

Photon Beam Systematics Update

Richard Jones, University of Connecticut

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Photon Beam Working Group

progress report

reporting on work by others, including:

- [Michael Dugger](#)
- [Alexander Austregesilo](#)
- [Andrew Schick](#) (*separate talk, Fri.*)
- [Alexander Somov](#)

1. polarization

Update from Michael Dugger, ASU:

1. polarization

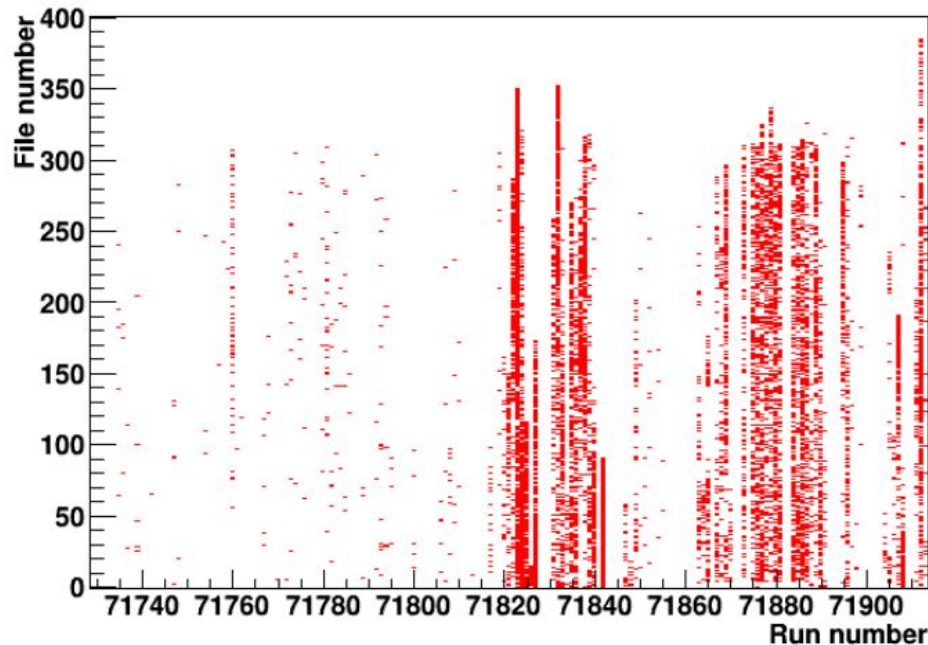
Update from Michael Dugger, ASU:

- TPOL results available for run periods through fall 2019.
- Consistent with relative determination using $\varrho(770)$.
- Work on 2020 results is advancing.

Using files RunPeriod-2019-11//recon/ver01/ps

- Multiple attempts made
- Large portion of files fail

Bad files



1. polarization

Update from Alex Austregesilo, Jlab:

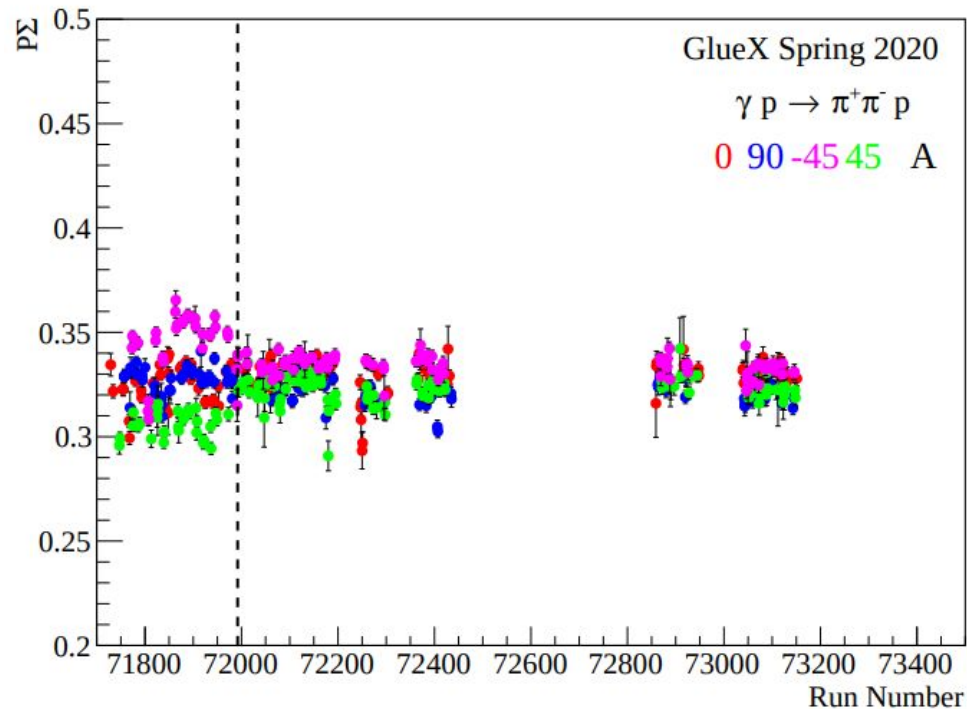
- relative determination using beam asymmetry of $\rho(770)$

1. polarization

Update from Alex Austregesilo, Jlab:

- relative determination using beam asymmetry of $\rho(770)$
- updates from spring 2020 run released as reconstruction progresses.

