DarkLight Commissioning

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DarkLight Collaboration Meeting

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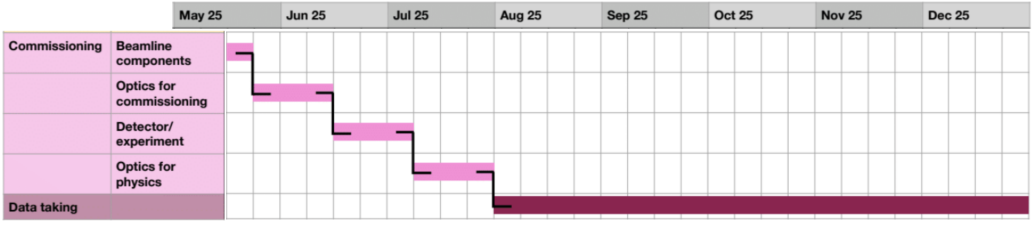
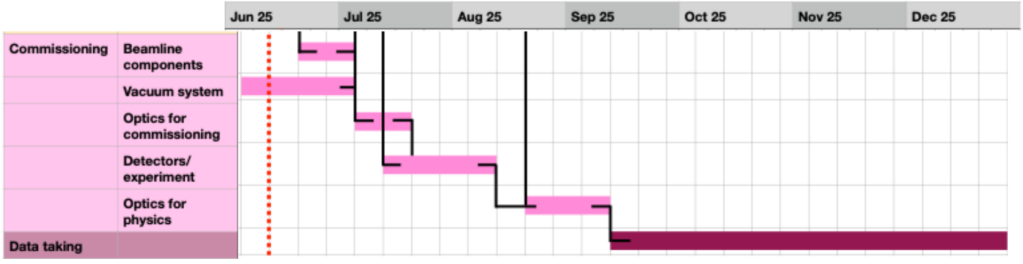
Commissioning DarkLight - January Schedule



10 weeks total, 3 weeks for the experiment to do its commissioning. Timeline from Kate's management chart. Note minimal changeover time between commissioning and production.

Commissioning DarkLight - Current Schedule



Schedule slipped by about 4 weeks. 4 weeks for the experiment to do its commissioning. Timeline from Kate's Gate Review talk. Note one week changeover time before commissioning optics for production.

Commissioning DarkLight - January Schedule

Key assumptions

- Installation of chamber, spectrometers, and magnets complete
- Both spectrometers fully instrumented
- DAQ set up and running
- e-linac in stable and routine running

Commissioning DarkLight - Current Schedule

Key assumptions

- Installation of chamber, spectrometers, and magnets complete - YES
- Both spectrometers fully instrumented - NO (90 %)
  - Install lead shielding
  - Finish cabling
  - Turn things on and see that they work, magnets, GEMs, trigger, etc.
- DAQ set up and running - NO (50 % ? Code written, not tested)
- e-linac in stable and routine running - NO (Not qualified to comment. My understanding is we are limited to 10 MeV for the next month or two.)

Finding the Focal Plane

With the carbon target and commissioning beam pipe installed, 10, 15, 20, 25, and 30 MeV beam energy and 1 - 5 μA beam current:

- Both magnets will be set to accept electrons
- The magnet currents will be varied to -20 %, -10 %, 0 %, 10 %, and 20 % of the nominal elastic scattering current value. This will sweep the elastic line across the surface of the focal plane detectors.
- Comparing to simulation will allow us to determine the position of the detectors with respect to the focal plane.
- **If the detectors are not in the focal plane, we may need to enter the hall and adjust the detectors!**
- Parasitic synchronization tests

*Estimate 5 days

Absolute Magnet Scale

Once the focal plane is established, we will calibrate the absolute momentum scale and linearity of the magnets, using the same beam energies as before:

- The elastic peak will be positioned at the high momentum edge of the GEM
- Inelastic peaks in carbon can be positioned in the GEM acceptance along with the elastic line
- Parasitic synchronization tests

*Estimate 5 days

Møller Scattering

First physics measurement of DarkLight. Again using the variable beam energy, but only the 20° spectrometer:

- Set the spectrometer to accept low energy (6-10 MeV) electrons
- Elastic Møller scattering is also a calibration data point
- Measure radiative tail in Møller scattering, verify event generators
- **Requires detectors relationship to focal plane to be well-understood, and magnet scale well calibrated**
- Parasitic synchronization tests

*Estimate 2 days

Change Polarity

The 20° spectrometer will be set to positron mode. **The DAQ between the two spectrometers needs to be synchronized.**

- We will look for coincident Bethe-Heitler events between the two spectrometers.

*Estimate 3 days

Tantalum target

The Tantalum target will be installed.

- We will slowly turn up the beam current and measure radiation dose outside the hall to confirm FLUKA calculations
- Check detector response in nominal setup of the experiment
- If time permits, run in production mode for several days

At this point the commissioning of the experiment is complete.

*Estimate 5 days (not including installation)

Commissioning Plan

To summarize:

1. Put carbon target in beam
2. Find focal plane (5 days)
3. Find absolute scale and determine linearity of magnets (5 days)
4. Physics and calibration point with Møller scattering (2 days)
5. Change polarity and measure Bethe-Heitler (3 days)
6. Install tantalum target
7. Turn up to nominal running current and test radiation dose and detector response (5 days)

Points 2 and 3 will have a little bit of a feedback loop. We hope there will be minimal need to enter the hall, but extremely likely we will need to touch detectors, and maybe shielding.

Total time, 20 out of 28 allocated days. I assume we will end up using all 28 days anyway.

Commissioning Plan - Limited to 10 MeV

E-linac group will have to correct me for anything I say that is incorrect.

- Currently are limited to 10 MeV maximum beam energy.
- I think this means we can do most of the DAQ debugging and magnet calibration.
- However, any physics measurements like Møller require higher energies.

So...

- I assume we will do commissioning with 10 MeV.
- Then we will stop and wait for the new power supply for the klystron.
- Once it is installed, some group return to finish commissioning at higher energy.

Obvious Problems

"I love deadlines. I love the wooshing sound they make as they pass by."-Douglas Adams

1. Almost everyone leaves < 1 week from today.
2. There are no firm plans for anyone to come back for commissioning as far as I know.
   - Dependent on e-linac schedule (not a complaint! Just noting travel schedules, if any, may need to change on short notice).
3. Given the compressed time-line there is very little chance to think about any commissioning data while we switch to production data. Maybe gap between 10 MeV and higher energy helps us here.

Obvious Problems

Do not miss when swinging a hammer.