calibGenCAL GCR Introduction

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calibGenCAL Overview

- **C++ code runs separate from Gleam / Gaudi**
  - **Think native C++ RootTreeAnalysis**
- **code contents include:**
  - **C++**
    - **generate offline calib from (LCI && LPA) event data.**
  - **Python**
    - **generate online settings from (largely) LCI test data**
    - **library for reading & writing Cal related file XML formats**
      - **online & offline**
    - **various manipulations (validation / analysis / formatting) of Cal XML data.**
  - **Most recently contains initial C++ GCR calibration code**
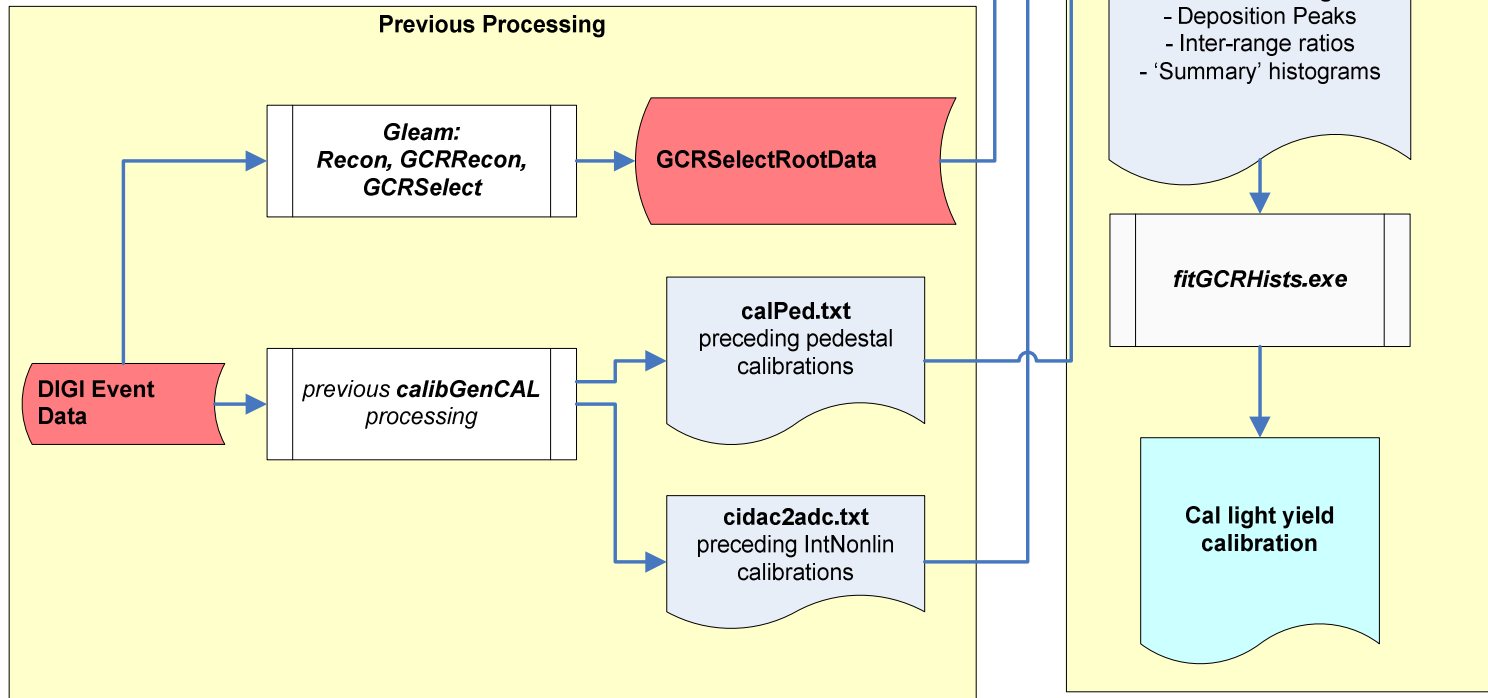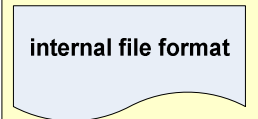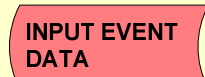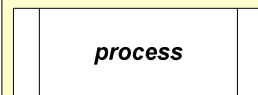
calibGenCAL GCR Overview

