

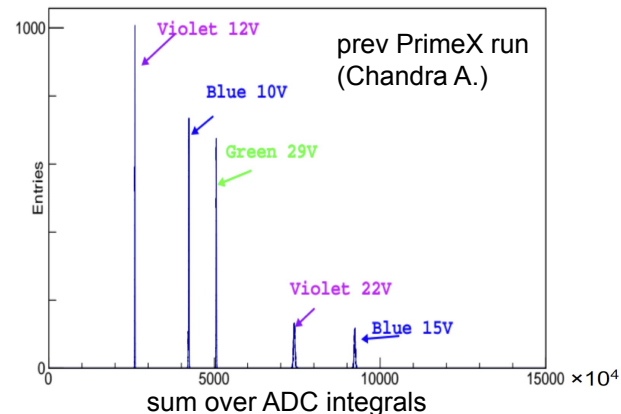
FCAL LED efficiencies and timing

RunPeriod-2021-08 PrimeX

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

introduction FCAL LED efficiencies

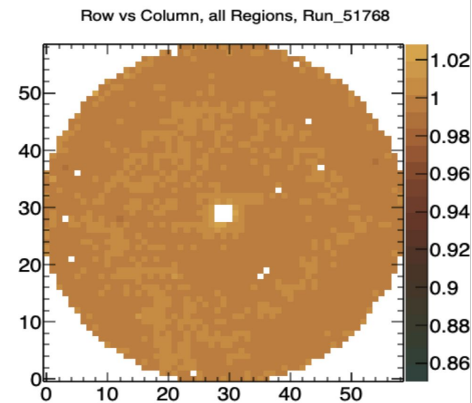
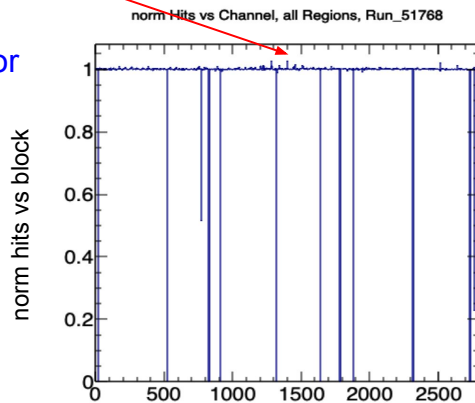
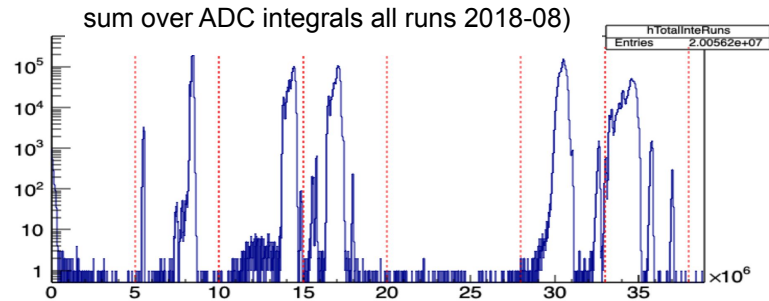
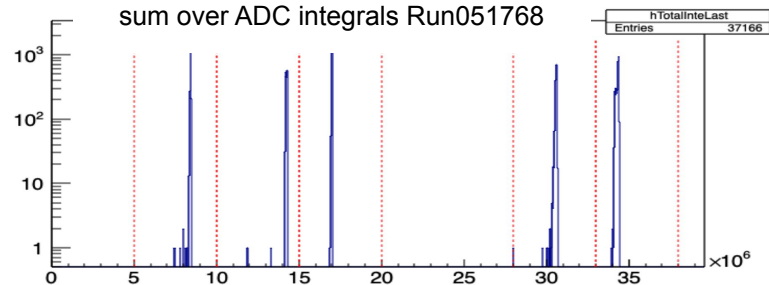
- **FCAL efficiency maps needed for efficiency from simulations**
- known issue: HV stability
 - sudden HV failure
 - loss of communication
 - hot blocks
- setup:
 - four acrylic panes each covering the upstream end of one quadrant
 - each pane is illuminated by forty LEDs, ten violet, ten blue, and 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**



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

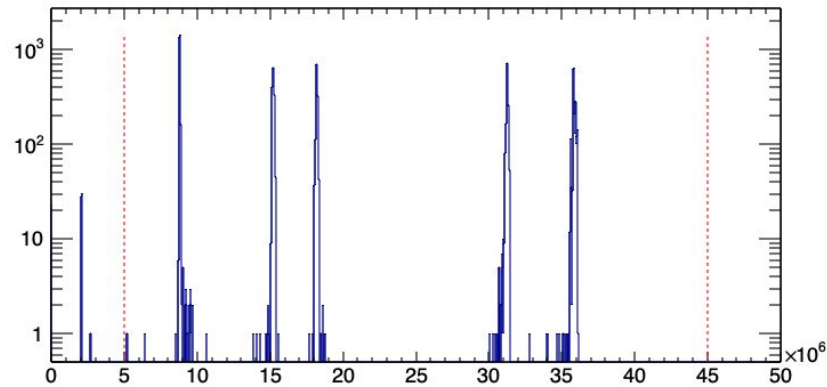
/work/halld3/home/susansch/FCAL-LED/RunPeriod-2021-08-PrimeX

Run_081262_Eff.txt

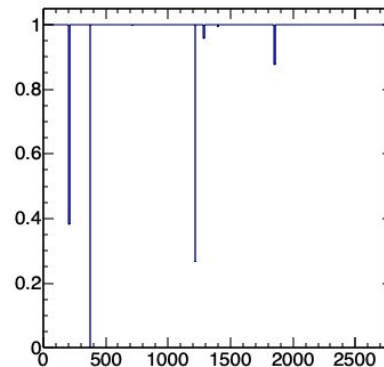
Run_081262_plot.root

...

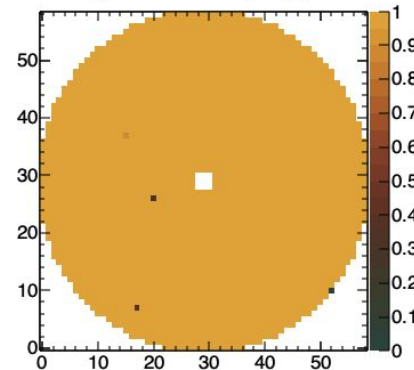
Sum over ADC Integrals, Run_81262



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 synching 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)

