TOF Issues
Status Update

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May 3, 2018, MICE VC

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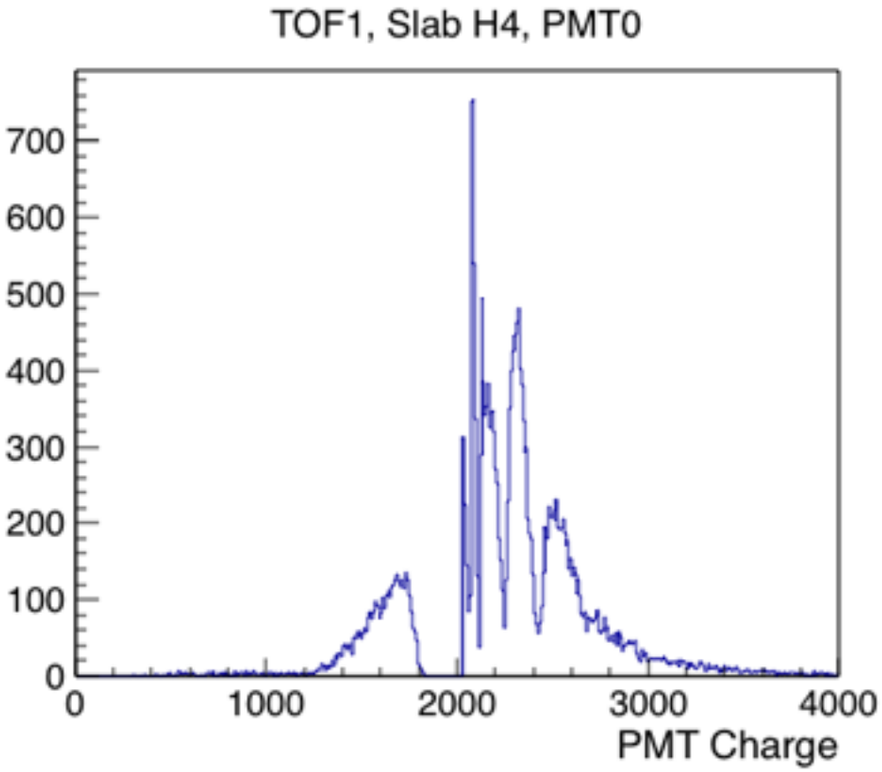
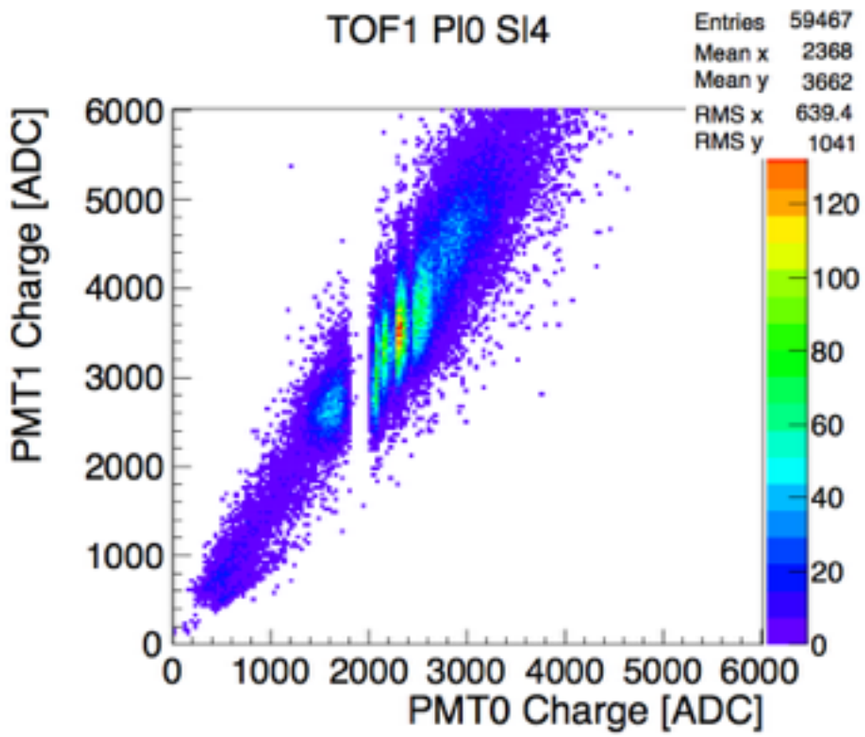
- Bad channels
- Channel quality determination from ADC distribution
- Time Walk calibrations
- Reconstruction

Bad Channels

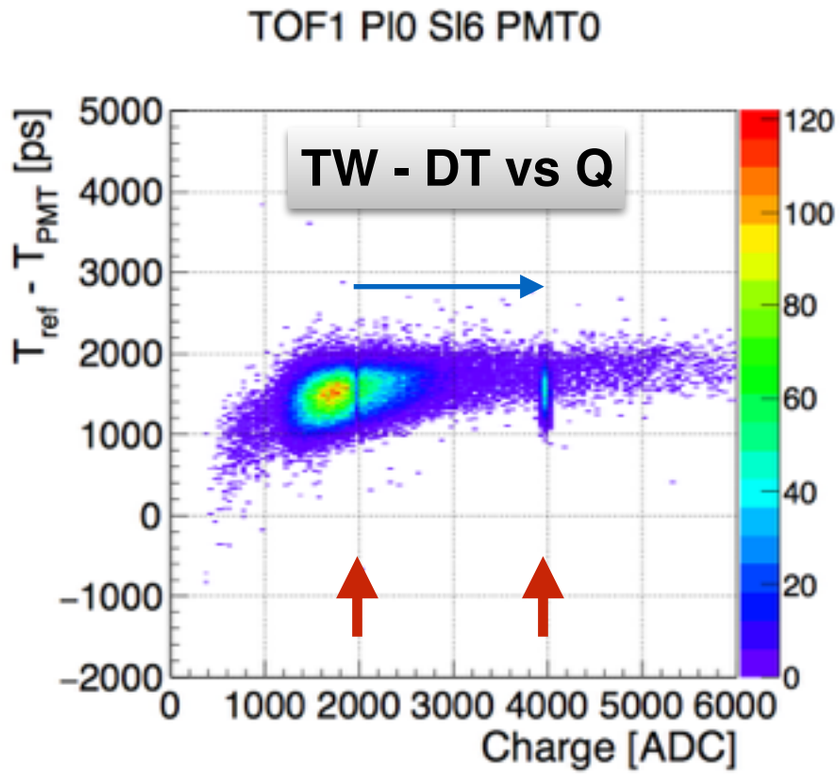
- Reported one bad channel in Glasgow
  - TOF1 Plane 0 Slab 4 PMT0

