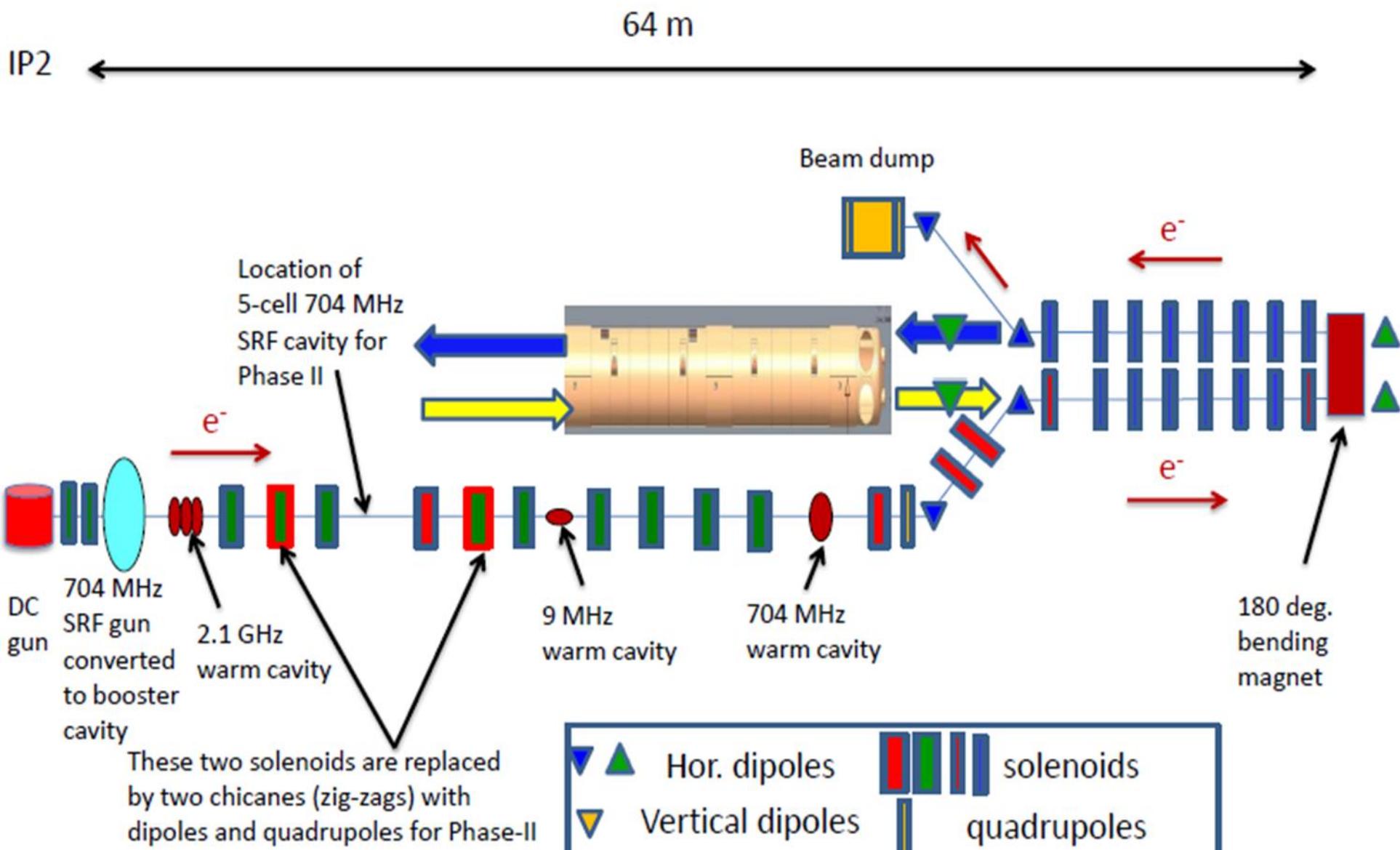


LEReC Phase-I (electron beam energies 1.6-2MeV):

Gun-to-dump mode

July 8, 2015



Overall Layout

64 m

IP2

H & V Correctors

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

Add Quad and Skew Quad Correctors

Move BPM close to 180 magnet combine with PM.

Add Quad and Skew Quad Correctors

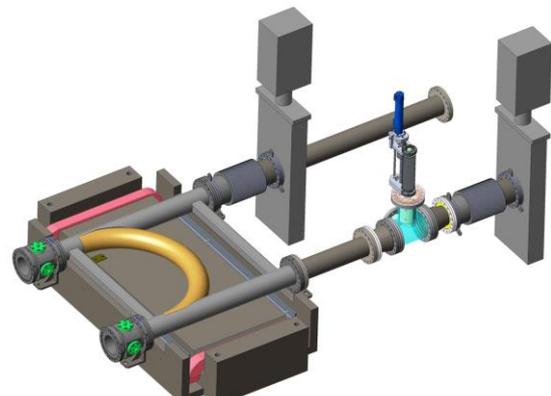
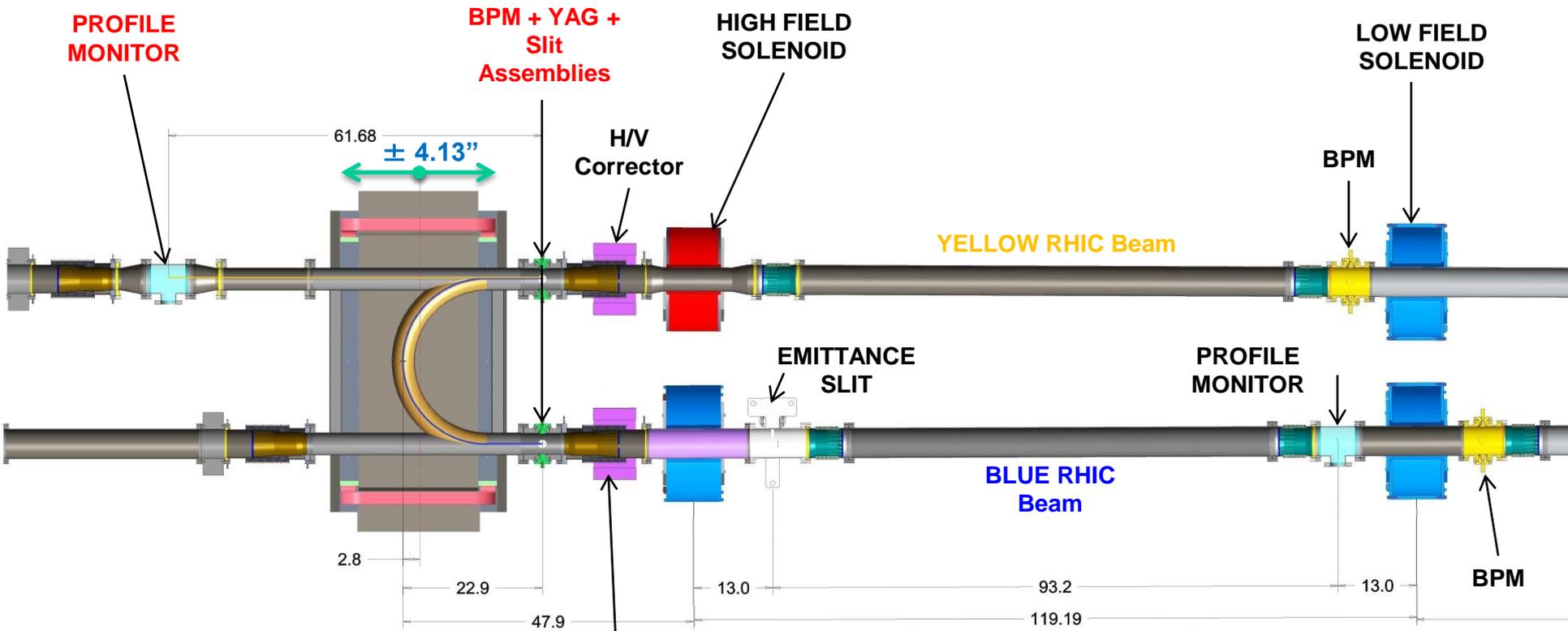
3.75"OD/3.62"ID beam line
 9.2 cm ID

5.0"OD/4.78"ID beam line
 12 cm ID

2.5"OD/2.38"ID beam line
 (6 cm ID)

