# Target Analysis for Spin-Duality

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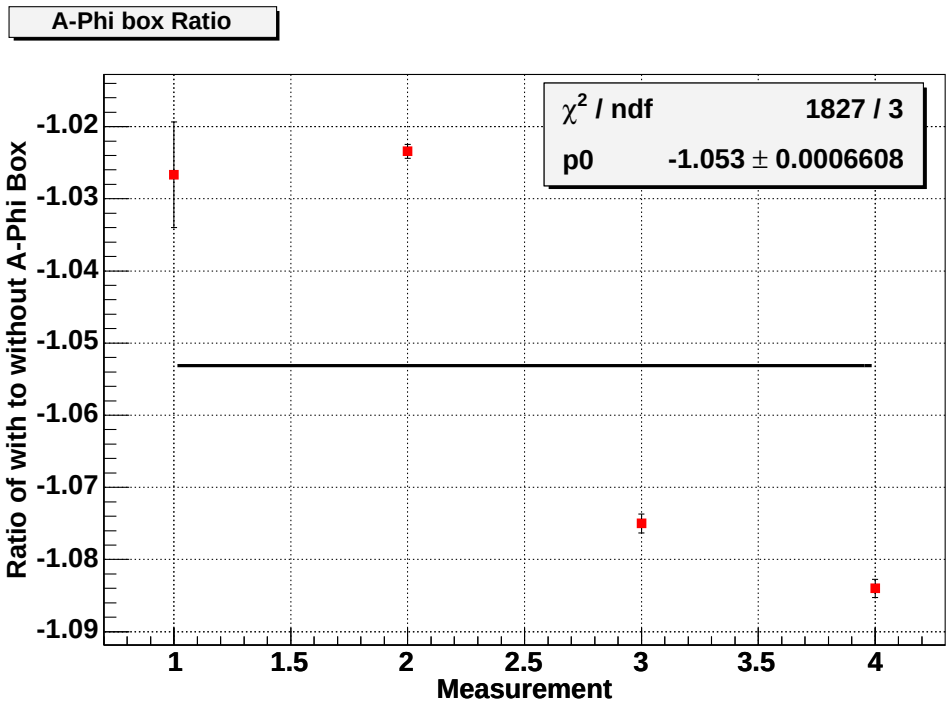
# Summary from A-$\phi$ Box Tests

- Clear that tests were needed to understand the signal effects from the A-$\phi$ box.
  - Test setup used a polarized $^3$He target.
  - Checked pick-up signal and arbitrary signal from RF function generator with and without circuit
  - $\langle$Ratio$\rangle$ = -1.02343 (ratio of pure signal to circuit signal)
  - Compare with results from Feb. 17, 2003, -1.02666 $\pm$ 1.5%
  - Took NMR with and without A-$\phi$ box, but did not correct for AFP loss.
  - These studies showed the correction factor was $\sim$ -1.07.

