FONT Meeting

Monday 16th December 2017

ATF data analysis from December 2017

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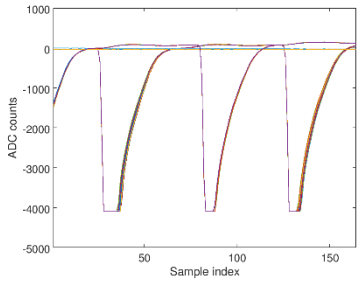
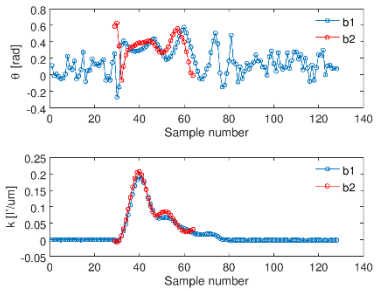
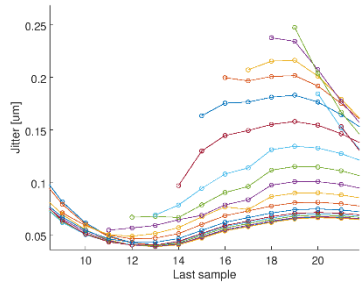


- Sample jumps



- IPB calibrations

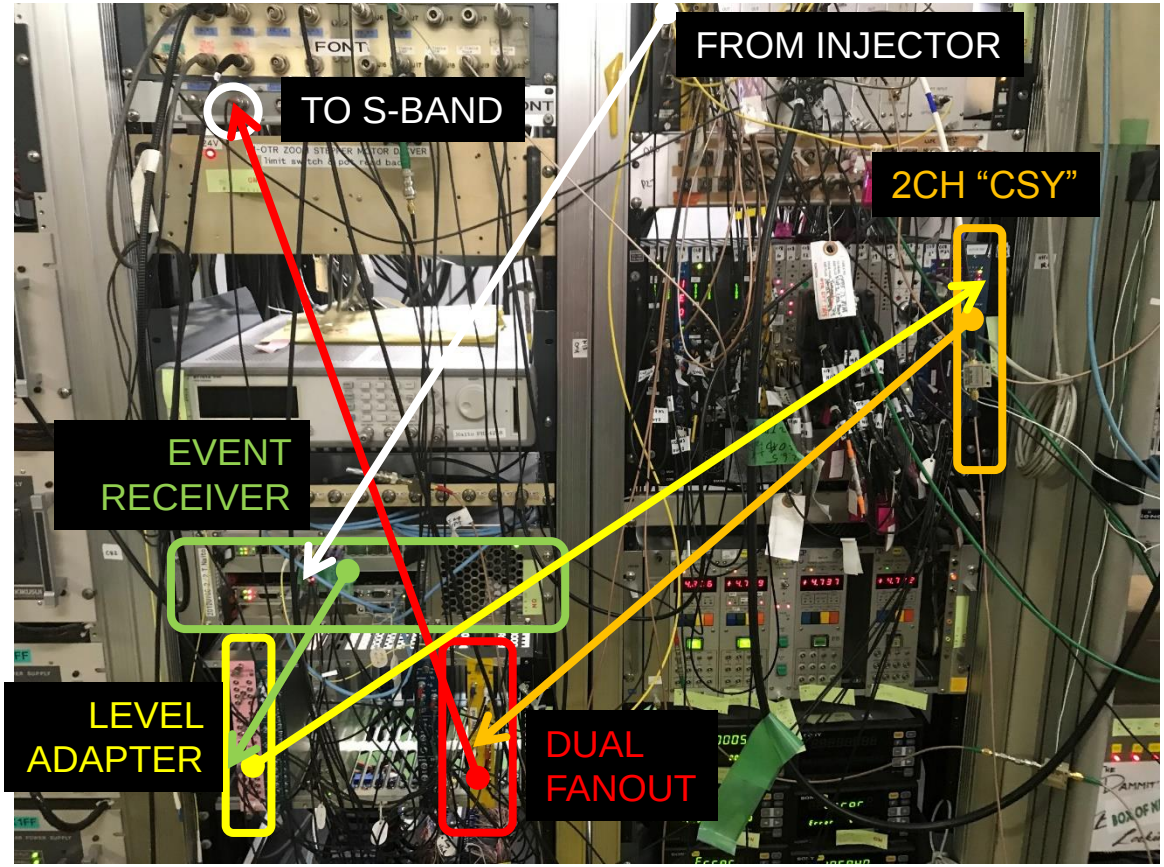


- Sample window optimization

Sample jumps

- Seemingly random jumps in beam arrival time continue to result in aborted data runs and extra configuration time.
  - Sample holdoff is 7-bit (0 to 127) but sample window length = 164.
  - Phase between board trigger and beam after jump frequently such that sample window cannot be returned to location before jump.
  - Some progress on this front - previously only method of returning sample window to original location was to power cycle board and hope it came back at a sufficiently different phase.
  - Worked but introduced extra configuration time, potential for operator error (e.g. forgetting to set channel offsets). Turns out that **sufficient manipulation of the "357 master delay" enables the sample window to be shifted back into the range of the sample holdoff**.
  - Phase jump not necessarily by integer number of 357 MHz clock cycle so BPMs may require recalibration. Alternatively scan delays which apply 70 ps taps to the ADC clocks could be used for fine adjustment of the sample window.
- Unable to diagnose cause of sample jumps but ruled out board issue.
  - SIS currently unusable – beam could not be observed using the short window as ADC data became garbage once the required delay (~250,000 sample clock cycles) applied. Using the long window resulted in ATF data collection system timing out and blocked triggers.
  - Able to observe co-ordinated sample jumps using the second FONT5 board at the IP.
  - Naito-san had a theory but only a temporary fix (change master frequency).