- **genGCRHists.exe**
  - **input GCR event data**
  - **output variety of histograms**
    - **particle peaks**
    - **gain ratios**

- **fitGCRHists.exe**
  - **fit *genGCRHists h*istograms**
  - **output cal *light yield* calib constants**

- **Current status**
  - **framework complete**
  - **ready for analysis & optimization**

calibGenCAL GCR data flow

CALIBGENCAL GCR DATA FLOW

LEGEND:

process

INPUT EVENT DATA

internal file format

OFFLINE CALIBRATION FILE

Previous Processing

Gleam:
Recon, GCRRecon,
GCRSelect

GCRSelectRootData

DIGI Event Data

previous ***calibGenCAL*** *processing*

calPed.txt
preceding pedestal calibrations

cidac2adc.txt
preceding IntNonlin calibrations

calibGenCAL GCR

genGCRHists.exe

GCR ROOT Histograms
- Deposition Peaks
- Inter-range ratios
- 'Summary' histograms

fitGCRHists.exe

Cal light yield calibration

genGCRHists.exe Overview

- **genGCRHists.exe**
  - **inputs:**
    - **GCRSelect ROOT Events**
    - **CalDigi ROOT Events**
    - **previous stage input calibrations**
      - **derived in similar manner to current ground calib**
        - » **pedestals**
        - » **intNonlin**
  - **outputs:**
    - **ROOT Histograms**
      - **particle peaks**
      - **inter channel ratios**

fitGCRHists.exe Overview

- **fitGCRHists.exe**
  - **inputs:**
    - **genGCRHists histograms**
  - **main output:**
    - **final light yield calibration quantities (eventually)**
  - **2ndary outputs:**
    - **fitted histograms**
    - **fit results**

genGCRHists Overview

- **Separate from fitGCRHists**
  - *allow to re-run fit code w/ out event analysis*
- **Cuts on GCRSelect hits**
  - *in addition to event cuts made in GCRSelect/GCRRecon*
- **Group hits by Z, crystal, ADC range**
- **Wide variety of histograms currently generated.**
  - *may be trimmed when final analysis algorithm is known.*
- **Both 'per Z' and 'All Z' histograms included in case analysis moves in this direction.**
- **'Summary' histograms, sum all channels**

Test Run Data

- **All examples in this talk from simulation run #61 @ Lyon**
    - **100k events**
    - **CrHeavyIon**
    - **140 x 1min orbit subruns**
    - **USE MC Dir**
    - **GR v9r18c1**
    - **no HFC / TE4 simu (yet)**

genGCRHists Cuts

- **Sample statistics:**
  - **Triggered events: 828763**
  - **nGcrHits: 541103**
    - **input GCR xtal hits (not events)**
  - **hits cross top & btm xtal faces : 173686**
    - **avoid 'corner clippers'**
  - **nHitsAngle: 149836**
    - **30 deg (from vert) orthogonal to xtal**
    - **60 deg longitudinal**
  - **nHitsPos: 121589**
    - **> 30 mm from xtal end**

genGCRHists Histograms

- **sparse histogram arrays**
  - Flexible generic (template) system supports sparse arrays of histograms
    - w/ compound-key indexing (Z, channel, etc)
    - Can efficiently read & write large numbers of histograms to ROOT file
    - break up compound indices into subfolders.
- **'summary' histograms**
  - sum all xtals together
  - helpful w/ ideal mode since calibrations are identical for all xtals
    - gives factor x1600 statistics increase
    - can omit single xtal histograms which take up large amount of memory.
    - mostly helpful w/ ideal mode simulations