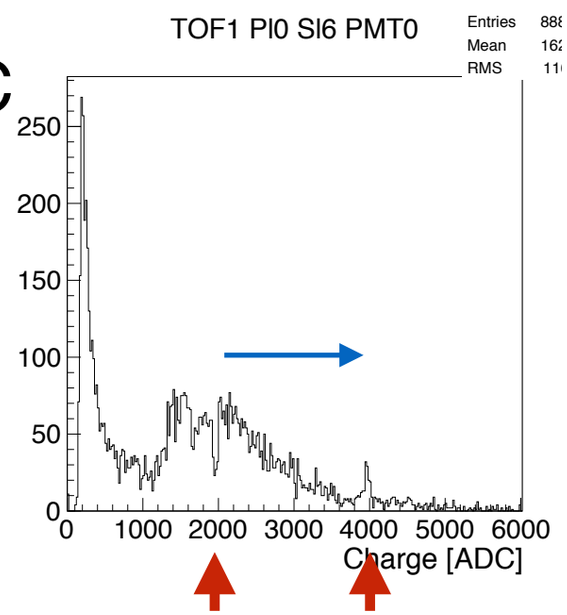


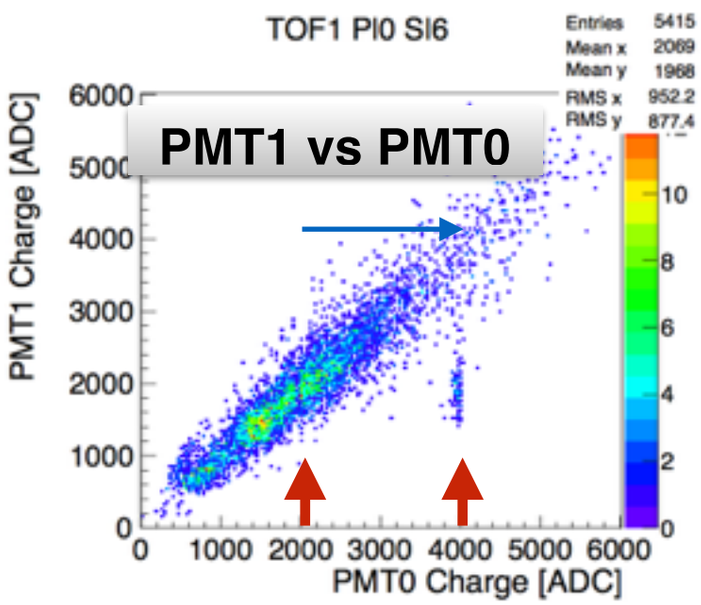


Bad Channels

- Reported one bad channel in Glasgow
  - TOF1 Plane 0 Slab 4 PMT0
- New channel found very suspicious
  - TOF1 Plane 0 Slab 6 PMT0 (connected to the same fADC board)
  - looks like bit shift (x2)

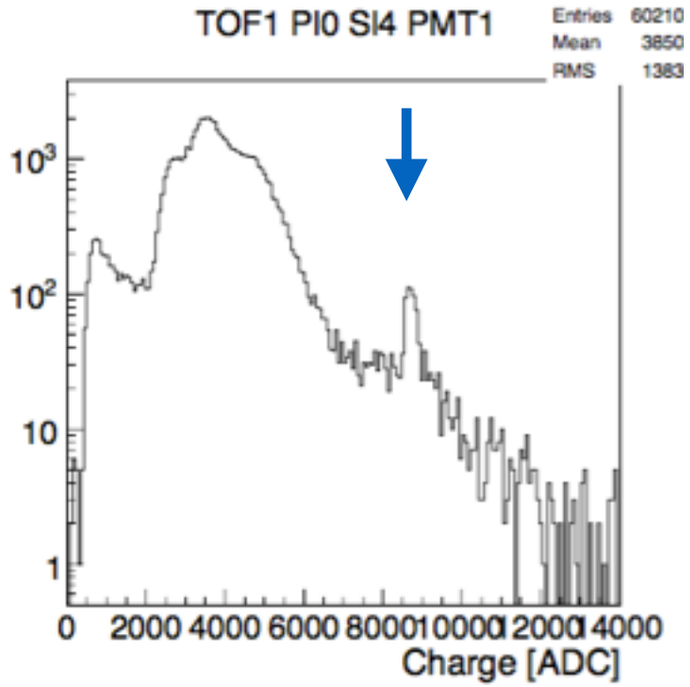


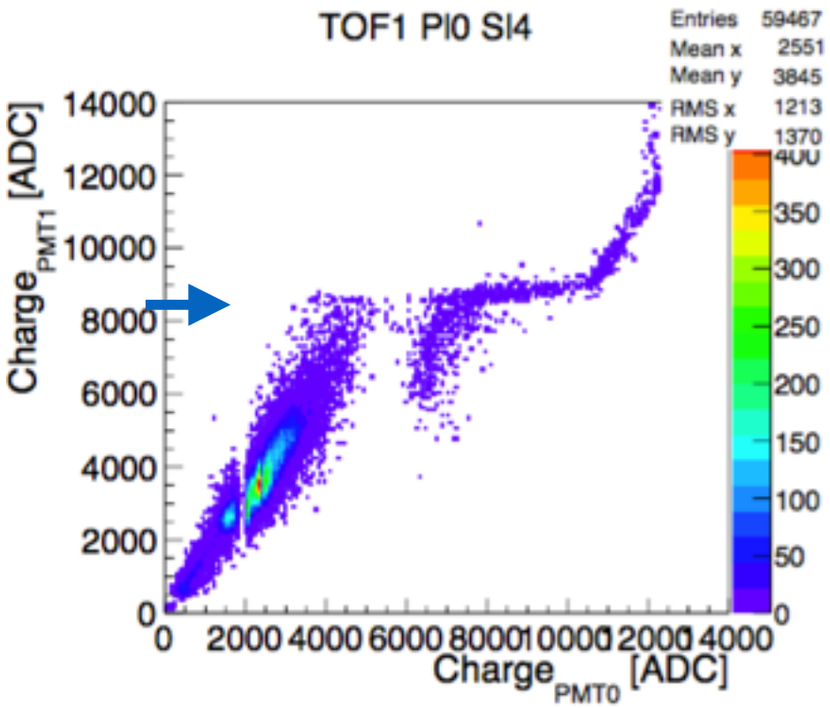




Bad Channels

- Reported one bad channel in Glasgow
  - TOF1 Plane 0 Slab 4 PMT0
- New channel found very suspicious
  - TOF1 Plane 0 Slab 6 PMT0 (connected to the same fADC board)
  - looks like bit shift (x2)
- Other suspicious channels





