# ATF2 Cavity BPM System Stability

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Instability

- Changes between calibrations both in IQ rotation ($\sim 10^{-1}$ rad) and position scale ($\approx 15\%$)

- Trigger time variation
  - Difference in frequency between position and reference cavities causes change in IQ phase

- Quadrupole strength
  - Kick of quadrupole magnet affects position scale determination in calibration
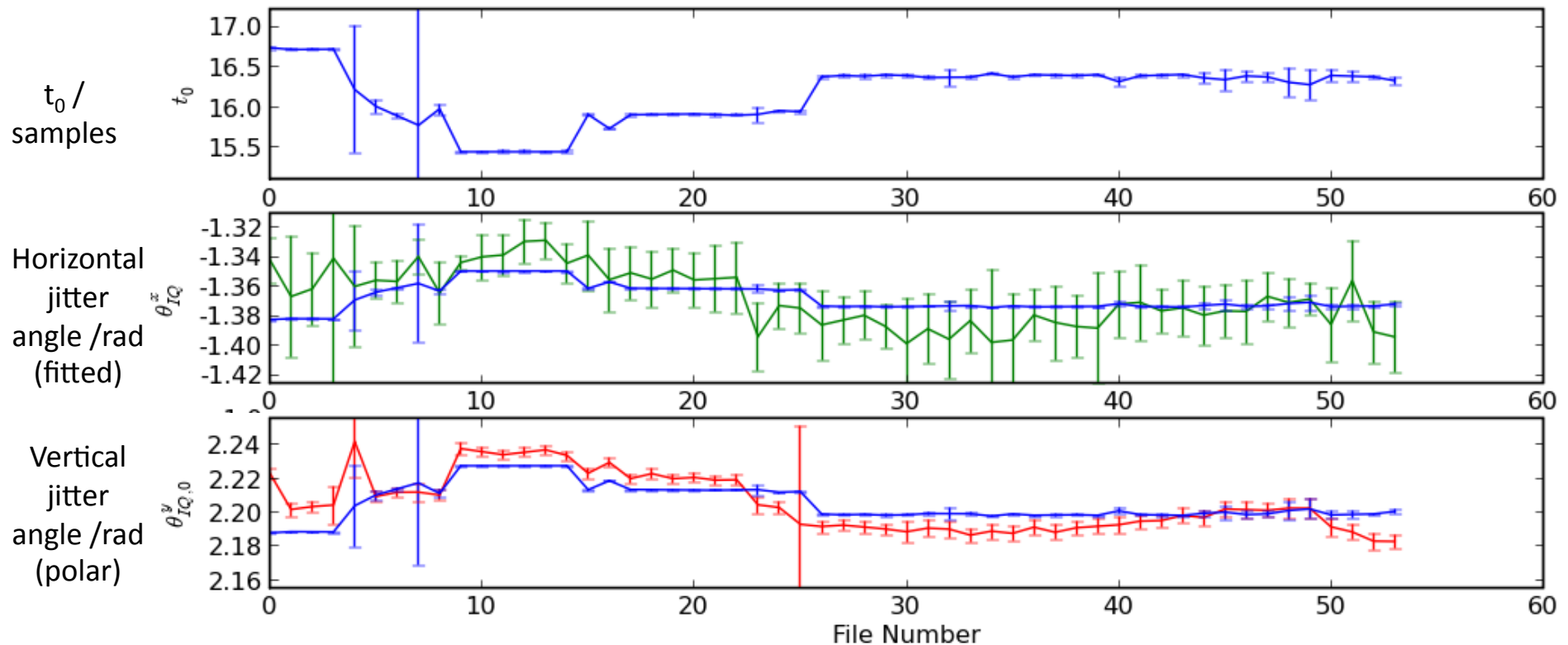
