INTT Online Monitoring

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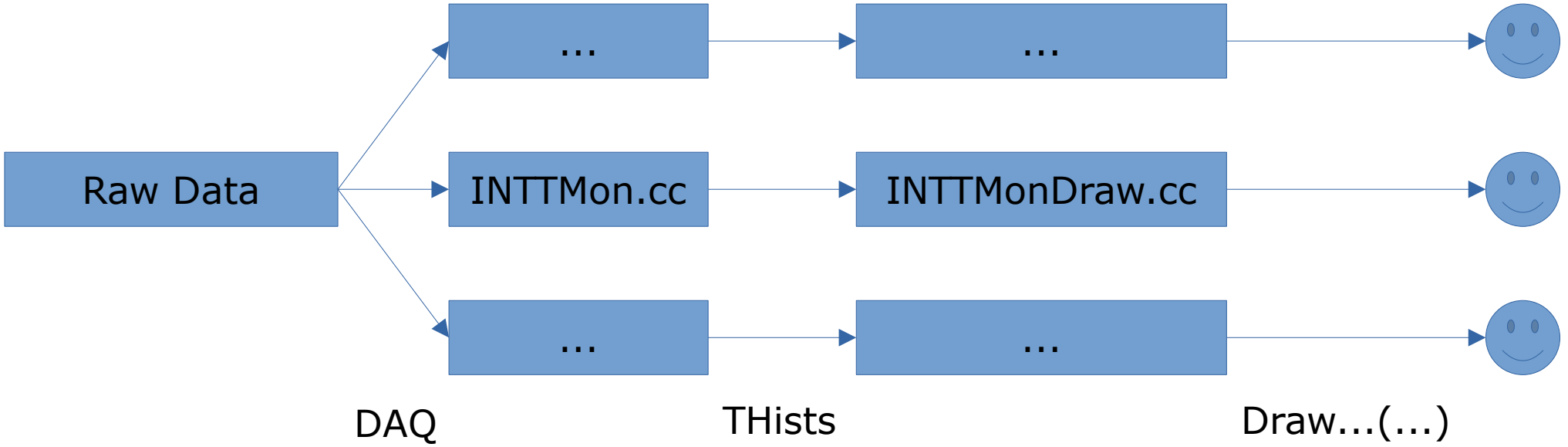
Online Monitoring Overview

- Raw data passed to OnlMon servers via the DAQ
- OnlMon servers parse the data and pass to OnlMon clients as histograms
- OnlMon clients contain drawing methods to show detector status
- Monitoring crew invokes those methods to view detector status

Online Monitoring Overview



INTT OnlMon Progress

- Found a satisfactory visualization scheme
  - Each layer has its own TH2D, a cell is a chip
  - Each chip has its own TH1D, a bin is a channel