Bad Channels

- No systematic checks implemented
- Only a few runs were looked at
- Channels **TOF1 Plane 0 Slab 4 PMT0** and **TOF1 Plane 0 Slab 6 PMT0** misbehave in all of those

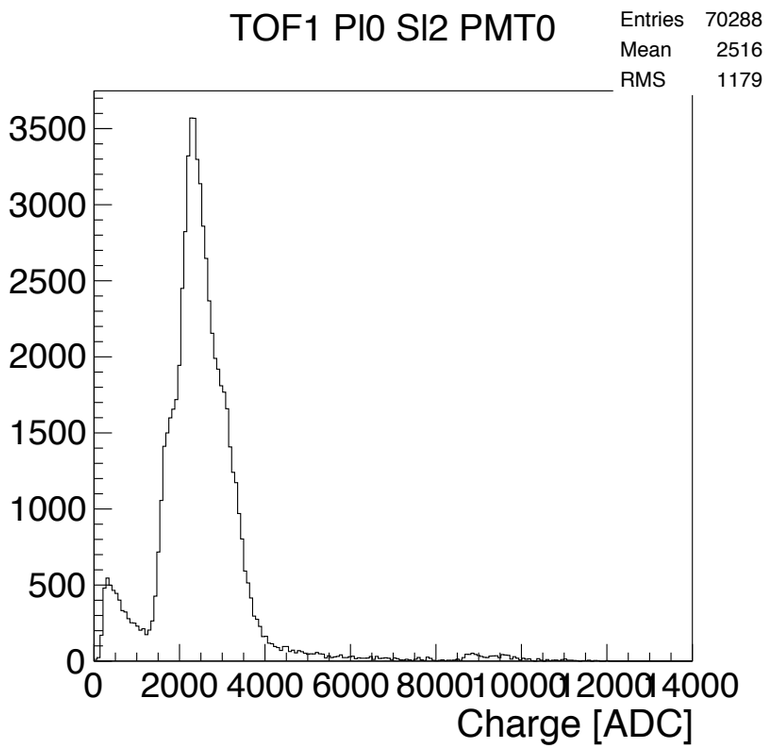
Automated Test of Channel

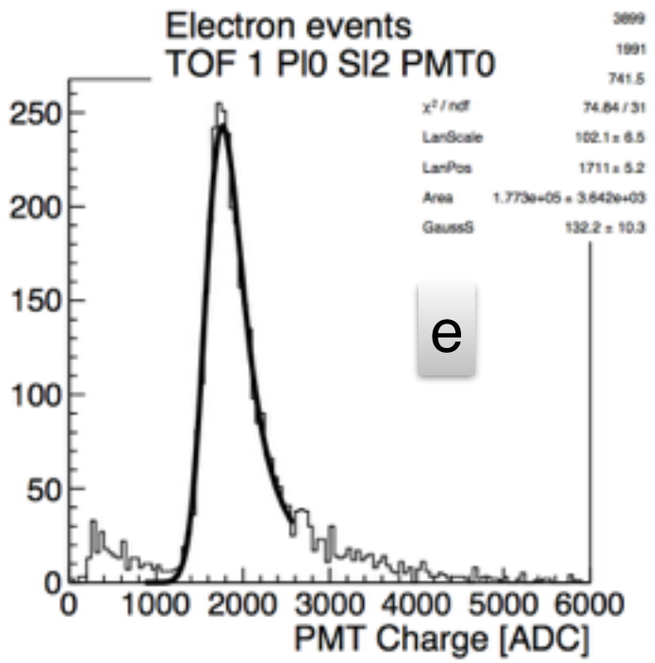
- One possible test
  - fit to ADC distribution
  - check how bad the fit is

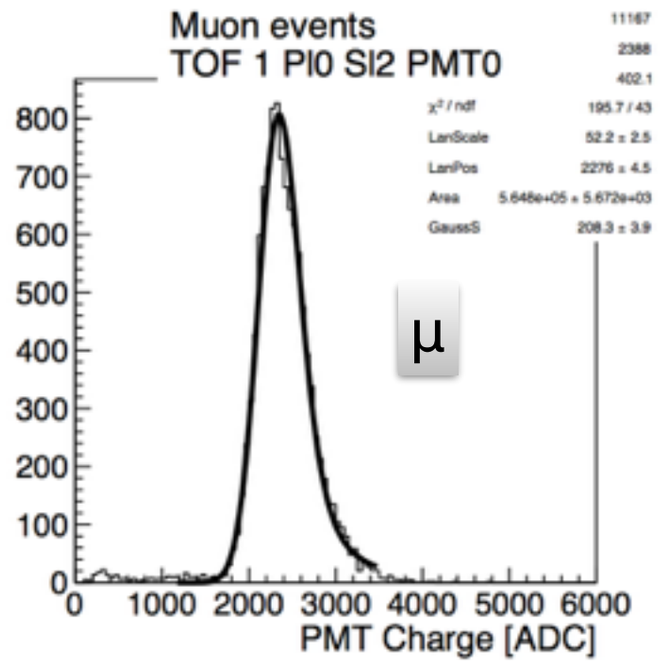
- Full ADC distributions difficult to fit with a model function

