Summary of the Hall D Spring 2019 run

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Jefferson Lab
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Spring 2019 run coordinator summaries: https://halldweb.jlab.org/hdops/wiki/index.php/Summary_Spring_2019_Run
All the run summaries: https://halldweb.jlab.org/hdops/wiki/index.php/Hall_D_Runs
Spring 2019 run

Initial schedule:

1. Jan. 22nd - Feb 7th: Electron beam restoration;
2. Feb. 7th - Feb. 20th: DIRC Commissioning; (part 1: first optical box);
3. Feb. 20th: Charge Pion Polarizability (CPP) test;
Spring 2019 run

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1. Jan. 22nd - Feb 7th: Electron beam restoration;

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   CCP test pages: [https://www.overleaf.com/read/yzzgqtddbfmy](https://www.overleaf.com/read/yzzgqtddbfmy)

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

**Run Coordinators**:

- Feb. 7th-Feb. 13th Alexandre Deur (accelerator restoration)
- Feb. 7th-Feb. 13th, 7 days: Alexandre Deur
- Feb. 13th-Feb. 20th, 7 days: Wenliang Li
- Feb. 20th-Feb. 27th, 7 days: Sean Dobbs
- Feb. 27th-March 6th, 7 days: Justin Stevens
- March 6th-March 13th, 7 days: Alexander Austregesilo
- March 13th-March 20th, 7 days: Colin Gleason
- March 20th-March 27th, 7 days: Richard Jones
- March 27th-Apr. 3rd, 7 days: Stuart Fegan
- Apr. 3rd-Apr. 10th, 7 days: Ilya Larin
- Apr. 10th-Apr. 15th, 5 days: Joshua Crafts

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Physics Division Liaison: Lubmir Penchev.
Analysis Coordinator: Alexander Austregesilo.
Run coordination, subsystem status, data quality monitoring, offline analysis are discussed at daily RC meetings (8:45am, counting house).

https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w4
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**Leadership:** C. Meyer/M. Shepherd, E. Chudakov/E. Smith

**Run Coordinators:**

- Feb. 7th-Feb. 13th Alexandre Deur (accelerator restoration) [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w1-3)
- Feb. 7th-Feb. 13th, 7 days: Alexandre Deur
- Feb. 13th-Feb. 20th, 7 days: Wenliang Li [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w4)
- Feb. 20th-Feb. 27th, 7 days: Sean Dobbs [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w5)
- Feb. 27th-March 6th, 7 days: Justin Stevens [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w6)
- March 6th-March 13th, 7 days: Alexander Austregesilo [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w7)
- March 20th-March 27th, 7 days: Richard Jones [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w9)
- March 27th-Apr. 3rd, 7 days: Stuart Fegan [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w10)
- Apr. 10th-Apr. 15th, 5 days: Joshua Crafts [Link](https://halldweb.jlab.org/wiki/index.php/Run_Coordinator_report:_spring_2019_w12)

**Physics Division Liaison:** Lubomir Penchev.
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Actual schedule:

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**Fall 2018 run**

Initial schedule:
1. Aug. 21st - Oct. 28th: GlueX-I final run (11.6 GeV)
3. Nov 20th - Dec. 12th: GlueX-II (DIRC) and PrimEx (ComCal) tests. E=10.3 GeV

Also, take GlueX-I data at lower energy, to compare with CLAS

Actual events:

Due to late start, ran GlueX production until Nov. 24th

Beam available for physics on Sept. 21st

Also, take GlueX-I data at lower energy, to compare with CLAS

DIRC not ready for installation

ComCal installation mostly done opportunistically during beam down time (beam study, spin dance, etc.)
Spring 2019 run configuration

- **Energy**: 11.61 GeV until March 5th then 11.17 GeV (Fall 16-Spring 18: 11.64 GeV. Energy was lowered to 11.17 due to high RF trip rate and end of critical high-energy requirement by Hall C program.)
- 4-hall ops, 1-pass for Hall A, 5-pass for Hall B, 3-5 pass for Hall C. D: 5.5-pass. High currents for A & C.
Spring 2019 run configuration

• Energy: **11.61 GeV** until March 5th then **11.17 GeV** (Fall 16-Spring 18: 11.64 GeV. Energy was lowered to 11.17 due to high RF trip rate and end of critical high-energy requirement by Hall C program.)
  • 4-hall ops, 1-pass for Hall A, 5-pass for Hall B, 3-5 pass for Hall C. D: 5.5-pass. High currents for A & C.

