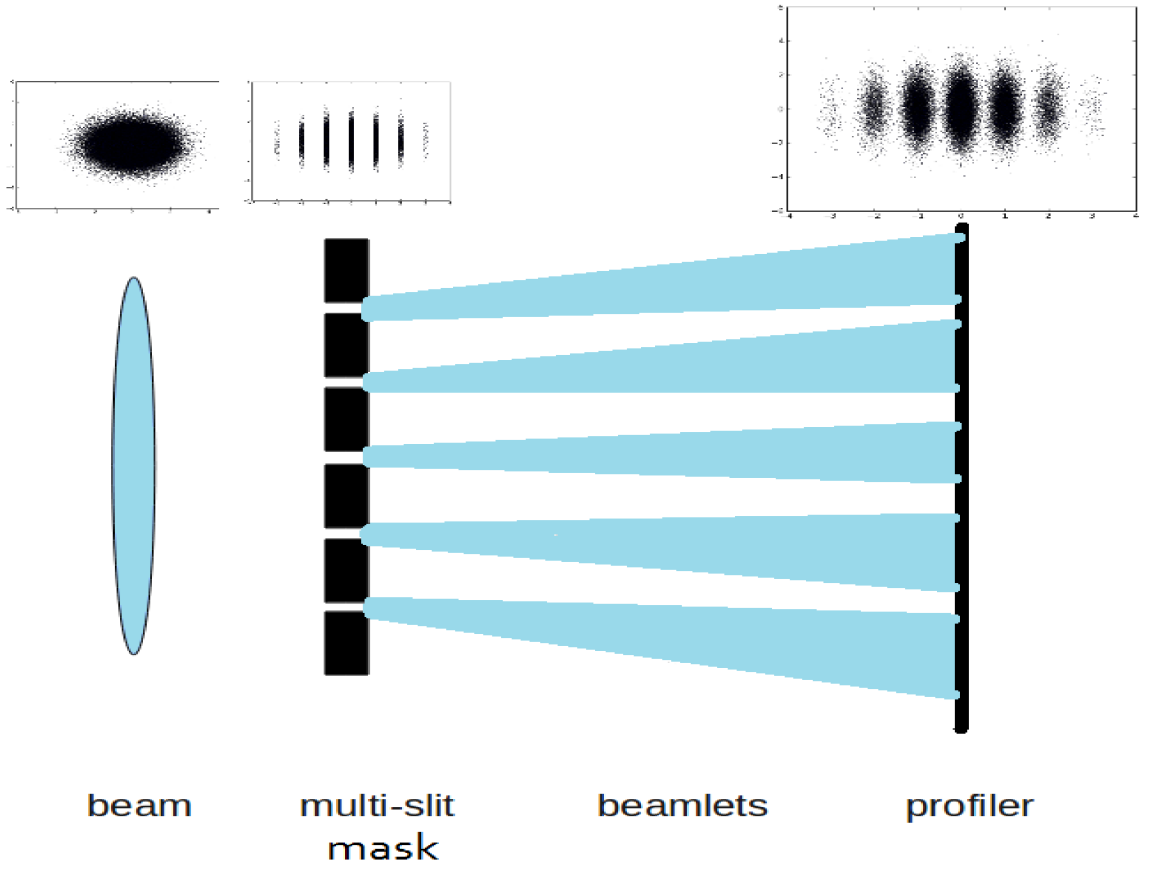
Emittance measurement considerations

C. Liu J. Kewisch

Apr. 7, 2016

LEReC instr meeting

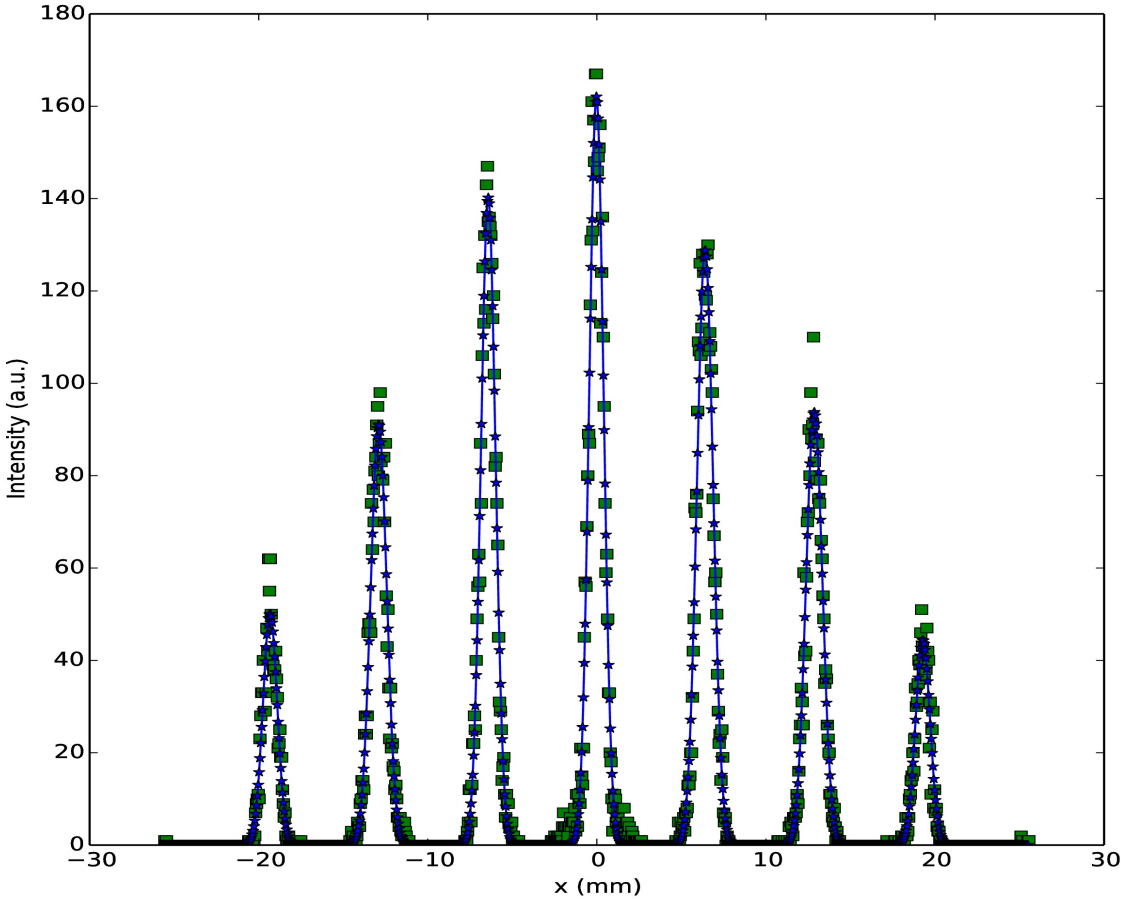
Multi-slit schematics



Design considerations

- Thickness of flag large enough to stop most of the beam.
- Slit width small. Ratio of slit width to thickness not too small to limit the divergence of the beamlets.
- Drift space enough for beamlets to diverge, not too much that they ovelap.
- Profile monitor large enough for diverged beamlets.

