Overall feedback performance in 2011
Issues and Test made

- Feedback performed well and 2010 teething problems were solved for 2011
  (e.g. DoS, NaN, MTG energy transmission errors, …)
- OP-Feedback on Beam-Feedbacks (Evian'11):
  "Feedbacks saved more fills than they dumped: we cannot leave without it"

- 33 fills lost directly/indirectly due to FBs (↔ 12% of total fault duration)
  - 5 fills lost due to FB specific instabilities
  - 23 fills lost due QPS ↔ Tune-FB ↔ BBQ signal quality interdependence
    - required continuous post-fill performance monitoring and Q-tracker tuning

- Main limitations/Issues:
  - Availability of reliable Q-Diagnostics:
    "ADT adding noise to/damping the very same signal that needed to measure Q/Q'"
  - Not enough machine time allocated to test and optimise feedbacks
  - Orbit-FB induced energy changes
  - Medium- to long-term orbit/BPM stability for tight collimation settings
  - Can increase Orbit-FB bandwidth x10 for dedicated test fills but ultimately limited by COD rate limit/non-linear phase response

Plans for 2012

- Some margin to improve, aim at < 2-3 dumps in 2012
  - Threshold increase for RQT[F/D]s circuits to mask spurious QPS triggers
    → however: not long-term sustainable solution

    (→ need to investigate a more robust solution & fix the problem at the source for after LS1)
  - BBQ HW optimisations to reduce saturation sensitivity

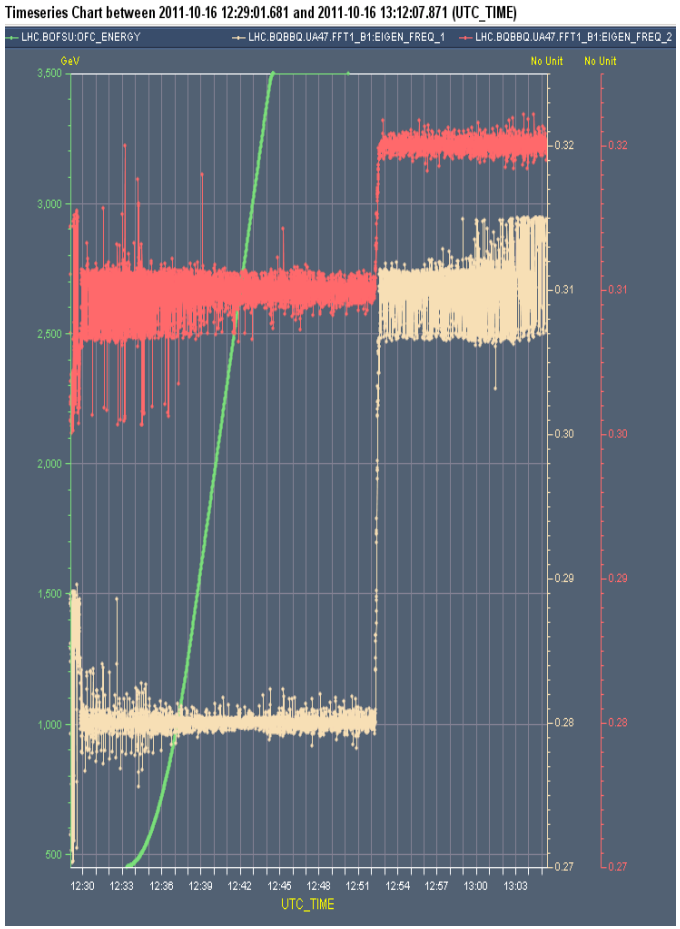
    (N.B. trade-off w.r.t. available signal-to-noise performance (tbc.))
  - *A very long list of controls integration and misc. GUI improvements:*
    - Split Q/Q'-diagnostic & acquisition chain according to use cases
      → more flexible/optimised settings for Tune-FB, $|C^-|$ & Q'-Meas., etc.
    - Deploy/commission Energy-FB
    - Arbitrary user-controlled reference functions, ATS, BLM-based FB, *[..]*