• Hall D configuration:
  • Solenoid at 1350A (DIRC commissioning) or ramped-down (PrimEx-eta run).
  • Rep. rate 250 MHz.
  • Slit shared with C (as in Fall 18. It was with B in Fall 17 and A in Spring 18)
  • Beam current 1 nA-1.5 µA. **225 nA** for most of DIRC commissioning. Up to **900 nA** for high intensity tests. **200 nA** for standard PrimEx production.
  • Radiators: DIRC comm.: old (degraded) **17 µm J70-104 diamond**. Then PrimEx: **10 µm Al. radiator**;
  • 5mm collimator hole;
  • LH₂ target (DIRC comm.), then PrimEx: no target, solid **Be foil** target, then empty and filled **L₄He** target interspersed.
  • TPol on during DIRC runs for systematic studies, with **75 µm TPol convertor**. Off during PrimEx, with **750 µm TPol convertor** for the PS.
  • CDC & FDC: on for DIRC comm. Off at start of PrimEx. Then CDC on (March 8th) to provide vertex monitoring and background diagnostic for little DAQ performance cost. FDC off except for short time during low lumi. runs.

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  - Radiators: DIRC comm.: old (degraded) 17 µm J70-104 diamond. Then PrimEx: 10 µm Al. radiator;
  - 5mm collimator hole;
  - LH₂ target (DIRC comm.), then PrimEx: no target, solid Be foil target, then empty and filled L⁴He target interspersed.
  - TPol on during DIRC runs for systematic studies, with 75 µm TPol convertor. Off during PrimEx, with 750 µm TPol convertor for the PS.
  - CDC & FDC: on for DIRC comm. Off at start of PrimEx. Then CDC on (March 8th) to provide vertex monitoring and background diagnostic for little DAQ performance cost. FDC off except for short time during low lumi. runs.

Hall D goals:
• Commission DIRC’s first optical box;
• DAQ and Trigger high-intensity tests during DIRC commissioning;
• CPP tests during last day of DIRC commissioning;
• PrimEx production on Be and ⁴He targets;
• TAC runs during PrimEx run;
• (TRD non-invasive runs).
1. Verify electron beam quality and establish photon beam.
2. Detector and beamline checkout.
3. Check 17 µm diamond (JD70-104) alignment.
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2. Detector and beamline checkout.
3. Check 17 µm diamond (JD70-104) alignment.
4. DIRC commissioning
   1. Standard configuration: 17 µm diamond, 225 nA, 5 mm hole, TPol on (for syst. studies. Not necessary for DIRC)
      75 µm TPol convertor. Solenoid at 1350 A.
   2. Luminosity scans on amorphous radiator. 50-900 nA on 10 µm Al (1.12·10⁻⁴ R.L.)
   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up).
   4. One Empty target run.
5. CPP (Charged pion polarizability) tests
   1. Move downstream platform downstream
   2. Install passive shielding in front of TOF.
   3. Set-up and check specific CPP trigger.
   4. Tests (to be done for various thicknesses of passive shielding).
   5. End of test: ramp down solenoid, remove shielding.
6. PrimEx -
   1. Standard configuration: 10 µm Al (11.2·10⁻⁵ R.L). Beam current depends on target. 750 µm TPol convertor.
      Solenoid off.
   2. Snake scans for ComCal calibration.
   3. Production on no target, solid Be foil target, then 4He target (full and empty).
   4. Two TAC runs (to be done with the TAC detector, not with ComCal).
   5. HARP scan (only Hall D harp): 10 min. Every two days.
   6. Long mode 10 min runs to monitor neutron radiation damage to ST due to nuclear target higher neutron yield.
      Twice or Thrice a week.
1. Verify electron beam quality and establish photon beam.
2. Detector and beamline checkout.
3. Check 17 μm diamond (JD70-104) alignment.
4. DIRC commissioning
   1. Standard configuration: 17 μm diamond, 225 nA, 5 mm hole, TPol on (for syst. studies. Not necessary for DIRC) 75 μm TPol converor. Solenoid at 1350 A.
   2. Luminosity scans on amorphous radiator. 50-900 nA on 10 μm Al (1.12 · 10⁻⁴ R.L.)
   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up).
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Spring 2019 runplan

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2. Detector and beamline checkout.
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4. DIRC commissioning
   1. Standard configuration: 17 µm diamond, 225 nA, 5 mm hole, TPol on (for syst. studies. Not necessary for DIRC) 75 µm TPol convertor. Solenoid at 1350 A.
   2. Luminosity scans on amorphous radiator. 50-900 nA on 10 µm Al (1.12 \cdot 10^{-4} \text{ R.L.})
   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up).
   4. One Empty target run.

