Fall 2014 Commissioning Plans

A. Deur
Jefferson Lab

Run plan

Everything is at:

https://hdops.jlab.org/wiki/index.php/Fall_2014_Commissioning_Plan

Fall 2014 goals

- CW beam to tagger with acceptable radiation levels.

- Create unpolarized photon beam and tune it through:
  - Collimators;
  - Target location;
  - Photon beam dump.

- Detectors and trigger check out, optimization, calibration and alignment (drift chambers).

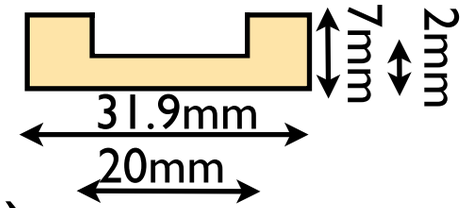
What I will discuss today

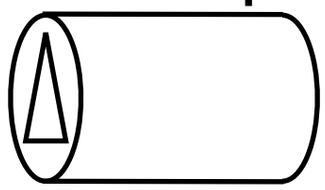
Specifics for Fall 2014 commissioning

- CW e^- beam
  - ~10.5 GeV;
  - Nominal: 50 nA, up to 200 nA.

- Amorphous radiators: 0.2, 1.1 and 3.3 $\times 10^{-4}$ RL.

- Commissioning targets (disks of CH_2 and ^{12}C. CH_2 cup:



Al cross, barrel target: ).

  - 0.25% to 1.8% RL.
  - Can be positioned between +12cm and -32cm of nominal target center.

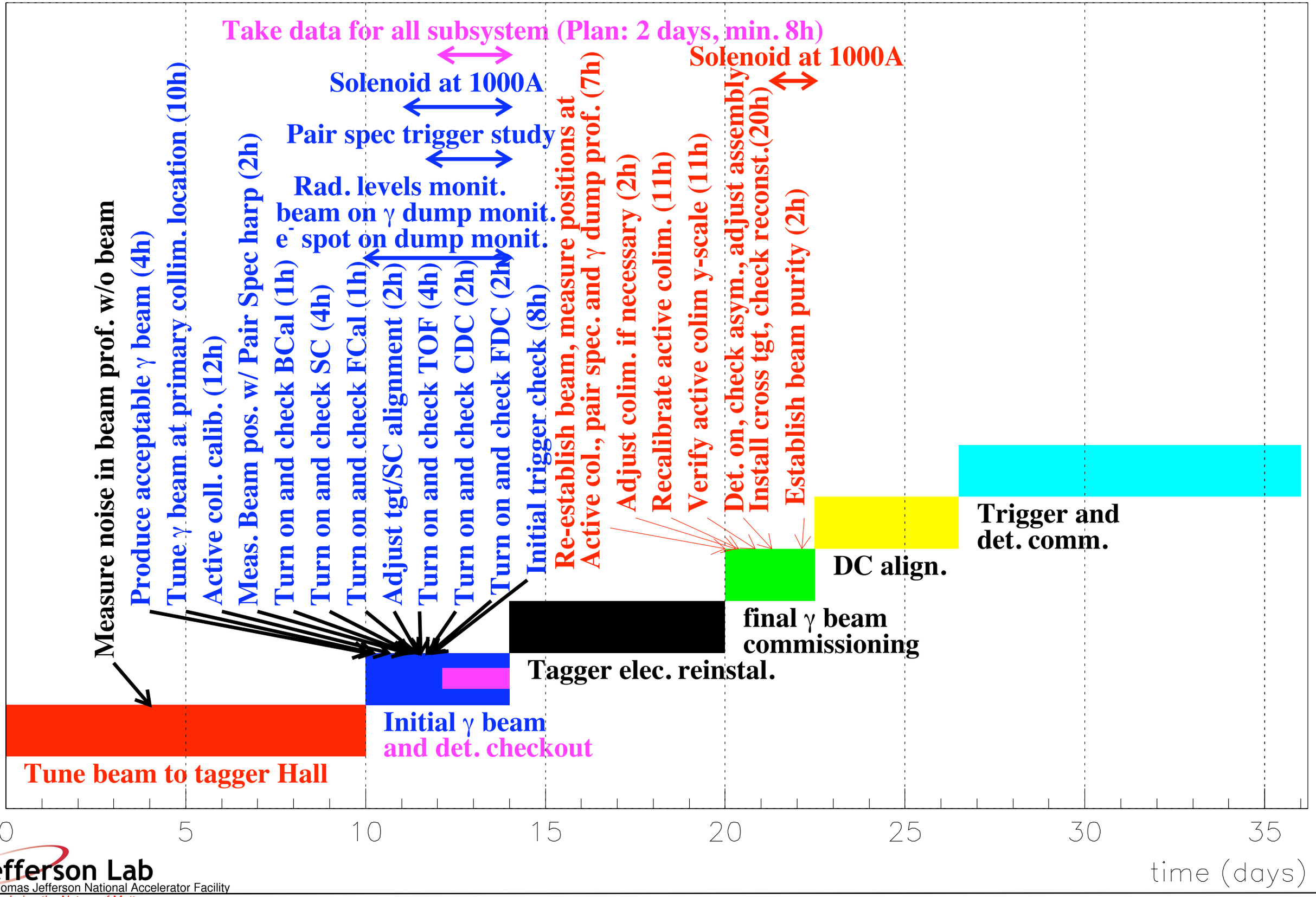
- Two Beam Profilers

- Radiation monitoring equipment (borrowed from RadCon group).

