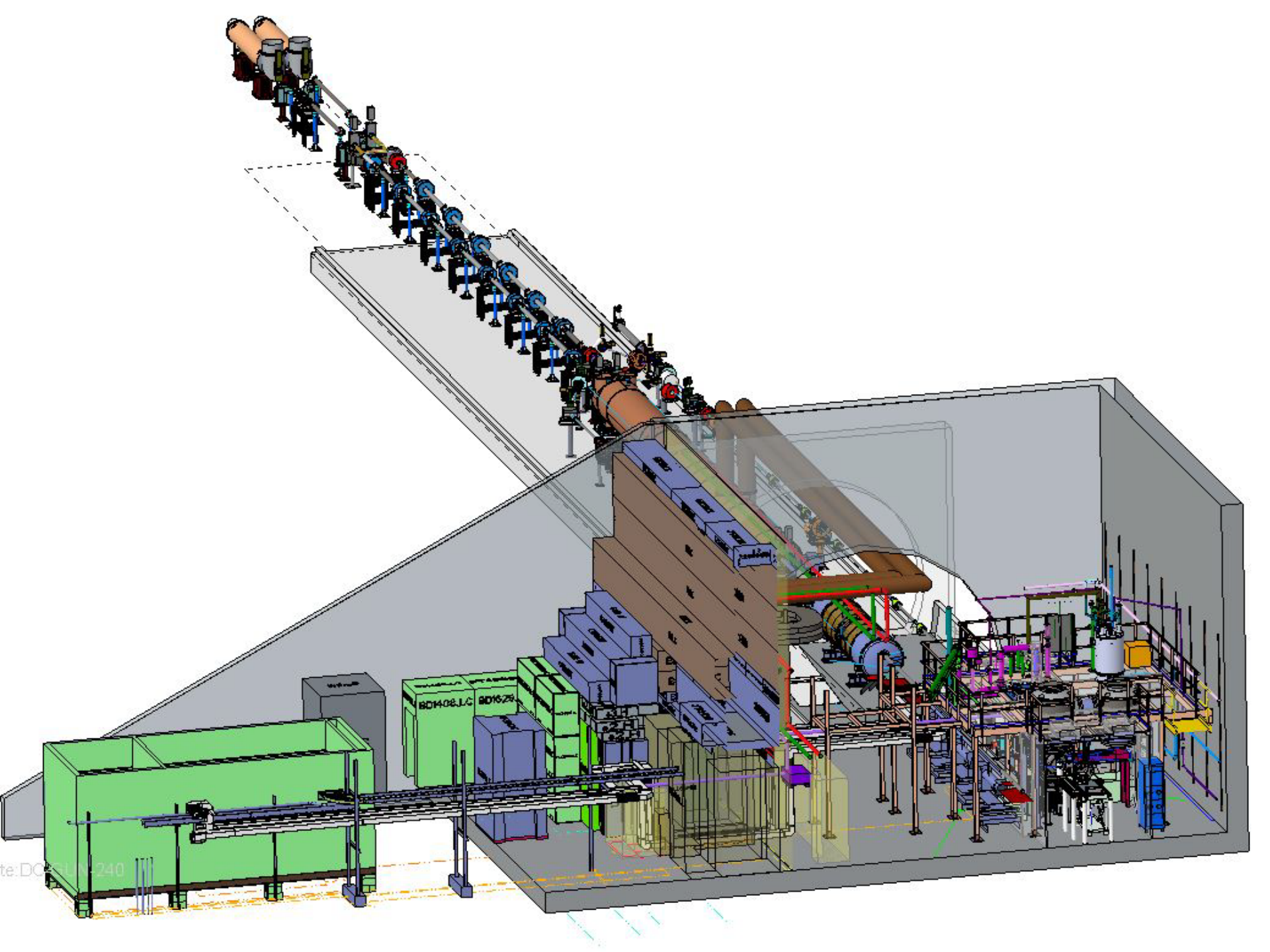
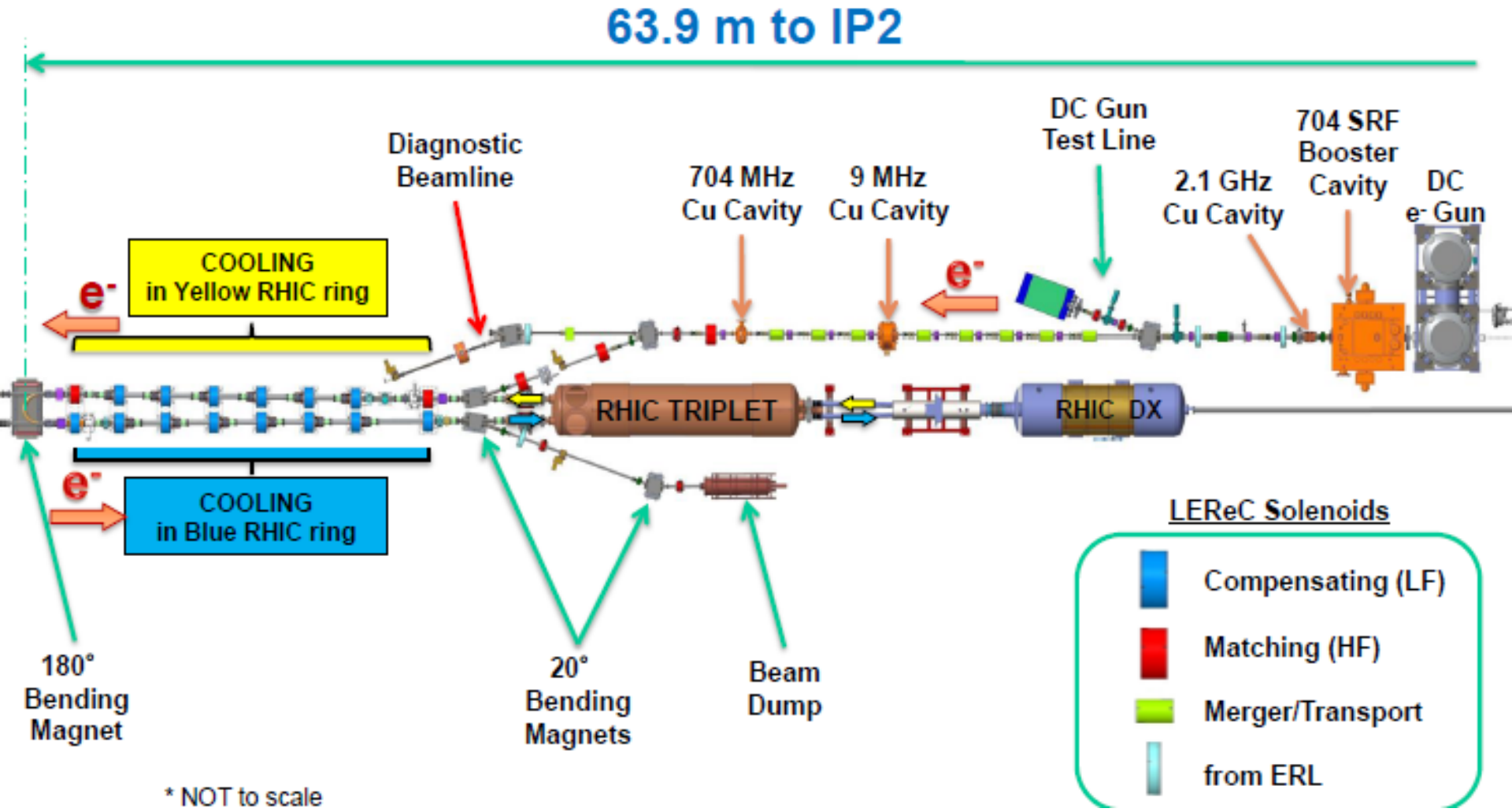
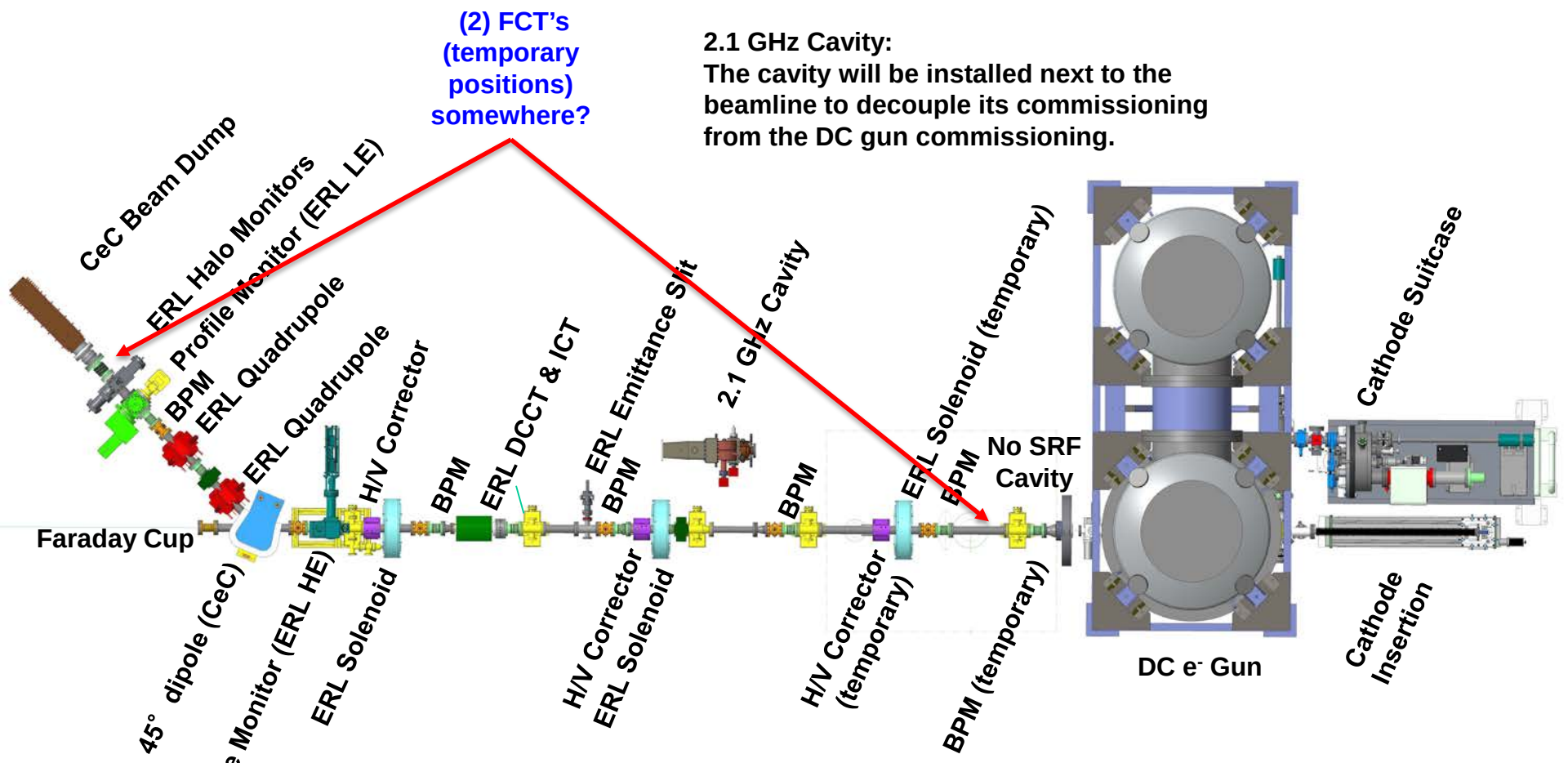

BD1408.LC
BD1629

LEReC System



LEReC DC Gun Test section 2016 (6/9/16)



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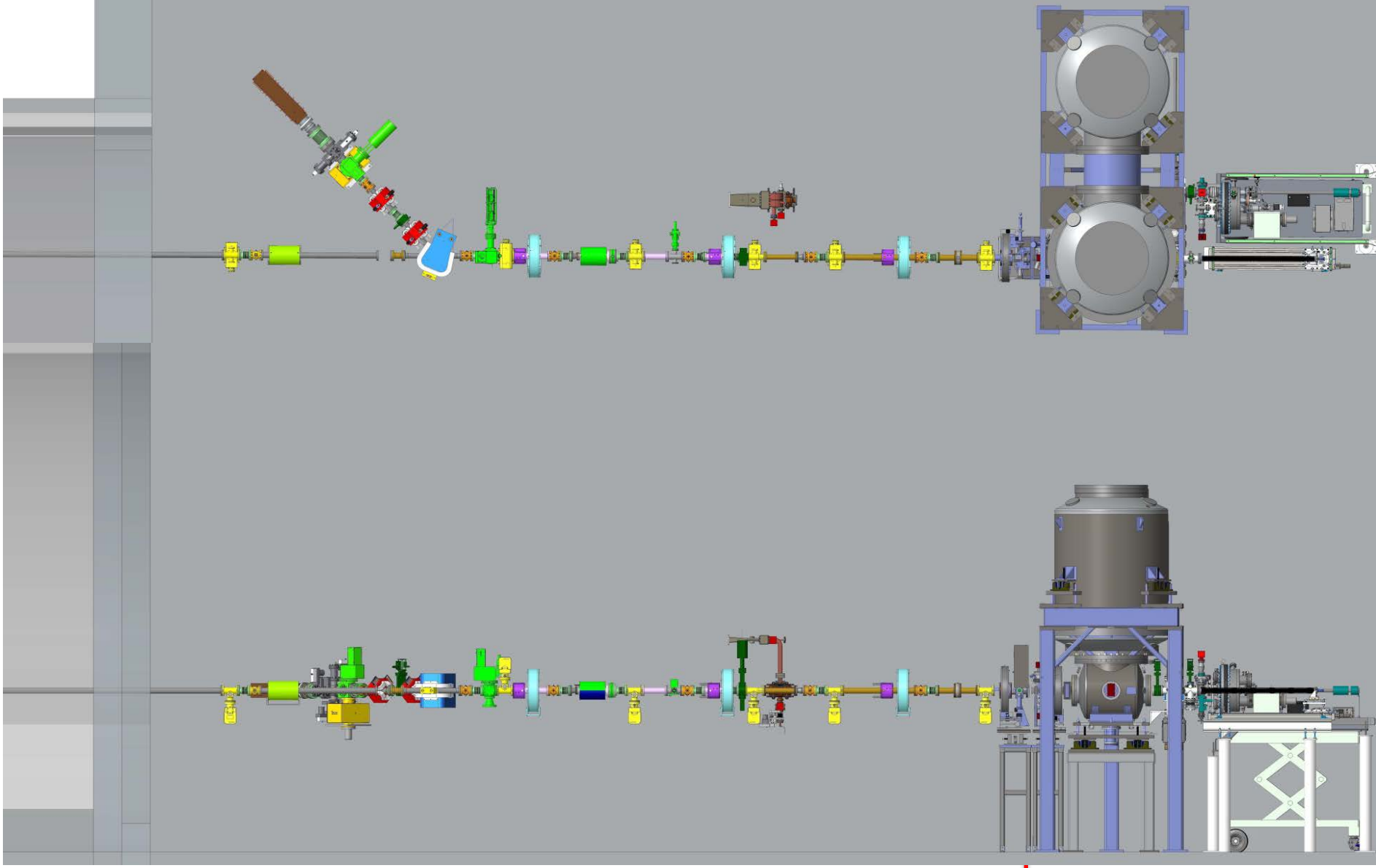
LEReC DC Gun Test Section 2016 (8 10 2016)



