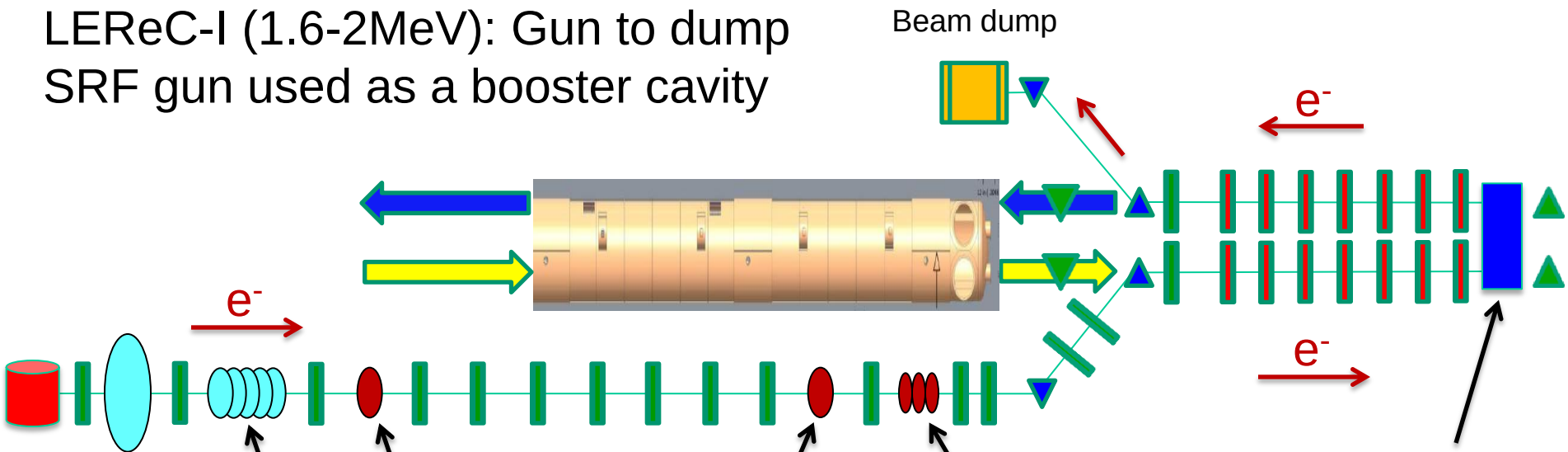
64 m

IP2

LEReC-I (1.6-2MeV): Gun to dump
SRF gun used as a booster cavity



20 & 180 deg Dipole

- 20 dipole design is ready for procurement – steel and field accuracy discussion
- Spectrometer Magnet for energy spread measurement:
  - Will be either the 180 dipole or another dipole magnet feeding a diagnostic line.
  - 180 dipole affects cooling section design and schedule.
  - BOTH field quality and reproducibility are important. Other means of doing the energy spread measurement are being reviewed.
  - 180 and 20 Dipole multipoles must be =/<10e-3
  - Study of low packing factor steel dipoles continues.
  - Subsequent to meeting Wuzheng found a major difference between 2D and 3D Opera analysis. 3D analysis showed that much higher currents were not needed with low PF (to achieve the same field as when using solid core).
  - Anamesh Jain will evaluate the field quality at low field on one of the CEC 45 dipoles.
  - Review of sliding design of 180 in process: K. Hamdi produced magnet design where chamber and dipole steel move together +/- 10 cm Z together.

LF Solenoids

- Bids received with good pricing (lower than estimated)
- Phone conference with low bidder successful
- Requested PPM to place order. **Contract this week.**

HF Solenoids

- Bids received with good pricing (lower than estimated)
- Requested PPM to place order. **Contract this week.**

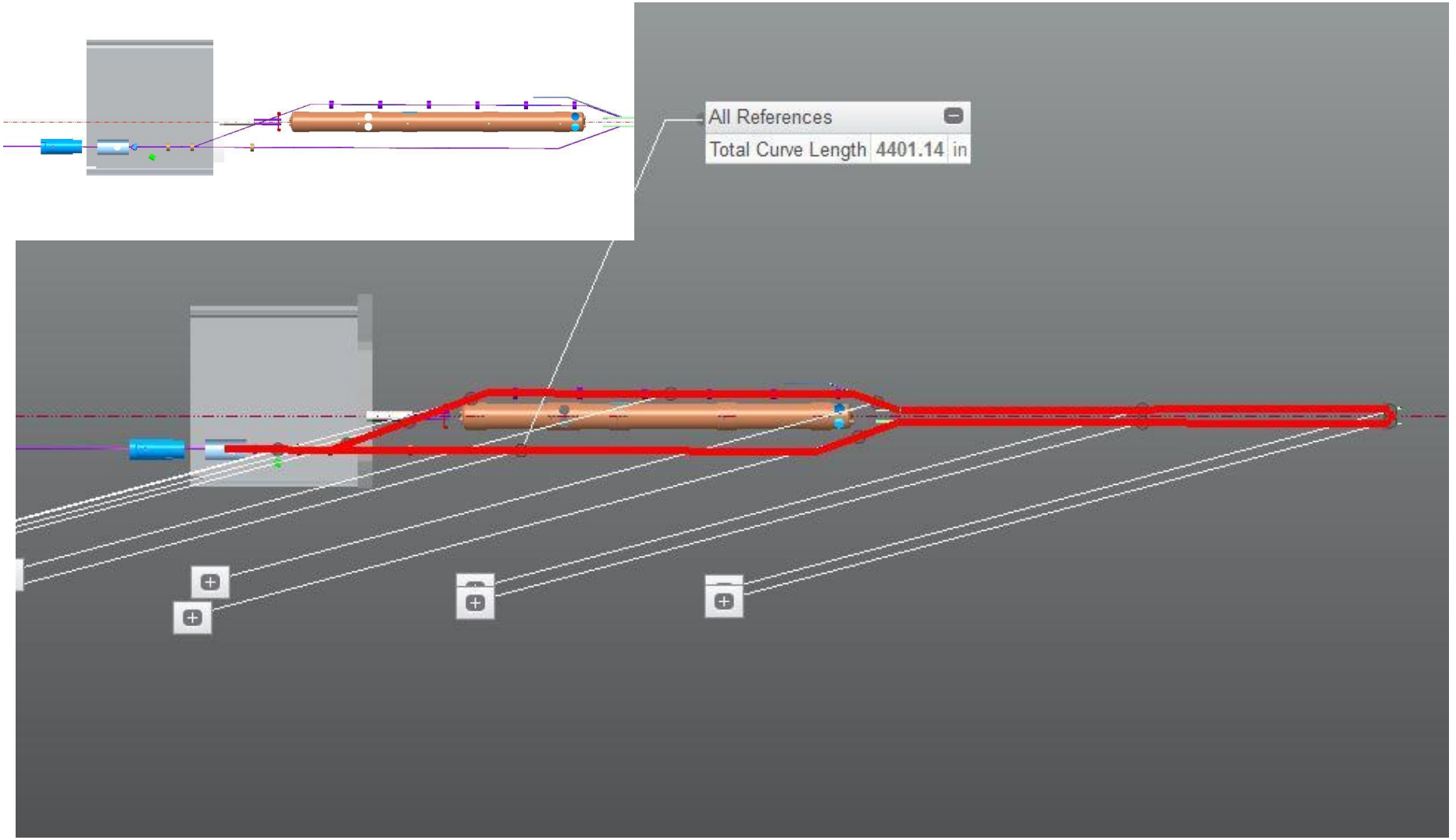
Instrumentation

- D. Gassner expects quotation from MPF for BPM's soon (expects $40K). There has been back and forth discussion on manufacturing tolerances.
- Discussion of competitive vs. sole source bid. A spec-controlled drawing will be needed for competitive bid. MPF quote with drawing is proprietary.