Trigger path



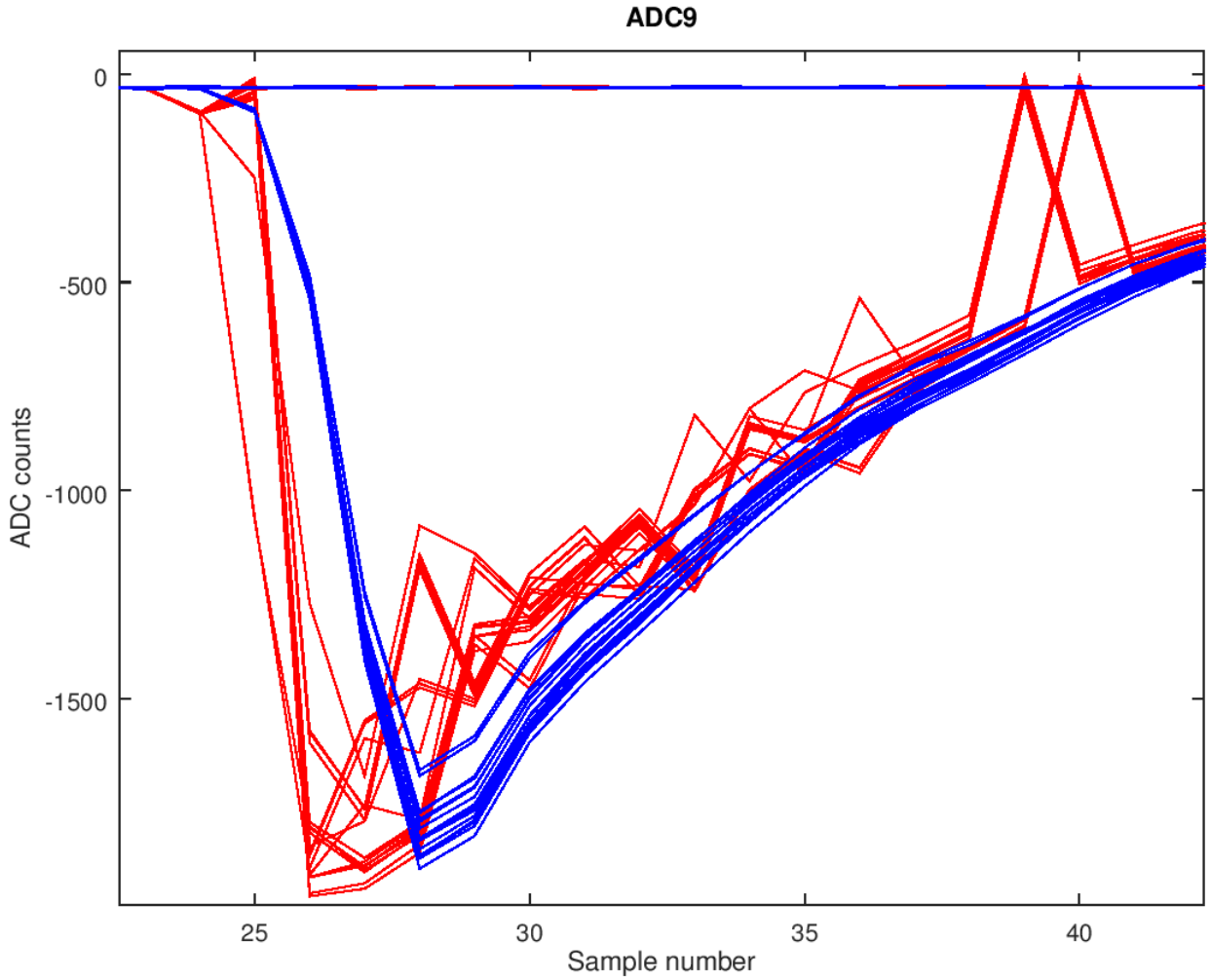
IN C-BAND HUT

1. Signal from injector enters the `RX` input of the event receiver (`VME-EVR-230RF`)
2. `OUT1` of the event receiver connected to `TTL IN` of the level adapter (`1020`)
3. `NIM OUT` of the level adapter connected to `CH1 IN` of the CSY module (`C-TS 802a`)
4. `CH1 OUT` of the CSY module connected to `INPUT` of the `DUAL FANOUT` module
