Meeting Minutes – 11/26/14

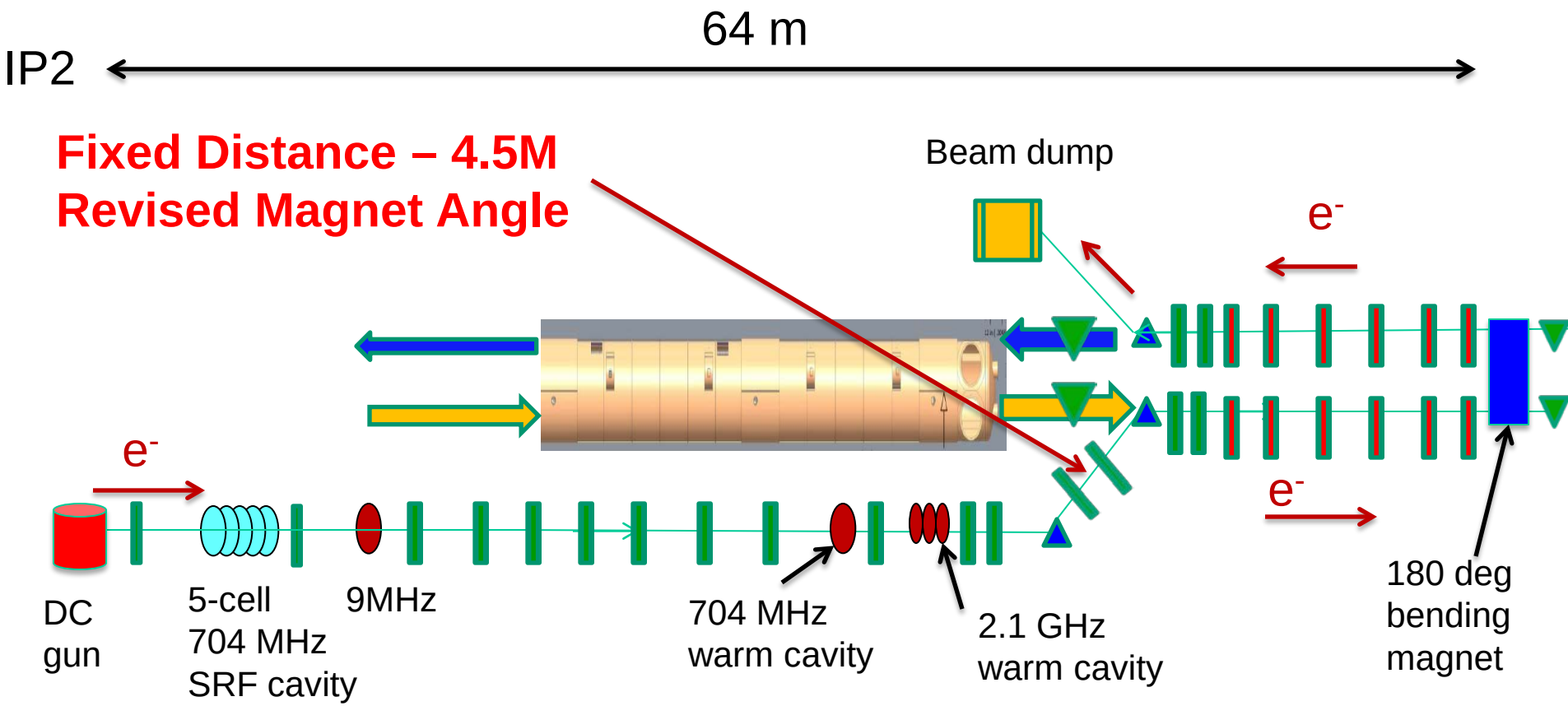
1. Alexei discussed significant upgrade and added components for beam diagnostics before, in, and after the cooling section. Beam line with instrumentation drawings/sketches needed for MAC Review on 8, 9 December.
2. 20˚ injection line to cooling section:
   - Per A. Fedotov the length of the 20˚ injection line to cooling section to be verified with J. Kewisch. There must be enough resolution to measure energy spread. This line has profile monitor, BPM, and solenoids.
3. Cooling Section:
   - W. Meng and K. Hamdi have developed the design of the 180˚ dipole. The beam pipe for this dipole has a smaller vertical aperture then the RHIC standard pipe of 5” so adapters are needed.
   - Length of beam line between the 180˚ dipole and adjacent solenoid may need to be longer than 1 meter for instrumentation (to be determined).
   - A small beam line with a 45^{o} dipole for beam diagnostics and tuning will be added after the 180˚ dipole on the yellow beam line side.
   - Length of beam line between 20˚ dipole and first HF solenoid on the yellow side to be determined to accommodate profile monitor and slits.
   - All HF Solenoids have H & V corrector windings, they may not be powered; but, the option is there.

4. Power Supplies:
   - Compensating Solenoids remain at 6 in series (6B & 6Y) with 1 power supply for blue and 1 power supply for yellow.
   - The fringe field cancelling (bucking) coils in LF Solenoids will be powered in series with 1 power supply for blue and 1 power supply for yellow.
   - R. Lambiase needs thermal calculation (average temperature) of LF (air-cooled) and HF (water-cooled) Solenoids to determine power requirements. K. Hamdi will do the calculations.
   - The power supplies for the matching solenoids (HF) need to be purchased. These solenoids are 2 kW and $12K each.

