PEPPo Experimental Apparatus & Operations

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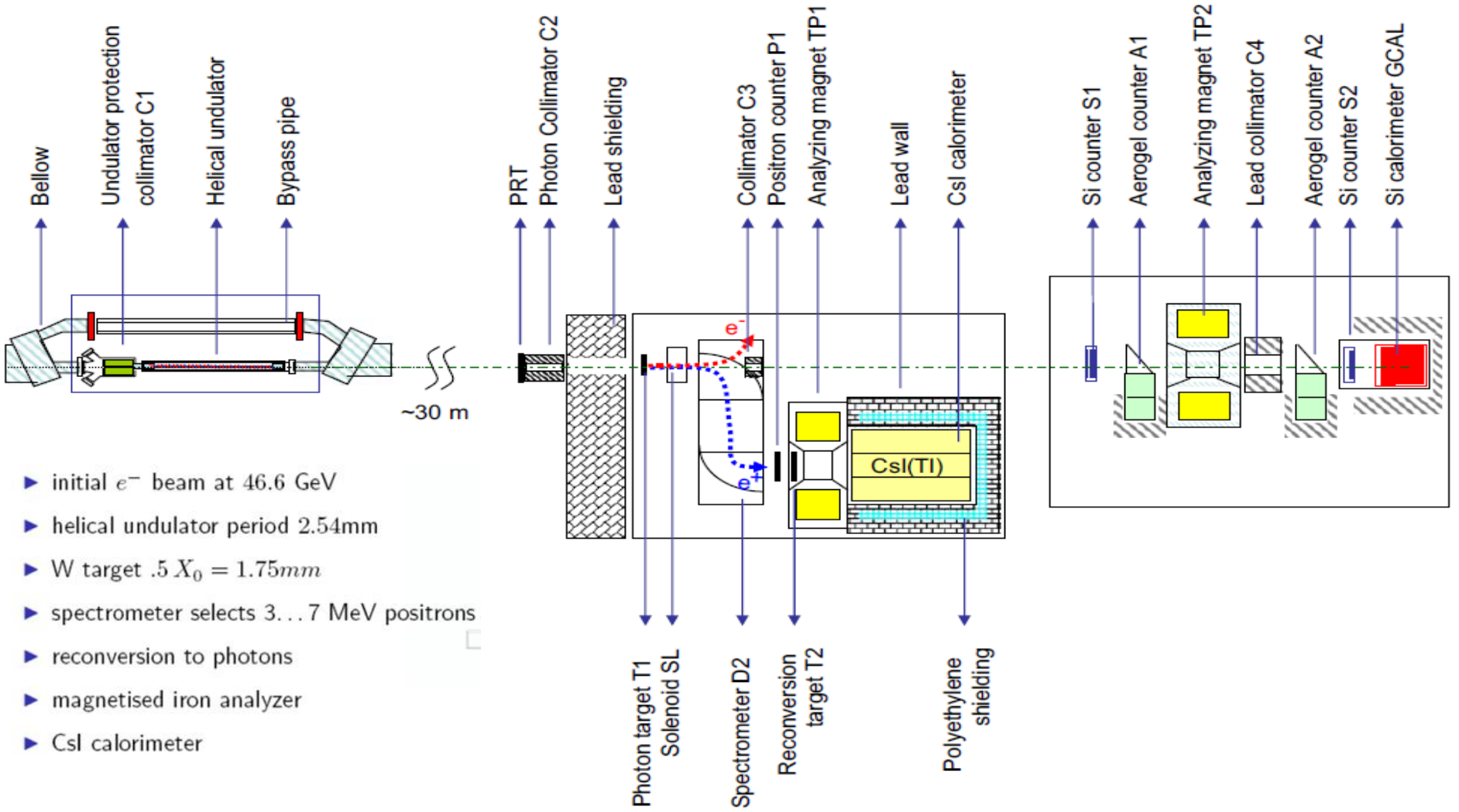
PEPPo Collaboration Meeting
November 8, 2010

Two topics:

- Fabricating & installing the PEPPo experimental apparatus
- Running "CEBAF" during 6-month shutdown

SLAC E166 - Experimental Apparatus:

Fortunately, the experimental apparatus is largely based upon (and borrowed from) the SLAC E166 experiment (NIMA **610** (2009) 451–487)

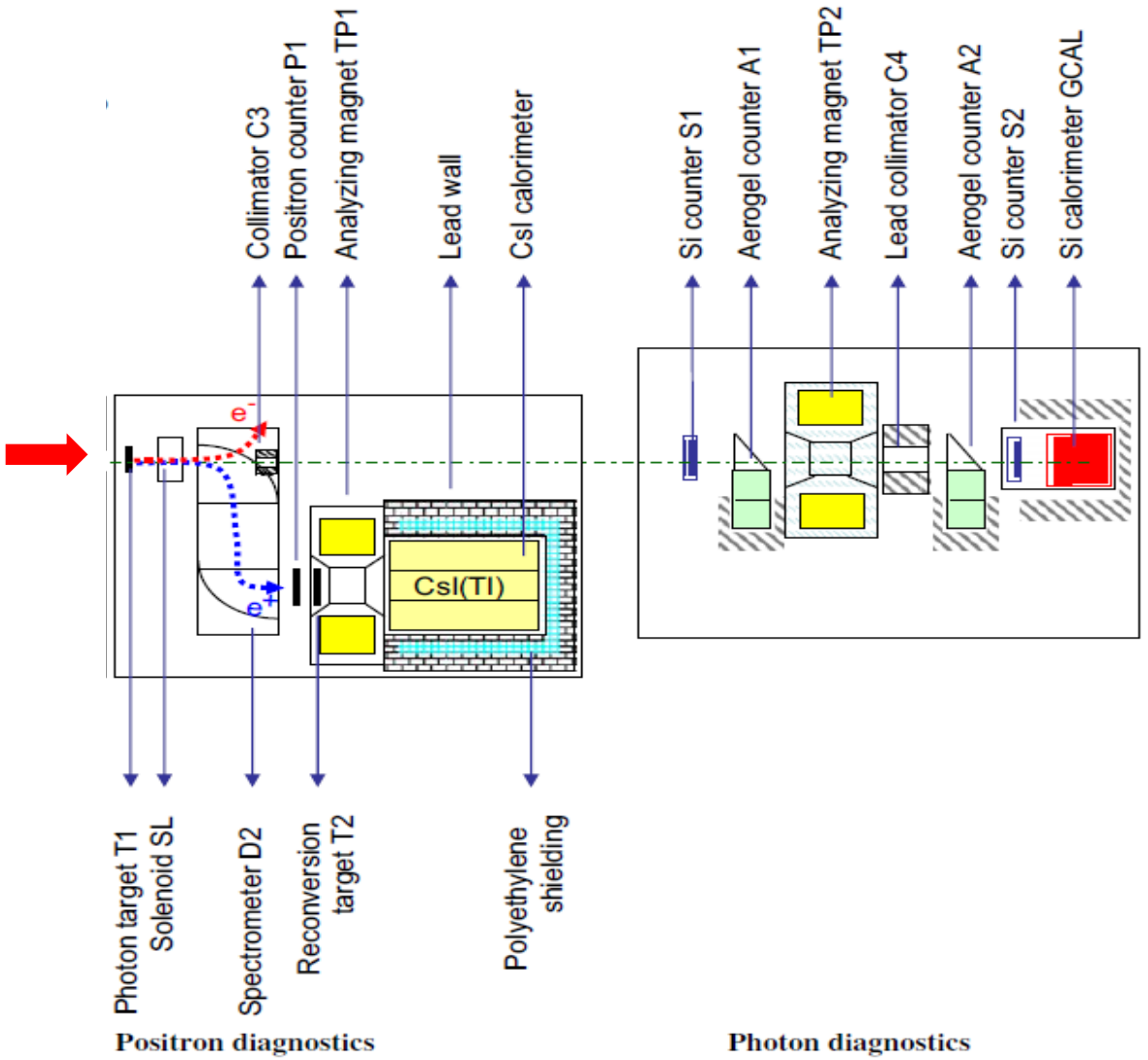


- initial e^- beam at 46.6 GeV
- helical undulator period 2.54mm
- W target $.5\,X_0 = 1.75mm$
- spectrometer selects 3...7 MeV positrons
- reconversion to photons
- magnetised iron analyzer
- CsI calorimeter

JLab Experimental Apparatus:

