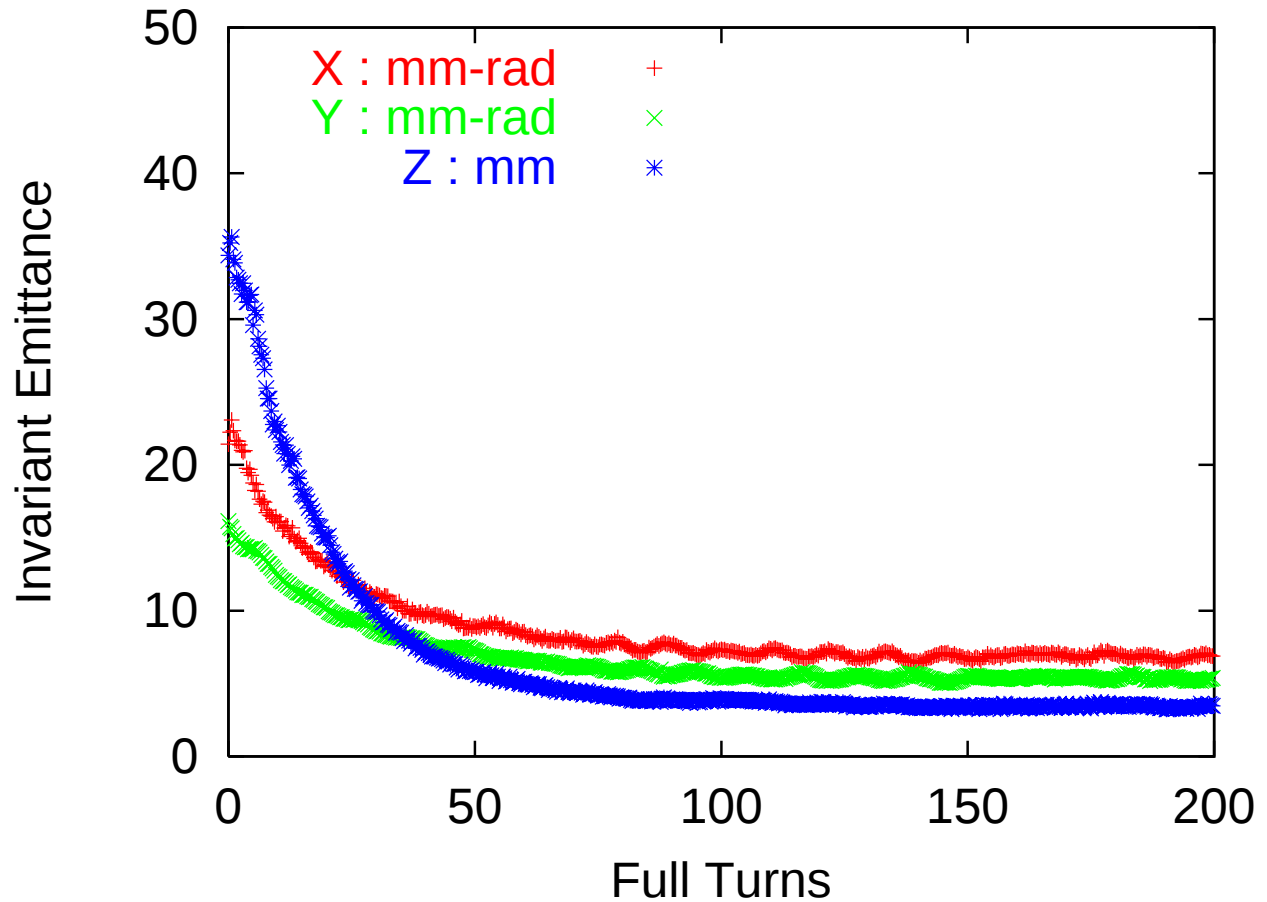


Soft-edge Modeling in Dipole cooling Rings

Muon Simulations Workshop
Miami Beach, Fl.
December 13, 2004

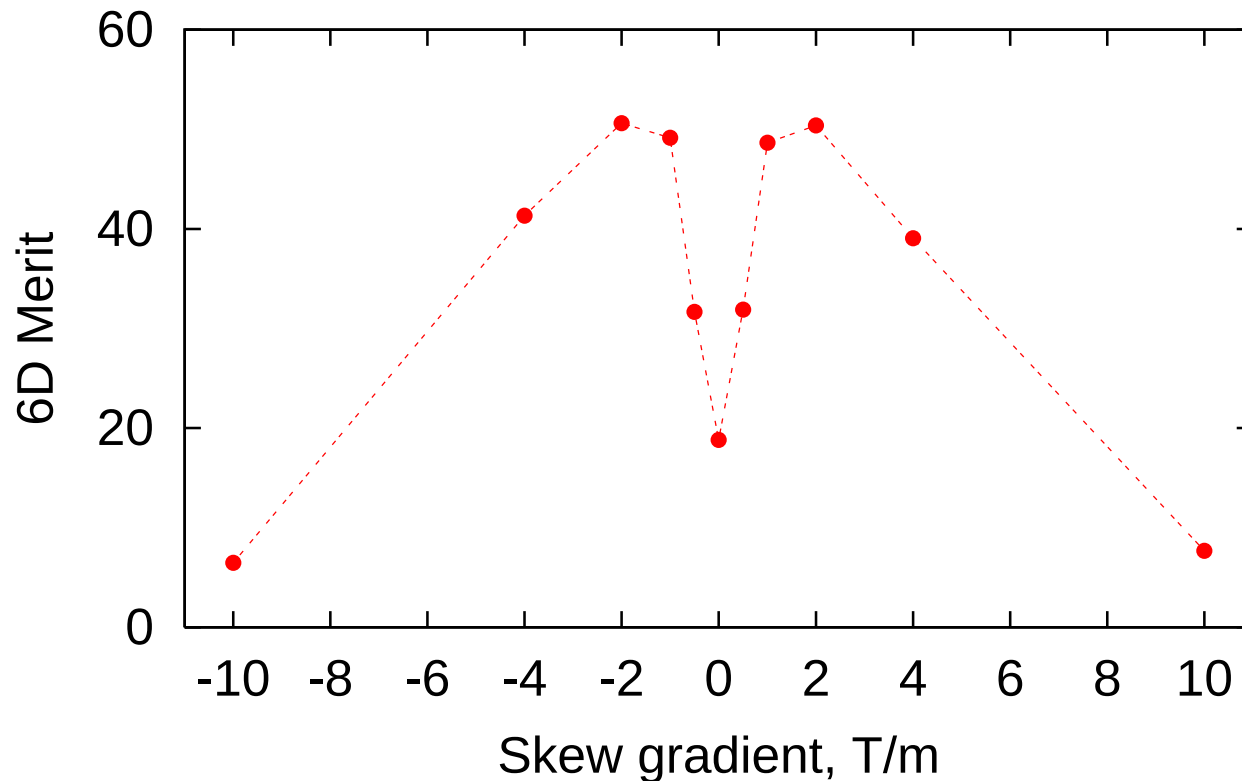
Introduce Skew Quadrupoles

