Fall 2016 run summary and Spring 2017 run plan

A. Deur
Jefferson Lab
Fall 16 run

• Operation was for physics running. Energy: 11.64 GeV (Lower than Fall15/Spring16: 12.05 GeV)
• Accelerator development (beam studies 8h/week): goals related Hall D:
  • Re-commission RF separator.
  • Test multi-hall operations.
  • Other small tests: Act. Col. fast calibration, fix energy determination code, ...
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• Hall D configuration:
  • Solenoid at 1200A. (Initial plan: 1350A but ramp-up problems forced us to use a safer value)
  • 50 µm diamonds (1 old: J1a50 + 2 new: J70-100 and J70-105), 2 backup 20 µm diamonds (old J70-118, new JD70-104).
  • Tagger quadrupole on (negative polarity).
  • 5mm collimator hole (no 3.4mm).
  • LH2 target.
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Hall D main goals:
  • Gather GlueX low luminosity polarized data with its necessary systematic data.
  • Check high rate trigger/DAQ/L3 performances and gather data to assess performance during GlueX high luminosity run.
  • ToF/CDC HV scans.
  • (Commission ComCal for PrimEx)
Schedule

Original timeline (11 weeks):

• Oct. 1st-8th: Electron beam restoration.
• Oct. 8th-Nov. 22nd: Hall D Fall run, part 1.
• Nov. 23rd-27th: Thanksgiving break.
• Nov. 28th-Dec. 18th: Hall D Fall run, part 2 (includes 2 day of beam restoration).
• Dec. 19th-21st: TBD.
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Actual timeline (6 days):
• Dec. 15th (11am) - 21st (4am)

Delays due to:
• Failure of power supply in CEBAF's arc 7: precluded 5- and 5.5-pass running: 2 months delay.
• Vacuum failure of RF-separator cavity + Hall A priority: 2 weeks delay.

Not a time loss for GlueX. (Physics programs go by PAC days)

Run plan: https://halldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Fall_2016_Run
Actual run plan

1 week period

Thursday, February 16, 2017

A. Deur. GlueX collaboration meeting, 02/16/2017
Actual run plan

Fall 2016 GlueX run, t=0 is 12/13. Assume 50% eff.

Staggered tasks are accelerator responsibility

1 week period
What was done

Beam current limit test
Run up to 1.5 µA w/o rad., w/ the two 10^4 Al. rads. & w/ diam.
30 min TPOL rate check
Ion Chamber calib. with diamond & 1.5 µA
High rate DAQ Tests
Trigger L1 high rate test
2h Trigger L1 high rate test
2h Rho polarimetry

High rate L3 test 1 (4h)
High rate L3 test 2 (4h) w/ DAQ group (3h)
DAQ bottleneck search w/ DAQ group (3h)
Low energy T-Polarimetry
10h

8.12h GlueX prod. data (50%/50% on Al radiator & Harp Scan (both Hald D and MCC) (30min)
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High electron current mapping (4h)
L1 trigger high rate test (12h)
L1 trigger Th. setting study (8h)
PS magnetic field scan (2h)
L1 trigger study part 3 (6h)
L1 trigger study part 2 (6h)
L1 trigger study part 1 (3h)
ToF studies (12h) w/ CDC Volts scans
DAQ check IN (2h)
Harp Scan (both Hald D and MCC) (30min)
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What was done

53% accelerator efficiency (Halls A & D running).
51% beam & Hall D data taking efficiency.
What was done

https://halldweb.jlab.org/hdops/wiki/index.php/Summary_of_the_Fall_2016_GlueX_Run

Accelerator:

• Re-commission RF separator. (✔)
• Test multi-hall operations. ✗ (Able to run Hall A and D concurrently, but not at desired energy (4-pass for Hall A))
• Other small tests: Act. Col. fast calibration ✗, energy determination code ✗
• Establish physics-quality beam ✗

Tuning not optimal for production: Due to lack of time, we had to be content with beam focused on diamond rather than main collimator. Radiation levels at goniometer unacceptable otherwise.
What was done

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Hall D main goals:

- Gather GlueX low luminosity polarized data with its necessary systematic data. ✗
  - We did gather enough data for global detector checkout.
  - 2 nights of data taking in production mode. (No Al. radiator triggers, solenoid at 1200A.)
What was done

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- Gather GlueX low luminosity polarized data with its necessary systematic data. ✗
- Check high rate trigger/DAQ/L3 performances and gather data to assess performance during GlueX high luminosity run. ✓

Lot of beamtime and work dedicated L1 trigger and DAQ.
Results: expect to run production in **Spring 17 at 50-70 kHz.** (This is now confirmed). Spring 16 ran around 30 kHz.
What was done
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Hall D main goals:
• Gather GlueX low luminosity polarized data with its necessary systematic data. ✗
• Check high rate trigger/DAQ/L3 performances and gather data to assess performance during GlueX high luminosity run. (√)
• ToF/CDC HV scans. (√)
• (Commission ComCal for PrimEx) (√)

