

# 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.
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  - Solenoid at **1200A**. (Initial plan: 1350A but ramp-up problems forced us to use a safer value)
  - 50  $\mu\text{m}$  diamonds (1 old: J1a50 + 2 new: **J70-100** and J70-105), 2 backup 20  $\mu\text{m}$  diamonds (old J70-118, new JD70-104).
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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.
- 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](https://halldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Fall_2016_Run)

# Original run plan

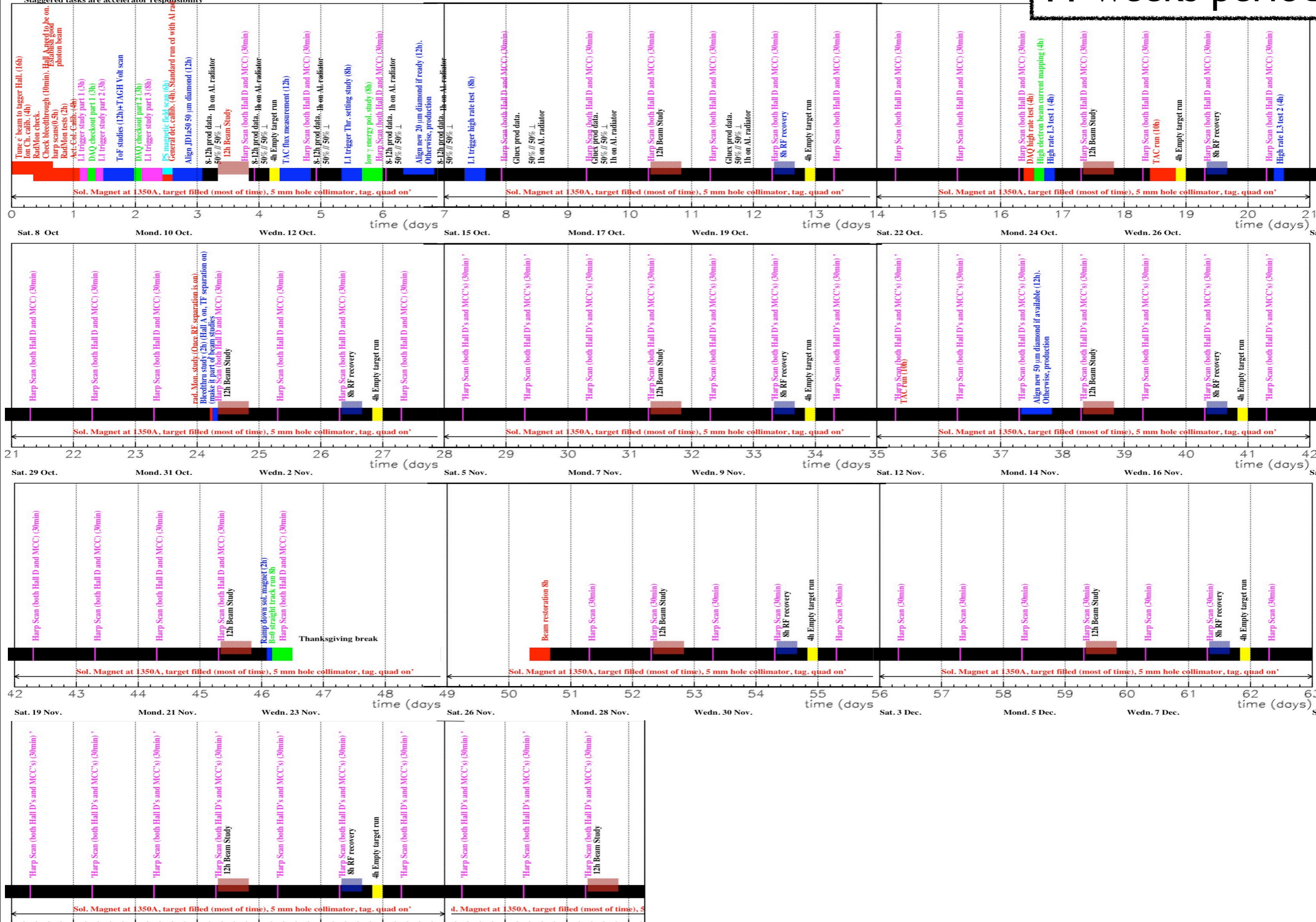
11 weeks period

Fall 2016 GlueX run. t=0 is 10/08. Assume 50% eff.