- Hit Map

- ADC

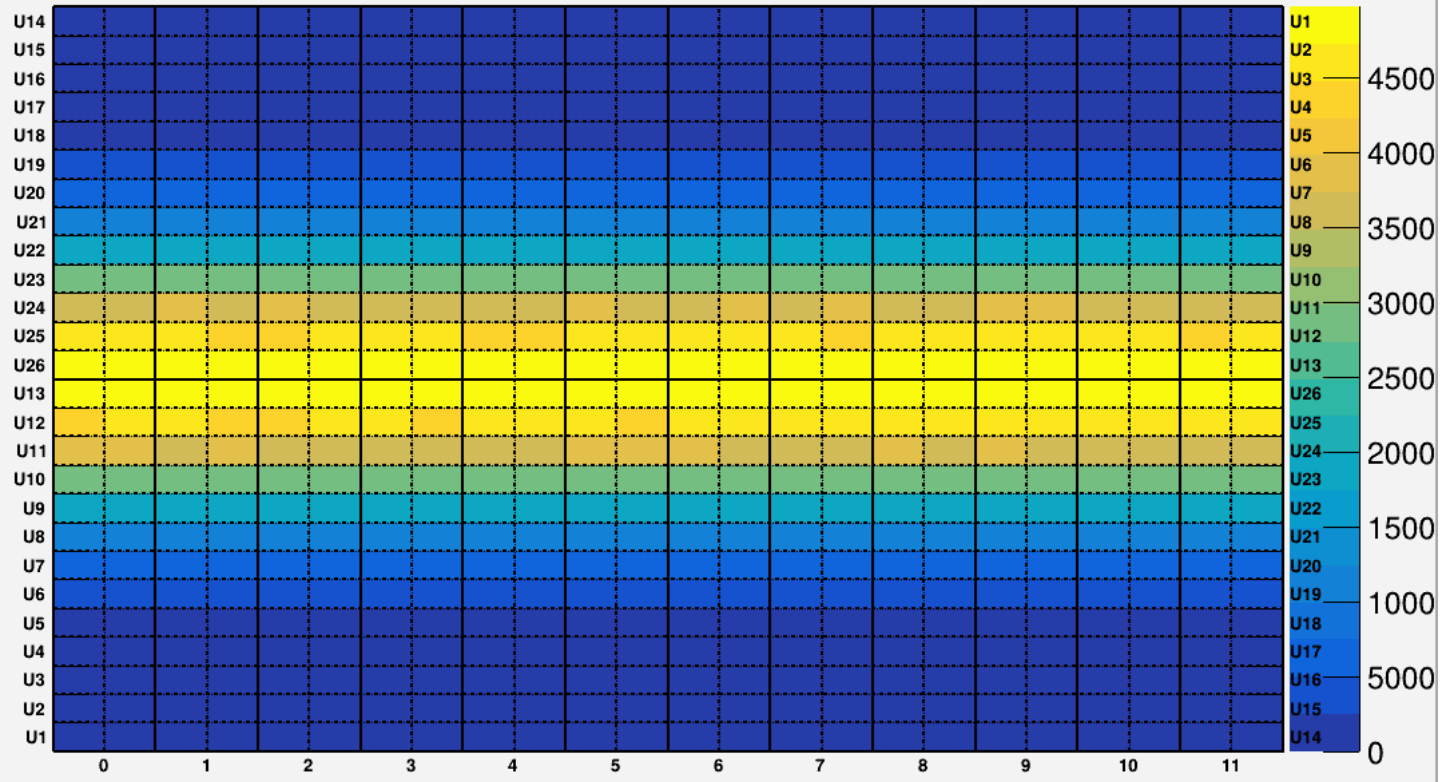
INTT HitMap

- Hit Map
  - Draw raw counts
  - Hit rates can be specified for each chip
  - Highlight chips based on z score (normalized hit map)
  - Very easy to change numbering conventions with LAYER_OFFSET and CHIP_OFFSET variables

- To do:
  - Choose a key/labeling convention (explained on next slide)