Cost and Schedule Review 11/16/2016

- Complete update of schedule underway now.
  a) Complete to end of project
  b) Goal to complete October 1
  c) Send to DOE (G. Capps) for review October 15

- Update cost estimate to complete.
  a) Calculate earned value on procurements to date
  b) Identify cost overruns and determine contingency needs to complete installation
  c) Goal to complete October 15
  d) Send to DOE November 1

Critical Dates

- DC Gun Arrival at BNL **9/20/16**
- LEReC Cost and Schedule update 10/1/2016
- DC Gun conditioning underway 10/18/2016
- DOE Review 11/16/2016

DOE Review Walkthrough Wishlist – 11/17/2016

a. DC Gun installed, conditioned or conditioning
b. DC Gun line stands and beam dump installed
c. 45^{o} magnet, solenoids, quads, halo monitor, LE profile monitor
d. Cathode transfer system in place, baked
e. Laser optics tables installed in tunnel, 1002F block installed
f. 1002D Racks: Power Supplies and Diagnostic Electronics installed
g. Cable trays installed, pulling cables

DC Gun at Cornell

7/27 - 8/1	Cornell finished assembling DC gun.
8/1 - 8/12	Move to floor, final cathode alignment, vacuum bakeout.
8/15 - 8/17	Power supply assembly, charge SF6, prepare for conditioning
8/18 – 9/9	Conditioning at Cornell to 450kV
9/12 – 9/16	Prepare for shipping and ship receive BNL
9/19	Ship to BNL

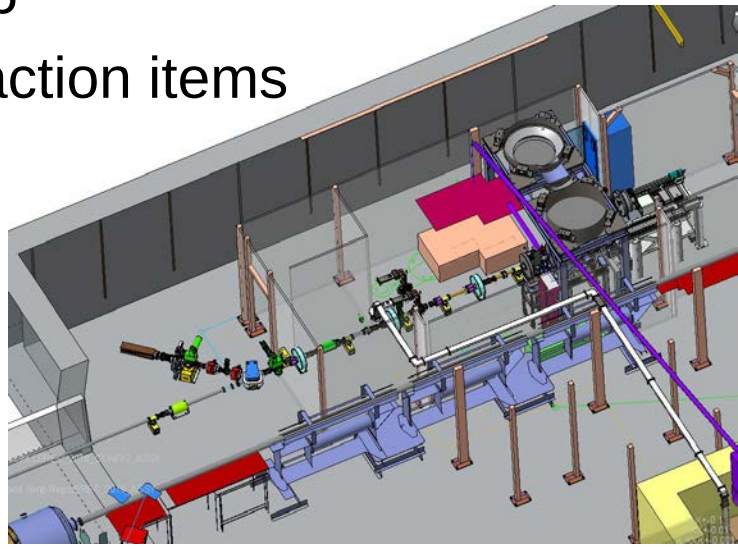
Prepare for shipping:

- Remove SF6/disassemble power supply
- Re-establish portable clean-room
- Install cathode shipping fixture
- Pack and load into Karl's U-haul (Karl will drive down).

DC Gun Installation Preparation at BNL

Before DC Gun arrival at 02:00: September 20

- **Survey beam line and stand locations on 02:00 floor**, install redheads.
- Prepare 912 cleanroom for DC gun arrival
- Remove yellow walkway
- Install power supply AC power
- Install water connections
- Pull cables for vacuum and power supply control
- Move SF6 cart 04:00 to 02:00, procure SF6
- Complete DC gun pressure safety review action items
- Complete DC gun test ASSRC review



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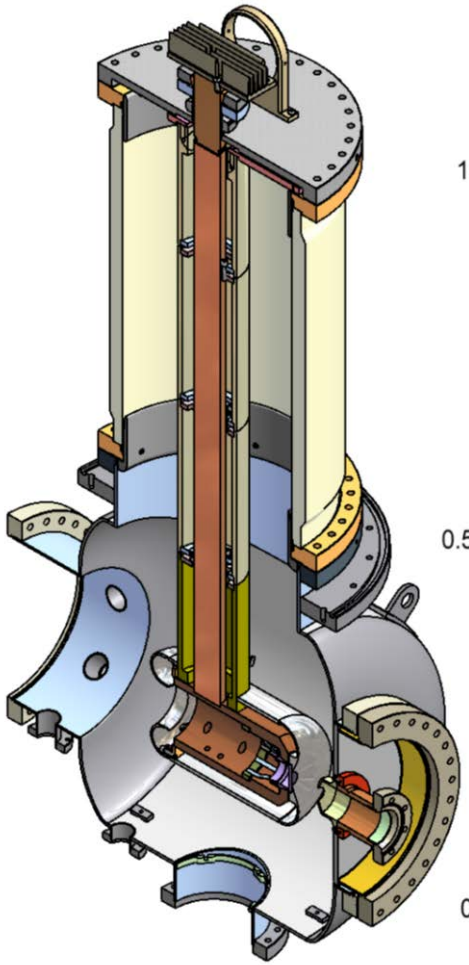
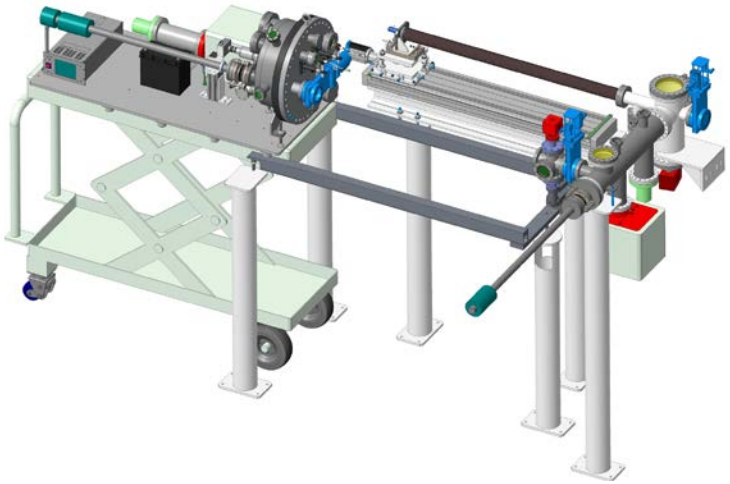
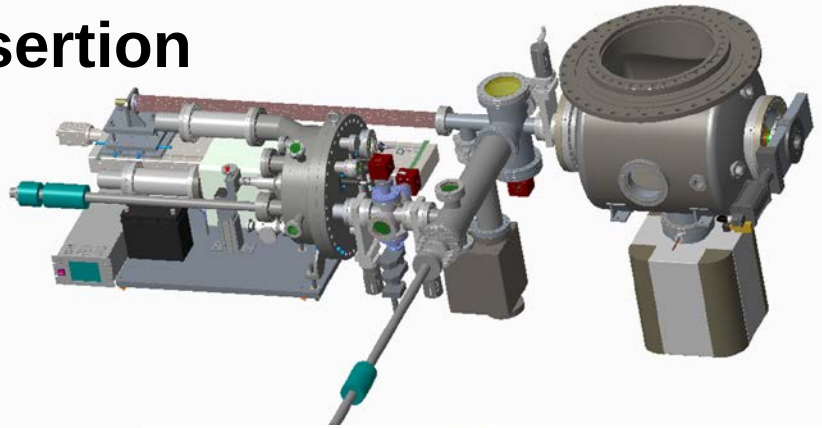
DC Gun Assembly at BNL: proposal 2

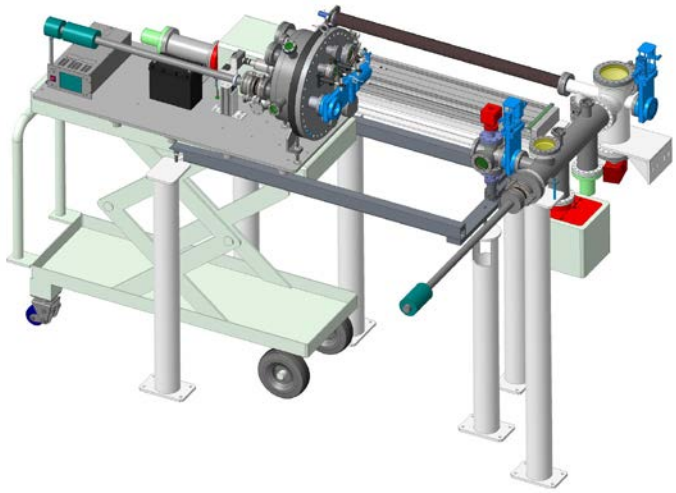
- Off-load DC gun at 912 clean room area (forklift). **(Karl S.) 9/21/16**
- Clean room prep DC Gun (arrive from Cornell cleaned and bagged).
- Move into 912 cleanroom.
- Install top flange (wireseal) with cathode support **(Karl S.)**
- Remove cathode shipping fixture **(Karl S.)**
- Survey and align cathode **(Karl S.)**
- Close up vacuum vessel. **(Karl S.)**
- Leak check **9/30/16**
- Slowly ship to 02:00 (Preliminary vibration measurements)
- Crane to final location, bolt down, and survey
- Install cleanroom, inspect cathode (4 days) ***weekend***
- Bake-out complete (without inspection) 10/10/2016
- Power supply assembled and charged 10/17/2016
- Conditioning 10/18/2016 to 11/10/2016



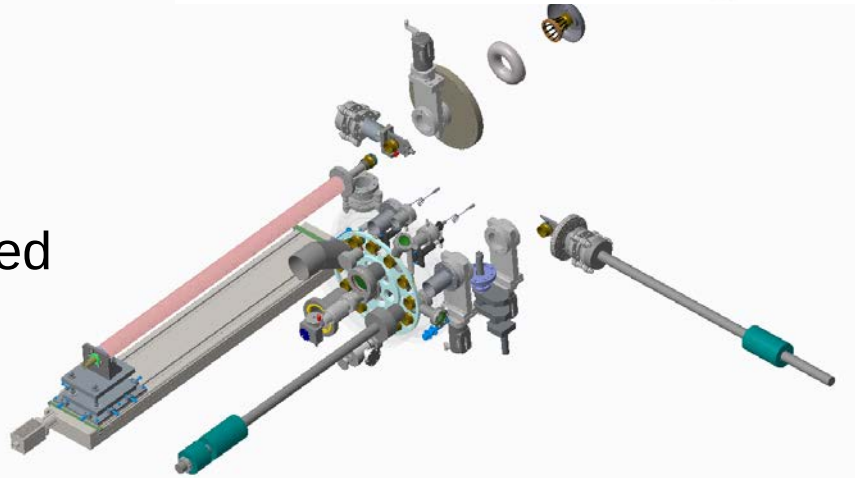
Cathode Insertion



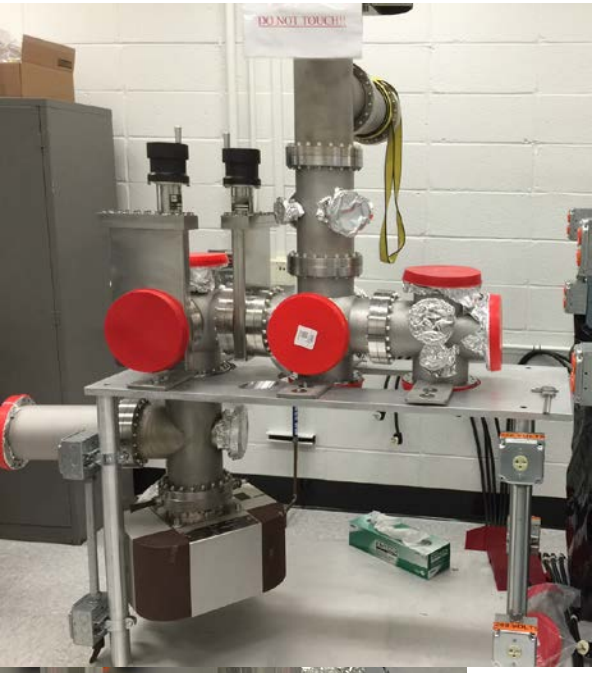




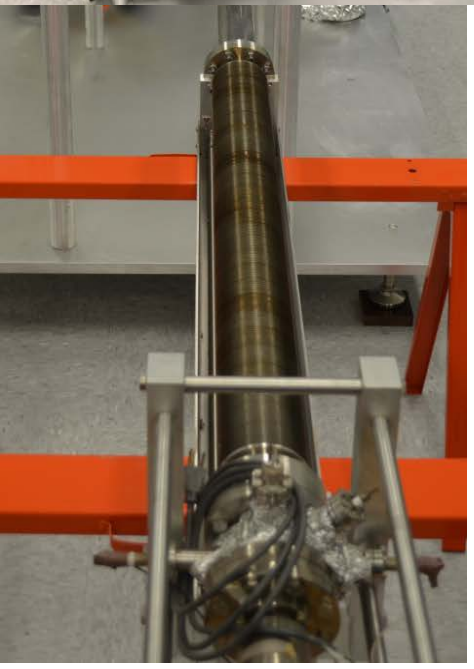
- Transport system vac. comp. in shops
- Insertion system vac. comp. in shops
- Transfer manipulators ordered
- Cathode material ordered
- Windows, pumps, gauges ordered
- Long bellows and stage in house
- Vacuum ASME code burst disks ordered
  (2 installed on DC Gun)
- Transport Cart to be ordered
- Over the road transport frame to be ordered



Cathode R&D Tasks and Status



Build and Test effusion Cells for Large Scale Production (up to 9/week)



Production: Three effusion cells have been fabricated and tested.

Develop Recipe for Na_2KSb cathode: Based on existing literature, baseline recipe ready, Multiple K-Cs-Sb cathodes with a few % QE have been fabricated in a similar system. Bulk alkai metal procured. **1st and 2nd cathodes coated (CeC)**

Design, Fabricate and Test R&D Vacuum Chamber: Design complete, Components have been ordered, fabrication underway

Effusion Cell: Has been designed, fabricated, and tested.