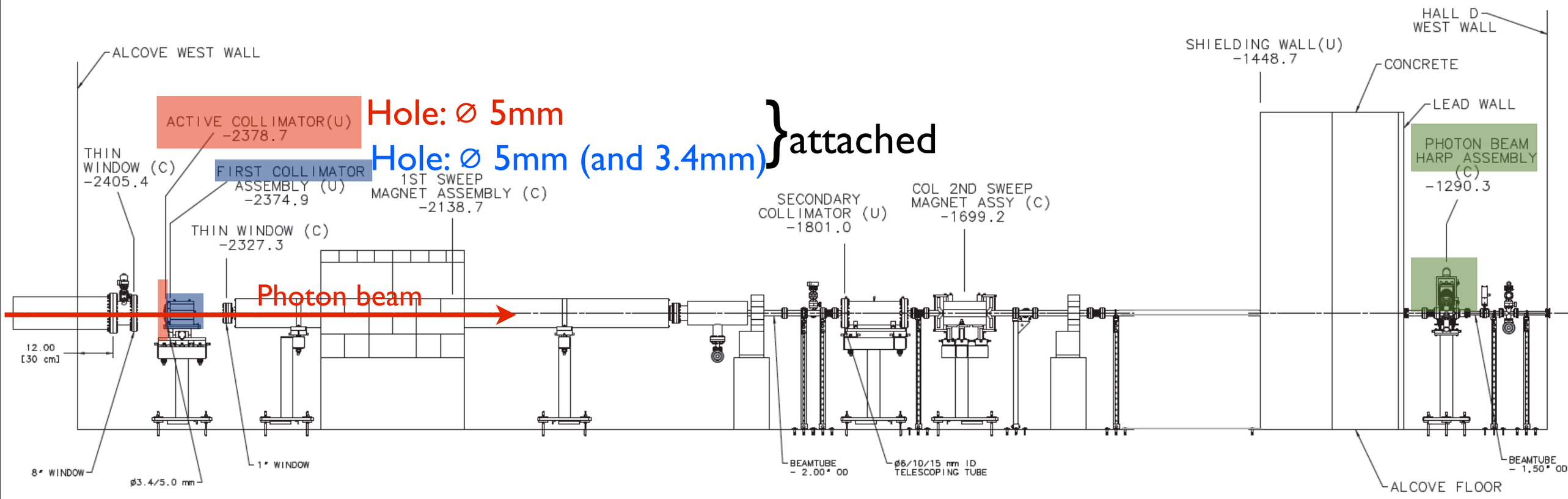
  Will be used during both e^- and γ beam commissioning.

Commissioning timeline

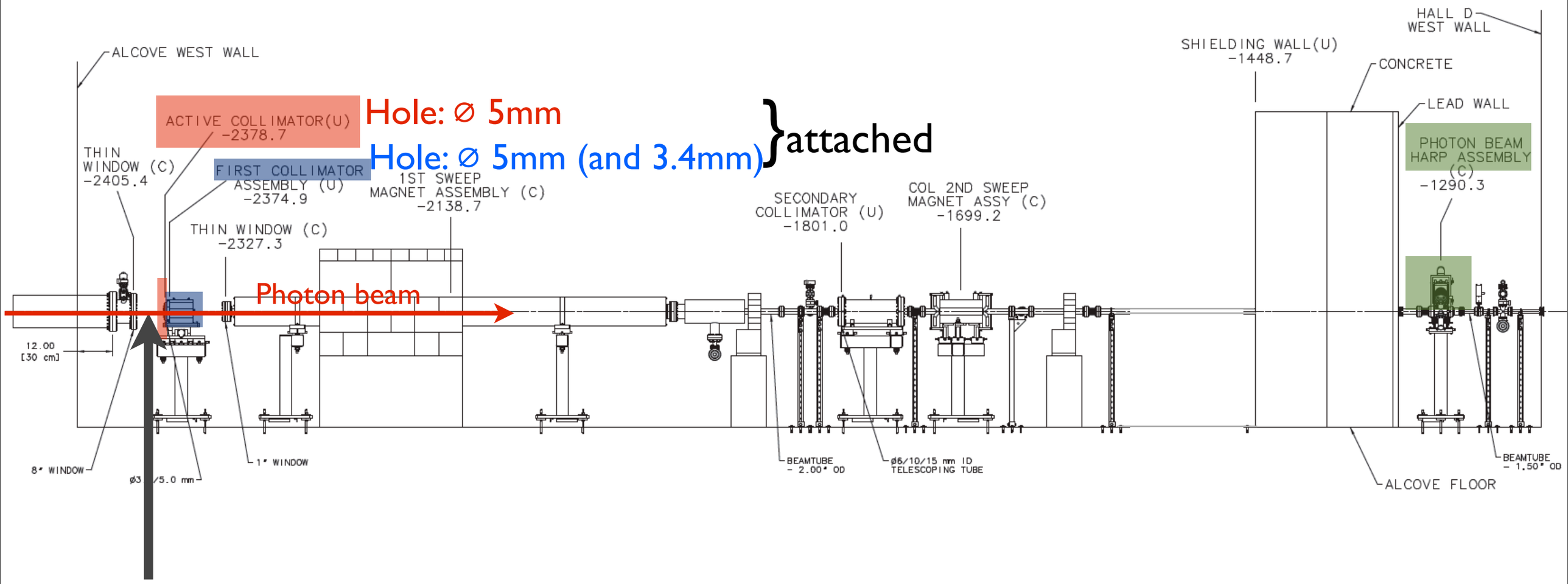
Fall commissioning. Hall D and tagger close at t=0