1. Polarized photons will be replaced by polarized electrons (PEPPo concept):

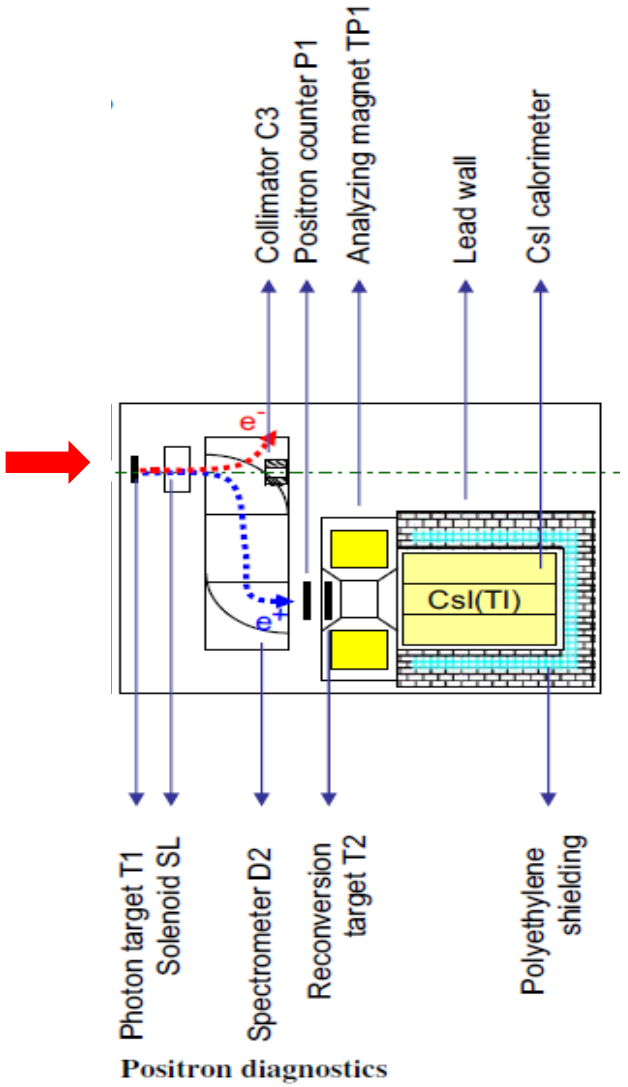
CEBAF Injector
P=85%, E=2-8 MeV, I<10μA



JLab Experimental Apparatus:

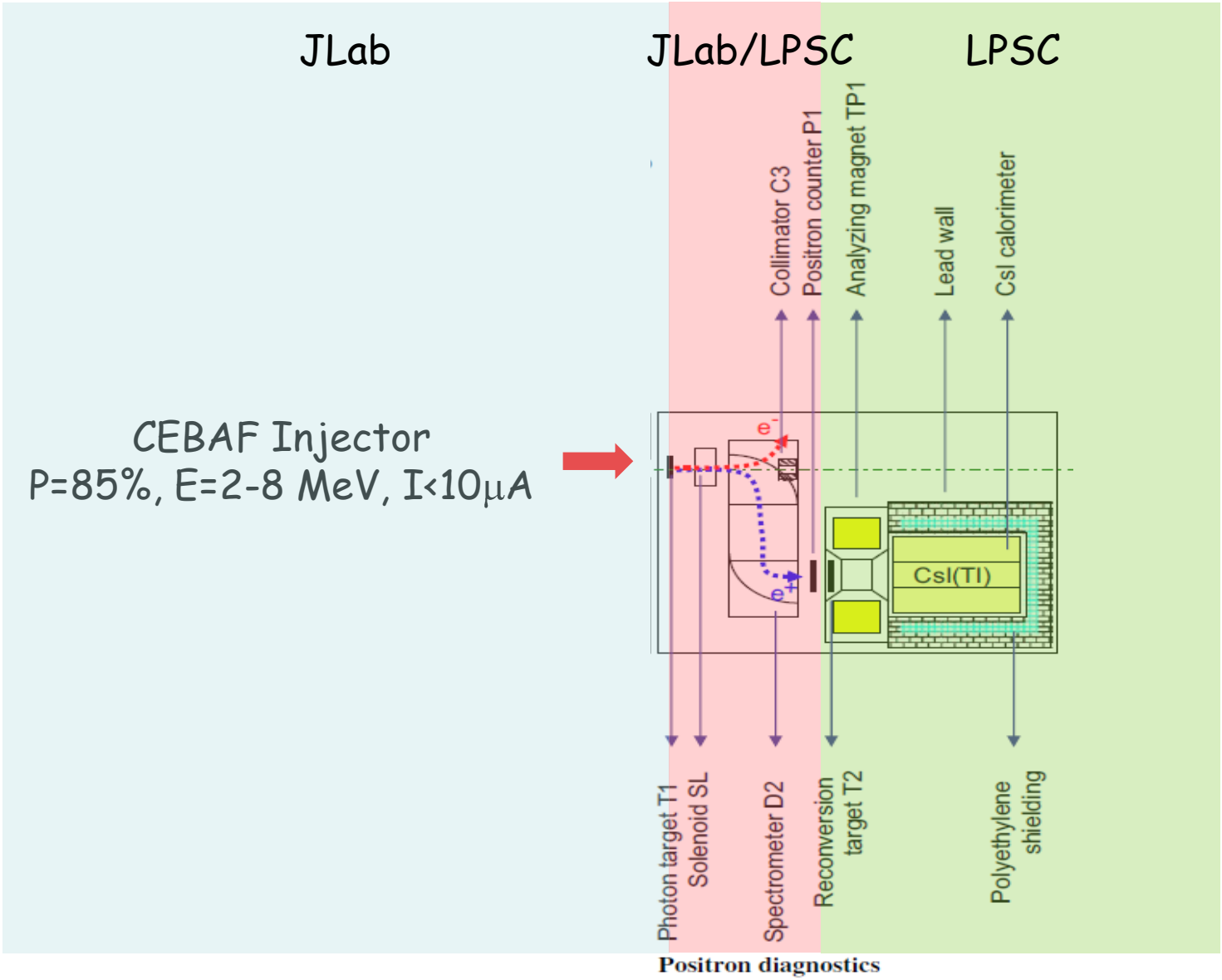
2. We do not plan (need) to measure the exiting photons.

CEBAF Injector
P=85%, E=2-8 MeV, I<10μA



PEPPo Apparatus: basically 3 systems

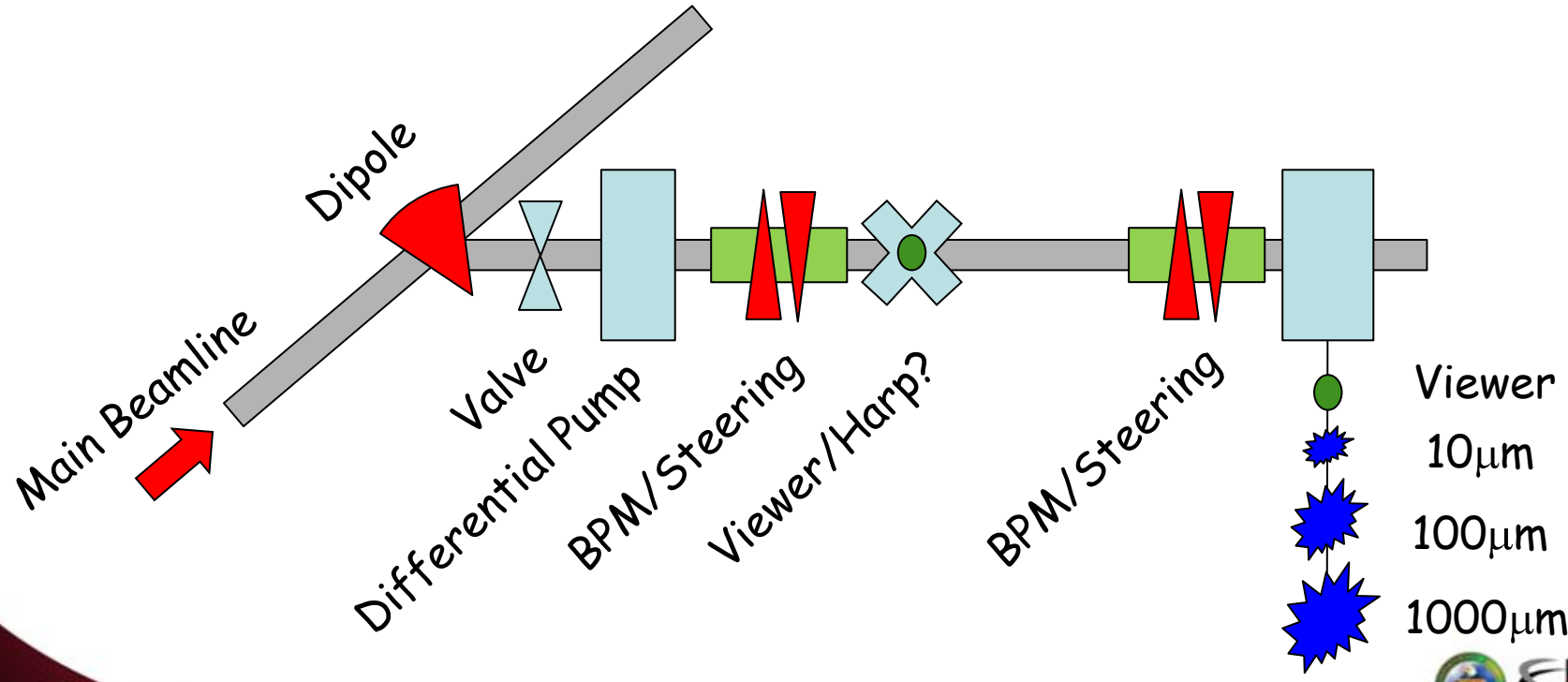
new e- beam spigot, e+ collection, Compton polarimeter.



