CALICE MAPS
Initial Beam Test Analysis

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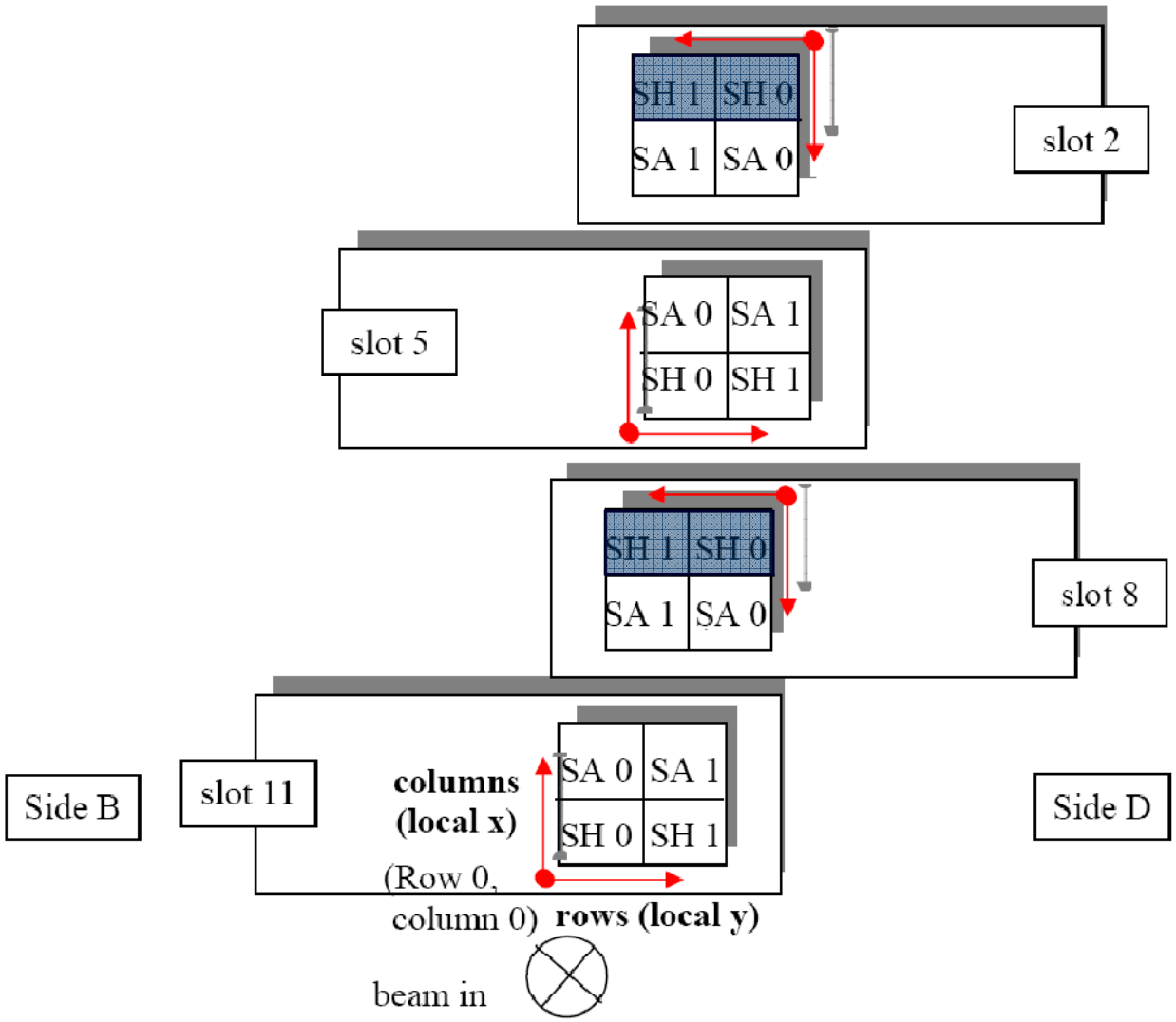
Data File Used

- **Using Run 490084**
- **mpsBeamThresholdScan**
- **1.3M BunchTrains (only used first million)**
- **3 GeV e-, No W plates**
- **Take Shapers on S2 & S8**
- **Only when Threshold=120 on BOTH -> ~ 500,000 bunch trains**

