E06-010/E06-011 and Hall A Polarized ^{3}He Collaboration Meeting

Preparation of the Transversity Experiments

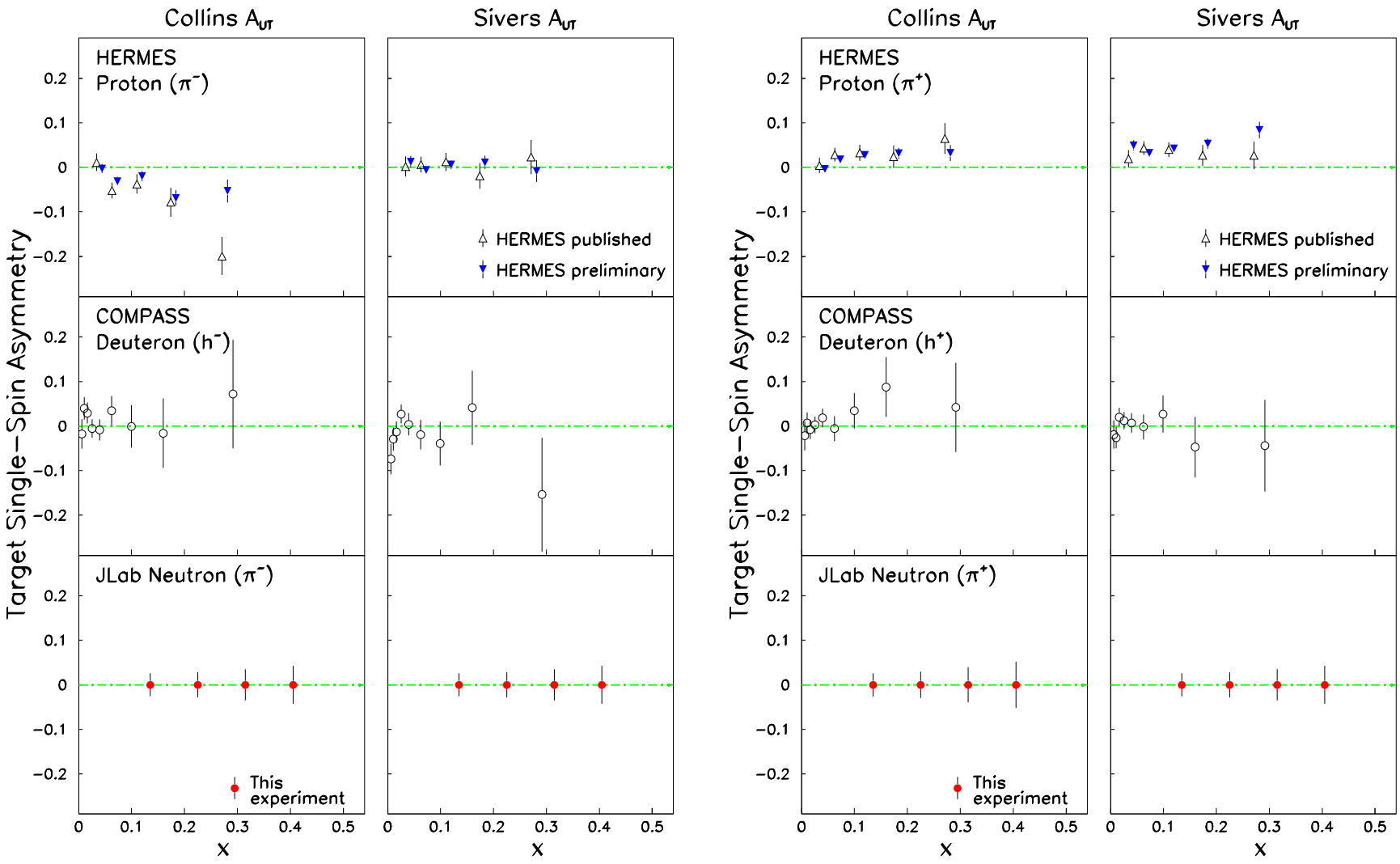
Xiaodong Jiang, Rutgers Univ. Feb. 2^{nd}, 2006.

