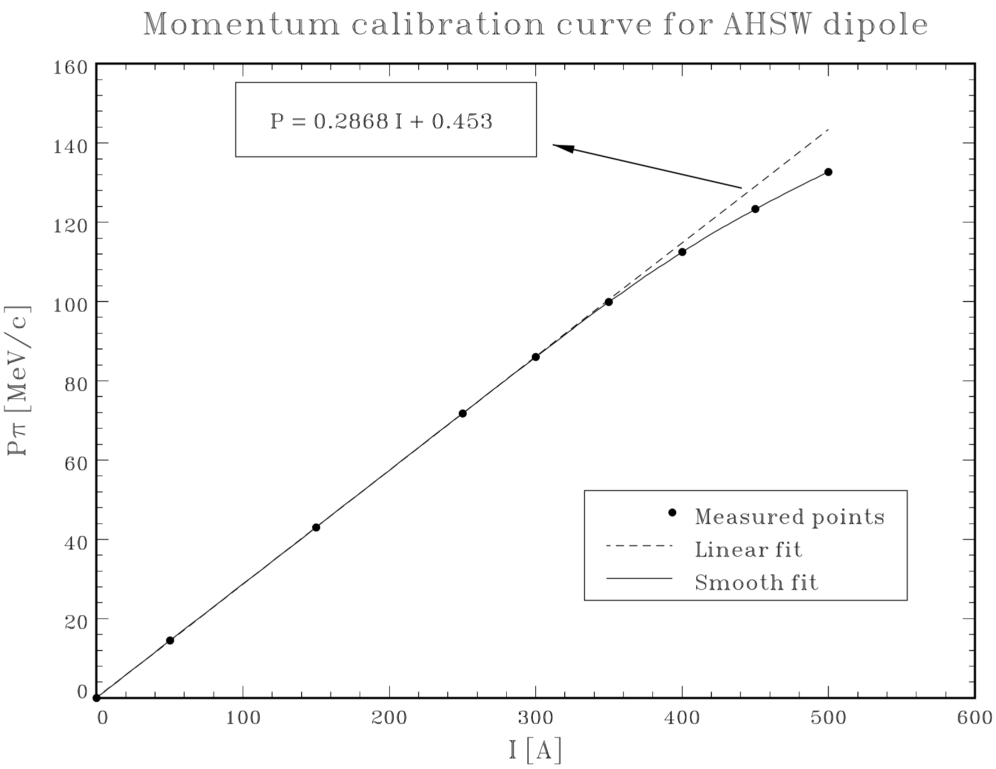


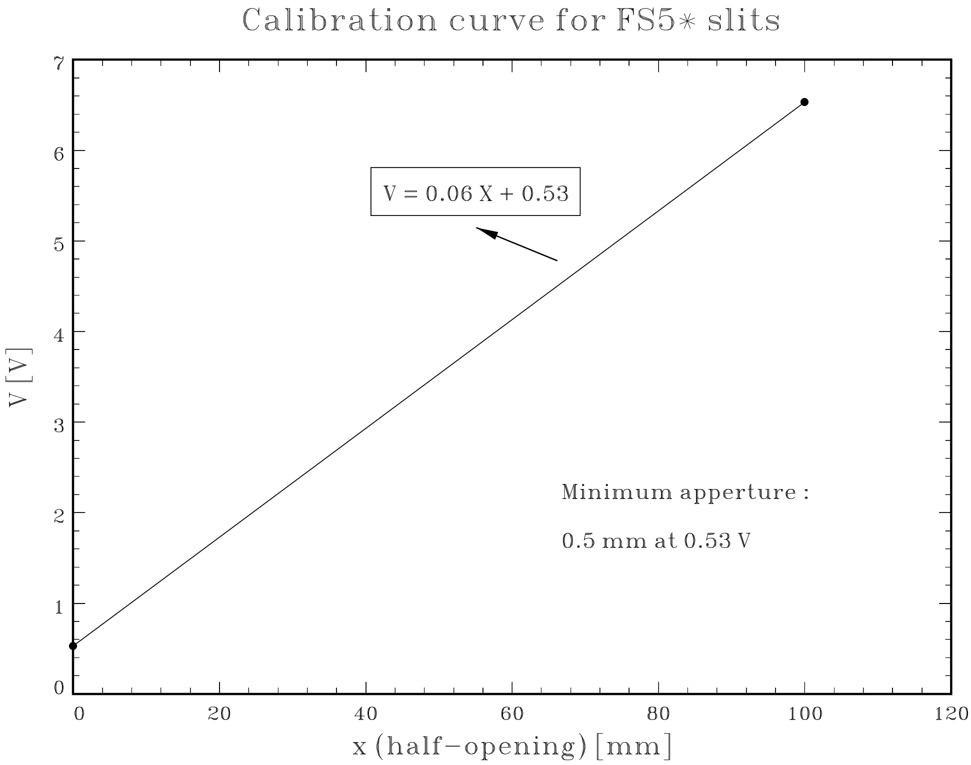
Figure 4: π and μ phase space for πE5 beam line