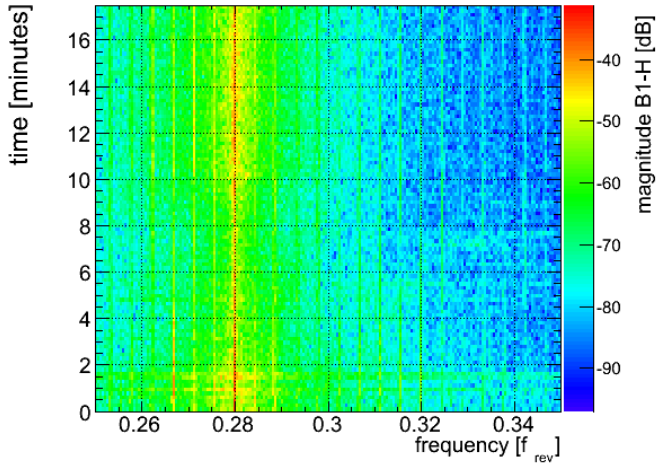
- What we need:
  - As any other system acting on the beam:
    We need time for optimisations at each significant commissioning step!
  - Many of the BPM & Q/Q'-effects/improvements cannot be tested in the lab
    - need beam time (→ BI MD requests)
    - need Software release and test procedures (e.g. after TS)

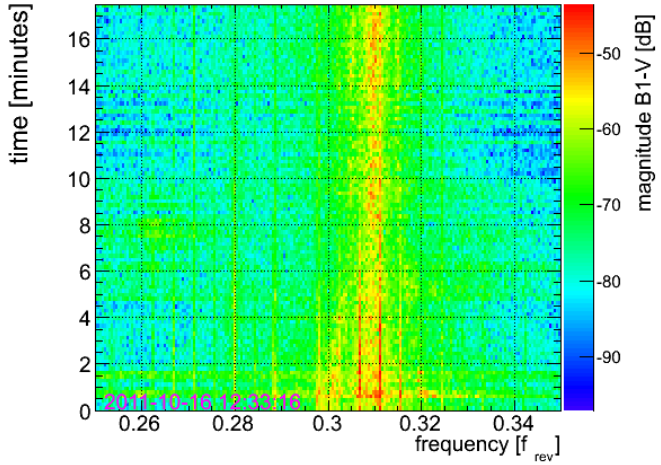
- Disclaimer: will test various BPM, ADT- and BBQ-based diagnostics improvements in 2012 but OP should expect similar performance as in 2011
  → novel/improved systems integrated and operationally deployed for >LS1

BBQ Q-Diagnostics Performance

- Superior BBQ performance for single bunches, but deteriorates for multi-bunch operation → need to envisage upgrade/improvement for > LS1
  - Performance during injection dominated by ADT-gain/feedback loop