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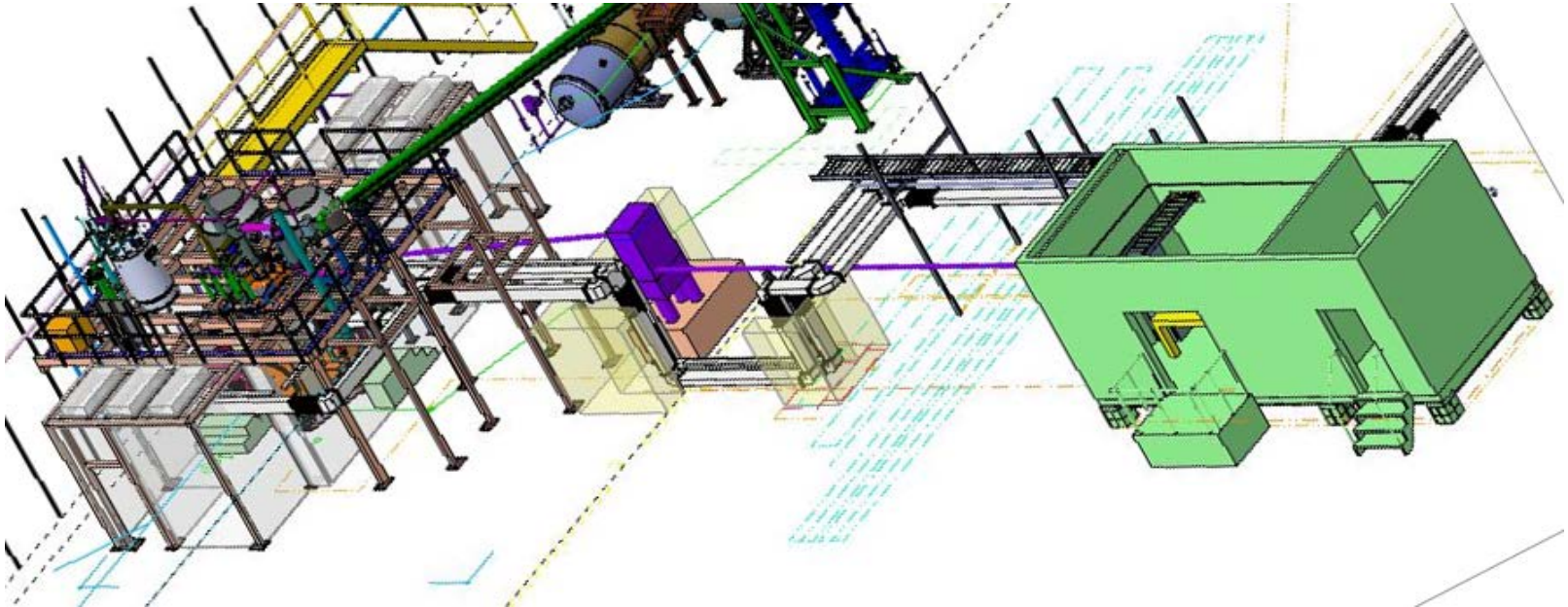
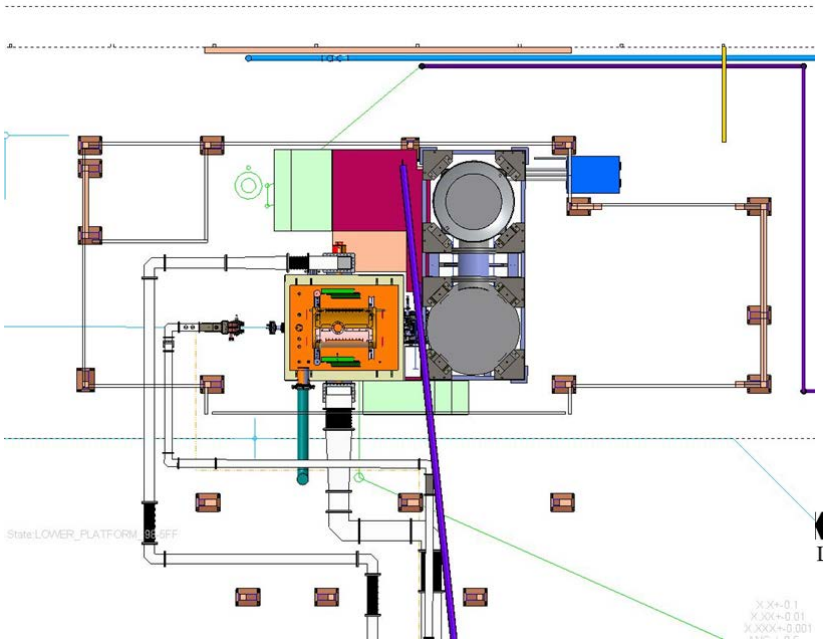
EP&S Support

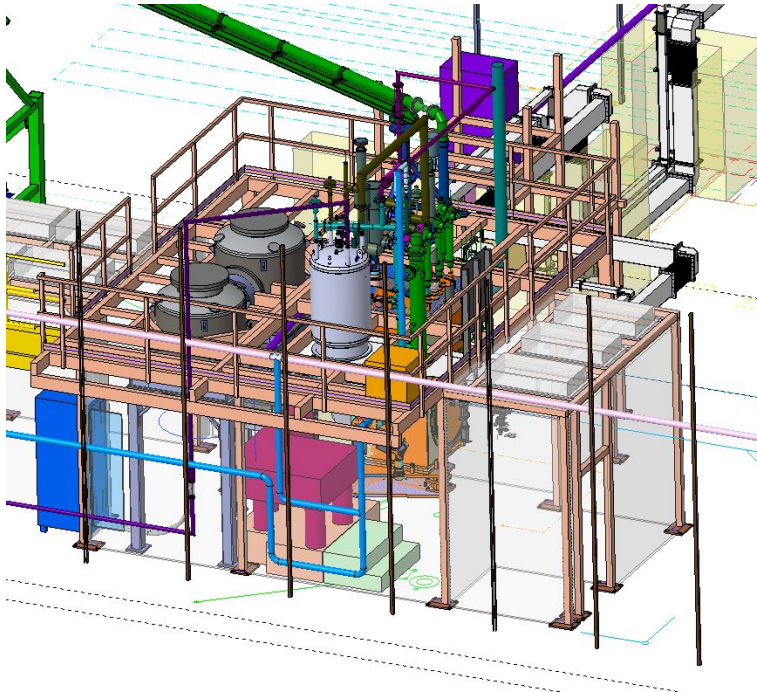
- Work Platform, order Rexroth and floor plate (Dave)
- Power for DC Gun PS & Cleanroom fans & lights (PK, Dennis)
- 1002D power and cable tray installation, Finalized magnet/power supply specifications (Don, PK, Dave)
- Tunnel cable tray layout (Dave, Bob)
- Tunnel penetration for laser transport (Dave, Bob, Zhi, Steve)
- Custom shield blocks for laser optics table (Dave, Bob, Zhi)
- 1002F Vibration mitigation
- 1002B additional RFPA, install wave guide and coax



Work Platform

- Dave/Bob completed design, revising post and beam sizes, opened area near Booster Cavity, stainless steel floor: preparing order.
- Clean room equipment vendor need a second review.
- Dave is investigating small filter unit to be built over the GtB section.
- “gowning” entrance on the north side. Added (Bob)
- Add raised walkway space. (Dave, Bob)
- Reduced the number of flex joints in the Booster Cavity waveguide. (Cliff)





Cooling Water so far

	Device name	Heat Load	Rec. dT	Rec. Flow	Cal. Flow	Max Inlet H20 T	Stability	Delta P	Notes
		KW	C	GPM	GPM	C	C	PSIG	
2017	DC Gun Power Supply	19	10	2	7.2	30			Has Power Supply flowmeter
2018	SRF Booster Cavity FPC1 Vac Inner Conductor	0.57	10.8	0.36	0.2	30		30	
2018	SRF Booster Cavity FPC1 Vac Outer Conductor								
2018	SRF Booster Cavity FPC1 Window OD	0.13	0.4	2.3	1.2	30		25	
2018	SRF Booster Cavity FPC1 Air Outer Conductor	0.36	7.3	0.34	0.2	30		30	
2018	SRF Booster Cavity FPC1 Air Inner Conductor	0.09	0.7	0.8	0.5	30		30	
2018	SRF Booster Cavity FPC1 Waveguide and Knob	0.16	1.2	0.9	0.5	30		3	
2018	SRF Booster Cavity FPC2 Vac Inner Conductor	0.57	10.8	0.36	0.2	30		30	
2018	SRF Booster Cavity FPC2 Vac Outer Conductor								
2018	SRF Booster Cavity FPC2 Window OD	0.13	0.4	0.13	1.2	30		25	
2018	SRF Booster Cavity FPC2 Air Outer Conductor	0.36	5.2	0.36	0.3	30		30	
2018	SRF Booster Cavity FPC2 Air Inner Conductor	0.09	0.8	0.09	0.4	30		30	
2018	SRF Booster Cavity FPC2 Waveguide and Knob	0.16	1	0.16	0.6	30		3	
2017	2.1 GHz Cavity (body)	1	1	4	3.8	30		1	
2017	2.1 GHz Cavity (Tuner)	0.4	1	2.5	1.5	30		1	
2017	2.1 GHz Cavity (tuner Port)	0.4	1	3	1.5	30		1	
2017	45o dipole magnet	Air Cooled							
2017	Beam Dump 1 (Test)	10	10		3.8	30			
2017	704 RF Cavity	36	10		13.6	30		4	
2017	704 RF Cavity (Tuner)	2.6	10		1.0	30		10	
2017	9 MHz RF Cavity								
2018	704 RF Diagnostic Cavity								
2018	Beam Dump 2 (diagnostic)								
2018	Beam Dump 3 High Power	130							

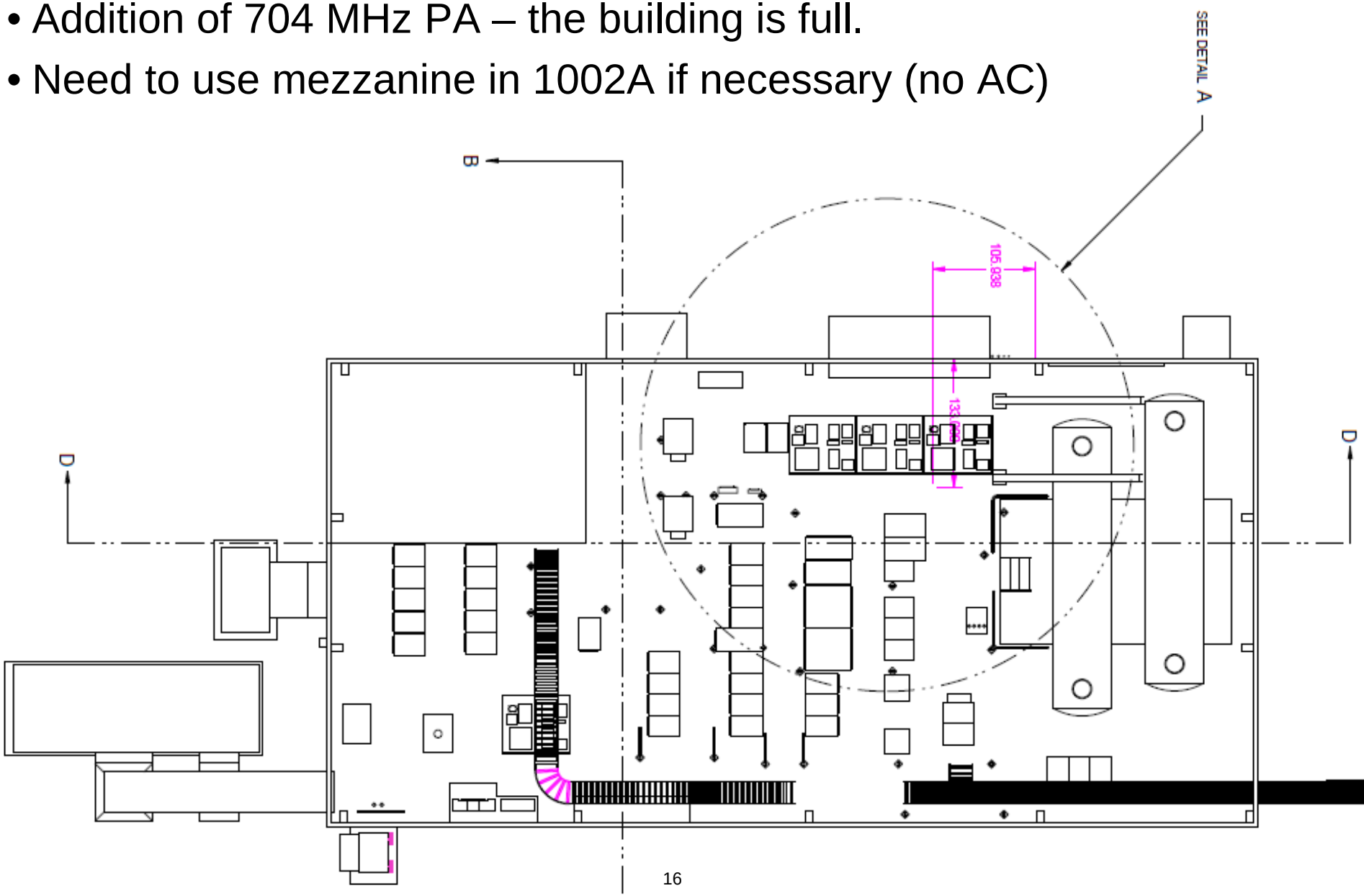
Cooling Water so far

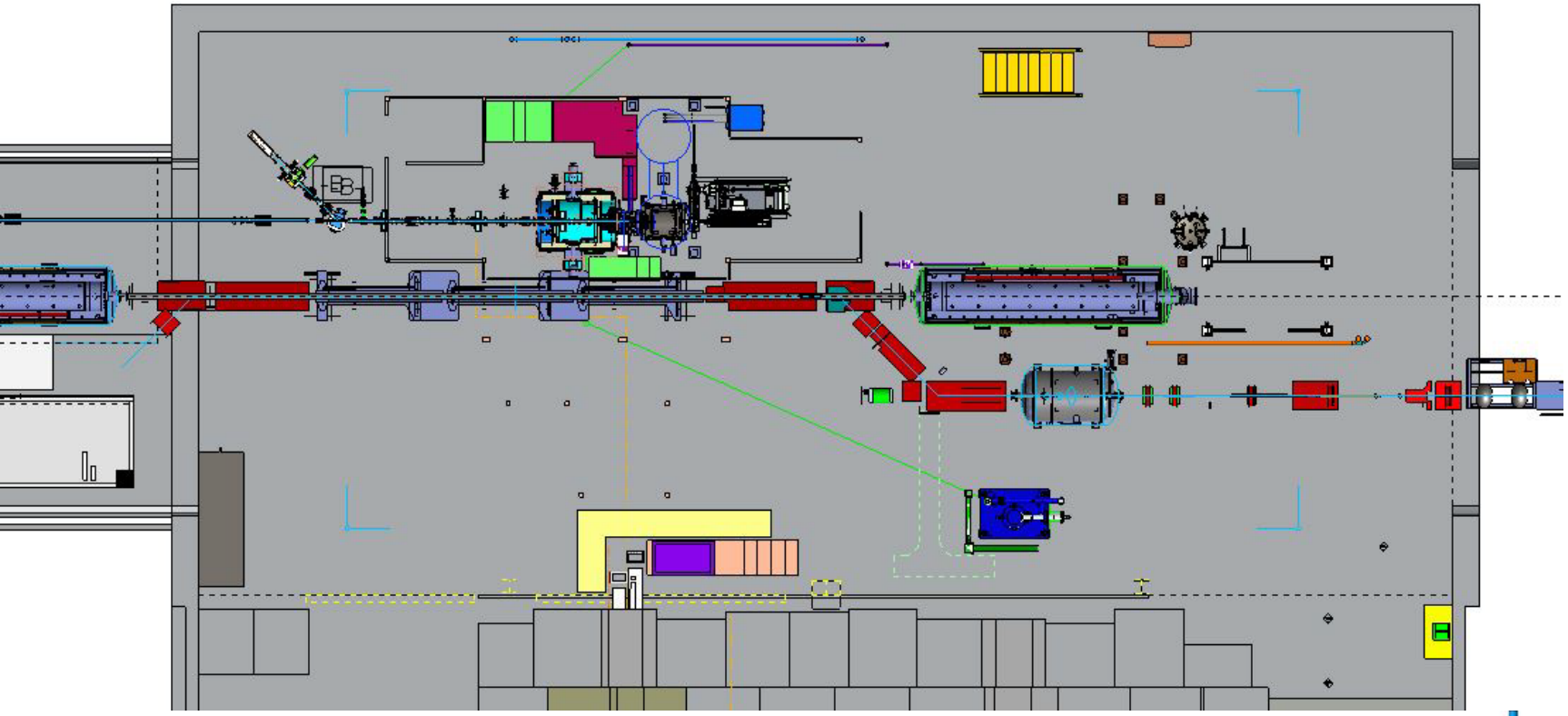
The Booster Cavity will be running at with at much input lower power for LEReC.

