Meeting Minutes: **LEReC DC Gun, Transport Lines, and Dump Installation 2016, May 26, 2016**

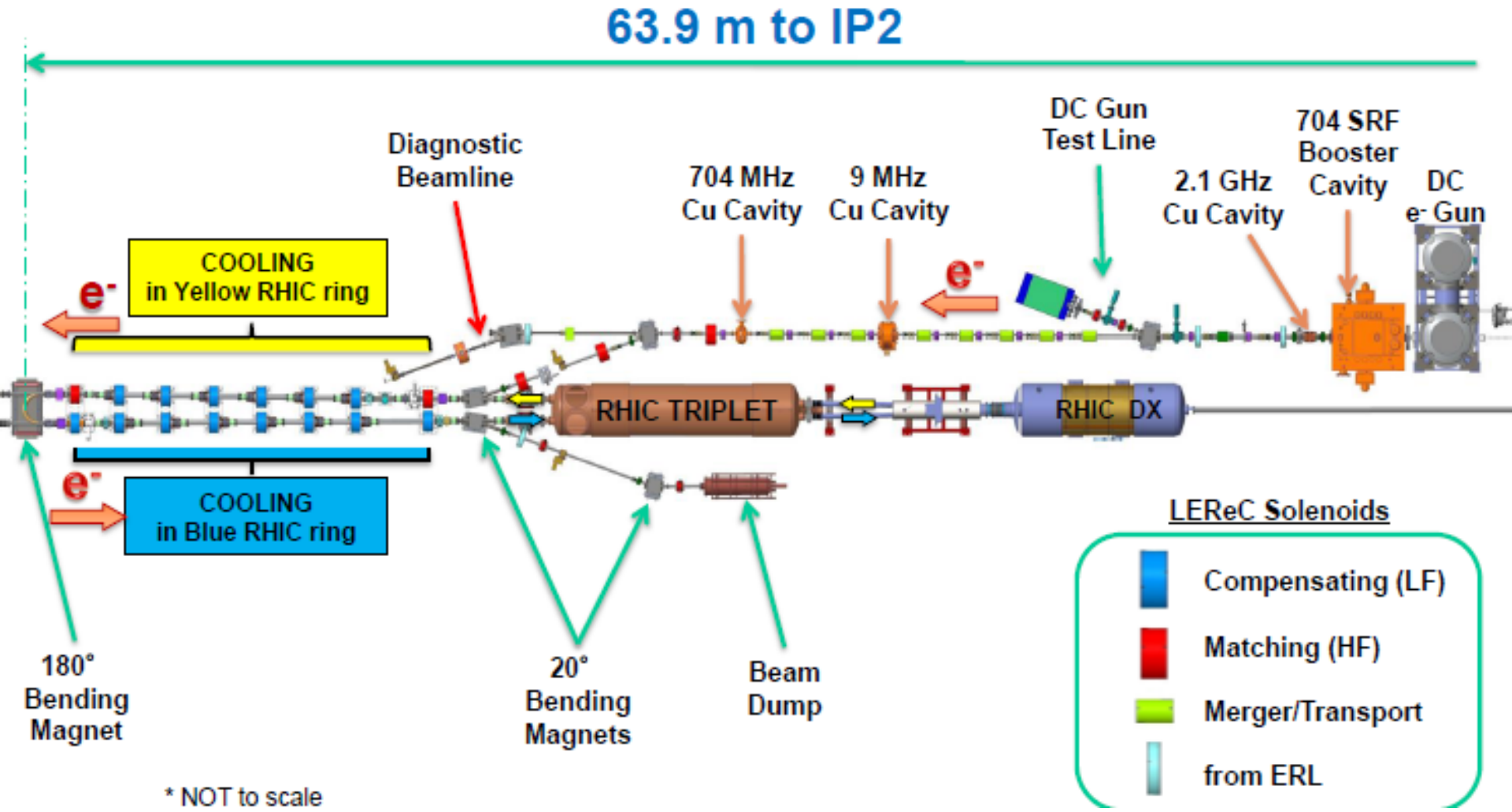
D. Kayran, A. Fedotov, T. Miller, D. Gassner, D. Weiss, G. Mahler, M. Mapes, S. Nayak, J. Fite, K. Hamdi, T. Arno, M. Costanzo, M. Paniccia, L. Hammons, S. Seletskiy, A. Zaltsman, P. Thieberger

The beam line layout for the DC gun dump line shown to the right on slide should stay as is. The quadrupole magnets will not change positions and the apertures will not change.

45^{o} dipole magnet: It was agreed that the magnet would not be shimmed. The present vertical gap is 2.37” (60.3 mm). The beamtube would be reduced in diameter to 2.25” OD x 2.125” ID (57.2” OD x 54mm ID) with a smooth transition at each end. The appendage beam tube for the 45^{o} bend would also be 2.25” OD x 2.125” ID (57.2” OD x 54mm ID) and then have a step transition at the sector valve.

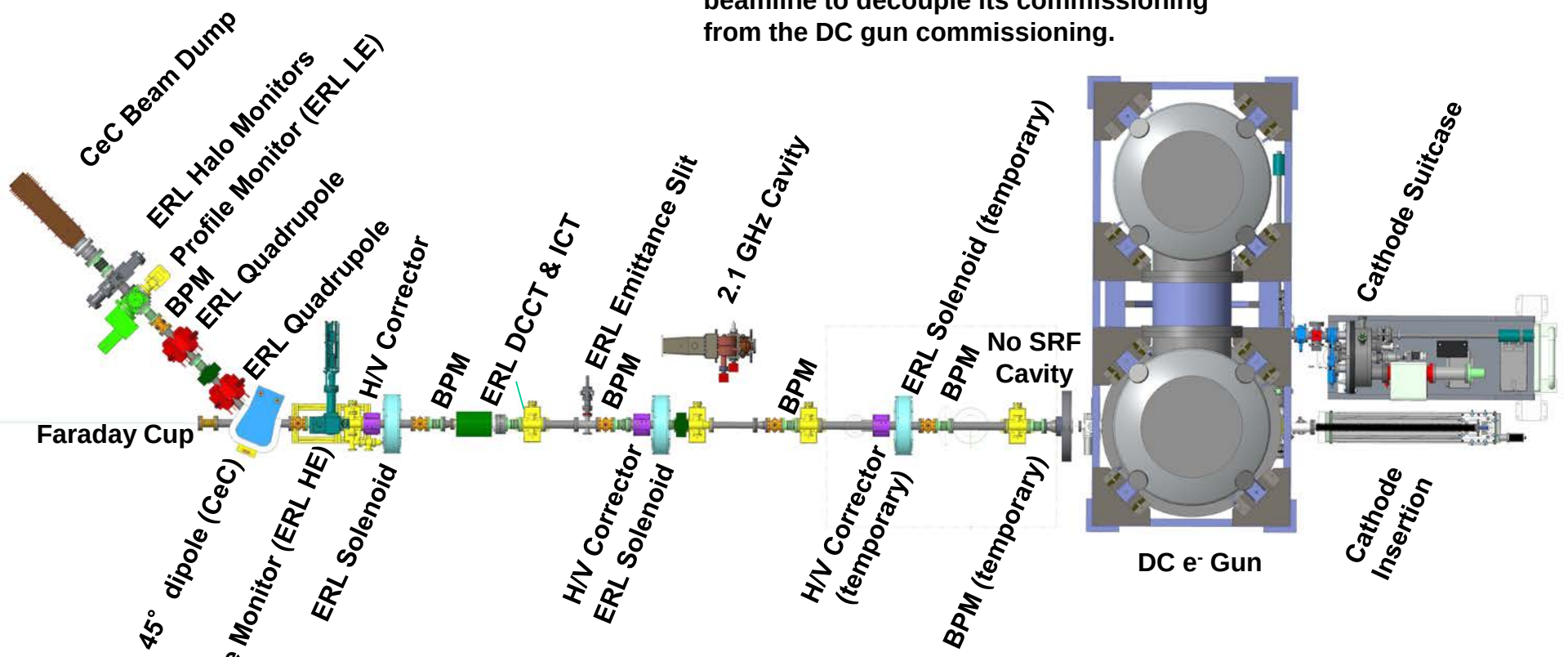
There was some uncertainty whether the design and drawings for the ERL HE profile monitor are complete. Toby and Dan will meet to make sure Gary Whitbeck has proper guidance.

LEReC System



LEReC Injection section 2016 (5/23/16)

2.1 GHz Cavity:
The cavity will be installed next to the beamline to decouple its commissioning from the DC gun commissioning.



