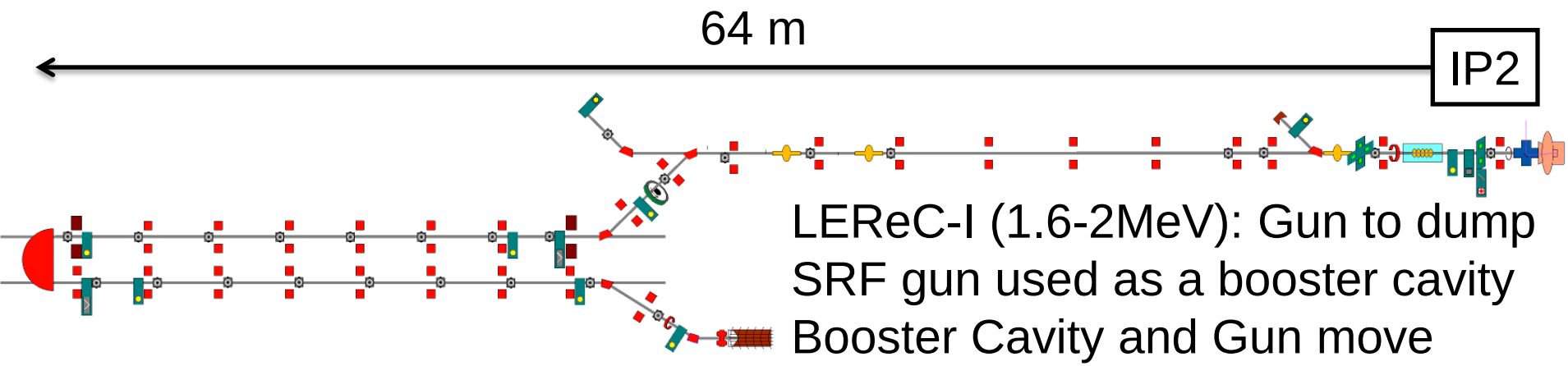
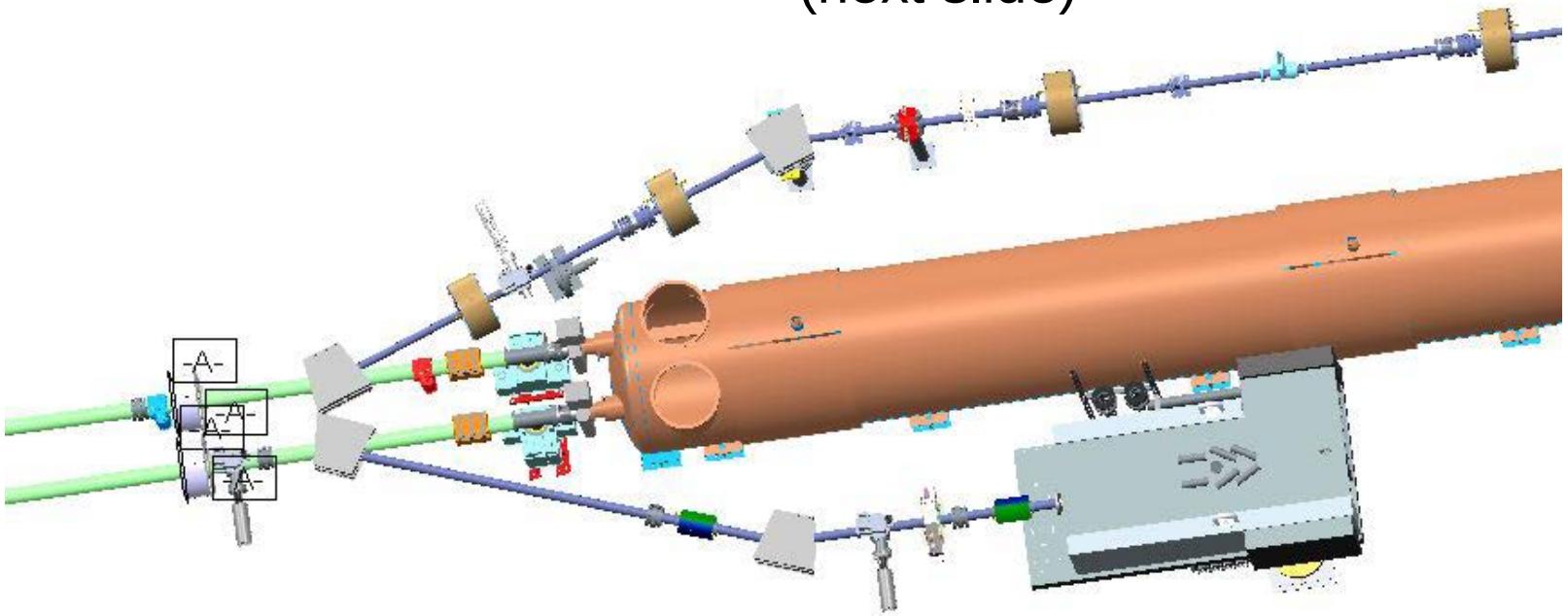
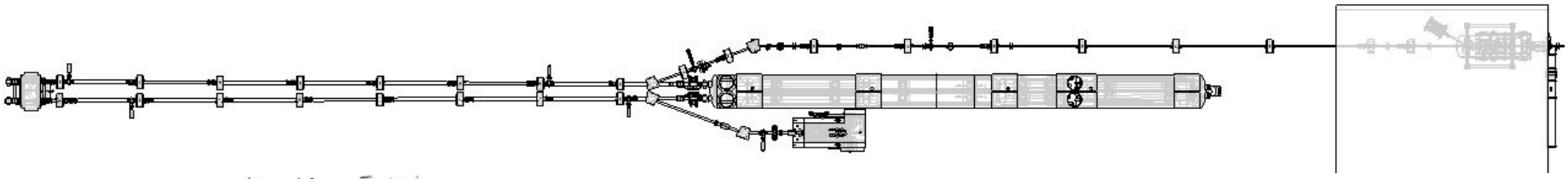
Overall Layout



