

Updates on A_y experiment E05-015

(Target Single-Spin Asymmetry in Quasi-elastic ${}^3\text{He}^\uparrow(e, e')$)

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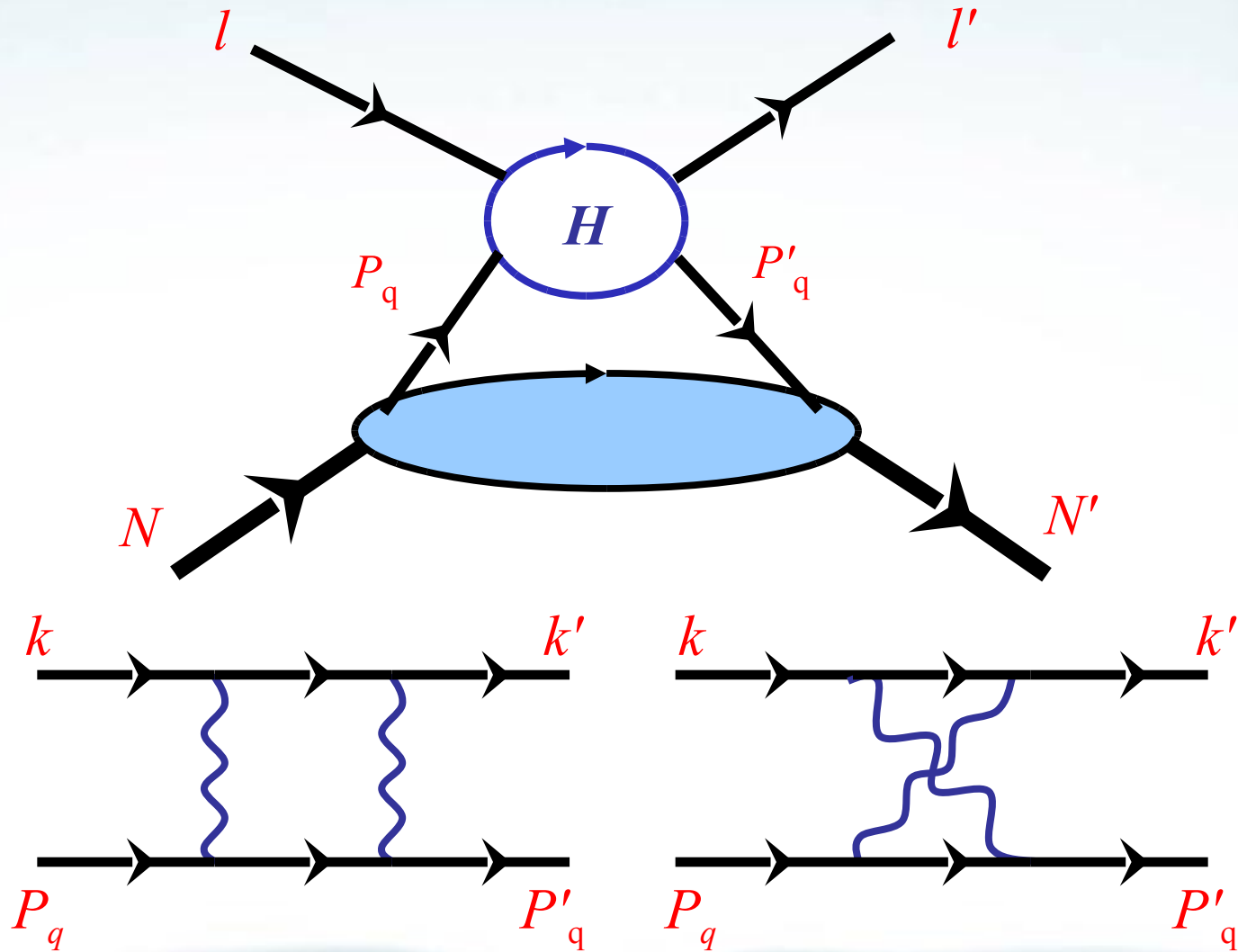
Hall A Collaboration meeting, Dec. 15, 2009



Outline

- Physics Motivation
- Experimental setups
- Data analysis
- Summary

Two-photon Exchange Process



Target Single-Spin Asymmetry (SSA)

