# *Jitter Update*

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# *Questions*

- Should we believe that actual processor is around 1 micron or less, as indicated from digital jitter measurements?
  - I think yes, assuming that the calibration is reliable.
- Why does the analogue jitter/resolution always seem to be larger than digital?
  - 8- vs 14-bit ADCs - discretisation noise larger ?
  - Attenuation in heliax pre-processing?
  - How well do well know the calibrations?
- Unfortunately, there is no perfect dataset for comparisons – small statistics, jittery digital clock

# *A quick look at T-shirt jitter*

- Mean jitter for feedback off, ‘central’ gain value:
  bunch1: 6.7, bunch2: 3.3, bunch3: 3.5 um
  across seven corrector settings from digital data
- Using measured bunch-bunch correlations to get an upper-limit of resolution (providing $P<0.05$):
  - Pos 1: NSS
  - Pos 2: 1.9
  - Pos 3: 0.9
  - Pos 4: 1.1
  - Pos 5: 0.9
  - Pos 6: 0.6
  - Pos 7: 1.0
  - Mean: 1.1

# *Resolution measurement 13 May*

- 3 processors on 1-BPM + 1 flaky digital
- Jitter (bunch1): P1: 24.04, P2: 16.91, P3: 25.83 um

# *T-shirt Digital/Analogue Comp*

- Looked at both the jitter and bunch-bunch correlation for analogue and digital for all seven corrector settings and all three gain settings.
- Analogue jitter always ‘looks’ 2-3 x greater than digital
- Calculate a resolution for each setting (if legal), then pick the lowest resolution for each corrector setting (res should not vary for different bunches, nor for different gain, but maybe for position).
- Average over the corrector settings:
  - Digital: 1.1 um, Analogue: 3.0 um
- Need to understand jitter first, resolution second order effect!

# *Problems*

- Difficult to estimate discretion noise from normalised data – want the original signals before normalising
- Also, wanted to recalibrate and estimate errors on slope
- Unfortunately, didn't have the time or data to do this as well as would have liked...
- Very rushed!

# May '07 Calibration Data

- Assume that resolution of should be same for two processors – real beam jitter has to be the same, so  measured jitters equal. Same argument should apply to last years data as well!
- Have 11 pulses from ILA, 20 from scopes per corrector (roughly the same number)
- Purposely rough analysis
  - Use peak value only – should allow more direct comparison analogue and digital, i.e.  don't need to worry about window size, baseline subtraction etc.
  - No charge normalisation – charge variation should affect both analogue and digital in same way. Bit noise more transparent.
  - No flyers rejected – visual inspection showed only one. Reject the entire bunch for the corrector setting. Don't mind slightly larger errors on the calibration in the first instance.

