

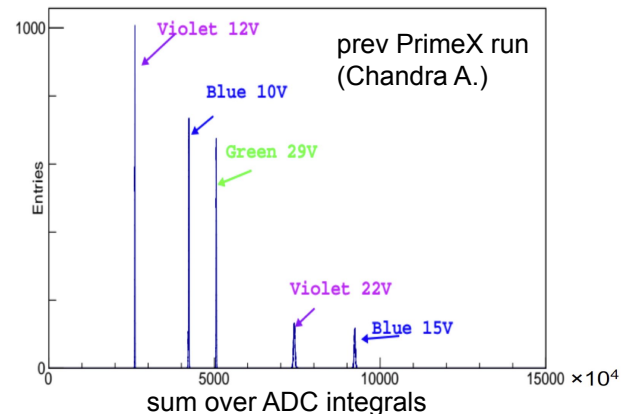
# FCAL LED efficiencies and timing

RunPeriod-2021-08 PrimeX

Susan Schadmand, Feb 22, 2022 PrimEx-eta (informal) Calibration & Analysis Meeting

# introduction FCAL LED efficiencies

- **FCAL efficiency maps needed for efficiency from simulations**
- known issue: HV stability
  - sudden HV failure
    - loss of communication
  - hot blocks
- setup:
  - four acrylic panes each covering the upstream end of one quadrant
  - each pane is illuminated by forty LEDs, ten violet, ten blue, and twenty green
  - the different colors are used to study the wavelength dependence of the transmission
  - transmission of blue is sensitive to radiation damage which causes brownish color of lead glass
- usage:
  - during production running the FCAL LEDs are cycled through 6 configurations, each 10 minutes long and tied to the wall clock
    1. Violet 12 V (00 to 09 minutes)
    2. Blue 10 V (10 to 19 minutes)
    3. Green 29 V (20 to 29 minutes)
    4. Violet 22 V (30 to 39 minutes)
    5. Blue 15 V (40 to 49 minutes)
    6. No pulsing (50 to 59 minutes)
- evaluate LED events, find “bad” blocks\* (inconsistent response to LEDs)
- **goal: LED efficiencies per run per block**

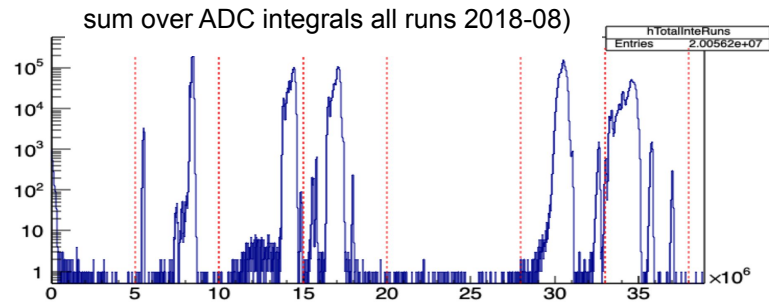
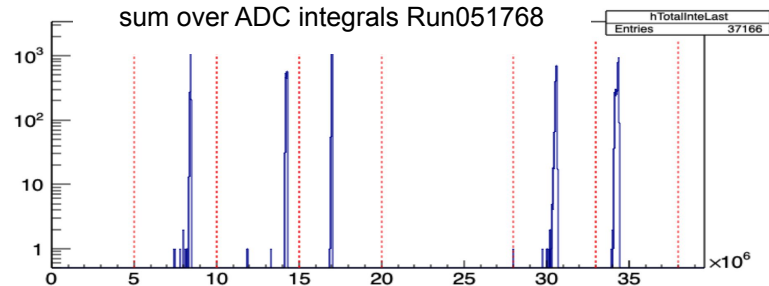


\* detector channels are called blocks (ref to shape of the lead glass detectors)

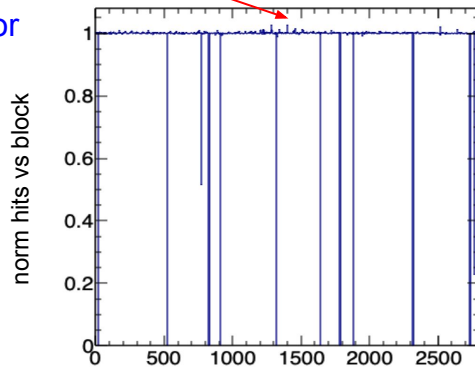
# FCAL LED efficiencies

- analyze FCAL-LED skims
  - plugin\* for histograms (hd\_root file) records ADC integrals per hit
- step 1: **loop over hits** (using DFCALDigiHit)
  - sum over ADC integrals shows distinct peaks for the different **“LED Regions”** which **shift with time**
  - **consider entire LED region**
  - count # hits per block
    - **> 1 hits per block** can result from double pulsing (at high rates) and switching noise
      - mostly at small angles
- **step 2: loop over blocks**
  - efficiency histogram
  - **increment entries only once for blocks with 1 or more hits**
- **LED efficiencies per block**