400 keV



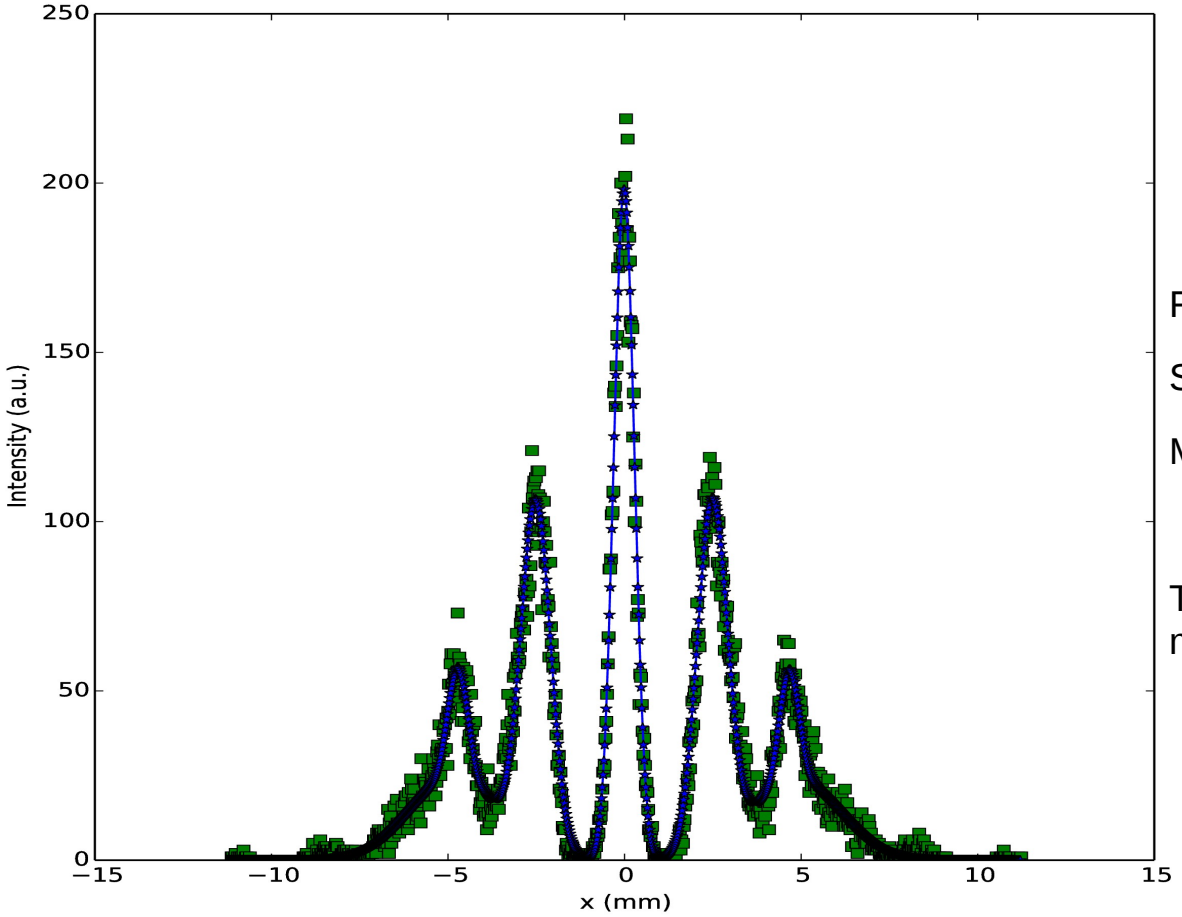
Real emittance:
0.655251966295

Sampled emittance:
0.629857938323

Measured emittance:
0.623495500861

With slit width 0.15mm, spacing 2.5 mm. Drift space 2. m.