News-1: BigBite is ready for the G_E^n experiment to start on Feb. 24^{th}.

News-2: Both experiments were approved with "A" rating at PAC29, with a combined beam time of 29 days (requested 48 days). Statistical error bars will increase by 30% compared with the proposal.

- Our goal is to start installation in summer-2007 (15 months left), finish data collection before the end of 2007.
  At that time, the updated HERMES $p^\uparrow$ data ($2\times$ stat.) and the COMPASS $d^\uparrow$ data ($4\times$ stat.) will have been published, the COMPASS $p^\uparrow$ data will be already collected.
- Statistics is the key of success for these experiments. Beam time will be very limited for calibration and debugging. All sub-systems should be extensively tested and debugged before installation.
- Avoid significant changes on the BigBite detectors unless there's a clear problem during the Gen experiment.

Statistical Uncertainties, if we have 48 days:



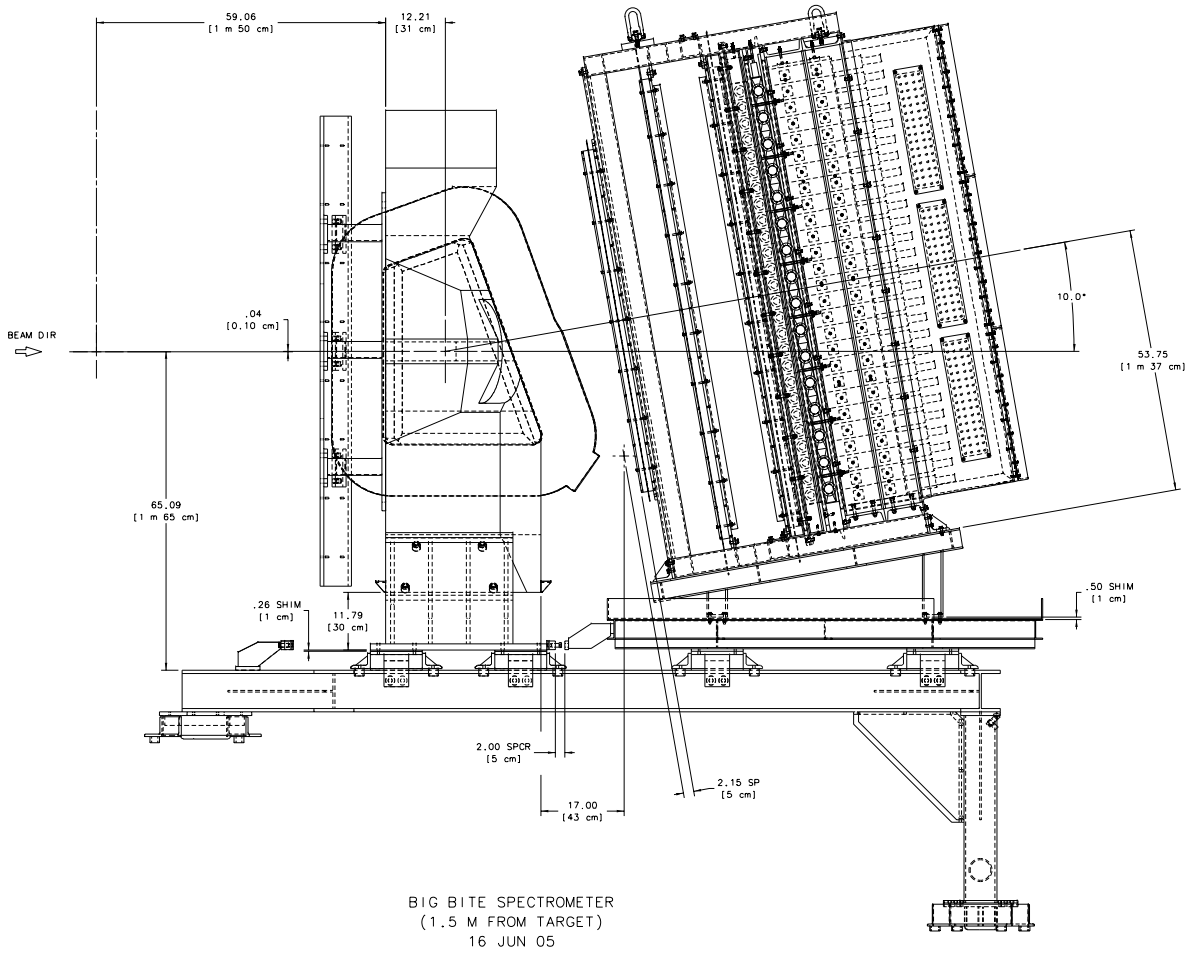
With 29 days total, error bars grow by 30%.