For $l(k) + N(p) \rightarrow l(k') + N(p')$

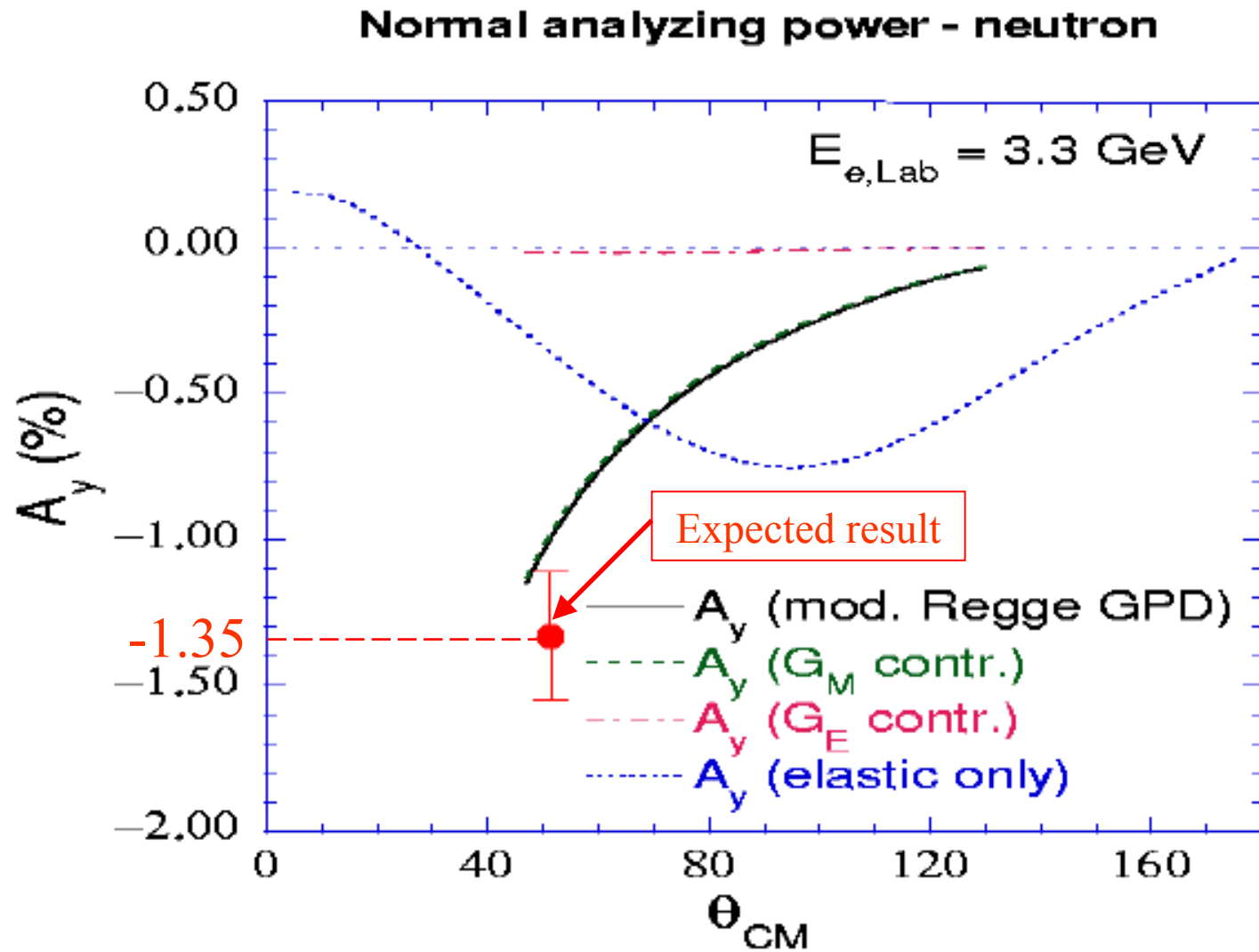
$$A_y = \frac{\sigma^\uparrow - \sigma^\downarrow}{\sigma^\uparrow + \sigma^\downarrow} = \sqrt{\frac{2\varepsilon(1+\varepsilon)}{\tau} \frac{C_B(\varepsilon, Q^2)}{d\sigma}} \times \left\{ -G_M \mathcal{I} \left(\delta\tilde{G}_E + \frac{\nu}{M^2} \tilde{F}_3 \right) + G_E \mathcal{I} \left(\delta\tilde{G}_M + \left(\frac{2\varepsilon}{1+\varepsilon} \right) \frac{\nu}{M^2} \tilde{F}_3 \right) \right\}$$

In terms of GPD moments

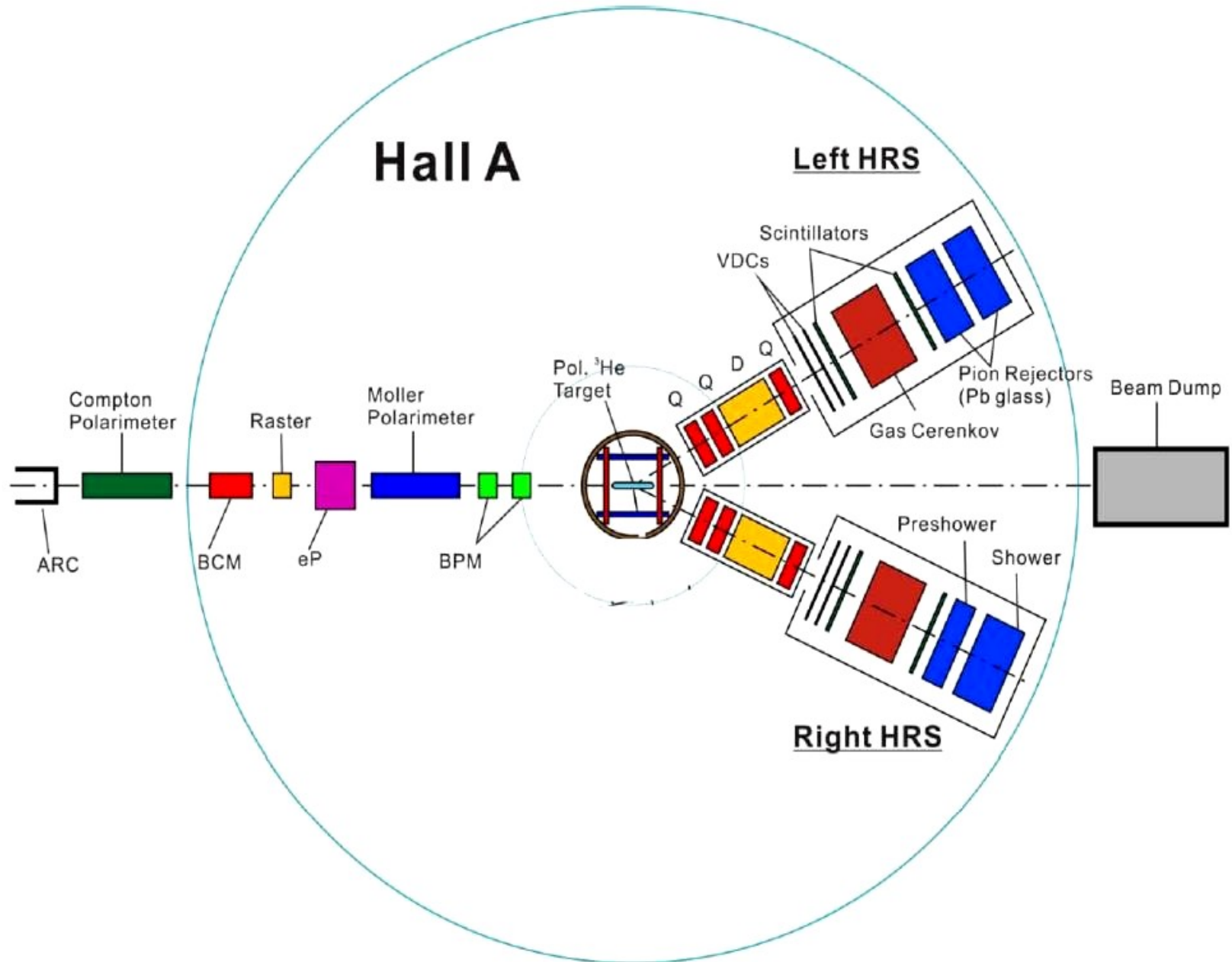
Y.C. Chen etc., PRL 93, 122301 (2004)

