ATF2 February Shifts

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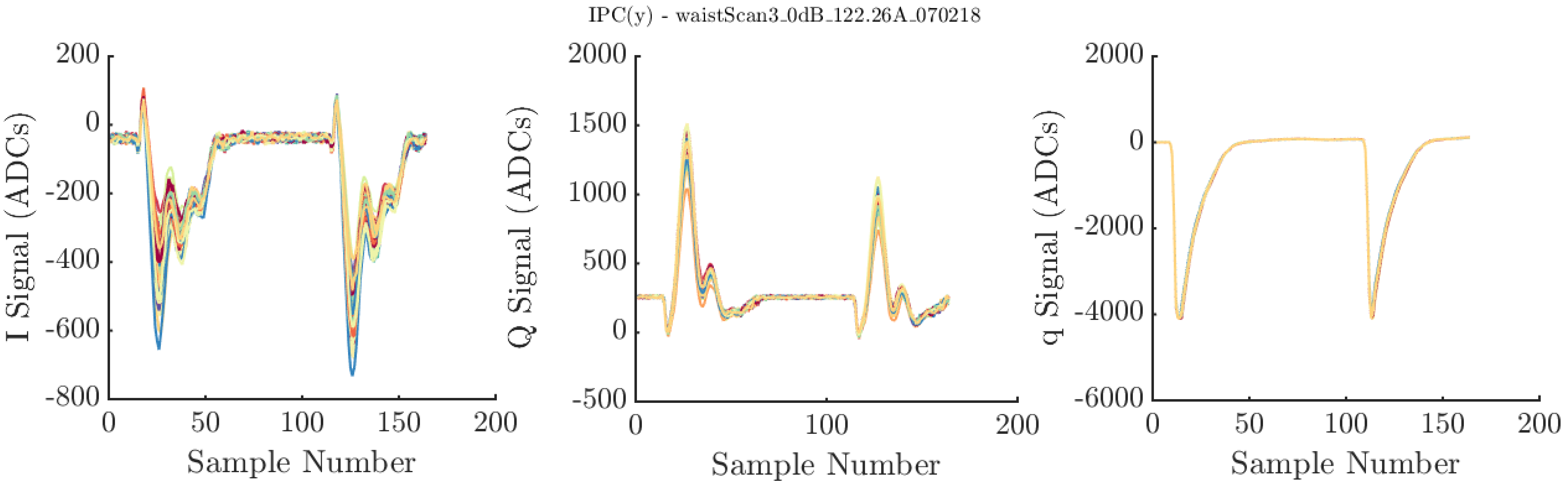
Friday, 16th February 2018

Shift Outline

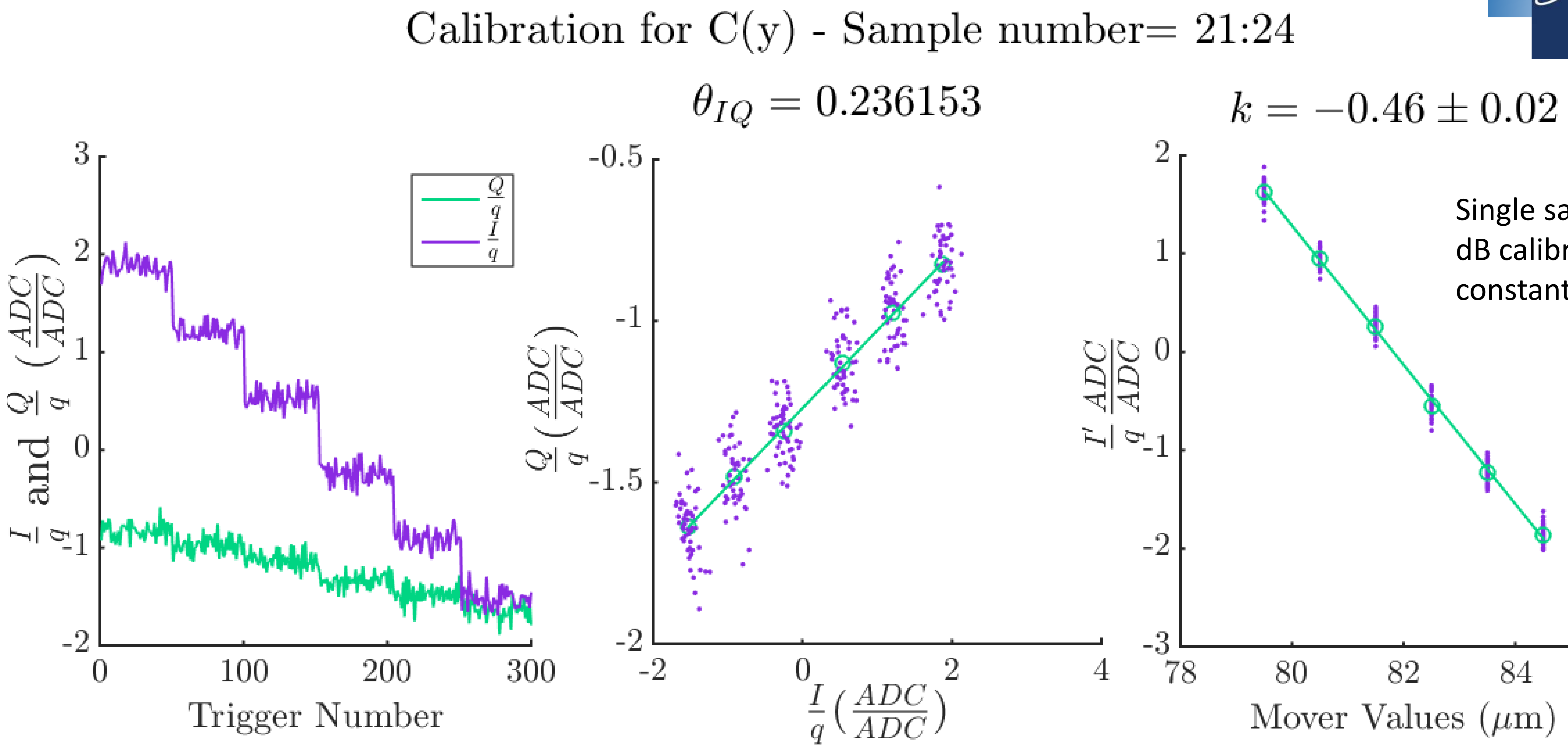
- Shift one: (10 dB)
  - Waist scan,
  - Measure baseline with and without baseline subtraction,
  - Latency scan,
  - Repeat calibrations.
- Shift two: (0 dB)
  - Unsuccessfully attempted feedback, poor beam conditions.
- Shift three: (high-beta optics, 10 dB)
  - Sample jump diagnosis,
  - QD0FF and QF1FF quad scan,
  - Attenuation scan,
  - Charge scan.

Shift One

IPC Waveforms (Nominal Optics)