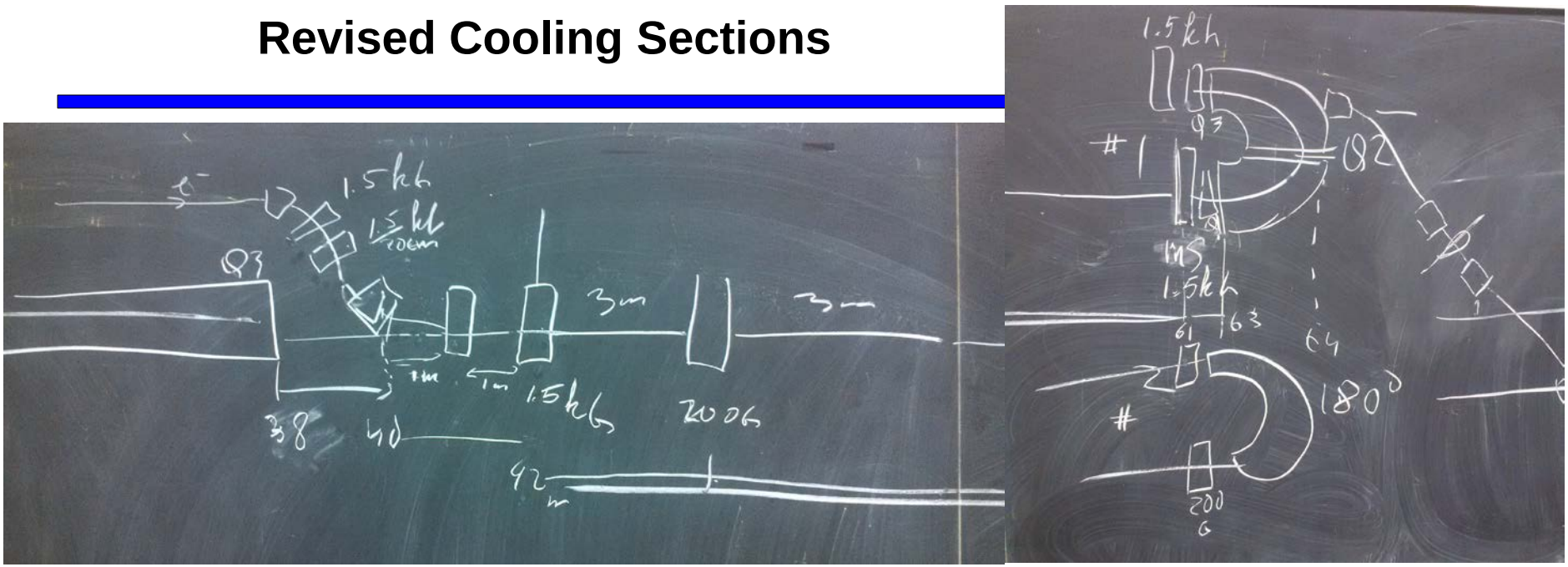
NOTE: Because of lattice changes (1st bullet) parameters for many magnets are not defined: the dipole in short diagnostic line used for e-gun commissioning, 20˚ dipoles in/out of cooling sections (qty: 3 or 4), compensation dipoles for ion beam (4), new dipole yellow beam diagnostic line. Bob also needs to know the normal operating range of magnets for various LEReC energies.

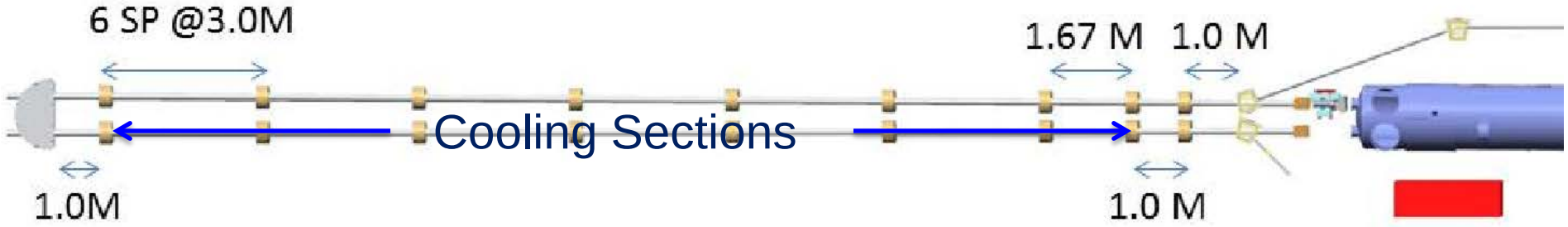
5. Compensating dipoles for the ion beam (at 20º and 180º dipoles) may be available from NSLS I (21º). J. Tuozzolo to verify.

LEReC-I (2MeV): Gun to dump



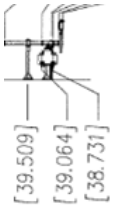
Revised Cooling Sections





Q3 Details: valve, bellows, 10 Hz corrector, RHIC BPM, ion pump, transition chamber, survey points.

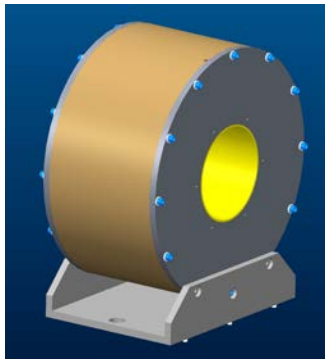
NSLS I compensating dipoles and PS: specifications?

