

Quad test beam: synchronisation issues

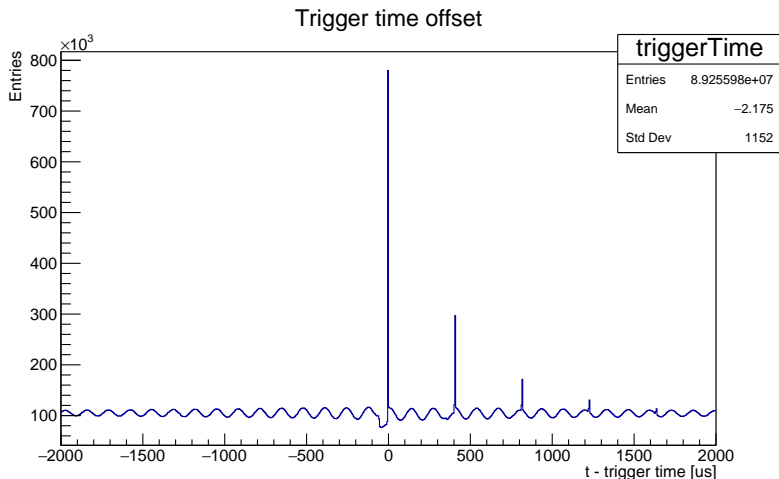
Kees Ligtenberg

Lepcol meeting

November 19, 2018



Difference between trigger time and timepix time



Shift in SPIDR time

Timepix3 hit package:

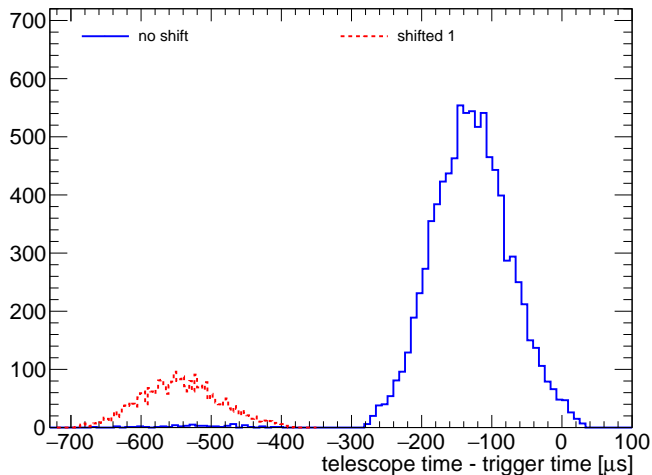
- 4 bit header
- 16 bit pixel address
- 14 bit Coarse ToA
- 10 bit ToT
- 4 bit fine ToA

Added by SPIDR:

- 12 bit SPIDR time

The shift is exactly the first bits of the SPIDR time

Difference between track time and telescope time



trigger time is the (wrongfully) corrected trigger time

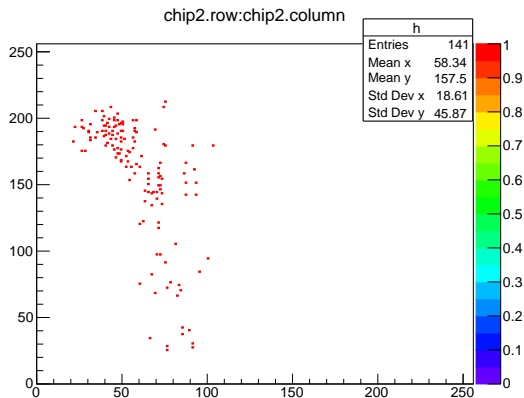
Same trigger matches to multiple sets of timepix hits

