

APA 3 readout problems

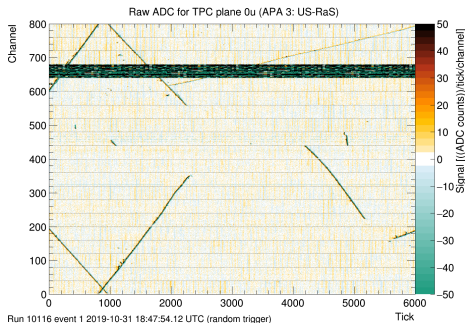
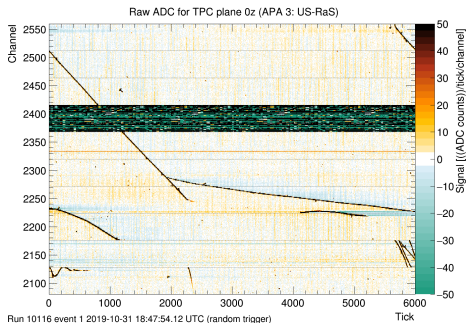
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First realization of problem

- ▶ Run 10116, plots from David Adams:



- ▶ Two clear problems:
 - ▶ FEMB302 timing offset. Seen before with RCE readout
 - ▶ FEMB307 data corrupt. Not seen with RCE
- ▶ Concentrate on corrupt data first

Narrowing down corrupt-data runs

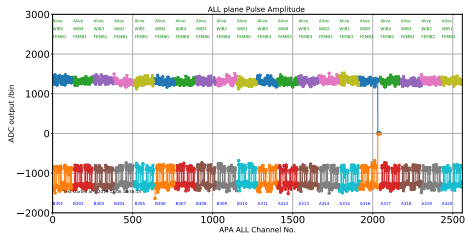
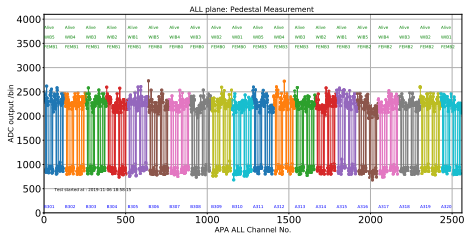
- ▶ APA 3 switched to FELIX on October 21. First run I could find with FELIX APA 3 included was 9883
- ▶ David checked some more runs for corrupt data: 9852 OK, 10050 bad
- ▶ So this looks connected to the switch to FELIX readout

Attempted mitigations/diagnostics

- ▶ Maura reseated WIB304. Took run 10222. Corrupt data seen in same place
- ▶ Maura reprogrammed FELIX fw on APA 3 WIBs. Run 10233. Same corrupt data, same channels
- ▶ Swapped WIBs 304 and 305. Run 10238. Same corrupt data, same channels
- ▶ Swapped wib 304 and 305 WIB->FELIX fibers. Run 10271. Same corrupt data, same channels

BNL FW APA 3 tests

- ▶ APA 3 was loaded with BNL firmware and Shanshan ran some direct tests Nov 6



- ▶ Left: pedestal measurement. All channels look OK. This is surprising, since a whole FEMB of channels is corrupt
- ▶ Right: pulser pulse height. One ASIC appears to not respond to pulser. Also surprising. These channels have noise $2\times$ lower, but nonzero

