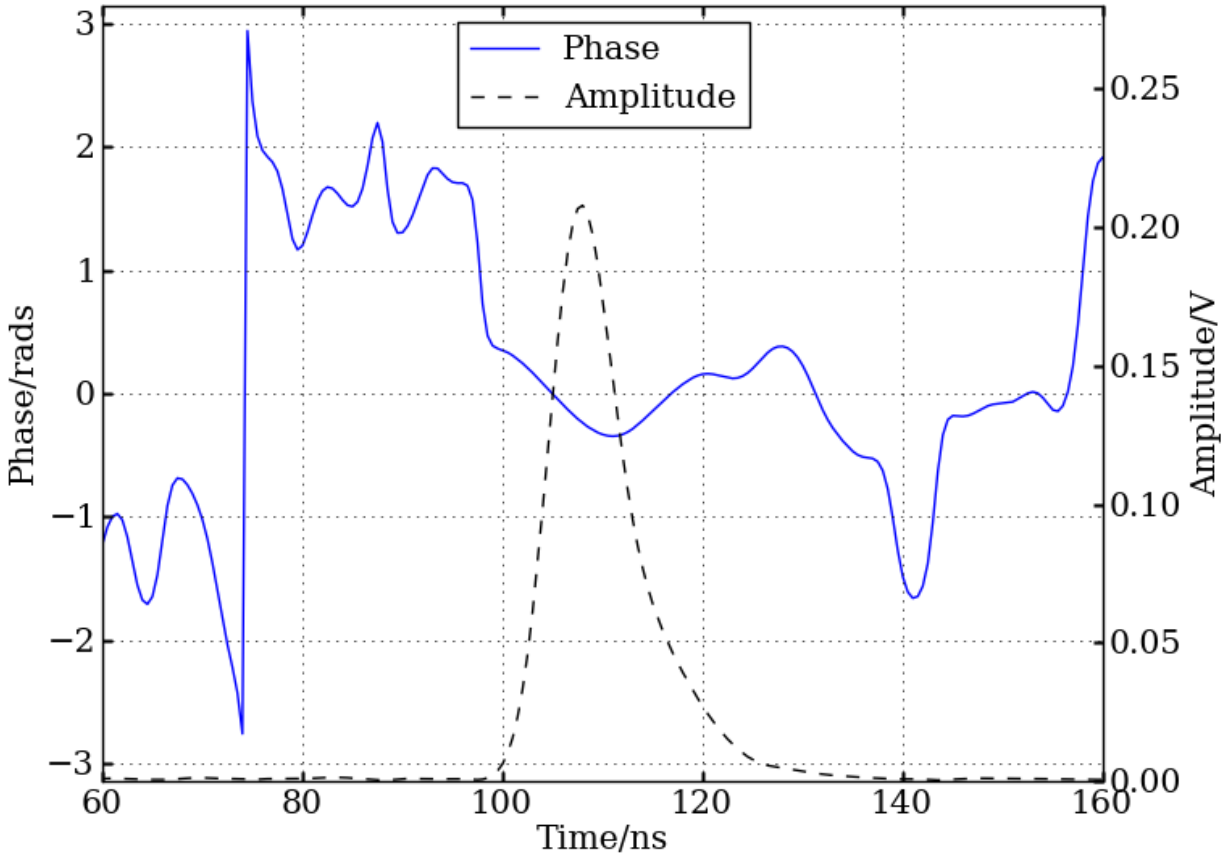