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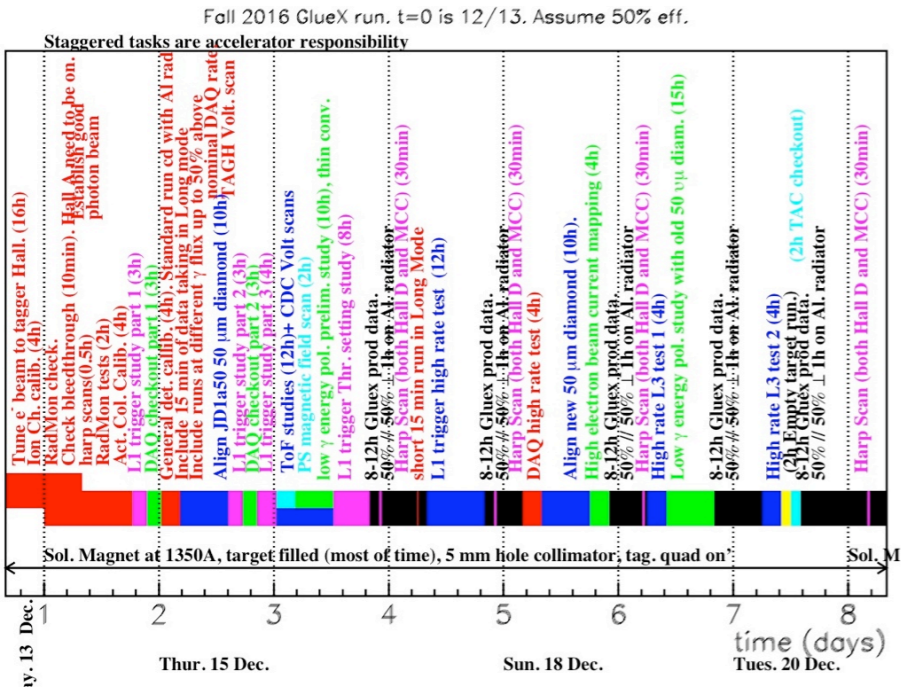
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Staggered tasks are accelerator responsibility