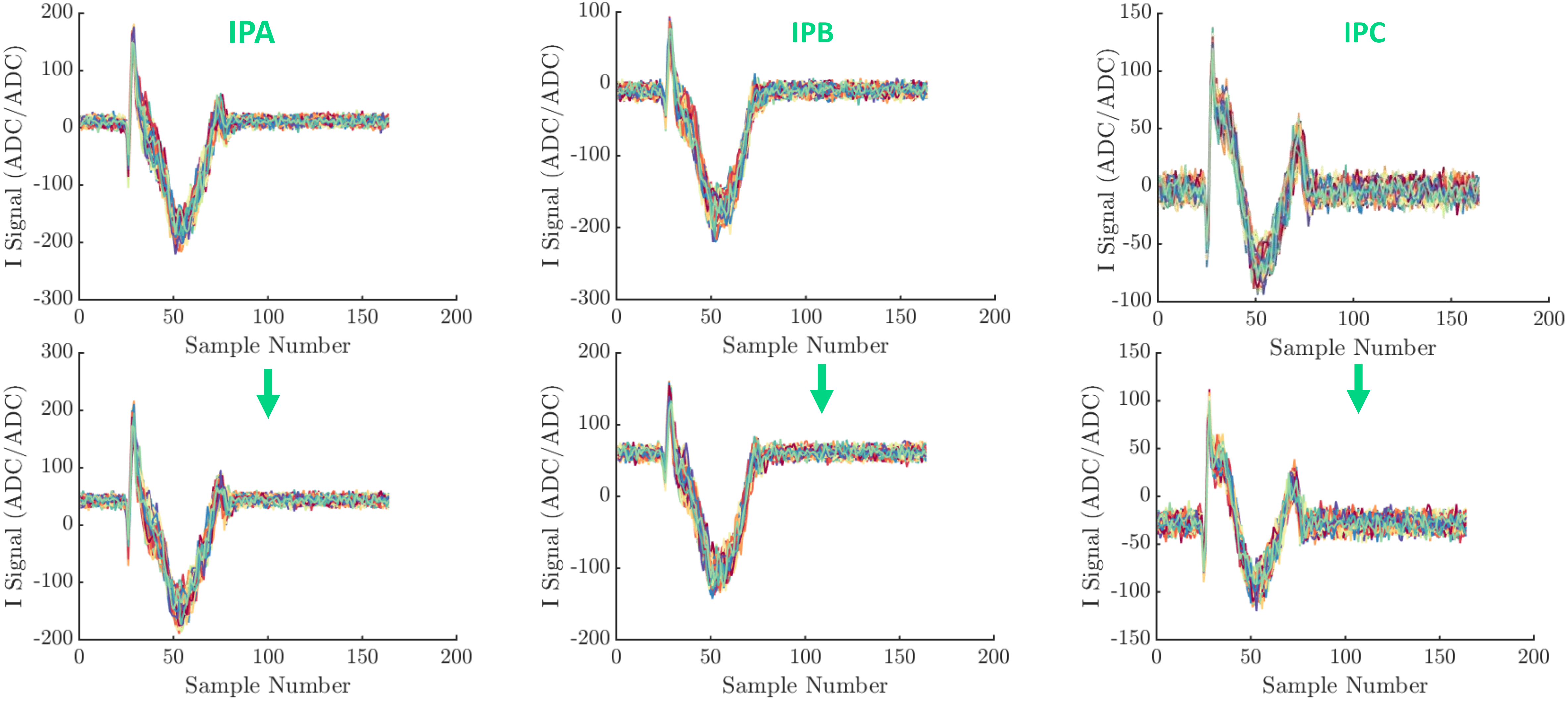
Calibrations (10 dB)



Single sample 0 dB calibration constant: -0.36

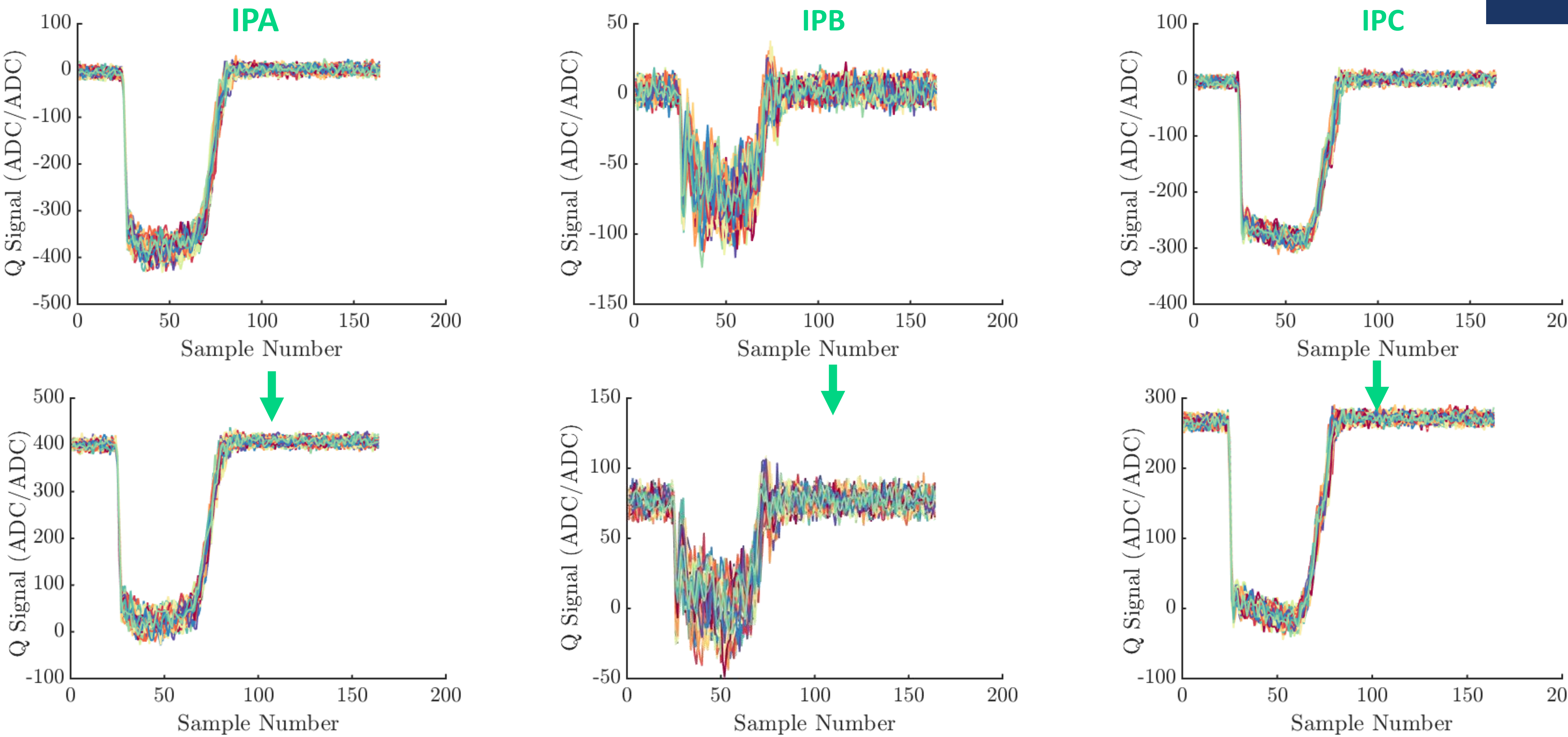
I Signal Baseline Subtraction

Samples used in analysis: samples 33:40.