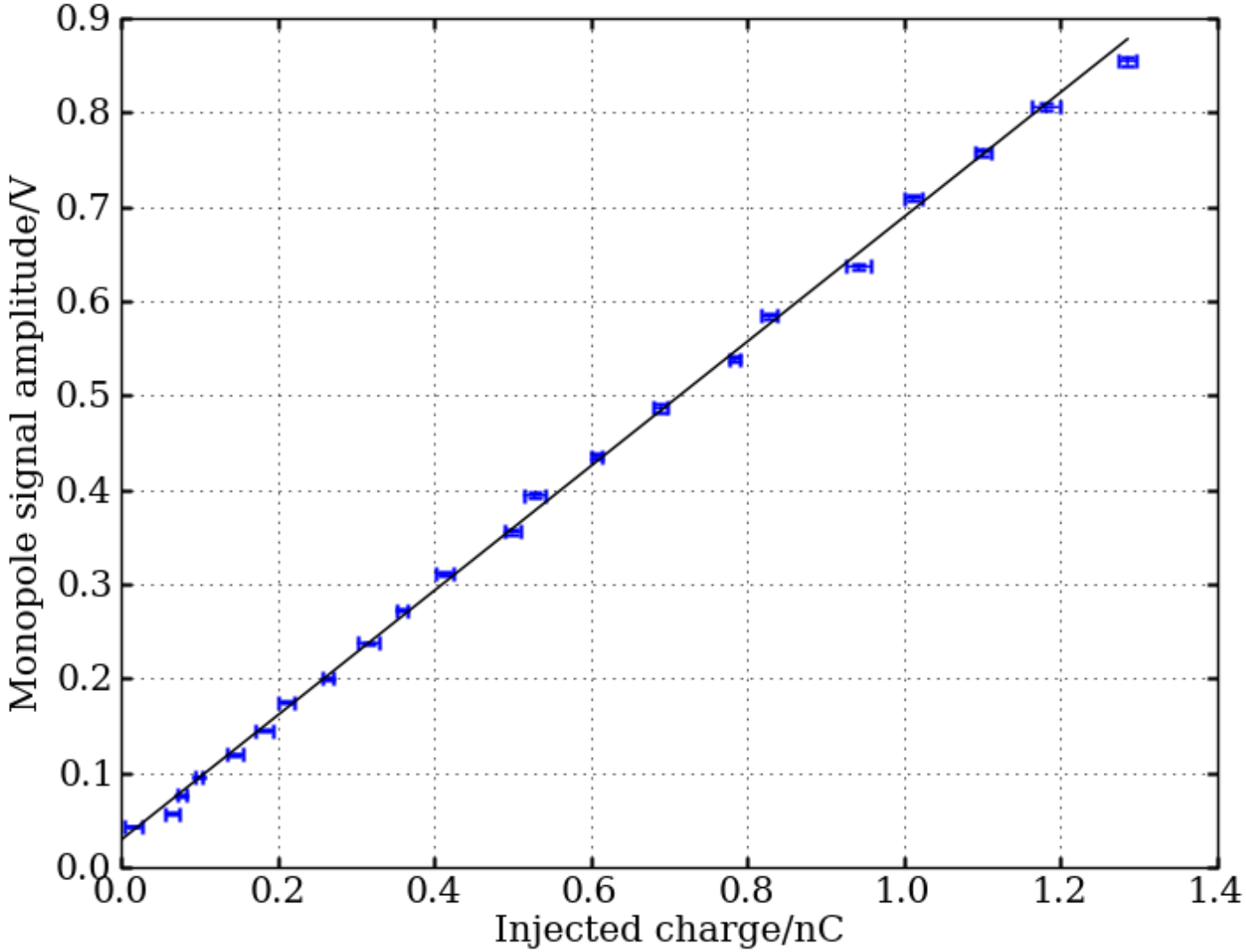
Digital Signal Processing