# Actual run plan

I week period



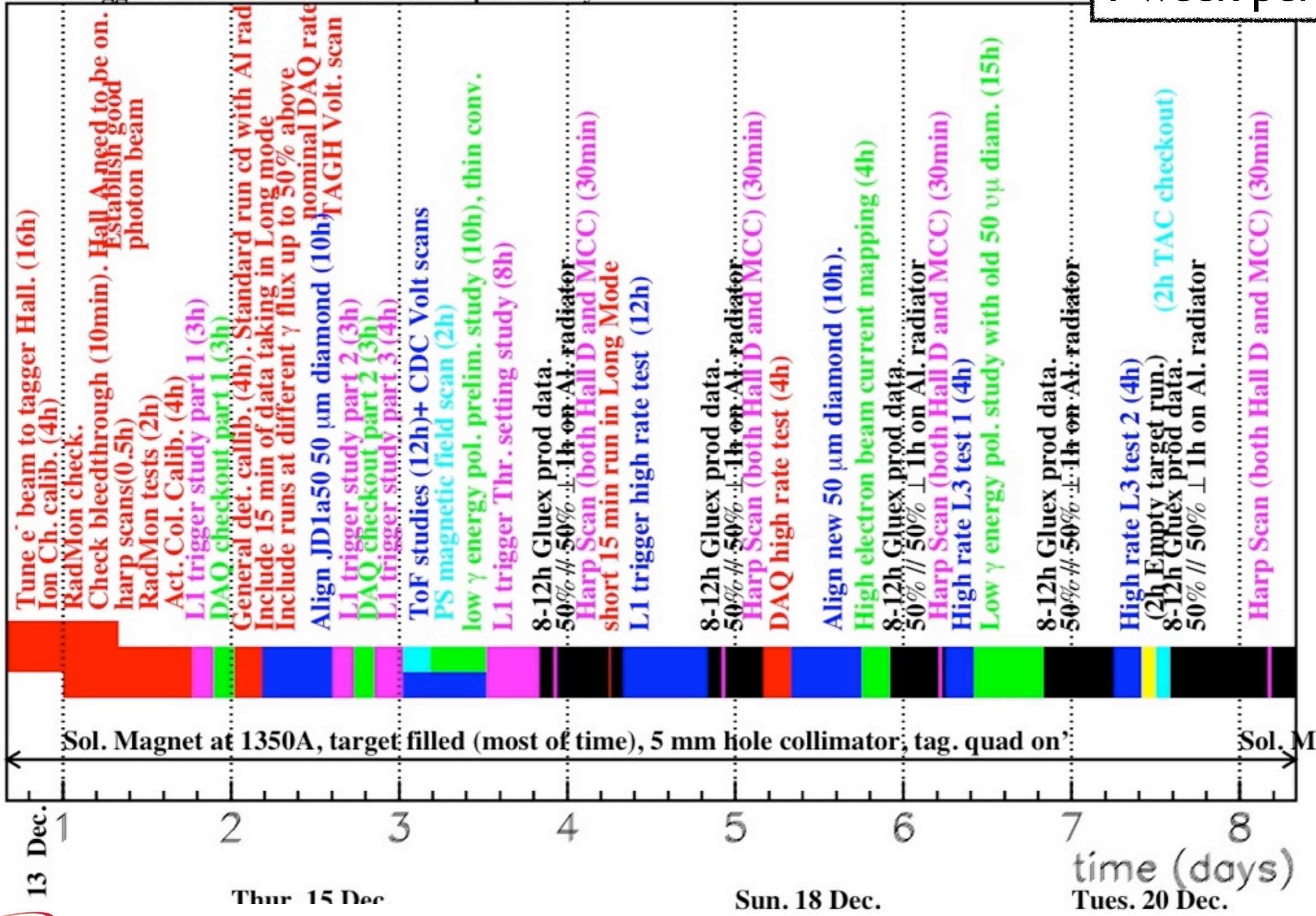


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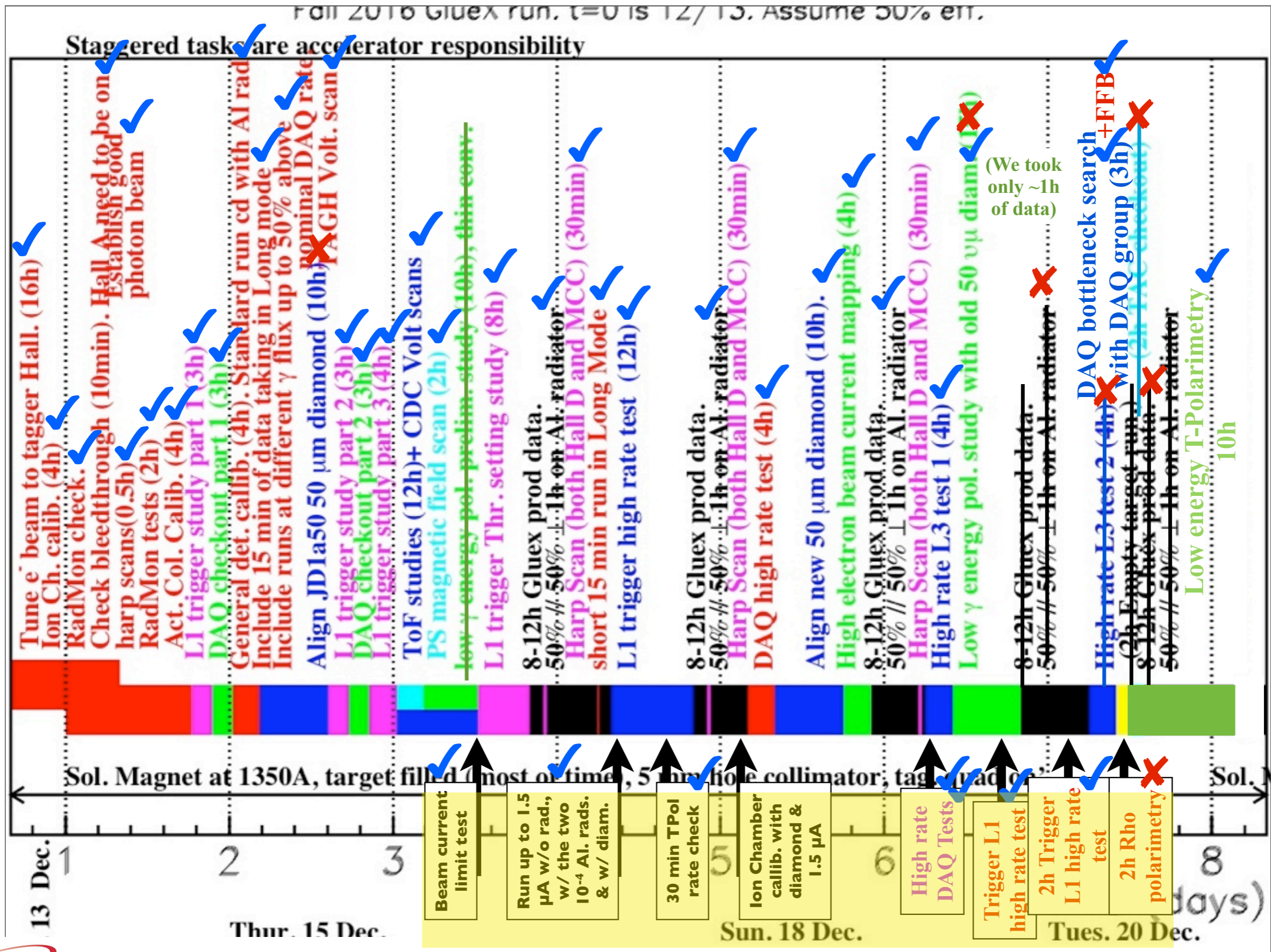