Photon beam line: collimator cave

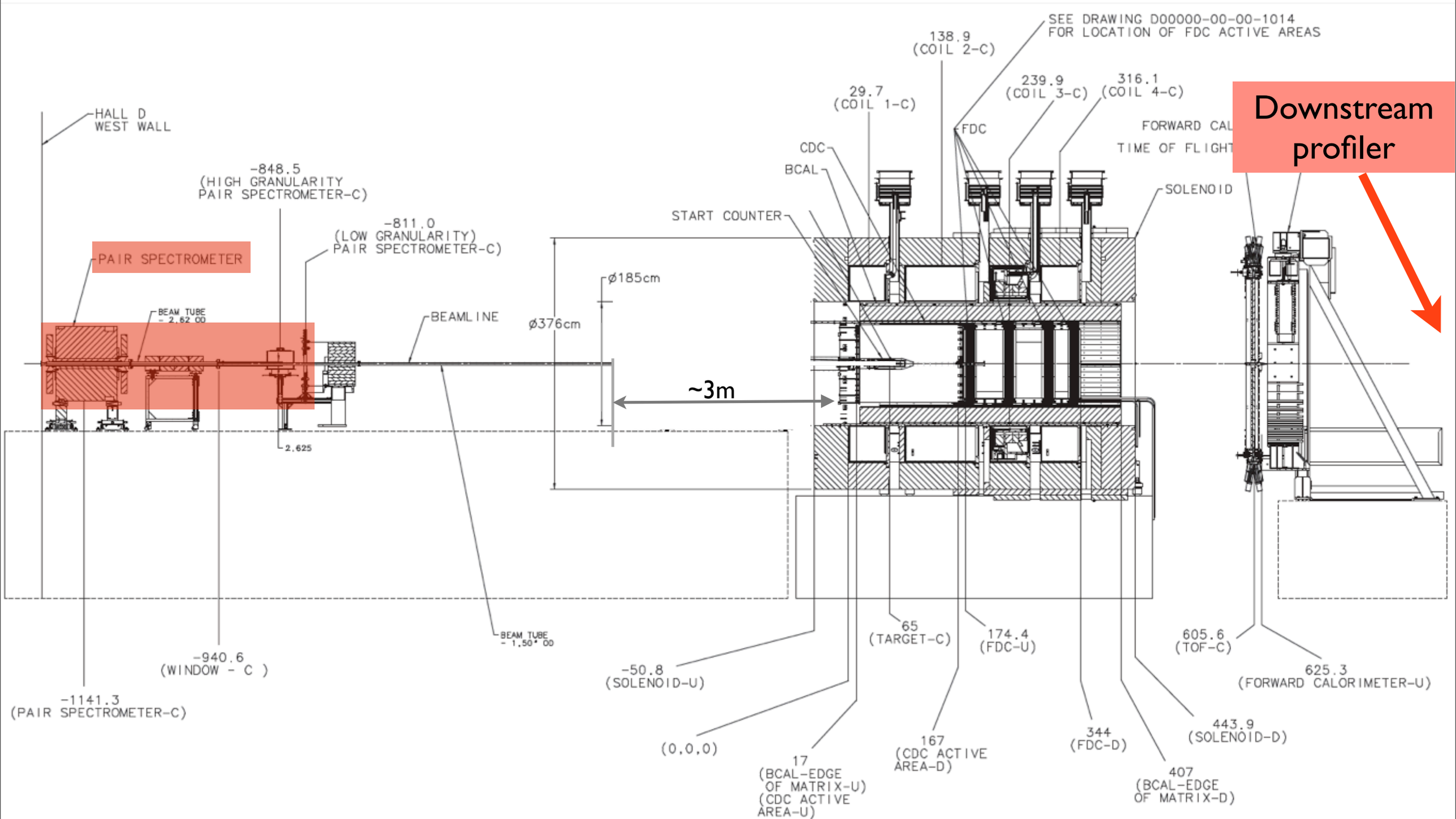


Photon beam line: collimator cave



Upstream Beam profiler. (Static, not attached to collimators.)

Photon beam line (Hall D)



Prerequisistes for photon beam commissioning

1. Tagger electronics sensitive to radiations remain removed.
2. Calibrated Ion Chambers.
3. No commissioning target on beamline.
4. Detectors off, except possibly BCal and outer rings of FCal.
6. Radiator 1.7×10^{-5} RL inserted.
7. Primary collimator blocks photon beam.
8. Active Collimator operational.
9. Pair Spectrometer on, converter retracted.
10. Solenoid on with current ~300A (quench safe).