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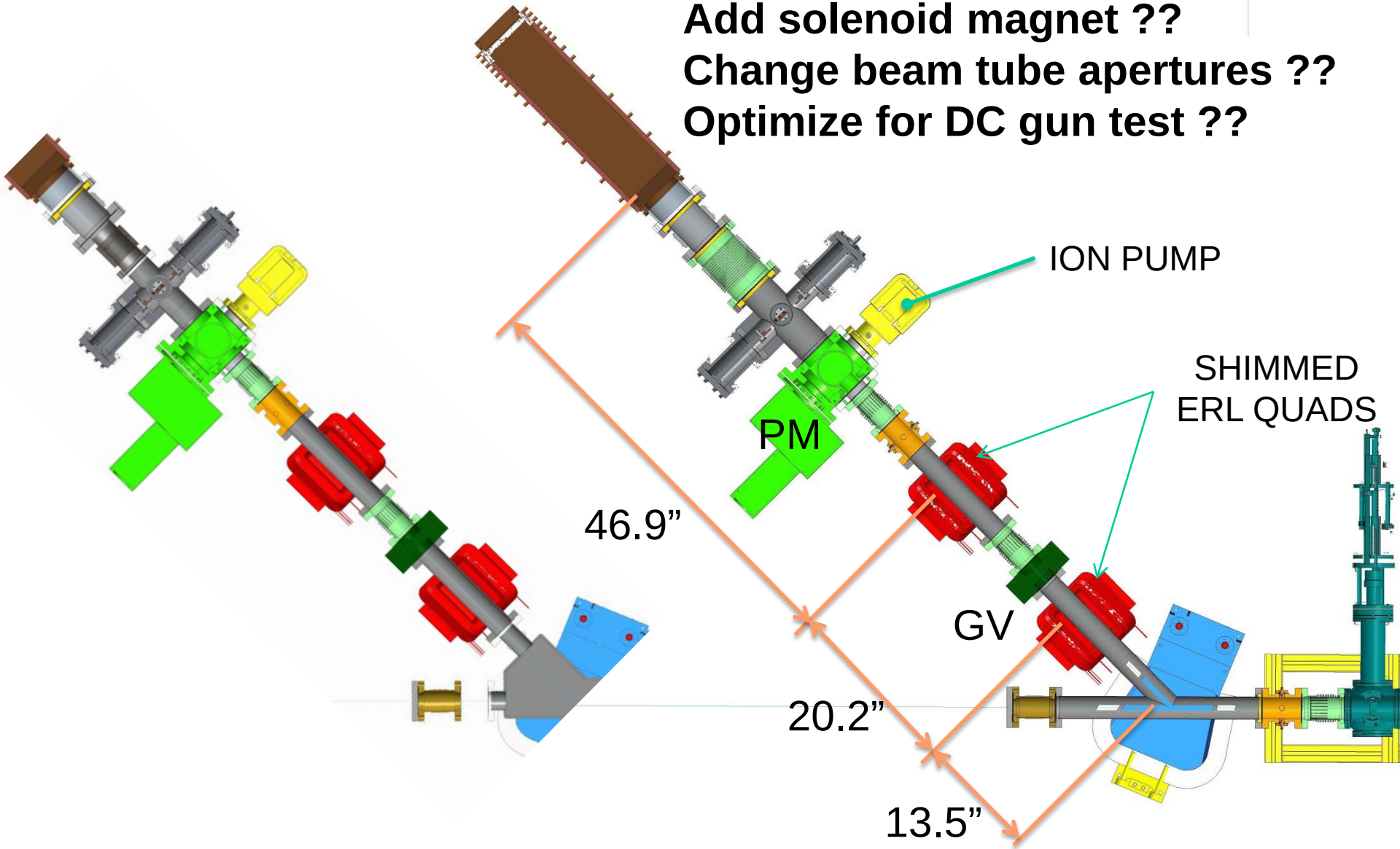
Change Quad spacing ??
Add solenoid magnet ??
Change beam tube apertures ??
Optimize for DC gun test ??



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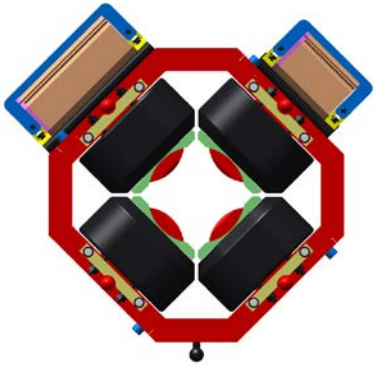
Component Status

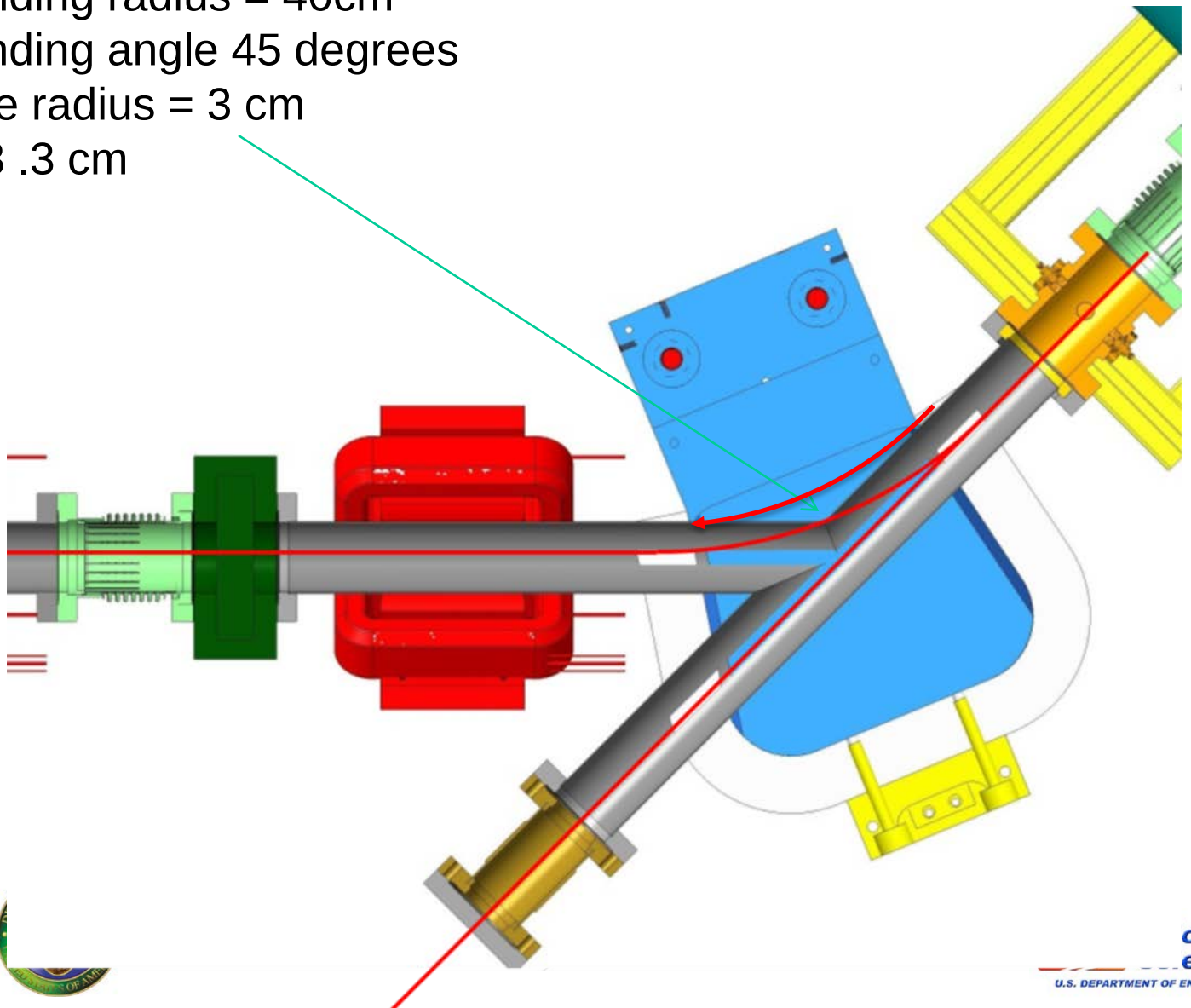
Magnets:

- (3ea) ERL solenoids – removed, sent to magnet measurement
- (6ea) H/V corrector magnets – New GtB aircooled design fabricate in house.
- (2ea) ERL quadrupoles – remove, shim, magnet measurement
- (1) CeC 45^{o} dipole magnet – shim, magnet measurement, new vacuum chamber (next slide)
- Magnet base, survey adjustment hardware, and stands for the all above.