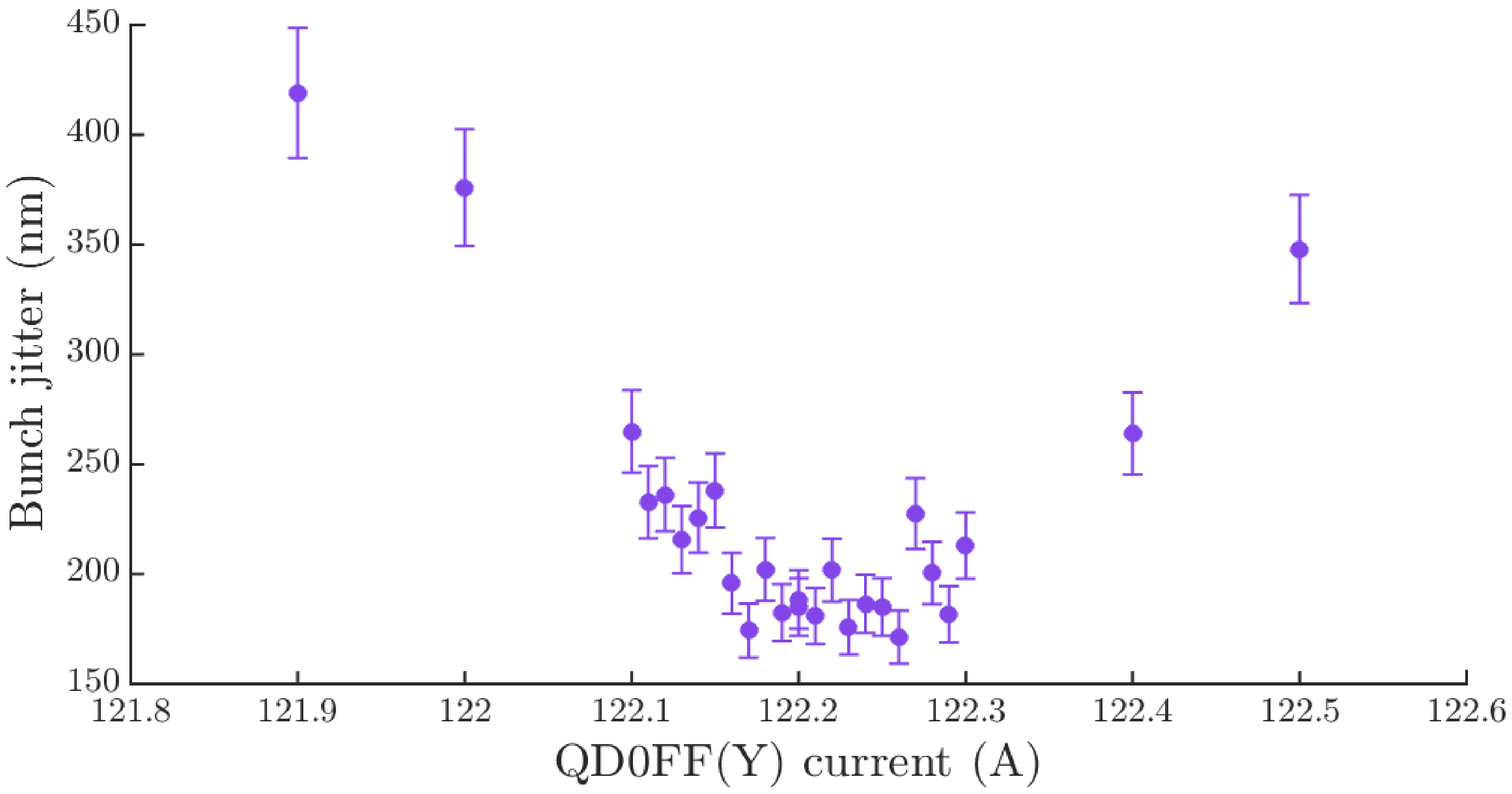
Q Signal Baseline Subtraction

Samples used in analysis: samples 33:40.



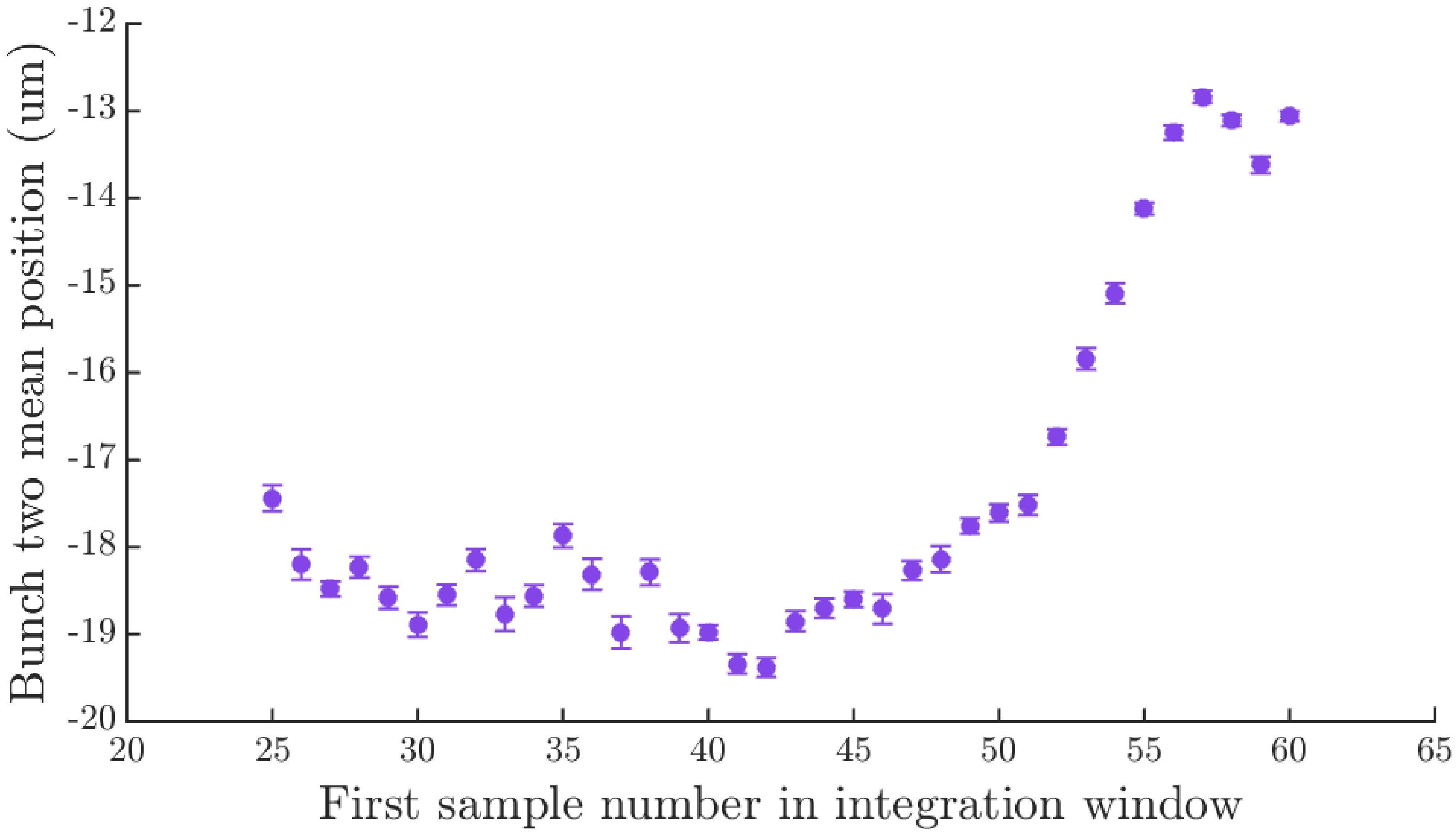
Waist Scan

- Change QD0FF current in increments of 0.01 around the waist position.
- Minimum measured bunch jitter 171 ± 12 nm, at 122.27 nm.



Latency Scan

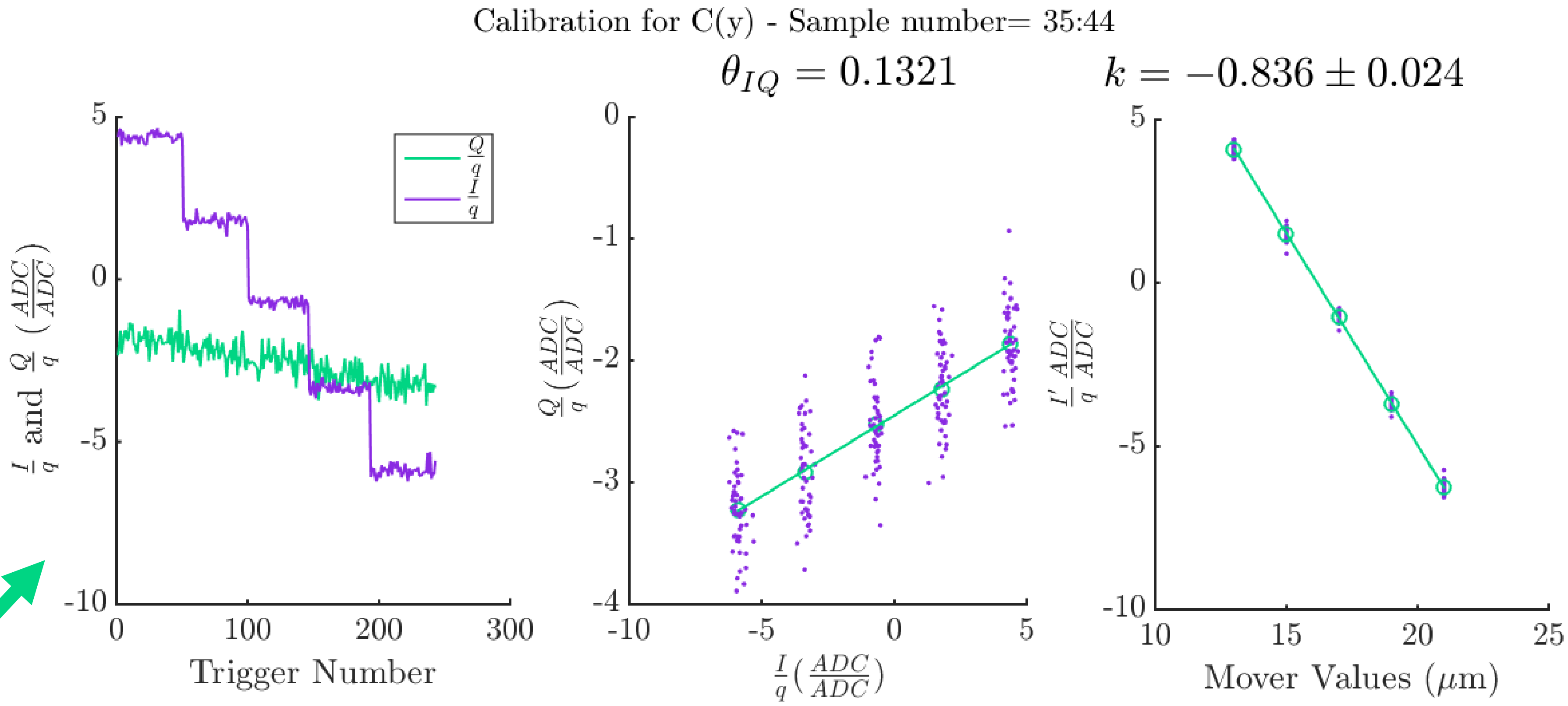
- When the DAC value is clocked out is independent of the number of samples integrated by the firmware. The value is clocked out at the same time as if it were 15 sample integration.
- *x*-axis shows first sample number in the integration window.
- First sample number selected for feedback on this data set would be sample 33.
- Dipole and reference sample set to same value for this scan.