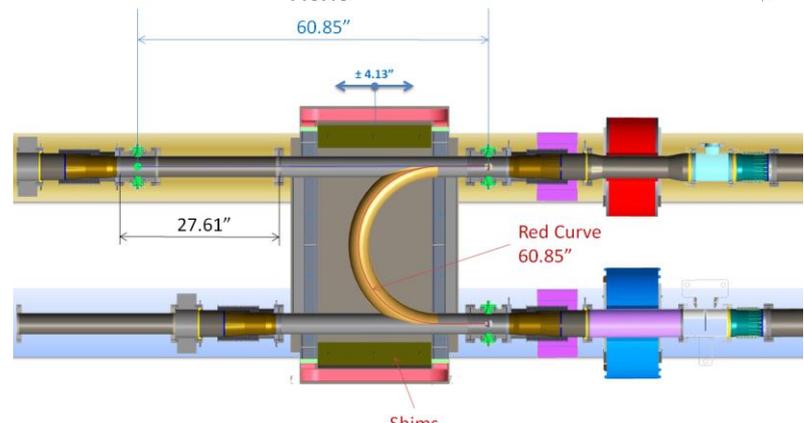
Low Energy RHIC electron *Cooling*

180° Dipole Magnet Neighborhood IV

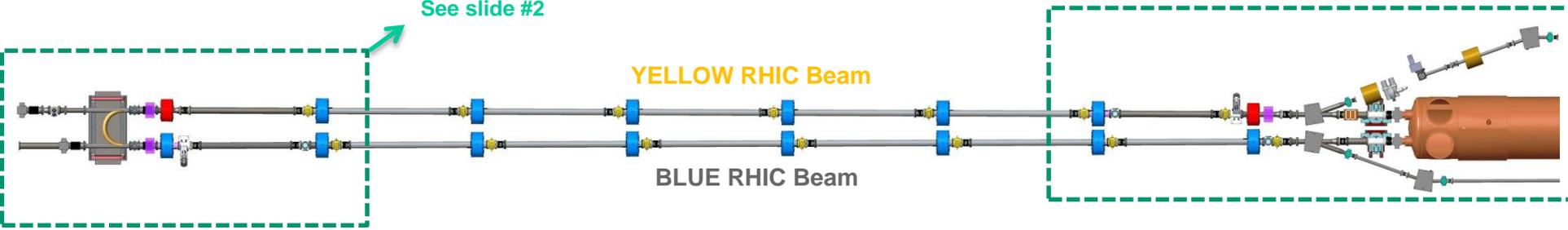


Quad/SQ Corrector

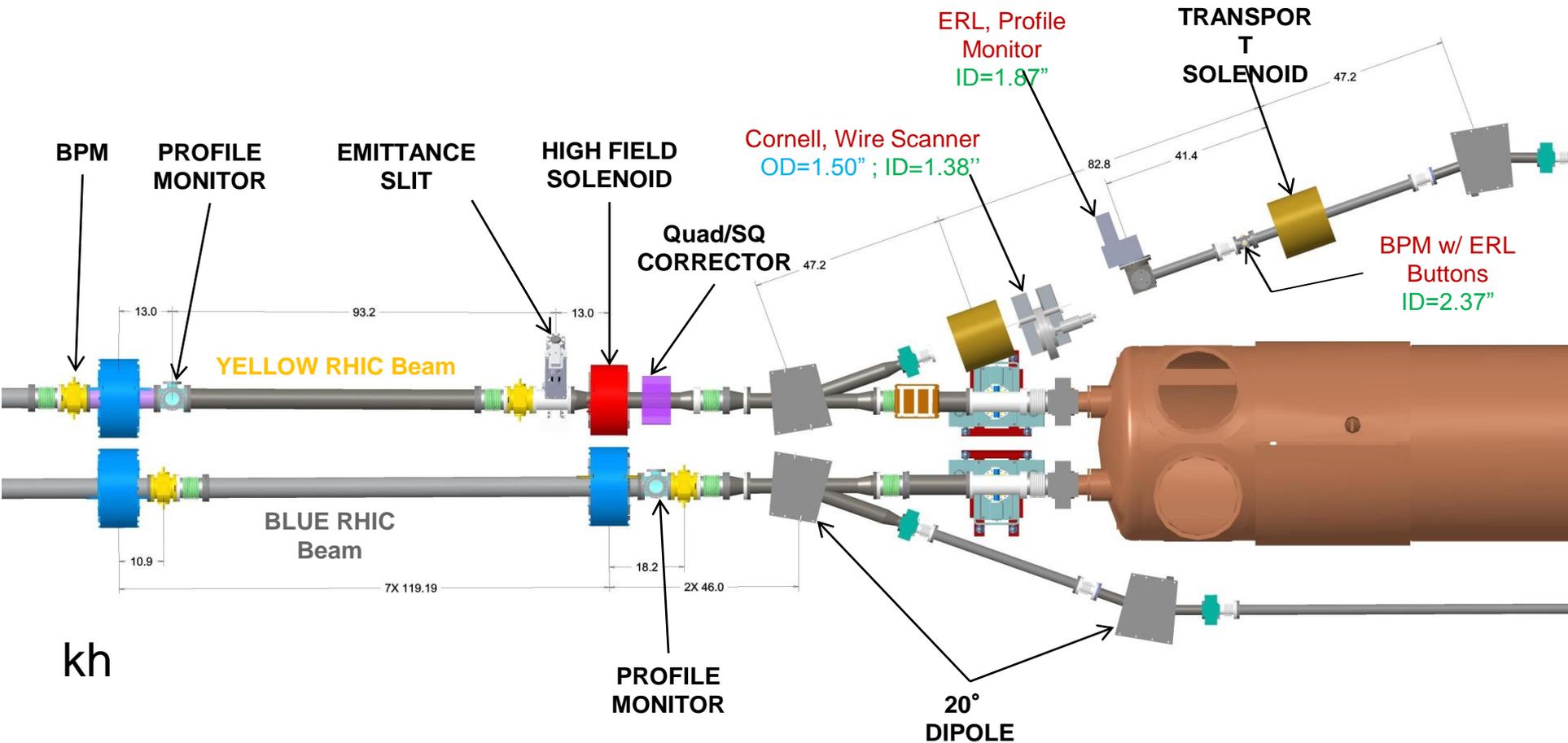
kh



See slide #2



20° Dipole Neighborhood IV



Large Dia. BPM Housings (4.8 ID), 28mm buttons

- Order Placed with MPF
- Final Design Review 6/23/2015, no issues
- MPF approved to start fabrication
- Increased number of button first articles for 2 BPM's one standard, one 180 magnet special
- MPF updated delivery schedule
- Agreed on vacuum bakeout for components

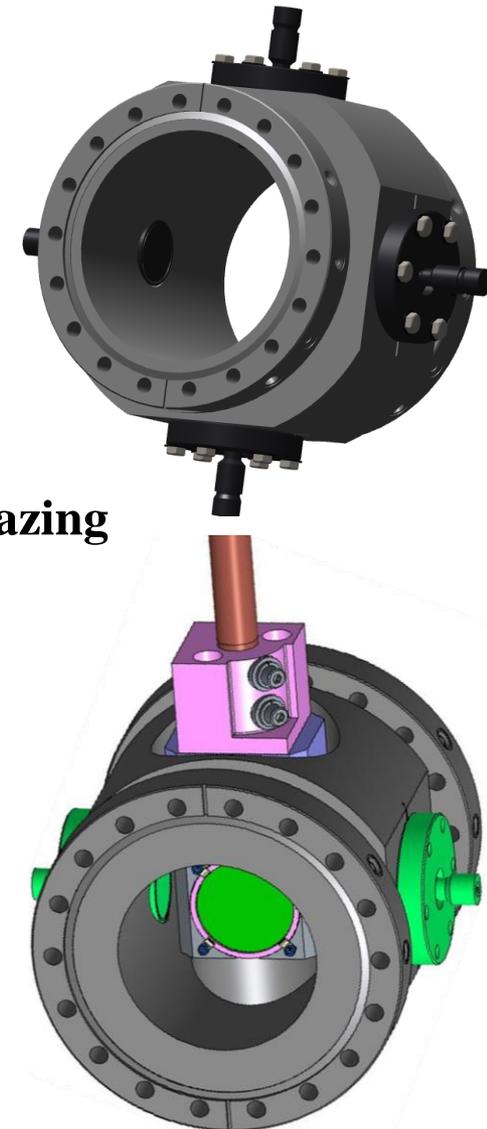
MPF will vacuum bake buttons @900C/1hr during brazing

MPF will vacuum bake housing @450C/48hr

BNL will vacuum bake 1st article housing

Special ID for 180 Magnet (hybrid BPM, PM Slit)

- Same button size, Analysis OK
- Combined with profile monitor & emittance slit
- Impedance OK with fingers and ferrite
- Final Design of contact fingers



Cooling Section *Standard* Profile Monitors

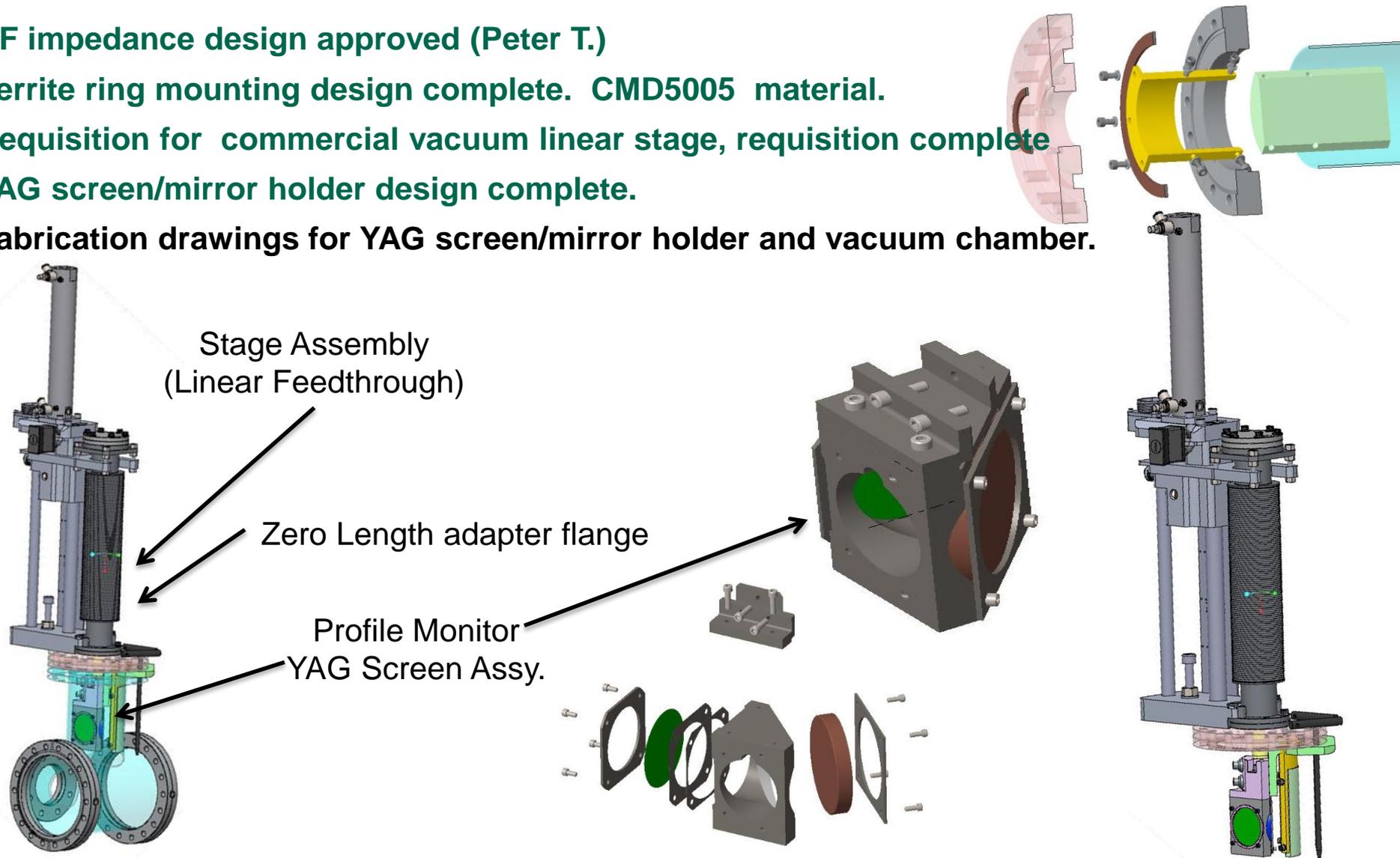
RF impedance design approved (Peter T.)

Ferrite ring mounting design complete. CMD5005 material.

Requisition for commercial vacuum linear stage, requisition complete

YAG screen/mirror holder design complete.

Fabrication drawings for YAG screen/mirror holder and vacuum chamber.