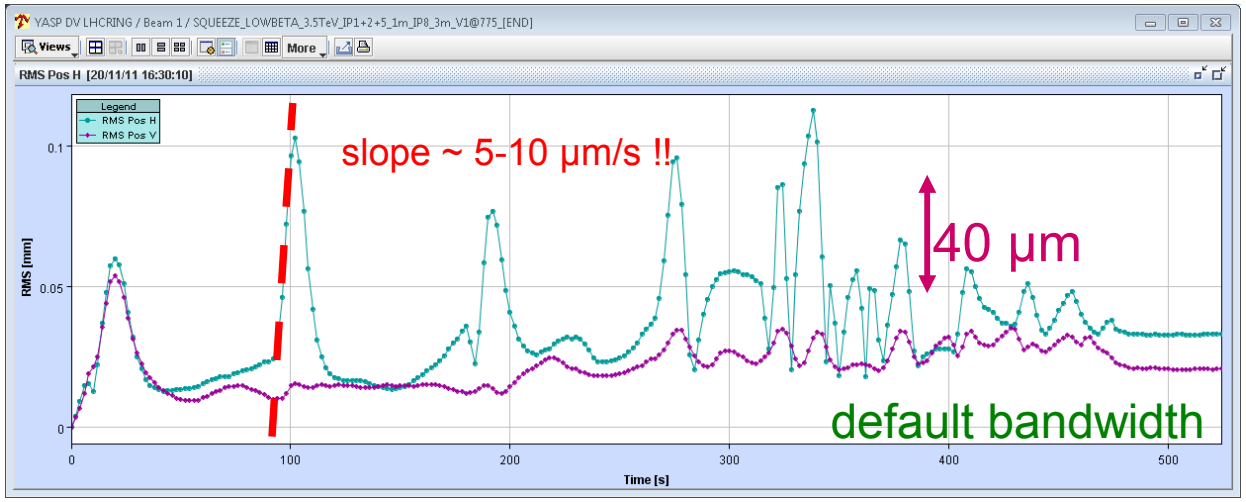


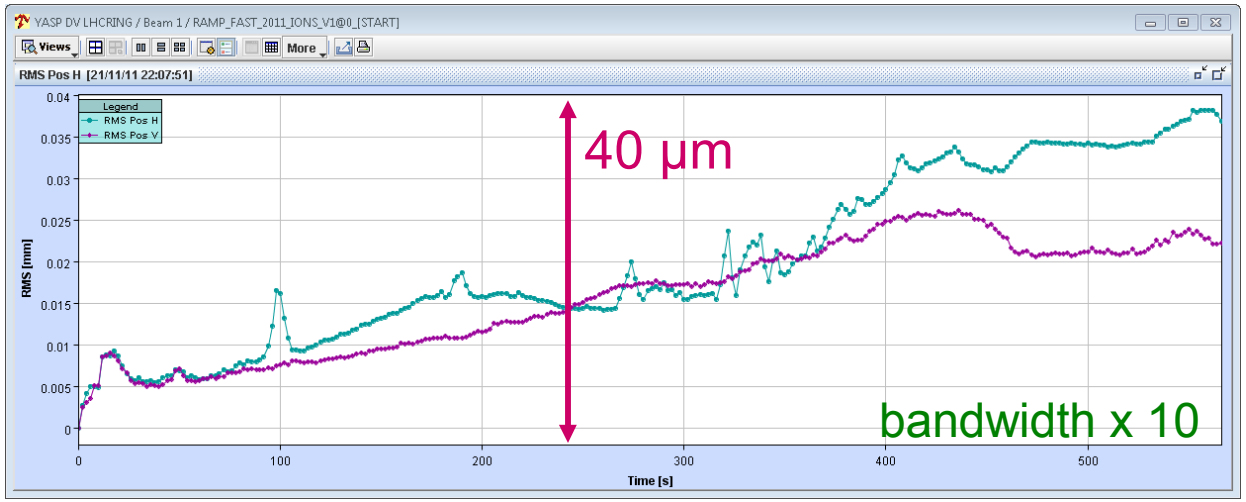


- Tune-FB only «6 dB S/N ratio ratio available → one QPS trip factor

2011-11-22 Orbit-FB Bandwidth Tests during a Test-Dump Fill – The Good …

- Orbit transients at the 'matched points' – issue for tight collimators

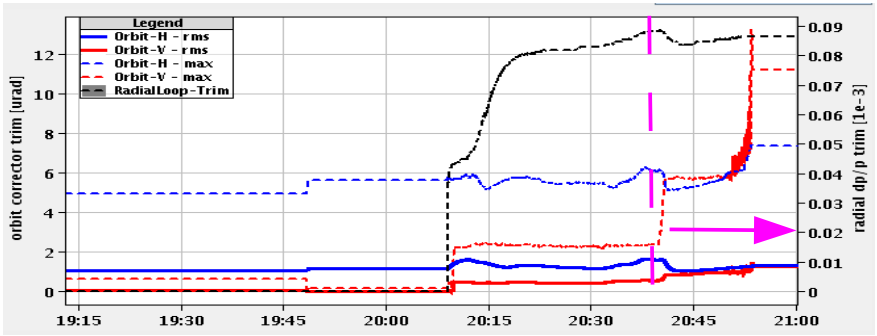


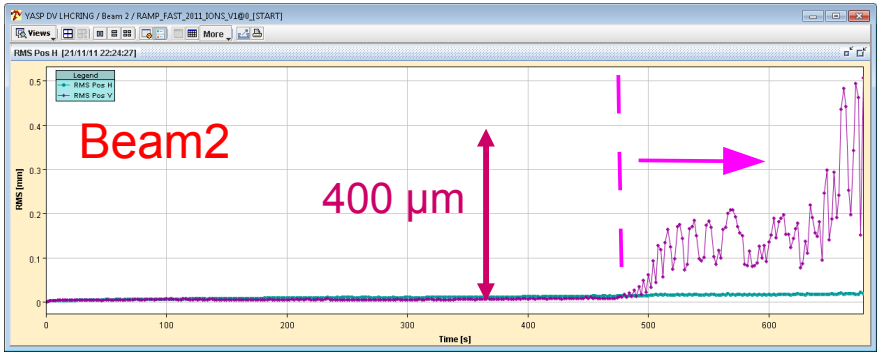