Repeat Calibrations (for Talitha)

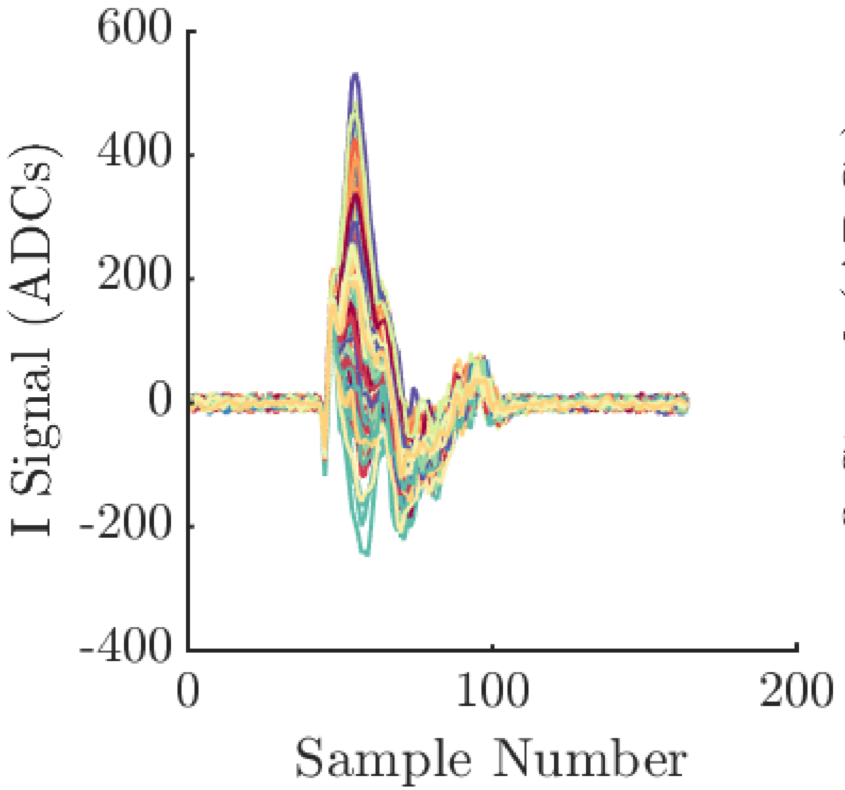
Scaled calibration constants and thetaIQ values for eight consecutive repeat calibrations.
Analysed using dipole samples: 35:44, ref sample: 39.

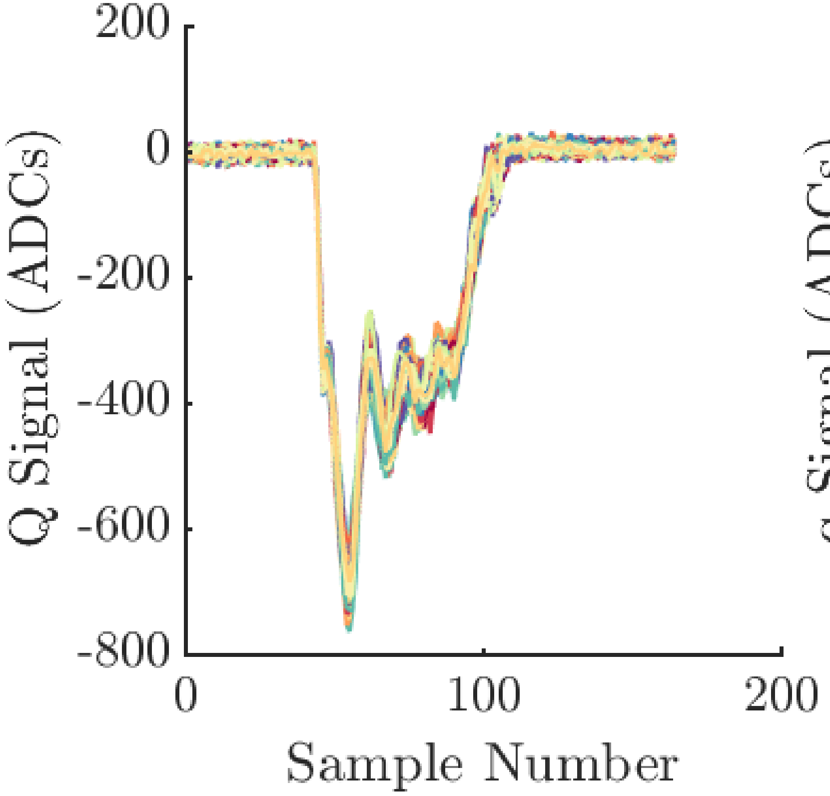
Scaled *k*	θ_{IQ}
-0.085	0.136
-0.0836	0.138
-0.0828	0.139
-0.0841	0.133
-0.0831	0.1
-0.0829	0.11
-0.0827	0.125
-0.0836	0.132

