Does the Chip lock up?

RD53B Testing Meeting - 14.03.21

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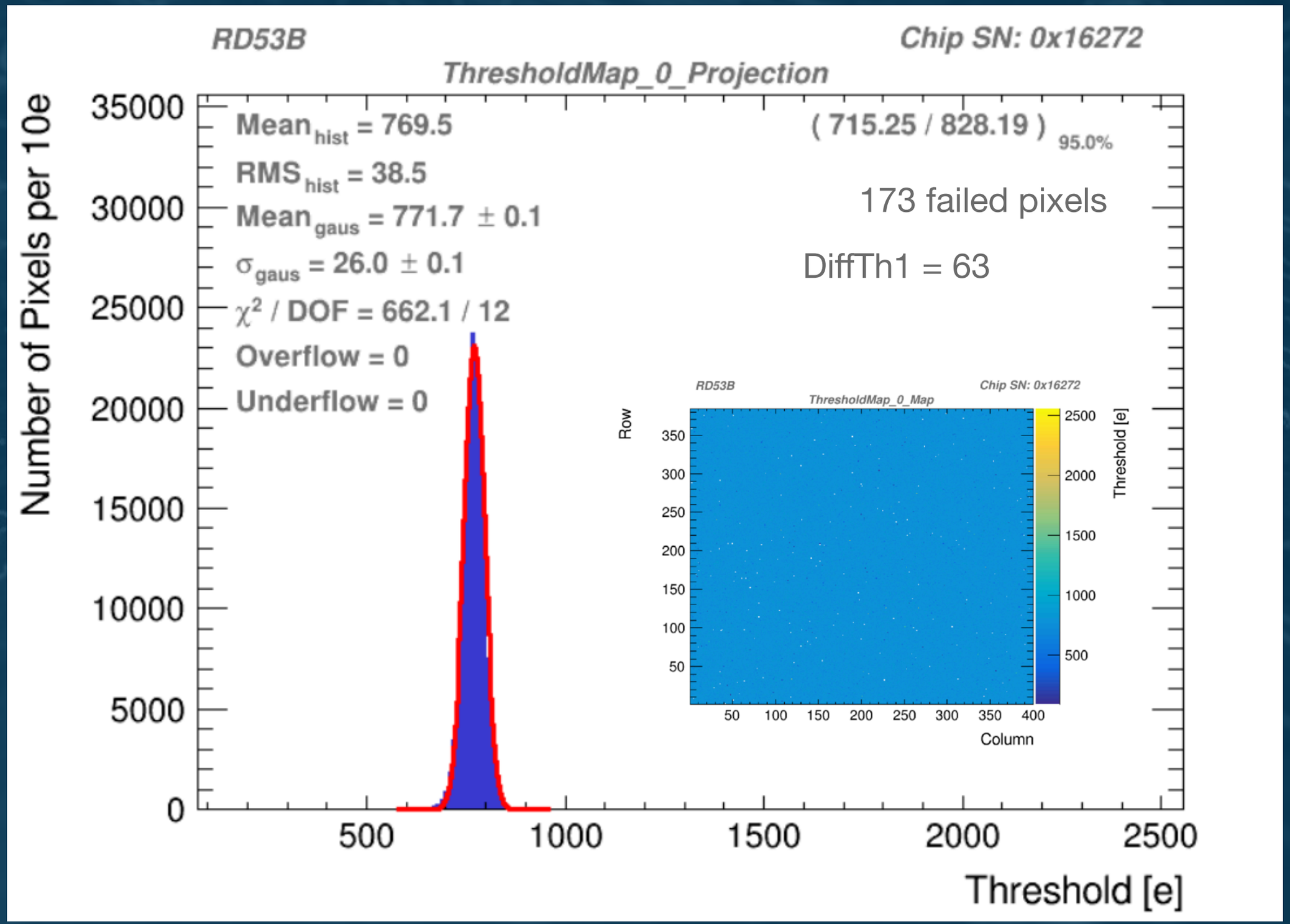
Reminder

- Reported here that chip would lock up under high load
  - Here induced by digitally injecting into large number of pixels
  - Also seen when tuning to low threshold too fast
- Looked like chip keeps sending the same hit pattern over and over
- This could potentially point to a misbehaving readout pipeline in the chip
- Tried reproducing this in simulation unsuccessfully, while chip might drop hits due too high link occupancy or buffer overflows it does not lock up