- Bracket dipoles with thin (3cm) skew quadroles
- Skew quadrupoles real estate at 9% circumference
- Test various gradients.
- X/Y Coupling achieved



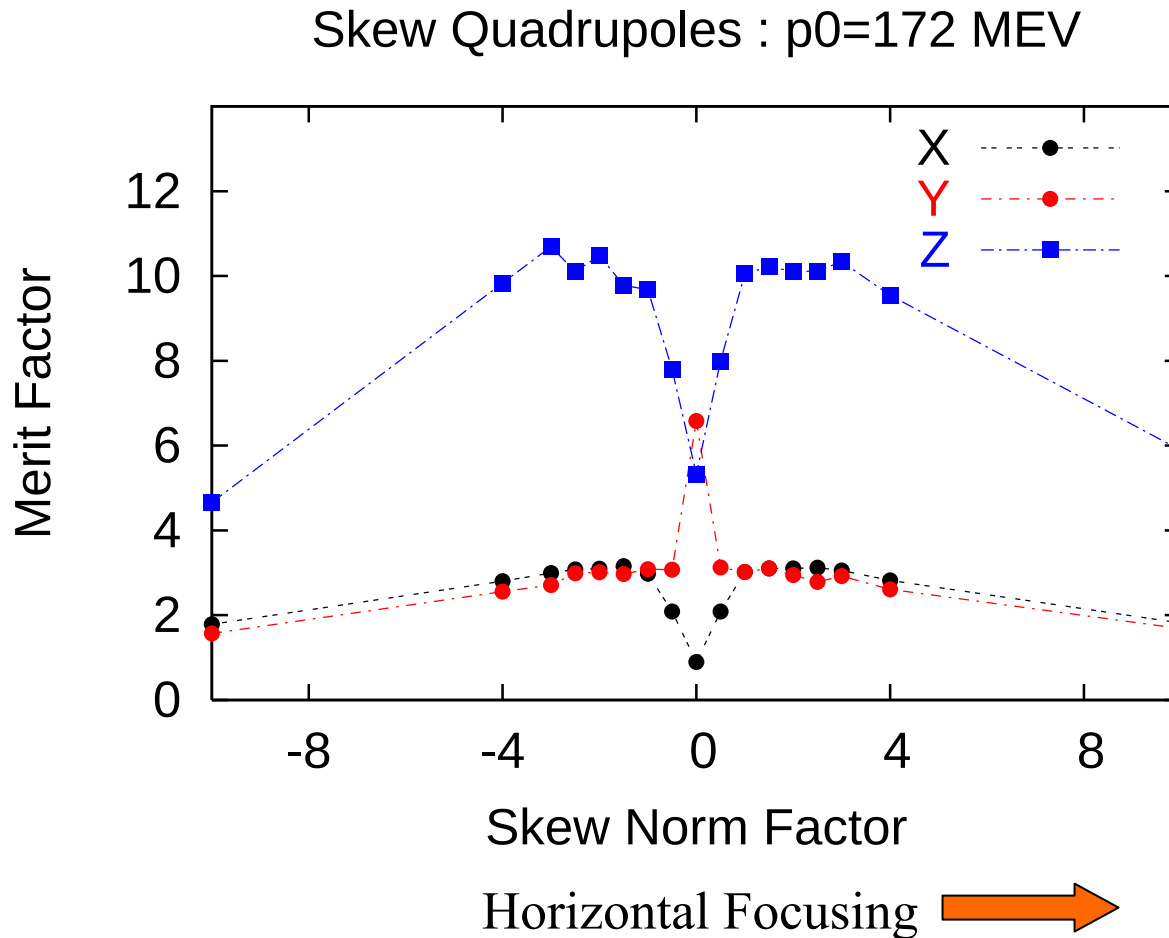
Performance for 6 sector ring : 100atmos

