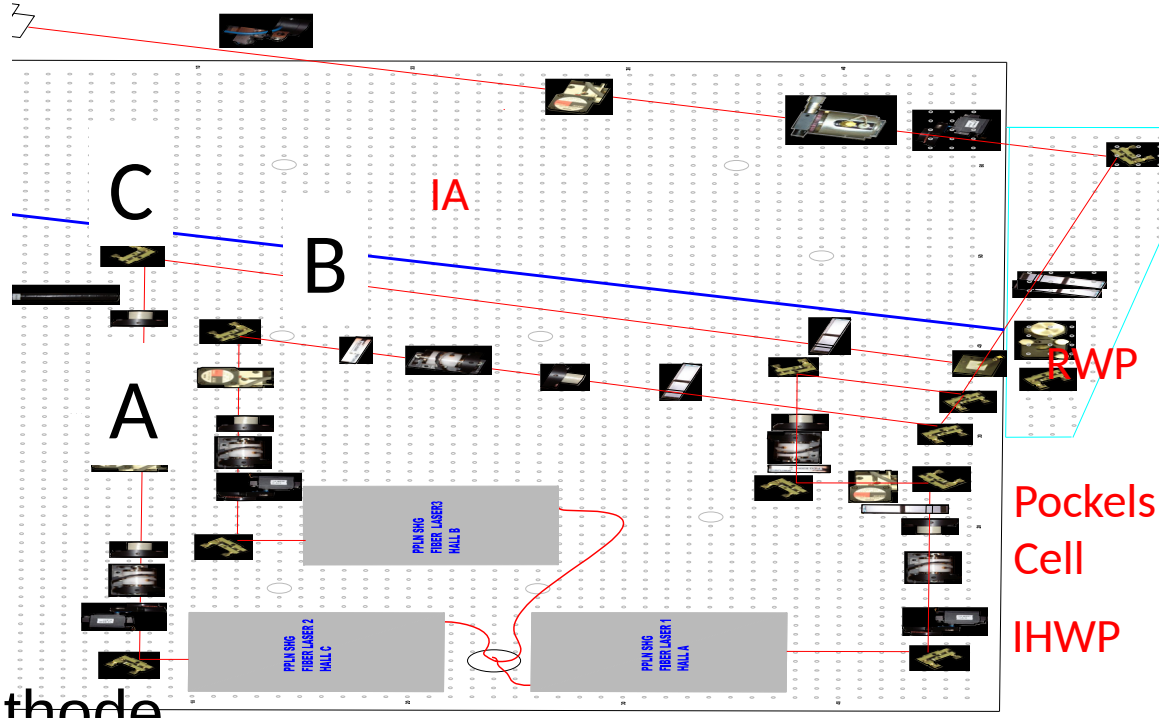
Polarized Source - Spring 2016

Laser System

- Still 3-lasers
- Each 249.5 or 499 MHz



High-Polarization Photocathode

- Retired 5247-1 work horse of 6 GeV era 2009-2012
- Installed 5756-4 for 12 GeV (QE > 1%, P ~87%)

Gun

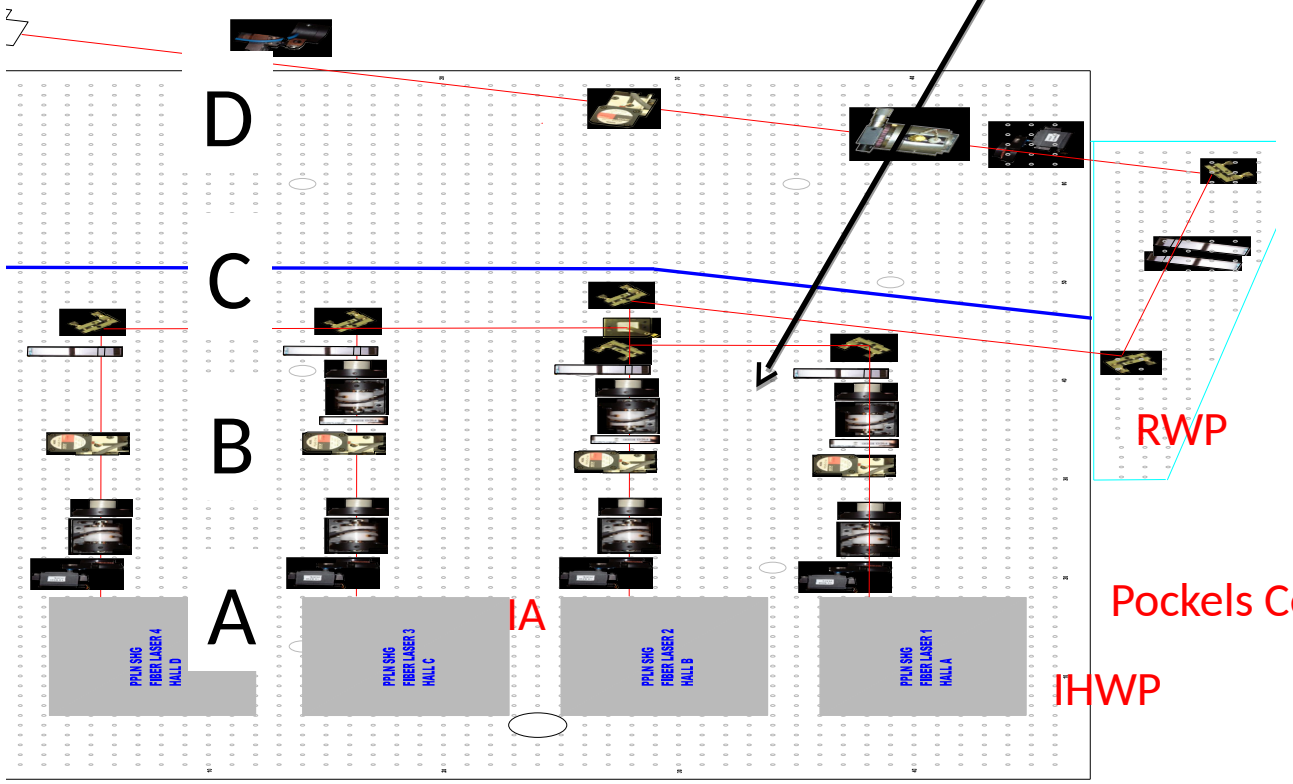
- Continues operating at -130 kV
- Baked gun/activated NEG's => Charge lifetime >150C