- summer 2020 results continue to look stable



1. polarization

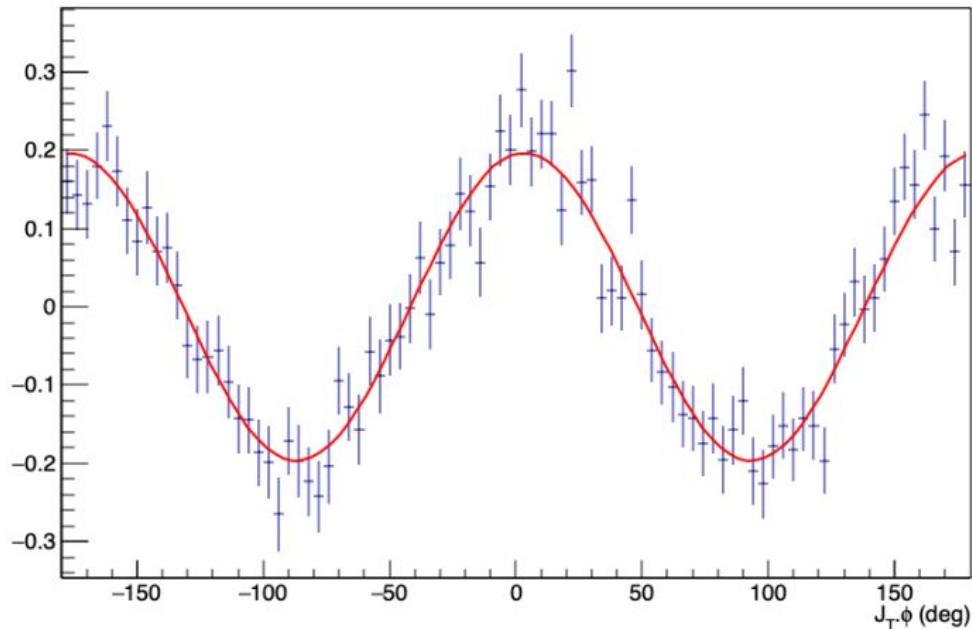
Update from Andrew Schick, UMass:

- *absolute* measurement using azimuthal distribution of Bethe Heitler pairs

1. polarization

Update from Andrew Schick, UMass:

- *absolute* measurement using azimuthal distribution of Bethe Heitler pairs
- different systematics from TPOL, provides an independent check
- *see dedicated talk by Andrew first thing on Friday*



- TPOL: fall 2018, 0/90 orientation:
 $p = 0.346 \pm 0.005$
- BH method: fall 2018, 0/90 orientation:
 $p = 0.337 \pm 0.011$

1. polarization

Update from Andrew Schick, UMass:

- comparable statistical precision
- systematics of Bethe Heitler polarimetry in GlueX are under study
 - a. QED generator
 - b. pion background

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1. UMass generator

- based on analytic formula from *Berlin, Madansky, 1950*
- uses a number of approximations, only 2 of 4 QED l.o. diagrams.
- generator provided by R. Miskimen
- computationally fast for GlueX acceptance

2. UConn generator

- based on Dirac++ library
- full l.o. QED, no approximations.
- generator provided by R. Jones
- computationally demanding for GlueX acceptance

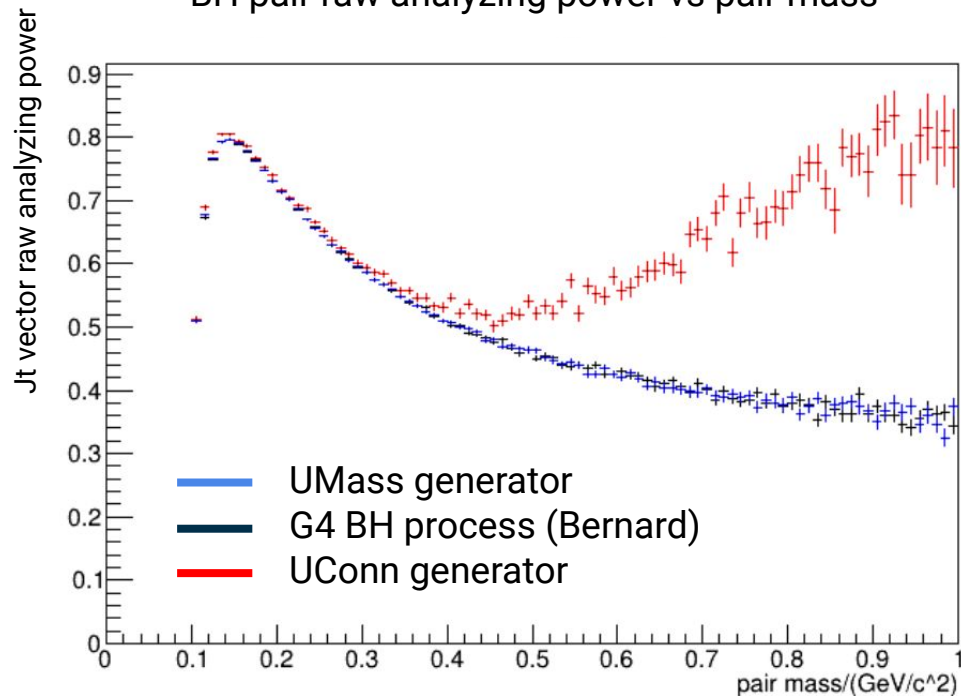
1. polarization

Update from Andrew Schick, UMass:

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 - QED generator
 - pion background

- both tracks with $\theta_{\text{lab}} > 0.75^\circ$

BH pair raw analyzing power vs pair mass



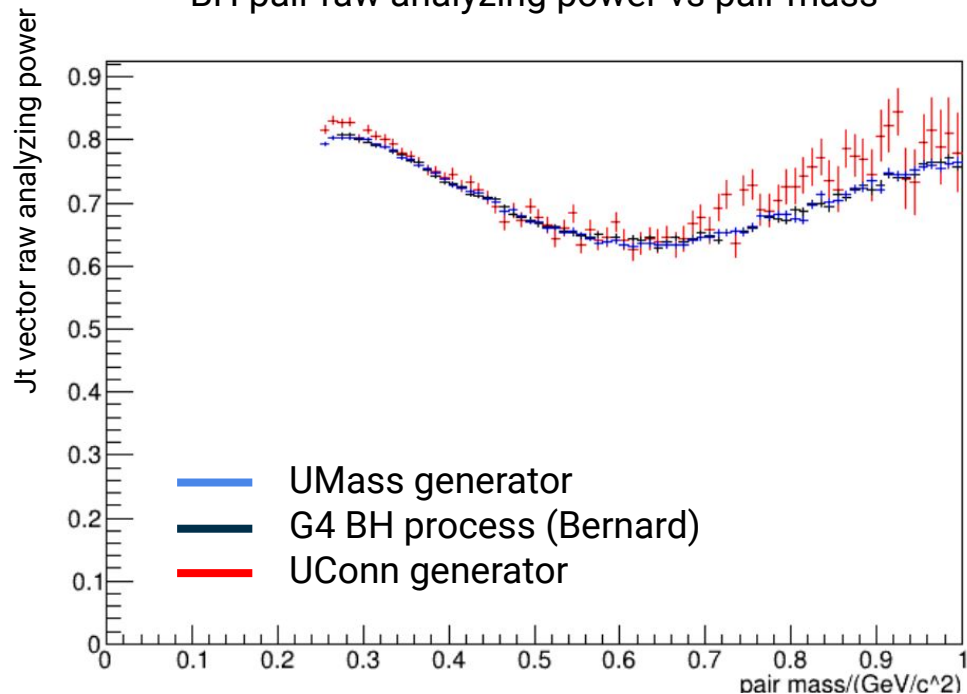
1. polarization

Update from Andrew Schick, UMass:

- comparable statistical precision
- systematics of Bethe Heitler polarimetry in GlueX are under study
 - QED generator
 - pion background

- both tracks with $\theta_{\text{lab}} > 1.5^\circ$

BH pair raw analyzing power vs pair mass



2. energy

systematics of beam energy

- work underway by Primex
- details are forthcoming from Alex Somov

Sean -- *new fix to halld_recon for REST file analysis*

- original production of pre-2020 REST files had inaccurate beam photon energy information
- new fix overwrites the beam photon energy in REST based on updated formula, CCDB tables
- fix is back-ported to relevant versions in use, see Sean...

3. flux

systematics of flux

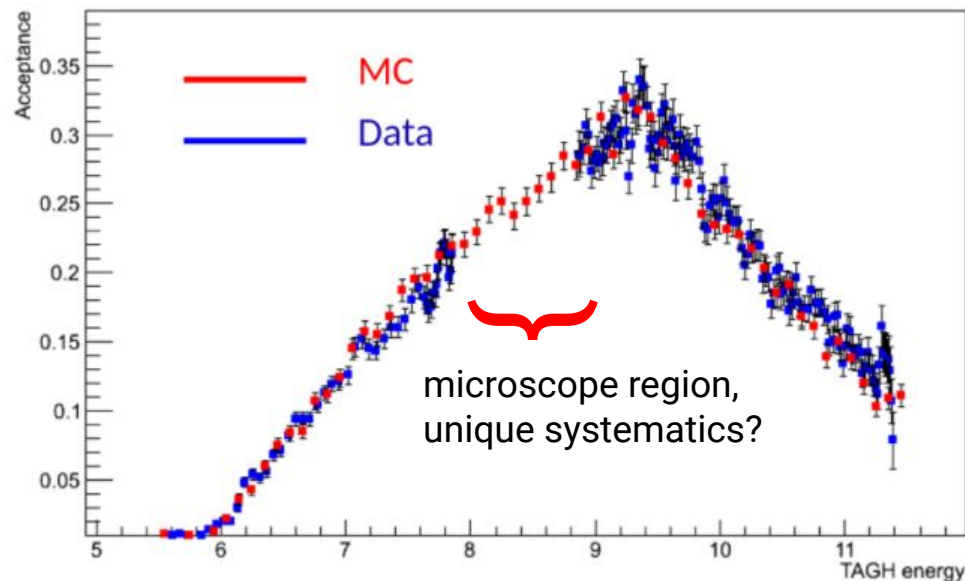
1. normalization (TAC) runs
2. scaling up to running current
3. subtracting accidentals

3. flux

systematics of flux

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- TAC runs 30852, 30853



3. flux

systematics of flux

1. normalization (TAC) runs
2. **scaling up to running current**
3. **subtracting accidentals**

3. flux

systematics of flux

1. normalization (TAC) runs
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scaling up by factor ~ 200

- exchange of 750um converter with 75um

3. flux

systematics of flux

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2. **scaling up to running current**
3. **subtracting accidentals**

scaling up by factor ~ 200

- exchange of 750um converter with 75um
- rate-dependent changes in electronics
 - currents in phototube bases
 - shifts in baselines, gains
 - electronic deadtime

3. flux

systematics of flux

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scaling up by factor ~ 200

- exchange of 750um converter with 75um
- rate-dependent changes in electronics
 - currents in phototube bases
 - shifts in baselines, gains
 - electronic deadtime
- current-dependence in the properties of the electron beam
 - position shifts?
 - bleed-through?
 - tails?