1.6 MeV



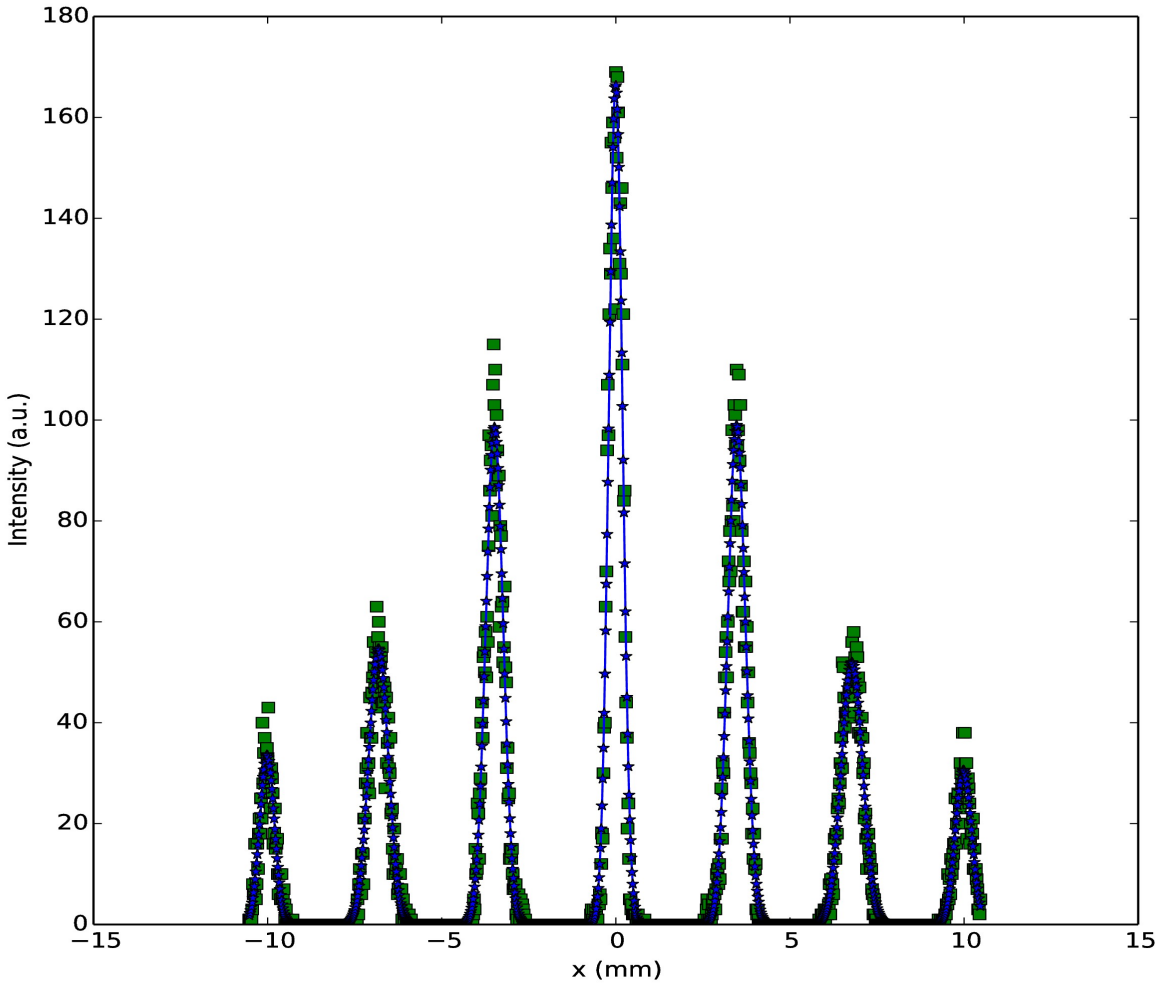
Real emittance: 0.414456561932

Sampled emittance: 0.416869820292

Measured emittance: 0.325469730076

The Slit width 0.15 mm, slit spacing 1.2 mm, drift space is 1 m.

2.6 MeV



Real emittance: 0.317663580351
Sampled emittance: 0.316721697019
Measured emittance: 0.369303714218

The Slit width 0.15 mm, slit spacing 2 mm, drift space is 2. m.

One multi-slit for 3 energies?

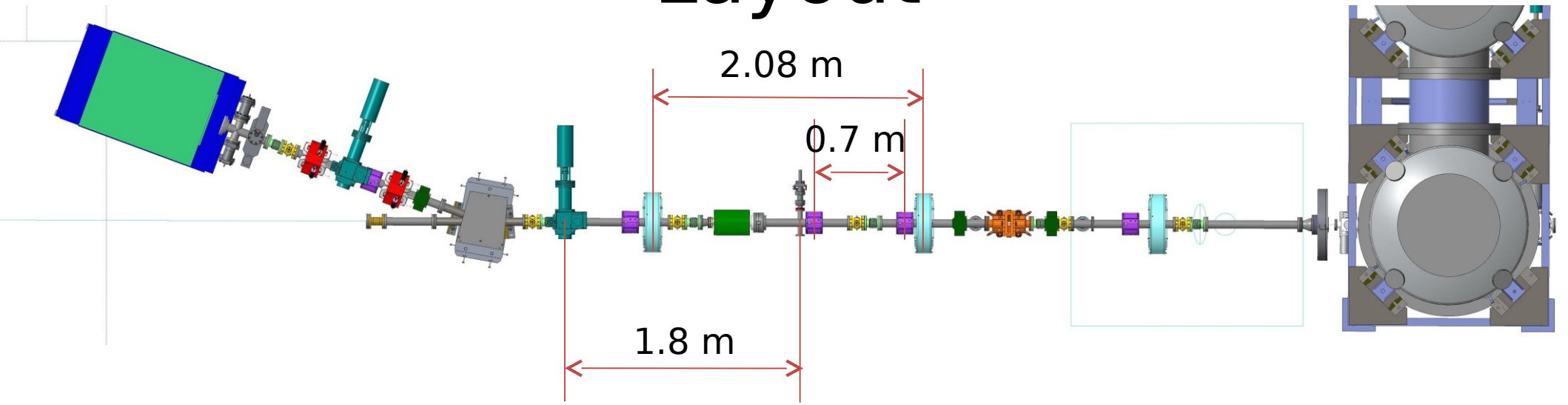
E (MeV)	Slit width (mm)	Spacing (mm)	Drift (m)	PM size (mm)	Error (%)
0.4	1.5	2.5	2.0	50	5
1.6	1.5	1.2	1.0	25	20
2.6	1.5	2.0	2.0	25	15