- Some slabs sensitive to different particles differently

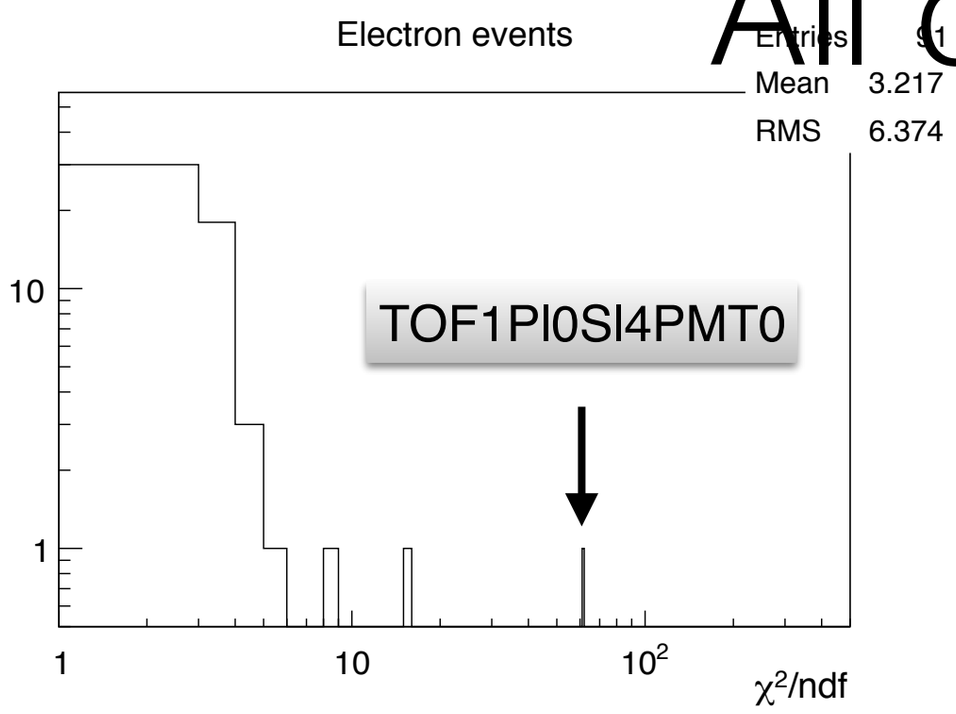
- Trying (Landau ∗ Gauss)