Hall D Manpower

Leadership: E. Chudakov, C. Meyer.

Coordination: RC (A. Deur), PDL (Y. Qiang), Offline Analysis Coordinator (V. Crede).

Online shifts:

- e^- beam commissioning: No shift crew.
- Rest of commissioning: 2 shift takers
  - http://www.jlab.org/Hall-D/shifts/

Systems experts: Available in addition to shift crew when specifically needed.

Offline shifts:

2 persons. Organized by Analysis Coordinator.

Commissioning plan overview

A) Tune beam at nominal position (upstream Profiler). Collimator blocks beamline.

B) Move collimator in. Tune photon beam on 5mm hole of primary collimator. Check beam position at photon dump.

C) Active Collimator calibration.

D) Beam position measurement with Pair Spec. harp. (+parasitic Pair Spec. checkout)

E) Detectors & trigger initial checkout.

One week pause to reinstall tagger electronics and remove upstream profiler.

F) Re-calibrate Active Collimator. Fine-tune beam control calibration.

G) Turn on detectors, check for azimuthal asym. and reconstruct cross-target profile.

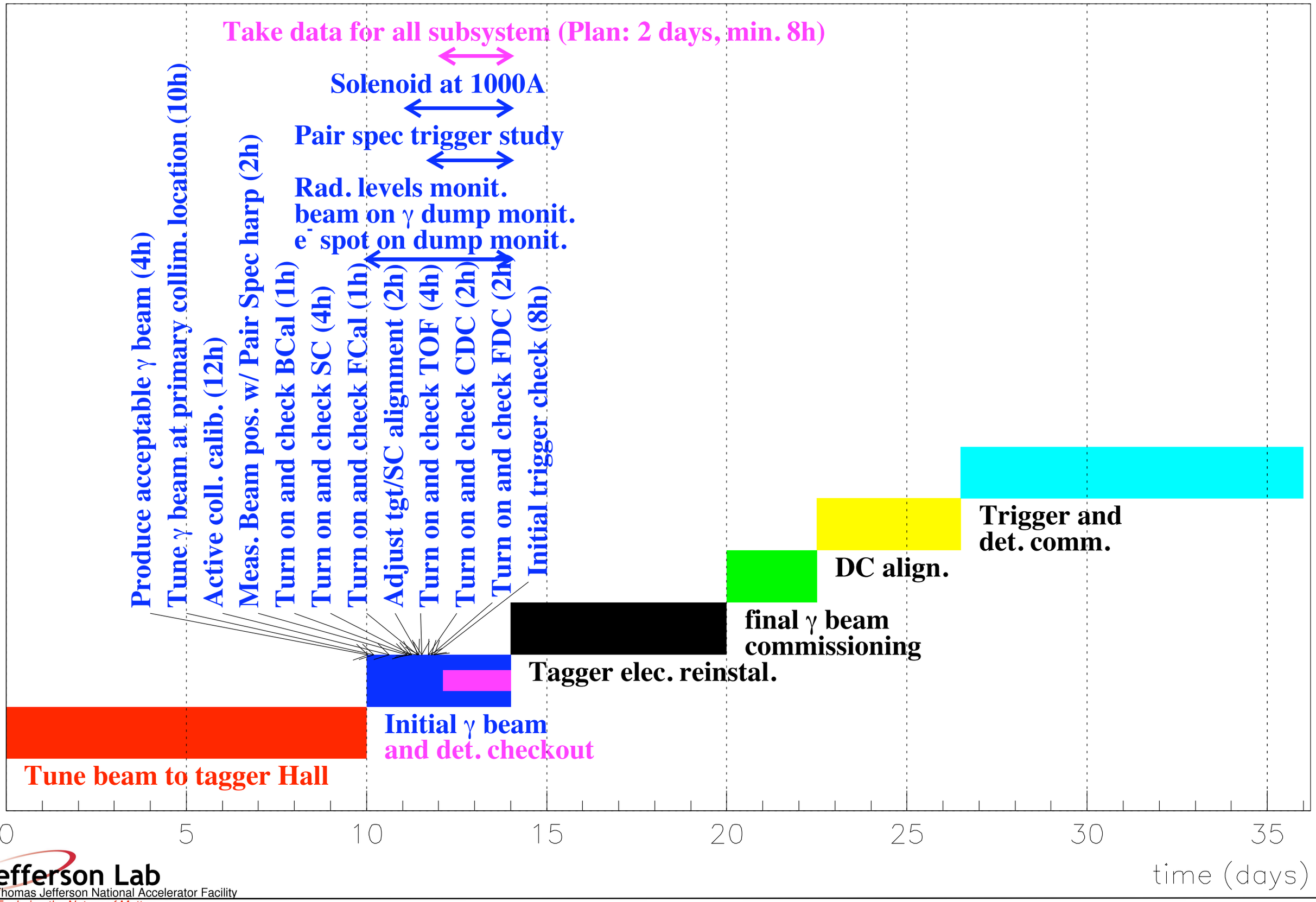
H) Check beam purity.

I) DC alignment.