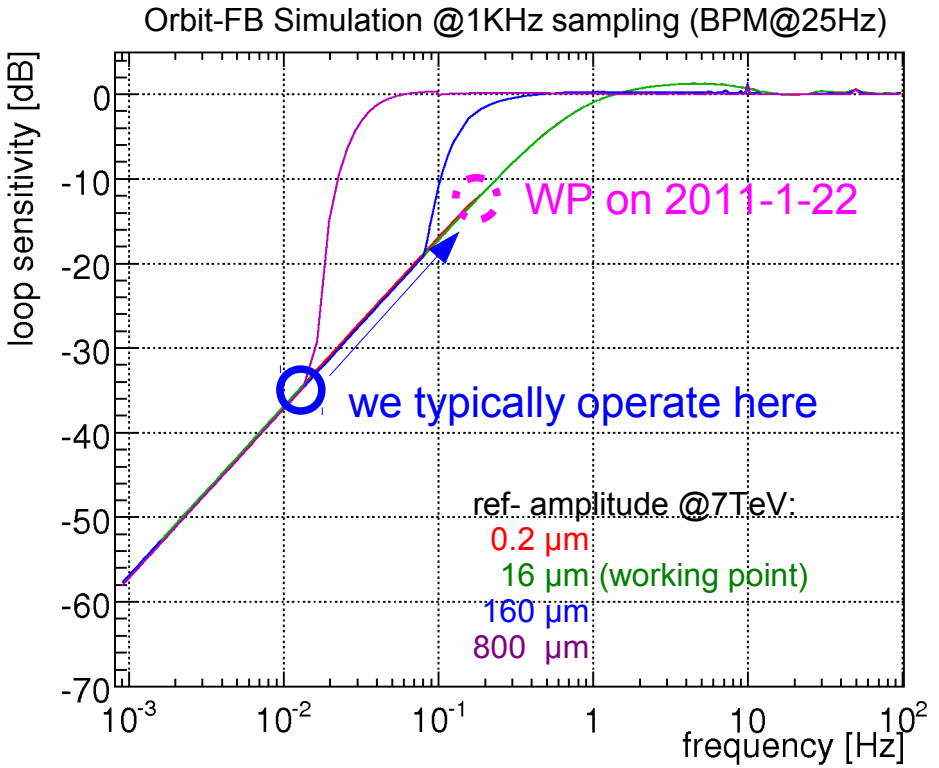
- Linear/design performance…*don't count chicken until they are hatched!*

2011-11-22 Orbit-FB Bandwidth Tests during a Test-Dump Fill – The Less Good …

- …Orbit-FB became unstable during Squeeze in IP2 β* = 3 m → 1 m
  - Factor 10 stability margin radically lost if encountering rate-limit or delays → should be validated early-on in 2012!