Beam is very close to the wall of vacuum chamber

Banding radius = 40cm
Banding angle 45 degrees
Pipe radius = 3 cm
d=3 .3 cm



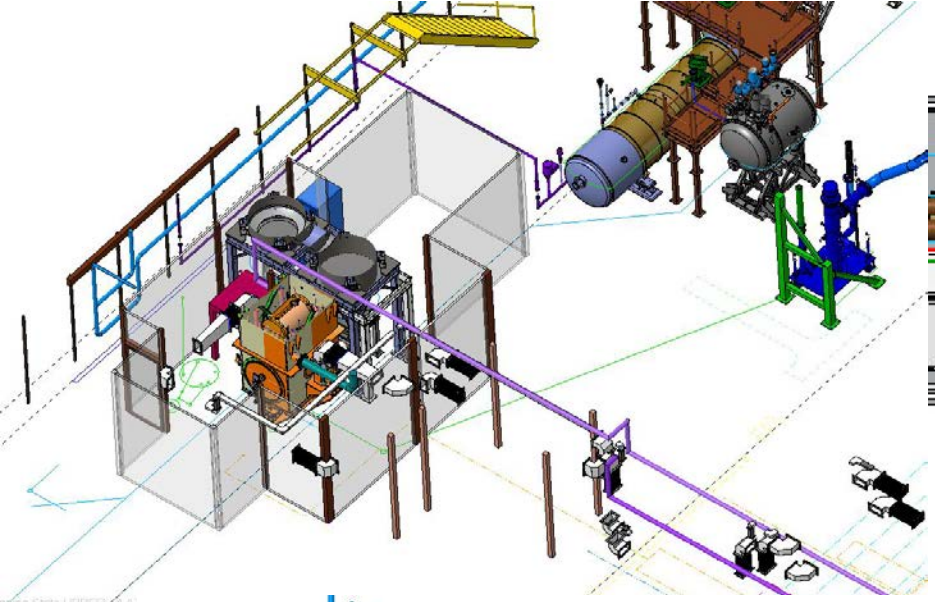
Component Status

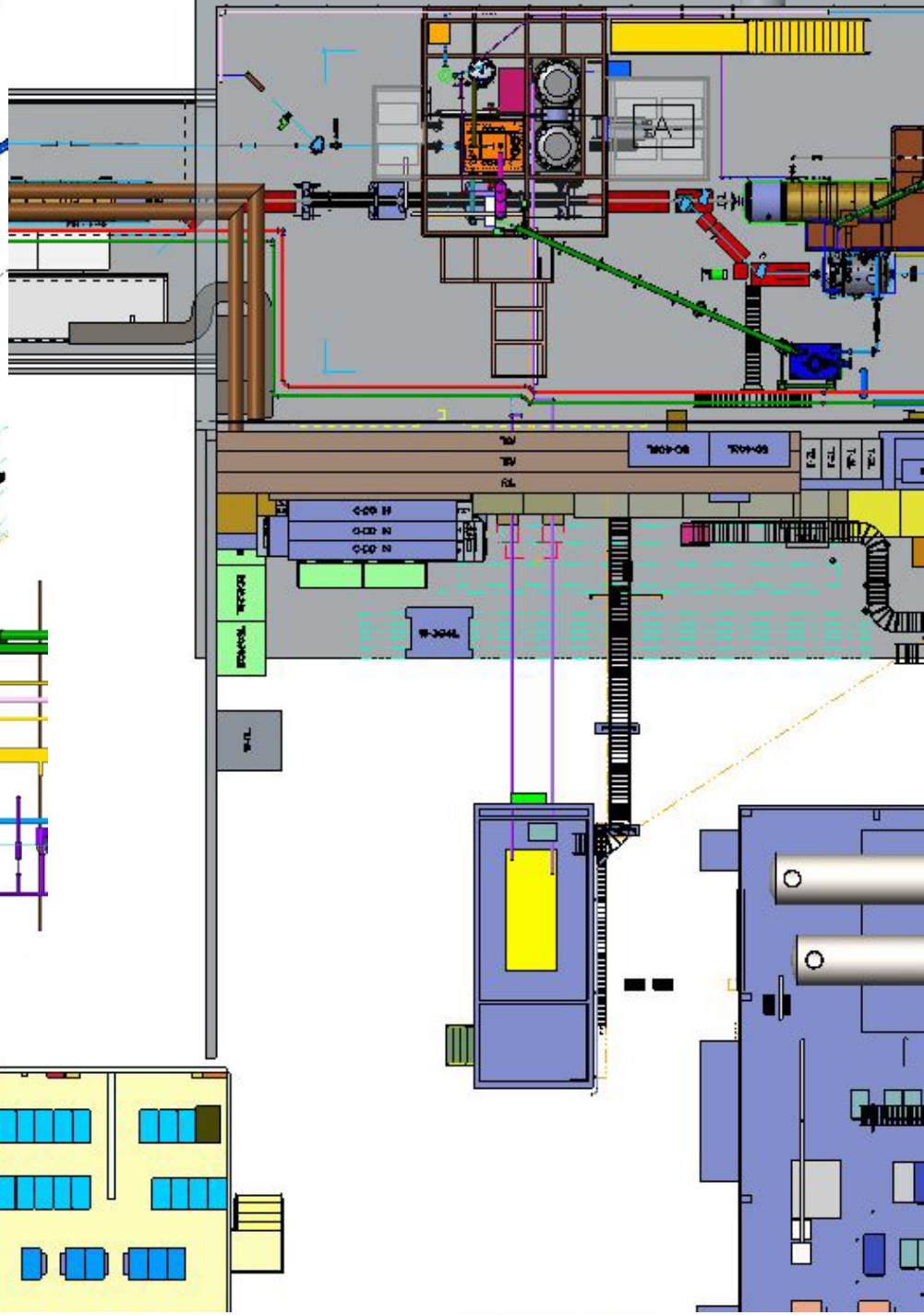
Diagnostics:

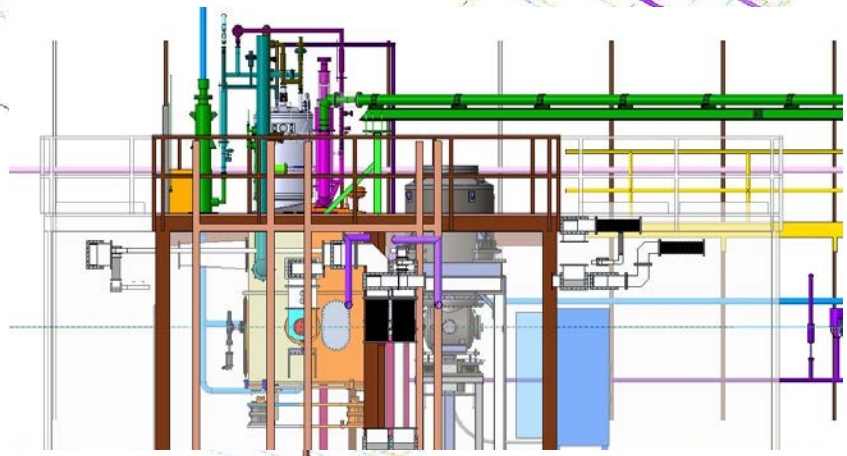
- DCCT and ICT from ERL (internal RF shielding analyzed) any further modifications - no
- (1) ERL HE Profile Monitors (new internal RF shield for vacuum chamber, ferrites, new larger YAG screen) any further modifications?
- (1) ERL LE Profile Monitors – no shields, some internal modification
- (1) Emittance slit drive (new vacuum chamber and slit shape)
- (1) ERL Halo Monitor (same vacuum chamber)
- (1) Faraday cup (ceramic insulated vacuum flange?) 1 watt limit?

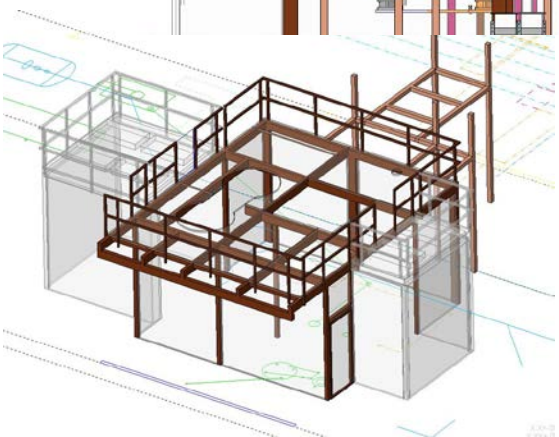
Laser Systems:

- Laser building modifications (AC unit change, vibrations)
- Transport line (work platform meeting)
- In tunnel optics table (detailed layout underway)









EP&S Support

- Work Platform, Cleanroom design proceeding
- Tunnel power for DC Gun PS and Cleanroom fans and lights
- 1002D power and cable tray requirements
- Tunnel cable tray layout
- Tunnel penetration for laser transport

Minutes, 5 19 2016 Platform meeting:

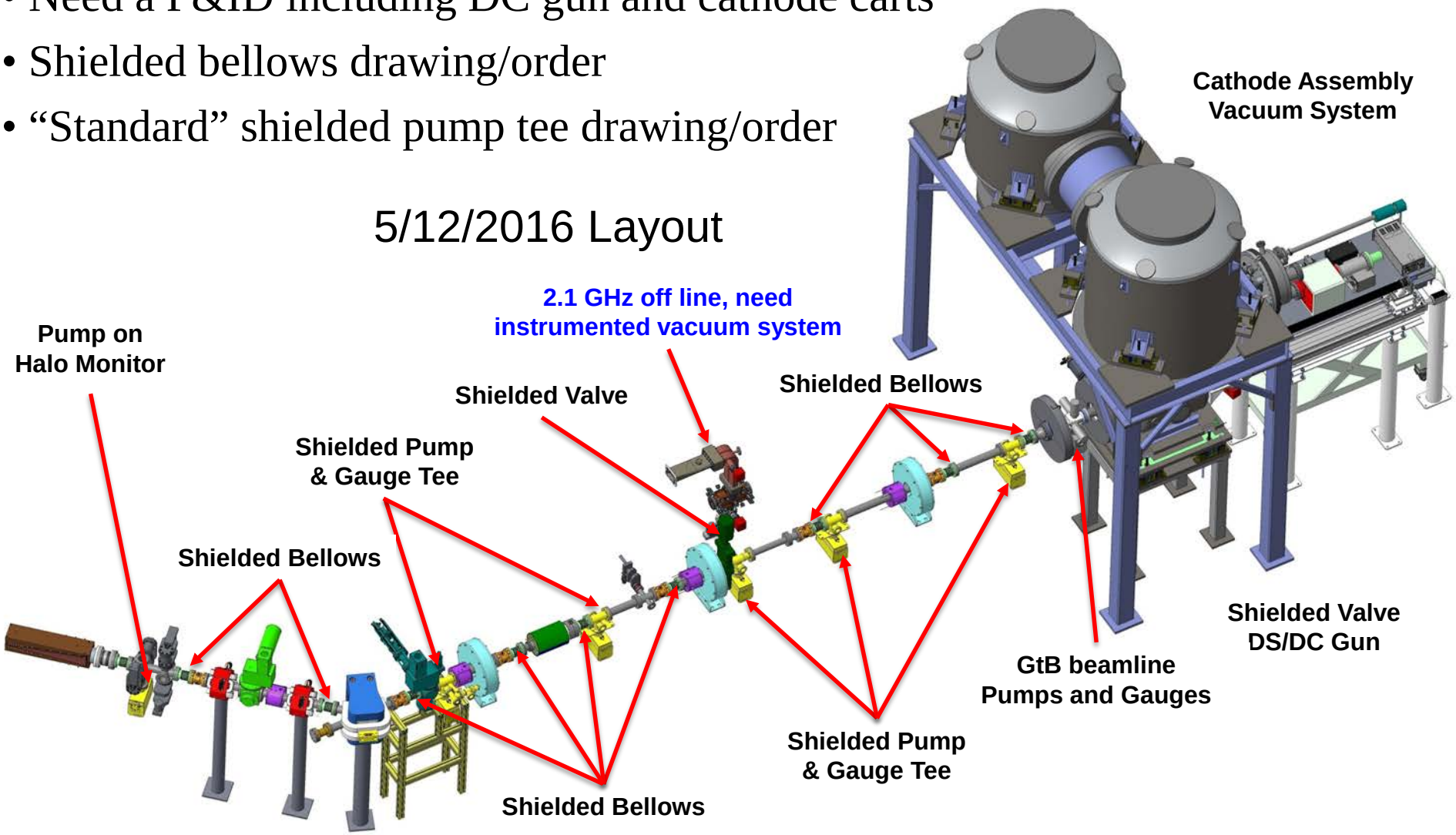
(Mapes, Zhao, Soria, Meier, Bellavia, Aron, Smith, Tuozzolo, Zaltsman)

- Victor is near done on **cryogenic drawings, no changes**. Needs a specification control drawings for the return heater.
- Bob has **updated the cleanroom layout** so it can be transmitted to a cleanroom equipment vendor. It was agreed to move the curtain wall so that the cleanroom boundary will be on the CeC undulators so that the undulators will be just outside the cleanroom.
- **Doors** were added on both ends of the cleanroom including a double door for the cathode transport cart. Larger filter element sections were added
- **Bob has looked at straighter runs for the laser.** Still needs 3/90^{o} bends near wall, not a problem per Zhi. Also clarified that the final laser position to the tunnel optics table does not need to align with laser port on the beamline. Bob, Dave, Steve, and Zhi will meet in the laser room to update the table location and laser start to tunnel location.
- Zhi will provide some dimensions for the in line **laser alignment box** near the wall..
- Bob and Dave Phillips are considering a **raised floor design** that will use more Rexroth and the aluminum plate to be used for the upper platform.

Vacuum Components

- Need a 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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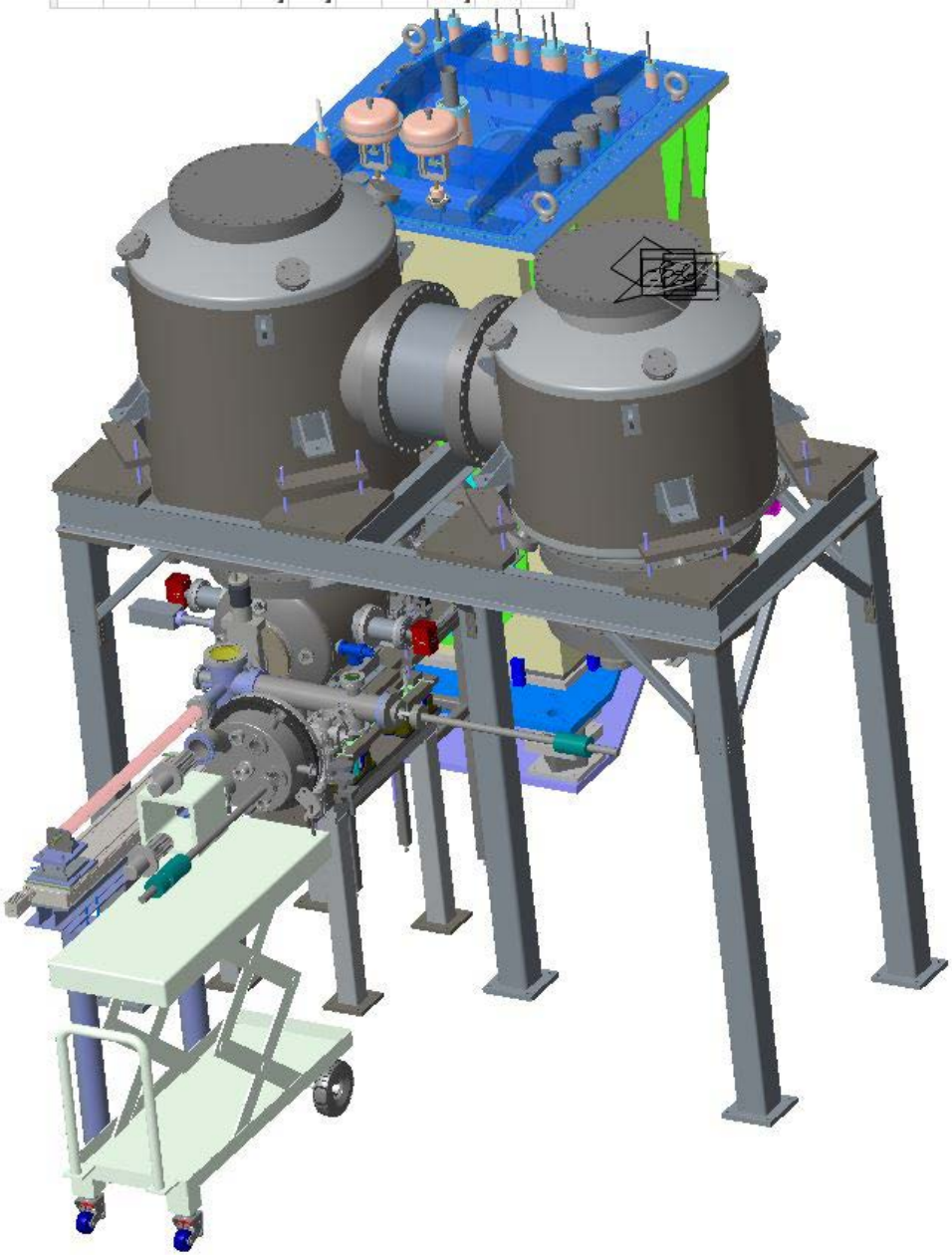

DC Gun Vacuum

- Ion pump and NEG
- Bake-out 150-200C
- 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