Skew Quadrupoles : $p_0=250$ MEV



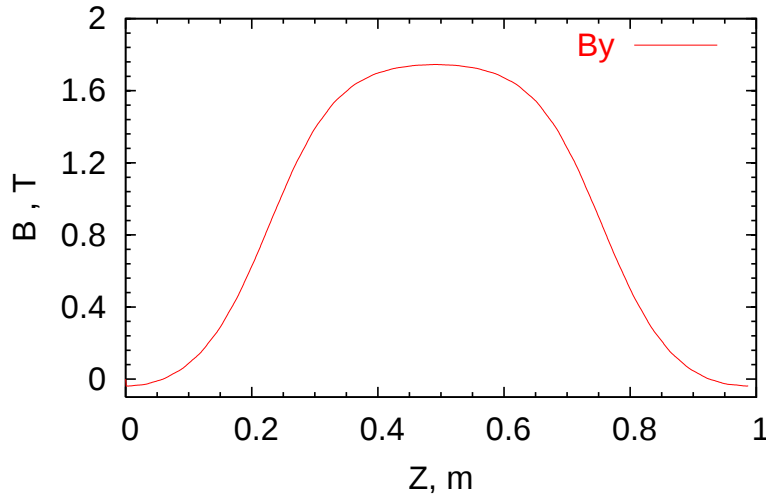
Horizontal Focusing 

Performance for 6 sector ring (cont)

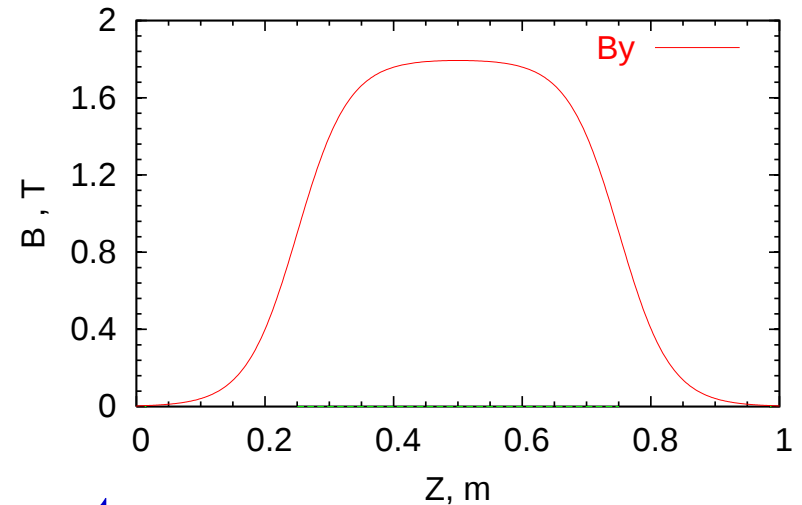


Soft Edge Dipoles

Kahn 4 Sector Dipole Ring



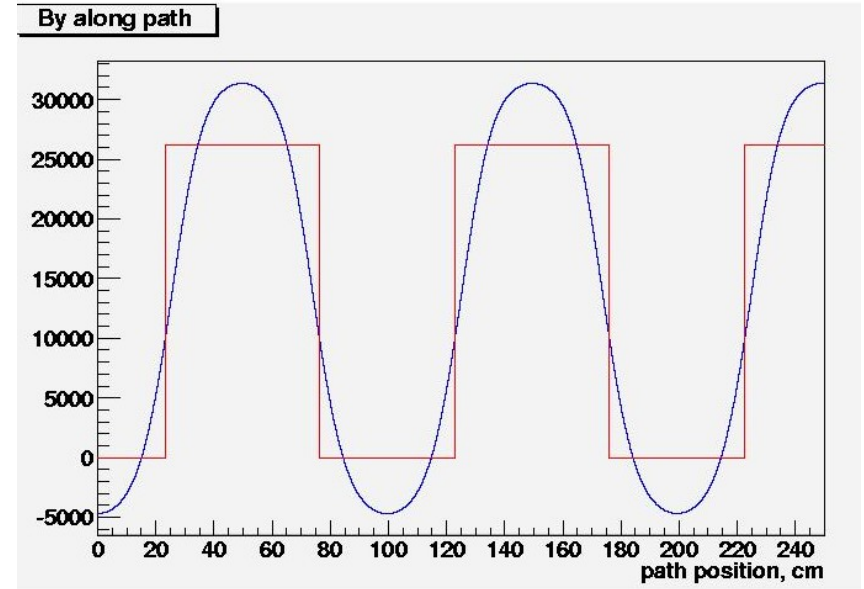
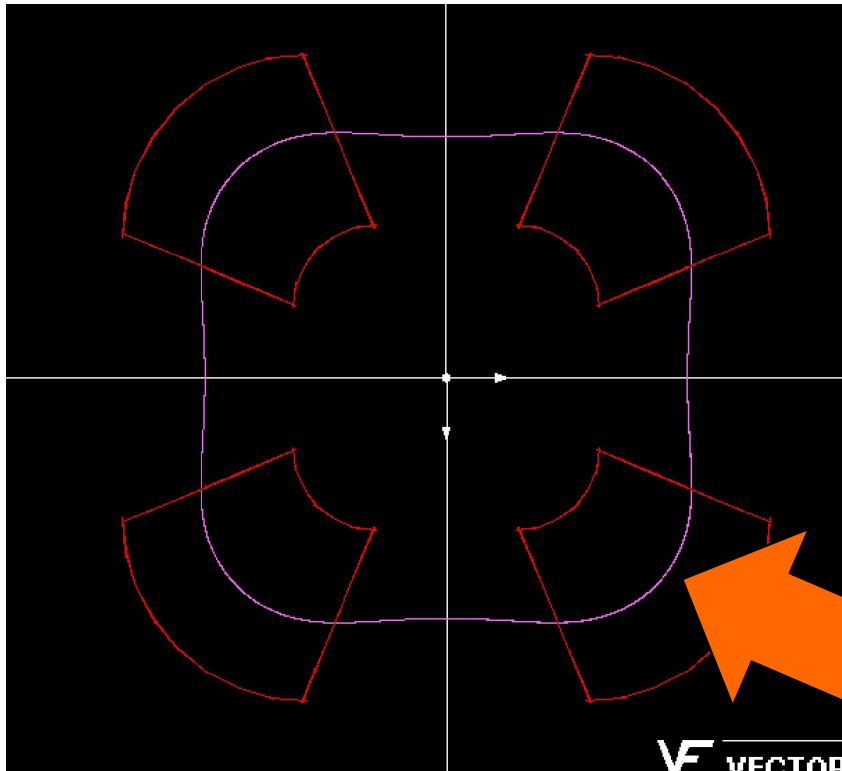
Palmer 4 Sector Dipole Ring