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systematics of flux

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scaling up by factor ~ 200

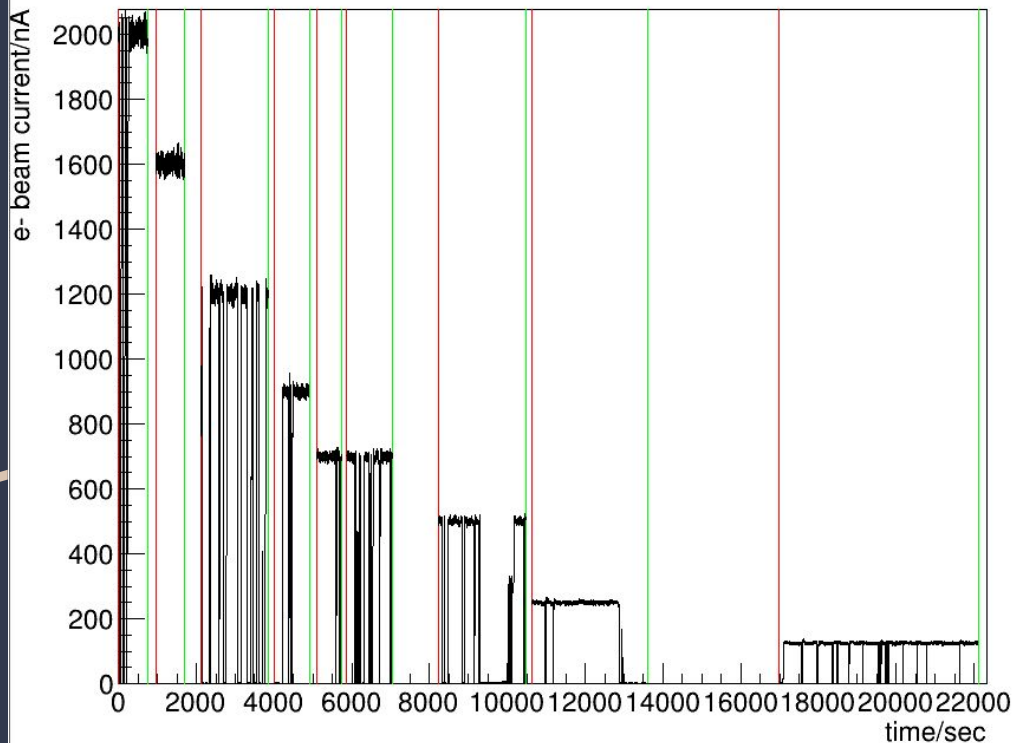
- exchange of 750um converter with 75um
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- current-dependence in the properties of the electron beam
 - position shifts?
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 - tails?
- dependence on how the current increase is achieved, eg. slit vs laser intensity.

3. flux

beam intensity scaling study:

- runs 72306-72315
- standard 50um diamond radiator, edge at 8.8GeV
- most detectors are off
- focus of study is tagger, PS

electron beam current (bcm AD00)