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   1. Move downstream platform downstream
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6. PrimEx-η
   1. Standard configuration: 10 µm Al (11.2 \cdot 10^{-5} \text{ R.L}). Beam current depends on target. 750 µm TPol convertor. Solenoid off.
   2. Snake scans for ComCal calibration.
   3. Production on no target, solid Be foil target, then \(^4\text{He}\) target (full and empty).
   4. Two TAC runs (to be done with the TAC detector, not with ComCal).
   5. HARP scan (only Hall D harp): 10 min. Every two days.
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1. Verify electron beam quality and establish photon beam. ✔
2. Detector and beamline checkout. ✔
3. Check 17 µm diamond (JD70-104) alignment. ✔
4. DIRC commissioning ✔
   1. Standard configuration: 17 µm diamond, 225 nA, 5 mm hole, TPol on (for syst. studies. Not necessary for DIRC) 75 µm TPol convertor. Solenoid at 1350 A. But ramp up delayed due to motherboard demise. ✔
   2. Luminosity scans on amorphous radiator. 50-900 nA on 10 µm Al (1.12 \cdot 10^{-4} \text{ R.L.}) ✔
   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up). ✔
   4. One Empty target run. ☒
5. CPP (Charged pion polarizability) tests
   1. Move downstream platform downstream
   2. Install passive shielding in front of TOF.
   3. Set-up and check specific CPP trigger.
   4. Tests (to be done for various thicknesses of passive shielding).
   5. End of test: ramp down solenoid, remove shielding.
6. PrimEx-η
   1. Standard configuration: 10 µm Al (11.2 \cdot 10^{-5} \text{ R.L.}). Beam current depends on target. 750 µm TPol convertor. Solenoid off. Was turned off during high luminosity runs. ✔
   2. Snake scans for ComCal calibration.
   3. Production on no target, solid Be foil target, then \(^4\text{He}\) target (full and empty).
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Started 2 days late due to CEBAF cooling issues. Initially, feared a longer delay, but physics quality beam (“commissioning quality” for Hall D) was very quickly established. Not the greatest coherent peak ever seen (used-up diamond good enough for commissioning).
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1. Verify electron beam quality and establish photon beam. ✔
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   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up). ✔
   4. One Empty target run. ❌
5. CPP (Charged pion polarizability) tests ✔
   1. Move downstream platform downstream ✔
   2. Install passive shielding in front of TOF. ✔
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   5. End of test: ramp down solenoid, remove shielding. ✔
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   2. Snake scans for ComCal calibration. ✔
   3. Production on no target, solid Be foil target, then ^4He target (full and empty). ✔
   4. Two TAC runs (to be done with the TAC detector, not with ComCal). ✔
   5. HARP scan (only Hall D harp): 10 min. Every two days. ✔
   6. Long mode 10 min runs to monitor neutron radiation damage to ST due to nuclear target higher neutron yield. Twice or Thrice a week. ✔

Started 2 days late due to CEBAF cooling issues. Initially, feared a longer delay, but physics quality beam (“commissioning quality” for Hall D) was very quickly established. Not the greatest coherent peak ever seen (used-up diamond good enough for commissioning). Was turned off during high luminosity runs. Done more than once (thrice), due to concern after long beam down time. Not at nominal position.
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1. Verify electron beam quality and establish photon beam.✔
   - Started 2 days late due to CEBAF cooling issues. Initially, feared a longer delay, but physics quality beam (“commissioning quality” for Hall D) was very quickly established.

2. Detector and beamline checkout.✔
   - Not the greatest coherent peak ever seen (used-up diamond good enough for commissioning).

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   2. Luminosity scans on amorphous radiator. 50-900 nA on 10 µm Al (1.12 · 10⁻⁴ R.L.)✔
   3. Harp scan: Only once in the middle of the DIRC commissioning (beside the ones done during beam set-up).✔
   4. One Empty target run.✗
      - Done more than once (thrice), due to concern after long beam down time.

5. CPP (Charged pion polarizability) tests✔
   1. Move downstream platform downstream
   2. Install passive shielding in front of TOF.
   3. Set-up and check specific CPP trigger.
   4. Tests (to be done for various thicknesses of passive shielding).
   5. End of test: ramp down solenoid, remove shielding.
   - Not at nominal position.