A measurement of A_y has sensitivity to
GPD model input

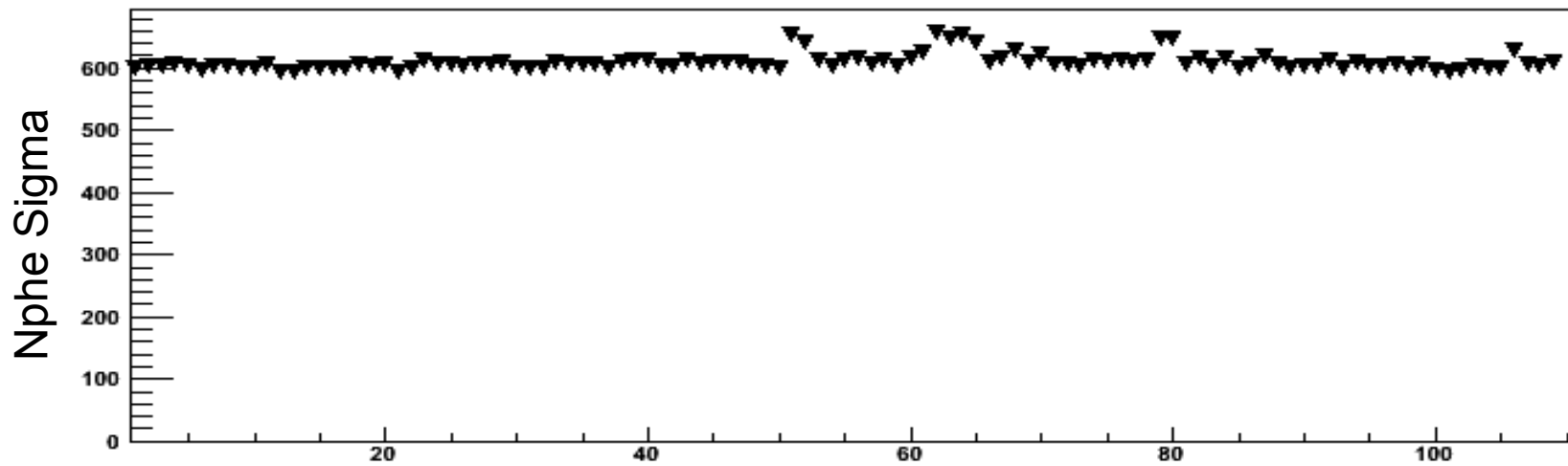
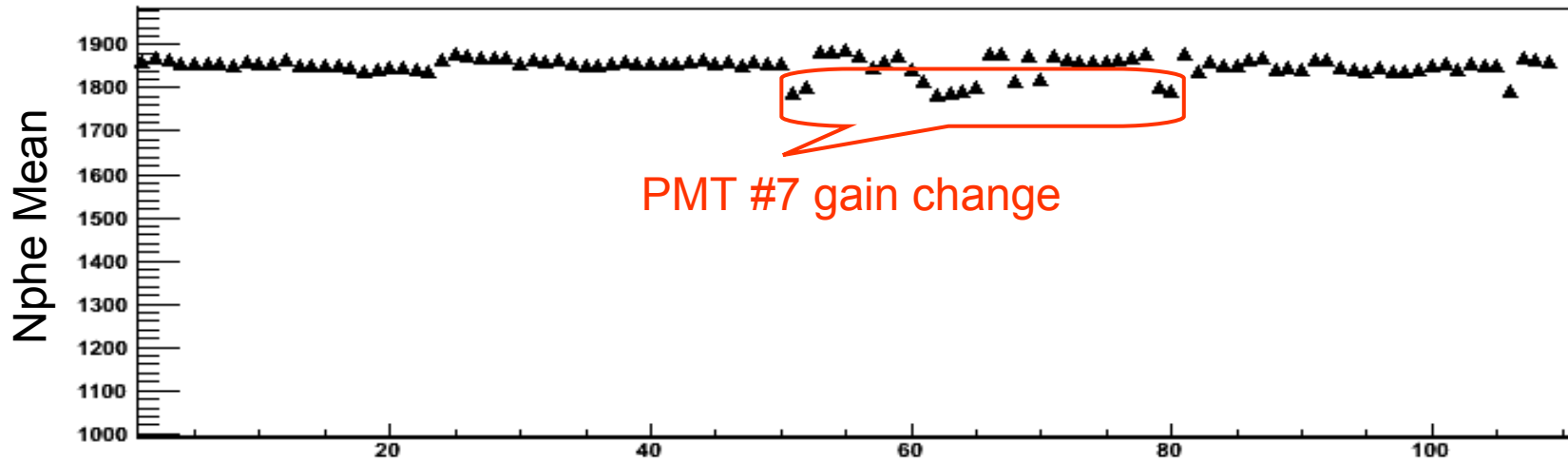
Expected result from our A_y experiment



