

Polarized Injector Status

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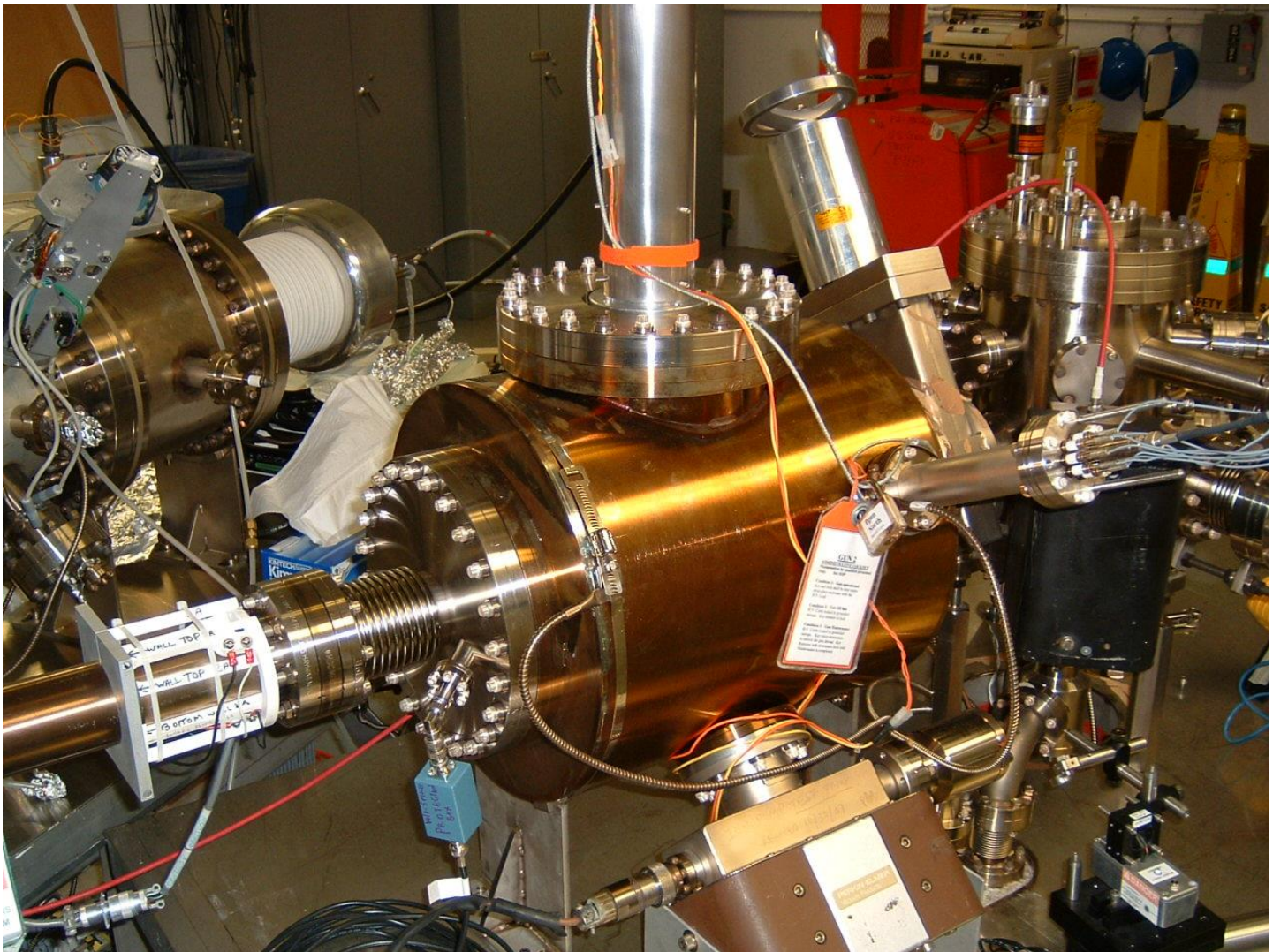
QWeak Collaboration Meeting
February 1, 2010

Outline

- Inverted Gun & Higher Voltage
- Electron Polarization Reversal
- Fast Helicity Reversal & New Helicity Board
- New QWeak IA Electronics
- Injector Commissioning & Optimization for QWeak