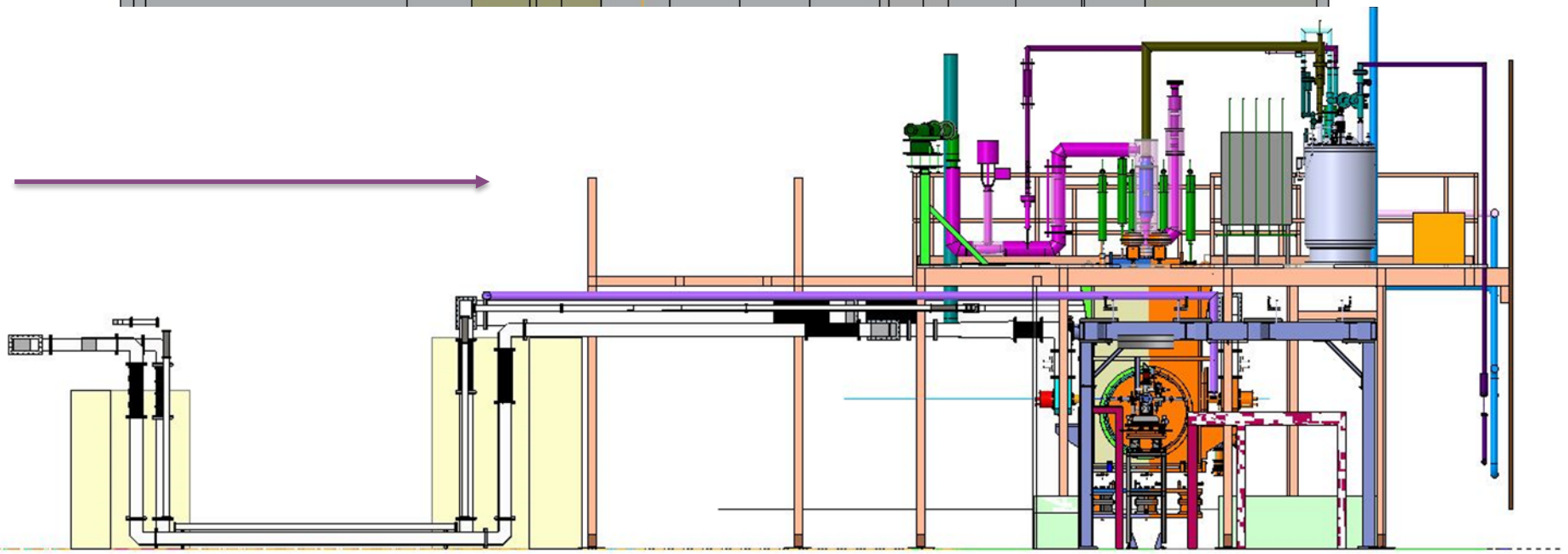
1. Are all of the water cooling circuits still needed running at lower power?
2. Are all of these circuits critical? Therefore do they all need accurate (and expensive and maybe redundant) flow meters?
3. Can temperature sensors be used in some spots instead of flow switches
4. If the power requirement is lower, it could be considered to run some of the circuits in series with a lower pressure drop and therefore lower flow rate. This will reduce the cost of instrumentation. As it is, some of the Delta T values are very low.

1002B

- Addition of 704 MHz PA – the building is full.
- Need to use mezzanine in 1002A if necessary (no AC)

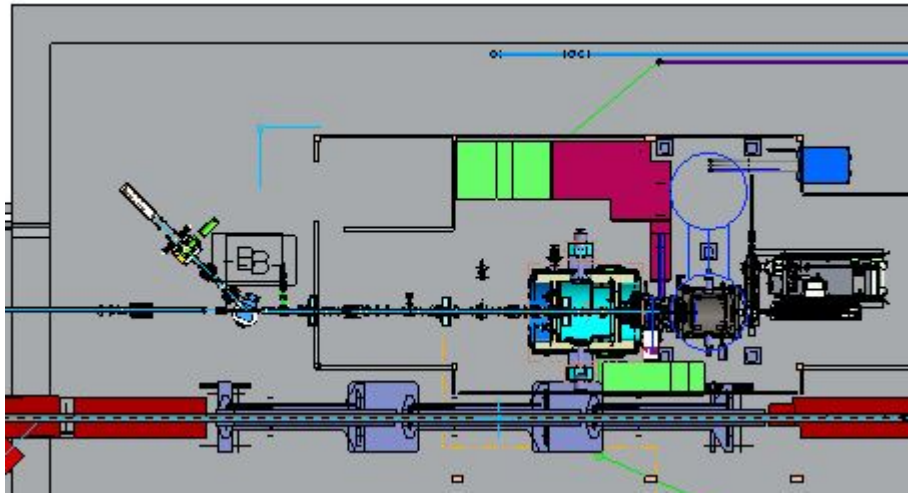


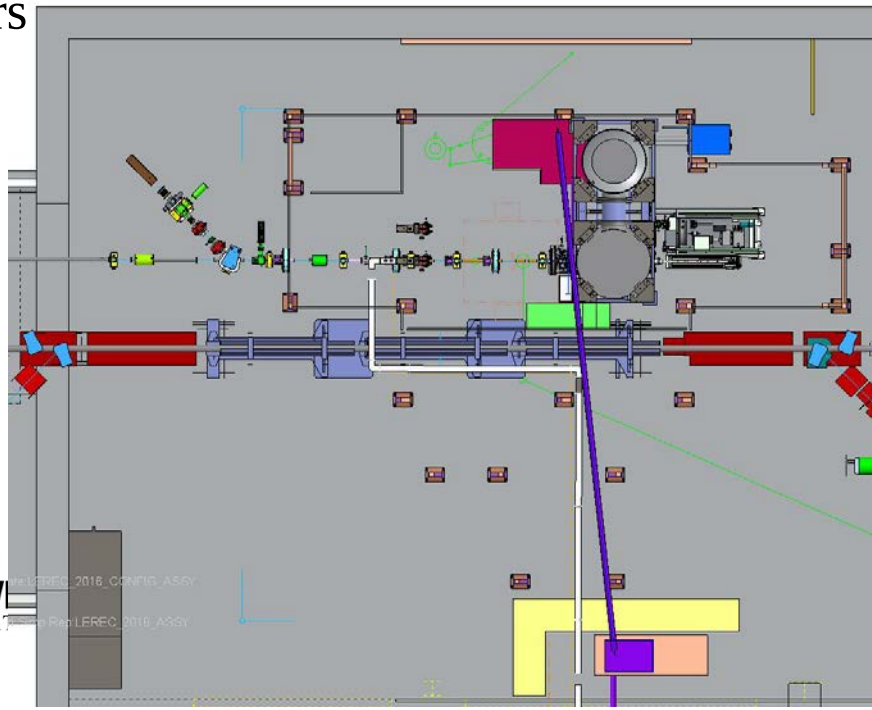




Laser Systems

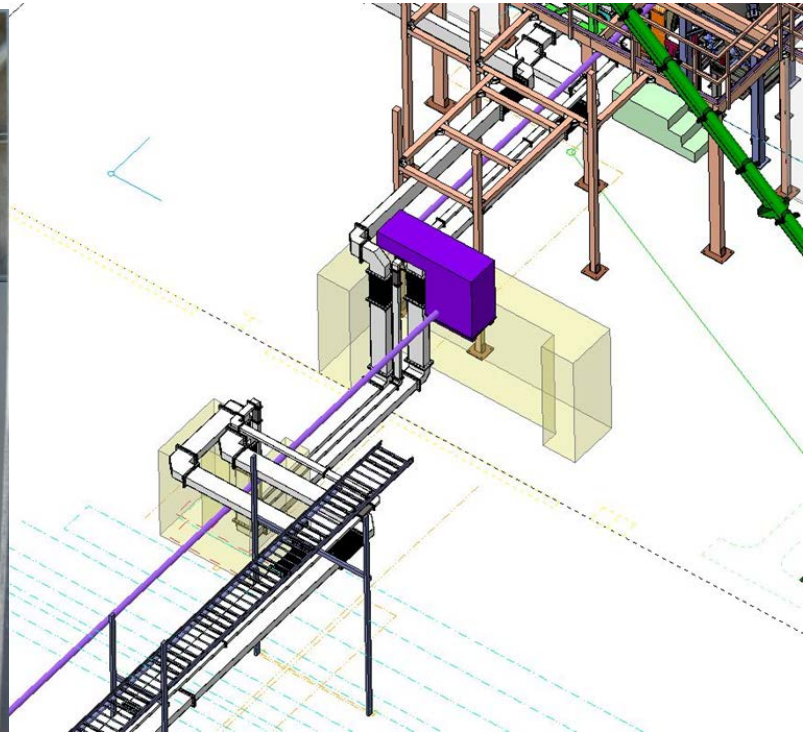
- Laser transport: (Zhi, Steve, Patrick, Bob)
  a) Tunnel DC Gun optics table size and location defined ordered??
  b) Tunnel wall optics table size and location defined (2x4) ordered??
  c) Laser transport path defined
- Tunnel table (DC gun and wall) support and configuration being defined
  a) Custom concrete block from floor to bottom of optics table top
  b) Grout floor under block and grout optics table top to top of block
  c) Optics table top configuration to be defined
  d) Direct connection, no vibration absorbers





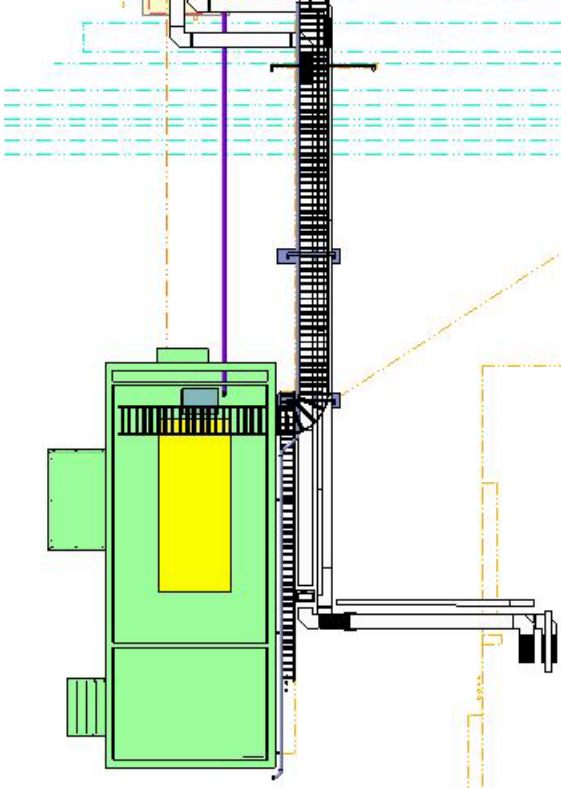
Laser Systems

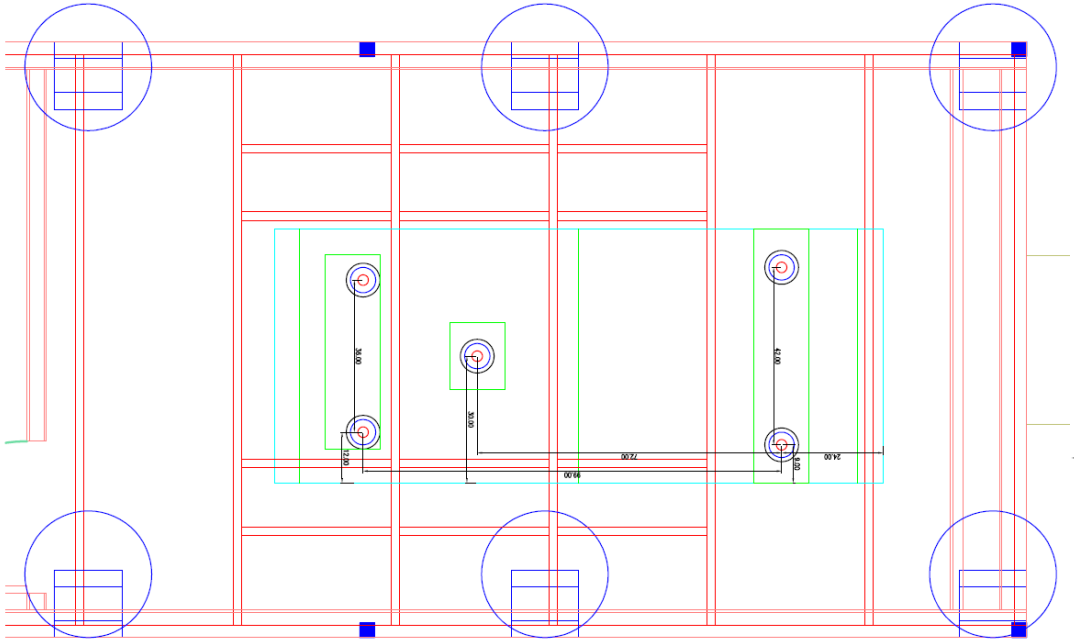
- Through hole location defined/surveyed, bore work order 80” off floor. (Dave)
- Laser building modifications (AC unit change, vibration mitigation) (Dave)
  a) Remove building from piers (planning: carpenters, electrical, and riggers)
  b) Place steel block in ground (with concrete?)
  c) Build up from block with heavy pipes that will extend through bored out holes in laser building floor and align with laser optics table legs
  d) Direct connection (bolted down) to laser optics table legs, no shock absorber
- Order new laser table for 1002E (Zhi, Inacker)