Also done:
• Aligned and used 58 µm diamond JD-70-100. (√) Goniometer operated reliably. (√)
• Gathered reasonable statistics to study small polarization at low photon energy (with both rho and TPol). (√)
• Used new collimator vertical motion successfully. (√)
Para and perp differences

Rates:
Para, perp rate difference: \( \sim 5-10\% \) rate difference. Much improved compared to Spring 16 (30\%). Supports the hypothesis that we were missing part of the J1a50 diamond. (Goniometer motion fixed, larger diamond)
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Polarization at top of coherent peak

Rho analysis (Preliminary, A. Austregesilo):

Para: \(32.7 \pm 1.3\%(\text{stat})\); Perp: \(32.0 \pm 1.2\%(\text{stat})\)

TPol analysis (Preliminary, N. Sparks):

Para: \(31.4 \pm 4.7\%(\text{stat})\); Perp: \(36.0 \pm 4.8\%(\text{stat})\)

No para/perp polarization difference like in Spring 16 (~44 \(\pm\) 1.5\% para, 38 \(\pm\) 1.5\% perp). Lower than the ~40\% obtained in Spring 16 with 3 different diamonds. Maybe due to special beam tune: focus on diamond rather than collimator \(\Rightarrow\) dilution of coherent beam core. Supported by higher Spring 17 polarization.
Preliminary numbers:

TPol: 3.5% +/-1.1%. (Para: 8.0 +/-1.1%, perp 0.3 +/-1.1%)
Rho: 3.5% +/-0.5%.

Agrees with the 5% seen in Spring 16 after normalizing to 40% polarization at the top of the coherent peak.

This will be discussed in beamline session tomorrow (R. Jones).
Problems

• Several trips of the solenoid power supply occurred while ramping it up. To be safe, the run was done at 1200A rather than at the planned 1350A. Solved for Spring 17 run.

• A bad FCal crate (crate 10) severely limited the DAQ performance for production. Solved for Spring 17 run.

• Could not quickly align old J1a50 diamond. (May have partly fallen from the holder.) Probably fixed for Spring 17 run.

• Beam tune was not adequate for production or polarimetry studies. Solved for Spring 17 run.
Conclusion

Fall 16 was not the expected start of production for GlueX, but it allowed us to start the Spring 17 run in excellent position.
Spring 17 run

• Operation is for physics running. Energy: 11.64 GeV (Same as Fall 16)

• Priorities:
  1. Hall B and C Key Performance Parameter.
  2. Establish that 5-pass RF separation works and is reliable. Important for Fall 17 run.
  3. GlueX. (Needed to reach goal #2)
  4. Hall C commissioning/Physics.
  5. Hall A physics when Hall C is down.
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• Accelerator development (beam studies 8h/week): goals related Hall D:
  • Finalize RF separator commissioning.
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- Accelerator development (beam studies 8h/week): goals related Hall D:
  - Finalize RF separator commissioning.
  - Test multi-hall operations.
  - Other small tests: Act. Col. fast calibration, energy determination code, FFB
- Hall D configuration:
  - Solenoid at 1350A. Repetition rate: 250 MHz (Fall 16: 500 MHz)
  - 50 µm diamonds (2 old: J1a50 + J70-100, 1 new: J70-105), 1 backup 17 µm diamond (new JD70-104).
  - Tagger quadrupole on (negative polarity).
  - 5mm collimator hole (2-day test on 3.4mm with thin JD70-104).
  - LH2 target.
Schedule and organization

Timeline (7 weeks):


Run plan: https://halldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Spring_2017_Run
Schedule and organization

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Run responsibilities:

Leadership: C. Meyer, M. Shepherd, E. Chudakov, E. Smith

Run Coordinators:
- Wed. Mar. 8 - Wed. Mar. 15: (7 days): R. Jones

Physics Division Liaison: Benedikt Zihlmann.

Analysis Coordinator: Paul Mattione

Run coordination, subsystem status, data quality monitoring, offline analysis: discussed at daily RC meeting (usually 8:45am, counting house).

