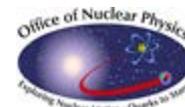


Minutes of LEReC Cooling & Merging Sections Meeting

11 June 2015



Beam Line Layout – Cooling Section

- There seems to be two options for energy measurement: at the 180 dipole and/or in a diagnostic branch at the end of the electron inlet line at first 20 dipole bend.
- The 20 dipole at electron 'merge in' location will be moved toward the triplet. HF Solenoid near the 20 dipole will also be moved in same direction.
- Bid for standard CS bellows (qty-26): Order placed.
- Bid for sliding bellows at 180 dipole: Order placed.

Beam Line Layout – Merging Cooling Section

- Possible diagnostic line to be added
- d, including 20 dipole, BPM and PM.

Instrumentation

- The BPM's mounted at the 180 dipole chamber flanges will be converted to 'hybrid' BPM's, a combination of a BPM and a PM or Slit. The vertical buttons on the Blue BPM will be removed and replaced with PM. The vertical buttons on the Yellow BPM will be removed and replaced with Energy Slit. A PM chamber will be placed upstream of the hybrid BPM/Slit and the HF Solenoid will be moved further away from 180 magnet. Installing both PM and Slit in the BPM is not possible for a RF compatible design.
- Small BPM will also be added to Yellow beam line on the other side of the 180 dipole chamber (beyond Cooling Section) and 1.5m (60.85") away, but before bellows. The 180 dipole chamber has to be extended to create 1.5 m distance. The 1.5m corresponds to the BPM to BPM distance around the U-turn.

Magnets

- 180 Dipole Magnet: Drawings are to be modified to correct quadrupole multipole with shims on pole faces (W.Meng, G. Mahler). Note: Per A. Fedotov the multipole content required is $2e-4$ quadrupole and $3e-3$ hextapole.
- 180 Dipole Chamber: No bidders. K. Hamdi to design a chamber with mitered tube. (Possibility of aluminum chamber, copper plated).
- Chamber for 20 Dipole Magnet: Drawings are ready.

RF Cavities

- Warm RF Cavity Design Review on 15 June. (Plan to place order for 2.1MHz by August.)

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 II

Small Aperture BPM's
Both with PM's ??

HIGH FIELD
SOLENOID

WINDOW FRAME
H&V
CORRECTORS

$\pm 4.13''$

163.5
152.5

Remove H&V
PROFILE MONITOR?

Standard
BPM's

LOW FIELD
SOLENOIDS
w/H&V
Corrector

EMITTANCE
SLIT

PROFILE
MONITOR

WINDOW FRAME
Quad and Skew Quad
CORRECTOR

New Horizontal
PROFILE MONITOR

K Hamdi

2.8

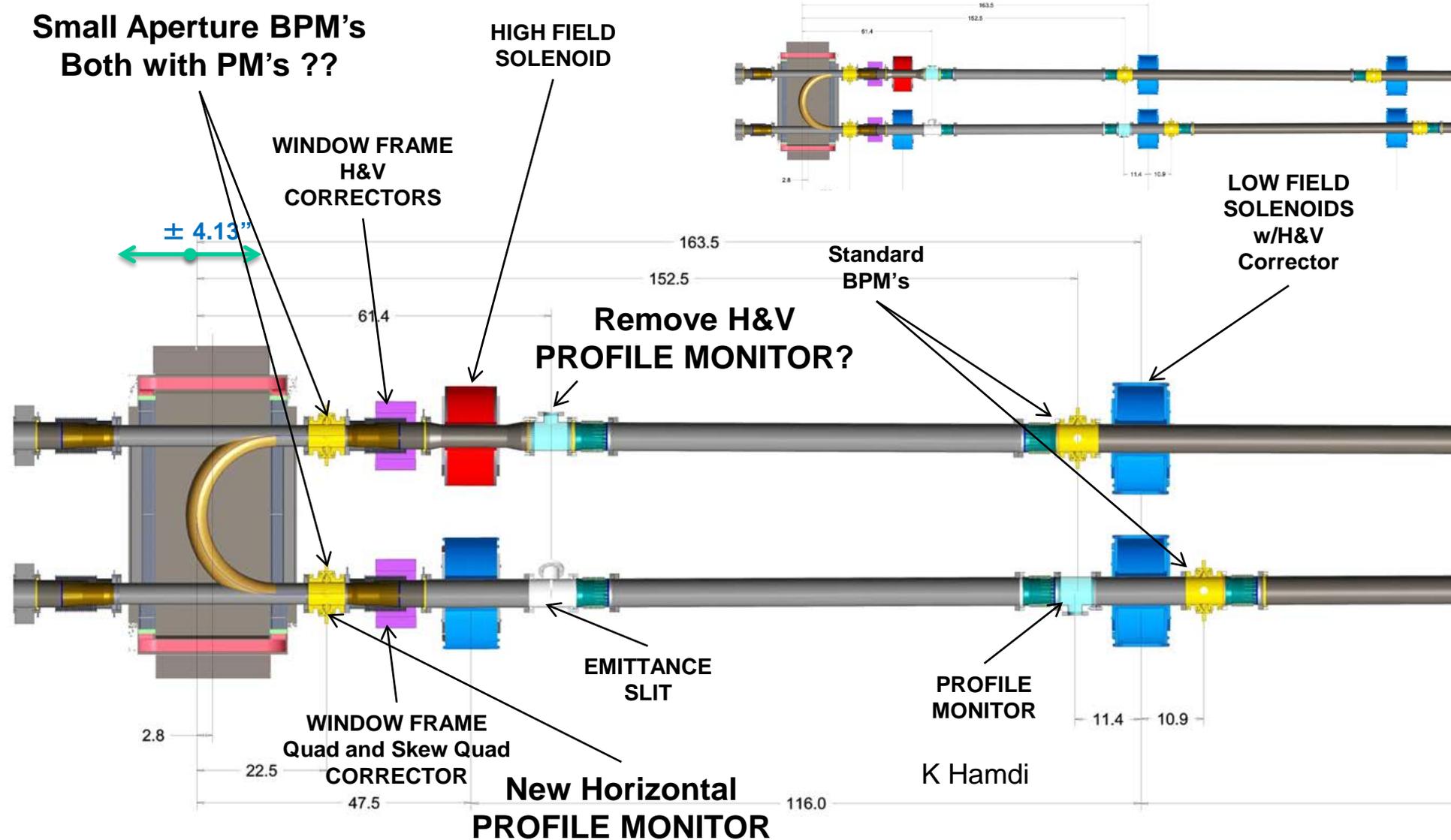
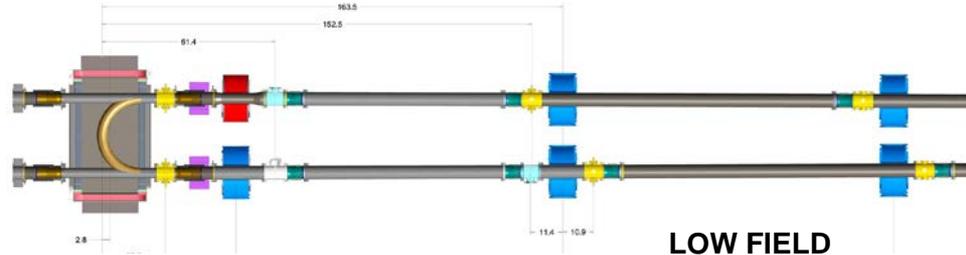
22.5

