Crosscheck of pixel noise

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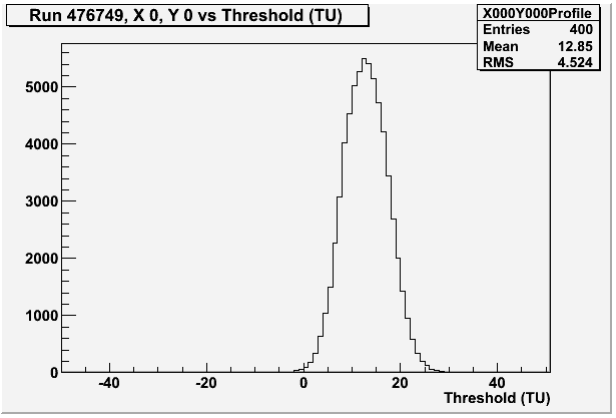
Pixel noise

- Comparator only fires when signal crosses threshold going $- \rightarrow +$
  - Complicates interpretation of threshold scan
- Renato showed (29/2/08) a threshold scan RMS should give the same value as the noise
  - With some assumptions which he thought should be checked
- Noise is higher than expected; for preShapers
  - Average value is ~ $45e^-$ while expectation was $23e^-$
  - Spread of values from ~ $35e^-$ up to two or three times this
- Try to crosscheck the noise using different assumptions
  - Importance is the rate of hits at a given threshold
  - Far from pedestal, expect this to go as $\int G(t)dt = \text{erf}(t)$
  - Try to fit erf function to tails and compare with RMS value from core

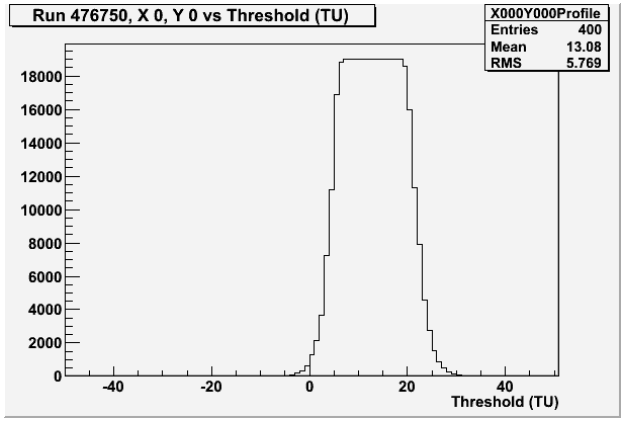
Threshold scans

- Need enough data in tail
- But hit memory saturation effects when more than 19 hits per region row
  - Minimise by unmasking only one pixel per region row
- Avoid pickup by only enabling 42 pixels per region (all Quad0)
- Vary number of bunch crossings (BX) per bunch train (BT)
  - For all do 1000 BT per threshold value