New e-beam "spigot"

Issues/Punchlist:

Decide exactly where we "break into" beam line => footprint (see later slide)
"new" mechanical layout
Parts straight-forward, but still lead time
Fabricate/purchases can begin soon, assembly too
Target ladder most "unique"
Basic design review, don't expect big "show stoppers"



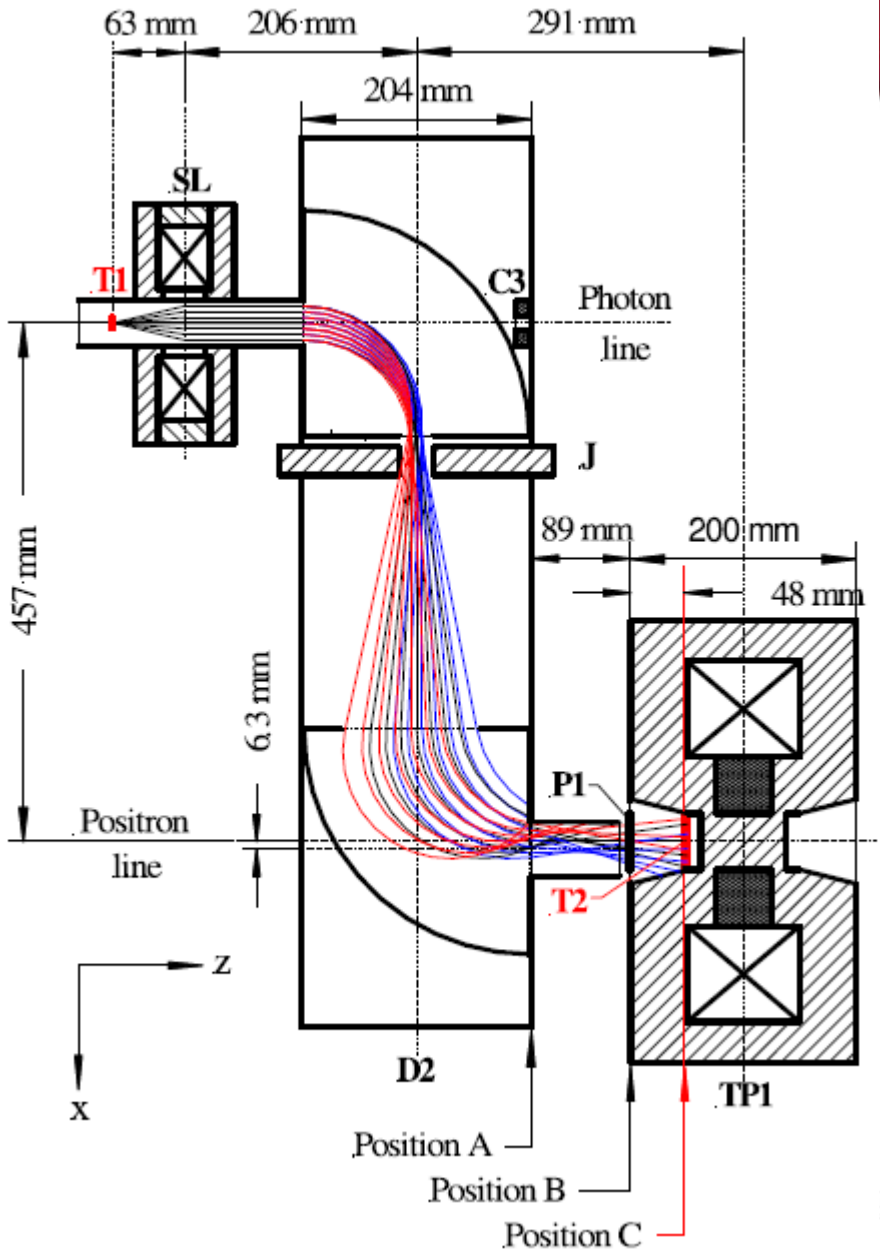
Integrating E166 components:

Issues/Punchlist:

Solenoid/Dipole not on-site yet
Analzying magnet leaving DESY any day…

Target/solenoid integration
Dipole exit port in wrong location
Dipole field map (& densimet) a concern
Revitalize jaws for momentum selection

Vacuum, mechanical, controls TBD
So, still much to do…



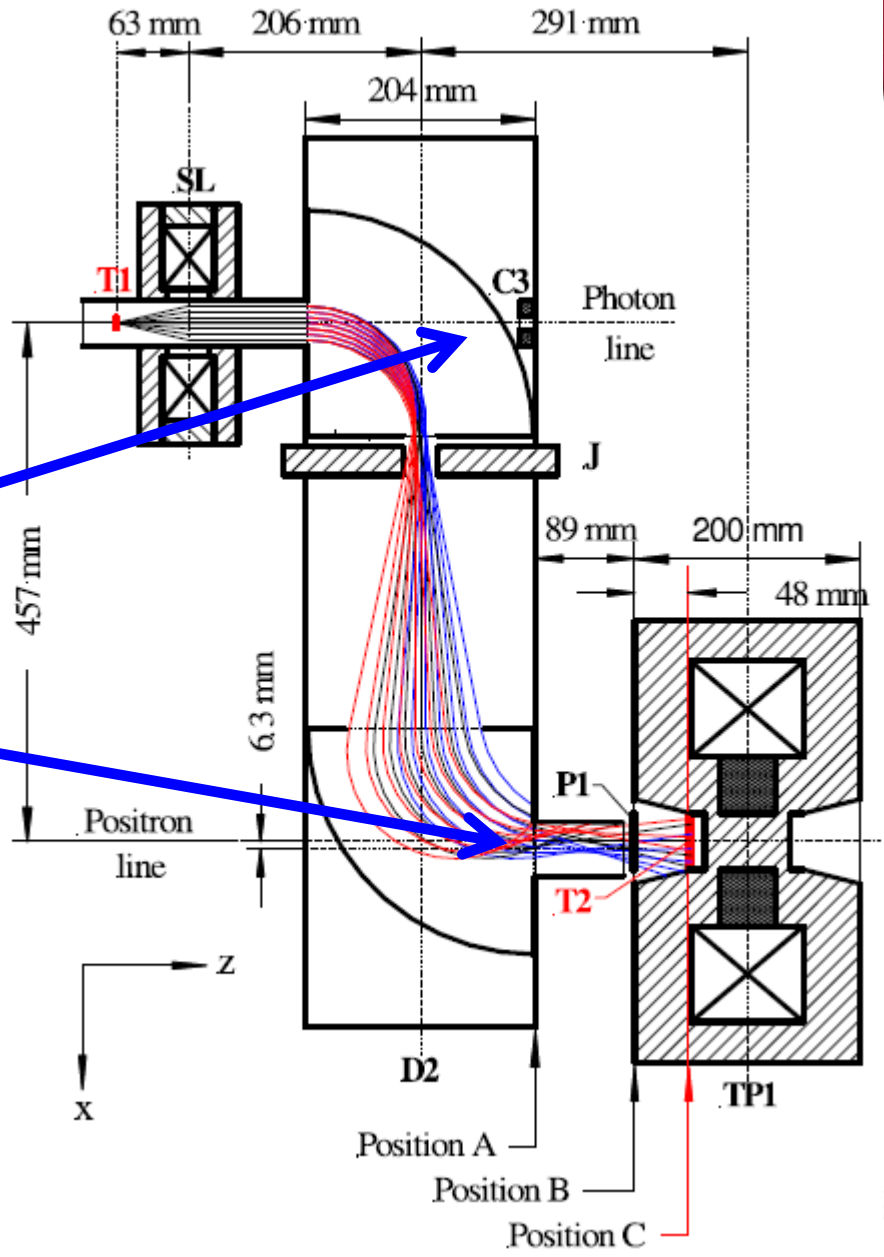
Integrating E166 components:

On the positive side, we benefit greatly from being able to calibrate system with precision electron beam.