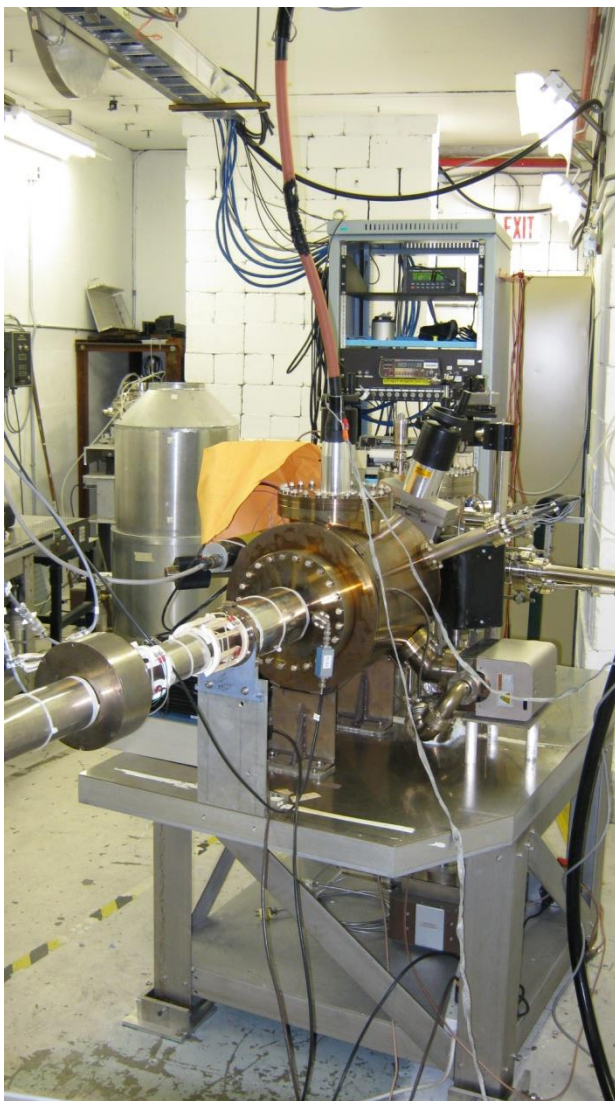
Inverted Gun at CEBAF

- **First Inverted Gun (with Stainless Steel electrode) installed at CEBAF, operational since July 23, 2009**
- **Running at 100 kV. Conditioned to 110 kV**
- **Lifetime about 75 C at 130 μ A average current**
 - **2 weeks between spot moves, 2-3 months between heat/activations**
- **HAPPEX-III, PVDIS, and PREx: 100 kV. QWeak: > 100 kV**
- **Maximum possible Gun Voltage is 150 kV (limited by Safety System and HV Power Supply)**