J) Finalize trigger and detector commissioning.

Initial photon beam commissioning (4 days)

Fall commissioning. Hall D and tagger close at t=0



Tune photon beam on primary collimator

Two devices measure the photon beam position:

- Profiler: 1st (crude) calibration (2-3mm precision);
- Active Collimator: Refine calibration (+/-0.2 mm precision).

- Use Profiler to center the beam on nominal x=0,y=0 position.
  - Control the photon angle by using the last e^- beam corrector. Always monitor e^- beam position in tagger dump when moving the beam.
- Move collimator in.

- Verify that the beam is centered with Active Collimator signals.
  (No Active collimator calibration needed)

- Calibrate accelerator scale (crude).
  - Shift the beam angle using last corrector on e^- beamline and measure the corresponding shift on the profiler's currents. Calibrate corrector currents in function of beam position at profiler.

- Measure beam position at photon dump with 2nd profiler.

Active Collimator calibration

1.Use profiler/calibrated accelerator scale to calibrate the active collimator signals (crude).

2.Refine Active Collimator x-scale calibration by translating Primary/ Active collimators by +/-3cm around nominal position.

3.Redefine beam nominal position according to active collimator, Refine calibration accelerator scale.

4.Move the beam in x by ±10 mm around center, measure the Active Collimator response. Do the same for y.

(Material from Profiler in front of Active Collimator may bias its calibration. Calibration will be repeated once the profiler is removed from collimator cave.)

Beam position measurement with Pair Spec. harp

1. Insert converter foil and check Pair Spectrometer Coarse Detectors. Measure rates and check vs. expectation.

2. Use wire scanner on Pair Spectrometer radiator ladder to measure beam position.

3. Re-insert converter. From now on, pair spectrometer will be running at all time for parasitic commissioning.

Beam positions

At this point, we have 3 locations where the beam position has been measured.

In case of discrepancy, we will install the upstream profiler in front of solenoid to obtain a 4th point.

If beam is offset from nominal y=0 by >5 mm, move the collimator from its nominal y-position.

Verify target/Start Counter alignment & Initial detector checkout

1. Set Solenoid current to 1000A. Install 1 cm CH_2 target.

2. Turn detectors to check for azimuthal asymmetries. First BCAL/FCAL if not already on, then Start Counter. Check effect of +/-1cm beam x-translation (by translating collimator) on Start Counter and FCAL rates.

3. Minimize possible large asymmetries by adjusting the collimator or target assembly.

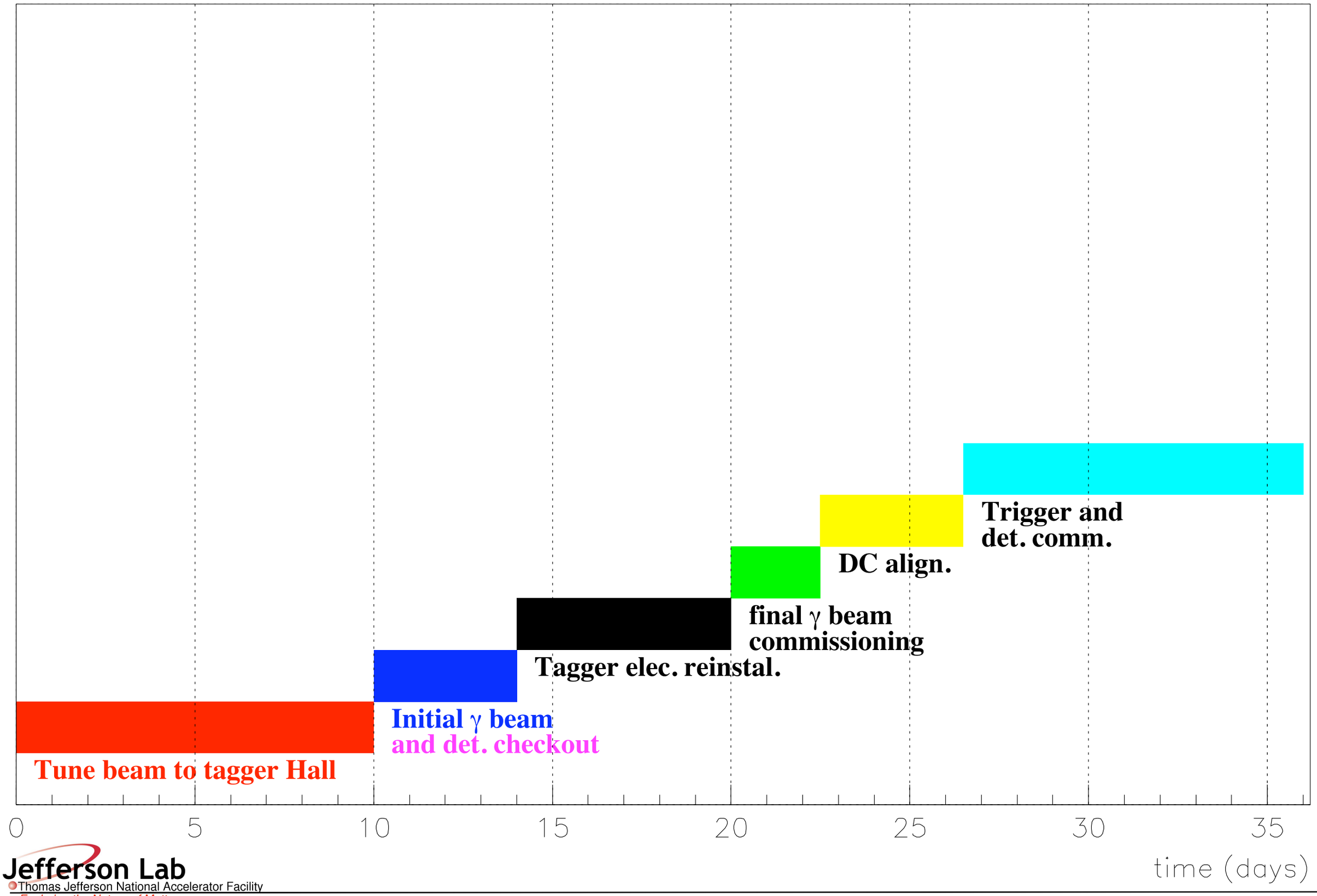
4. Turn on rest of detectors. Set nominal trigger and monitor rate.

