FC/ATF2 cavities (S. Boogert)

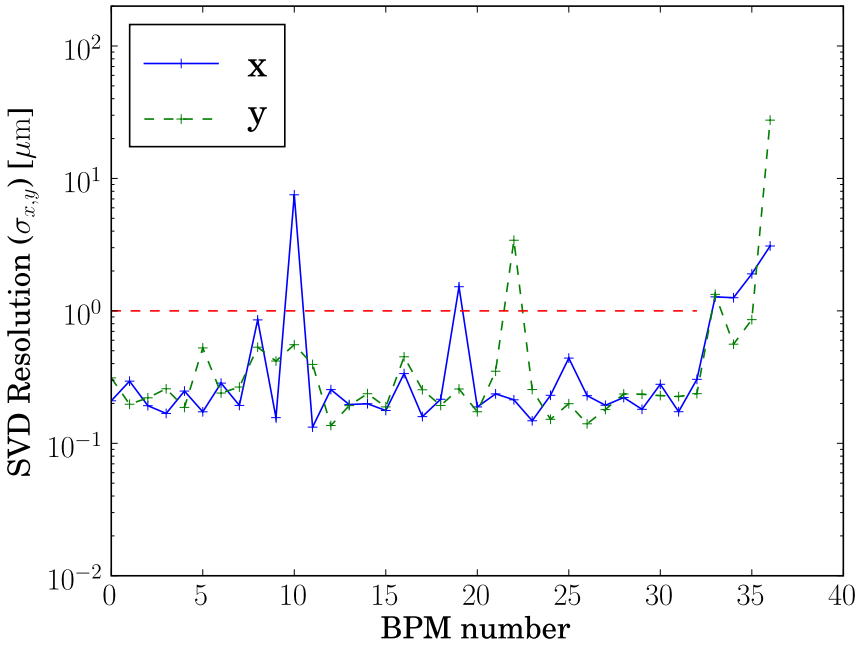
- ATF2
  - 35 C-band cavities, 2 S-band, 2 IP (C-band)
- ILC/CLIC requires
  - ~1000 of cavities 100 nm resolution
  - 25 nm resolution @ 3.2 nC ≈ 1000 nm @ 30 pC (not linear scaling)
  - Stability a key issue for ILC/CLIC cannot afford to calibrate so many BPMs often
  - Systematic effects which compromise the cavity calibration

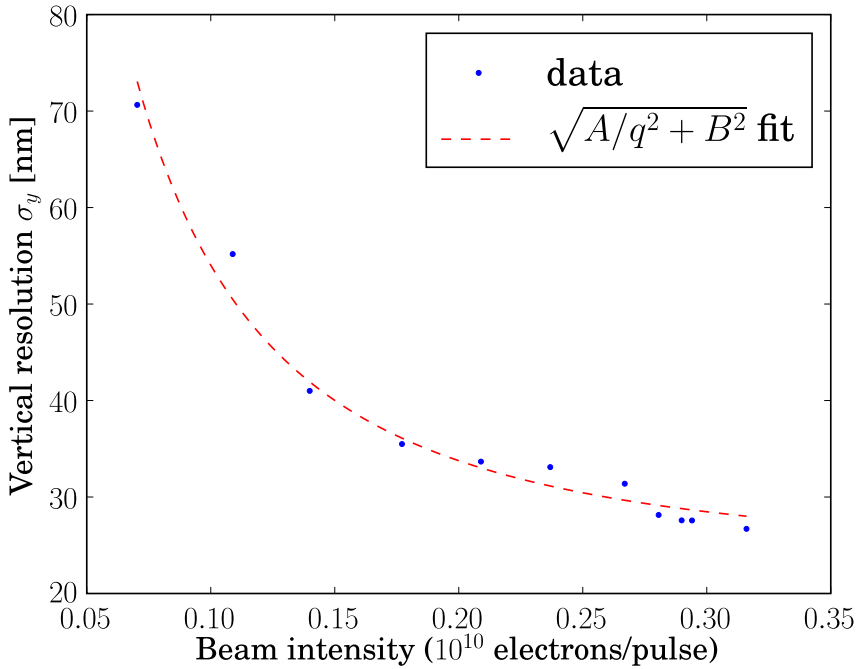
ATF2 CBPMs (long term stability)

- Resolution as function of
  - charge
  - bunch length
  - offset (so with possible extrapolation)
- Systematics
  - Charge
  - Bunch length
  - Calibration parameters
  - Pilot tone into cavity/electronics, usage?
- SVD usage ubiquitous now
  - Orbit verification and wakes
  - Dispersion
  - Beam based alignment

CBPM : System performance

- Resolution measured using SVD model independent analysis
- Resolution as function of charge (no attenuation)