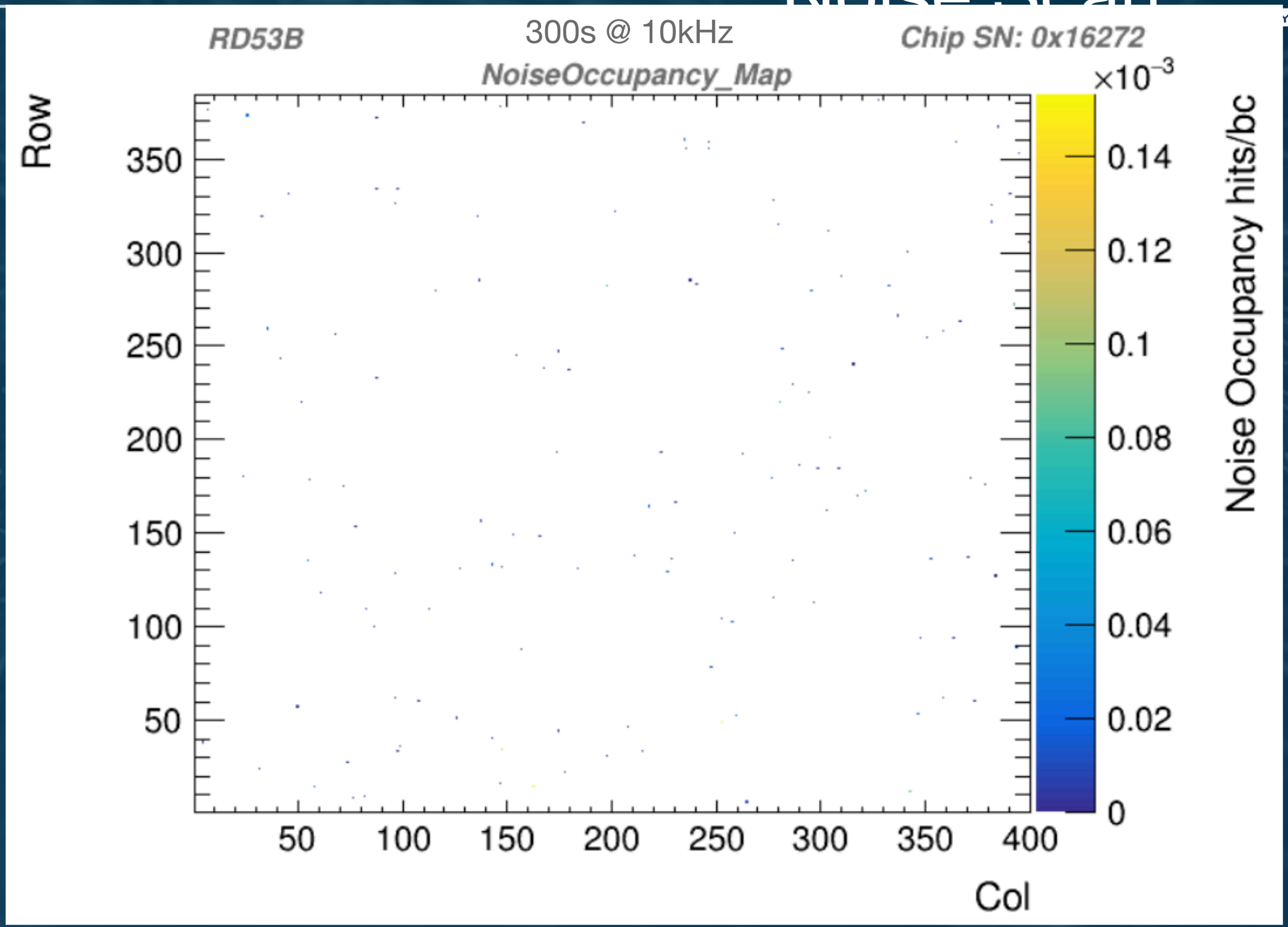
Bug

- Recently looked at this again as I encountered it during conditions where I would have not expected it (too high threshold)
  - Same symptomatic behavior that I see repetition of the same hits over and over
- When looking into this again realized that I see hits being generated but no actual data being transferred
- Identified bug in data decoder
  - Rare condition where there are two quarter rows aligned perfectly within one 32-bit word that a rare if/else clause was triggered which moved the read pointer back to the 0th bit without iterating the 32-bit word
  - After fixing this bug not able to produce lock-up condition anymore