4-Laser Upgrade Summer (Jun-Aug) 2016

Must add support for an additional 4th laser – big job

Retain geometry downstream of polarization combining cube

New 4-laser configuration



4-Laser Upgrade Summer (Jun-Aug) 2016

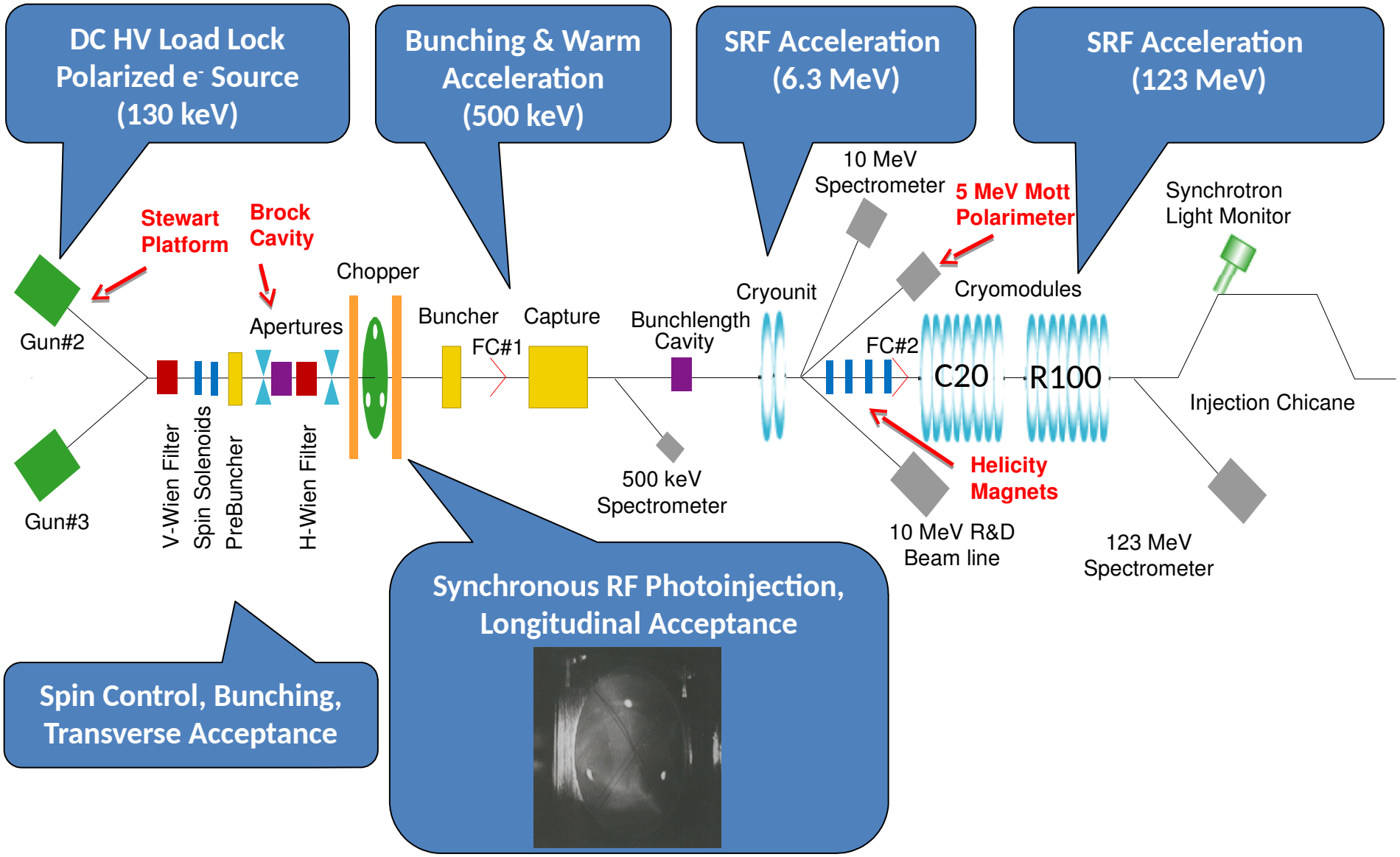
- ***New* pulsed mode generator**
  - *All electro-optic system, eliminate mechanical waveplates*
  - *Rise and fall times are about ten times faster ~25 ns*
- ***New* Service Catch All Module (SCAM)**
  - *Produces Viewer, Pulsed & CW beam modes now for 4-lasers*
  - *Provides new pre-triggering capability for diagnostics*
  - *Design moves parameters from firmware to software for greater flexibility*
- ***New* laser control chassis**
  - *All hardware switchyard between SCAM and PSS now for 4-Lasers*
- ***New* PSS Control**
  - *Gun HVPS will be able to remain ON in Power Permit & through Hall Accesses*
  - *New laser shutter control electronics deployed*
- *No changes to the Low-Level RF (LLRF)*
  - *Retain existing 499/250 MHz LLRF capability from Spring*

4-Laser Upgrade Winter (Jan) 2017

- ***New** 4-laser LLRF system deployed with 250 and 499 MHz capability*
  - *New system simpler (old system based on C100 control module)*
  - *Operators can remotely choose laser rep rate*
  - *360 deg phase shifter at each frequency*

- ***New** 4-Hall Operations*
  - *First commissioning period, April 2017*
  - *If successful, provide 4-beam operations in April-May, 2017*