  - Consider adding method to draw the HitRates (to compare visually to raw counts)
  - Add labels and titles manually

INTT HitMap

14	1
15	2
16	3
17	4
18	5
19	6
20	7
21	8
22	9
23	10
24	11
25	12
26	13
13	26
12	25
11	24
10	23
9	22
8	21
7	20
6	19
5	18
4	17
3	16
2	15
1	14



Example hitmap for Layer3 (innermost layer)

INTT HitMap

Given:

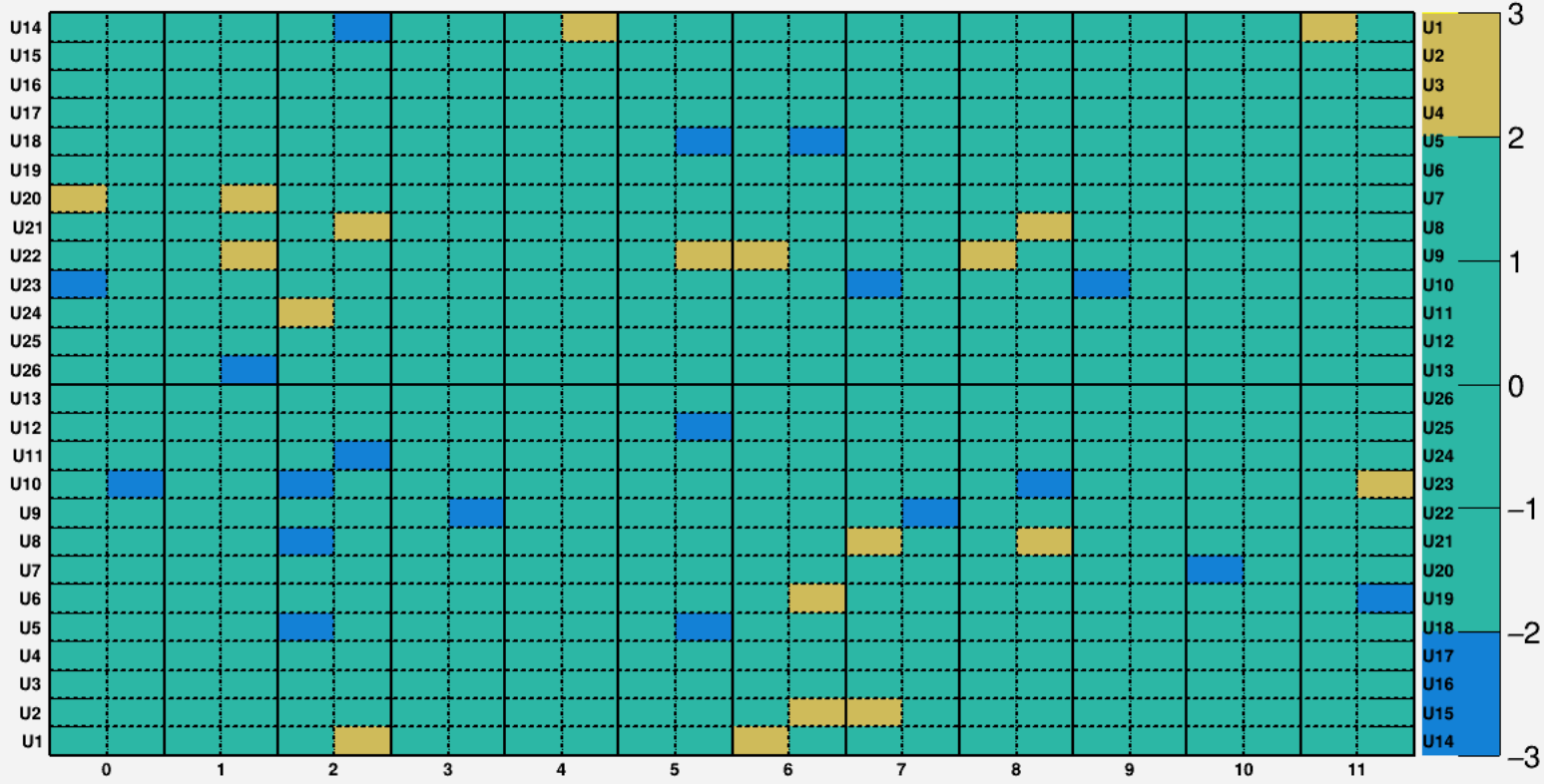
- A chip's hitrate (mean number of hits / event)
- Number of events

