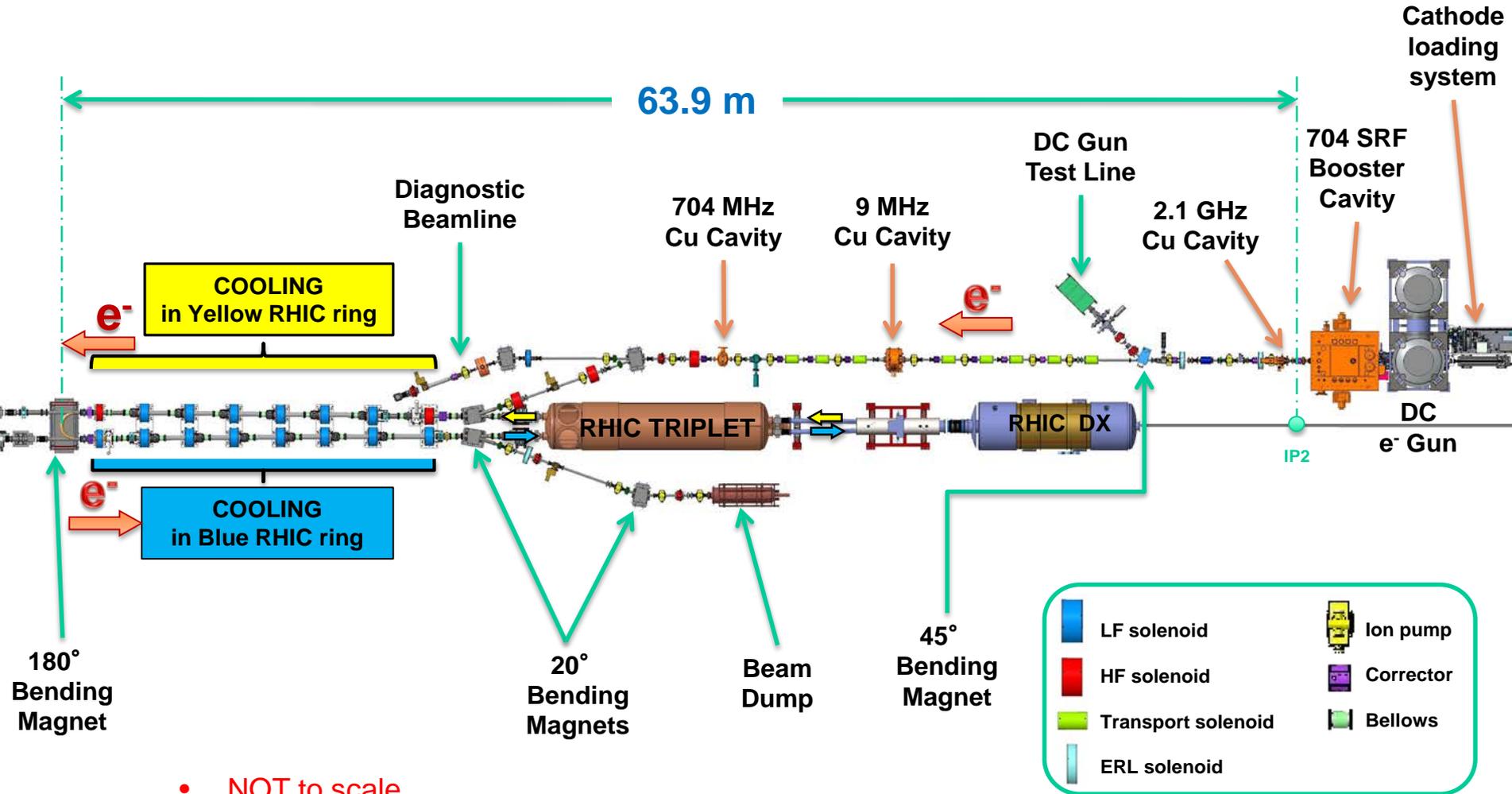
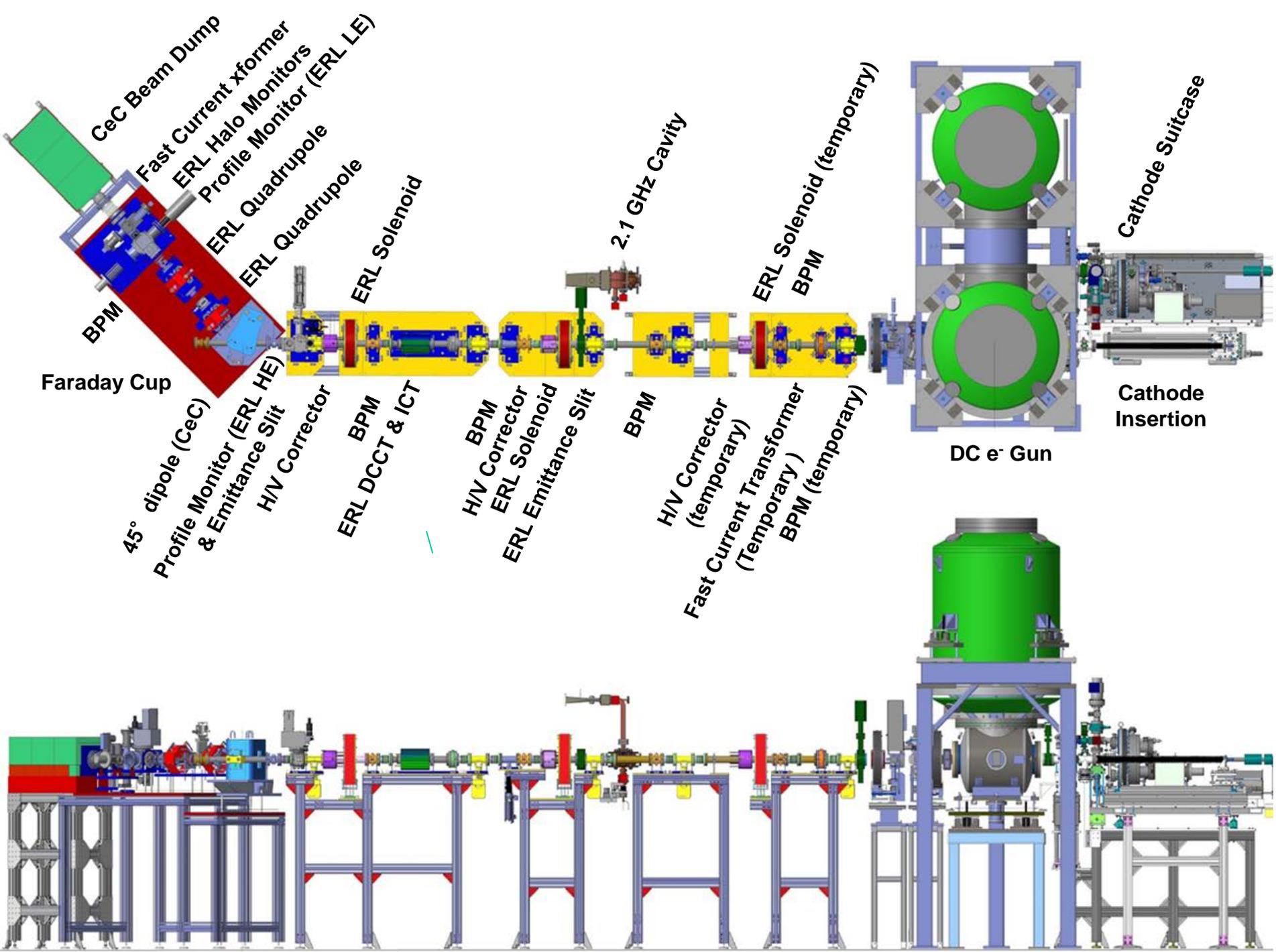