Beam Line Vacuum

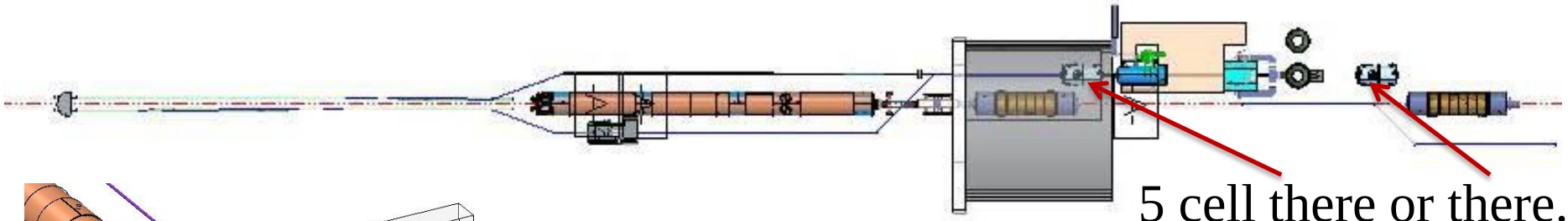
- The standard bellows design for cooling section has some problems bolting up to BPM – bolt can go in only one way. He prefers to not use studs.

5 cell cavity location

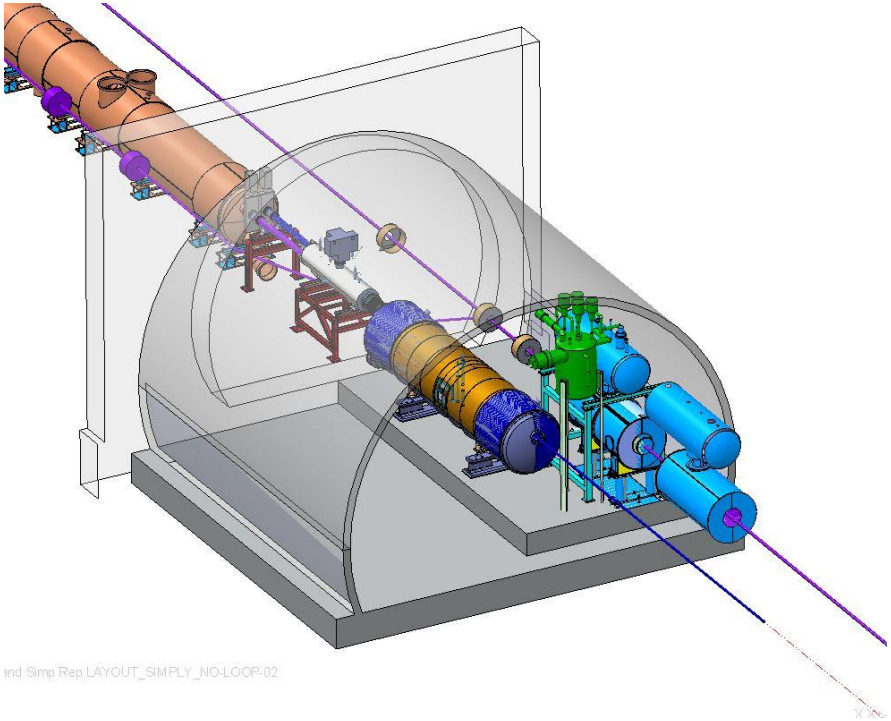


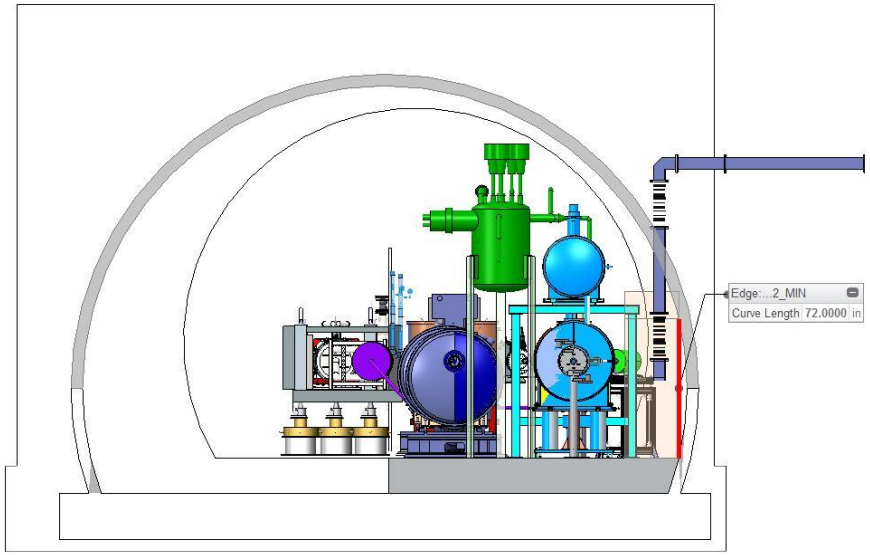
5 cell cavity location

Location of egun and 5-cell, the beam line length and distance from IR center and tolerance, is being updated by R. Meier.



5 cell there or there.
Need to change return line





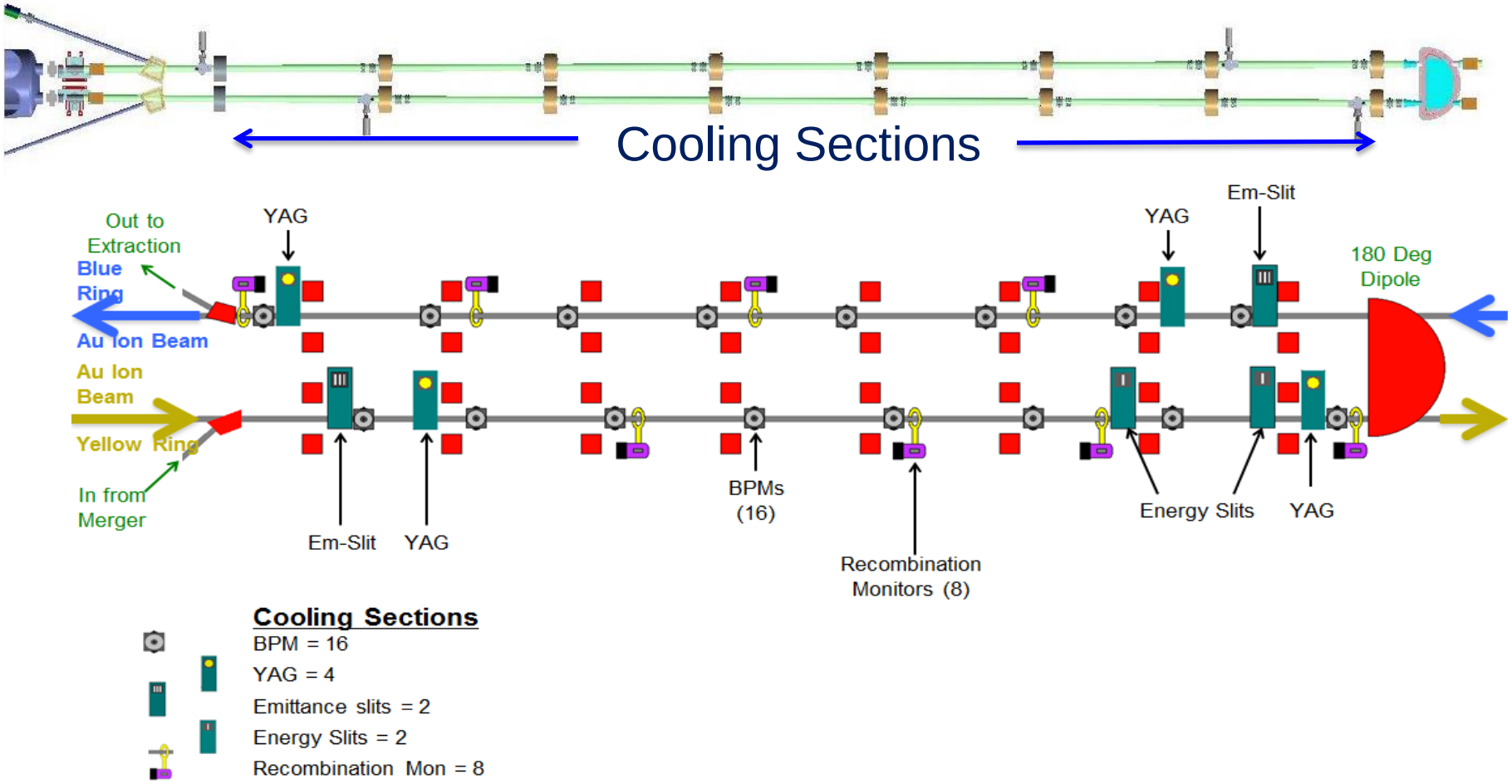
Reminder: Al Pendzick needs new penetration required at 2:00.

