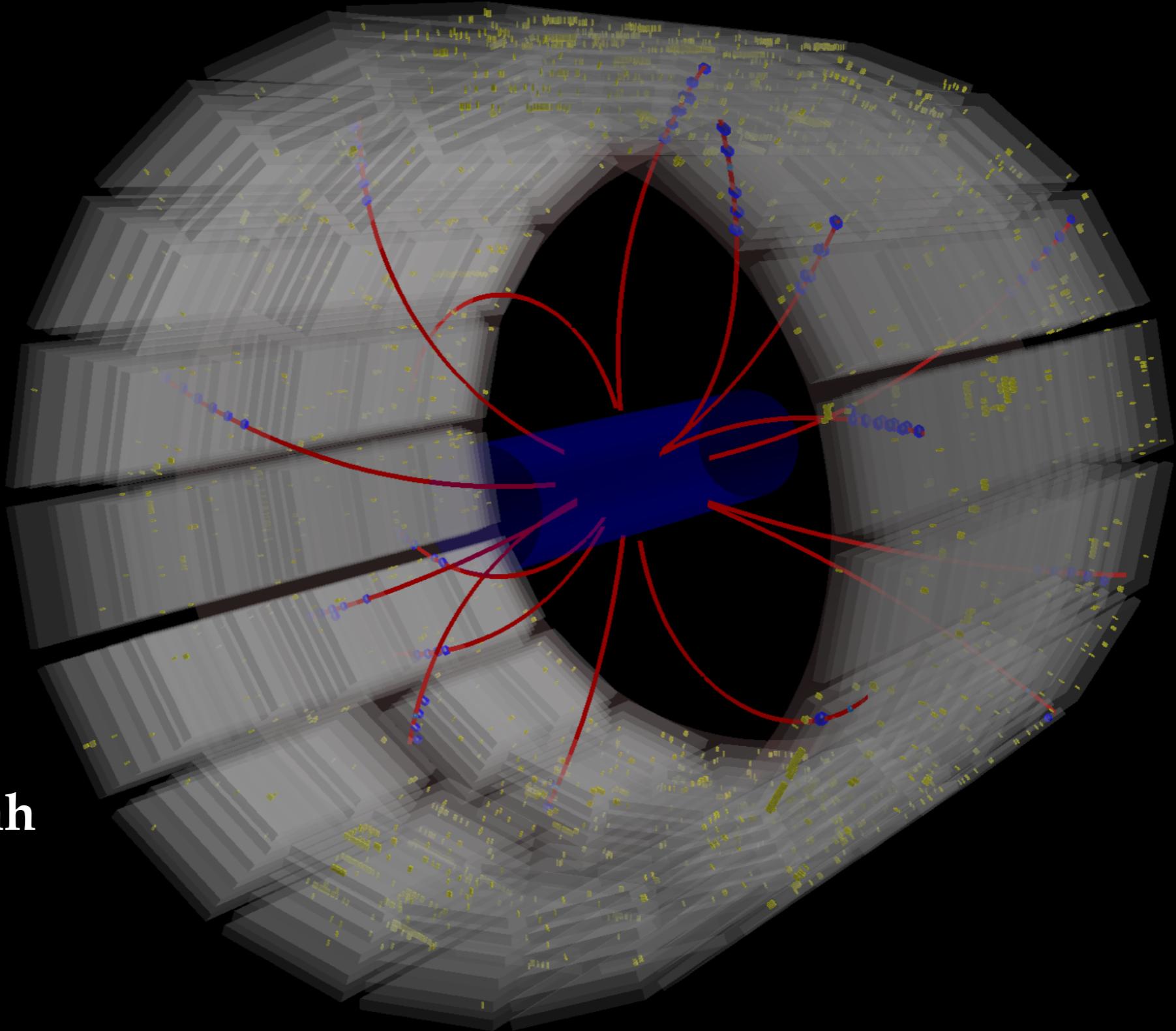


# Krypton Calibration Status Report



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Alexander Schmah  
University of  
Heidelberg  
26.07.2018



# Cluster Finder

- **AliTRDclusterFinderKr:**

1. Replaced THnSparse by TTree (new header + ADC class, optimized for low memory usage), estimated output size of all trees: ~70 GB.
2. Changed grid submission macro to something more up to date.
3. Bug(s) removed, e.g. wrong array length.
4. Replaced array initialization loops by memset.
5. Replaced max ADC finder loop (~70000 loops) by dynamic vector (~10 loops).

→ Programm speed up by a factor 10. One loop for one file takes now ~51s, comparable with the initialization time for the file.

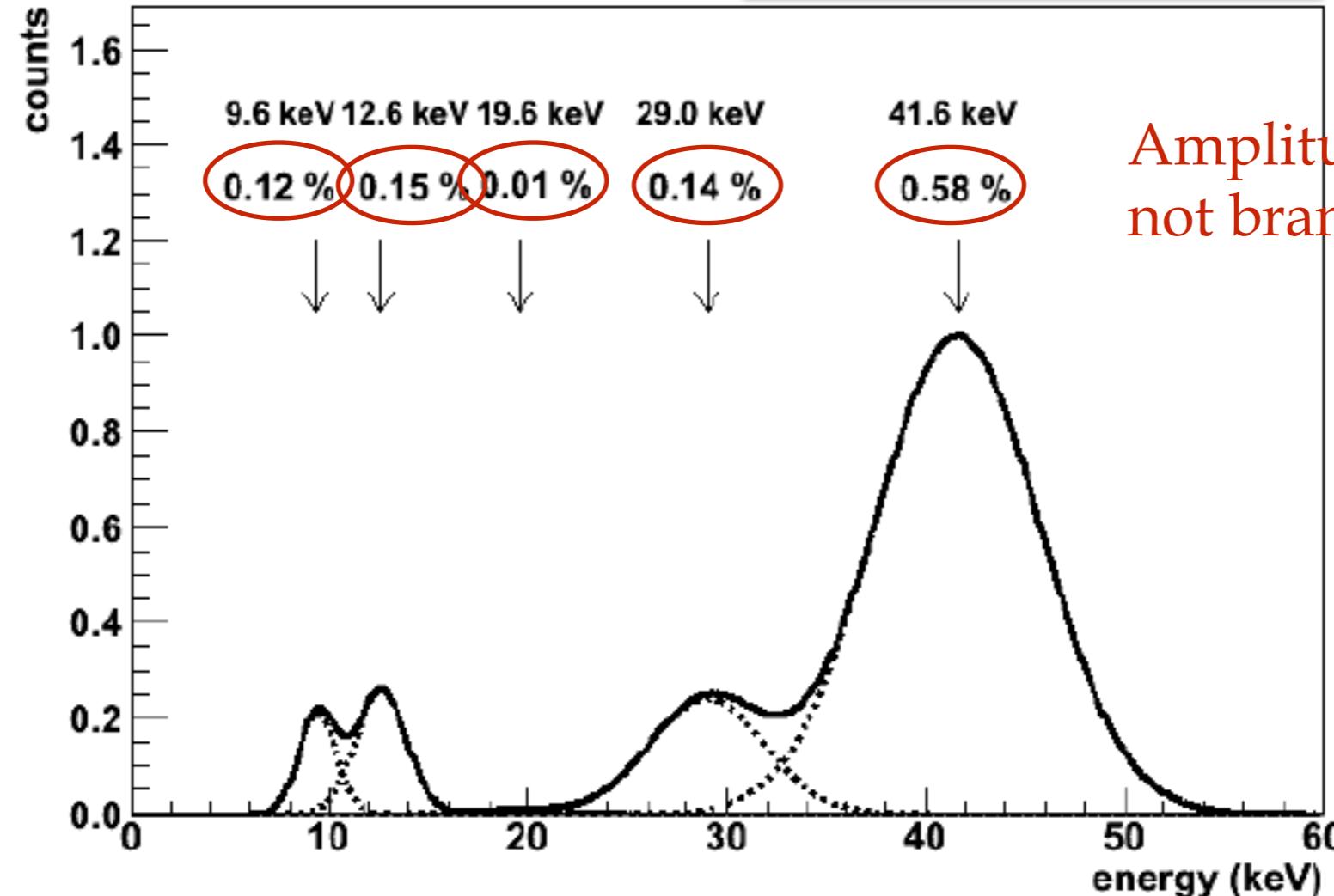
### Additional comments:

- 3 out of 33 Krypton files ended in a different output directory on the grid. Reason unknown. We need to be careful to get all the data.
- The **reconstructed** Krypton output trees (input trees for the cluster finder) on the Grid are somehow inefficient. For each trigger with about 5 Krypton events we have one directory with one tree. 8000 triggers/file. This is a very inefficient way of storing the data for I/O reasons.



# Krypton Decay

Johannes Stiller, Diplomarbeit

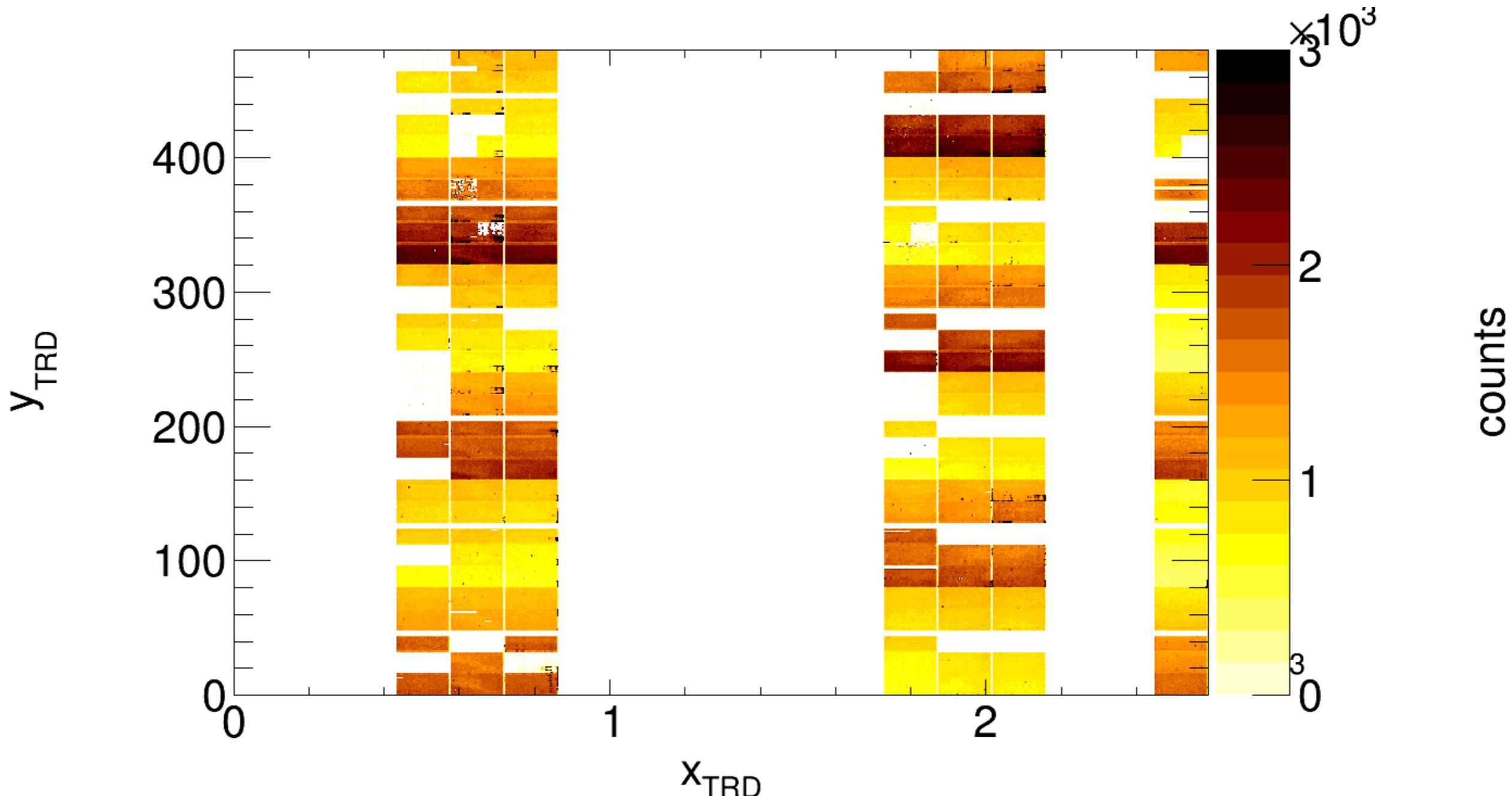


Amplitudes,  
not branching ratios...

**Figure 5.2.:** Expected  $^{83}\text{Kr}$  decay spectrum. Shown are the individual decay peaks at 9.6 keV, 12.6 keV, 29.0 keV and 41.6 keV (dashed lines), convoluted with a 10 % design energy resolution of the TRD [7]. In addition the branching ratio of each decay is displayed, estimated according to table 5.2. The peak at 19.6 keV is barely visible, due to the low branching ratio. The solid curve represents the complete spectrum.



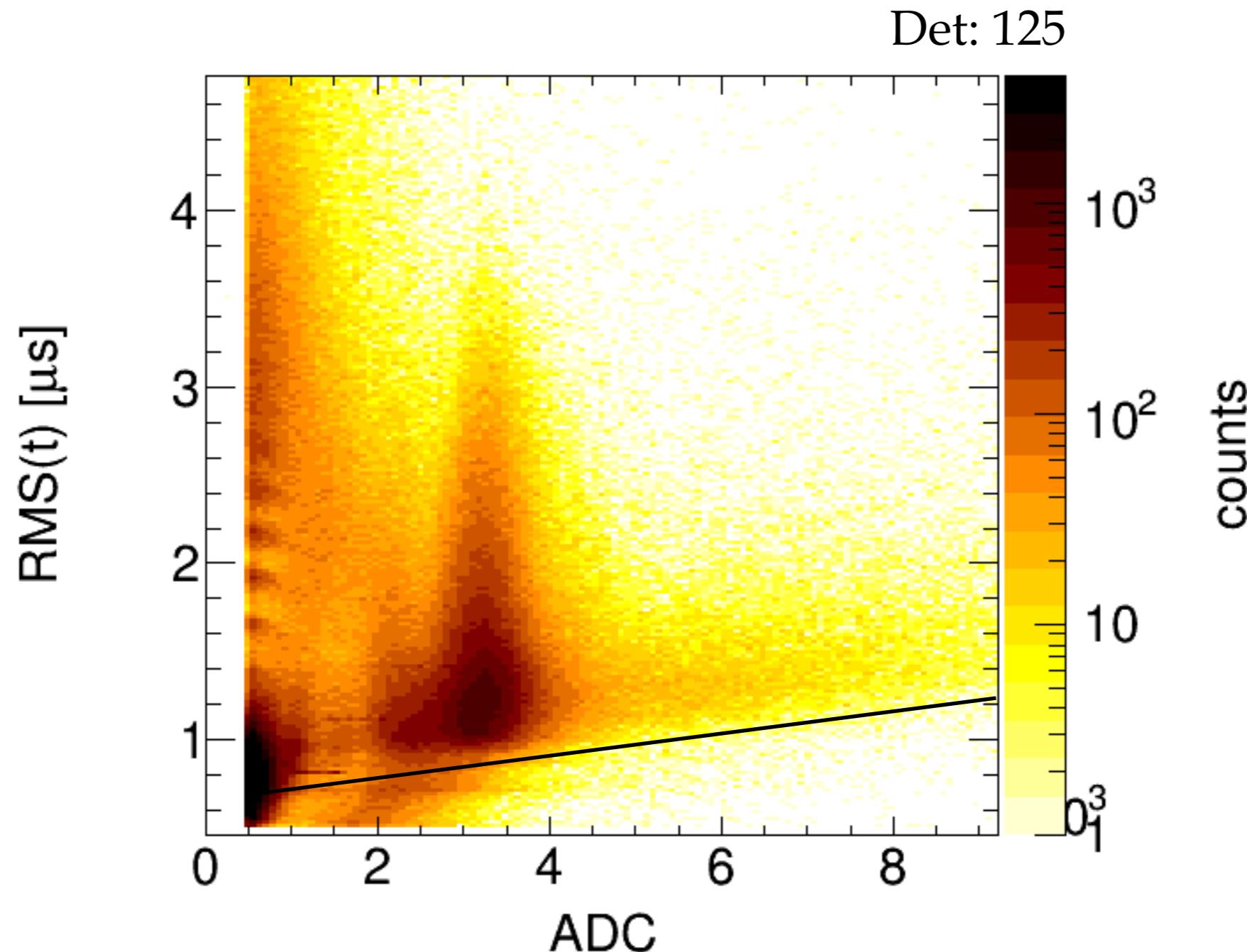
# Pad Counts



- So far only 5 test files out of 33 total files are produced.
- Ana\_Krypton\_clusters.cc + Ana\_Krypton\_clusters.h