5. First pass at trigger optimization.

6. Take data for all subsystems for 8h.

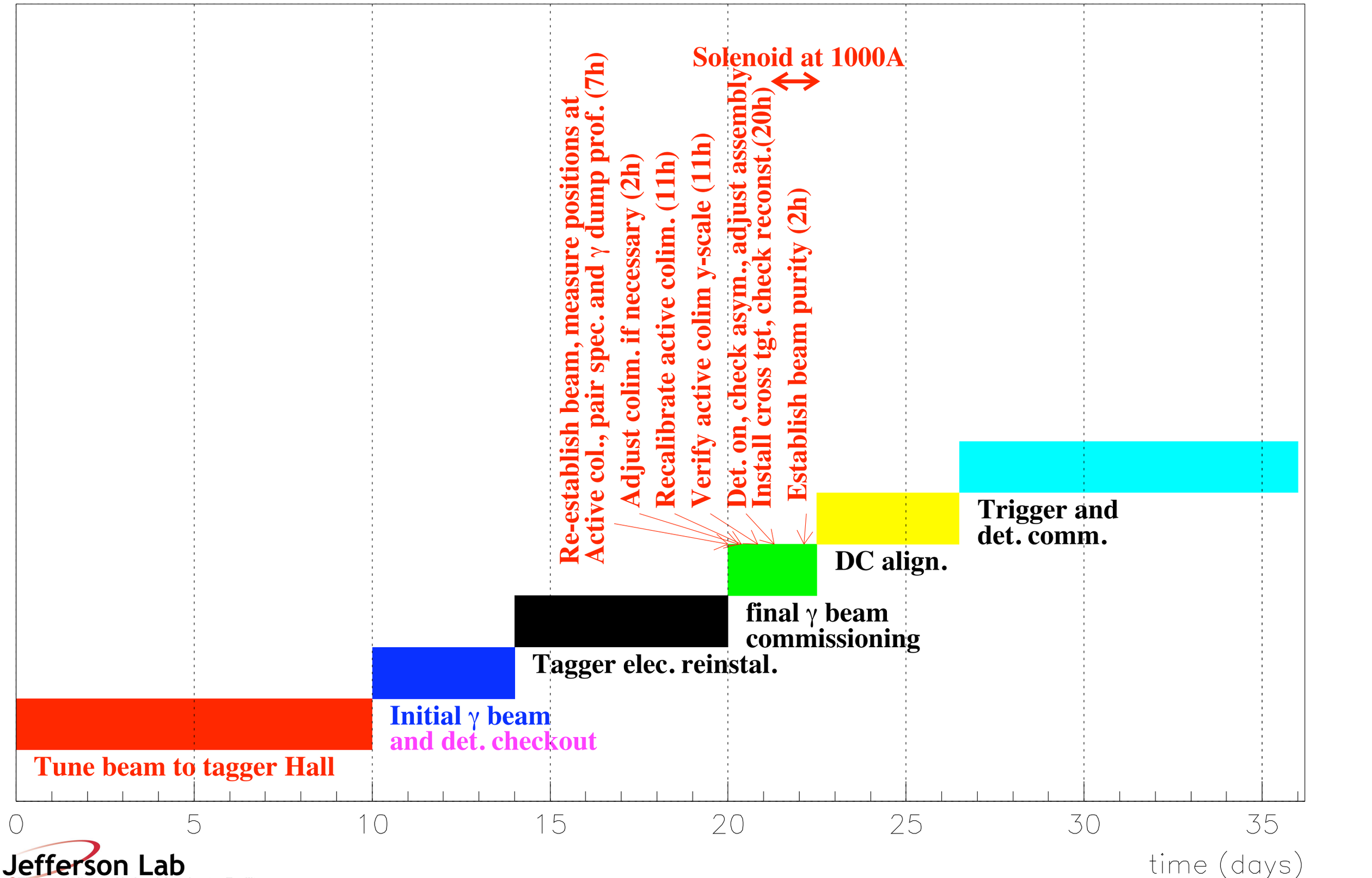
Reinstallation of Tagger electronics (6days)

Fall commissioning. Hall D and tagger close at t=0



Finalize photon beam commissioning (2.5 days)

Fall commissioning. Hall D and tagger close at t=0



Recalibrate active collimator/accelerator scale

No upstream profiler.

