SVT Hit-Time Calibration Studies: Another Update

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Previously…

- …I was looking at and equalizing times based on hit times relative to a reference sensor in order to account for the bucket of the actual track
- A better way is to equalize based on the matched cluster time…so that's what I've done here
  - Needed FinalStateParticle list in hpstr tuples to do this…these are now in "pass0b"
- I'm looking at run 14495 … yet a different run from other talks!
- I'm using Si clusters-on-track
  - Required #hits/track >= 10
  - Track momentum > 1 GeV
  - Matched to an ECal cluster
  - I do a rough calibration to get everything on same scale around ~0…shift slim sensors by 16.5ns, old sensors by 7ns.
- As before, equalize per-sensor and per-phase

ECal Cluster Time

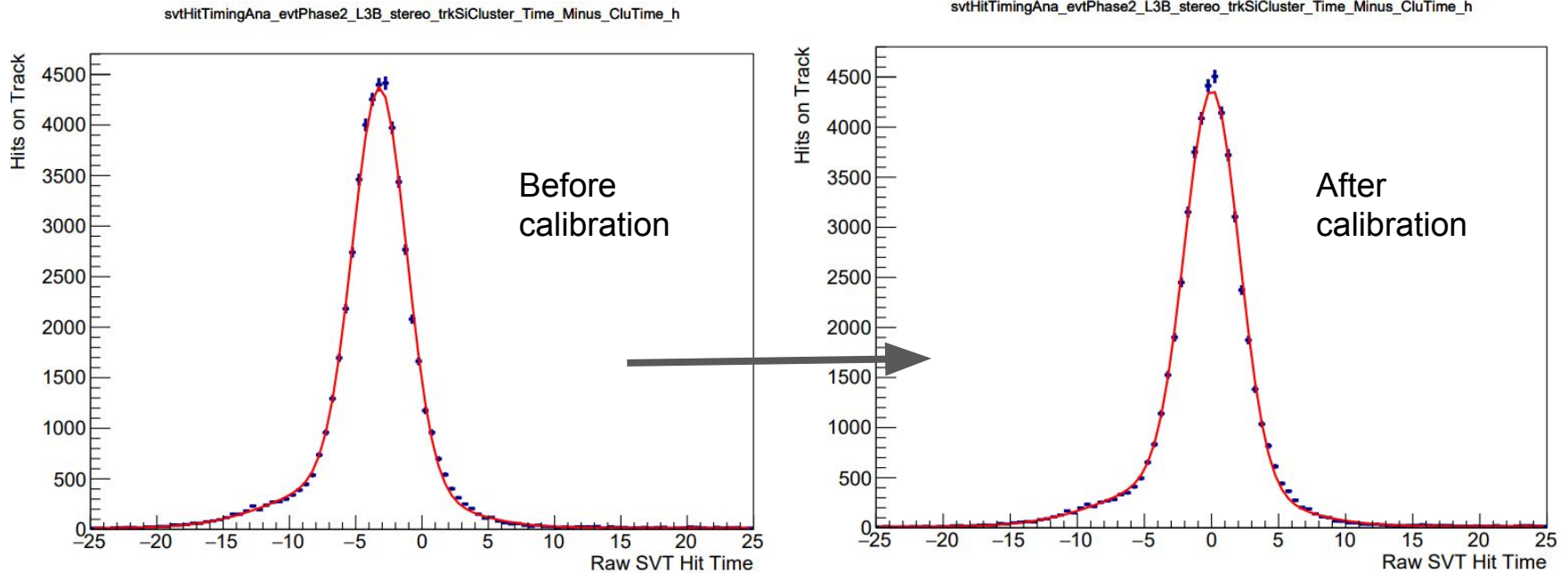Cluster time for matched tracks…looks pretty normal. Many more bottom tracks but I think this is known…

…the shape is funny (non-gaussian) because we are spread over a few beam bunches (relative to trigger time).