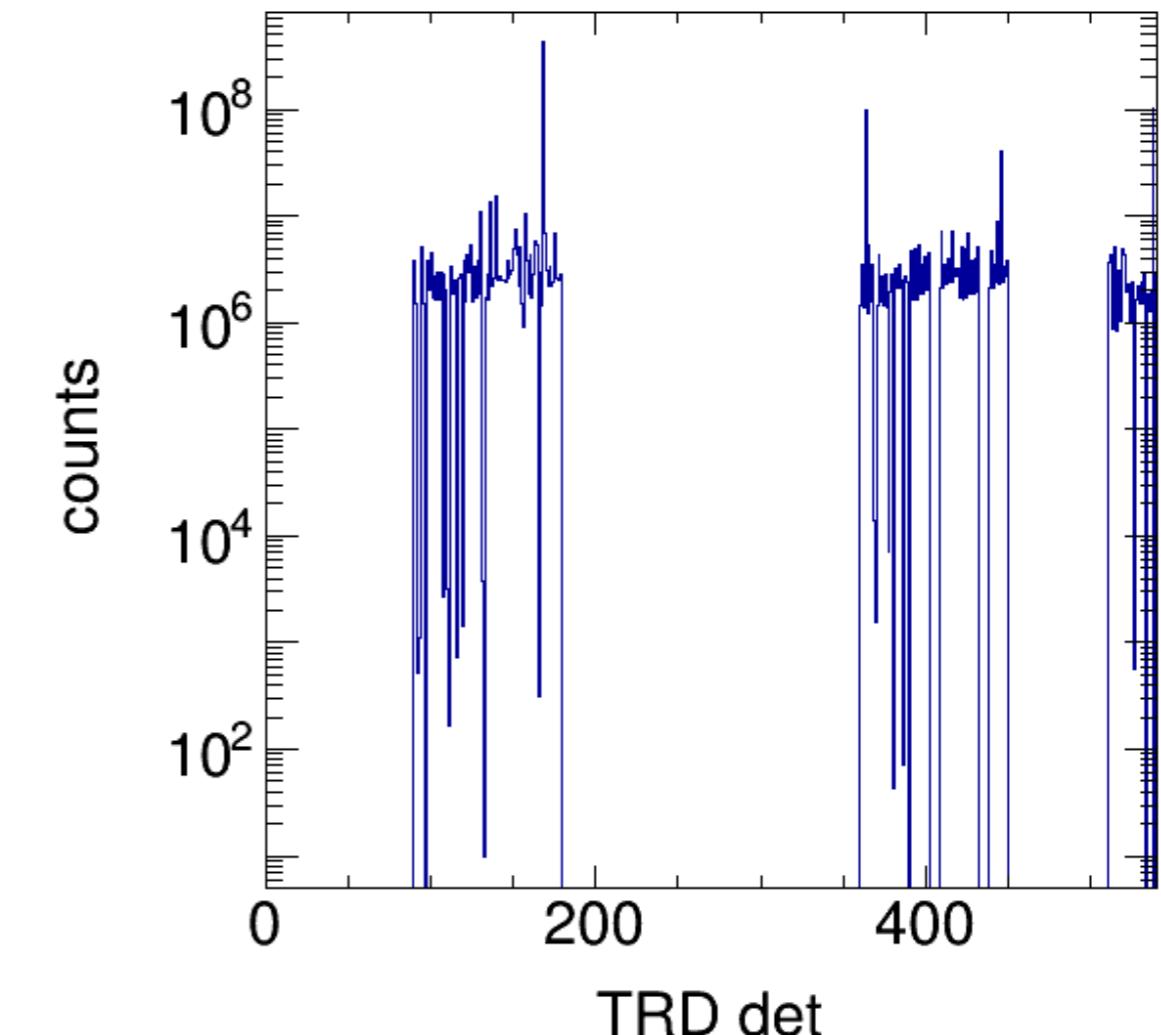
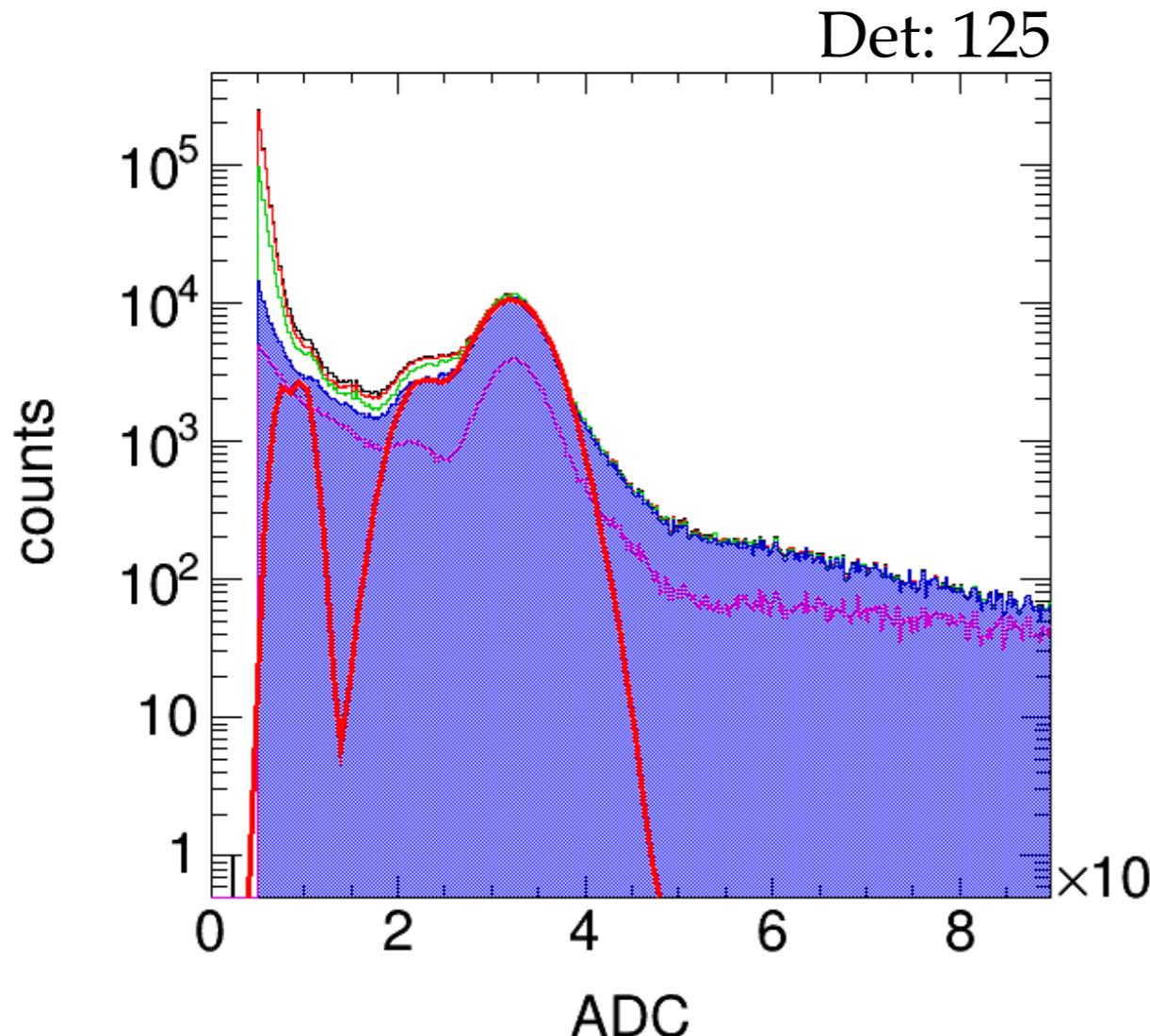
# RMS( $t$ ) vs ADC Spectrum



- Not clear so far how to apply cuts...



# ADC Spectra Example



- Preliminary 4 Gauss fit applied, 3 parameters so far.
- Different colors correspond to different preliminary cuts in RMS(t).



# Next Steps

- Loop over the full statistics, should be fast with the factor 10 speed up .
- Apply pressure correction, eventually not only for chambers but also for pad clusters.
- Do the fits for all pads...

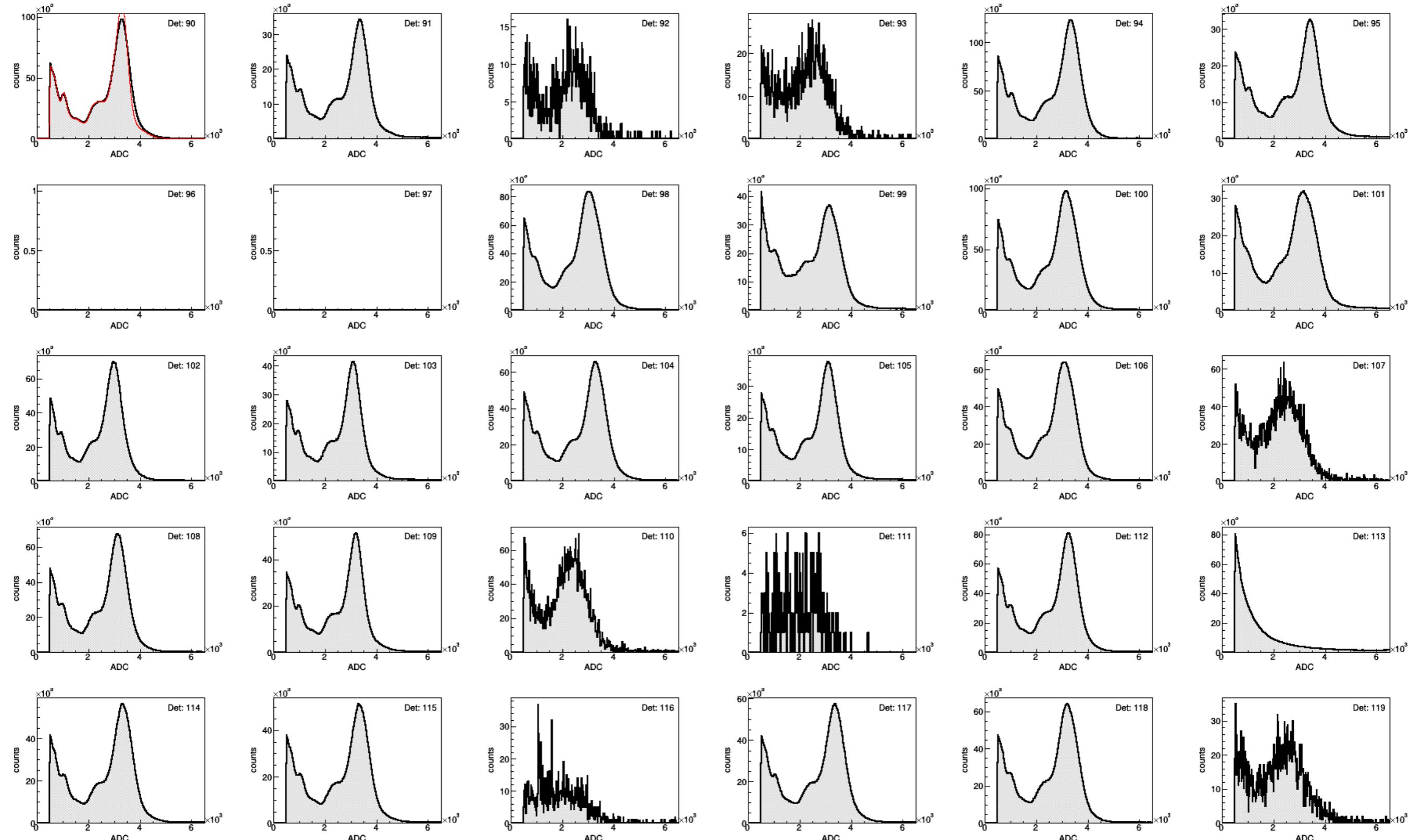


# Status: 02.08.2018

- Full statistics produced, can be done now within 1-3 days, size ~70 GB.
- Focus so far on detector 90 as an example.
- Pressure correction done, each chamber subdivided into 8 rows X 9 column bins for pressure correction.
- Histograms for individual pads already filled.