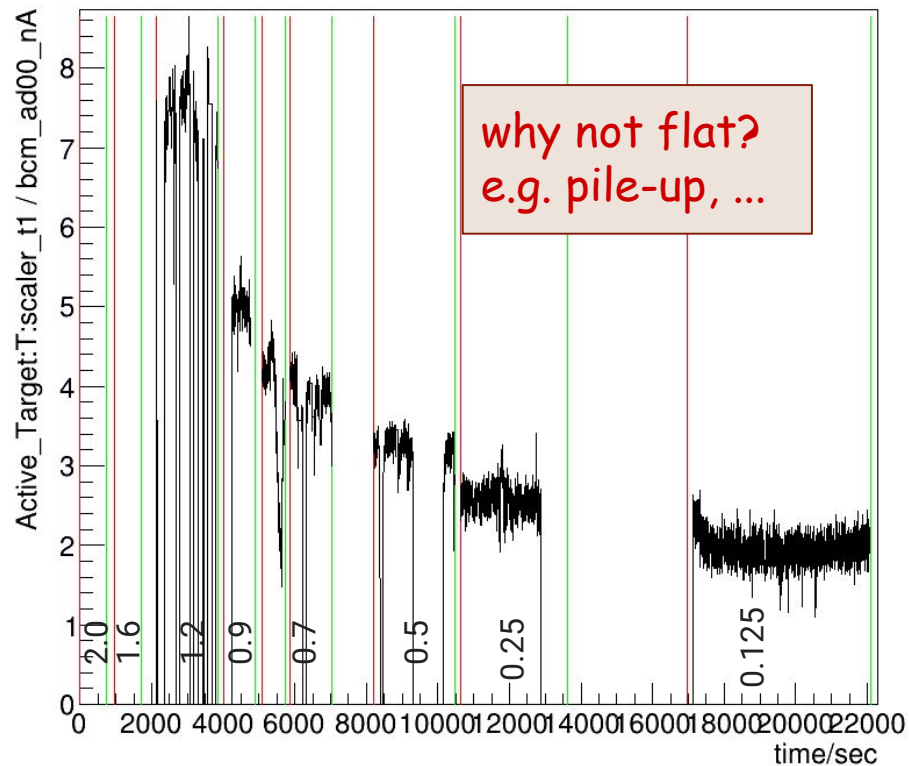


3. flux

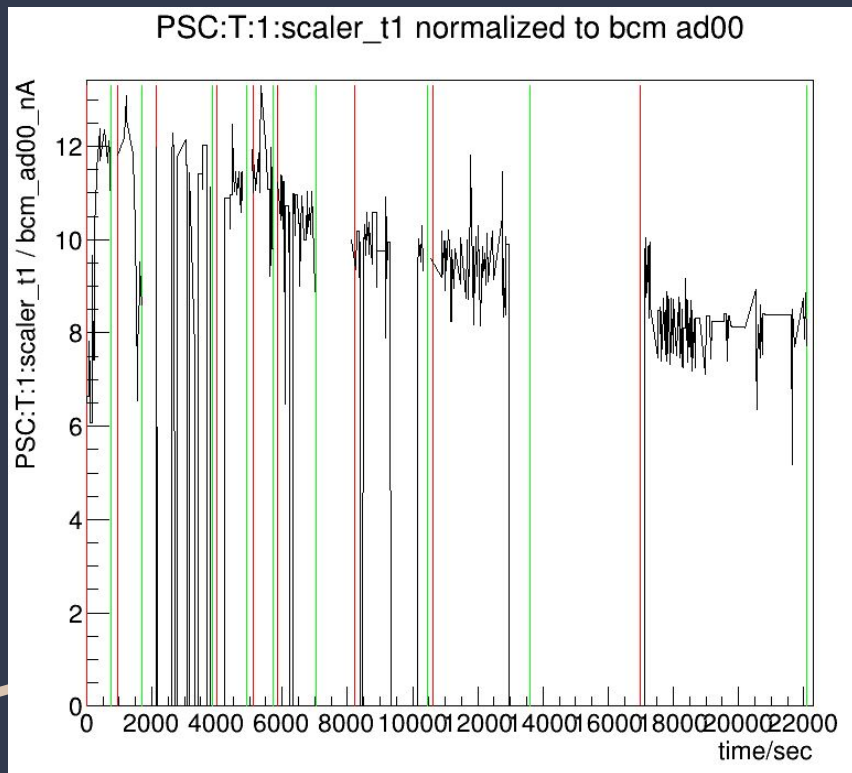
beam intensity scaling study:

- active target / beam current shows strong variation!
- is this scaler prescaled?
- switched off at 2.0, 1.6 uA
- strong variation at fixed current 0.7uA

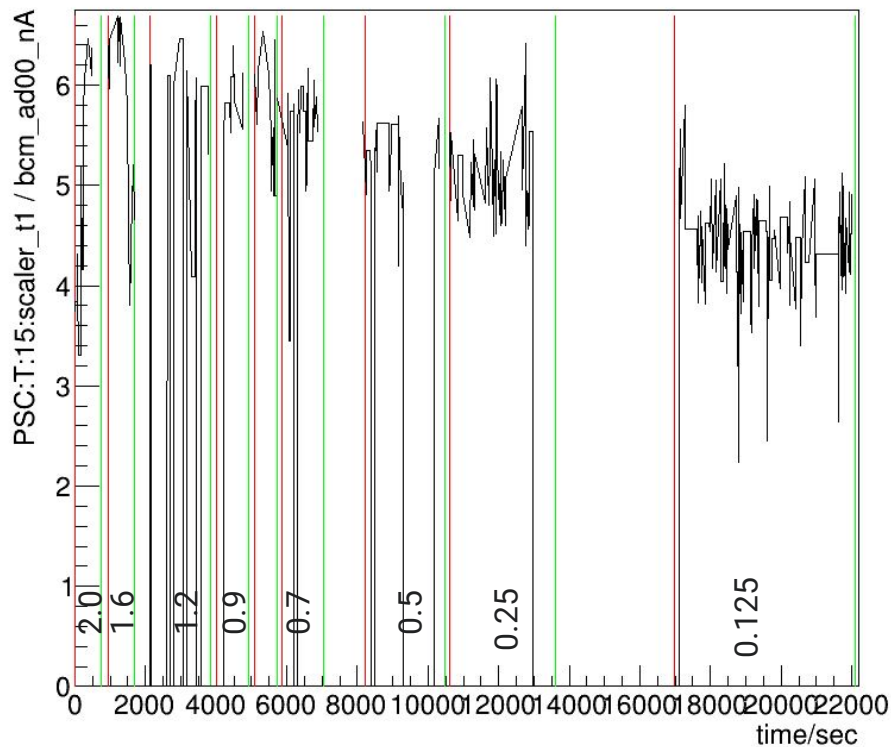
Active_Target:T:scaler_t1 normalized to bcm ad00