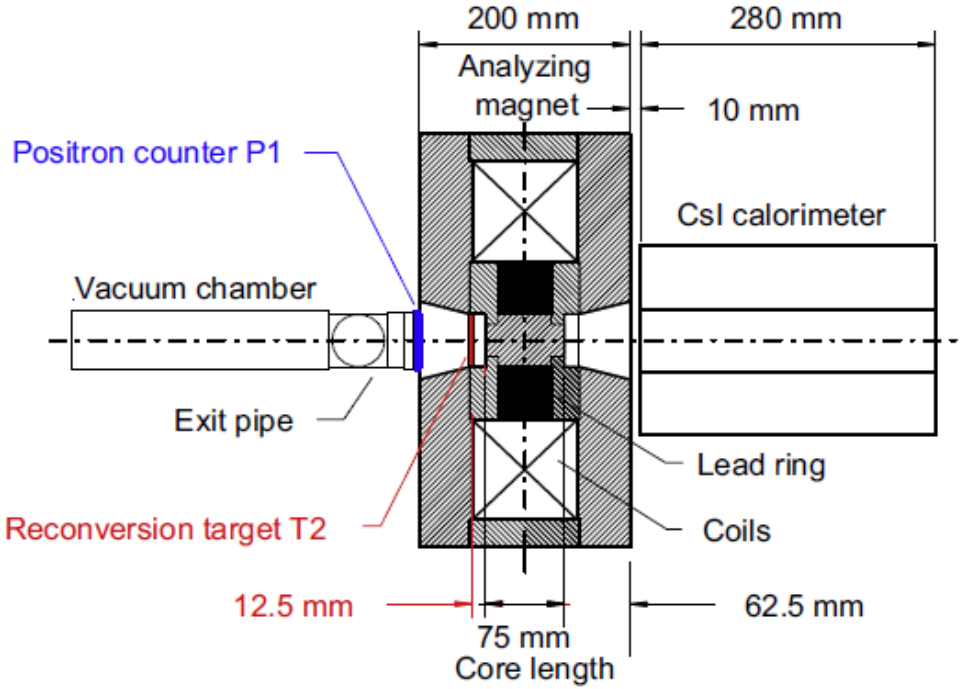
With this in mind we may consider:

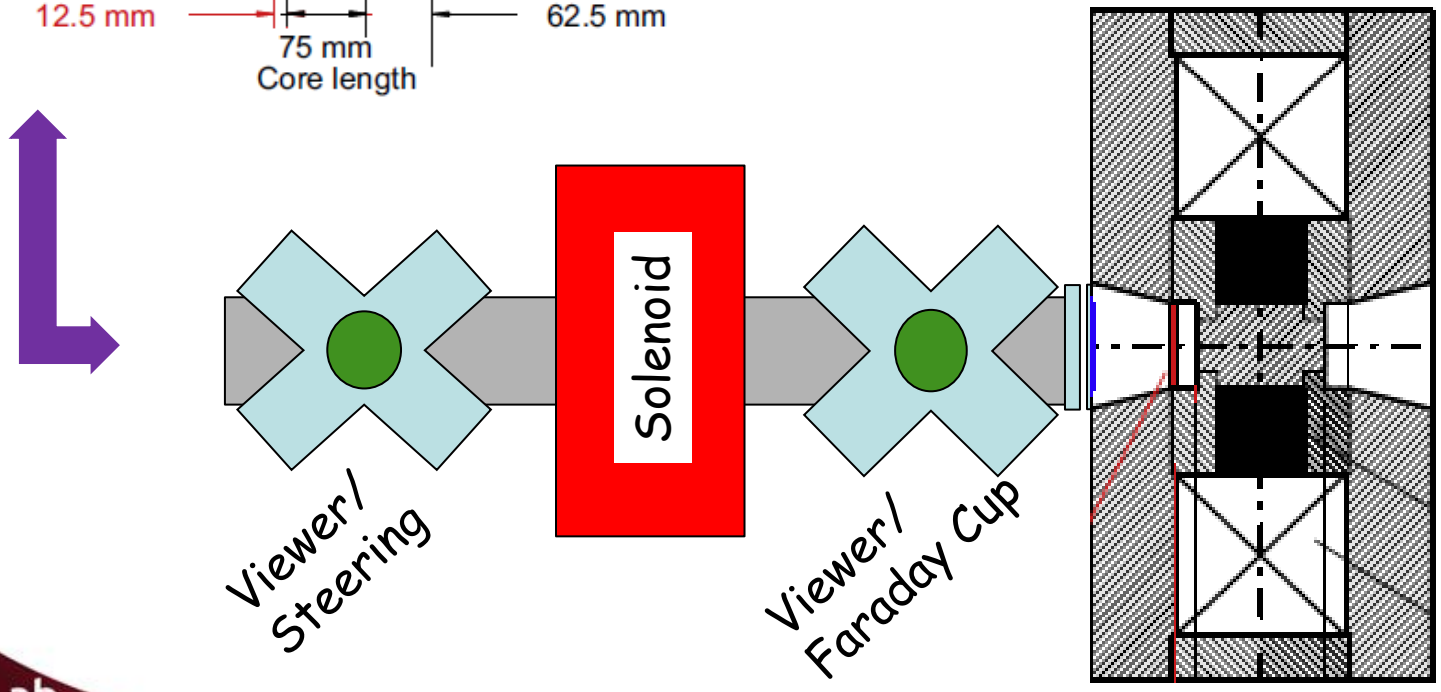
A. Using the photon line port as a diagnostic

B. Modifying region between exit port and reconversion target to improve calibration and collection

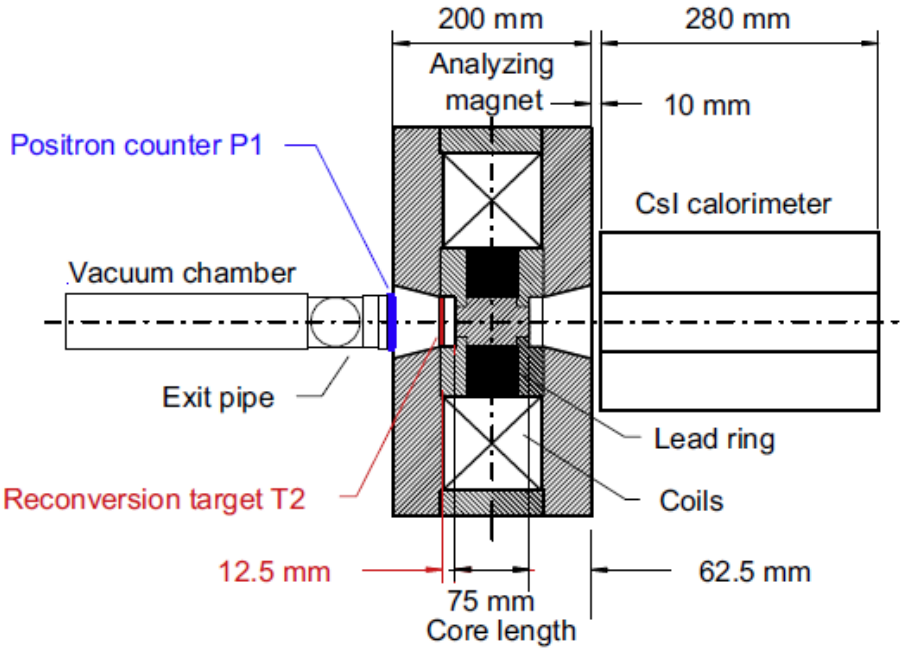


Complication or Improvement – Part 1?