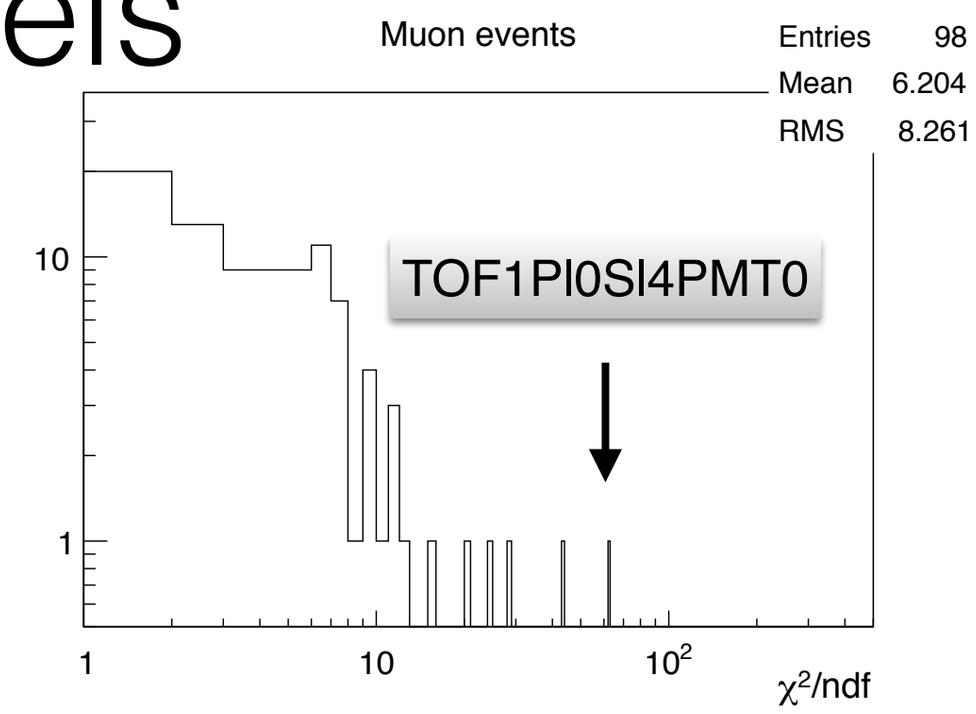


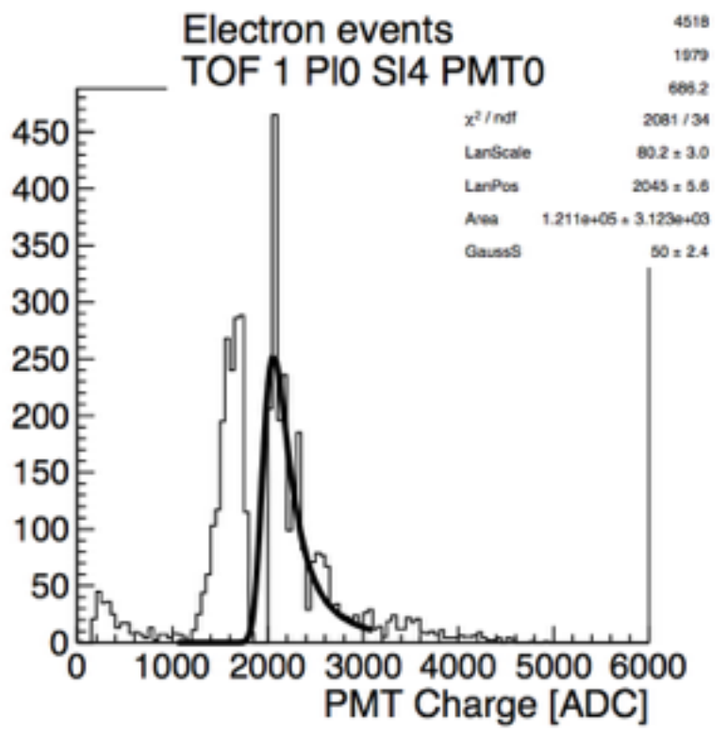


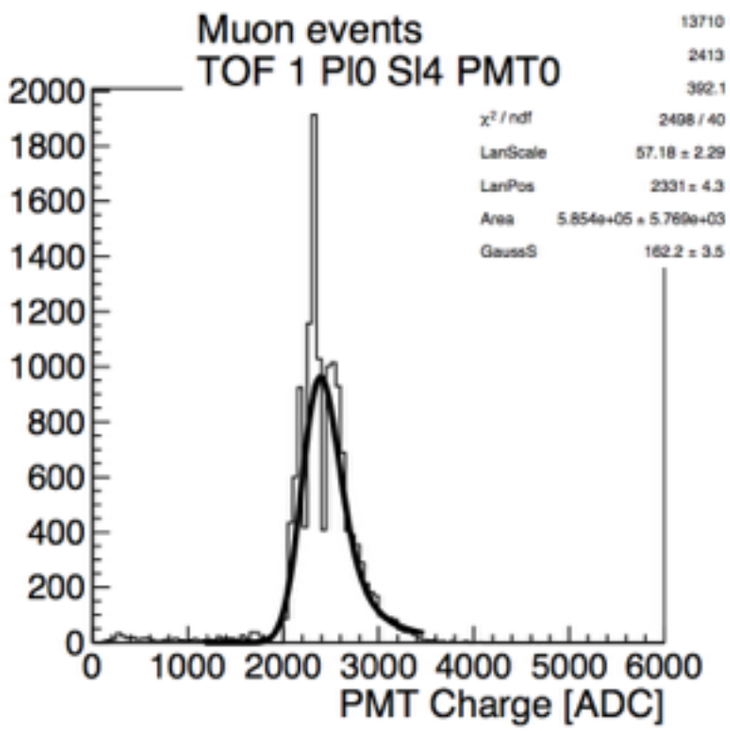


Fit Chi2 Distribution
All channels

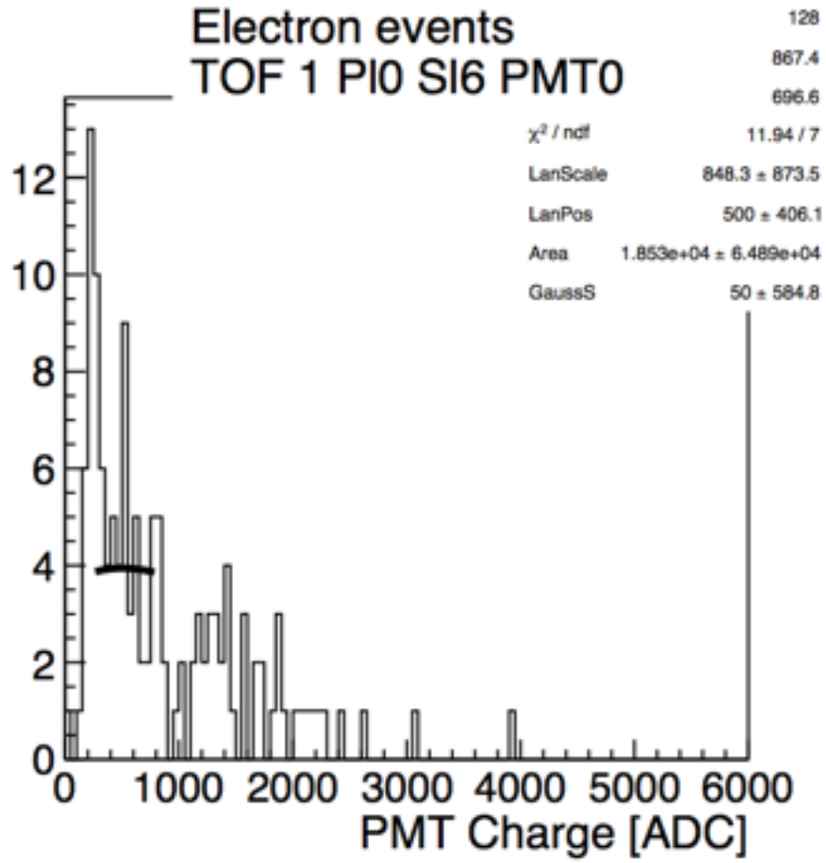


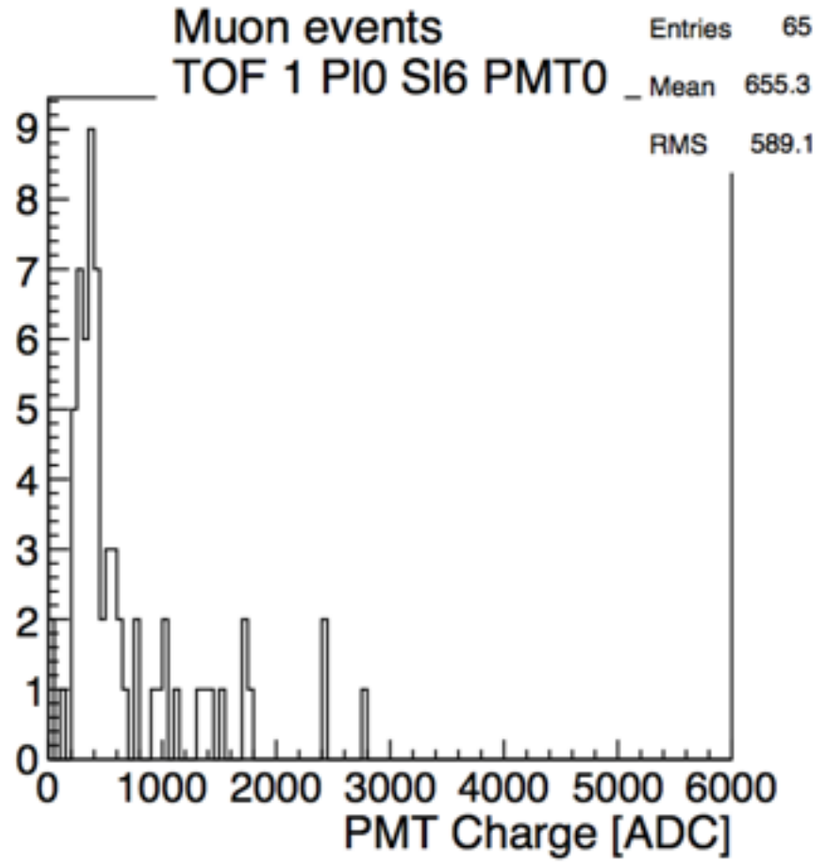






Low Stats Channels





- Sometimes no fit at all

