Status of the analysis review of B. Vernarsky's omega analysis from g1c and g8b data

Review committee: F. Klein, A. Filippi, S. Strauch

"long-lasting" story (review initiated on 7/8/2014):
1st round of comments on 7/31/2014, further discussions clarified
     that not the whole thesis should be regarded as analysis note
     (… but still: the thesis lacked a chapter on systematics!);
2nd round (12/2014) left one major issue unresolved: **systematics**;
Feb/May 2015: we sent comments & suggestions to authors, received a
     good study on effects of errors in photon polarization on SDMEs
     (but polarization error was assumed to be 2%, not 6% for g8b);
Oct. 2015: we received a draft of the intended paper
     (section on error discussion unfortunately empty);
April 2016: we estimate systematics based on other g11, g1c, g8b analysis
     (we suggested to compare with existing data: $\Sigma_x = tr(\rho^1)$);
July-Oct. 2016: we got B.V.'s data and studied the extracted beam asymmetry!

Side question: why did uploaded documents disappear from the review page?

First comparison of $\Sigma_x = tr(\rho 1)$ with published data

- beam asymmetry for ω typically extracted like for pseudoscalars (and decay particles used to identify the reaction):

$$\Sigma = \frac{1}{P_\gamma^L} \frac{\tilde{Y}_\parallel - \tilde{Y}_\perp}{\tilde{Y}_\parallel + \tilde{Y}_\perp}$$

(problem: spin transferred in final state: acceptance might depend on distribution of decay pions)
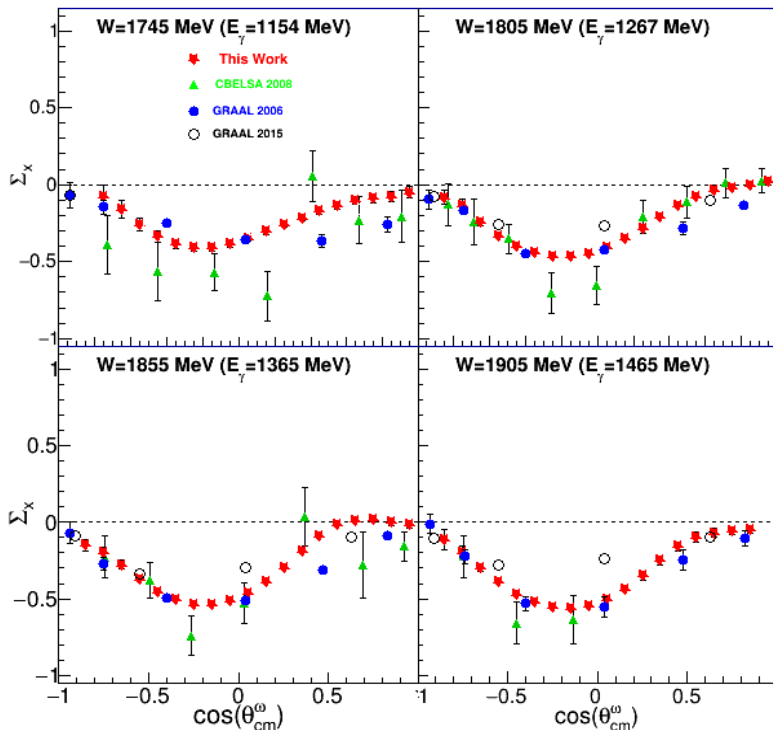
Published data
(low statistics, ≥100 MeV wide Eγ bins):
2 data sets from GRAAL (not consistent),
1 data set from CBELSA

B.Vernarsky: ΔW=10 MeV, Δcosθ=0.1
(with very small errors for almost all data)

New CLAS analyses:
ASU (g8b data): ΔEγ~26 MeV
FSU (g9b data): ΔEγ=100 MeV

July 2016 first comparison
(not showing the 25 W bins for 1.96-2.21 GeV)