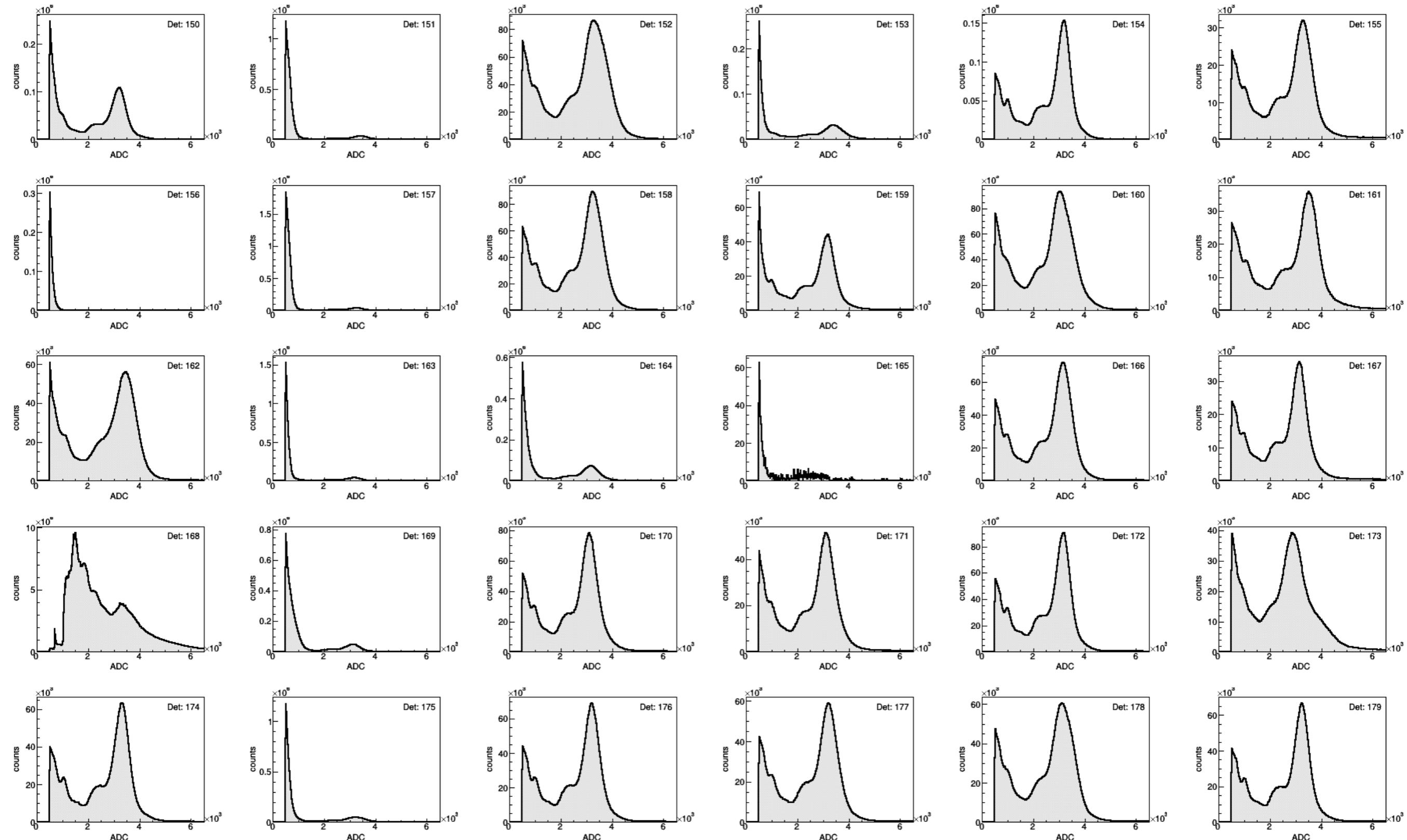


# Sector 3



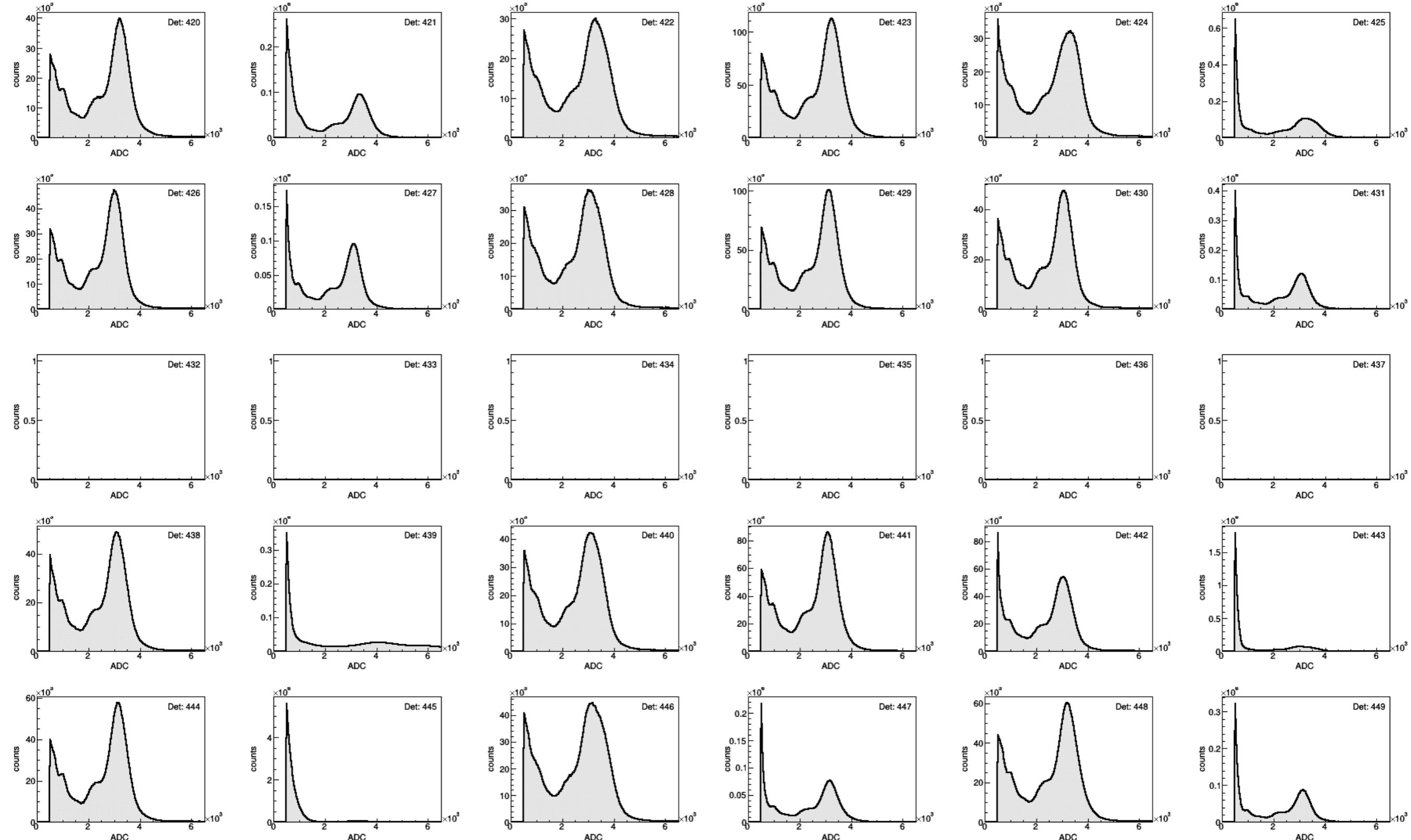


# Sector 5



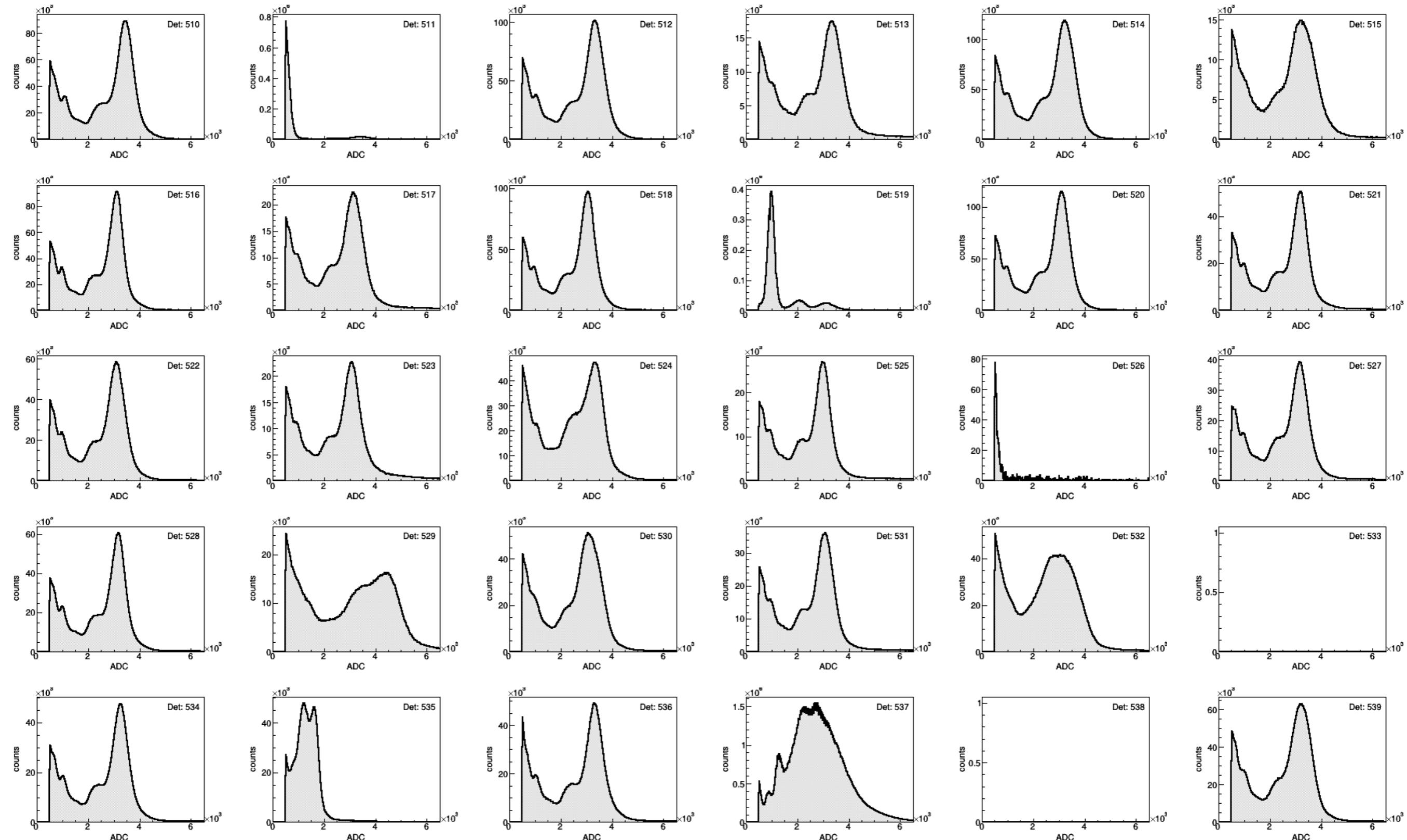


# Sector 14



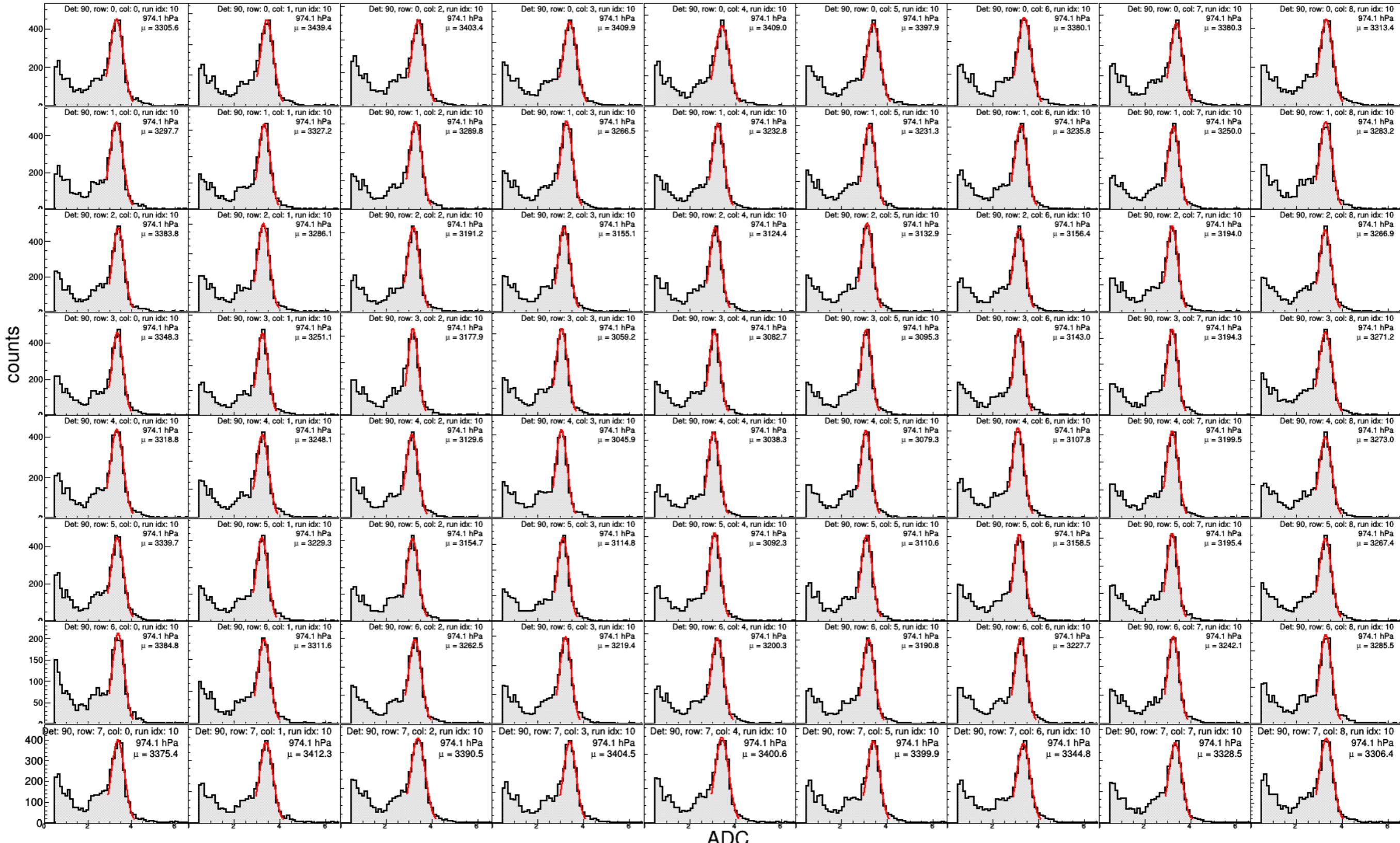


# Sector 17



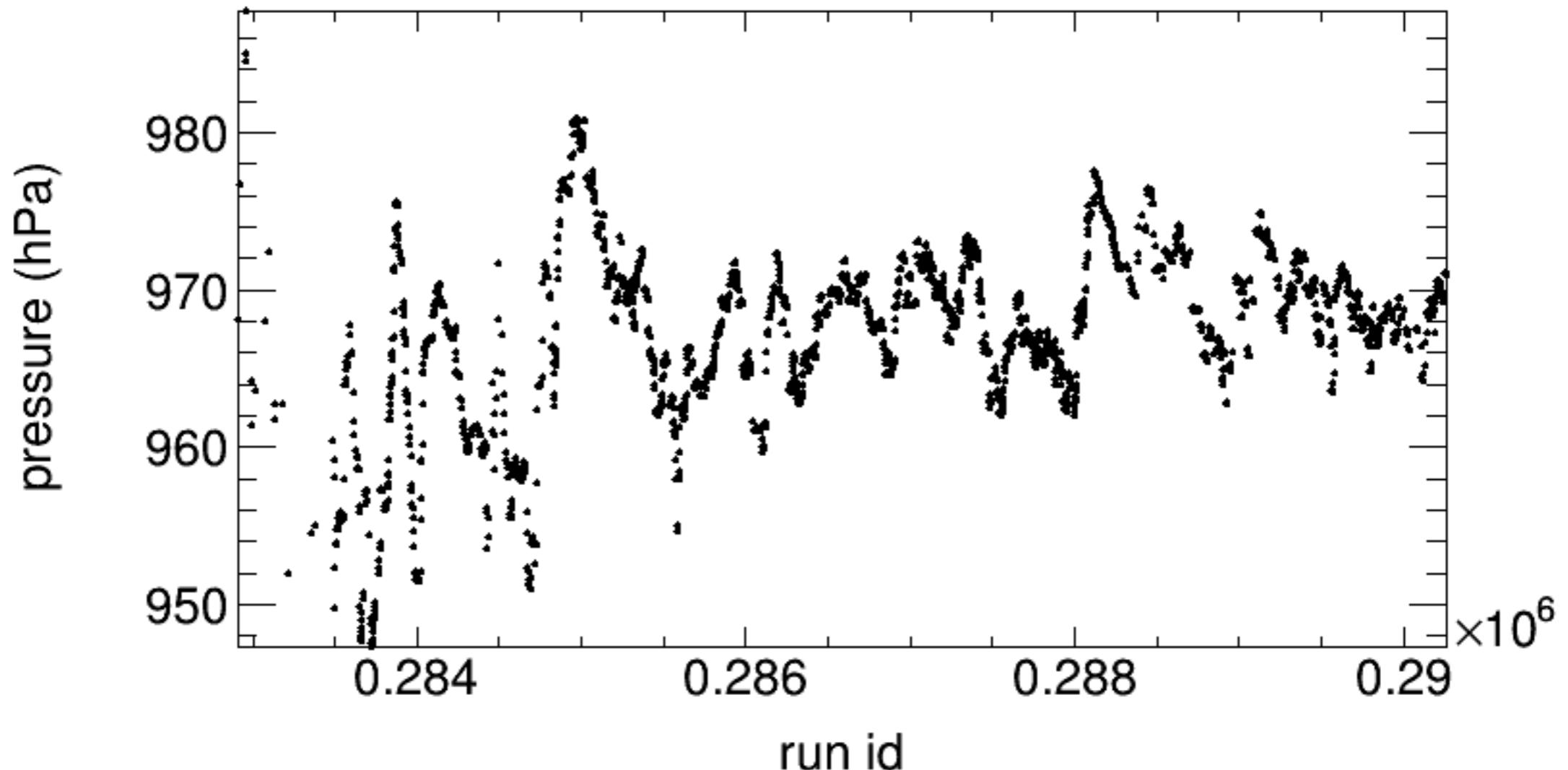


# Det 90 ADC Spectra



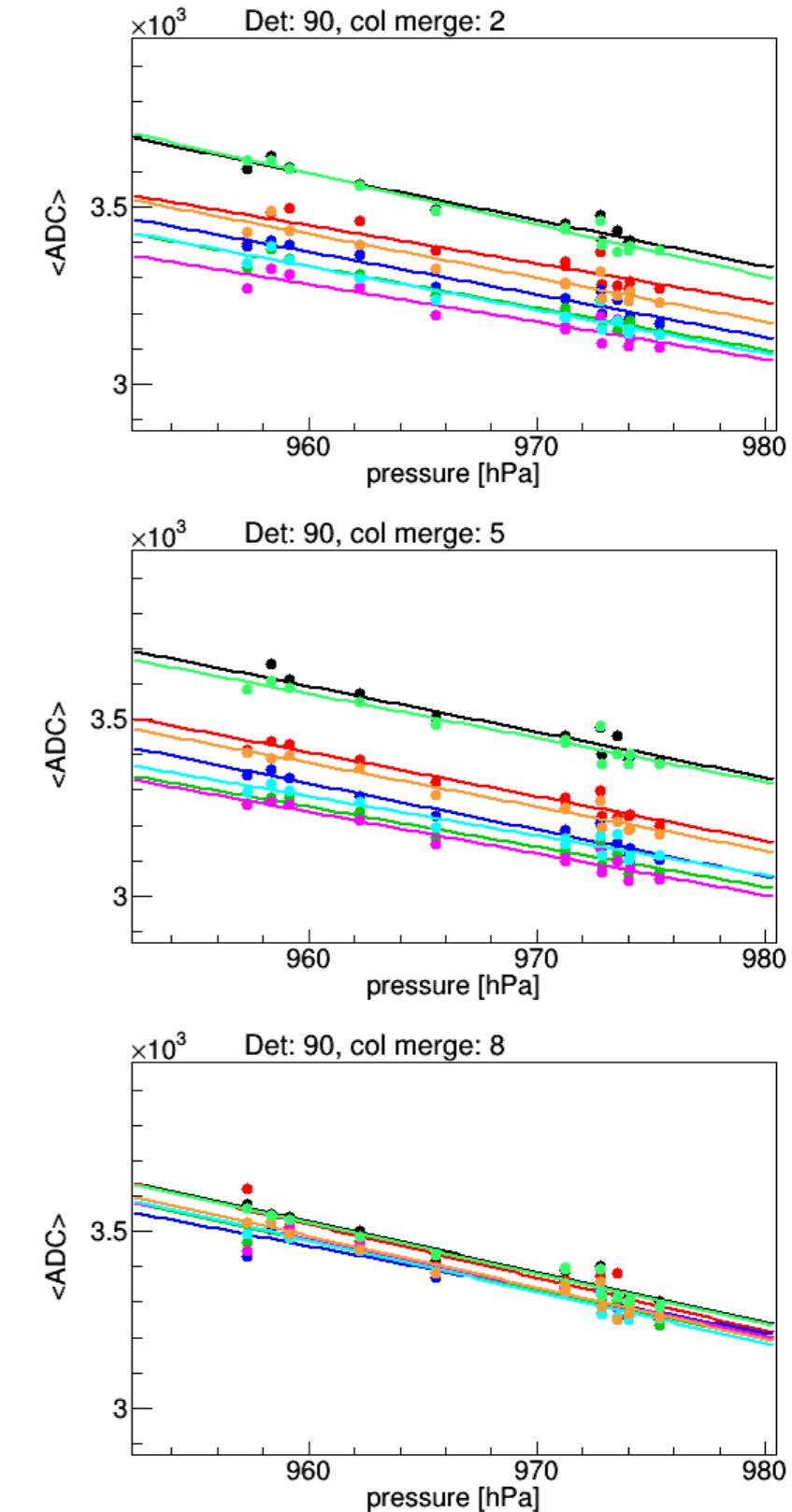
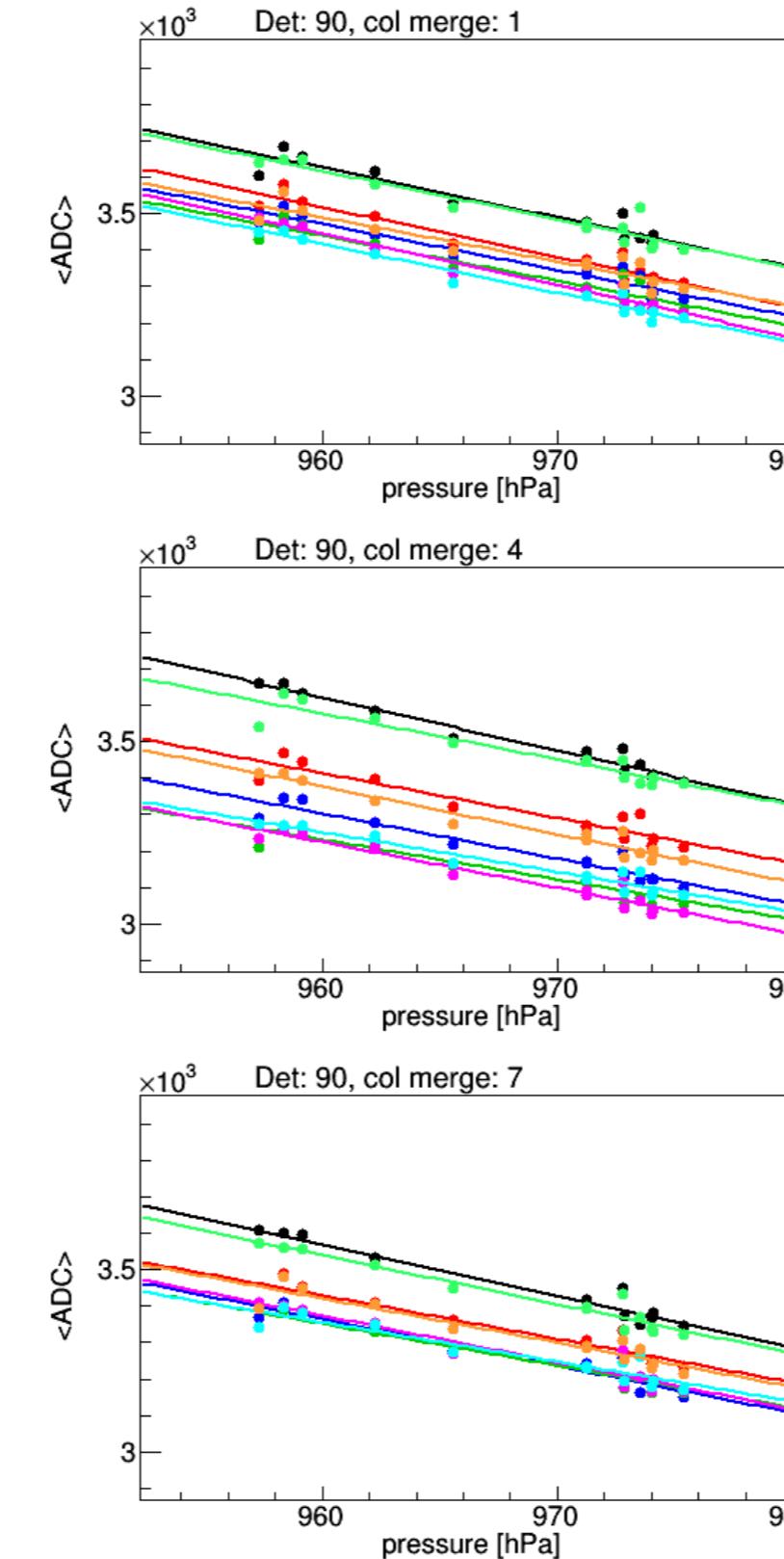
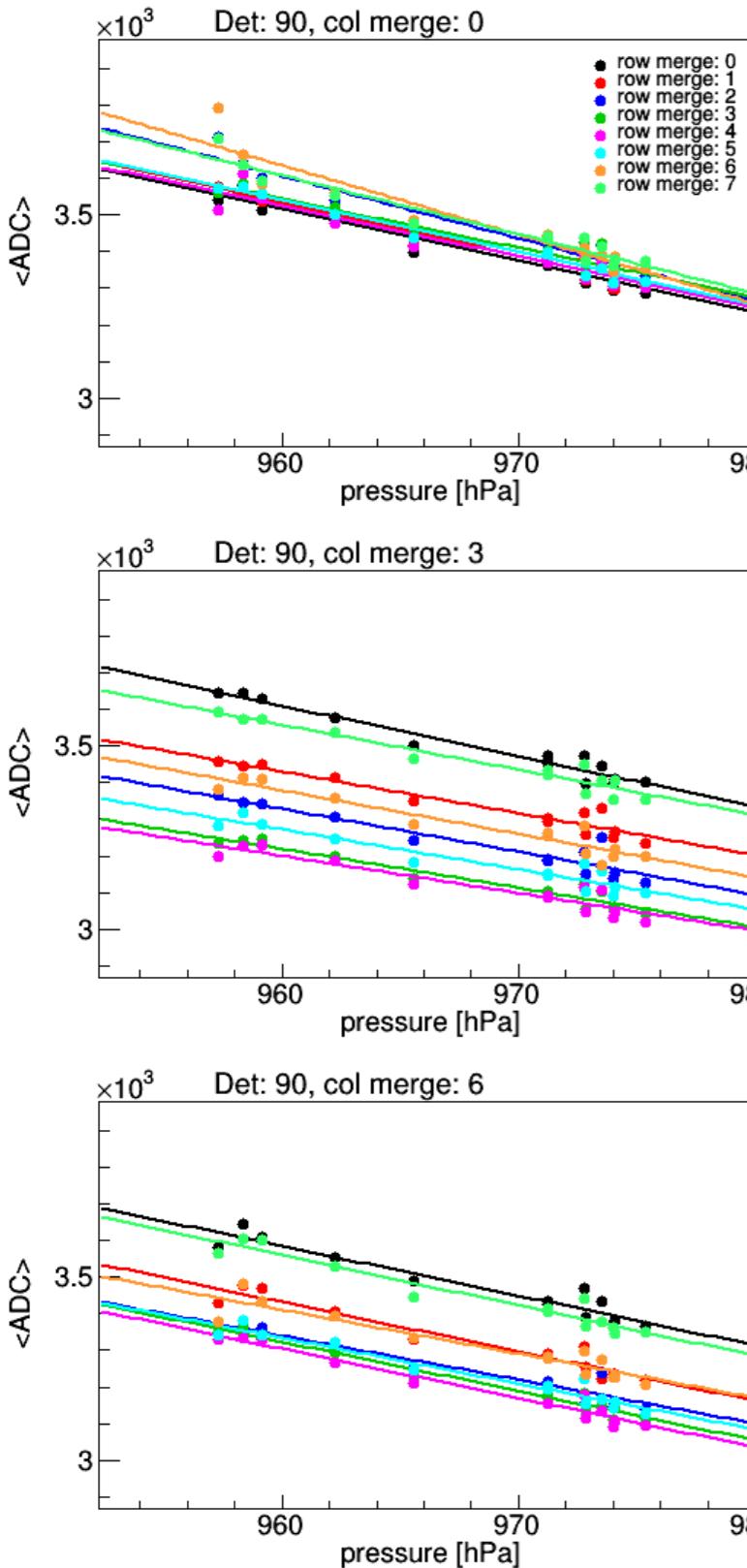