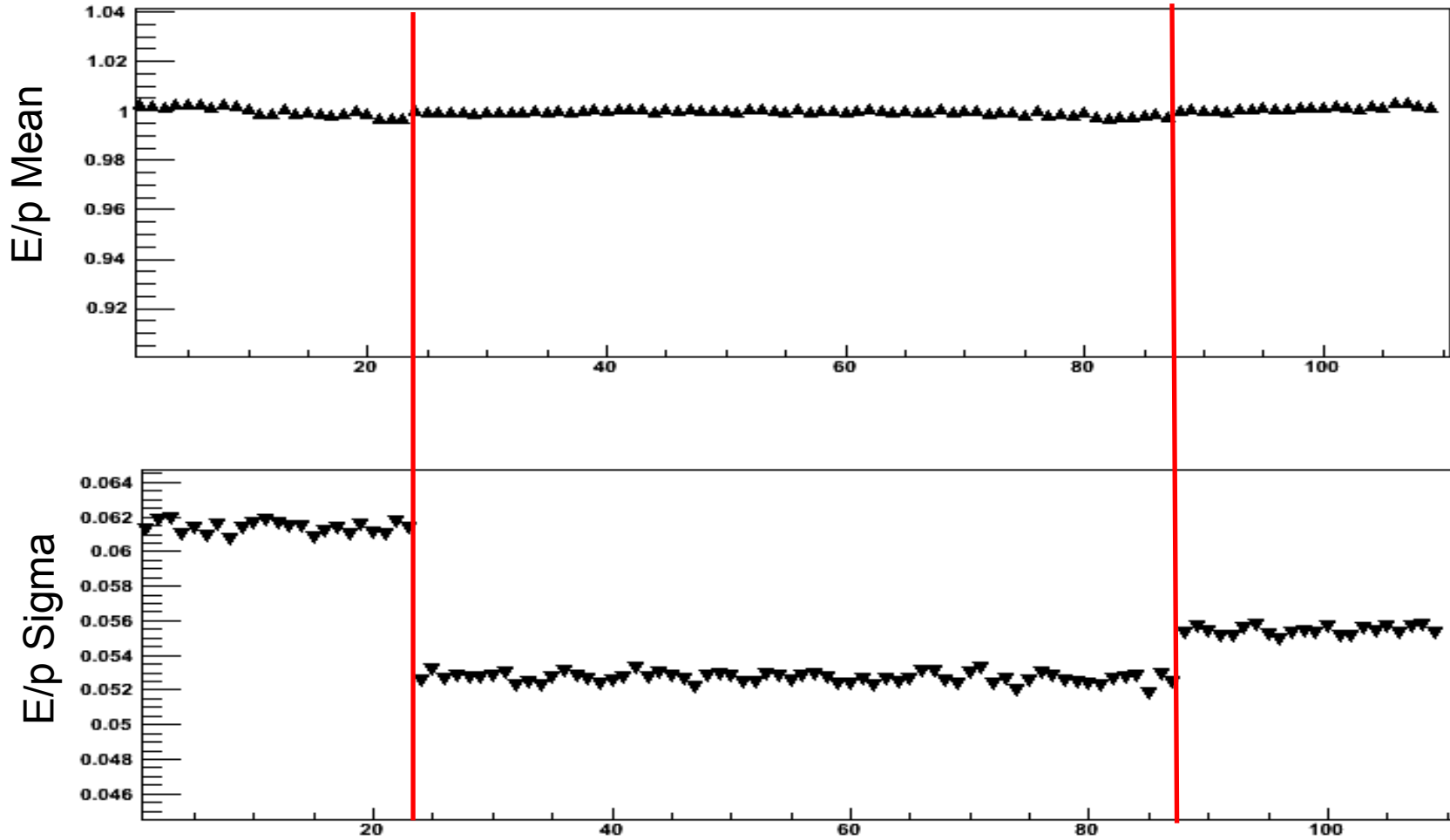
Experimental facility



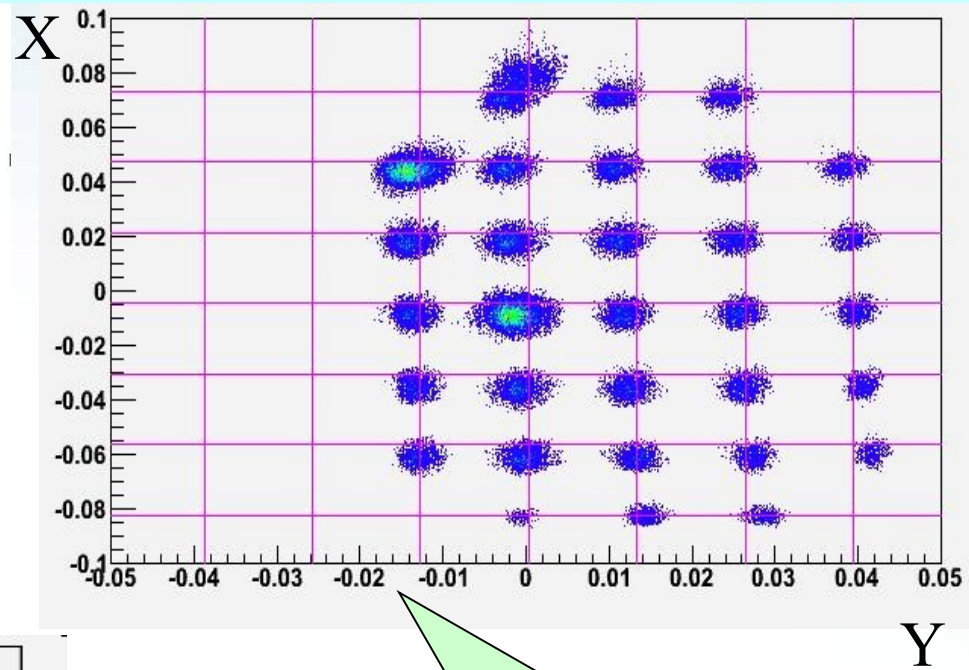
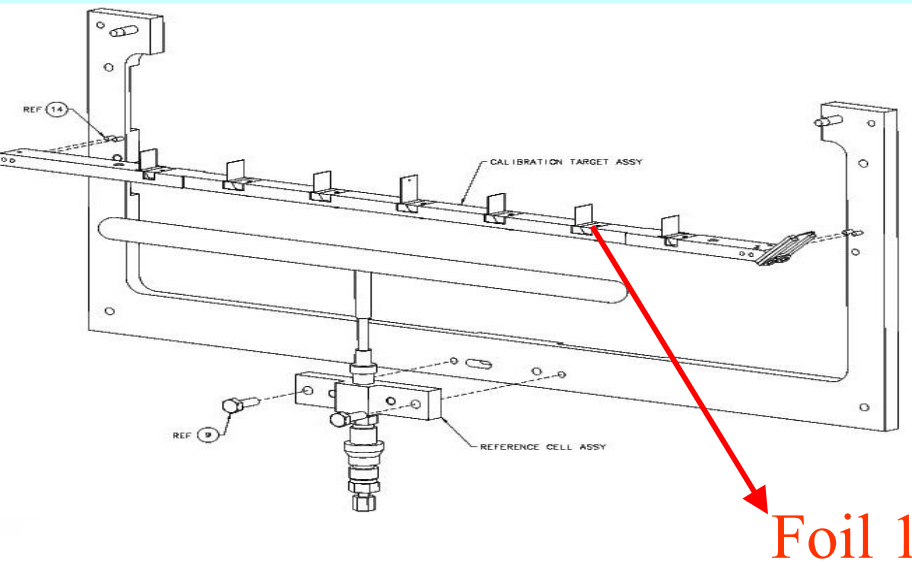