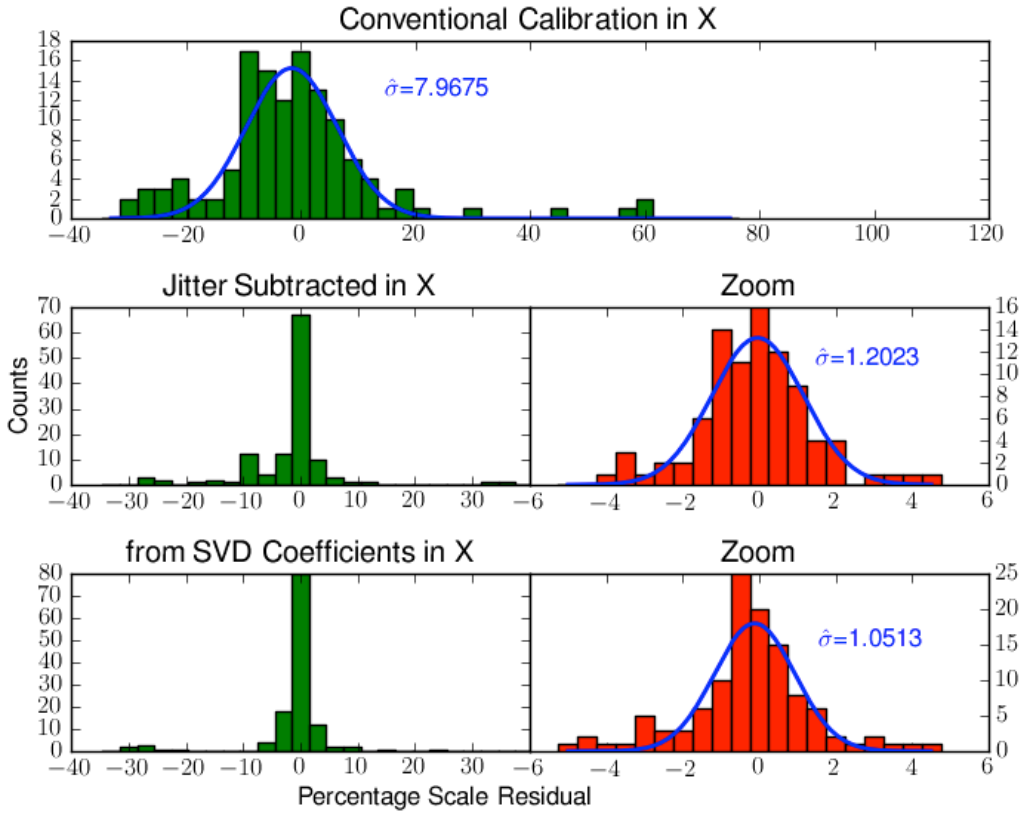
Calibration

$$I' = I\cos(\theta_{IQ}) + Q\sin(\theta_{IQ}) \qquad p = SI'$$

- 50 nm resolution, 1 um dynamic range
  - Stability to reach resolution at 1 um
  - 50 nm / 1 um = 5 %
  - 10 nm / 1 um = 1 %
- Impact of phase
  - cos(45+1)/cos(45) = 2 %

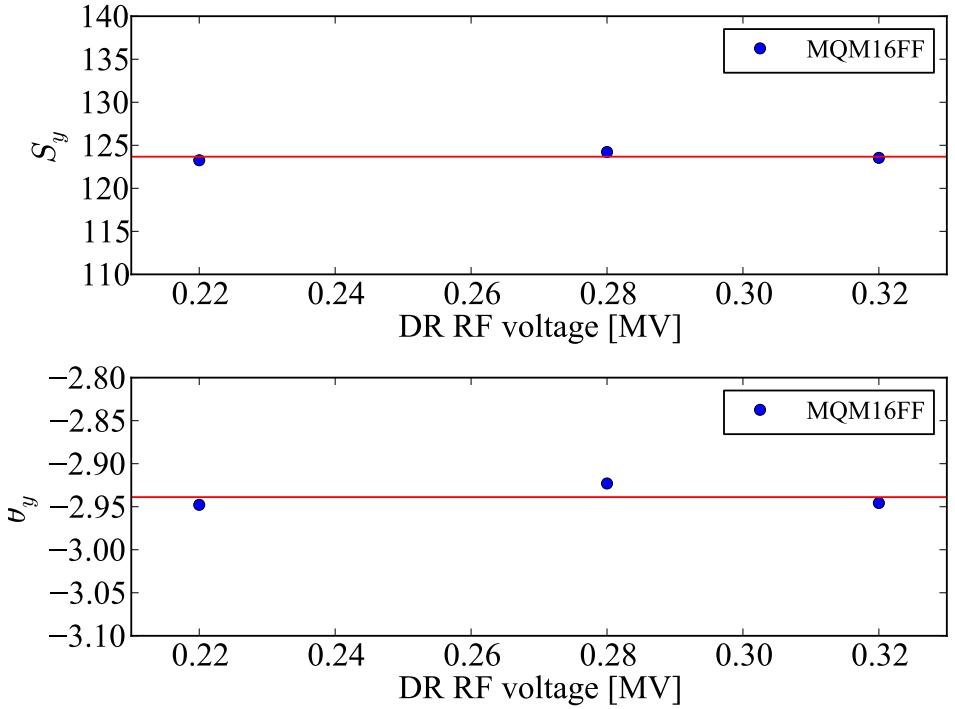
CBPM : Stability

- Repeat calibration over three week period
  - Electronics indicate
    - Scale < 1%
    - IQ rotation ≈1° @ C-band
  - Verify scale and phase not changed
  - Beam orbit slow drift and jitter important in calibration
    - Subtract using MIA-SVD



CBPM : Systematics

- Interesting to check the effect on BPMS of
  - Bunch charge
  - Calibration movement range
  - Bunch length
  - Saturation of electronics and digitiser
  - Temperature
  - Optics
- Have data for all, but need to complete analysis



Conclusions

- Large offset usage and performance
  - Can't always run at cavity centre
  - Effect on resolution when away from centre?
- Calibration systematics
  - important with operation with large offset
  - what are the drift requirements and over what times scales