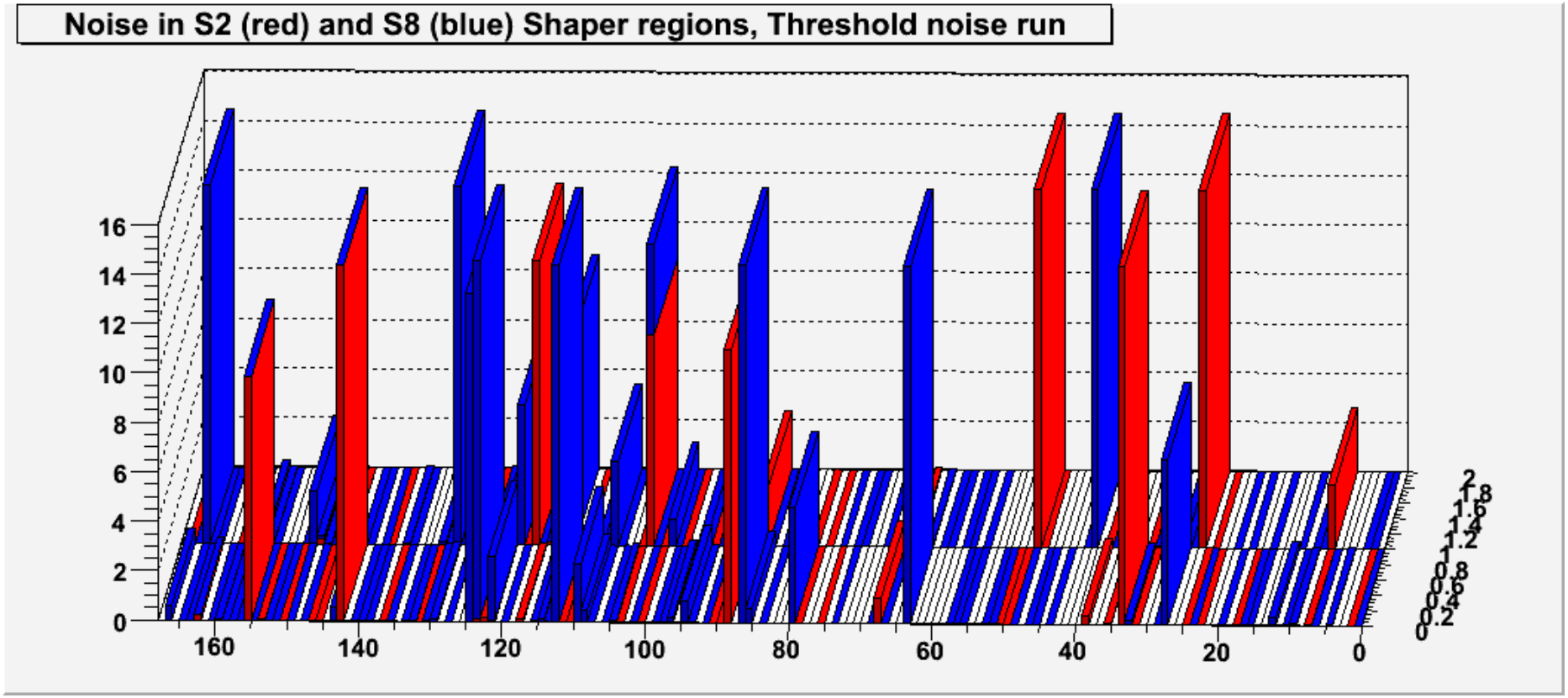

SH 1
SH 0
SA 1
SA 0
slot 2
slot 5
SA 0
SA 1
SH 0
SH 1
slot 8
Side B
slot 11
columns
(local x)
Side D
(Row 0,
column 0)
rows (local y)
beam in

Noise elimination

- **Any noisy pixel can fill up it's regions 19 SRAM registers within a few thousand bunch trains.**
- **Kill all regions with pixels firing at a averaged rate greater than 10^-4 per bunch train.**

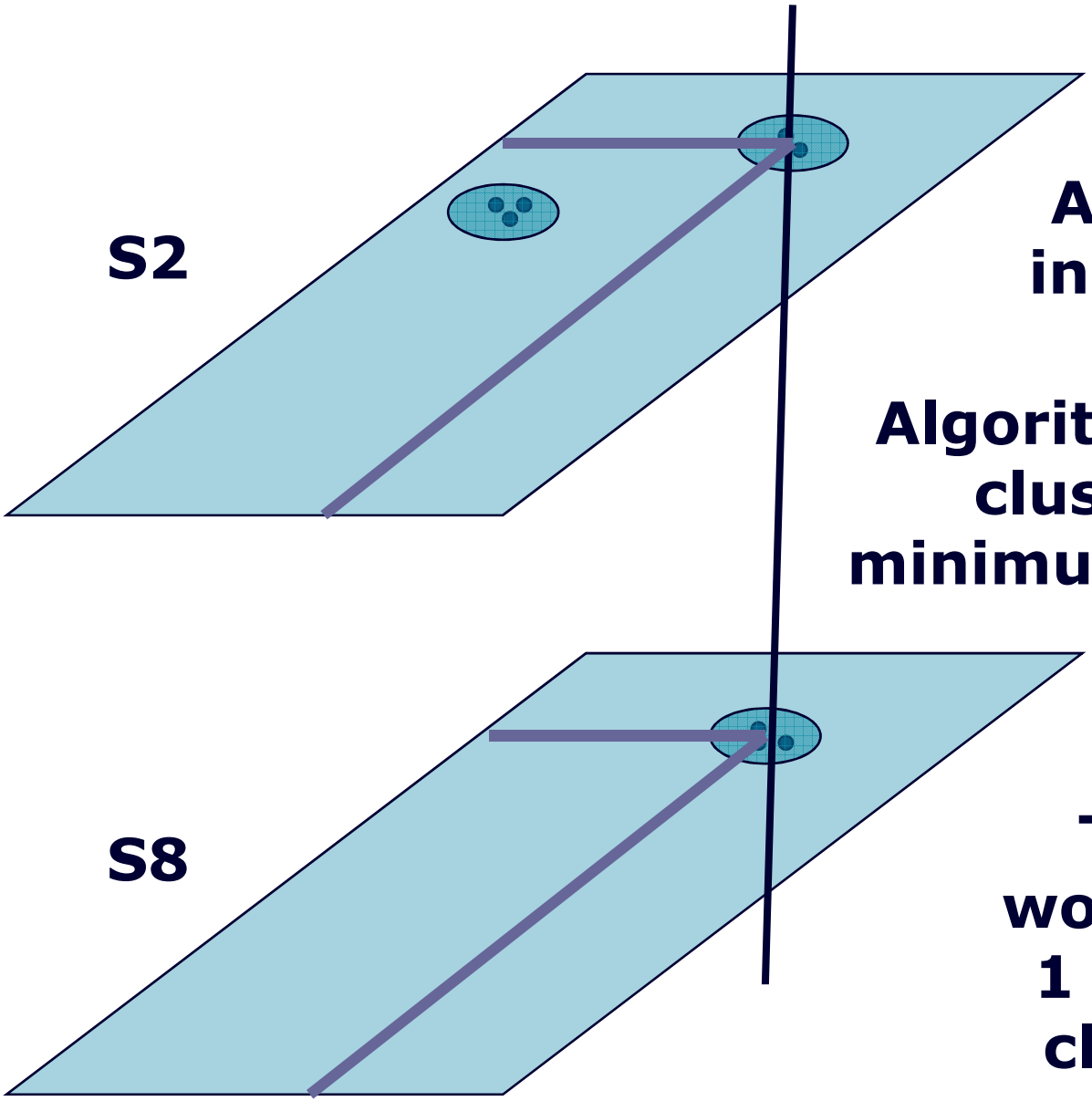
Noise map of the two sensors.
Linear scale so only the very worst pixels are showing here.