6. PrimEx-η
      - Solenoid warmed up on March 26th
      - Done at the start and end of Spring run period.
   2. Snake scans for ComCal calibration.✔
   3. Production on no target, solid Be foil target, then ⁴He target (full and empty).✔
   4. Two TAC runs (to be done with the TAC detector, not with ComCal).✔
   5. HARP scan (only Hall D harp): 10 min. Every two days. Not done every two days. Only after long beam down times.
   6. Long mode 10 min runs to monitor neutron radiation damage to ST due to nuclear target higher neutron yield.✔
      - Twice or Thrice a week.
List of problems during Spring 2019 run

- Solenoid power supply motherboard failed. Delayed the solenoid ramp up. Did not cost us time (thanks to accelerator ops who used the time to tune the beam to other halls). [https://logbooks.jlab.org/entry/3649136](https://logbooks.jlab.org/entry/3649136)
List of problems during Spring 2019 run (not importance ordered)

- **Solenoid power supply motherboard failed.** Delayed the solenoid ramp up. Did not cost us time (thanks to accelerator ops who used the time to tune the beam to other halls). [https://logbooks.jlab.org/entry/3649136](https://logbooks.jlab.org/entry/3649136)

- **DIRC SSP firmware.** Caused DAQ rates to drop to 0. Problem promptly patched after intense work by A. Somov and Ben Raydo. [https://logbooks.jlab.org/entry/3652894](https://logbooks.jlab.org/entry/3652894)
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- **TOF RF signal** initially reported uncorrelated times. Problem found and fixed by Beni: Main input cable was unplugged with wrong signals coming from an active unlocked phase lock circuit. [https://logbooks.jlab.org/entry/3656582](https://logbooks.jlab.org/entry/3656582)
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- **Energy lowered by ~450 MeV** due to unsustainable RF-trips (March 5th). Also, the Hall C program requiring highest energy had ended. Lower f.o.m for PrimEx. [https://logbooks.jlab.org/entry/3679070](https://logbooks.jlab.org/entry/3679070)

- **Short term beam energy drift** of up to 10 MeV (CEBAF path length changes, or no energy lock when Hall C was down: Hall A at 1-pass). Overall energy drift during 11.2 GeV period was small (5 MeV). Compare with 12 MeV in Fall 2018. [https://logbooks.jlab.org/entry/3679070](https://logbooks.jlab.org/entry/3679070)
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- **Rapid transmission degradation** (days). Not a critical issue with unpolarized beam, but need to be better understood. [https://logbooks.jlab.org/entry/3675433](https://logbooks.jlab.org/entry/3675433)
- **PS/Main trigger rate time dependence** (Not critical for PrimEx thanks to Compton rate normalization) [https://logbooks.jlab.org/entry/3675433](https://logbooks.jlab.org/entry/3675433)
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- DIRC SSP firmware. Caused DAQ rates to drop to 0. Problem promptly patched after intense work by A. Somov and Ben Raydo. [https://logbooks.jlab.org/entry/3652894](https://logbooks.jlab.org/entry/3652894)

- TOF RF signal initially reported uncorrelated times. Problem found and fixed by Beni: Main input cable was unplugged with wrong signals coming from an active unlocked phase lock circuit. [https://logbooks.jlab.org/entry/3656582](https://logbooks.jlab.org/entry/3656582)

- Energy lowered by ~450 MeV due to unsustainable RF-trips (March 5th). Also, the Hall C program requiring highest energy had ended. Lower f.o.m for PrimEx. [https://logbooks.jlab.org/entry/3679070](https://logbooks.jlab.org/entry/3679070)

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Will be discussed in beamline talk
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A. Deur. GlueX collaboration meeting, 05/14/2019
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- Usual FCal base maintenance, and DAQ, ROC, IOC, Network (slow/unresponsive CSS)… griefs.
Statistics for Spring 2019 GeV run

Scheduled run time: 1583h (66 days): Feb. 8\textsuperscript{th}-April 15\textsuperscript{th}
Acceptable beam used: 875h
⇒ Running efficiency for overall Spring 2019 period: 55%
Statistics for Spring 2019 GeV run

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DIRC commissioning + CPP

Scheduled run time: 312h (13 days): Feb. 8\textsuperscript{th}-21\textsuperscript{st}
ABU: 112h (beam available for 139h)
⇒ Physics run efficiency: 36\% (MCC eff.: 45\%)
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\textbf{DIRC commissioning + CPP} & \textbf{PrimEx} \\
\hline
Scheduled run time: 312h (13 days): Feb. 8\textsuperscript{th}-21\textsuperscript{st} & Scheduled run time: 1271h (53 days): Feb.8\textsuperscript{th}-Apr.15\textsuperscript{th} \\
ABU: 112h (beam available for 139h) & ABU: 756h (beam available for 853h) \\
$\Rightarrow$ Physics run efficiency: 36\% (MCC eff.: 45\%) & $\Rightarrow$ Physics run efficiency: 59\% (MCC eff.: 67\%) \\
\hline
\end{tabular}
### Statistics for Spring 2019 GeV run