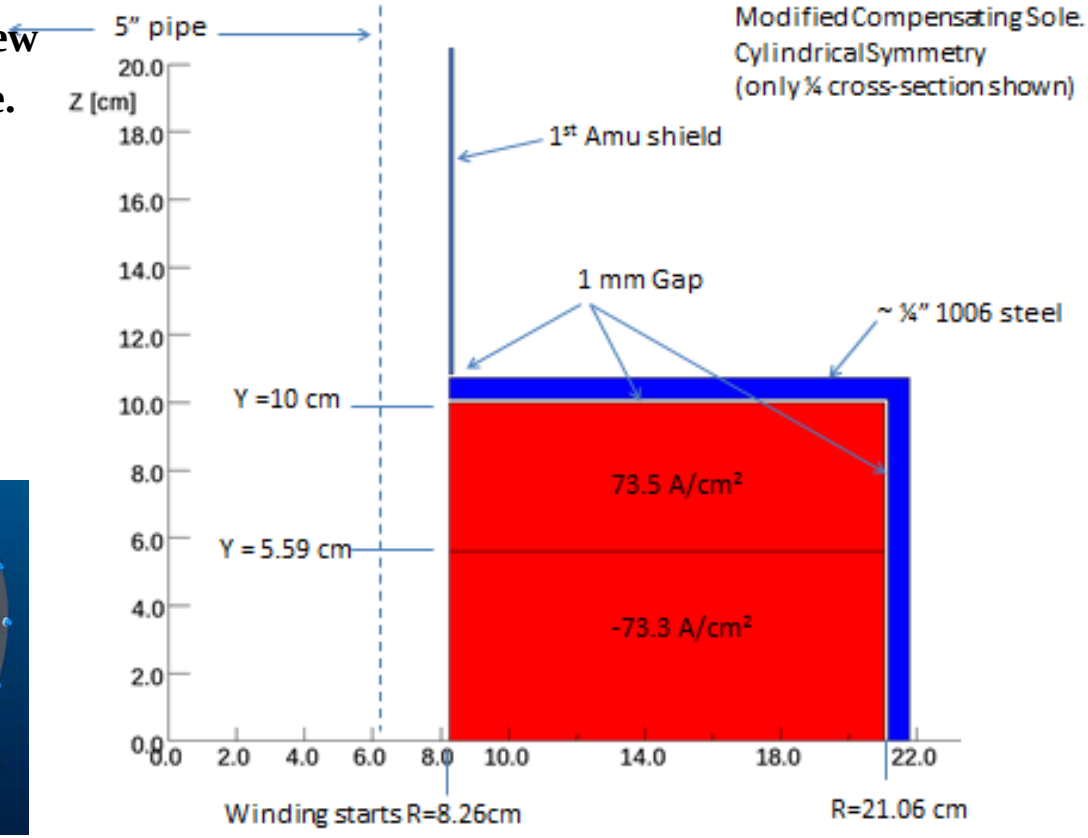


Compensating Solenoids

1. Compensating Solenoid: Presently based on W. Meng's design for 0.20kG with bucking coils.
2. Compensating Solenoid : The separate leads for the bucking solenoid coils and the main solenoid coil on the magnet assembly terminal block.
3. Compensating Solenoid Power Supplies: It has not been determined whether each solenoid will require 1, 2, or 3 power supplies.
4. Spacing: Compensating solenoids will be spaced 3 meters apart.
5. From the Excel file, the Bz < 1 Gauss starts at Z = 19.7 cm., where cooling will be effective. The B**2 integral meets the required value (4E5 Gauss^2 - cm). The Bz integral is much more than 2000 Gauss-cm.

- **Negotiate N vs I with PS group.**
- **Complete SCD's checked, SOW in review**
- **Layout BPM, Bellows, Chamber Flange.**

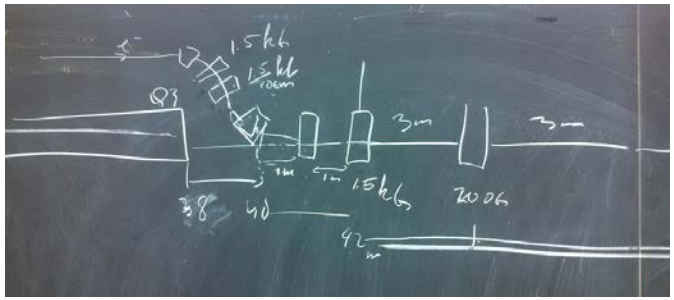


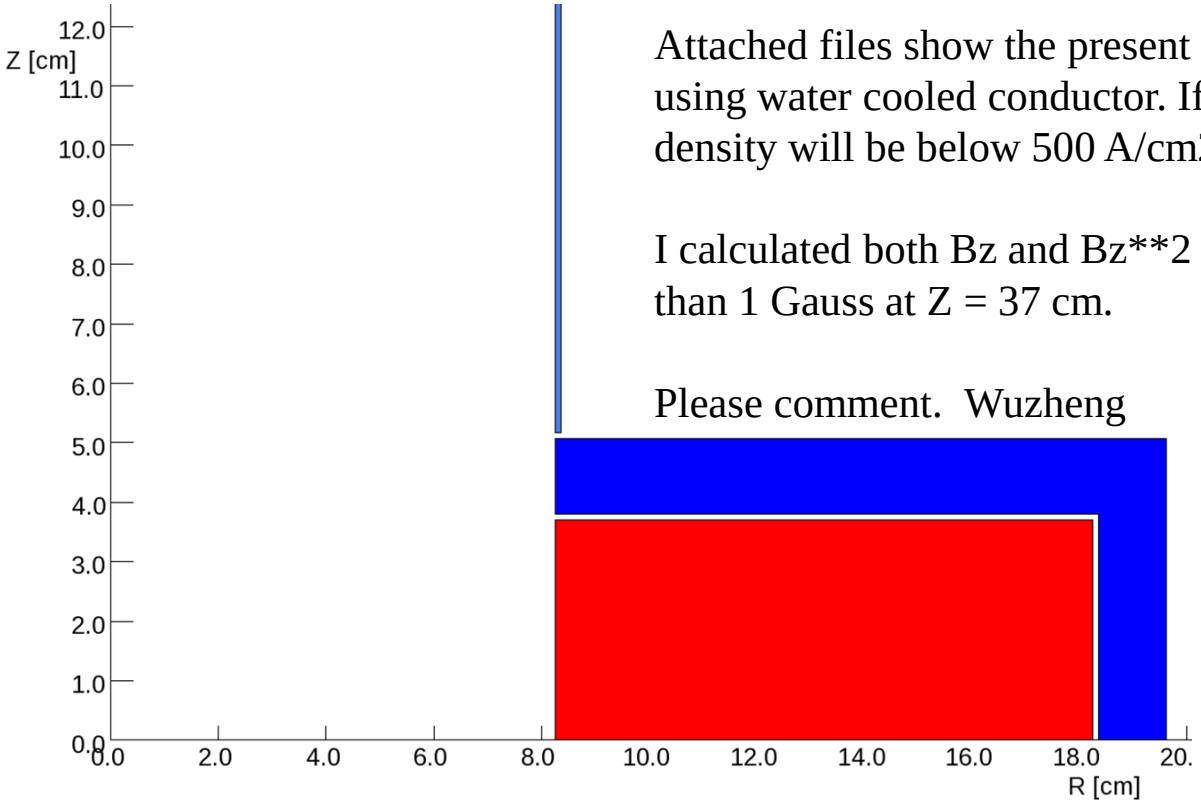


Matching Solenoids

Matching Solenoid w/corrector

- 4 required in cooling section w/o bucking coil
- Corrector 100 Gcm, present specification.
- **Need to define N vs. I.**





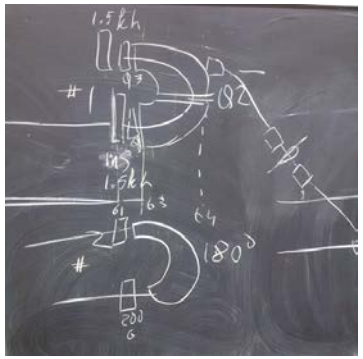
Attached files show the present status of 1.5 kG solenoid design by using water cooled conductor. If copper area is 50%, then the current density will be below 500 A/cm2 in the copper.