ECal Cluster –37.5ns

Blue: Bottom
Red: Top
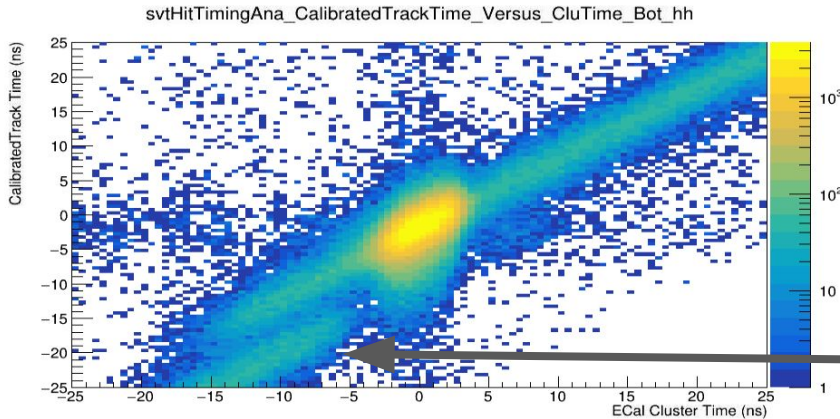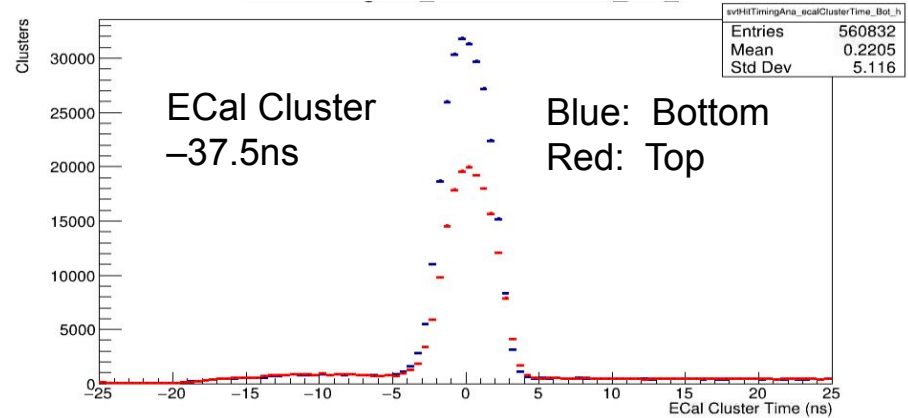
We can see the correlation between "track time" and cluster time even in the peak…(track-cluster) time is better.

What is going on here?

Example pre- and post- calibration

svtHitTimingAna_evtPhase2_L3B_stereo_trkSiCluster_Time_Minus_CluTime_h

Before calibration

svtHitTimingAna_evtPhase2_L3B_stereo_trkSiCluster_Time_Minus_CluTime_h

After calibration

..this is an example of the Si cluster - Ecal cluster time before & after calibration constants have been applied.
The "pre-calibration" has the "rough" calibration applied (see slide 2) but for "after calibration" those are included in the constants.