# Pressure



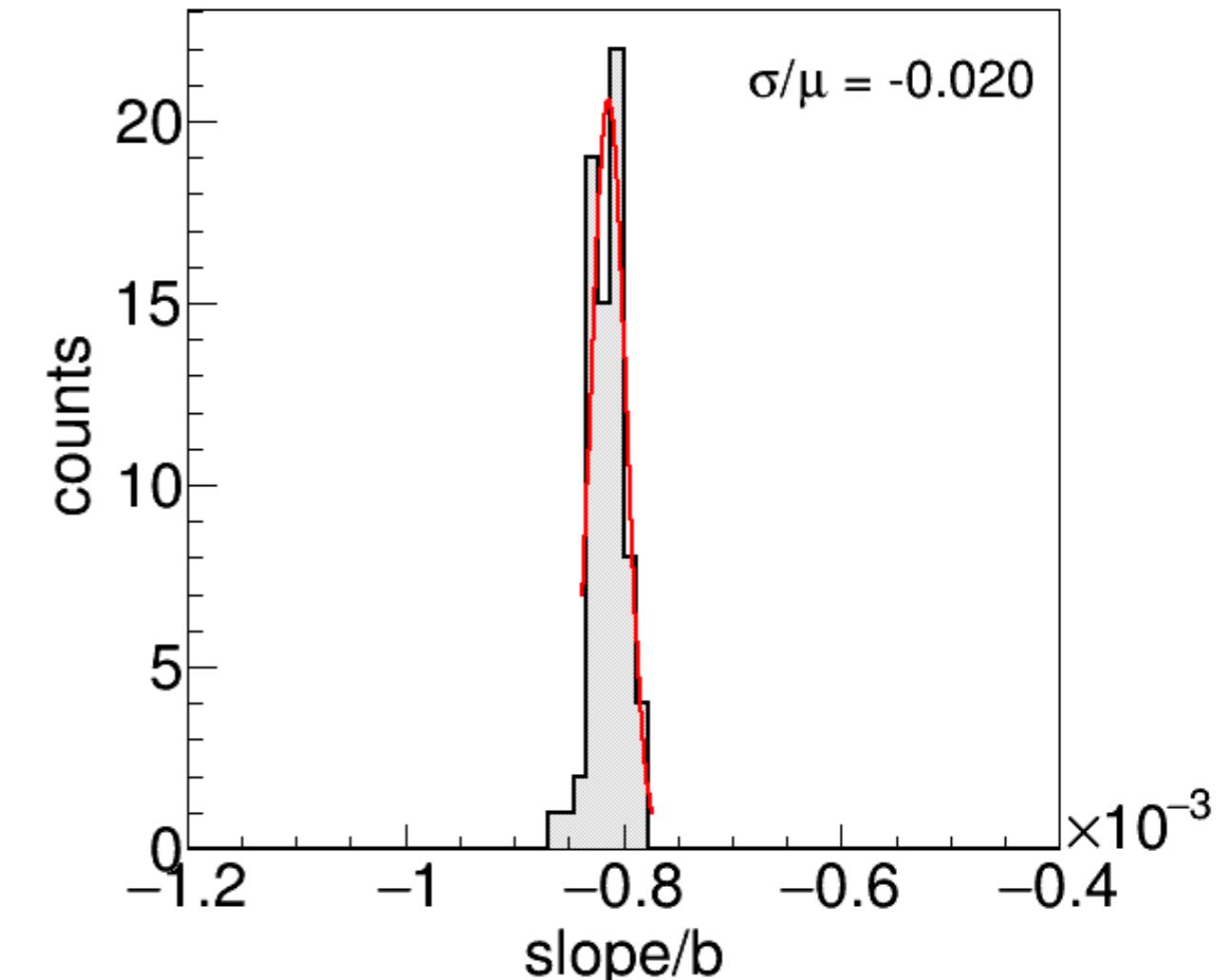
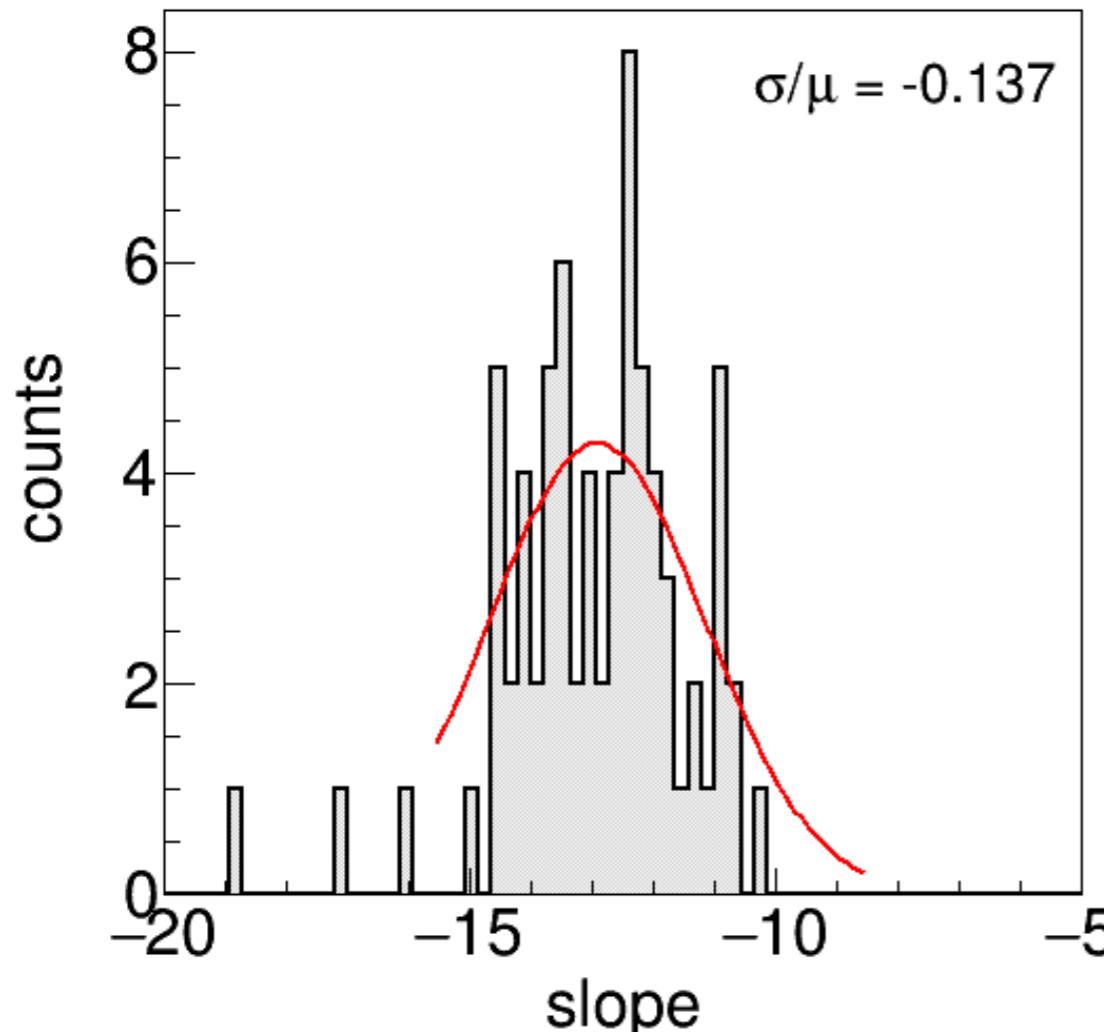


# <ADC> vs Pressure



# Slopes

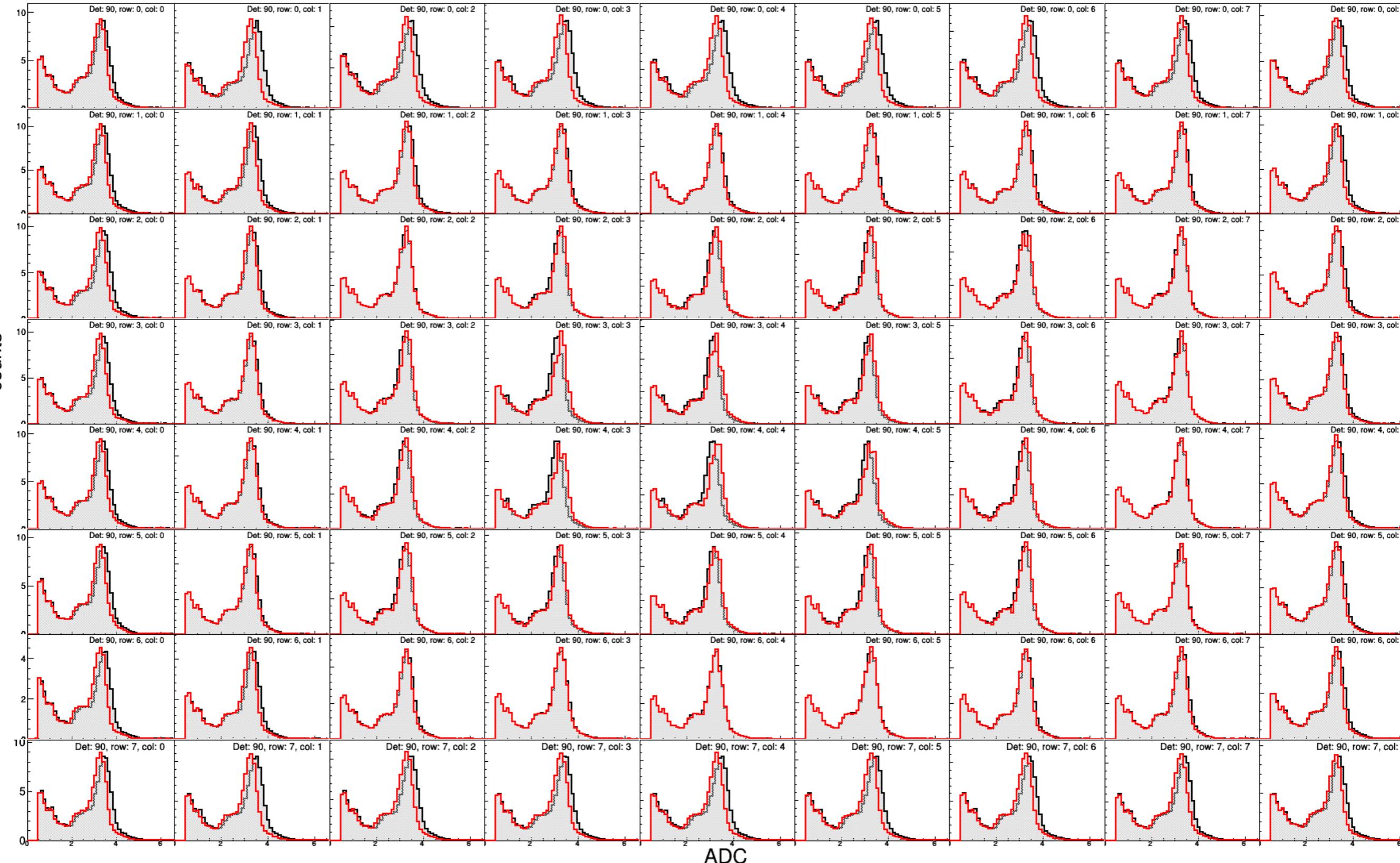
Det: 90



- Slope is showing a broad distribution due to different gains.
- Slope/y-axis parameter from fit (b) is very narrow, this is in principle the global correction factor to be used once the reference gain for each pad at a given reference pressure is known.

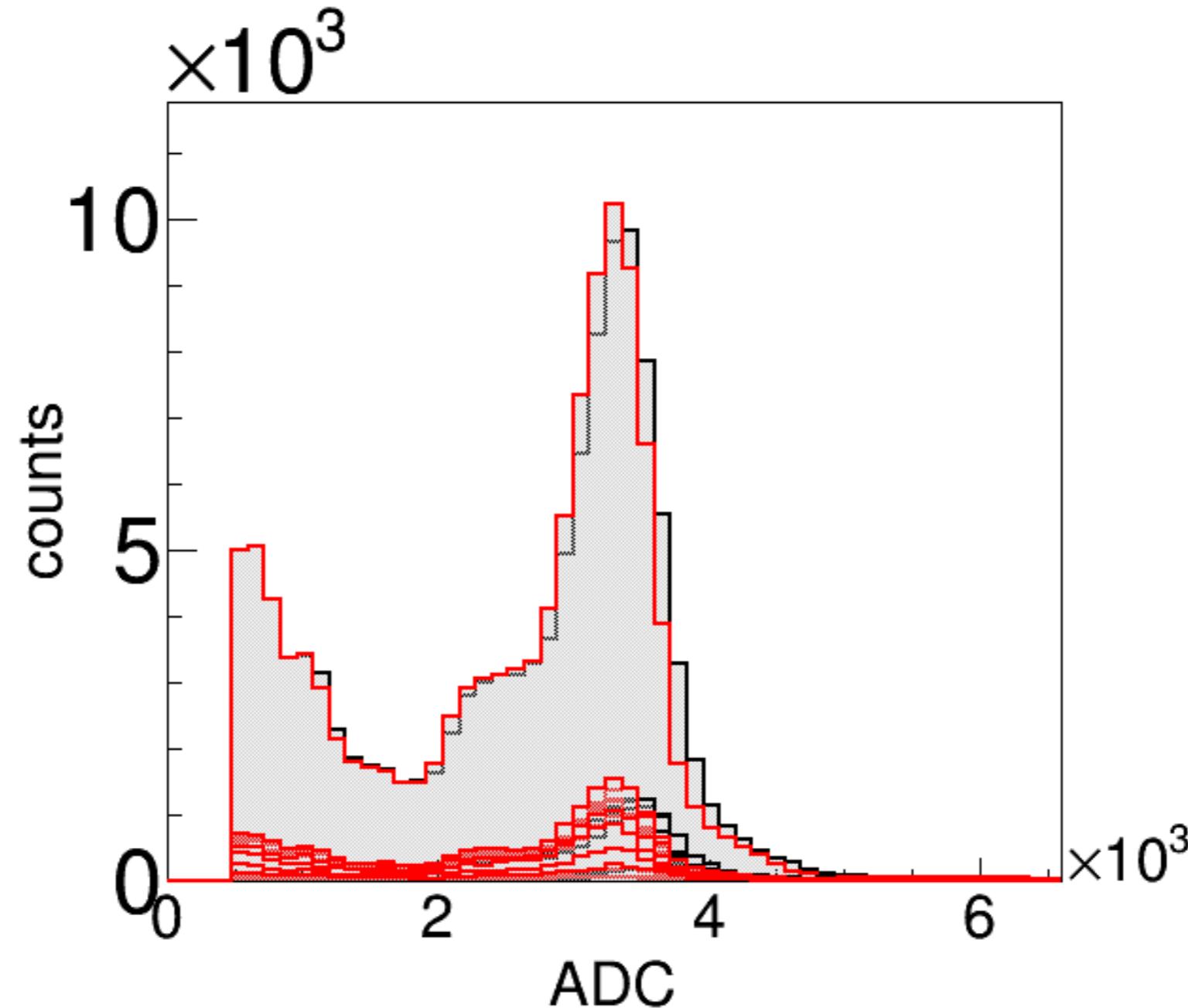


# Run Id (Pressure) Merged





# Det 90 Example



- The lower histograms show the entries per run (pressure value).
- Red is after pressure correction.



# Next Steps

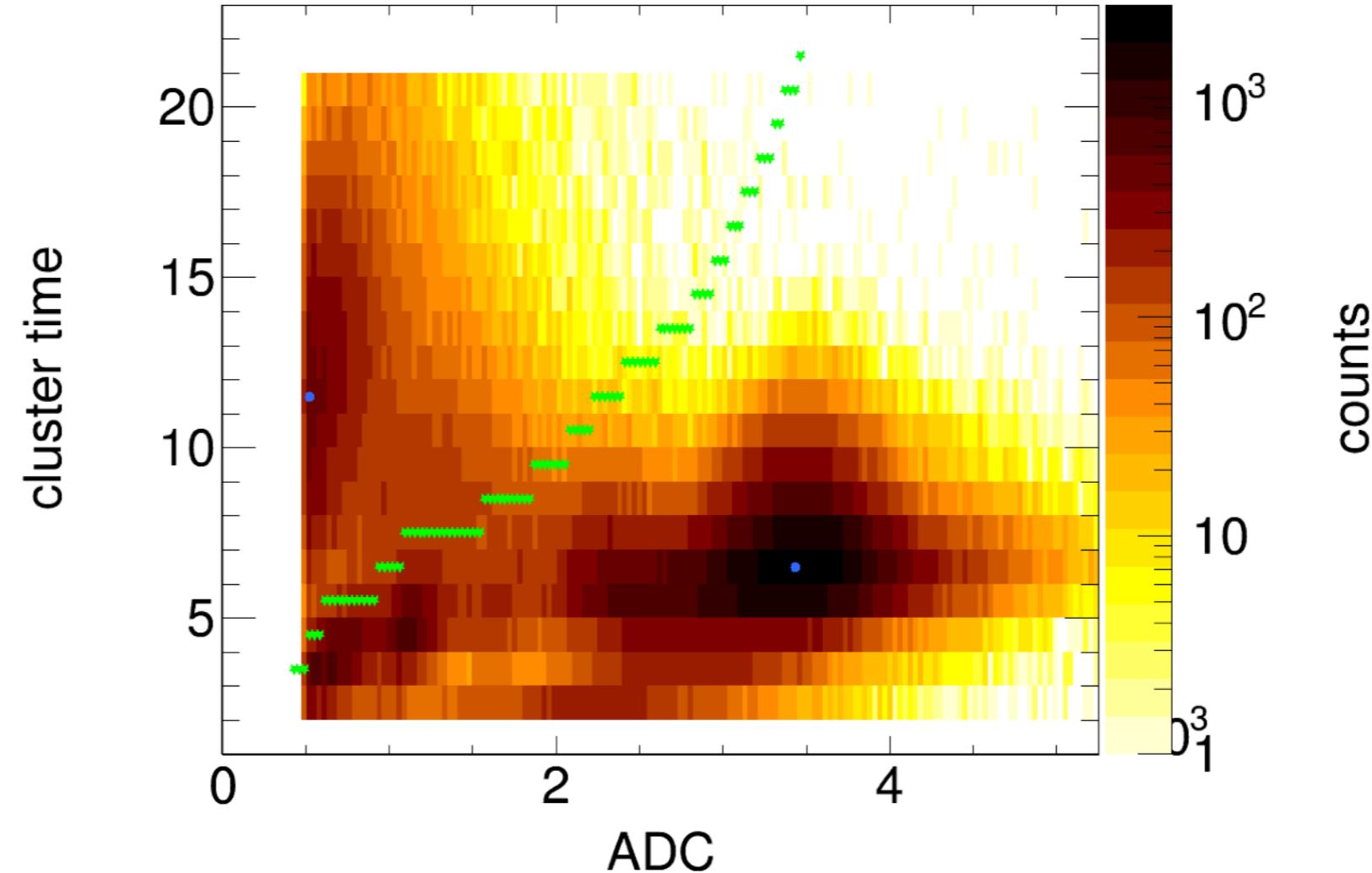
- I am looking right now into the cluster finder. There might be ways to significantly improve it and to reduce the background, e.g. cutting on the cluster size.
- Check chambers which look strange.
- Fits for all pads.



- Sebastian and I studied the cluster finder algorithm and signal and background structures:
  - Additional cuts added for cluster finder to remove background:  
`if(delta_row > 1) continue;`  
`if(delta_col > 2) continue;`
  - Cluster finder could be dramatically simplified.
- Additional variables added to tree: cluster size in row, column, and time.
- Full statistics with new trees reproduced, size ~100 GB.
- Pressure correction files for all detectors produced, each detector subdivided into 8\*9 row-column blocks.
- Automatic cut (drift time vs ADC) determination.
- Batch farm scripts now in place for easy and fast production.



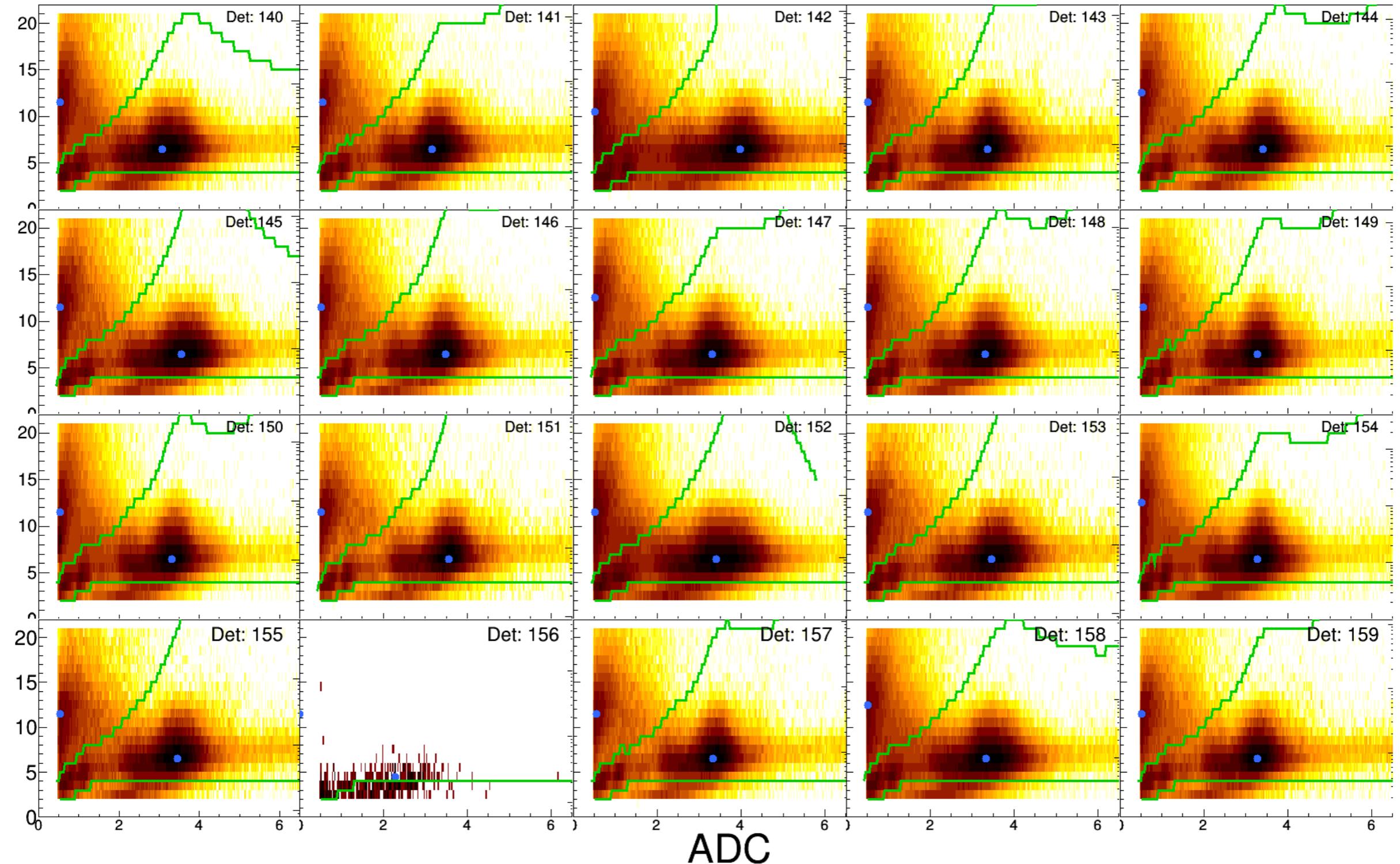
# Automatic Cut Determination



- Maxima for main Krypton peak and main background determined.
- Width in time of main background parametrized with a Gaussian.
- Falloff of main background in ADC parametrized with an exponential.
- ADC amplitudes of Krypton signal parametrized with multi Student-t function.
- Falloff of Krypton signal in time parametrized with an exponential.  
→ Cut determined via background/signal < 1.5.