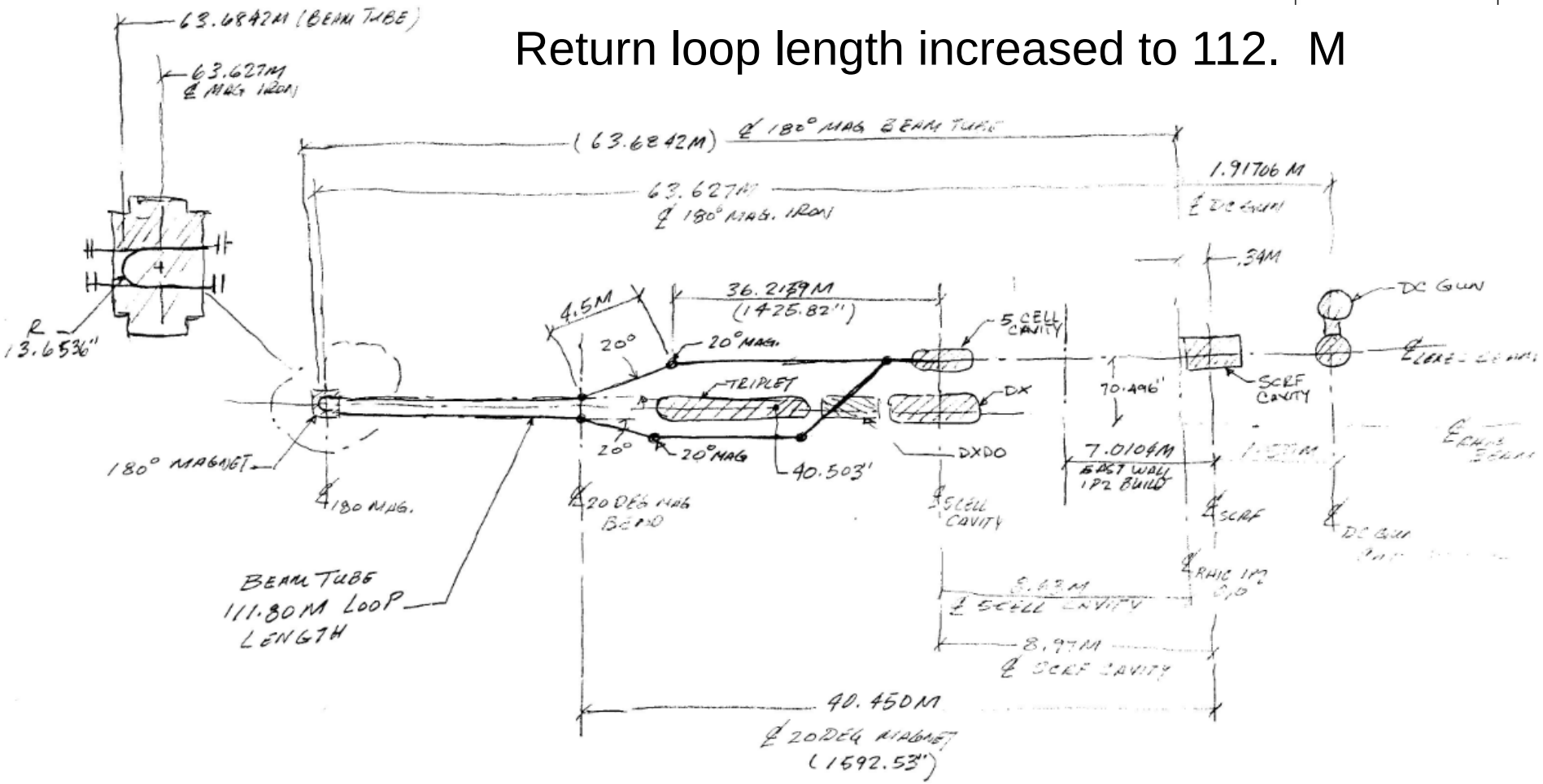
LEReC-I (1.6-2MeV): Gun to dump
SRF gun used as a booster cavity
Booster Cavity and Gun move (next slide)



LEReC Loop Dimensions

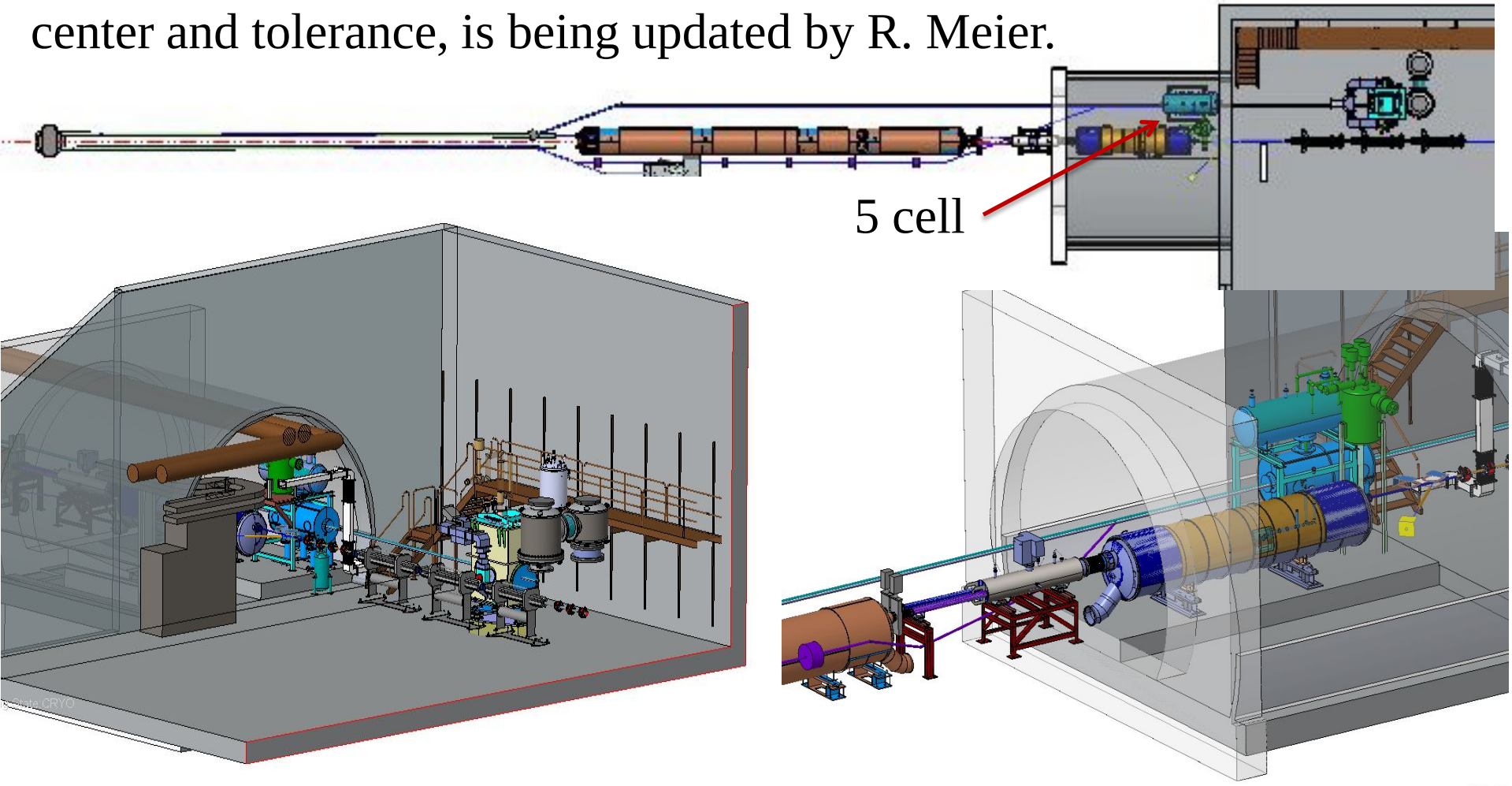


Return loop length increased to 112. M

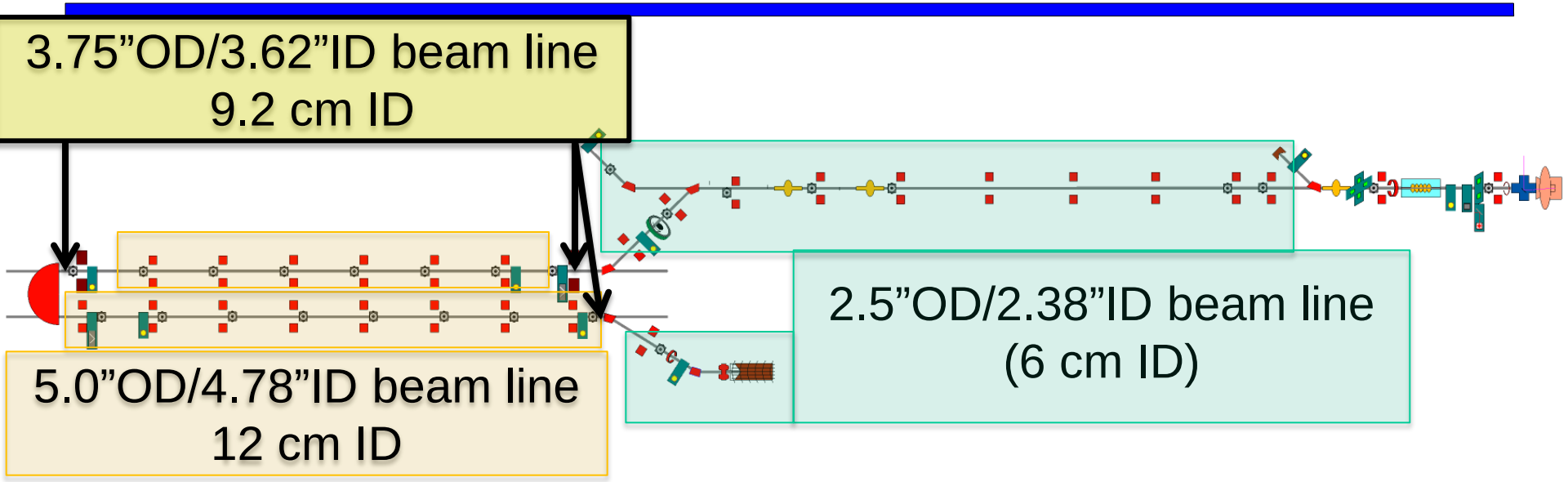


5 cell cavity location

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



Overall Layout



From: Fedotov, Alexei
Sent: Friday, April 03, 2015 2:22 PM
Subject: RE: LEReC Cooling Section Component Design Meeting 4 - 2 - 15

2.38” ID gives sufficient margin for the merger section (from one 20 deg. dipole to another). It is sufficient for beam transport line of LEReC Phase-I as well.