The Tune Parameters

	β_x	ν_x	β_y	ν_y
Synch-Hardedge	0.379	0.277	0.570	0.257
ICool-Hardedge	0.380	0.278	0.571	0.257
Kahn-Softedge	0.443	0.257	0.734	0.215
Palmer-Softedge	0.404	0.272	0.723	0.208

Tosca Results – Steve Kahn

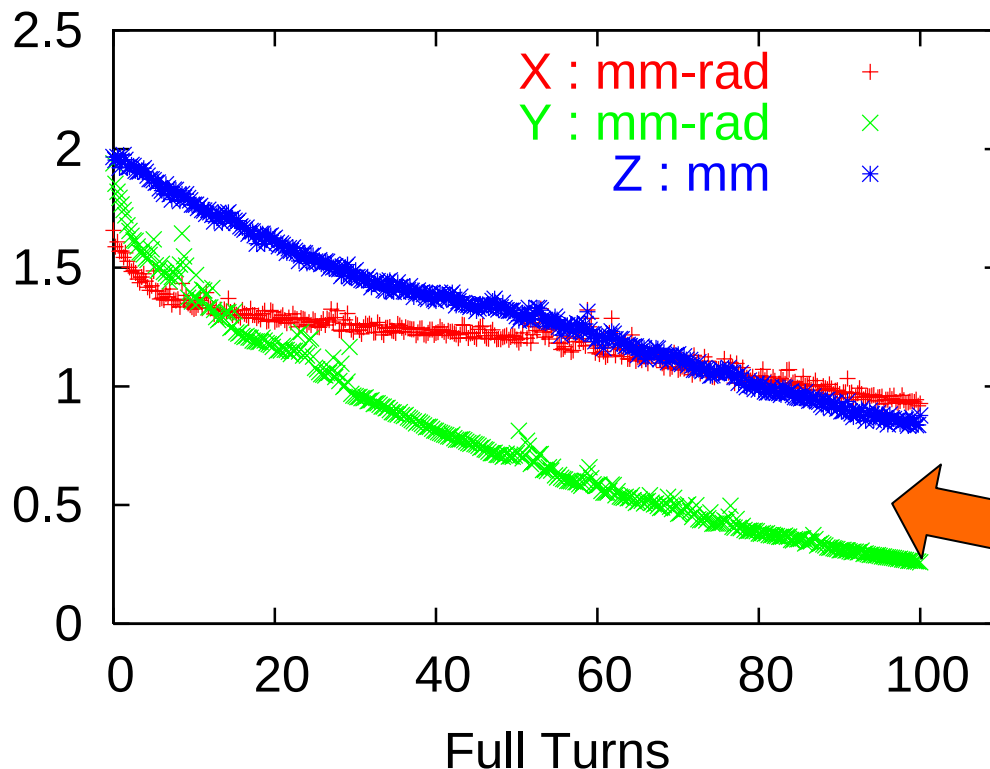


Closed orbit for
250 MeV/c muons
at $r = 55.03\text{cm}$

Performance of the Kahn Model

Kahn's 4 Sector Dipole Lattice: 172 MeV/c

Admittance