Red: CMU (g8b from SDMEs)
Blue: 'old' ASU (g8b)
Black: 'old' FSU (g9b)
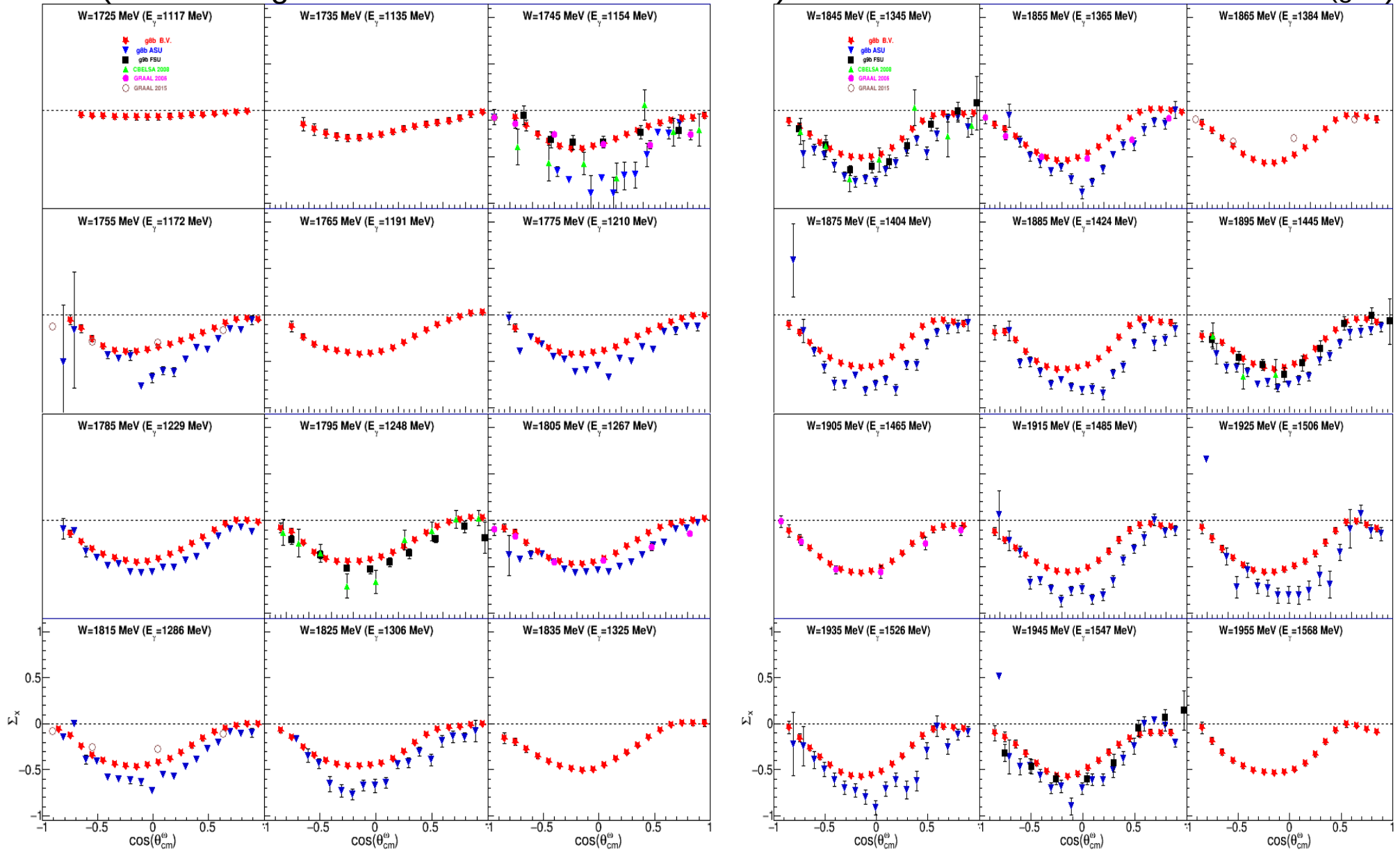
Great results!! when compared to GRAAL, CBELSA, ASU, and FSU !