genGCRHists Histogram Samples
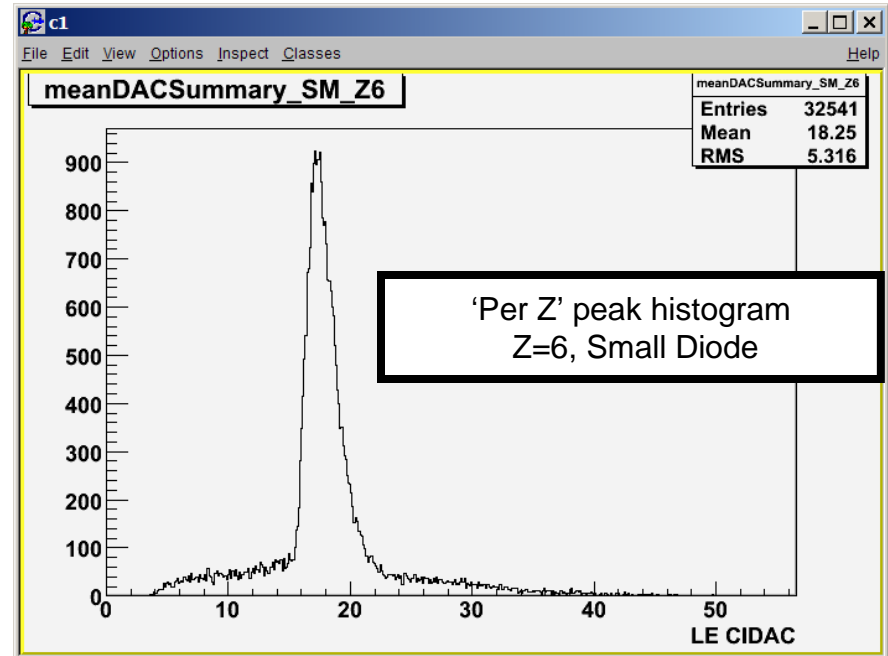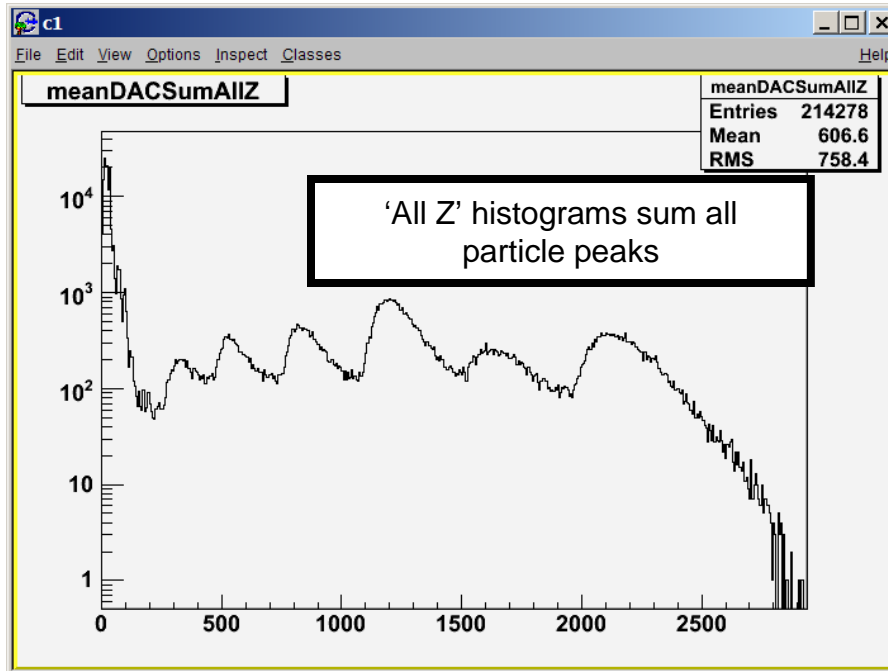