Known:

- Probability distribution of total hits on the chip (Poisson)
  - Mean = HitRate * NumEvents
  - Std. Dev. = sqrt(Mean)

- Can draw the z scores of chips (Hits – Mean) / (Std. Dev.)
- Can highlight chips with a z score above/below +/-n

INTT HitMap



Example normalized hitmap for Layer3

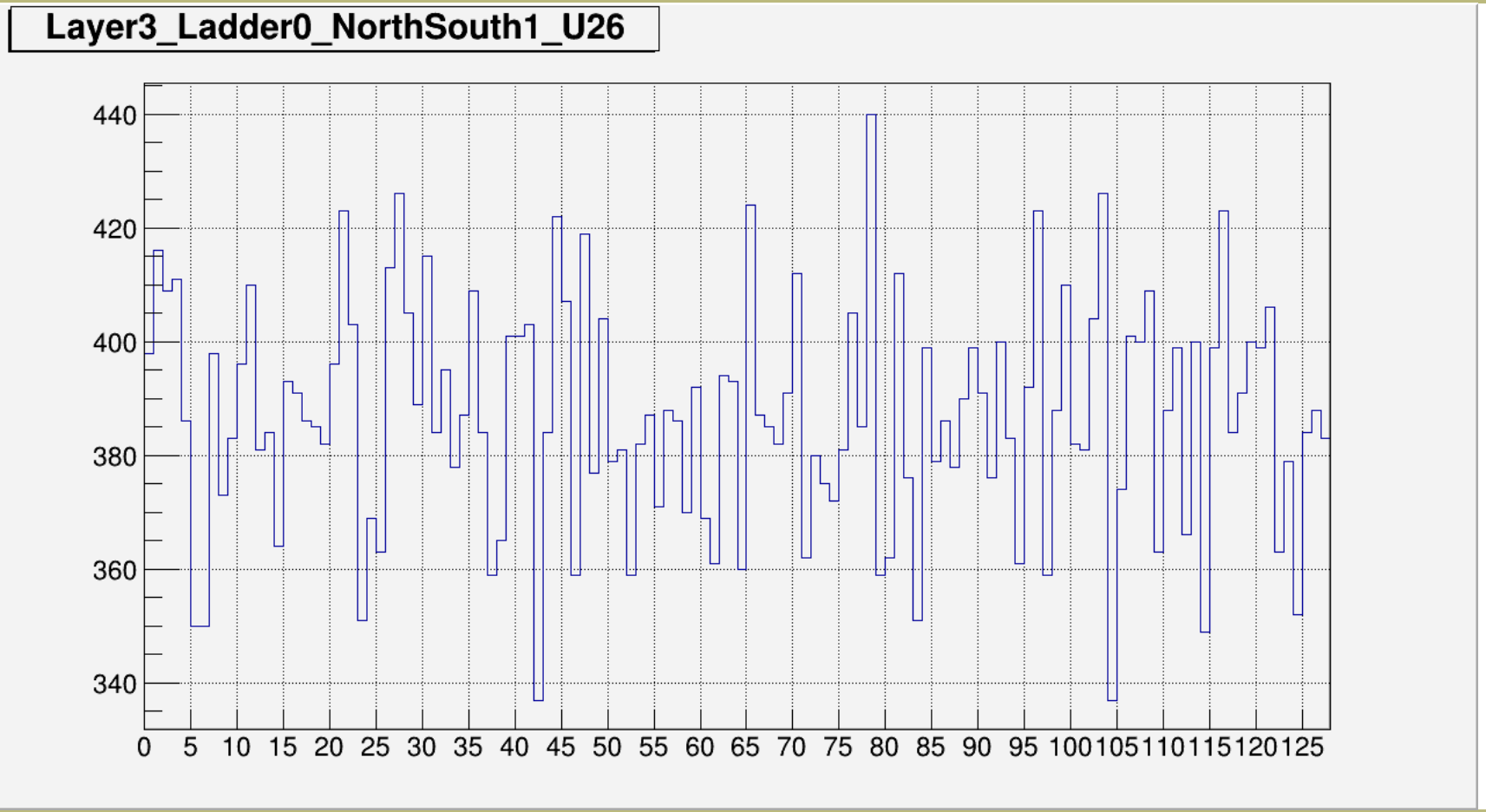
INTT HitMap

- Equipped to specify a hit rate for each chip
  - Could be z/eta dependence
  - Could be radial dependence

- In principle, could be done per channel as well, however:
  - A chip’s channels only vary in phi relative to each other
  - There isn’t a reason to suspect variation with phi

- Since the channels only vary in phi, each chip has a TH1D representing the hits by channel:

INTT HitMap



Example channel hitmap for chip 26 in: Layer3 Ladder0 (north half)

INTT ADC

- Draw the chips of one or more INTT layers showing
  - Chips’ mean ADC
  - Chips’ ADC Std. Dev.
  - Chips’ mean channel
  - Chips’ channel Std. Dev.
  - Energy weighted method
  - …

INTT ADC

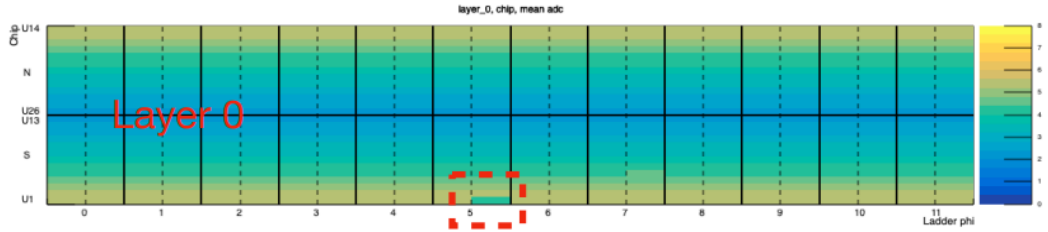
- Draw 1D histograms
  - By chip "ring" (all channels/chips with same z coordinate)
    - 1 bin for both chips with the same z coordinate per ladder
    - 1 bin for each chip with the same z coordinate per ladder
  - By half ladder
    - 1 bin for chip in a half ladder
    - Chip indexes shown on x-axis for the entire layer (possibly adjust this)

- Some examples from Cheng-Wei's recent presentation:

INTT ADC

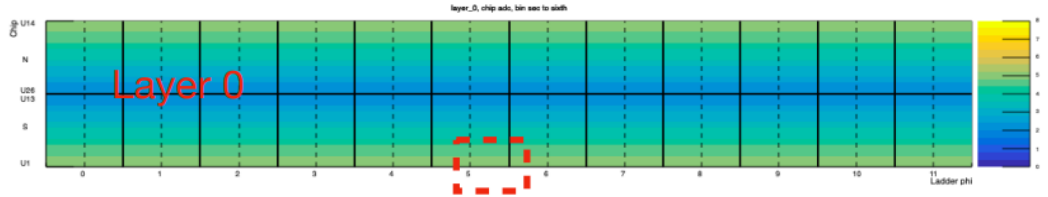
Draw_adc_overall (0)

Overall - adc value
(avg value from stats box)