Static Calibration
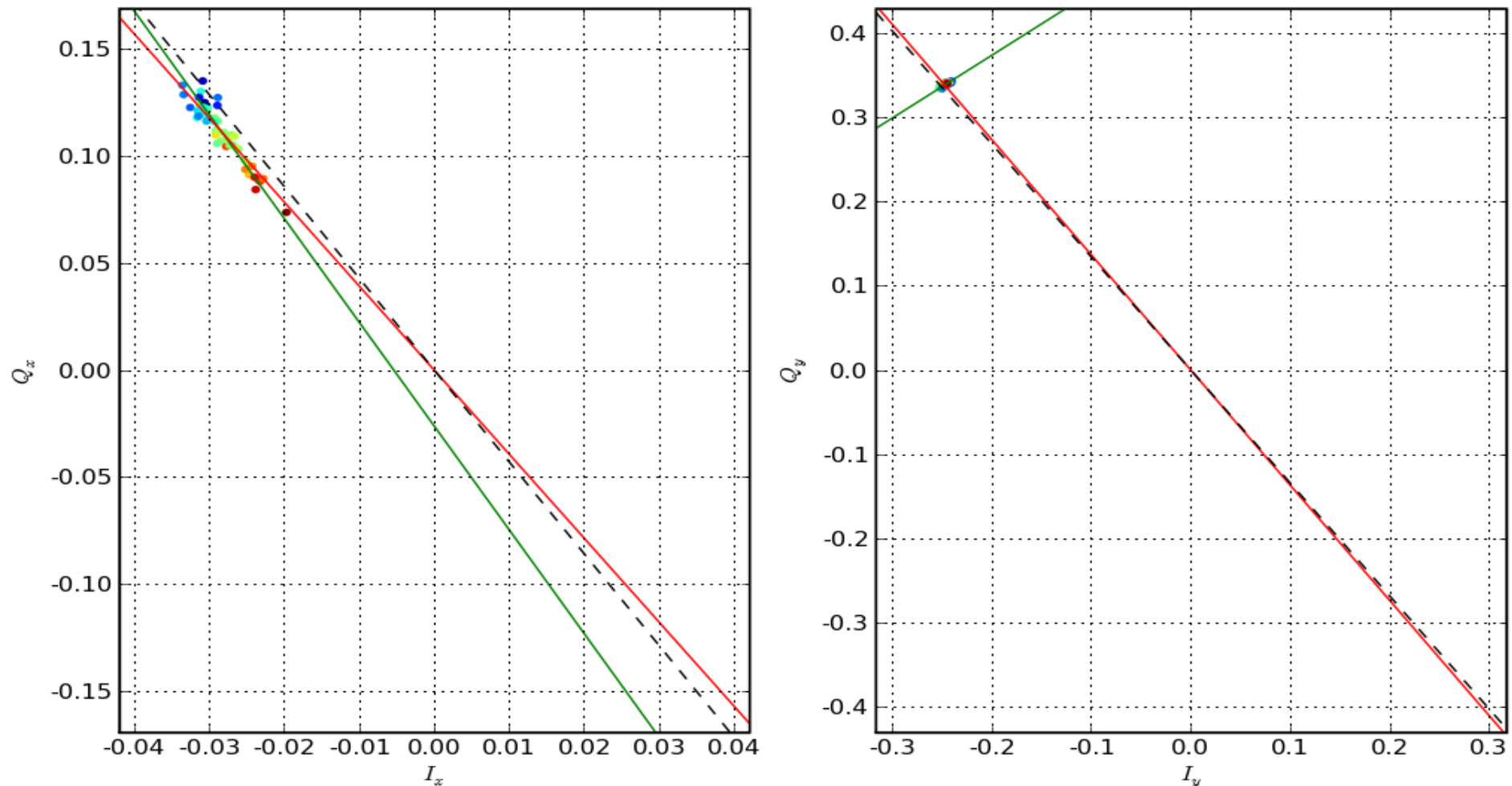
- IQ plots of 100 pulses logged by QD10X – horizontal on left, vertical on right
- Dashed line shows pure positional variation according to calibration
- Colour of points represents sampling point (t_0) – time (/samples) after trigger when phase and amplitude are measured
- Green line fitted to jitter
- Red line fitted to mean jitter and origin – only valid in certain conditions