Observation:
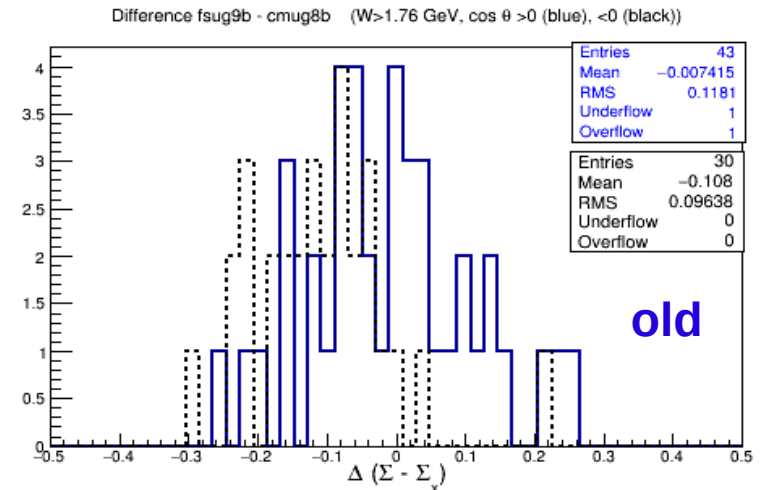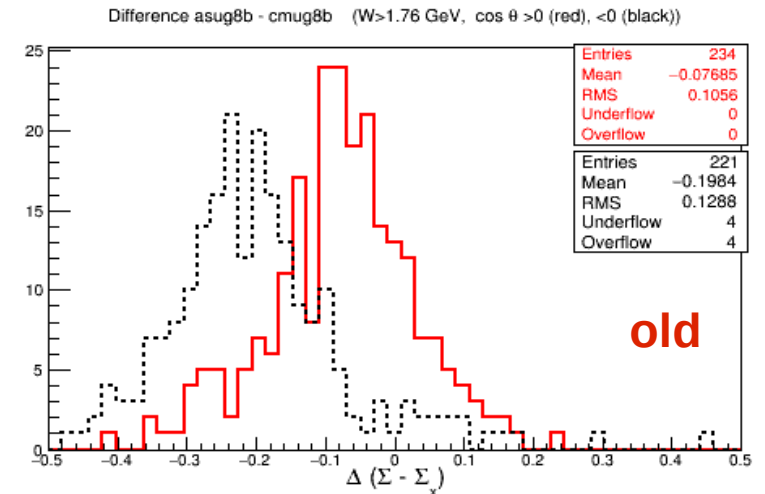CMU data have ~30% smaller |Σ| than ASU data
  with FSU data in between.