47.5

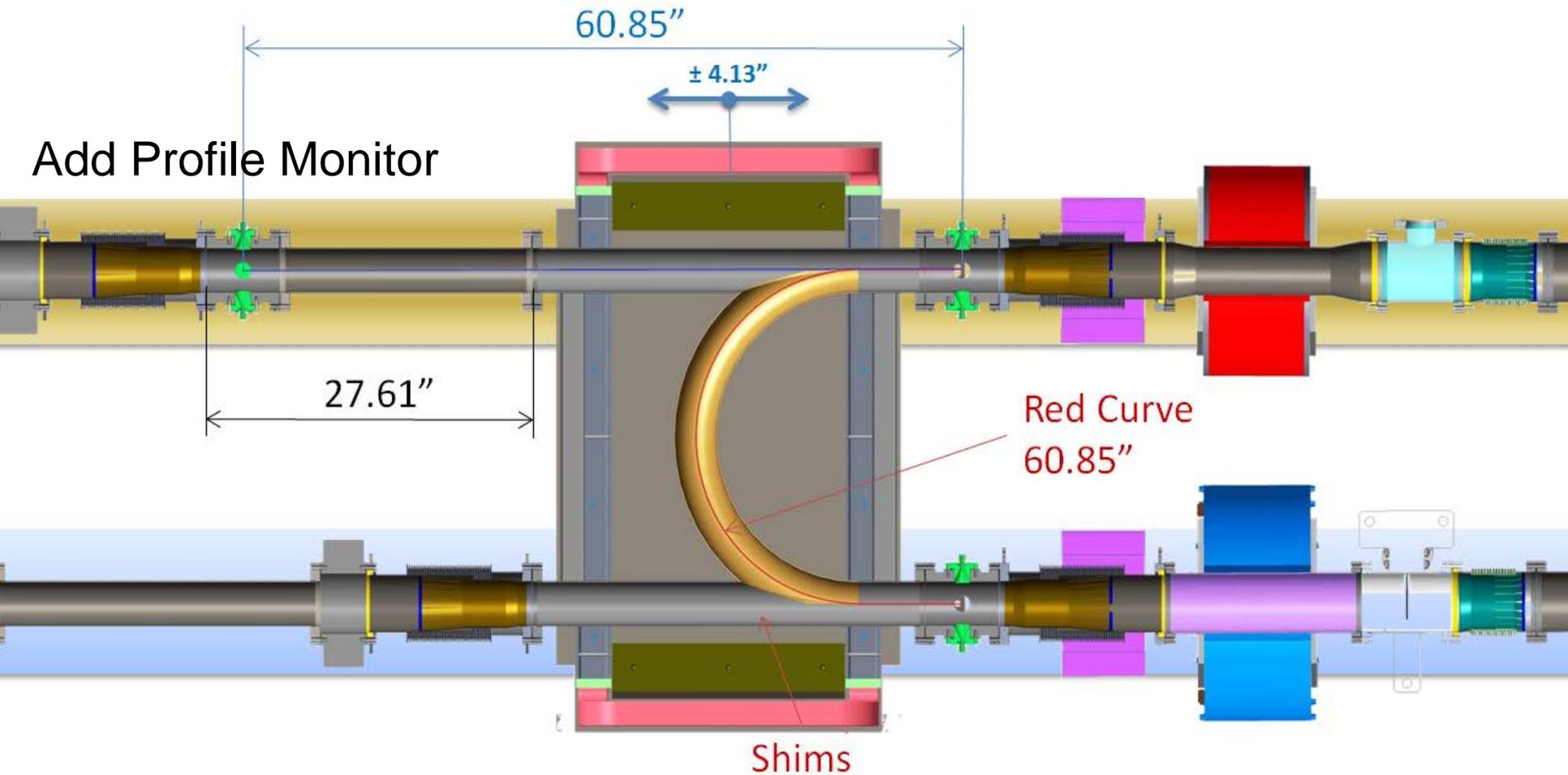
116.0

11.4

10.9

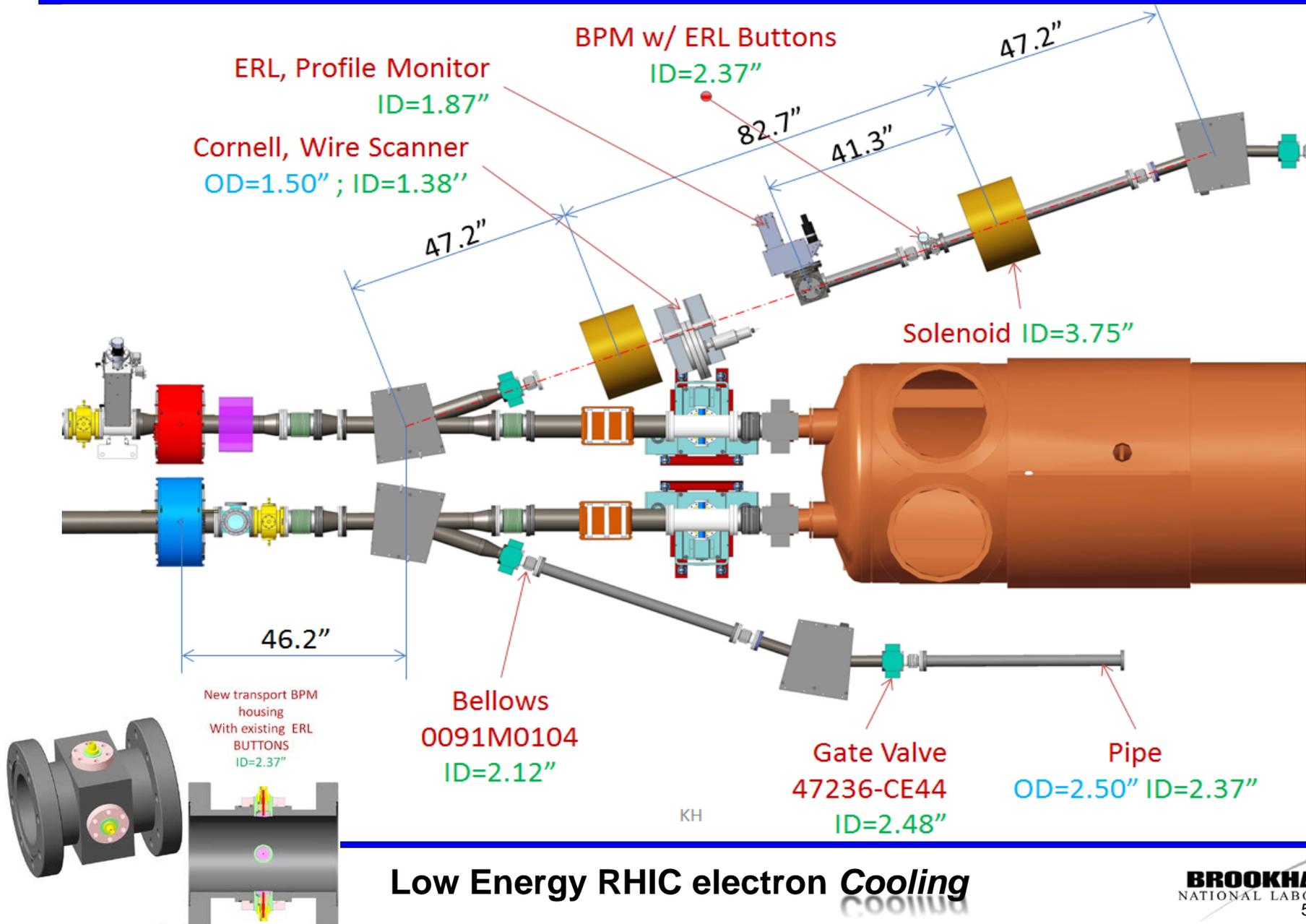


180° Dipole Magnet Neighborhood III



Low Energy RHIC electron Cooling

20° Dipole Neighborhood II



Low Energy RHIC electron Cooling

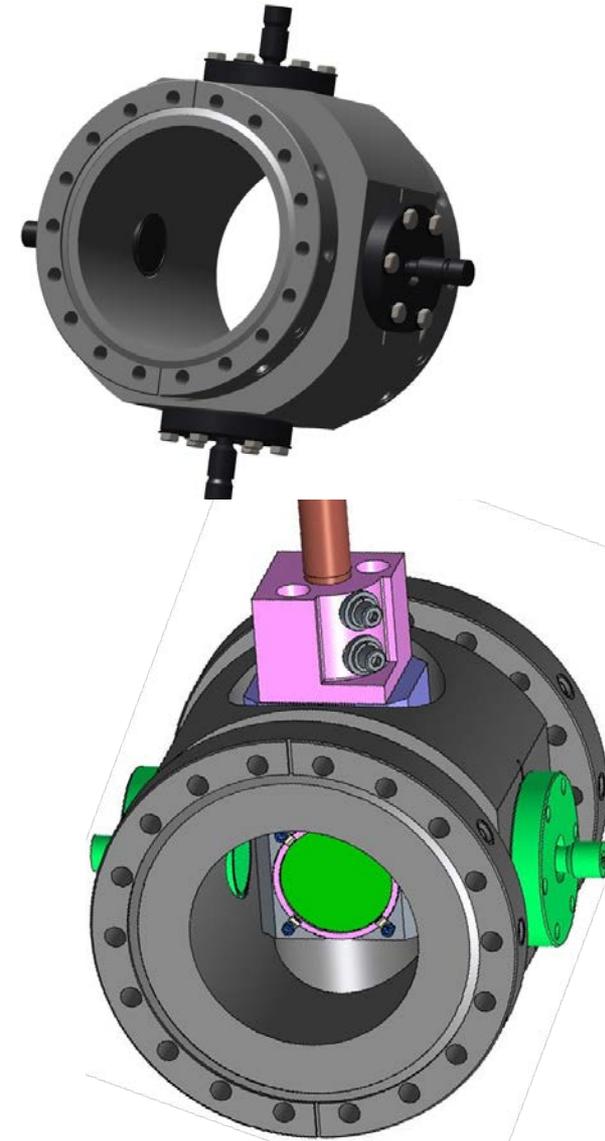
Large Dia. BPM Housings (4.8 ID), 28mm buttons

- Order Placed with MPF
- Vendor's Project Schedule
 - 1st Article Button(s) 10/5/15
 - 3 month housing fabrication
 - Housing fabrication start 10/12/15

- Increase number of button first articles
- Start housing fabrication now

Special ID for 180 Magnet

- Same button size, Analysis OK
- Eliminate vertical button for PM
- Combined with Profile Monitor, **Add single emittance slit, impedance??, ferrite location??**



Compensating and Matching Solenoids

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

Alpha Magnetics update: We have started winding the trim coils and we are machining all the parts, the only materials I don't have yet is the main coil wire yet... should be here next week. *Ken Wadsworth Alpha Magnetics*

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.