QD10X

$$\Delta\Theta_{IQ} = 2\pi\left(f_{bpm} - f_{ref}\right)\Delta t_0$$

t_0 / samples

Horizontal jitter angle /rad (fitted)

Vertical jitter angle /rad (polar)

- Results from logs taken over last week of running in December`
- First plot is t_0 against file number
- Colour of lines correspond to colours in plots on previous slide
- Blue line shows predicted pattern of change in IQ rotation angle – absolute values not predicted
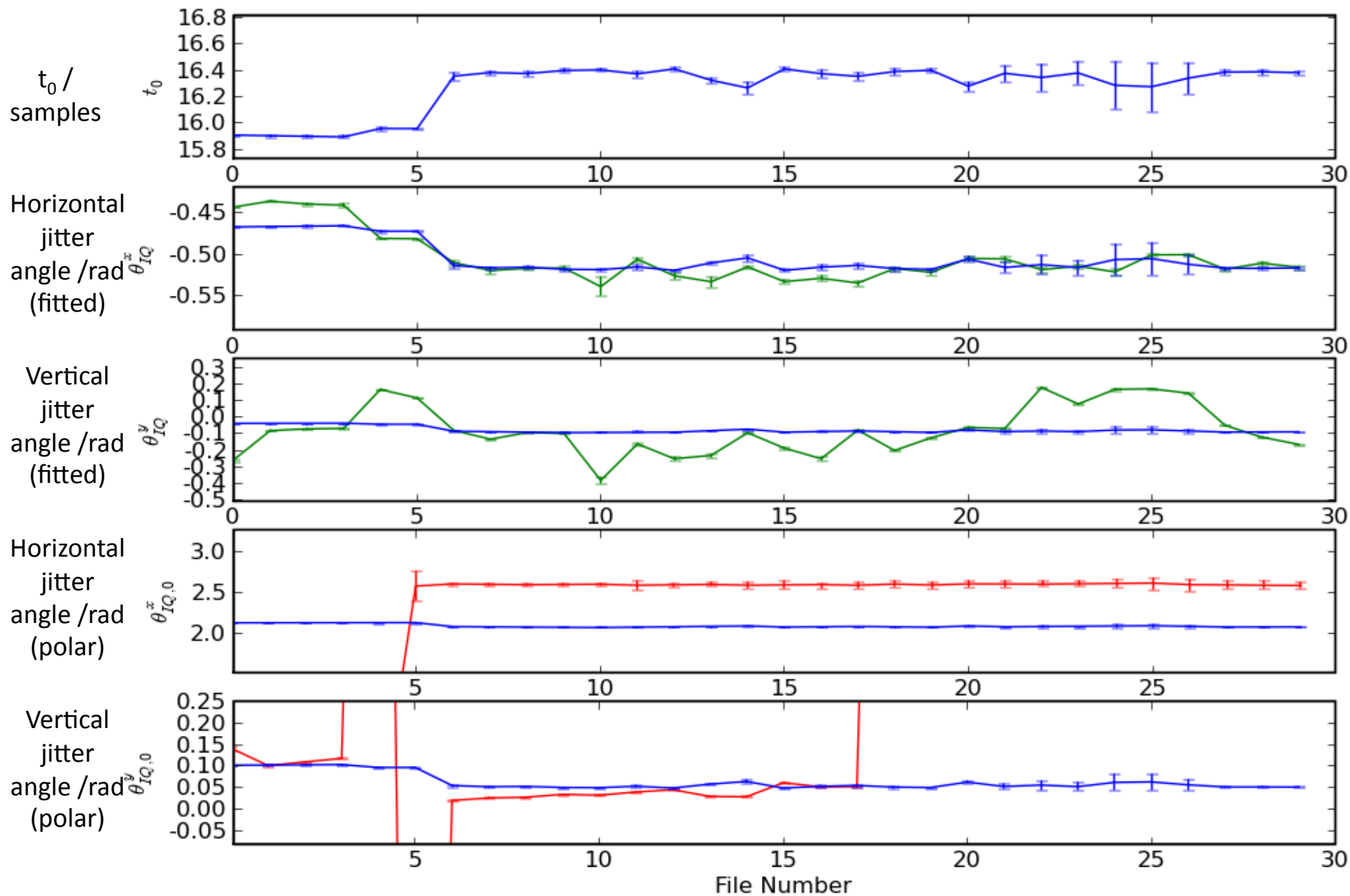
QD10X
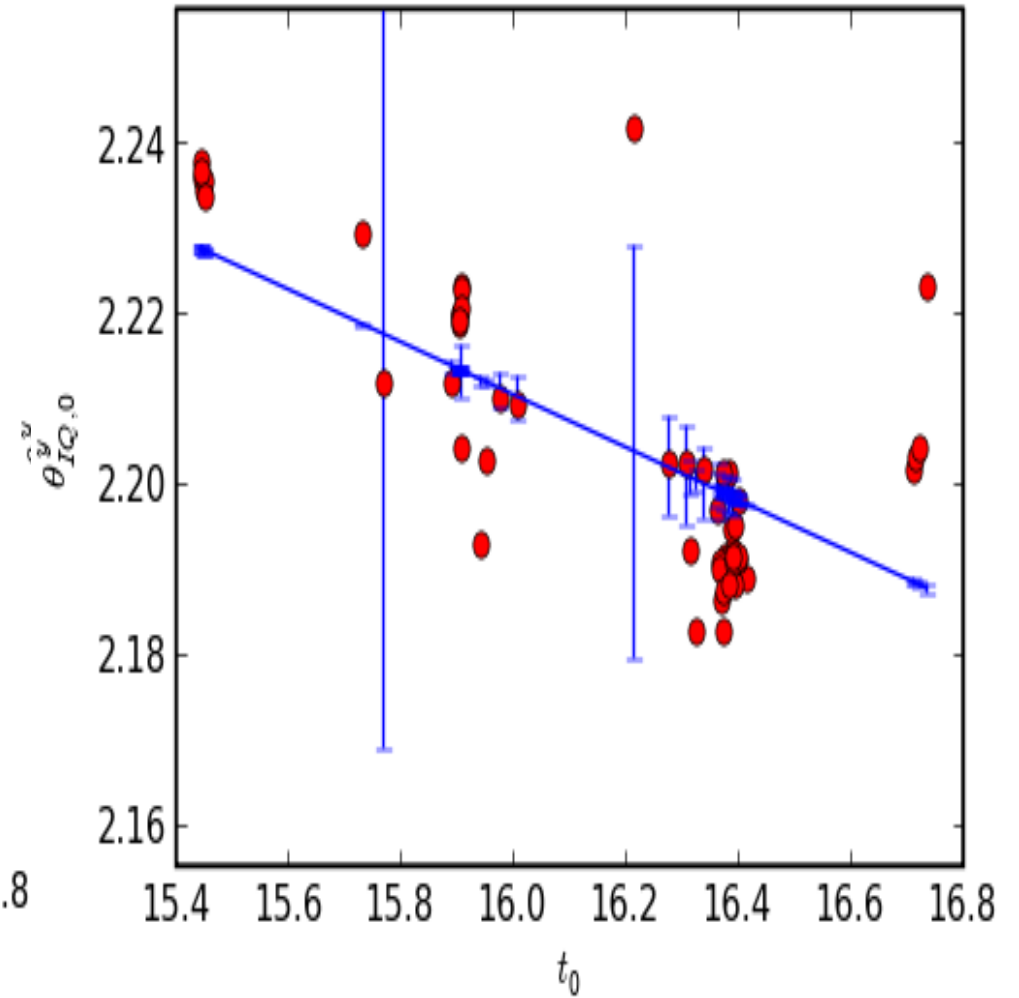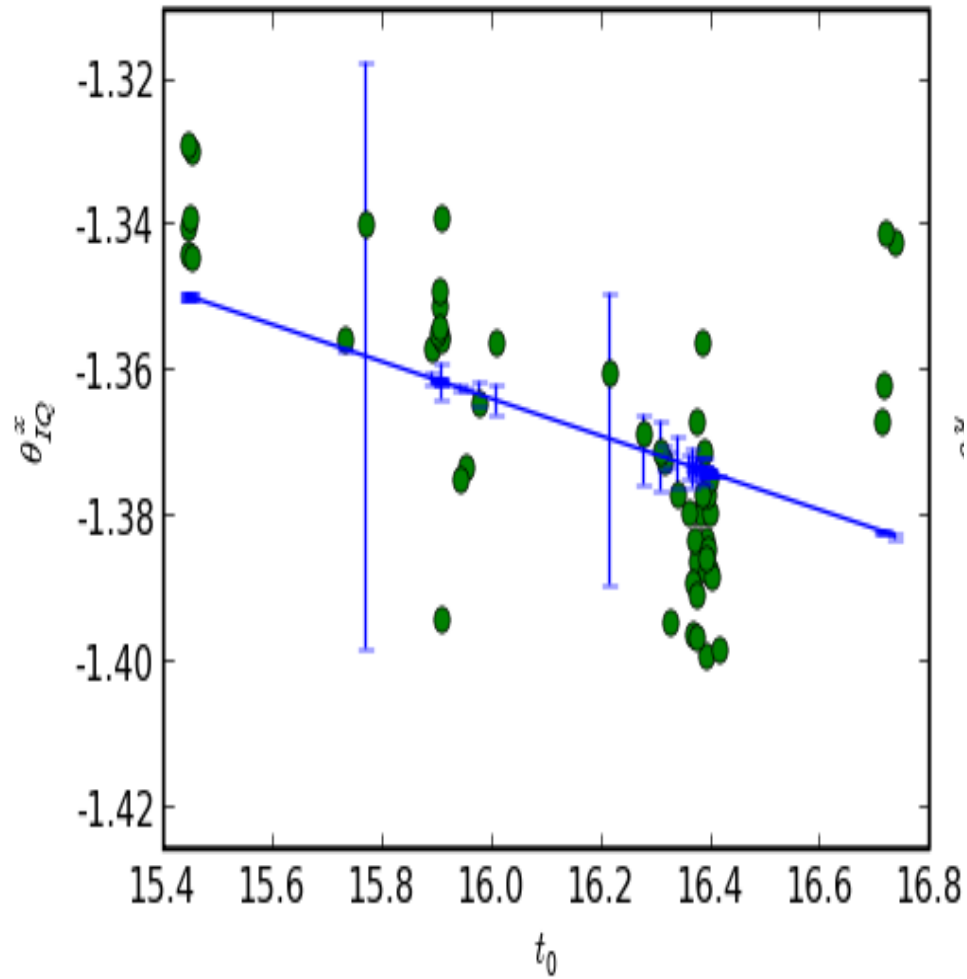
- Correlation of jitter angle and t_0