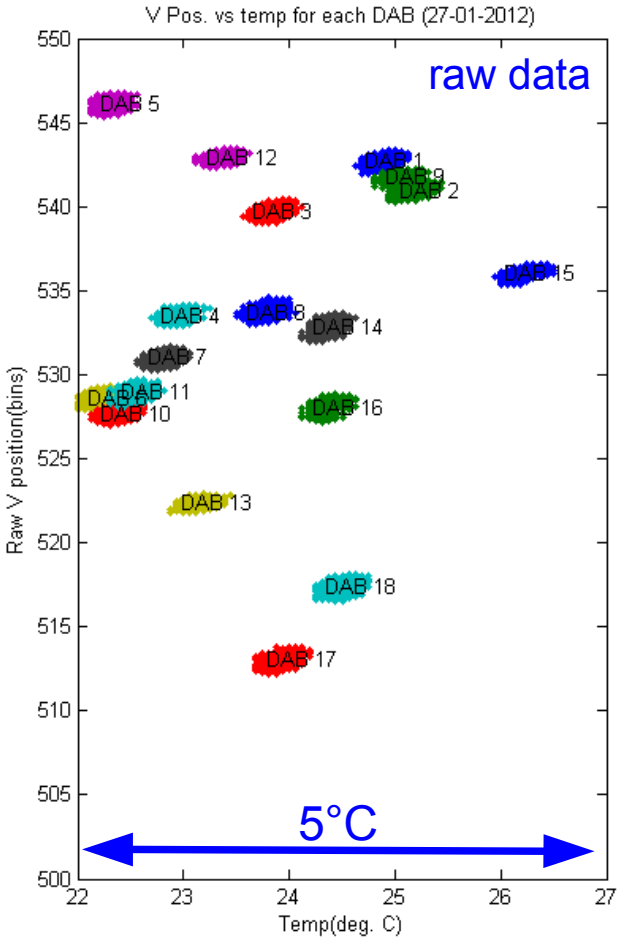


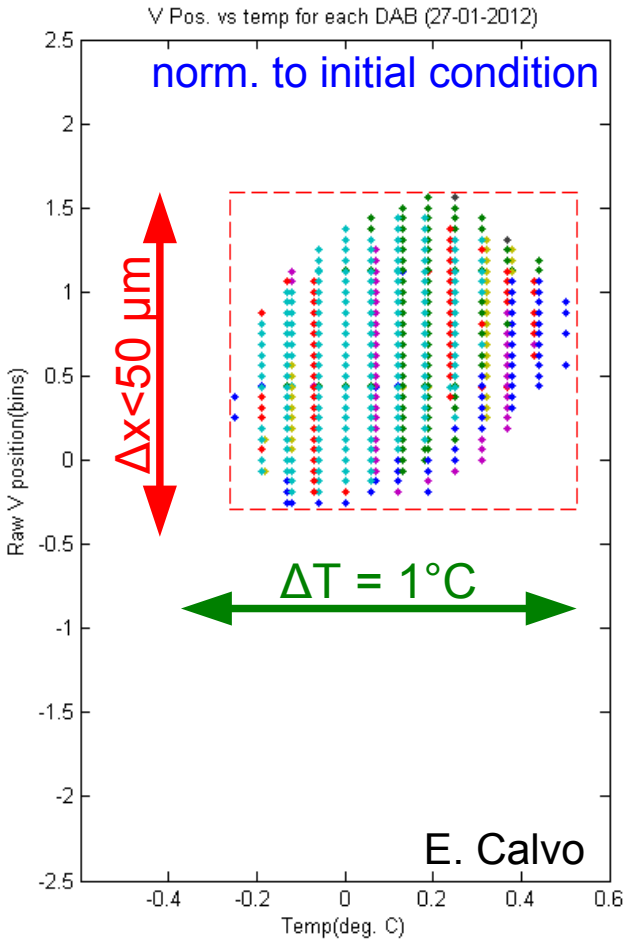


Preliminary Results of Temperature Stabilised BPM Rack Tests (tbi. after LS1)

- Achieved temperature stability <1°C over a 3 day period

(N.B. SR temperature variations typ. 6°C)





- 2012: should expect same performance but more verbose warning if actual temperature exceeds calibration limits