Magnet measurement fixture plan for prototype and design test fixtures

Brookhaven LeRiC Matching Solenoid Project, Revised Manufacturing Schedule



**Status Report / BSL-0NL-001
LeRiC Matching Solenoid project**

BSL reference: 12/59 BNL Contract No: 200154
 Attention: George Mahler Date: 6th June 2015

Tasks performed since last report

- The coil tooling has been finalised and works orders released to the workshop for manufacture.
- All materials for tooling have arrived and are ready to use.
- All works orders for parts have been released and materials for the contract have been ordered.
- The copper delivery issue has been addressed and BSL will do it's best to accelerate the coil production once the copper arrives.

Tasks for this month

- Complete the coil tooling
- Develop the necessary traveller and QA documentation
- Commence machining magnet components

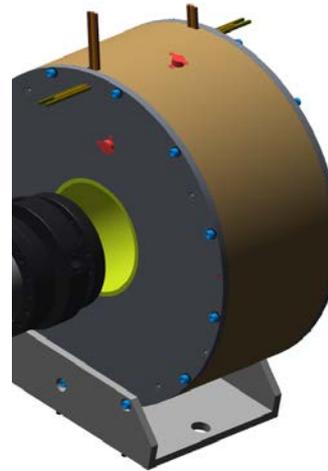
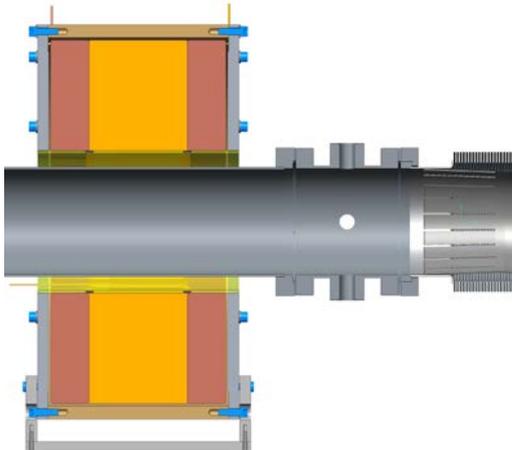
Issues/ Suggestions to notify

- Copper delivery is due on 6th July. Coil Production must commence immediately to meet the delivery milestones.

Proposed shipment date

- 20/6/2015

Regards
 Mick Kerr
 Project Manager



Brookhaven LeRiC Matching Solenoid Design Schedule - Contract # 200154										
Item	Design	Details	Start Date	End Date	Start Date	End Date	Start Date	End Date	Start Date	End Date
Solenoid Assembly	2015/06/11	2	Complete	Complete	15/07/2015	20/08/2015	04/09/2015	12/09/2015	12/09/2015	12/09/2015

Brookhaven LeRiC Matching Solenoid Coil Schedule - Contract # 200154										
Item	Design	Details	Start Date	End Date						
Coils	2015/06/11	2	2	20/06/2015	02/07/2015	04/07/2015	20/07/2015	24/07/2015	11/08/2015	17/08/2015

Brookhaven LeRiC Matching Solenoid Assembly - Contract # 200154										
Item	Design	Details	Start Date	End Date						
Solenoid Assembly	2015/06/11	2	14/07/2015	01/08/2015	10/07/2015	22/08/2015	04/09/2015	14/09/2015	24/09/2015	24/09/2015



Cooling Section Profile Monitors

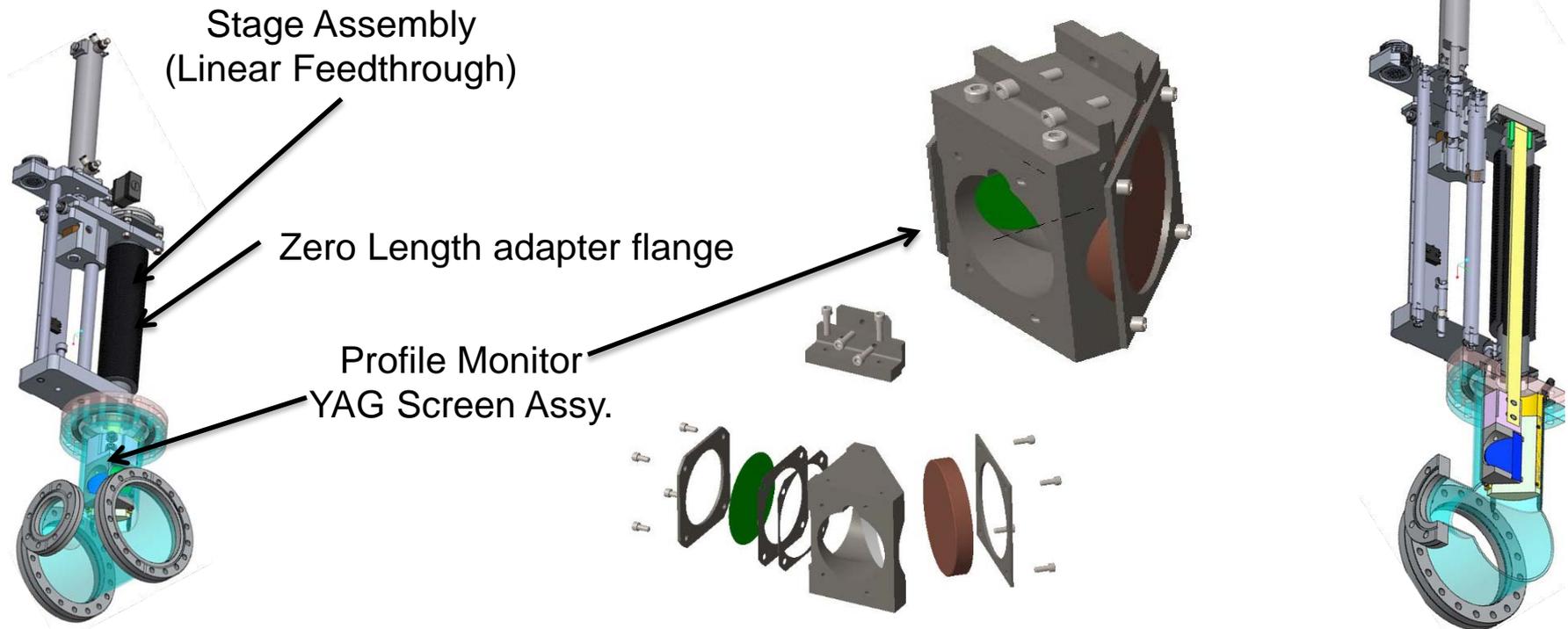
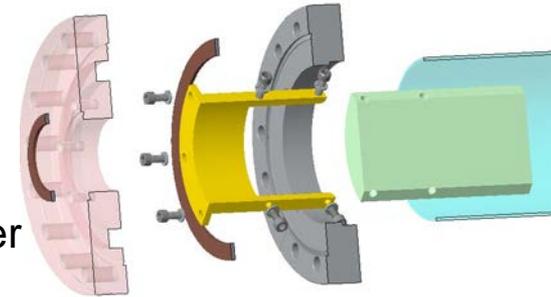
Ferrite ring mounting design complete. CMD5005 material.

Requisition for commercial vacuum linear stage, requisition complete

YAG screen/mirror holder design complete.