Nphe of Cerenkov Counter (LHRS)



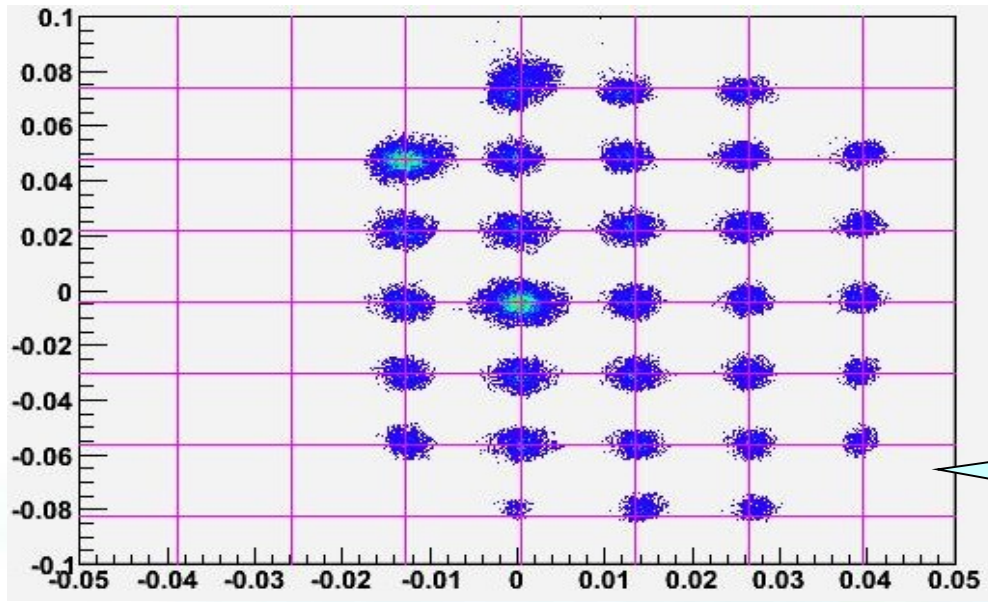
E/p of Pion Rejector (LHRS)