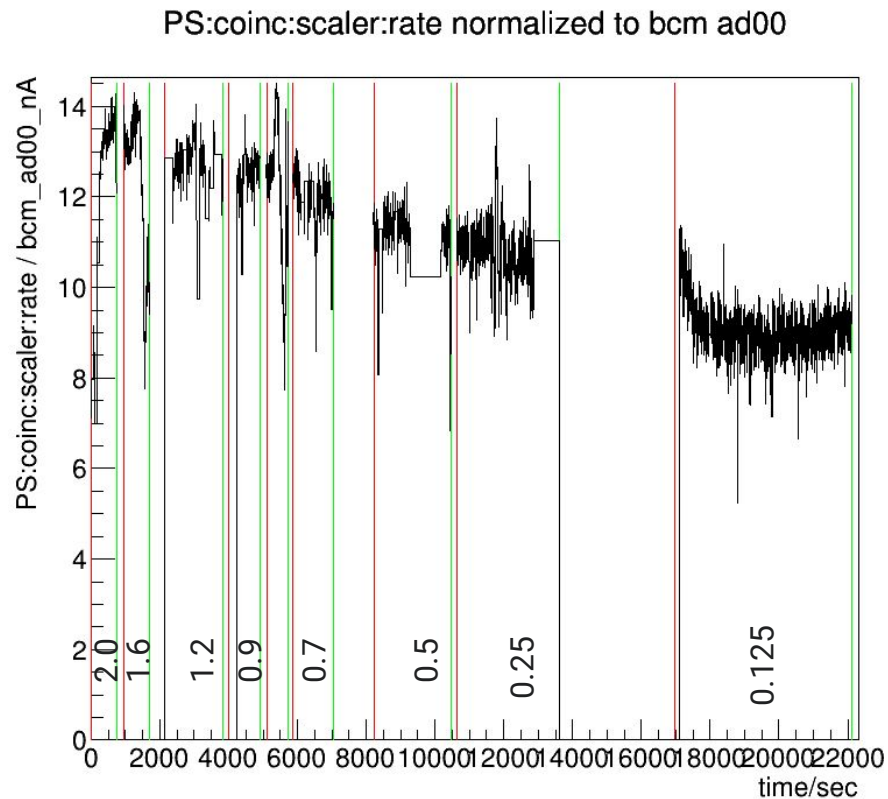
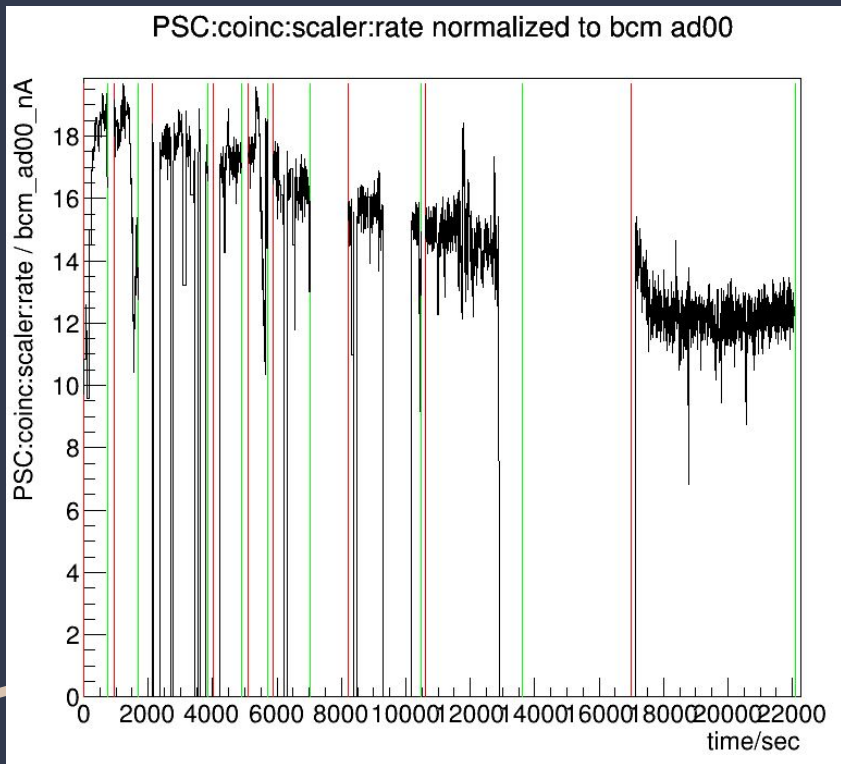
3. flux