This will include type (RF, instrumentation, power), location (from/to), and area of cable space. The request for this contract must be by March-April in order to have penetrations installed during this shutdown (takes 6 mo. to get jobs done - October).

Cooling Sections

Magnet Lattice Physics Review

Beam Instrumentation Meetings on Thursday 3:00 PM



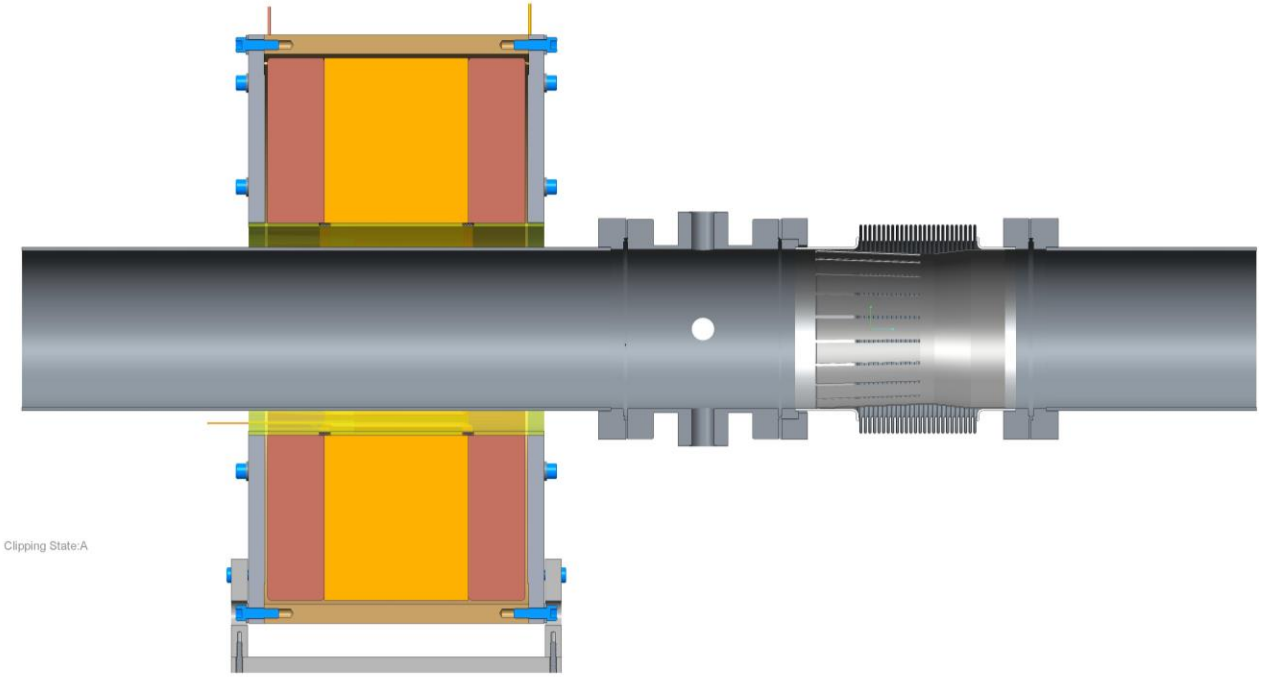
Compensating Solenoids

Bids received. Awaiting best and final 9/15/2015 delivery

Matching Solenoids. Awaiting best and final 9/15/2015 delivery

Design Review:

- Field measurements and positioning accuracy specifications.
- Magnetic shielding measurements
- Magnet measurement fixture Plan for mu metal prototype and test fixture.



20º Dipole Magnet

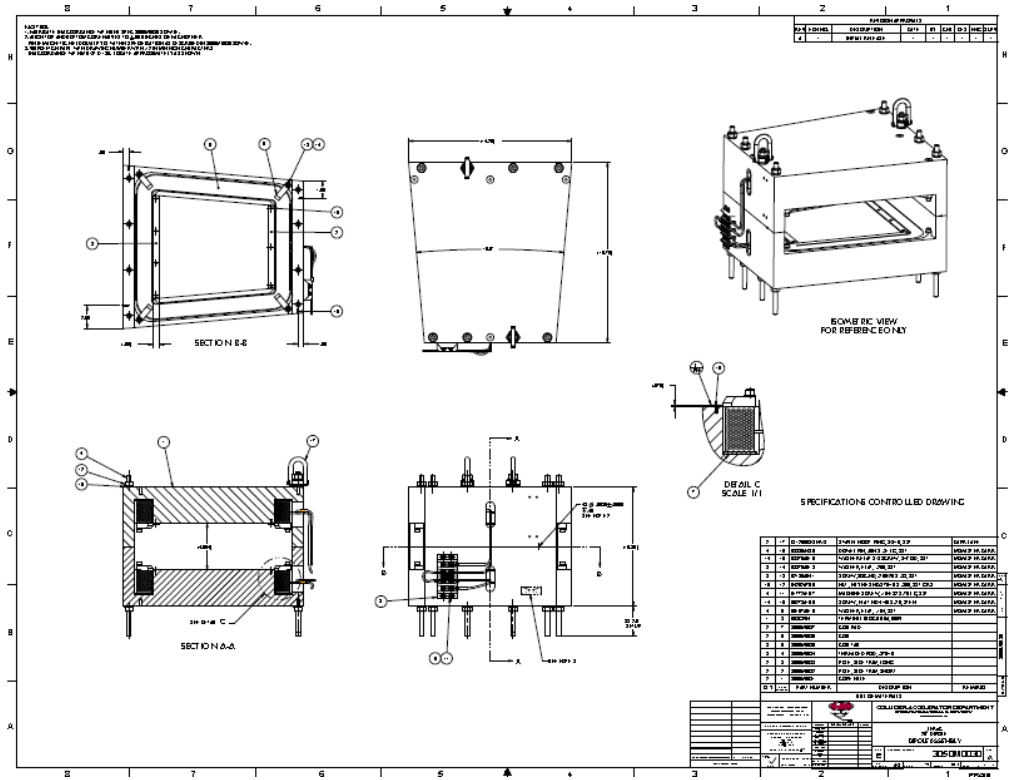
Drawings checked – preparing requisition.