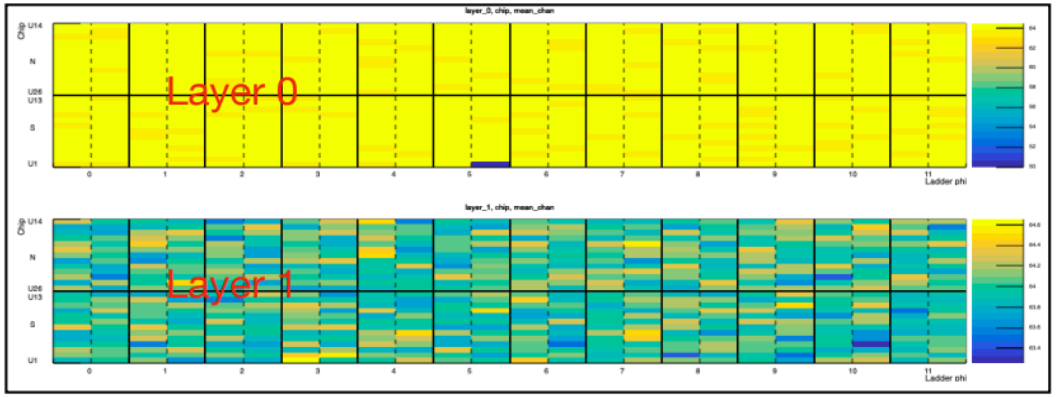
Draw_adc_overall (5)

Overall - adc value
(energy weighted method)
(bin 2nd ~ bin 6th)



Draw_adc_overall (1)

Overall - mean chan
(avg value from stats box)



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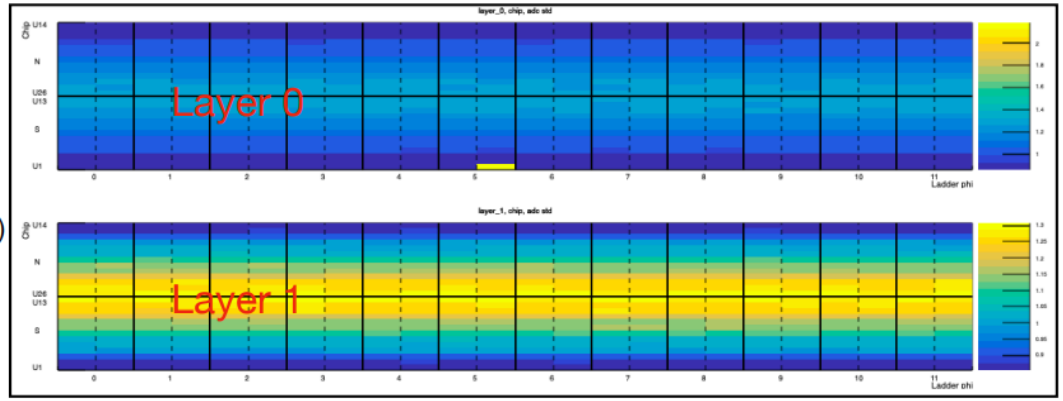
INTT ADC

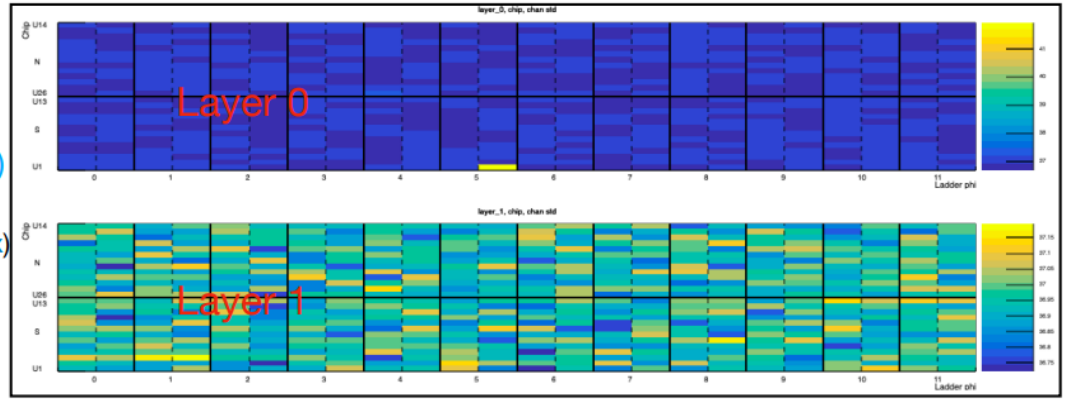
Draw_adc_overall (2)

Overall - adc stddev
(avg value from stats box)



Draw_adc_overall (3)

Overall - chan stddev
(avg value from stats box)