LEReC layout*

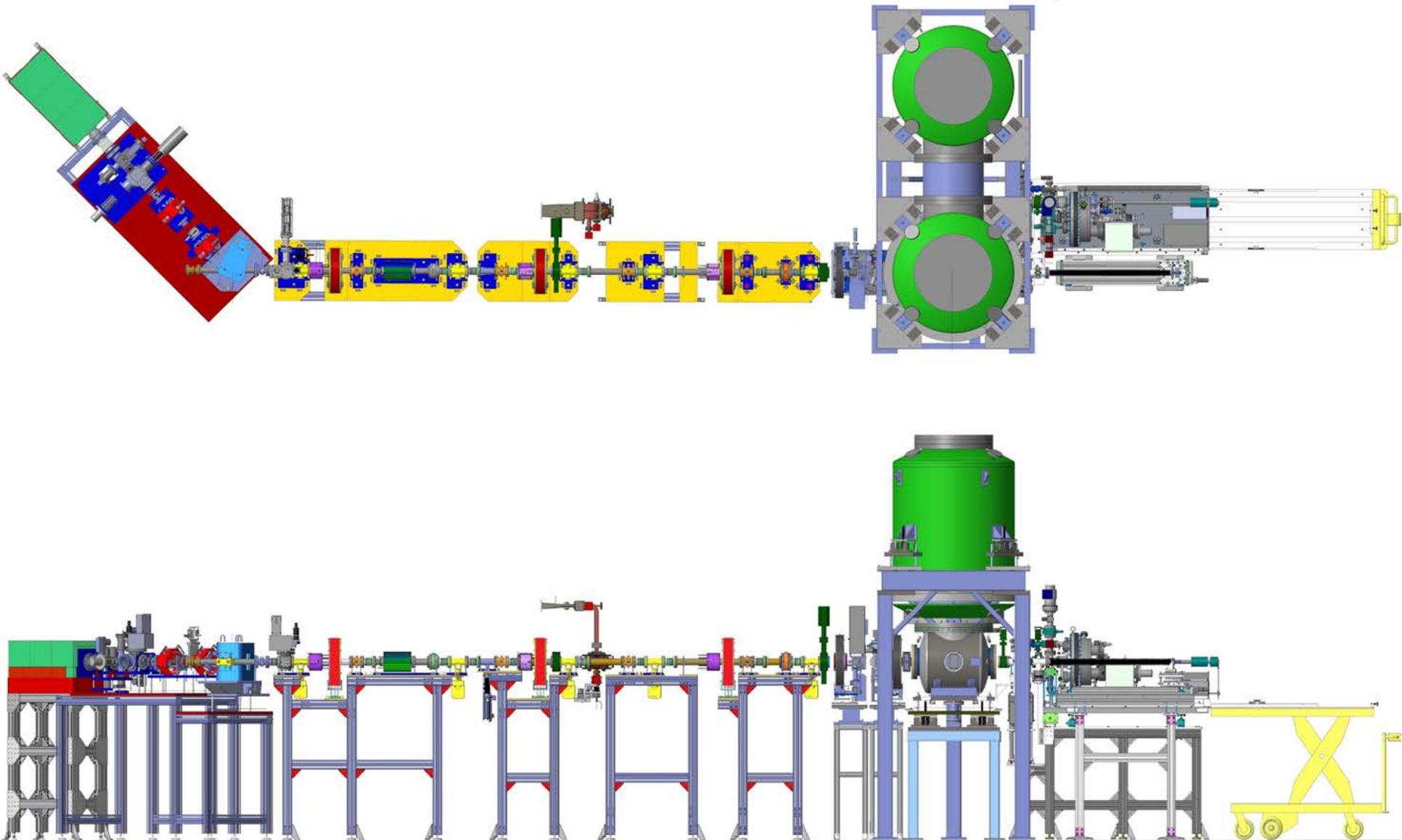


• NOT to scale
Karim 9 14 16

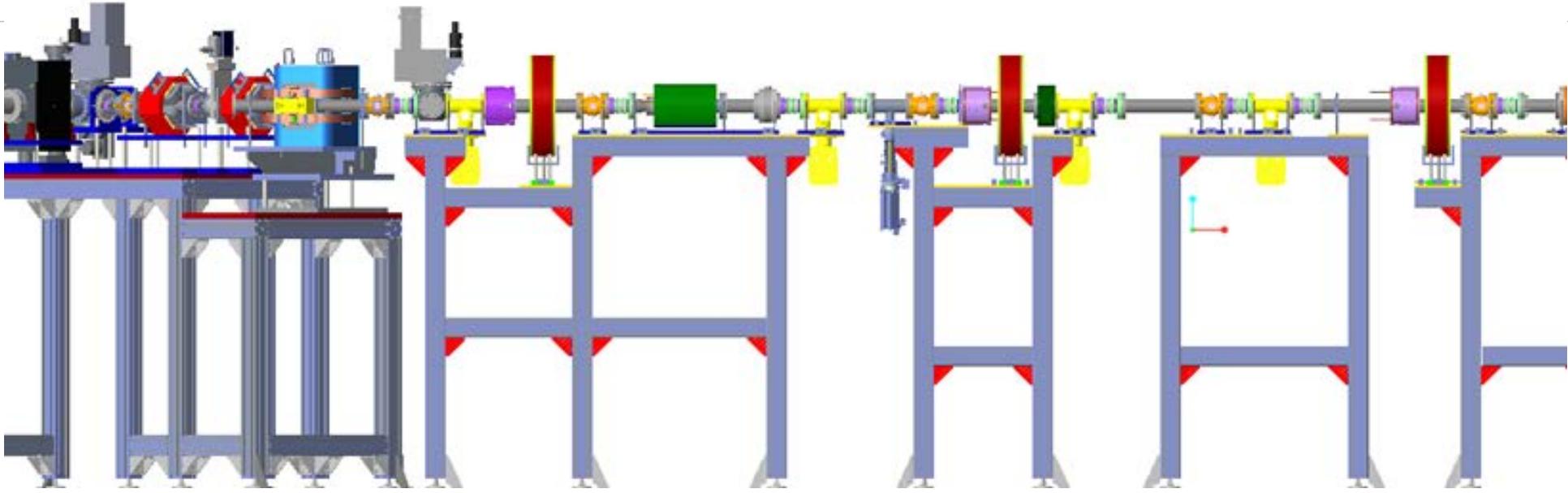
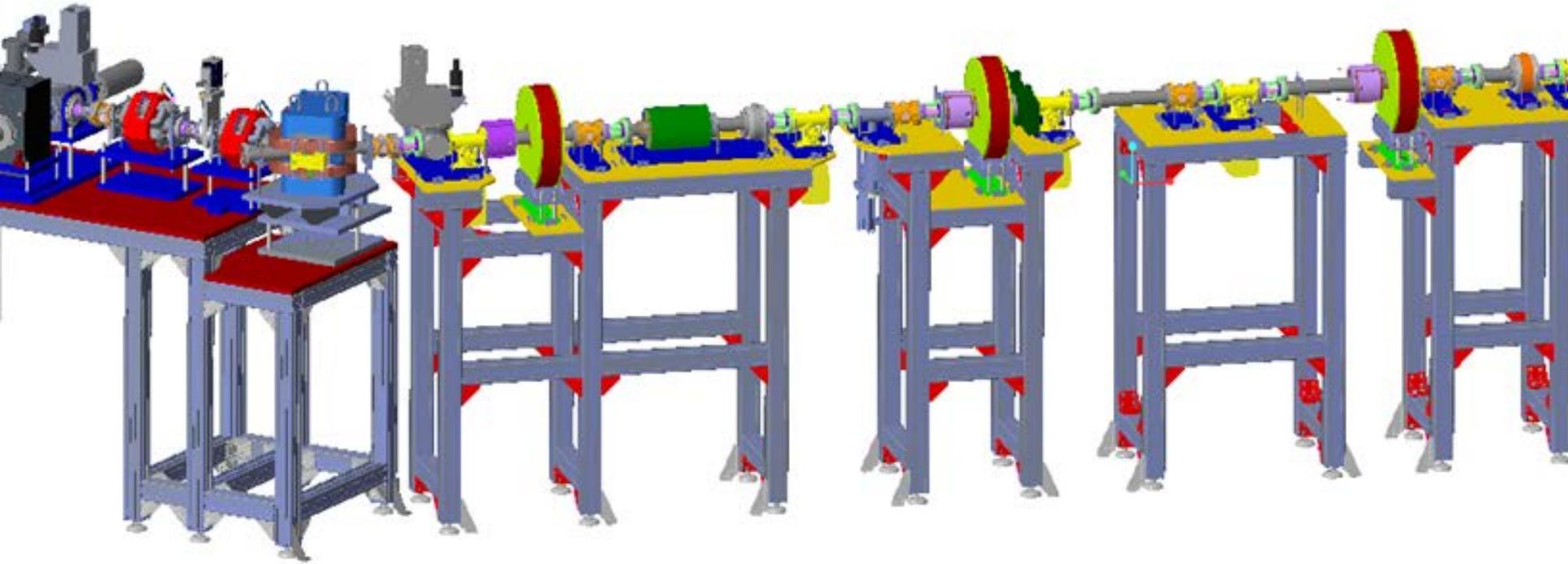




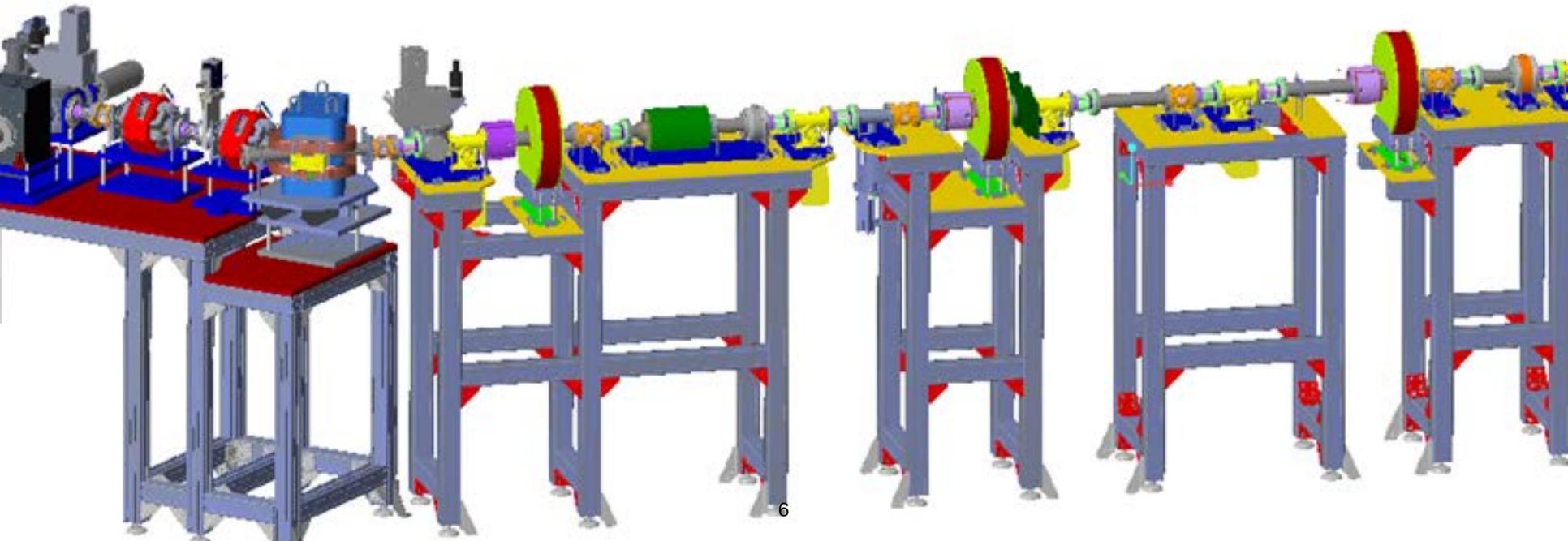
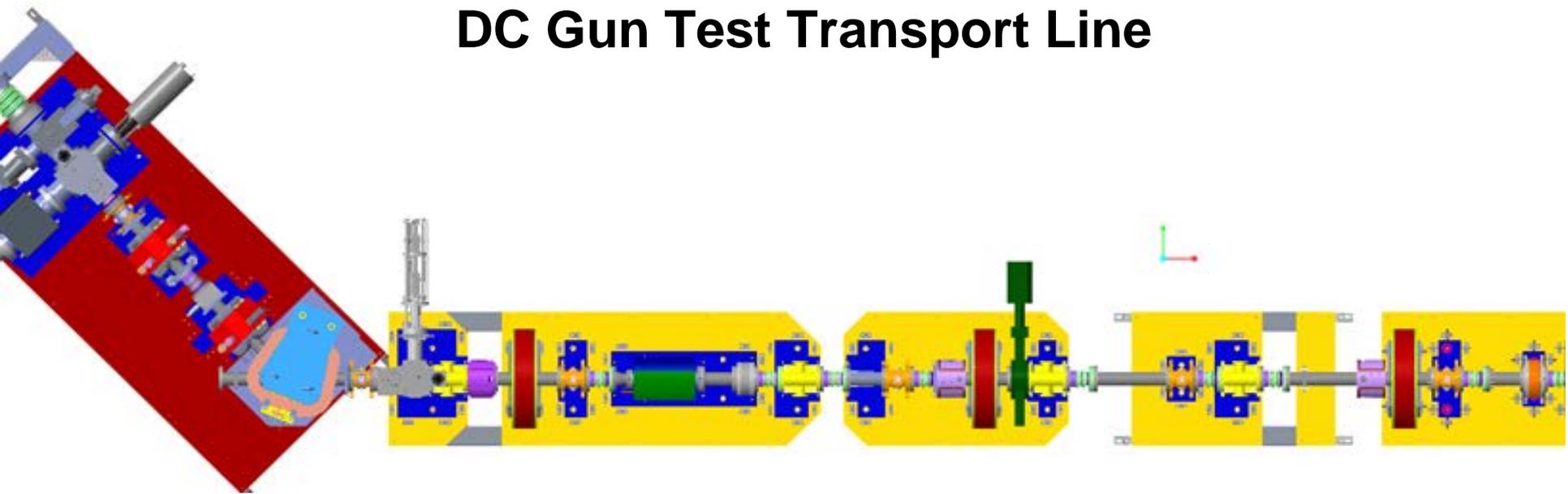
LEReC DC Gun Test Section 2016 (10 6 2016)



DC Gun Test Transport Line



DC Gun Test Transport Line



Cost and Schedule Review 11/16/2016

Production/Fabrication/Installation schedules complete Final Review before sending to DOE

- Complete update of schedule underway now.
 - a) **Complete to end of project**
 - b) **Completed Sept 28, meeting with system leaders**
 - c) **Preliminary discussion with G. Capps**
 - d) 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
 - c) Goal to complete October 15
 - d) Send to DOE November 1



Critical Dates

- **DC Gun conditioning at Cornell underway 10/3/16**
- DC Gun Arrival at BNL **10/19/16**
- **LEReC Cost and Schedule update 10/3/2016**
- **DC Gun conditioning underway 11/2/2016**
- DOE Review 11/16/2016