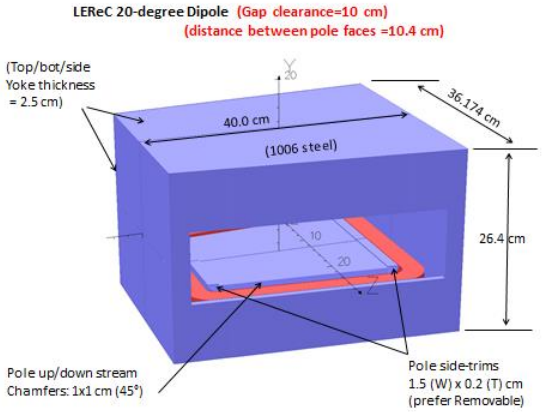
Magnetic field quality and repeatability for energy spread measurement – only 20º

Distance Between Pole Faces = 10.4 cm (4.1 in.)

Magnet Vertical Gap = 10 cm

Vacuum Chamber V Aperture = 9.5 cm (3.74 in.)





Electron tracking results and field qualities along trajectory on R=1 cm curved cylinder:

	Ek = 5 MeV	Ek = 1.6 MeV
Current per coil (Amp-turn)	1053.288	393.192
Overall current density (A/mm²) (overall coil cross-section 3.0x4.8 cm)	0.73145	0.27305
Central Gap Field (Gauss)	251.20	93.73
Half b1-integral (dipole) (G-cm)	3.1982E3	1.1930E3
Half b3-integral (6-pole) (G-cm) [Ratio to dipole integral]	1.803E-2 [5.64E-6]	7.019E-3 [5.88E-6]
Half bending angle from tracking tests (required 10°)	10.013°	10.006°

180º Dipole Magnet

Magnetic field quality and repeatability for energy spread measurement

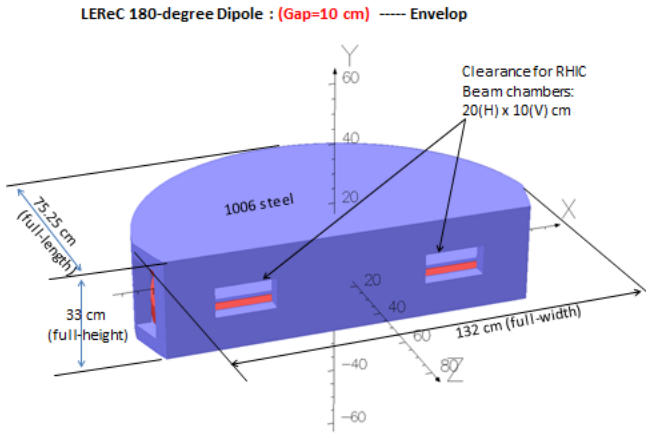
Range of motion for magnet core +/- 10cm.

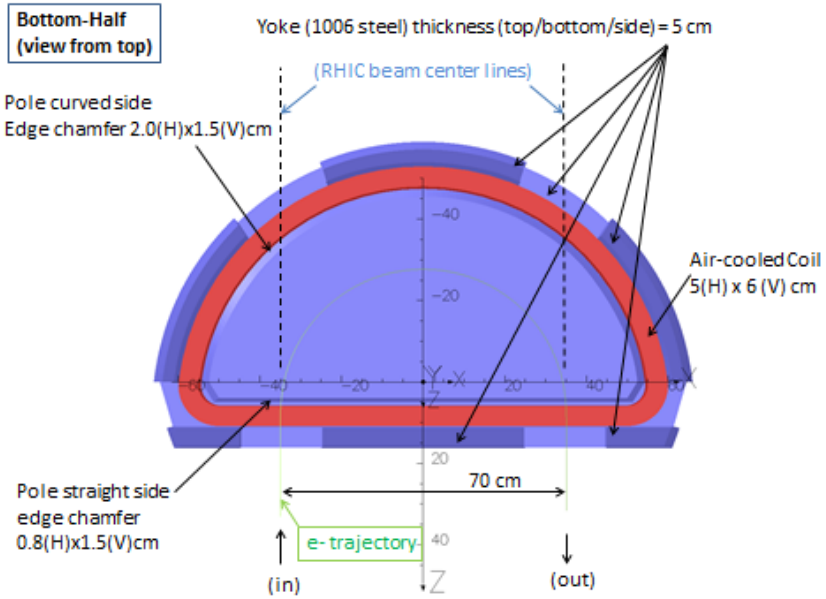
Core field quality: Test using CeC dipole (A. Jain)

Magnet Vertical Gap = 10.0 cm (3.94 in.)

Vacuum Chamber Aperture = 9.5 cm (3.74 in.)