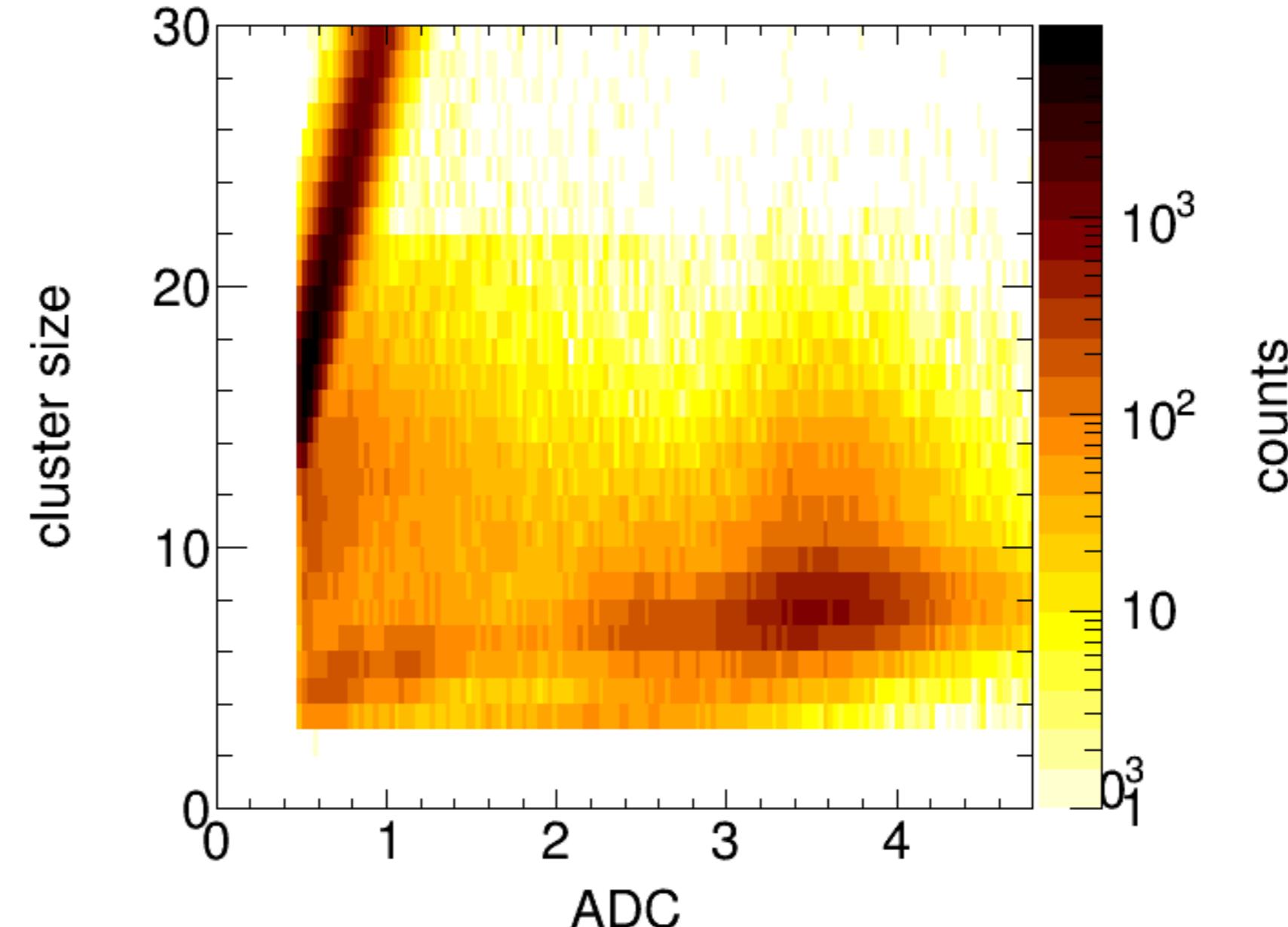
# Example for one Sector



- Lower cuts are fixed for all detectors.



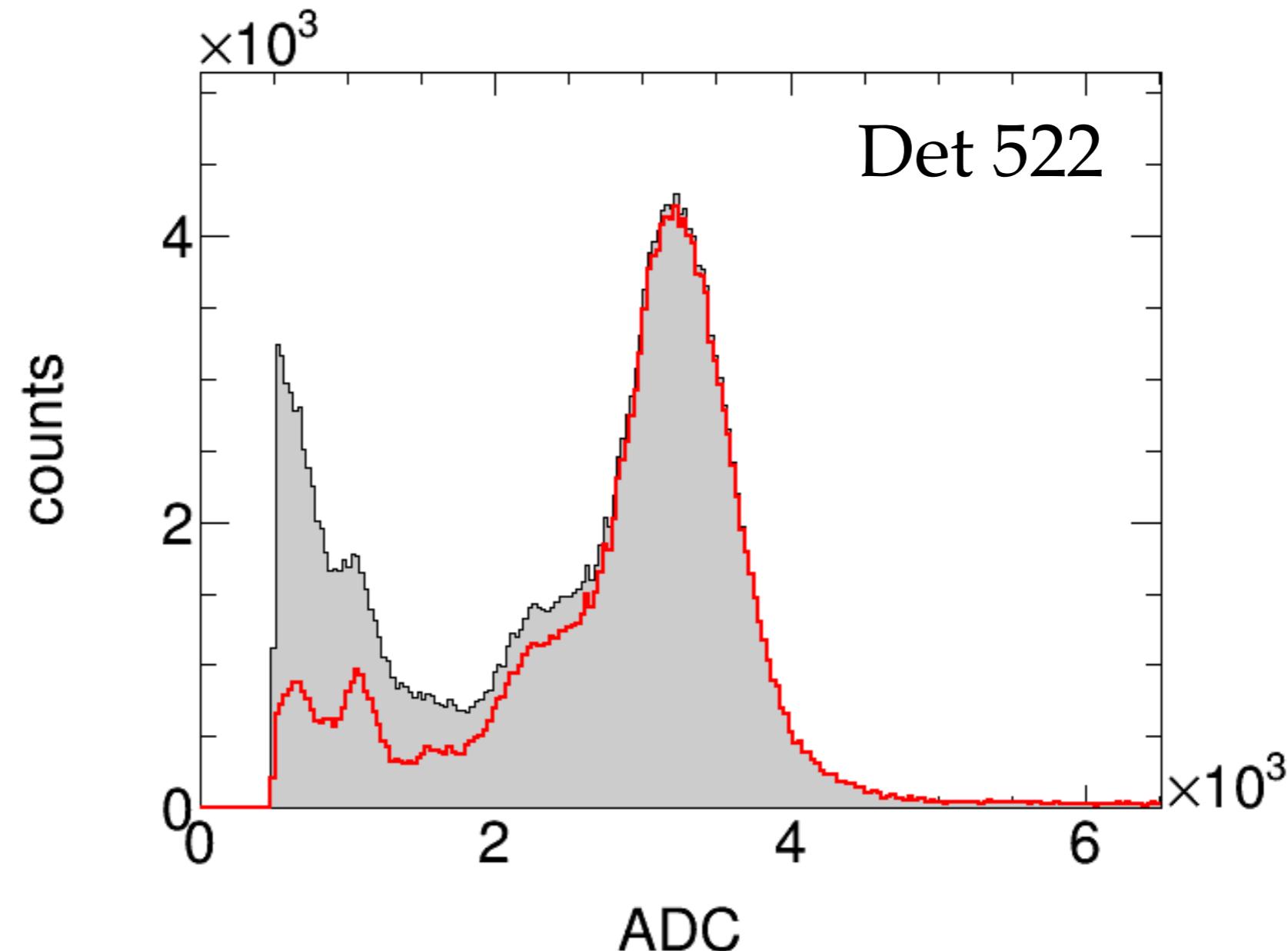
# Strange Chambers...



- Some chambers have some issues...
- In this particular case a cut on the cluster size will remove all of the strange background. RMS(time) is not efficient in most cases.



# Preliminary 2D Cut Applied



- Grey before cut, red after cut.
- At least 4 Krypton peaks are clearly visible.



# Next Steps

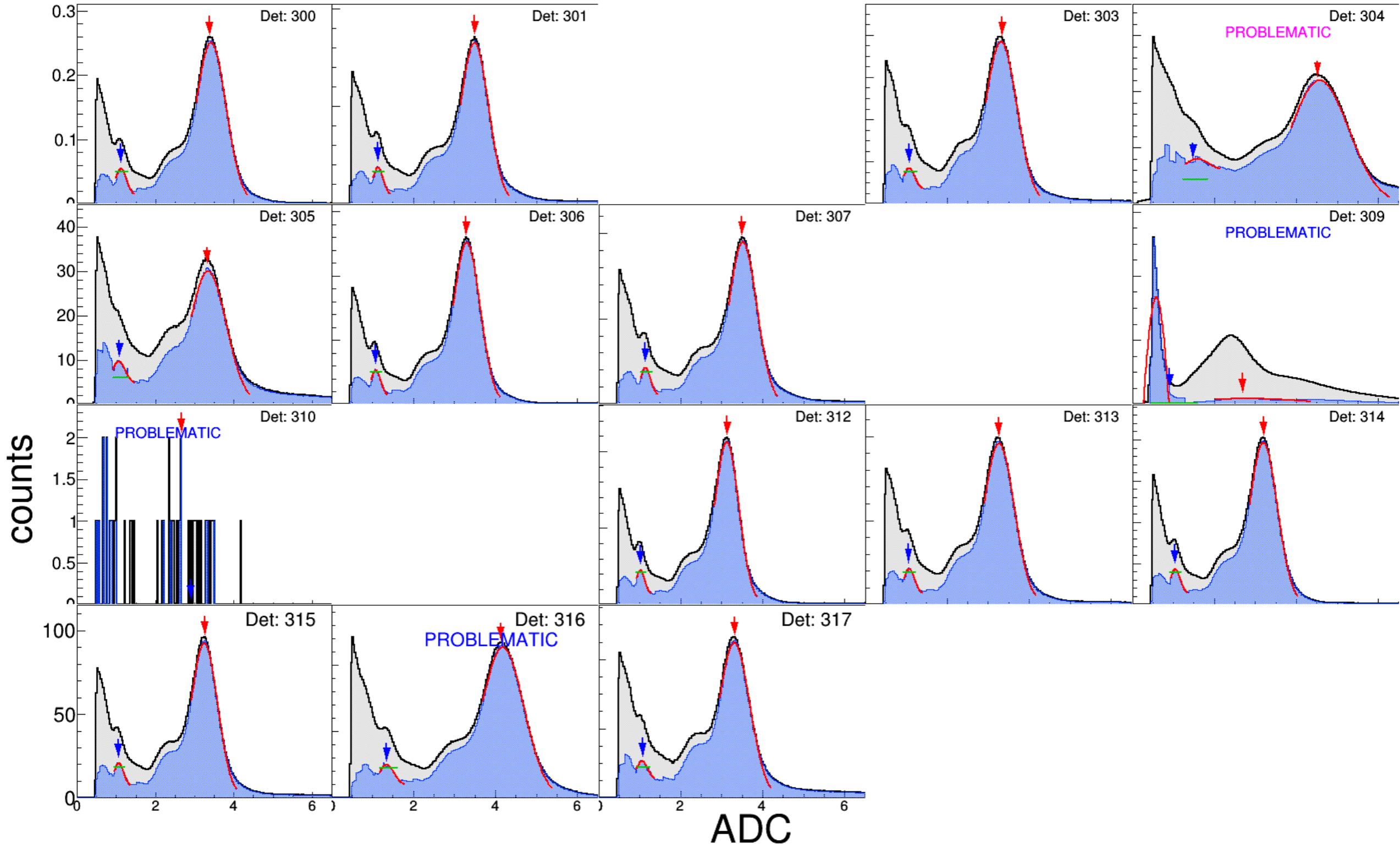
- Apply pressure correction and 2D cuts, fits for all pads.
- Do HV scan analysis.



- 2D cuts finalized.
- Bad chambers (HV etc.) flagged.
- QA for every single chamber added.
- Initial parameters for every chamber determined.
- Pressure correction + background cuts applied for all pads.
  - Main peak position determined for a full chamber.
  - Two iterative Gaussian fit for main peak.
  - Parameters for 2nd Krypton peak estimated from main Krypton peak result.
  - Two iterative Gaussian fit for 2nd peak.
  - Parameters used only as a search window (a few sigma) for single pad fits.
  - Single pad fits done in the same way as described above.

