Hall C Introduction

Mark Jones , Hall C Staff

- Hall C has two small acceptance spectrometers:
  - High Momentum Spectrometer (HMS) from 6 GeV era
    - P_{max} = 7.3 GeV/c, Ω = 6.5 msr, $-10 < \delta < 10\%$, $10.5 < \Theta < 85^o$
  - Super High Momentum Spectrometer (SHMS) , new for 12 GeV era
    - P_{max} = 11 GeV/c, Ω = 4 msr, $-15 < \delta < 25\%$, $5.5 < \Theta < 40^o$
- The similar detector packages in HMS and SHMS and similar to Hall A.
  - Drift Chambers, Scintillator Hodoscopes, Aerogel, Gas Cerenkov, Calorimeter
- Experiments ran in Spring 2018
  - Four commissioning experiments :
    - F2 (Inclusive ep & ed in DIS & Resonance),
    - EMC (Inclusive eA).
    - Color Transparency, A(eep)
    - D(eep)
  - SIDIS Pt experiment partially ran.
- Fall 2018, run SIDIS KAON-LT, SIDIS Pt and SIDIS CSV.

Overview of Talk

Hall C Software Overview

- The standalone C++ library is called HCANA
- Git for version control and Github as repository server.
  - Steve Wood, manages main git repository
  - Use Travis to check commits.
  - Users fork from main repo and make pull requests to main git repo.
  - Activity monitored by Hall A experts: Ole Hansen and Bob Michaels
- Nightly builds on multiple machine types.
- SCONS for building code.
- Doxygen for documenting code.
- Biweekly software meetings. User involvement.
- Annual software meetings. Last joint A/C software meeting

Hall C Personnel

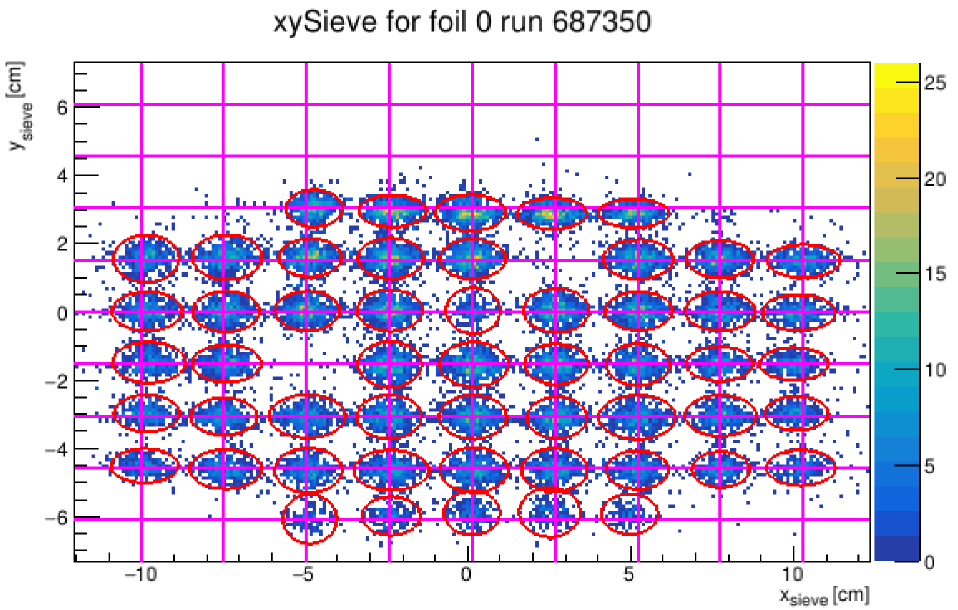
- Software Manager : Mark Jones, Hall C staff.
- Detectors, parameter database, code integration: Steve Wood, Hall C staff.
- DAQ, detectors : Brad Sawatzky, Hall C staff.
- DAQ, detectors : Eric Pooser, Hall C postdoc.
- Optics, Magnet commissioning : Holly Smuzila, Hall C postdoc.
- Simulation: Dave Gaskell, Hall C staff.