'ADCRatio' histograms for inter-adc range ratios
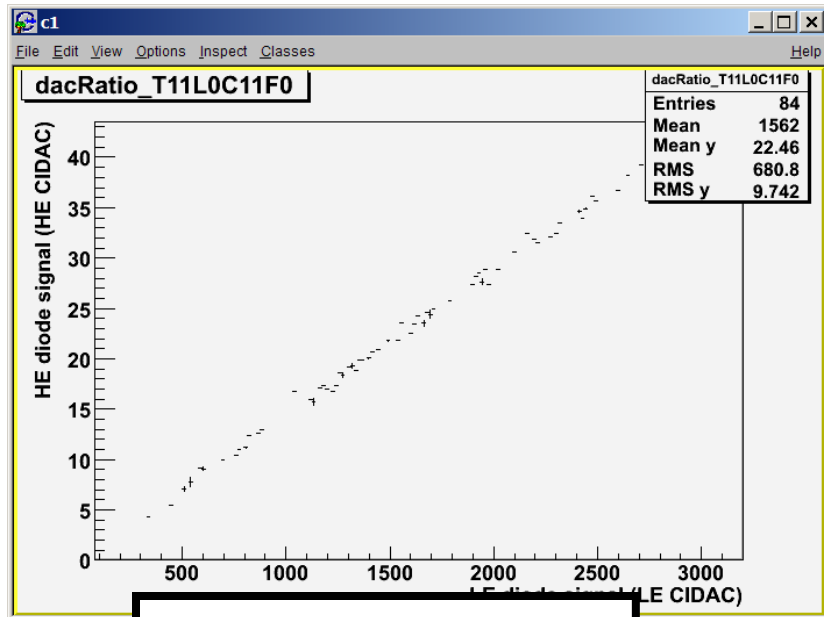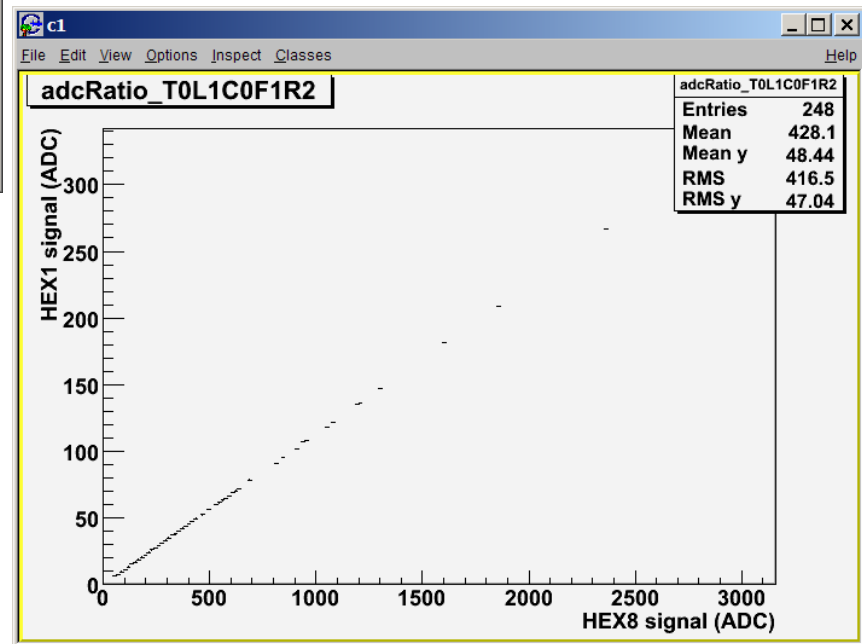
'DACRatio' histograms for small 2 large diode signal ratio

Note: these are simplified since we are using 'ideal mode' calibrations

genGCRHists Histogram Samples (cont)

'All Z' histograms sum all particle peaks

'Per Z' peak histogram Z=6, Small Diode

genGCRHists Histogram Samples (cont)