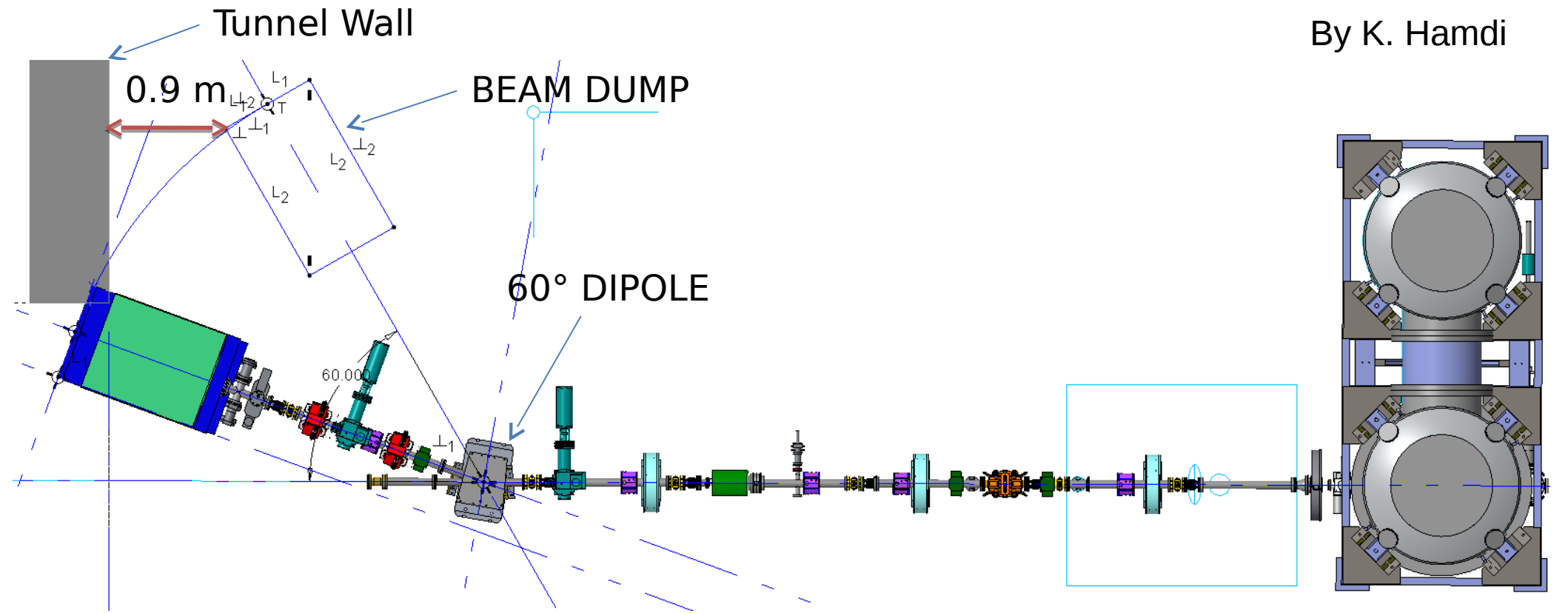
Not easy.....

A single slit?

- It is possible to do more samples than multi-slit, plus there is no interference between samples. One can use a common drift length. In short, a single slit works for all energies.
- Need 2 correctors to steer the beam, by ~20 mm.