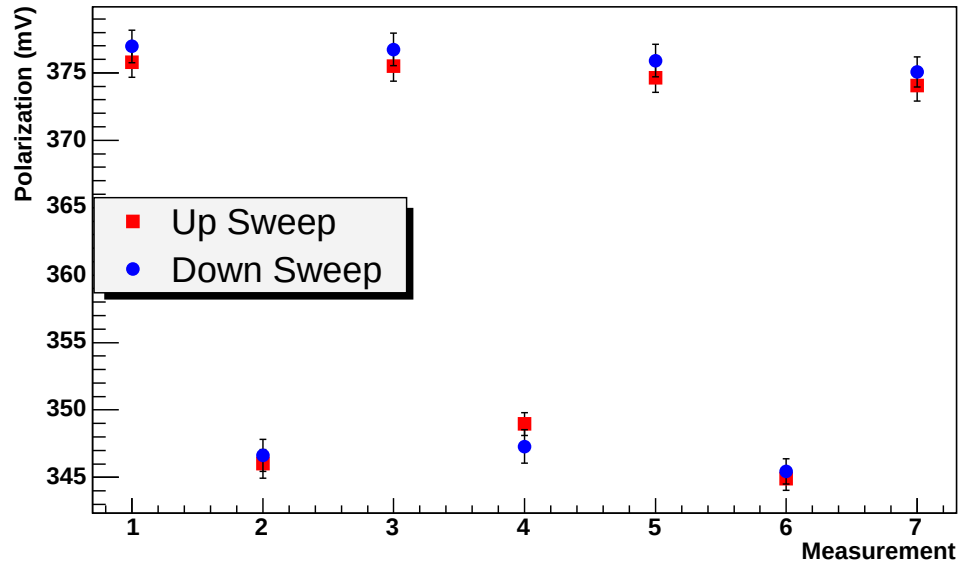
# Conclusions

- Accounted for AFP loss in NMR without and with A-$\phi$ signals.
  - AFP loss without A-$\phi$: 0.32 %/sweep
  - AFP loss with A-$\phi$: 0.13-0.19 %/sweep
    (second test shows down signal discrepancy)
  - Determined A-$\phi$ correction factor: 2.7% Sys. Uncertainty.
  - Applied correction factor to A-$\phi$ signals.