$$\epsilon_x = 1.7 \text{ mm}$$

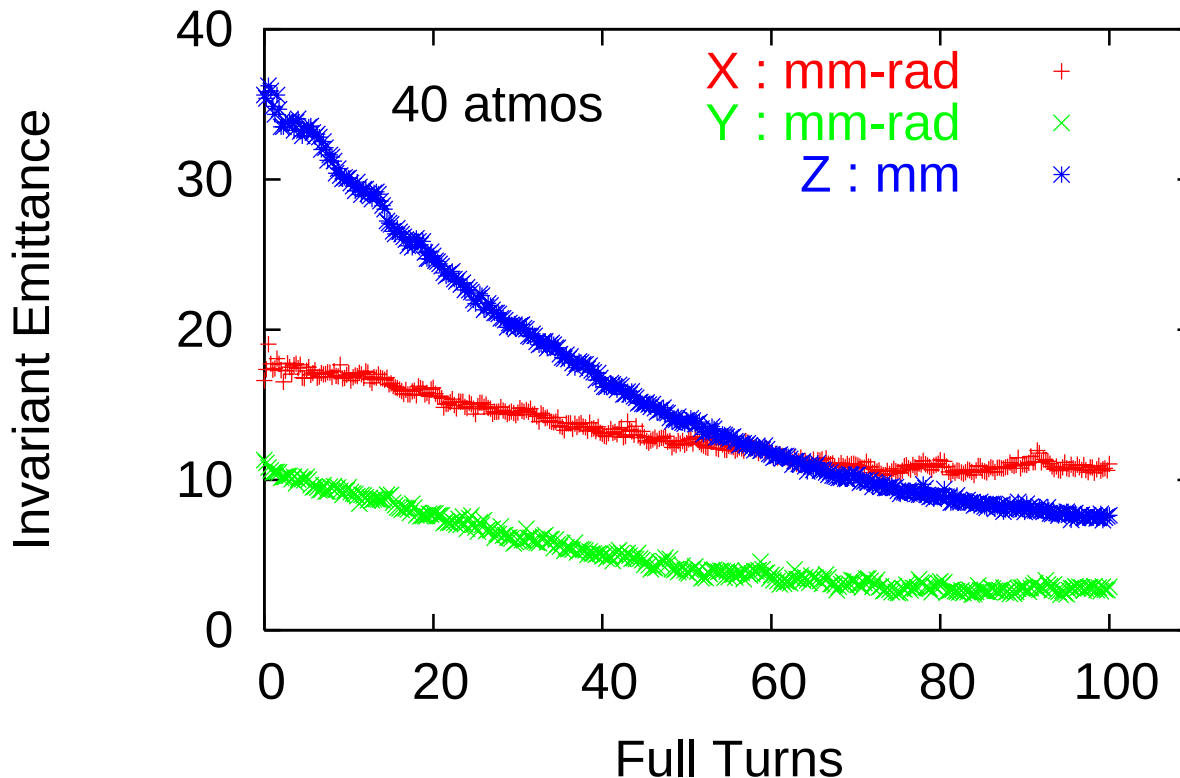
$$\epsilon_y = 1.9 \text{ mm}$$

$$\epsilon_z = 2.0 \text{ mm}$$

Note: No MC or Straggling

Performance of the Palmer Model

4 Sector Lattice: 172 MeV/c



Admittance

$$\epsilon_x = 17 \text{ mm}$$

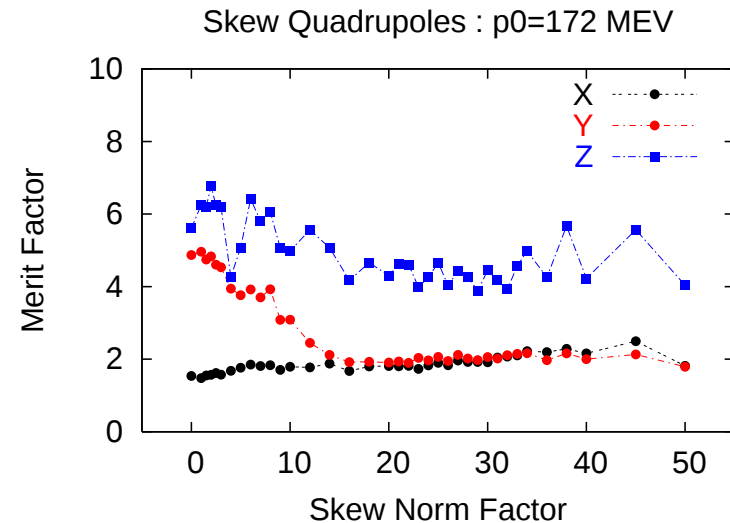
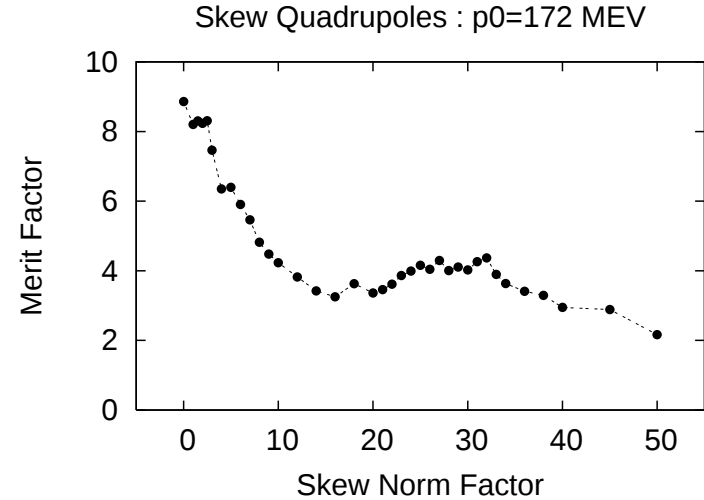
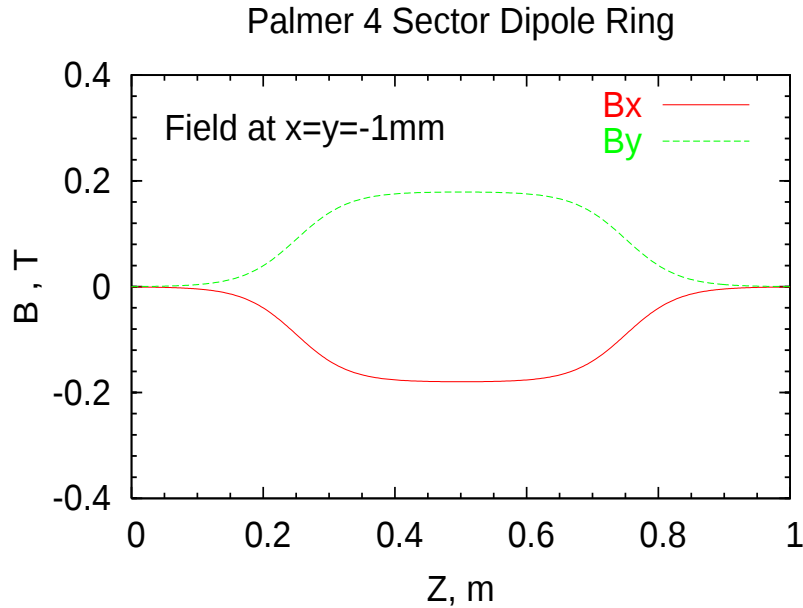
$$\epsilon_y = 11 \text{ mm}$$