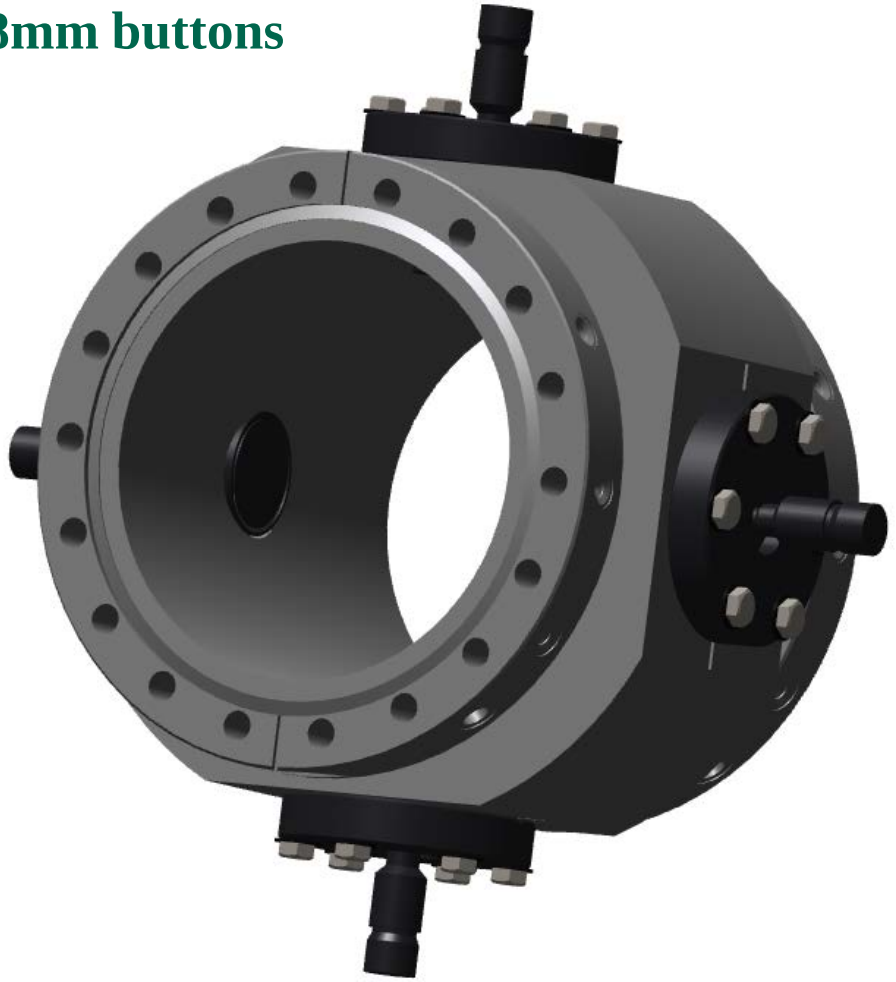
However, to take into account LEReC Phase-II with higher charges, the area from the DC gun to the SRF booster and then additional area where for Phase II zig-zag will be needed from the SRF booster to the SRF 5-cell cavity should be revisited when choosing appropriate vacuum chamber size.

Alexei

BPMs in Cooling Section (14 Locations)

Orthogonal Installation – simple processing.

- Large Dia. BPM Housings (4.8 ID), 28mm buttons
- Drawings complete
- SOW and Spec complete.
- Requisition approved



Compensating and Matching Solenoids

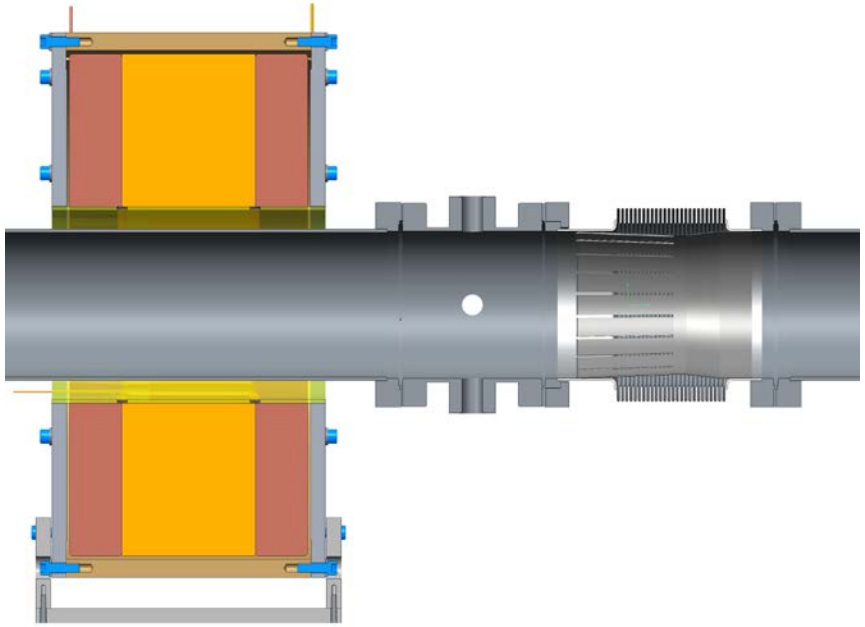
Contract Awarded: 9/15/2015 delivery for both

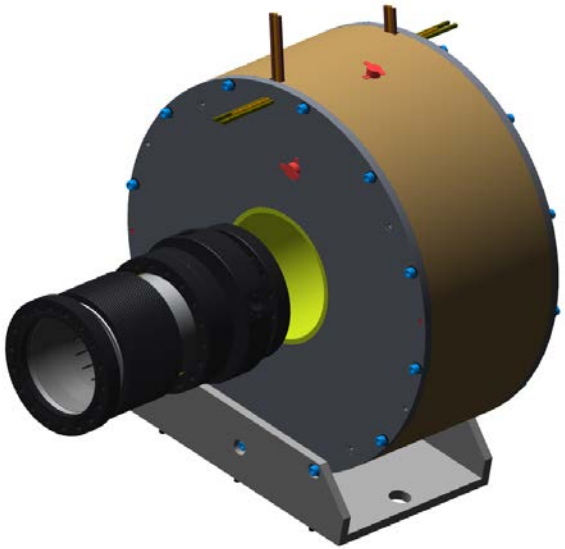
Design support stand assembly – provide space for mu metal shields, separate beam pipe stand support.

Magnetic shielding analysis (Wuzheng)

Design prototype mu metal shields and supports.

Magnet measurement fixture plan for prototype and design test fixtures.