Optics calibration (LHRS)



Before calibration



After calibration

Glass Thickness (Reference: GMB2)

Average: 1.62 mm

Average: 1.62 mm

Points	Incident angle (°)	Fitting Results (mm)	UVA Results (mm)
A	14.5	1.679	1.58
B	3	1.699	1.66
C	7.5	1.702	1.67
D	9	1.712	1.51
E	10	1.591	1.61
F	9	1.610	1.48
G	4	1.547	1.70
H	7	1.533	1.78
I	6	1.514	1.61
J	5	Thrown out	1.63
W1	6.5	0.141	0.151
W2	13	0.134	0.132

Glass Thickness (3He: Dominic)

Average: 1.68 mm

Average: 1.65 mm

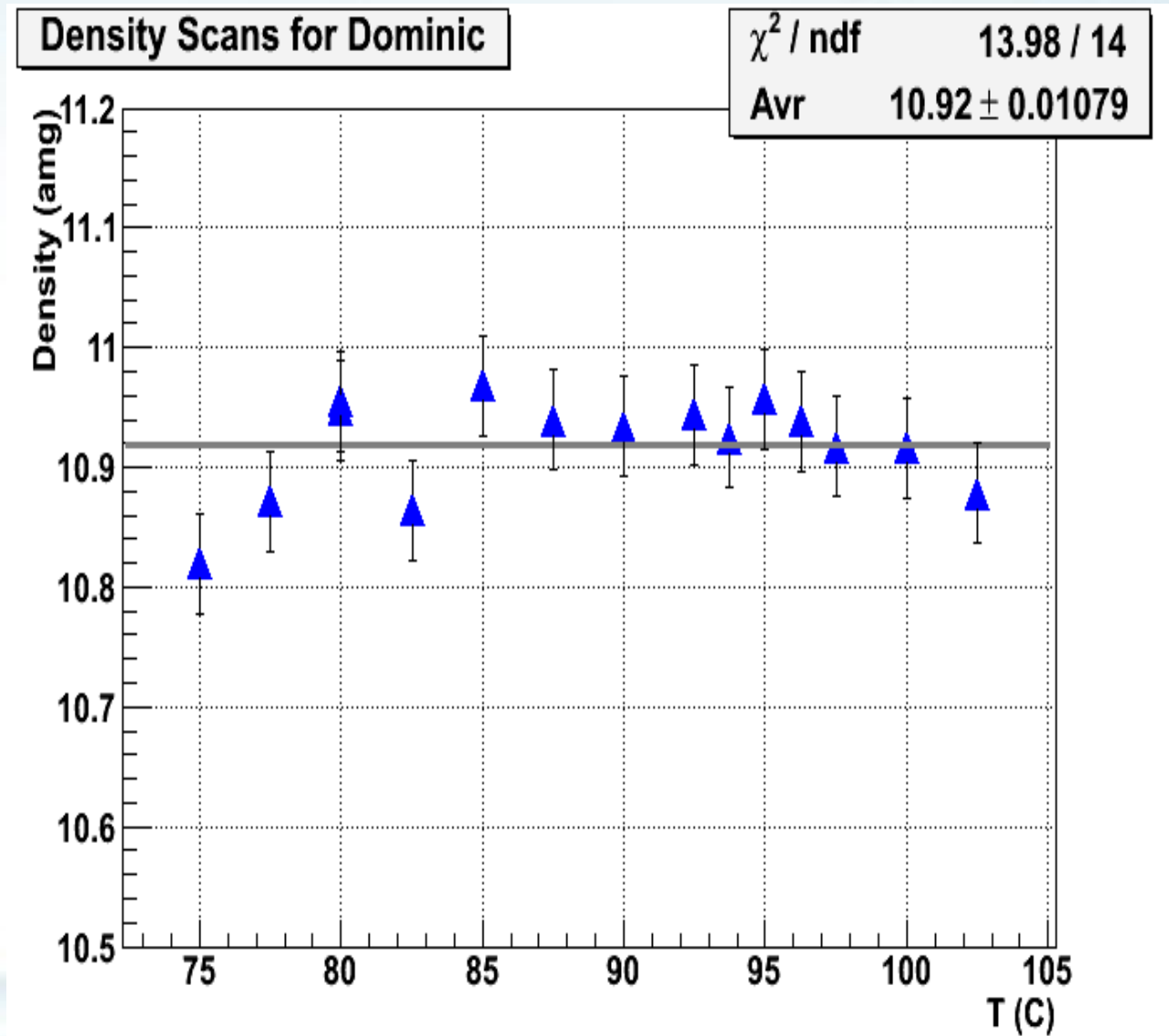
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Target Density (3He: Dominic)