Low Threshold Tuning

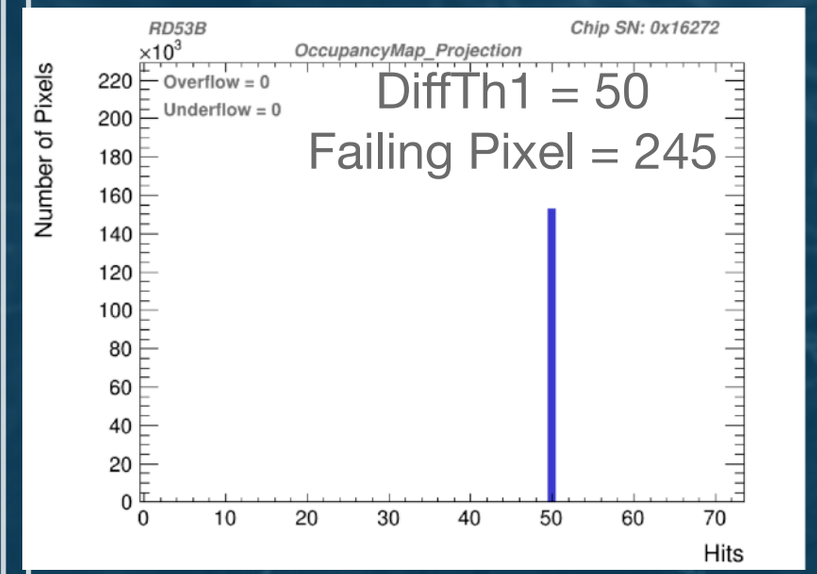


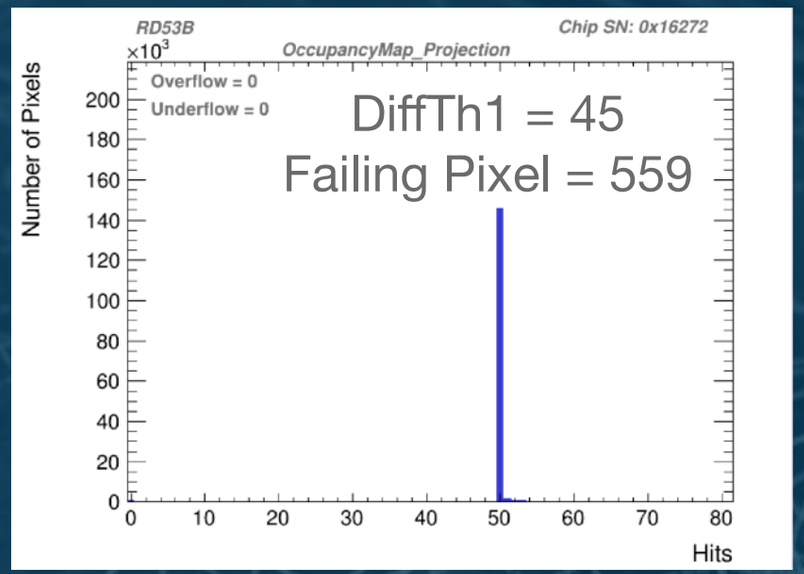
Noise Scan

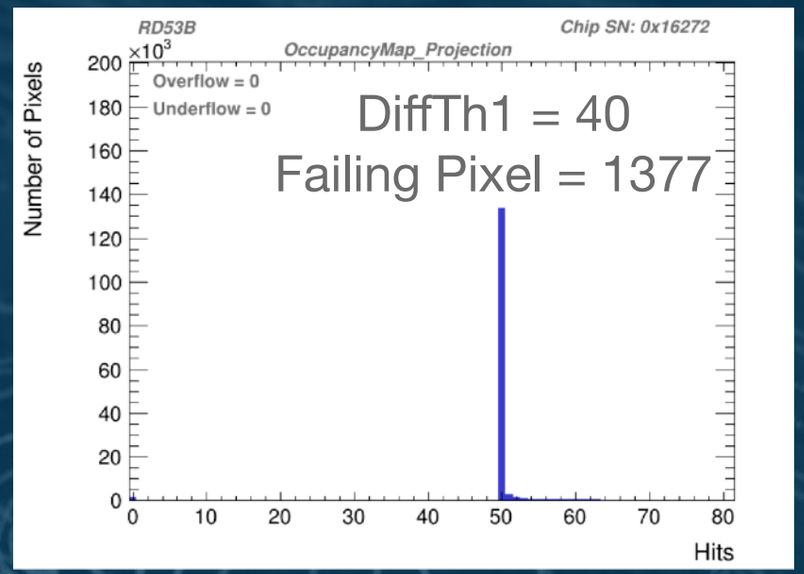

RD53B
300s @ 10kHz
Chip SN: 0x16272
NoiseOccupancy_Map
Row
Col
Noise Occupancy hits/bc
×10⁻³
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
350
300
250
200
150
100
50
50
100
150
200
250
300
350
400

Stability at low Threshold

Decrease global threshold from Tuning (63 ~ 800e) without retuning.







35 is roughly 500e