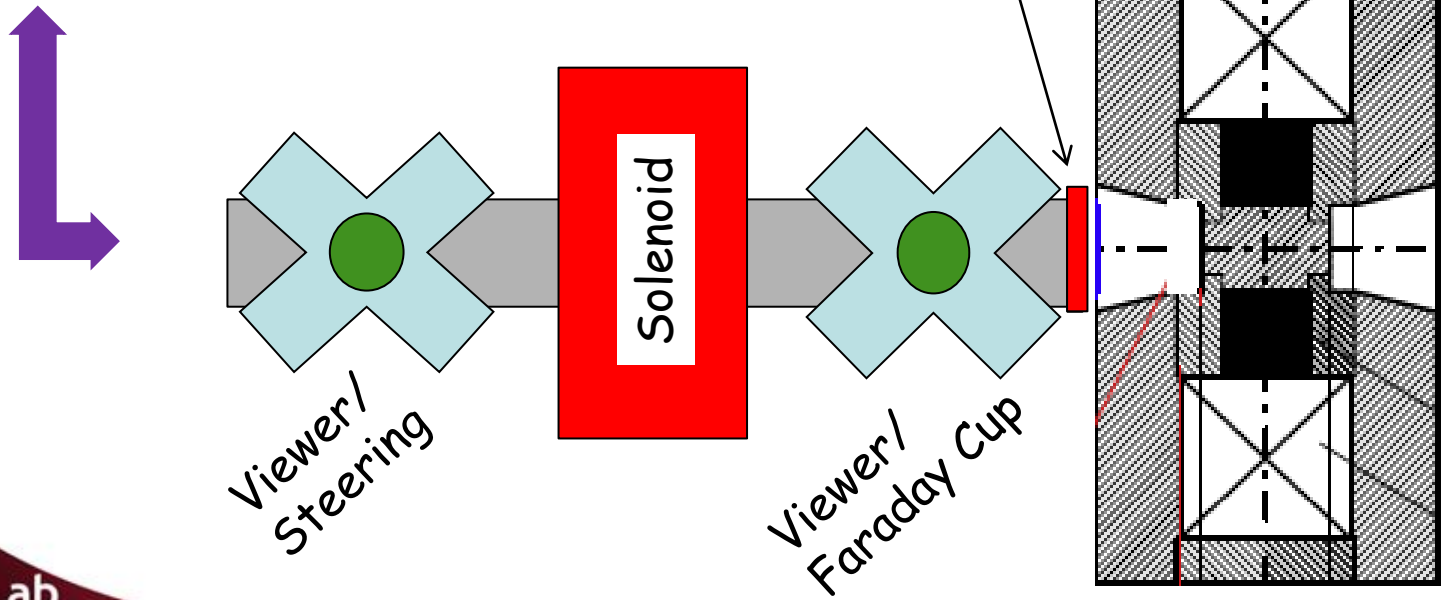




Complication or Improvement – Part 2 ?



Exit window is reconversion foil



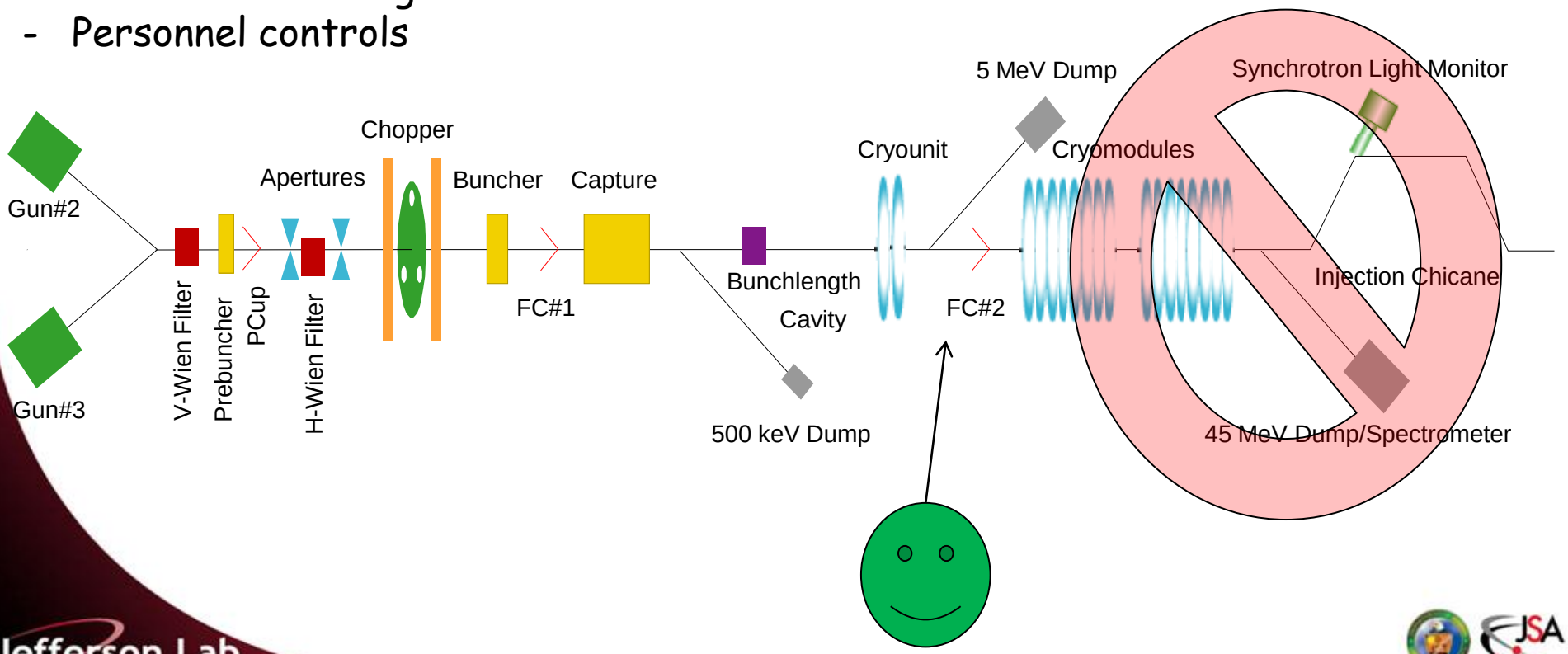
Running CEBAF during 6-month shutdown

Significant work in the accelerator for 12 GeV upgrade (mid-May to mid-November, 2011) precludes running beam into cryomodules.

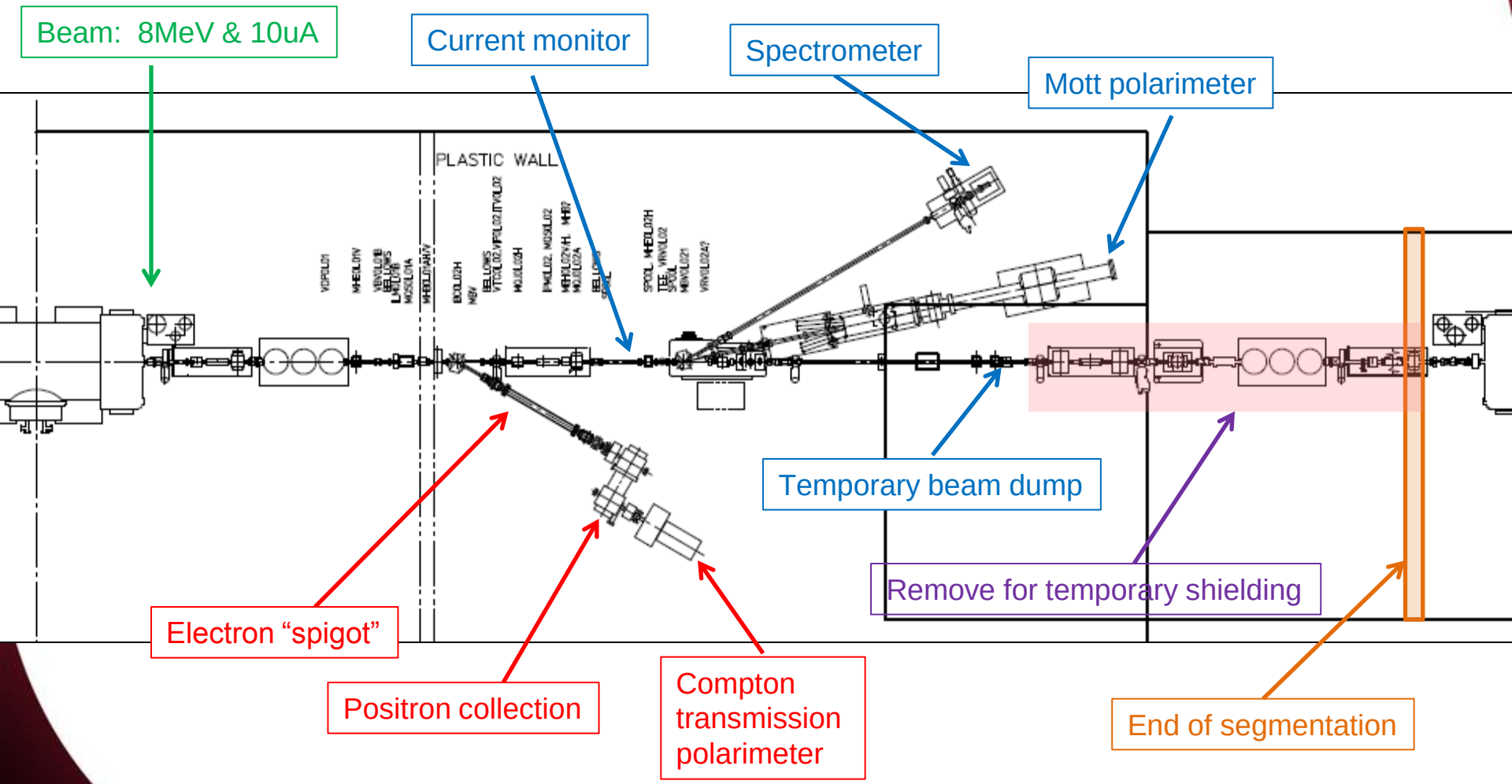
Injector will have typical maintenance activities, but within usual 6-8 week span