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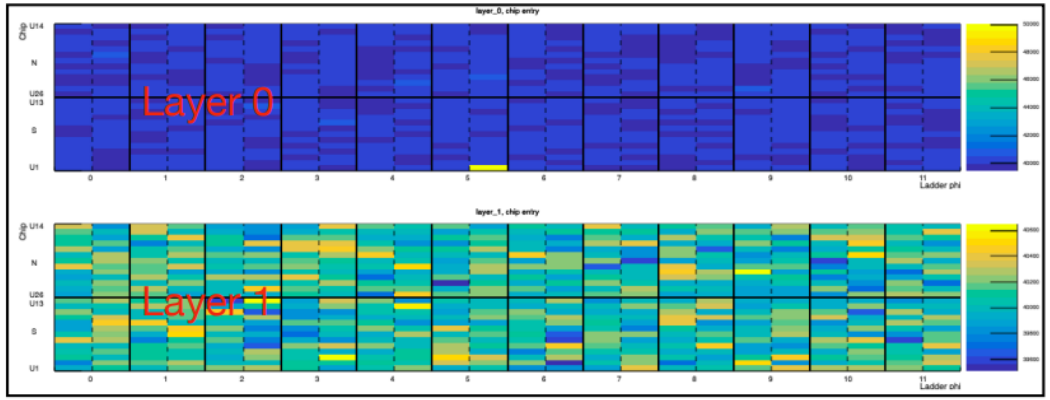
INTT ADC

Draw_adc_overall (6)

Overall - chip entry
(avg value from stats box)



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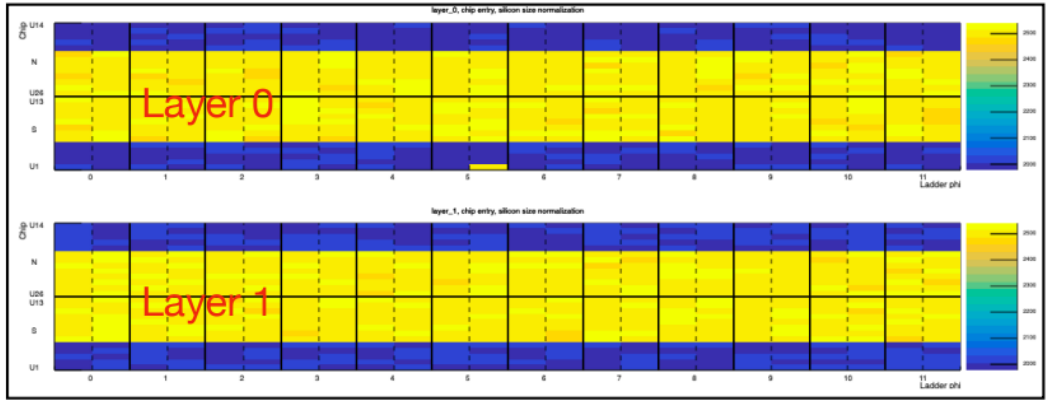
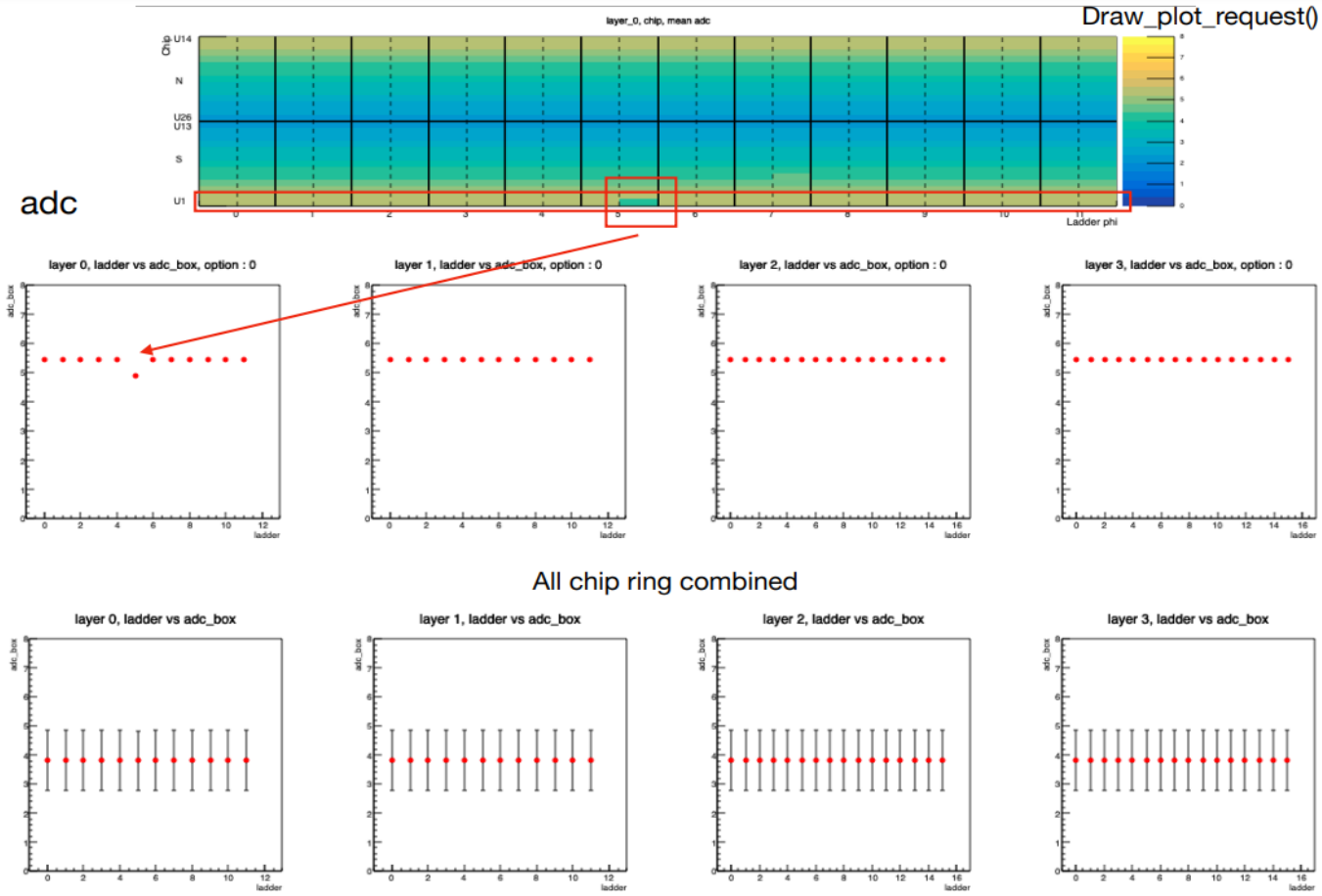
Draw_adc_overall (7)

