Considerations for CEBAF Injector Upgrade

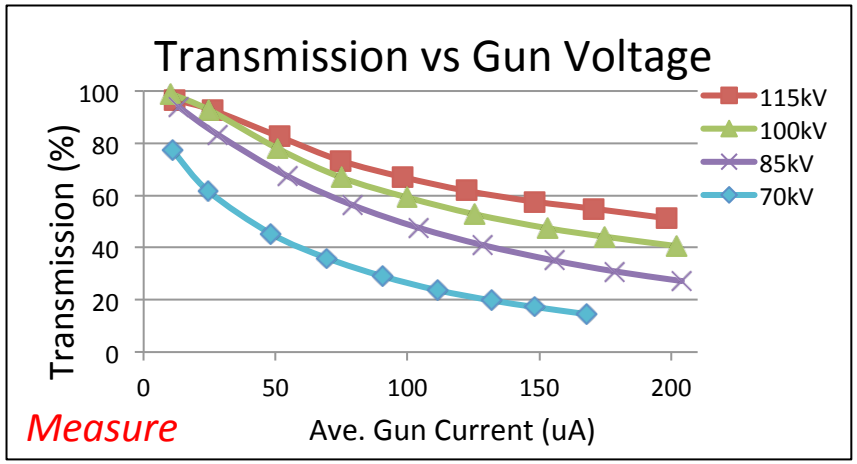
Initial Planning Meeting

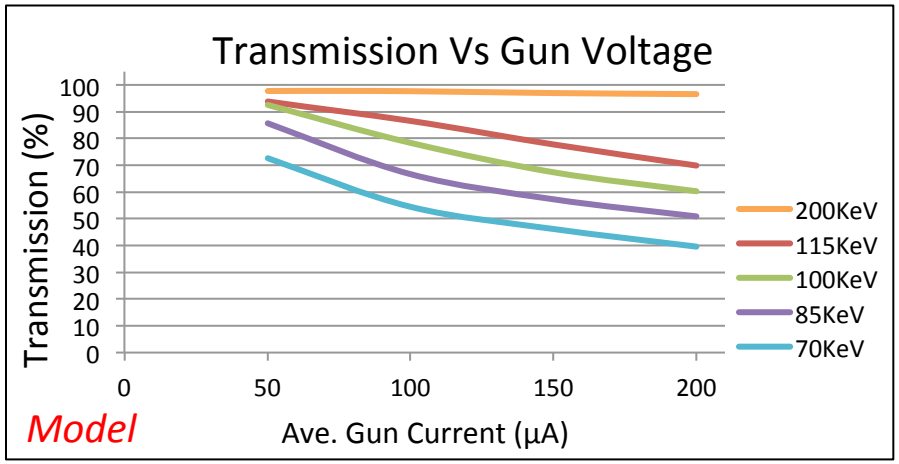
August 27, 2015

Joe Grames

Upgrade gun for 200 kV operation : improves Parity Quality Beam

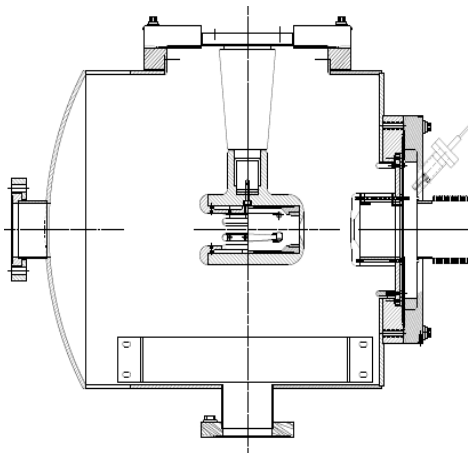
- Beam quality, including transmission, improves at higher gun voltage
- Continuous application of high voltage from local HVPS