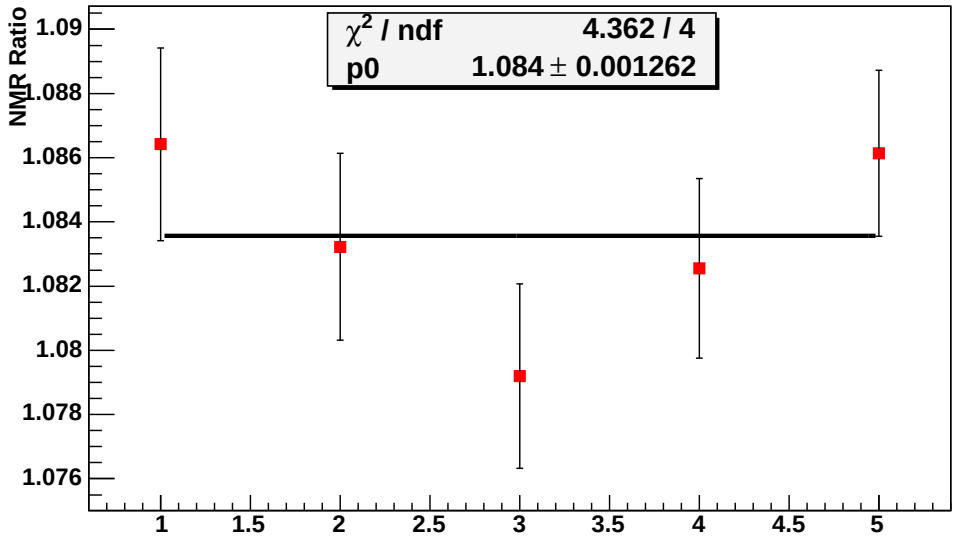


NMR without and with A-Phi box

**June 17, 2004**

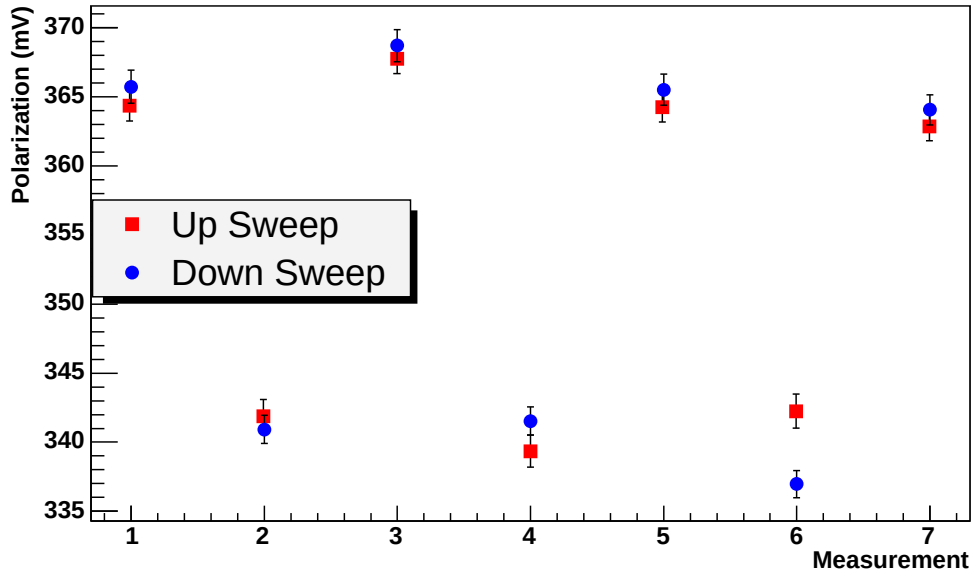



NMR Ratio without/with A-Phi box

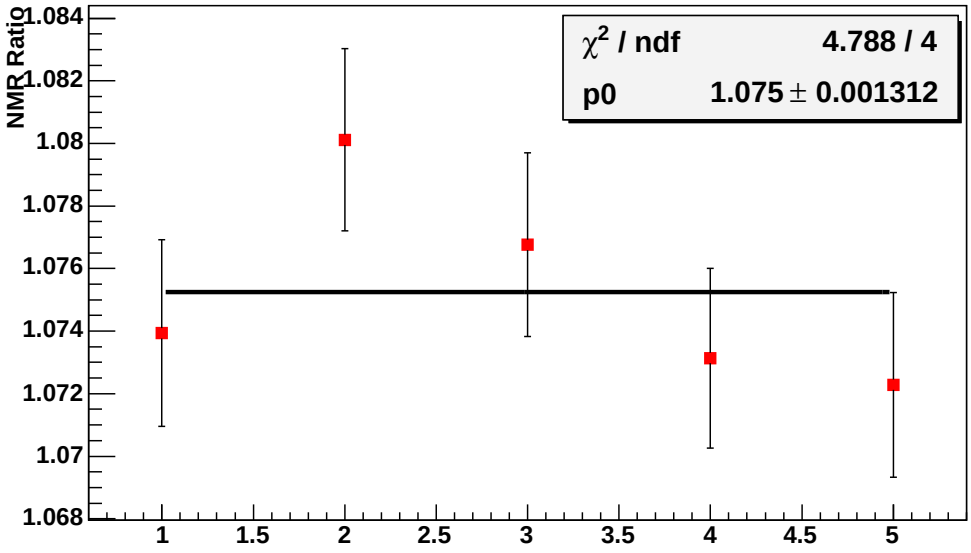


NMR without and with A-Phi box

**June 18, 2004**

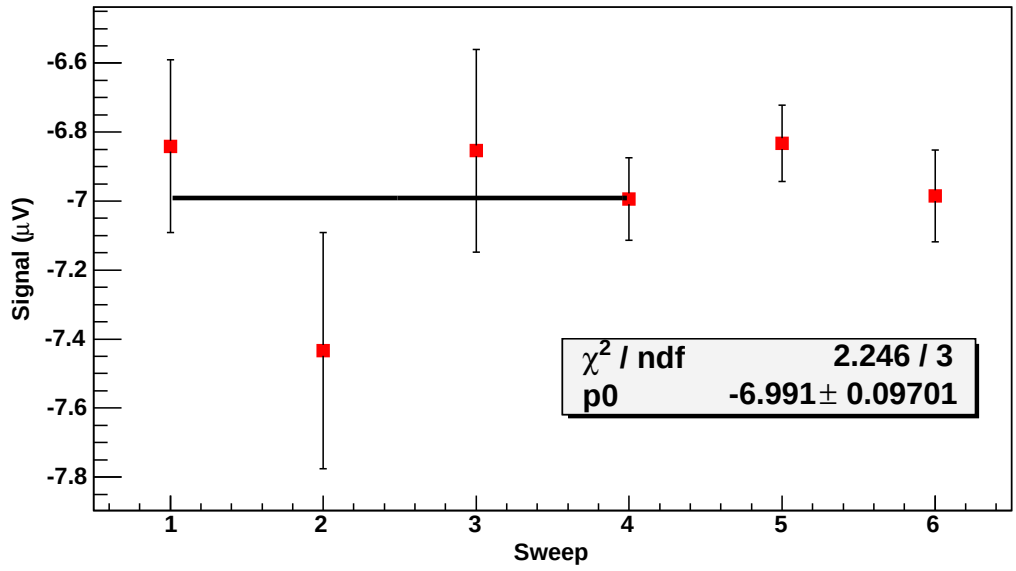



NMR Ratio without/with A-Phi box

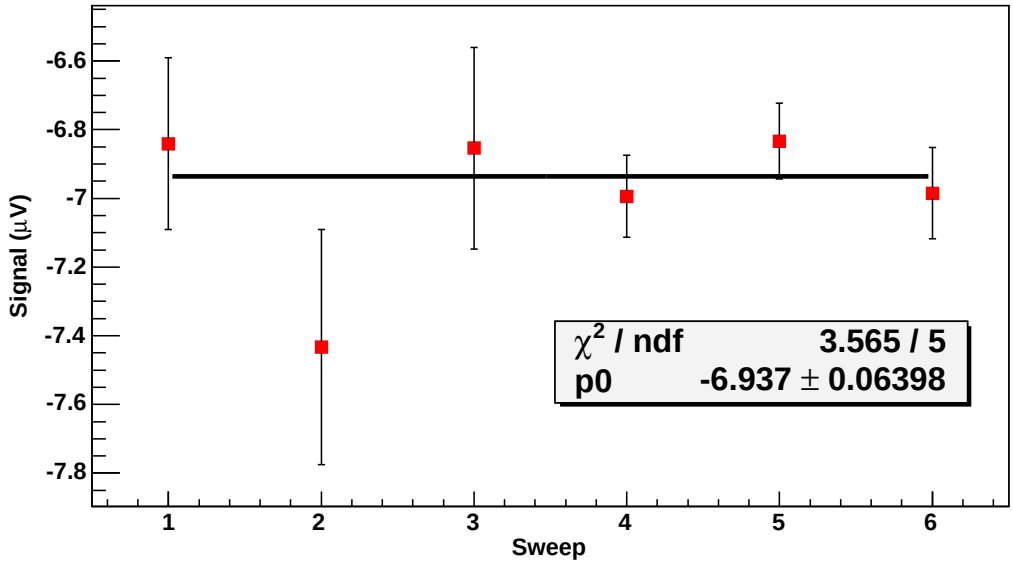


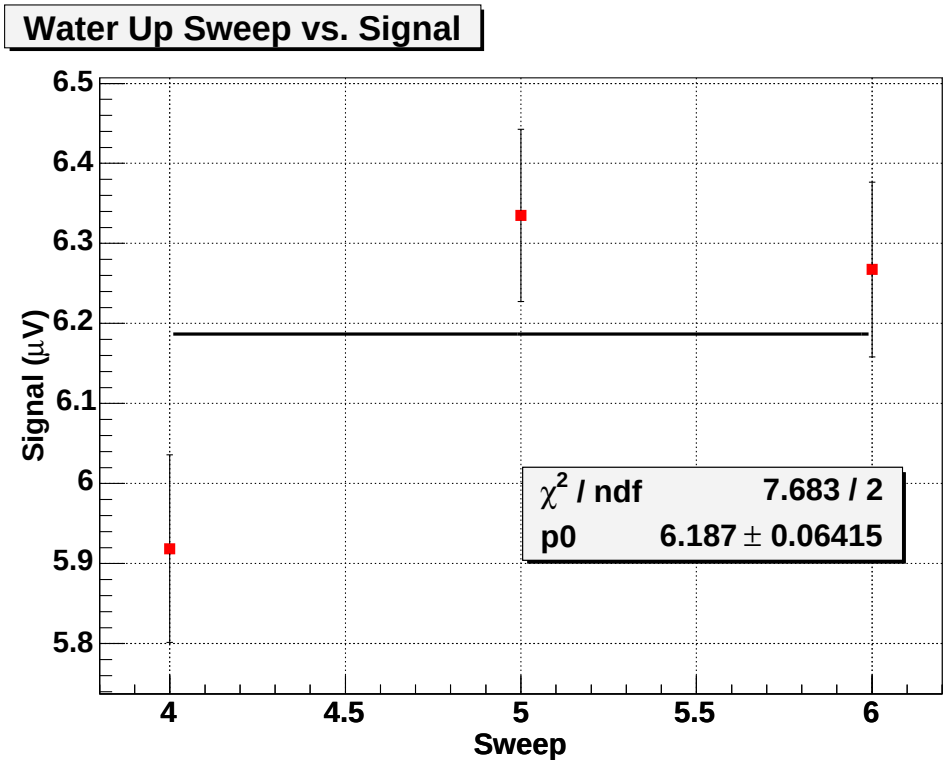
# Water Signal Results

Water Down Sweep vs. Signal




Water Down Sweep vs. Signal



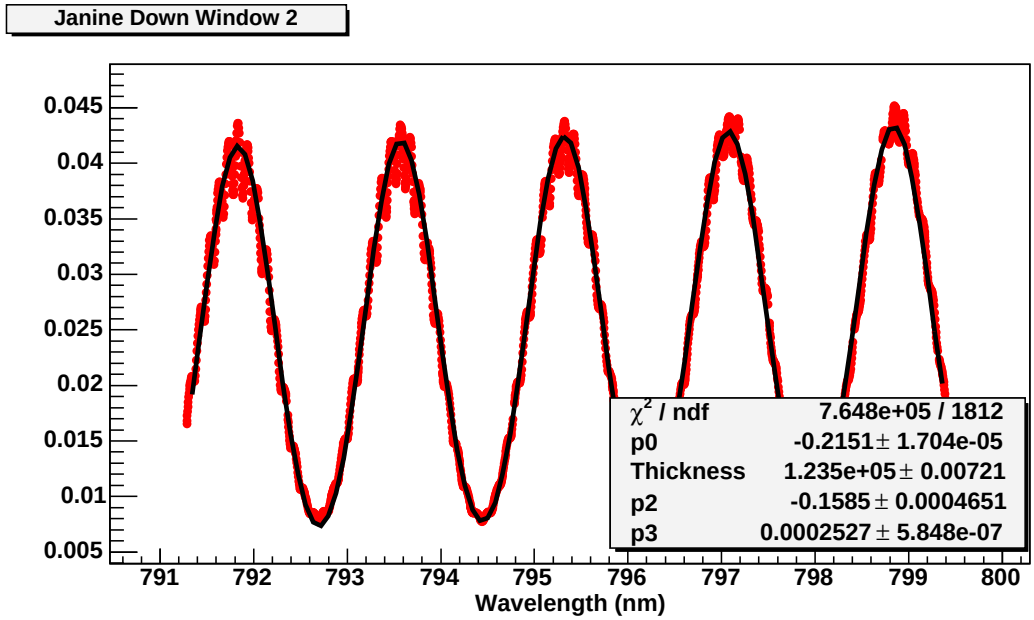