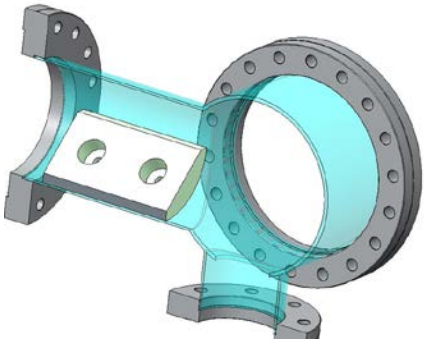
Profile Monitors – New designs for Cooling Section

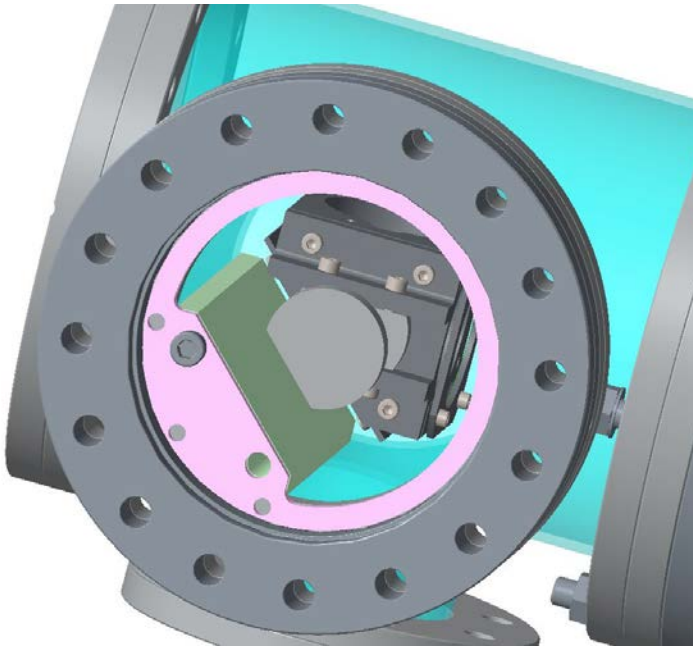
Ferrite ring mounting point. Low power loss - CMD5005 material.

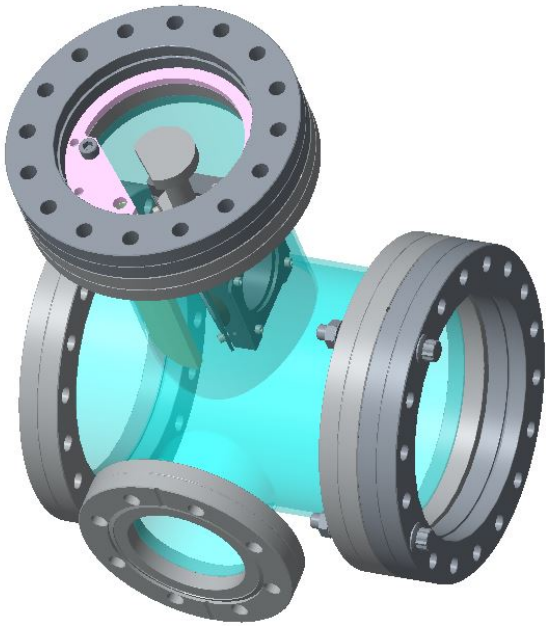
Ferrite shape is not critical

Peter re-analyzed the chamber. modeled is 1.65” OD, 1.45” ID and 1” high.

Chamber design being finalized and detailed.





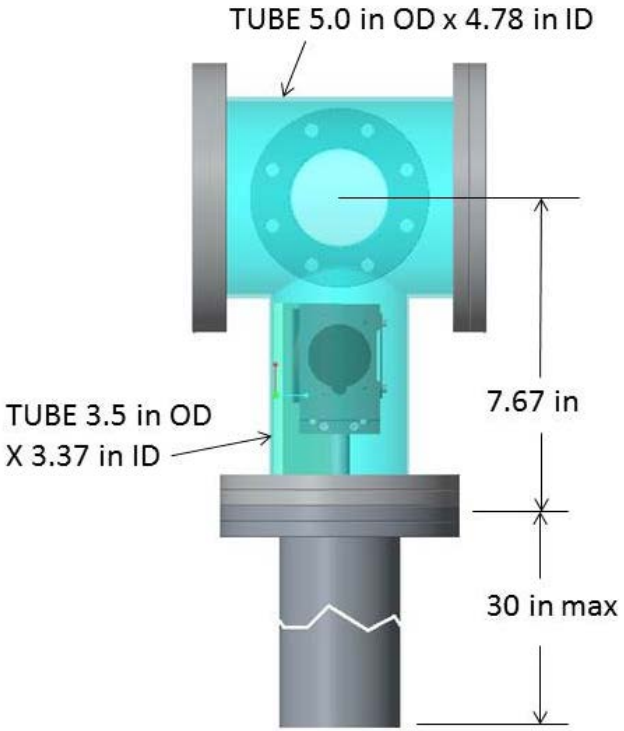


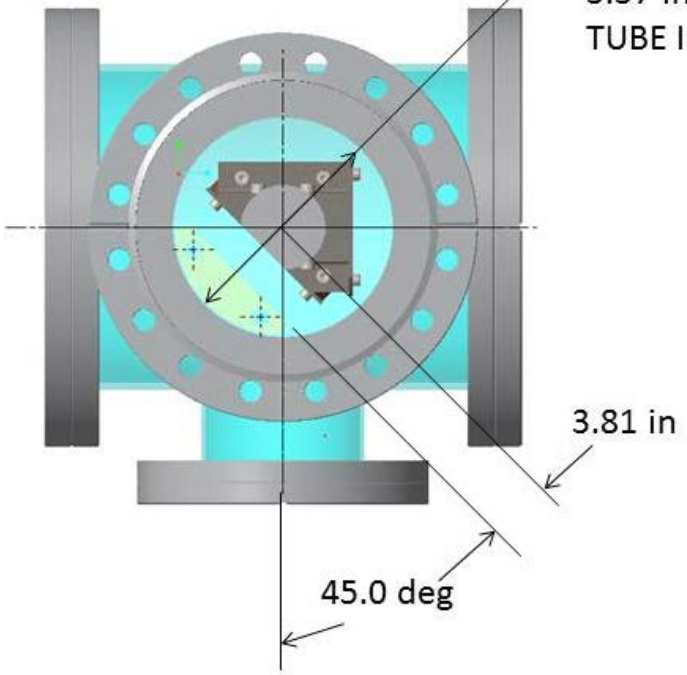
Profile Monitors – New designs for Cooling Section

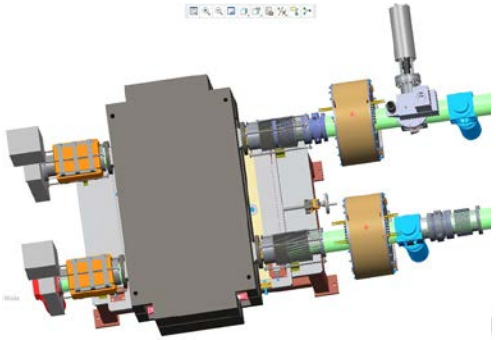
Utilize commercial vacuum linear feedthrough/drive system (D. Weiss)

Need to adapt YAG screen/mirror holder and emittance slits to drive shaft.

Create fabrication drawings for YAG screen/mirror holder and emittance slits







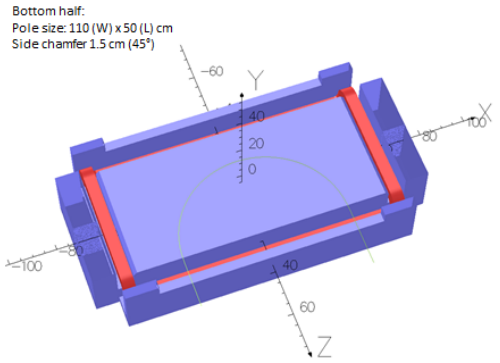
180º Dipole Magnet

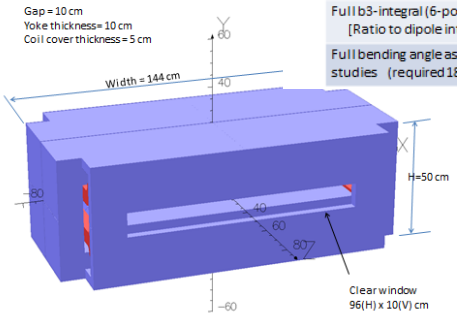
Magnetic field quality and repeatability for energy spread measurement. Test using CeC dipole complete(A. Jain)

Meeting next week 02:00 with A. Jain (solid vs laminated)

Need to add H corrector + LF quadrupole to the magnet.