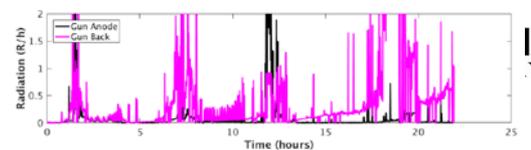
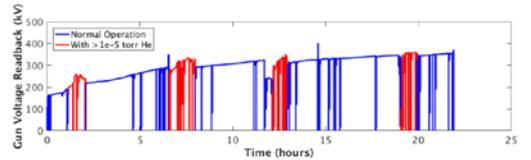
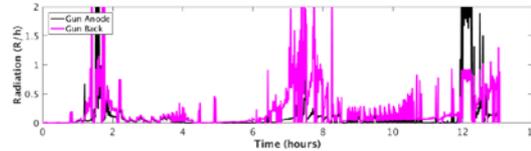
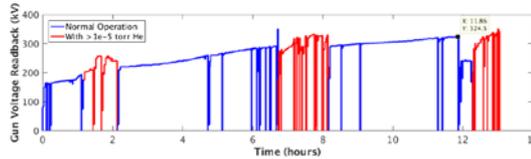
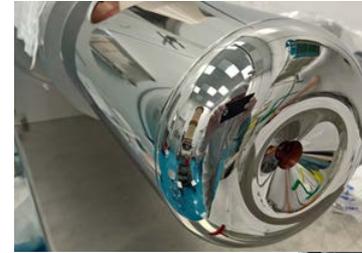
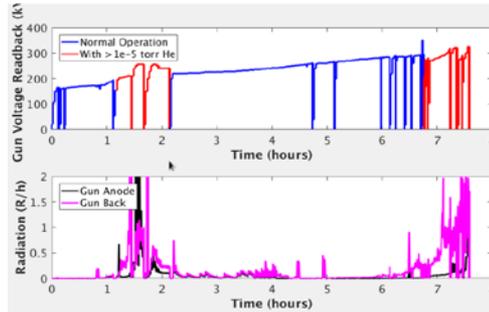
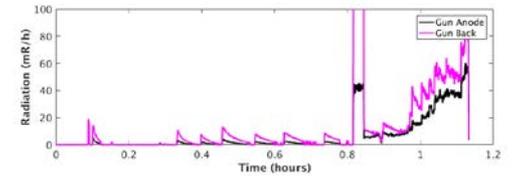
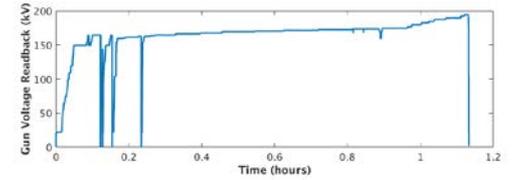
DOE Review [Photograph](#) Wishlist – 11/17/2016

- a. DC Gun installed, conditioning
- b. DC Gun line stands and beam dump installed
- c. 45° magnet, solenoids, quads, halo monitor, LE profile monitor
- d. *Cathode transfer system in place*
- e. Laser optics tables installed in tunnel, **1002F back in place**
- f. 1002D: **Power Supplies** and Diagnostic Electronics installed
- g. *Cable trays installed, pulling cables*



DC Gun at Cornell

- Tested power supply to 600kV 9/29/16
- Began conditioning DC gun 165kV 10/2/16
- 10/3 220 kV, 10/4 280kV (325 w/He)
- 10/5 324kV (334), 10/6 354kV (359) >50 hrs.
- Condition until Monday evening, Tuesday vent SF6

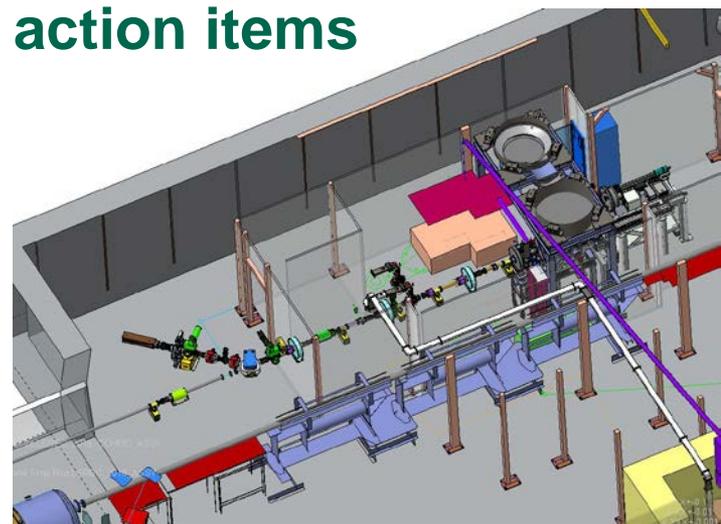


DC Gun Installation Preparation at BNL

Sending technician team next week for disassembly and packing

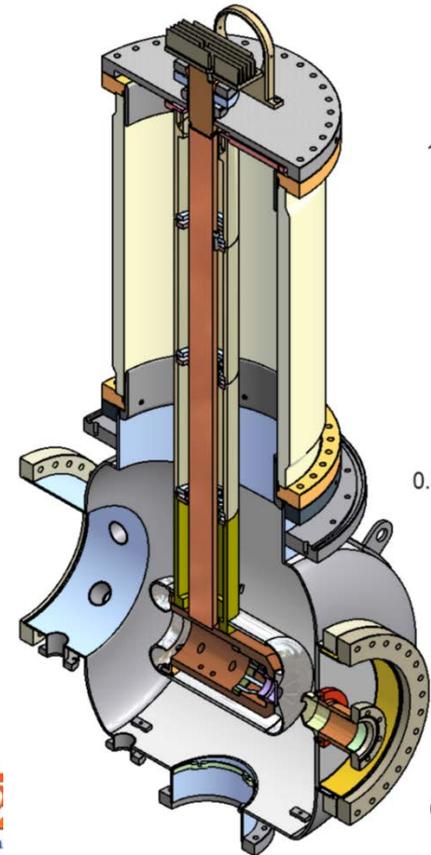
Before DC Gun arrival at 02:00:

- **Survey beam line and stand locations on 02:00 floor**
- Prepare 912 cleanroom for DC gun arrival
- **Remove yellow walkway**
- **Install power supply AC power**
- Install water connections (underway)
- 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**
- **SF6 handling OPM**
- ASSRC walk through before conditioning



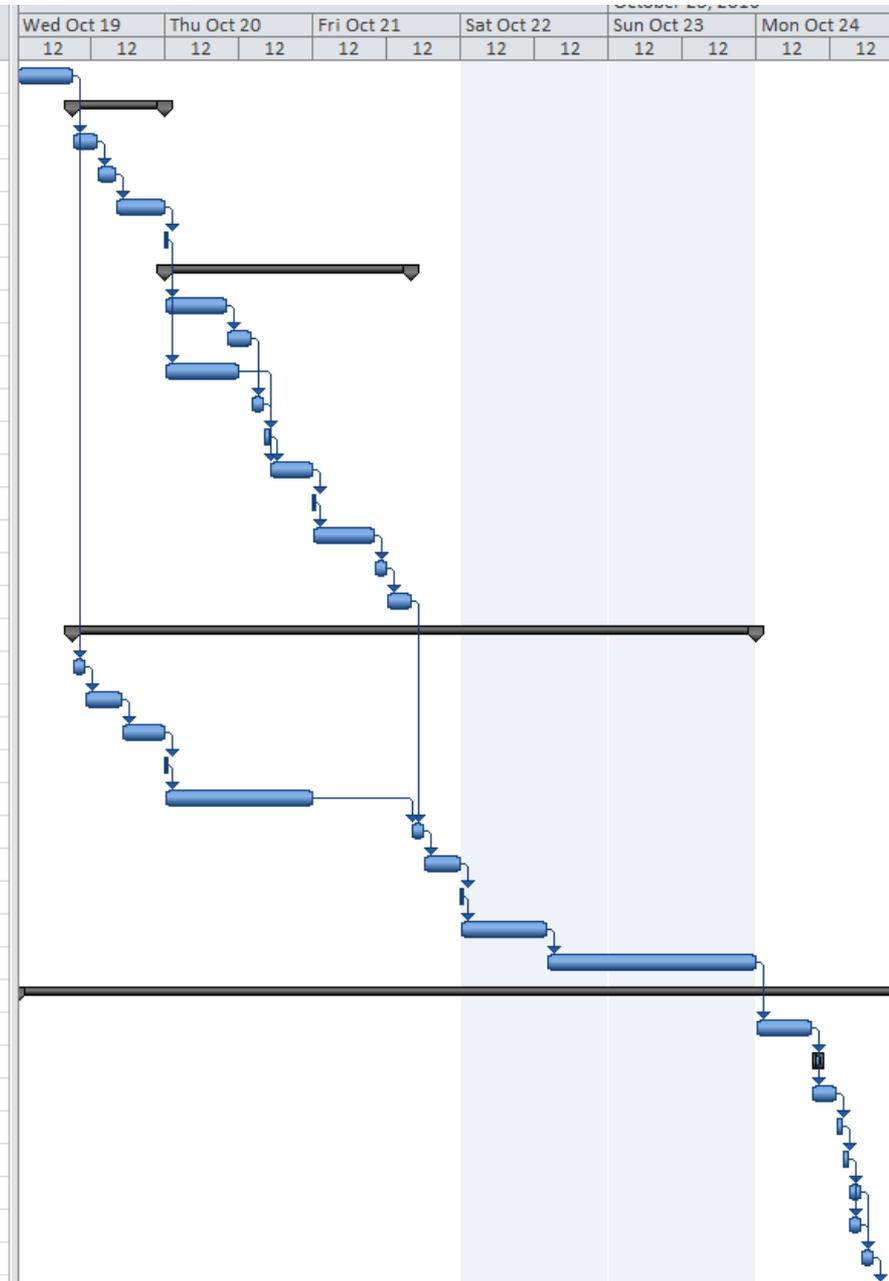
DC Gun Assembly at BNL

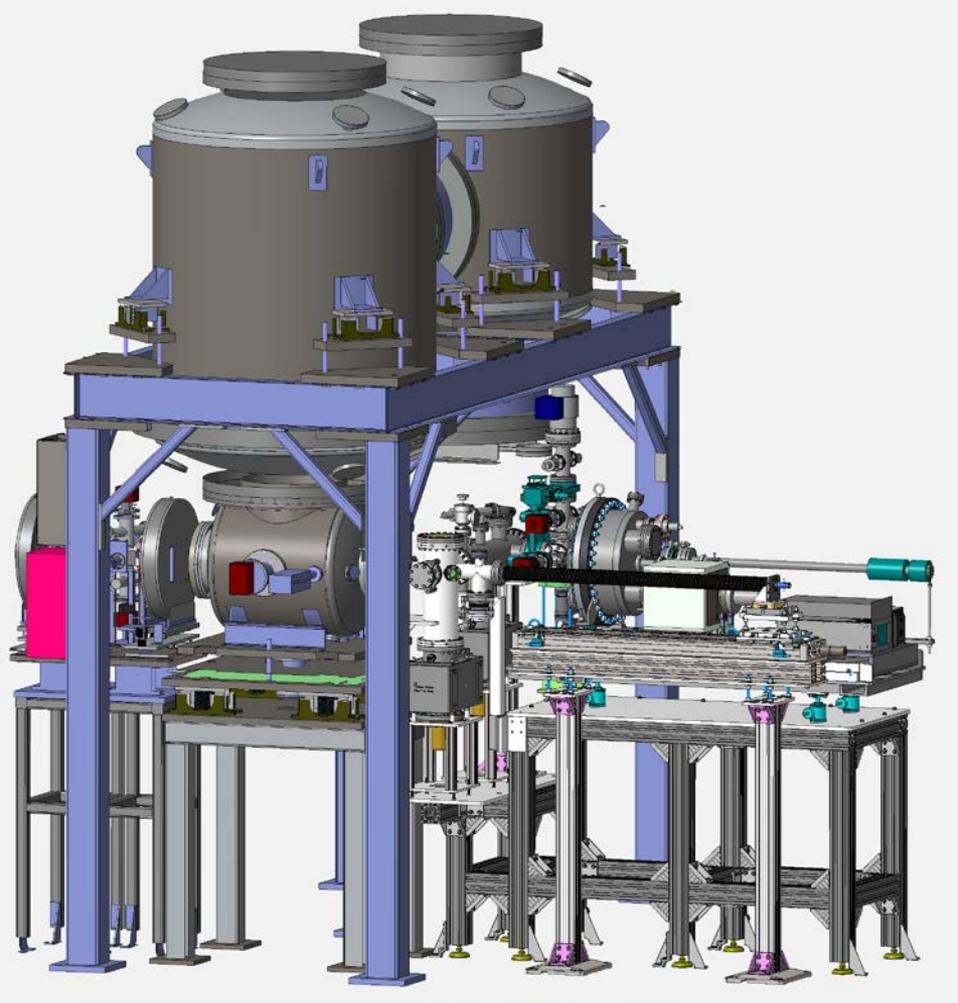
- Off-load DC gun at 912 clean room area (forklift). **(Karl S.) 10/19/16**
- Clean room prep DC Gun (arrive from Cornell cleaned and bagged).
- Move into 912 cleanroom.
- Install top flange (wireseal) **(Karl S. & Seberg, Gill)**
- Install cathode support assembly **(Karl S. & Seberg)**
- Remove cathode shipping fixture **(Karl S. & Seberg)**
- Survey and align cathode, install end valves **(Karl S. & Karl, Seberg, Gill)**
- Close up vacuum vessel. **(Karl S. & Seberg, Gill)**
- Leak check **10/21/16**
- Vent vessel, install cathode shipping fixture, loosen cathode support assembly **(Karl S. & Seberg, Gill)**
- Slowly ship to 02:00 (Preliminary vibration measurements) **10/24/16**
- Crane to final location, bolt down, and survey **(Karl S. & Karl, Seberg)**
- Install cleanroom, remove fixture, survey cathode **(Karl, Seberg, Gill)**
- Seal, leak check & bake-out **11/4/2016 (Gill)**
- Power supply assembled **11/10/2016 (Badea, Bannon)**
- Leak check PS, SF6 Charged **11/11/2016 (Liaw, Gill, Carlson)**
- Conditioning **11/12/2016 (Bruno, Mi, Costanzo, Gu)**