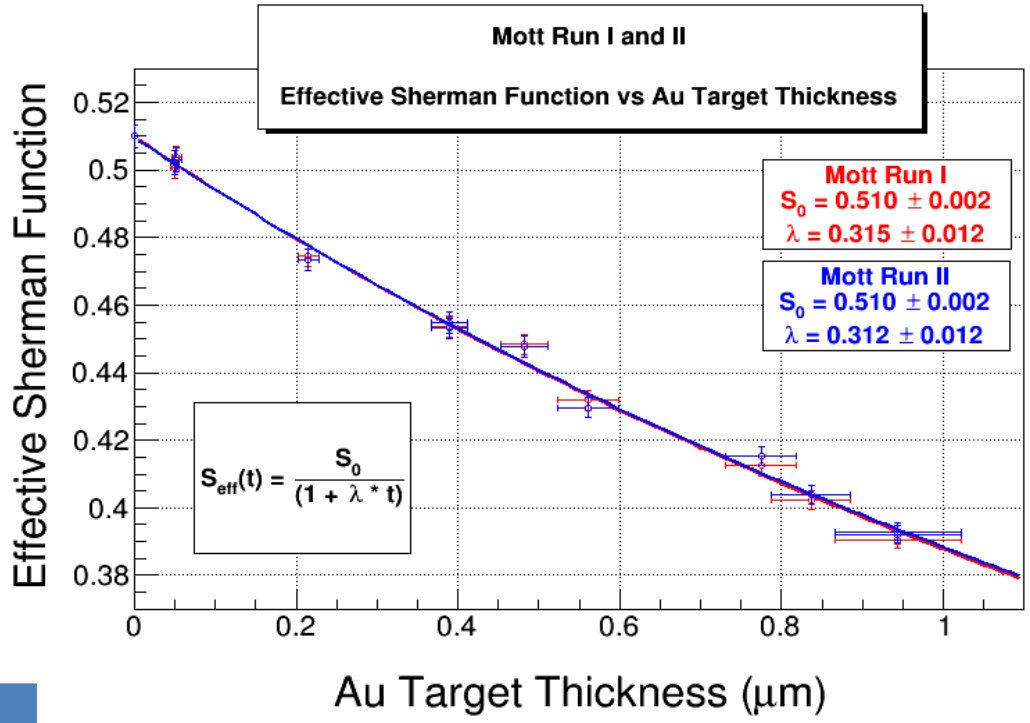
12 GeV CEBAF Polarized Electron Injector



Precision Test of 5 MeV Mott Polarimeter

Run I – January 2015
- Instrument systematics
- Extrapolation I (SLSP-5247)

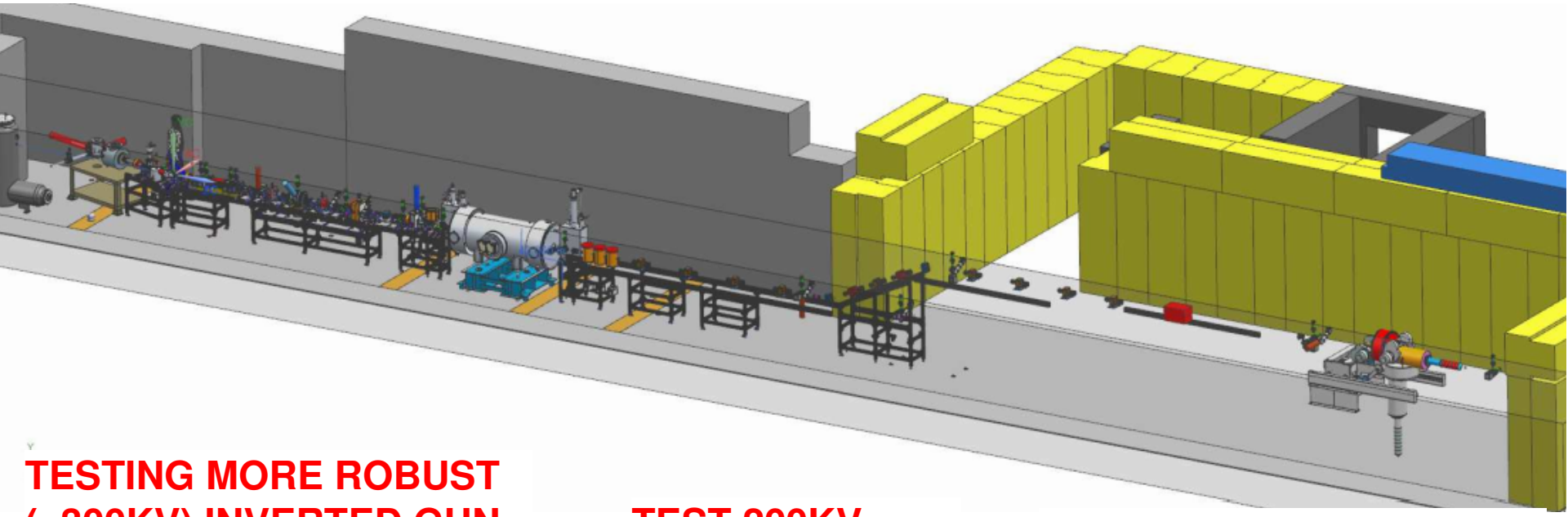
Run II – October 2015
- Beam systematics
- Extrapolation II (SLSP-5756)



Expected Range of Uncertainty		
Source	**2014 Expectation**	**2016 Preliminary**
Theory	**0.5 – 1.0%**	**0.5 – 0.6%**
Extrapolation	**0.2 – 0.5%**	**0.2 – 0.3%**
Instrumental	**0.2 – 0.4%**	**0.2 – 0.3%**
BUDGET	**0.6 – 1.2%**	**0.6 – 0.7%**

- We are planning **publication this Fall**, but Users benefit immediately from this work
- Future Run 3 may test largest systematic (theory) with low-Z target

