Hall C

Mark Jones , Hall C Staff

Overview

- In first 3 years of running, experiments will use the existing High Momentum Spectrometer (HMS) and the new Super High Momentum Spectrometer (SHMS). SHMS replaces the Short Orbit Spectrometer (SOS).
- HMS and SHMS have similar detector packages: Drift Chambers, Scintillator hodoscope, gas Cerenkov, Aerogel, Lead-glass calorimeter.
- After 2018, several experiments use new apparatus: neutron polarimeter, neutral meson spectrometer, backward angle hodoscope as 3rd arm.

Status and Timeline

- SHMS carriage, detector hut constructed. Calorimeter installed.
- Installation of hodoscope soon with other detectors to follow.
- Q1 magnet installed. HB to be installed in March. Construction of other magnets on schedule.
- Beam commissioning in Fall 2016 (Shift from Feb 2016)

Goal of Hall C 12 GeV Software

Main goal is to have online/offline software ready for start of experiments.

To achieve this goal decided:

- Develop a Hall C specific standalone C++ library that utilizes the existing Hall A PODD C++ library. Use the existing well-tested Fortran code (ENGINE) as basis for the C++ library.

Management Structure

Activity	Person	Institute
Software Manager	Mark Jones	Jefferson Lab
C++/ROOT Analyzer	Gabriel Niculescu	James Madison University
Calibrations	John Arrington	Argonne National Lab
Online histogramming	Pete Markowitz	Florida International Univ.
Simulation (SIMC)	David Gaskell	Jefferson Lab

HMS and SHMS comparison

HMS detector	SHMS detector	Comment
Front X-Y scintillator plane Rear X-Y scintillator plane	Front X-Y scintillator plane Rear X scintillator plane Rear Y quartz plane	Coding done Coding done New code (easy)
Drift Chamber	Drift Chamber	Coding done
Gas Cerenkov	Noble Gas Cerenkov Heavy Gas Cerenkov	Coding done
Aerogel	Aerogel	Coding done
Lead Glass Calorimeter 4 columns oriented perpendicular to central ray	Pre Shower Column “Fly’s Eye” Arrangement of Calorimeter	HMS coding done. SHMS coding being done by experts. SHMS similar to Hall A

Test new HMS code against original Fortran code (ENGINE) using 6 GeV HMS data

Test new SHMS code against original Fortran code (ENGINE) using 6 GeV SOS data

Computing requirements

Year	2015	2016	2017	2018
Trigger rate (kHz)	1	1	4	4
Event size (kB)	5	5	3	3
Data rate (MB/s)	5	5	12	12
DAQ volume (TB)	4	10	50	50
Tape Volume (TB)	30	60	330	330

- 2015 is debugging HMS/SHMS with cosmics
- Fall 2016 Commissioning experiments then 2017/2018 Physics
- All experiment use HMS/SHMS which have low event size. Event size larger in 2015/2016 assuming some F250 data taken in full waveform readout mode for debugging. In general, data taking will use F250 in integrated mode.

Present Status

- HMS Drift Chamber tracking code is working. Added best track selection and tracking efficiency code. In depth comparison of tracking efficiency in progress. (See Deep Dive)
- HMS hodoscope, gas Cherenkov, aerogel and calorimeter coding and comparisons completed. (See Deep Dive)
- SOS (Same as SHMS) drift chamber tracking working with comparisons completed. (See Deep Dive)
- Hall C report templates added to code. (See Deep Dive)
- PODD updated Event Decoder and added new Event Handler. Working to implement Hall C scalers and EPICS into HCANA.
- Using git for version control and Github as repository server.
- SCONS for building code. (Still have Make available. Hope to phase out)
- Documentation on Hall C wiki to allow users to get involved.
- Nightly builds

2014 Milestones Status

Jan: Hall C specific BPM/Raster code. Hall C report templates Completed

Mar: Implement Hall C scalers. Work in progress (New milestone July 2015)

June: Complete documentation of Fortran code.

Work in progress (New milestone July 2015)

July: HMS Calibration codes ready.

Calorimeter and drift chambers done.

Optics and hodoscope just starting. (New milestone Aug 2015)

Aug: HMS Online histogramming ready

Work in progress (New milestone June 2015)

Oct: Test software for SHMS calorimeter with FADC.

Code compatible with PODD in place. Need to integrate in HCANA.

Dec : Full analysis of HMS data with C++ Analyzer verified by comparison to Fortran analyzer.