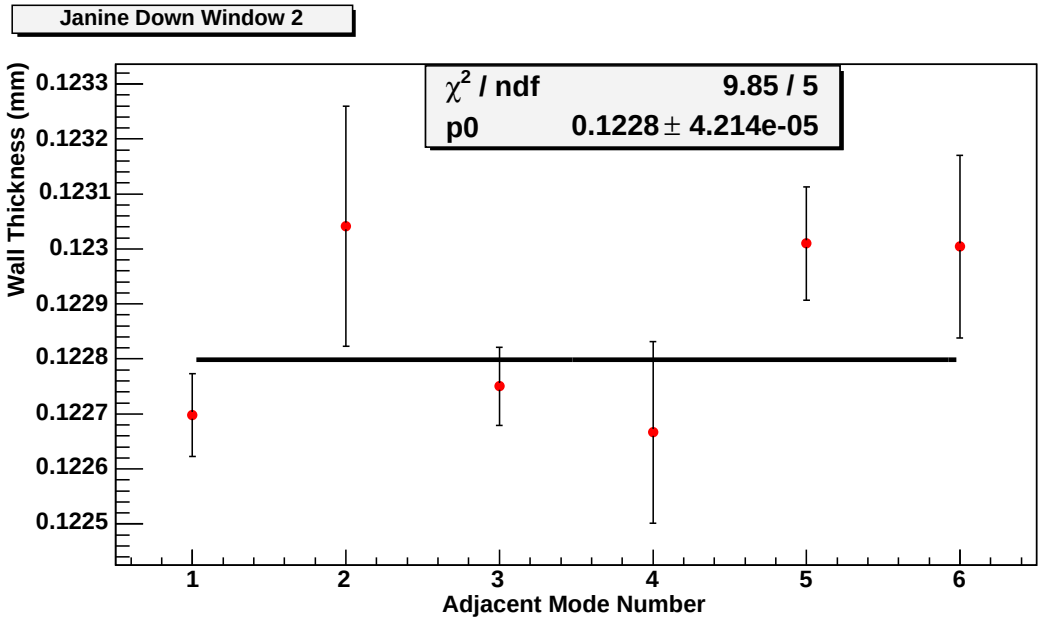

| Sweep | Corr. Factor (%) | Signal ($\mu$V) | $\chi^2$/NDF |
|---|---|---|---|
| Up | 2.3 | 6.063 | 1.164 |
| | 5.3 | 6.187 | 3.842 |
| Down | 2.3 | -6.821 | 1.661 |
| | 5.3 | -6.937 | 0.713 |
| | 8.0 | -7.035 | 0.678 |

# Window Thickness Measurements

- Wall and window thickness measurements on second Duality reference cell (Nate Justis)
- Nate analyzed the wall thickness measurements over the summer.
- First time windows were measured at JLab.
- $\sim$ 10 $\mu$m difference with mechanical measurement.