DC Gun Assembly at BNL

Project start	1 hr	Wed 10/19/16	Wed 10/19/16	
Gun Arrival and Prep	1.92 days	Wed 10/19/16	Thu 10/20/16	
Off load DC Gun and Power Supply	4 hrs	Wed 10/19/16	Wed 10/19/16	1
prepare DC Gun for cleanroom	3 hrs	Wed 10/19/16	Wed 10/19/16	3
Move into cleanroom, align with crane	4 hrs	Wed 10/19/16	Wed 10/19/16	4
Clean room overnight clean out	12 hrs	Wed 10/19/16	Thu 10/20/16	5
DC Gun Preparation	2.67 days	Thu 10/20/16	Fri 10/21/16	
Install top flange and blank flange	2 hrs	Thu 10/20/16	Thu 10/20/16	6
Pump down, leak check, vent	4 hrs	Thu 10/20/16	Thu 10/20/16	8
Survey chamber	4 hrs	Thu 10/20/16	Thu 10/20/16	6
Install cathode stark	2 hrs	Thu 10/20/16	Thu 10/20/16	9
Connect cathode	1 hr	Thu 10/20/16	Thu 10/20/16	11
Survey cathode	4 hrs	Thu 10/20/16	Thu 10/20/16	10,12
Overnight	11 hrs	Thu 10/20/16	Fri 10/21/16	13
Install cathode shipping fixture	2 hrs	Fri 10/21/16	Fri 10/21/16	14
Bag for transport	2 hrs	Fri 10/21/16	Fri 10/21/16	15
Ship gun to 0200	4 hrs	Fri 10/21/16	Fri 10/21/16	16
Install Gun 0200 and prep cleanroom	9.92 days	Wed 10/19/16	Mon 10/24/16	
Off load DC Gun Stand	2 hrs	Wed 10/19/16	Wed 10/19/16	1
Ship stand to 0200	6 hrs	Wed 10/19/16	Wed 10/19/16	19
Rig to DC gun position	3 hrs	Wed 10/19/16	Wed 10/19/16	20
Survey stand into position	1 day	Wed 10/19/16	Thu 10/20/16	21
Red head stand to floor	1 day	Thu 10/20/16	Thu 10/20/16	22
Move gun to stand and install on stand	2 hrs	Fri 10/21/16	Fri 10/21/16	17,23
Survey gun chamber to operating position	4 hrs	Fri 10/21/16	Fri 10/21/16	24
Overnight	8 hrs	Fri 10/21/16	Sat 10/22/16	25
Install clean room, clean and install survey tools	8 hrs	Sat 10/22/16	Sat 10/22/16	26
(let cleanroom run over weekend)	42 hrs	Sat 10/22/16	Mon 10/24/16	27
Remove shipping fixture and leak check	11.92 days	Wed 10/19/16	Tue 10/25/16	
remove bagging	1 hr	Mon 10/24/16	Mon 10/24/16	28
remove rear support frame	2 hrs	Mon 10/24/16	Mon 10/24/16	30
Survey cathode position	4 hrs	Mon 10/24/16	Mon 10/24/16	30
install processing puck by hand	1 hr	Mon 10/24/16	Mon 10/24/16	32
Install rear electrode cover	1 hr	Mon 10/24/16	Mon 10/24/16	33
Install rear flange/manual & RF gate valves	2 hrs	Mon 10/24/16	Mon 10/24/16	34
Install bake out turbo pump system	2 hrs	Mon 10/24/16	Mon 10/24/16	34
Pump down, leak check	2 hrs	Mon 10/24/16	Mon 10/24/16	36,35





DC Gun Vacuum **system ready October 20**

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

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

Laser System Vacuum

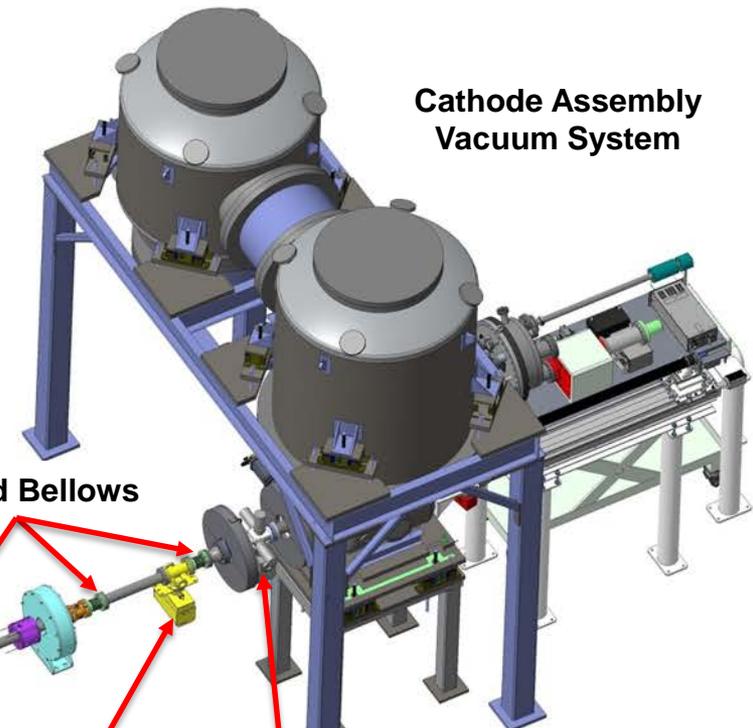
- **2 Thermocouple gauges**



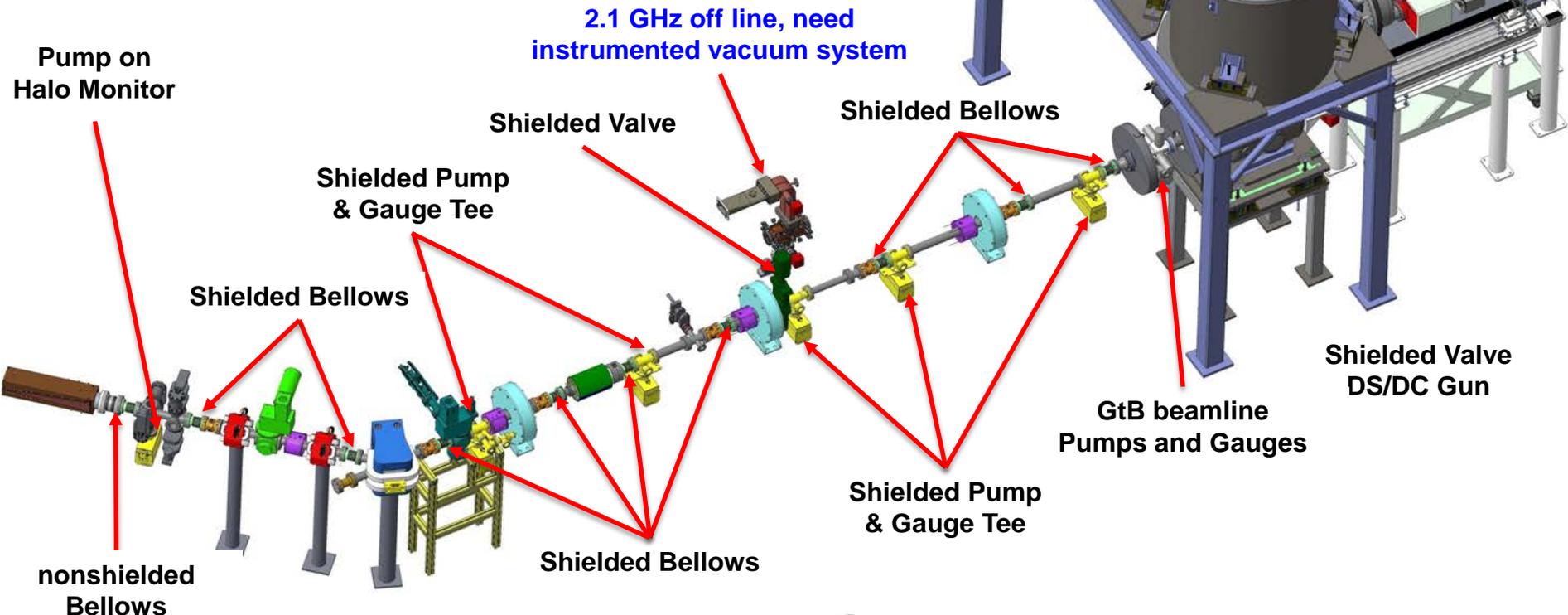
Vacuum Components

- P&ID including DC gun and cathode carts
- Shielded bellows ordered (more added)
- “Standard” shielded pump tee ordered