5. `OUTPUT1` of the fanout connected to patch panel port `BNC2 TO S-HUT`

IN S-BAND HUT (not pictured)

1. Patch panel port `BNC2 TO C-HUT` connected to patch panel port `BNC 2 TO IP`

Scan delay waveform corruption

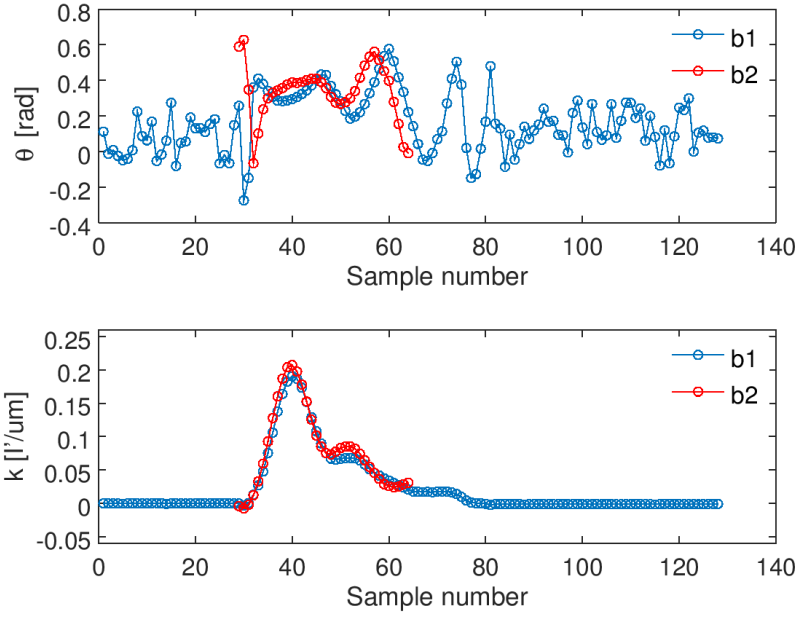


While attempting to use P3 scan delay to recover shape of reference waveform after a sample jump, noticed that one value of the scan delay resulted in corruption of waveforms using that ADC clock.