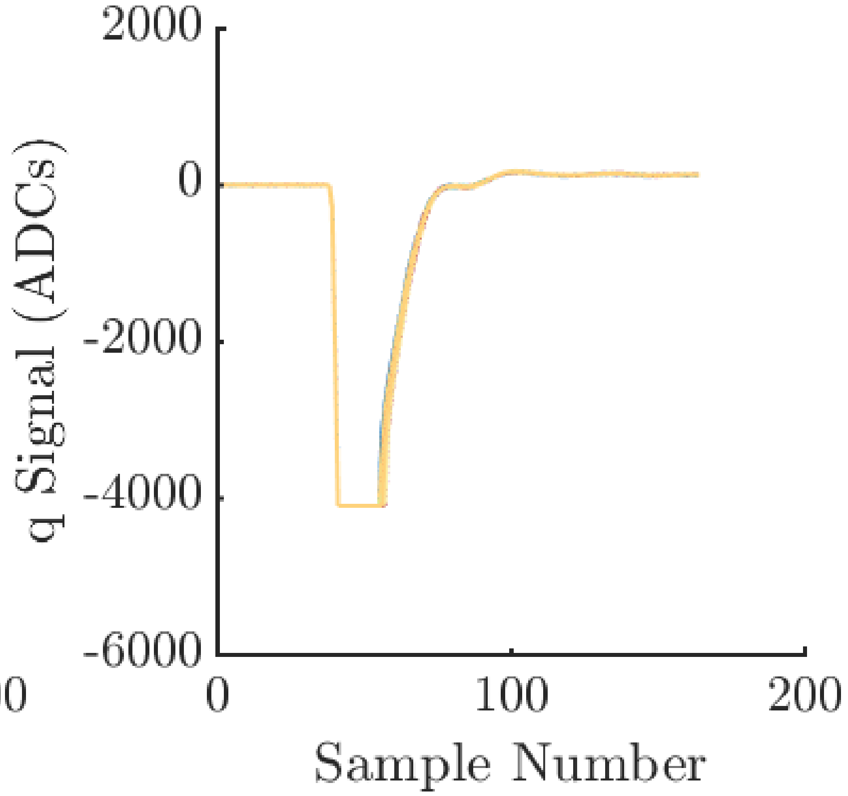


Shift Three

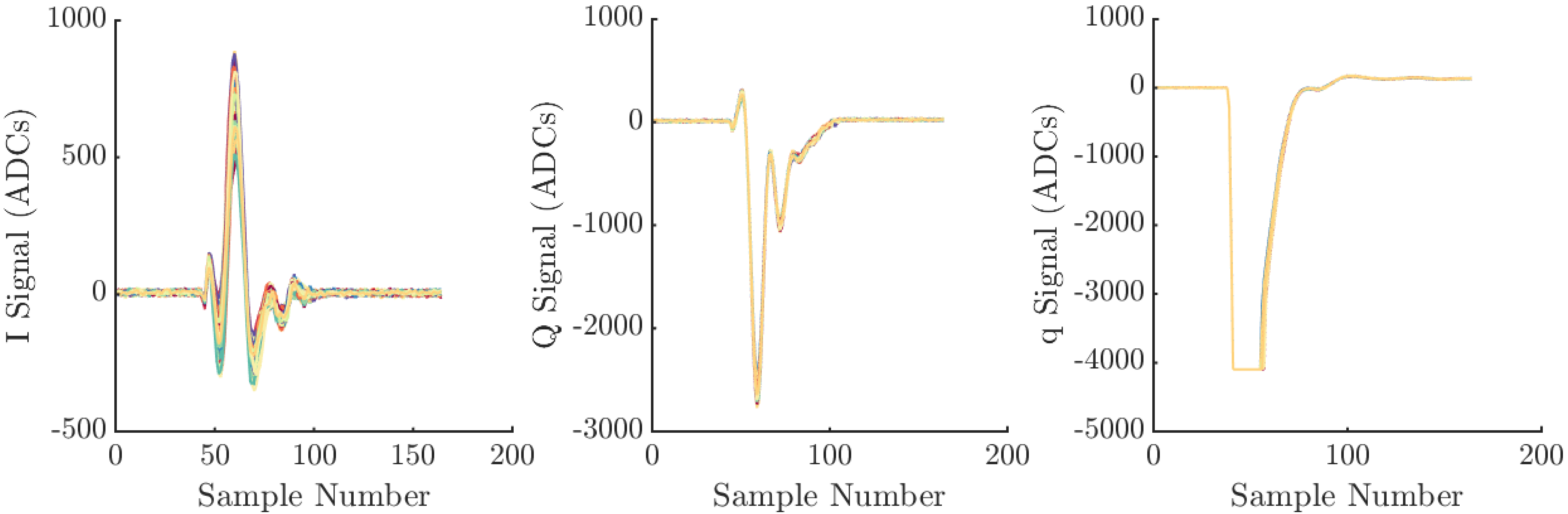
High-beta Optics Waveforms



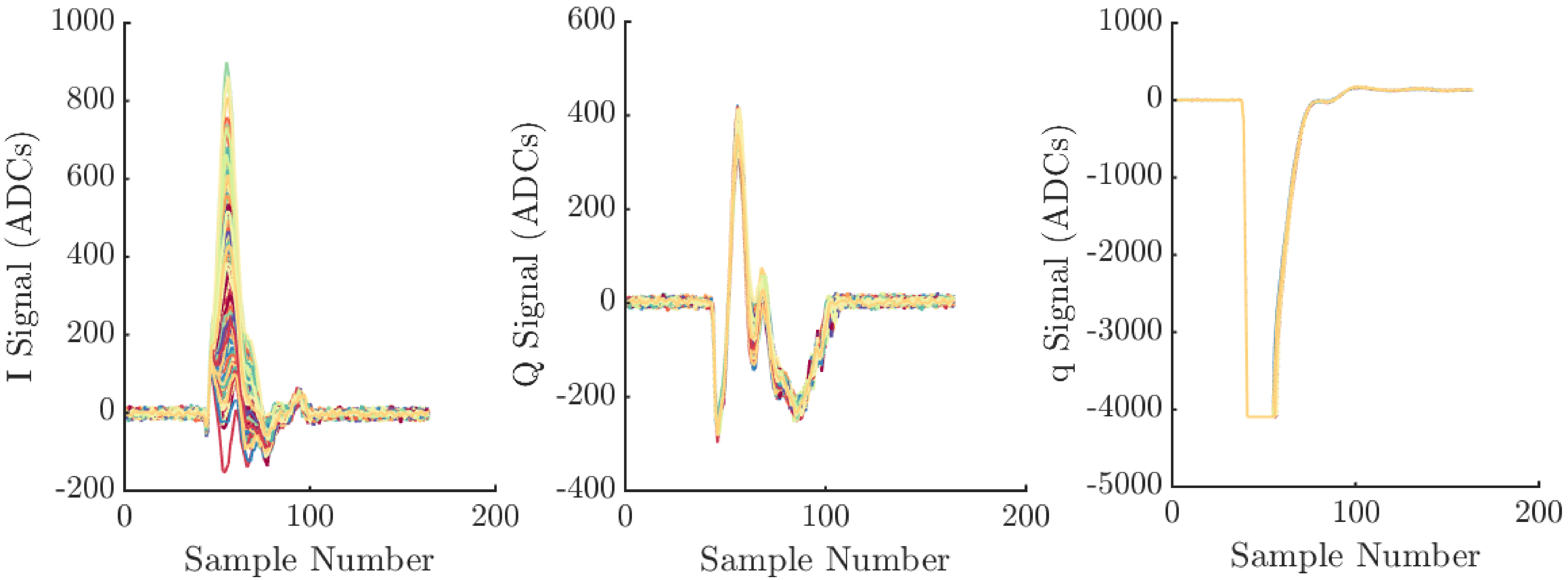




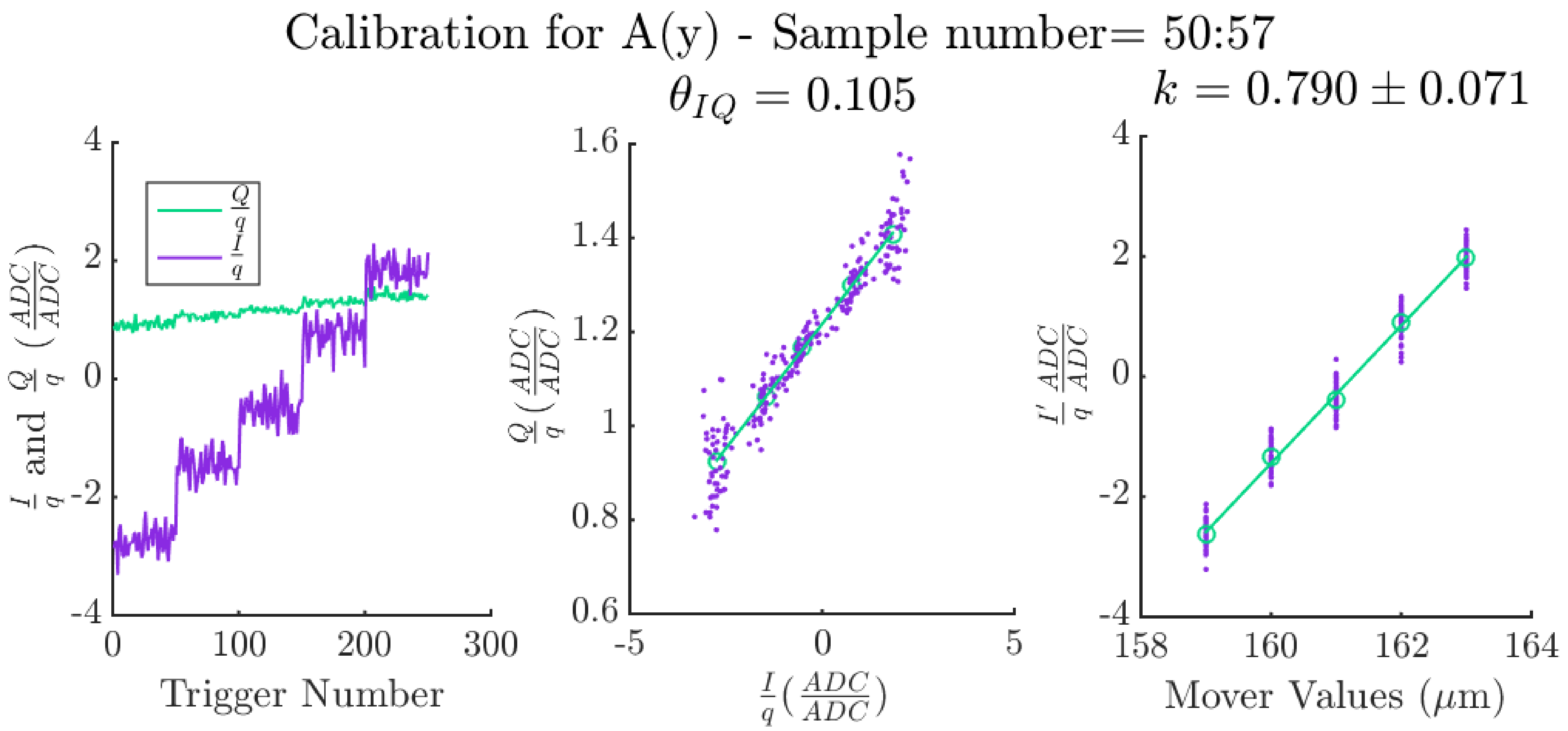
High-beta Optics Waveforms



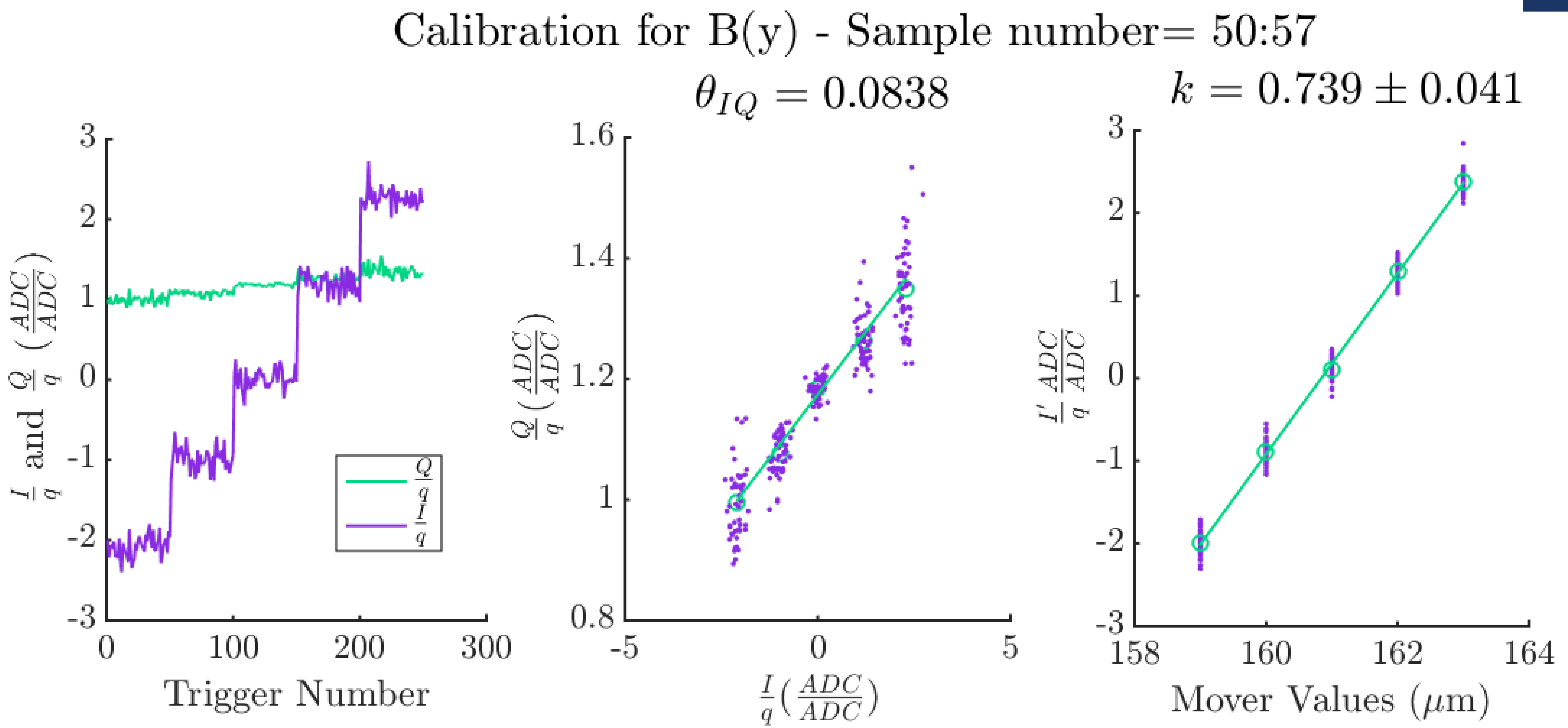