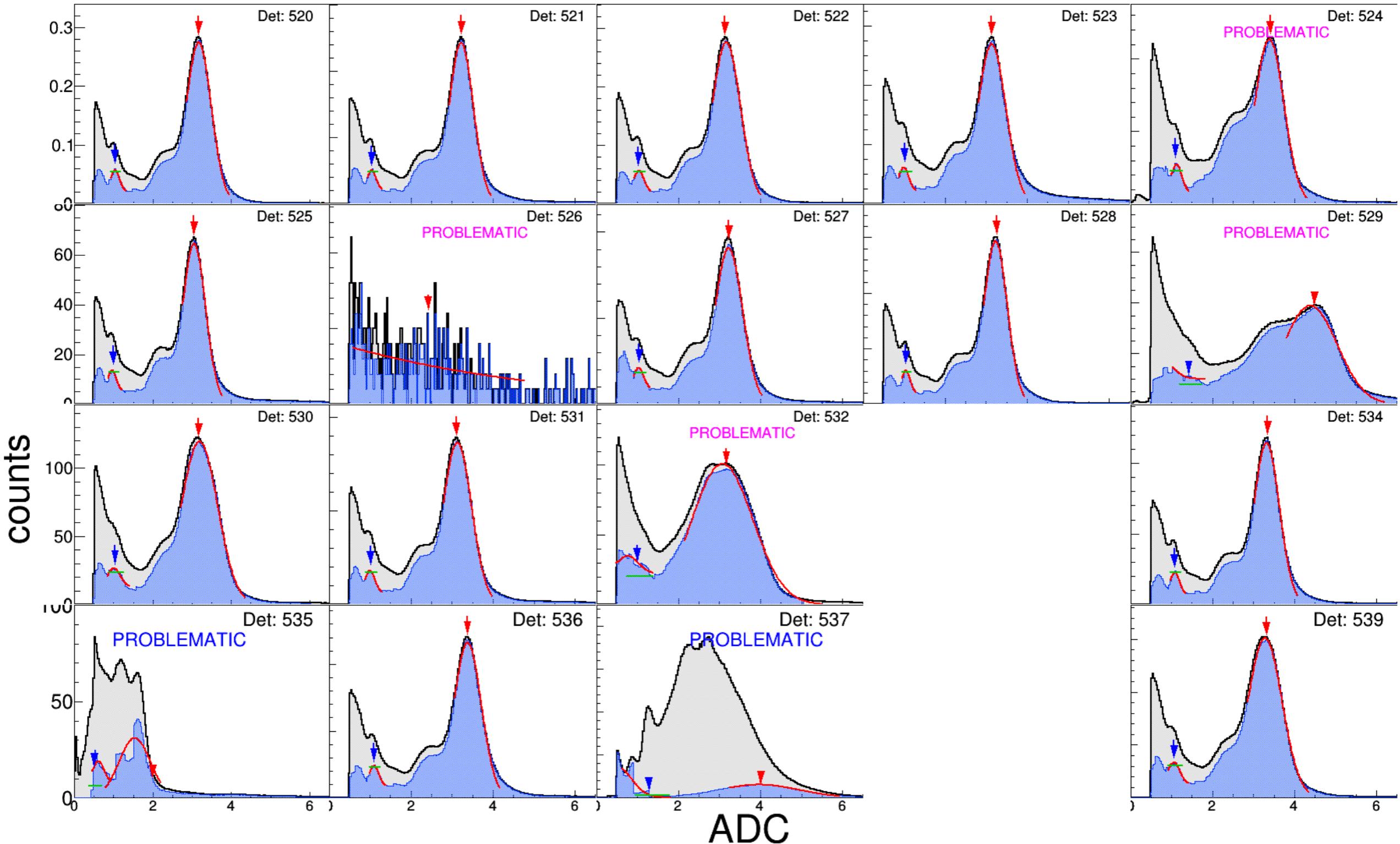


# Example QA and Prefits I



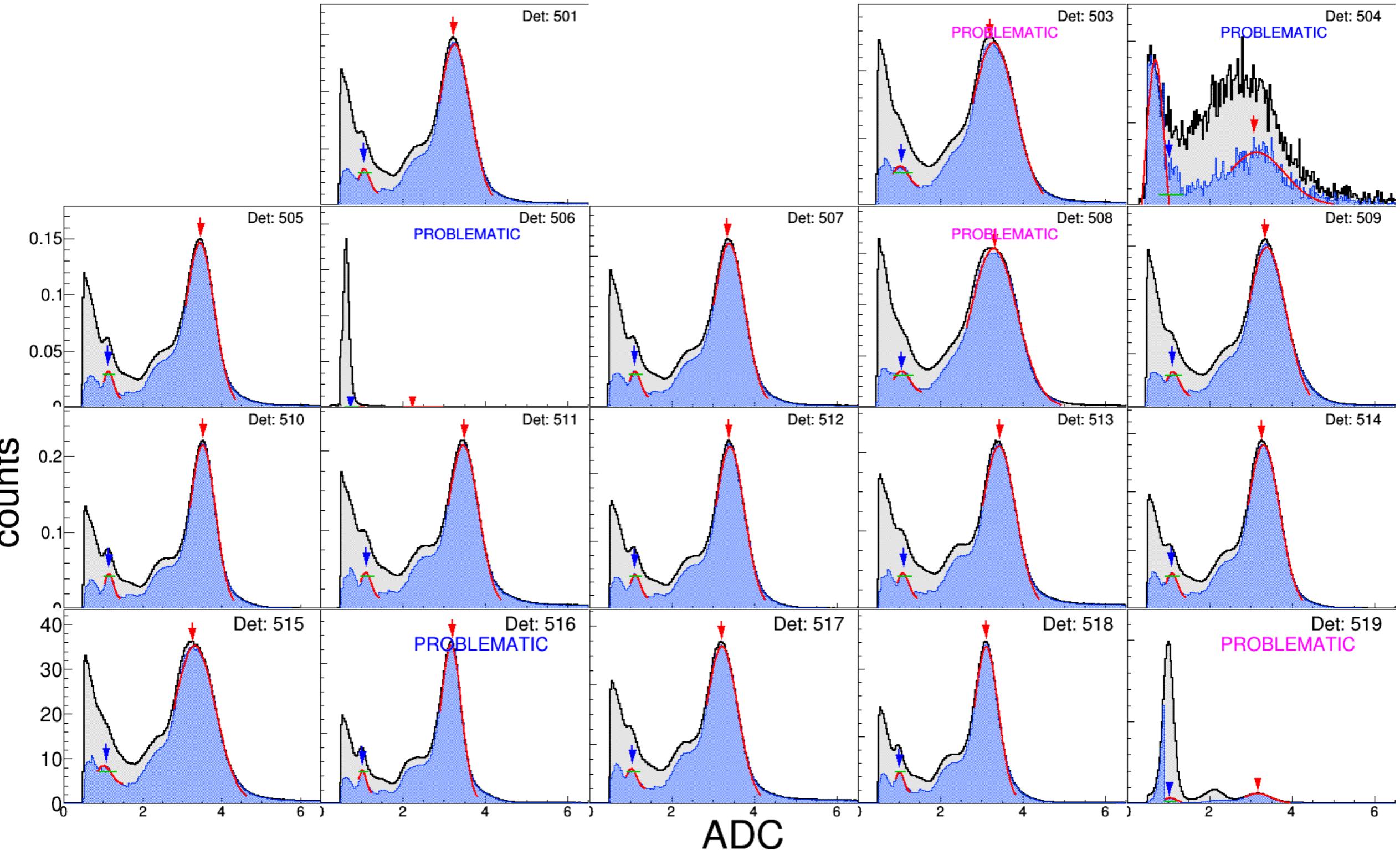


# Example QA and Prefits II



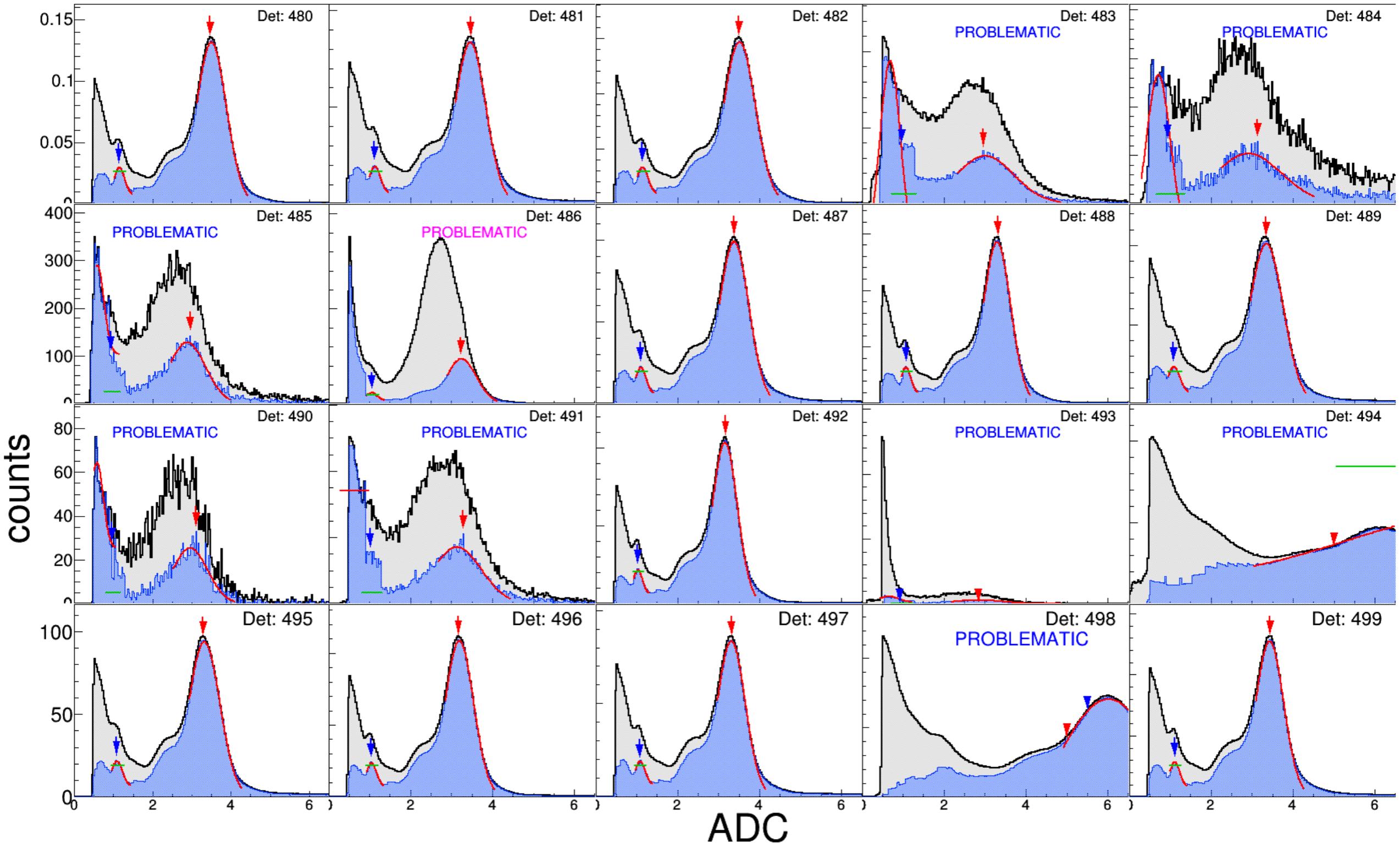


# Example QA and Prefits III



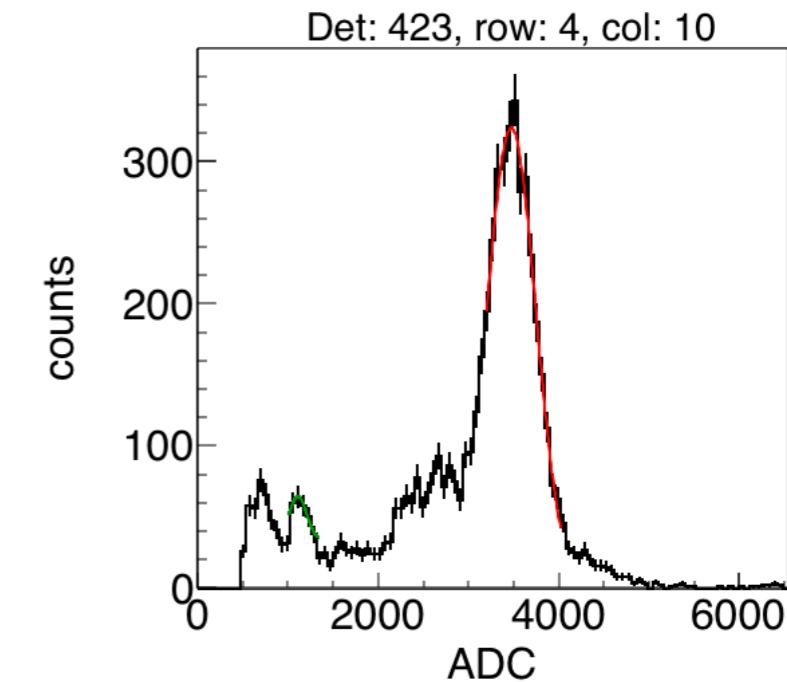
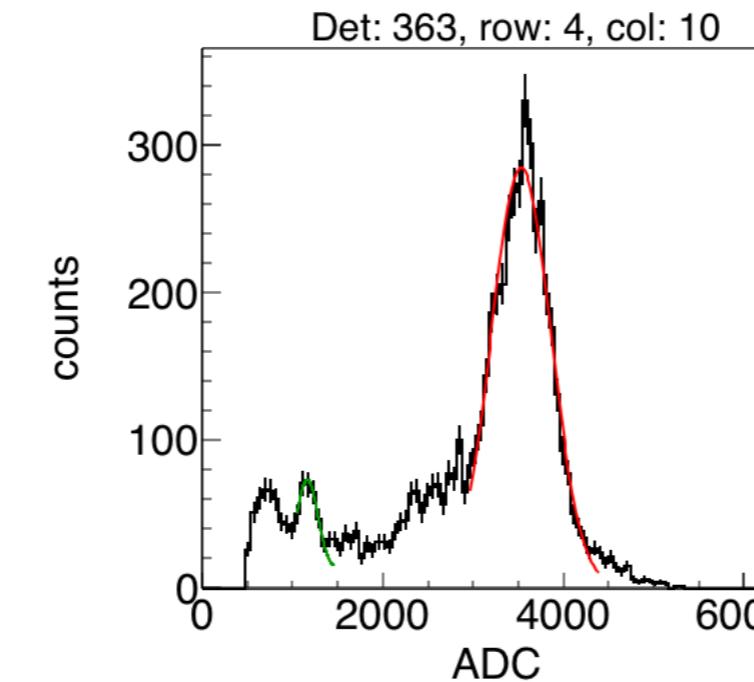
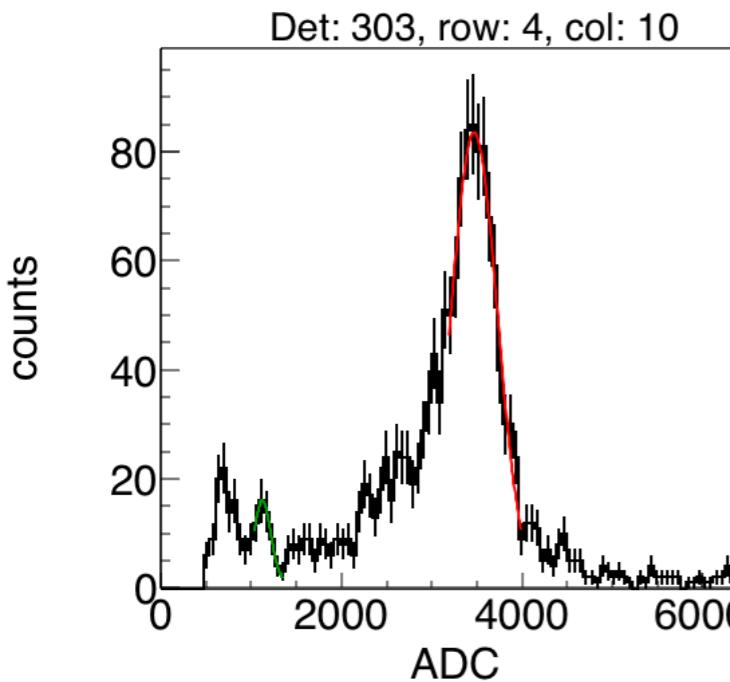
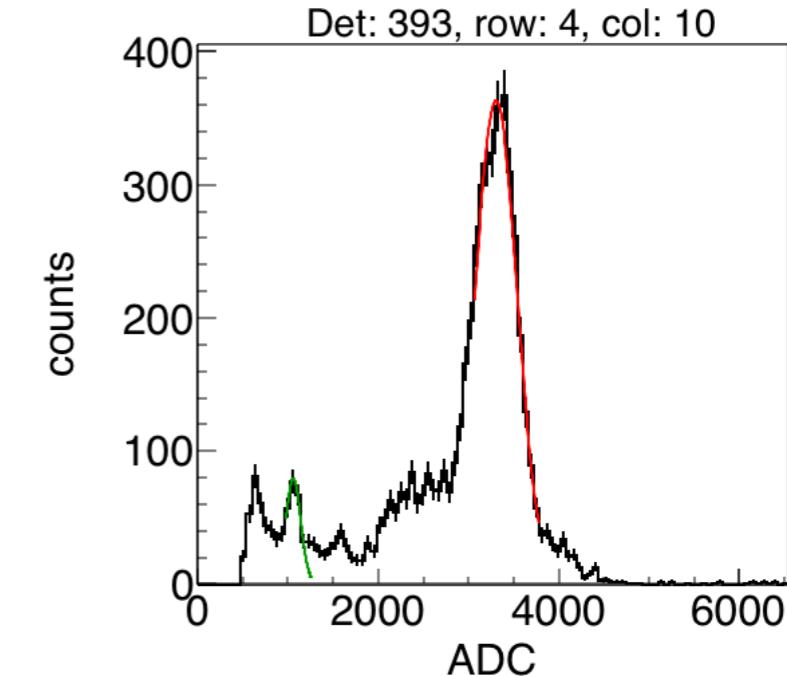
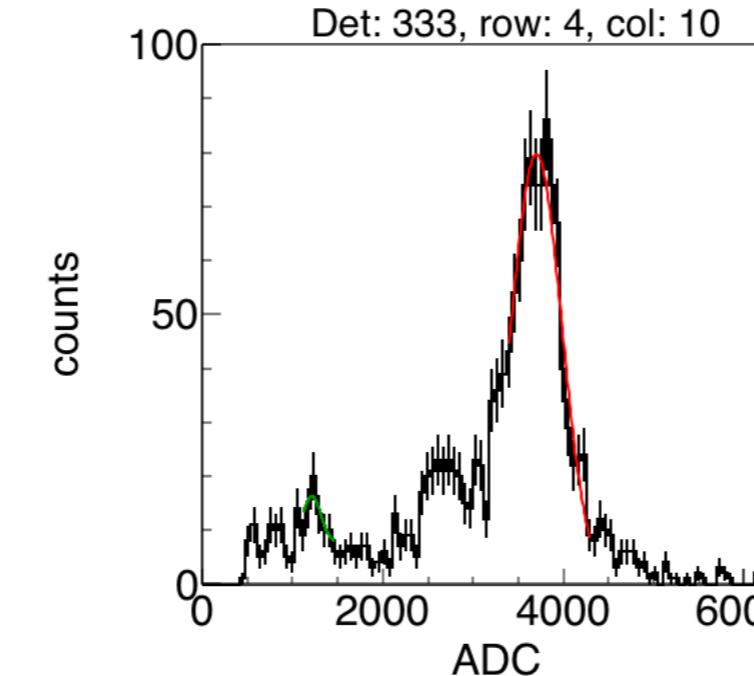
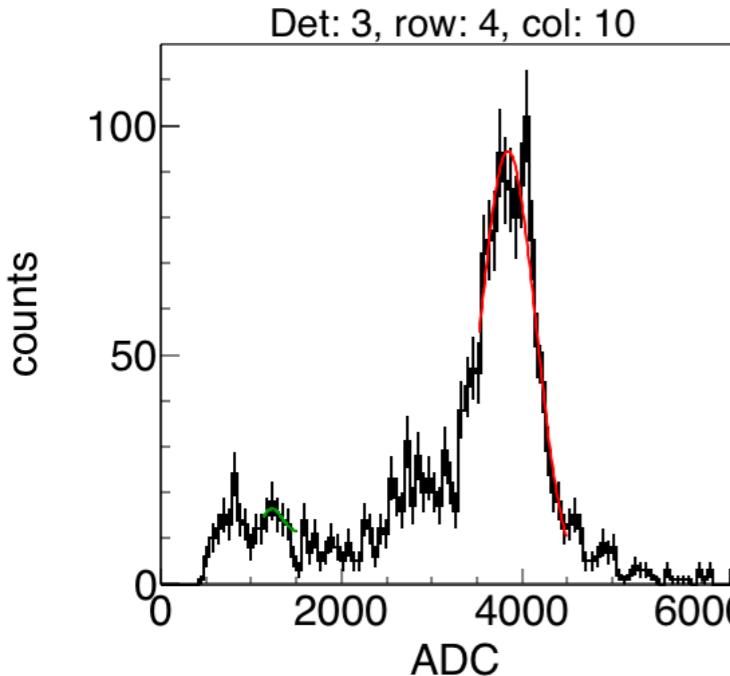


