

Parity Quality Beam (PQB)

B-Team Meeting

September 10, 2008

Upcoming Parity Experiments

Experiment	Hall	Start	Energy (GeV)	Current (uA)	Target	A_{PV}	Charge Asym (ppm)	Position Diff (nm)
HAPPEX-III	A	Aug 09	3.4	100	^1H (20 cm)	16.9 ± 0.4 (ppm)	✓	✓
PV-DIS	A	Oct 09	6.0	90	^2H (25 cm)	63 ± 3 (ppm)	✓	✓
PREx	A	Jan 10	1.05	50	^{208}Pb (0.5 mm)	500 ± 15 (ppb)	0.1	2
QWeak	C	July 10	1.165	180	^1H (35 cm)	234 ± 5 (ppb)	0.1	2

Requirements

1. Fast Helicity Reversal:

- ✓ Reduces target density fluctuations
- ✓ Change from 30 Hz to 1,000 Hz
- ✓ Smaller Pockels Cell settle time
- ✓ Now sensitive to 60 Hz line frequency

2. Slow Helicity Reversal:

1. Now we have Insertable HWP

- ✓ Cancels electrical pickup and Pockels Cell steering

2. New Wien Flip (similar to g-2 flip at SLAC):

- ✓ Consists of 2 Wiens and a solenoid
- ✓ Cancels residual laser linear polarization effects and helicity correlated beam size differences

3. Upgrade Gun HV to 200 kV:

- ✓ Reduces space charge effects (better transmission)
- ✓ Better lifetime

4. Machine Optics Matching:

- ✓ Achieve maximum adiabatic damping
- ✓ Added 7 Injector BPMs to parity DAQ for comparison

5. Phase Trombone:

- ✓ Cancels helicity correlated beam properties in the hall

6. New Beam Modulation System:

- ✓ Add more coils
- ✓ Compatible with FFB?
- ✓ Phase advance and phase space coverage

7. Maximum Linear Polarization in the Halls:

- ✓ Transverse polarization $P_T \leq 1\%$, $P_n \leq 1\%$

8. Accurate Polarimetry in the Halls:

- ✓ Upgrade Compton and Moller Polarimeters in Hall A
- ✓ New Compton Polarimeter in Hall C
- ✓ Low beam halo
- ✓ Working injector Mott Polarimeters

9. Low Current Calibrations:

- ✓ PREx: 50 nA, Qweak: 1 nA
- ✓ New cavity BPMs in the Halls

10. Improve Laser Table Setup:

- ✓ Add clean-up polarizer before Pockels Cell
- ✓ Rotate photocathode to eliminate window birefringence

11. Measure Helicity Correlated Beam Size:

- ✓ Un-decided how to do it

12. New Charge Feedback Scheme:

- ✓ Voltage applied to the Pockels Cell depends on current and previous helicities
- ✓ Will require the new “Injector Net”

13. Option to do Position Feedback with Helicity Magnets:

- ✓ Helicity Magnets are ready

14. Accelerator FFB measurement of PQB:

- ✓ Runs on Hall A iocse9 and Hall C iocse14
- ✓ Implement in the Injector iocs

15. The effect of the Beam of One Hall on the Parity Quality of Another Hall Beam (Halls Crosstalk):

- ✓ Observed during G0: when Hall A changes its current or its beam status, the PQB of Hall C would change
- ✓ Mainly due to the photocathode surface charge limit and to RF loading in the accelerator cavities



Item	Requirement	Needed by?	Overall Effort?	Critical?	Comments, Status, ...
1	Fast Helicity	Aug 09	2	5	Qweak
2	Wien Flip	Aug 09	5	3	PREx & QWeak
3	200 kV Gun	July 10	4	4	Qweak
4	Matching	Aug 09	2	3	Worked for G0 & HAPPEx
5	Phase Trombone	Aug 09	1	1	Worked for HAPPEx
6	Beam Modulation	Aug 09	1	1	Worked for G0 & HAPPEx
7	Transverse Polarization	Jan 10	1	4 / 2	
8	Accurate Polarimetry	Aug 09/July 10	5	5	Physics Div.
9	Low Current	Aug 09	2	4	Almost ready
10	Laser Table	Aug 09	1	3	
11	Beam Size Monitor	Jan 10	?	2	Unknown
12	Charge Feedback	Jan 10	2	1	Worked for G0 & HAPPEx
13	Position Feedback	Jan 10	1	3	Ready
14	Accelerator FFB Parity	Aug 09	1	1	Dickson
15	Halls Crosstalk	Aug 09	2	4	