- Re-calibrate active collimator following same procedure as for initial calibration.

- Rotate by 90° the active collimator to calibrate y-channels

- If necessary, fine tune accelerator scale.

- Access while ramping up solenoid to 1000A. Rotate back the active collimator. Install cross target.

Check target/Start Counter alignment & continue detector checkout

1. Turn detectors to check for azimuthal asymmetries. First BCAL/FCAL if not already on, then Start Counter. Check effect of +/- 1cm collimator x-translation on Start Counter and FCAL rates.

2. Possibly, minimize large asymmetries by adjusting the collimator or target assembly.

3. Turn on rest of detectors.

4. Verify the standard BCal vs FCal trigger (timing and thresholds).

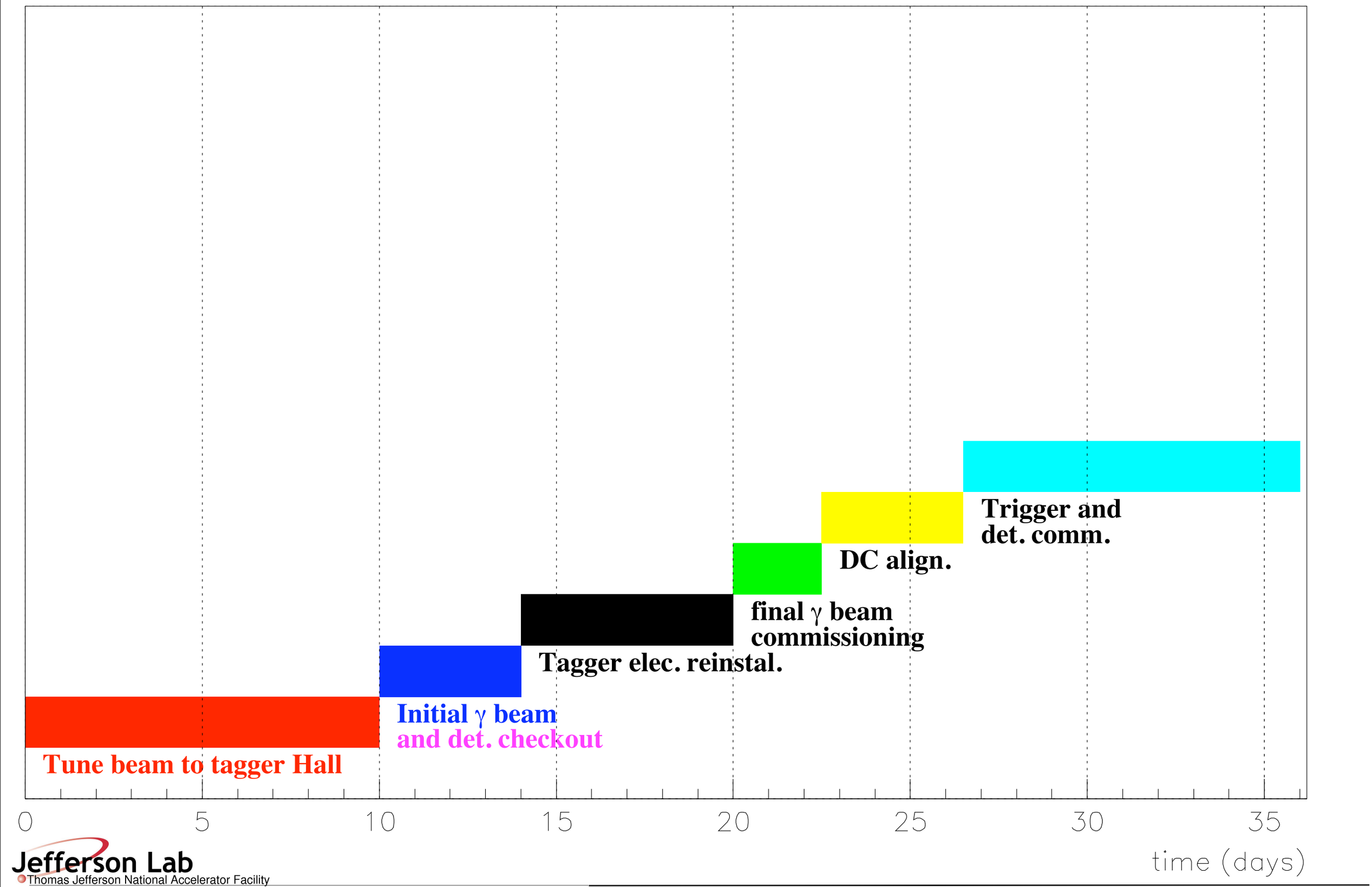
5. Take data for 8h. Reconstruct target profile.

6. Establish beam purity.

   - Take 1h of data without radiator.
   - Compare Pair Spec., Profiler and radiation monitor rates with corresponding rates when radiator is in.
   - Compare photon energy spectrum with radiator-in spectrum.