Generated from 490083 run. Threshold, no beam, 252k bunch trains.



Procedure

- **Look for timestamps with >1 hit**
- **Find all clusters in the sensor at that timestamp**
- **Do for second sensor**
- **If >0 clusters in each sensor then match the clusters to minimise separation.**

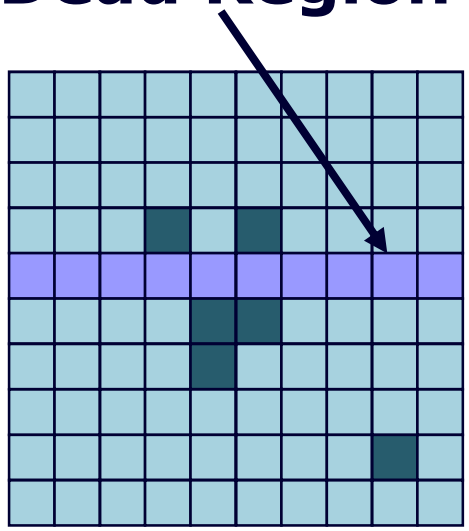


All happening in 1 timestamp

Algorithm matches clusters with minimum separation

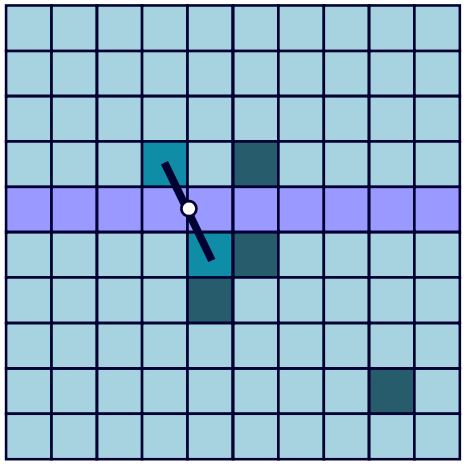
This event would result in 1 unmatched cluster in S2

Dead Region



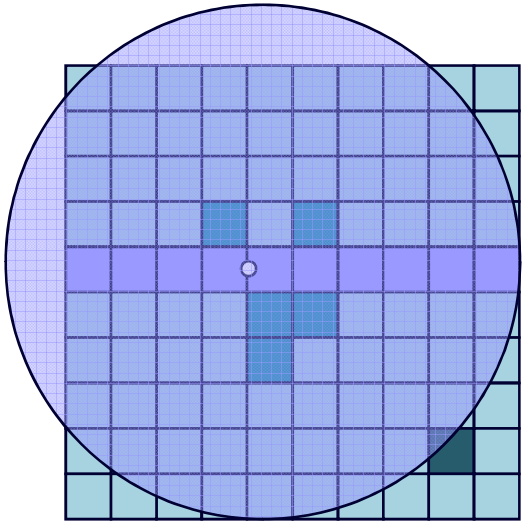
1.

Cluster Seed - ◦



2.

Find all pixels less than 6 pixels away from Seed



3.

Remove the pixels making up this cluster and repeat until N Pixels < 2

Some Run Stats

N BUNCH TRAINS : 997,592
Useable Bunch Trains: 541,592

N Unmatched S2 Clusters: 119,765
N Unmatched S8 Clusters: 133,723

NTrackThroughs: 4,549
Average – 3.7% Cluster Match Efficiency

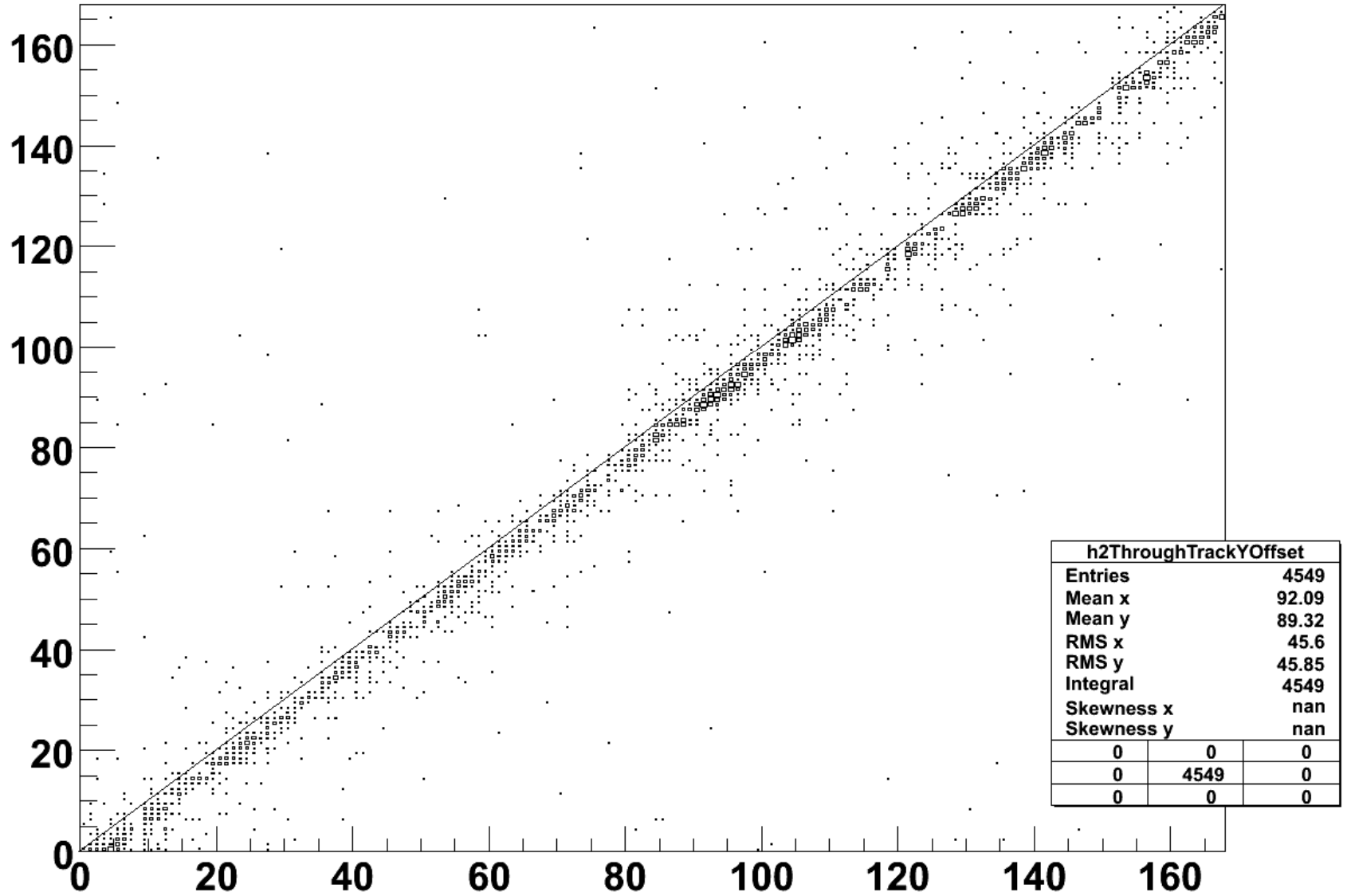
N Events Where Pixels Found but No Cluster in S2: 6,750
N Events Where Pixels Found but No Cluster in S8: 7,524