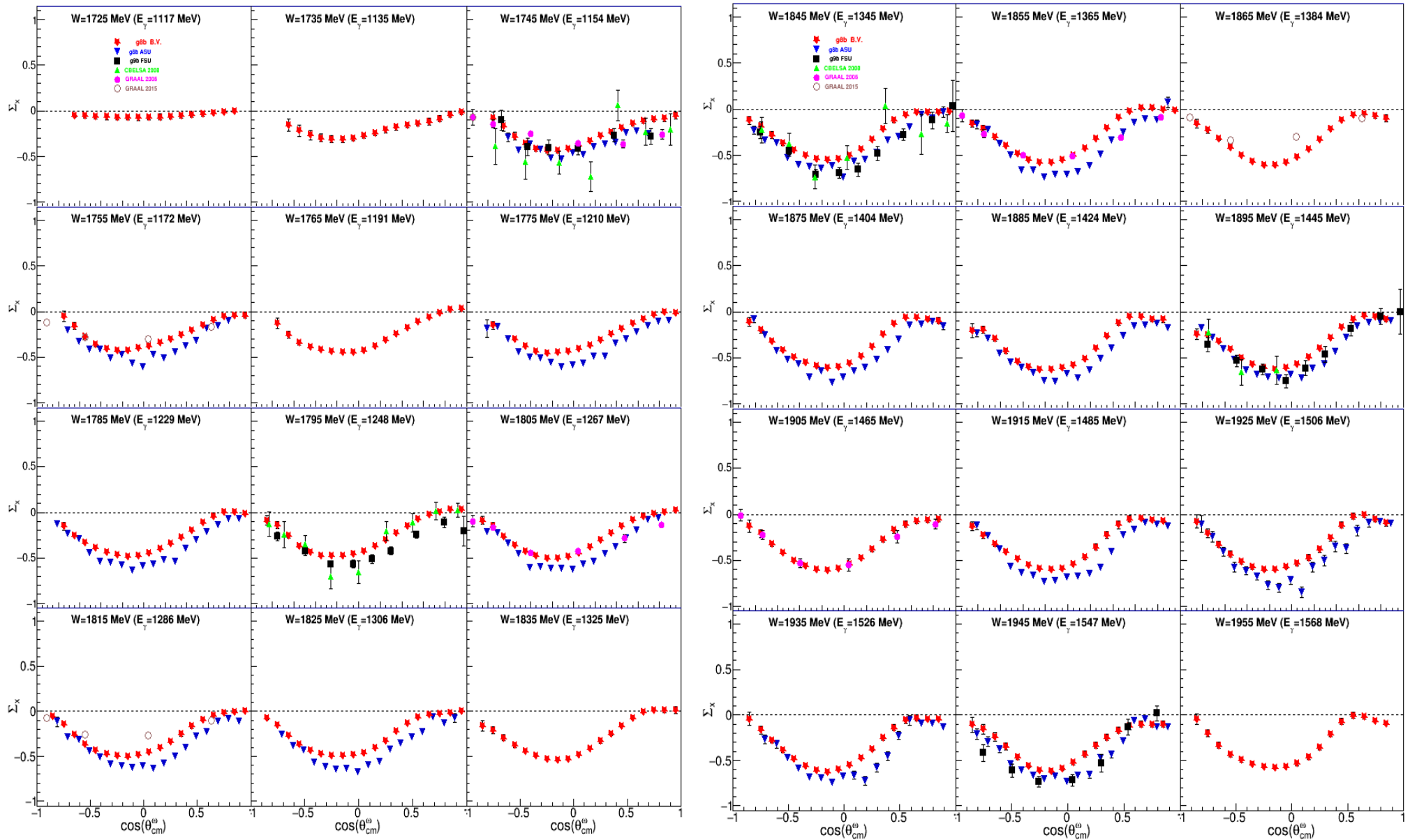Decision within the FROST/g8b group:
  Reanalyze the data!
- it turned out that the ASU results were based on
    ~1/3 of the g8b statistics:
    Mike reanalyzed the data and improved the fits;
- the FSU data used the same metric for the
    Q-factor method as CMU (M.Williams, B.V.),
    which did not include an explicit phi dependence;
    Priya added a phi dependence for the nearest-
    neighbor search;
- study the dependence of the extracted beam
   asymmetry from specific decay distributions:
   Franz compared $\gamma p \rightarrow \omega p$ simulations with 3
   different decay distributions: VMD, phase-space,
   B.V.'s SDMEs
  (for all E bins of the ASU analysis: as a result all
   ASU data points were corrected by ~0.01,
   i.e. minor correction compared to 30% difference to CMU data).

See next slides!

Difference asug8b - cmug8b   (W>1.76 GeV, cos θ >0 (red), <0 (black))

Entries	234
Mean	−0.07685
RMS	0.1056
Underflow	0
Overflow	0

Entries	221
Mean	−0.1984
RMS	0.1288
Underflow	4
Overflow	4

old

Difference fsug9b - cmug8b   (W>1.76 GeV, cos θ >0 (blue), <0 (black))

Entries	43
Mean	−0.007415
RMS	0.1181
Underflow	1
Overflow	1

Entries	30
Mean	−0.108
RMS	0.09638
Underflow	0
Overflow	0

old

Aug/Sept. 2016: re-analyzed ASU and FSU data

Red: CMU (g8b from SDMEs)
Blue: 'new' ASU (g8b)
Black: 'new' FSU (g9b)

ASU and FSU data fully consistent, both off by ~30% compared to B.V.'s data

5

What now ???