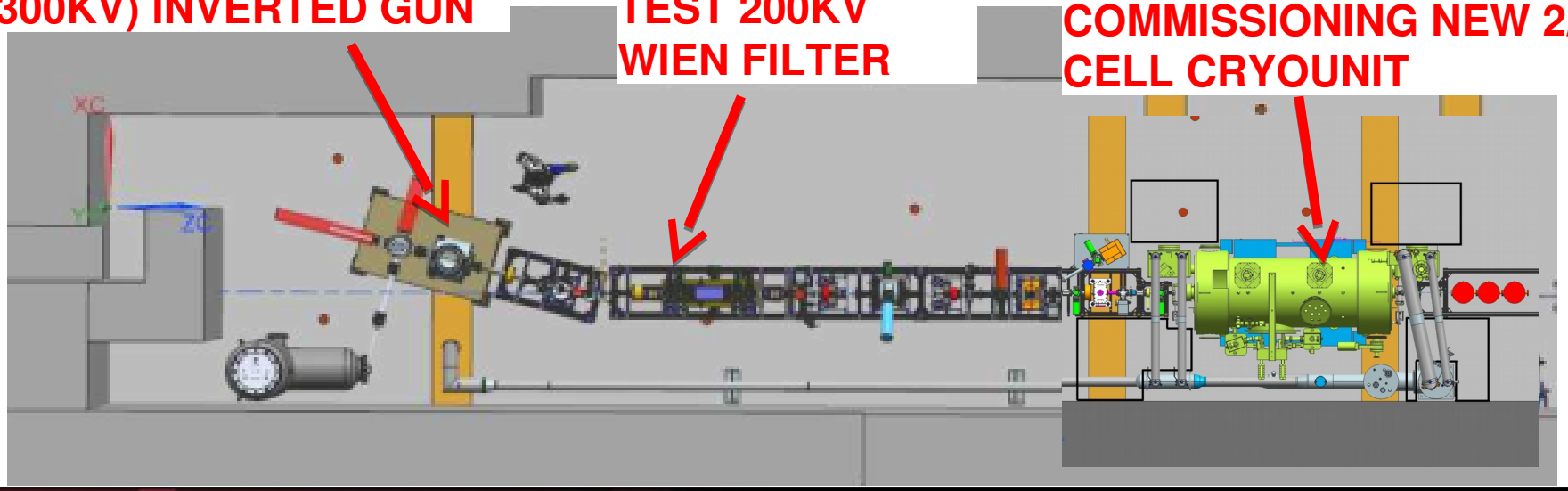
Commissioning of CEBAF Upgrade at UITF



TESTING MORE ROBUST (>300KV) INVERTED GUN

TEST 200KV WIEN FILTER

COMMISSIONING NEW 2/7 CELL CRYOUNIT

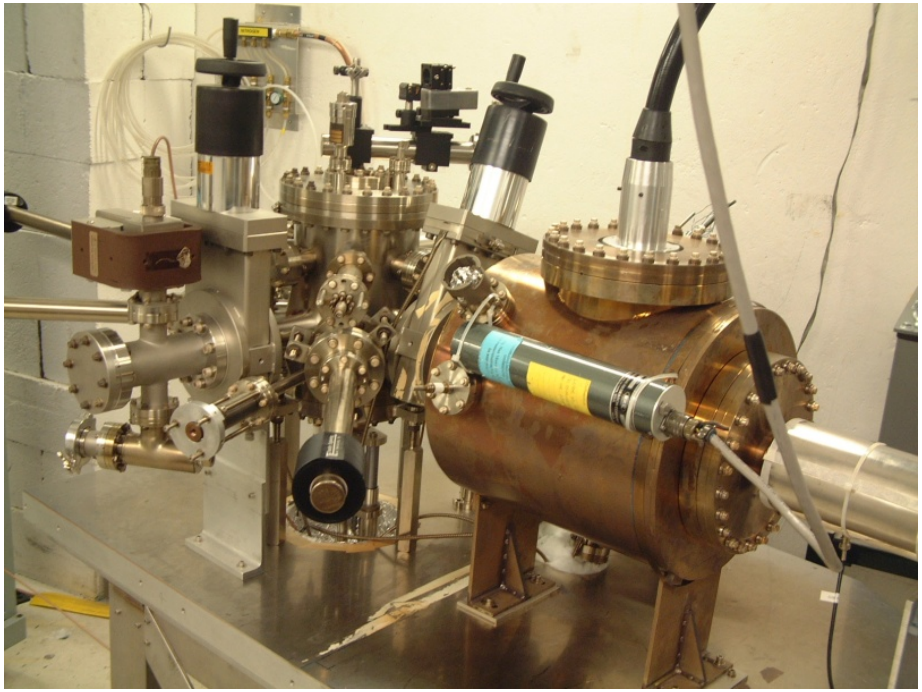


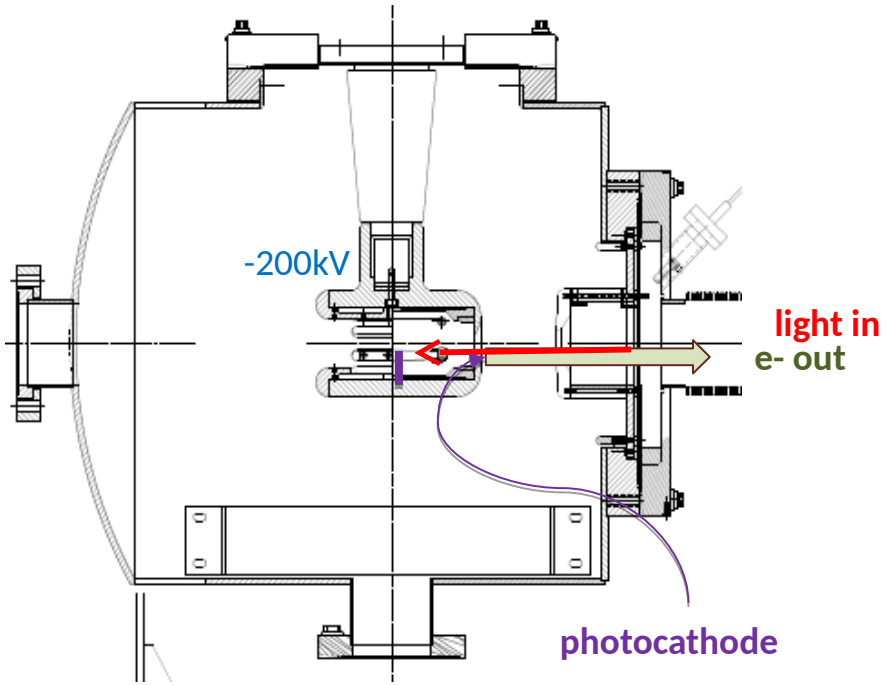