Experiment to publication

- Detector commissioning
  - Plan in place
  - Users in charge of individual detectors
  - Online histogramming ✓ done
- Scalers ✓ done
- Slow control data (e.g. HV, LV, collimator ,target info …) ✓ done
- Detector calibrations ✓ done
  - Code and documentation exist for each detector, (examples to follow)
- Optics matrix for focal plane to target quantities. Calibration code. ✓ done
- Beam/Raster ✓ done
- Understand acceptance with known cross section, comparison to HMS
- Knowledge of SHMS absolute central angle and momentum.
- Beam energy measurement
- Measure tracking, trigger and PID efficiencies. ✓ done
- Calibration beam current and measured target density versus current.
- Simulations and radiative corrections ✓ done

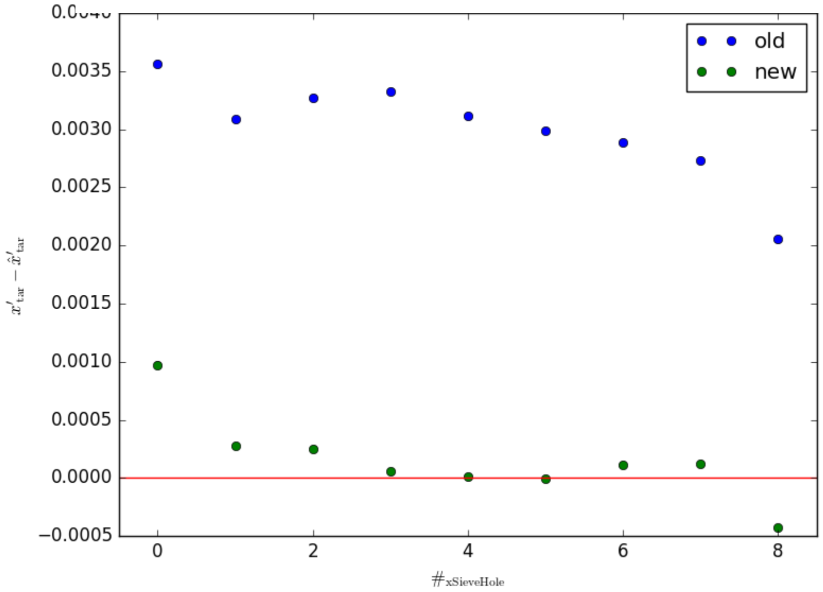
Optics calibration

- Code based on existing HMS code and checked by old HMS data.
- Monthly meetings since April 2016 have produced a run plan for optic commissioning and calibration.
- Jure Bericic has written as ROOT based version.



Ysieve versus Xsieve

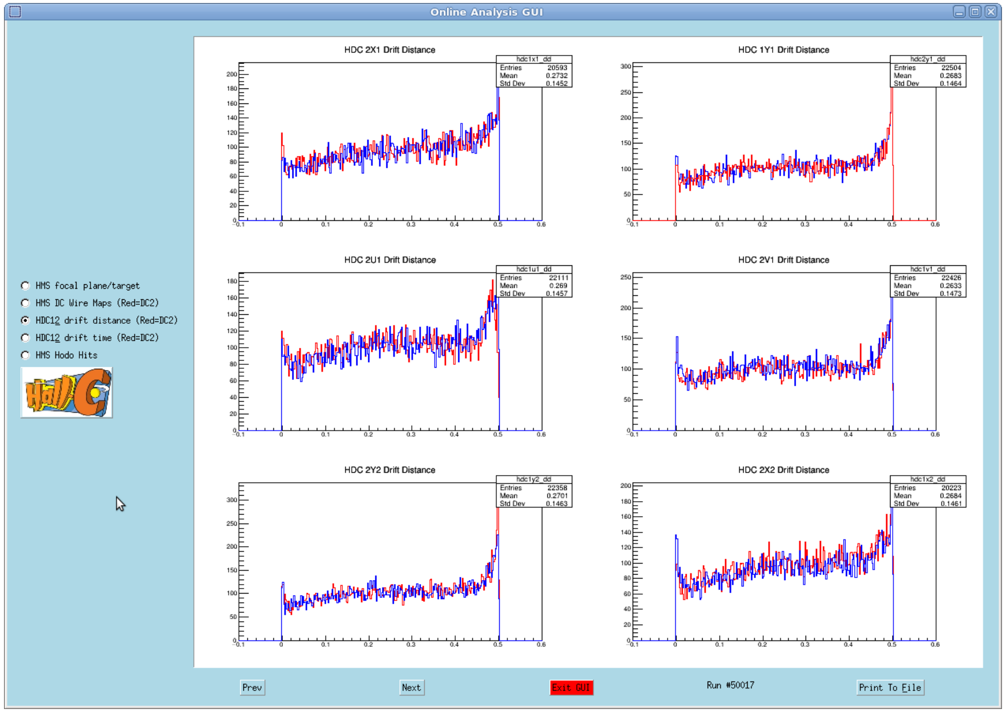
Diff between measured and known X’