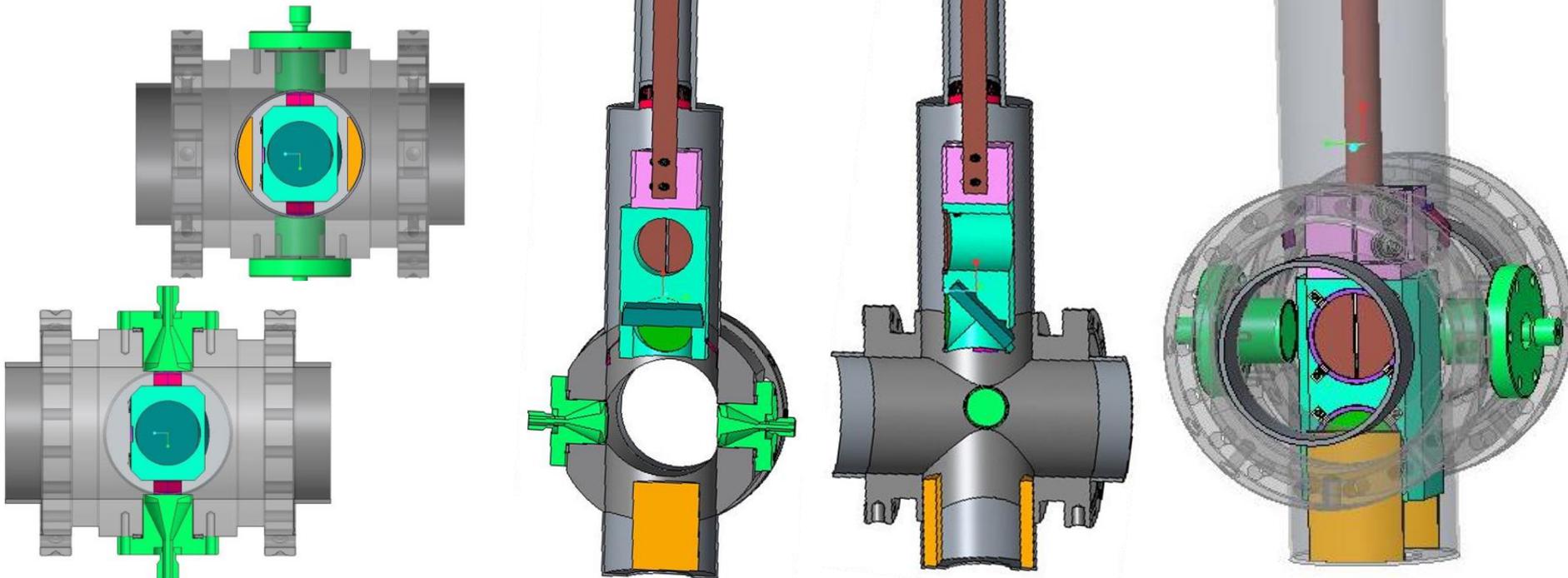
Cooling Section “hybrid” BPM, PM, Slit

RF impedance analysis complete

Chamber design complete

Final design of RF impedance grounding fingers

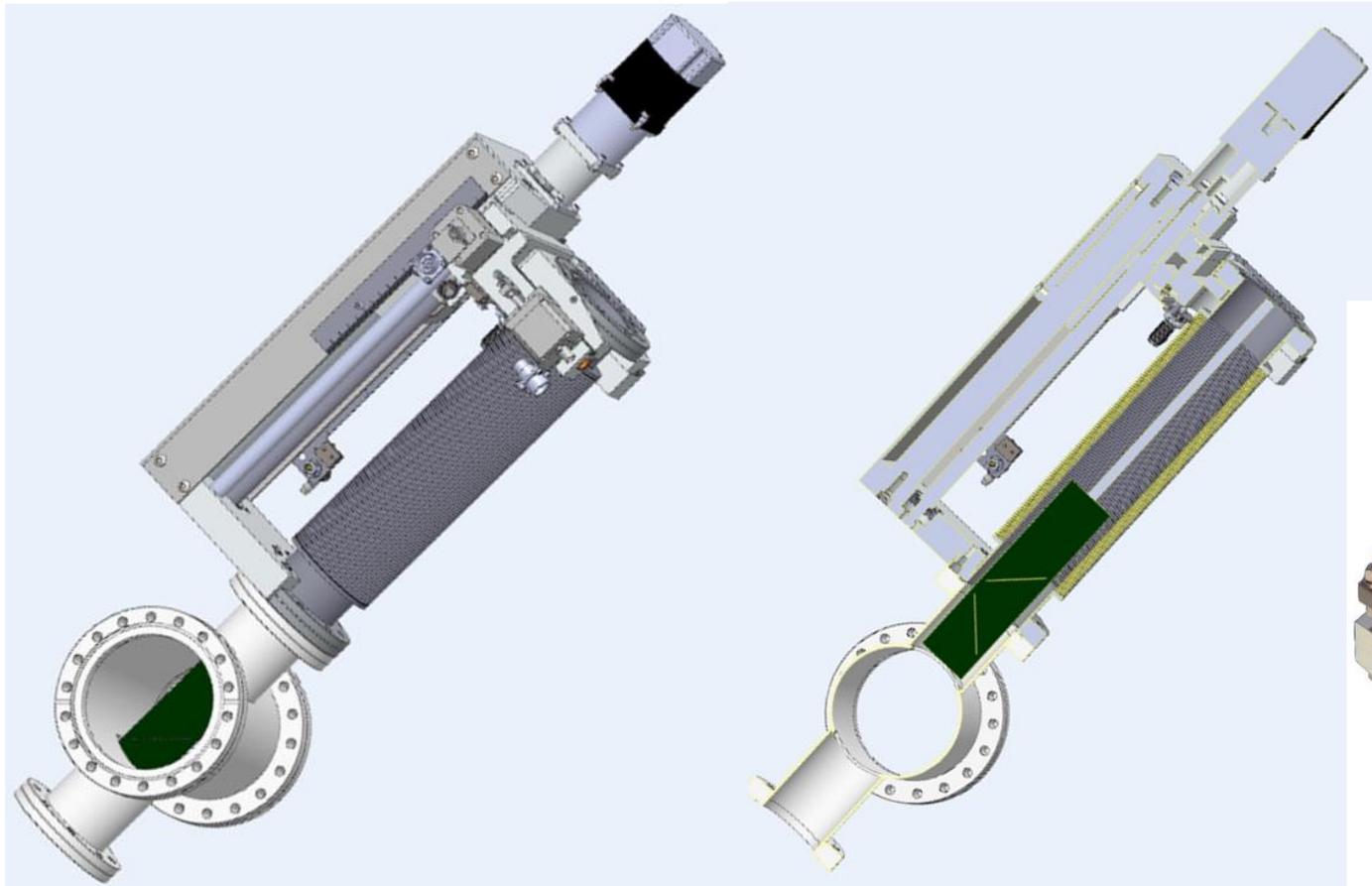
Final design of RF impedance ferrite configuration and mounting



Low Energy RHIC electron Cooling

Cooling Section Emittance Slits

- Requisition for commercial vacuum linear stage.
- Fabrication drawings complete. Checked and approved?
- Central Shops estimate?



Low Energy RHIC electron Cooling

Vacuum Hardware

Beam line bellows & 180 accordion bellows purchase orders.

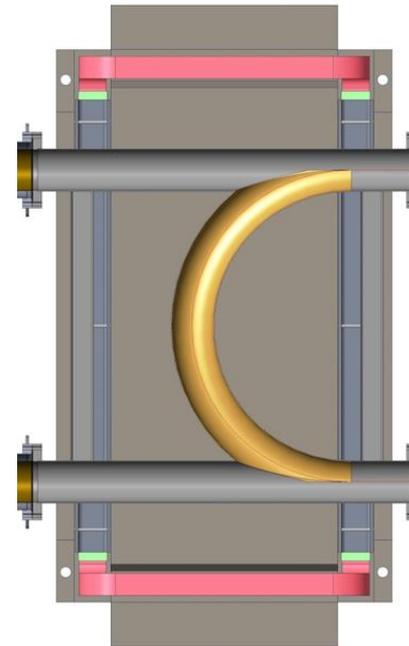
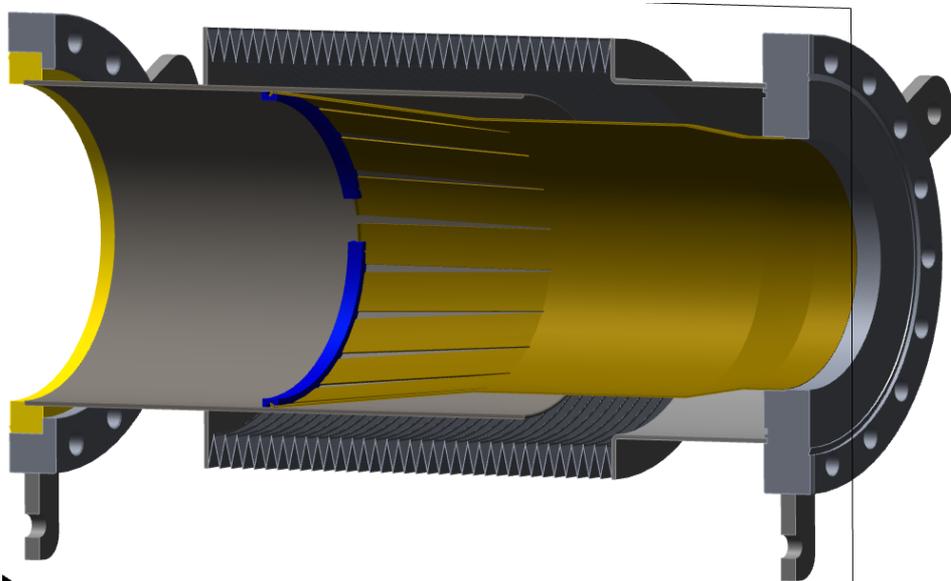
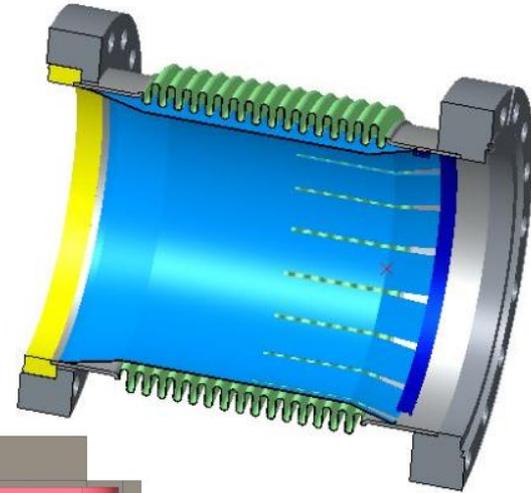
“Standard Chamber Length” defined

180 chamber 316L vacuum annealed to 900C after welding.

Test chamber welded and measured.

Shielded valves on order

need DC Gun shielded valves and vacuum equipment.



Low Energy RHIC electron Cooling

20° Dipole Magnet

Requisition approved SOW – 2 magnets by 10/1/2015.