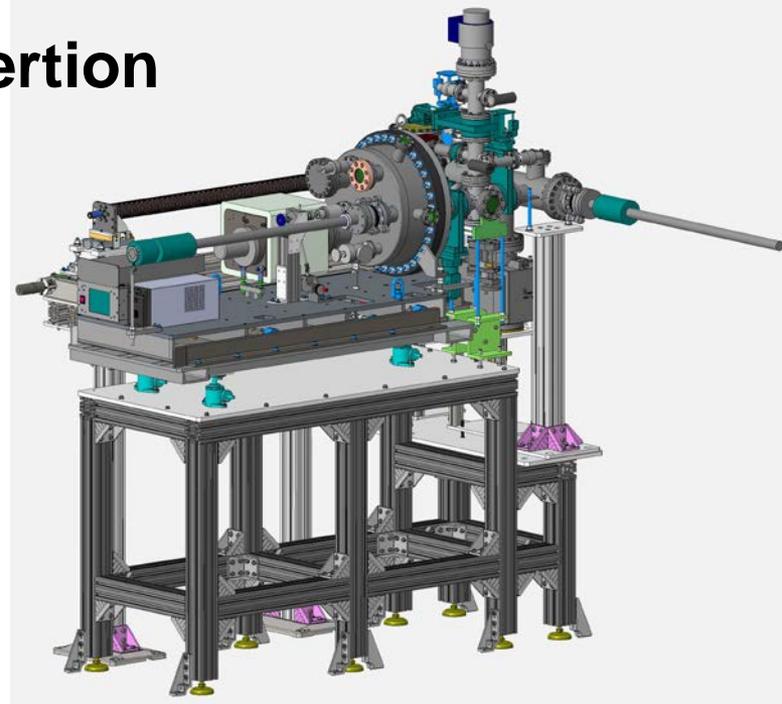
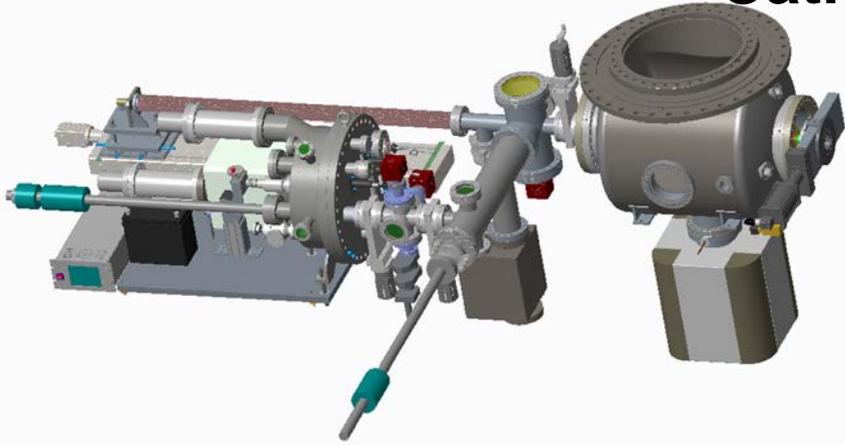
5/12/2016 Layout



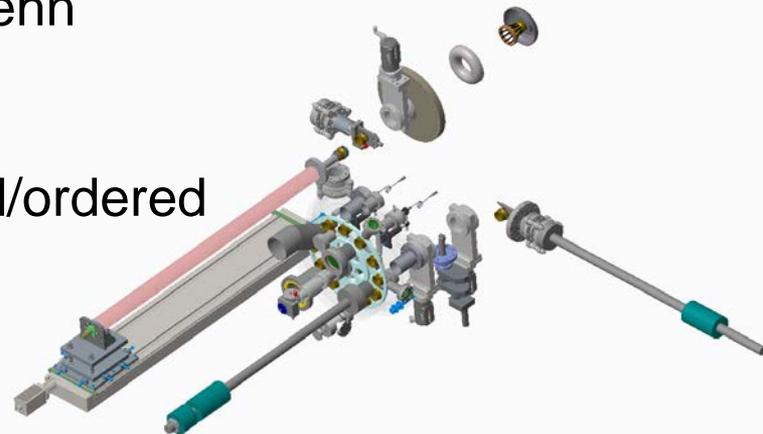
Cathode Assembly Vacuum System



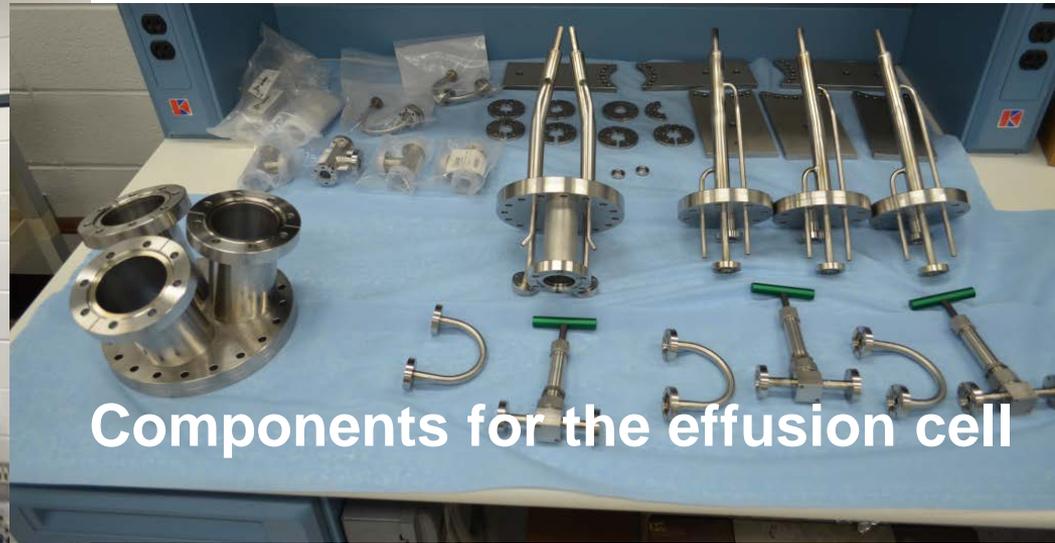
Cathode Insertion



- Transport system vac. comp. in shops
- Insertion system vac. comp. in shops
- **Transfer manipulators ordered/on hand**
- **Cathode material in hand, machining ordered**
- **Windows, pumps, gauges ordered/in hand**
- 4 Vacuum ASME burst disks (2 on DC Gun, 1 upstream, 1 downstream)
- **Stand drawings complete**, parts list to D. Lehn
- **Long bellows and stage in house**
- **Transport Cart ordered**
- Over the road transport frame to be designed/ordered



Cathode R&D Tasks and Status



Components for the effusion cell

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 alkali 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.



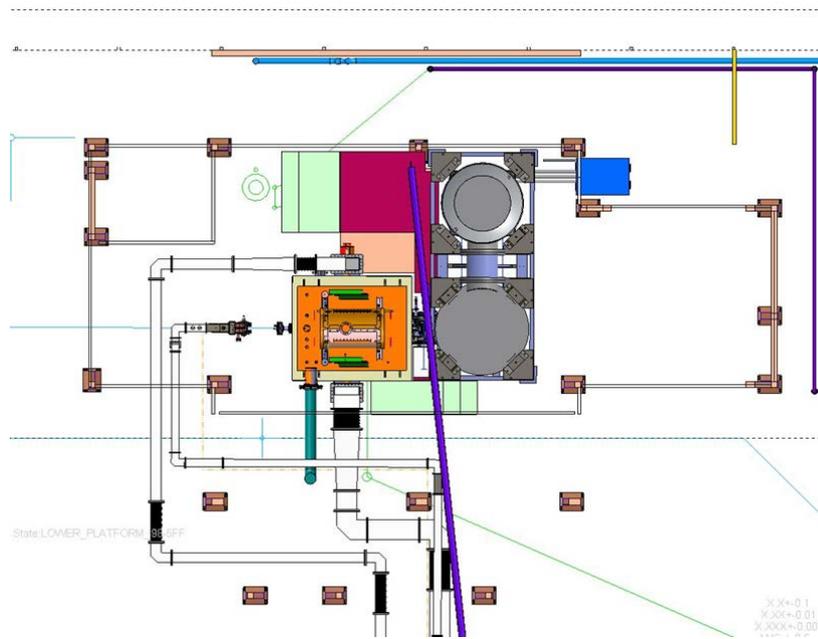
EP&S Support

- Work Platform, **Rexroth and floor plate ordered** (Dave)
- **Power for DC Gun PS & Cleanroom fans & lights (PK, Dennis)**
- 1002D power and cable tray installation **underway** (Don, PK, Dave)
- Tunnel cable tray layout (Dave, Bob)
- Tunnel penetration for laser transport & RF coax **underway** (Dave)
- **Custom shield blocks for laser optics table ordered** (Dave, Bob, Zhi)
- 1002F Vibration mitigation **near complete**
- 1002B additional RFPA, install wave guide and coax



Work Platform

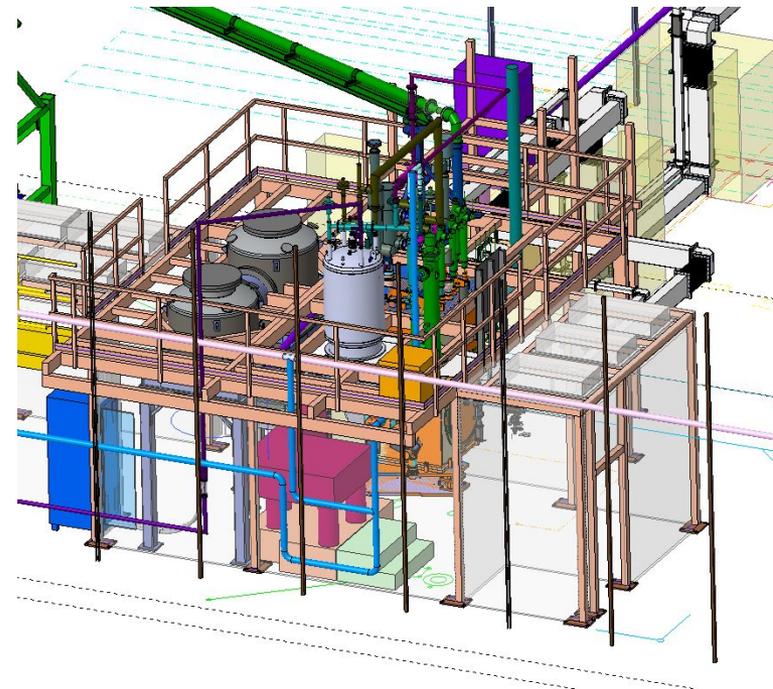
- Dave/Bob completed design, Rexroth ordered.
- Rexroth vendor providing estimate for clean room equipment.
- Dave is investigating small filter unit to be built over the GtB section.
- Bob: design “standard” laser vacuum transport tubes
- Bob: layout for order 704 warm cavity coax
- Bob: Tunnel cable tray layouts
- Karim: RF Cavity Location layout for water system