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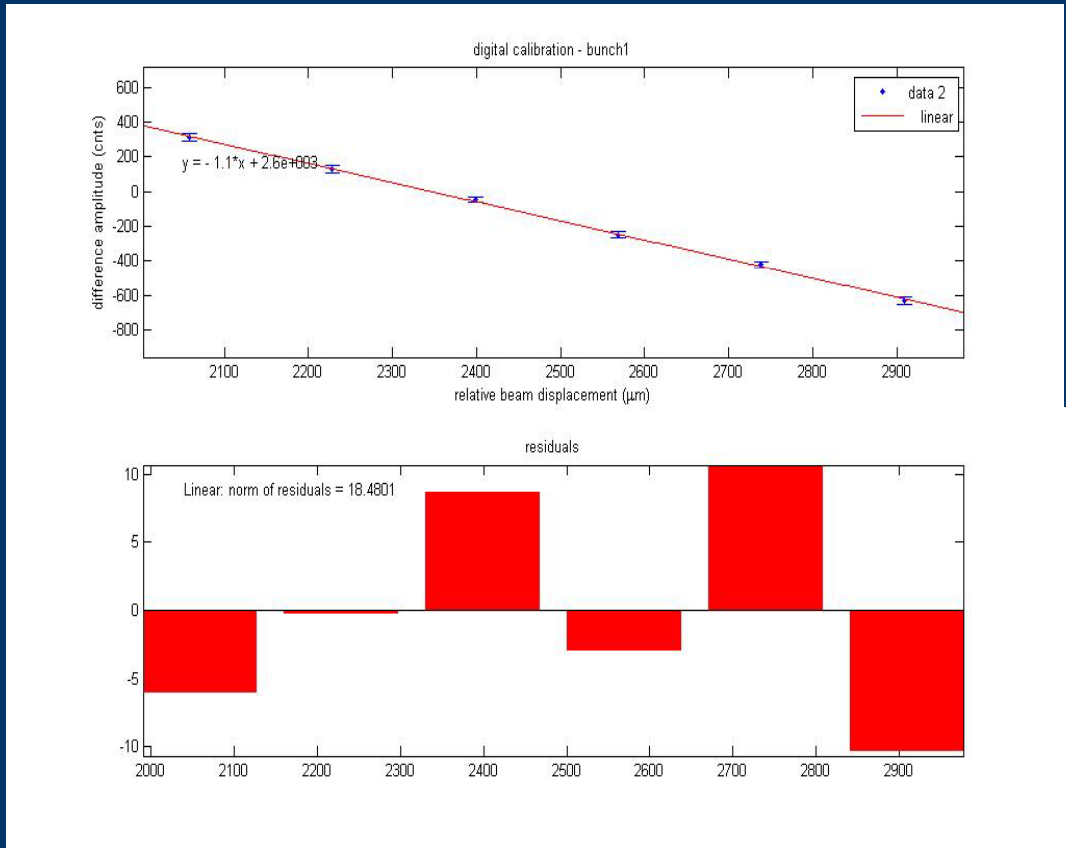
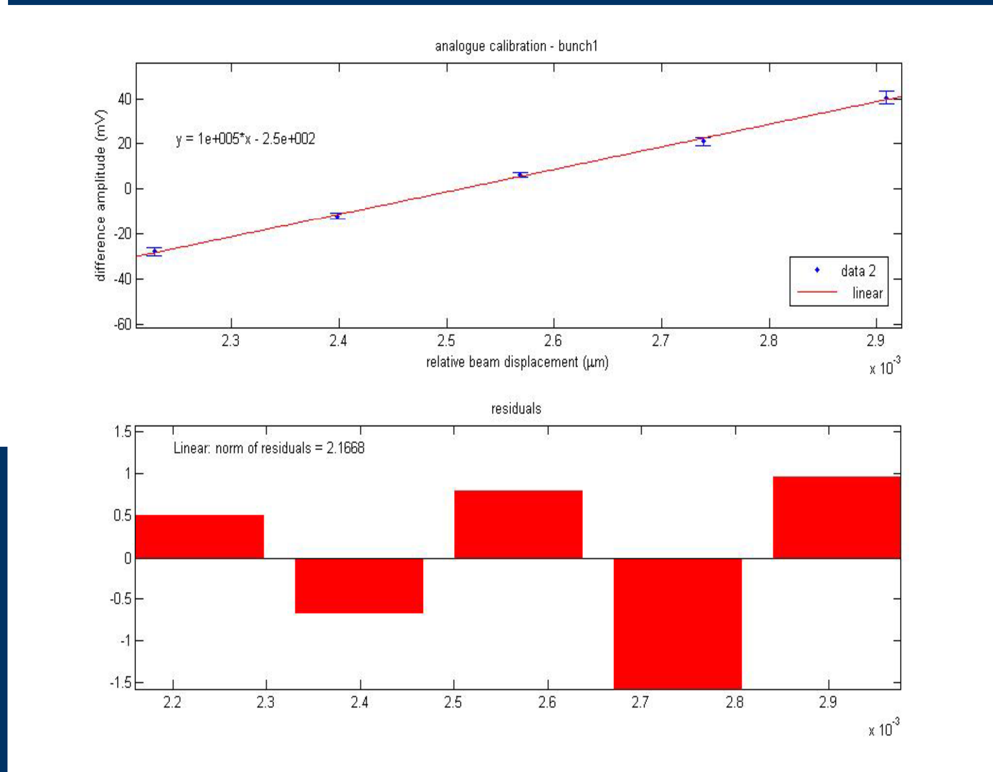
# Calibrations (bunch1 shown)




- B1:0.0996+-0.0037
- B2:0.0994+-0.0041
- B3:0.0998+-0.0034
- mV/micron




- B1:-1.104+-0.029
- B2:-1.082+-0.027
- B3:-1.107+-0.025
- cnts/micron

| Pos Setting | Bunch No | Analogue | Scope noise | Digital |
| --- | --- | --- | --- | --- |
| 2 | 1 | 18.2+/-0.7 | 2 | 17.4+/-0.5 |
| xxxxxxxxxxx | 2 | 70 +/- 3 | 2 | 47 +/- 1 |
| | 3 | 17.7+/-0.6 | 2 | 16.7 +/-0.4 |
| 3 | 1 | 12.4+/-0.5 | 1 | 12.6+/-0.3 |
| | 2 | 9.3+/-0.4 | 1 | 8.1+/-0.2 |
| | 3 | 11.9+/-0.4 | 1 | 9.8+/0.2 |
| 4 | 1 | 10.0+/0.4 | 0.4 | 14.9+-0.4 |
| ZERO Xing | 2 | 7.7+/-0.3 | 0.4 | 12.9+/-0.3 |
| | 3 | 10.6+/-0.4 | 0.4 | 15.2+/-0.3 |
| 5 | 1 | 17.9+/-0.7 | 1 | 14.8+/-0.4 |
| | 2 | 18.0+/-0.7 | 1 | 13.4+/-0.3 |
| | 3 | 15.3+/-0.5 | 1 | 17.5+/-0.4 |
| 6 | 1 | 28 +/- 1 | 2 | 19.6+/-0.6 |
| | 2 | 26 +/- 1 | 2 | 26.1+/-0.6 |
| | 3 | 23.4+/-0.8 | 2 | 20.9+/-0.5 |
| Digital noise | | | Negligible | 0.5 |

# *Comments on results*

- Not too bad!
- For both analogue and digital data, bit noise negligible wrt the measured jitters.
- Maybe no reason to assume the resolution to be same for both processors, but would have liked to see consistency
- Perhaps it is not possible to get any level of consistency from the data?
- Bad choice of dataset
  - Fairly large jitter compared to last shift last time + lack of any bunch-bunch correlations
- Would be tempted to repeat with the recent T-shirt data. Similar problems exist with size of datasets, but don't have this data anyway!
  - Could also attempt to estimate resolution from correlations from this.