- ASU data finalized, paper in preparation;

- FSU will publish beam & target asymmetries;

- Committee informed C. Meyer that:
(a) it would be a loss if B.V.'s data cannot be
    published;
(b) data should be reanalyzed using phi-dependent
    metric in the Q-factor method
  or: state a very large systematic error!
  Unfortunately we cannot disentangle whether
  all polarized SDMEs should get the same large
  systematic error.

At this point the committee cannot recommend
to go forward with a publication!

Further information at
 clasweb.jlab.org/rungroups/g9/wiki/index.php/
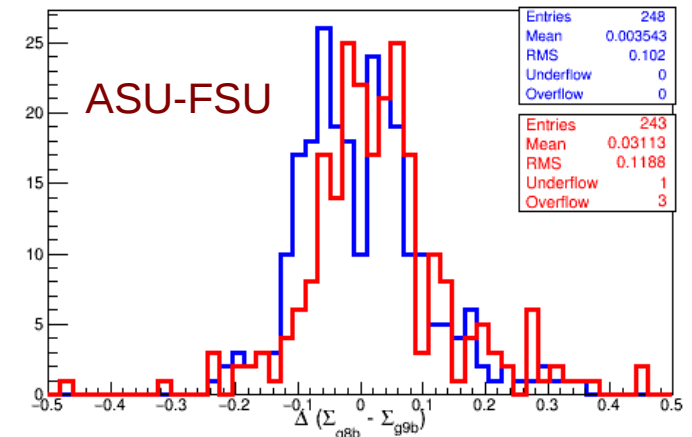   Comparison_of_g8,_g9,_ASU,_FSU

www.jlab.org/Hall-B/secure/g9/fklein/Bvern_AppendixEv2.pdf
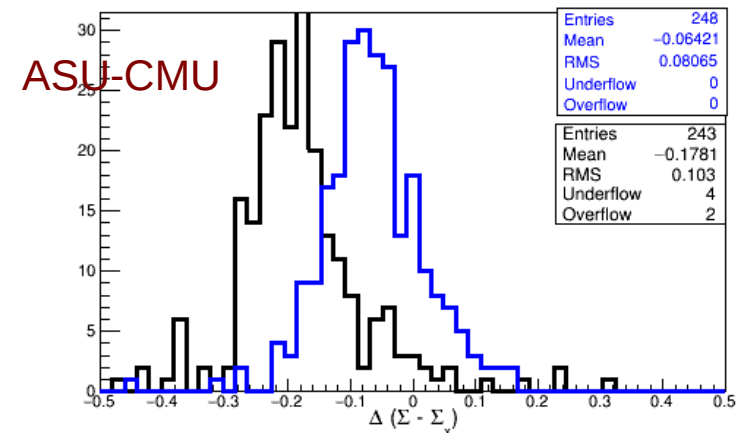www.jlab.org/Hall-B/secure/g9/fklein/Bvern_AppendixD.pdf
www.jlab.org/Hall-B/secure/g8b/fklein/omega_MC.html

Differences after re-analysis

ASU-FSU

Σ Difference ASU(g8b) - FSU(g9b)   (red: $\cos\theta<0$, blue: $\cos\theta>0$)

Entries	248
Mean	0.003543
RMS	0.102
Underflow	0
Overflow	0

Entries	243
Mean	0.03113
RMS	0.1188
Underflow	1
Overflow	3

$\Delta (\Sigma_{g8b} - \Sigma_{g9b})$

ASU-CMU

Σ Difference ASU(g8b) - CMU(g8b)   (blue: $\cos\theta>0$, black: $\cos\theta<0$)

Entries	248
Mean	−0.06421
RMS	0.08065
Underflow	0
Overflow	0

Entries	243
Mean	−0.1781
RMS	0.103
Underflow	4
Overflow	2

$\Delta (\Sigma - \Sigma_x)$

FSU-CMU

Σ Difference FSU(g9b) - CMU(g8b)   (blue: $\cos\theta>0$, black: $\cos\theta<0$)

Entries	46
Mean	−0.07274
RMS	0.1355
Underflow	0
Overflow	1

Entries	33
Mean	−0.1632
RMS	0.1061
Underflow	0
Overflow	0

$\Sigma_{FSU} - \Sigma_{CMU}$

6