Courtesy Joseph Grames

CEBAF – ILC 200 kV Inverted Gun

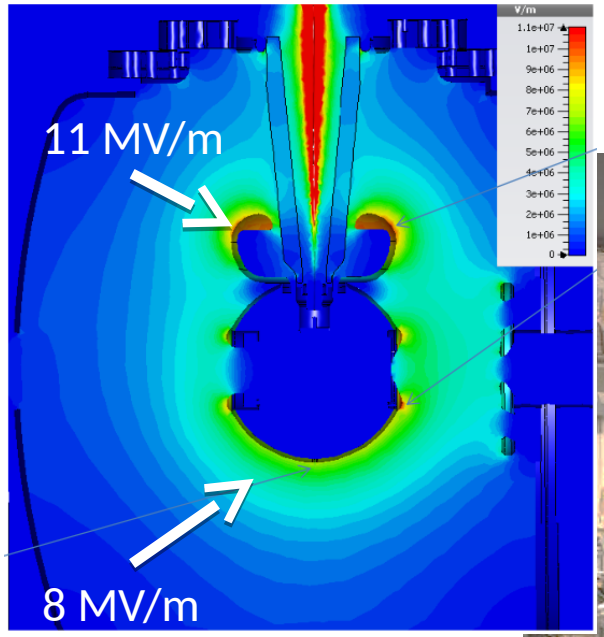
Developed and ready for installation

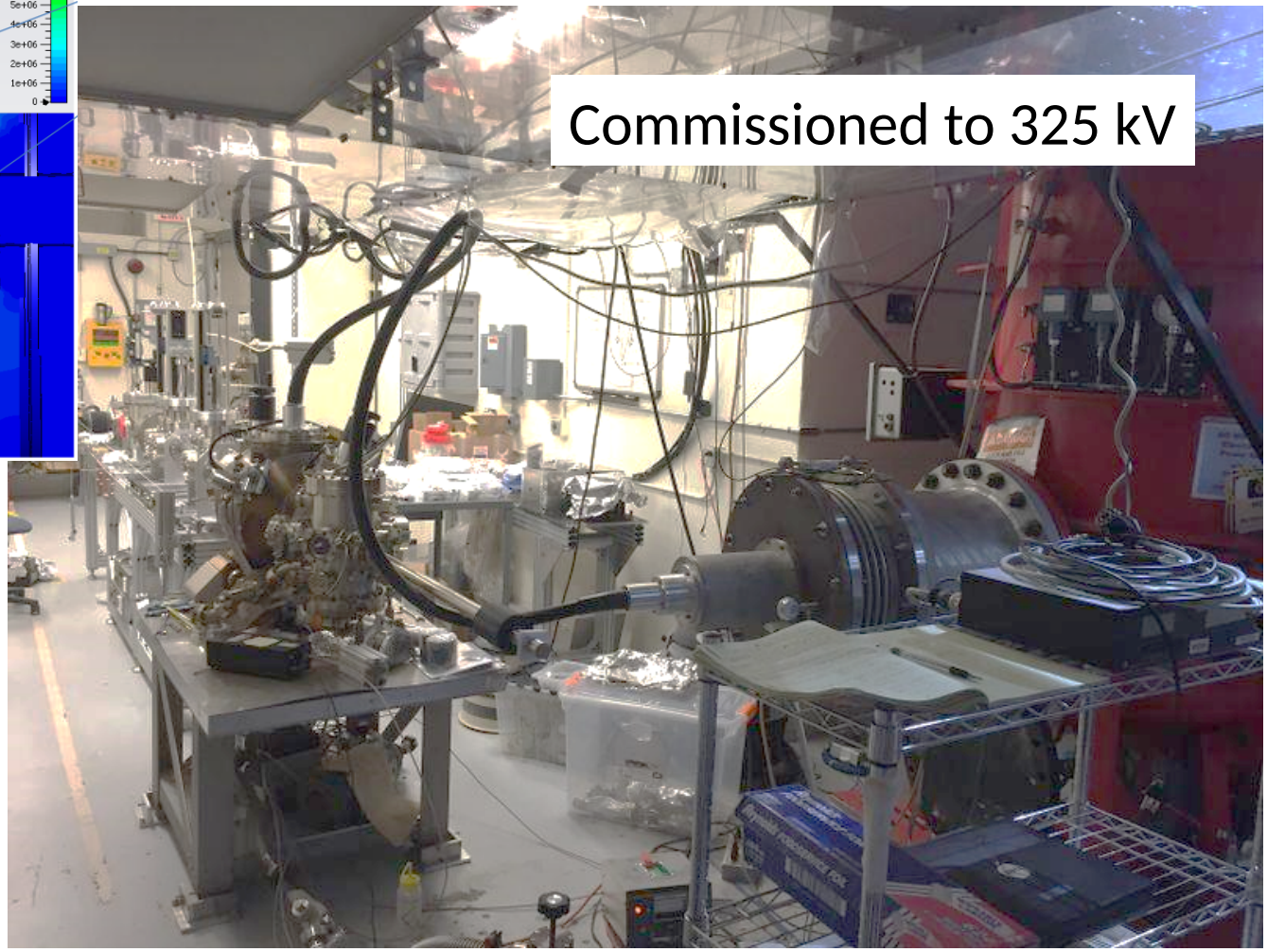
- Commissioned at Test Cave to 225 kV w/o field emission
- Large grain Niboium electrode