N Timestamps with >0 Clusters in (S2): 123,086
N Timestamps with >0 Clusters in (S2): 137,004
Cluster found a sensor in (on average) 24% of Bunch Trains

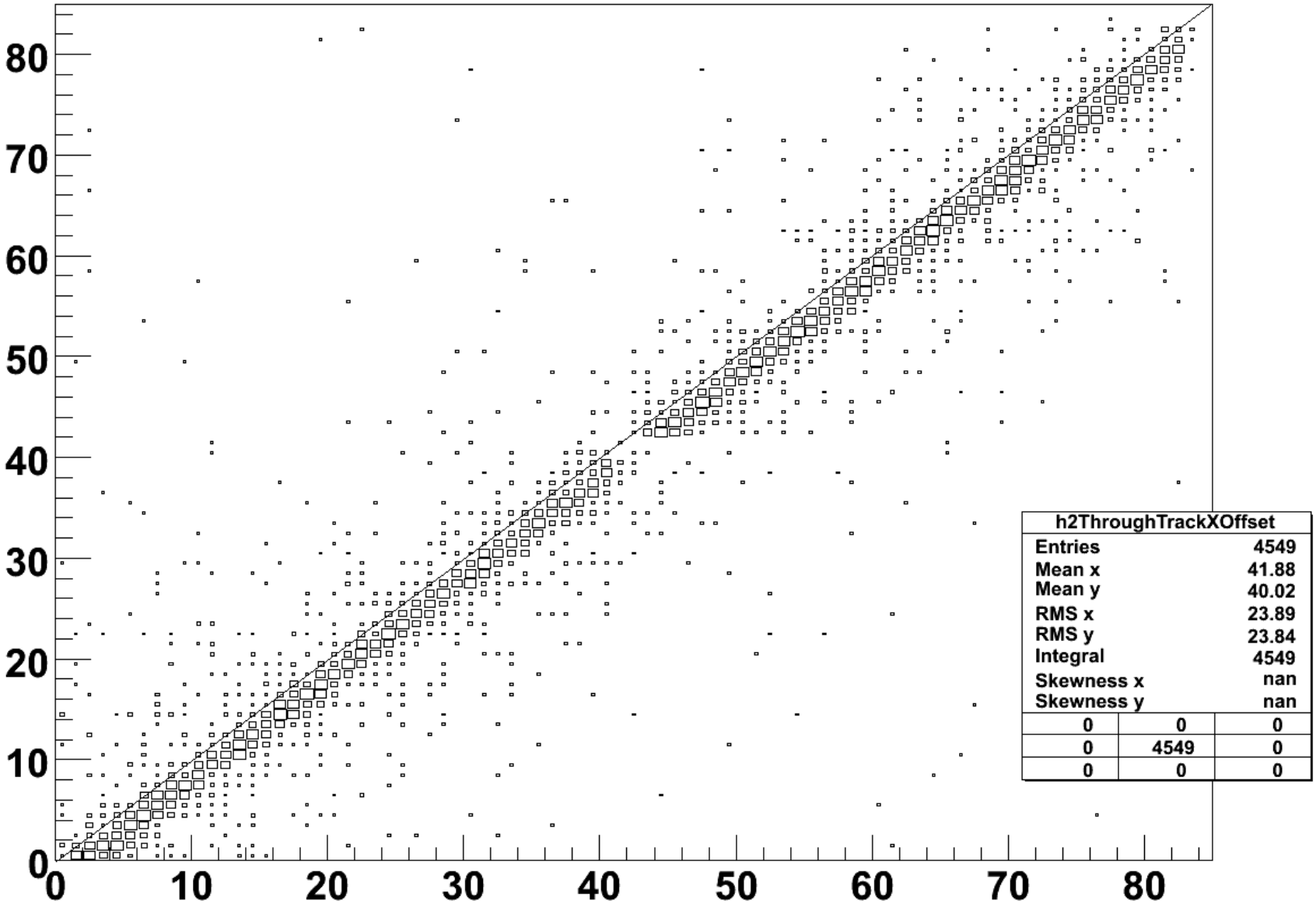
Quick noise check

- **Run 490085**
- **Another Threshold, no beam**
- **Ran analysis, 154k trains (82,000 useable bunch trains).**
- **Using our noise map from run 83**
- **Saw total of 52 clusters in both sensors & no trackthroughs – excellent!**