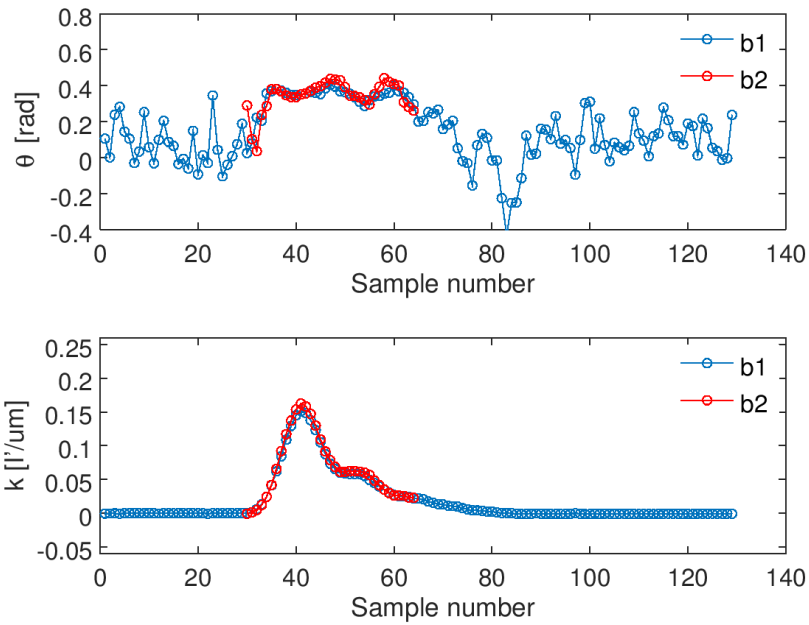
Not entirely unexpected but something to be aware of.

IPB calibrations

AQD0FFyScan1



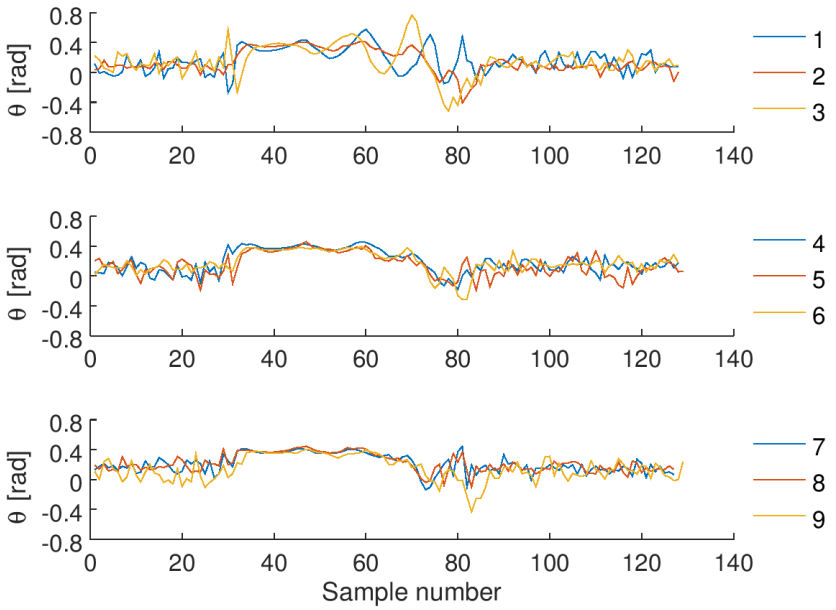
AQD0FFyScan9



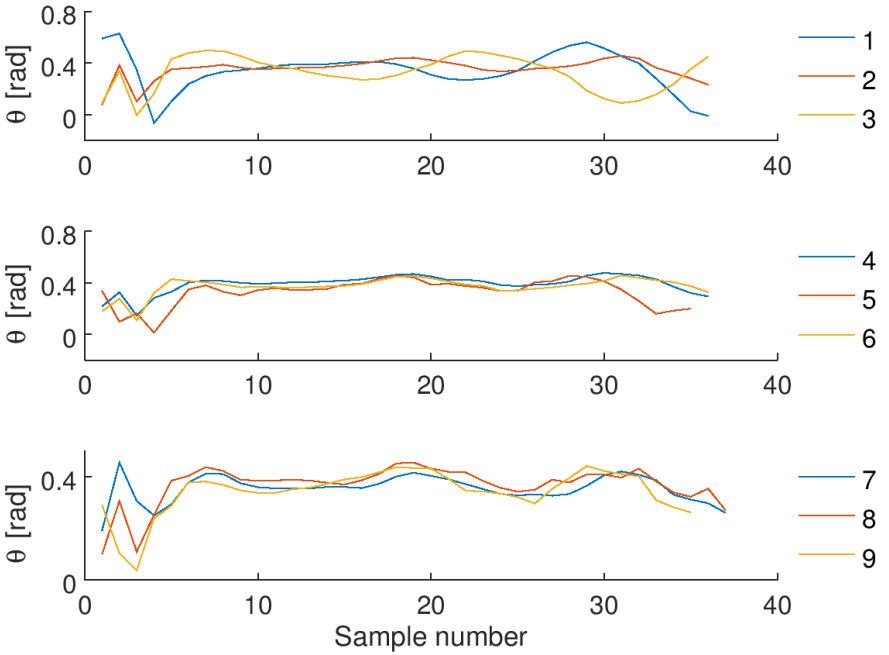
k, θ can be calculated for each point of the waveform but is not meaningful until the bunch arrives. θ not completely random before/after bunch but close to zero.
Bunch 1: plotted from start of sample window until arrival of second bunch.
Bunch 2: plotted from arrival of second bunch until end of waveform.
Bunches not necessarily in phase.