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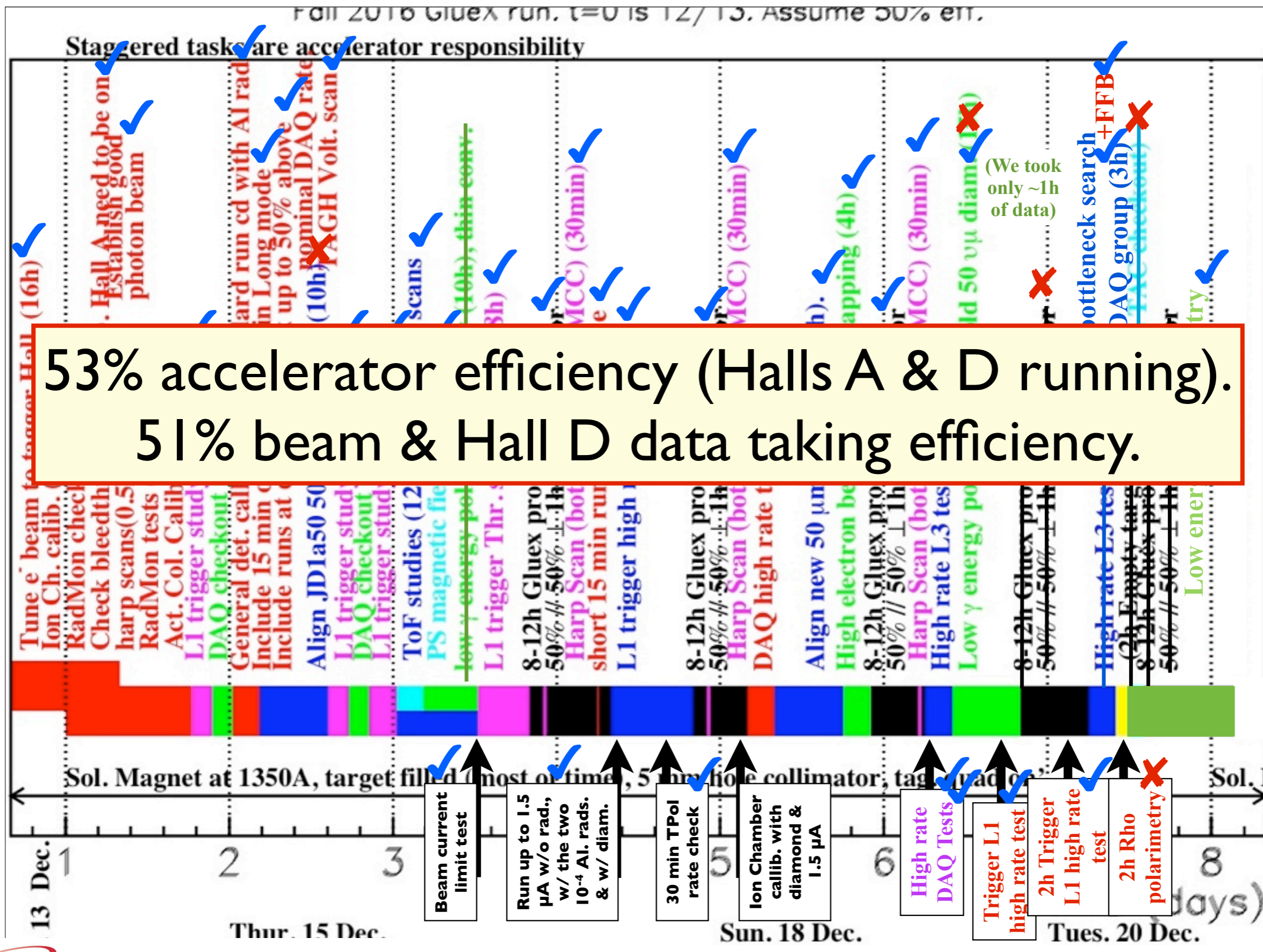
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# What was done