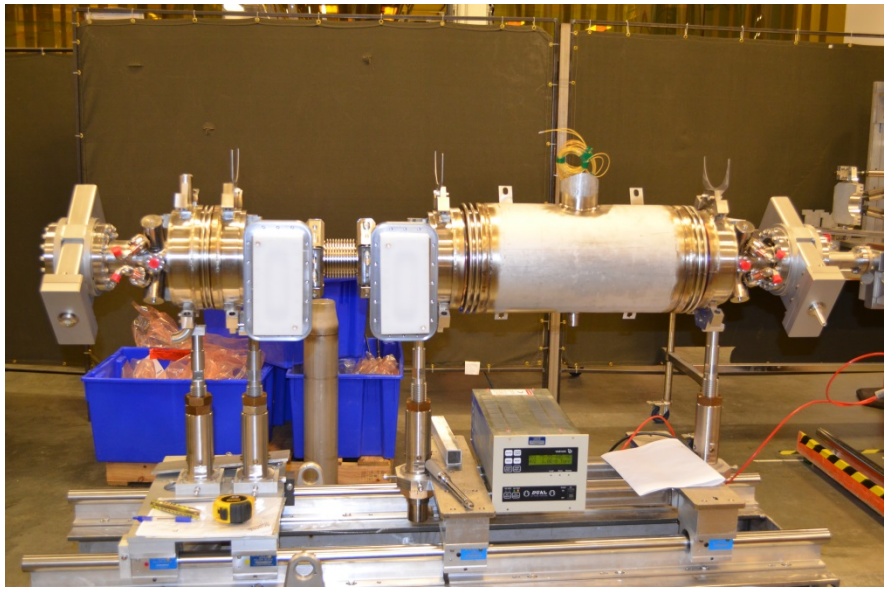


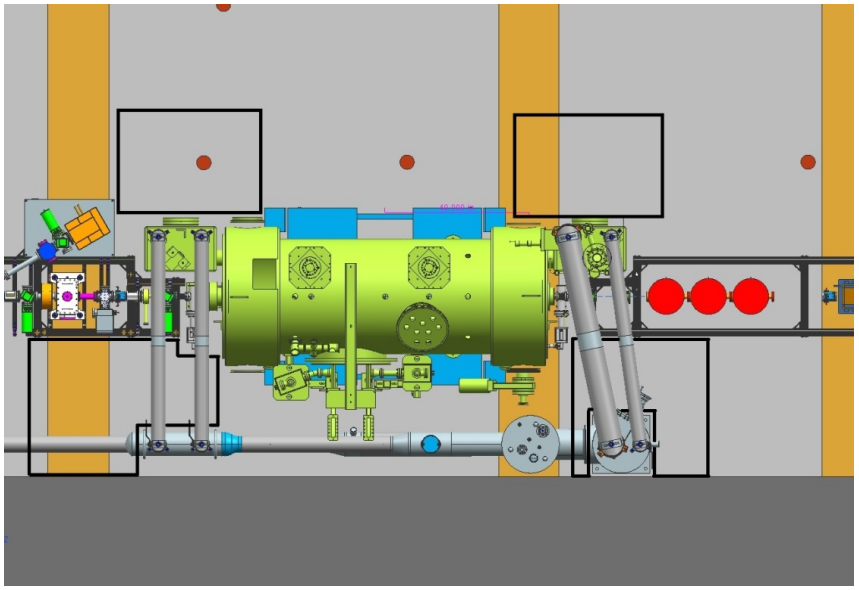
Testing > 300 kV Inverted Guns at GTS / UITF





Status of New ¼ CM





2016 Commissioning plan at Test Lab

- Spring: assembly + cryo/RF @ UITF
- Summer: SRF commissioning @ CMTF
- Fall: install UITF, klystron-limited to ~8 MeV