HAVEN
LABORATORY

XJXX-0.1
XJXX-0.01
XJXX-0.001

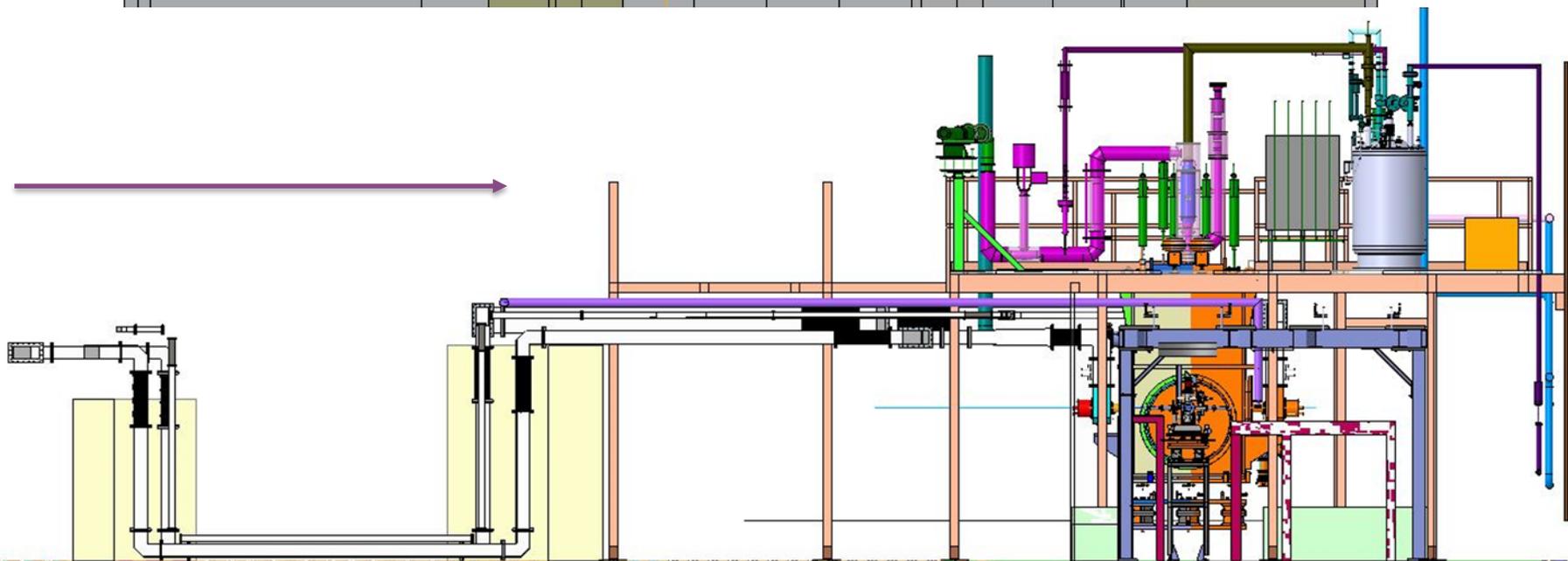
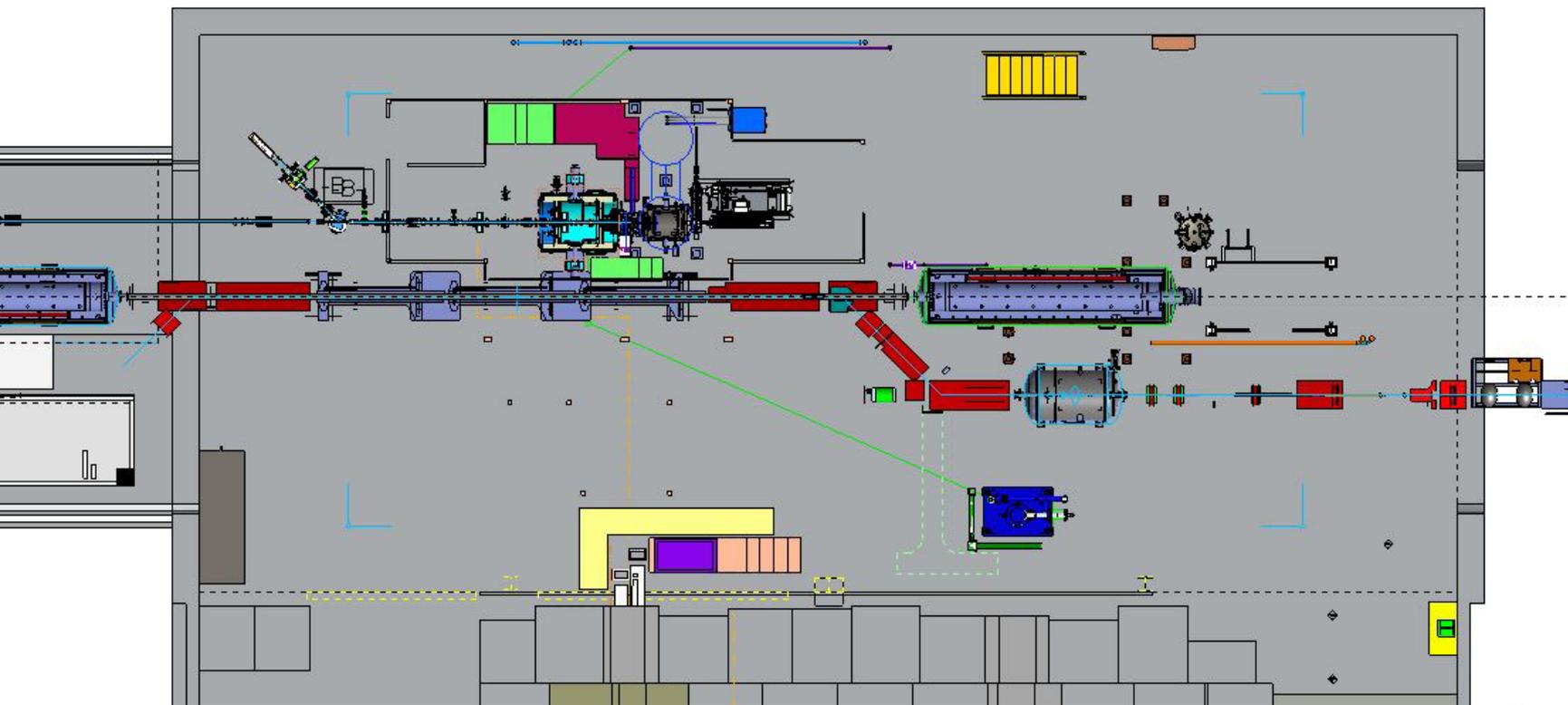
18



1002F

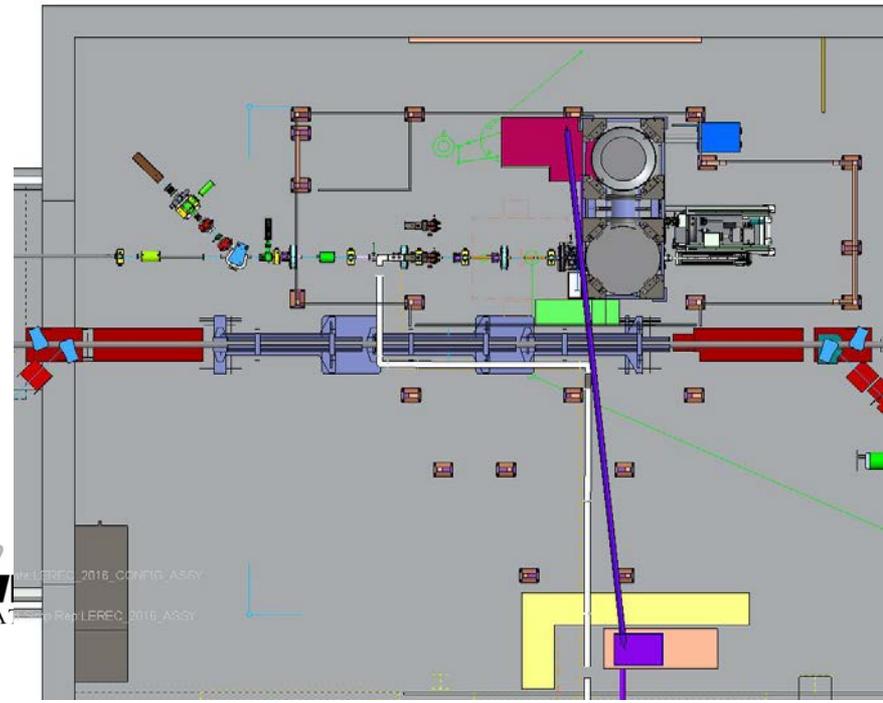
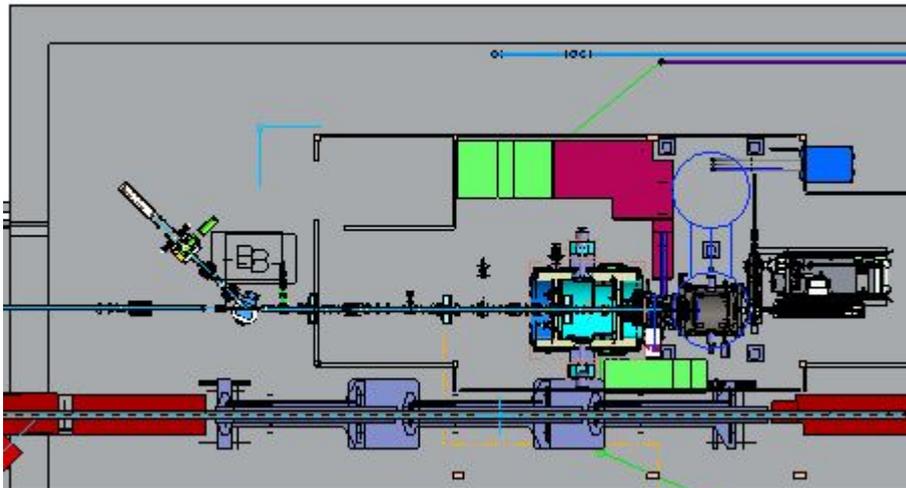
- Laser building back in place
- Electrical work underway
- Ready 10/14/16



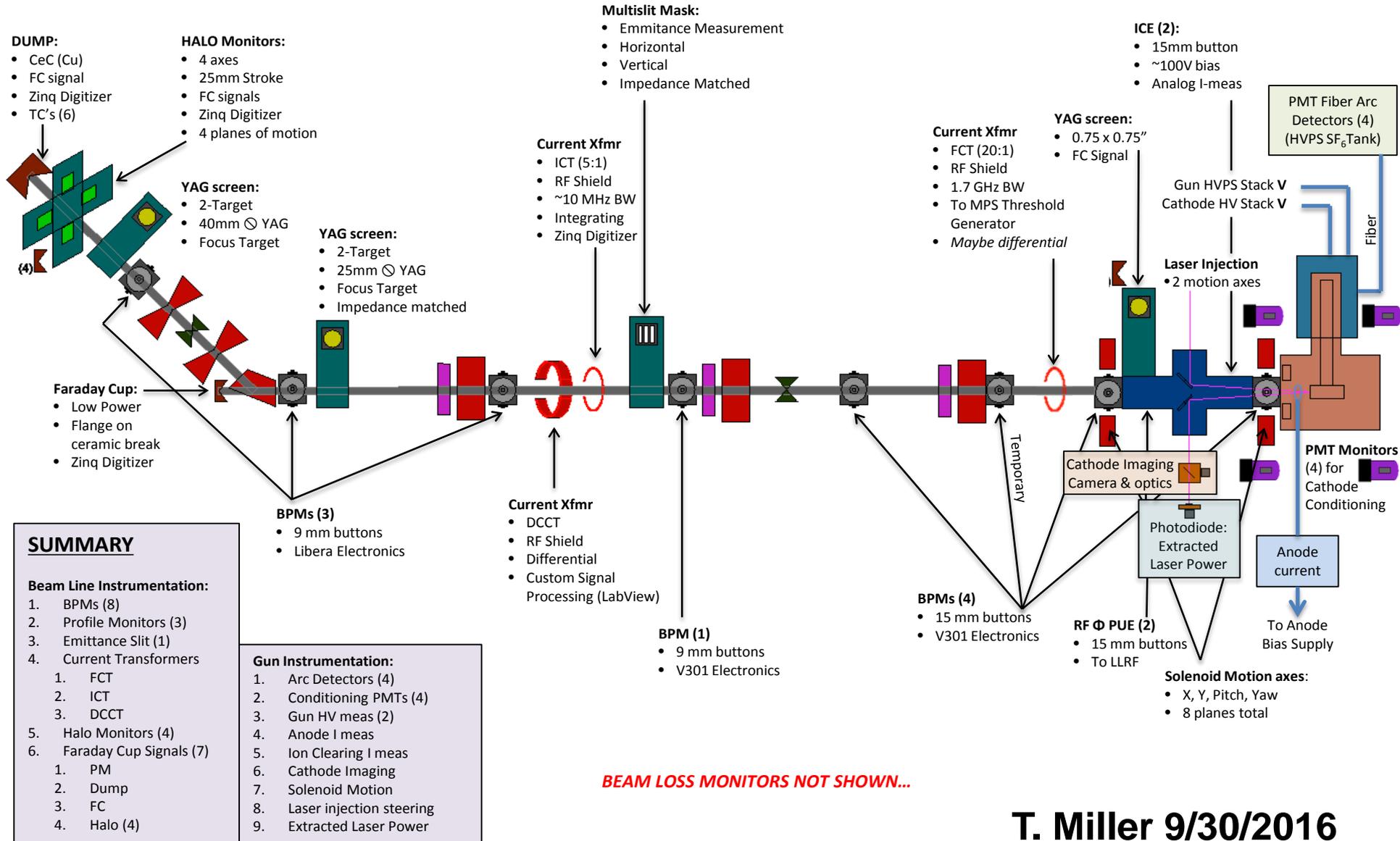


Laser Systems

- Laser transport: (Zhi, Steve, Patrick, Bob)
 - Tunnel DC Gun optics table size and location defined - ordered**
 - Tunnel wall optics table size and location defined (2x4) - ordered**
 - Laser transport path defined**
 - No extension for 2017 test/commissioning**
- Tunnel table (DC gun and wall) support and configuration being defined
 - Custom concrete blocks from floor to bottom of optics table - ordered**
 - Grout floor under block and grout optics table top to top of block
 - Direct connection, no vibration absorbers