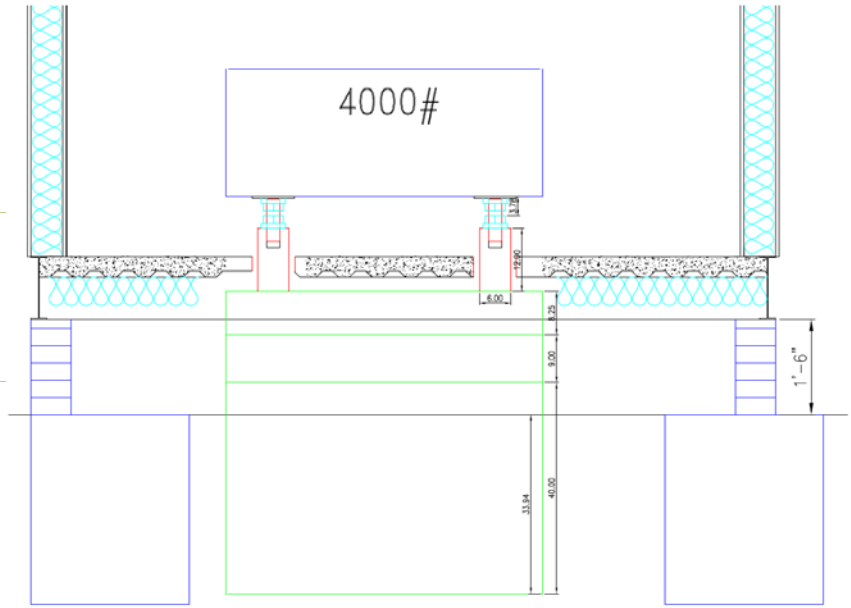


Laser Table in 1002F

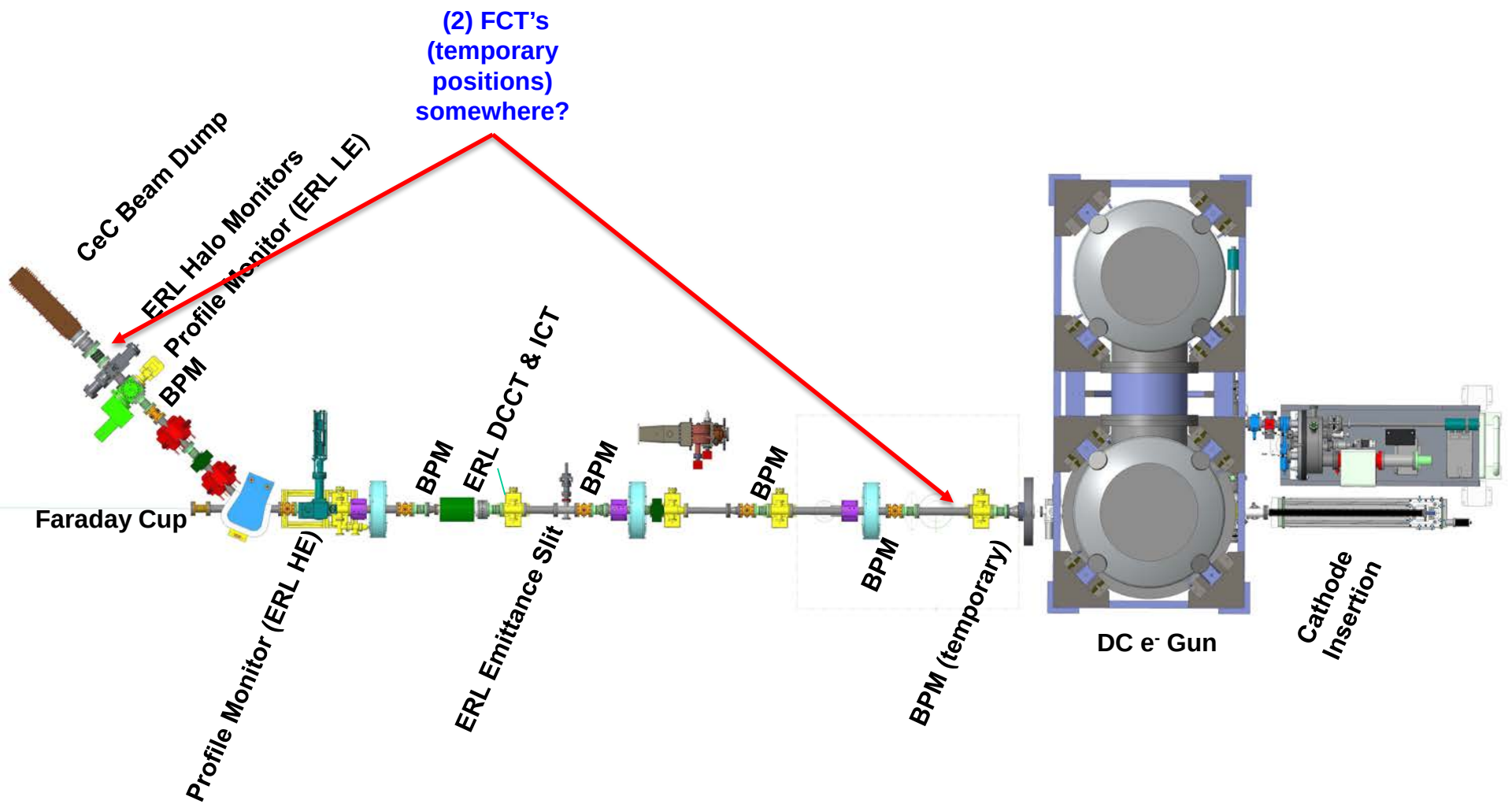
- Fiber optic cable being removed
- Power disconnect underway
- 1002F may be moved out late next week
- Vibration measurements of the steel blocks before re-installation?







Diagnostics Component Status



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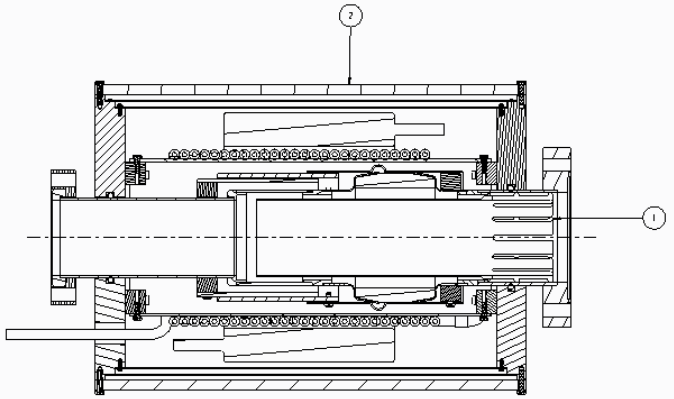
Diagnostics Component Status

- BPM chambers (in house) and buttons (1st articles shipping soon). (Gassner)
- DCCT and ICT from ERL (internal RF shielding analyzed) shield drawings complete. In house. Ready for installation?
- (1) ERL HE Profile Monitors (new internal RF shield for vacuum chamber, ferrites, new larger YAG screen) model complete, drawings checked – back check and approval. (Miller, Weiss)
- (1) ERL LE Profile Monitors –assembled, pre-surveyed, and tested. (Weiss)
- (1) Emittance slit drive (new assembly) (Miller, Weiss)
- (1) ERL Halo Monitor drawing complete, chamber requisition (Fite, Corbin)
- (1) Faraday cup (ceramic insulated vacuum flange?) 1 watt limit?
- Cables and electronics/1002D installations?



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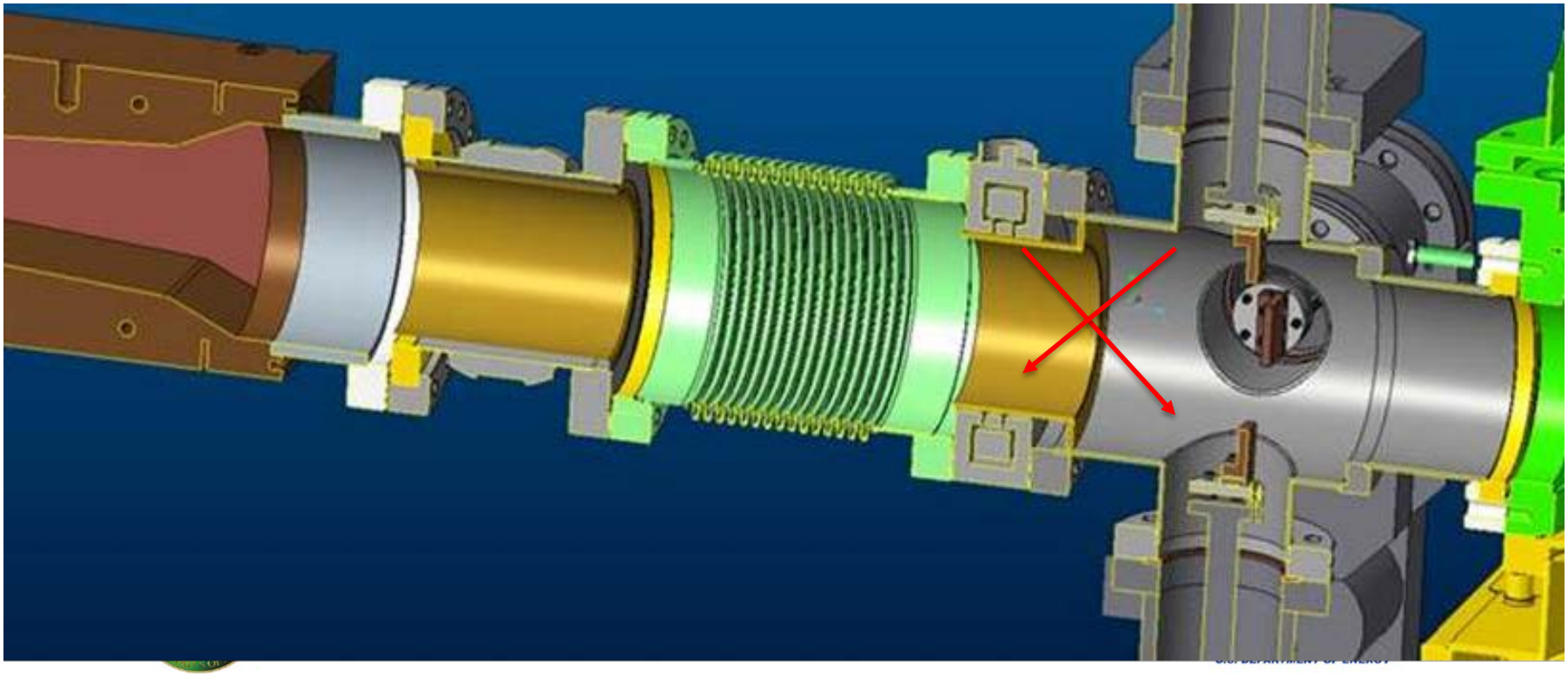
Diagnostics Component Status
Position Controls DC Gun Test

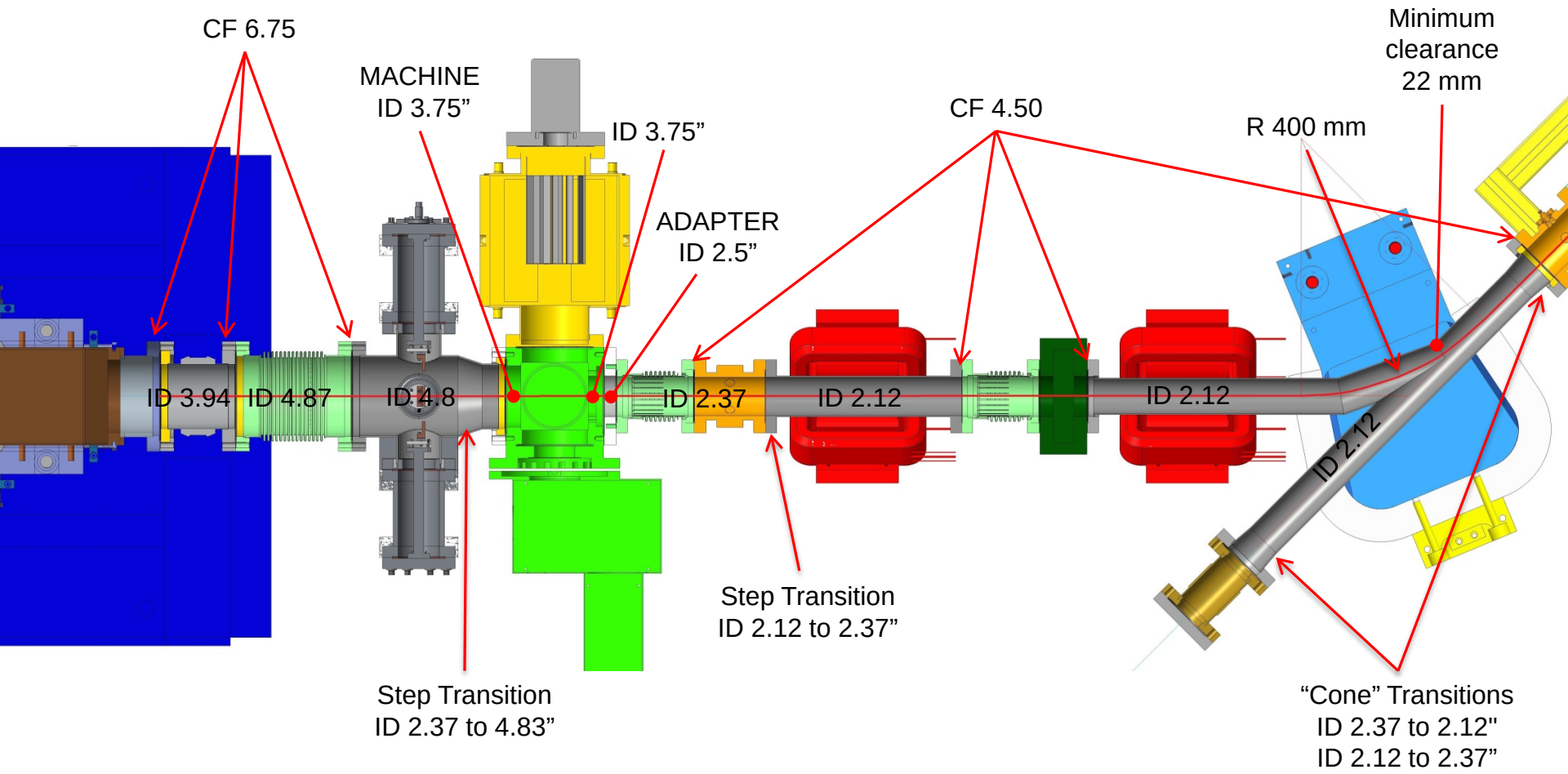
- Cathode insertion – local (in tunnel) manual motor control
- (2) G2B Solenoid Magnets X & Y + skew X & Y
- (1) G2B Profile Monitor – in/out position drive
- (1) Emittance slit drive - ?? position drive
- (1) ERL HE Profile Monitor – in/out position drive
- (1) ERL Halo Monitor – 4 drives, variable position

Diagnositcs Component Status

- (1) Fast Current Transformer (FCT) for MPS test where the booster cavity is installed and dump line.
- Do not weld shield to adjacent chamber (can't change the seal).