$$\epsilon_z = 36 \text{ mm}$$

Pressure at 40 atmos

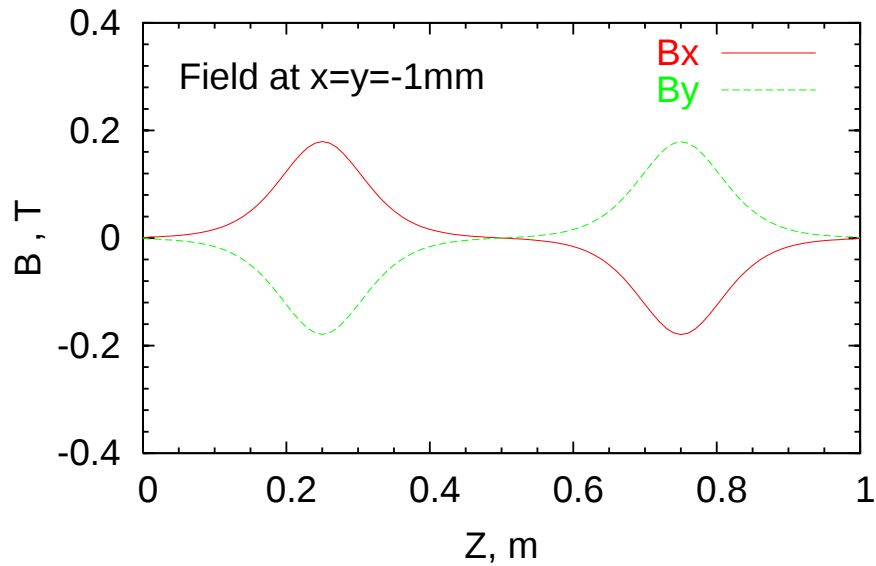
Total 6D Merit 9

Introduce Skew Quad to the Palmer Ring

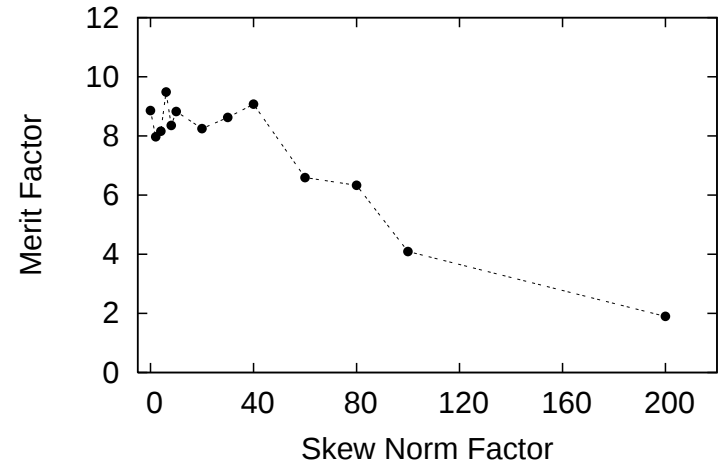


Palmer Ring : Skew configuration 2

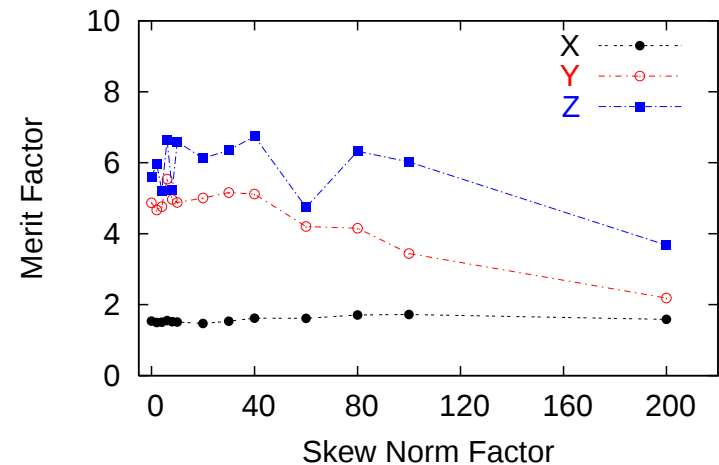
Palmer 4 Sector Dipole Ring



Skew Quadrupoles : $p_0=172 \text{ MEV}$

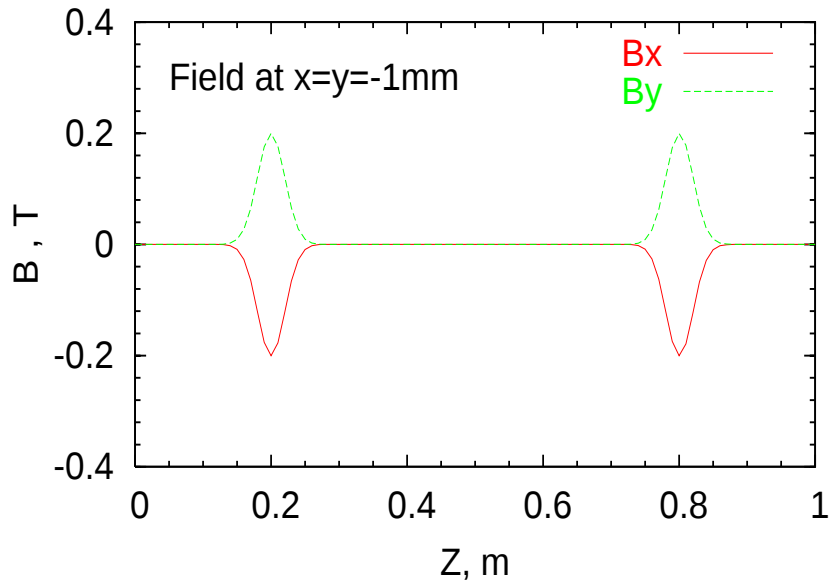


Skew Quadrupoles : $p_0=172 \text{ MEV}$

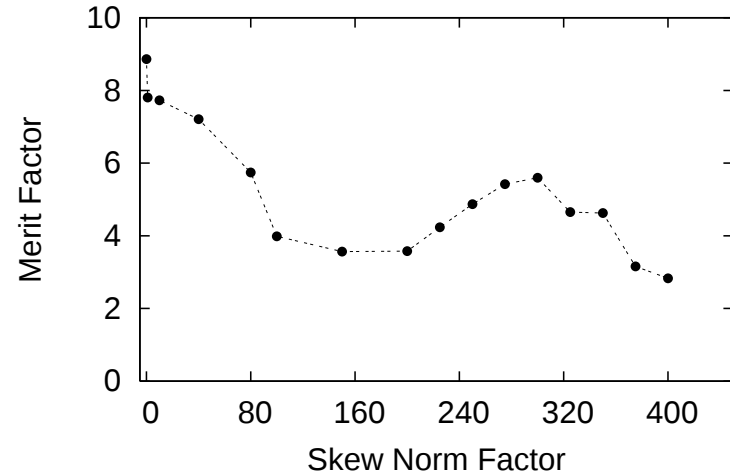


Palmer Ring : Skew configuration 3