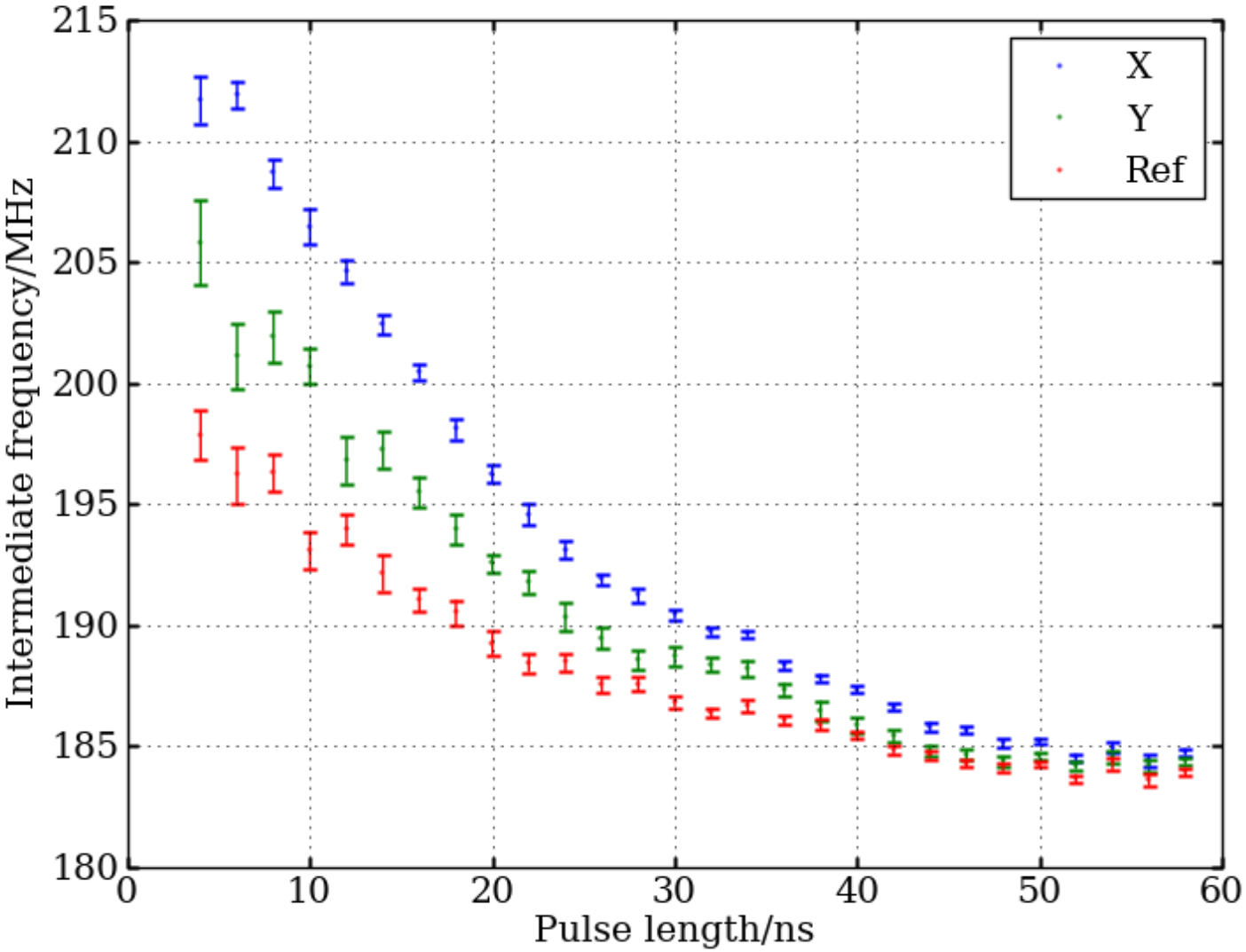
- 15 GHz dipole (position) and monopole (reference) cavities
- Down convert to 200 MHz in tunnel
- Digitally demodulate and sample amplitude and phase just after the peak
- Normalise the amplitude to remove charge dependence and reference the phase for beam angle dependence
- In-phase (I) and quadrature-phase (Q) components