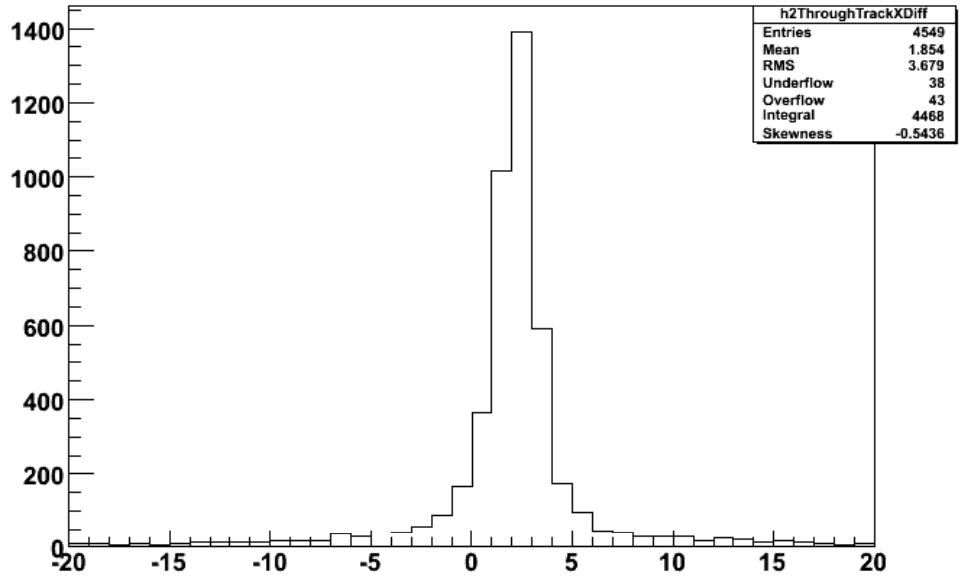
hThroughTrackYOffset



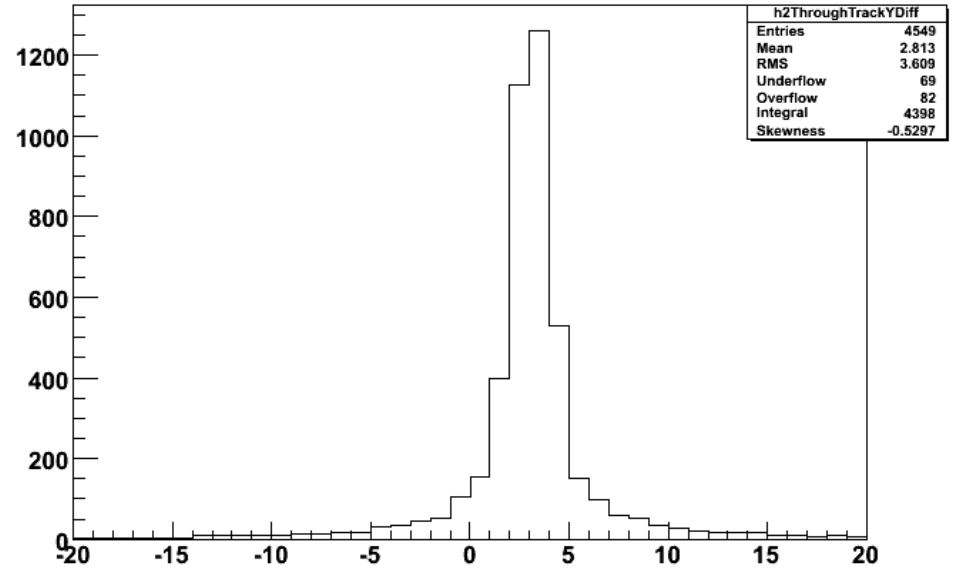
hThroughTrackXOffset



hThroughTrackXDifference

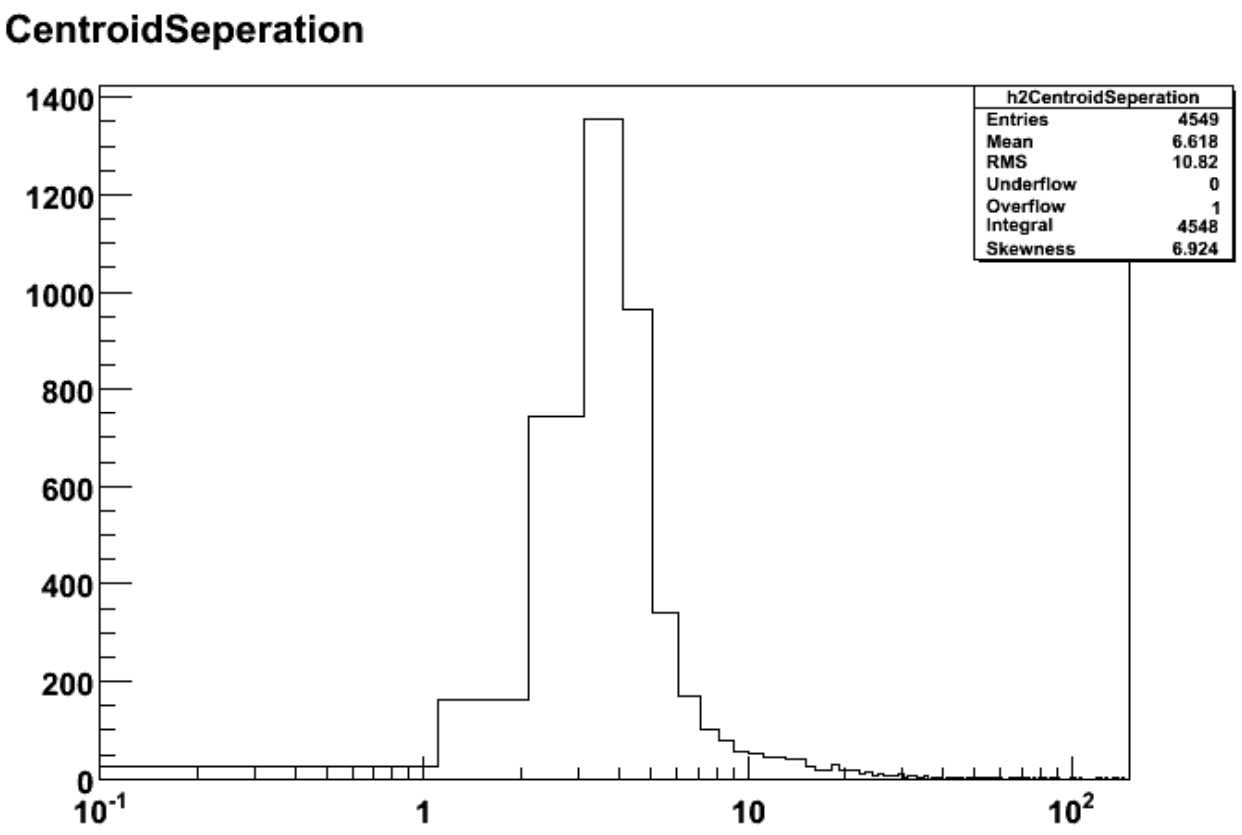


hThroughTrackYDifference