Z distribution for run 61
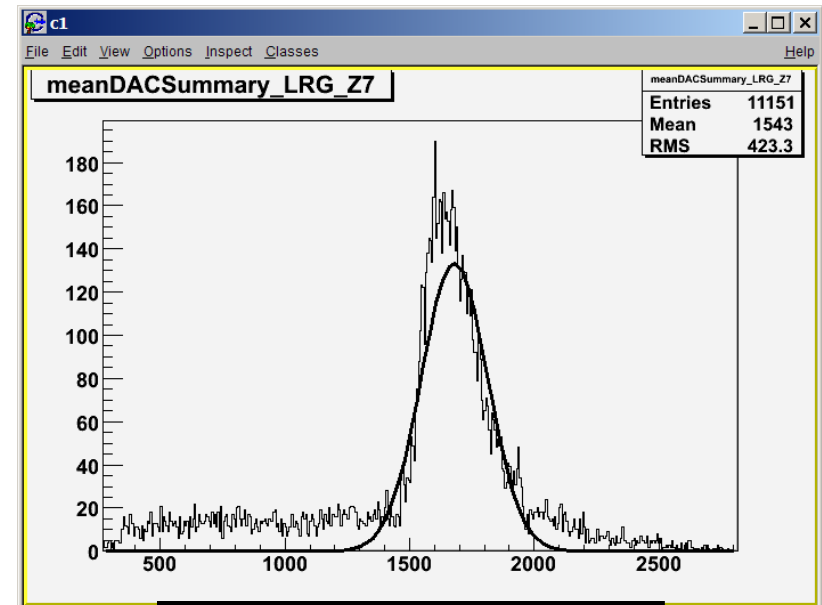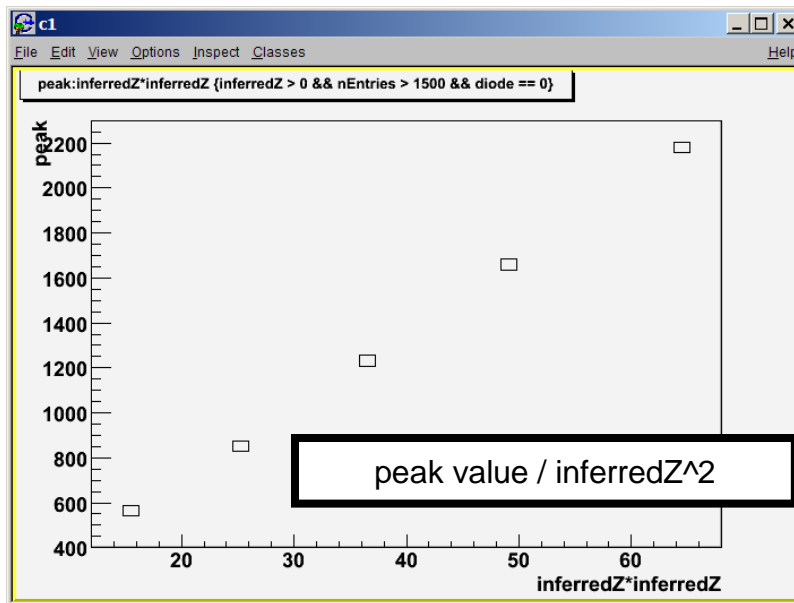'0' indicates unknown Z