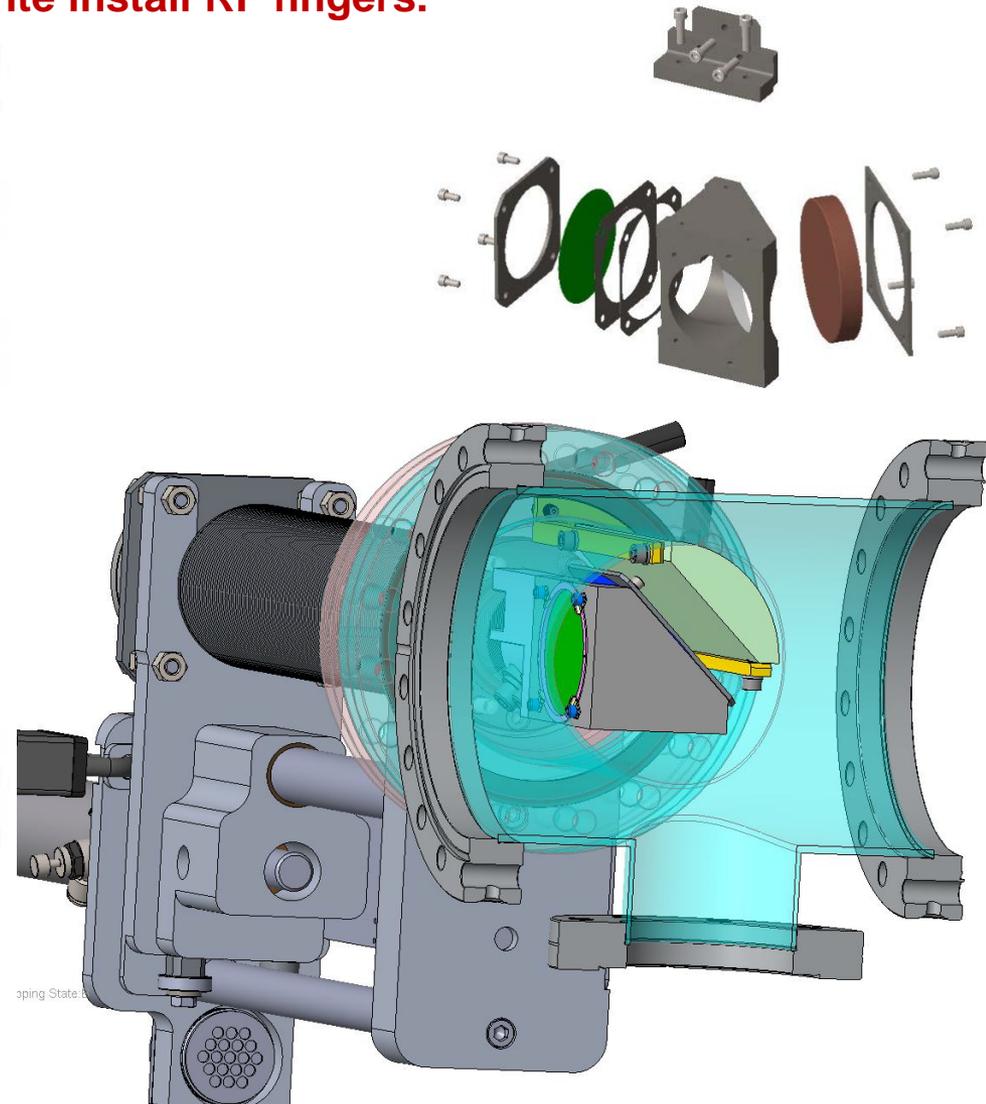
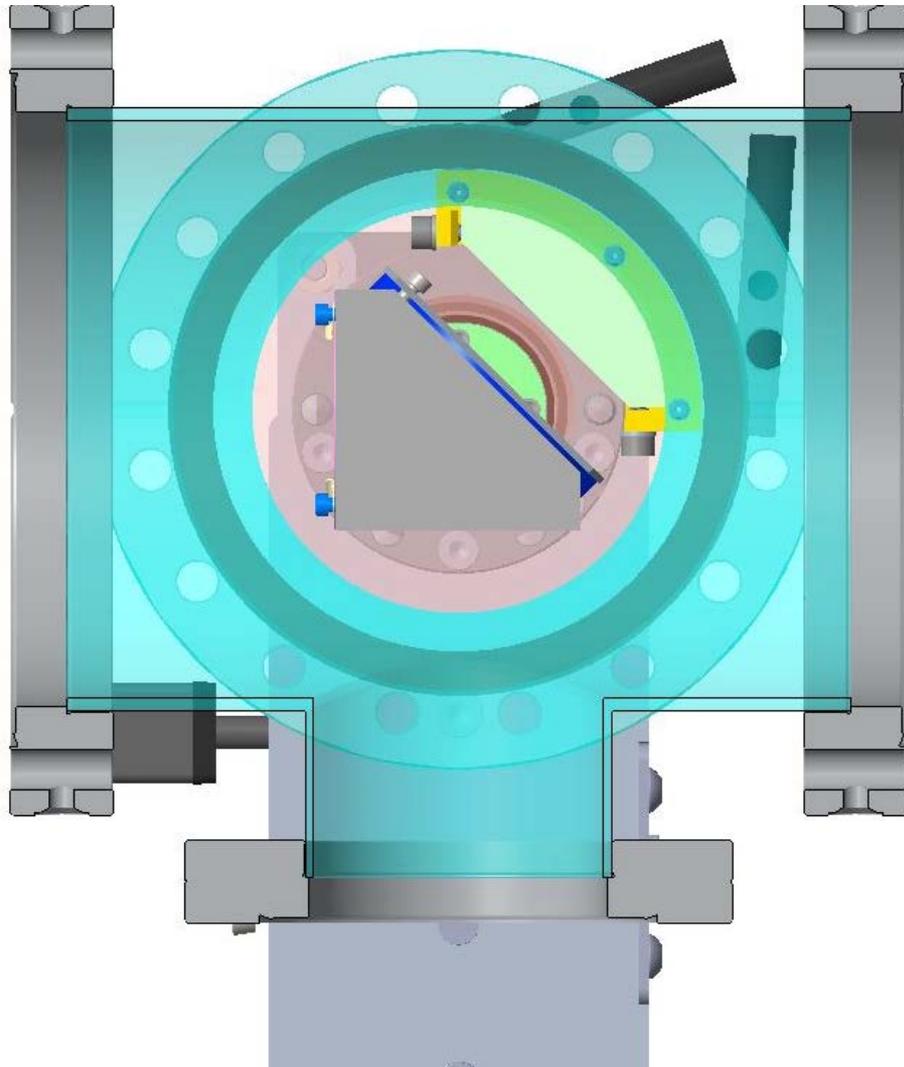
Fabrication drawings for YAG screen/mirror holder and vacuum chamber

Revise RF impedance design



Cooling Section Profile Monitors

Revise RF impedance redesign: remove ferrite install RF fingers.



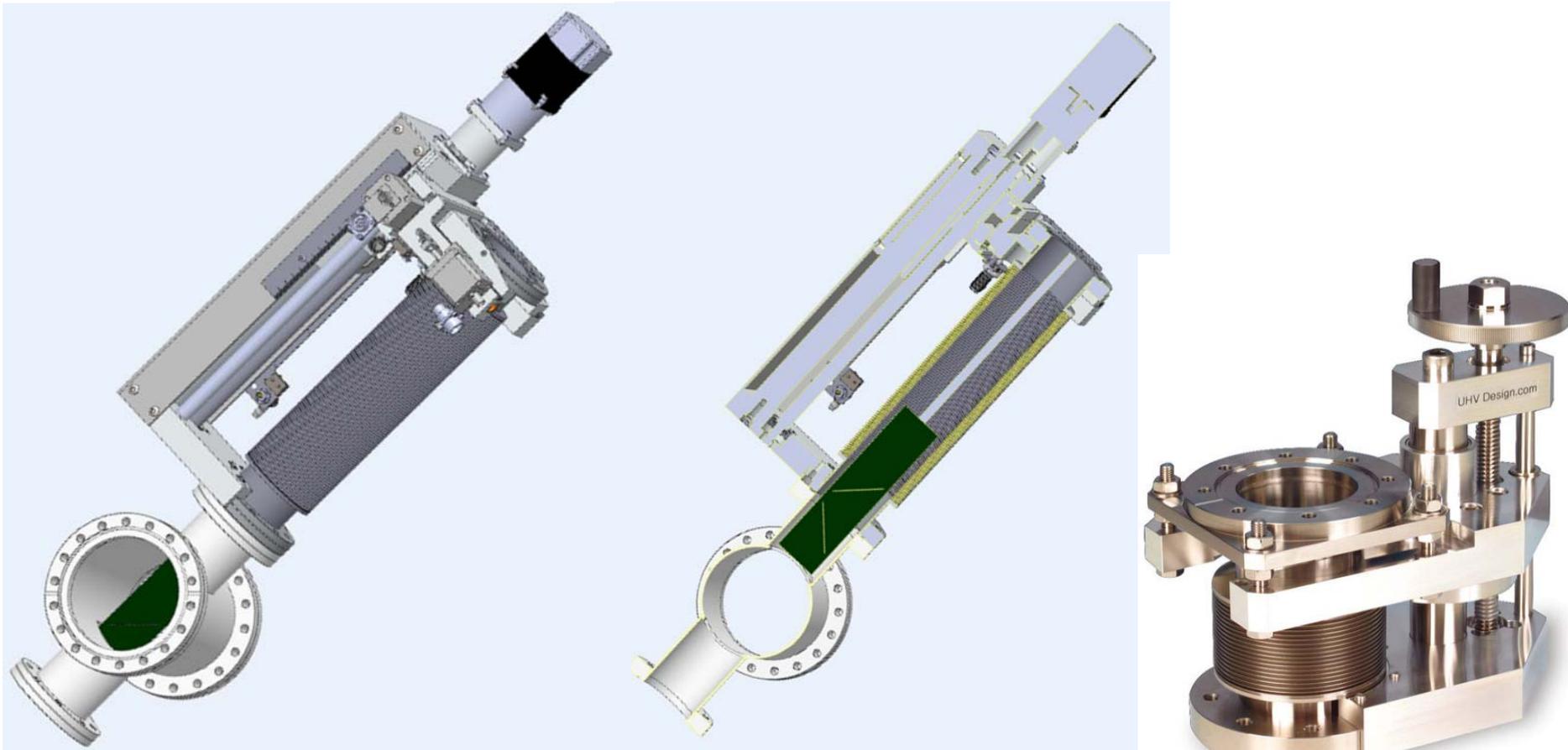
Low Energy RHIC electron Cooling

Cooling Section Emittance Slits

Motor drives and position indication specs. approved by vendor.