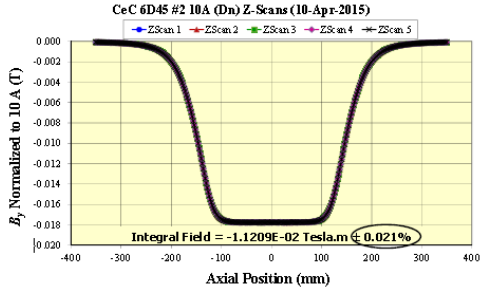
Range of motion for magnet core +/- 10cm.
Magnet Vertical Gap = 10.0 cm (3.94 in.)
Vacuum Chamber Aperture = 9.5 cm (3.75 in.)

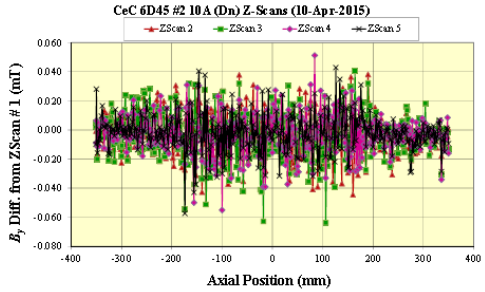




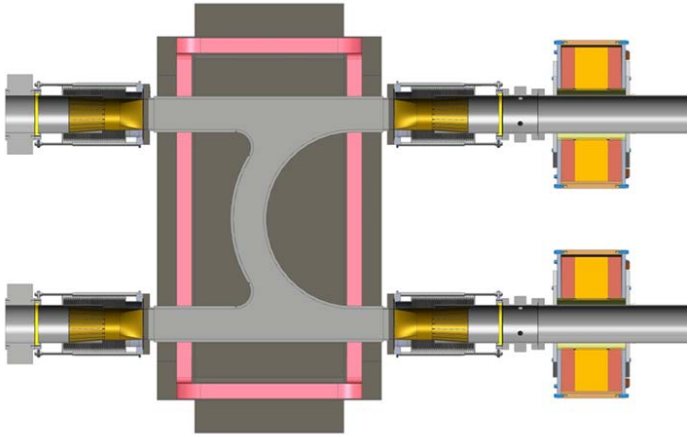
Electron tracking results and field qualities along entire trajectory on R=2 cm curved cylinder:

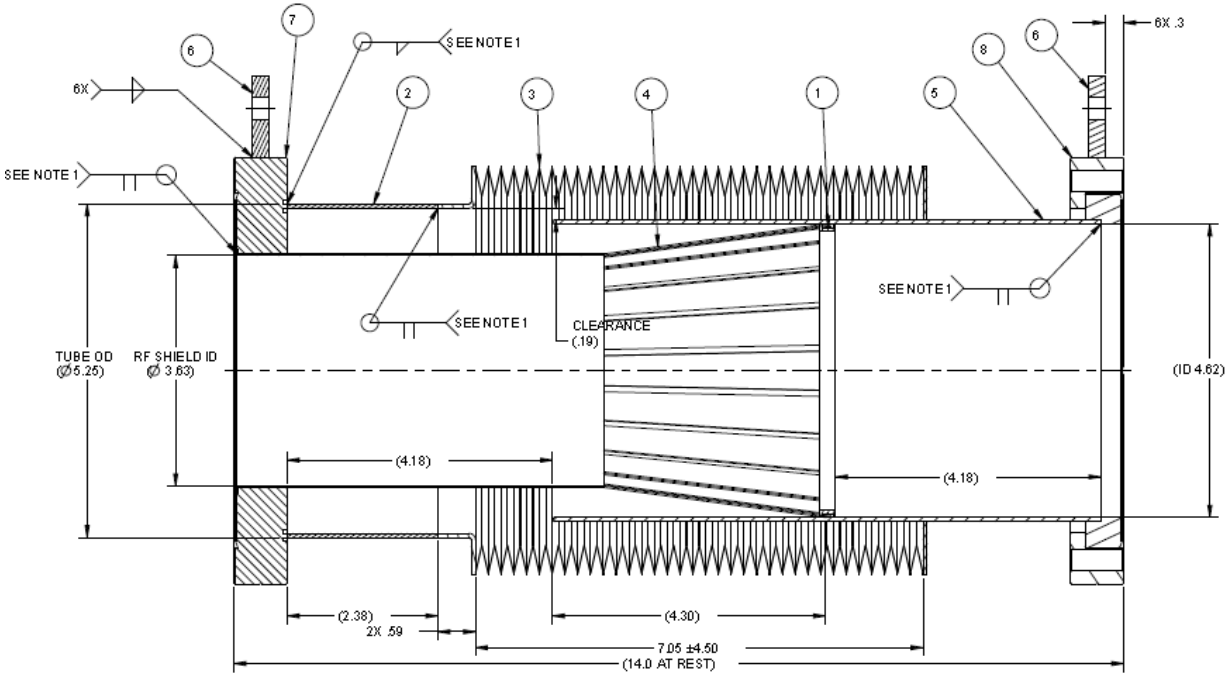
	Ek = 5 MeV	Ek = 1.6 MeV
Total current per coil (Ampere-turn)	2119.146	791.077
Overall current density (A/mm²) (coil-pack cross-section: 5.0 x 6.0 cm)	0.7064	0.2637
Central Field deep inside magnet (Gauss)	525.21	195.78
Effective Magnetic Length (cm)	109.43	109.57
Full b1-integral (dipole) (G-cm)	5.7471E4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



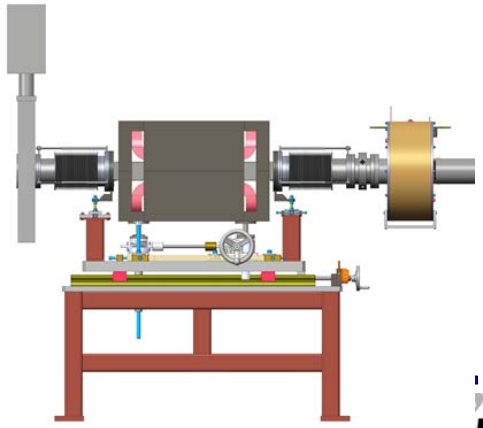


Crossing tube aperture (3.94 in. vertical)

Circular tube, vacuum Chamber ID = 9.5 cm (3.75 in.)

Binping Xiao has completed analysis.

Final review and approval (Alexei)