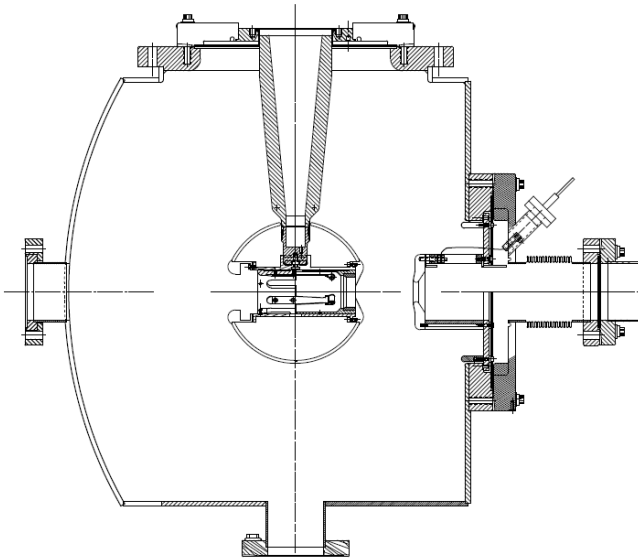




Sibling to CEBAF 130 kV Gun

225kV ILC "Tee" Electrode Inverted Gun



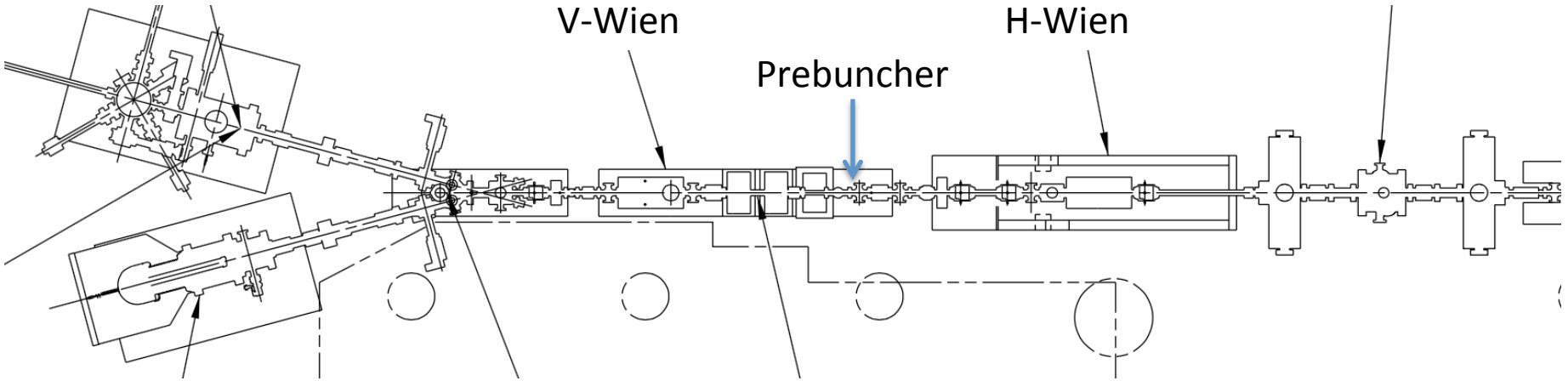


350kV UITF/GTS "Ball" Electrode Inverted Gun

Two Wien Flipper :

- Extend SLAC 100 kV design to >200kV
- Improve layout (remove intervening prebuncher)
- Improve transport (appropriate quadrupoles to correct astigmatism)

Beam Voltage	*keV*	200.00	250.00	300.00	350.00
Integrated BL @ 10A	*G-cm*	3993.86	4878.05	5816.55	6788.51
Current	*A*	**15.36**	18.76	22.37	26.11
Precession	*deg*	100.00	100.00	100.00	100.00
Effective Length	*cm*	31.00	31.00	31.00	31.00
Electric Field	*MV/m*	2.67	3.49	4.36	5.27
Differential Voltage	*kV*	26.73	34.90	43.62	52.74
Bi-Power Supply Voltage	*kV*	13.36	17.45	21.81	26.37



Chopping : improve independent control of 3- or 4- beams

- Consider routine 4-hall operation (reliable, process driven)
- Improve mechanical alignment control of chopping apertures