Layout





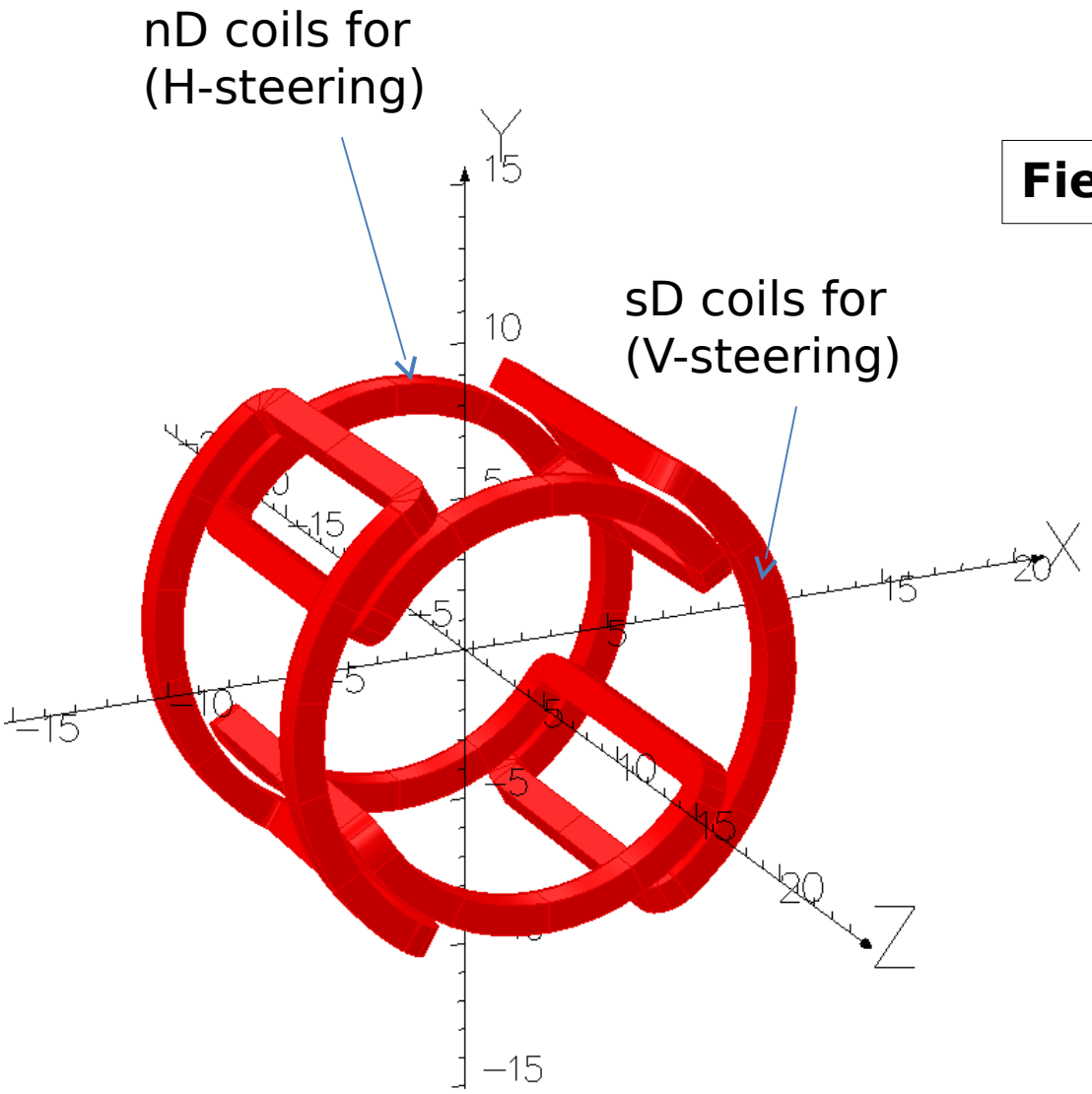
By K. Hamdi

correctors

- Angle = 20mm/0.7m=30mrad
- Brho = 0.01 Tm for 2.6 MeV
- Field integral is 300 Gauss*cm.
- Field integral precision: 0.25% (equivalent to 50 um position error).
- Use the same magnet design by W. Meng, more current and turns of coils.

The dipole coil package can be used in multiple locations for transport line:

(Coils: Rmin = 6.22 cm; Rmax = 8.50 cm; Vacuum Pipe: R = 3.175 cm)



Field Integral and Quality (Air-Core)

	Current Per coil	Dipole Integral	6-pole Ratio (R=1cm)
nD coils	60 A-t	70.8 G-cm	6.3E-5
sD coils	60 A-t	60.0 G-cm	3.0E-5