Cluster offset between layers peaks at (3,4) pixels with respect to Sensor 2s coordinate system.

Due to board alignment?

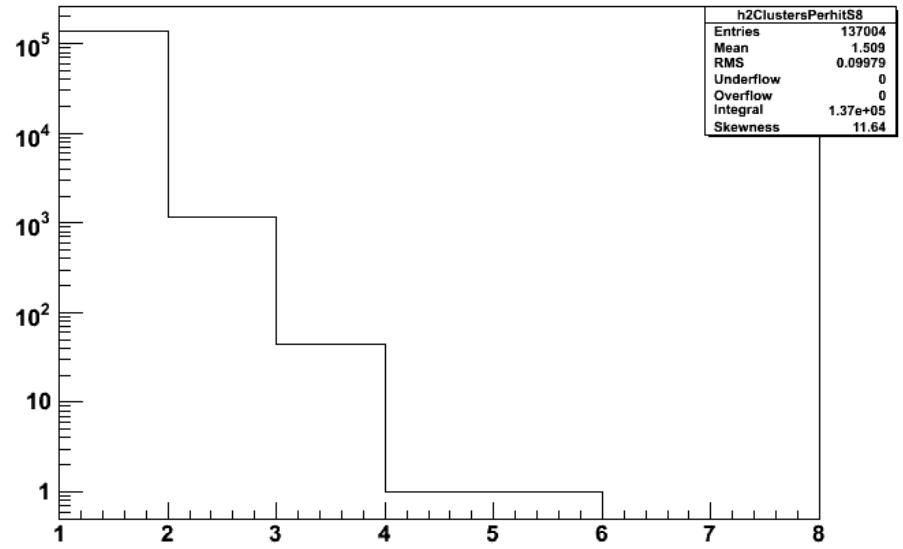


Magnitude of separation peaks at 3 pixels.

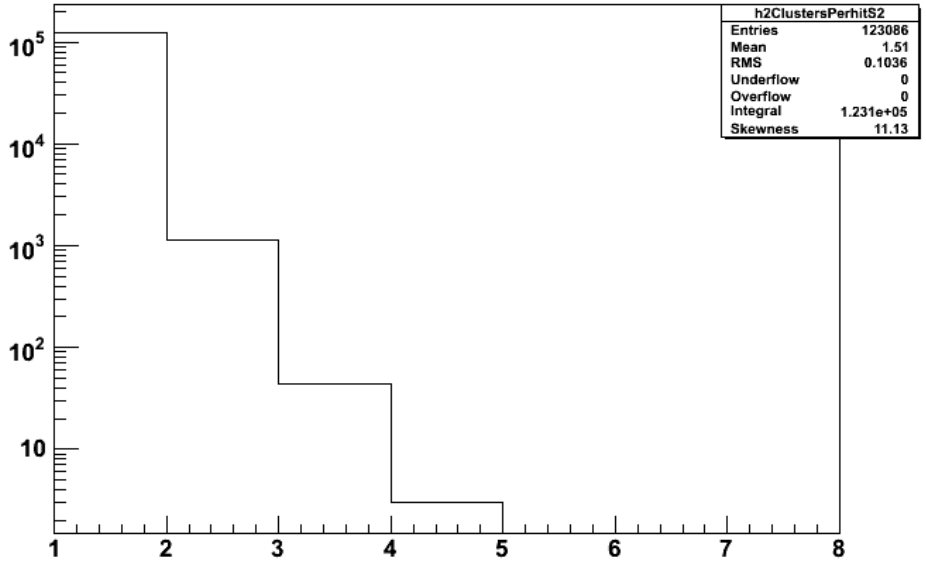
Small tail still present up to large separation.