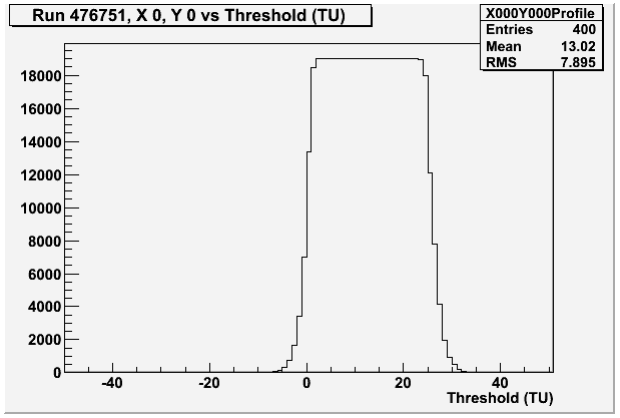
19BX/BT



190BX/BT

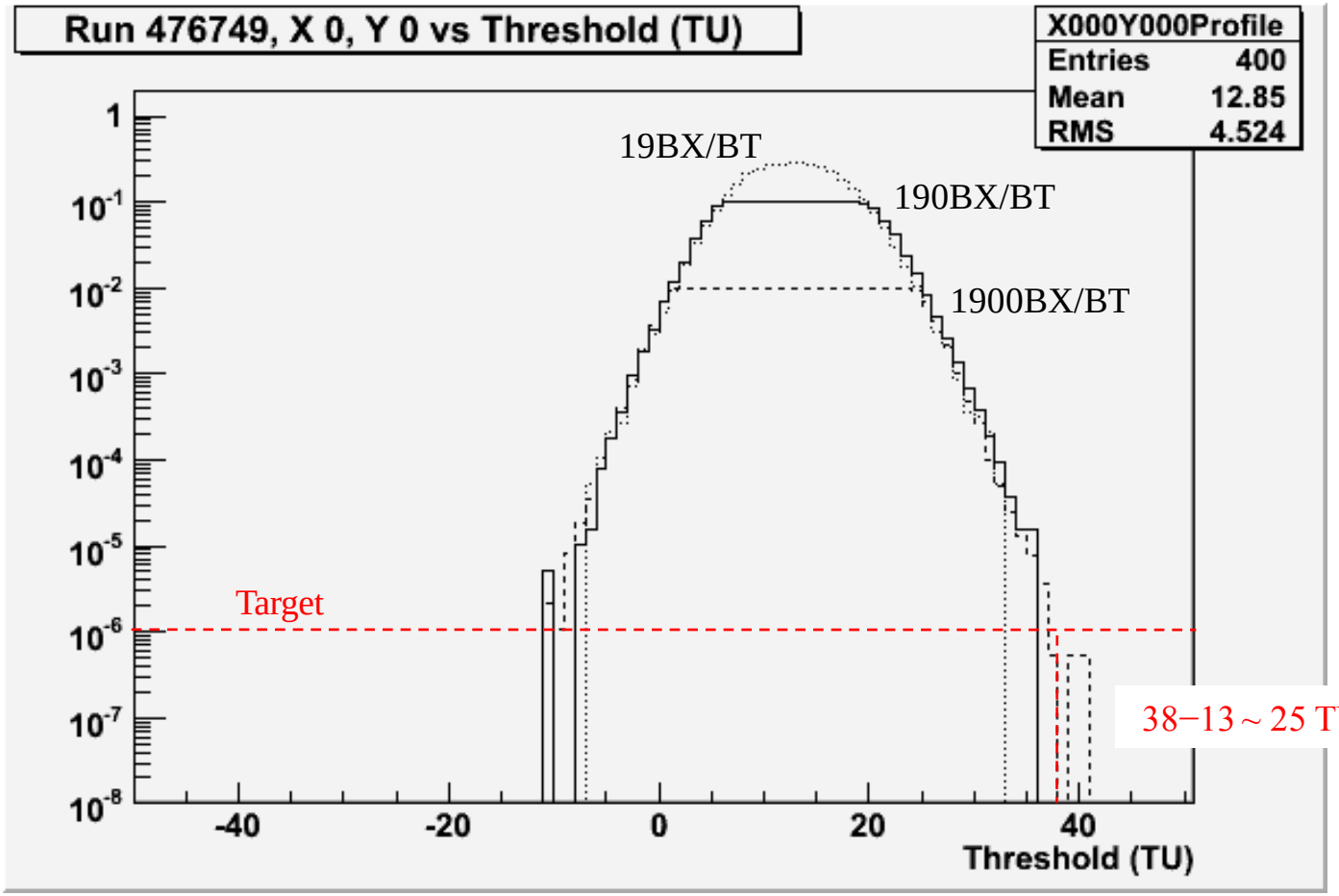


1900BX/BT



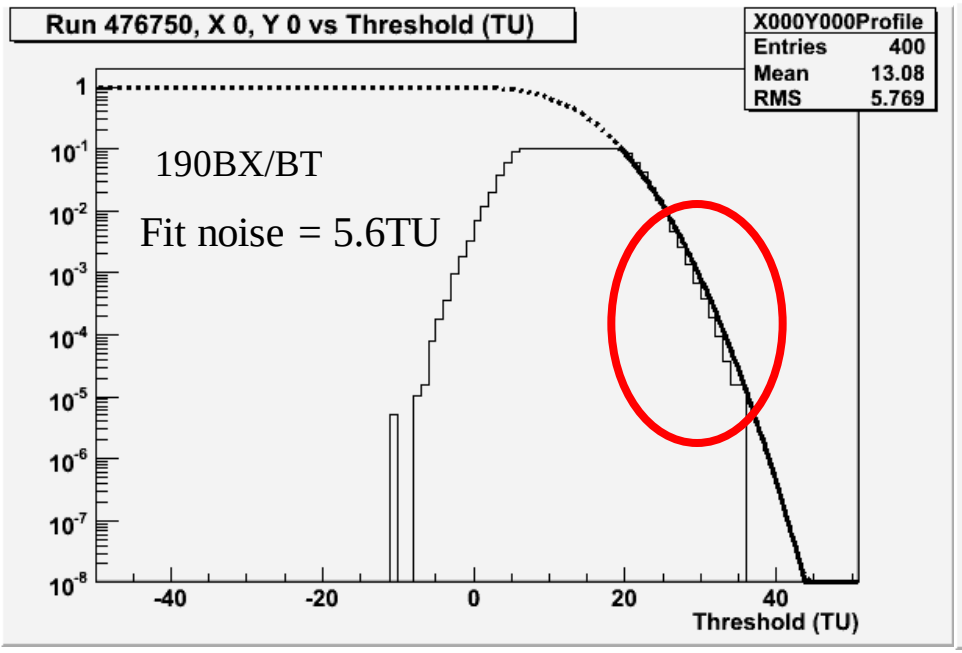
Scans seem consistent

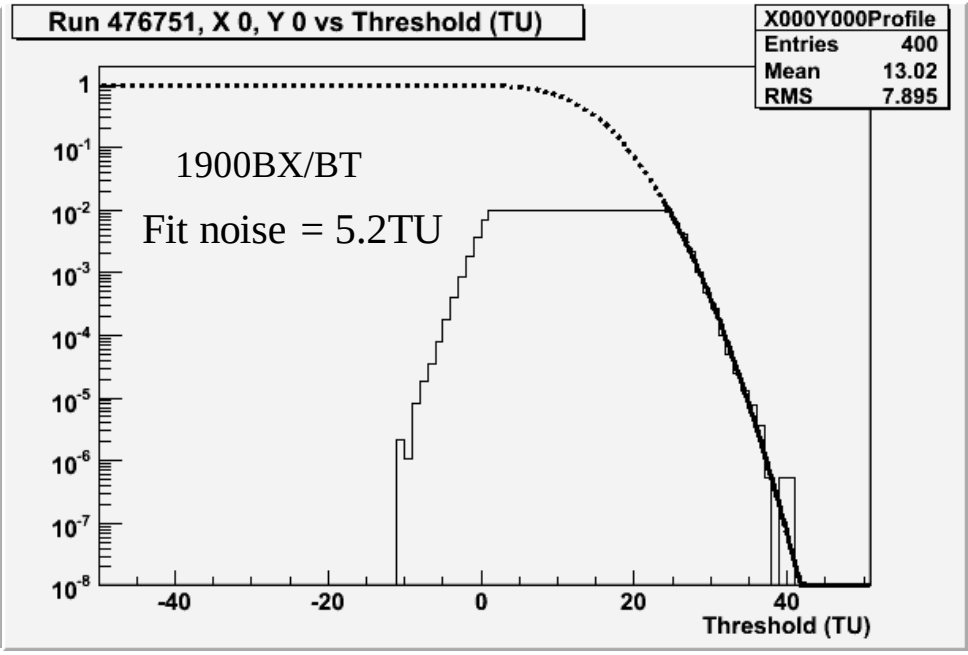
- Scale each to average number of hits per BX
  - I.e. divide previous by 19000, 190000, 1900000 respectively
  - Not valid for saturation region



Fit to tails

- Fit for erf function to high side
  - Fix normalisation of erf to 1 = value at low thresholds
  - Fix 50% point of erf to pedestal value
  - Only remaining fit parameter is noise value (corrected for √2)