Overall - chip entry normalized
(avg value from stats box)

Due to the difference of strip length of type A and B



INTT ADC



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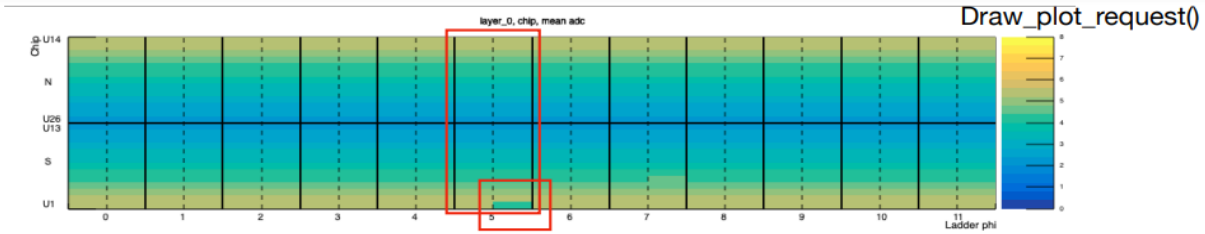
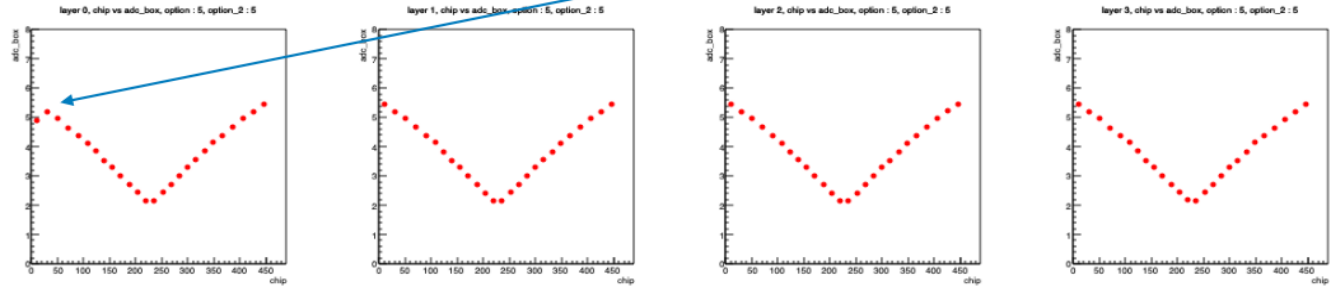
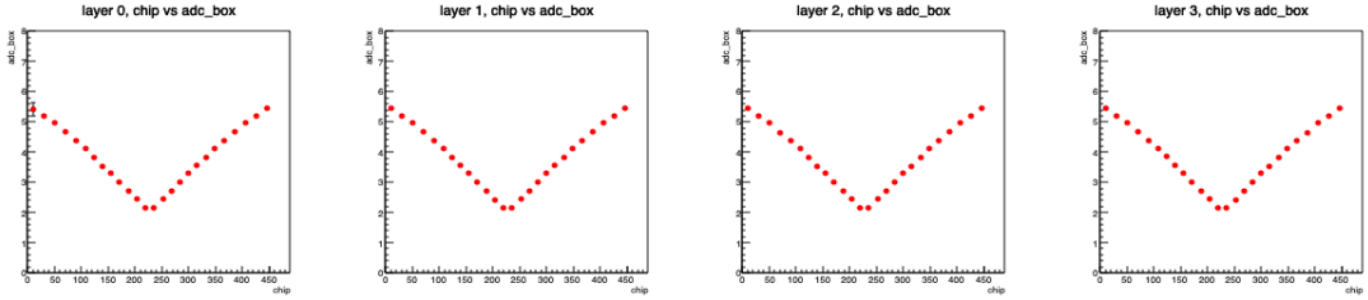
INTT ADC