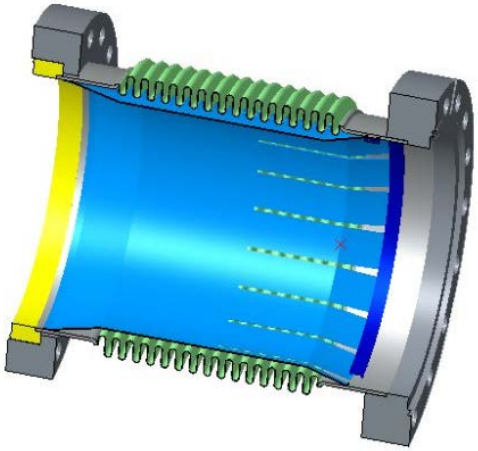


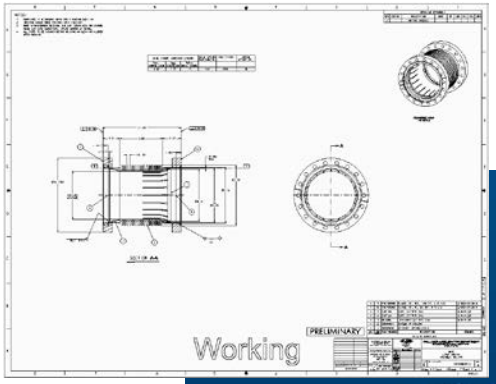
Vacuum Hardware

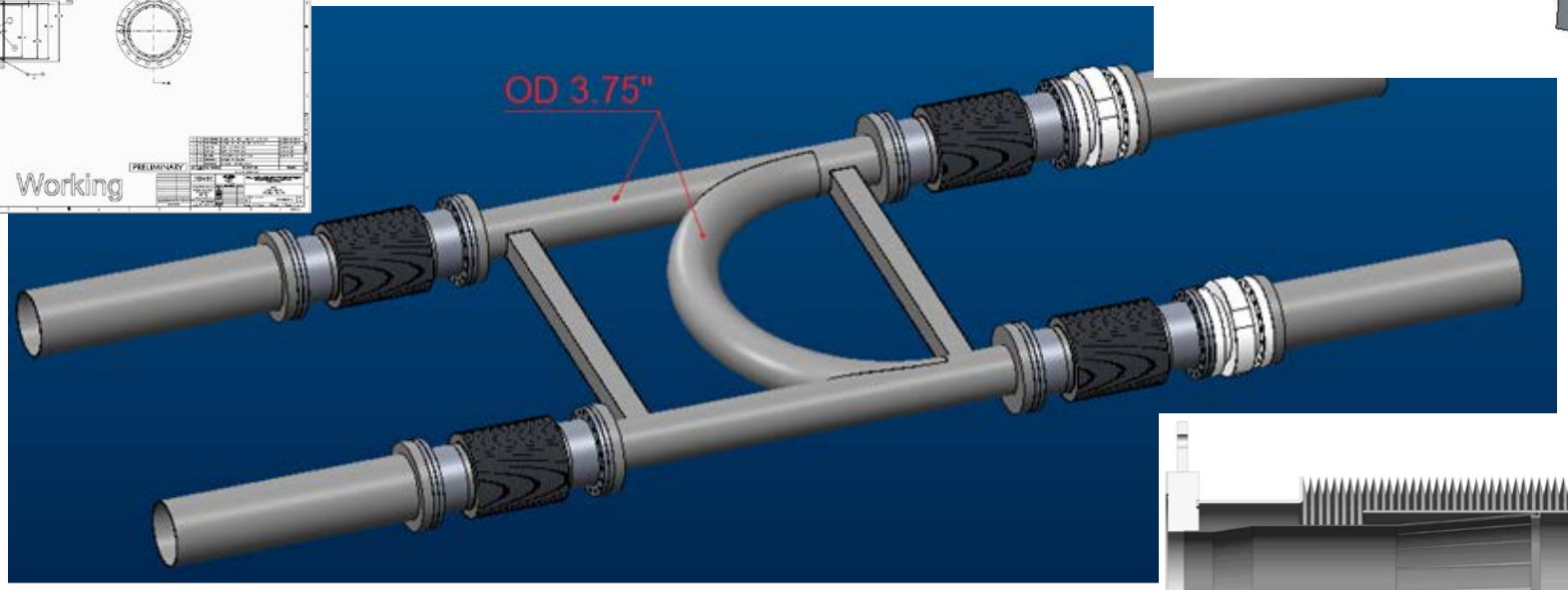
Beam line bellows fabrication drawing in checking.

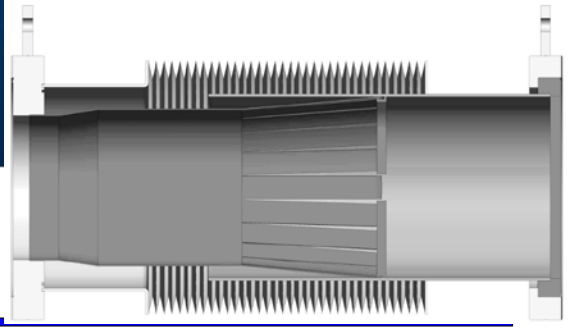
180 chamber fabrication drawing underway.

180 accordion bellows being designed.









20º Dipole Magnet

Drawings checked – Spec/SOW approved (4/1/2015).

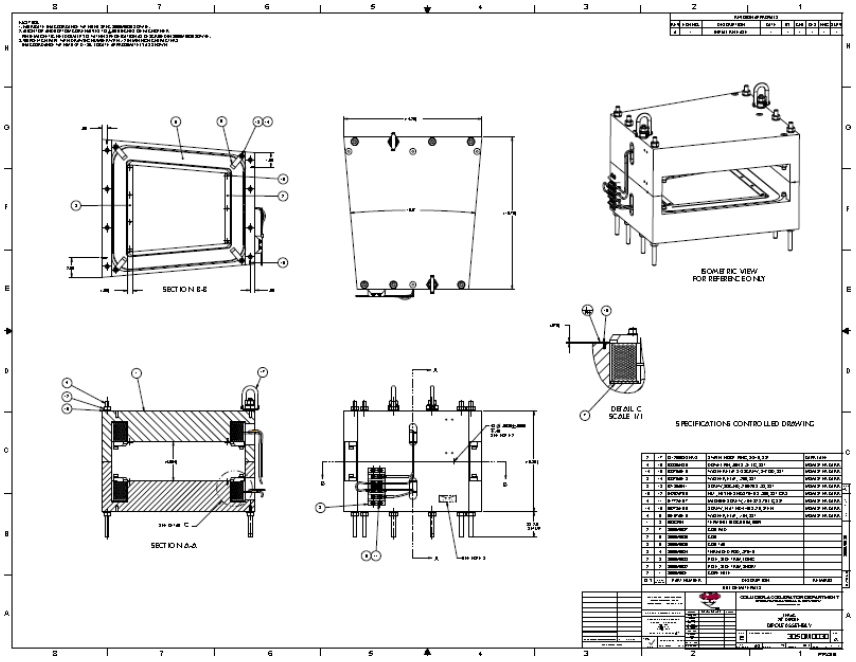
Requisition approved SOW – 2 magnets by 10/1/2015.

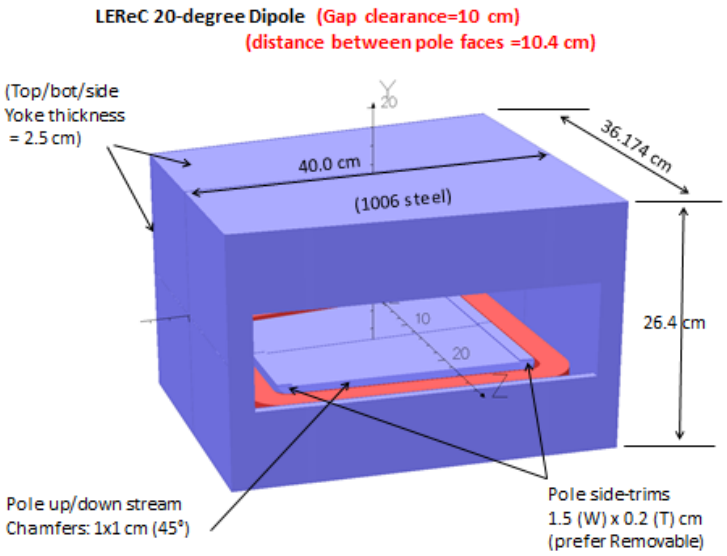
Out for Bid?

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.)