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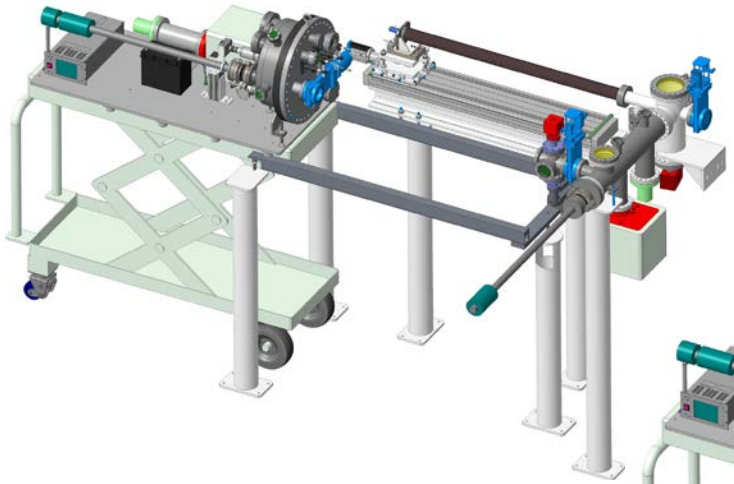
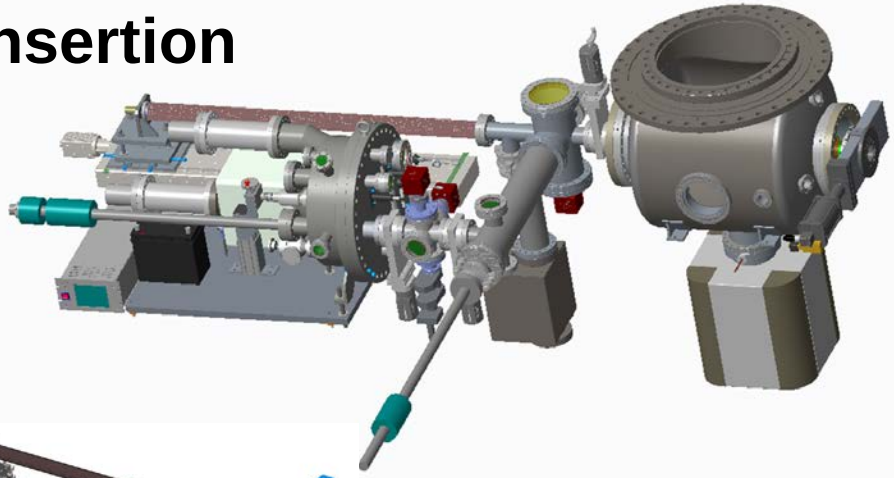
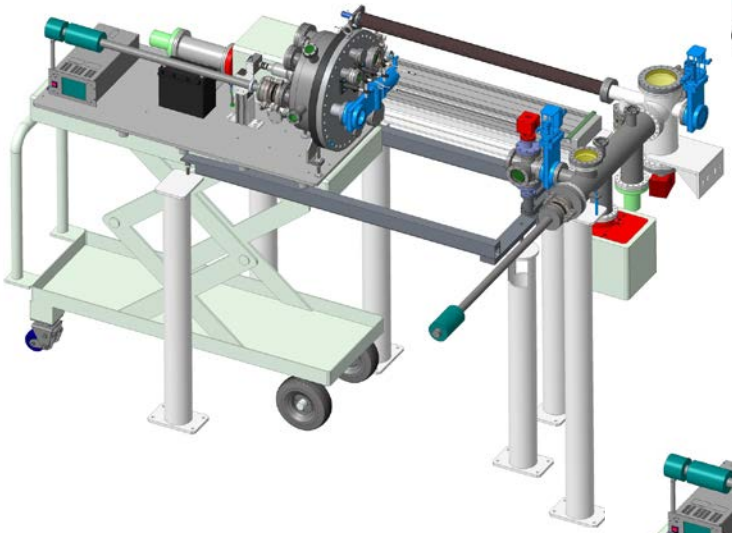
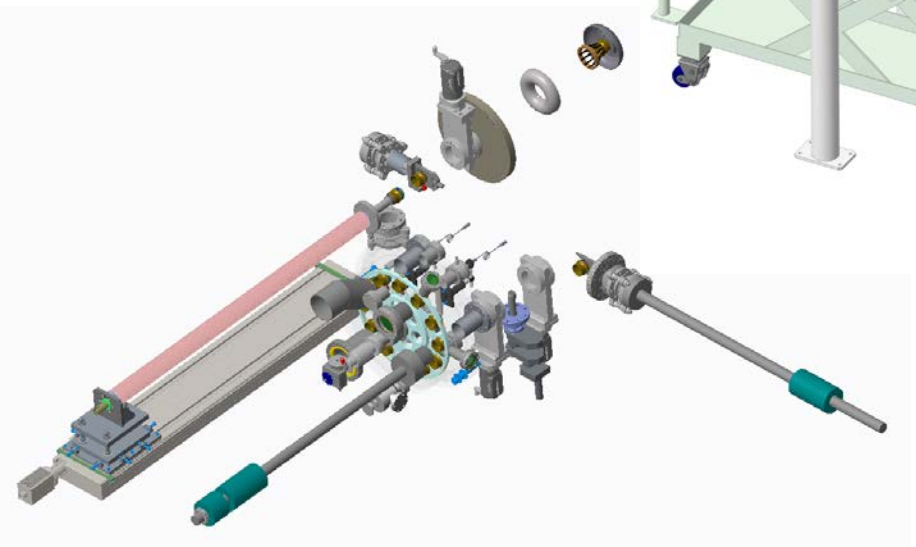
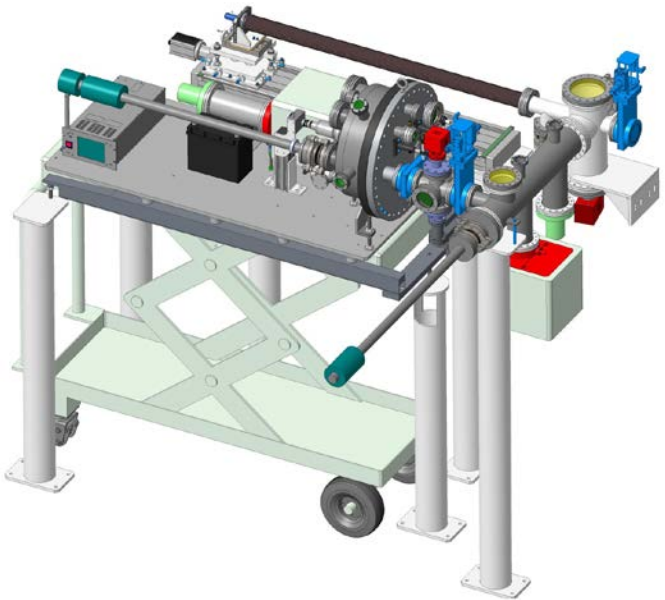
Cathode Insertion











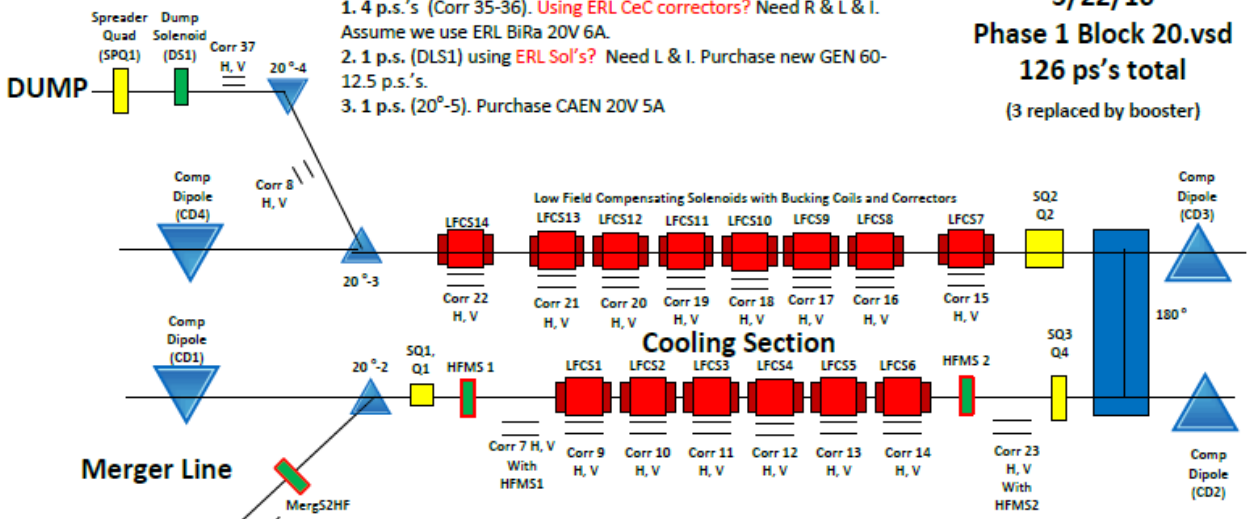
Gun Injection Section

1. **1 p.s.** Kaiser High Voltage ps for gun
2. **1 p.s.** High Voltage Anode Bias ps. Does this go into the tunnel? Cornell specs ~1kV and 30uA. Purchase Stanford 1.25kV, 20mA with GPIB.
3. **1 p.s.** (BC1). I op=4.2A. I max = 6A 1000ppm. Using ERL BiRa 20V, 6A p.s.
4. **2 p.s.'s** (Corr 24), I op=0.6A 100ppm Purchase new CAEN 20V 1A 100ppm p.s. bipolar.
5. **2 p.s.'s** (GIS1-GIS2) using New GM Sol's. Iop=8.4A, I max=10A @ 100ppm. Purchase New CAEN EZ 20V 10A 100ppm ps's
6. **3 p.s.'s** (GIS3-GIS5) ERL Sol. I op=8.4A, I max=10A @1000ppm Purchase New CAEN FAST-PS 40V 10A 100ppm ps's
7. **8 p.s.'s** (Corr 25H, V, Q, SQ & Corr 26H, V, Q, SQ). New GM Correctors. Purchase CAEN 20V 1A 100ppm ps's for 25H,V & 26H,V. Use ERL BiRa 20V 2A 1000ppm for 25Q,SQ and 26 Q,SQ
8. **10 p.s.'s** (Corr 27-30). Using GM new correctors. Use ERL 20V 2A 1000ppm or CAEN 20V 1A 100ppm ps's??
9. **1 p.s.** ComD1. CeC 45° dipole. I op=20A 1000ppm required. Use kepco 50V 20A 100ppm. 20A is ps limit, buy another ps?
10. **2 p.s.'s**. Q5 & Q6. ERL Quads. Waiting on Dmitry for magnet specs.