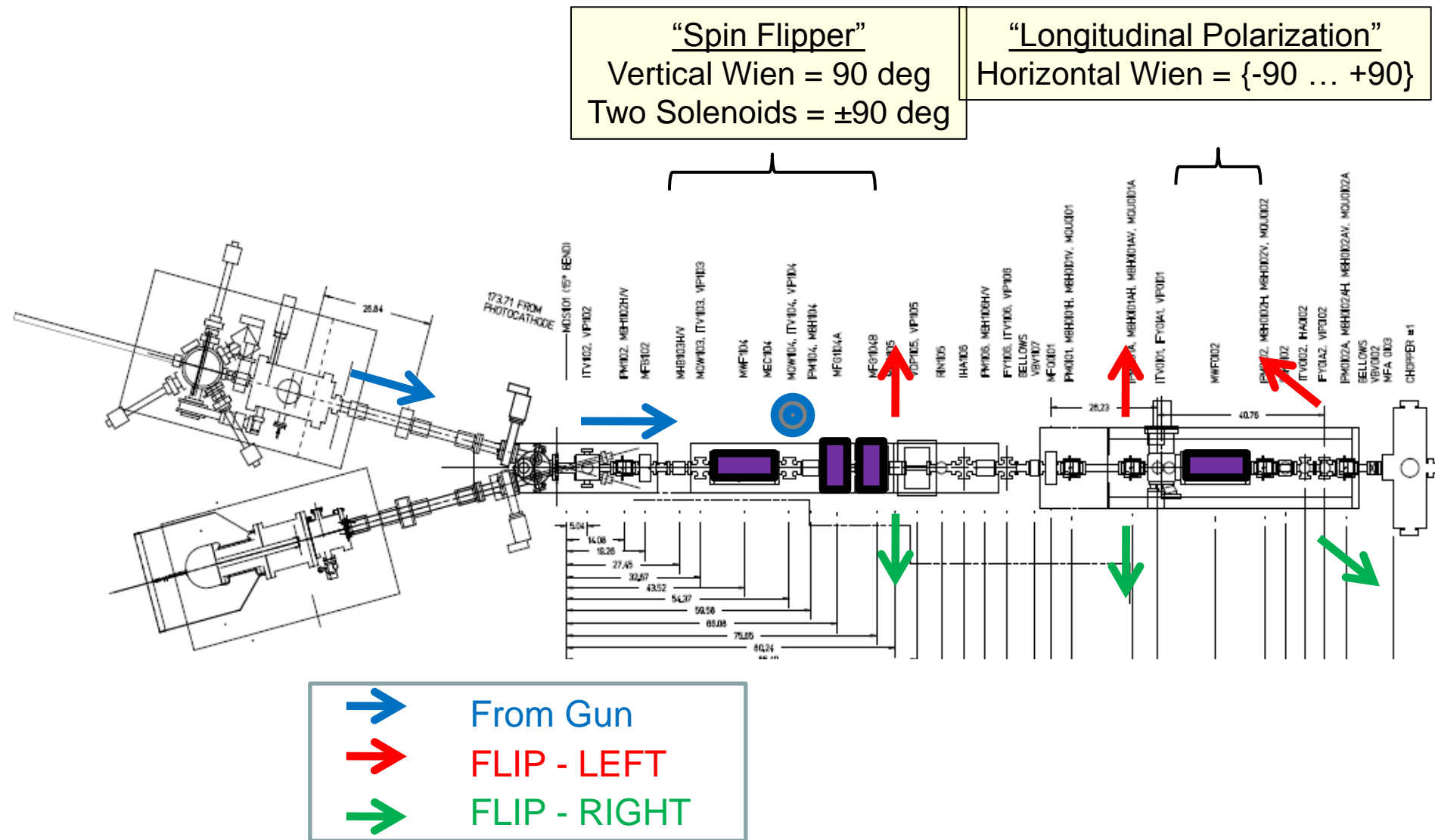
Inverted Gun at Test Cave & Higher Voltage

- Second Inverted Gun (with Nb electrode) installed at Test Cave by in November 2009
- Conditioned to 150 kV (no vacuum activities, small FE)
- Measured lifetime at 100 kV
- Will measure lifetime at 140 kV this week
- Reminder: still need to test the CEBAF injector up to 150 keV for compatibility with higher voltage gun, mainly warm RF: PreBuncher, Chopper, Buncher, Capture.



HV (kV)	FE (pA)	Radiation (mR/h)
135	-0.1	0.07
140	-0.6	0.20
145	-1.4	0.45
150	-3.1	1.00