Order Placed 5/6/2015 Everson Tesla

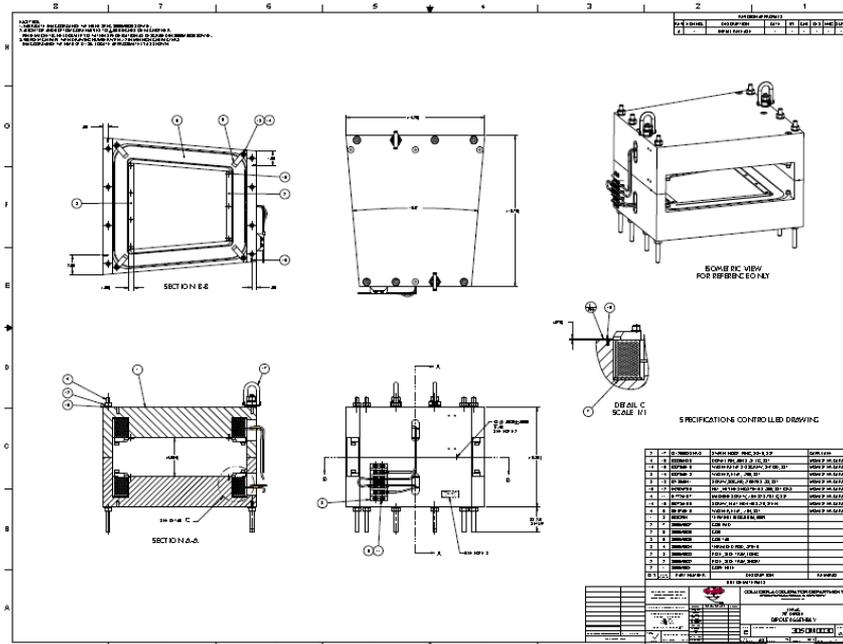
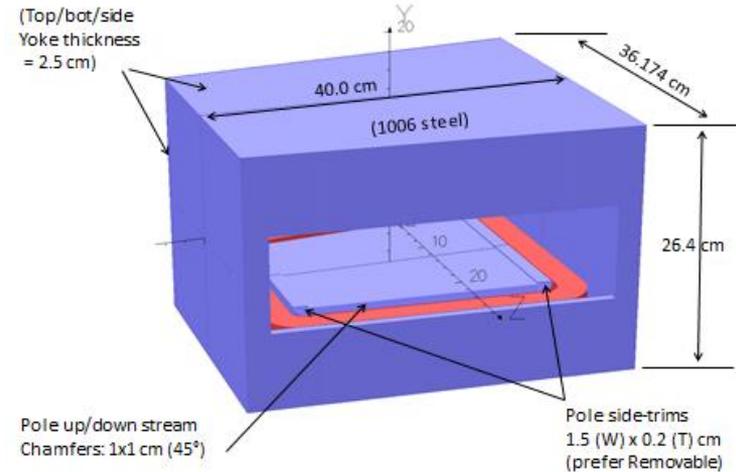
Estimated Delivery 1st two magnets 10/1/2015

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.)

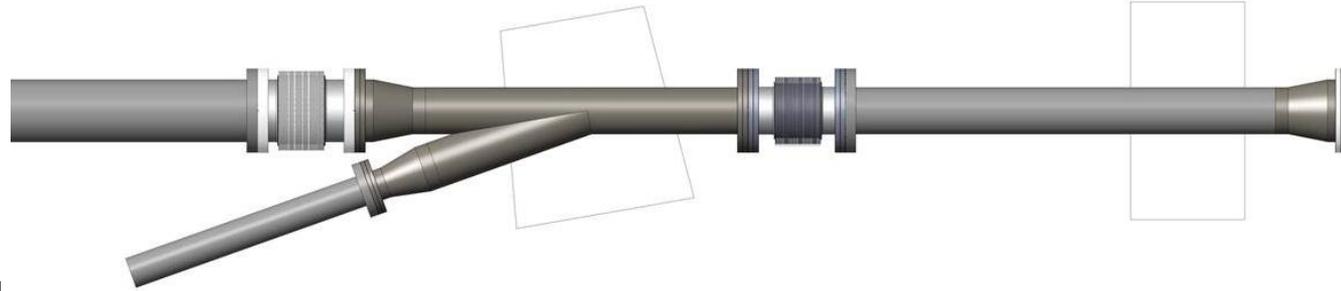
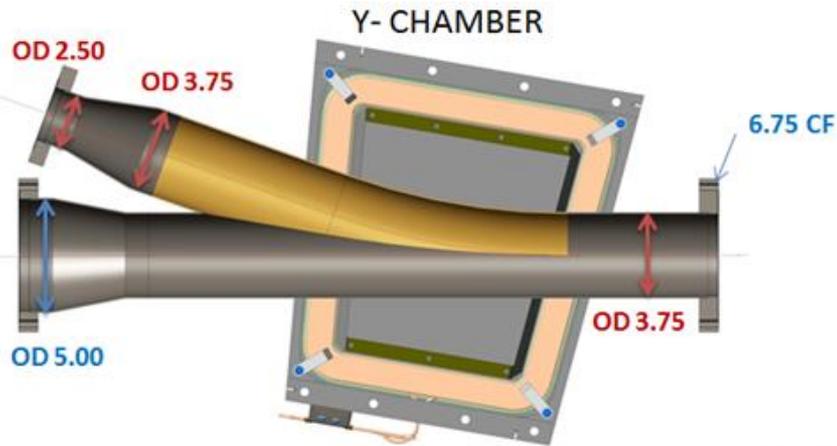
LEReC 20-degree Dipole (Gap clearance=10 cm)
(distance between pole faces =10.4 cm)



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/mm ²) (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°

