Transversity Data Management / Quality Checks

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December 12, 2009
Hall A Analysis Workshop

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Outline

- Overview of the experiment
- Data Processing
- Skim Process
- Data Quality Checks
- LHRS Data Quality/Stability
- BigBite Data Quality/Stability
- Scaler Checks
- Conclusion/Status

Brief Overview of Transversity

- Single Target Spin Asymmetry in semi-inclusive deep inelastic $n^{\uparrow}(e, e'\pi^{\pm})X$ on a transversely polarized ^{3}He target
- Valence quark region, $x = 0.1$ to $x = 0.4$ and $Q^2 = 1$ to 3 GeV^2

- Beam energy, E = 5.9 GeV
- Polarized ^{3}He target
- LHRS at 16° to detect $\pi^{\pm}/K^{\pm}$
- BigBite at 30° to detect electrons
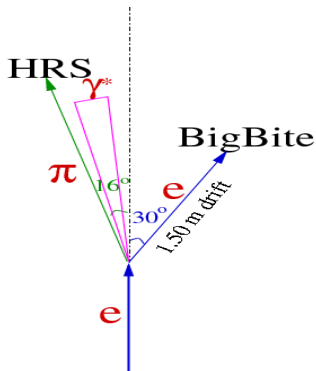
Transversity Data Processing

- Raw data stored at /mss/halla/e06010/raw
- Size>10 Tb
- Processed rootfiles in the work disk (work 5602)
- Replayed 4 times to check different detectors and to debug various problems
- The last replay (4th pass)is the $\sim$ final replay
- Summary of the charges collected in different configurations:

Target	LHRS	Total charge(C)
Transverse	Negative	10.3
Transverse	Positive	8.43
Vertical	Negative	9.05
Vertical	Positive	8.24

Pass 4 rootfiles ("final" replay)

- Energy loss calculation for beam and out going particles
- LHRS optics module and R-cut
- BigBite calorimeter energy correction
- Addition of RICH
- BigBite acceptance cut
- BigBite photon module
- Photon coincidence module
- EDT pulser for livetime calculation

Skim Process : to make the data quality checks efficient

- Normal rootfiles⟶Skimmed rootfiles
- Skimmed process gets rid of : beam trips, chamber trips etc.
- Skimmed process eliminates : any problematic period of running, dead time issues, trigger issues etc.
- Formation of ss scaler (gated only by target spin)
- Calculation of offline kinematic variables
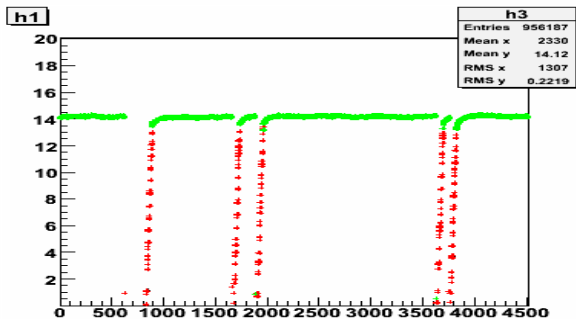
Pass-4 Skim Process Summary from Xin

- Total time to replay, skim and check the rootfiles $\sim$ 4 weeks

  - 1st level skim:
    - Shift scalers and label the beam trips
  - 2nd level skim:
    - Shift scalers and label chamber trip/dead time issue/trigger etc
  - 3rd level skim:
    - Add in kinematics variables, R-cut, BigBite acceptance cut.
  - 4th level skim:
    - Skim to small size rootfiles with major variables.
  - Special Skim for L1A runs

Overview

- Accumulated charge, total number of events etc. on run-by-run basis
- BigBite optics variables/tracking variables on event-by-event basis
- Independent checks of BigBite shower-preshower
- Independent checks of wire chamber tracking etc.
- Independent checks of LHRS PID detectors
- All kinematic variables,scalers etc.
- Coincidence timing module, photon module etc.