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[https://halldweb.jlab.org/hdops/wiki/index.php/Summary\\_of\\_the\\_Fall\\_2016\\_GlueX\\_Run](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.

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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:  $1.5 \times 10^{10}$  para triggers.  
 $1.0 \times 10^{10}$  perp triggers. (No Al. radiator triggers, solenoid at 1200A)

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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.

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- Gather GlueX low luminosity **polarized data** with its necessary **systematic data**. ✗
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- ToF/CDC HV scans. ✓
- (Commission **ComCal** for PrimEx) ✓

## Also done:

- Aligned and used 58 diamond  $\mu\text{m}$  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: ~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:  $32.7 \pm 1.3\%$ (stat); Perp:  $32.0 \pm 1.2\%$ (stat)

**TPol analysis** (Preliminary, N. Sparks):

Para:  $31.4 \pm 4.7\%$ (stat); Perp:  $36.0 \pm 4.8\%$ (stat)

**No para/perp polarization difference** like in Spring 16 ( $\sim 44 \pm 1.5\%$  para,  $38 \pm 1.5\%$  perp).

Lower than the  $\sim 40\%$  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.

# Polarization at low energy

## 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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  - 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  $\mu\text{m}$  diamonds (2 old: J1a50 + **J70-100** 1 new: J70-105), 1 backup 17  $\mu\text{m}$  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):

- Jan. 26th-29th: Electron beam restoration.
- Jan. 30th-Mar. 22nd: Hall D Spring run.

