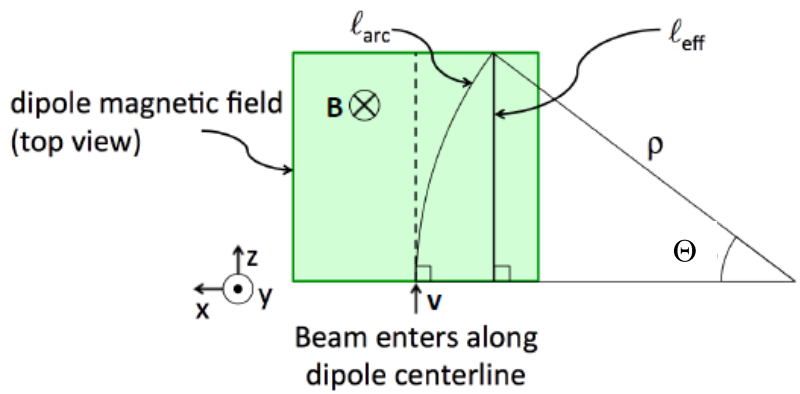
Measuring/Setting Momentum

$$p\ [\mathrm{MeV/c}] = 2.9980\mathrm{E}\text{-}4 \cdot (BL[\mathrm{G\text{-}cm}]) / \sin(\Theta)$$



$$L_{eff} = [\ \int B_y(0,0,z)\ dz\ ] / B(0,0,0)$$

Errors

1. Dipole magnetic field
   - model
   - current dependence
   - spatial uniformity
   - reproducibility
2. Dipole magnet power supplies
   - field mapping
   - tunnel operation
3. Alignment of elements
   - surveys
   - BPM calibration
4. Diagnostic accuracy
   - BPM vs. viewer
5. Stray magnetic fields
   - (un)shielded beam line
   - fixed steering coils

Momentum Measurement Capability Estimate

Parameter	Term	As-Is	Level 1	Level 2
Dipole – linearity	$\delta B/B$	0.25%	0.25%	<0.10%
Dipole – spatial	$\delta BL/BL$	0.30%	0.10%	<0.10%
Dipole – reproduce	$\delta B/B$	0.10%	0.10%	0.05%
Dipole – PS	$\delta I/I$	0.20%	0.20%	<0.10%
Position – surveys	$\delta\theta/\theta$	0.01%	0.01%	0.01%
Position – BPM cal	$\delta\theta/\theta$	0.05%	0.05%	0.05%
Stray magnetic field	$\delta\theta/\theta$	0.50%	0.05%	0.05%
TOTAL	**$\delta p/p$**	**0.67%**	**0.36%**	**<0.19%**

Level 1 Effort

- Shield Earth's field with mu-metal
- Improve spatial analysis of existing field map

Level 2 Effort

- Shield Earth's field with mu-metal
- Design and fabricate higher quality dipole (more uniformity, higher field)
- Move from trim to precision power supply