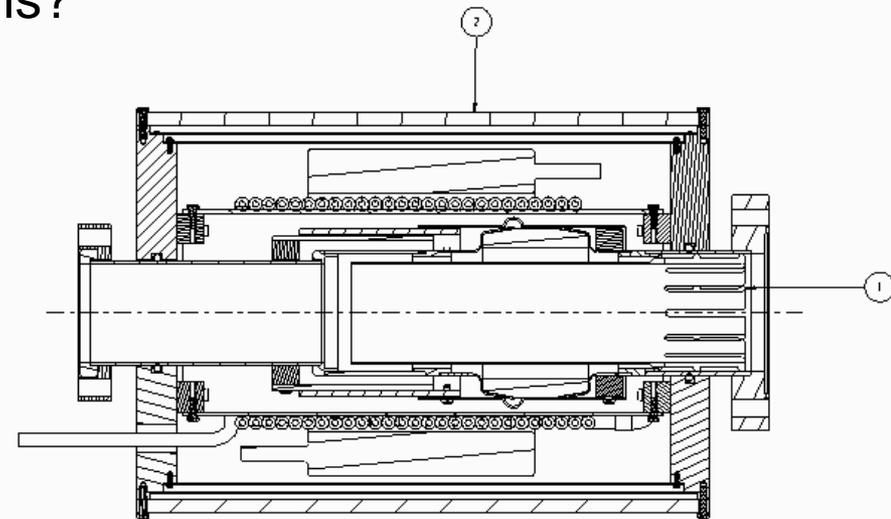
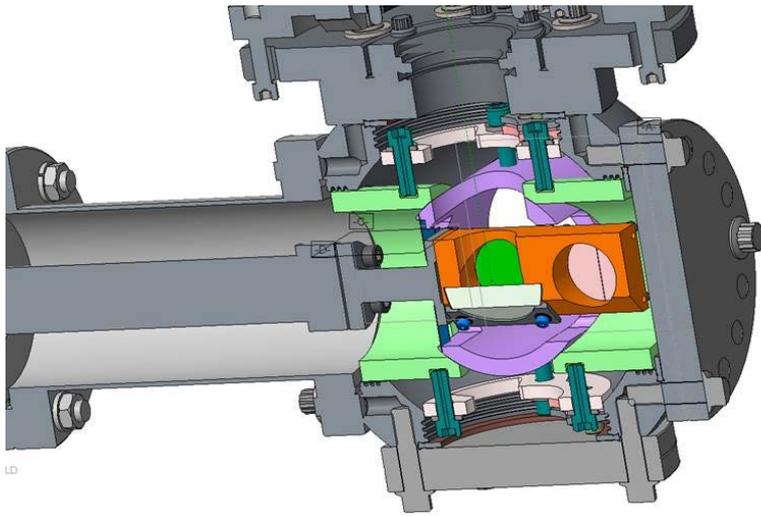


DC Gun Test Beam Line Diagnostics



Diagnostics Component Status

- **BPM chambers (in house) and buttons.** (Gassner)
- **DCCT and ICT from ERL (internal RF shielding analyzed) shield drawings complete.** Stand design complete (Miller, Weiss)
- (1) ERL HE Profile Monitors (ferrites, larger YAG screen, horz. emittance slit) **drawings complete, parts ordered.** (Miller, Weiss)
- **(1) ERL LE Profile Monitors assembled, pre-surveyed, & tested.** (Weiss)
- (1) Emittance slit drive **parts ordered.** (Miller, Weiss)
- (1) ERL Halo Monitor **parts ordered.**(Fite, Corbin)
- (1) Faraday cup (from ERL) (Gassner)
- Cables and electronics/1002D installations?



Diagnostics Component Status

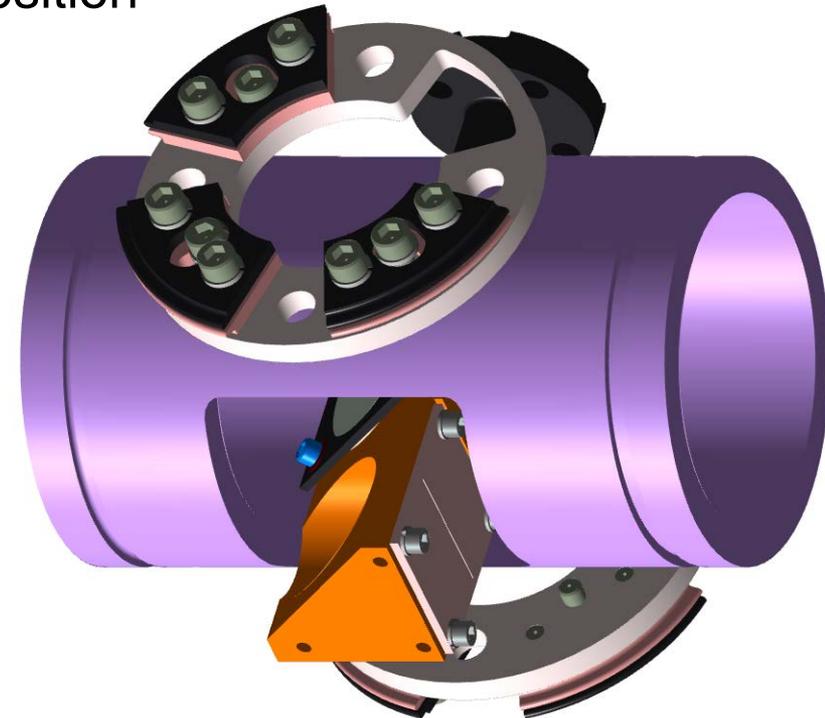
Position Controls DC Gun Test

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

+

RF Cavity commissioning

- (1) 2.1 GHz cavity tuner
- (1) 704 MHz cavity tuner



Component Status

Magnets:

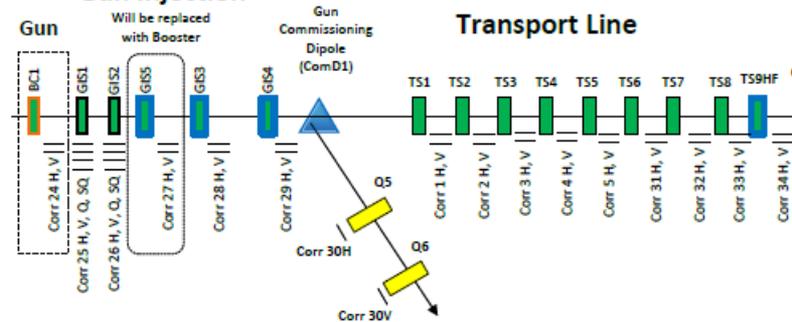
- **(2ea) GtB solenoids – delivered**, to magnetic measurement.
- **(6ea) ERL solenoids – magnet measurement complete.**
- (6ea) H/V corrector magnets – New GtB aircooled design, 1st article has high multipole components – need updated design.
- **(2ea) ERL quadrupoles – magnet measurement?**
- **(1) CeC 45° dipole magnet – not shimmed**, chamber being fabricated, survey adjustment hardware, and stands for above.
- (2ea) Hi-field transport solenoids, order placed (2017 installation).



Gun Injection Section

- 1 p.s. Kaiser High Voltage ps for gun
- 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.
- 1 p.s. (BC1). I op=4.2A. I max = 6A 1000ppm. Using ERL BiRa 20V, 6A 1000ppm.p.s.
- 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.
- 10 p.s.'s (Corr 25Q, SQ & Corr 26Q, SQ & 27H,V-29H,V). New GM Correctors. Use ERL BiRa 20V 2A 1000ppm.
- 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
- 2 p.s.'s (GIS3-GIS4) ERL Sol. I max=5A @1000ppm Use ERL SHIM 15V 10A 100ppm (limit 100W) ps's.
- 1 p.s. (GIS5) ERL Sol. I op=8.4A, I max=10A @1000ppm Use ERL SHIM 15V 10A 100ppm p.s.
- 1 p.s. (ComD1) CeC 45° dipole. I op=20A 1000ppm required. Use New GEN 30-25 1000ppm ps
- 2 p.s.'s. (Q5 & Q6) I op=0.6A & 0.4A. Use 2 ERL 20V 2A 1000ppm BiRa's.
- 2 p.s.'s (Corr 30H,V) I op = 0.55A. Use 2 ERL 20V 2A 1000ppm BiRa's.

Gun Injection



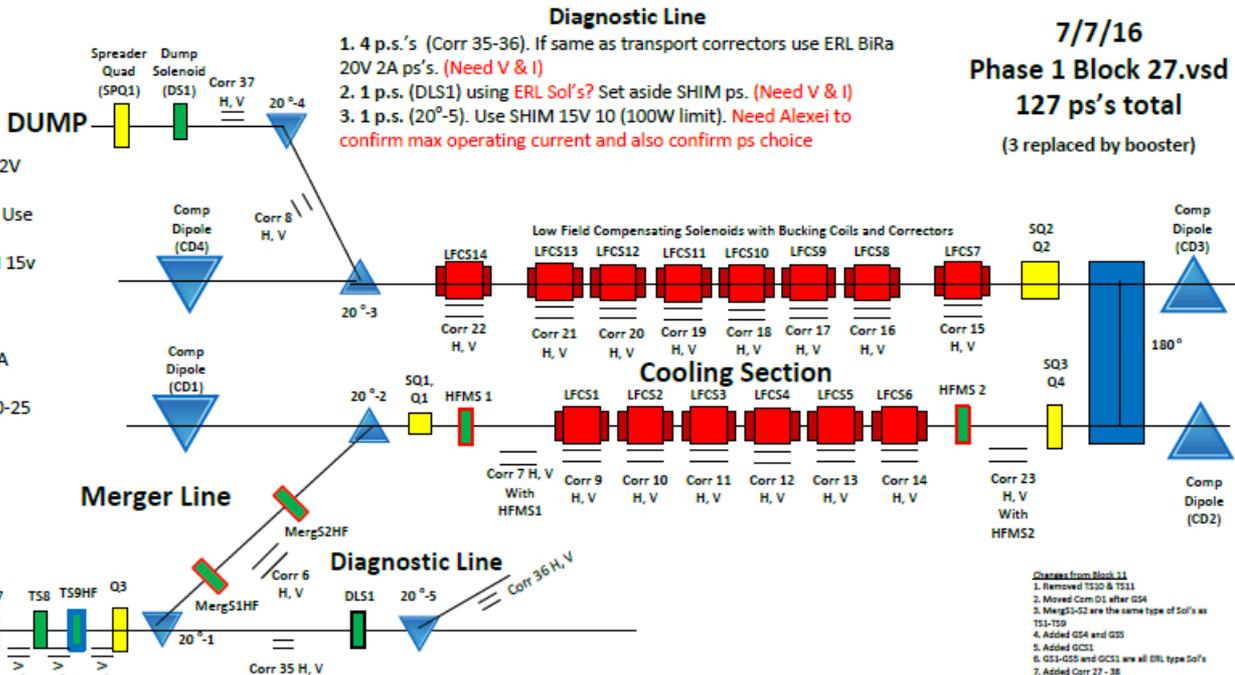
Transport Section

- 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.
- 10 p.s.'s for 5 New GM Correctors (Corr1-5) magnets. Use ERL 20V 2A 1000ppm.
- 8 p.s.'s for 4 New GM Correctors (Corr 31-34) magnets. **Purchase new CAEN 12V 1A 100ppm ps's.**
- 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.
- 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

- 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 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
- 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