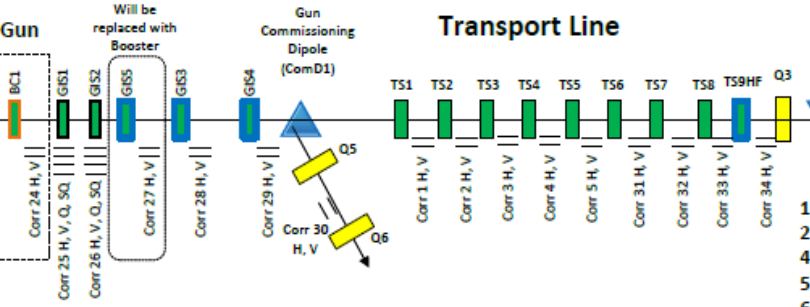
Diagnostic Line

1. **4 p.s.'s** (Corr 35-36). Using ERL CeC correctors? Need R & L & I. Assume we use ERL BiRa 20V 6A.
2. **1 p.s.** (DLS1) using ERL Sol's? Need L & I. Purchase new GEN 60-12.5 p.s.'s.
3. **1 p.s.** (20°-5). Purchase CAEN 20V 5A

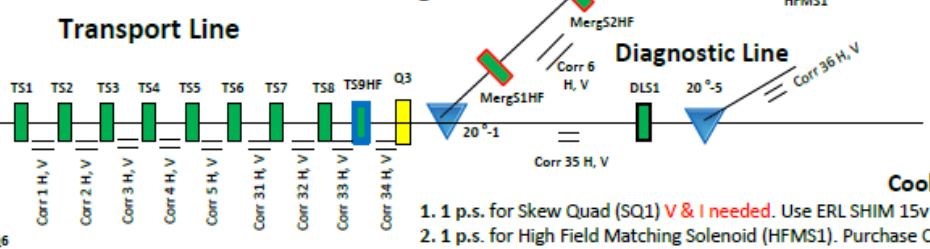
5/22/16
Phase 1 Block 20.vsd
126 ps's total
(3 replaced by booster)



Gun Injection



Transport Line



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 @ 6.8A.
2. **18 p.s.'s** for 9 New GM Correctors (Corr1-5 & 31-34) magnets. Purchase new CAEN 20V 1A 100ppm ps's or use ERL 20V 1A 1000ppm
3. **1 p.s.** for TS9HF. Use ERL Sol. I op=8.4A, I max=10A @100ppm Cannot use SHIM, may need CAEN FAST-PS 40V 10A
4. **1 p.s.** for one ERL Quad, Q3, Waiting on magnet Specs. Use ERL 15V 10A SHIM ps (limit 100W)?

Merger Section

1. **2 p.s.'s** 100G Solenoid Magnets (MergS1HF & MergS2HF). I op=11.3A Purchase new CAEN FAST-PS 20V 20A ps's?
2. **2 p.s.'s** needed for one Corrector magnet (Corr 6). Use new GM corr, Purchase new CAEN 20v 1A p.s.?
3. **2 p.s.'s**, ERL Kepco BOP GL 50V 20A or new CAEN 20V 5A for 20° magnets. Merger Section has 20°-1 on its own p.s. and 20°-2 on its own p.s. 20°-1 will also have a new laminated magnet. There is a possibility of using a shunt p.s. on 20°-1 but this is not included in count now.

Cooling Section

1. **1 p.s.** for Skew Quad (SQ1) V & I needed. Use ERL SHIM 15v 10A (limit 100W)
2. **1 p.s.** for High Field Matching Solenoid (HFMS1). Purchase CAEN EZ 20V 10A.
4. **1 p.s.'s** 30V 25A for High Field Matching Solenoid (HFMS2). Received
5. **4 p.s.'s** for HFMS Correctors (Corr 7 & 23), need real Mag V & I. For now using ERL 15V 10A SHIMS
6. **1 p.s.** 150V 22A for LFCSc1-6 cores 6 in series. Received.
7. **1 p.s.** 150V 22A for LFCSbc1-6 buck coils (2x) 6 in series. Received.
8. **28p.s.'s** 20V 2A BIRA MCOR for Correctors (Corr 9-22) with LFCS magnets.
9. **1 p.s.** for SQ3 V & I needed. Use ERL SHIM 15v 10A (limit 100W)
10. **1 p.s.** for Q4 V & I needed. Use ERL SHIM 15v 10A (limit 100W)
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 V & I needed. Use ERL SHIM 15v 10A (limit 100W)
13. **1 p.s.** for Q2 V & I needed. Use ERL SHIM 15v 10A (limit 100W)
14. **1 p.s.** for Compensating Dipoles (CD1-4). All 4 in series. Use one kepco 50V 20A p.s.
15. **1 p.s.** 30V 25A for LFCSc7 core single. Purchase new GEN 30-25
16. **1 p.s.** 30V 25A for LFCSbc7 buck coils 2 in series from one magnet. Purchase new GEN 30-25.
17. **1 p.s.** 150V 22A for LFCSc8-13 cores 7 in series. Received.
18. **1 p.s.** 150V 22A for LFCSbc8-13 buck coils (2x) 7 in series. Received.
19. **1 p.s.** 30V 25A for LFCSc14 core single. Received.
20. **1 p.s.** 30V 25A for LFCSbc14 buck coils 2 in series from one magnet. Received

Dump

1. **1 p.s.** needed for one Spreader Quad Magnet (SPQ1), No V & I, told to use ERL 15V 10A SHIM p.s.
2. **1 p.s.** 60V 12.5A needed for Dump Solenoid (DS1). Use ERL Solenoid
3. **1 p.s.** Dump Section has 20°-3&4 in series on one 50V 20A kepco or one 20V 5A CAEN p.s.
4. **2 ps's** for Corr 8 (V&I needed). Use ERL SHIM 15v 10A (limit 100W)??
5. **2 p.s.'s** for Corr 37. Using ERL CeC correctors? Need V & I. Assume we use ERL BiRa 20V 6A.

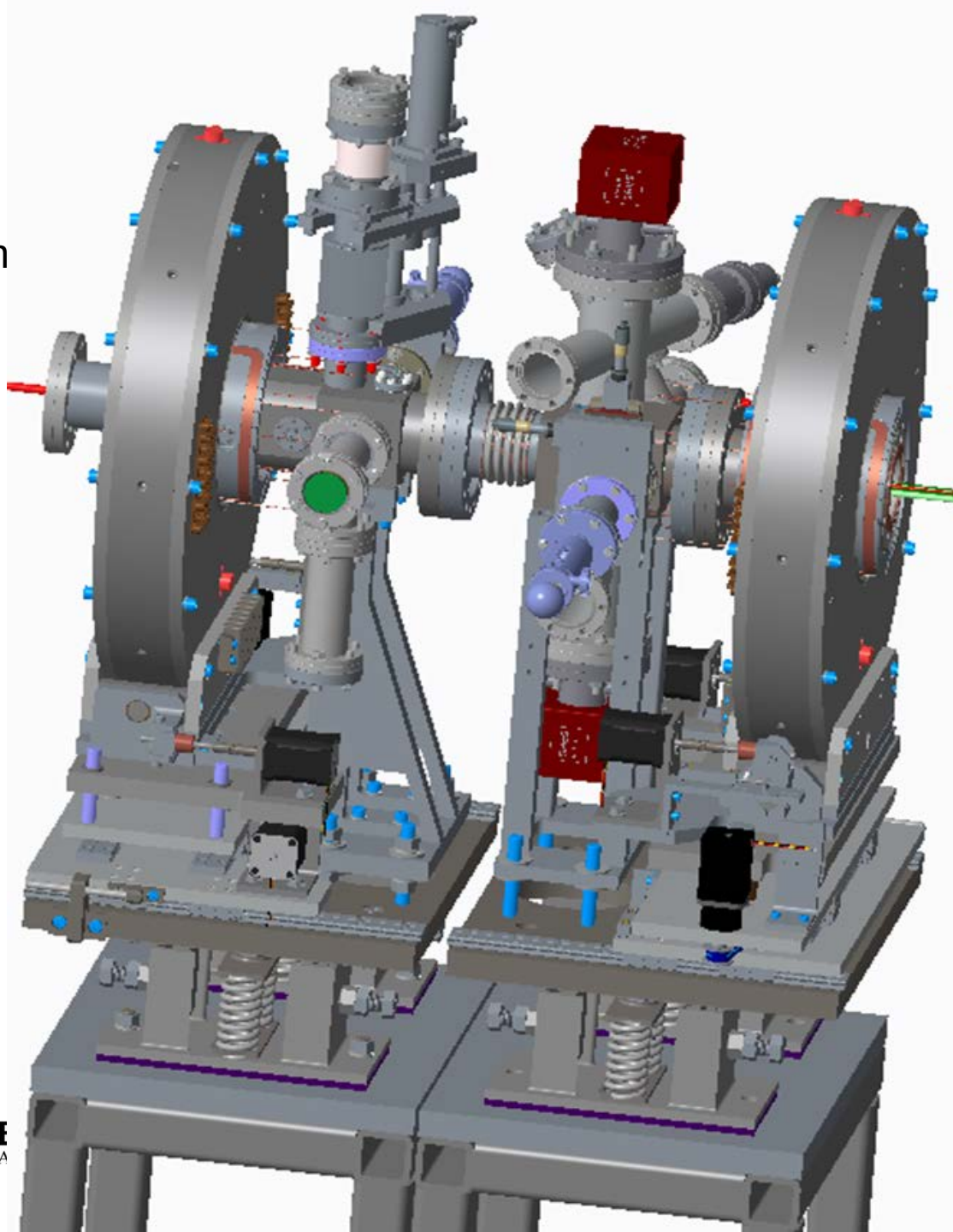
Changes from Block 11
1. Removed TS10 & TS11
2. Moved Corr D1 after GIS4
3. MergS1-S2 are the same type of Sol's as TS1-TS9
4. Added GS4 and GS5
5. Added GCS1
6. GS1-GS5 and GCS1 are all ERL type Sol's
7. Added Corr 27 - 38
8. Added Q, SQ only to Corr 25 and Corr 26
9. Added BC1
10. TS1-TS9 and MergS1-S2 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