  Use special conflat gasket w/shield tube
- Swap bellows and ceramic break for larger aperture near the dump.
- No shield on bellows





- **Quads, not shimmed.**
- **Dipole is not shimmed.**
- **Note beam tube apertures.**

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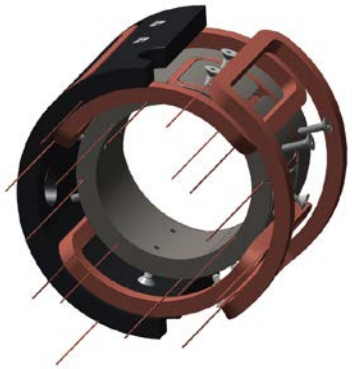
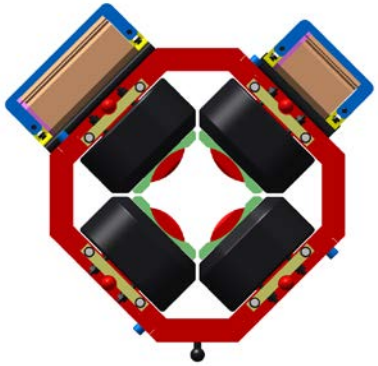
Component Status

Magnets:

- (2ea) GtB solenoids – Order placed - Oct 1, 2016 delivery
- (6ea) ERL solenoids – magnet measurement complete
- (6ea) H/V corrector magnets – New GtB aircooled design, being fabricated in house.
- (2ea) ERL quadrupoles – remove, not shimmed, magnet measurement?
- (1) CeC 45^{o} dipole magnet – not shimmed, new vacuum chamber Magnet base, survey adjustment hardware, and stands for above.
- (2ea) Hi-field transport solenoids, order placed (2017 installation).





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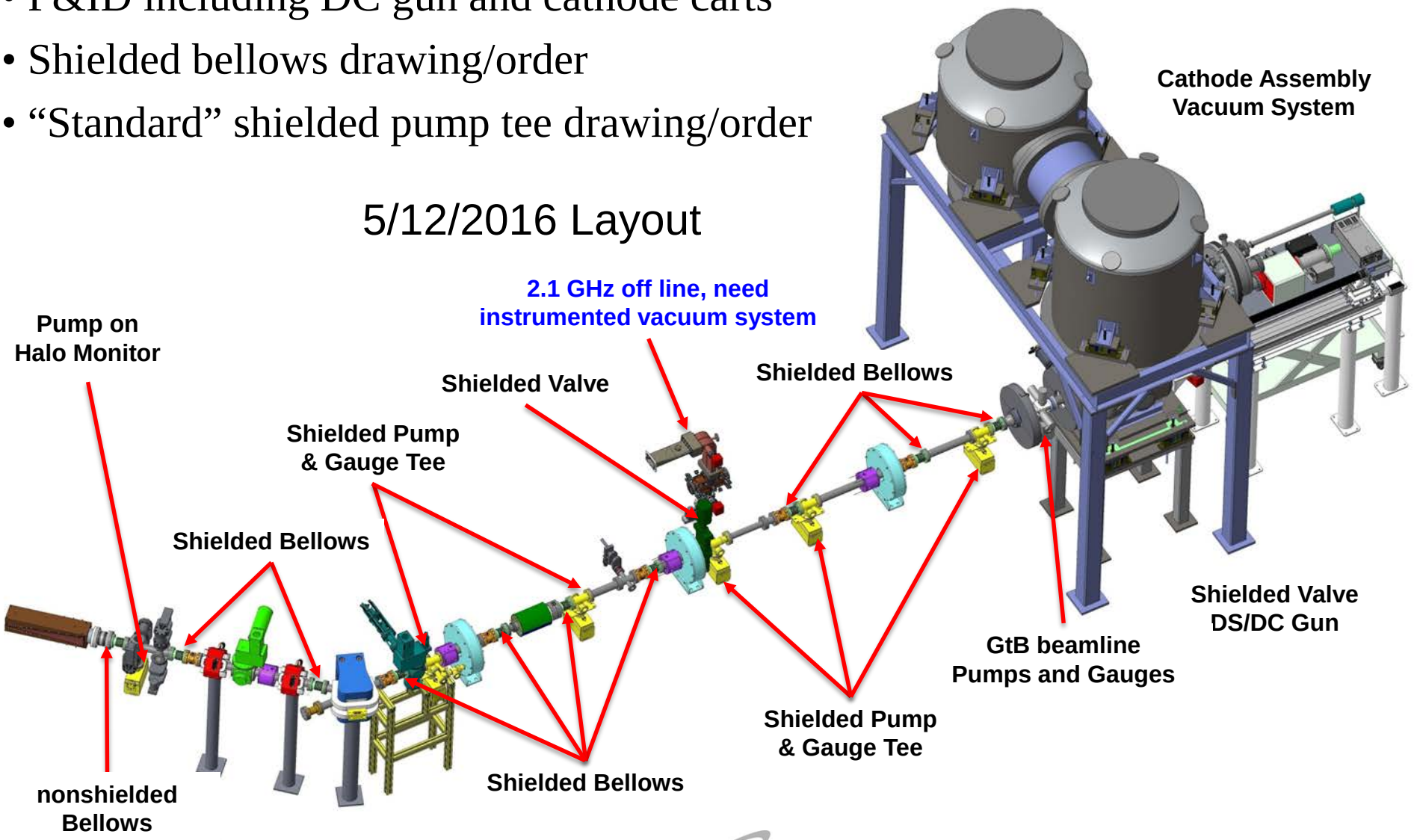
Vacuum Components

- P&ID including DC gun and cathode carts
- Shielded bellows drawing/order
- “Standard” shielded pump tee drawing/order

5/12/2016 Layout



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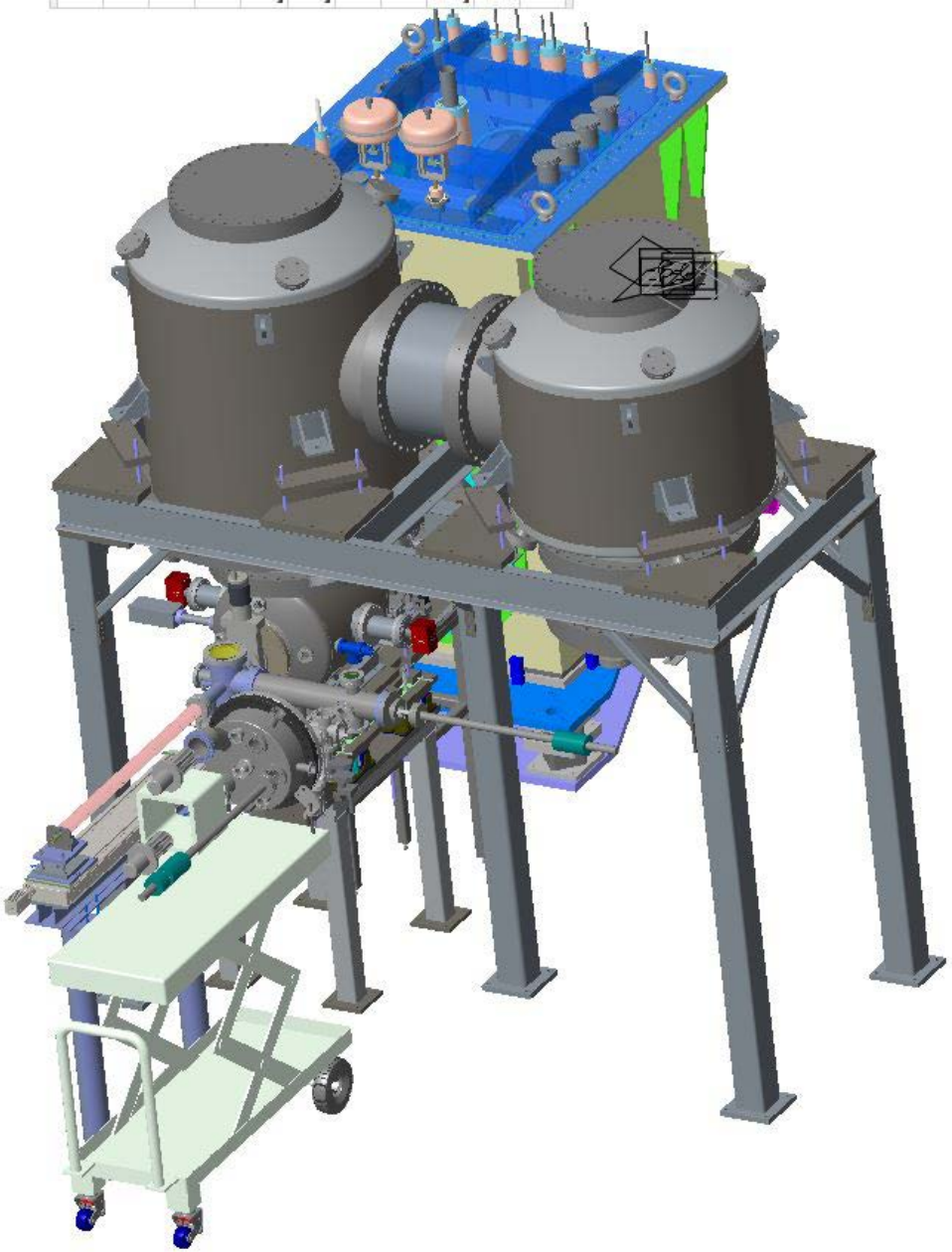


DC Gun Vacuum **operational in September**

- Ion pump and NEG
- Bake-out 150-200C (blankets at Cornell)
- Extractor vacuum gauge
- Remote bleed valve for HV conditioning
- 1 shielded, 1 non-shielded valve

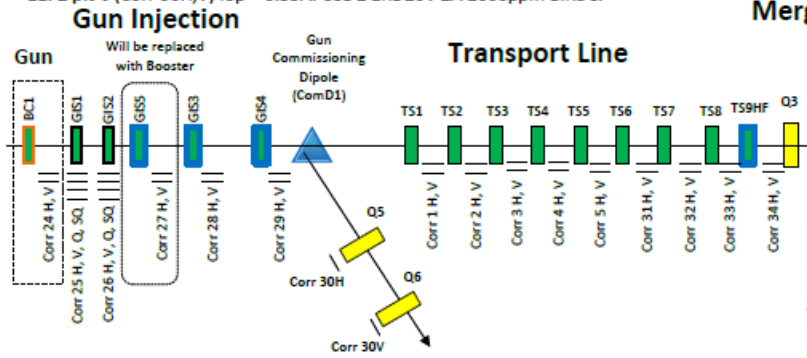
Cathode Systems Vacuum

- Bake-out 150-200C
- Vacuum gauges and pumps
- Plug in cables for transport cart pumps and gauges – remote monitoring
- Bake-able Vacuum “load lock” with remote monitoring and remote temperature control
- Valves w/interlocked controls (local MPS)
- Tunnel switches for interlocked “load lock” valves

SF6 Vessel Pressure Safety Review scheduled for July

Gun Injection Section

1. 1 p.s. Kaiser High Voltage ps for gun
2. 1 p.s. High Voltage Anode Bias ps. Will go in tunnel. Cornell specs ~1kV and 30uA. Purchase Spellman 1kV 10mA, SL1PN10/FGLL/SIC/LR.
3. 1 p.s. (BC1). I op=4.2A. I max = 6A 1000ppm. Using ERL BiRa 20V, 6A 1000ppmp.s.
4. 6 p.s.'s (Corr 24H,V, 25H,V, 26H,V), I op=0.6A 100ppm New CAEN EZ Driver 12V 1A 100ppm p.s. bipolar.
5. 10 p.s.'s (Corr 25Q, SQ & Corr 26Q, SQ & 27H,V-29H,V). New GM Correctors. Use ERL BiRa 20V 2A 1000ppm.
6. 2 p.s.'s (GIS1-GIS2) using New GM Sol's. I max=8A @ 100ppm. Use ERL SHIM 15v 10A 100ppm (limit 100W) ps's
7. 2 p.s.'s (GIS3-GIS4) ERL Sol. I max=5A @1000ppm Use ERL SHIM 15V 10A 100ppm (limit 100W) ps's.
8. 1 p.s. (GIS5) ERL Sol. I op=8.4A, I max=10A @1000ppm Use ERL SHIM 15V 10A 100ppm p.s.
9. 1 p.s. (ComD1) CeC 45° dipole. I op=20A 1000ppm required. Use New GEN 30-25 1000ppm ps
10. 2 p.s.'s. (Q5 & Q6) Iop=0.6A & 0.4A. Use 2 ERL 20V 2A 1000ppm BiRa's.
11. 2 p.s's (Corr 30H,V) Iop = 0.55A. Use 2 ERL 20V 2A 1000ppm BiRa's.



Transport Section

1. 8 p.s's ERL SHIM 15V 10A 100ppm (limit 100W each) for 8 New design Sol magnets (TS1-8) . These magnets are 200G @ 6.2A. Alexei has confirmed operating current.
2. 10 p.s.'s for 5 New GM Correctors (Corr1-5) magnets. Use ERL 20V 2A 1000ppm.
3. 8 p.s.'s for 4 New GM Correctors (Corr 31-34) magnets. Purchase new CAEN 12V 1A 100ppm ps's.
4. 1 p.s. for TS9HF. Use ERL Sol. I op=8.4A, I max=10A @100ppm Use ERL Kepco 50V 20A 100ppm. Alexei has confirmed use of kepco.
5. 1 p.s. for one ERL Quad, Q3, Use ERL 15V 10A SHIM ps (limit 100W)? Waiting on magnet Specs. See George Mahler.

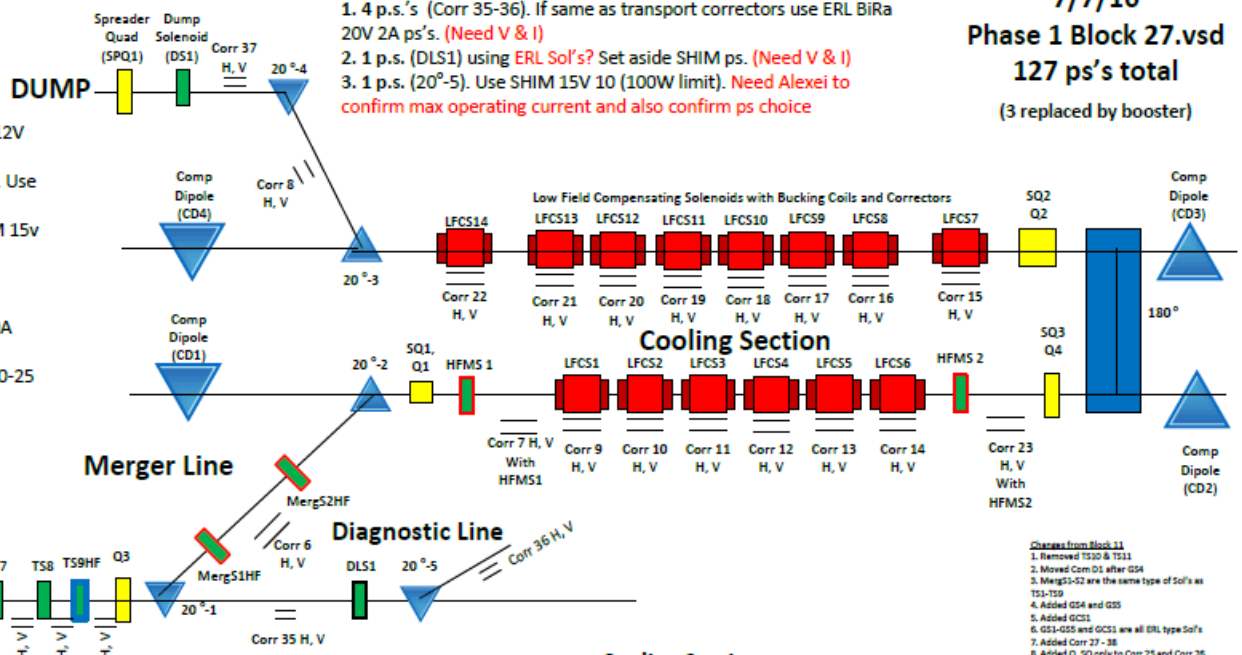
Merger Section

1. 2 p.s.'s 100G Solenoid Magnets (MergS1HF & MergS2HF). I op=11.3A Alexei confirmed I can purchase new CAEN FAST-PS 20V 20A 100ppm ps's
2. 2 p.s.'s needed for one Corrector magnet (Corr 6). Use new GM corr, Alexei confirmed we could purchase the CAEN 12v 1A 100ppm p.s.'s
3. 2 p.s.'s, 20°-1 on its own p.s. and 20°-2 on its own p.s. Use 2 SHIM ps's for now. We must measure voltage ripple of SHIMs. If the ripple on SHIMs is as good as kepcos we can use them. If not we will use 2 kepcos here. For now use SHIM's. Alexei said 100ppm@10A preferred over 100ppm@20A. Ask Alexei to confirm operating current 2A to 4A