20° Dipole Magnet Vacuum Chamber



Fabrication Drawing

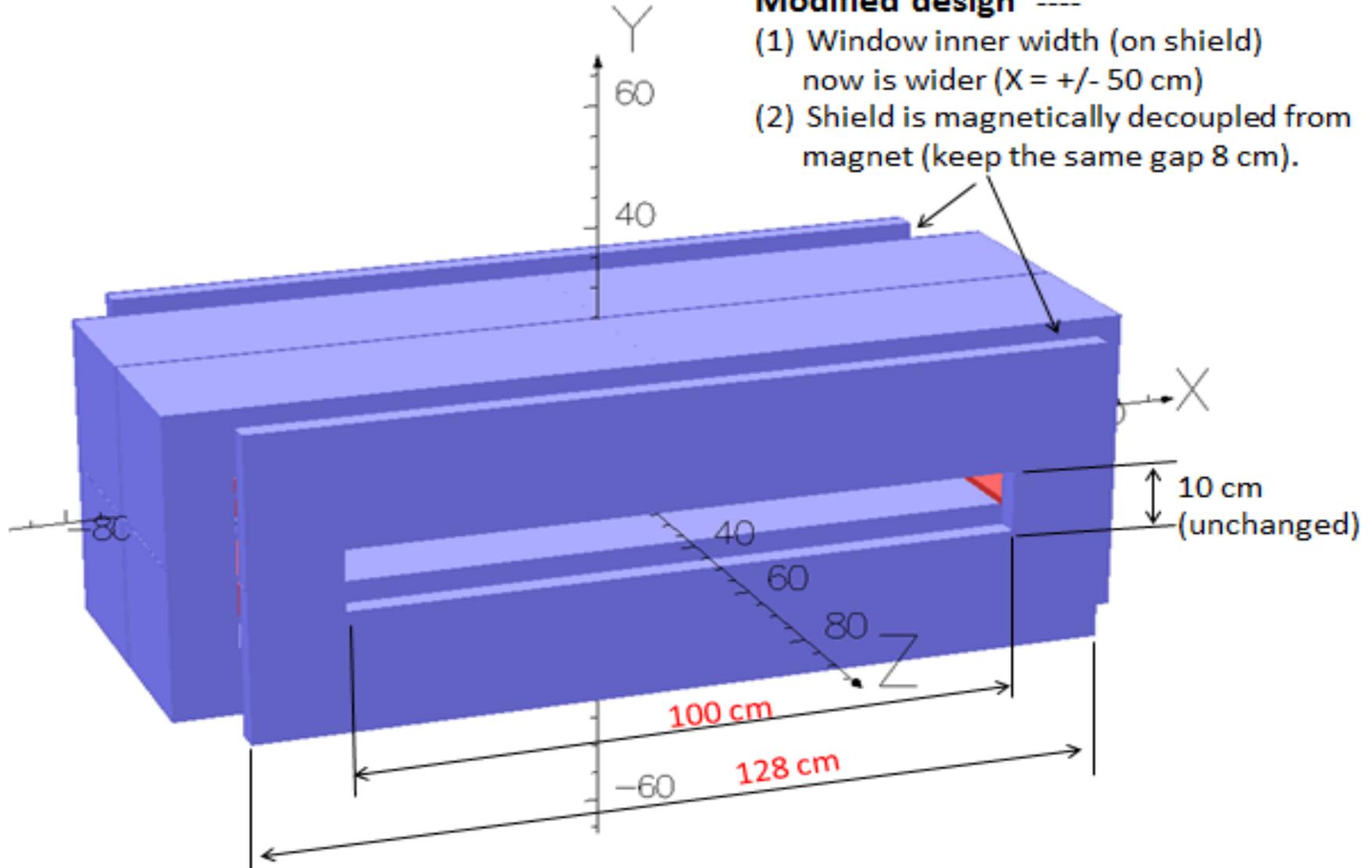


Low Energy RHIC electron Cooling

180° Dipole Magnet Revised

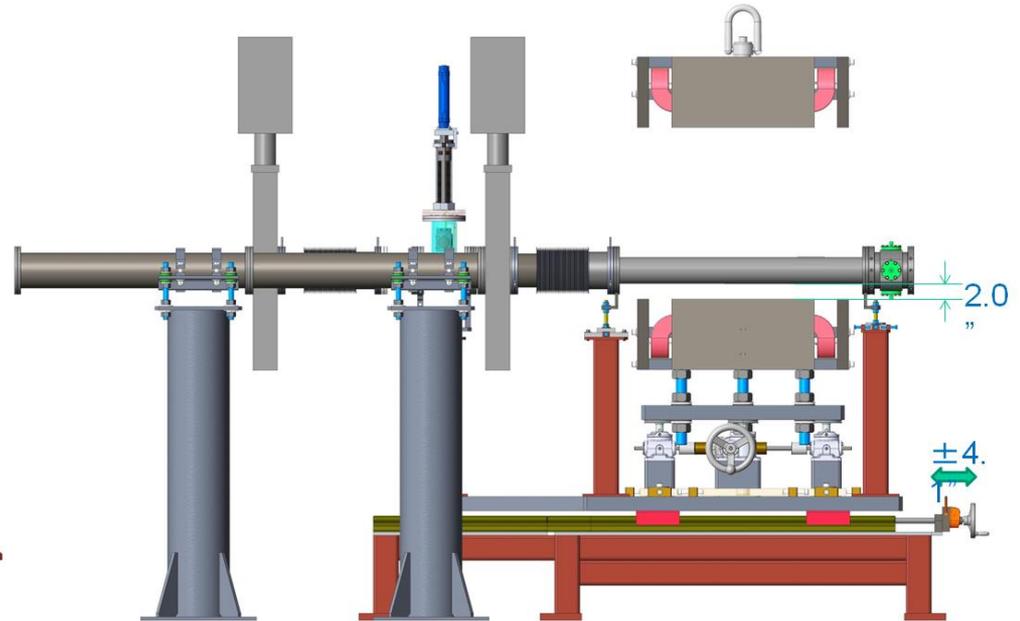
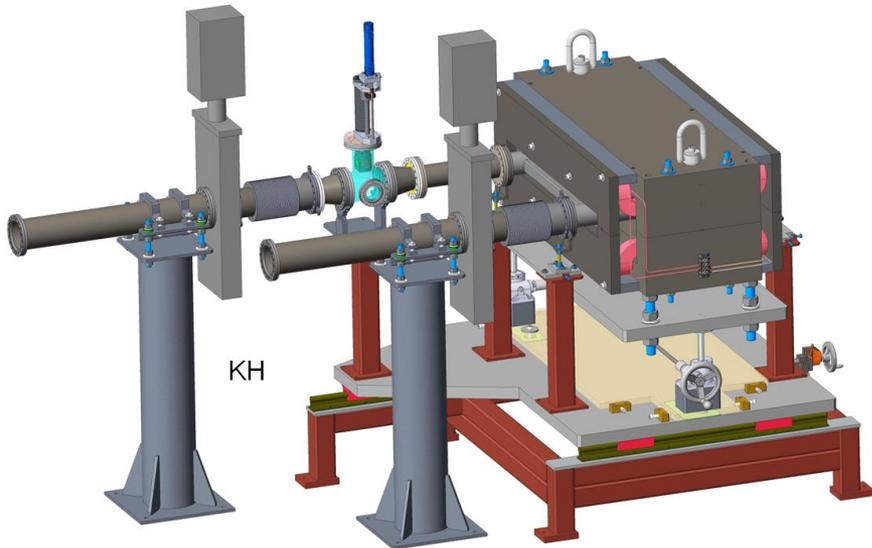
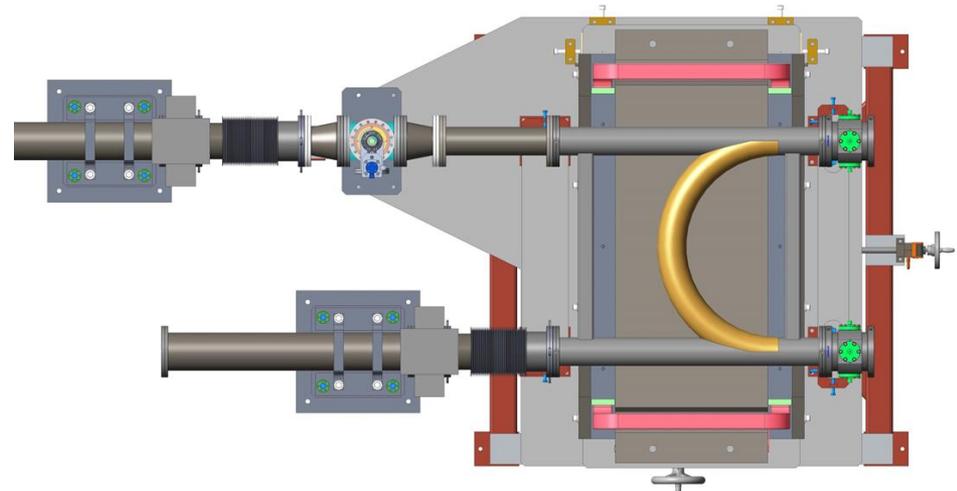
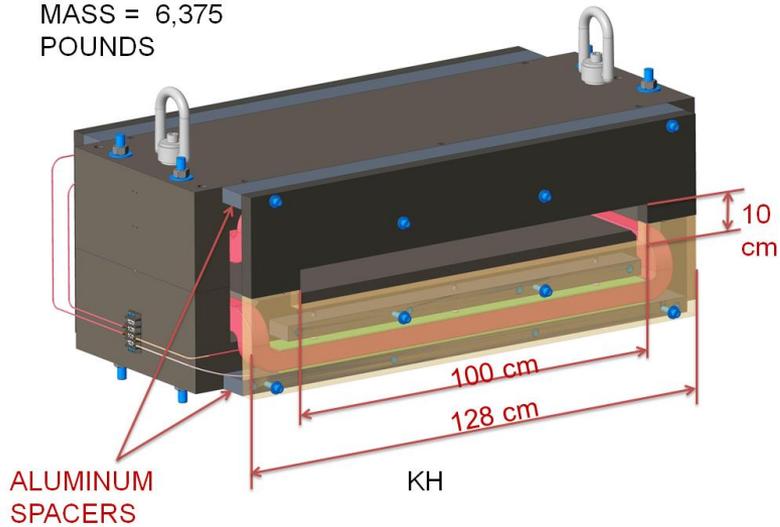
Modified design ----

- (1) Window inner width (on shield) now is wider ($X = \pm 50$ cm)
- (2) Shield is magnetically decoupled from magnet (keep the same gap 8 cm).



180° Dipole Magnet Revised

MASS = 6,375
POUNDS



Compensating and Matching Solenoids

Buckley magnets complete 8/20/2015 + 6 weeks shipping + customs.

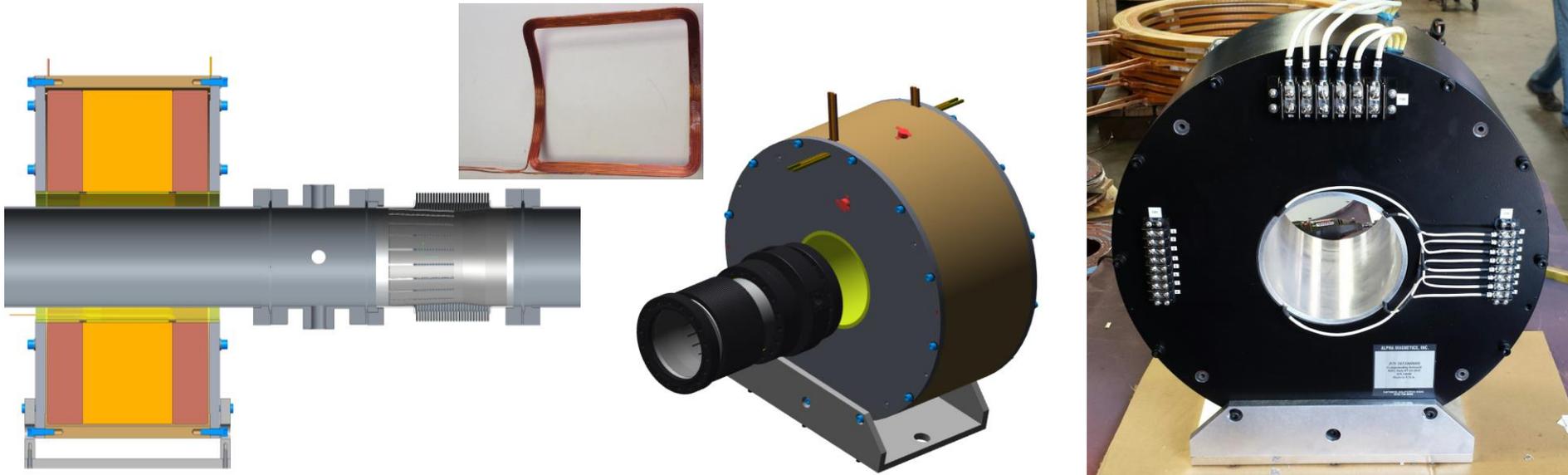
Alpha Magnetics update: Will ship first production magnet this week.

Magnetic Measurement ordered and received 1% 3D probe,
0.1% ordered, late August delivery.

Design support stand assembly – provide space for mu metal shields, separate beam pipe stand support.

Magnetic shielding analysis (Wuzheng).

Design prototype mu metal shields and supports - measure.



Low Energy RHIC electron Cooling

LEReC Cooling Section Design Room



LF & HF solenoid and 20° dipole magnets fabrication drawings (KH)

Beam Diagnostics: BPM chamber and buttons (VDM)

Beam Line 5" bellows with shields fabrication drawings (GW)

20° dipole vacuum chamber for impedance review (KH)

180° dipole fabrication drawings (KH) **Spectrometer magnet (180° dipole) revisions (KH)**

180° vacuum chamber + large sliding bellows fabrication drawing (KH)

Beam Diagnostics ES W slit & chamber fabrication drawings (VDM)

Checking: 20° dipole vacuum chamber fabrication drawings (KH)

Beam Diagnostics: standard PM fabrication drawings (GW)

Beam Diagnostics: special "hybrid" ES/PM/BPM fabrication drawings (GW)

Beam line solenoid/BPM stands & vacuum chamber stand (VDM)

20° and 180° magnets stand drawings (KH)

Cable tray and penetration drawings (AF)

Magnetic shielding drawing and solenoid magnetic measurement test station

HF dipole, quadrupole, and skew quadrupole corrector drawings

LEReC Design Room



RHIC 1:00 move real estate drawings (V.DM.)

Phase 2: 5 cell cavity positioning (RM) – Revised Position

Phase 1 and 2 cryogenic system layout (RM)

DC Gun Vacuum Chamber Fabrication Drawings (JH)

DC Gun SF6 Pressure chamber specification control drawings (JH)

DC Gun cathode cooling design for Karl S. Cornell (JH)

DC Gun stands (JH)

DC Gun to Booster SRF booster cavity beam line (JH)

DC Gun cathode coating system upgrade – coating system vacuum chamber (PC)

DC Gun cathode transfer load lock and vacuum chamber

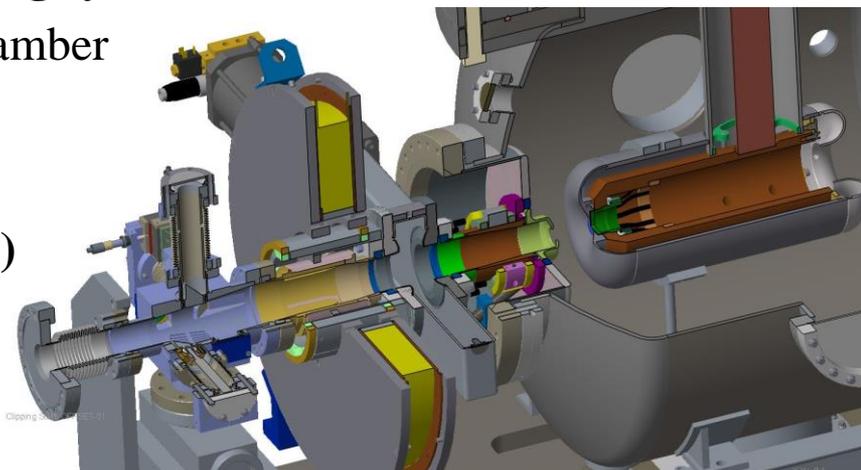
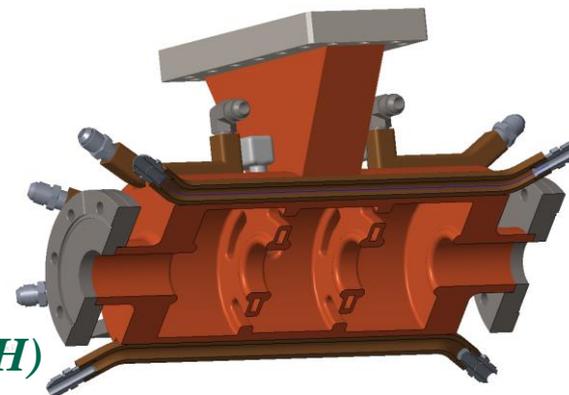
DC Gun cathode insertion drive ↘