Requisition for commercial vacuum linear stage?

Tungsten plate vendor, design adapter tungsten plate to drive shaft flange.

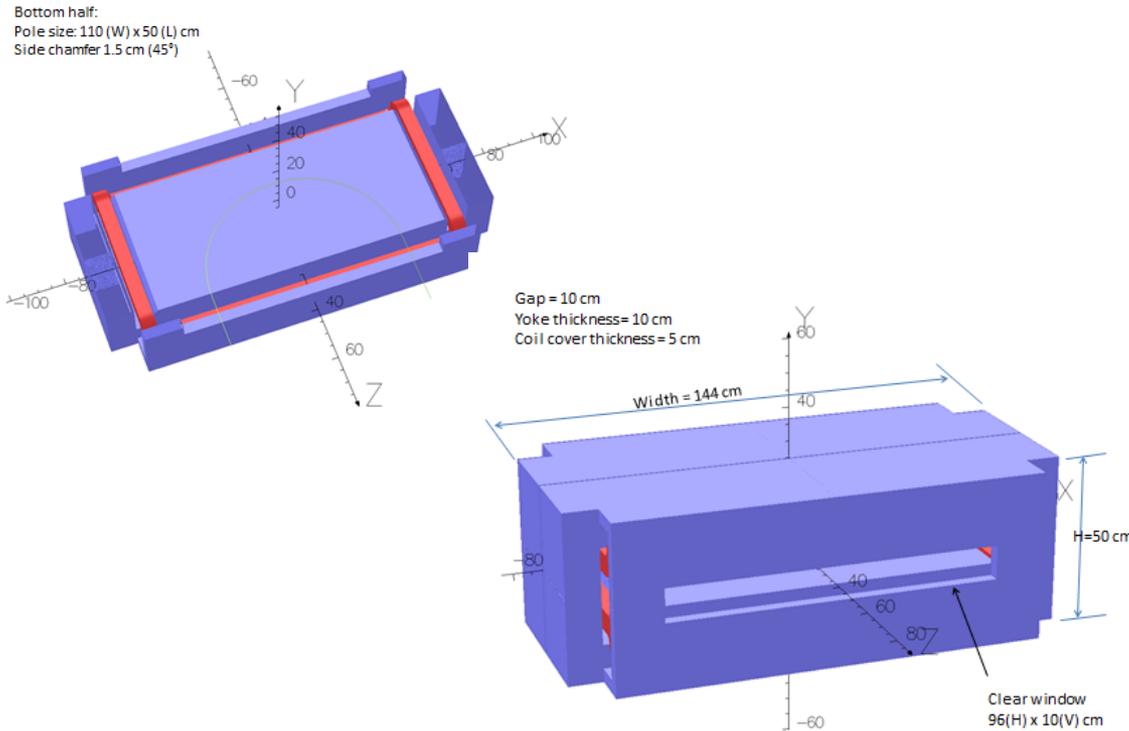


Low Energy RHIC electron Cooling

180° Dipole Magnet

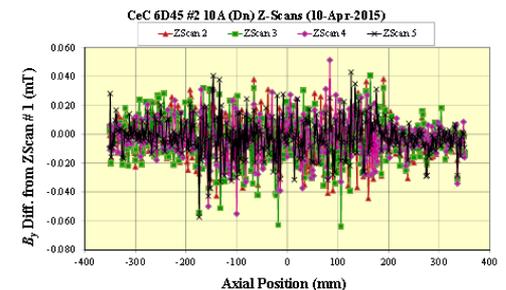
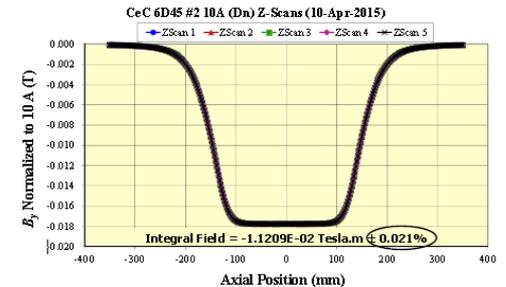
Requisition Status

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°



Vacuum Hardware

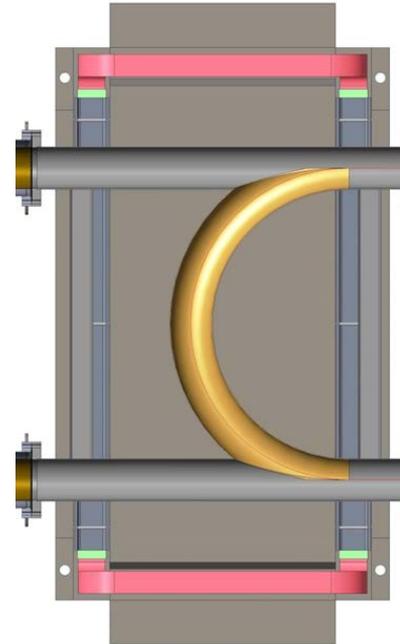
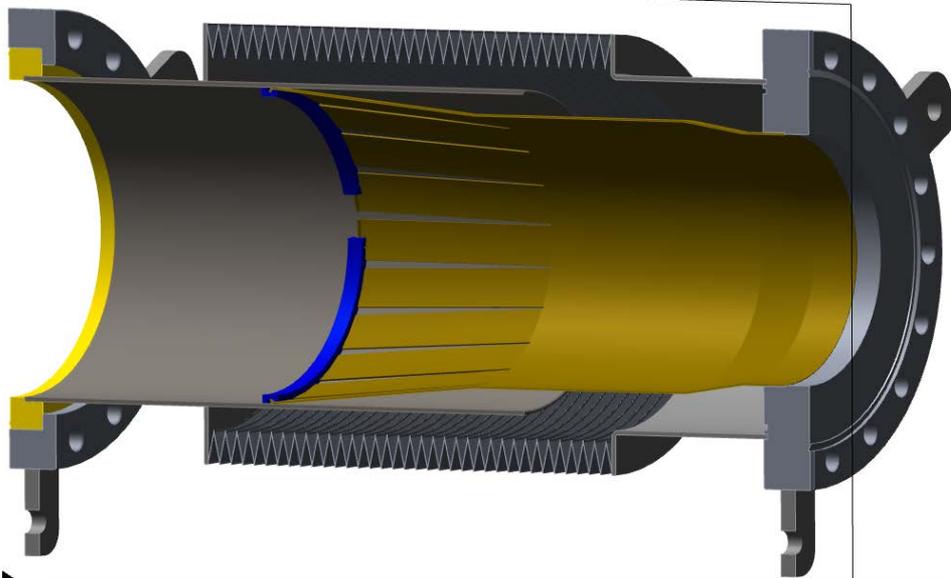
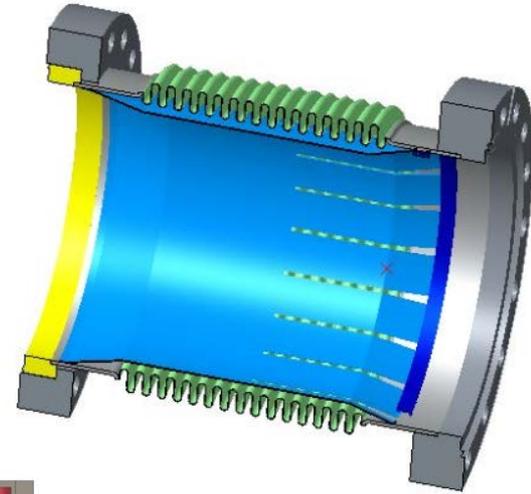
Beam line bellows & 180 accordion bellows requisition status.