•UVA result:
10.82 amg
1% uncertainty

•W & M result:
10.98 amg
4% uncertainty

•Jlab result:
10.92 amg
2% uncertainty



Ay important scalars

T1 ← Main trigger in RHRS

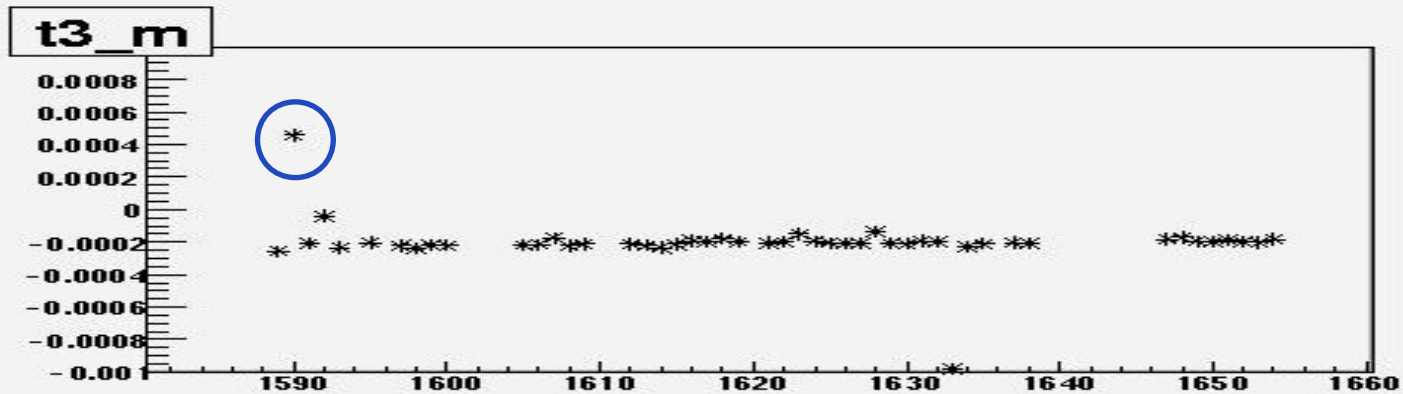
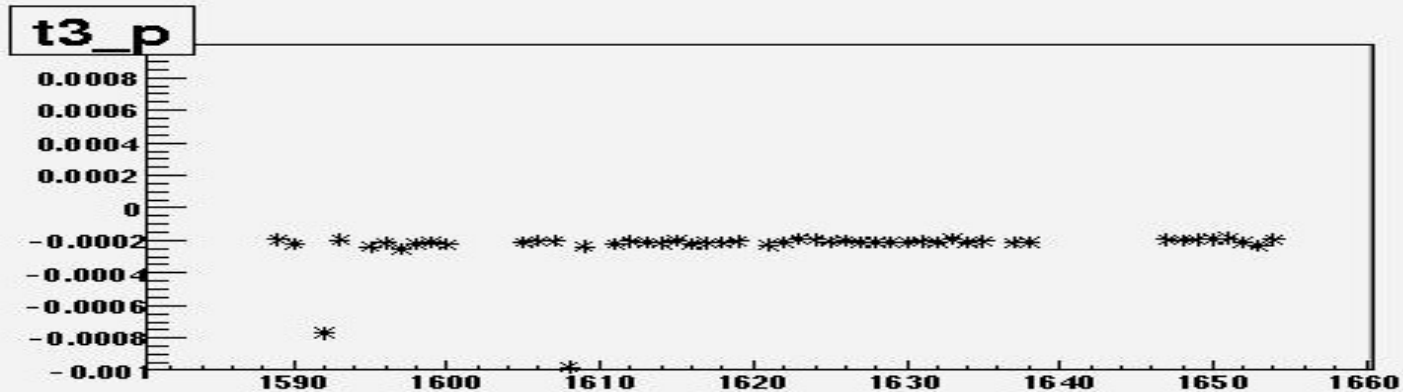
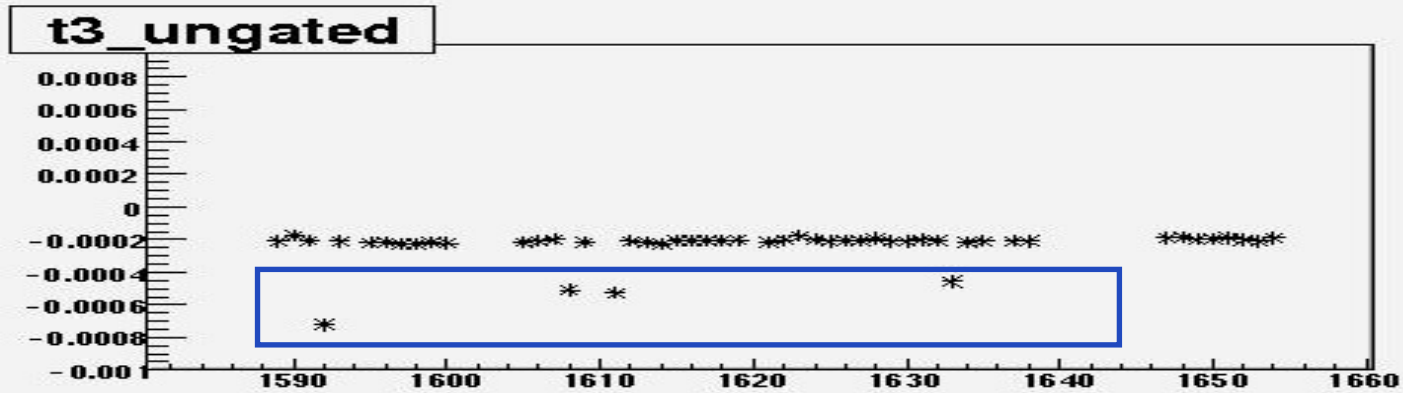
T3 ← Main trigger in LHRS