Scheduled run time: 1583h (66 days): Feb. 8\textsuperscript{th}-April 15\textsuperscript{th}

Acceptable beam used: **875h**

$\Rightarrow$ Running efficiency for overall Spring 2019 period: **55%**

#### DIRC commissioning + CPP

Scheduled run time: 312h (13 days): Feb. 8\textsuperscript{th}-21\textsuperscript{st}

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$\Rightarrow$ Physics run efficiency: **36%** (MCC eff.: 45%)

#### PrimEx

##### Overall

Scheduled run time: 1271h (53 days): Feb.8\textsuperscript{th}-Apr.15\textsuperscript{th}

ABU: **756h** (beam available for 853h)

$\Rightarrow$ Physics run efficiency: **59%** (MCC eff.: 67%)

#### 11.6 GeV run

Scheduled run time: 366h (15 days): Feb.8\textsuperscript{th}-Mar.5\textsuperscript{th}

ABU: **137h** (beam available for 190h)

$\Rightarrow$ Physics run efficiency: **37%** (MCC eff.: 52%)

#### 11.2 GeV run

Scheduled run time: 366h (15 days): Mar.5\textsuperscript{th}-Apr.15\textsuperscript{th}

ABU: **619h** (beam available for 663h)

$\Rightarrow$ Physics run efficiency: **68%** (MCC eff.: 73%)

---

A. Deur. GlueX collaboration meeting. 05/14/2019
Statistics for Spring 2019 GeV run

Scheduled run time: 1583h (66 days): Feb. 8th-April 15th
Acceptable beam used: 875h
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Scheduled run time: 312h (13 days): Feb. 8th-21st
ABU: 112h (beam available for 139h)
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PrimEx
Overall

Scheduled run time: 1271h (53 days): Feb.8th-Apr.15th
ABU: 756h (beam available for 853h)
⇒ Physics run efficiency: 59% (MCC eff.: 67%)

11.6 GeV run

Scheduled run time: 366h (15 days): Feb.8th-Mar.5th
ABU: 137h (beam available for 190h)
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Effect of not pushing CEBAF energy

11.2 GeV run

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Not accounting for lower figure of merit
<table>
<thead>
<tr>
<th>Year</th>
<th>Season</th>
<th>Actual Run time</th>
<th>Running efficiency</th>
<th>Production triggers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2019</td>
<td>312h</td>
<td>36%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Spring 2018</td>
<td>1111.8h</td>
<td>55%</td>
<td>1.5×10¹¹</td>
<td></td>
</tr>
<tr>
<td>Spring 2017</td>
<td>354.1h</td>
<td>56%</td>
<td>4.7×10¹⁰</td>
<td></td>
</tr>
<tr>
<td>Spring 2016</td>
<td>458h</td>
<td>41%</td>
<td>6.9×10⁹</td>
<td></td>
</tr>
<tr>
<td>Spring 2015</td>
<td>122h</td>
<td>20%</td>
<td>0 (5.5 GeV run)</td>
<td></td>
</tr>
<tr>
<td>Fall 2018</td>
<td>788h</td>
<td>52%</td>
<td>8×10¹⁰</td>
<td></td>
</tr>
<tr>
<td>Fall 2017</td>
<td>10.5h</td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Fall 2016</td>
<td>84h</td>
<td>5.4%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Fall 2015</td>
<td>30.2h</td>
<td>20%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Fall 2014</td>
<td>324h</td>
<td>34%</td>
<td>0</td>
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<td>788h</td>
<td>52%</td>
<td>8×10¹⁰</td>
<td></td>
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</tbody>
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### Comparison with other GlueX runs

<table>
<thead>
<tr>
<th>Year</th>
<th>Run Time</th>
<th>Efficiency</th>
<th>Production Triggers</th>
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</thead>
<tbody>
<tr>
<td>Spring 2019</td>
<td>312h</td>
<td>36% (55%)</td>
<td>0.</td>
</tr>
<tr>
<td>Spring 2018</td>
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<td>1.5 × 10^{11}</td>
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</tbody>
</table>
Summary of the summary

- Run started nearly on time.
- Good CEBAF performance at 11.6 GeV, then excellent at 11.2 GeV.
- Performance in line with Spring 17-18 and Fall 18 runs.
- Successful DIRC and CPP commissioning.
- Successful first part of PrimEx-η run.
- No significant problems.

Getting ready for high-luminosity GlueX run in Fall.

Thank you