Gas Čerenkov

- No HV change during the run period
- One calibration for the experiment
- SPE aligned to channel 200
- Main peak fitted with a Gaussian to get the mean
- Run-by-run stability of the mean checked

- Main peak is fitted. (ch 600- ch 1900)

- Mean of the fit Vs Run number
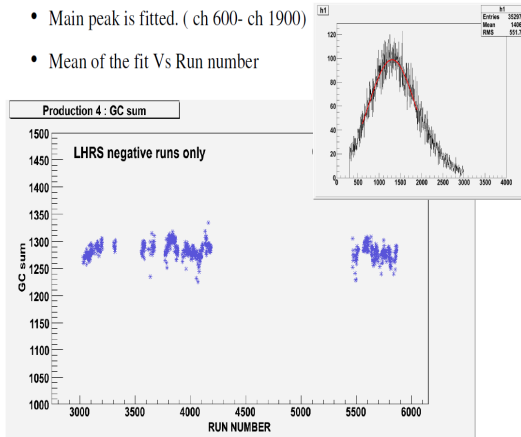
Aerogel

- HV changed 4 times for one PMT
- Few different calibrations done
- SPE aligned to channel 100
- Main peak fitted with a Gaussian to get the mean
- Run-by-run stability of the mean checked

- Main peak is fitted (ch 270-ch 800)
- Mean of the fit Vs Run Number
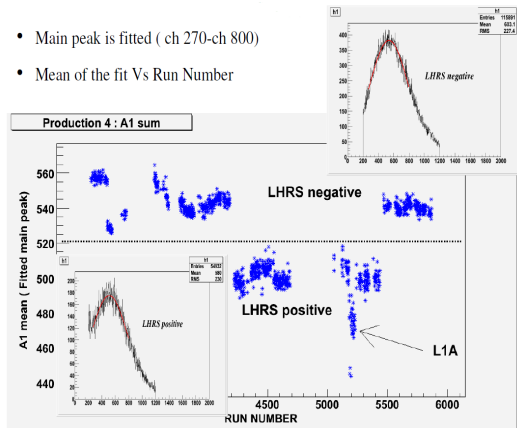
Lead Glass Counters

- No HV change during the entire run period
- One calibration for the experiment
- Pion peak aligned to channel 100 during calibration
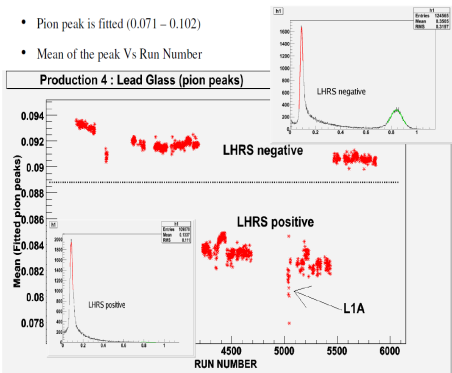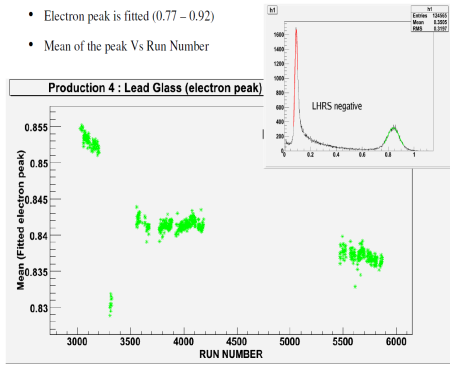
Vertical Drift Chambers

- Offset calibrations done for different periods
- Checked for both T3 and T5 events separately on a run-by-run basis
- A lot of timing changes made at the beginning
- Very stable during the main production period except the L1A problem period
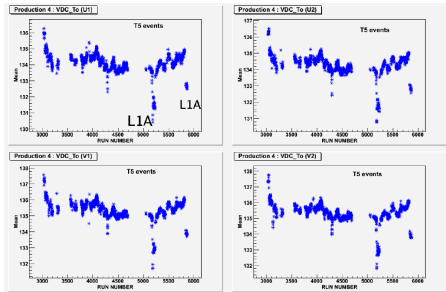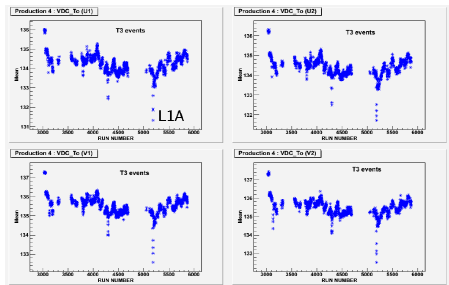
S2m TDCs