Recent Hall B Beam-line Experience

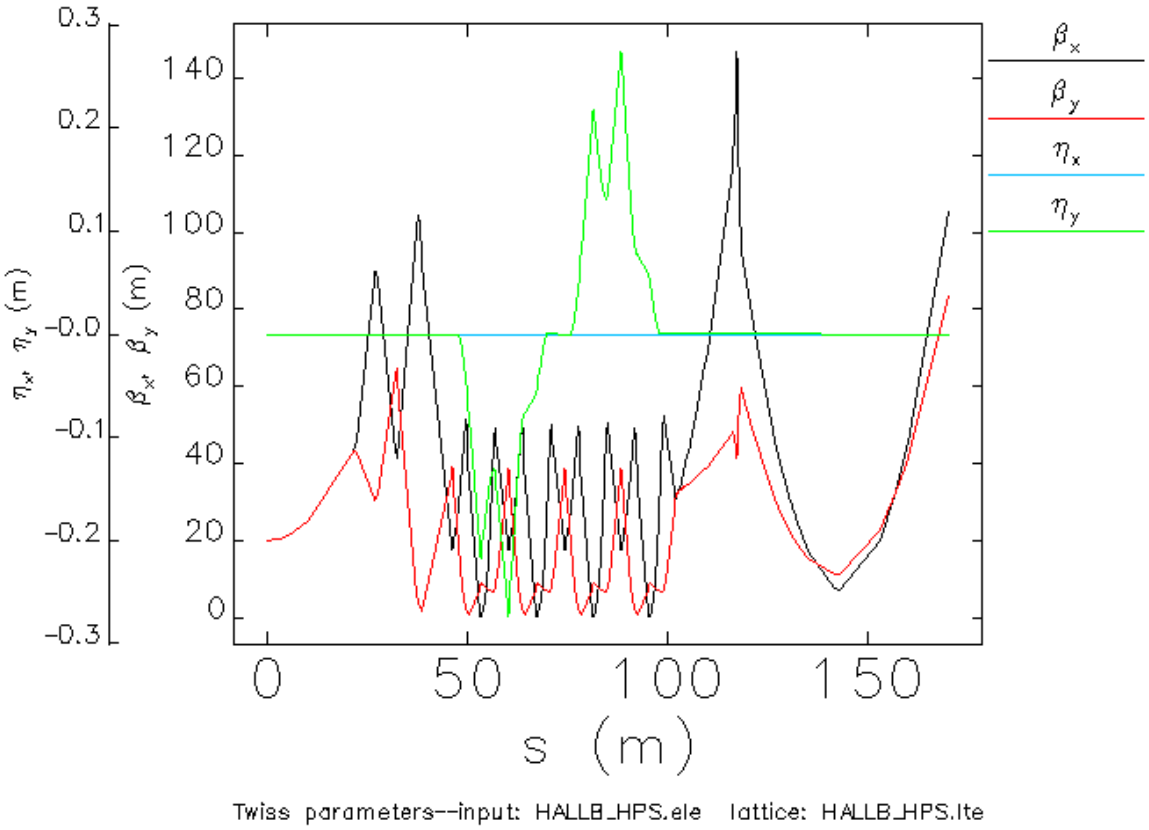
2015/2016 Operations in Hall B

- Fall/Spring: HPS
  - Evening and weekend running in Fall
  - Weekends only for HPS in Spring
  - Interference from weekday changes for other halls
- Summer: Prad
  - Weekday and weekend running
  - Good reproducibility (PRad sole user)
- Fall: Plan exists (but plans change)

Recent Hall B Optical Layouts -- HPS

HPS Optics

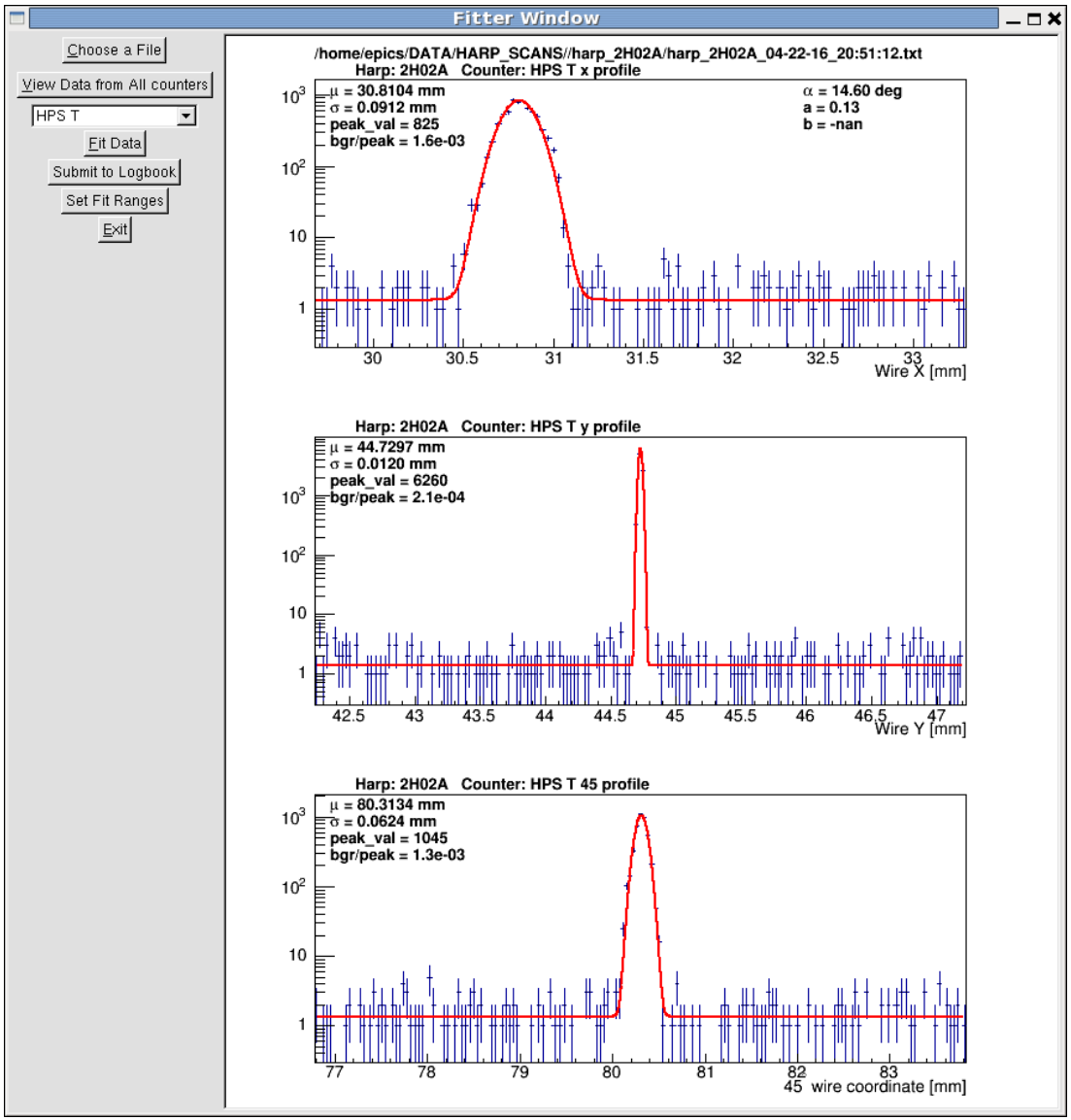
- Target far downstream from CLAS12
- Supplementary quads and BPMs used