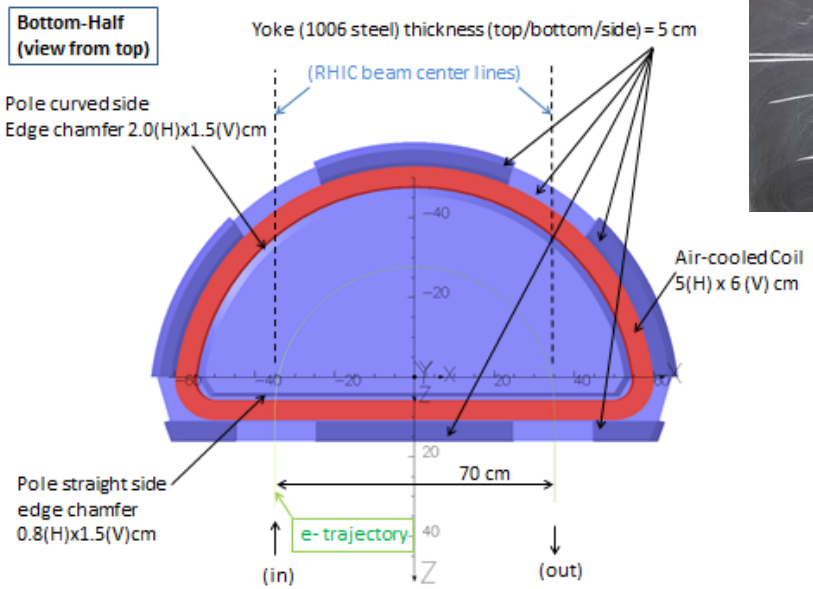
I calculated both Bz and Bz**2 along the Z-axis. Bz becomes less than 1 Gauss at Z = 37 cm.

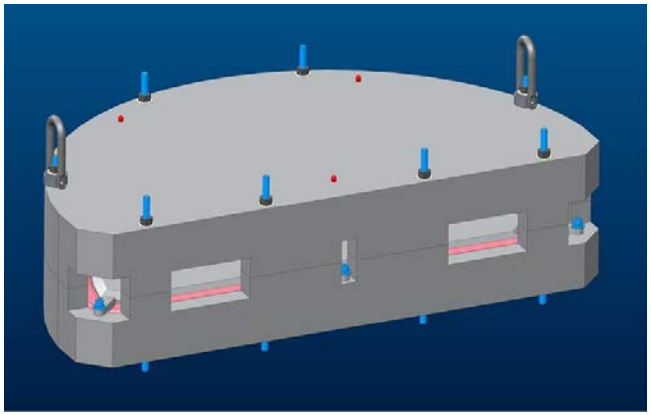
Please comment. Wuzheng

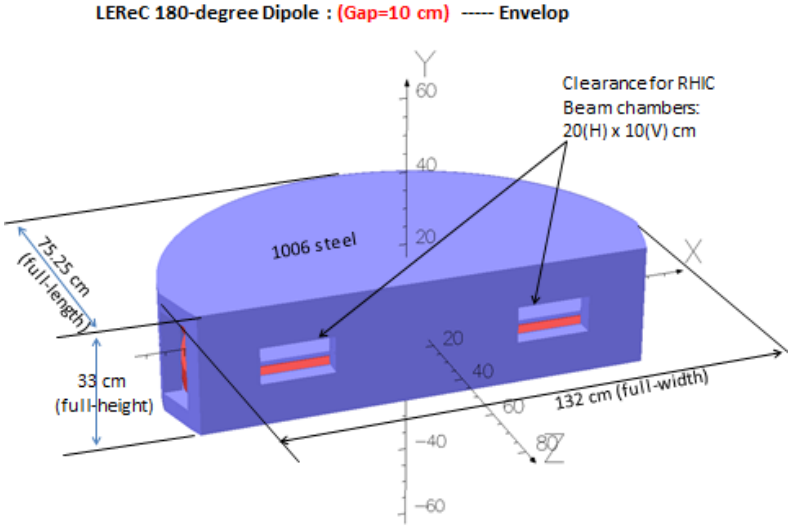
180º Dipole Magnet

Need to define N vs. I.





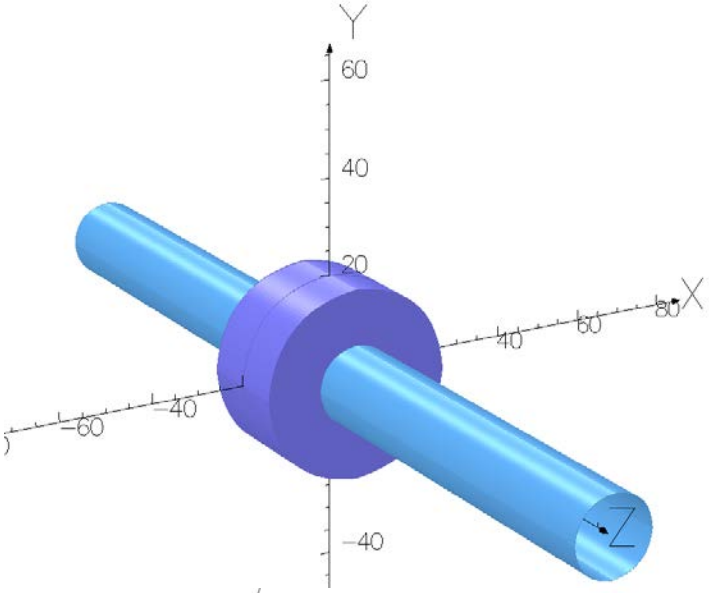


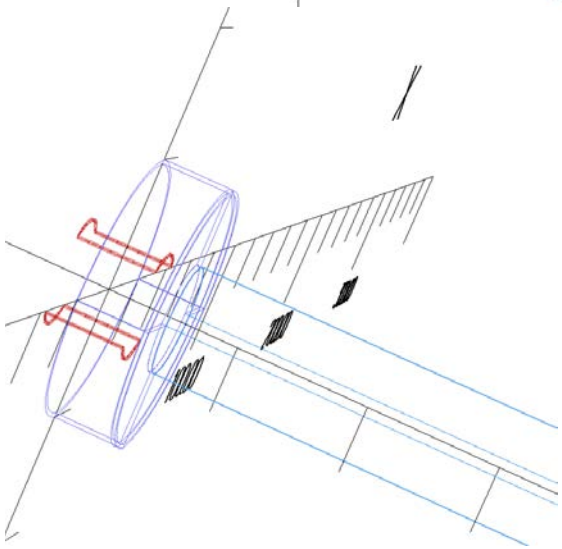


Electron tracking results and field qualities along entire trajectory on R=2 cm curved cylinder:

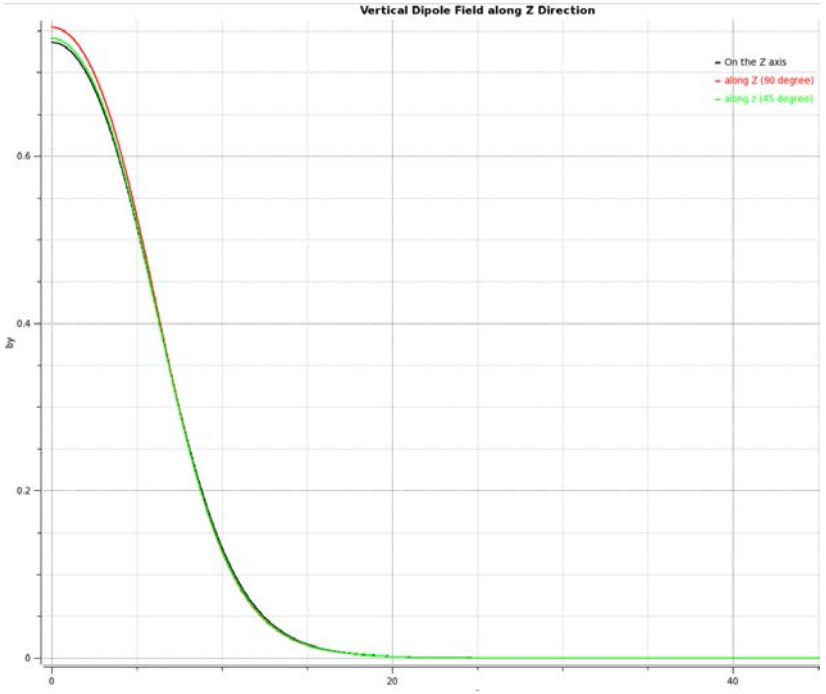
	Ek = 5 MeV	Ek = 1.6 MeV
Total current per coil (Ampere-turn)	2119.146	791.077
Overall current density (A/mm²) (coil-pack cross-section: 5.0 x 6.0 cm)	0.7064	0.2637
Central Field deep inside magnet (Gauss)	525.21	195.78
Effective Magnetic Length (cm)	109.43	109.57
Full b1-integral (dipole) (G-cm)	5.7471E4	2.1452E4
Full b3-integral (6-pole) (G-cm) [Ratio to dipole integral]	0.132 [2.30E-6]	0.005 [2.44E-7]
Full bending angle as shown in tracking studies (required 180°)	180.002°	180.003°

Compensating Solenoid Corrector



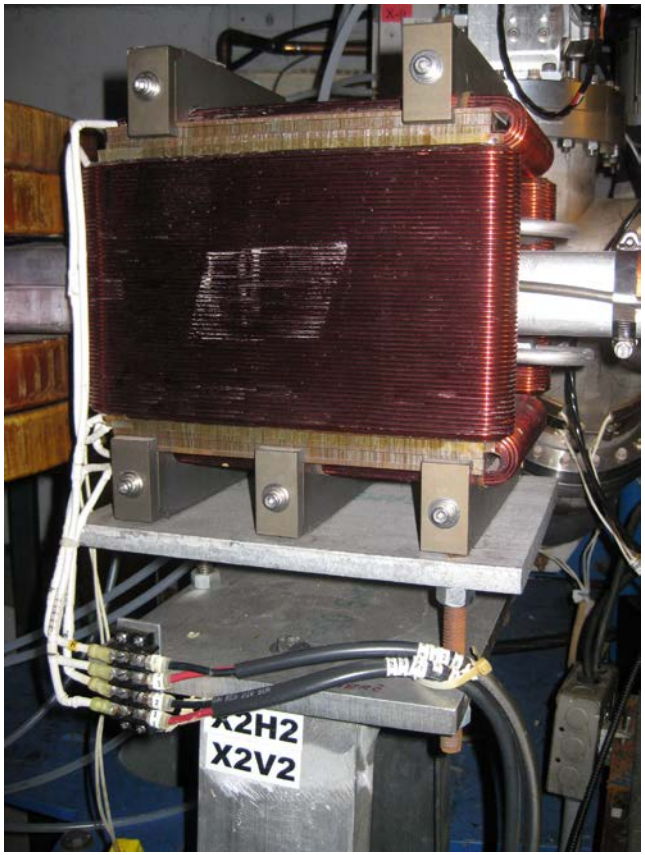


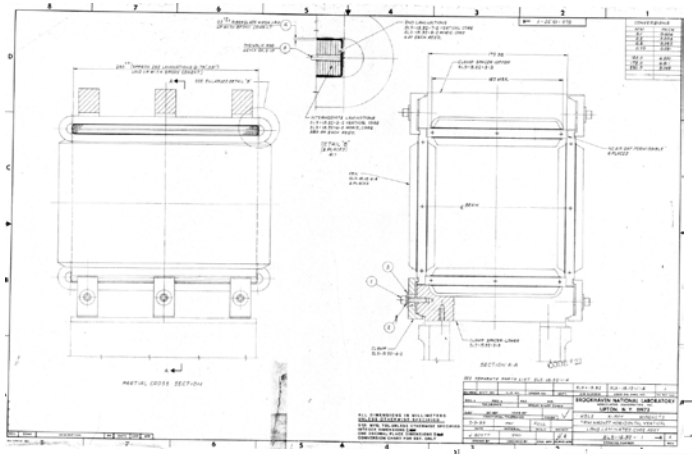
Dipole correction 10.24 A-T
Per coil; Straight section
Half-length: H1=6 cm
13 turns/.8 amps = 1 amp PS
(AWG #18 = 0.98 A/mm2)