Cathode production coating system design

2.1 GHz warm cavity fabrication drawings (MG)

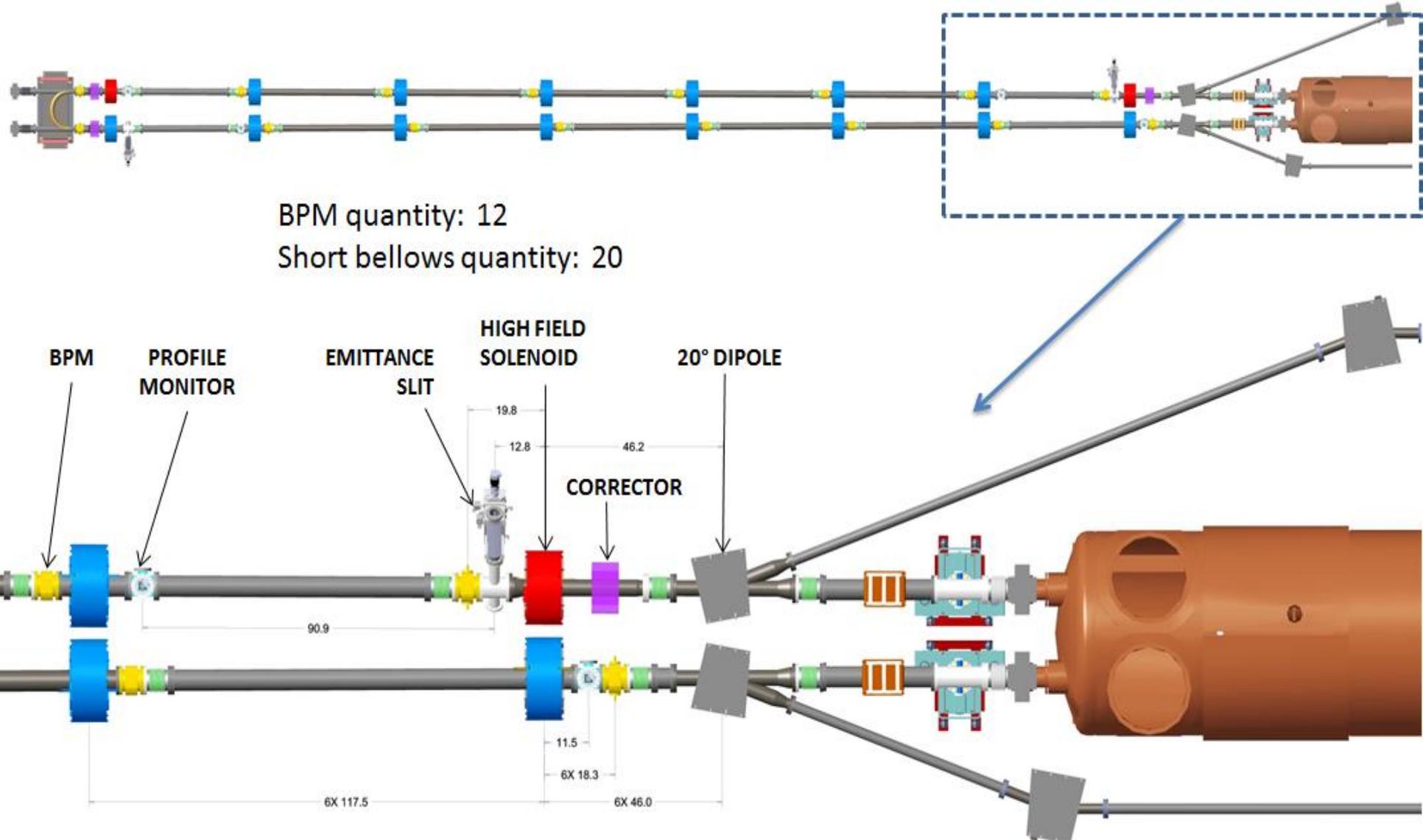
704 MHz warm cavity fabrication drawings

Transport line layout drawing (RM/VDM)