- S2m contains 16 paddles
- Only left TDCs considered since the right side was selftimed
- Very stable except at the beginning of the experiment
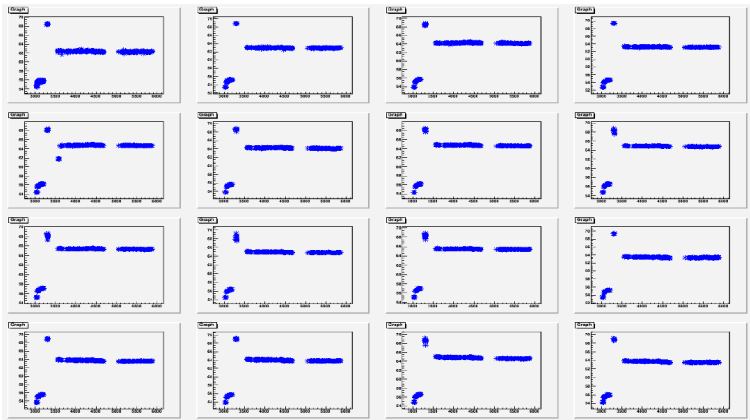
Wire chamber/Calorimeter

- Calibrations and extensive data quality checks done by Xin
- Tracking efficiency study
- Shower calibration and checks done by Kalyan
- $\sim$15% gain drop in Preshower due to radiation damage
- $\sim$5% gain drop in Shower due to radiation damage
- Corrections done after dividing the data into different periods
- Stable after all the corrections applied

Calorimeter degradation/ correction
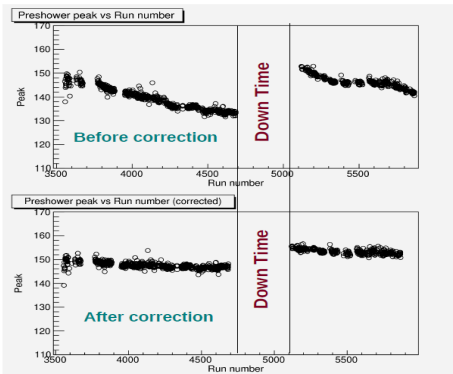
Figure: Preshower peak
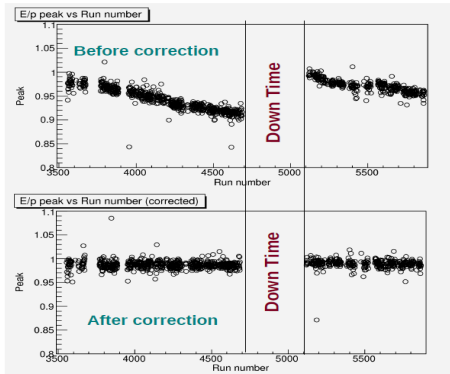
Figure: Shower $\frac{E}{P}$