Excitation curve for AST dipole
B = 12.46 I + 2.6
Measured points
B [G]
I [A]
0
1000
2000
3000
4000
5000
6000
7000
0
100
200
300
400
500
600



Momentum calibration curve for AHSW dipole
P = 0.2868 I + 0.453
Measured points
Linear fit
Smooth fit
Pπ [MeV/c]
I [A]
0
20
40
60
80
100
120
140
160
0
100
200
300
400
500
600



1.1 Some other informations

- The beam high is 155.5 cm
- If an end beam window is needed, it is of Mylar and has usually 150 μm
- The standard beam pipe diameter is 320 mm
- The DAC values for the slits run from 0 to 600

In case of problems contact :

- for **electricity** : A Widmer , M Horvat
- for **cooling water** : Markus Koller
- for **beam setting** : U Rohrer
- for **vacuum system** : U Kalt
- for **Experimental hall** : H Vetterli
- for **SU** : W Wittwer

29-MAR-96

Setting for πE5-Z

P = 100. MeV/c Particle : $\boldsymbol{\mu^+}$ Mode : **Z**

Elements	B [KG]	I [A]	DAC	$\frac{I}{Imax} \cdot \frac{100}{r}$	r Range factor	Imax [A]
QSF 41	-2.7976	-294.77	-2414	0.59	100	500
HSC 41	0.3818	41.37	678	0.165	100	250
QSF 42	1.8779	204.17	1672	0.408	100	500
QSF 43	-1.7886	-194.95	-1597	0.39	100	500
HSC 42	-0.7445	-80.6	-1320	0.322	100	250
QSF 44	0.7807	86.26	706	0.173	100	500
QSF 45	0.852	94.08	771	0.188	100	500
HSC 43	-0.4504	-48.82	-800	0.195	100	250
QSF 46	-2.3619	-252.26	-2066	0.505	100	500
QSF 47	2.0231	218.69	1791	0.437	100	500
HSC 44	0.298	32.27	529	0.129	100	250
QSF 48	-1.3874	-152.19	-1246	0.304	100	500
AST 41	4.3208	346.91	2841	0.694	100	500
ASC 41	5.2305	195.86	1604	0.392	100	500

Example for QSF 41 : $\frac{|I|}{Imax} \times \frac{100}{r} = \frac{|-294.77|}{500} \times \frac{100}{100} = 0.59$

$\frac{-294.77}{500} \times \frac{100}{100} = -0.5895 \rightarrow \text{DAC} = -0.5895 \times 4095 = -2414$

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Setting for πE5-U

$P\ =\ 100.$ MeV/c   Particle : $\boldsymbol{\mu^+}$ Mode : **U**

Elements	B [KG]	I [A]	DAC	$\frac{I}{Imax} \cdot \frac{100}{r}$	r Range factor	Imax [A]
QSF 41	-2.7976	-294.77	-2414	0.59	100	500
HSC 41	0.3818	41.37	678	0.165	100	250
QSF 42	1.8779	204.17	1672	0.408	100	500
QSF 43	-1.7886	-194.95	-1597	0.39	100	500
HSC 42	-0.7445	-80.6	-1320	0.322	100	250
QSF 44	0.7807	86.26	706	0.173	100	500
QSF 45	0.852	94.08	771	0.188	100	500
HSC 43	-0.4504	-48.82	-800	0.195	100	250
QSF 46	-2.3619	-252.26	-2066	0.505	100	500
QSF 47	2.0231	218.69	1791	0.437	100	500
HSC 44	0.298	32.27	529	0.129	100	250
QSF 48	-1.3874	-152.19	-1246	0.304	100	500
AST 41	4.3208	346.91	2841	0.694	100	500
QSE 41	3.4124	235.75	1931	0.471	100	500
QSE 42	-3.5004	-241.93	-1981	0.484	100	500
SEP 41	125.	35.	143	0.07	100	500
QSE 43	2.5004	172.11	1410	0.344	100	500
QSE 44	1.5004	103.01	844	0.206	100	500
QSE 45	-0.5004	-34.38	-282	0.069	100	500

Example for QSF 41 : $\frac{|I|}{Imax} \times \frac{100}{r} = \frac{|-294.77|}{500} \times \frac{100}{100} = 0.59$

$\frac{-294.77}{500} \times \frac{100}{100} = -0.5895 \rightarrow \mathrm{DAC} = -0.5895 \times 4095 = -2414$

For the separator the value under B is the value of Hight Voltage in KV !!

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