Note log x scale

hClustersPerhitS8

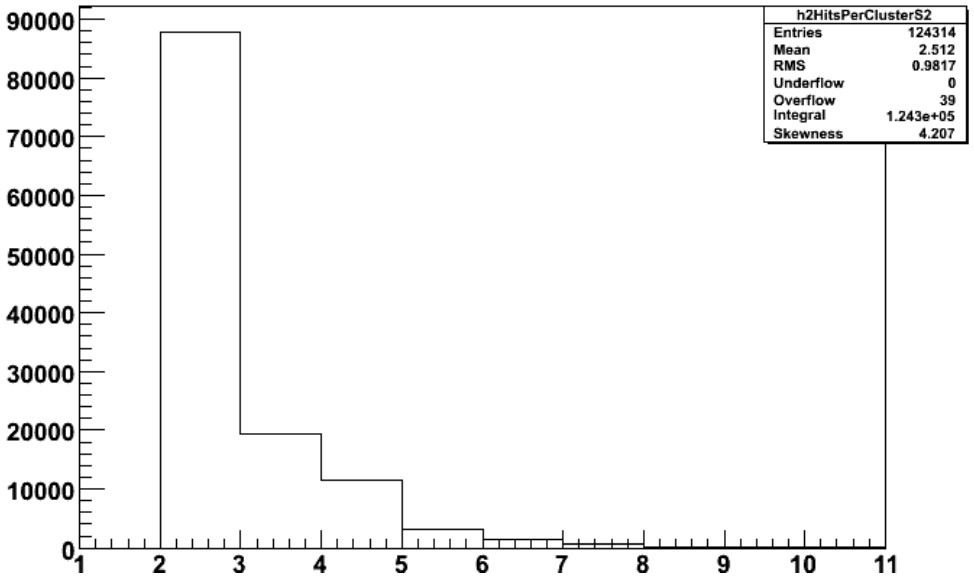


hClustersPerhitS2

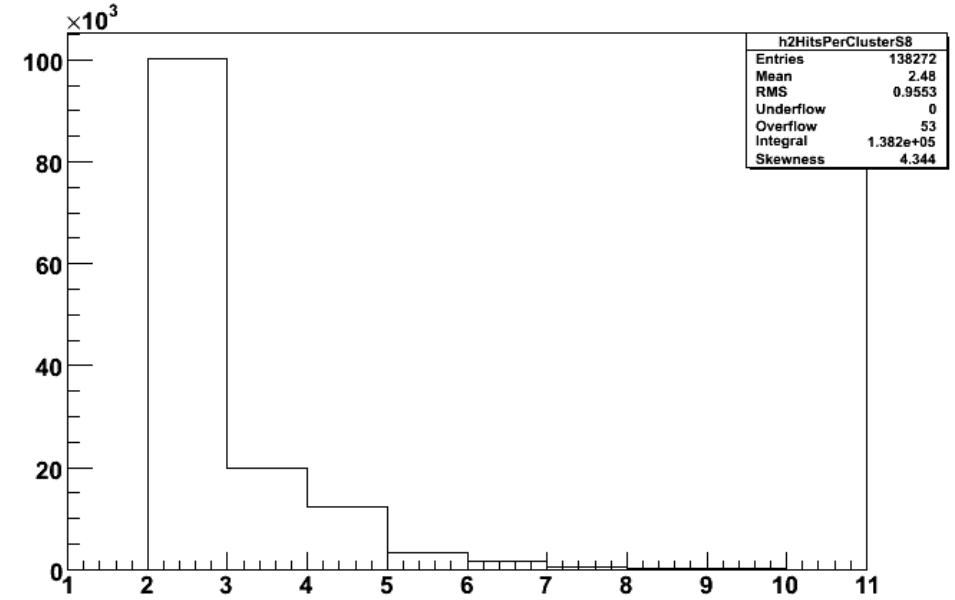


Finding multiple clusters in a sensor at a timestamp does not appear as rare as I would have thought.