| Window | Thickness ($\mu$m) | Stat. | Syst. |
|---|---|---|---|
| Upstream | 126.7 | 0.023 | 0.78 |
| Downstream 1 | 123.2 | 0.046 | 0.78 |
| Downstream 2 | 123.15 | 0.077 | 0.86 |


Janine Down Window 2
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
791
792
793
794
795
796
797
798
799
800
Wavelength (nm)
χ² / ndf 7.648e+05 / 1812
p0 -0.2151 ± 1.704e-05
Thickness 1.235e+05 ± 0.00721
p2 -0.1585 ± 0.0004651
p3 0.0002527 ± 5.848e-07


Janine Down Window 2
Wall Thickness (mm)
0.1233
0.1232
0.1231
0.123
0.1229
0.1228
0.1227
0.1226
0.1225
1
2
3
4
5
6
Adjacent Mode Number
χ² / ndf 9.85 / 5
p0 0.1228 ± 4.214e-05

# Summary

## Summary

- Inconsistency of A-$\phi$ gain factor from polarized $^3$He tests.
- 2.7% Sys. Uncertainty on correction factor.
- New A-$\phi$ tests with water signal. (Hai Zhang)
- Duality reference cell window and wall thickness measurements completed.

## Plan

- Exodus window thickness measurements.
- Analyze A-$\phi$ tests with water signal and finalize water signal uncertainty.
- Study NMR signal shape (lock-in time constant, gradients, etc.)
- Finalize flux uncertainty.
- Compare NMR and EPR calibrations.