Run plan: [https://halldweb.jlab.org/wiki/index.php/Run\\_Coordination\\_Meetings:\\_Spring\\_2017\\_Run](https://halldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Spring_2017_Run)



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## Run responsibilities:

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

### Run Coordinators:

- Thur. Jan. 26 - Sun. Jan. 29 (4 days): A. Deur (accelerator restoration)
- Mon. Jan. 30 - Wed. Feb. 8 (10 days): A. Deur
- Wed. Feb. 8 - Wed. Feb. 15 (7 days): M. Dalton
- Wed. Feb. 15 - Wed. Feb. 22 (7 days): A. Ostrovidov
- Wed. Feb. 22 - Wed. Mar. 1 (7 days): W. Boeglin
- Wed. Mar. 1 - Wed. Mar. 8: (7 days): S. Dobbs
- Wed. Mar. 8 - Wed. Mar. 15: (7 days): R. Jones
- Wed. Mar. 15 - Wed. Mar. 22: (7 days): D. Lawrence

**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](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  $\mu\text{m}$  diamond (JD70-100)**. Later on, align new 17  $\mu\text{m}$  diamond JD70-104.

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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°/90°/45°/135°** data.
    - 2h runs and no more.
    - Switch polarization every run.
    - Started run with **58  $\mu\text{m}$  diamond** (JD70-100).
    - When new 17  $\mu\text{m}$  diamond is aligned, do 2 evenings 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.

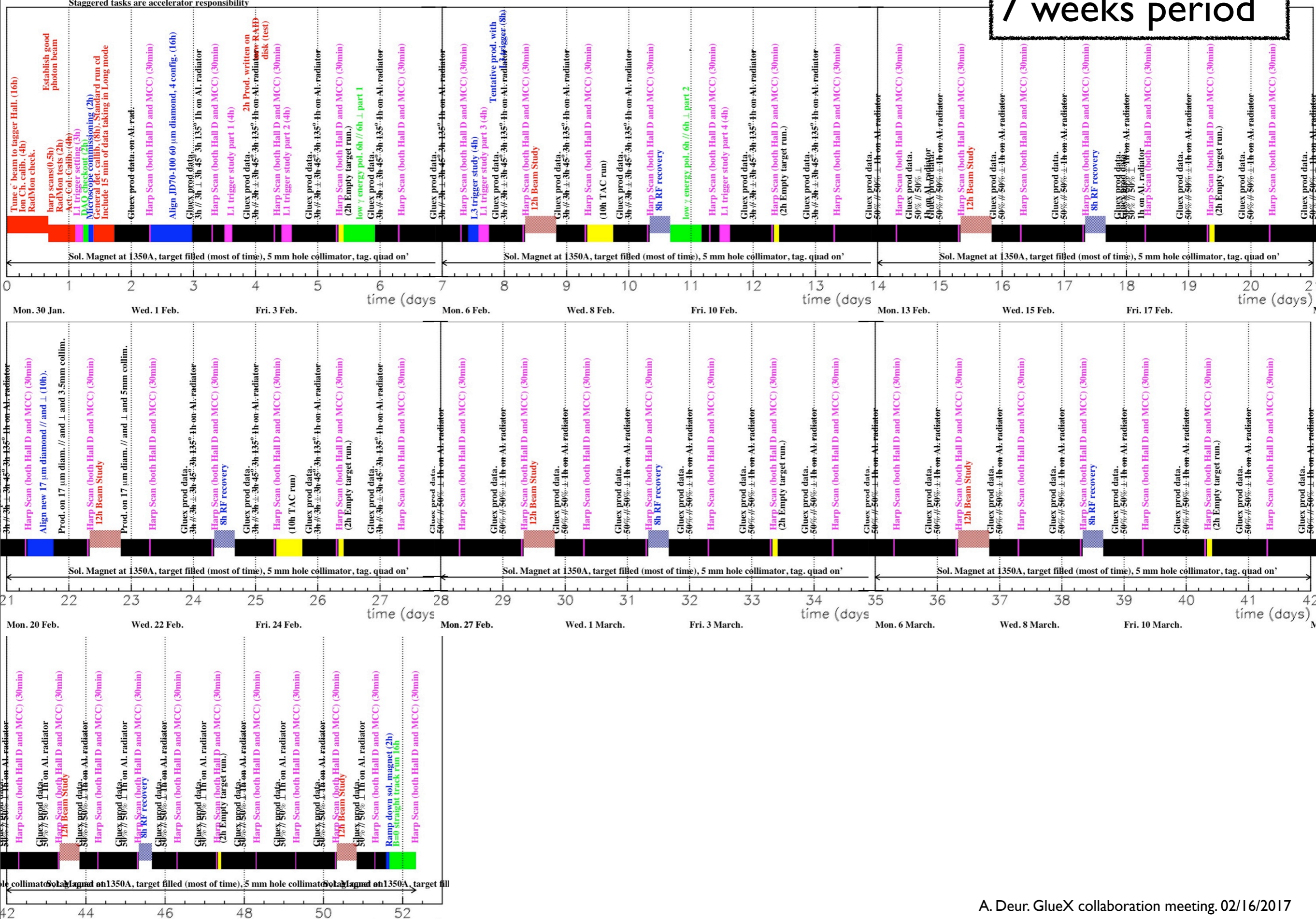
# Run plan time chart

Spring 2017 GlueX run.  $t=0$  is 01/30. Assume 50% eff.