Operation will require., "segmenting" injector and it's systems from rest of CEBAF

- Final beam termination point
- Radiation shielding
- Personnel controls



First pass PEPPo Footprint

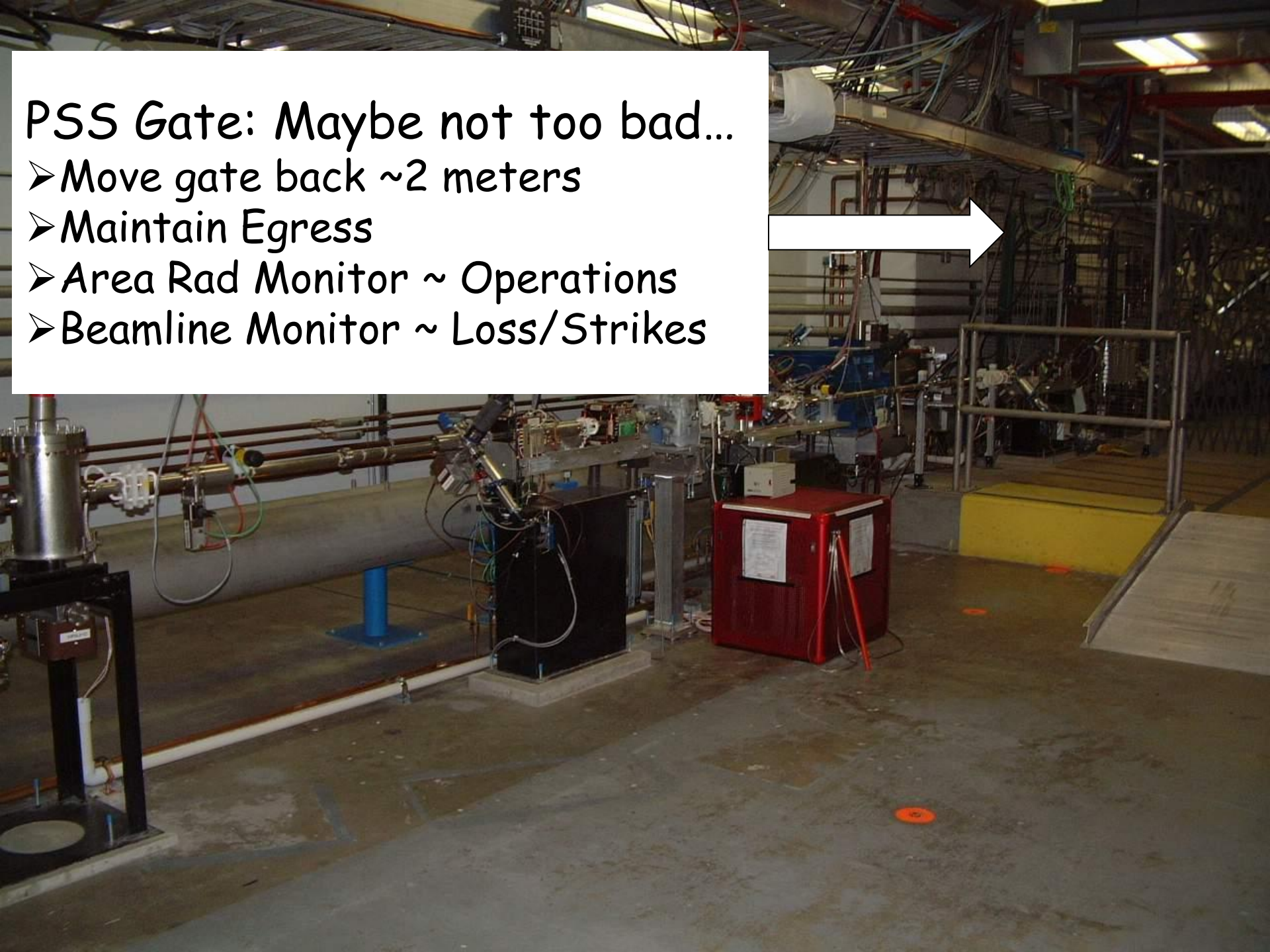


Will consider moving line downstream (of BCM, easier shielding)