Major Milestones:

- May 2006, all major decisions made on design concepts. BigBite, target, trigger and DAQ, HRS RICH detector, A1 and A2, BigBite Cherenkov.
- Sept. 2006, readiness review. BigBite hardware fits, cables made. Detector package set up at the test lab. Target conceptual design finished, parts manufacturing in progress.
- Dec. 2006. BigBite detector package under cosmic ray test. Target assembly in progress. Start producing target cells.
- March 2006. Readiness review, safety documentation. HRS detectors installed and under beam tests. BigBite detectors ready, Aerogel Cherenkov ready for tests. Target system under test.
- June 2006. Installation starts, run plans ready.

  Late summer 2006, DAQ and on-line software ready. Target works. Luminosity monitors work. Ready to take data.

Transversity Requirements-I: BigBite related work



Hardware and support structure:

- Fits at 30 degree, 1.5 meter drift.
  - BigBite magnet's right foot need to be modified/redesigned.
  - Downstream side detector platform need to be modified. Supports for additional luminosity monitors.
- Shielding on the downstream side.
- Hall A floor arrangement, cables, DAQ/control crates and shielding.

BigBite detectors: avoid changes and re-works if it performs to the expectation during Gen.

Do not change: relative position between Ch1 and Ch3, Ch3 and Pre-shower etc.

Consider improvements:

- Wire chamber: pre-Amp cards, noise reduction and threshold, improve read-out speed.
- Aerogel Cherenkov: n=1.03 aerogel from Bates (decision around March 15). Redesign box, magnetic shielding, test 5" PMT. Make hardware ADC sums.
- Pre-shower+scintillator+shower: calibration, hardware sum and trigger.
- Coincidence time-of-flight with HRS, and with beam RF signal.

The option of an aerogel Cherenkov in BigBite:

30 cm box thickness, 50cm$\times$200cm active area, 9 cm aerogel thickness.

13 PMTs (5") on each side.

The design goal: $7 \sim 8$ photo electrons per event. To reject low-momentum pions on-line such that pre-shower+shower PID can be more effective offline.

n=1.03, pion threshold: 567 MeV/c.

Mount back-to-back with the 2nd chamber at the existing mount point. Keep the 2nd chamber for tracking.

The Arizona State Group is willing to make the new box and fill in aerogel from Bates.

Transversity Requirements-II: BigBite cables

Most cables used in Gen will go to Hall C for the Gep-II experiment, we need to start making cables as soon as possible. We need:

for HV and ADC signals:

Pre-shower: 2x27=54

Scintillator: 13x2=26

Shower: 7x27=189

Cherenkov: 2x10=20

sub-total: 289.

For TDC, need Scintillator, Cherenkov, pre-shower-sums, shower-sums: ≈ 56.

Trigger related cables: 20. Spares: 20

Total HV: ≈ 300

2 HV control crates (each HV crate holds 16 modules, 12 channel each)

Total long delay cables: $\approx$ 350. Total cables to TDC: $\approx$ 80.