“Standard Chamber Length”

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

Test chamber welded and measured. Annealing

Shielded valves on order, need DC Gun shielded valves.



Low Energy RHIC electron Cooling

20° Dipole Magnet

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

Order Placed 5/6/2015 Everson Tesla

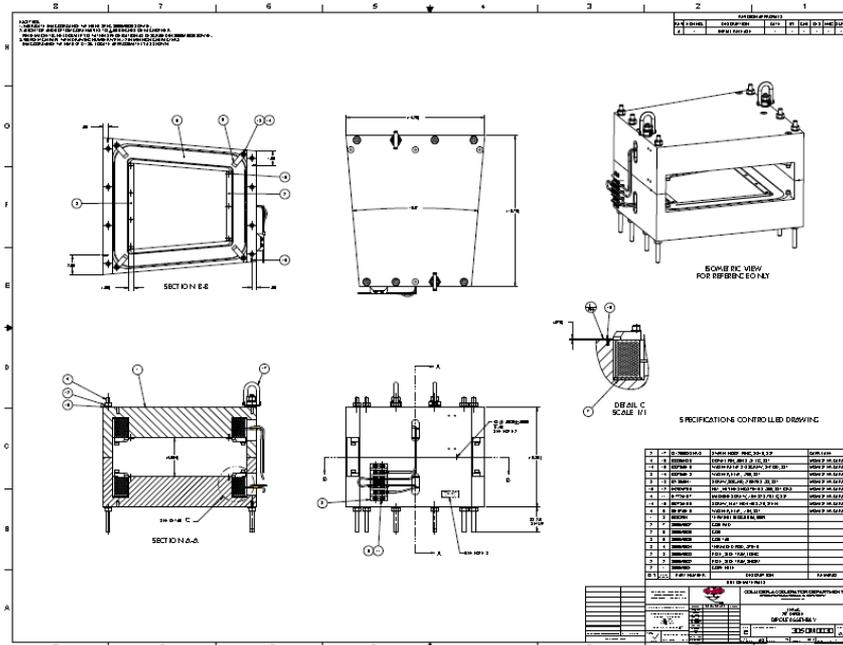
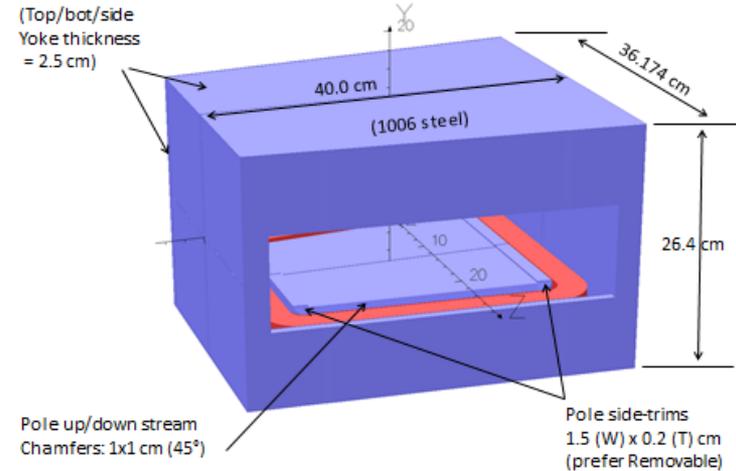
Estimated Delivery 1st two magnets 10/1/2015

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.)

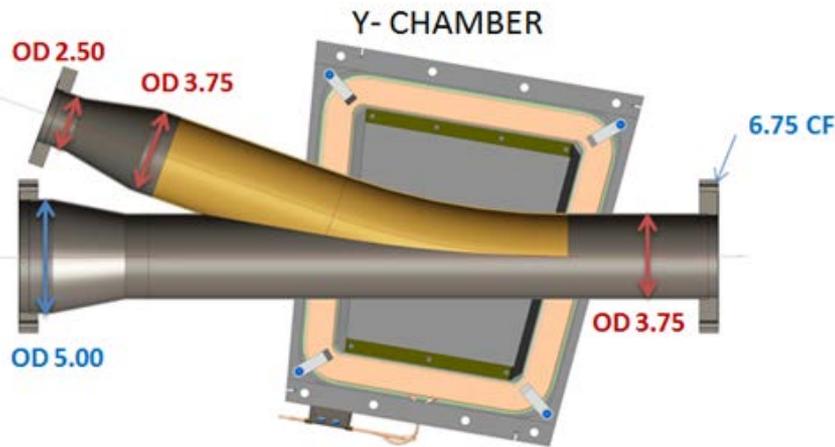
LEReC 20-degree Dipole (Gap clearance=10 cm)
(distance between pole faces =10.4 cm)



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°

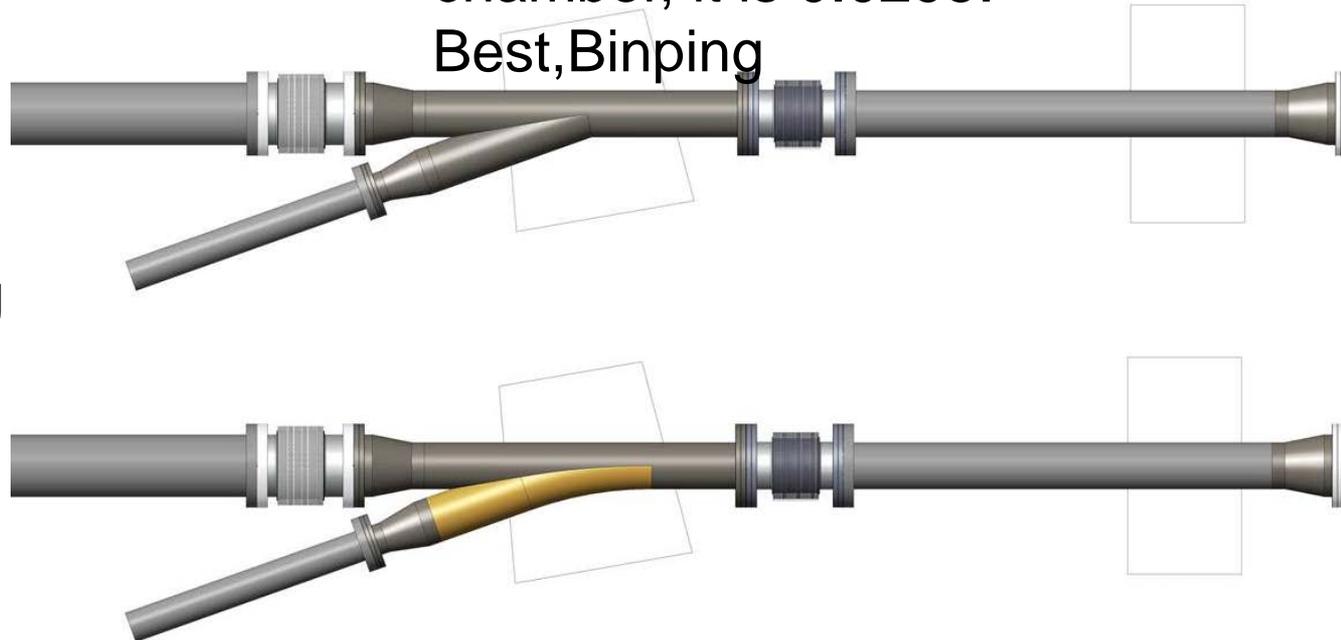
20° Dipole Magnet Vacuum Chamber



Here attached the wake field analyses of the 180 degree and 20 degree chambers for LEReC. The 180 degree chamber shows a wake loss factor at 0.0186 V/pc, and for the 20 degree chamber, it is 0.0295.

Best, Binping

Fabrication Drawing



LEReC Cooling Section Design Room



Design 180° dipole chamber for impedance review (KH)

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

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)

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

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

Beam Instrumentation PM YAG, mirror, mount, & chamber fab. drawings (GW)

Beam Instrumentation PM ferrite insert (GW)

20° dipole vacuum chamber (KH)

20° and 180° stand drawings (KH) ↘

Beam line solenoids, BPM's, and long pipe independent stands.