Diagnostic Line

1. 4 p.s.'s (Corr 35-36). If same as transport correctors use ERL BiRa 20V 2A ps's. (Need V & I)
2. 1 p.s. (DLS1) using ERL Sol's? Set aside SHIM ps. (Need V & I)
3. 1 p.s. (20°-5). Use SHIM 15V 10 (100W limit). Need Alexei to confirm max operating current and also confirm ps choice

7/7/16
Phase 1 Block 27.vsd
127 ps's total
(3 replaced by booster)



Changes from Block 11
1. Removed TS10 & TS11
2. Moved Com D1 after GS4
3. MergS1-S2 are the same type of Sol's as TS1-TS9
4. Added GS4 and GS5
5. Added GCS1
6. GS1-GS5 and GCS1 are all ERL type Sol's
7. Added Corr 27 - 38
8. Added Q, SQ only to Corr 25 and Corr 26
9. Added BC1
10. TS1-TS9 and MergS1-S2 are new Sol's. Use Karim's design
11. Include High Voltage Anode Bias ps for gun, need info from Karl Smolenski
12. Include Kaiser HI V p.s. for Gun

Cooling Section

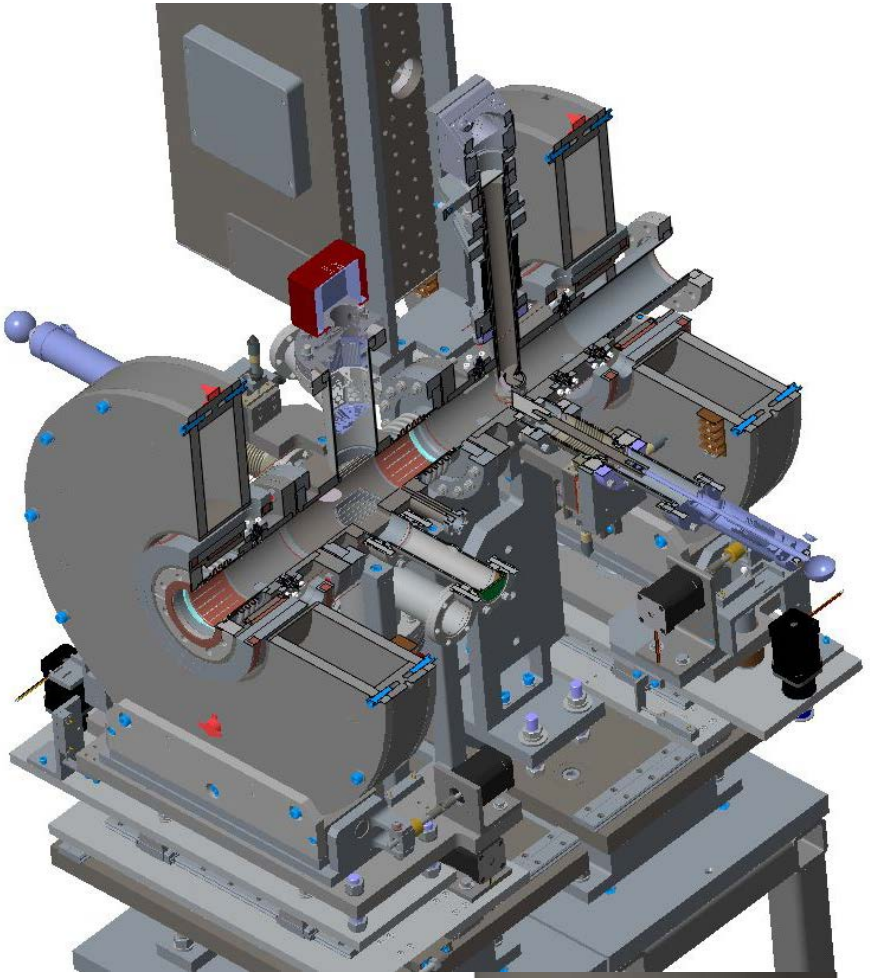
1. 1 p.s. for Skew Quad (SQ1). Use ERL SHIM 15v 10A (limit 100W). (V&I needed)
2. 1 p.s. for Quad (Q1). Use ERL SHIM 15V 10A (limit 100W). (V&I needed)
3. 1 p.s. for High Field Matching Solenoid (HFMS1). Purchase CAEN FAST PS 20V 20A p.s..
4. 1 p.s.'s 15V 10A SHIM for High Field Matching Solenoid (HFMS2). Cannot use GEN 30-25, moved GEN 30-25 to ComD1. Review this ps choice with Alexei.
5. 4 p.s.'s for HFMS Correctors (Corr 7 & 23), Purchase CAEN EZ 12V 1A. (V&I needed)
6. 1 p.s. 150V 22A for LFCSc1-6 cores 6 in series. Received. Alexei confirmed we can still use.
7. 1 p.s. 150V 22A for LFCSbc1-6 buck coils (2x) 6 in series. Received. Alexei confirmed we can still use.
8. 28p.s.'s Purchase 12V 1A CAEN Easy Diver for Correctors (Corr 9-22) with LFCS magnets.
9. 1 p.s. for SQ3. Use ERL SHIM 15v 10A (limit 100W). (V&I needed)
10. 1 p.s. for Q4. Use ERL SHIM 15v 10A (limit 100W). (V&I needed)
11. 1 p.s. for 180° magnet. Have LSII p.s. in house. Assembling it. Add FWD to COTS ps?
12. 1 p.s. for SQ2 Use ERL SHIM 15v 10A (limit 100W)
13. 1 p.s. for Q2 Use ERL SHIM 15V 10A (limit 100W)
14. 1 p.s. for Compensating Dipoles (CD1-4). All 4 in series. Use ERL Kepco 50V 20A 100ppm. Review ps choice with Alexei
15. 1 p.s. 30V 25A for LFCSc7 core single. Purchased new GEN 30-25, Alexei confirm p.s. still ok at low currents
16. 1 p.s. 30V 25A for LFCSbc7 buck coils 2 in series from one magnet. Purchased new GEN 30-25, Alexei confirm p.s. still ok at low currents
17. 1 p.s. 150V 22A for LFCSc8-13 cores 7 in series. Received. Alexei confirmed we can still use.
18. 1 p.s. 150V 22A for LFCSbc8-13 buck coils (2x) 7 in series. Received. Alexei confirmed we can still use.
19. 1 p.s. 30V 25A for LFCSc14 core single. Received. Alexei confirm p.s. still ok at low currents
20. 1 p.s. 30V 25A for LFCSbc14 buck coils 2 in series from one magnet. Received. Alexei confirm p.s. still ok at low currents

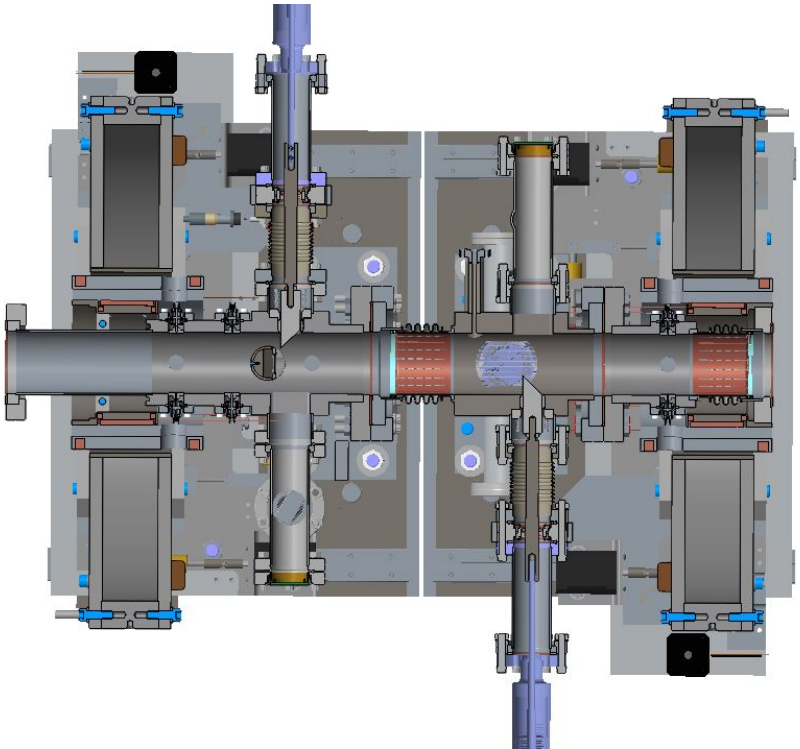
Dump

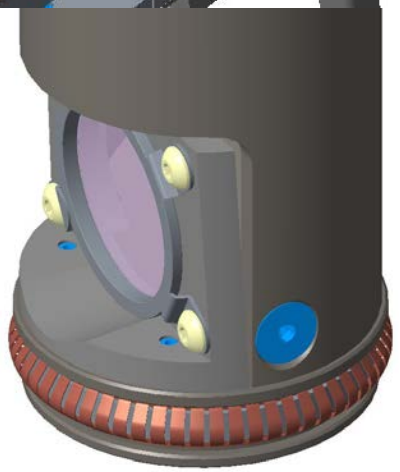
1. 1 p.s. needed for one Spreader Quad Magnet (SPQ1), Alexei said to use ERL 15V 10A SHIM p.s. (V&I needed)
2. 1 p.s. for Dump Solenoid (DS1). Use ERL Solenoid. Set aside SHIM 15V 10A 100ppm (100W limit) p.s (V&I needed)
3. 1 p.s. Dump Section has 20°-3. Use SHIM 15V 10A 100ppm (100W limit) p.s. Alexei I op and PS OK
4. 1 p.s. Dump Section has 20°-4 . Use SHIM 15V 10A 100ppm (100W limit) p.s. Alexei I op and PS OK
5. 2 ps's for Corr 8. If same as transport correctors use 2 Bira 20V 2A ps's from ERL. (V&I needed)
6. 2 p.s.'s for Corr 37. If same as transport correctors use 2 Bira 20V 2A ps's from ERL. (V&I needed)

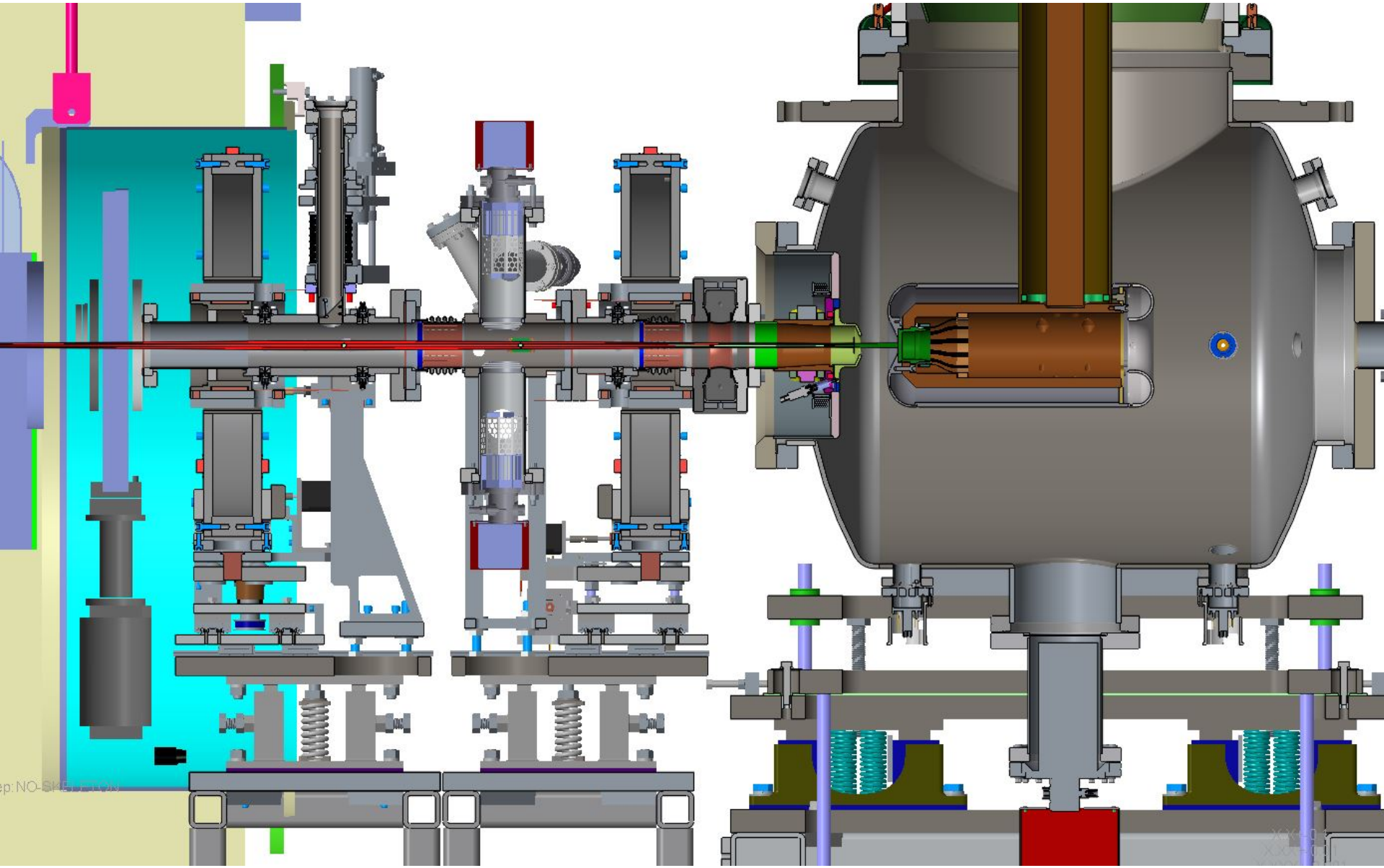
Gun to Booster Transport Line

1. Mirror assembly complete, checking
2. Vacuum chambers (3), ordered (10/31/16)
3. Profile monitor design complete, checking
4. Ion pumps, gauges, NEG pumps ordered – cables next
5. Solenoids motorized base, checked and approved, preparing parts orders.
6. Support Stands, checking