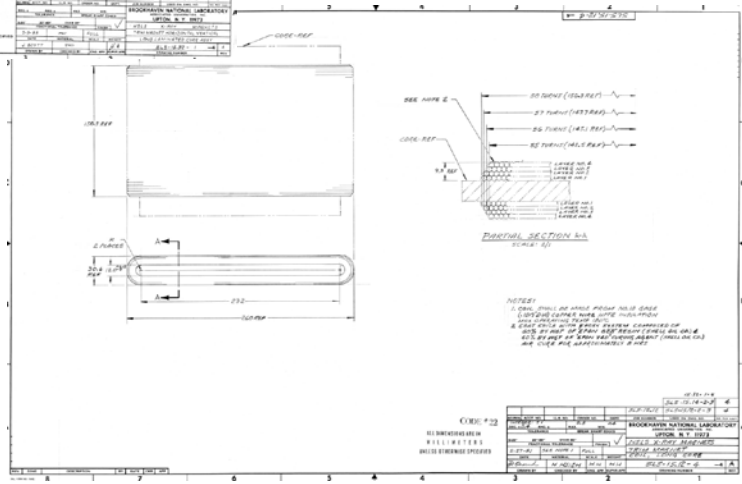


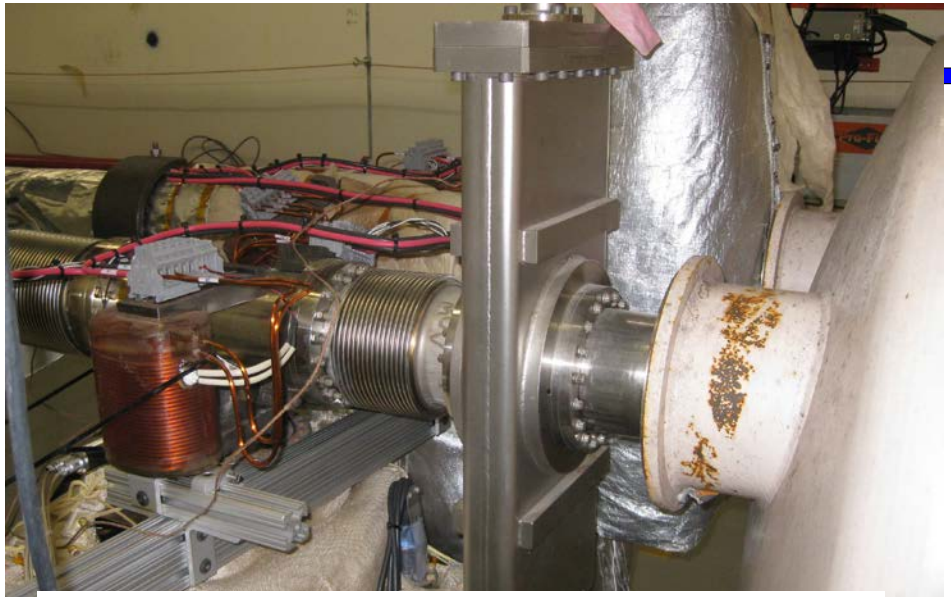
NSLS I Equipment

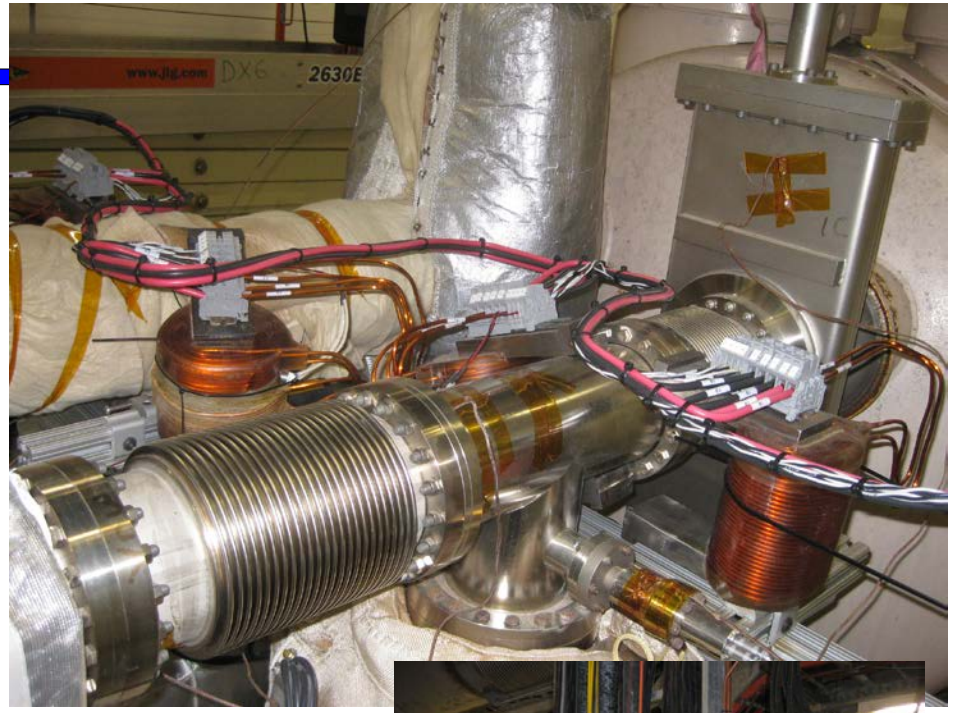
- Compensating dipole for 21^{o} e beam injection/extraction
- 375 Gcm/A
- Define Bl requirement for 21^{o} and 180^{o} compensation.