- Or really bad fit, but not classified due to small number of events

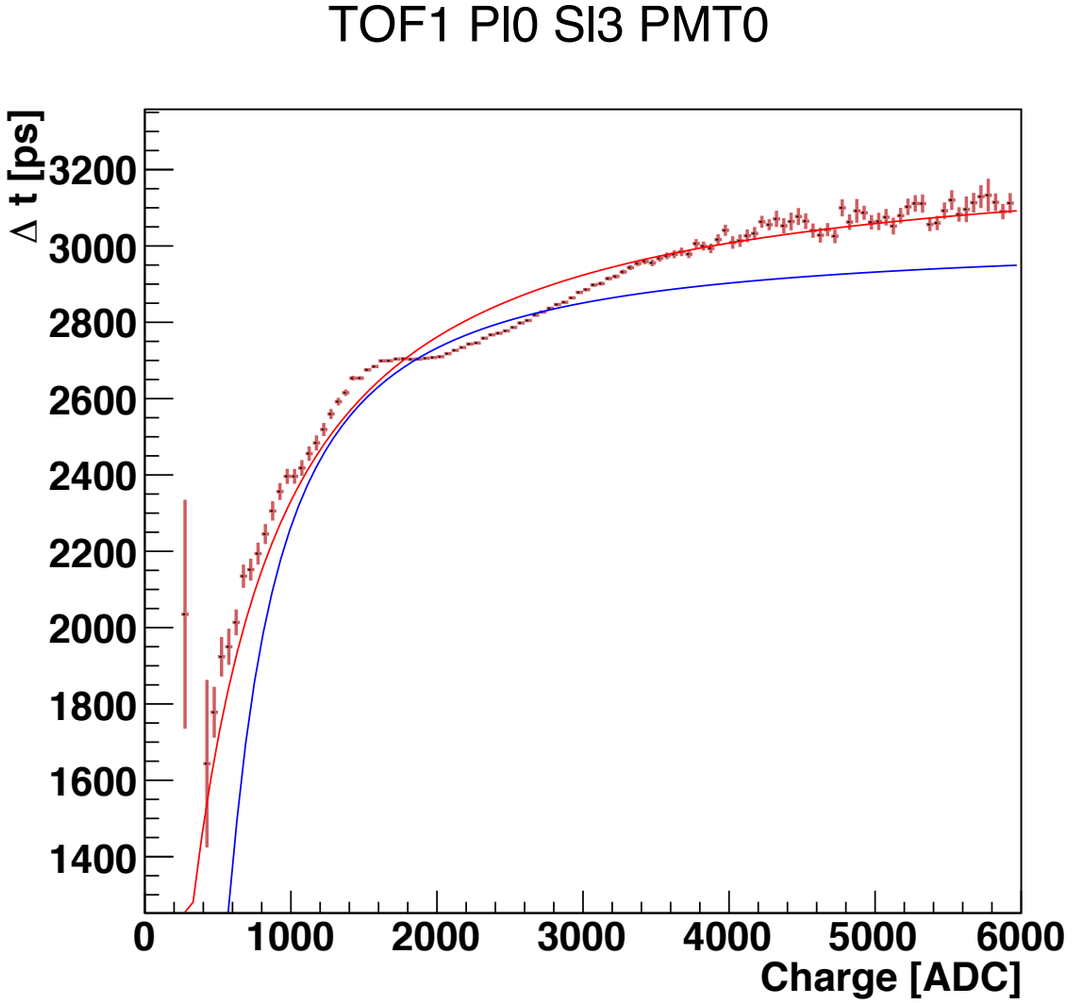
Time Walk Calibrations

- Biases in TOF times observed
- Dominant cause is improper TW calibration
- Correction necessary for proper space point reconstruction
    - 2 slabs matched based on hit times
- Introduce systematic errors in T-o-F/momentum measurement