Improve optics : improve management of beam and through apertures

- Solenoids with improved aperture uniformity
- Improve or manage DS magnet (req'd for PQB laser)
- Improve integration in the 6MeV to 0L03 space

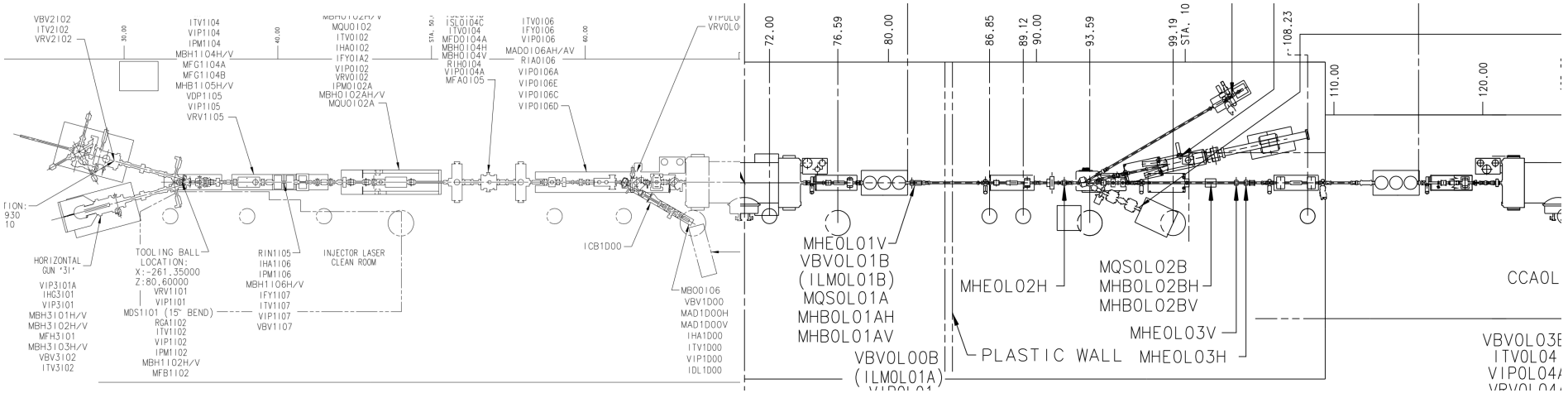
Improve vacuum : better lifetime means better PQB beam quality

- Developing NEG coating process for vacuum components
- Replace ion pumps, add NEG's, upgrade failing power supplies

Improve diagnostics : systematic control of beam setup

- Replace chromox/harps w/ YAG to improve beam measurement and control
- Design and implement procedural precision spectrometers
- Improve BPM coverage from chopper to cryounit

Green Footprint : strategy towards an idealized injector upgrade



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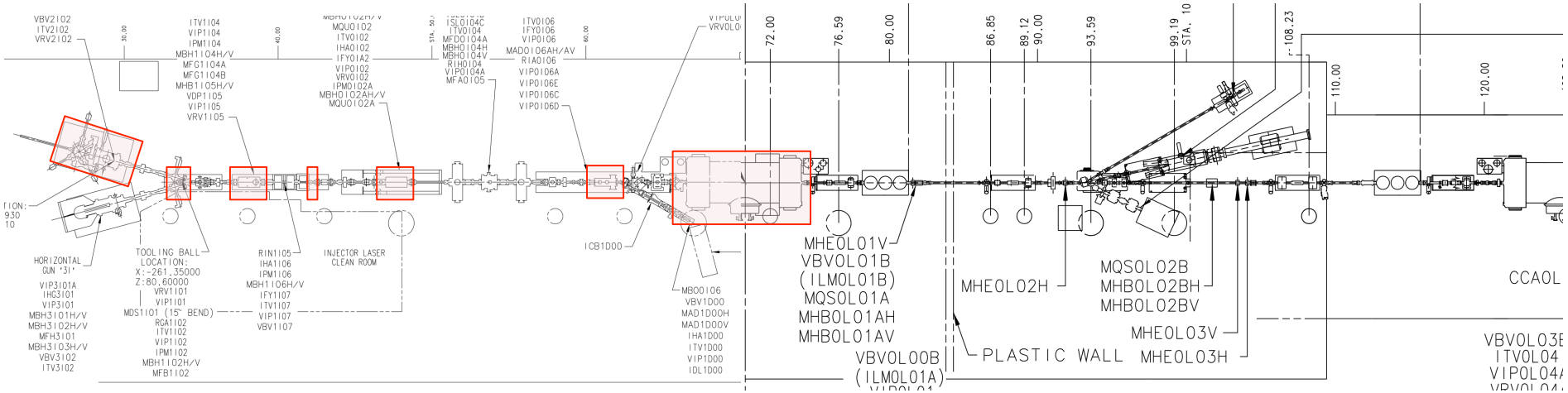