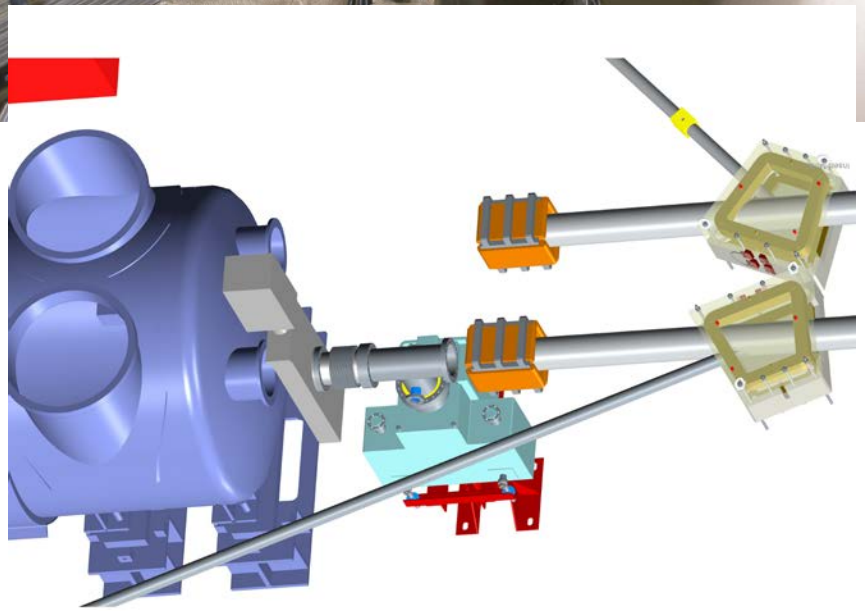


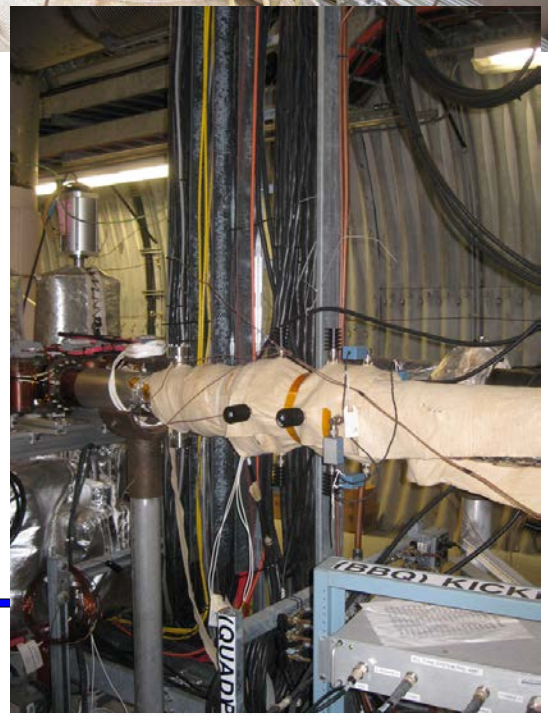












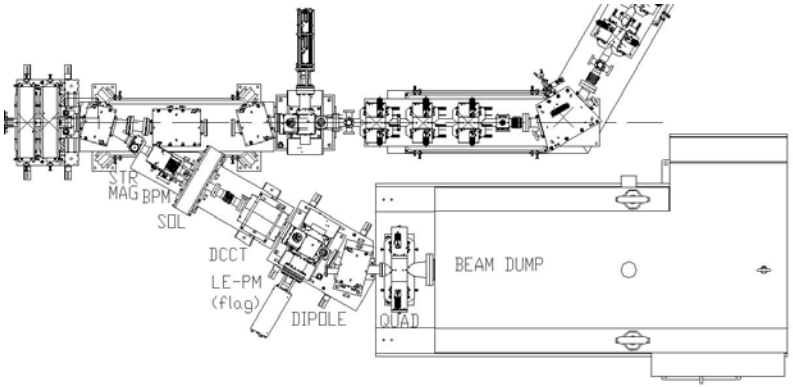
BROOKHAVEN NATIONAL LABORATORY

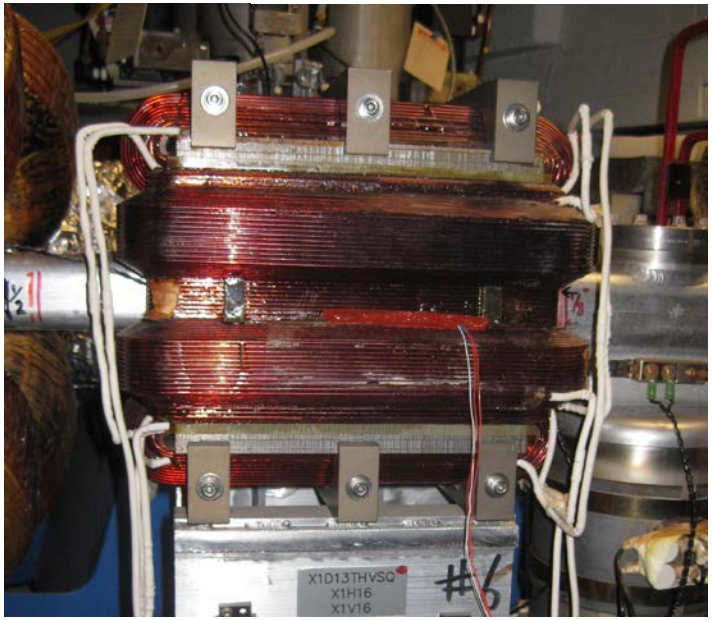
Low Energy RHIC e$^-$ Cooling

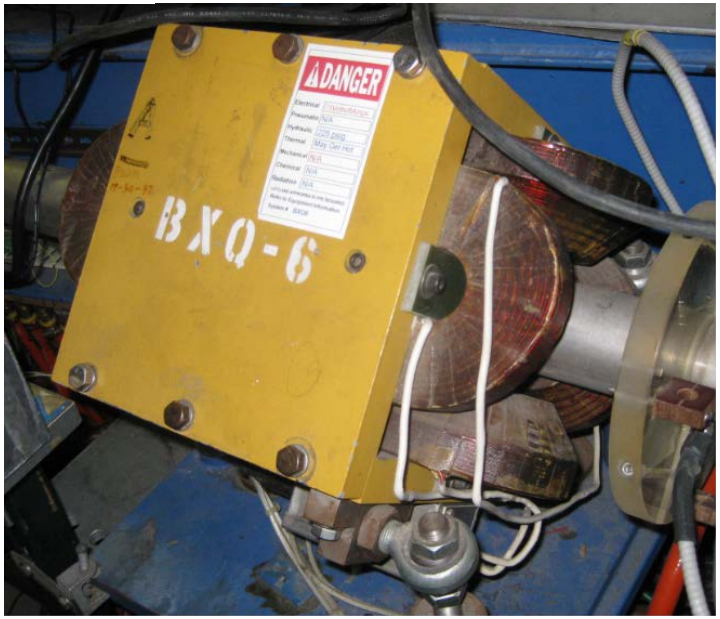
NSLS I Equipment

Beam dump line quadrupole(s)?