adc



All chip ring combined



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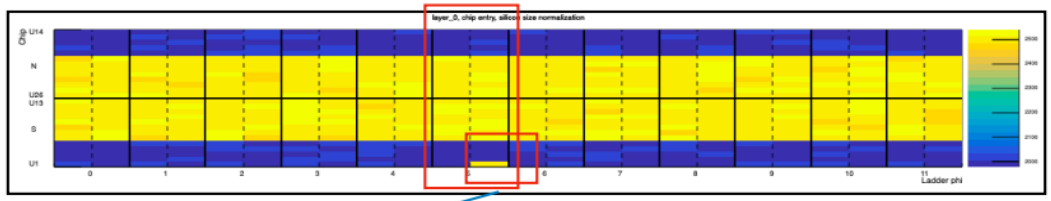
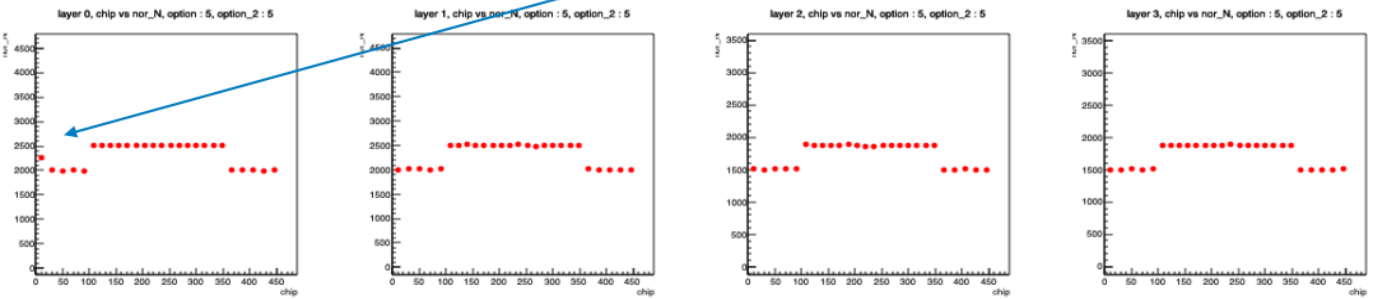
INTT ADC

Draw_plot_request()

N hit





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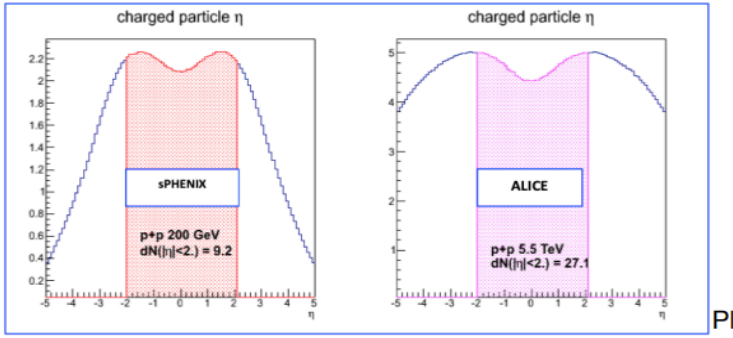

Something we should see with data

Plots from MVTX

INTT ADC

- Something to add is:
  - Given a theoretical ADC distribution per chip, compute the negative log likelihood (NLL) of the measured ADC distribution
    - Know distribution of each bin for the ADC chip—compute its z score using the mean and std. dev.
    - The NLL should be half the sum of the squares of the z scores (approx. as Gaussians)
    - Compare the NLL with, for example, -ln(0.05) or ln(0.01) for 2-sigma or 3-sigma significance
    - If greater, can highlight the chip

Future OnlMon Tasks

- Hit multiplicity per event by packet ID
  - functionally similar to current hitmap implementation

- Hit multiplicity per event by packet ID vs. time
  - Will be similar to current hitmap implementation—maybe show current hitmap visualization and normalize by time

- DAQ errors by packer ID