Xsieve Row Number

Online histogram monitoring

- Use the standard Hall A online histogramming package.
- Has been used in past experiments in Hall C



Online GUI

Online GUI config file

```
rootfile hodtest.root
guicolor lightblue
canvassize 1000 800

definecut thtarcut abs(H.tr.tg_th)<0.01
definecut phtarcut abs(H.tr.tg_ph)<0.01
definecut ytarcut abs(H.tr.tg_y)<4
definecut tarcut phtarcut&&thtarcut

newpage 2 2
title HMS focal plane/target
H.dc.x:H.dc.y -type scat
H.tr.tg_y ytarcut -title "Target Position"
RB.raster.frx:RB.raster.fry -type colz
H.tr.tg_ph:H.tr.tg_th phtarcut&&thtarcut -type colz -title "Target Xp vs Yp"

newpage 2 3
title HMS DC Wire Maps (Red=DC2)
macro     overlay.C("hdc1x1_wm","hdc2x1_wm")
macro     overlay.C("hdc1y1_wm","hdc2y1_wm")
macro     overlay.C("hdc1u1_wm","hdc2u1_wm")
macro     overlay.C("hdc1v1_wm","hdc2v1_wm")
macro     overlay.C("hdc1y2_wm","hdc2y2_wm")
macro     overlay.C("hdc1x2_wm","hdc2x2_wm")

newpage 2 3
title HDC1&2 drift distance (Red=DC2)
macro     overlay.C("hdc1x1_dd","hdc2x1_dd")
macro     overlay.C("hdc1y1_dd","hdc2y1_dd")
macro     overlay.C("hdc1u1_dd","hdc2u1_dd")
macro     overlay.C("hdc1v1_dd","hdc2v1_dd")
macro     overlay.C("hdc1y2_dd","hdc2y2_dd")
macro     overlay.C("hdc1x2_dd","hdc2x2_dd")


newpage 2 3
title HDC1&2 drift time (Red=DC2)
macro     overlay.C("hdc1x1_dt","hdc2x1_dt")
macro     overlay.C("hdc1y1_dt","hdc2y1_dt")
macro     overlay.C("hdc1u1_dt","hdc2u1_dt")
macro     overlay.C("hdc1v1_dt","hdc2v1_dt")
macro     overlay.C("hdc1y2_dt","hdc2y2_dt")
macro     overlay.C("hdc1x2_dt","hdc2x2_dt")

newpage 2 4
title HMS Hodo Hits
macro overlay.C("hpostdc1","hnegtdc1")
macro overlay.C("hposadc1","hnegadc1")
macro overlay.C("hpostdc2","hnegtdc2")
macro overlay.C("hposadc2","hnegadc2")
macro overlay.C("hpostdc3","hnegtdc3")
macro overlay.C("hposadc3","hnegadc3")
macro overlay.C("hpostdc4","hnegtdc4")
macro overlay.C("hposadc4","hnegadc4")
```

Simulation Code

- The 6 GeV era code, SIMC, for Monte Carlo simulation of the HMS/SOS coincidence experiments was updated for the SHMS.
  - Radiative corrections included (*PHYSICAL REVIEW C, VOLUME 64, 054610)*
  - Cross section models can updated for 12 GeV experiments.
- For inclusive experiments, a single arm Monte Carlo simulation for SHMS was written, MC_SHMS_SINGLE. Separate radiative correction code.
- SIMC, MC_SHMS_SINGLE and inclusive radiation code are in a git repository managed by Dave Gaskell.

Computing requirements

- Background load in cores (nominal): 300 cores
- Background tape consumption (nominal): 0.5 TB/week
    - Background usage rates based on 2.8M core-hour usage in 2015
- Weeks Running (estimated): 23 [FY18] ? [FY19]
- Resource use per week of Running
  - Simulation load in core-weeks: N/A *
  - Non-simulation load in core-weeks: N/A *
  - Simulation data to tape: N/A *
  - * Simulation and offline analysis captured in above background estimates for Hall C.
  - Online analysis typically carried out on Hall compute cluster.
  - Non-simulation data to tape: 1 TB/week
    - Based on (nominal) 5 MB/sec data rate to disk and 40% Accel*Hall uptime

Conclusion