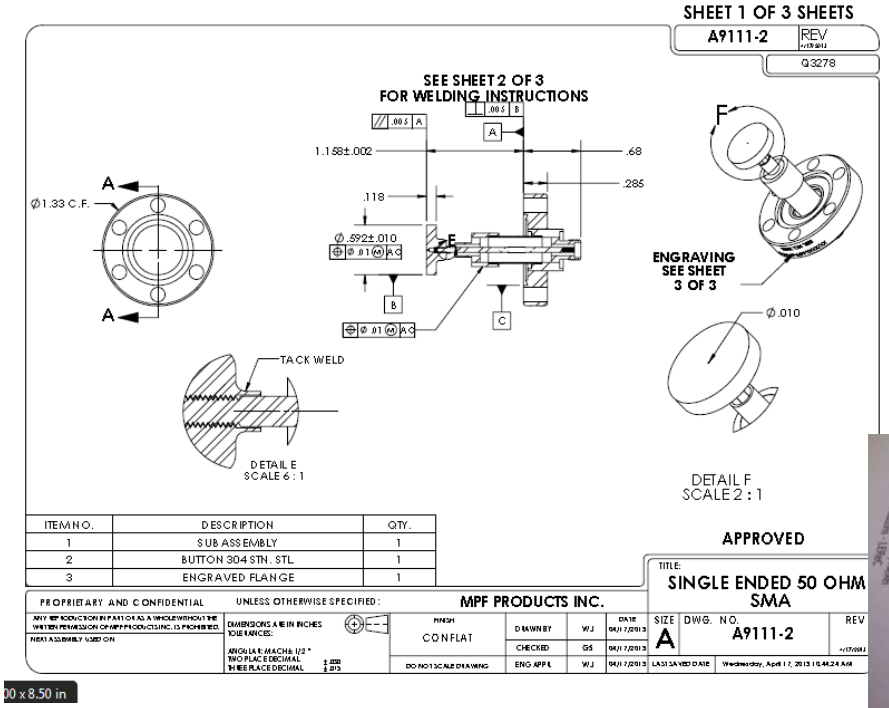
- ERL or
- NSLS I

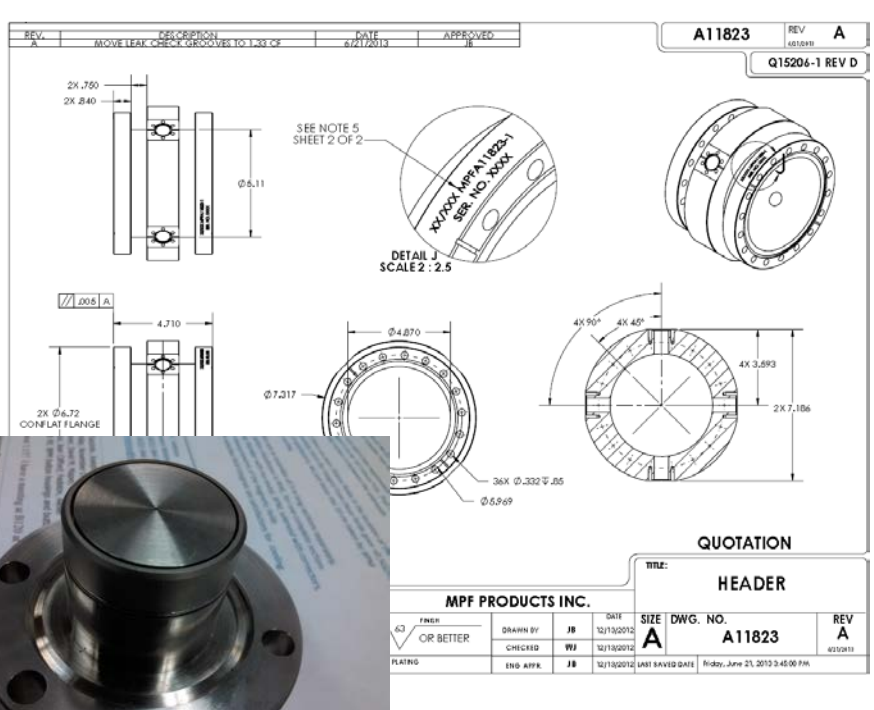






Cooling Section BPM's

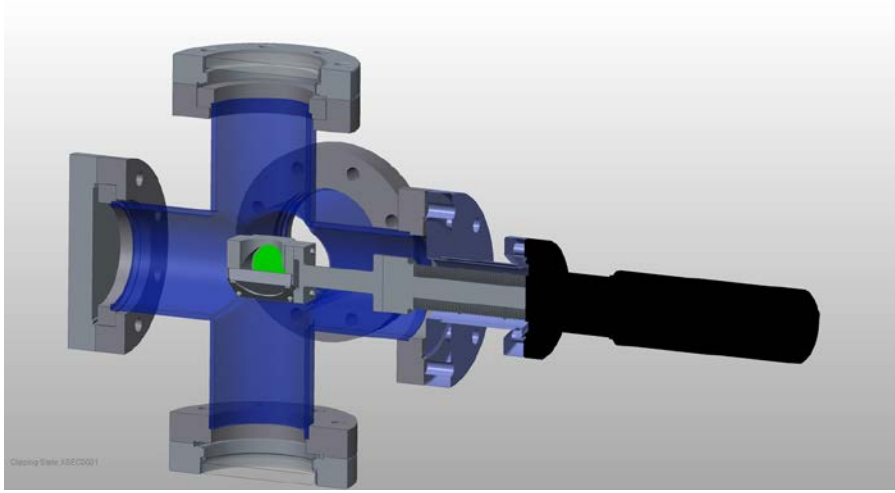


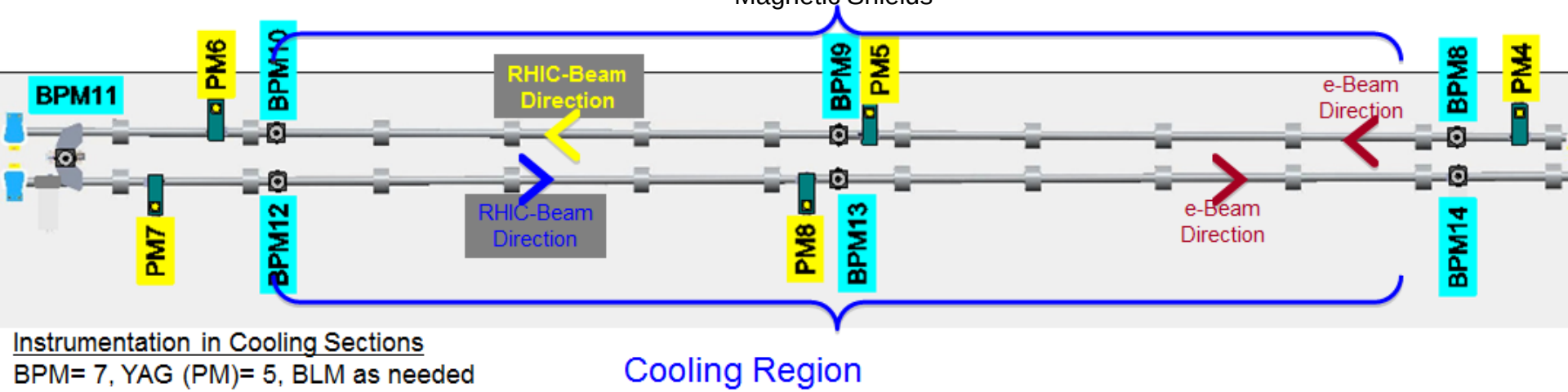


- Phone conference with MPF
- Larger diameter buttons on pick-up – 27 to 30 mm diameter
- Machined vacuum chamber, 304L, no threaded holes on flanges.
- Button hole size TBD microwave studio (D. Gassner).

Vacuum Chamber/System Requirements:

- 5” (12.7 cm) OD vacuum chamber, bake-out temperature.
- No ion pump tees in the cooling section.
- One RHIC shielded bellows per solenoid
- Transitions to 10 cm aperture dipole magnets.
- Dipole magnet vacuum chambers.
- 6 Profile Monitors, screen size??





Instrumentation in Cooling Sections
BPM= 7, YAG (PM)= 5, BLM as needed

Cooling Region