Power Supplies DC gun Injection Section

Need to specify PS building (1002D) power, AC, cable tray requirements

1) BC1, operating current 4.2A-6A 1000ppm, will use ERL BiRa 20V 6A 1000ppm
2) Corr 24H,V. operating current 10mA-0.6A 100ppm, will purchase 2 CAEN Easy Driver 12V 1A 100ppm ps's. $2.9K each
3) Corr 25H,V, operating current = 10mA-0.6A 100ppm, will purchase 2 CAEN Easy Driver 12V 1A 100ppm ps's. $2.9K each
4) Corr 25 Q, SQ, operating current 10mA-0.72A 1000ppm, will use ERL BiRa 20V 2A 1000ppm ps's? This is a question that needs to be answered.
5) Corr 26 H,V, operating current = 10mA-0.6A 100ppm, will purchase 2 CAEN Easy Driver 12V 1A 100ppm ps's. $2.9K each
6) Corr 26 Q, SQ, operating current 10mA-0.72A 1000ppm, will use ERL BiRa 20V 2A 1000ppm ps's? This is a question that needs to be answered.
7) Corr 27H,V to Corr 30H,V, operating current 10mA-0.6A 1000ppm, will use ERL BiRa 20V 2A 1000ppm ps's? This is a question that needs to be answered.
8) GIS1-GIS2, operating current = 8A-10A 100ppm, will purchase 2 CAEN Easy Driver 20V 10A 100ppm bipolar ps's. $3.25K each + 1 spare. This needs confirmation before I write the order. The ERL SHIM ps's cannot be used here because they don't have enough voltage. The ERL kepco ps's cannot be used here because they are 20A 100ppm, not 10A 100ppm. There are no other ERL ps's that match these magnets.
9) GIS3-GIS5, operating current = 6A-8A 100ppm, will purchase 2 CAEN FAST-PS 40V 10A 100ppm bipolar ps's. $5.148K each + 1 spare. This needs confirmation before I write the order. The ERL SHIM ps's cannot be used here because they don't have enough voltage. The ERL kepco ps's cannot be used here because they are 20A 100ppm, not 10A 100ppm. There are no other ERL ps's that match these magnets.
10) ComD1, operating current = 20A 1000ppm, We can use ERL kepco 50V 20A bipolar ps for this test but I don't like being limited to 20A when the operating current is 20A. Should I consider purchasing a CAEN FAST-PS bipolar ps 20V 30A? It will probably cost about $7.8K. This is a question that needs to be answered.
11) Q5 and Q6, I think we are using ERL Quads here. What is operating current? This is a question that needs to be answered. Waiting on Dmitry?

1. Solenoid drawings complete, checked, requisition
2. Corrector drawings complete, (Bakeout)
3. Mirror assembly complete, checkin
4. Vacuum chambers (3), checking
5. Profile monitor design complete
6. Order ion pumps, gauges, NEG pumps
7. Profile Monitor near complete, checking
8. Support Stands modeled



5/25/16 Gun to Booster Transport Line Meeting Minutes: A. Fedotov, D. Kayran, S. Bellavia, M. Mapes, T. Rao, B. Sheehy, J. Tuozzolo, Z. Zhao, B. Sheehy, J. Halinski, T. Arno, J.C. Brutus, K. Hamdi, J. Fite, D. Gassner

Status of component drawings was reviewed:

- All the chamber drawings have been checked by Sumanta. John and Sumanta will work on getting them appoved. They have been given to KJL for quotation.
- Solenoid magnets drawings complete and approved.
- Corrector magnets complete. Being checked (Tony)
- Mirror system drawings complete. Being checked (Sumanta)
- Vibration Isolators are incorporated to the beam line brackets including the solenoid magnets.
- Design of the positioning mounts are complete (x and y positioning transverse to beam and skew on both x and y axis)
- Layout for profile monitor-camera assembly has started.

It was agreed to proceed with YAG crystal mounting design shown in the slide with 3^{o} angle.

Extended discussion on laser mirrors stainless steel and copper. The following was agreed to:

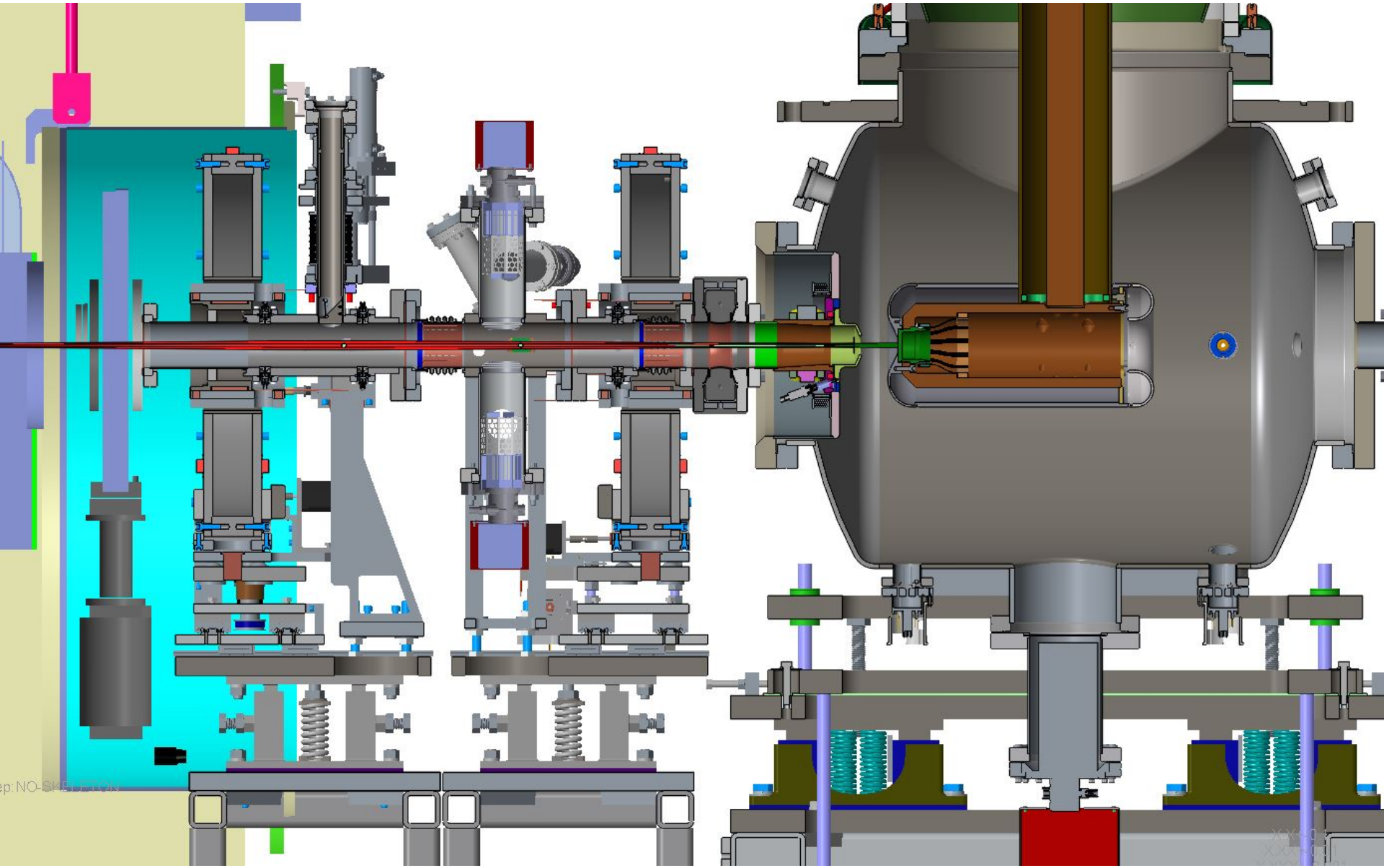
- Fabricate 3 stainless steel 440C mirrors that will be polished by Cabot Microelectronics. Sumanta is checking where protective silver coating would be done, Cabot/LT-ULTRA.
- Fabricate 3 copper mirrors that will be polished and silver coated by LT-ULTRA

Cabot Microelectronics is also making profile monitor mirror with the specification same as the laser mirror w/o any coating. There was agreement in the meeting that if the bakeout is done without incident that the copper mirror should not be damaged. There is time in the schedule to do some bakeout testing.