Completed HMS detector comparison.

Working on physics comparison. (New milestone May 2015)

Dec: Nightly builds Completed

2015 Milestones

May: Complete HMS ENGINE/HCANA physics comparison

June: Complete HMS/SOS ENGINE/HCANA coincidence comparison

June: HMS Online histogramming ready

July: Implement Hall C scalers. Complete documentation.

Aug: HMS/SHMS Calibration codes ready.

Sept: SHMS Calorimeter Calibration code ready.

Oct: C++ Analyzer ready for SHMS detector package.

Detector Installation Status

- SHMS calorimeter installed in hut in Dec 2014
- SHMS Front X-Y Scintillator Plane and Gas Cerenkov to be installed in April 2015
- SHMS Rear X Scintillator Plane and Y Quartz plane to be installed in May 2015
- SHMS Aerogel to be installed in August 2015
- SHMS Drift Chambers at Jlab in March 2015. Need to wait until SHMS Dipole installation is done. Chamber installation in June 2016.

Nightly Builds

- Implemented simple nightly builds
  - Test compile and run on different platforms
  - Uses cron and shell scripts
  - Based on Hall D scripts
- Plan to add reference histograms and other checks to build status page

Hall C Analyzer Nightly Build Report for 2015-02-02

Host	Compile Warnings	Runtime Warnings	GCC Version	ROOT Version	Events	Pedestals	Branch/Commit
ifarm1101	3	4	Red Hat 4.4.6-3	5.34/13	23475	1000	develop/db791ac
jlabl1	3	4	Red Hat 4.4.7-11	5.34/25	23475	1000	develop/db791ac
jlabl3	3	4	Red Hat 4.4.7-11	5.34/13	23475	1000	develop/db791ac
steve	0	4	Red Hat 4.8.3-7	5.34/21	23475	1000	develop/db791ac
wood64	3	2	Red Hat 4.4.7-11	5.34/21	0	0	badcommit/ec0c0f3

Response to Recommendations

Recommendation	Response
Adoption of code evaluation tools	1) Cppcheck is part of SCONS build. 2) Using Valgrind intermittently.
Consider code reviews	Rely on Hall A experts to review code. Use PODD as example Review as “pull request” in GitHub
Software workshops and tutorials	Annual workshops. Wiki pages.
Looking at TagFS as a potential tool for file metadata and data discovery	Does not seems appropriate for Hall A/C
Provide a generic mechanism to capture the a vailable monitoring histograms and other output at the end of a data acquisition run.	Explanation of past and planned practice in “deep dive” session
Effort should be made to identify personnel capable of extending the Hall C Software migration to full tracking, calibration, and physics calculations.	See next slide

Personnel for completed tasks

Completed Tasks	Personnel
Hodoscope	Gabriel Niculescu, JMU
HMS/SOS drift chamber	Steve Wood, JLab
Golden track selection	Ahmed Zafar, Regina
HMS calorimeter	Simon Zhamkochyan, Yerevan Vardan Tadevosyan, Yerevan
Cerenkov/Aerogel	Ahmed Zafar, Regina
Hall C raster	Buddhini Waidyawansa, JLab
Hall C parameter files, Run templates	Steve Wood, JLab
SCONS	Ed Brash, CNU
SIMC (Simulation code)	Dave Gaskell, Jlab Dipangkar Dutta, MSU

Personnel for remaining tasks

Remaining Tasks	Personnel
Comparison of HMS physics quantities	Ioana and Gabriel Niculescu, JMU *(spokesperson commissioning exp)*
HMS and SHMS histogramming	Pete Markowitz and student, FIU
Optics calibration	Ed Brash and students, CNU
Hall C Scalars/EPICS	Ed Brash
Tracking Efficiency	Ahmed Zafar, Regina
Comparison of HMS/SOS coincidence	Dipangkar Dutta, MSU *(spokesperson commissioning exp)*
SHMS calorimeter	Simon Zhamkochyan, Yerevan Vardan Tadevosyan, Yerevan
HMS/SHMS Hodoscope calibration	Ahmed Zafar, Regina

Deep Dive Session

- “Hall C: Deep Dive”, Gabriel Niculescu, JMU
- Users available for questions:
    - Ed Brash, CNU
    - Simon Zhamkochyan, Yerevan
    - Dipangkar Dutta, MSU

With detectors on site for testing and installation, we expect that students and post-docs from those institutions will use and expand the software.