Hall B HPS Beam Profiles at Target

HPS Optics Goal
- small vertical size

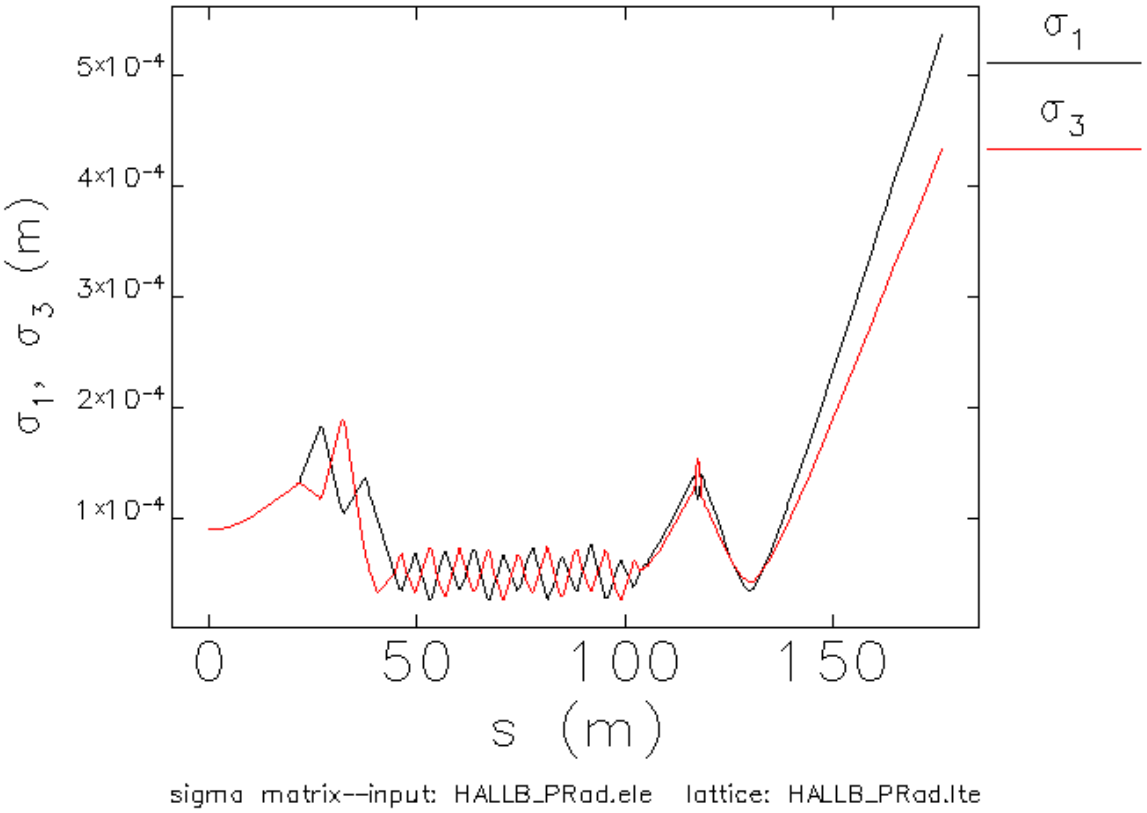
By end of run,
Y_rms < 50 microns



Recent Hall B Optical Layouts -- PRad

PRad Optics

- Target upstream from CLAS12
- Supplementary target harp for target-plane profiles

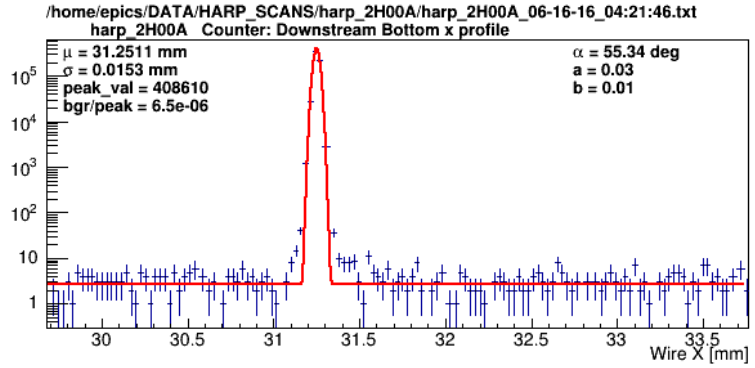


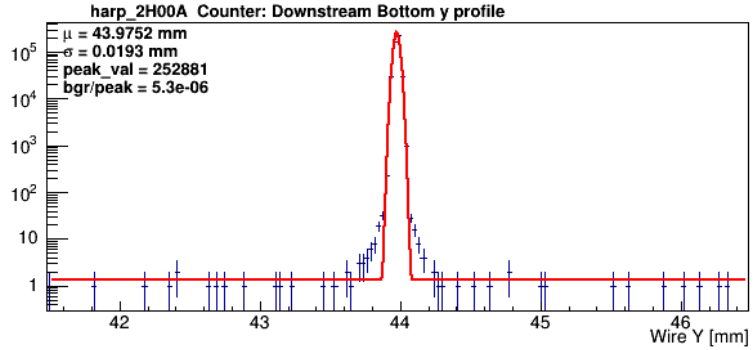
Hall B PRad Beam Profiles at Target (today)

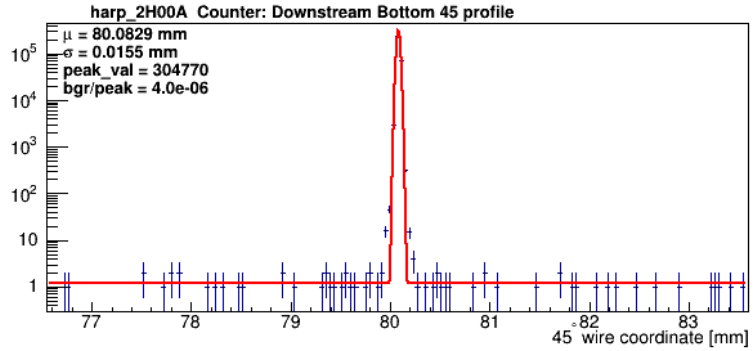
PRad Optics Goal

- Clean transmission through 2mm window aperture

As of this writing, RMS radii for Prad are reproducibly below 25 microns at 2.14 GeV







The Future – Diagnostics and Procedures

Beam diagnostics are in place and their use is improving

- Wire scanners
- YAG/OTR viewers
- BPMs (SEE, cavity/nanoAmp, Digital Receiver/Stripline)

We are refining our ability to use and interpret Twiss measurements for deterministic envelope control

PRad runs have demonstrated reproducible setup procedures and we are improving those procedures. We have identified important omissions in accelerator magnet monitoring. Beam line control is improving.