Discussion on the view ports. Zhi stated that the vendor needs to be aware of the laser intensity and Zhi will provide specifications for that will transit through the window. As far as clear aperture is concerned, Spectrum Thin Films quotation works fine. Zhi wants to check the following with the vendor.

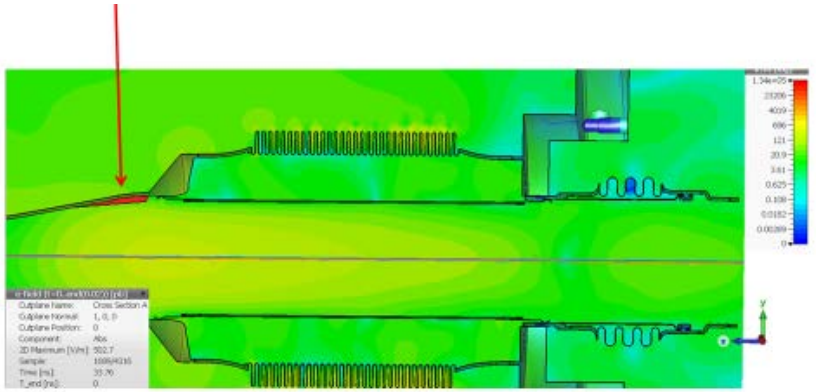
1. what's the highest bake temperature?
2. what could be the best tolerance of vacuum level?
3. what's the average and peak power damage threshold?
4. AR coating specification for s- and p- light?

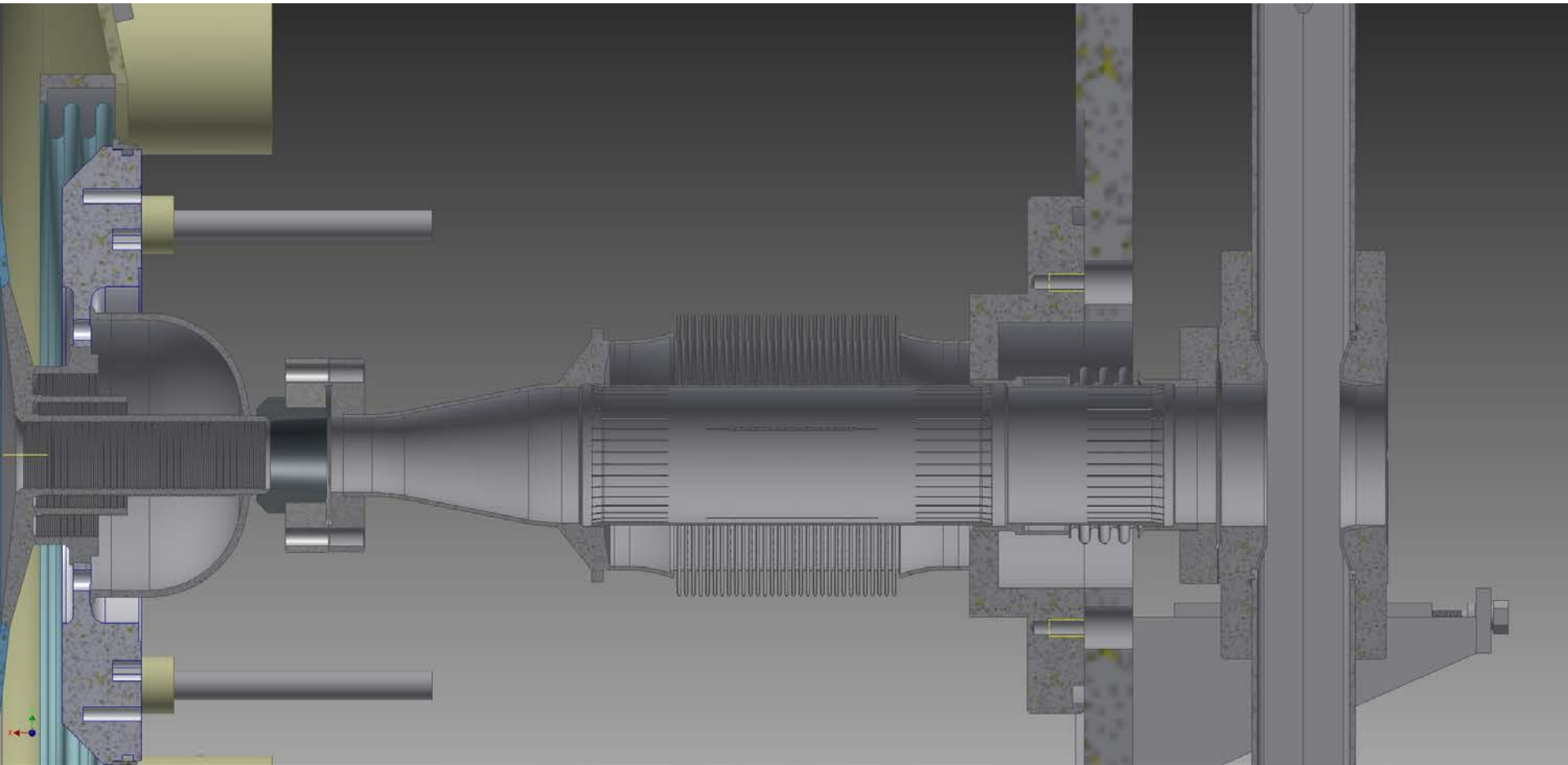
Additional discussion on the windows and mirrors for the laser transport (under rough vacuum) from the laser building to the tunnel optics table. Zhi stated that the requirements for those windows are less stringent. Steve noted that the commercially available vacuum mirror mounts were designed for 1" mirrors. It was agreed that 2" mirrors provide easier alignment and they should be used for the transport system. Steve will contact the vendor to find out the cost for mounting the larger mirrors in larger chambers.



Booster Cavity

- Upstream end analysis complete





RF Component Status

2.1 GHz Cavity (offset on beamline): Cavity and wave guide transition ordered.

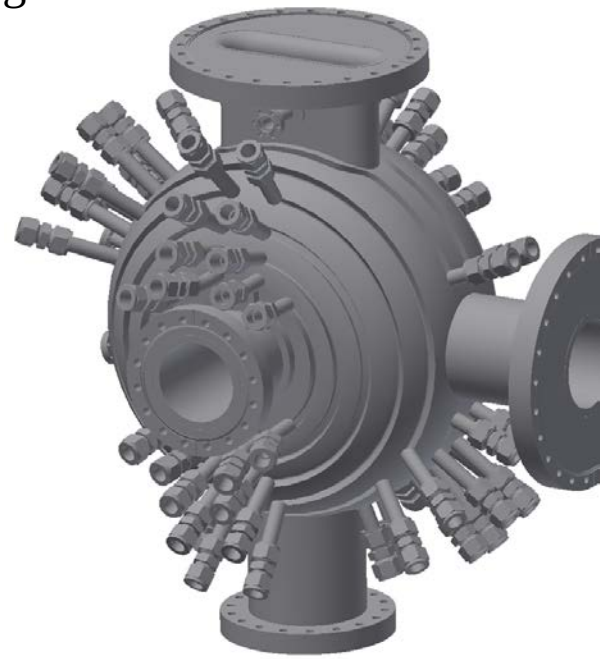
- 1002B new PA: delivery July 2016
- Tuner system w/drive, design complete, components being ordered
- Wave guide design near complete – being ordered, stand design underway

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

- 1002B use Booster Cavity PA for commissioning (2017 ops - retune CeC 500 MHz)
- tuner system w/drive - design underway
- wave guide (Booster Cavity at wall to coax transition) to be designed.
- RF window transition, stand to be designed

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

ACS interlocks, MPS, water, cables



Cognizant Engineers

1. Cathode system: Liaw, Tuozzolo, Hamdi,
2. Laser System: Zhao, Sheehy, Bellavia
3. DC Gun: Liaw, Halinski Cornell – Karl Smolenski
4. DC Gun HV power supply: Bruno, Sandberg, Costanzo
5. Magnet Power Supplies: Bruno
6. GtB Transport Line: Nayak, Halinski
7. Magnets: Mahler
8. Beam Diagnostics: Miller, Gassner, Weiss
9. Vacuum: Mapes, Steszyn
10. Beam Dump: Fite, Corbin
11. Warm RF Cavities: Zaltsman, Smith, Brutus, DeSanto
12. Controls: Theisen, Jamilkowski, Costanzo MPS: Selenski, Altinbas
13. Civil construction: Phillips, Folz
14. Commissioning: Kayran, Hammons

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