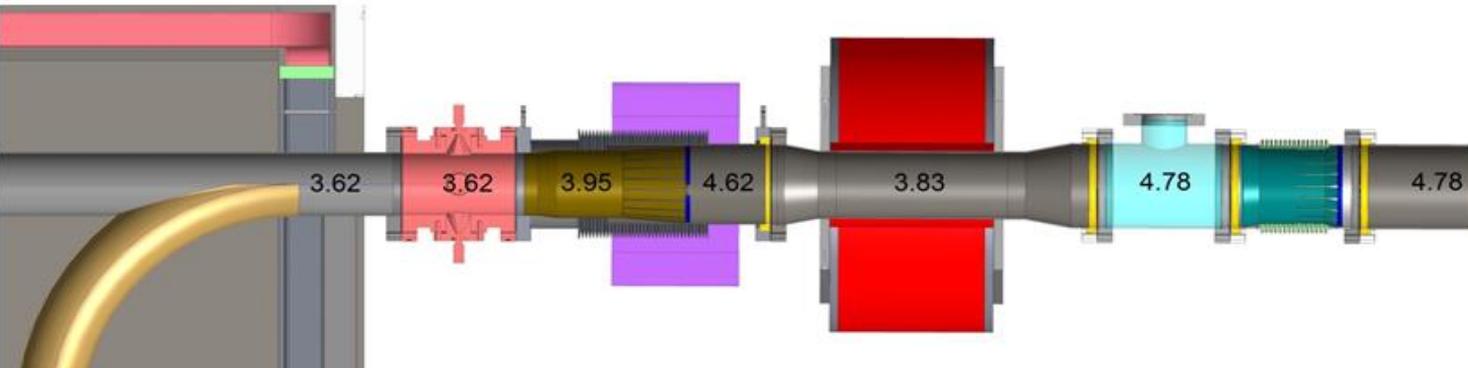
Reference Slides

20° Dipole Magnet Neighborhood

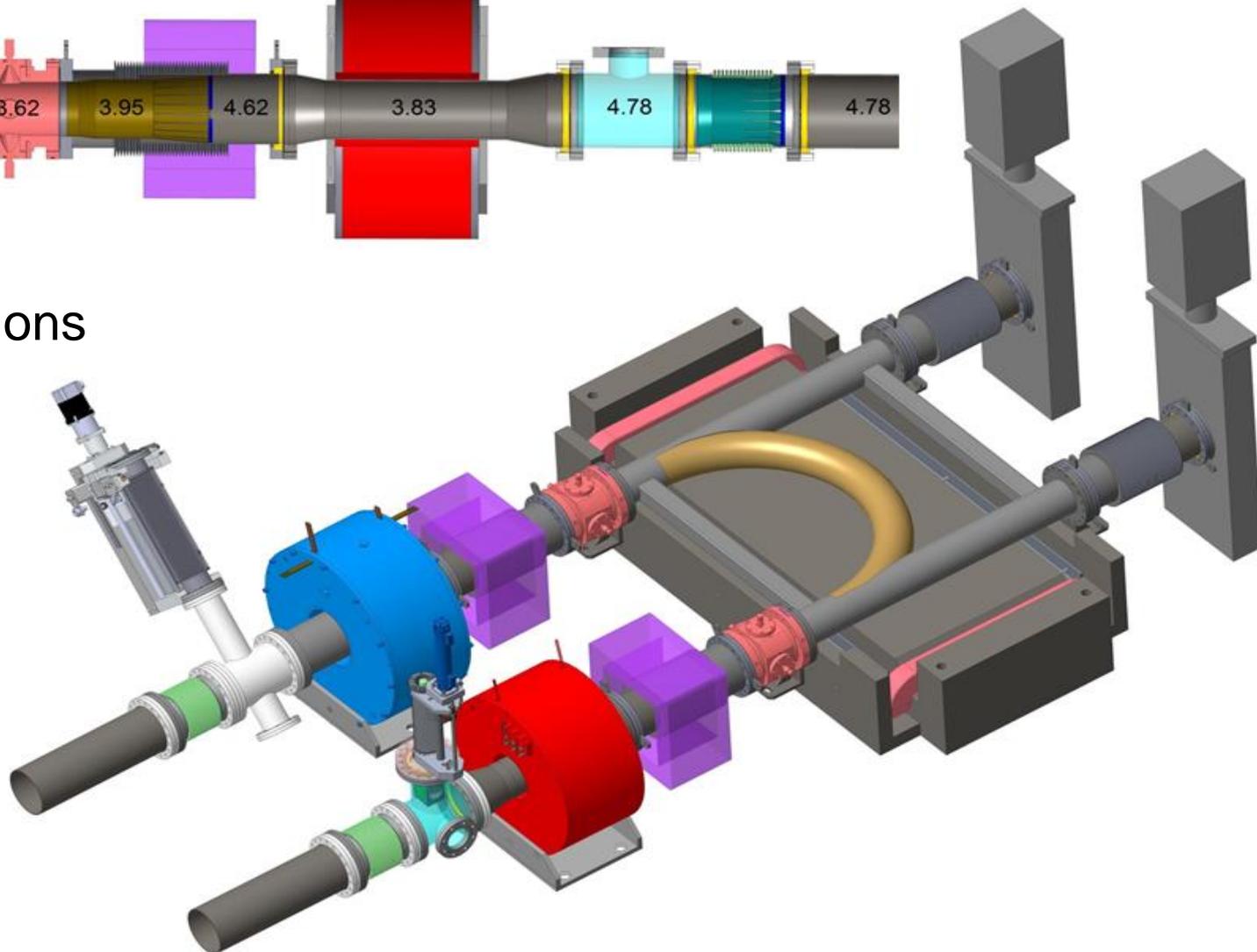


Low Energy RHIC electron Cooling

180° Dipole Magnet Neighborhood II



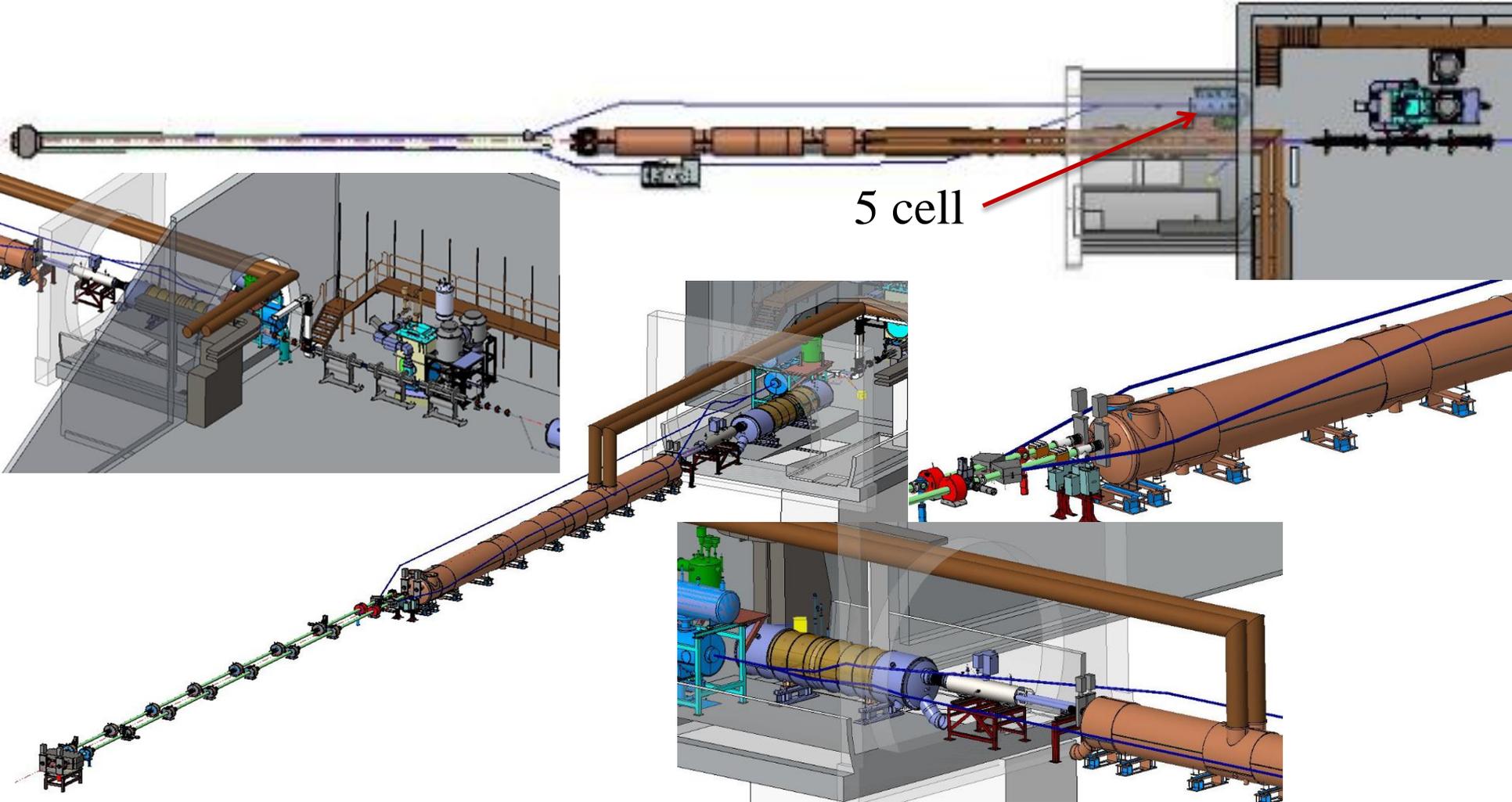
Aperture Transitions



Low Energy RHIC electron Cooling

5 cell cavity location

New updates?

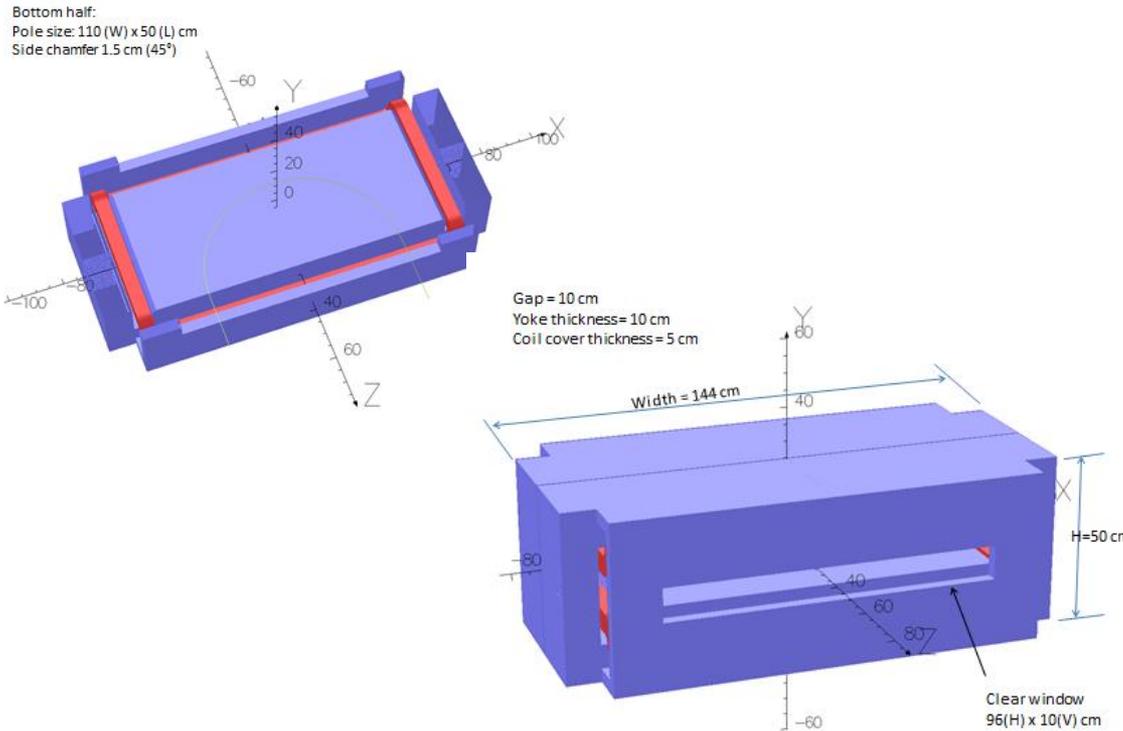


Low Energy RHIC electron Cooling

180° Dipole Magnet

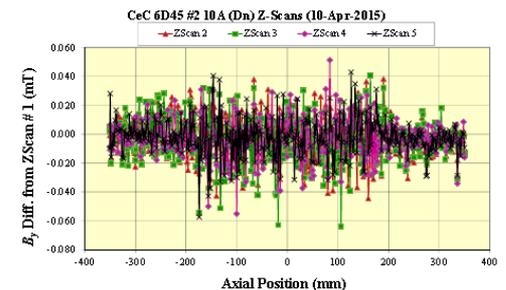
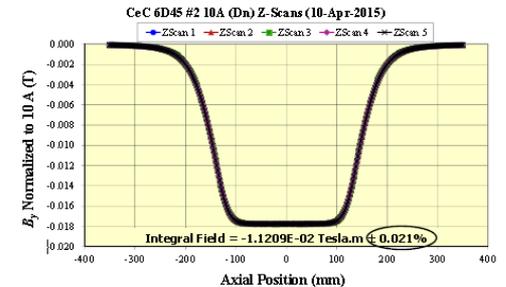
Requisition Status

Range of motion for magnet core +/- 10cm.
 Magnet Vertical Gap = 10.0 cm (3.94 in.)
 Vacuum Chamber Aperture = 9.5 cm (3.75 in.)



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/mm ²) (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°

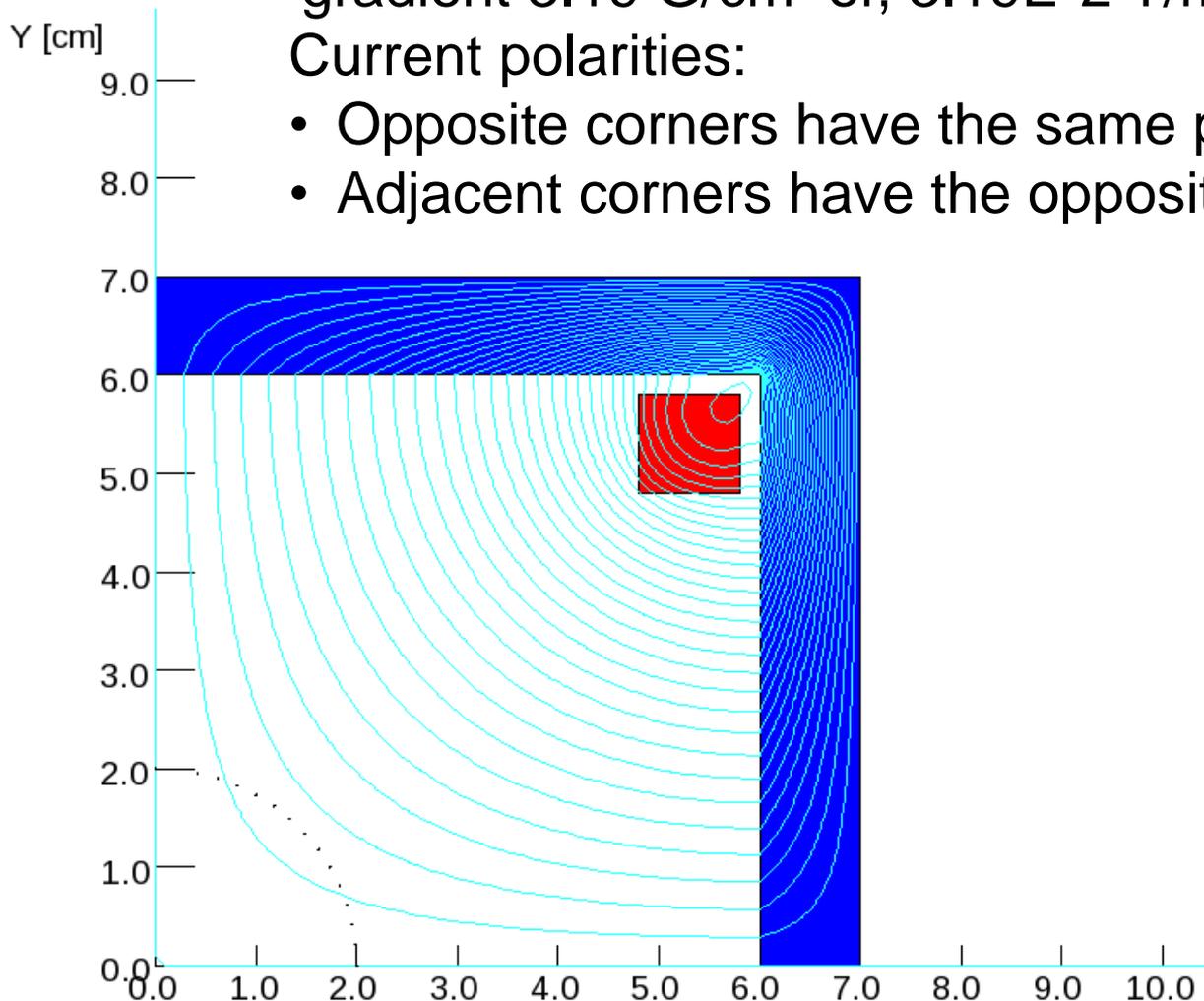


LEReC Dipole Skew Quad Corrector

Window-frame Skew Quad: 100 A-turn per corner = s-quad
gradient 3.19 G/cm or, 3.19E-2 T/m