# Example QA and Prefits IV



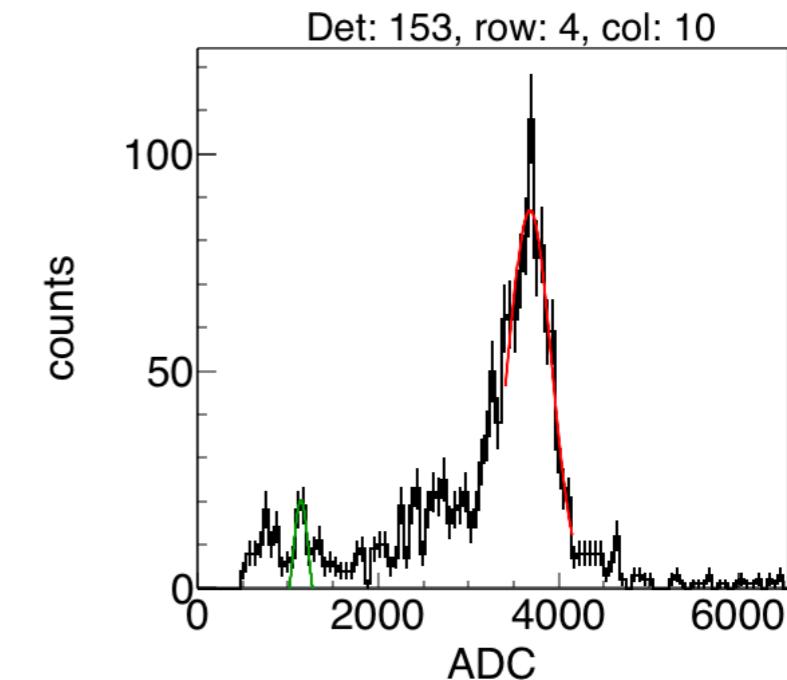
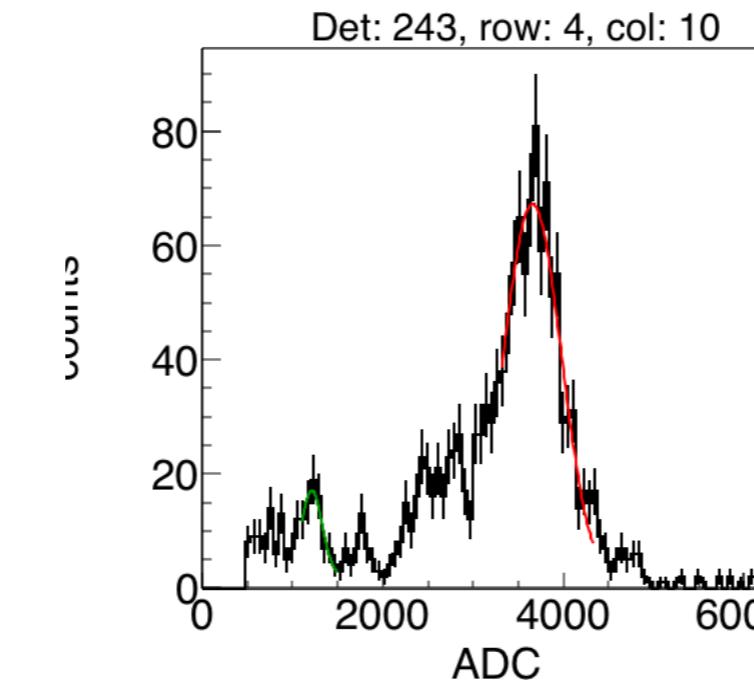
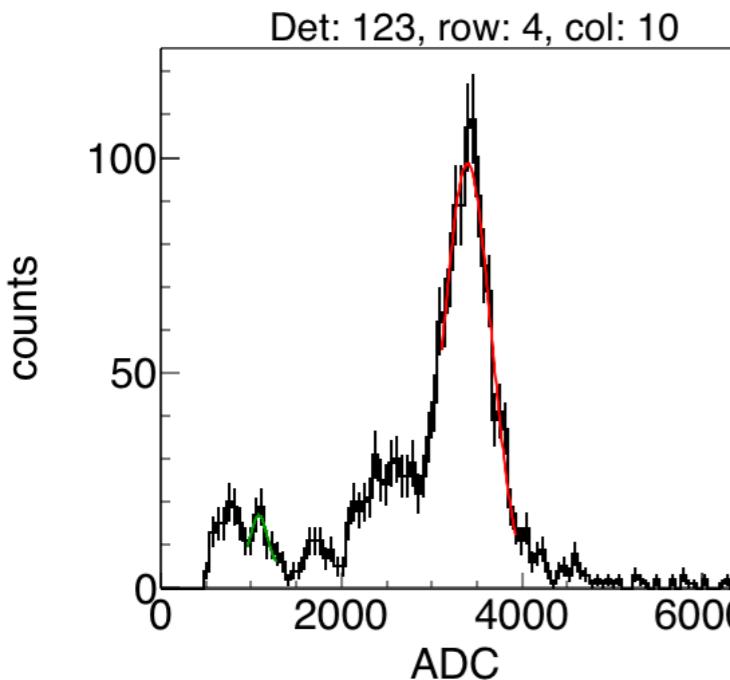
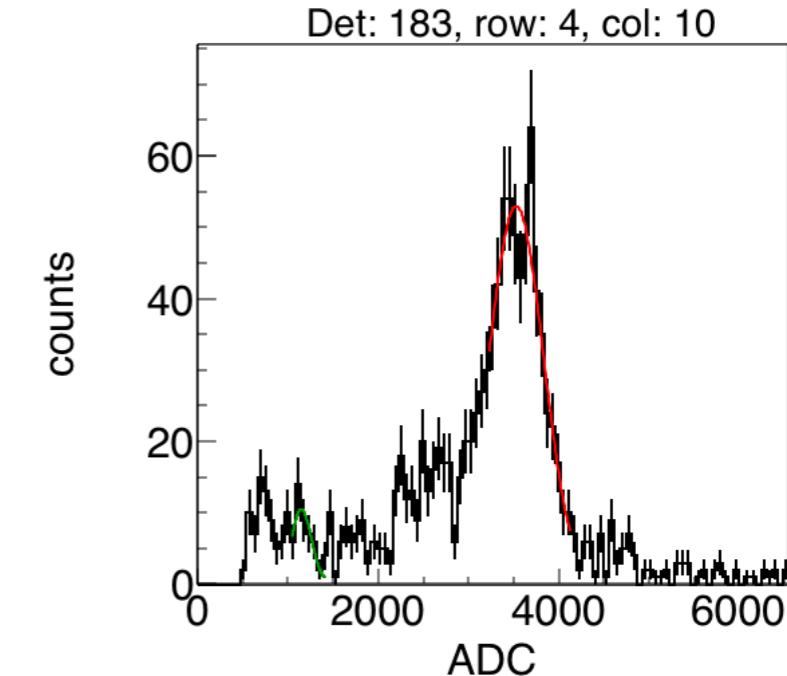
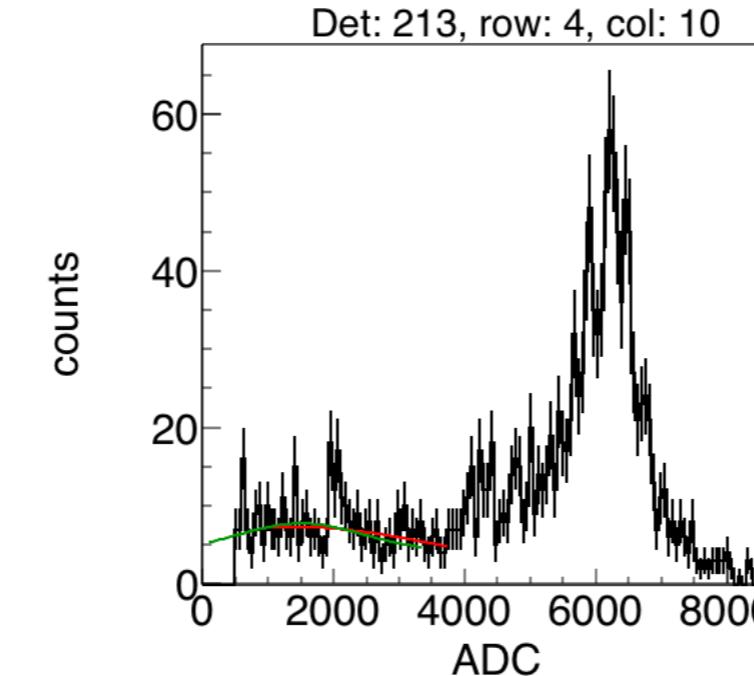
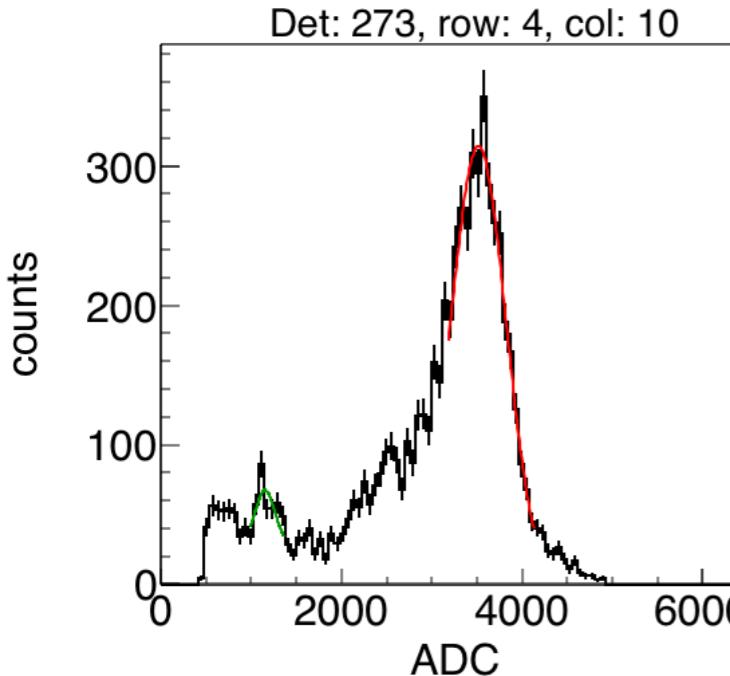


# Single Pad Examples I



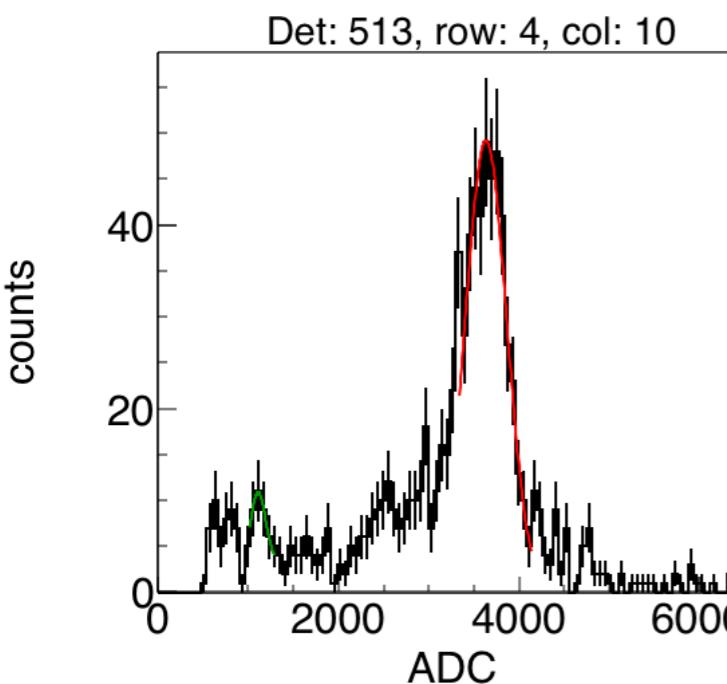
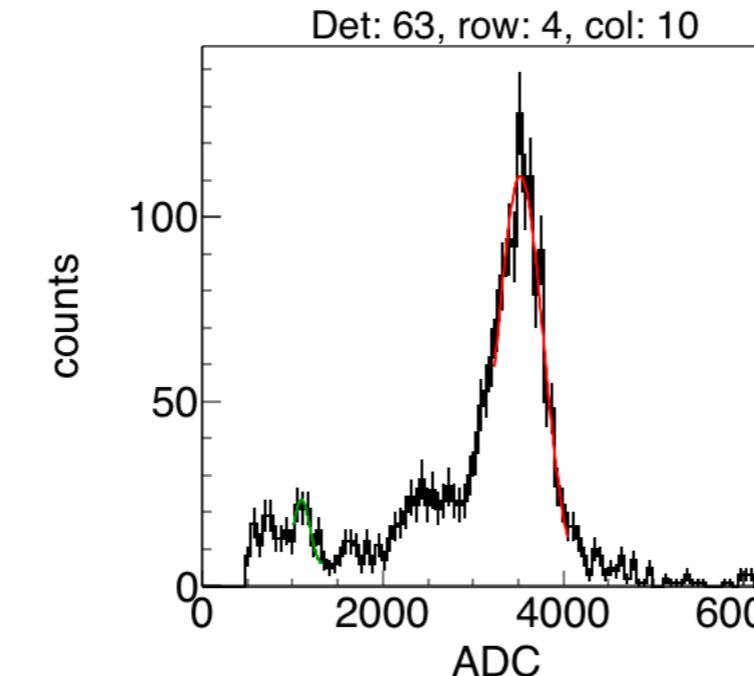
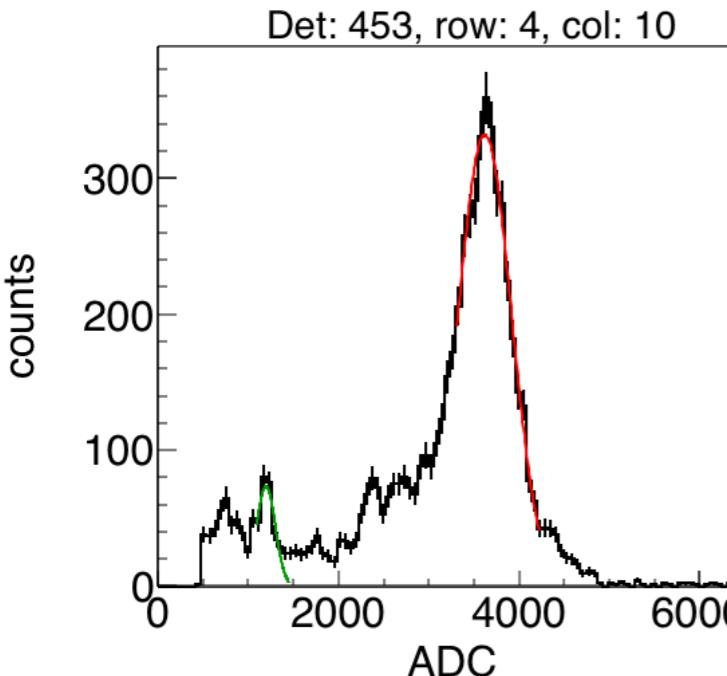