'Per Z' peak histogram
Z=14, Small Diode
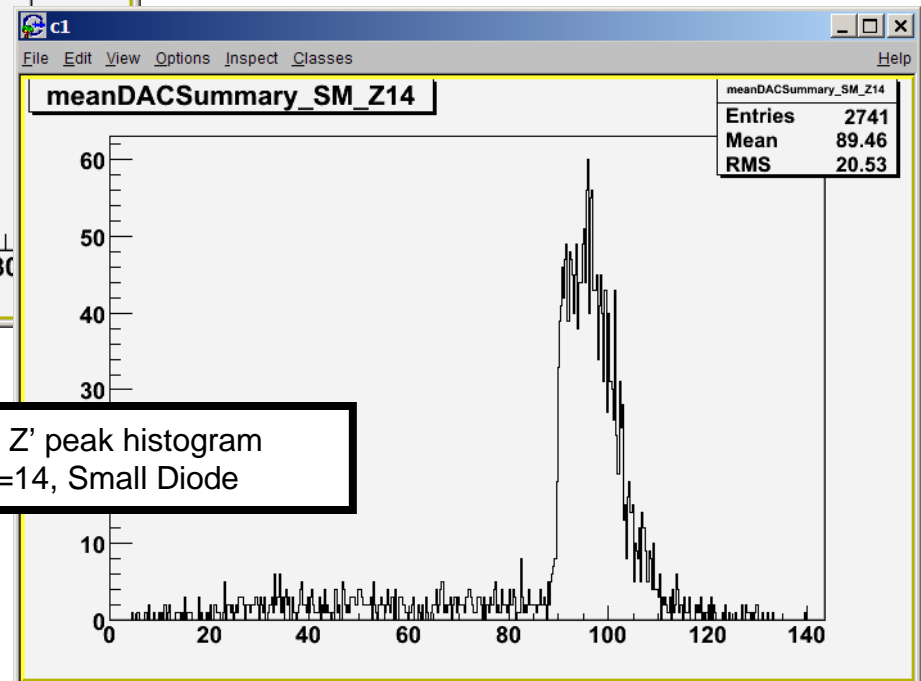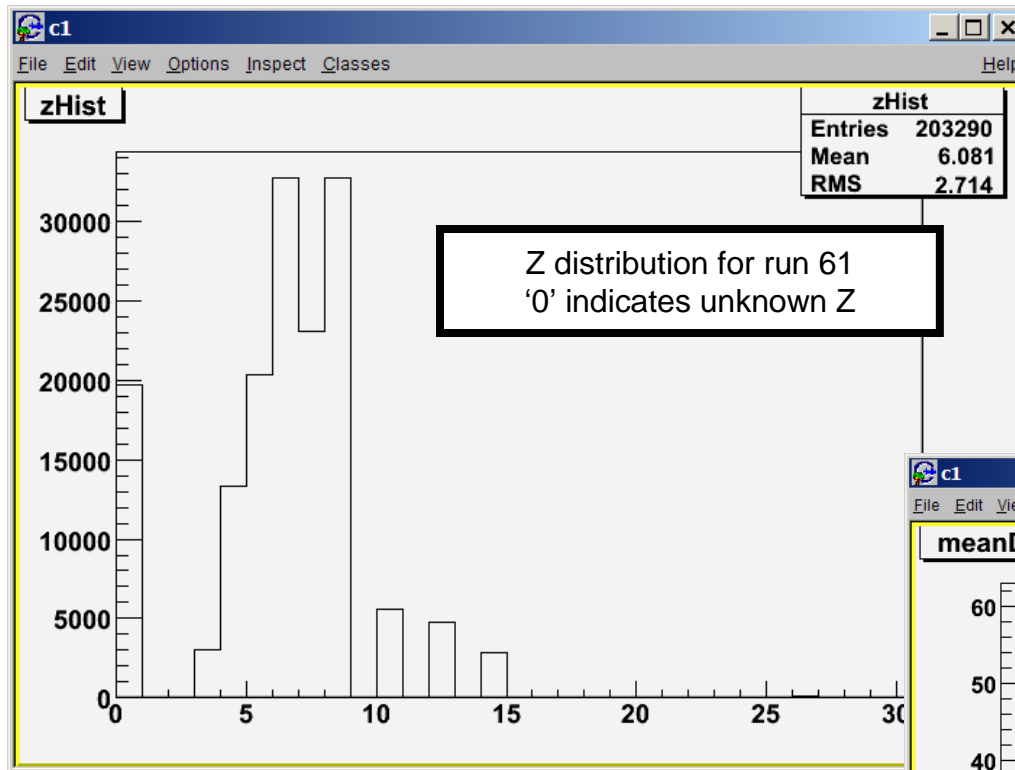
fitGCRHists