Electron Polarization Reversal



Spin Flipper = Wien + Solenoid

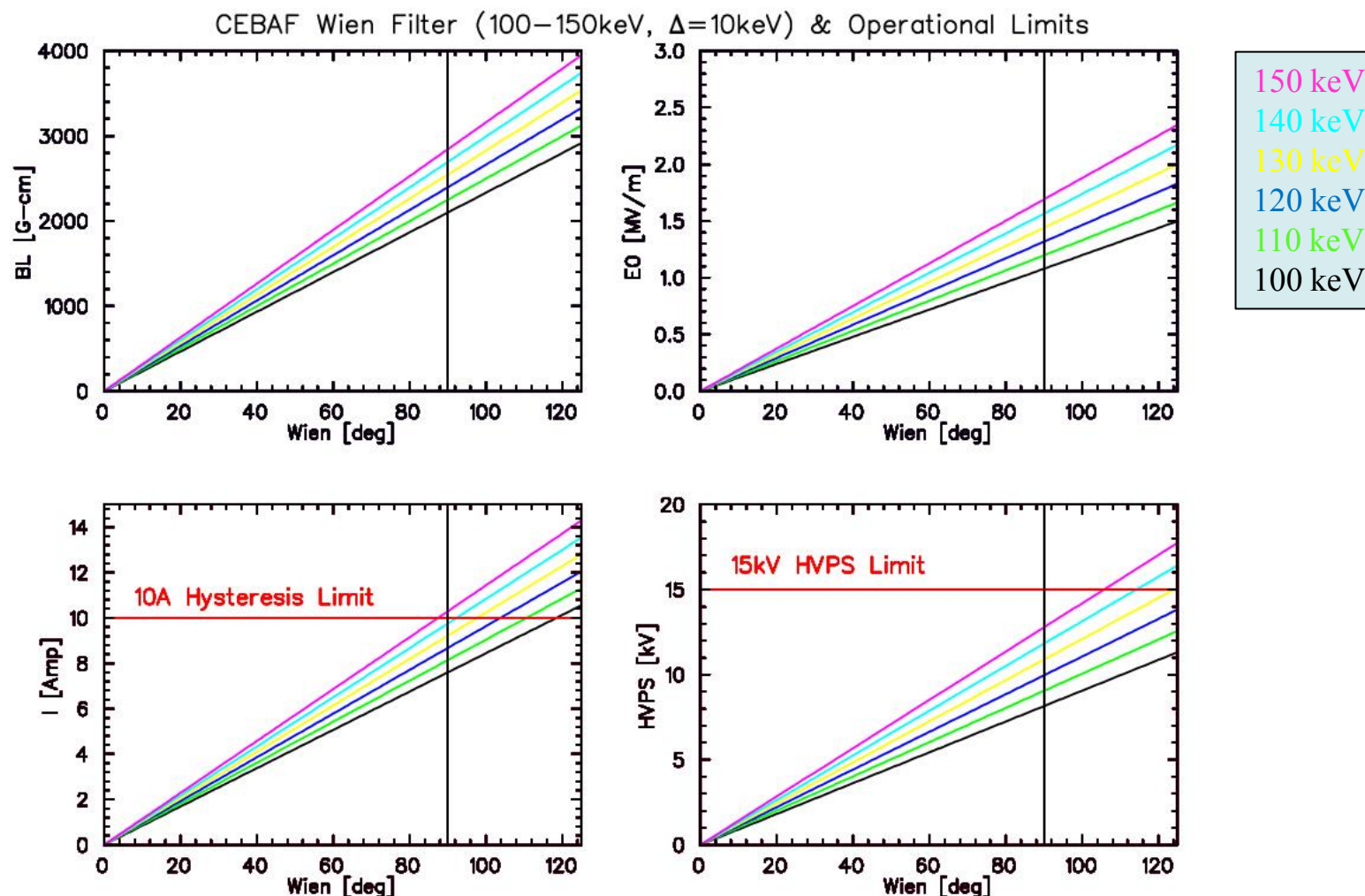
Long. Pol = Wien

4 Most Important Configurations	Vertical Wien (MWF1I04)	Two Solenoids (MFG1I04A/B)	Horizontal Wien (MWF0I02)
NO FLIP (old method)	0 deg	0 deg	+43 deg
VERTICAL POL	90 deg	0 deg	+0 deg
FLIP - LEFT	90 deg	-90 deg	-47 deg
FLIP - RIGHT	90 deg	+90 deg	-47 deg

Some facts...

- “Spin Flipping” is accomplished without changing Wien filters
- Vertical Polarization is a “subset” of “Spin Flipper” operation
- “Old Method” achieved by turning Vertical Wien off
- Ability to uniquely define spin in 4π