# Single Pad Examples II



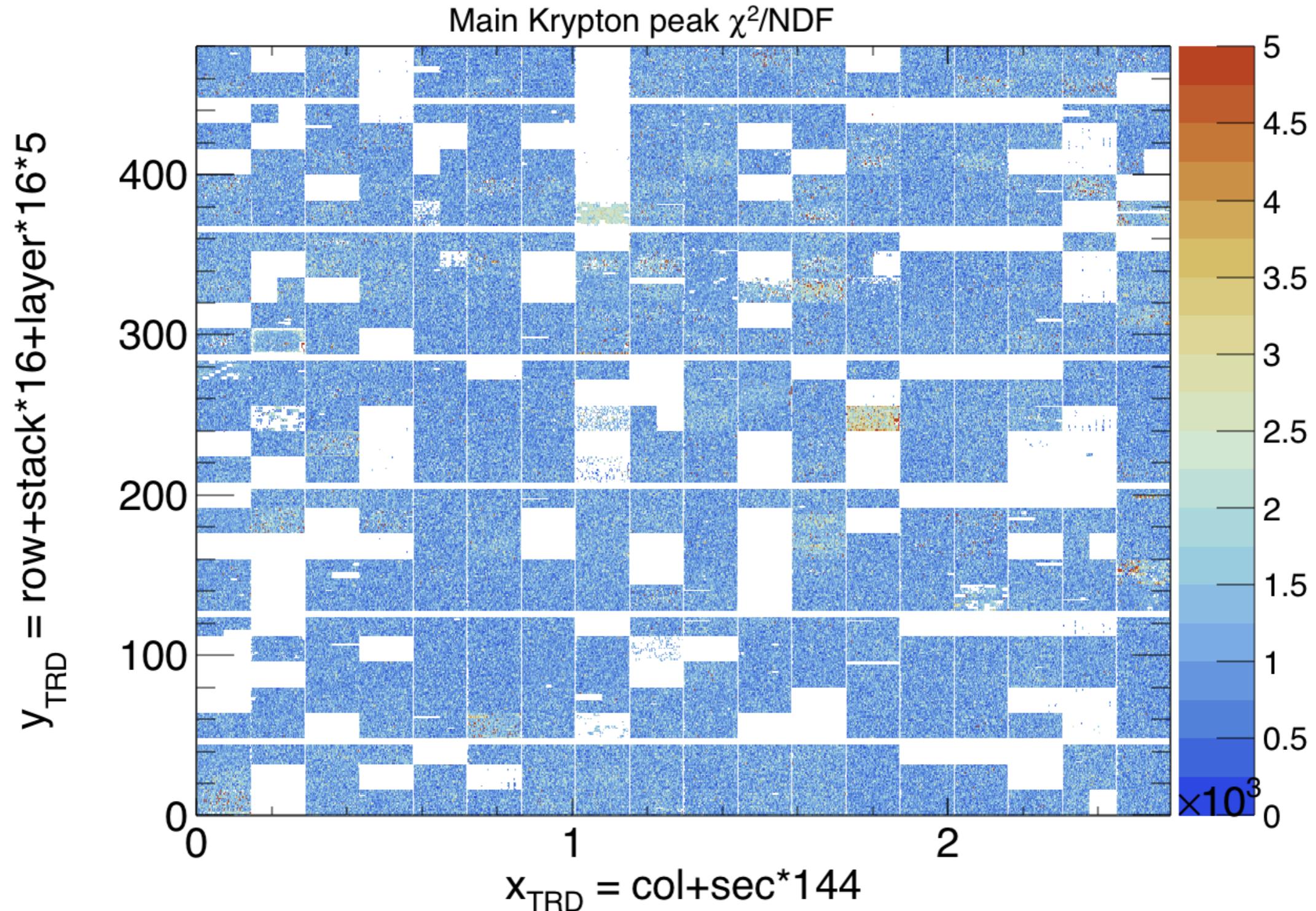


# Single Pad Examples III



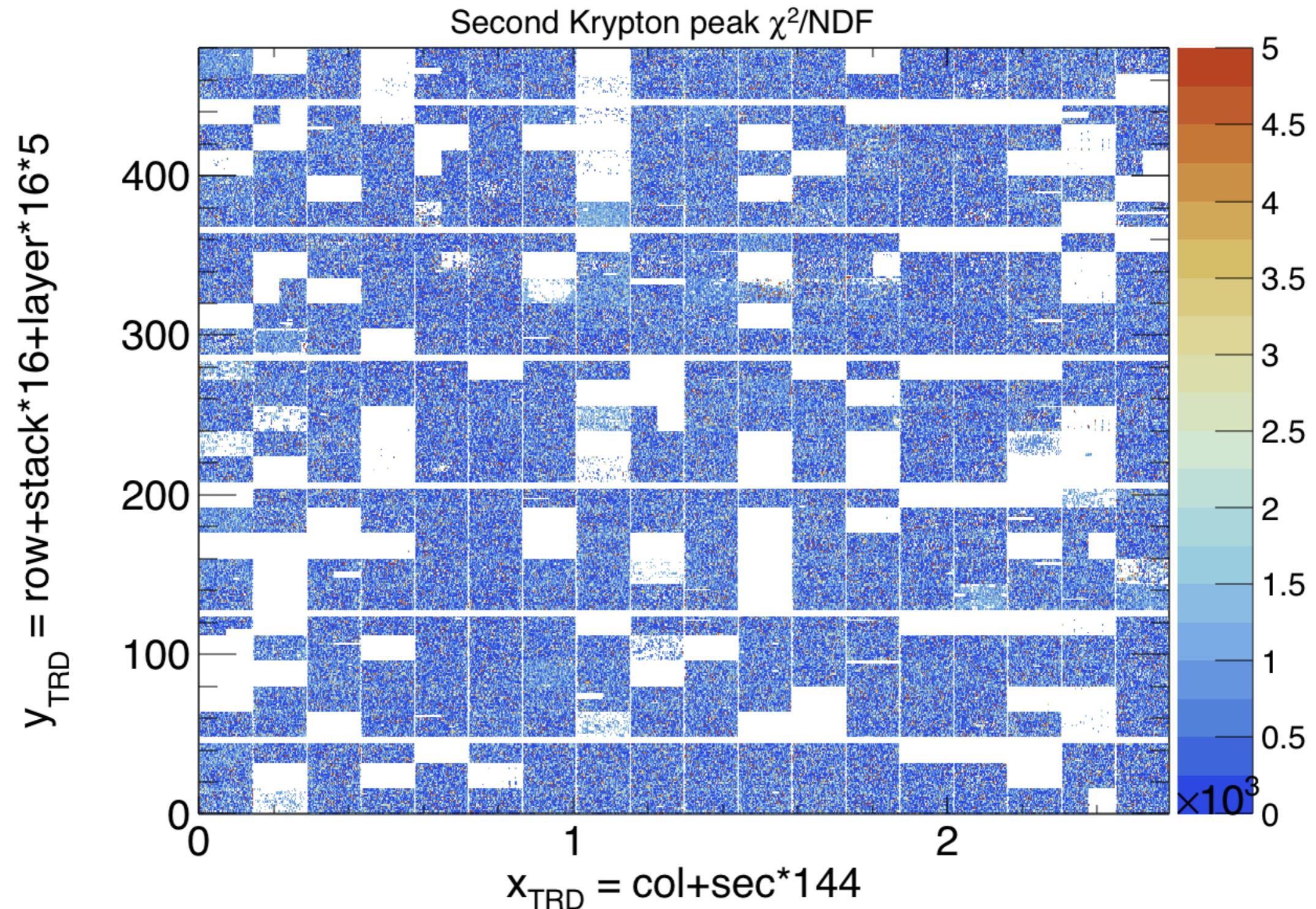


# Main Krypton Peak Chi2



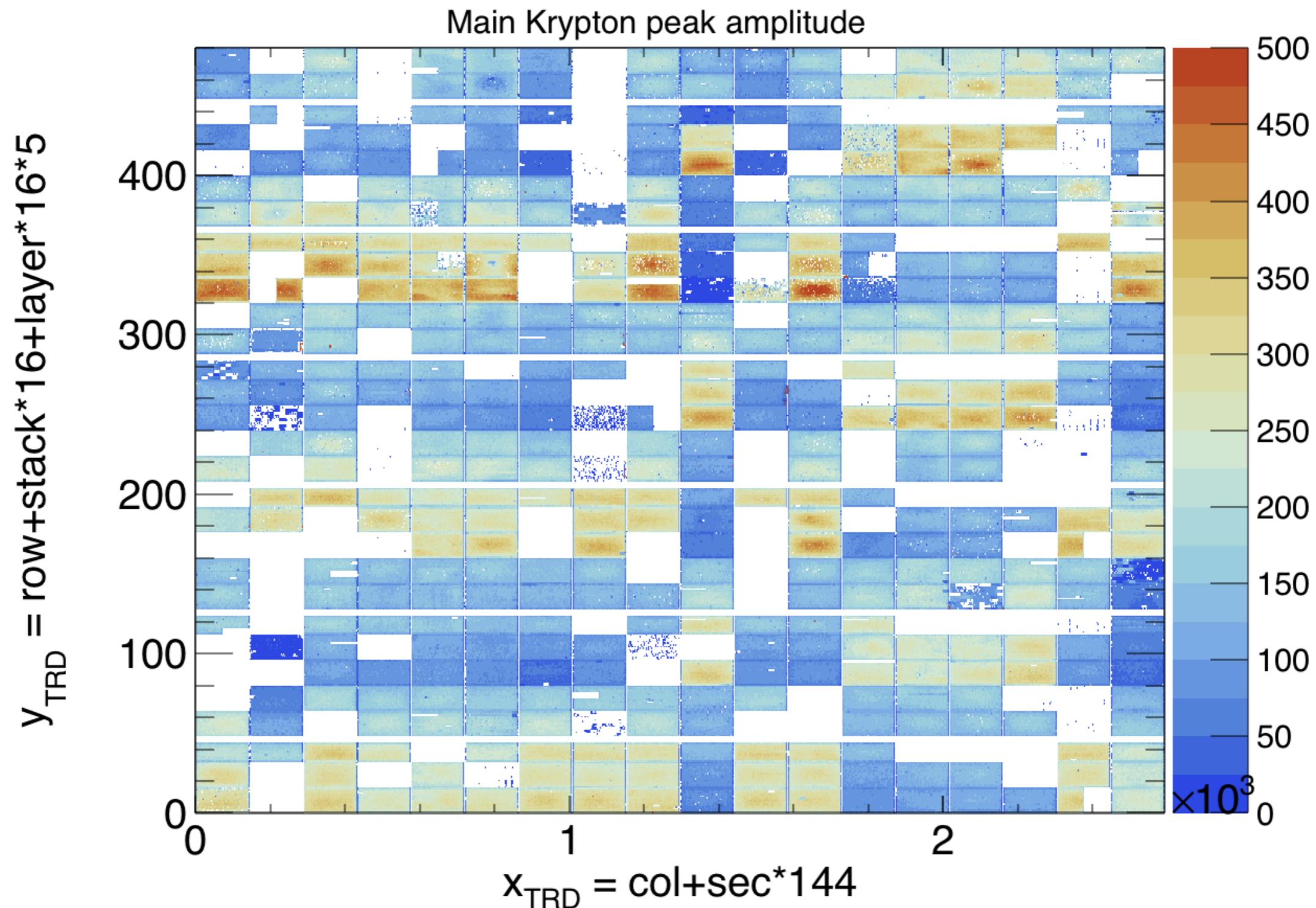


# Second Krypton Peak Chi2



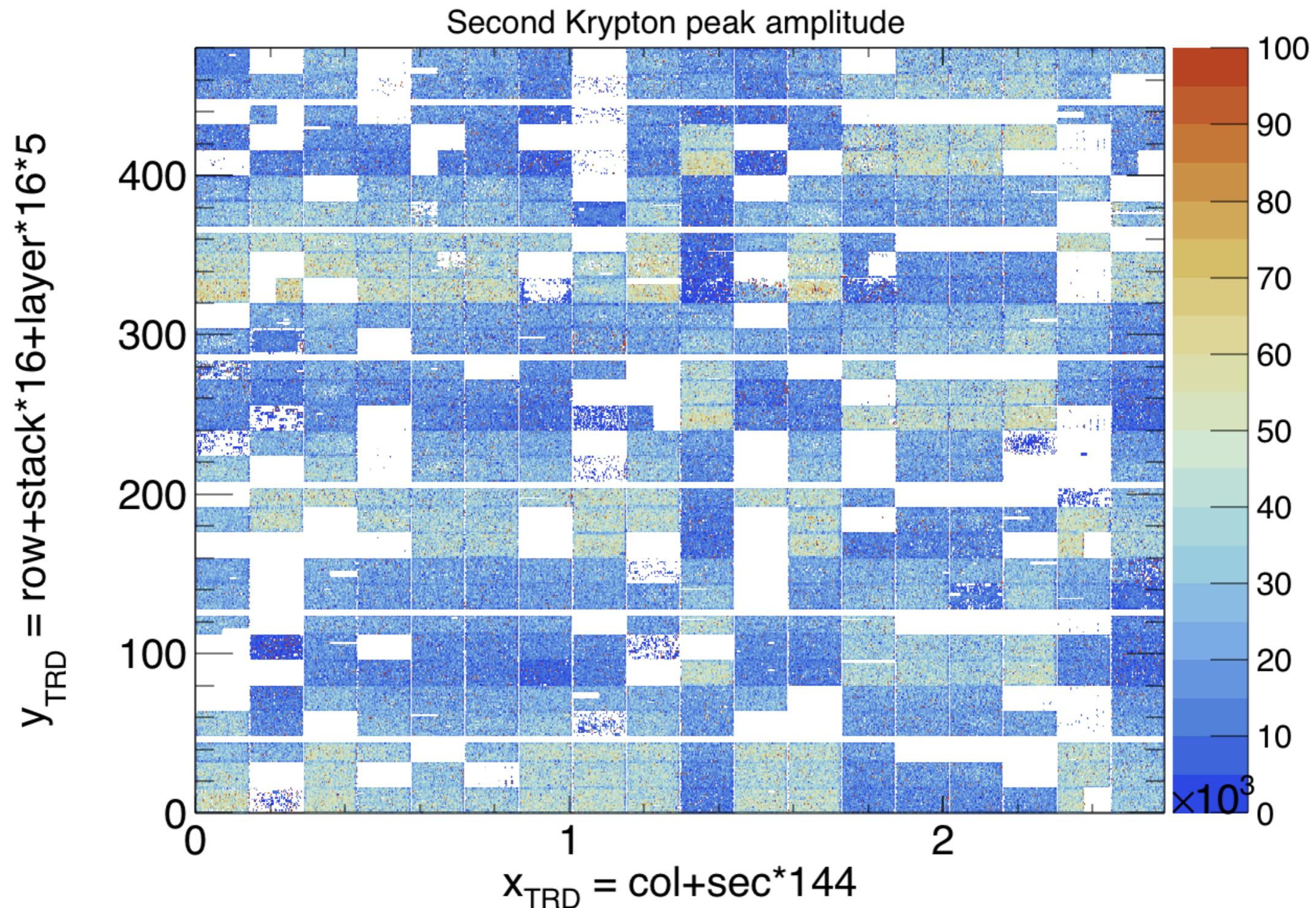


# Main Krypton Peak Amplitude



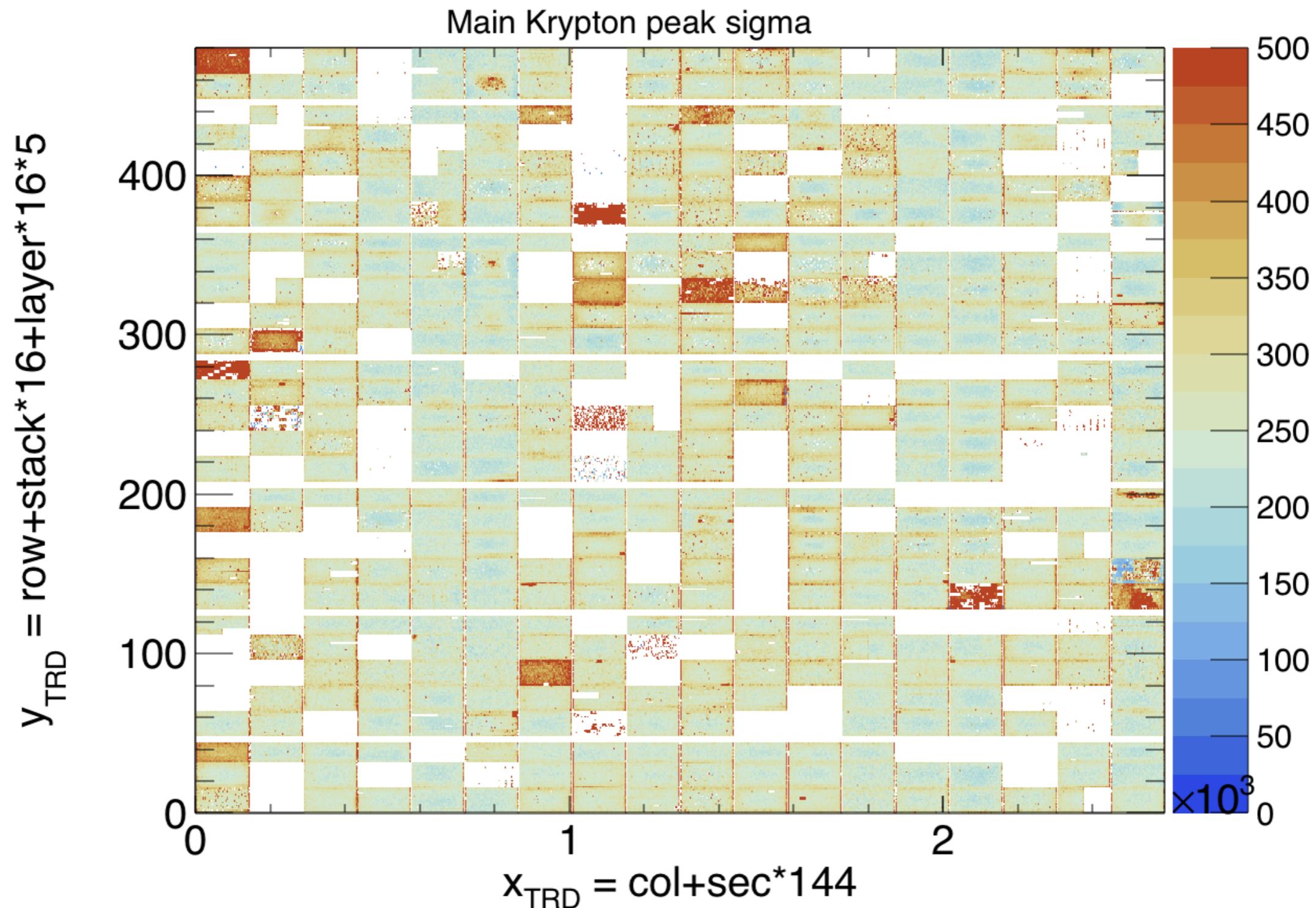


# Second Krypton Peak Amplitude



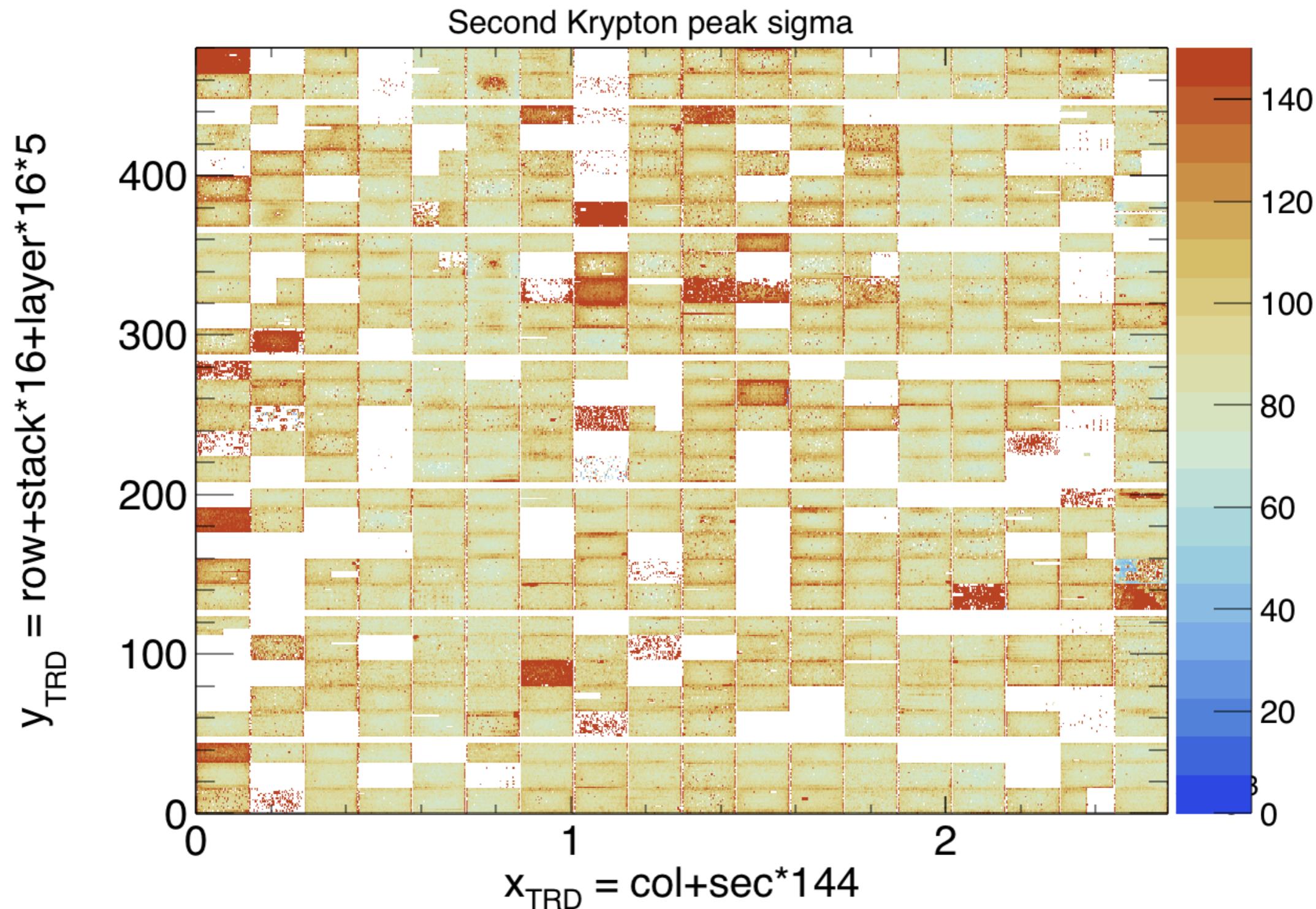


# Main Krypton Peak Sigma



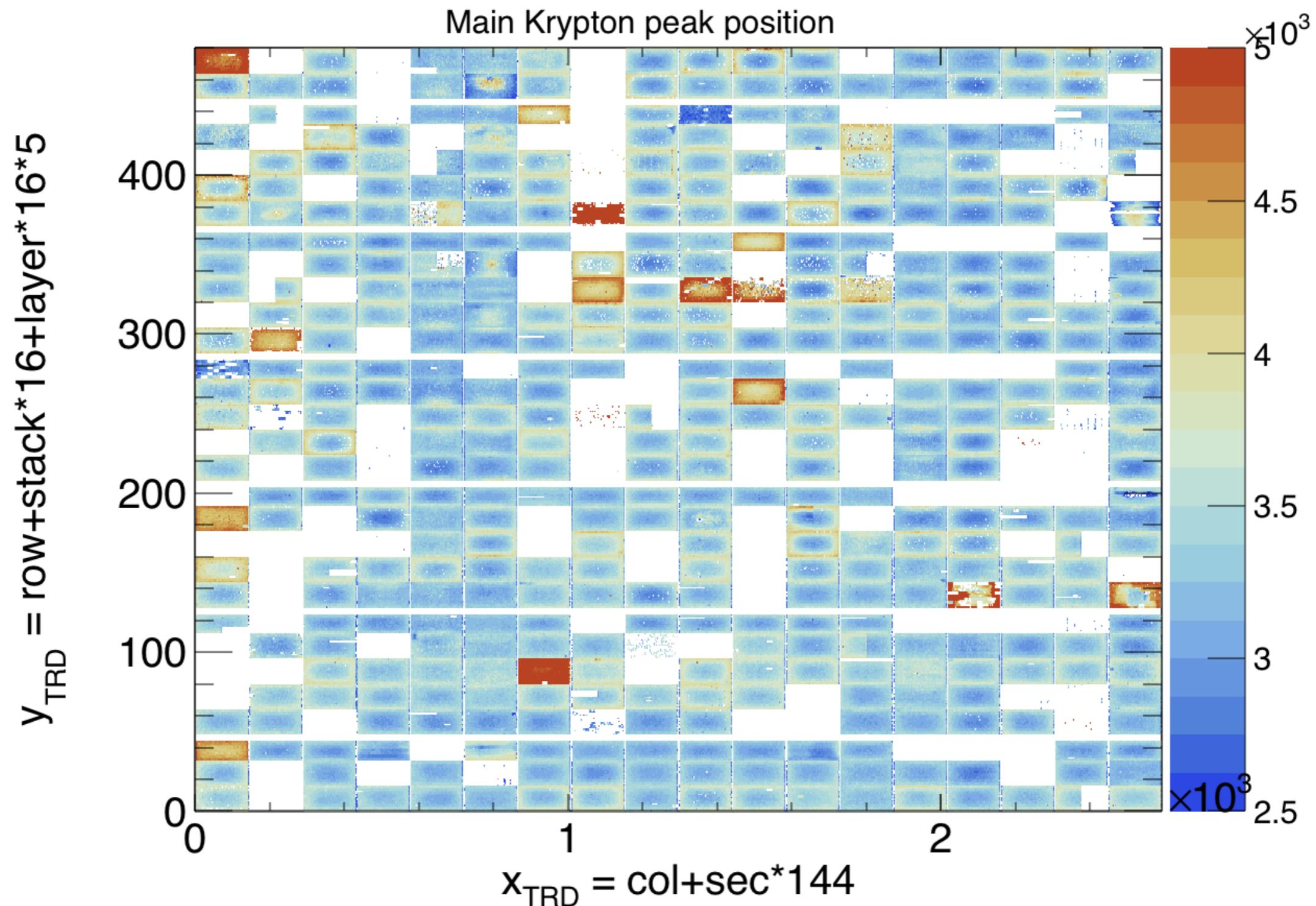


# Second Krypton Peak Sigma



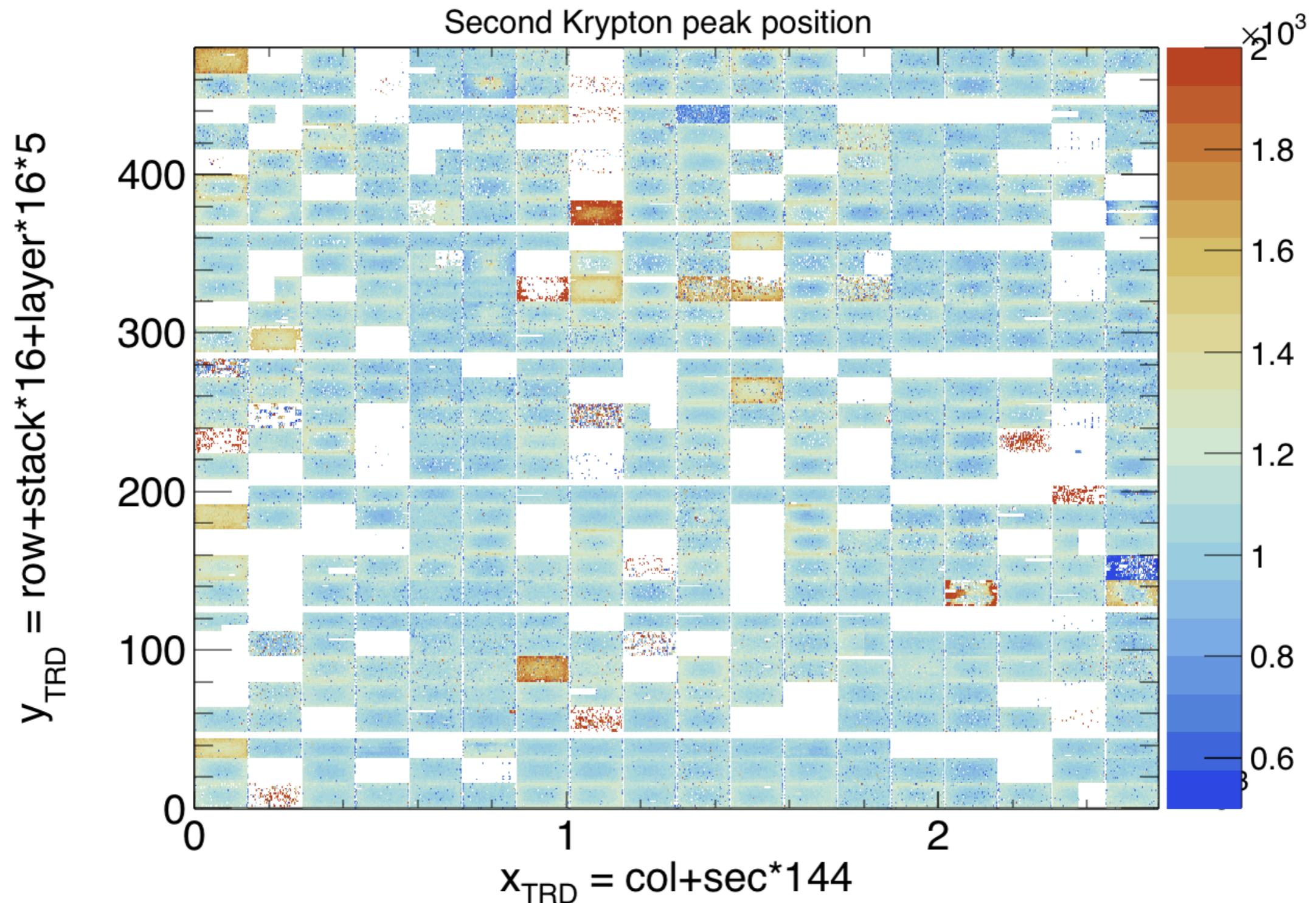


# Main Krypton Peak Positions





# Second Krypton Peak Positions





# Next Steps

- Doing final QA.
- Calculate pad response in respect to average of chamber.
- Gain vs HV correlation.