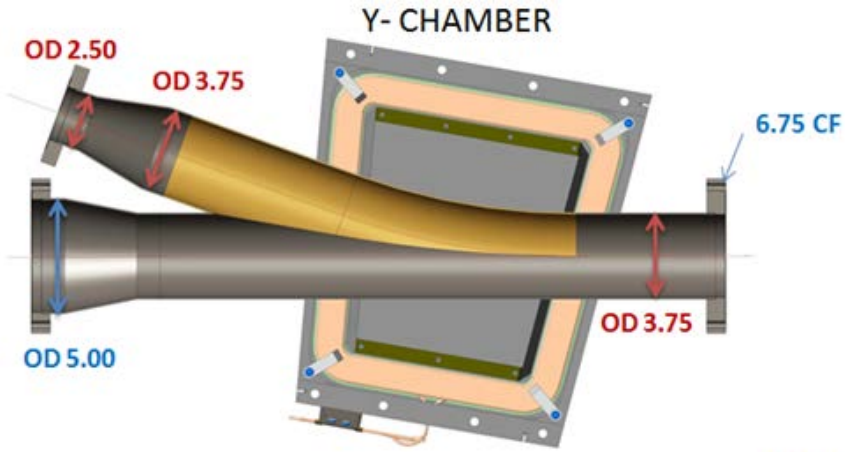




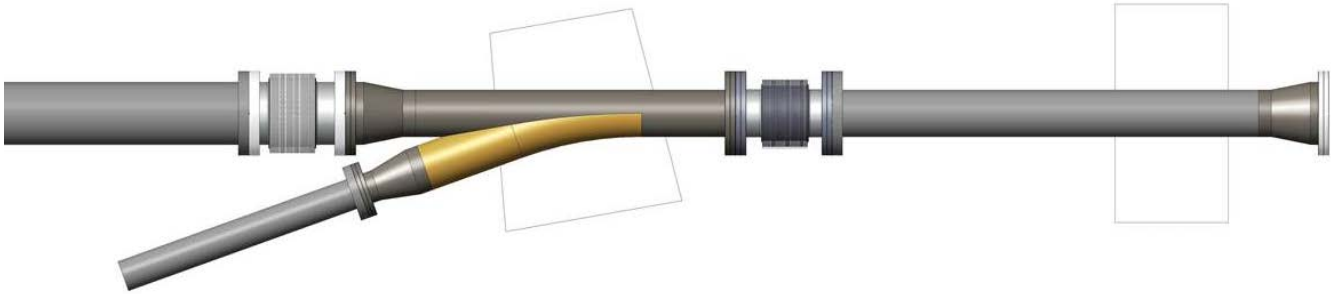
Electron tracking results and field qualities along trajectory on R=1 cm curved cylinder:

	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°

20º Dipole Magnet Vacuum Chamber



Sent to Binping for analysis



LEReC Cooling Section Design Room

Design 180^{o} dipole chamber for impedance review (KH)

LF & HF solenoid and 20^{o} dipole fabrication drawings (KH)

BPM chamber and buttons (VDM)

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

20^{o} dipole vacuum chamber for impedence review (KH)

180^{o} dipole fabrication drawings (KH)

Beam Instrumentation PM and ES drive fabrication drawings (GW and VDM)

180^{o} dipole magnet and vacuum chamber integration + large sliding bellows (KH)

Beam Instrumentation PM and ES Vacuum Chambers & ferrite insert (GW)

Beam Instrumentation PM ferrite insert (GW)

180^{o} and 20^{o} dipole vacuum chamber (KH)

20^{o} and 180^{o} stand drawings (KH)

Beam line solenoid stand LF Solenoid, BPM, and long pipe are to be independently positioned and surveyed on common stand.

Magnetic Shielding drawing and solenoid magnetic measurement test station

Cable tray and penetration drawings

LEReC Design Room

Phase 2: 5 cell cavity positioning (RM)

DC Gun Vacuum Chamber Fabrication Drawings (JH)

DC Gun SF6 Pressure chamber specification control drawings (JH)

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

Phase 1 and 2 cryogenic system layout (RM)

DC Gun stands (JH)

DC Gun cathode insertion drive

2.1 GHz warm cavity specification control drawings

704 MHz warm cavity specification control drawings

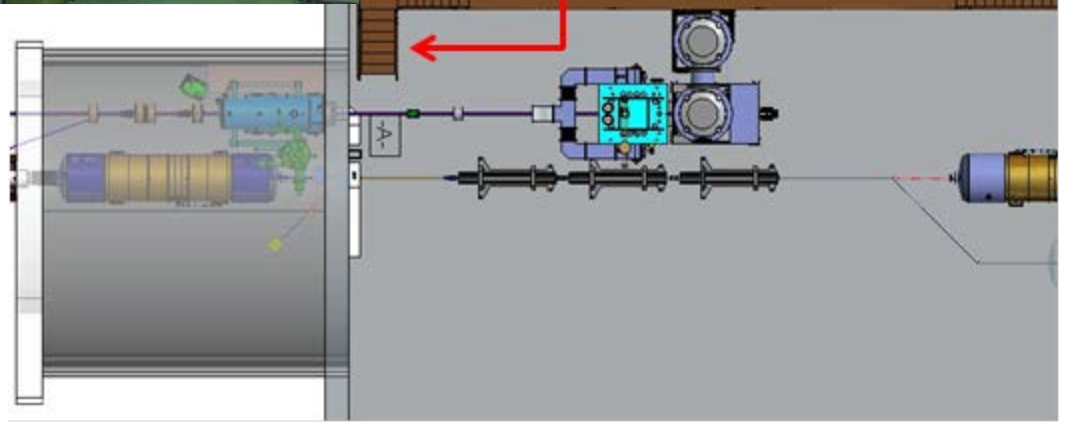
DC Gun to Booster SRF booster cavity beam line

DC Gun cathode coating system upgrade – coating system vacuum chamber

Transport line layout drawing (RM/VDM)