Charge Scan



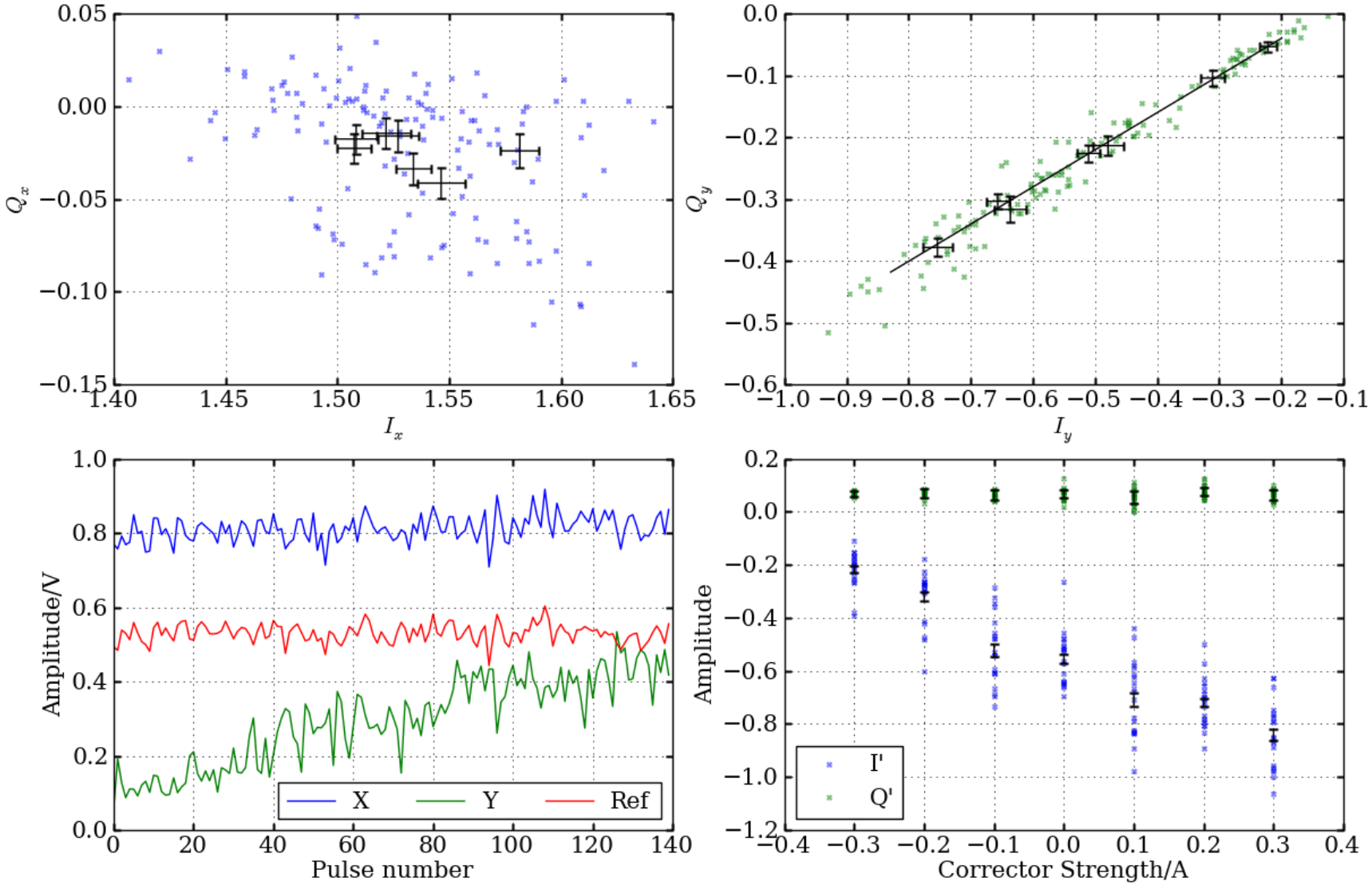
- Injected charge measured using beam charge monitor
- Gradient:
  0.661+/0.004 V/nC
- Cavity sensitivity:
  29.85+/-0.17 V/nC
- Compares to RF simulation (ACE3P/CST):
  52 V/nC