High-beta Optics Waveforms



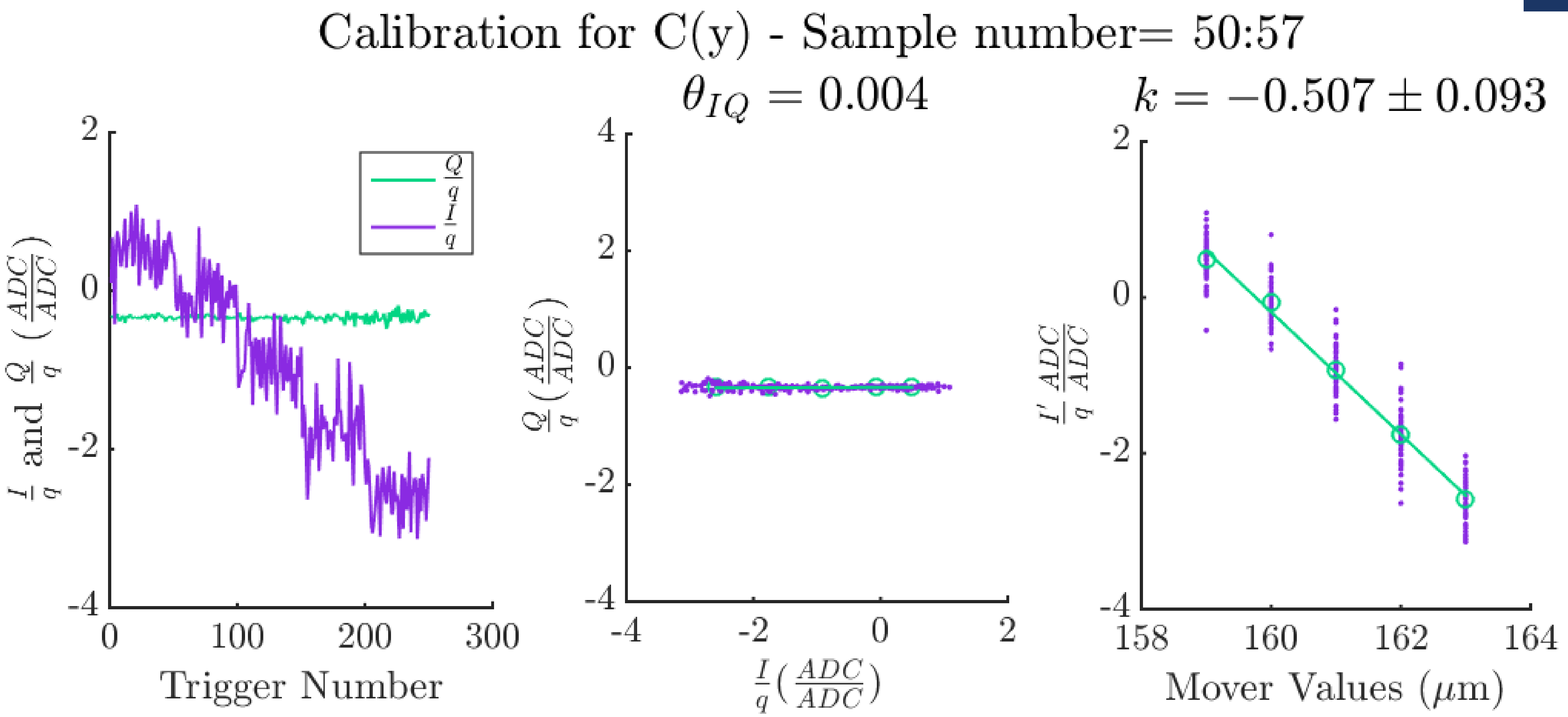
High-beta Optics Calibrations



High-beta Optics Calibrations

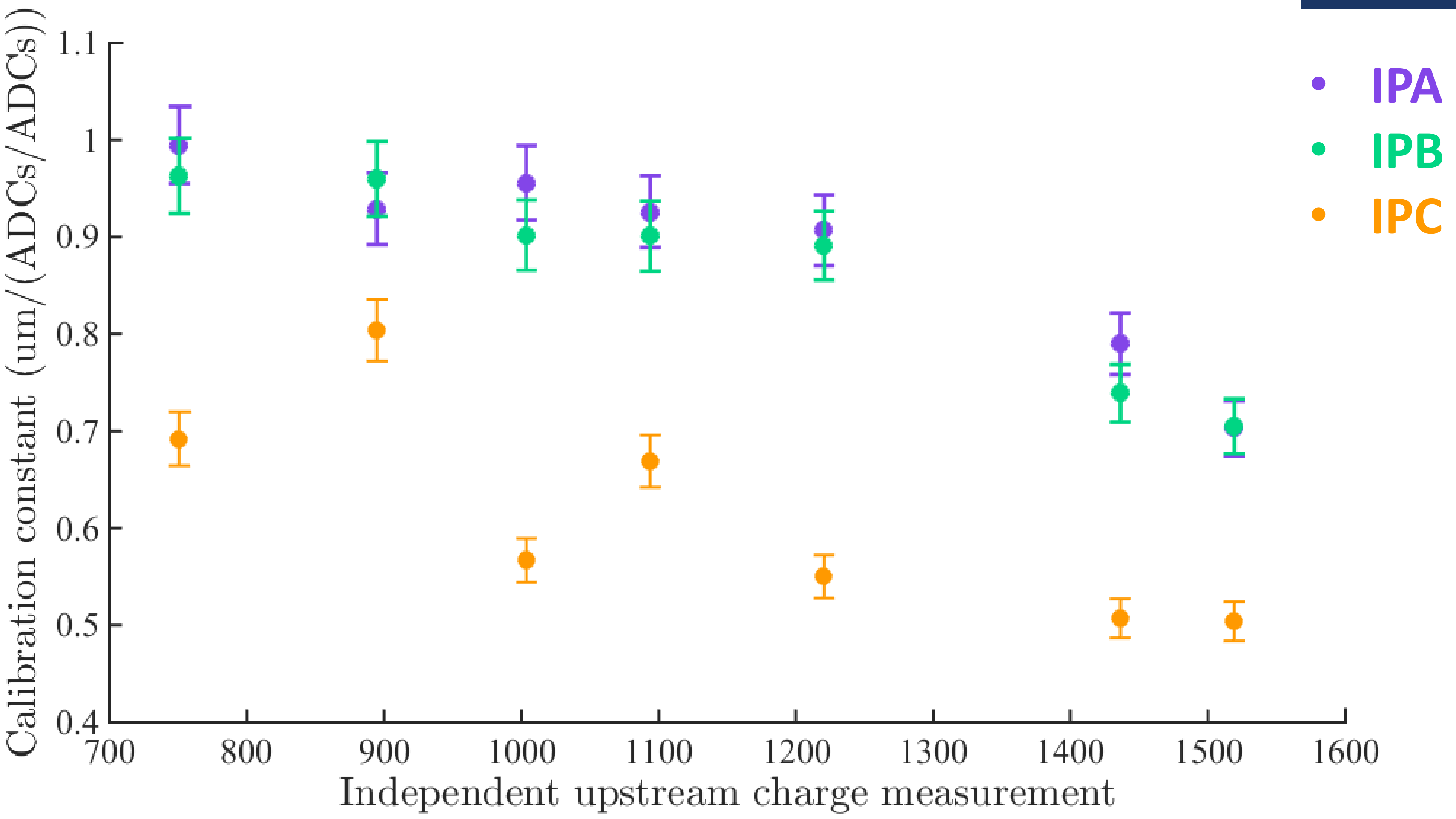


High-beta Optics Calibrations



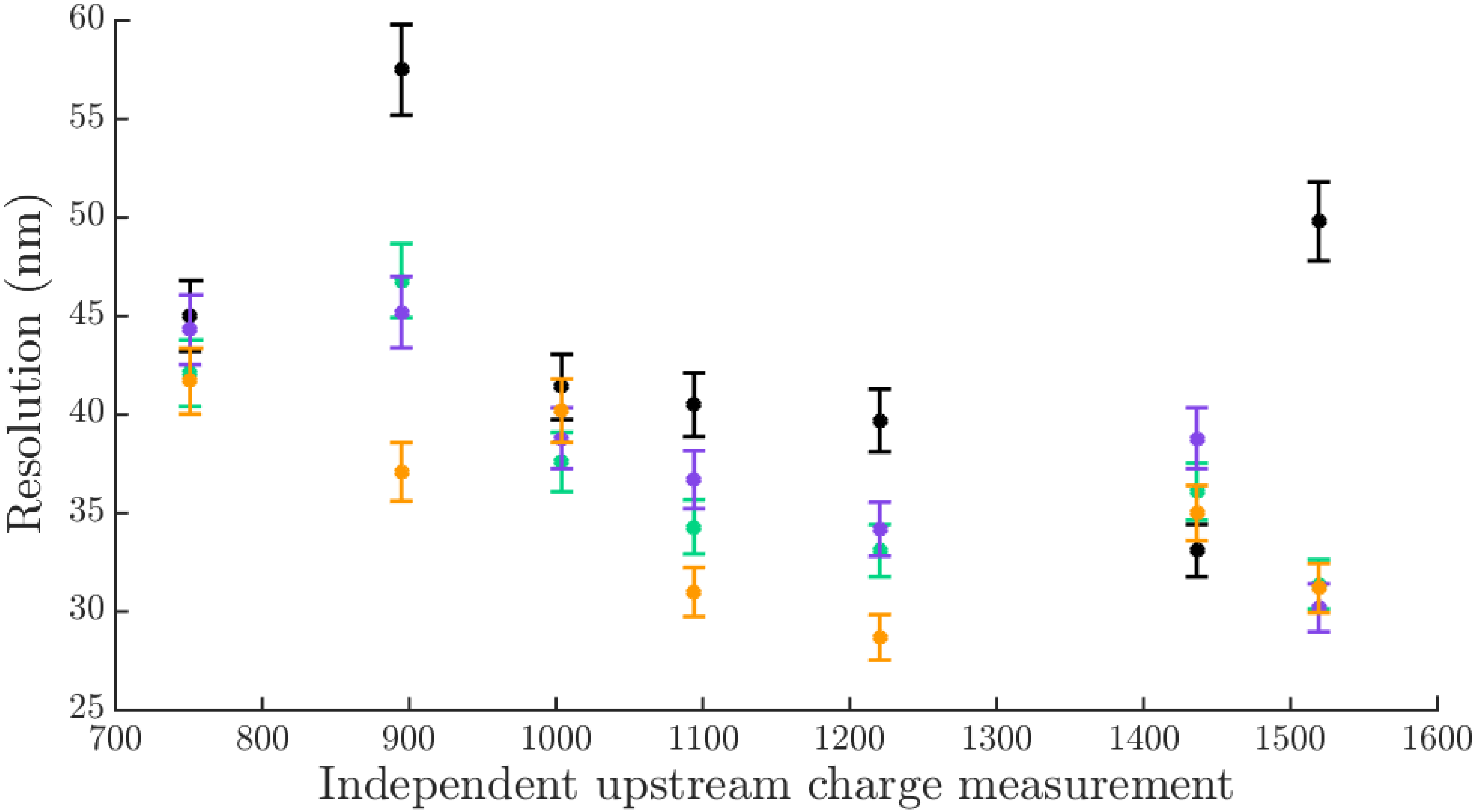
Charge Scan – Calibration Constant

- Calibration constant across a charge scan.
- The same sample numbers were used for the whole scan.
- We were trying to gauge how much fluctuations in the charge would effect the calibration constant and consequently the feedback gains.