Functionality of spin controls – operate to 140 keV



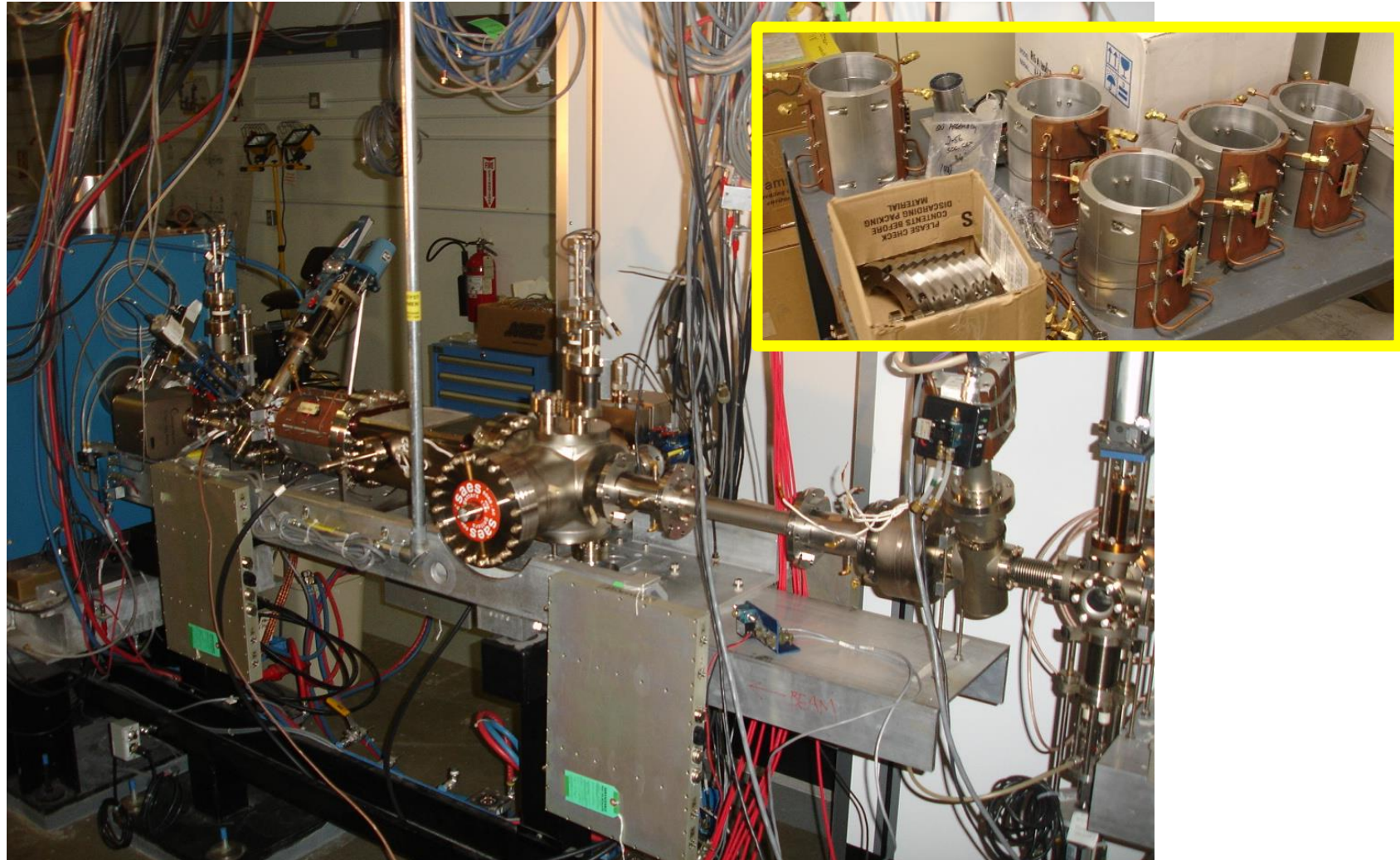
January 27, 2010

Region 1 Girder – “Spin Flipper”