Pulse Length Scan

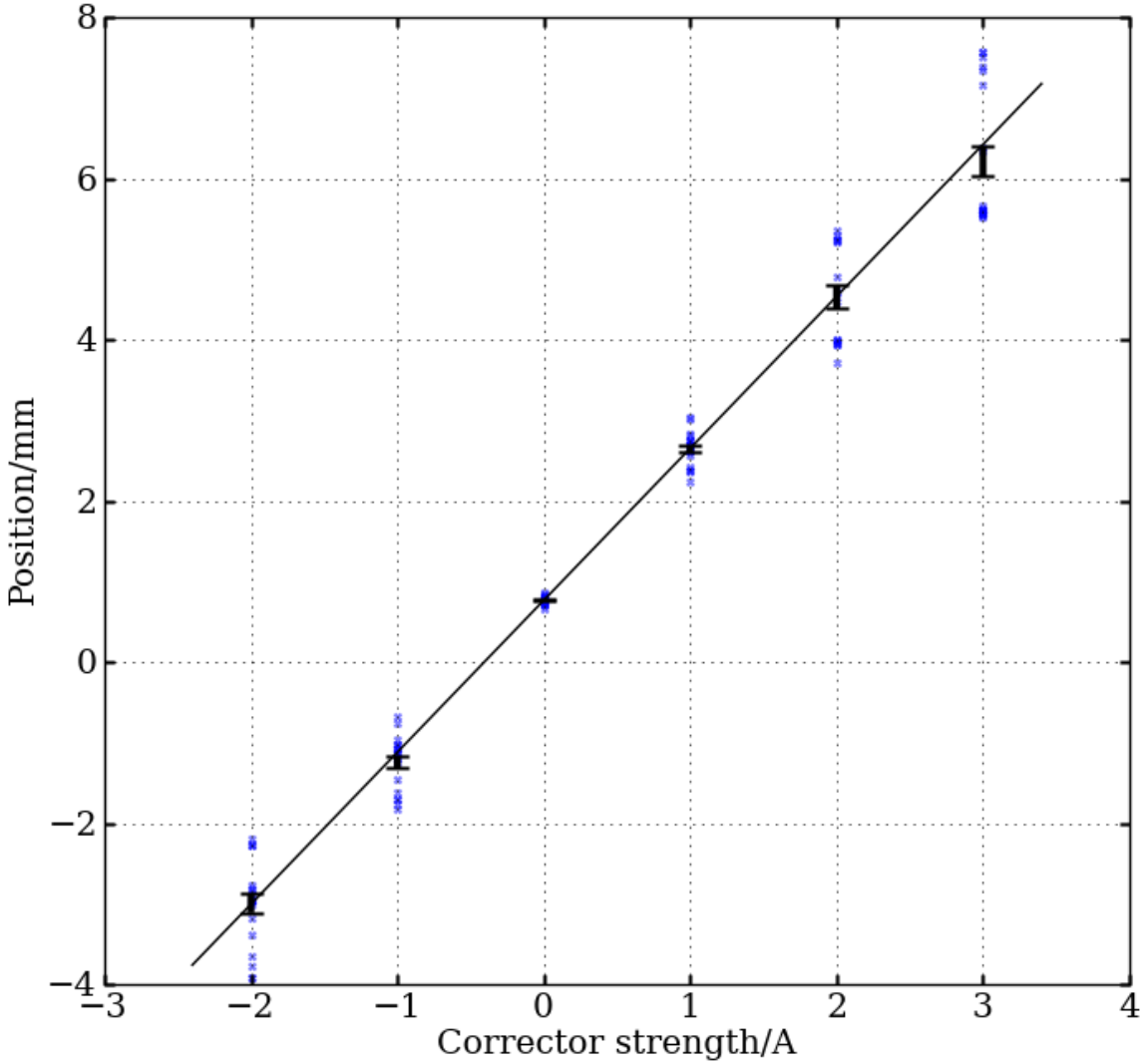


- As pulse length is increased, the dominant signal frequency is the nearest multiple of the bunch repetition frequency.