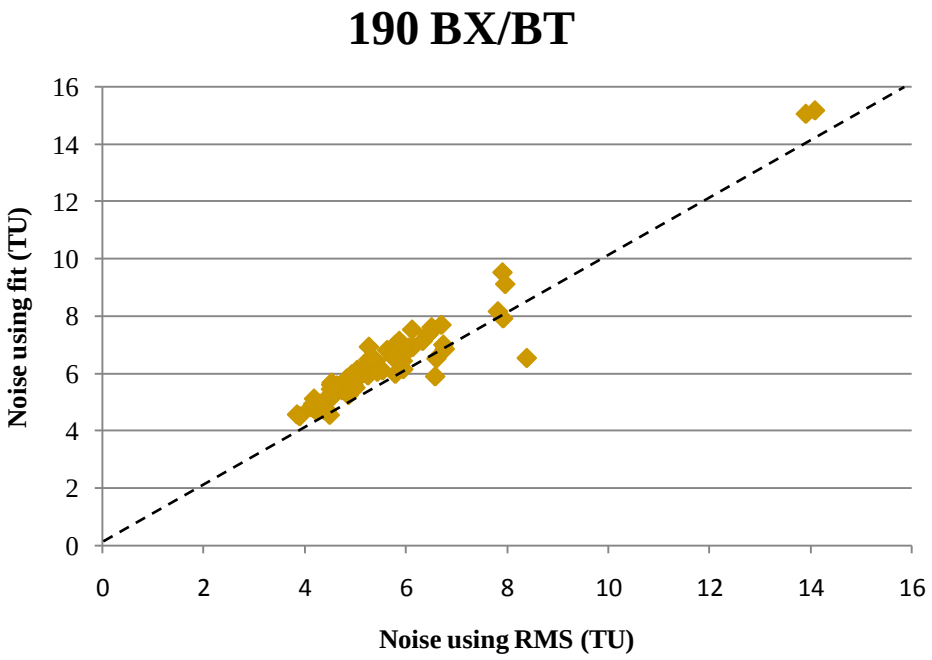


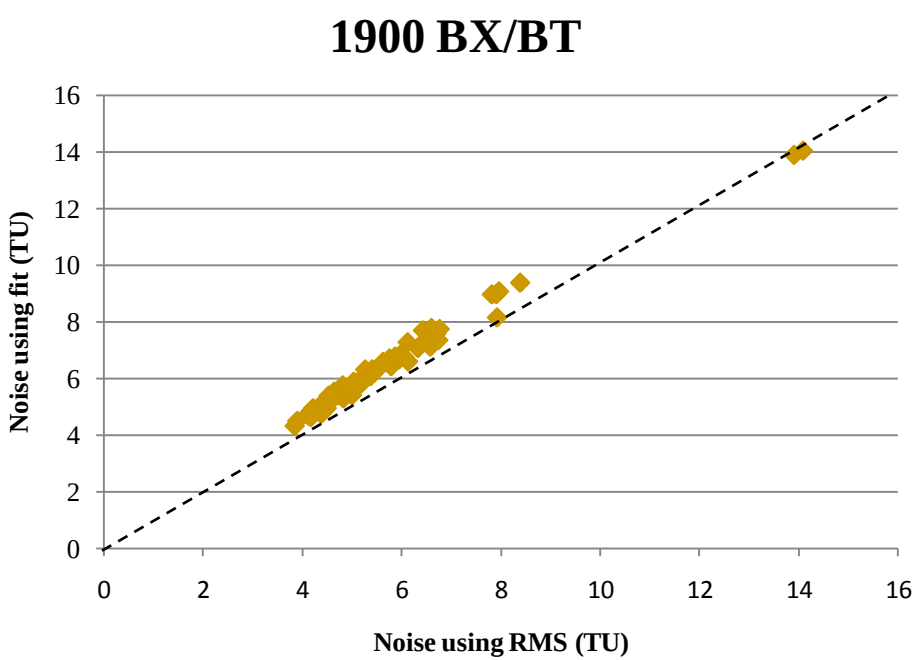


For this pixel, noise value using RMS = 4.5TU

Comparison to RMS values

- Measured 42 pixels in two preShaper regions





- Approximately 15% difference for 1900BX/BT
  - Residual effect from memory saturation?
- Within that level, agreement is very good
  - Noise from RMS is a good measure of hit rate at high thresholds