hHitsPerClusterS2

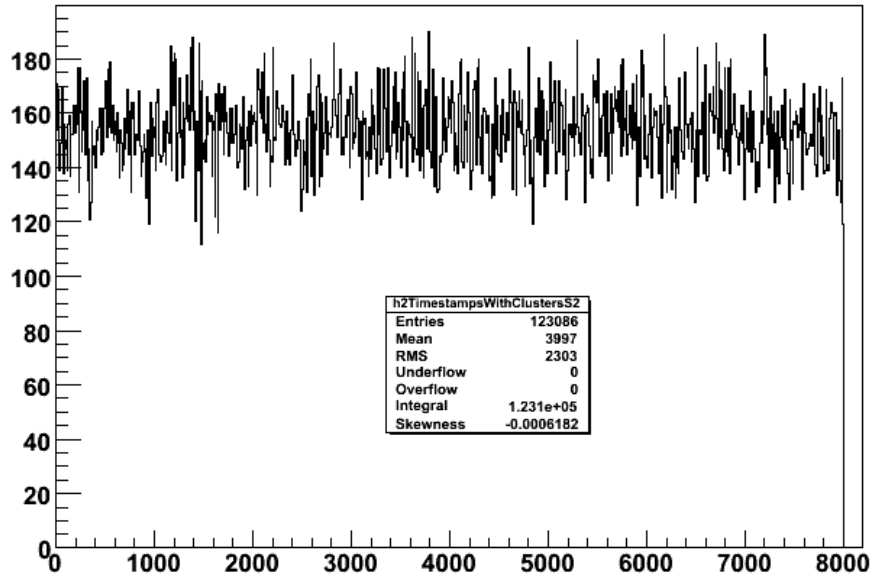


hHitsPerClusterS8

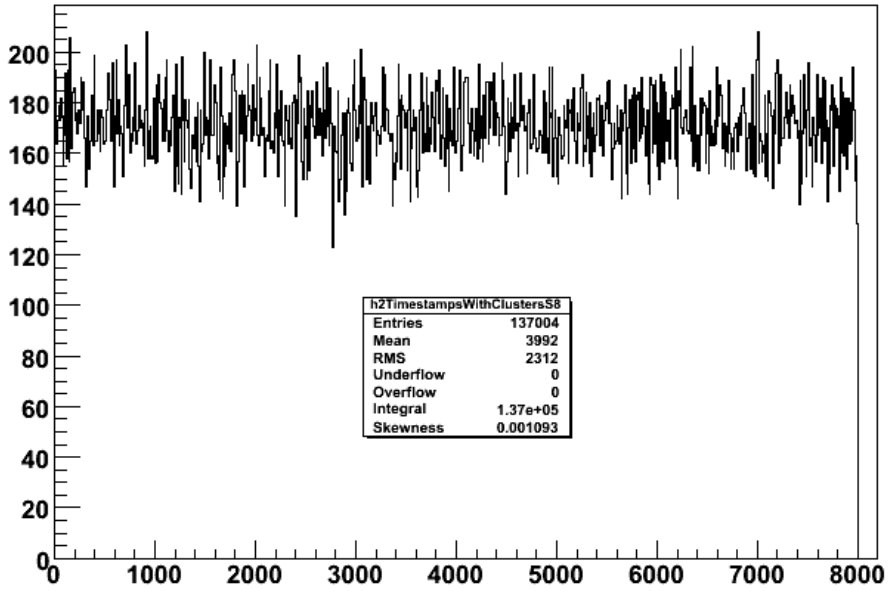


Number of pixels firing per cluster

hTimestampsWithClustersS2



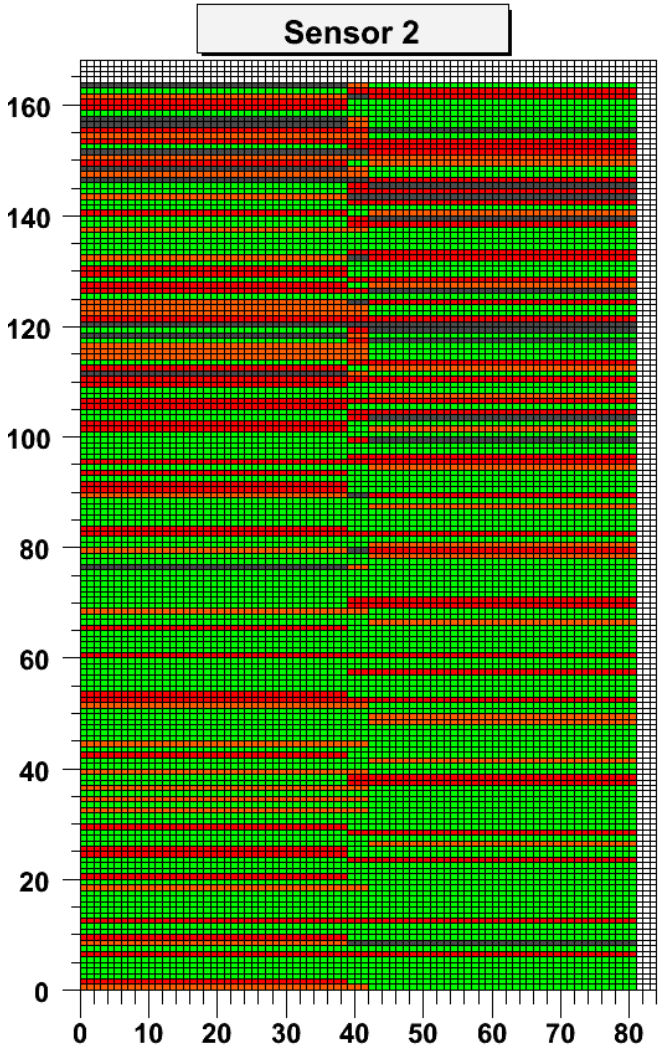
hTimestampsWithClustersS8



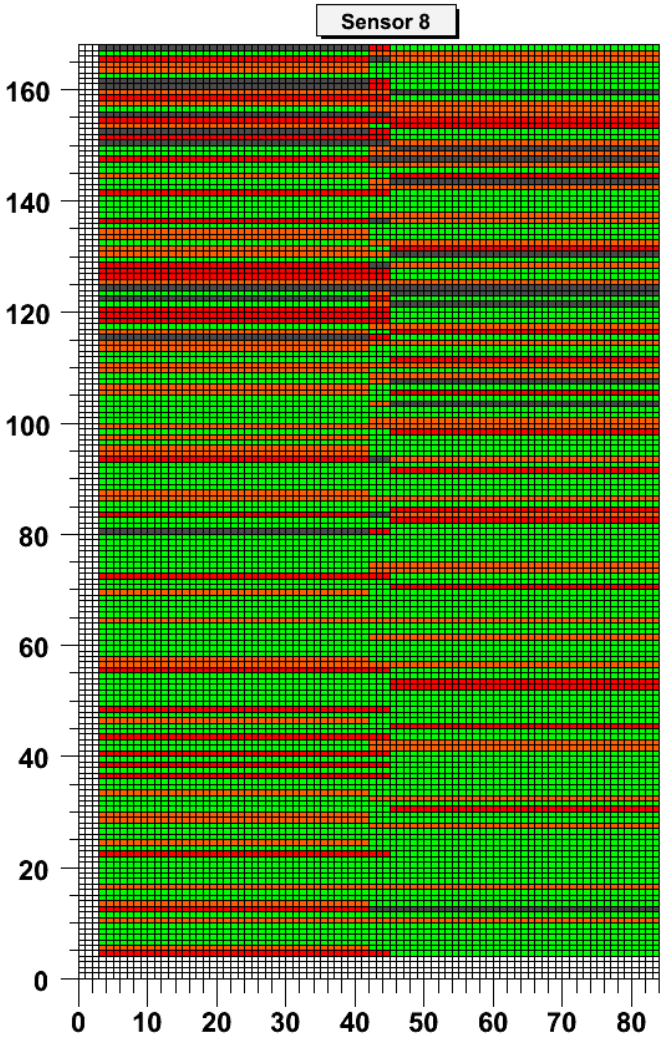
Clusters appear evenly spread over all timestamps.

No evidence of SRAM buffers filling up.

Dead Just Here – 11.86%
Dead Both – 6.02%
Alive Just Here – 20.37%
Alive Both – 55.89%
OutOfBounds – 5.87%



Dead Just Here – 20.36%
Dead Both – 6.02%
Alive Just Here – 11.86%
Alive Both – 55.89%
OutOfBounds – 5.87%



Conclusion

- **Looking for clusters dramatically cuts down on sensor noise.**
- **Using a noise map practically eliminates misbehaving pixels at the expense of whole regions.**
- **Multiple clusters within a timestamp is not understood. Could the PMT scintillator be affecting the beam?**
- **Evidence of particles passing through the stack but efficiency still low.**