DC alignment (4 days)

Fall commissioning. Hall D and tagger close at t=0

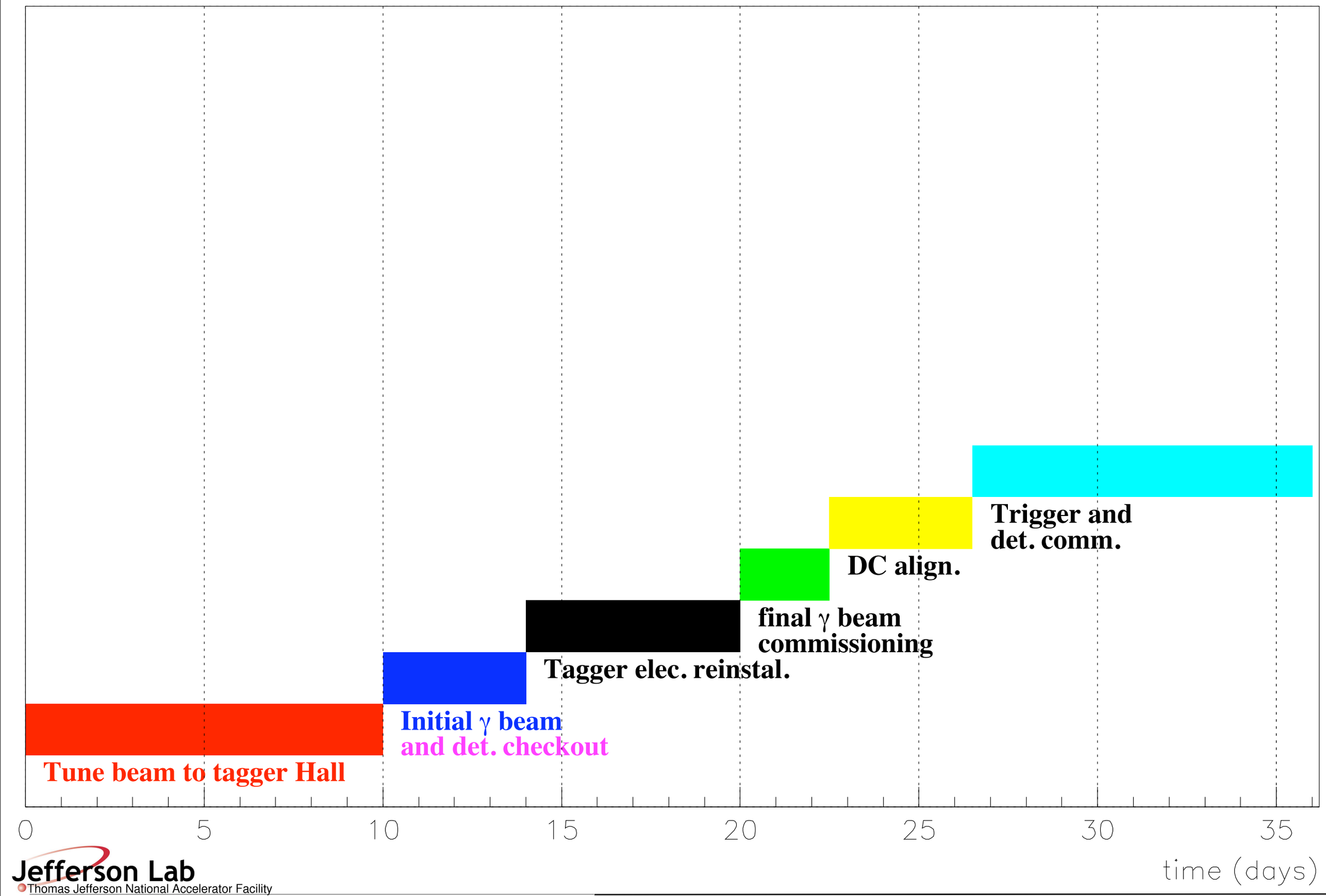


DC alignment (4 days)

- Collect data with no or low field.
- 2 "target" locations: Nominal target (2mm CH_2 disk) & vacuum window protection at end of beam pipe (about 4m upstream from target disk).
- If necessary, collect data with disk in several positions between +12cm and -32cm of nominal center.

Trigger and detectors final commissioning (9.5days)

Fall commissioning. Hall D and tagger close at t=0



Trigger and detectors final commissioning (9.5days)

- Finalize trigger commissioning (8 days).
  - Tune FCal trigger.
  - Add CDC,FDC,BCal,SC,TOF to readout.
  - Tune Bcal trigger.

- Check GlueX production rates and background.
  - Take 8h of data with the expected "low intensity" conditions of 10 MHz/GeV photons:
    - 100 nA, 1.1×10^{-4} RL radiator,
    - 5 mm collimator,
    - 10 mm CH_2 target at nominal position.

  Close to the "low intensity" settings of GlueX.

- Take more data for preliminary calibration and alignment of the detectors.

Commissioning runplan: what remains to be done

1. Continue documenting step by step detailed procedures for each stage of the commissioning.

2. Compute expected rates.

3. Offline analysis plans

4. Detailed run plan for DC alignment and final detector commissioning.