Magnetic Shielding drawing and solenoid magnetic measurement test station

Cable tray and penetration drawings

Phase 2: 5 cell cavity positioning (RM)

DC Gun Vacuum Chamber Fabrication Drawings (JH)

DC Gun SF6 Pressure chamber specification control drawings (JH)

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

DC Gun & SF6 Chamber stands (JH)

RHIC 1:00 move real estate drawings (VDM)

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

Phase 1 and 2 cryogenic system layout (RM)

2.1 GHz warm cavity fabrication drawings (MG)

704 MHz warm cavity fabrication drawings

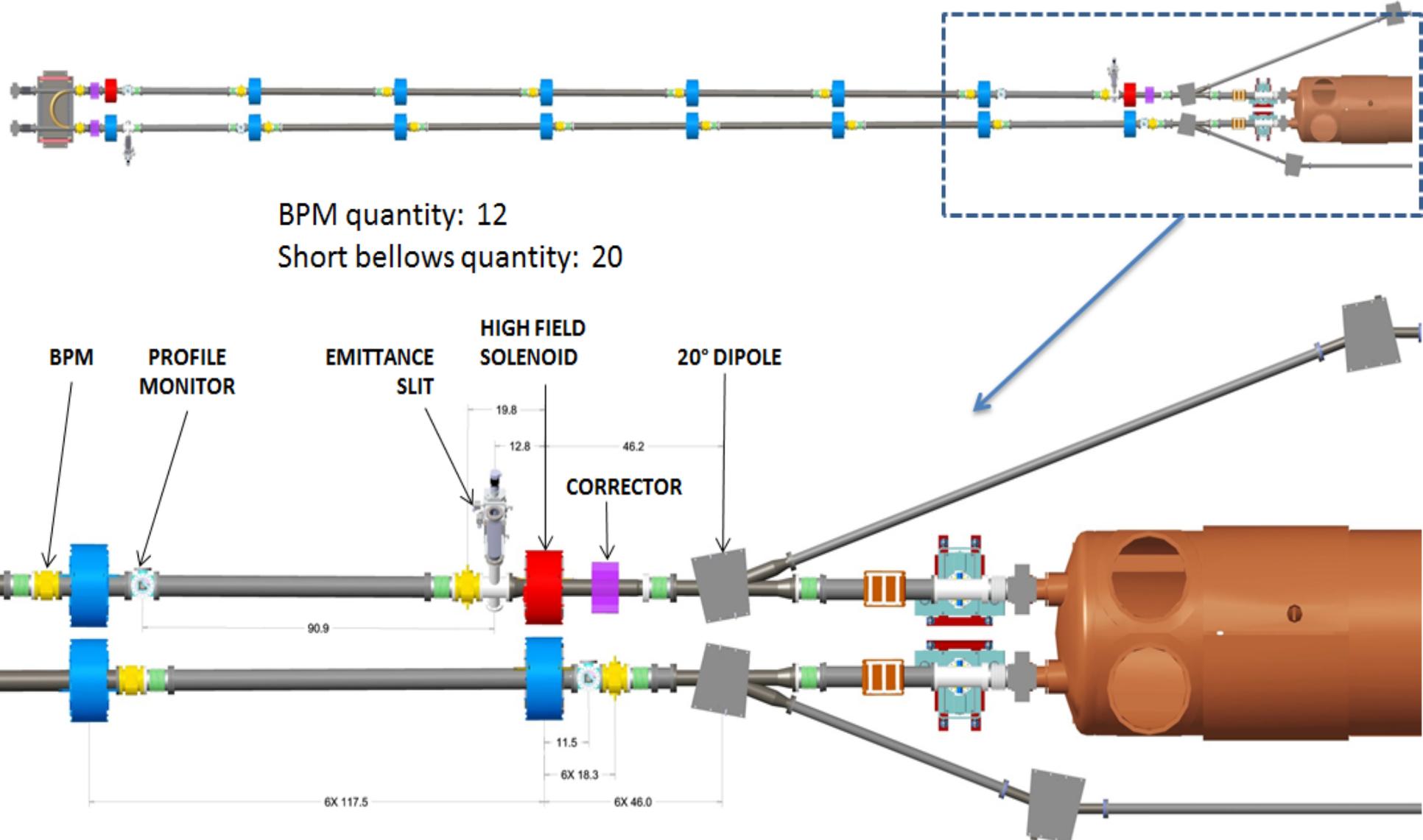
DC Gun cathode insertion drive ↘

DC Gun cathode coating system upgrade – coating system vacuum chamber

Transport line layout drawing (RM/VDM)