RC meeting minutes: https://halldweb.jlab.org/wiki/index.php/Run_Planning_Meeting_Notes,_Feb_9-Feb_15,_2017
Spring 17 runplan

1. Verify electron beam quality and establish photon beam.
2. DAQ, L1 trigger, detectors and beamline checkouts.
3. Realign 58 µm diamond (JD70-100). Later on, align new 17 µm diamond JD70-104.
Spring 17 runplan

1. Verify electron beam quality and establish photon beam.
2. DAQ, L1 trigger, detectors and beamline checkouts.
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4. **Gluex data production:**
   - Harp scans (now once every 2 days).
   - Empty target run every week. Standard production current. (Doing one every week is being questioned).
   - Amorphous runs every day. Goal: gather 10-15% of total number of triggers with Al. radiator.
   - TAC runs. 2 TAC runs (one at the beginning, one in the middle of the run).
   - Physics production with diamond(s) and 5 mm collimator.
     - Balanced amount of $0^\circ/90^\circ/45^\circ/135^\circ$ data.
     - 2h runs and no more.
     - Switch polarization every run.
     - Started run with 58 µm diamond (JD70-100).
     - When new 17 µm diamond is aligned, do 2 days of production to assess its quality and decide what diamond should be used.
     - Luminosity: Initially, same as Spring 16 run (30 kHz). Test at 50 kHz or higher. If offline analysis indicates that the data are good, run at higher luminosity.
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5. DAQ, L1 and L3 trigger tests for high-rate performance tests.
6. Low photon energy polarization measurement (on hold until more studies by R. Jones are done).
7. Straight track run (16h, nominally at the end of the run).
8. Parasitic TRD/ComCal tests.
Run plan time chart

7 weeks period

- Staggered tasks are accelerator responsibilities
- Spring 2017 GlueX run, t=0 is 01/30. Assume 50% eff.

A. Deur. GlueX collaboration meeting. 02/16/2017

Thursday, February 16, 2017
What has been done so far (as of 02/14/17)
Progress charts updated daily:
https://halldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Spring_2017_Run#Runplan_time_charts

Thursday, February 16, 2017
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  - beam not y-focused at collimator. Beam pol.: ~35% (TPol, rho, preliminary).
  - beam scraping upstream and downstream of the radiator.
  - T. Satogata developed automatic procedure to improve focusing.
    - Applied successfully. Beam seems now well focused on collimator (diagnostic is difficult, see H. Egiyan talk on Friday.)
  - Beam pol.: ~35-40% (TPol preliminary). ~50% higher photon transmission.
  - Harp scans (at least every 2 days) & BPMs (constant monitoring) monitor beam transport.

All subsystems checked out. New TagM fibers show excellent light transmission. Detector calibration is being done.

Production at 30 kHz with ~100 nA on 58 µm diamond (4 orientations) and Al. radiator. So far, $5.8 \times 10^9$ triggers ($1.3 \times 10^9$, $1.1 \times 10^9$, $0.8 \times 10^9$, $1.2 \times 10^9$, $0.9 \times 10^9$, Al). High level monitoring and offline analysis show good physics quantities with current calibration.

L1 trigger+DAQ test shows that we may run at 70 kHz with 96% livetime. Offline to check the data quality prior to increase rate above 30 kHz.

Empty target runs (2) show good track reconstructions.

One TAC run done (for “free”).
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• One TAC run done (for “free”).
Incidents

Accelerator

• Several Central Helium Liquefier trips (6 so far).
• Several ARC power supply problems (breaker, cooling).

Hall D

• Accidental trip of Solenoid (human mistake during maintenance work in Hall D refrigeration building).

⇒ Opportunistic TAC run. (Only 2h of beam time loss instead of 10h)

• Target IOC crashes (seemed to now be solved by running program in different computer).
• Frequent DAQ crashes (every few hours).
What remains to be done
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- Production, probably at larger rate (~50kHz).
- Levels 1 and 3 triggers tests to prepare for future high luminosity runs.
- Empty target runs (weekly, although this is being discussed).
- TAC run(s),
- Measurement of polarization at low photon energy (?).
- ~2 days of data taken with the new 17 µm diamond and 3.4mm collimator.
- Straight-track runs.
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Concurrent run with Hall A or C:

- Hall C:
  - KPP (3-pass): Starts ~March 7th. (?)
  - SHMS commissioning: 1-pass
  - (Start physics program: 5-pass, until end of spring run.)

- Hall A:
  - Starting now. Will finish when Hall C starts.
  - Physics (Argon experiment using target designed for $^3$H): 1-pass.
Fall 16:
• Start of production for Gluex.
• Multi-hall operation difficult.
• Given the short time allocated, it was a success.
• Allowed us to prepare well for Spring 17.
Summary

Fall 16:
• Start of production for Gluex.
• Multi-hall operation difficult.
• Given the short time allocated, the run was a success.
• Allowed us to prepare well for Spring 17.

Spring 17:
• Start of production for Gluex.
• Very good start of run: Most of the specific tasks are done.
  Large amount of data already taken, $5.8 \times 10^9$ triggers (comparable
to analysis-worthy triggers from Spring 16, but with lower polarization).
• No major problem so far (accelerator or Hall D).
• 5-pass separator commissioned (1 beam) and worked (1 week).
• Excellent Multi-hall operation (B+D) so far.