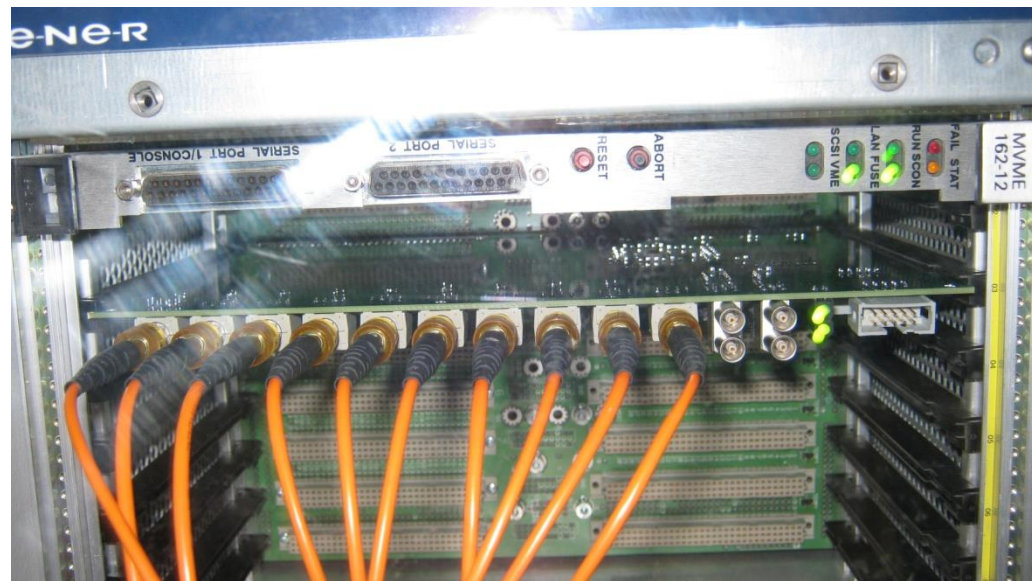
January 27, 2010

Region 2 Girder – “A1/A2 + Horizontal Wien Filter”



Fast Helicity Reversal

- **New Helicity Board installed on Nov 2, 2009**
- **Features:**
 - Transition to T-Settle will start 1 μ s before all other signals
 - 30-bit Pseudo-random Shift Register
 - Patterns: Toggle, Pair, Quartet, Octet
 - T-Settle: 10 μ s – 1,000 μ s
 - Clock:
 - I. Line-Locked: Helicity Reversal of 30 Hz, 120 Hz, or 240 Hz
 - II. Free: T-Stable of 400 μ s – 1,000,000 μ s
- **More Fiber Outputs:**
 - Real Time Helicity:
 - I. Standard: Pockels Cell & IAs
 - II. Complementary: Helicity Magnets
 - 20 MHz board internal clock
 - Two outputs indicate current and previous helicity patterns to QWeak IA



Experiment	Rate	Clock	Pattern
HAPPEX III & PVDIS	30 Hz	Free	Quartet
PREx (Preliminary)	240 Hz	Line-Locked	Octet
QWeak (Preliminary)	1 kHz	Free	Quartet

Helicity Control Board

When Configuration is changed please contact
Scott Higgins to set new configuration as default