Scaler checks

- Different independent checks performed
- Extensive study of different scalers by Min Huang (DUKE)
- Total 10 scalers(2 copies) (5 to LHRS and 5 to BB)
- Ungated,++,+-,- -,-+
- Few gated scalers had issues
- Ungated scaler used for the analysis
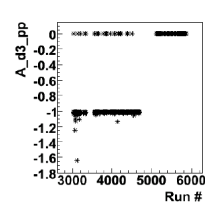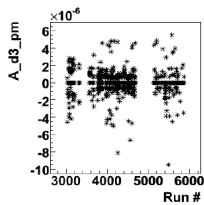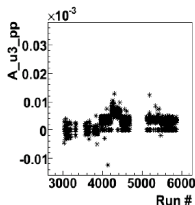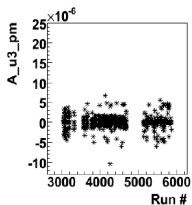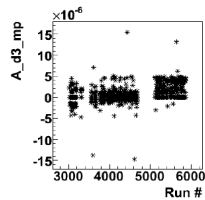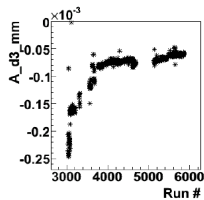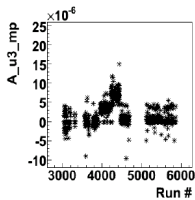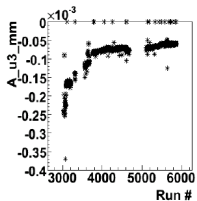- Ungated scaler gated by the target spin in the skimming process
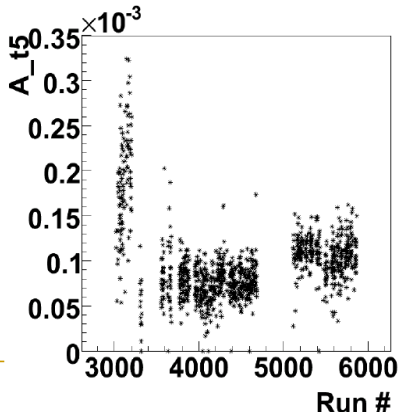
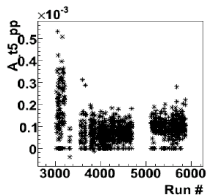# Ungated u3 and d3

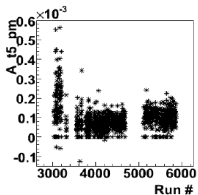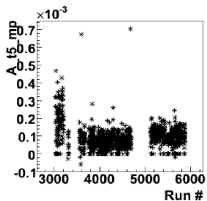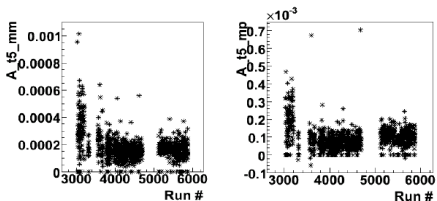- Asymmetry between LHRS and BigBite (10^{-6})
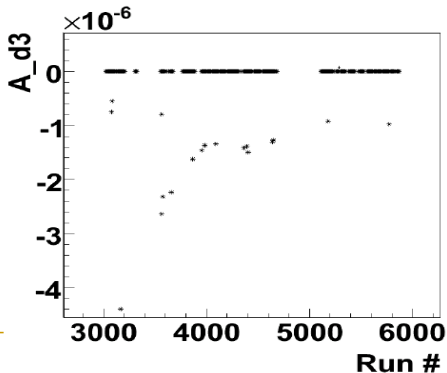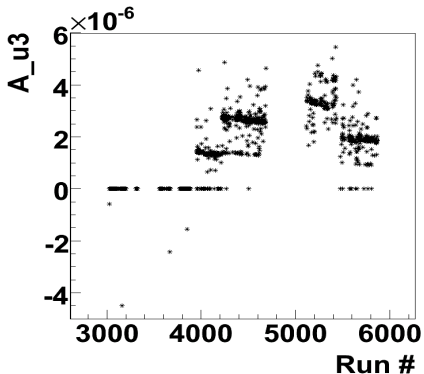
Gated u3,d3

- Asymmetry between LHRS and BigBite

T5 scalers(gated and ungated)

- Asymmetry between LHRS and BigBite

Scaler check summary

- A nice summary from Min Huang

	u1	d1	u3	d3	u10	d10	t1	t5	t6
Ung-ated	√	√	Good~10^{-6}	Good~10^{-6}	√	Good~10^{-6}	√	Good~10^{-4}	Good~10^{-4}
--	Left	Left	Left	Left	Left	Left	Left	√	Left
-+	√	√	√	√	√	√	√	√	√
+-	√	√	√	√	√	√	√	√	√
++	√	√	√	Left	√	√	√	√	Left

Good: Best channels

√ : Not so precise, problem of individual runs

Conclusion

- An extensive data quality check carried out during the last few months
- Replay of the data done 4 times already to debug and fix different issues
- Both the detectors (LHRS and BigBite) reasonably stable during the entire run period
- The final replay done and rootfiles ready for the asymmetry analysis
- Preliminary raw asymmetries already calculated
- Hopefully final results within next 6/7 months
- Thanks to Xin and Kalyan for their inputs and plots