Use CeC 45º dipole for low field measurements

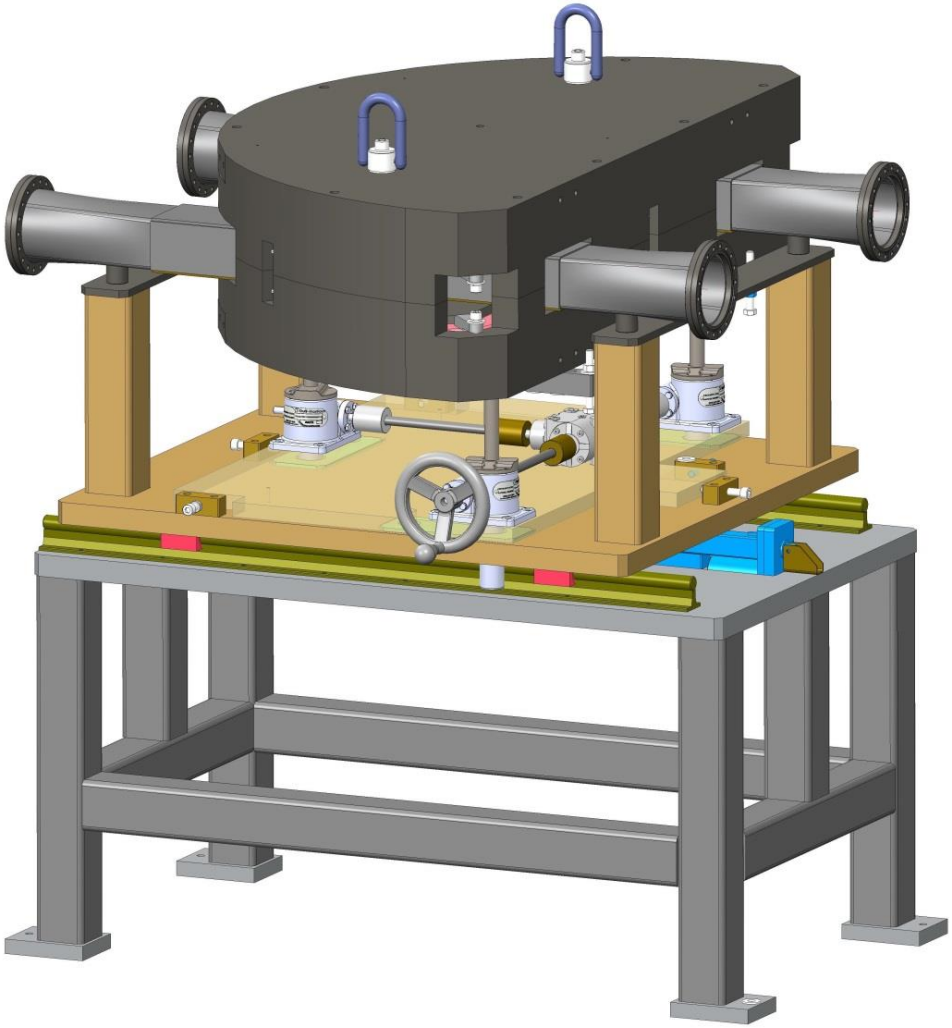


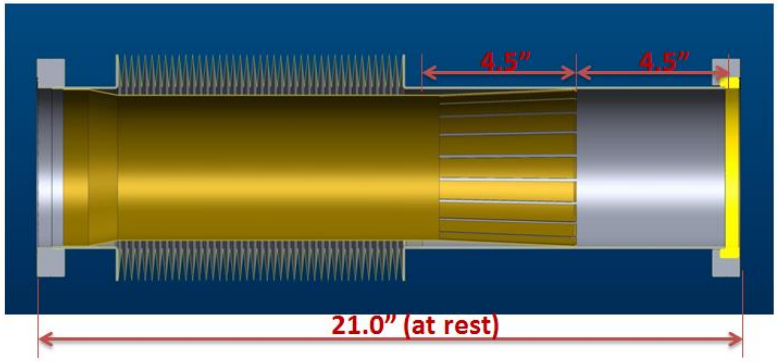


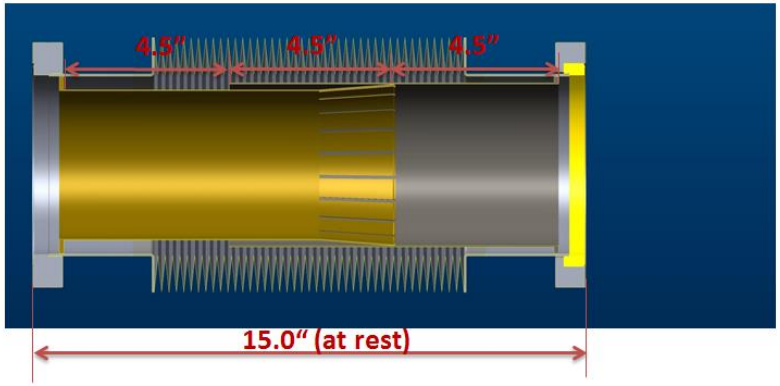
Electron tracking results and field qualities along entire trajectory on R=2 cm curved cylinder:

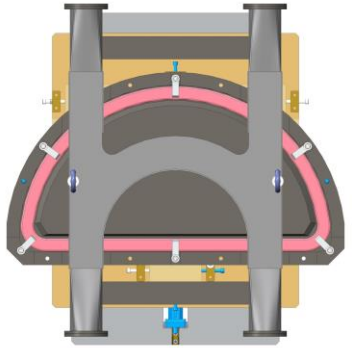
	Ek = 5 MeV	Ek = 1.6 MeV
Total current per coil (Ampere-turn)	2119.146	791.077
Overall current density (A/mm²) (coil-pack cross-section: 5.0 x 6.0 cm)	0.7064	0.2637
Central Field deep inside magnet (Gauss)	525.21	195.78
Effective Magnetic Length (cm)	109.43	109.57
Full b1-integral (dipole) (G-cm)	5.7471E4	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°