Another, uglier example

svtHitTimingAna_evtPhase1_L0B_axial_positron_trkSiCluster_Time_Minus_CluTime_h
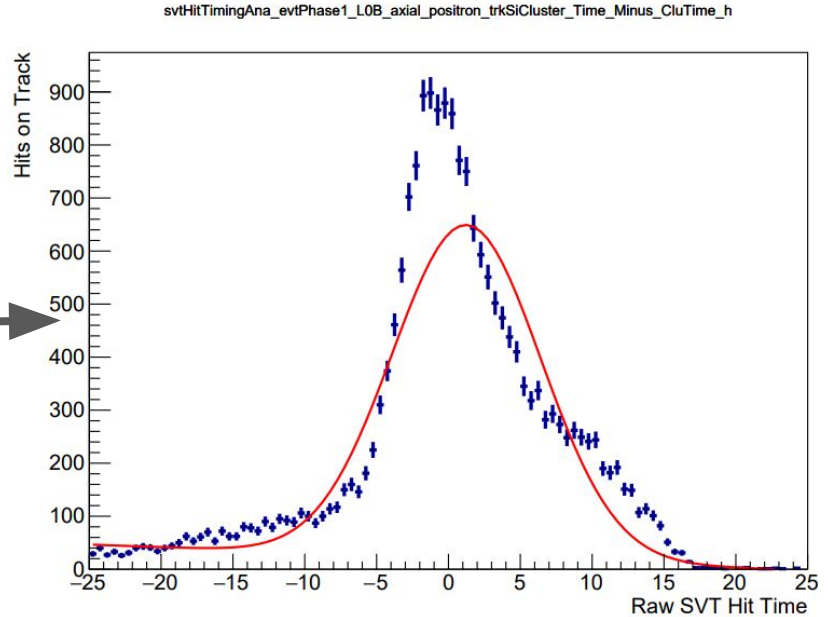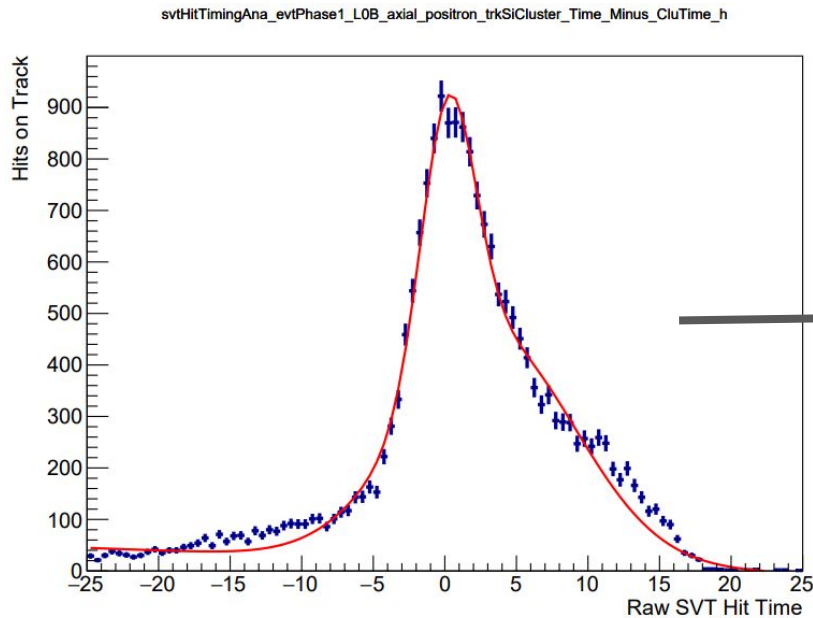
I do the dumb simple thing and average around the maximum bin (so ignore the fits in these plots).
In this case, the maximum is already around zero so things don't change much.

Hit time–Cluster Time Means pre- and post-
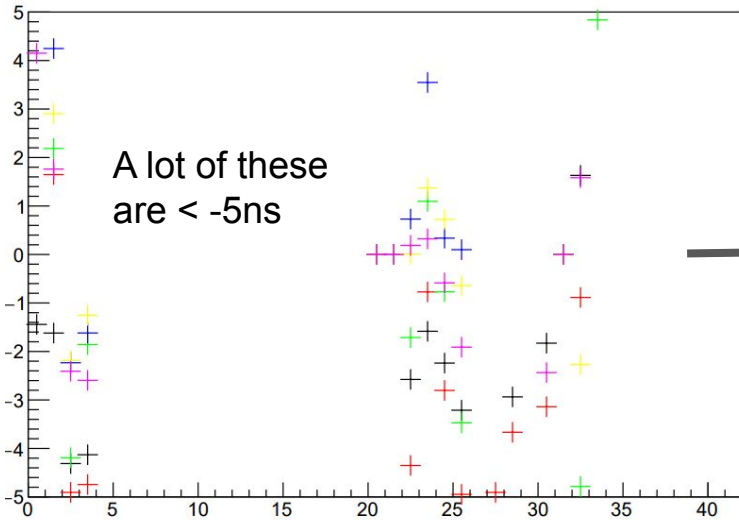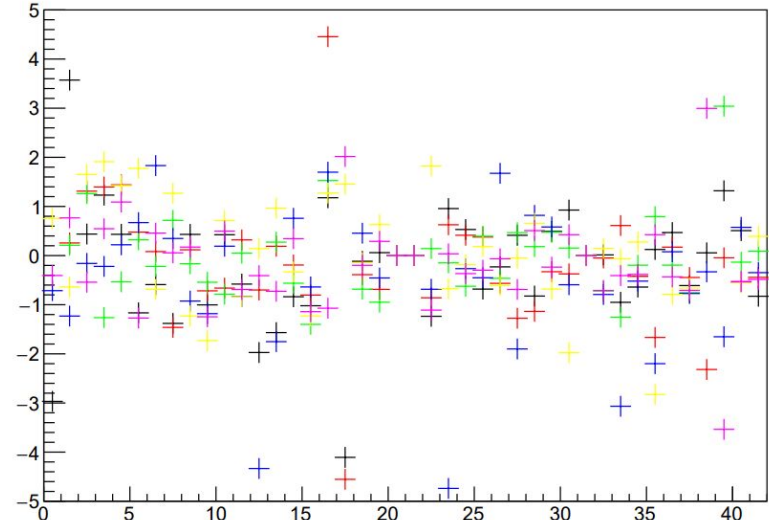
Clearly the per sensor and per phase scatter is way off before calibration (the sensors on layer>4 are mostly off scale)....after calibration looks better but the spread and outliers suggest we can do a bit better. Note, corrections are implemented per-event so things can migrate to/from adjacent bins in (track hit - cluster) time…those bins are 0.5ns.