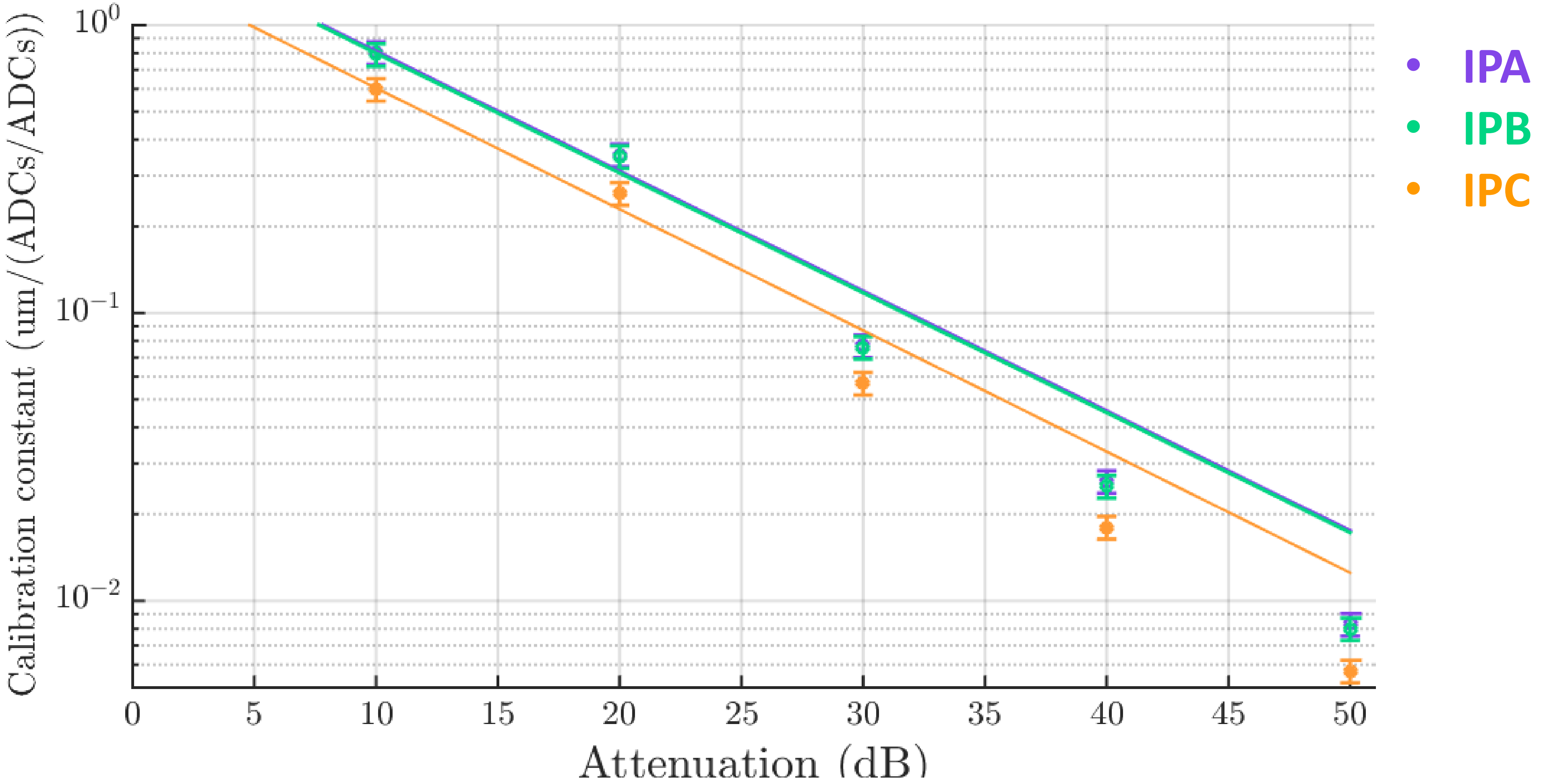
Charge Scan – Resolution

- **Geometric**
- **Fit: IPA**
- **Fit: IPB**
- **Fit: IPC**



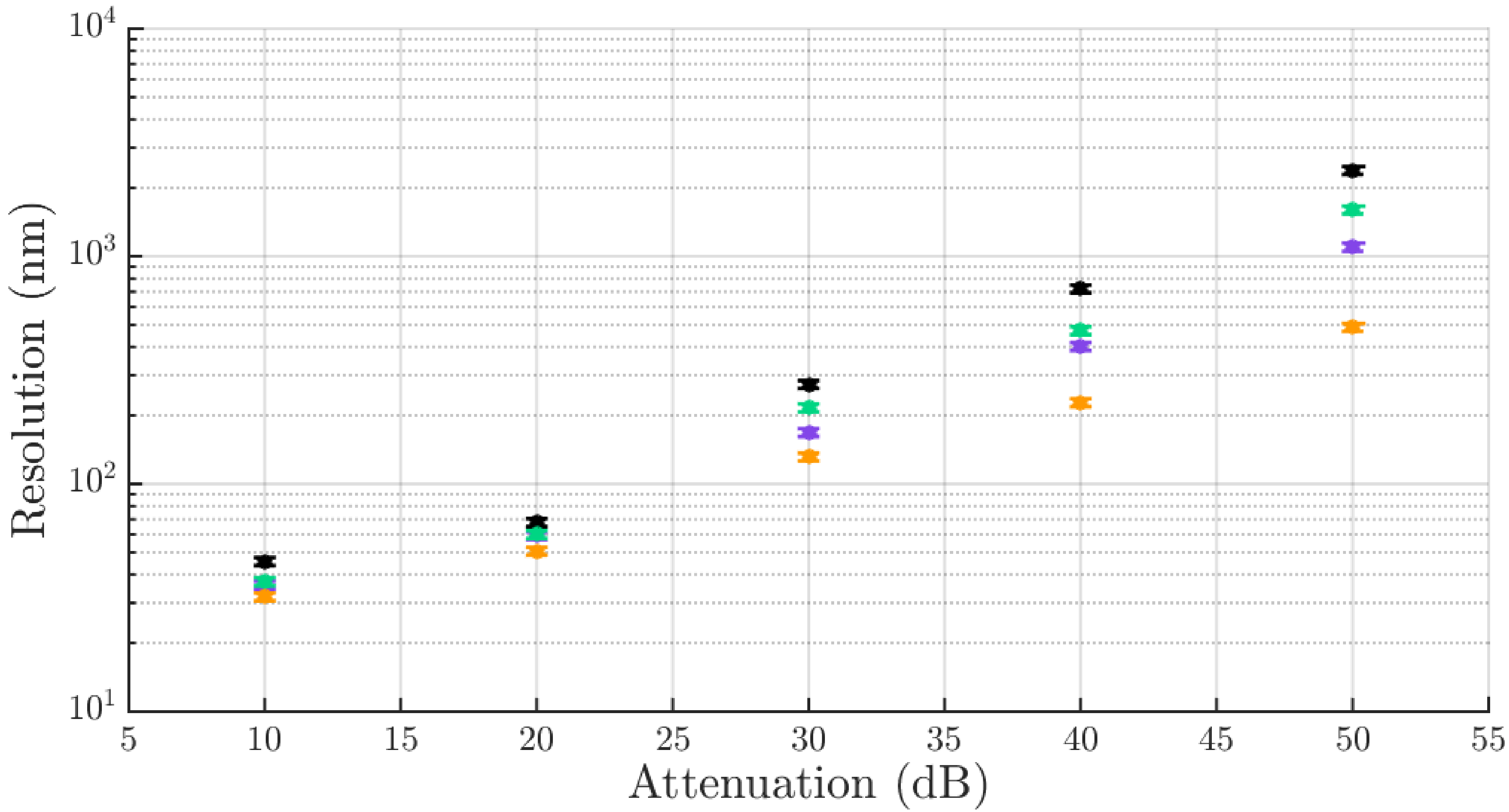
Attenuation Scan – Calibration Constant

We were unable to align the BPMs well enough to go down to 0 dB.



Attenuation Scan - Resolution

- Attenuation doesn't scale well.
- Predicts resolution 20 to 30 nm at 10dB. We saw only down to ~34 nm.



- **Geometric**
- **Fit: IPA**
- **Fit: IPB**
- **Fit: IPC**

Jitter and resolution in quadrature

- Bunch one resolution: 30 nm,
- Bunch two resolution: 39 nm,
- Bunch two jitter with feedback: 41 nm (96 nm without FB),
- Best possible stabilisation given bunch one resolution: 39 nm.
- Predicted stabilisation given imperfect correlation and jitters: 40 nm.
- If $jit_{meas}^2 = jit_{true}^2 + resolution^2$, then this suggests the true jitter is tiny, even though we don't predict we should be able to stabilise to such a level.
- $41^2 - 39^2 = true\ jitter^2 = \mathbf{12.6^2}$ << 40 nm.

Summary

- Calibration constant remained consistent throughout repeat calibrations.
- Waist scan: minimum jitter of 171 nm with nominal optics.
- Attenuation scan did not scale well to 10 dB and we couldn’t attempt 0 dB.
- Latency scan shows we are comfortably within latency limit.
- Charge scan shows poorer resolution performance at lower charge but improvement doesn’t continue to higher charges.