180° Dipole Magnet



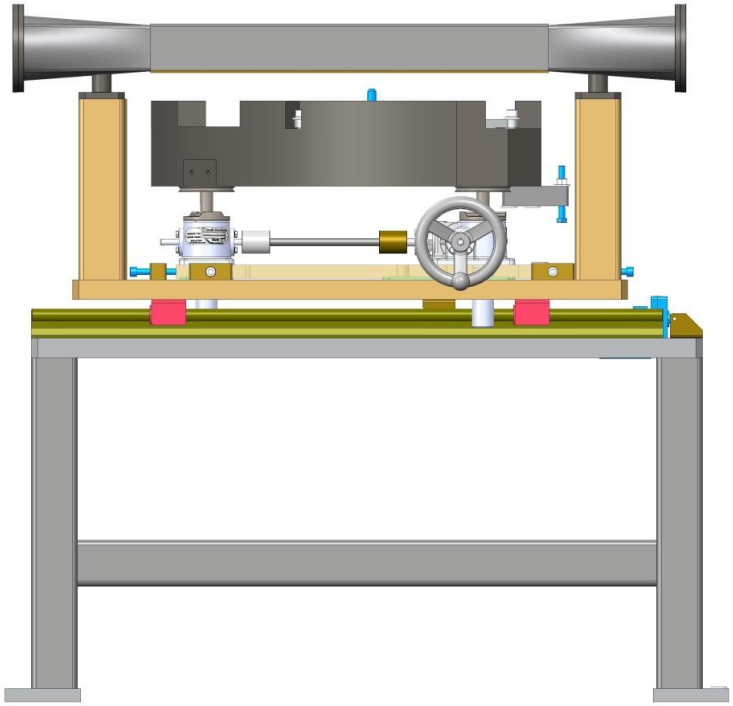




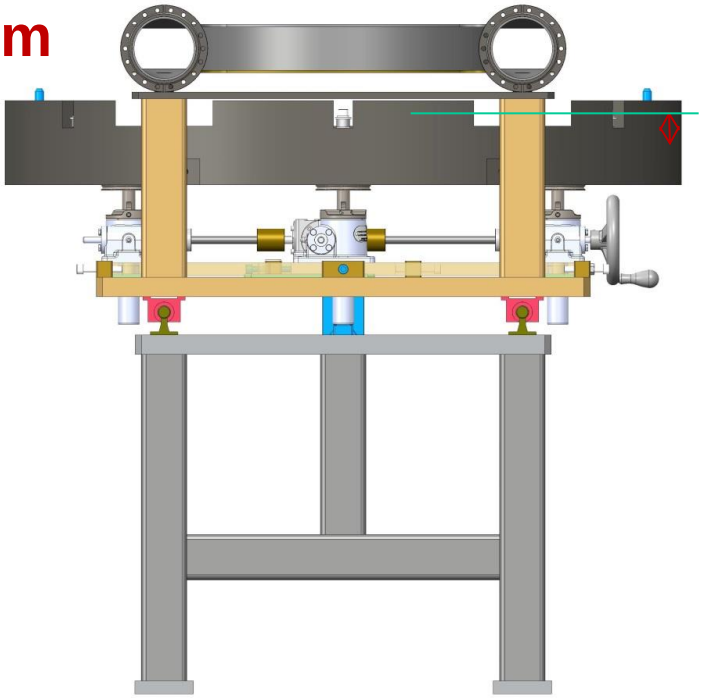


Dipole and vacuum chamber

± 10 cm



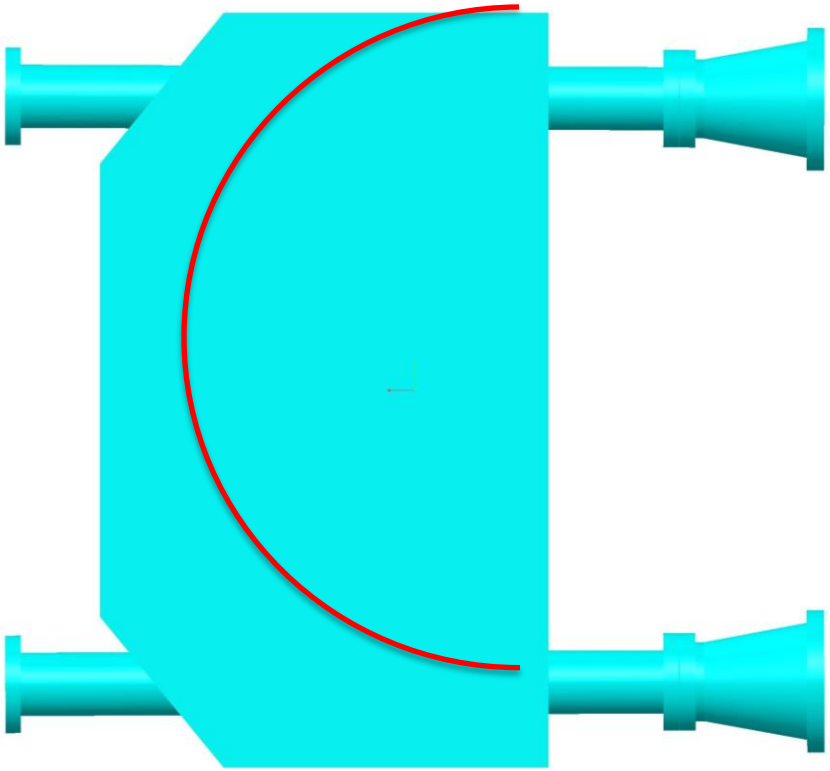
0-10 cm



5 cm

Vacuum Hardware

- Large open 180^{o} vacuum chamber and 20^{o} chamber - beam impedance concerns shield the electron beam path.
- Design and order 180^{o} vacuum chamber and 20^{o} chamber (KH)
- Design and order beamline RF shielded beamline bellows. (GW)



Design Room

180^{o} dipole magnet and vacuum chamber integration + large sliding bellows – beam line tuning magnet and vacuum chamber translation (KH)

Design 180o dipole chamber present for impedance review (KH)

Beam Instrumentation Profile Monitor Vacuum Chambers & ferrite insert (GW)

Beam Line 5” bellows with shields (GW)

Phase 2 5 cell cavity positioning (RM)

Phase 1 and 2 cryogenic system layout (RM)

20^{o} dipole fabrication drawings, vacuum chamber (KH)

20^{o} and180^{o} stand drawings (KH)

Beam line solenoid stand (GW) LF Solenoid, BPM, and long pipe are to be independently positioned and surveyed (Note: this can be on common stand).

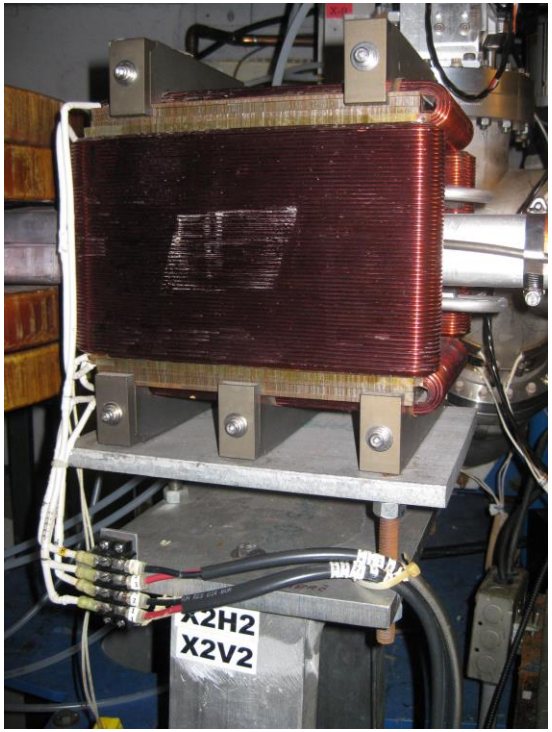
Beam line Beam Position Monitor drawings? (GW or VdM)

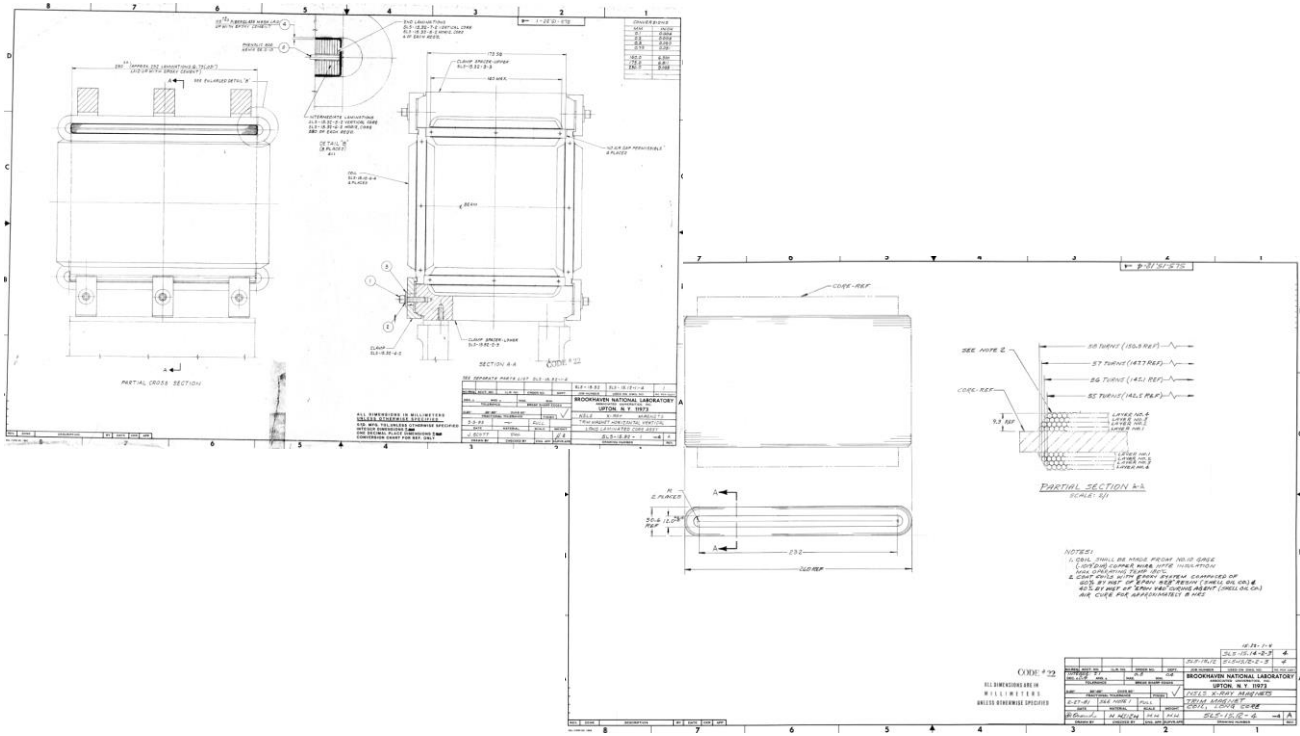
Magnetic Shielding drawing and solenoid magnetic measurement test station (GW)