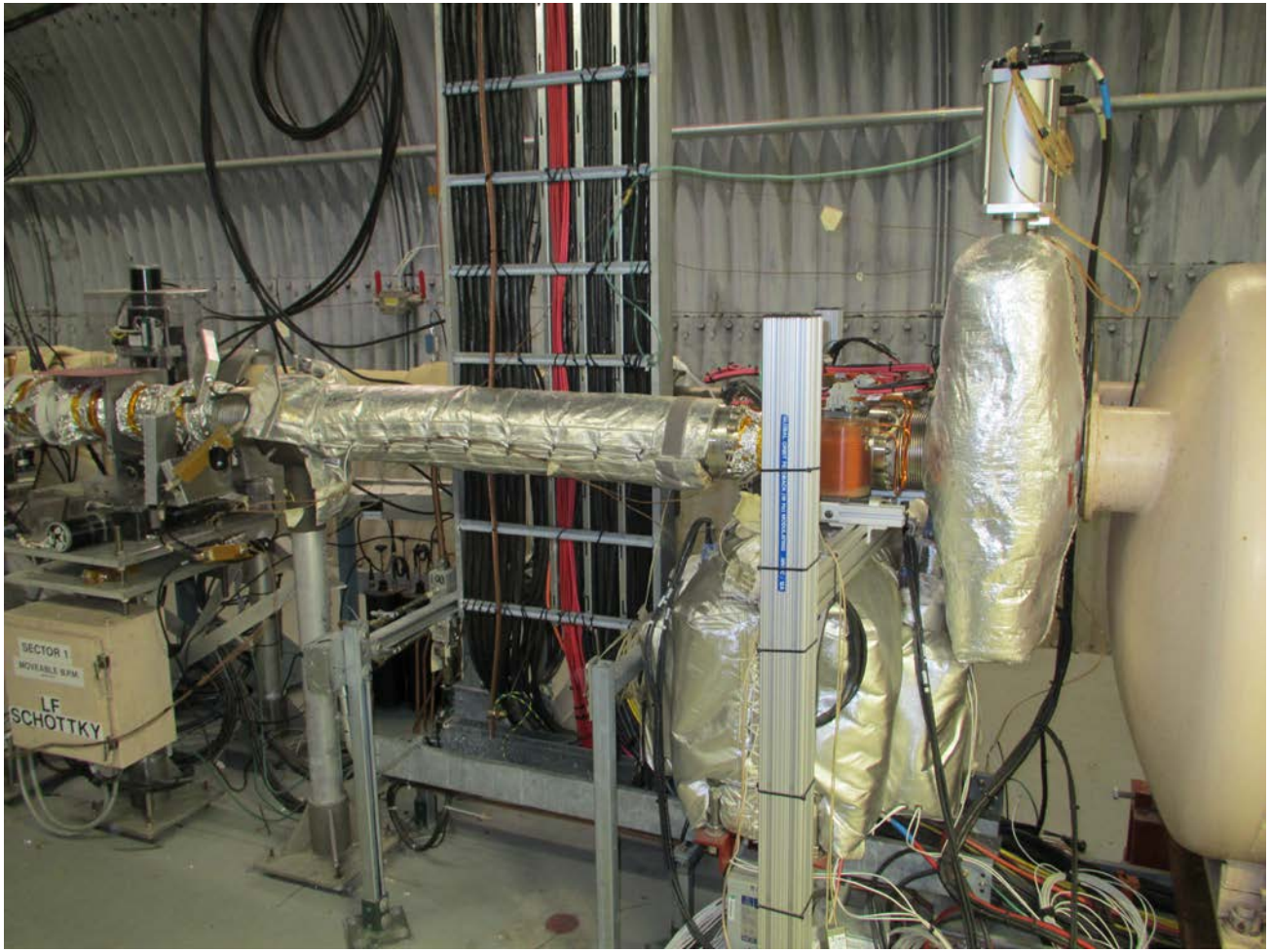
Sector 2 Modifications

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



Sector 1 Relocation

Remove/relocate cables: instrumentation, cryogenics, vacuum, power
Move cable trays



Sector 1 Relocation

Sector 1

Before Relocation

YO1 S	Meters from IP2	Yellow Outer (YO1) Label	Name	Notes	BI1 S	Meters from IP2	Blue Inner (BI1) Label	Name	Notes
2517.4	38.4		Start of warm sector	Y-valve	2517.4		Y-valve	Start of warm sector	
	38.7		10 Hz GOF Magnet					10 Hz GOF Magnet	
2515.9	39.8	KKR-1	Quad PU (0.25m, 10")	Not needed, future use?					
	40m		Start LEReC			40m		Start LEReC	
2515.2	40.1	KKR-2	BBQ (PLL) Kicker (1m, 39") (twisted pr push-pull)		2515.1	40.9	MBPM1	LF Schottky resonant PU (BPM)	All one moving assy
					2514.7	41.3	MBPM2	LF Schottky BPM for centering	53" length
2513.9	41.5	KKR-2	Head-Tail PU (1m)						
2513.3	42.4	KKR-1	Quad PU (0.25m, 10")	All one moving assy					
2512.6	42.7	KKR-2	BBQ (PLL) PU (1m)	115" length	2513.3	42.8	IPM H	B-Ionization PM Horiz (54")	
					2512.9	43.5	KKR-1	Hybrid Kicker (0.25m)	Not needed, future use?
2510.7	46.1	TMKH	ARTUS Kicker Horizontal (start) 2m long		2510.5		Electron det. Y	MCP & RHIC ED Vertical	
2508.7	48.1	TMKH	ARTUS Kicker Horizontal 2m long		2510.2	45.7	EDH-ANL	Electron Detector Horizontal	Not Needed
		EDY	Electron detector Y Pin diodes (4)	Not needed					
	53.1	LM	Lumi-mon (only a cross)	Not needed	2503.6	53.2	GCK+TMKY	ARTUS Kicker Y, 2m (or Bunch-by-Bunch longit damper?) This device was removed for service as of 10-21-13	
2501.75	55	IPM-Y	Y-Ionization PM Vert (58")		2501.6	55.2	GCK+TMKY	ARTUS Kicker Y, 2m (or Bunch-by-Bunch longit damper?)	
	63m		End LEReC U-Turn			63m		End LEReC U-Turn	
	64m		1 meter space needed?			64m		1 meter space needed?	
	~7 Meters of open space					~2 Meters of open space			
						66	R-SC Ceramic PU		
						68.6	R-SC PU	Existing	
						69	R-SC PU New desi	Future	
	71.5		Bellows & Vacuum pump						
2483.4	72.5		End of warm sector	Y-valve	2483.4		Y-valve	End of warm sector	

Sector 1 Relocation

Sector 1

YO1 S	Meters from IP2	Yellow Outer (YO1) Label	Name	Notes	BI1 S	Meters from IP2	Blue Inner (BI1) Label	Name	Notes
2517.4	38.4		Start of warm sector	Y-valve	2517.4		Y-valve	Start of warm sector	
	38.7		10 Hz GOF Magnet					10 Hz GOF Magnet	
2515.9									
	40m		Start LEReC			40m		Start LEReC	
2515.2					2515.1				
					2514.7				
2513.9									
2513.3									
2512.6					2513.3				
					2512.9				
2510.7					2510.5				
2508.7					2510.2				
2501.75					2501.6				
	63m		End LEReC U-Turn			63m		End LEReC U-Turn	
	64m		1 meter space needed?			64m		1 meter space needed?	
	64	KKR-1	Quad PU (0.25m, 10")	Not needed, future use?		40.9	MBPM1	LF Schottky resonant PU (BPM)	Likley abandoned
	64.3	KKR-2	BBQ (PLL) Kicker (1m, 39")	(twisted pr push-pull)		41.3	MBPM2	LF Schottky BPM for centering	Likley abandoned
	65.7	KKR-2	Head-Tail PU (1m)			43.5	KKR-1	Hybrid Kicker (0.25m)	Not needed, future use?
	66.6	KKR-1	Quad PU (0.25m, 10")	All one moving assy					
	66.9	KKR-2	BBQ (PLL) PU (1m)	115" length		66	R-SC Ceramic PU		
						68.6	R-SC PU	Existing	
						69	R-SC PU New desi	Future	
	71.5		Bellows & Vacuum pump						
2483.4	72.5		End of warm sector	Y-valve	2483.4	72.5	Y-valve	End of warm sector	

Sector 2 Modifications

Sector 2

After Relocation

YI2 S	Meters from IP2	Yellow Inner Label	Name	Notes	BO2 S	Meters from IP2	Blue Outer Label	Name	Notes
2594.4	38.4		Start of warm sector		2594.4			Start of warm sector	
			10 Hz GOF Magnet					10 Hz GOF Magnet	
		MBPM2	Moveable BPM (LF Schottky)		2596.5		KKR-2	BBQ Kicker (1m)	
2598	41.5	IPM-H	Y-Ionization PM horizontal						
			Beam Loss Monitor		2598.5	42.9	KKR-2	PLL BBQ PU (1m) Moveable)	
2599.3	42	KKR-2	Hybrid Kicker (0.25m)	can remove					
					2601	43.5	TMKH	ARTUS Kicker Horizontal (start)	
	46.1	TMKH	ARTUS Kicker Horizontal (start) 2m long		2603	46.1	TMKH	ARTUS Kicker Horizontal (end)	
	48.1	TMKH	ARTUS Kicker Horizontal 2m long		2604.1	48.3	EDV	Electron Det V	can remove
2605.1		EDV	Electron Det V	can remove					
						~4 Meters open space			
			Vacuum pump						
2608	53	TMKV	ARTUS Kicker V(or Bunch-by-Bunch longit damper)		2608.8	53	LM	Lumi-Mon (6-way cross only)	can remove
2610	55	TMKV	ARTUS Kicker V(or Bunch-by-Bunch longit damper)		2610	55	IPM-V	B-Ionization PM Vertical	
					2611			Vacuum pump	
					2612	58	TWC	Space where Traveling Wave Cavity used to be (now available)	
						60	GCK+TM	ARTUS Kicker V, 2m (or Bunch-by-Bunch longit damper?)	
						62	GCK+TM	ARTUS Kicker V, 2m (or Bunch-by-Bunch longit damper?)	
2617.4	61.8	SC Long Pick-up (start)							
	64	SC Long Pick-up (middle)							
	66	SC Long Pick-up (end)							
	67	Button BPM			2622	67	Button BPM		
2623	68	VCM			2623.5	68	VCM		
2614.3	68.6	DCCT			2624.3	68.6	DCCT		
	69	HF Schottky PU				69	HF Schottky PU		
		Pin diodes (2)							
	71	New Long SC pickup							
2628.4			V-valve, End of warm sector		2628.4			End of warm sector	