<u>Necessary shift</u>: HV chamber, HVPS, dipole, Wien's, no PB/capture, QCM

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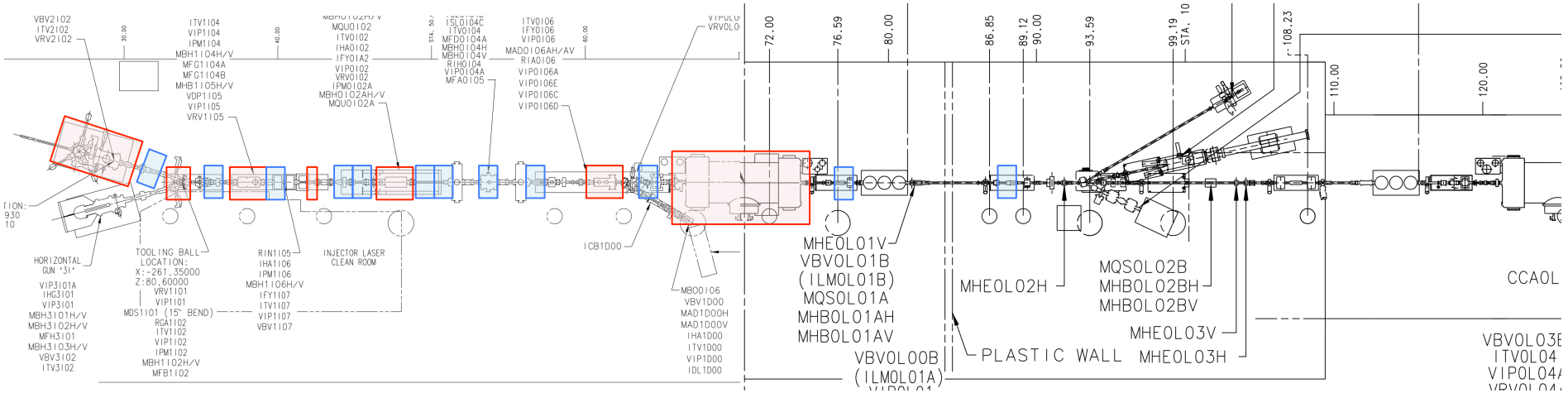