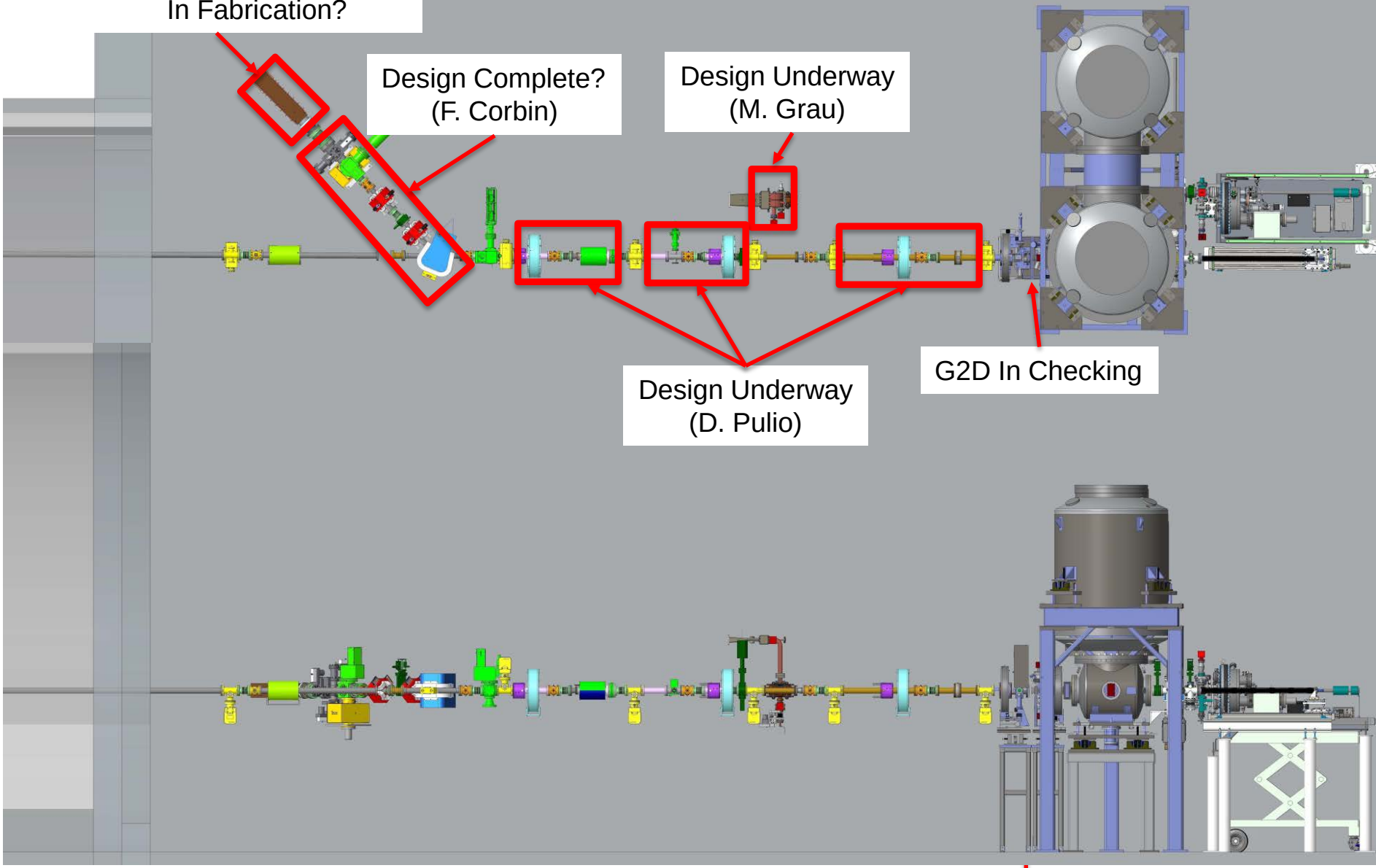






Component Stands

Designed, Fabricated and Installed 11/15/2016



RF Component Status

2.1 GHz Cavity (offset on beamline): cavity in house and wave guide in fabrication.

- 1002B new PA: delivery August 2016
- Tuner system w/drive, design complete, components ordered
- Wave guide design near complete – being ordered
- stand design underway

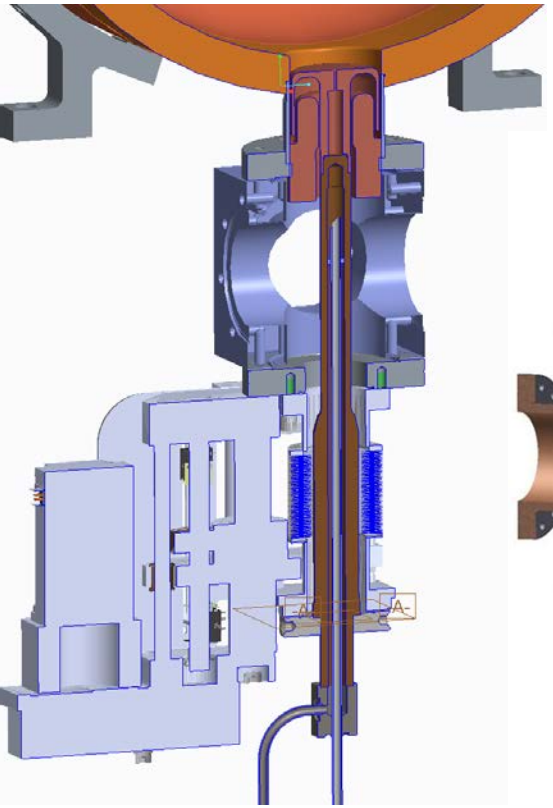
ACS interlocks, MPS, water, cables

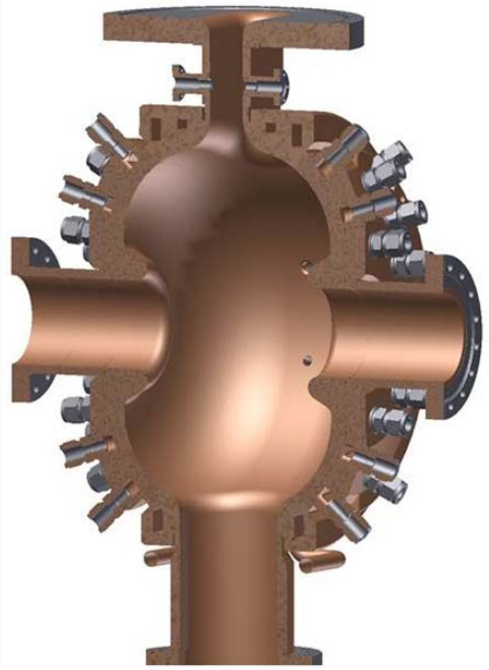
RF Component Status

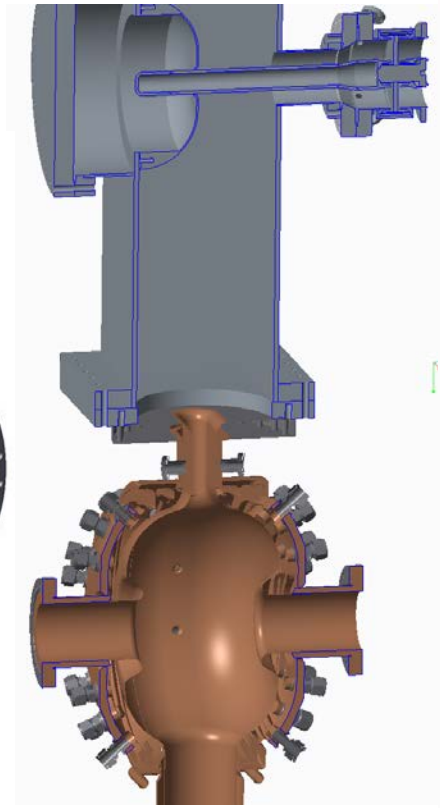
704 MHz Cavity (D/S DC gun beamline, in final position): Cavity FDR complete

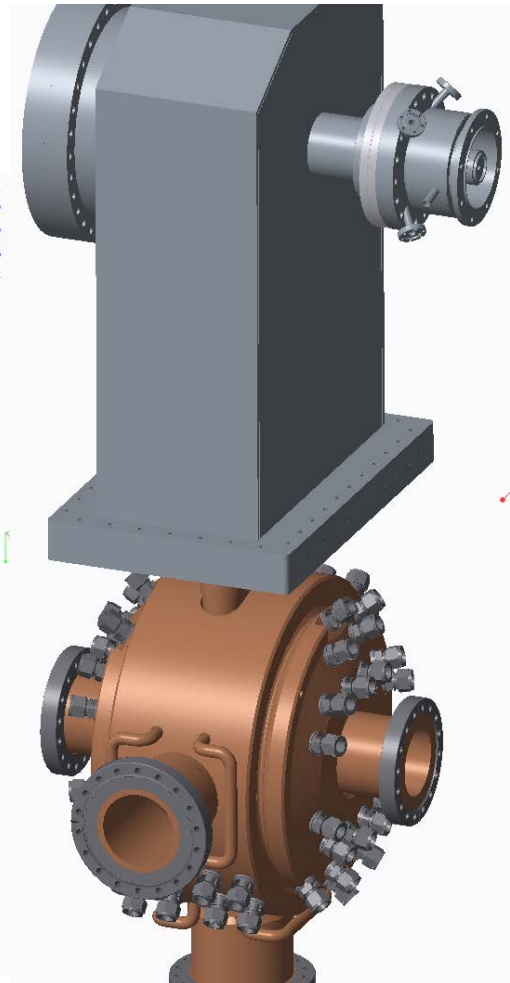
- 1002B use Booster Cavity PA for commissioning (2017 ops - retune CeC 500 MHz)
- tuner system w/drive – design complete, drawings in checking
- wave guide (Booster Cavity at wall to coax transition) to be designed
- RF window transition being designed

9 MHz RHIC Cavity (D/S DC gun beamline, in final position)



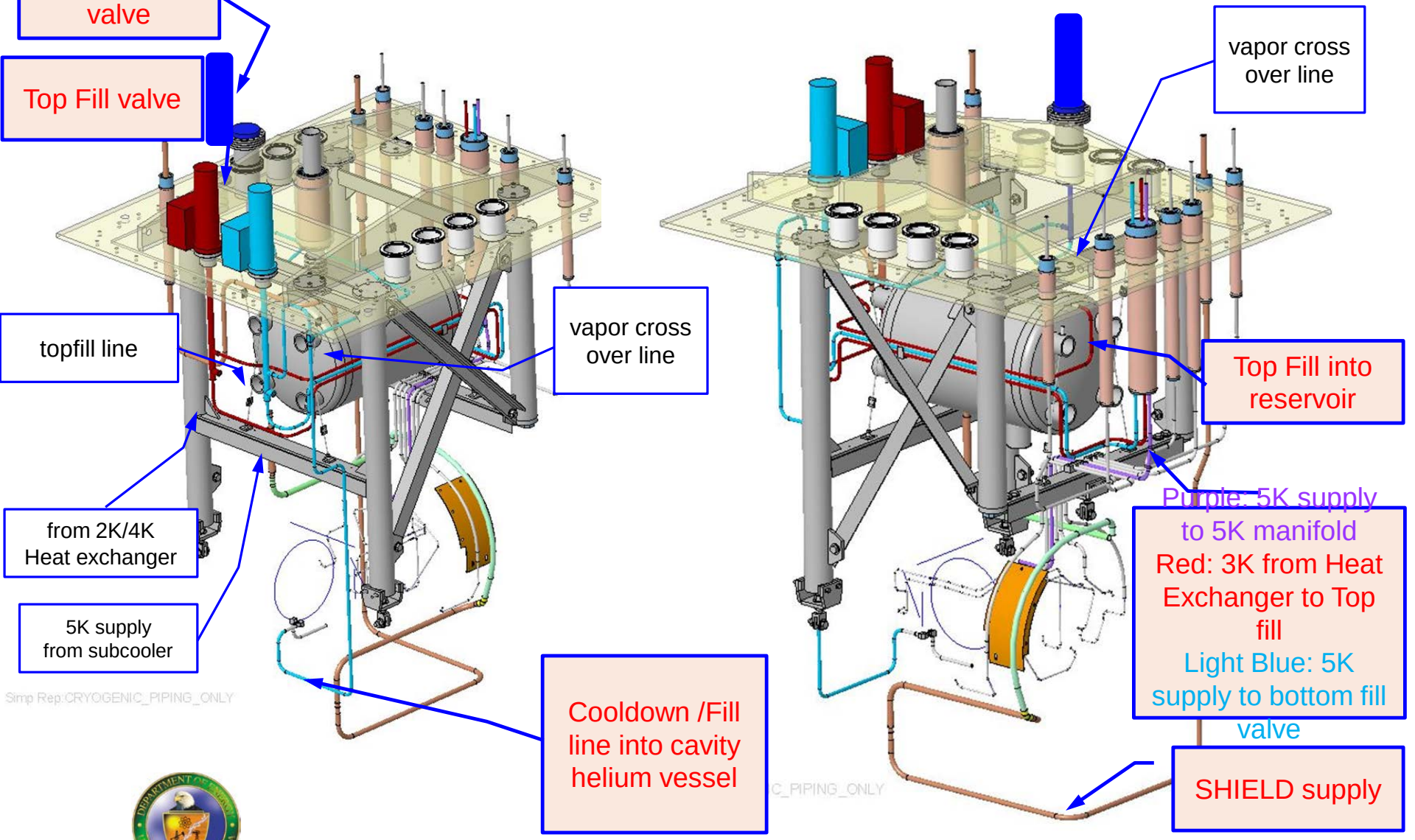






ERL SRF Gun Design Review

- No external piping modifications
- Internal modifications to reduce “vapor lock”



Vibration Measurements – meeting 6/21/16

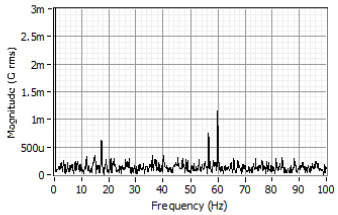
Measurements 1002F, 2:00, and 4:00 (56 MHz) during run.

Measurements being taken now at 02:00 tunnel and outside.

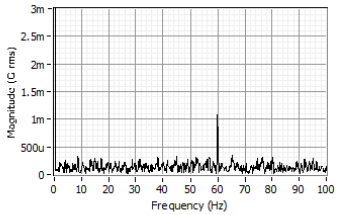
Reviewing results with support from NSLSII

RUN NUMBER 2 WITH LARGE CHILLER ONLY 4/25/2016

X-direction (A1=A)



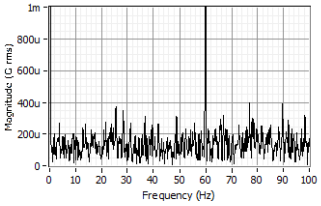
Y-direction (A1=A)



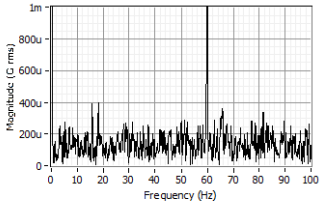
Z-direction (A1=A)

112 MHZ RUN 3 A1 FLANGE AND A3 ON FPC BLOWER OFF 5 27 16

X-direction (A1=A)



Y-direction (A1=A)



Z-direction (A1=A)