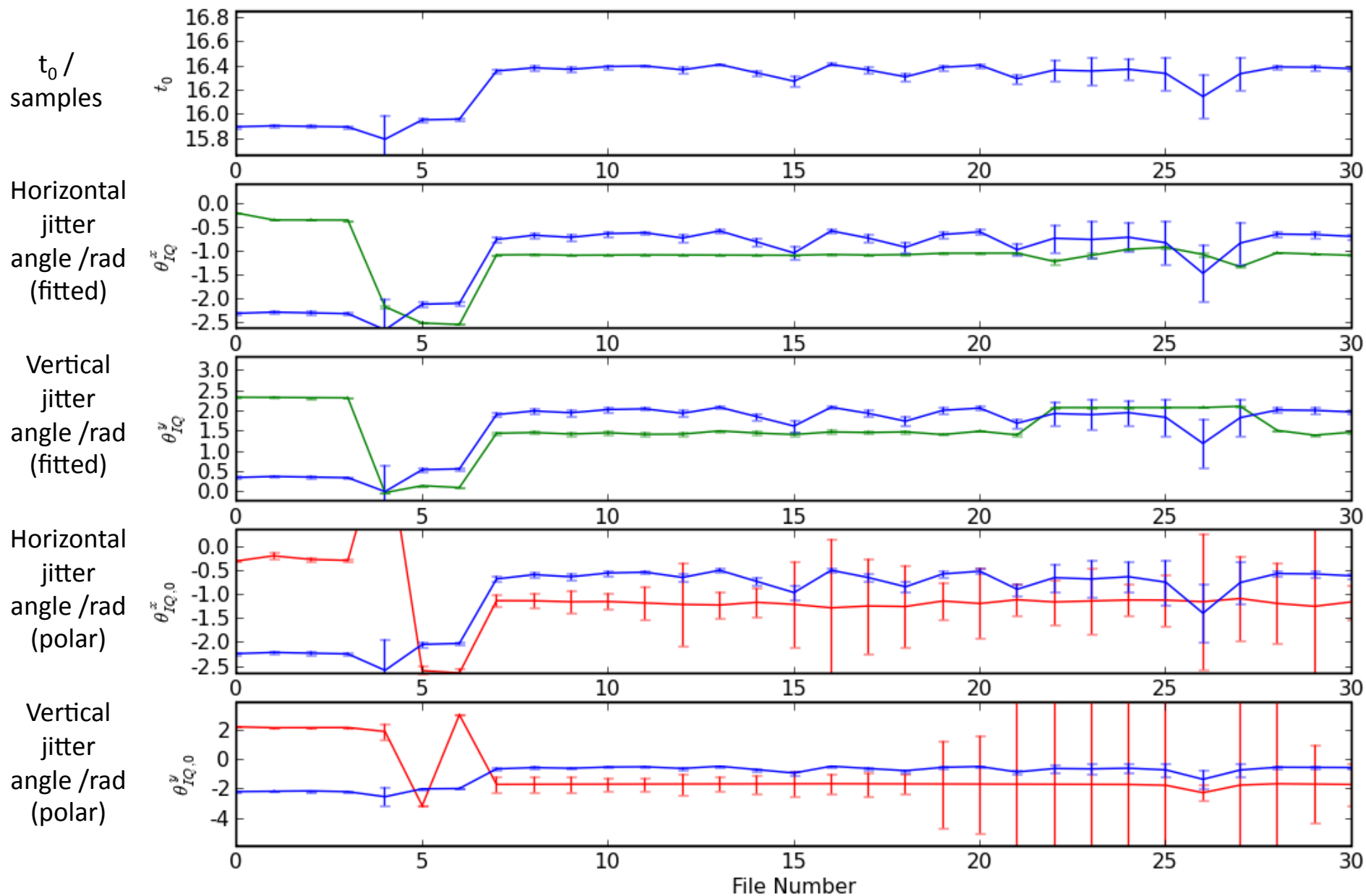- Blue line shows predicted slope of the correlation
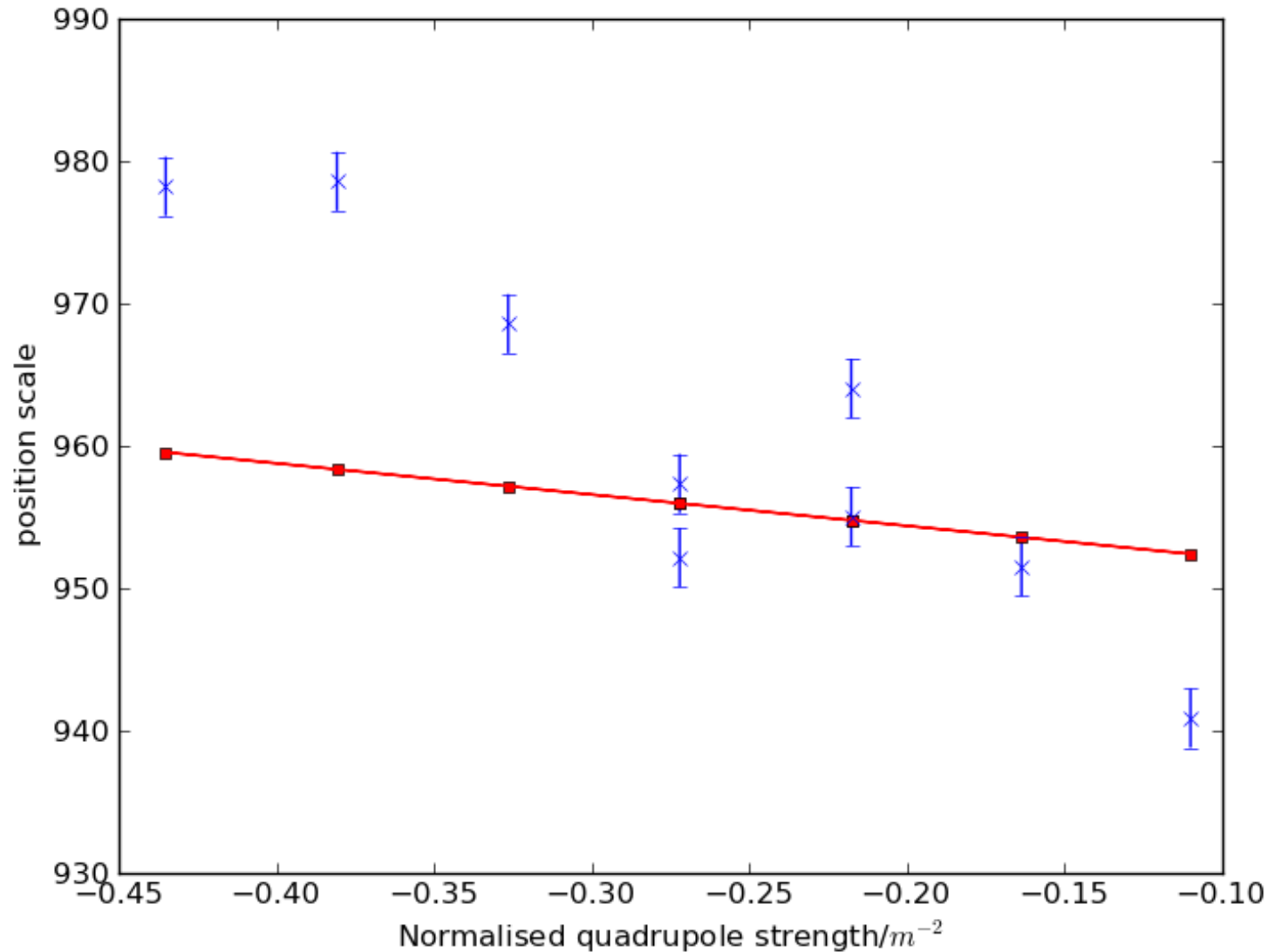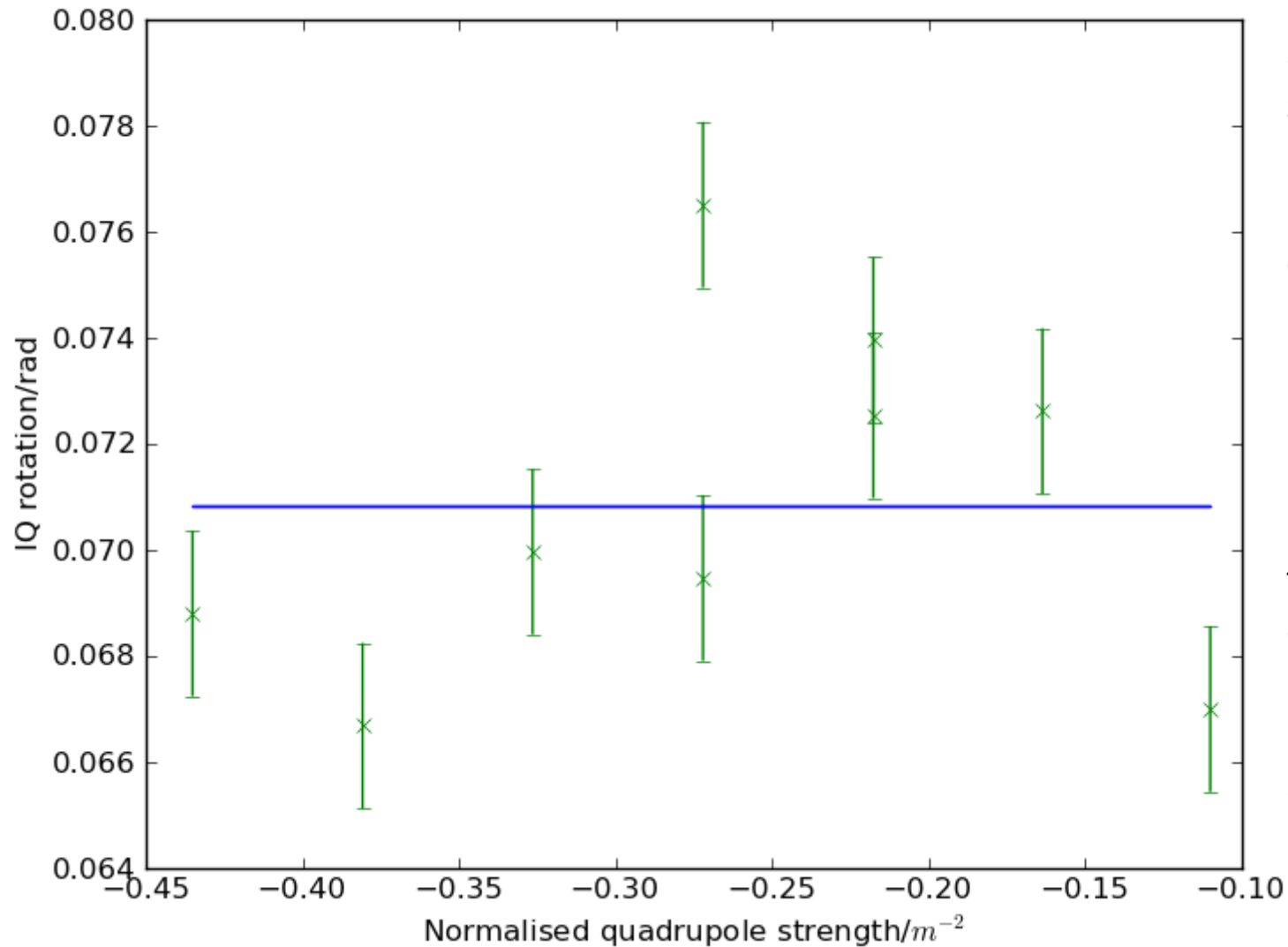
QD10BFF
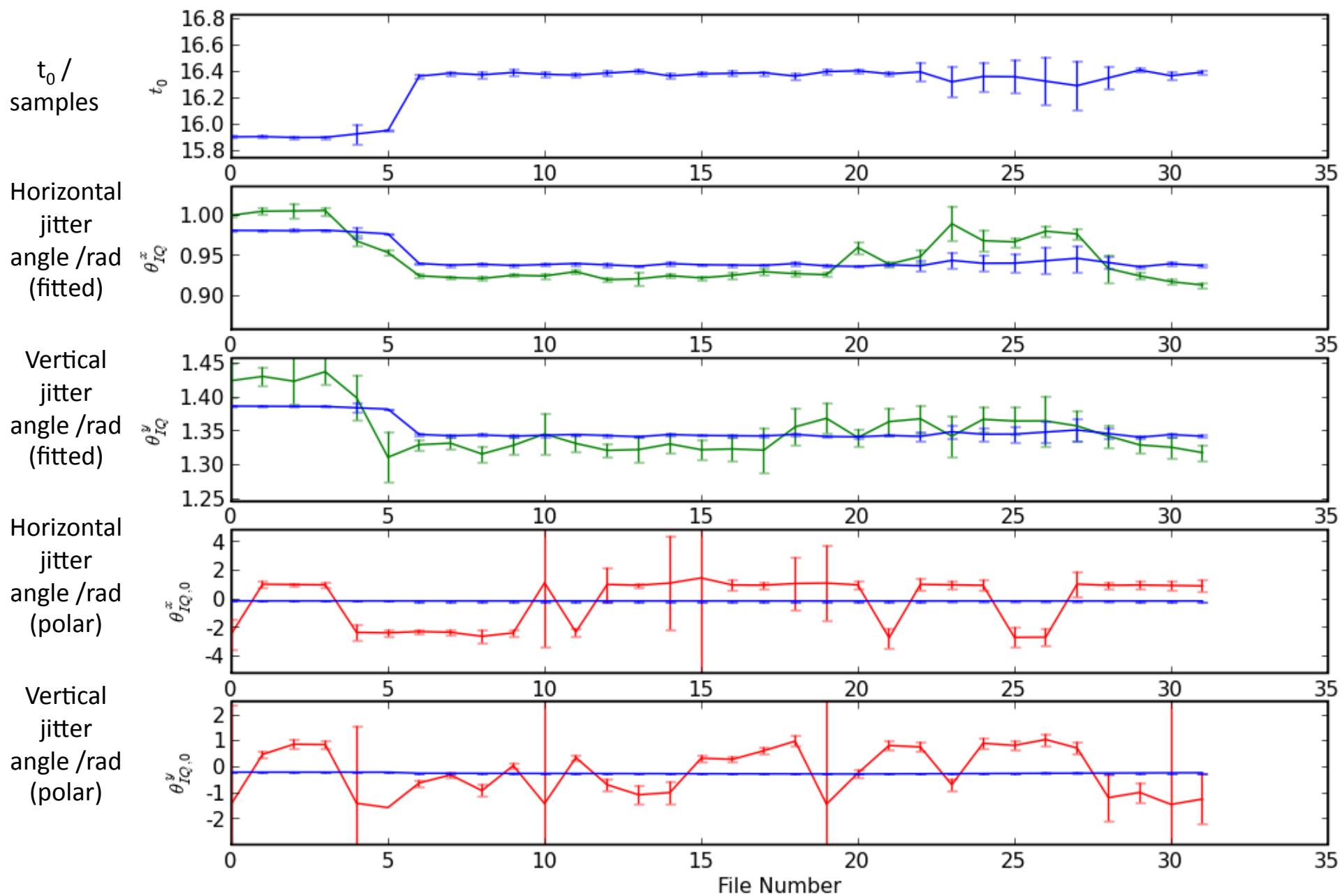
QD2AFF

SF1FF

Quadrupole Strength

- Plot of position scales against quadrupole strength

- BPMs are after magnets and on the same movers so magnet kick varies as the BPM is moved during calibration.

- Red line shows theoretical prediction.

- Errors were estimated from the repeated measurement of one data point only

Quadrupole Strength

- IQ rotation angle against quadrupole strength

- Not expected to change noticeably

- Blue line shows mean

- More variation than expected from errors

- Suggests drift during experiment

Summary

- May have a method for tracking changes in IQ rotation between calibrations.

- Need more logged data backed up with results from calibrations

- Also look into the effect of a change in frequency difference between position and reference cavities

- There is a change in position scale with quadrupole strength.

- Need repeat experiment with jitter subtraction to reliably determine whether it matches the prediction