Staggered tasks are accelerator responsibility

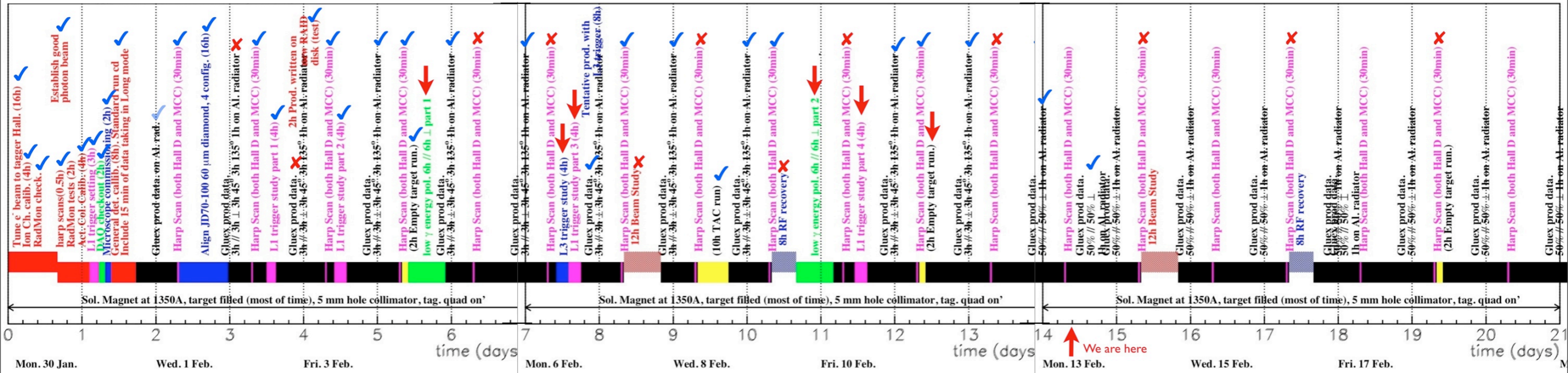
Spring

## 7 weeks period

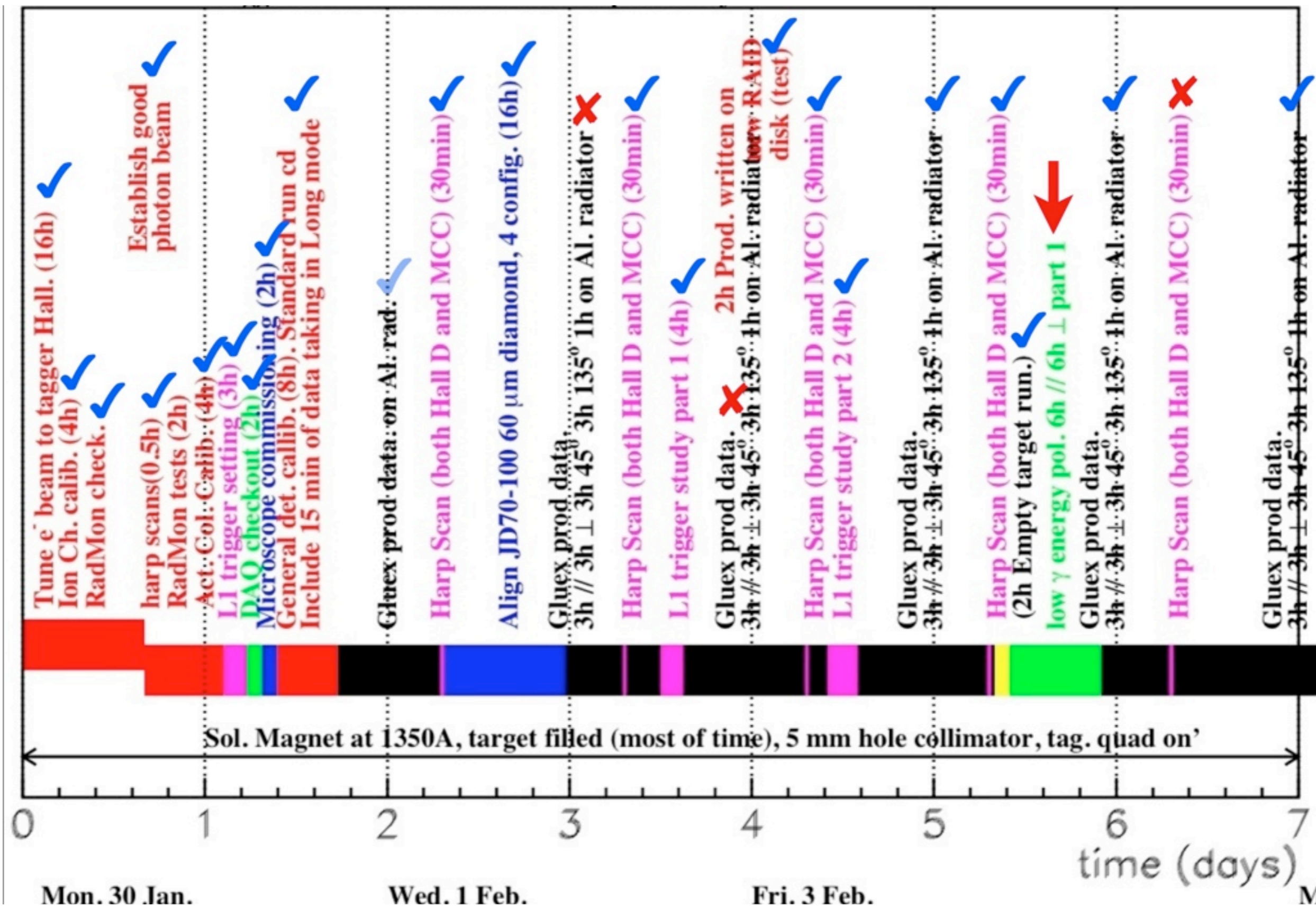


A. Deur. GlueX collaboration meeting. 02/16/2017

# What has been done so far (as of 02/14/17)



e.g. first week



Progress charts updated daily:

[https://haldweb.jlab.org/wiki/index.php/Run\\_Coordination\\_Meetings:\\_Spring\\_2017\\_Run#Runplan\\_time\\_charts](https://haldweb.jlab.org/wiki/index.php/Run_Coordination_Meetings:_Spring_2017_Run#Runplan_time_charts)

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  - 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.
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- 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.

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- 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  $\mu\text{m}$  diamond (**4 orientations**) and Al. radiator. So far,  **$5.8 \times 10^9$  triggers** ( $1.3 \times 10^9$  0°,  $1.1 \times 10^9$  90°,  $0.8 \times 10^9$  135°,  $1.2 \times 10^9$  45°,  $0.9 \times 10^9$  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 vertex reconstructions**.

# What has been done so far (as of 02/14/17)

- We effectively started on Jan. 31<sup>st</sup>.
- Prior (Jan 30<sup>th</sup>), accelerator **recommissioned 5-pass separator** successfully (but with Hall D beam only). Ran a week with it.
- Beam quality initially not nominal:
  - 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. )
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- **Empty target runs (2)** show **good vertex reconstructions**.
- One **TAC run** done (for “free”).

# Incidents

## Accelerator

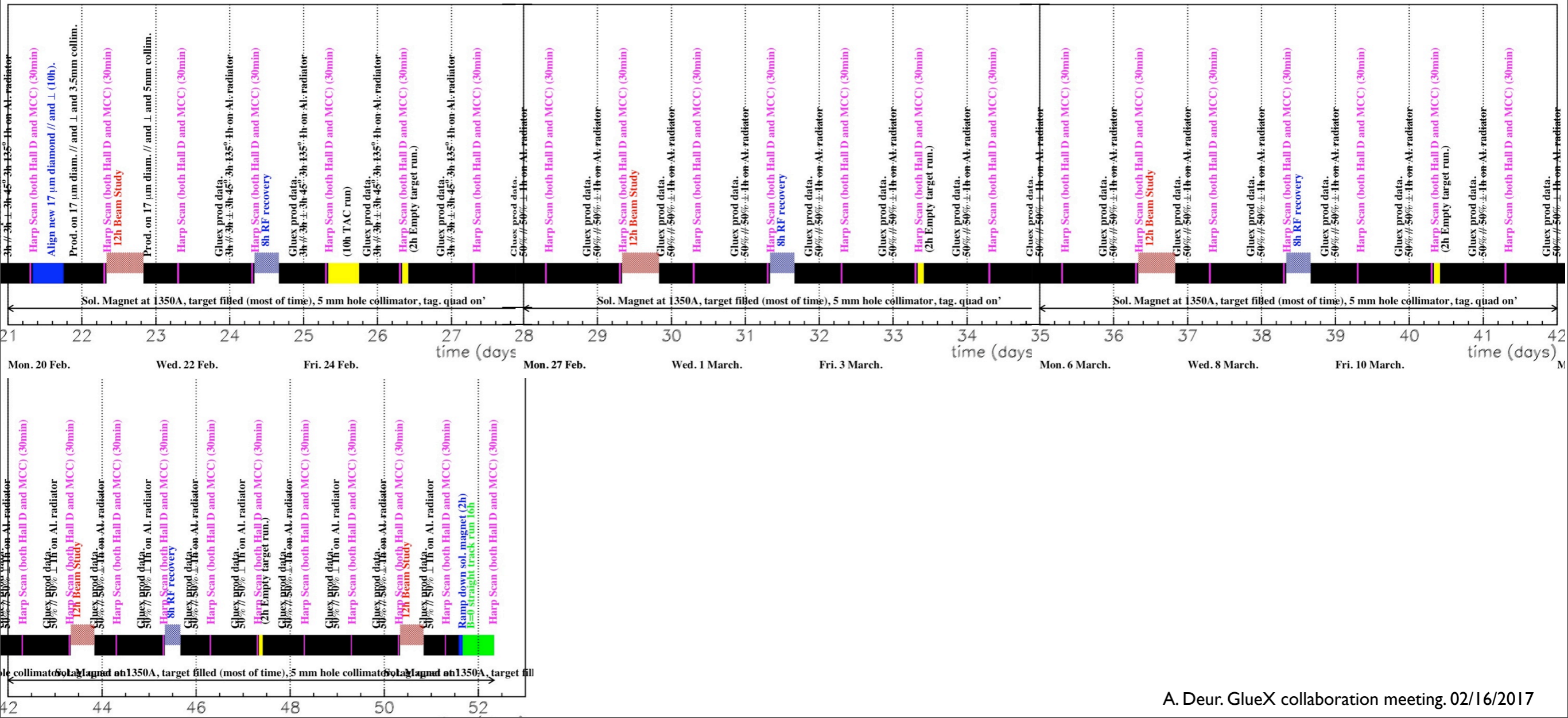
- Several Central Helium Liquefier trips (6 so far).
- Several ARC power supply problems (breaker, cooling).