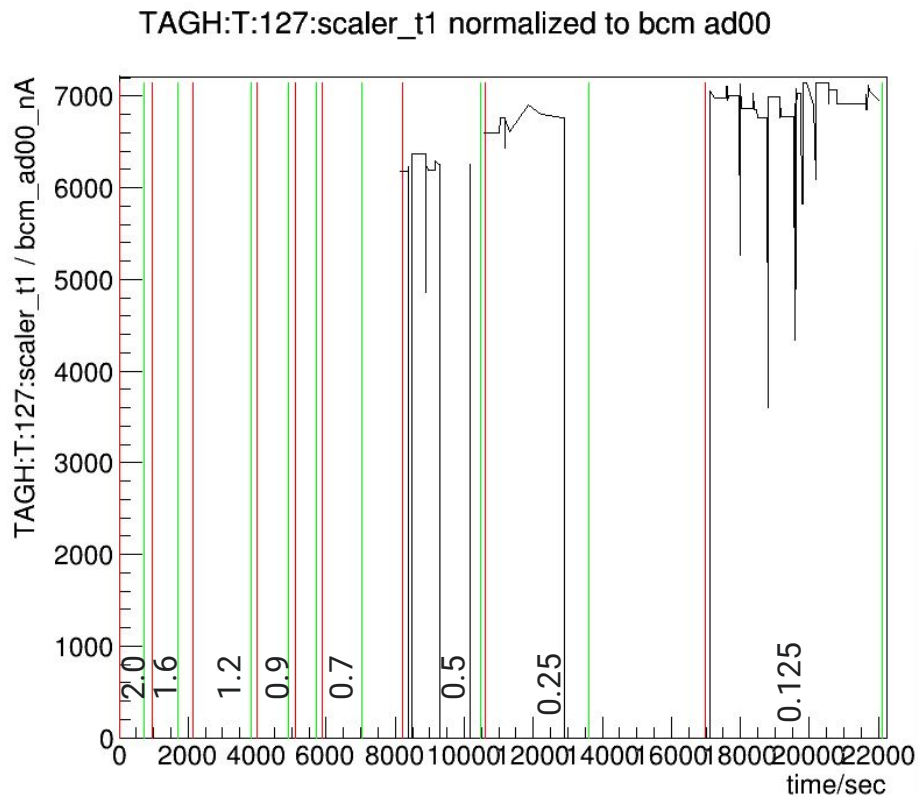
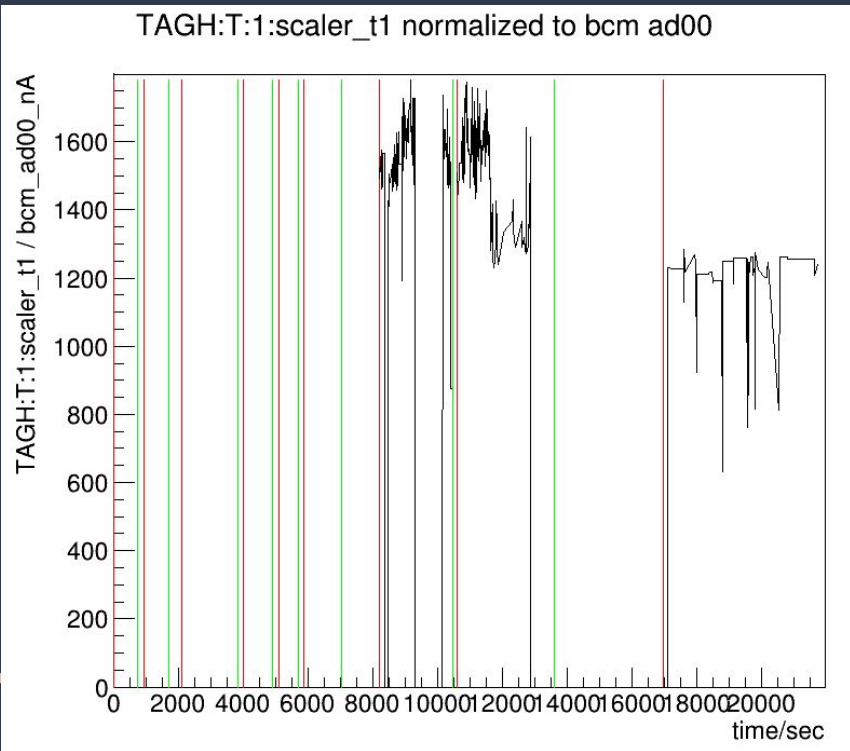
PSC:T:15:scaler_t1 normalized to bcm ad00