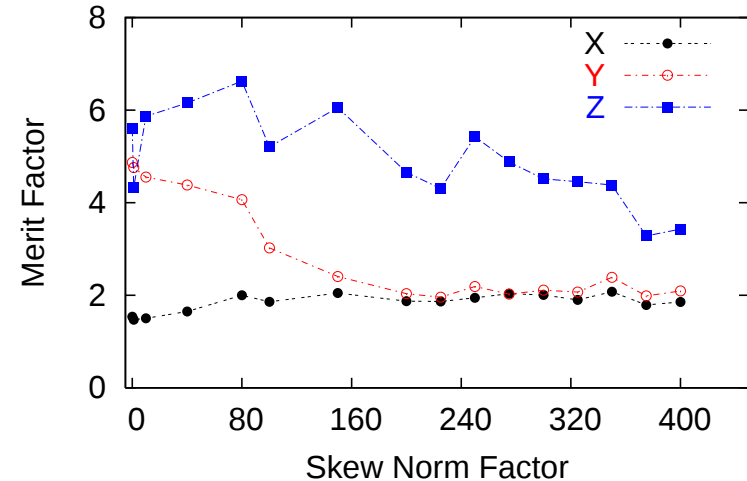
Palmer 4 Sector Dipole Ring



Skew Quadrupoles : $p_0=172 \text{ MEV}$



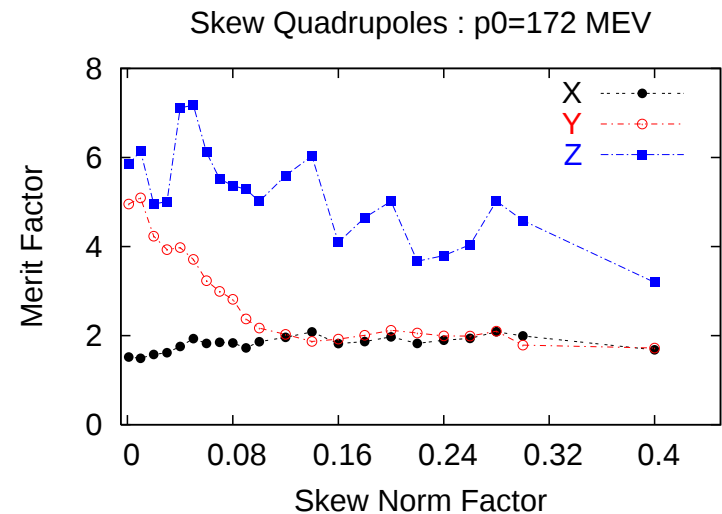
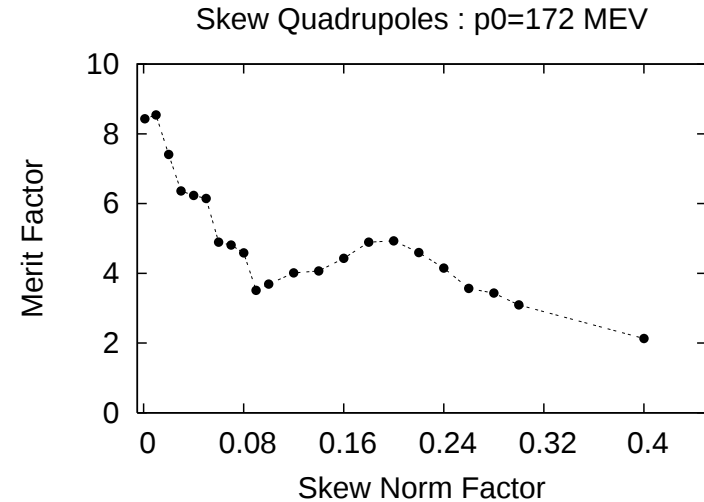
Skew Quadrupoles : $p_0=172 \text{ MEV}$



Palmer Ring : Skew configuration 4

Insert the skew component by introducing the skew transport term

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & k & 0 \\ 0 & 0 & 1 & 0 \\ k & 0 & 0 & 1 \end{pmatrix}$$

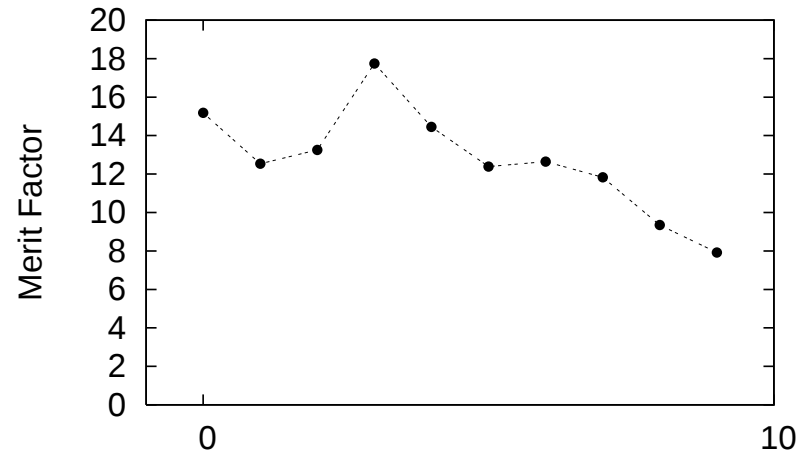