Cable tray and penetration drawings

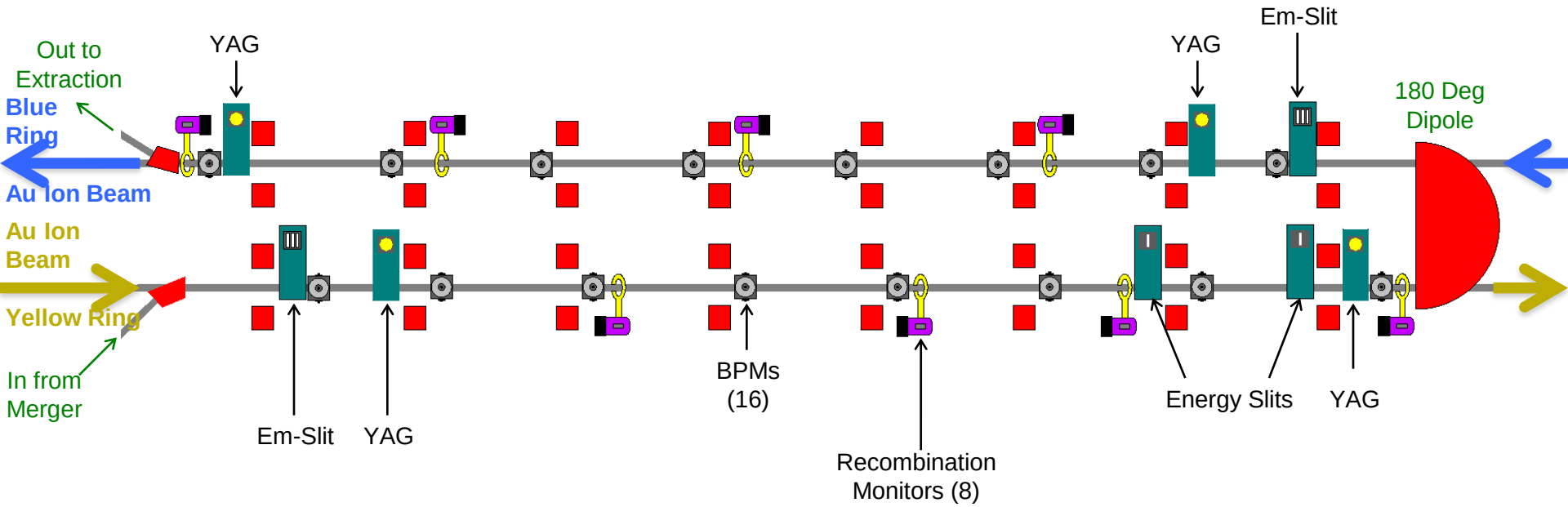
NSLS I Equipment

- Compensating dipole for 21^{o} e beam injection/extraction
- 375 Gcm/A
- On the list





Cooling Section Beam Instrumentation



Cooling Sections

BPM = 16

YAG = 4

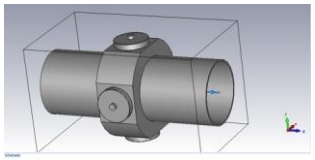
Emittance slits = 2

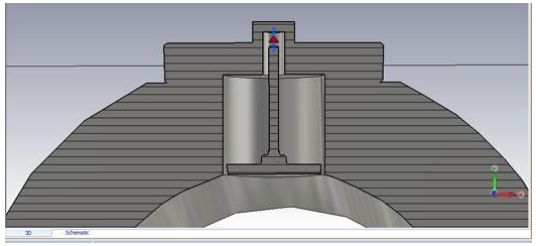
Energy Slits = 2

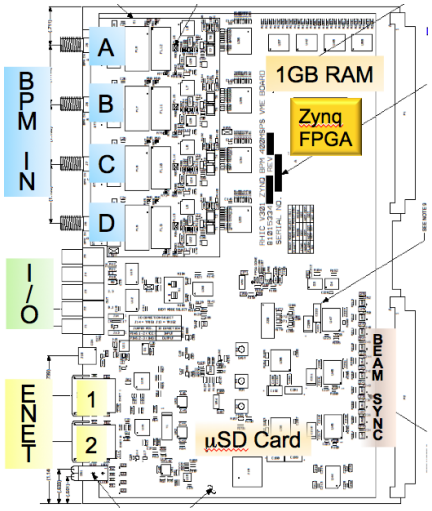
Recombination Mon = 8

BPMs in Cooling Section (14 Locations)