Calibration consistency

θ (bunch 1)



θ (bunch 2)



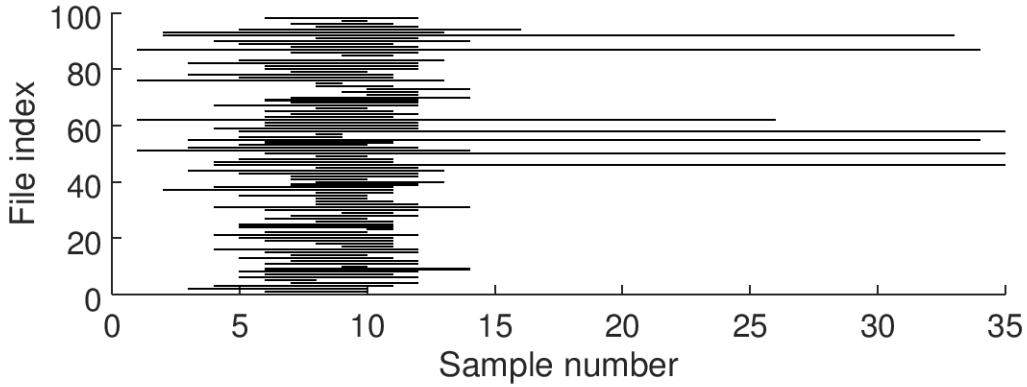
θ consistently has a value of about 0.4.

For calibrations 1-3, variation as a function of sample number is high and it is inconsistent between runs.

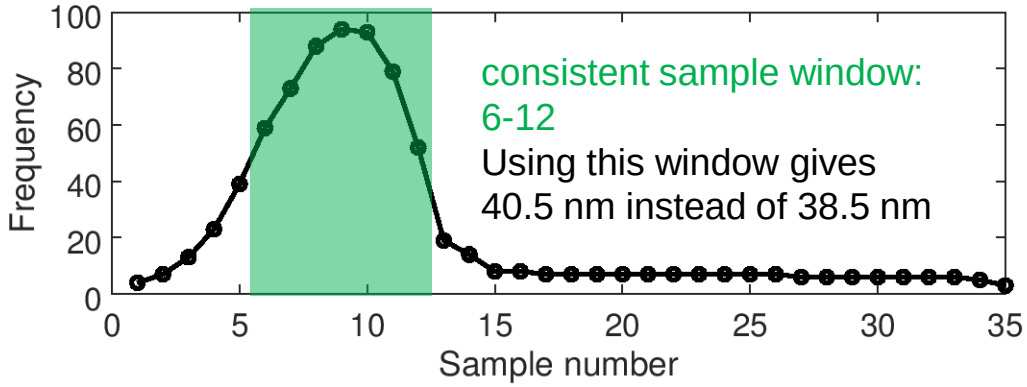
For calibrations 4-9, beyond the transient region variation is relatively low and consistent between runs.

Sample window optimization

- Try every possible option for the integration window to see which consistently delivers best results.
- Performance metric: minimal jitter of corrected beam (i.e. bunch 2, feedback on).



Each horizontal line represents optimized sample window for a given file.
e.g. best result was for file **gainRun4_10dB_0.9_repeat**.
Minimum jitter found was **38.5 nm** using samples 3-13 (where sample 1 denotes bunch arrival).



Histogram showing which samples most frequently appear in optimized sample window e.g. out of 98 files analysed, optimized sample window included sample 9 for all but 4 files.

Summary

- Sample jumps still a problem and only likely to be solved if our Japanese colleagues are able to provide a trigger locked to the beam.
- Calibrations generally consistent from bunch to bunch and run to run but can vary – cause of this variation not yet understood.
- Optimum sample window for the second bunch estimated to be from 6 to 12 samples after bunch arrival.