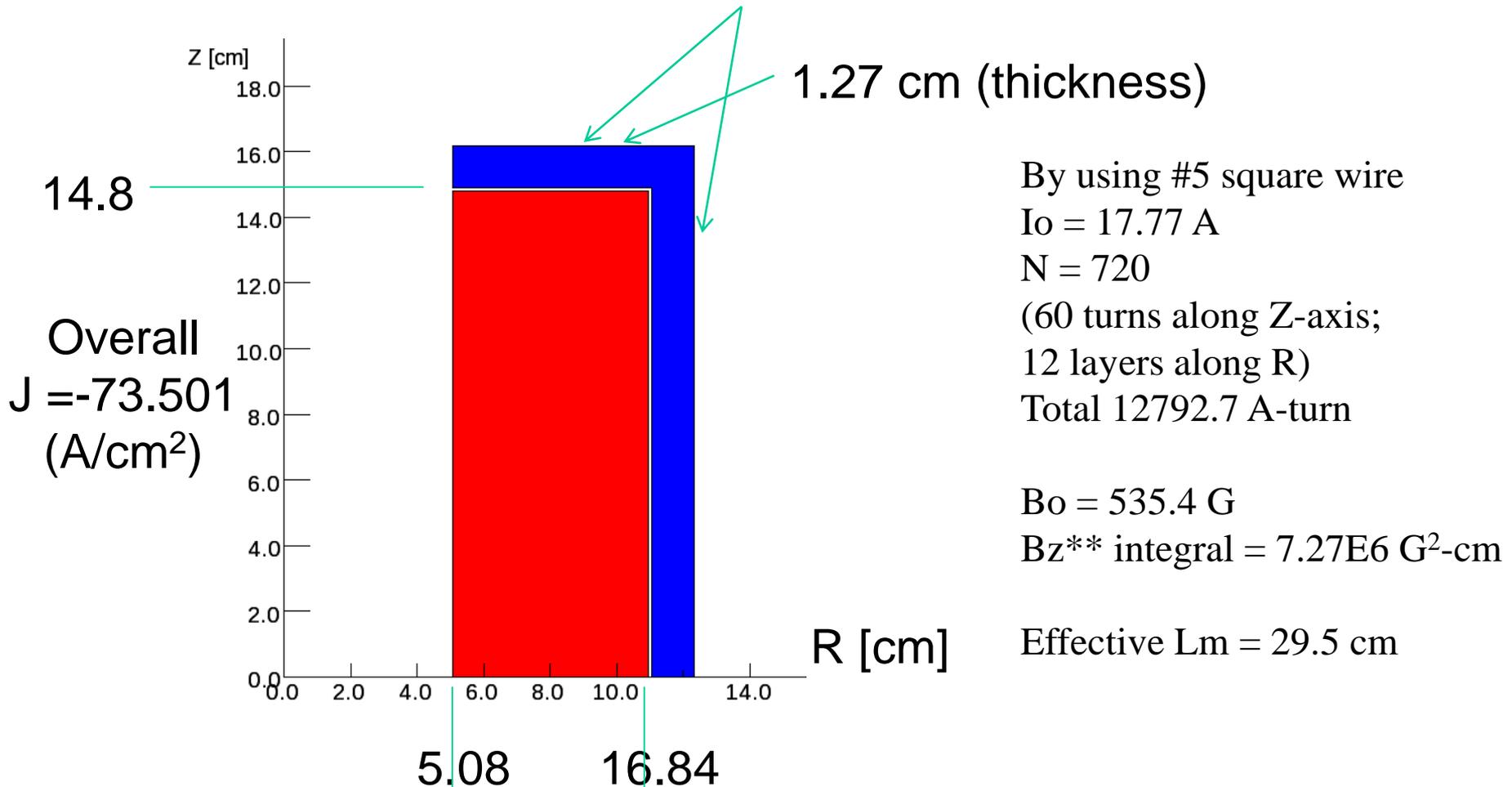
Current polarities:

- Opposite corners have the same polarity
- Adjacent corners have the opposite polarities.



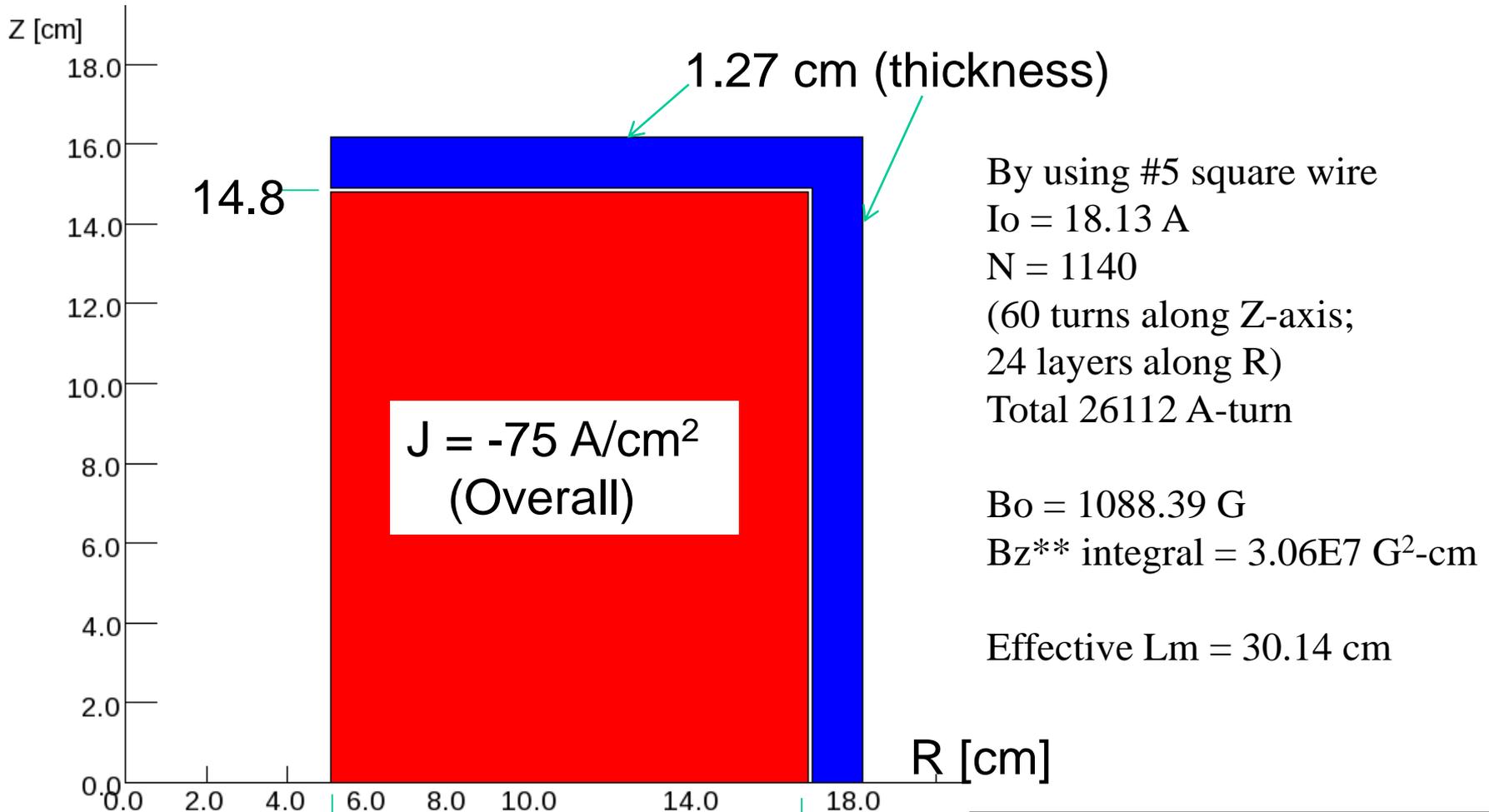
Transport Line Matching Solenoid

Transport Solenoid (preliminary) ----- to be mounted on 2.5" pipe
(Copper winding starts at R=2")



Transport Line Merging Solenoid

Merging Solenoid (preliminary) ----- to be mounted on 2.5" pipe
(Copper winding starts at R=2")



5.08 LOW ENERGY KHI 16.84 Electron Cooling

Sector 1 Relocation Meeting 5/22/2015

Sector 1 Instrument Relocation for LEReC Summary



Champions need to confirm the relocation plan so the *mechanical design work* can proceed.

More details can be found here:

http://www.cadops.bnl.gov/Instrumentation/InstWiki/index.php/Instrumentation_Relocation

Systems in the LEReC Region (40m - 63m) to be Relocated

7 separate mechanical assemblies

ARTUS Kickers - Blue V, Yellow H
IPMs (Ionization Profile Monitors)- Blue H, Yellow V
Moveable BPM & LF Schottky, X-Y stage BI1 41m
BBQ PLL Kicker stripline (1m) YO1
Triple Purpose Pick-Up on Moveable X-Y Stage YO1 ~42m
Cable Tray Waterfall

New Location

Sector 2
Sector 12
Sector 1 (closer to Q4)
Sector 1 (closer to Q4)
Sector 1 (closer to Q4)

Champion

Drees
Tepikian
Brown/Blaskiewicz
Marusic
Minty/Marusic

Mech E.

Fite

Phillips/Sampson

Systems to be Removed

Electron Detectors (8)
Quad Pick-up (0.25m) YO1 40.1m
Luminescence Monitor Cross at B02 53.1m
Stochastic Cooling Ceramic Pick-Ups[6-9 GHz] at BI1 67.8m



Zhang/Blaskiewicz
Minty
Minty
Mernick



Beam Loss Monitor Detector Reconfiguration, Sector 1

1 BLM per IPM will move with the IPMs to sector 12

Drees

Sector 2 Modifications

LEReC:

- Move cable tray/Modify cable tray
- Move Access Controls Gate
- Remove stairway and part of cross-over platform
- Tunnel Penetrations