Track Times: All phases, top+bottom, ele+pos

svtHitTimingAna_CalibratedTrackTime_h

svtHitTimingAna_CalibratedTrackTime_h

Black: pre-cal
Red: post-cal

*Run 14495
with calib
from 14495*

*Run 14507
with calib
from 14495*

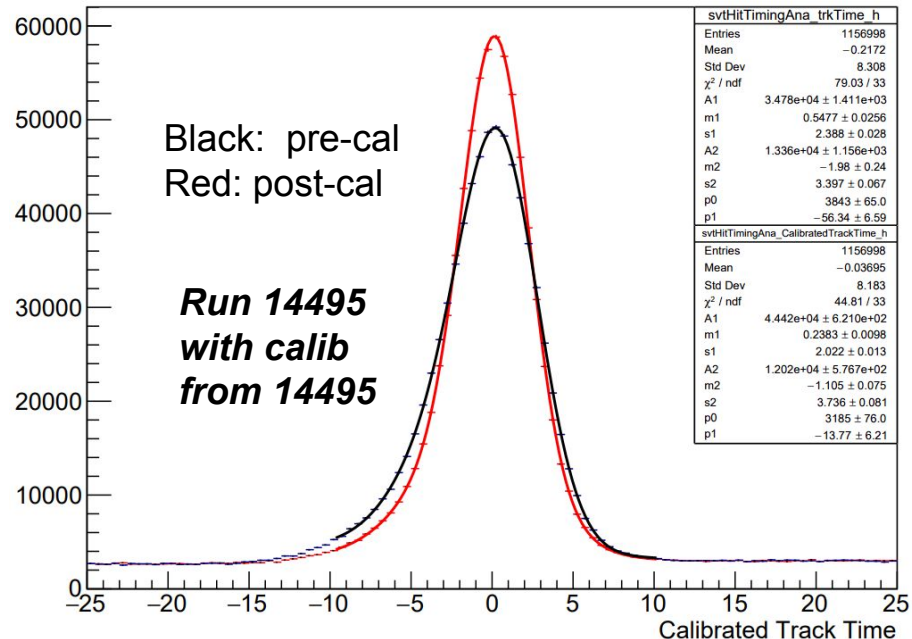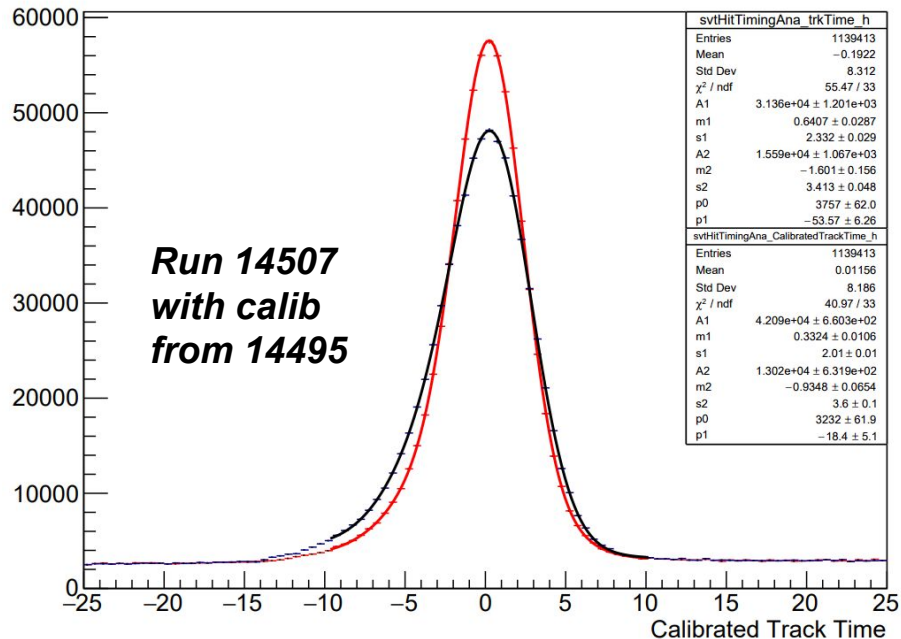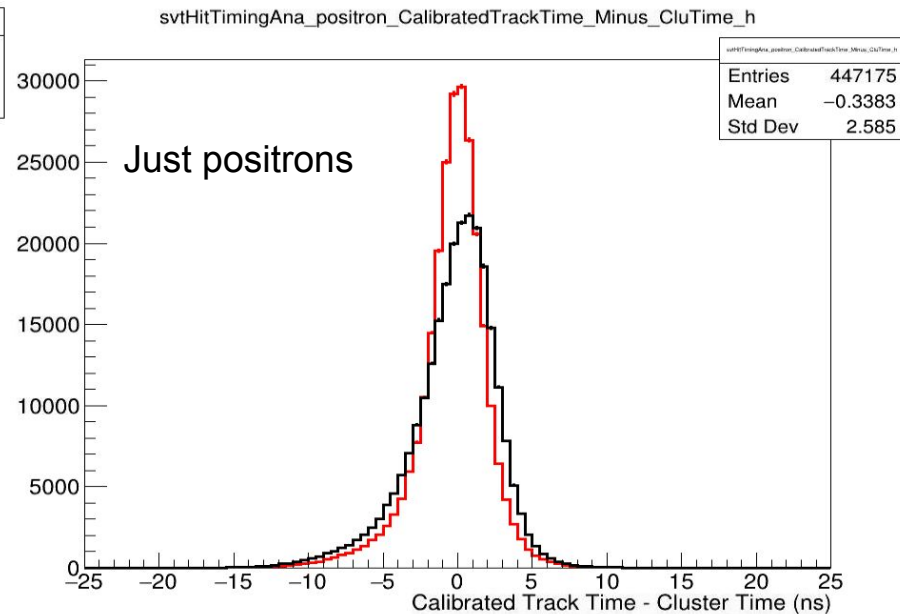| svtHitTimingAna_trkTime_h	
Entries	1156998
Mean	−0.2172
Std Dev	8.308
χ² / ndf	79.03 / 33
A1	3.478e+04 ± 1.411e+03
m1	0.5477 ± 0.0256
s1	2.388 ± 0.028
A2	1.336e+04 ± 1.156e+03
m2	−1.98 ± 0.24
s2	3.397 ± 0.067
p0	3843 ± 65.0
p1	−56.34 ± 6.59

svtHitTimingAna_CalibratedTrackTime_h	
Entries	1156998
Mean	−0.03695
Std Dev	8.183
χ² / ndf	44.81 / 33
A1	4.442e+04 ± 6.210e+02
m1	0.2383 ± 0.0098
s1	2.022 ± 0.013
A2	1.202e+04 ± 5.767e+02
m2	−1.105 ± 0.075
s2	3.736 ± 0.081
p0	3185 ± 76.0
p1	−13.77 ± 6.21

svtHitTimingAna_trkTime_h	
Entries	1139413
Mean	−0.1922
Std Dev	8.312
χ² / ndf	55.47 / 33
A1	3.136e+04 ± 1.201e+03
m1	0.6407 ± 0.0287
s1	2.332 ± 0.029
A2	1.559e+04 ± 1.067e+03
m2	−1.601 ± 0.156
s2	3.413 ± 0.048
p0	3757 ± 62.0
p1	−53.57 ± 6.26