Example list of triggers with more than 70 hits:

```
trigger 3795 at 665.913 ms shifted 4 times with 0, 0, 78, 2 hits
trigger 3813 at 667.246 ms shifted 0 times with 3, 0, 54, 78 hits
trigger 3814 at 667.474 ms shifted 0 times with 0, 0, 40, 31 hits
trigger 3823 at 668.431 ms shifted 0 times with 6, 7, 22, 49 hits
trigger 3827 at 669.404 ms shifted 0 times with 0, 1, 141, 6 hits
trigger 3828 at 669.753 ms shifted 0 times with 0, 0, 44, 27 hits
trigger 3827 at 669.814 ms shifted 1 times with 1, 2, 95, 13 hits
trigger 3827 at 670.223 ms shifted 2 times with 1, 1, 96, 15 hits
trigger 3832 at 670.387 ms shifted 0 times with 5, 0, 60, 48 hits
trigger 3836 at 670.944 ms shifted 0 times with 0, 0, 55, 23 hits
trigger 3837 at 671.069 ms shifted 0 times with 1, 0, 80, 25 hits
trigger 3838 at 671.134 ms shifted 0 times with 0, 1, 46, 31 hits
trigger 3840 at 671.425 ms shifted 0 times with 0, 0, 41, 37 hits
trigger 3842 at 671.609 ms shifted 0 times with 0, 0, 70, 73 hits
```

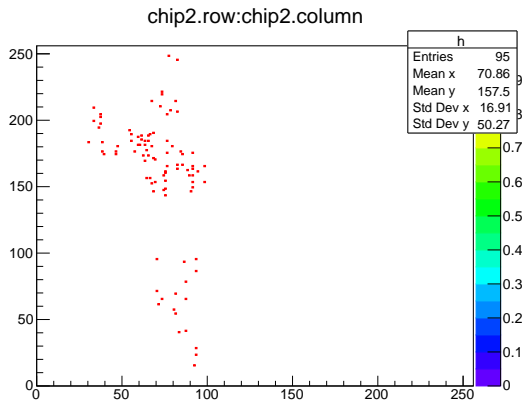
Hits in chip 3 for trigger 3827

shifted 0 time



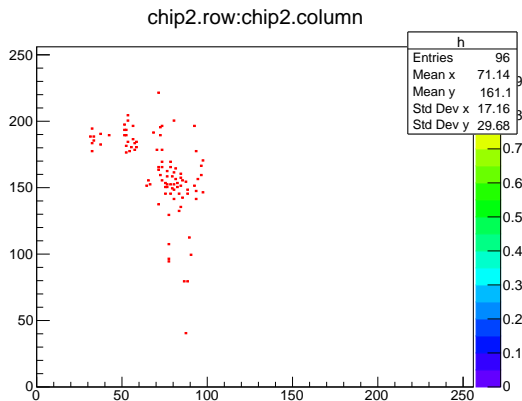
Hits in chip 3 for trigger 3827

shifted 1 time



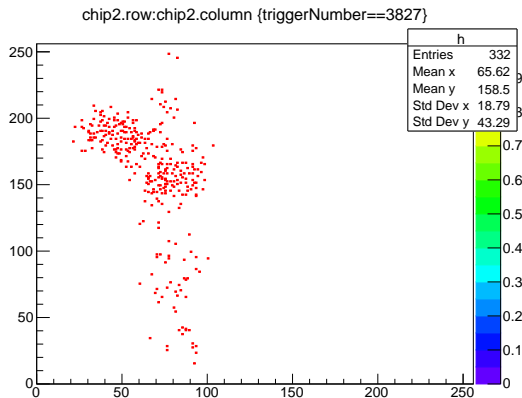
Hits in chip 3 for trigger 3827

shifted 2 times



Hits in chip 3 for trigger 3827

All



Delayed because of link speed per chip

Possibly the hits are delayed because the limited transfer rate to the SPIDR

- Link speed per chip is 160 Mb/s
- Pixel packet 48 bits + 12 bits 8b/10b encoding
- Maximum readout is 2.67 MHits/s
- Beam rate 10kHz (trigger rate 4 kHz) is one track per 100 μ s.
- maximum readout is 267 hits per 100 μ s

This should be enough except for a few fluctuations, in case of zero overhead and constant hit rate

Transfer rate

- The observed number is approximately 1.3 MHits/s.
- This is only 130 hits per 100 μ s
- Are we below the limit of 2.67 MHits/s Or is the transfer rate much lower

Conclusions

- The strange pattern and the low number of hits might be caused by the limited transfer rate
- To do:
 - ▶ Check the number of hits per coarse time (this should be maximal if there is an overflow)
 - ▶ Possibly check the maximum transfer rate with test pulses
 - ▶ Make a correction to match hits even at later times to the correct trigger

Trigger time vs telescope time