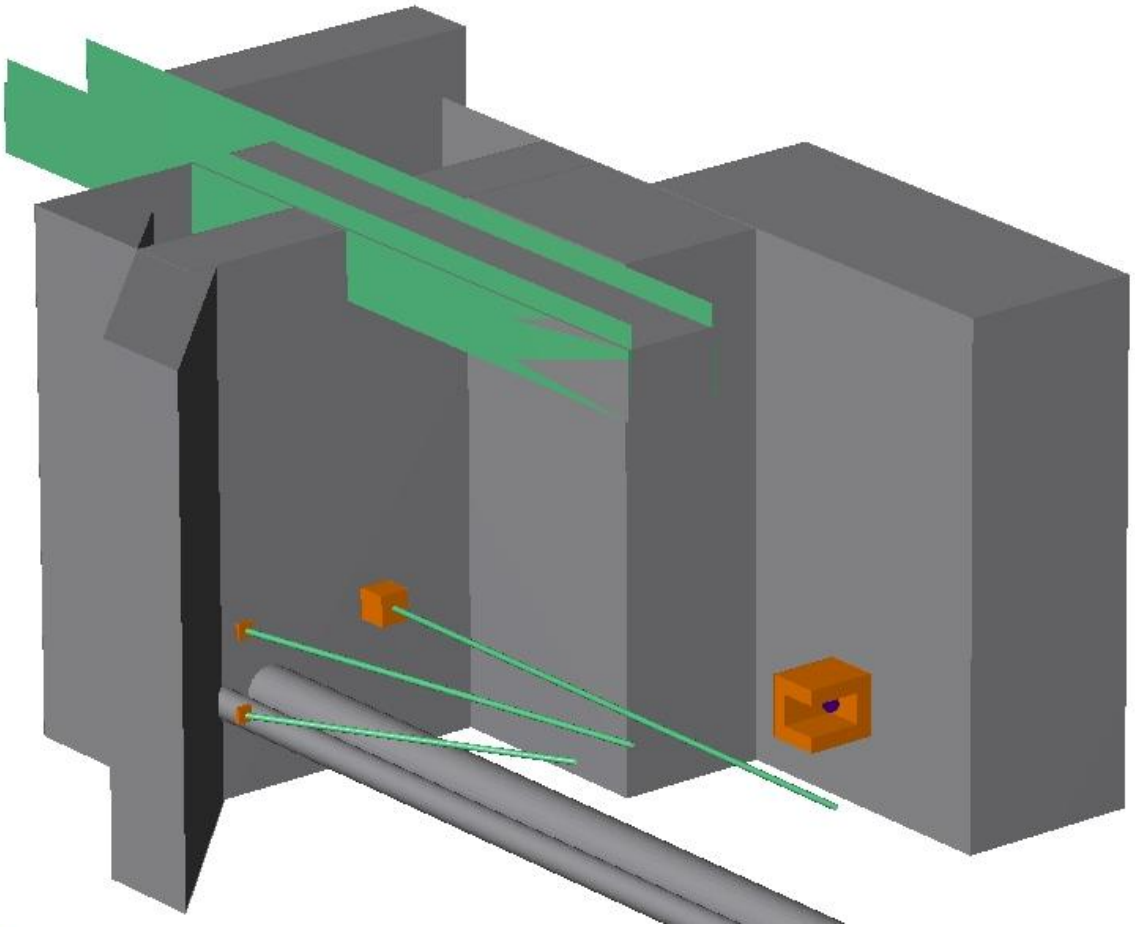
LCW Requirements: Again, the Big Hippo

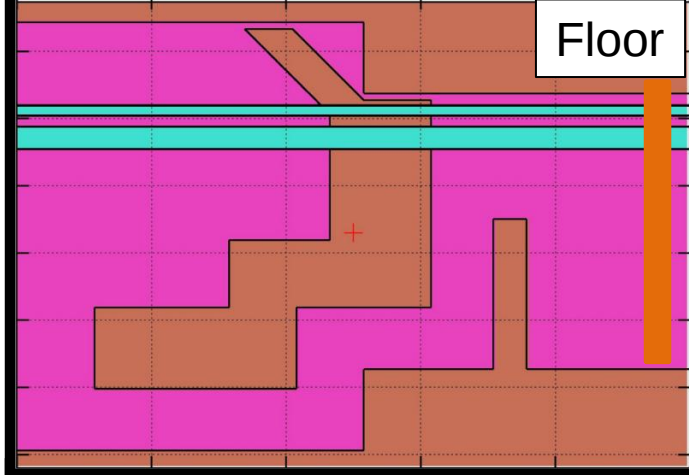
Injector Positron LCW Spreadsheet

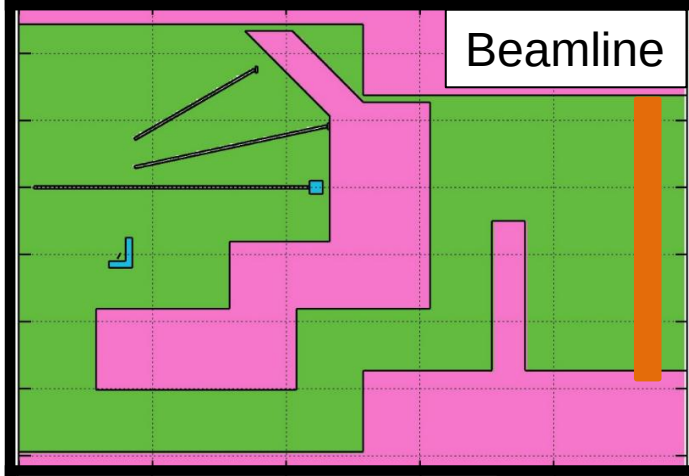
System	System Owner	Item	Location	Flow (GPM)	Heat Load
RF	EESRF	Chopper/Buncher system	IN01B07	1.0	
RF	EESRF	0L02 Klystrons	IN02B17	25.0	
RF	EESRF	MO Amplifiers	IN01B15	4.0	
RF	EESRF	Pre-Buncher	Tunnel Zone 1	2.0	
RF	EESRF	Capture	Tunnel Zone 1	10.0	
Beam Device	EESIC	A1	Tunnel Zone 1	1.0	
Beam Device	EESIC	A2	Tunnel Zone 1	1.0	
Beam Device	EESIC	A3	Tunnel Zone 2	1.0	
Beam Device	EESIC	A4	Tunnel Zone 2	1.0	
Beam Device	EESIC	Chopping appertures (5)	Tunnel Zone 1	3.0	
Beam Device	EESIC	P-Cup	Tunnel Zone 1	0.5	
Beam Device	EESIC	FC1	Tunnel Zone 1	1.0	
Beam Device	EESIC	FC2	Tunnel Zone 2	1.0	
Beam Device	EESIC	500keV/Mott dumps	Tunnel Zone 2	2.0	
Beam Device	EGG	Positron Dump	Tunnel Zone 2	2.0	
Beam Device	EESIC	5MeV Dump	Tunnel Zone 2	2.0	
Magnet	EESDC	QJ (5)	Tunnel Zone 2	3.0	
Magnet	EGG	PEPPo - target solenoid	Tunnel Zone 2	2.0	
Magnet	EGG	PEPPo - dipole spectrometer	Tunnel Zone 2	2.0	
Magnet	EGG	PEPPo - capture solenoid	Tunnel Zone 2	2.0	
Magnet	EGG	PEPPo - analyzer solenoid	Tunnel Zone 2	2.0	
			Totals (GPM)	68.5	0

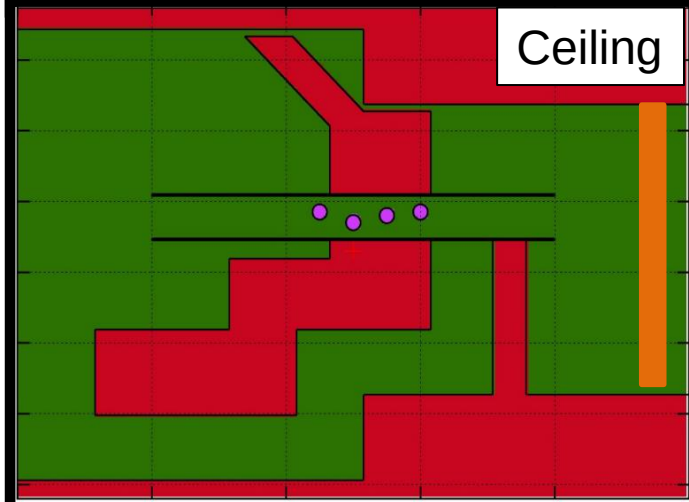

PSS Gate: Maybe not too bad…
Move gate back ~2 meters
Maintain Egress
Area Rad Monitor ~ Operations
Beamline Monitor ~ Loss/Strikes