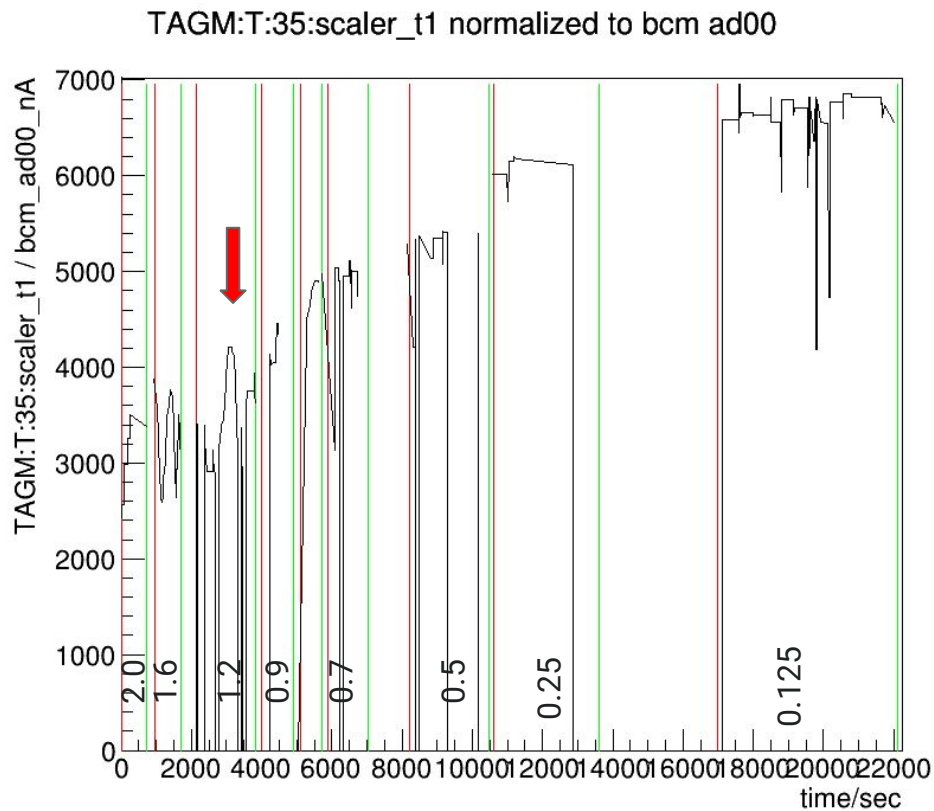
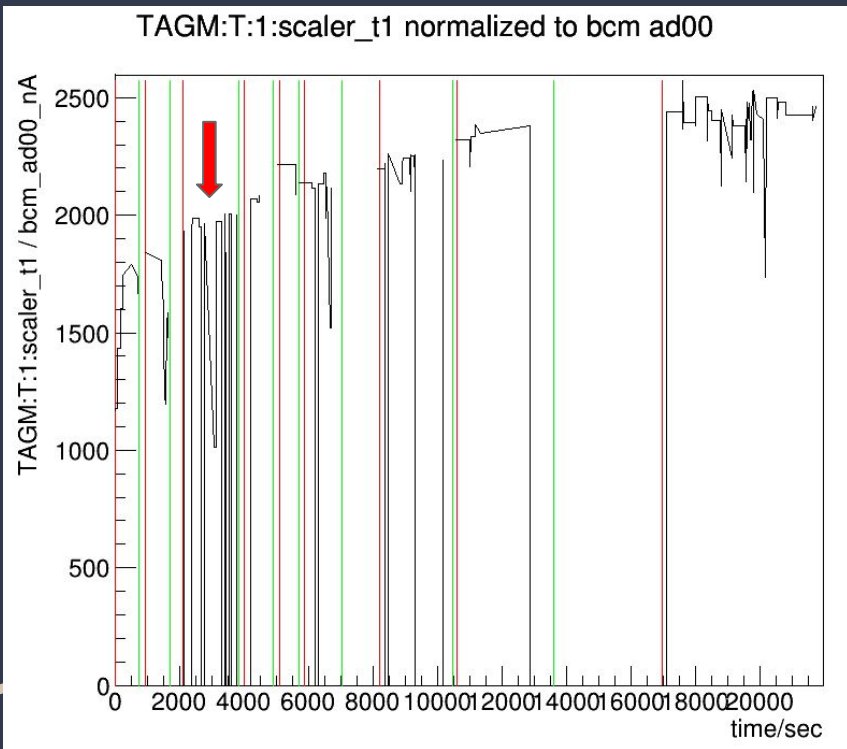
3. flux



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3. flux

systematics of flux

1. normalization (TAC) runs
2. scaling up to running current
3. **subtracting accidentals**

depends on good timing calibration

- accidentals scaling factor extraction hindered by inconsistent timing calibration
- work is ongoing at by UConn group (**D. Prather**) to improve the automatic calibration of the TAGM, esp. time-walk

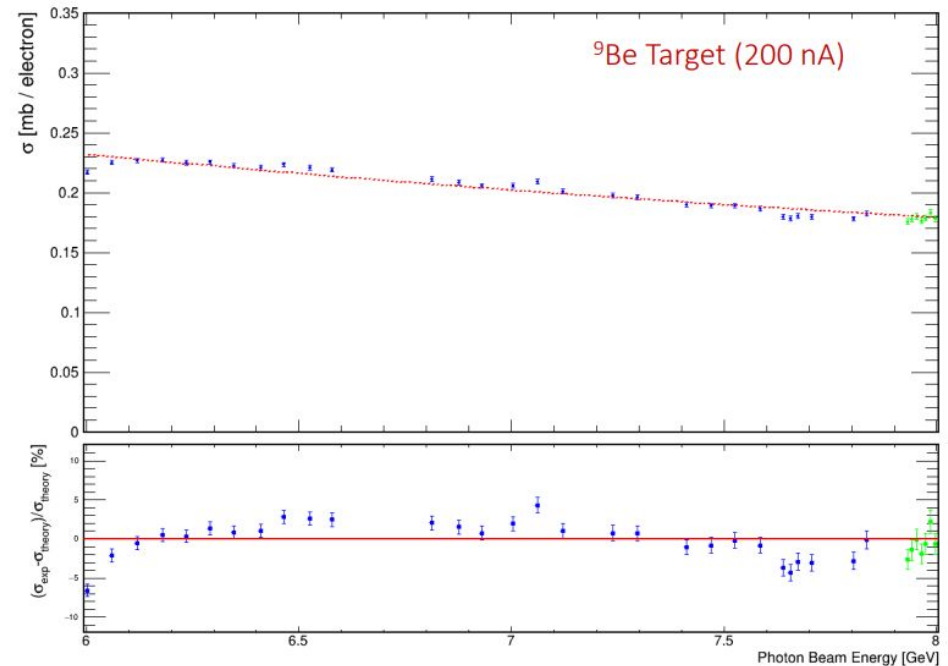
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in spite of these challenges, from *Drew (5/2021)*:

Compton cross section with 2-layer FCAL cut



Last slide: to-do list

- **Sasha** is working on a technical note summarizing his work on flux and energy calibration in the context of Primex analysis, including systematics.
- **Andrew** is working on finalizing the Bethe-Heitler analysis, including systematics.
- **Richard** is working on the flux systematics at full intensity, with focus on current-dependent effects and accidental subtraction.
- **Summary technical note** covering all beam systematics issues awaits the completion of the above steps.