Transversity Requirements-III: Target Related Works

Goal: By June 2007, fully tested at the target lab.

- Target spin directions: longitudinal, transverse in plane, vertical and 45° off-vertical.
- Spin reversal every 15-20 minutes while keeping target polarization above 40 $\%$.
- Map the BigBite magnetic field at the target location, build target correction coils to keep magnetic field gradients acceptable.
- Reliable operation with automatic controls to reduce overhead.

Transversity Requirements-IV: HRS Detectors

Goal: By June 2007, installed and tested.

- Aerogel detector A1 and A2: open box, check material first (FIU).
- RICH detector: beam test. DAQ improvements. Software ready.
- Pion rejector tested in earlier experiments.
- Online software tools ready.

Actions to take: Feb.-Apr. 2006

- Start target conceptual design right away.
- Actively taking part in the Gen experiment. Learn to support hardware and software, train students. Analysis optics data. Understand background rates.
- Make detector decisions: BigBite Cherenkov, HRS work on RICH and A1/A2.
- Identify major BigBite hardware works, start making designs for modifications.
- Get ready and plan for the BigBite detector's move from Hall A to the test lab after Gen.

Communications and organizations:

- Spokespersons' bi-weekly phone conference. Thursdays 10:00 am EST.
- On-site manpower weekly coordination. Mondays 9:30-10:00 am (?).
- Target design coordination with designer.

Actions to take: May 2006, BigBite optics test run (one shift)

The goal: collect $p(e, e'p)$ elastic coincidence data for the optics study of the BigBite at 1.5 meter drift.

Since the large neutron array will not be available after the Gen experiment, this is the last opportunity for the transversity and d_2^n experiments to collect hydrogen elastic coincidence data for optics study.

The BigBite spectrometer will be at 52 degree, same as in the Gen experiment. The plan:

1. At the Gen set up, take one Carbon multi-foil run (10 min.).
2. BigBite magnet off, take one Carbon multi-foil run (10 min.).
3. Access to the Hall, pull back BigBite detector package by 40 cm, and pull back the BigBite magnet by 40 cm, from 1.1 meter drift to 1.5 meter drift.
4. Beam back, take one Carbon multi-foil run (10 min.)
5. BigBite magnet power up, same current as before.
6. Take one carbon multi-foil run (10 min.)
7. Reference cell run with hydrogen gas, take $p(e, e'p)$ run (3 hours).

Hardware requirements of transversity, d_2^n, $(e, e'd)$ and A_y experiments.

Exp.	E_0 GeV	Time (day) PAC/real	Target spin	BigBite Angle	BigBite Detector	HRS_L	HRS_R
TransV.	6.0	29/48	$\uparrow \leftarrow$	-30°	Ch1-3, Aero ($\check{C}$?)+PbG	16°	Outside
d_2^n	$5.7 \sim 6.0$	13/22	Long. $\leftarrow$	-45°	Ch1,3, $\check{C}$+PbG	45°	Outside
$(e, e'd)$	2.4	15/25	+15°, -72.8°	-72.8°	Ch1,3, dE-E, neutron	15.0°	$-12.5°$
A_y	~ 3.3	8/13	$\uparrow$	N/A		$12.5° \sim 19.2°$	

Thesis Topis in Transversity Experiments

In semi-inclusive channel:

- SSA A_{UT}, π^-, both Sivers and Collins.
- SSA A_{UT}, π^+, both Sivers and Collins.
- A combined analysis of A_{UT} neutron, with and without HERMES and COMPASS data.
- Kaon asymmetries, both single-spin and double-spin.
- Double-spin asymmtries A_{LT} for, π^- and π^+, K^+ and K^-, extract g_{1T} on neutron for the first time.
- Spin-dependent and spin-independent cross sections, relative ratios.

Inclusive DIS:

- Double-spin asymmetries, $A_\perp$ and g_2^n.
- Target single-spin asymmetries in inclusive DIS, A_T.