Alexei to confirm operating current 2A to 4A



Cooling Section

- 1 p.s. for Skew Quad (SQ1). Use ERL SHIM 15v 10A (limit 100W). **(V&I needed)**
- 1 p.s. for Quad (Q1). Use ERL SHIM 15V 10A (limit 100W). **(V&I needed)**
- 1 p.s. for High Field Matching Solenoid (HFMS1). Purchase CAEN FAST PS 20V 20A p.s..
- 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.**
- 4 p.s.'s for HFMS Correctors (Corr 7 & 23), Purchase CAEN EZ 12V 1A. **(V&I needed)**
- 1 p.s. 150V 22A for LFCSc1-6 cores 6 in series. Received. Alexei confirmed we can still use.
- 1 p.s. 150V 22A for LFCSc1-6 buck coils (2x) 6 in series. Received. Alexei confirmed we can still use.
- 28p.s.'s Purchase 12V 1A CAEN Easy Diver for Correctors (Corr 9-22) with LFCs magnets.
- 1 p.s. for SQ3. Use ERL SHIM 15v 10A (limit 100W). **(V&I needed)**
- 1 p.s. for Q4. Use ERL SHIM 15v 10A (limit 100W). **(V&I needed)**
- 1 p.s. for 180° magnet. Have LSII p.s. in house. Assembling it. Add FWD to COTS ps?
- 1 p.s. for SQ2 Use ERL SHIM 15V 10A (limit 100W)
- 1 p.s. for Q2 Use ERL SHIM 15v 10A (limit 100W)
- 1 p.s. for Compensating Dipoles (CD1-4). All 4 in series. Use ERL Kepco 50V 20A 100ppm. Review ps choice with Alexei
- 1 p.s. 30V 25A for LFCSc7 core single. Purchased new GEN 30-25, **Alexei confirm p.s. still ok at low currents**
- 1 p.s. 30V 25A for LFCSc7 buck coils 2 in series from one magnet. Purchased new GEN 30-25, **Alexei confirm p.s. still ok at low currents**
- 1 p.s. 150V 22A for LFCSc8-13 cores 7 in series. Received. Alexei confirmed we can still use.
- 1 p.s. 150V 22A for LFCSc8-13 buck coils (2x) 7 in series. Received. Alexei confirmed we can still use.
- 1 p.s. 30V 25A for LFCSc14 core single. Received. Alexei confirm p.s. still ok at low currents
- 1 p.s. 30V 25A for LFCSc14 buck coils 2 in series from one magnet. Received. Alexei confirm p.s. still ok at low currents

Dump

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

7/7/16

Phase 1 Block 27.vsd

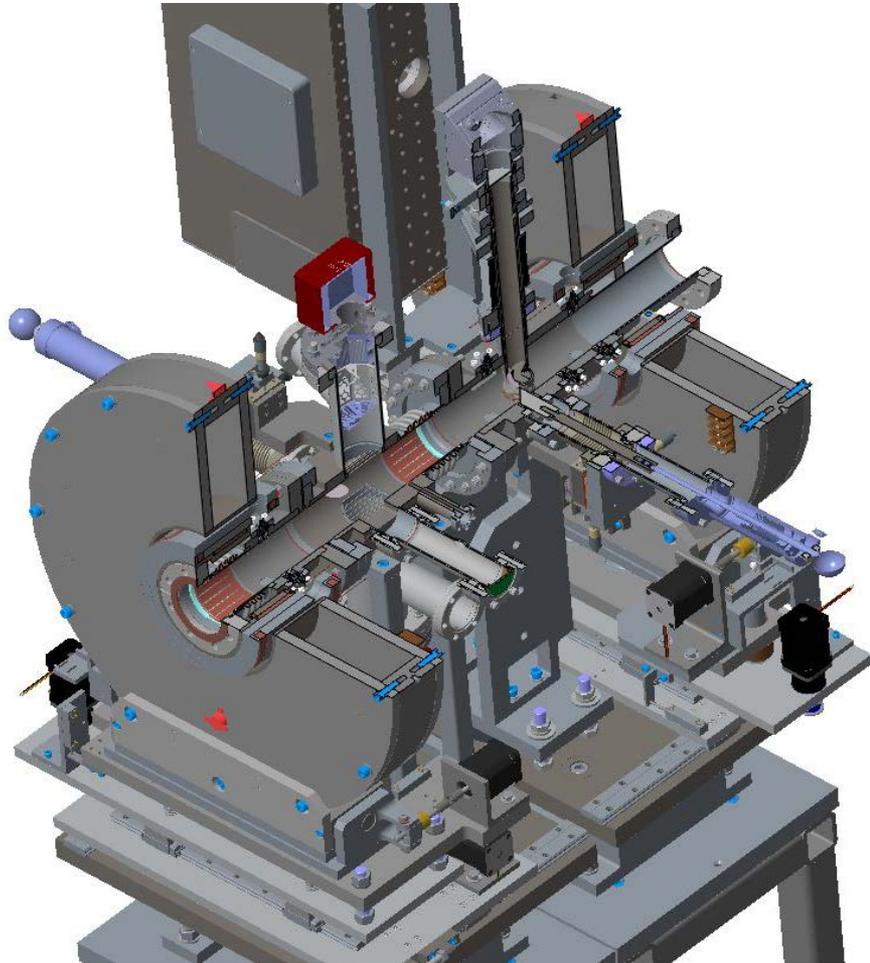
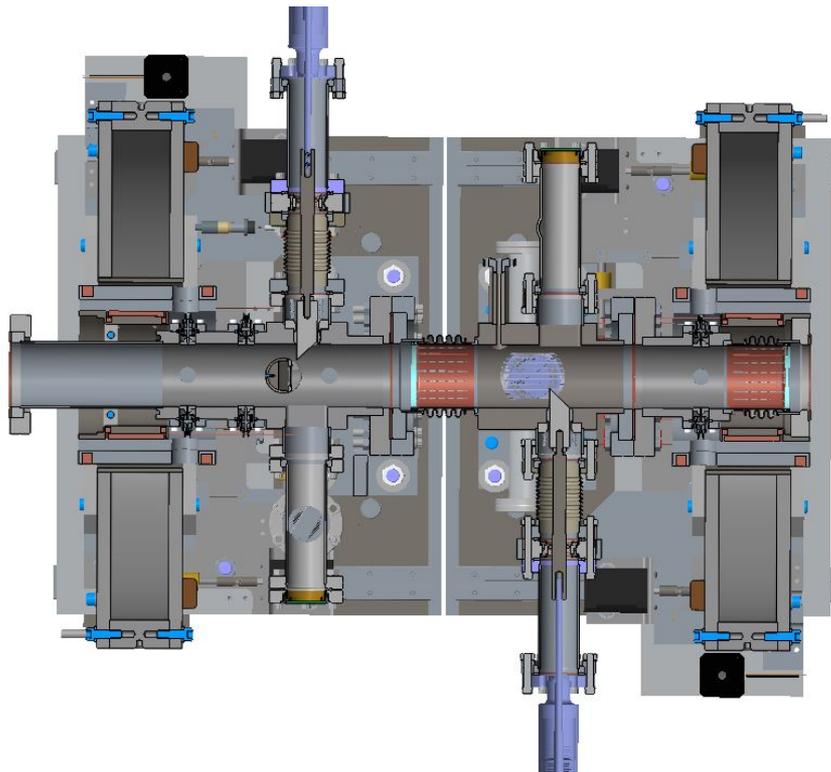
127 ps's total

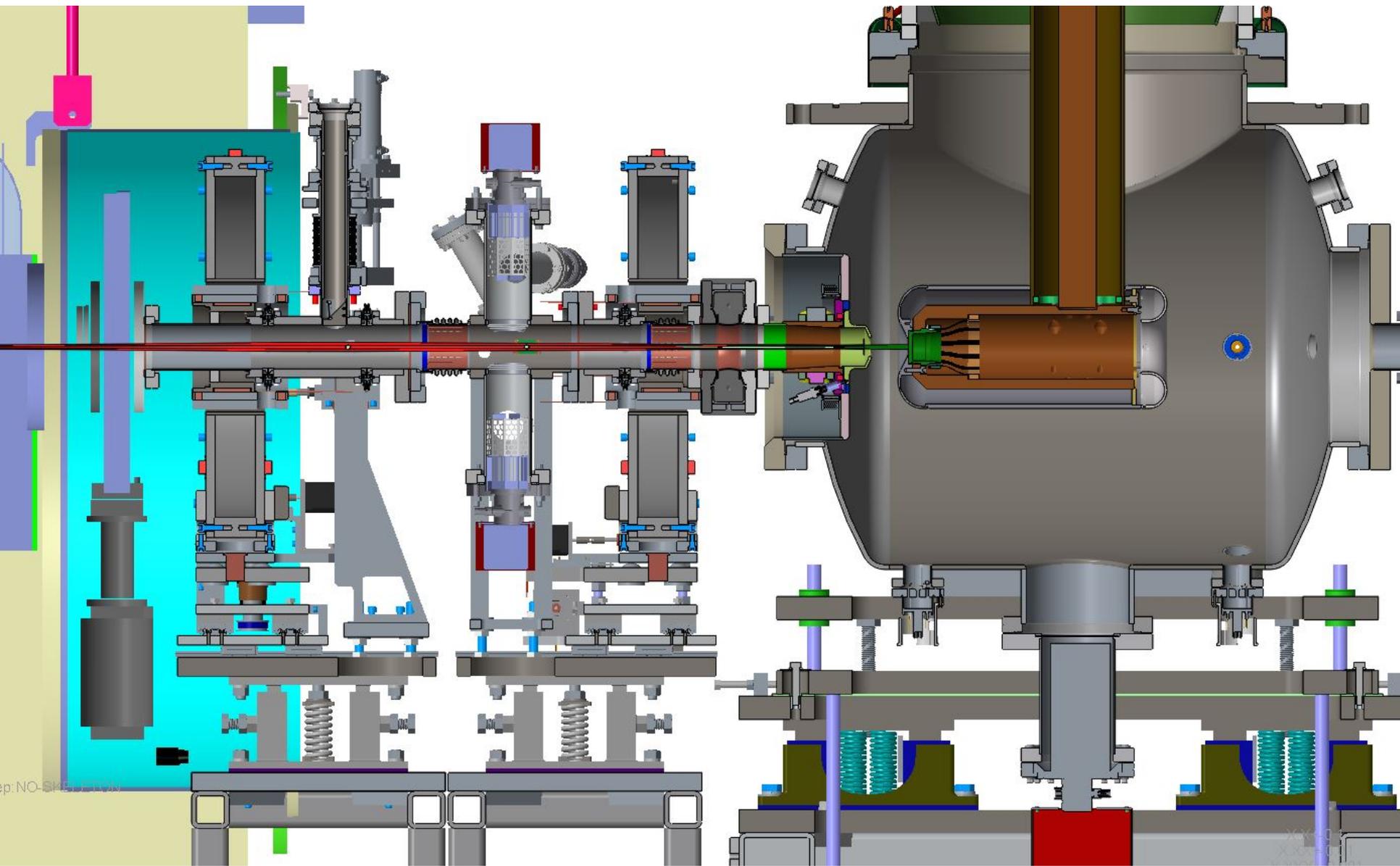
(3 replaced by booster)

- Changes from Block 11
1. Removed TS10 & TS11
 2. Moved Com D1 after G54
 3. MergS1-S2 are the same type of Sol's as TS1-TS9
 4. Added G54 and G55
 5. Added GCS1
 6. G51-G55 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 BCL
 10. TS1-TS9 and MergS1-S2 are new Sol's. Use Kaim's design
 11. Include High Voltage Anode Bias ps for gun, need info from Karl Strömstedt!
 12. Include Kaiser HV p.s. for Gun

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





ep-NO-SHE-11000

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BROOKHAVEN
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RF Component Status

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

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

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 – drawings complete, requisition in process
- 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)