## Hall D

- Accidental trip of Solenoid (human mistake during maintenance work in Hall D refrigerator 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).

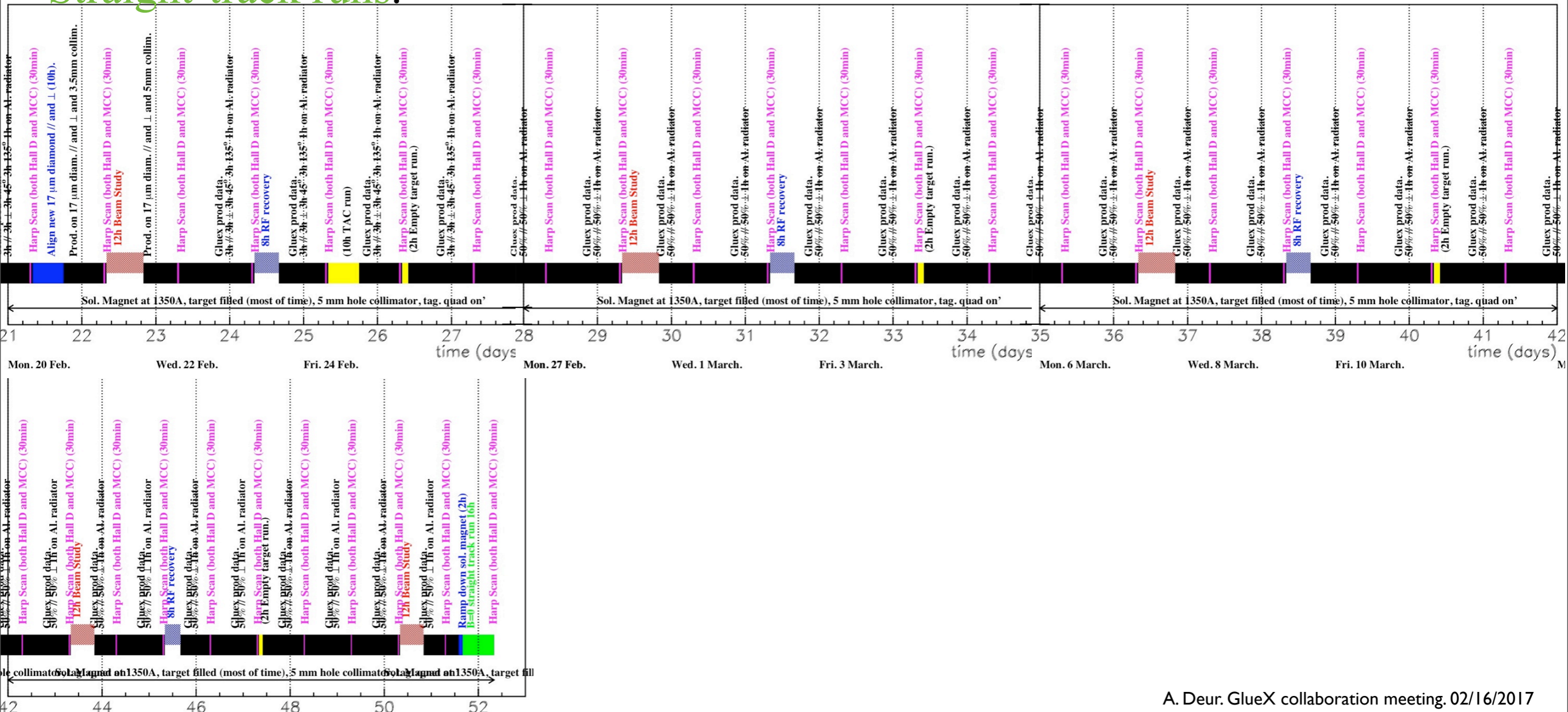


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- Production, probably at larger rate ( $\sim 50\text{kHz}$ ).
- Levels 1 and 3 triggers tests to prepare for future high luminosity runs.
- Empty target runs (weekly, although this is being discussed).
- TAC run(s),
- Measurement of polarization at low photon energy (?).
- $\sim 2$  days of data taken with the new  $17\ \mu\text{m}$  diamond and  $3.4\text{mm}$  collimator.
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## Concurrent run with Hall A and C:

### • Hall C:

- KPP (3-pass): Starts  $\sim$ 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  $^3\text{H}$ ): 1-pass.

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## 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, 5.8b 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.