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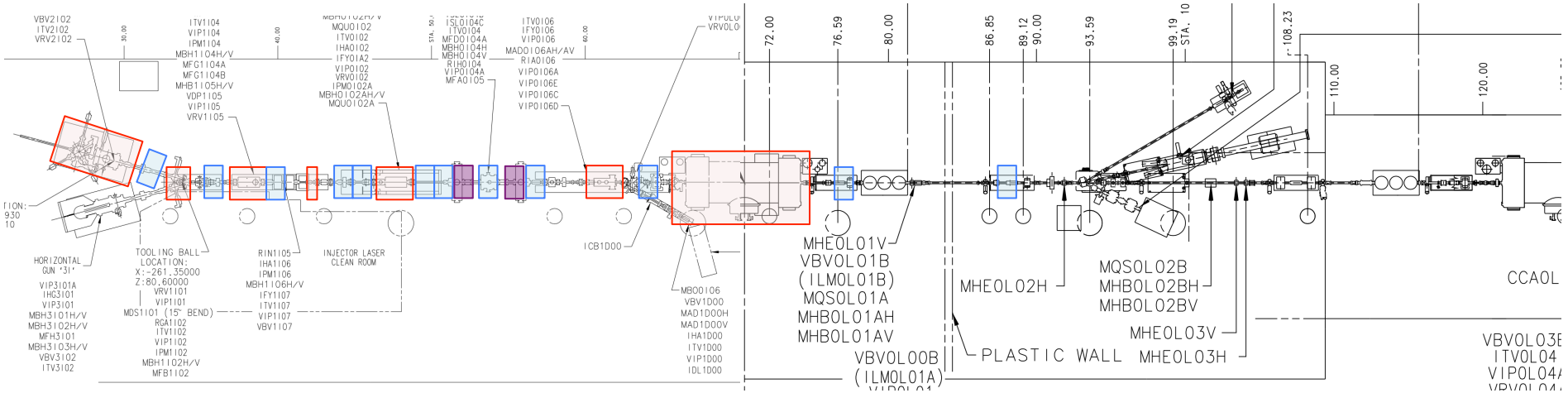

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Capability shift: 4-beam chopping system

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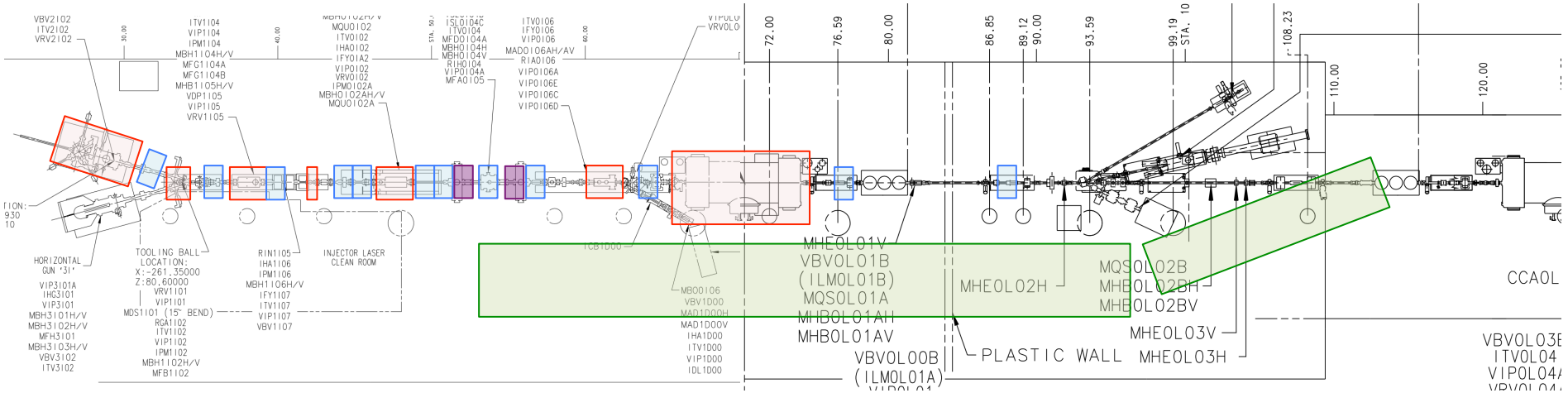

Paradigm shift: Build a second 6 MeV integrated injector

- Assemble the 200 kV footprint one would design if 6 MeV injector weren't there
- Assess utility of operation from 200 kV to higher voltage 350kV
- Eases installation & commissioning process to advanced 6 MeV injector
- Provide 1:1 fallback to a 3-hall 6 MeV injector
- Enables significant modes of mutual operation
  - Simultaneous (mixed energy or kicker combination) for up to 4-hall Ops
  - Fixed purpose for PV violation (1 photocathode, 1 laser, 1 everything)
  - Multi-purpose platform (R&D, development)
- Single purpose operation (100% transition to 3- or 4- beam chopping)