Radiation Control Group – Pass 2

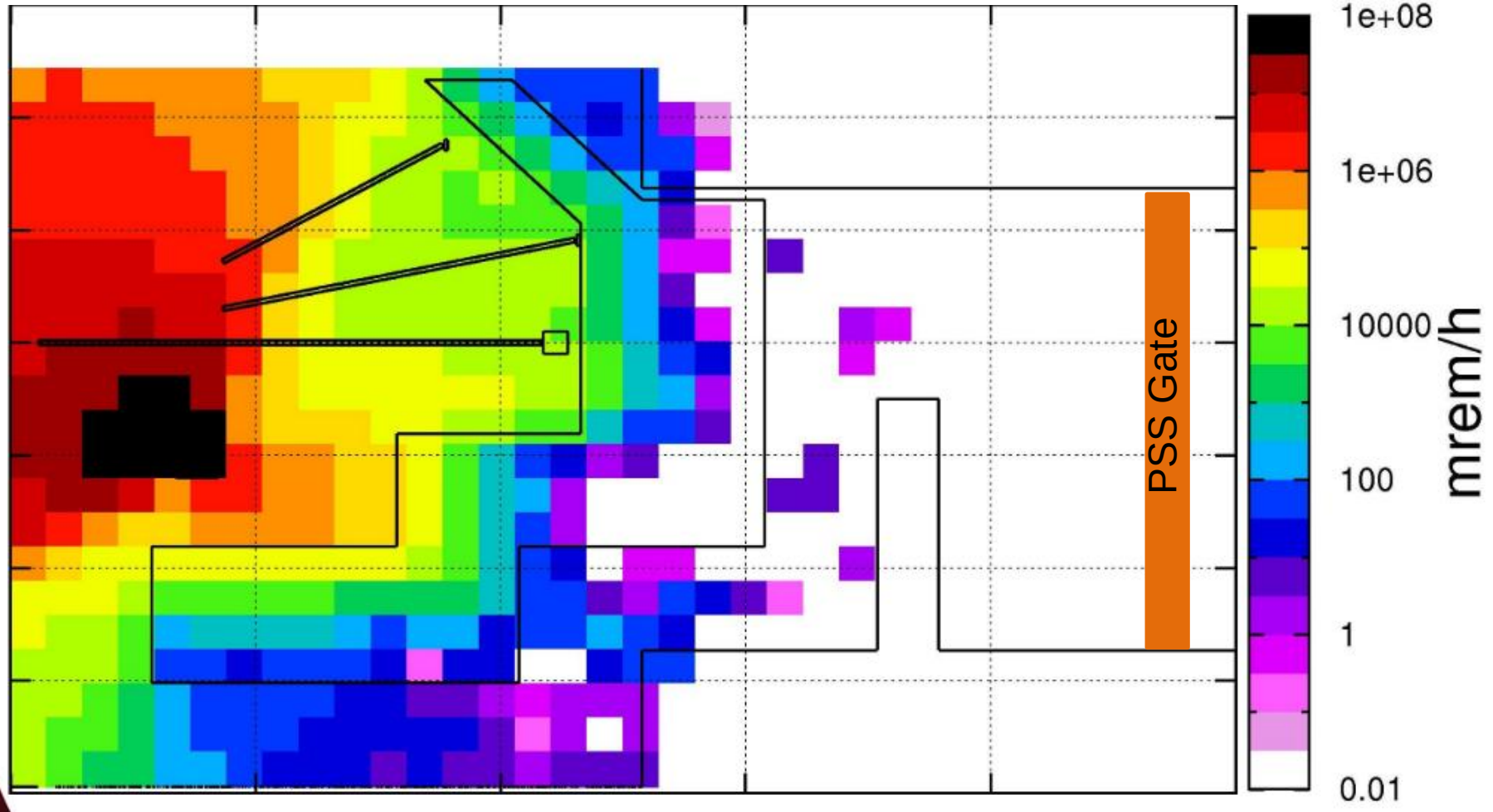




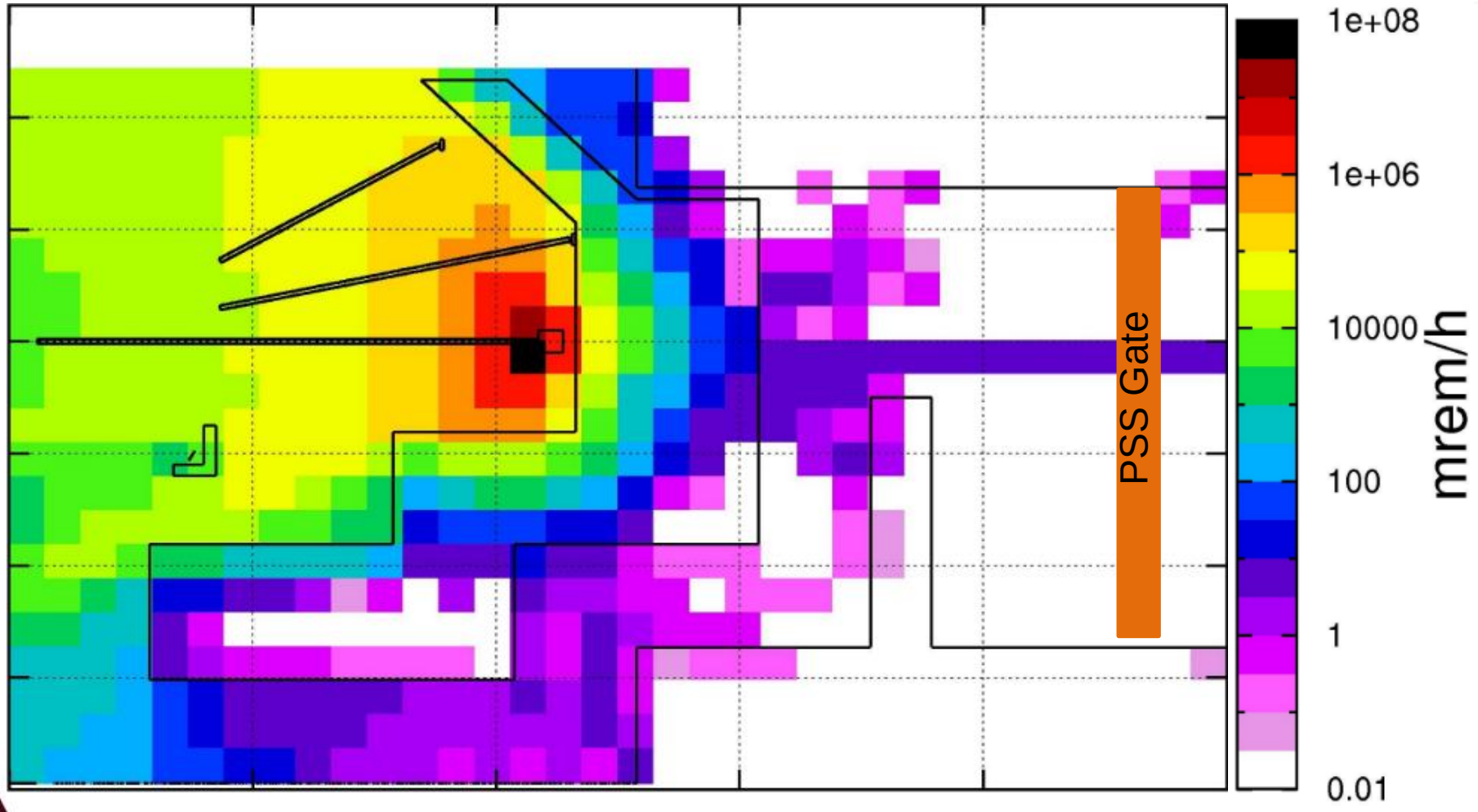




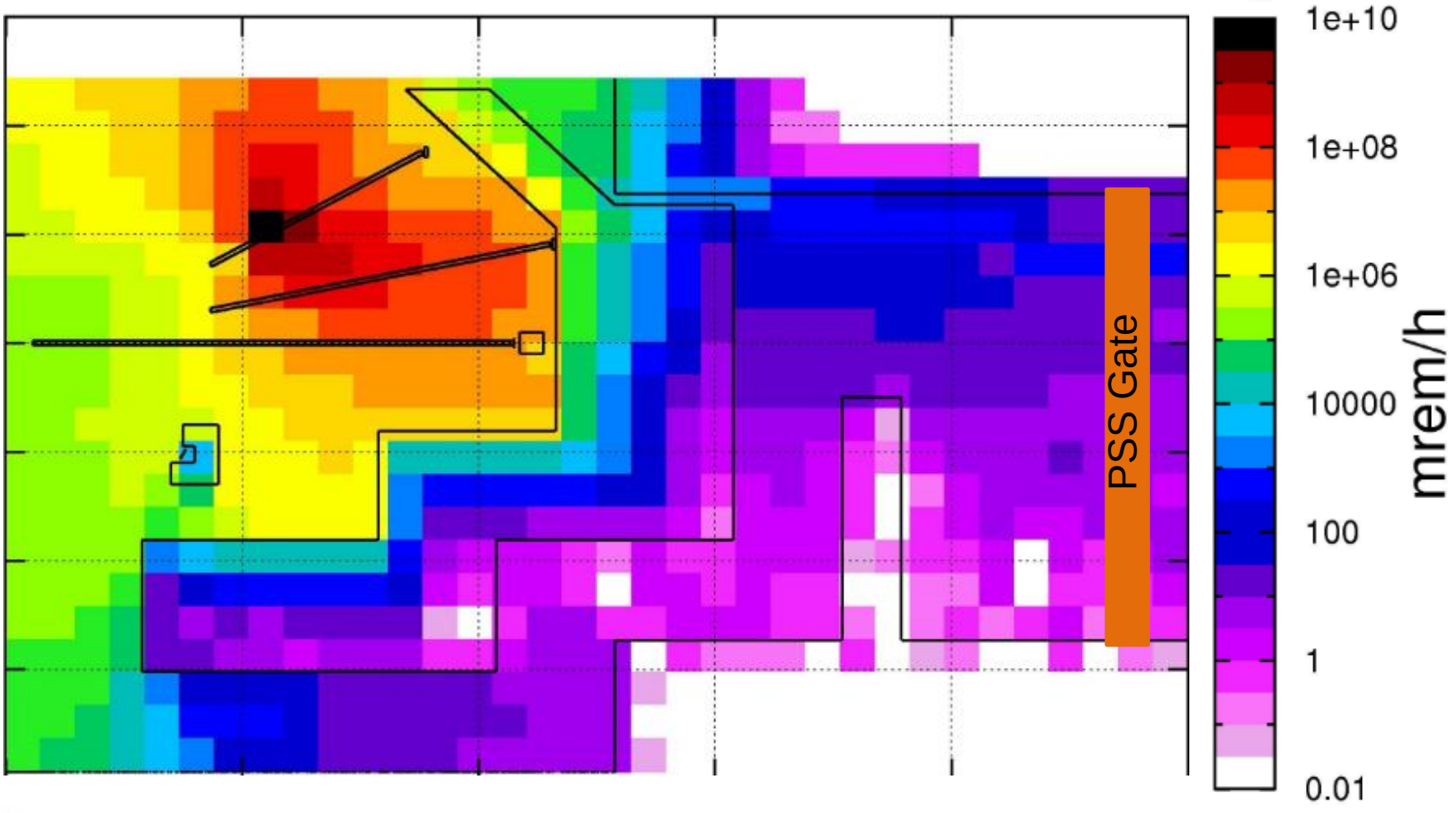
Beam on Target: 8MeV & 10μA on 1mm thick W



Beam on Dump: 8MeV & 10μA on "thick" dump



Beam Strike: 8MeV & 10μA loss above cryolines



Resources & Schedule

Broad Labor Requirements – configure segmentation, install PEPPo, run PEPPo, re-configure segmentation

Utility Interruptions – LCW (low conductivity water) will not be available for majority of shutdown, cryogens will not be at 2K (for SRF) early in shutdown

Activity	Start Date	Duration
Shutdown Begins	May 14	-
Segmentation/PEPPo Installation	May 16	7 weeks
Run PEPPo/Mott Programs	July 5	9 weeks
Backout Segmentation	September 5	2 weeks
Recommission Injector	September 19	2 weeks
CEBAF Recovery	October 3	6 weeks
Shutdown Ends	October Y	-

Summary

- Top priority has been assessing if/how we run CEBAF during shutdown
- The Compton polarimeter analyzing magnet should arrive in December.
- Ready to begin mechanical layout of electron beam spigot; then review/modify – want to begin fabrication/assembly by January, must identify resources to instrument/control beam line
- Next issue is to ship the E166 solenoid/spectrometer to JLAB
  - Highest priority over next ~couple months
  - Need to assess "new" diagnostic section
- RadCon making progress – next iteration requires better ME layout, particularly location

Tomorrow, we'll discuss work integration & planning in more detail, however, we need to converge on final design layout and by end of this year have detailed roadmap for 2011.