CONTROL

MONITOR

Mode ☐ Free Clock ☐ Free Clock

1 T-SETTLE Input 1 60 usec ☐ 60

2 T-SETTLE Input 2

1 T-STABLE Input 1 900 usec ☐ 900

2 T-STABLE Input 2

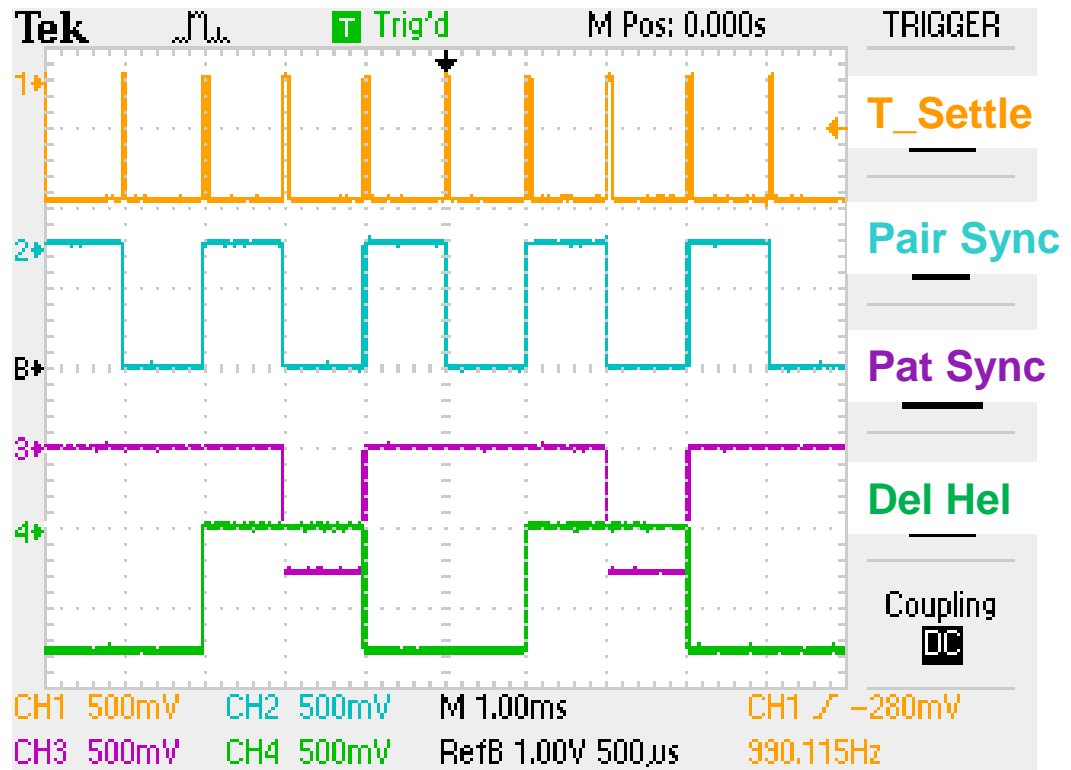
Helicity Pattern ☐ Quartet ☐ Quartet

Reporting Delay ☐ 8 windows ☐ 8 windows

Helicity Board Frequency (Hz) 1041.67

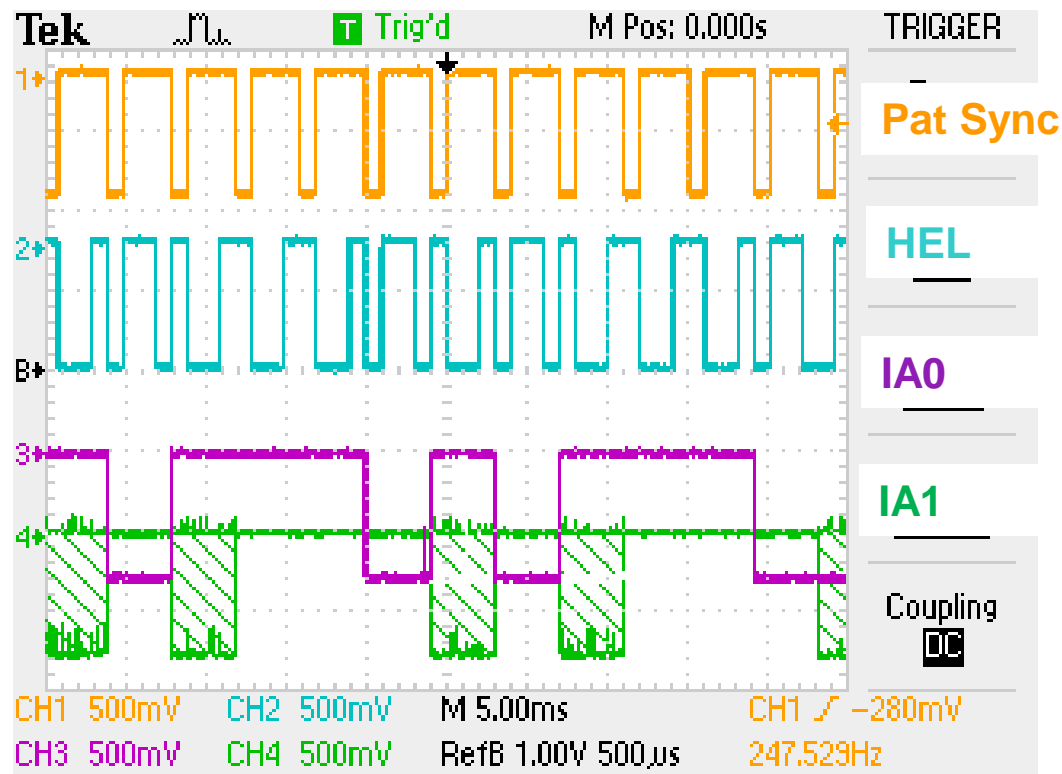
Hardware Rev. MONTH 12 DAY 11 YEAR 9

User Guide ☐



QWeak New IA Electronics

- Hardware to be installed in Feb 2010
- Commission during QWeak in May 2010



Injector Commissioning & Optimization

- **Coordinator: Suleiman**
- **Members: Poelker, Grames, Hansknecht, King, Carlini, Paschke, Ramsay**
- **Plan:**
 - **Higher Voltage:**
 - I. **Gun: Feb 2010, Test Cave**
 - II. **CEBAF Beamline: May 2010**
 - **Electron Polarization Reversal: Commission at 100 kV during PREx, >100 kV in May 2010**
 - **New Helicity Board: Commission during PREx**
 - I. **QWeak Reversal Rate: May 2010**
 - II. **QWeak Pattern: May 2010**
 - **New IA (Charge Feedback): May 2010 (need analysis support)**