- Large Dia. BPM Housings
- 28mm buttons
- N-Type feedthrough
- MPF Q7031-1



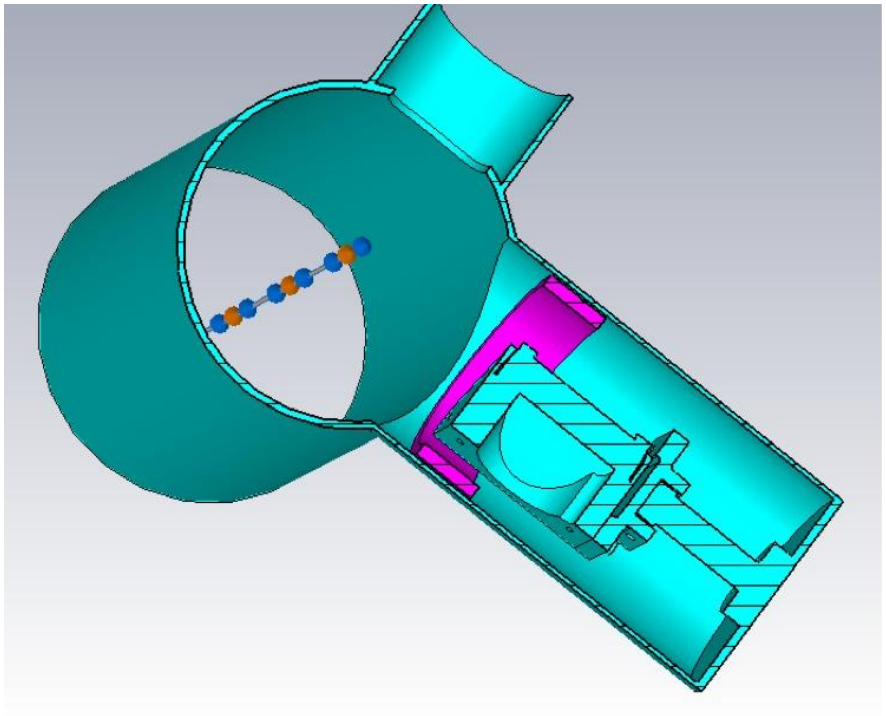


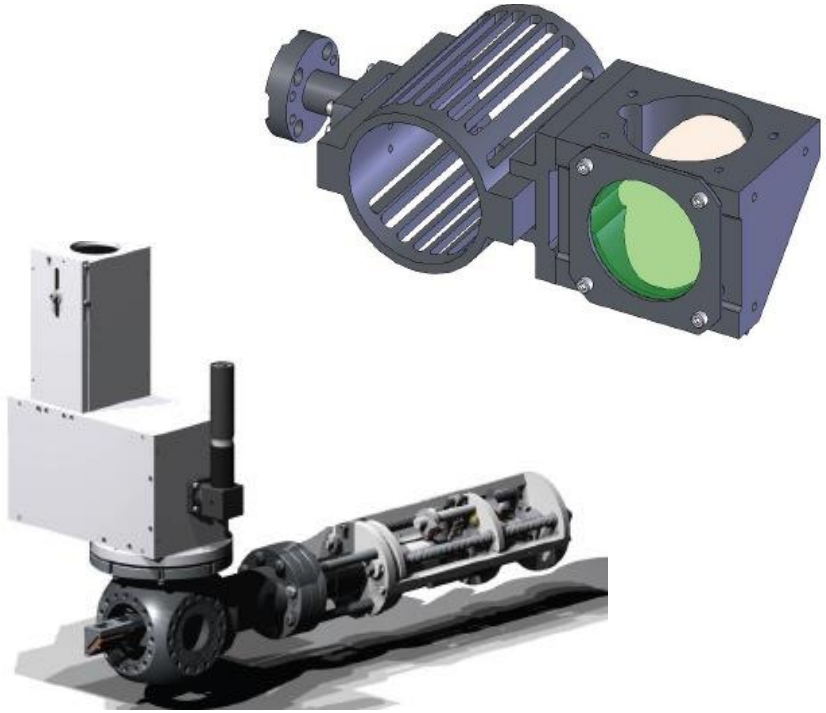


BPM board being ordered for CeC
2 boards for testing in LEReC cooling section

Profile Monitors – New designs for Cooling Section

We will need to install a ferrite ring inside the vacuum chamber in the LEReC profile monitors, as shown below in pink.
CMD5005 material.
The cylinder Peter modeled is 1.65” OD, 1.45” ID and 1” high.
This is a sticking point for procurement as it affects the aperture through which the vendor has to insert the YAG holder.

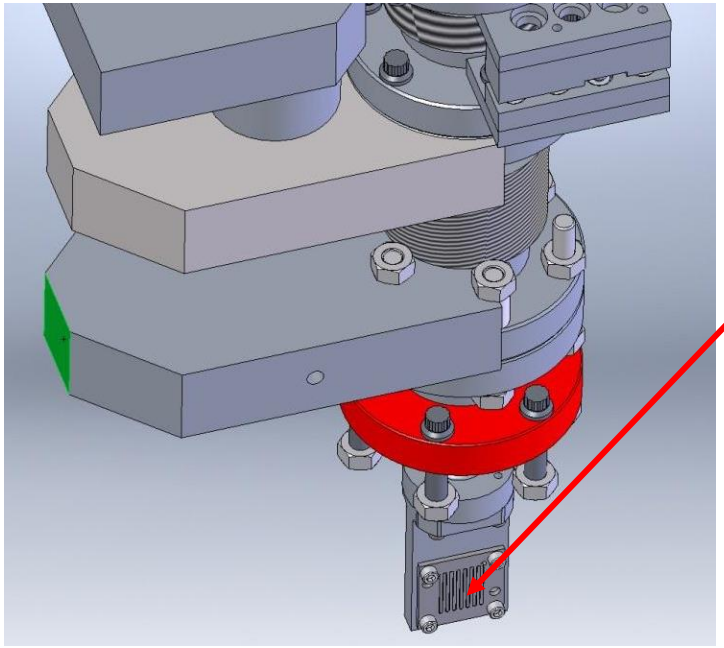


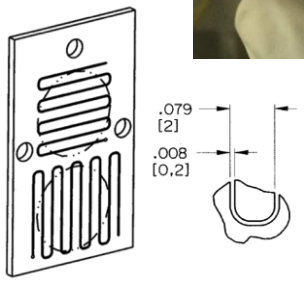


Emittance Slit Measurement

- Low Power Operations Only
- New Dual axis design for Horizontal & Vertical measurements.
- Positioned 0.16 – 1 m upstream of profile monitor
  - Final spacing TBD…
- Tungsten Slit mask, optimized for beam parameters
  - Mask 1.5mm thick… # slits & TBD…

Dual Station Actuator retrofitted for new dual axis mask.





ANALYSIS:
An algorithm was developed for analyzing the image from a multi-slit mask for emittance measurement.

Future plans are to automate the image analysis for on-line processing and data logging.

Intensity Distribution at mask

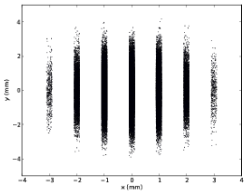
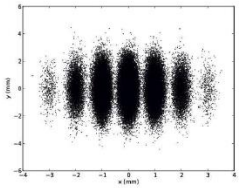
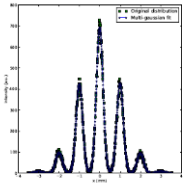


Image on profile monitor after drift distance

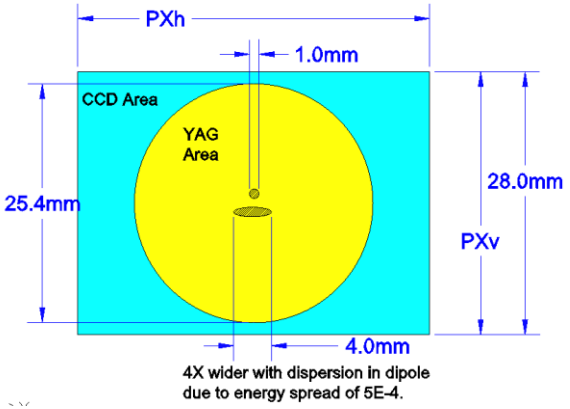




Energy Spread Measurements – 2 Locations

- Max. Energy Spread: Δp/p = <5e-4
- Beam Size (d): 1mm (dia.)
- Double Slit before dipole & drift to YAG
- May use **Quad** to increase resolution between cooling sections
- *Considering alternatives:*
  - *Dedicated energy spectrometer beam line*
  - *Cornell's method of using deflecting cavity*

Image of YAG as projected onto CCD



- 2MP CCD: 1292_h X 964_v px
- $Pitch_{YAG}$ = proj-H_{CCD}/px_v
  = 29μm/px

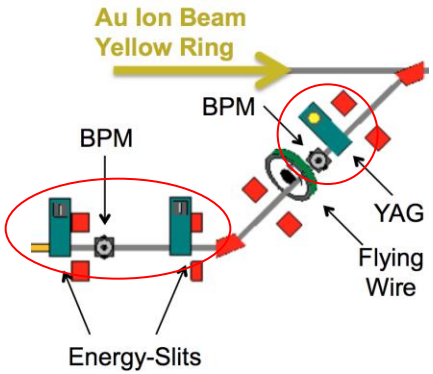
Before Cooling Sections

•σ_δ = 750μm

•Resolution = σ_δ / $Pitch_{YAG}$

• 750μm / 29μm/px = 25 px

➔ 4% Resolution



$\sigma_\delta = \eta\delta = 1.5m(5x10^{-4}) = 750\mu m$

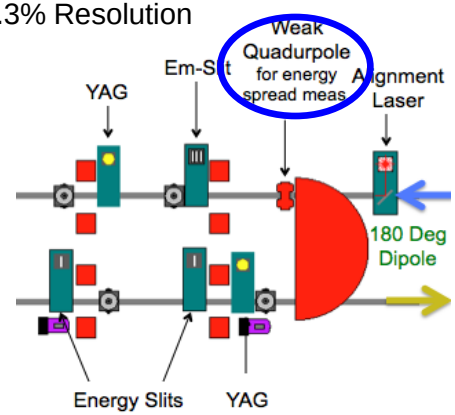
Between Cooling Sections

•σ_δ = 350μm

•Resolution = σ_δ / $Pitch_{YAG}$

• 350μm / 29μm/px = 25 px

➔ 8.3% Resolution



$\sigma_\delta = 2R\delta = 2(0.35m)(5x10^{-4}) = 350\mu m$

LEReC ERL schematic layout

Outside Issues: location of the 5 cell cavity and egun.

Beam line distance or distance as the crow flies?

Tolerance for the 5 cell location?