Clock }
Fast clock } Time scale

u1 }
u3 }
u10 } Charge scalars
d1 }
d3 }
d10 }

Scalar asymmetry between LHRS and RHRS for selected scalar above
(ungated, ++, +-, -+, -- by target spin/helicity)

Scalars extracted from the ungated one



Results of the scalar check

Scalar asymmetry between L and R

	T1	T3	fclk	u1	u3	u10	d1	d3	d10
L-R	✓	✓	✓	✓	✓	✓	✗	✗	✓

Charge Scalar check in L and R

	u1:u10	u3:u10	u1:u3
L	✓	✓	✓
R	✓	✓	✓

	d1:d10	d3:d10	d1:d3
L	✓	✓	✓
R	✓	✗	✗

✓: 2×10^{-4}

✗: $\sim 10^{-3}$



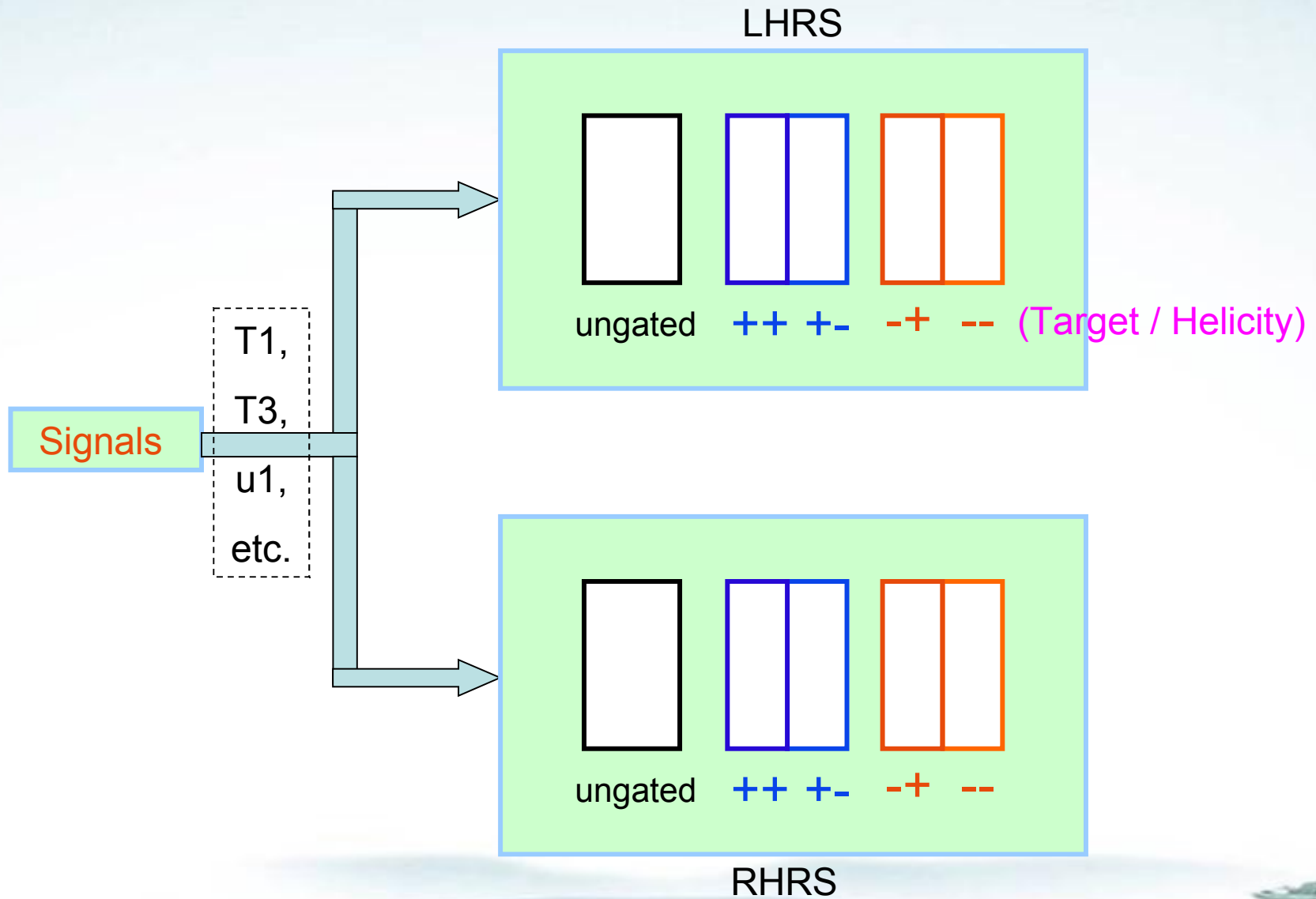
Summary

- Detectors calibration were completed for LHRS.
- Some data quality checks were done for LHRS production runs.
- Most of the target work were completed.
- Scalar check was done for 1-pass production runs. The same procedure is being applied to other production runs.
- The preliminary result (raw asymmetry) is expected in February, 2010.





Scalar modules in LHRS and RHRS



Investigation on inconsistent run pairs

run pair (1633, 20506) is selected

	1633	20506	
Clock	1847336	1847336	From epics in end of run
Clock	1846420	1847320	From replayed root file
Clock ↓ T1	1846420 30068900	1846420 30059300	Choose same clock scalar Consistent at 1.5e-4
Clock Fast clock T1	1847340 187243000 30075500	1847340 187257000 30085500	Consistent at 1e-4

ev scalar class
(every 100 events)

scalar class
(every 2 seconds)