- **no real analysis yet, simple gaussian fits**

- **more complex fit shapes will be plugged in.**

- **fit results & other channel info stored in tuple for easy analysis / tweaking.**
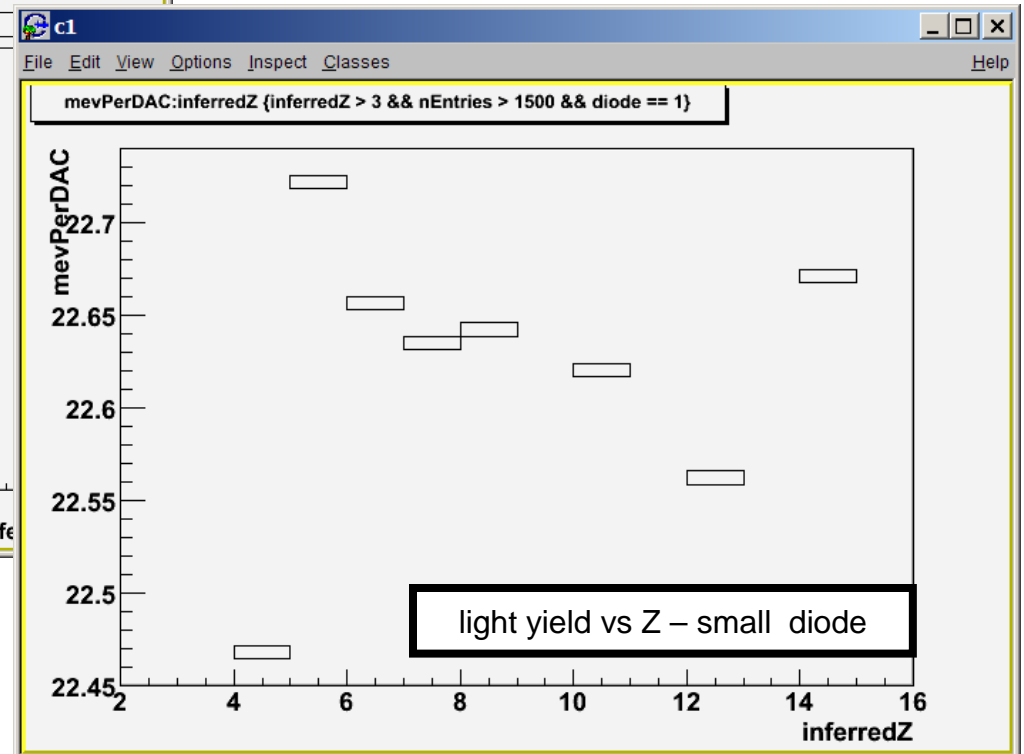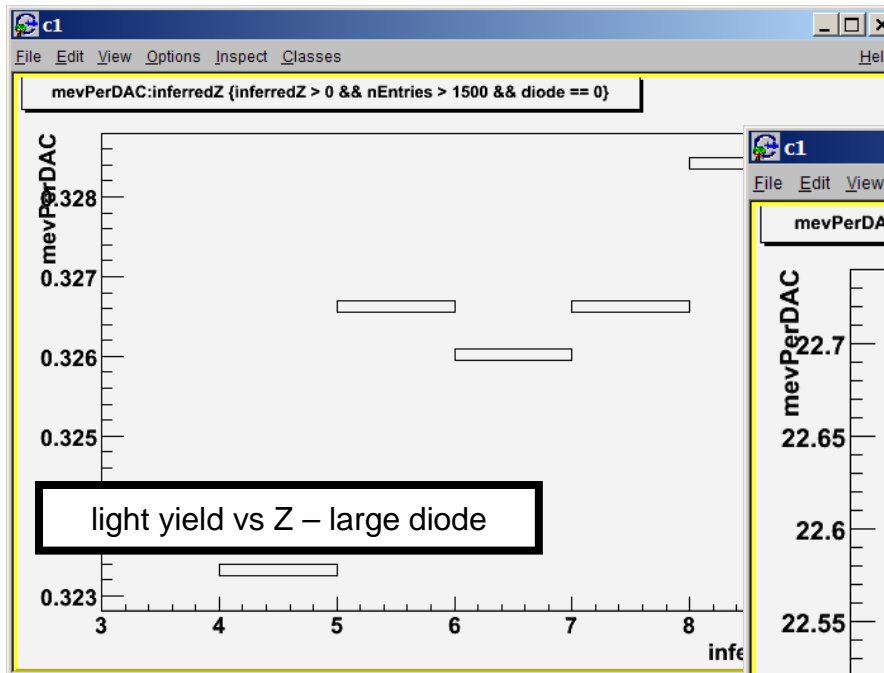

peak value / inferredZ^2

currently using rough Gaussian fits

fitGCRHists results

- **results are stable, but biased ~10% low**
  - **this is consistent w/ bias of Gaussian peaks**
  - **correct answers are .36 & 25**

light yield vs Z – large diode

light yield vs Z – small diode

Next Steps …

- **Improvements to peak shapes**
  - **A. Makeev investigating**
  - **currently testing lognormal, fits nicely but may need work to automate**
- **Use data w/ simulated HFC / TE4**
  - **simulations now exist @ lyon**
- **Real calibrations**
  - **will hold off for now to save processing time. (assuming peak shapes do not vary significantly w/ light yield)**
- **'calibrate' ADC peaks w/ MC truth energy deposits**
- **Quenching simulation**
- **Use Tracker track data**