Revisit the Hard Edge Model

Use Synch solution in ICOOL

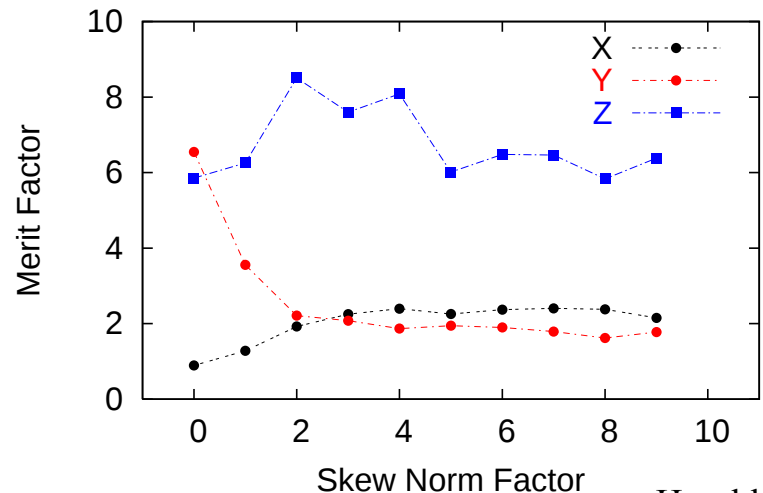
- 4 sector dipoles
- 1.8 peak field
- 20 atmos pressure
- $p_0 = 172 \text{ MeV}$

Skew Quadrupoles : $p_0=172 \text{ MeV}$



Skew Norm Factor

Skew Quadrupoles : $p_0=172 \text{ MeV}$



Summary

- Weak focusing dipole rings with soft edges continue to show 6D cooling
- The Kahn TOSCA dipole models to date yield field profiles that result in admittances which are a factor ~ 10 too small.