Observations from raw data

```
Offset | Data good frame | Data bad frame
-----|-----|-----
00000000 | 00 41 03 00 00 00 00 00 | 00 21 63 00 01 00 00 00 <-- start of frame 0
00000008 | 56 97 54 58 30 57 17 01 | e0 c5 55 58 30 57 17 01
-----|-----|-----
00000010 | 00 00 22 e4 2e 28 88 4b | 00 00 69 8b 8f bc bc 63 <-- start of ColdataHeader[0]
00000018 | 00 00 00 00 aa 2a aa aa | 73 a5 34 57 92 00 00 00
-----|-----|-----
00000020 | 34 6a a9 e9 93 97 57 a9 | 00 aa aa aa aa 41 40 e9 <-- start of ColdataSegment[0]
00000028 | 99 33 90 3d 8d aa 89 53 | d9 8e 8c be 26 93 69 3a
00000030 | 95 3d 95 c9 59 13 9e 3c | 94 c1 42 23 79 3b 92 dd
00000038 | fc 4c 33 e9 3e 94 d1 b8 | 82 93 29 3e 9c 0a bf 69
00000040 | e3 f8 38 8d c4 11 43 b9 | 83 8f 3b cf c6 e8 a3 8c
00000048 | 3b 90 81 5e f9 49 96 92 | 3a ff c1 28 13 94 3d d4
00000050 | 74 5e 09 69 94 93 14 c7 | 28 b8 79 93 90 02 cf a9
00000058 | f9 f3 95 3d 6a c9 b9 33 | d8 8d 94 83 3e f3 09 37
00000060 | 97 3f b9 f5 19 13 9c 3f | 93 8f fc 43 98 39 93 bf
00000068 | 10 c1 94 59 3c 95 d2 02 | 87 63 09 3d 9f 64 b3 69
00000070 | 93 b9 3f 90 b4 1d f3 d9 | f3 91 3a e4 ce b8 d3 89
00000078 | 3c 91 55 01 09 79 9d 91 | 38 df 9f 18 63 8c 38 09
-----|-----|-----
00000080 | 00 00 8e f2 a3 ed 88 4b | 00 00 95 3a 0e a4 f9 53 <--start of ColdataHeader[1]
00000088 | 00 00 00 00 aa aa aa aa | 98 3b 31 ed d9 b3 a1 3d
-----|-----|-----
00000090 | cd 52 e8 c9 96 91 e2 bf | c9 3b 23 c9 3c 95 a2 4e <-- start of ColdataSegment[1]
00000098 | 68 33 93 3c b9 c2 d9 63 | b3 e9 39 8d d9 ce f3 b8
000000a0 | 94 3b 77 bf 79 23 9e 43 | 39 95 1f 02 19 59 8f 92
000000a8 | a2 17 b3 c9 3b 92 bf 0d | d5 41 18 99 91 95 f4 cc
000000b0 | 43 f9 39 93 8c 30 a3 b9 | 68 63 93 3b 7b 99 99 13
000000b8 | 36 90 06 ff 69 58 94 8f | 92 3e 6a e9 f9 73 a0 40
000000c0 | 54 59 69 99 8f 90 34 a9 | b9 57 83 b9 39 95 8e 79
000000c8 | f9 e3 8d 39 11 ca 19 03 | c3 b9 38 97 98 4e f3 59
000000d0 | 98 3b 36 e3 19 b3 a0 40 | 39 99 db e2 b8 89 91 8f
000000d8 | b2 67 33 39 3a 8e ca db | bc bc 4c 21 57 f5 93 57
000000e0 | 73 48 3a 8b a3 f0 53 78 | 00 00 00 00 aa aa aa aa
000000e8 | 3b 8a 3d d1 99 88 8f 8a | 3b d4 b9 98 92 93 12 9e
```

- ▶ A good and a bad frame from the raw data file (ie, after FELIX)
- ▶ FELIX frame is WIB header followed by 4 ColdataBlock=(ColdataHeader+ColdataSegment)
- ▶ First two ColdataBlocks are bad, next two (not shown) are OK
- ▶ Blue header section *does* appear in bad blocks, but in the wrong place. Not sure if that is suggestive
- ▶ WIB header indicates a problem: red 0x1 is "coldata convert count mismatch"

Timing problem

- ▶ RCE had some mitigation for this issue. To mitigate with FELIX, need to understand the details of the problem
- ▶ From Giovanna:

So, in the case of the WIB containing data from FEMB301 and FEMB302 (on different clock) what are we receiving in a single frame?

FEMB301 data is aligned with the timestamp of the WIB header and FEMB302 contains some data that have a different timestamp? Or do FEMB302 data have the same timestamp though they refer to a different real time?

Do data for FEMB302 progressively get more and more out of sync? When does re-synch'ing occur?

Backup slides

Noise plot from Shanshan 1