svtHitTimingAna_CalibratedTrackTime_h	
Entries	1139413
Mean	0.01156
Std Dev	8.186
χ² / ndf	40.97 / 33
A1	4.209e+04 ± 6.603e+02
m1	0.3324 ± 0.0106
s1	2.01 ± 0.01
A2	1.302e+04 ± 6.319e+02
m2	−0.9348 ± 0.0654
s2	3.6 ± 0.1
p0	3232 ± 61.9
p1	−18.4 ± 5.1

Calibrated Track Time
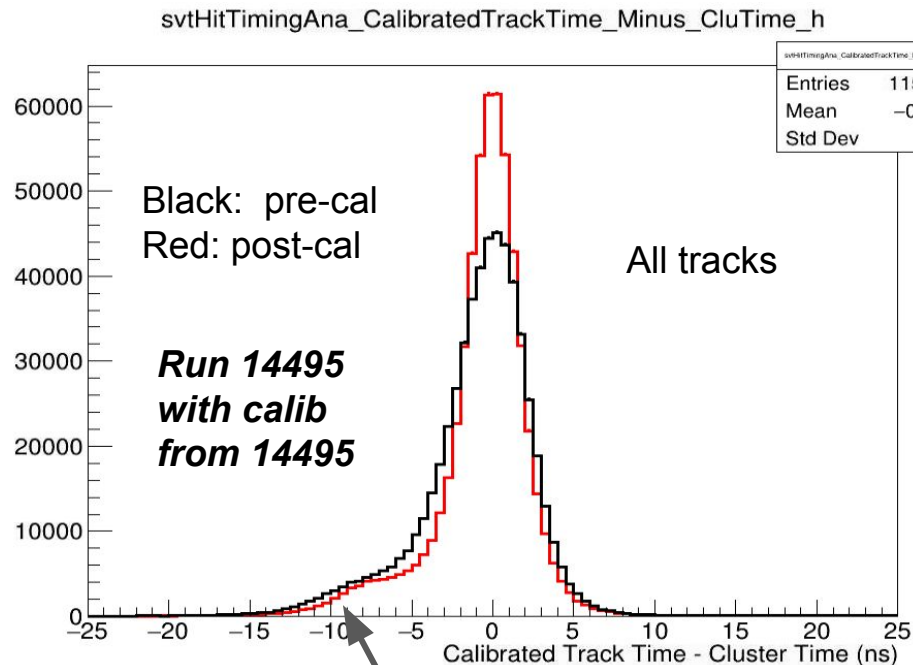
Calibrated Track Time

…at least for this one, near in time run, the calibration constants work…I will look at more runs

Track-ECal Cluster Time

svtHitTimingAna_CalibratedTrackTime_Minus_CluTime_h

svtHitTimingAna_CalibratedTrackTime_Minus_CluTime_h	
Entries	1156998
Mean	−0.5967
Std Dev	3.293

Black: pre-cal
Red: post-cal

All tracks

Run 14495 with calib from 14495

Calibrated Track Time - Cluster Time (ns)

svtHitTimingAna_positron_CalibratedTrackTime_Minus_CluTime_h

svtHitTimingAna_positron_CalibratedTrackTime_Minus_CluTime_h	
Entries	447175
Mean	−0.3383
Std Dev	2.585

Just positrons

Calibrated Track Time - Cluster Time (ns)

There are the weird tracks that have ~8ns offset shown on slide 3

Next Steps

- First, want to get this into hps-java
  - Need code to get these into hps-java
    - How much do these change run-to-run…if not significantly we can just use resource file (or a few)...other wise need db
  - Implement corrections in RawHitFitterDriver.java
  - UPDATE: iss950 has the hps-java code that reads in a new table and uses phase-dependent t0s…still needs to be tested and for that we need a (local) db with new table. Cameron will do this but not top priority.
- Take a closer look at spread & outliers.
  - Probably could use higher stats…some of the weird looking ones have significant error bars even at peak. Currently just using 10 files
  - Better way than just taking weighted mean around peak?