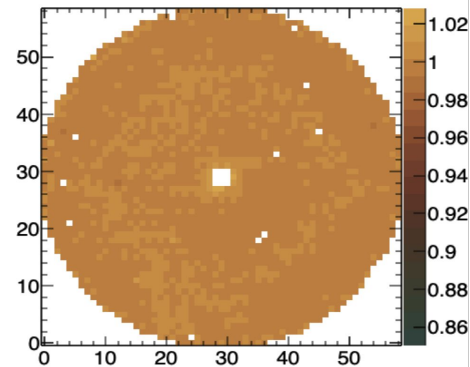
\*ifarm /u/home/susansch/GlueX/halld\_my/plugins/fcalbadchannels



norm Hits vs Channel, all Regions, Run\_51768



Row vs Column, all Regions, Run\_51768



# RunPeriod-2021-08 PrimeX

- consider entire LED region for sum over ADC integrals

- efficiency histogram
  - incremented entries only once for blocks with 1 or more hits

→ LED efficiencies per run per block

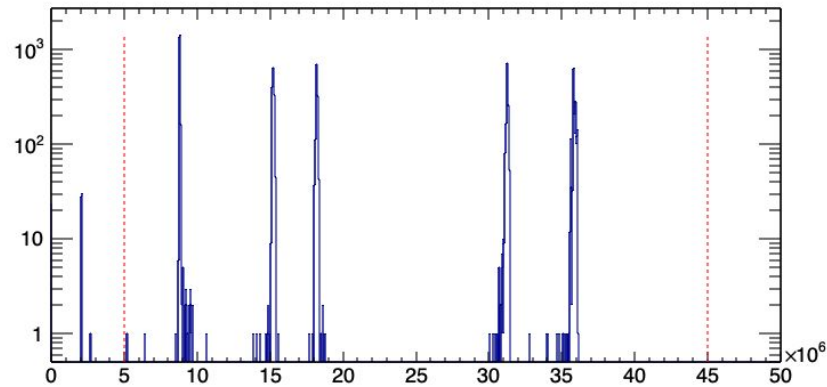
`/work/halld3/home/susansch/FCAL-LED/RunPeriod-2021-08-PrimeX`

`Run_081262_Eff.txt`

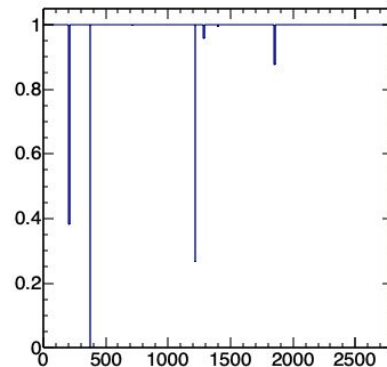
`Run_081262_plot.root`

...

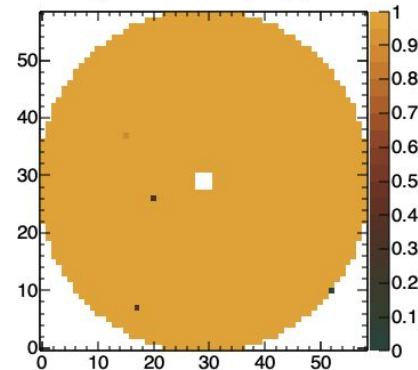
Sum over ADC Integrals, Run\_81262



Eff vs Block, Run\_81262



Eff, Row vs Column, Run\_81262



# FCAL LED efficiencies and timing

Run Periods 2021-08 (PrimeX) and 2021-11 (SRC/CT)

- LED efficiency maps
- LED time shifts

## FCAL-LED time status

RunPeriod-2019-11 Batch 1 (runs 71345 - 71591)  
using DFCALHit objects

~2ns time shifts from syncing to RF time, eg crate  
reboot then syncing to the RF signal

- 4 ns in phase with the previous choice  
(beam comes every ~4 ns)
- sometimes out of phase by 2 ns  
(RF signal is every ~2 ns)