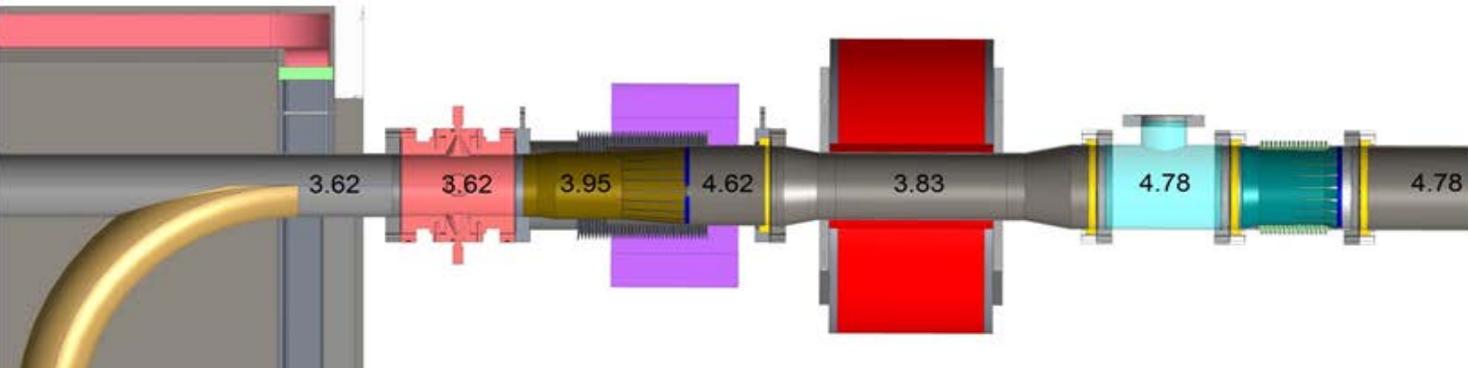
Reference Slides

20° Dipole Magnet Neighborhood

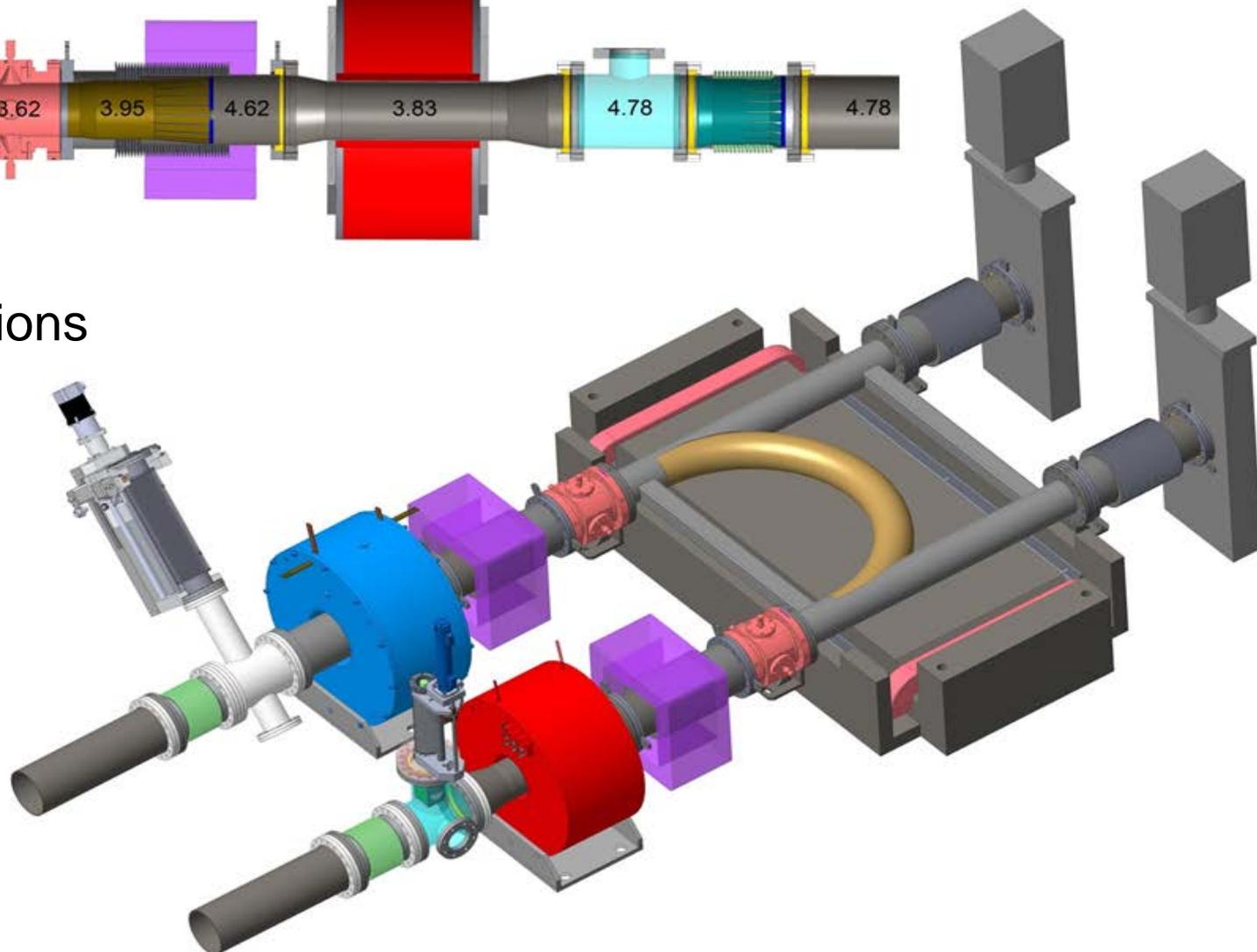


Low Energy RHIC electron Cooling

180° Dipole Magnet Neighborhood II



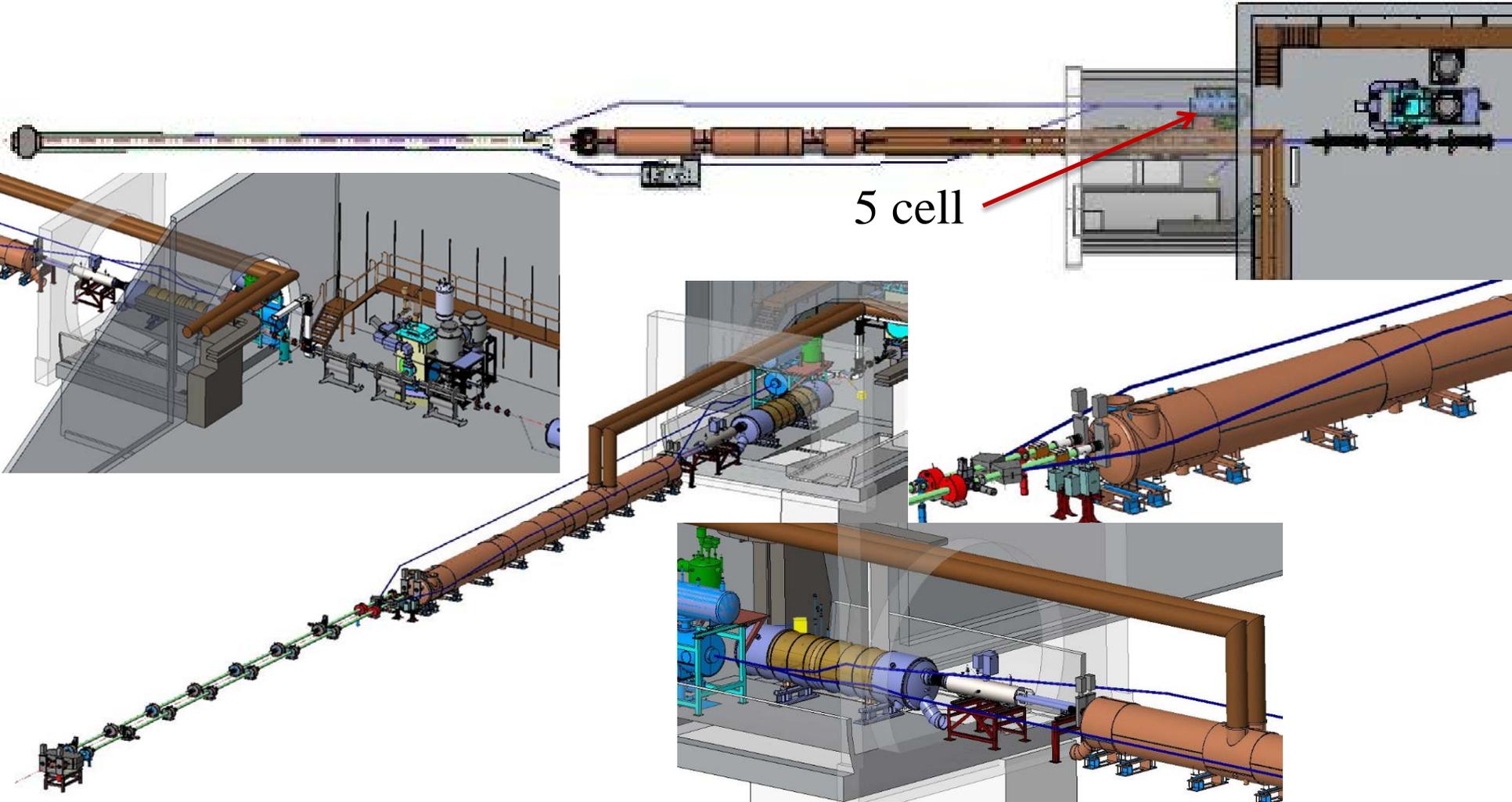
Aperture Transitions



Low Energy RHIC electron Cooling

5 cell cavity location

New updates?



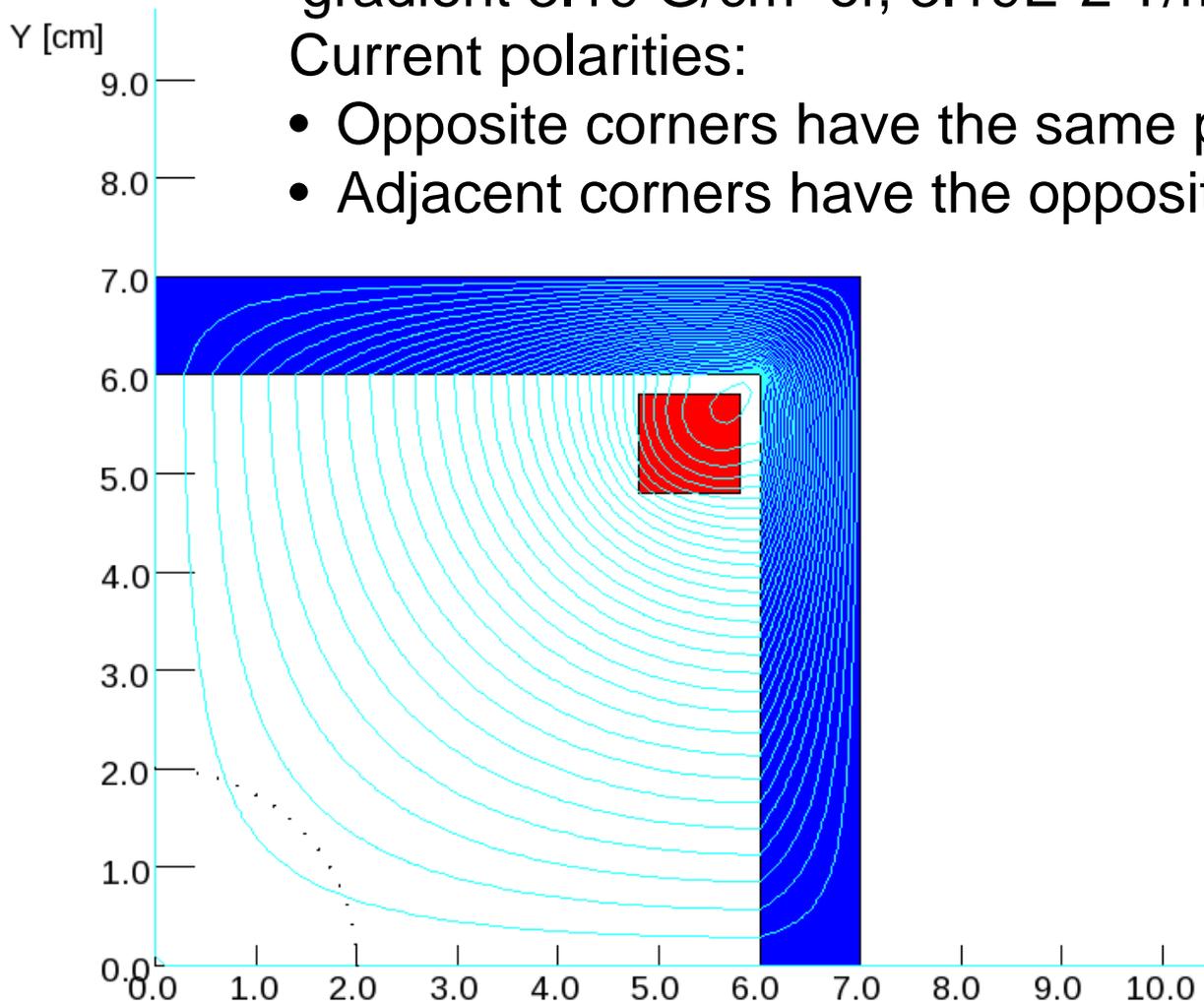
Low Energy RHIC electron Cooling

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.



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

