

ALPIDE

Threshold Scans and Noise Occupancy

Maurice Donner

21. July 2020

Threshold Scan

Inject well-defined amount of charge in a number of pixels

→ Then read out hits and repeat

- Inject charge in several pixels simultaneously
- Use only a representative fraction of the Chip (~1-5%)

Parameters used:

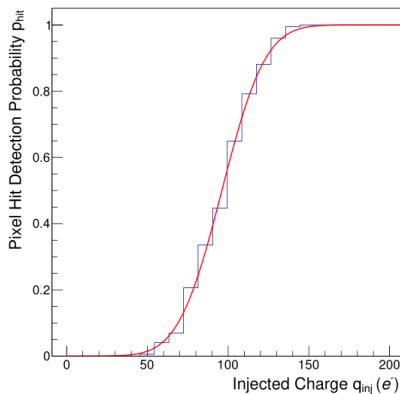
- PIXPERREGION 1
- NMASKSTAGES 164

} Corresponds to $32 \cdot 164 = 5248$ Pixels (1% of the chip)

Threshold Scan

50 Injections per charge point, then plot hit probability. (S-Curve scan)

Example:

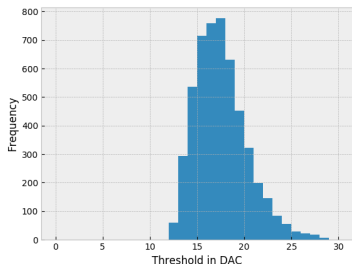


$$p_{Hit}(q_{inj}) = \frac{1}{2} \left(1 + \text{Erf} \left[\frac{q_{inj} - \mu}{\sqrt{2}\sigma} \right] \right)$$

Threshold Scan

- Extract mean

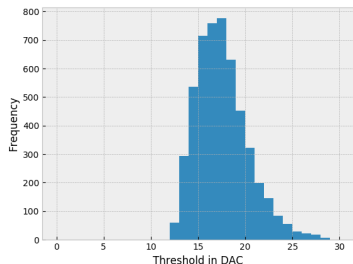
Distribution of Thresholds:



Threshold Scan

- Extract mean
- Repeat with different settings and compare the runs

Distribution of Thresholds:



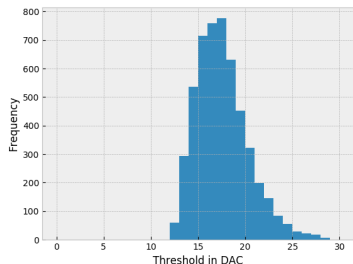
| VCASN | 101 | 105.84 +- 5.0 | 121.89 +- 2.73 | 138.2 +- 4.5 | 154.54 +- 4.87 | 170.44 +- 5.72 |
|-------|-----|---------------------|----------------------|----------------------|----------------------|----------------------|
| | 103 | 86.33 +- 4.63 | 100.3 +- 4.92 | 113.86 +- 4.29 | 127.25 +- 4.82 | 140.58 +- 4.62 |
| | 105 | 74.23 +- 4.38 | 86.36 +- 4.59 | 98.3 +- 4.65 | 110.12 +- 4.7 | 121.58 +- 4.74 |
| | 107 | 65.75 +- 4.51 | 76.8 +- 4.59 | 87.49 +- 4.52 | 98.0 +- 4.57 | 108.3 +- 5.07 |
| | 109 | 59.38 +- 4.53 | 69.71 +- 4.67 | 79.72 +- 3.93 | 89.4 +- 4.82 | 98.89 +- 4.4 |
| | 112 | 52.21 +- 4.61 | 61.93 +- 4.54 | 71.25 +- 4.66 | 80.33 +- 4.46 | 89.14 +- 5.04 |
| | | 60 | 70 | 80 | 90 | 100 |
| | | ITHR | | | | |

VCASN and ITHR are the main parameters to modify the Threshold

Threshold Scan

- Extract mean
- Repeat with different settings and compare the runs

Distribution of Thresholds:



| VCASN | 60 | 70 | 80 | 90 | 100 |
|-------|---------------------|----------------------|----------------------|----------------------|----------------------|
| | 105.84 +- 5.0 | 121.89 +- 2.73 | 138.2 +- 4.5 | 154.54 +- 4.87 | 170.44 +- 5.72 |
| | 86.33 +- 4.63 | 100.3 +- 4.92 | 113.86 +- 4.29 | 127.25 +- 4.82 | 140.58 +- 4.62 |
| | 74.23 +- 4.38 | 86.36 +- 4.59 | 98.3 +- 4.65 | 110.12 +- 4.7 | 121.58 +- 4.74 |
| | 65.75 +- 4.51 | 76.8 +- 4.59 | 87.49 +- 4.52 | 98.0 +- 4.57 | 108.3 +- 5.07 |
| | 59.38 +- 4.53 | 69.71 +- 4.67 | 79.72 +- 3.93 | 89.4 +- 4.82 | 98.89 +- 4.4 |
| 112 | 52.21 +- 4.61 | 61.93 +- 4.54 | 71.25 +- 4.66 | 80.33 +- 4.46 | 89.14 +- 5.04 |
| | ITHR | | | | |

VCASN and ITHR are the main parameters to modify the Threshold

For cosmic muons at 50 GeV: Energy Deposit ~ 0.0286 MeV

Noiseoccupancy Scan

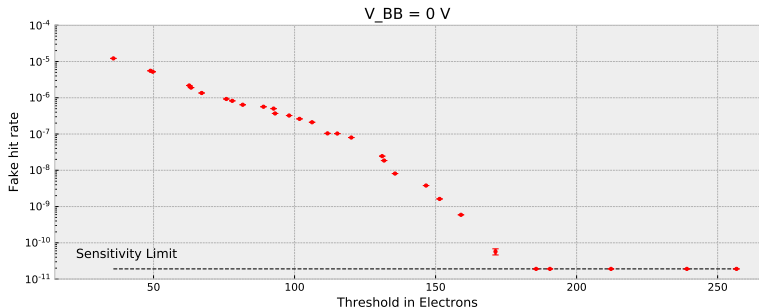
Gives a selectable number of triggers and returns the number of hits.

- If Threshold is low enough for electronic noise to produce a hit, measurements taken will be affected by a fake hit rate.

Noiseoccupancy Scan

Gives a selectable number of triggers and returns the number of hits.

- If Threshold is low enough for electronic noise to produce a hit, measurements taken will be affected by a fake hit rate.



Noiseoccupancy Scan

Gives a selectable number of random triggers and returns the number of hits.

- If Threshold is low enough for electronic noise to produce a hit, measurements taken will be affected by a fake hit rate.