Example

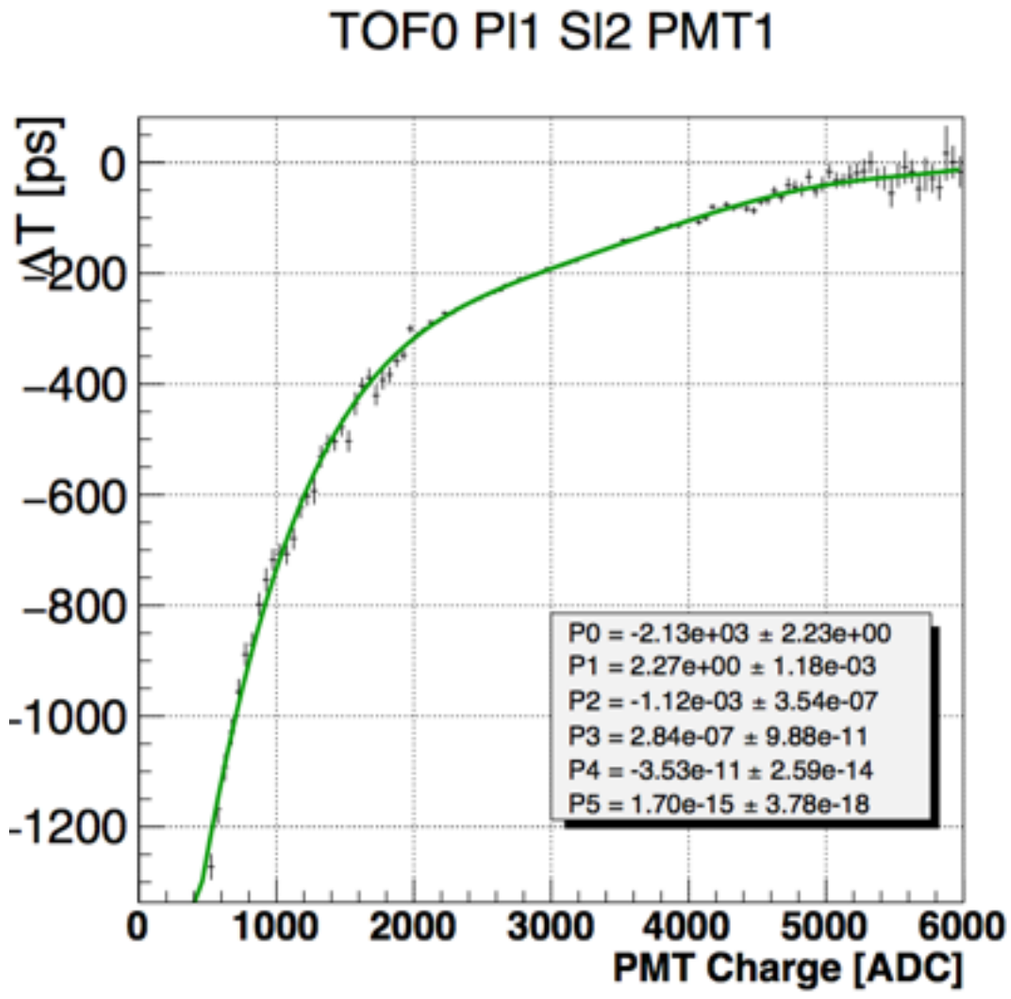
- Extreme channel

- Fit with $A + B/(X - K) + C/(X - K)^2$



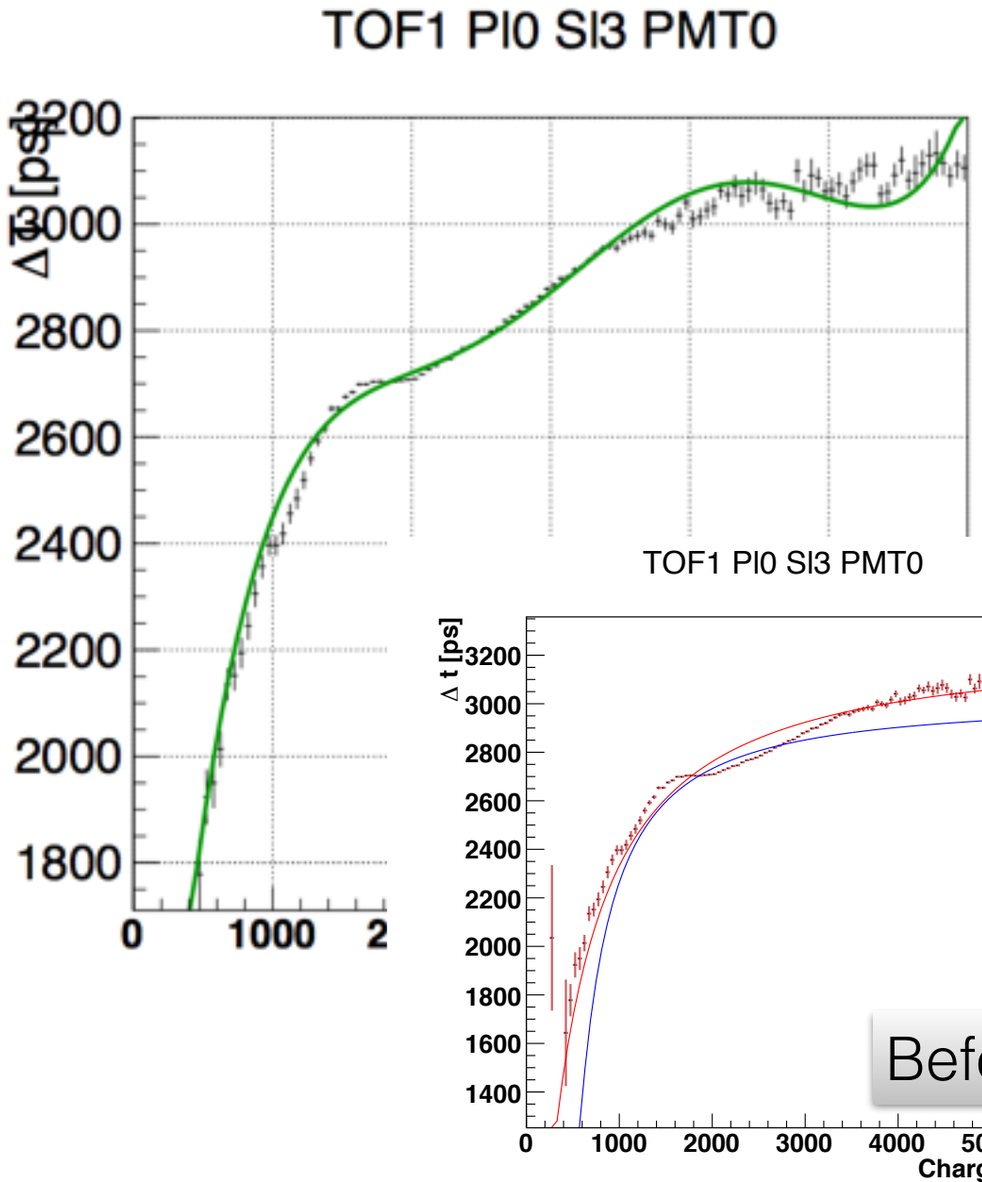
Polynomial Fit

- Trying a polynomial fit
- Degree 5
- Some channels fit nicely

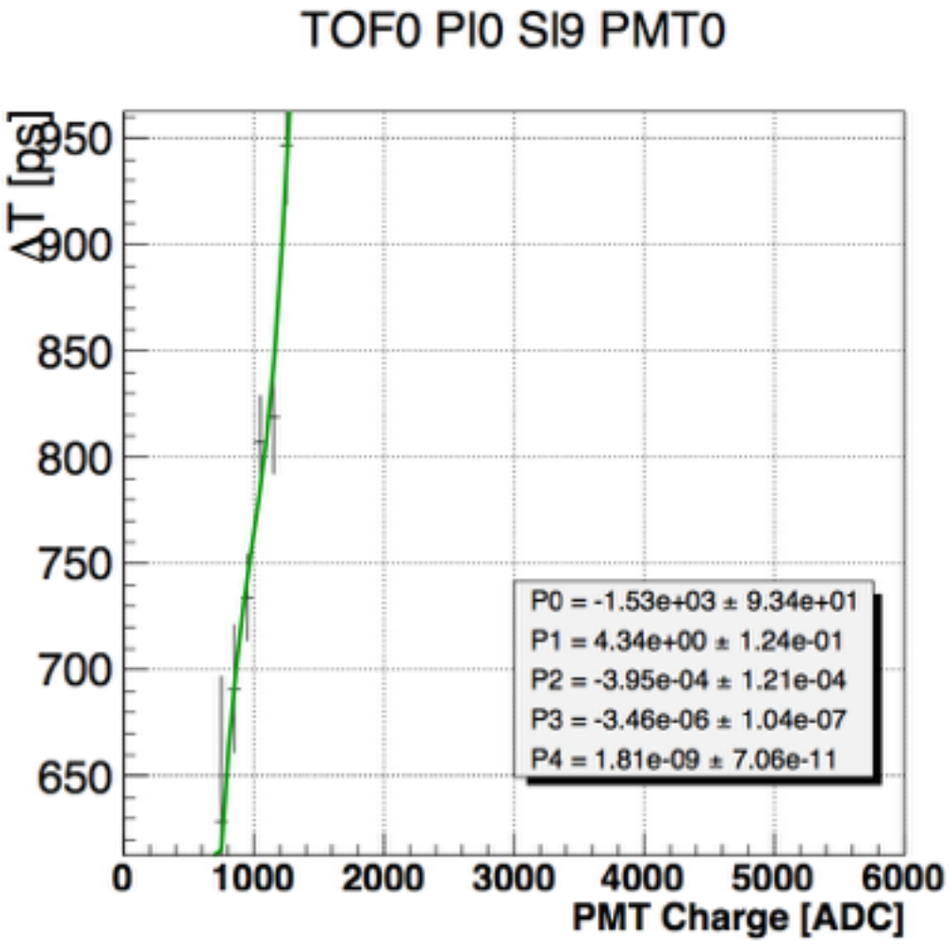


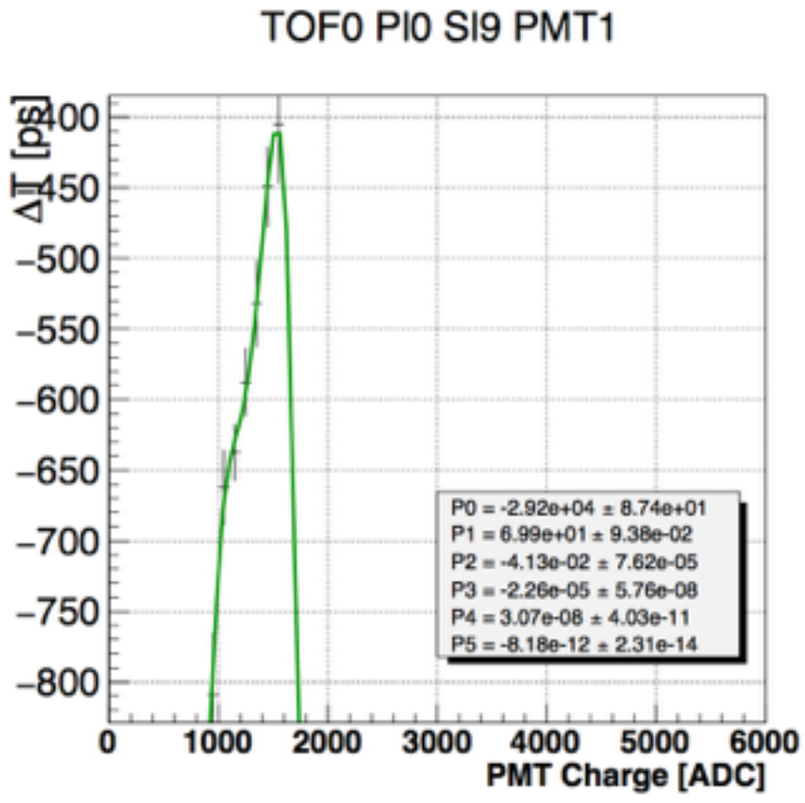
Comparison

- Degree 5 polynomial fit
- Even the difficult channel looks better
- Residuals in the statistically most populated interval **< 50 ps** (1500-3000 ADC)
- **Below 100 ps** over most of the range (500-6000)



But

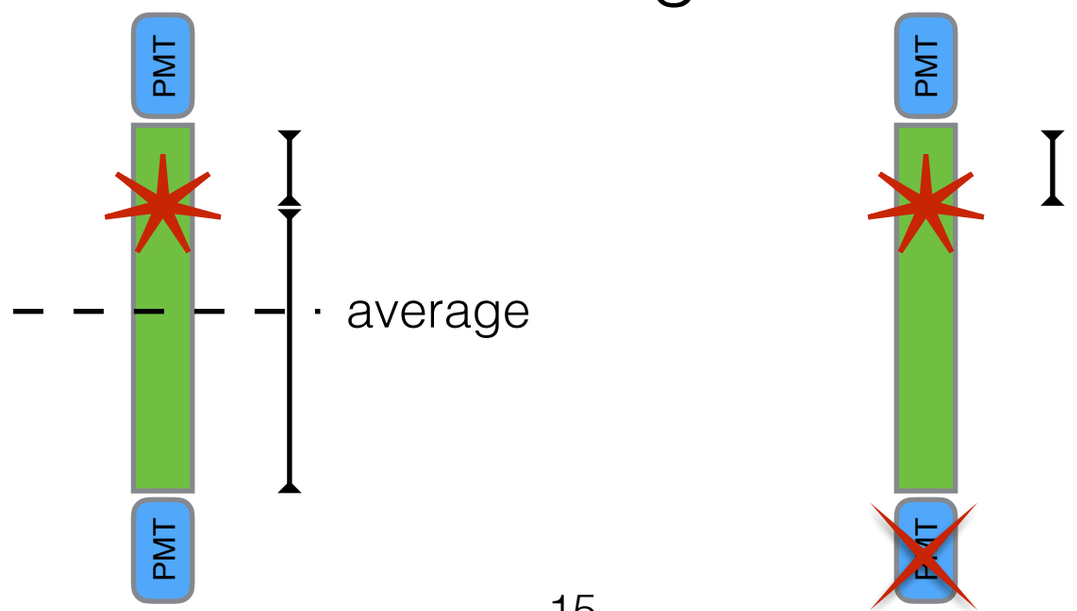




- There will always be fits which misbehave out of the calibration data interval
- Pragmatic approach:
  - see if this calibration range covers range of physics runs
  - ignore anomalous extrapolations

Reconstruction

- I started working on channel blacklisting in TOF reconstruction
- Possible issue:
  - When only 1 PMT used to determine slab hit time, position dependent bias introduced
  - 2 PMTs balance the timing



Summary

- 2 bad channels in TOF1 (from the same fADC board)
- Currently working on:
  - implementing channel blacklisting in TOF reconstruction
  - implementing better TW calibration
- Next to do:
  - test reconstructed data after the modifications
  - expected:
    - better space-point creation efficiency
    - smaller biasses in ToF measurements
- To think about:
  - systematic checks of all channels in all runs