Corrector Scan – Cavity BPM



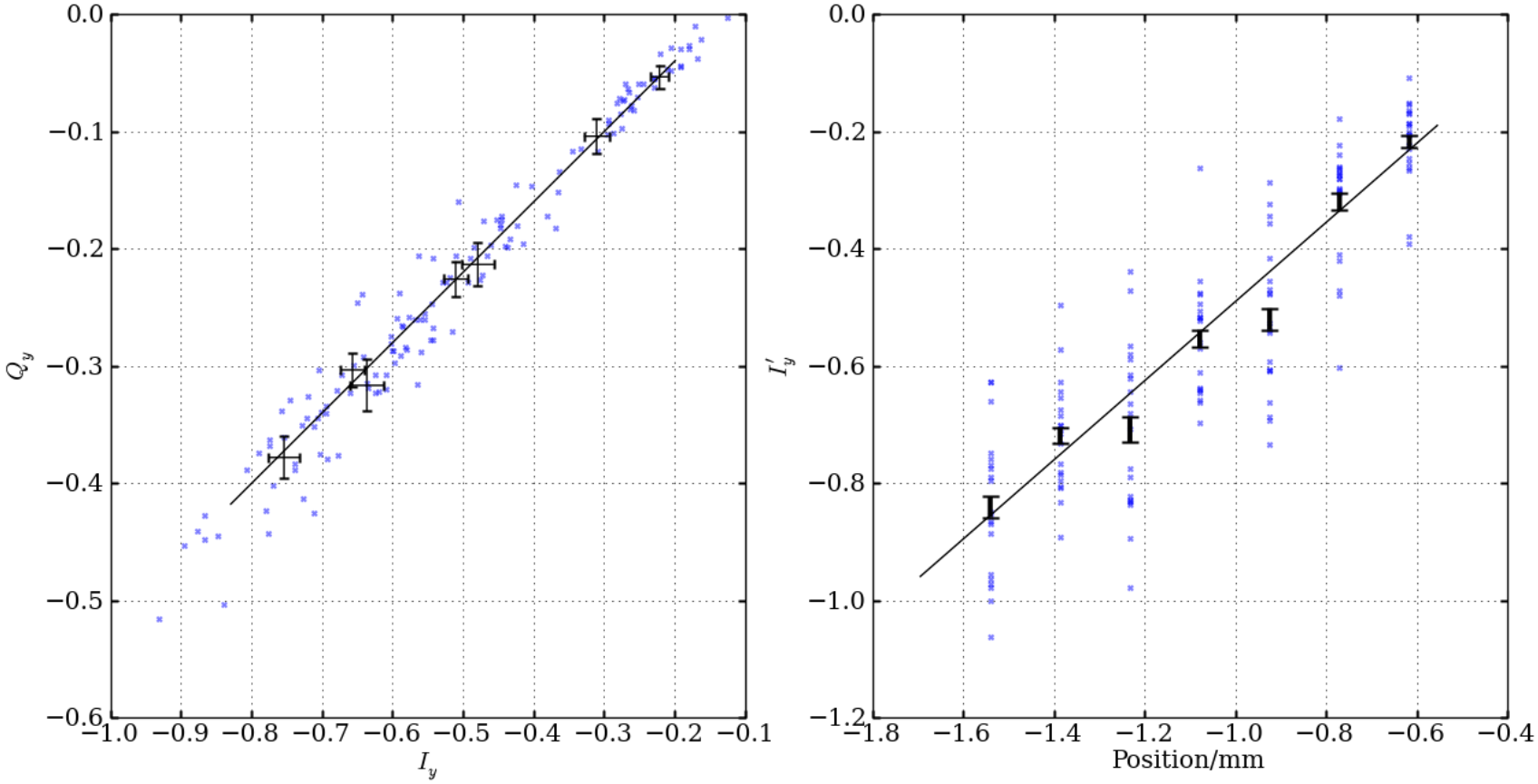
Corrector Scan – Inductive BPMs



Corrector response : 1.89 mm A^{-1} +/- 0.03

χ^2 /d.o.f. : 0.98

Calibration



Position scale/mm	1.48	0.92	1.00	1.03	1.64	1.63
IQ rotation/degrees	31.0	31.4	32.2	32.0	31.5	24.5
Sensitivity/[V/nC/mm] (Reference 30 V/nC)	4.0	6.5	6.0	5.8	3.6	3.7

Summary

- Charge scans
  - Maximum attenuation and multiple bunches means measurement is probably not too accurate. We should repeat with different configurations.
- Pulse length scans
  - Data promising
- Calibration
  - Unable to calibrate effectively in X
    - Degaussing of spectrometer magnet to center beam
  - Signals already look reasonably stable in phase ($<1^{o}$)
  - Scales are unstable, jitter could be a factor
    - Use reentrant cavity BPMs upstream to subtract – need connectors
    - Data with smaller vertical emittance
    - Still waiting on software for movers (hardware ready)
- To be done:
  - Data with long bunch trains (~100 ns)
  - Measurement of temporal resolution

Pulse Length – Single Bunches