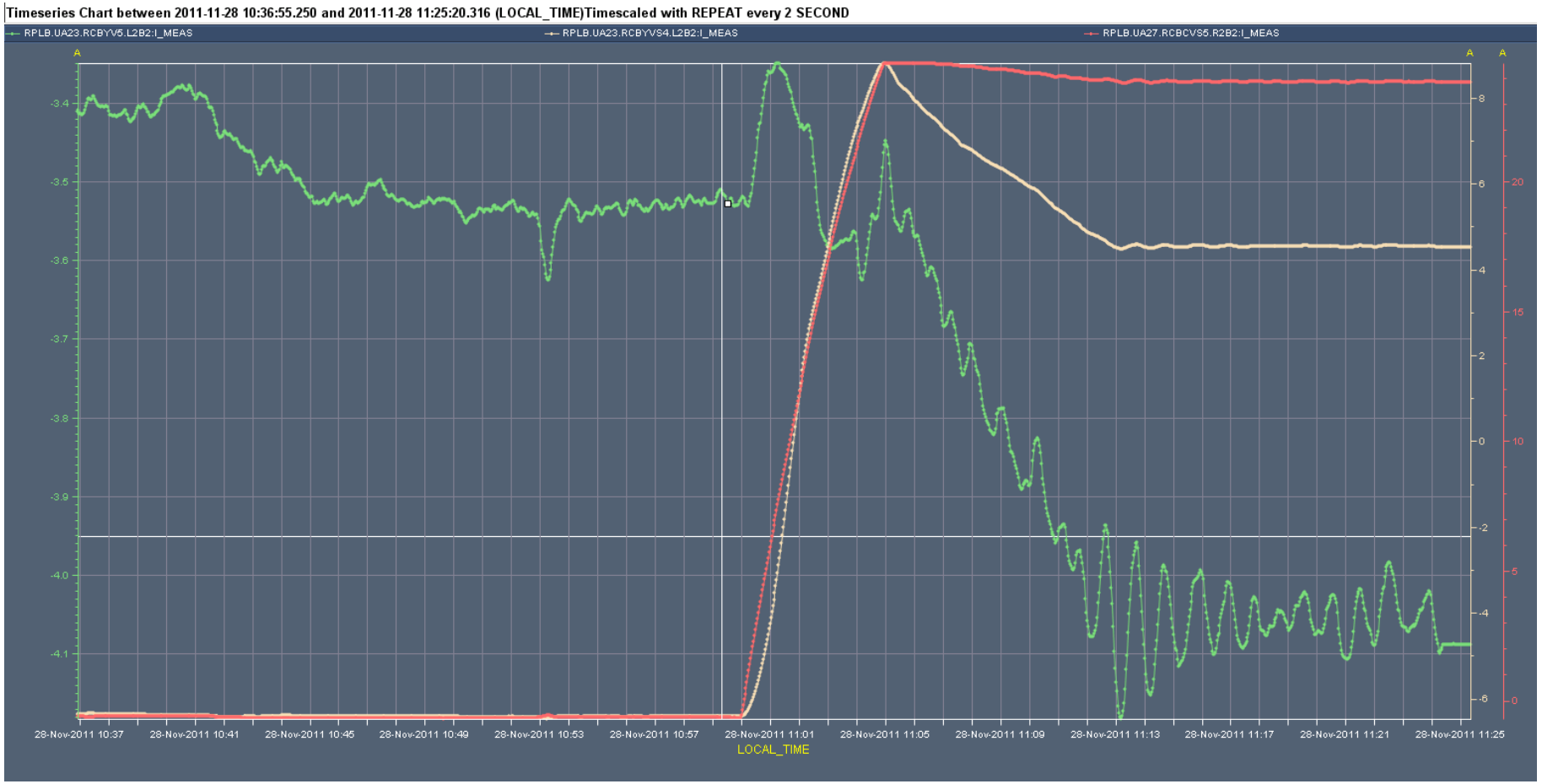
Miscellaneous slides

Difference of Bandwidth – The Bad …
Squeeze in IP2 β* = 3 m → 1 m

- RT COD current ringing condition:

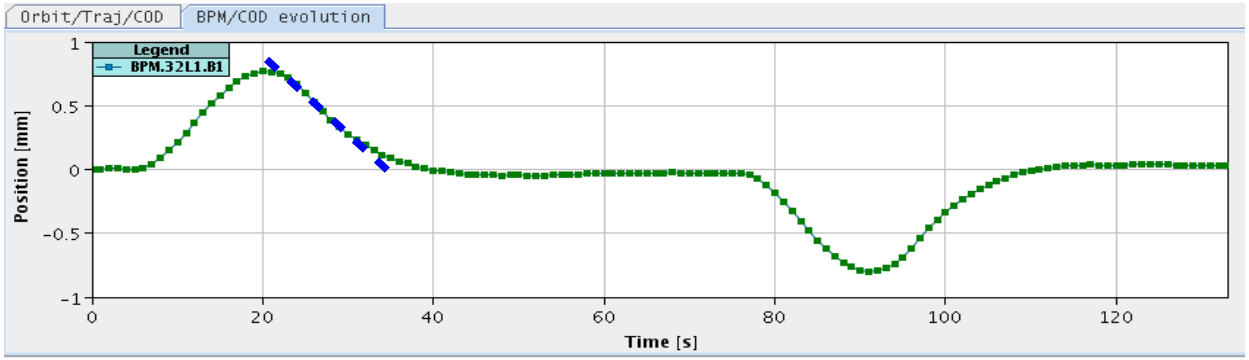
$$\frac{dI}{dt} \geqslant 2\pi \left.\frac{dI}{dt}\right|_{max}$$

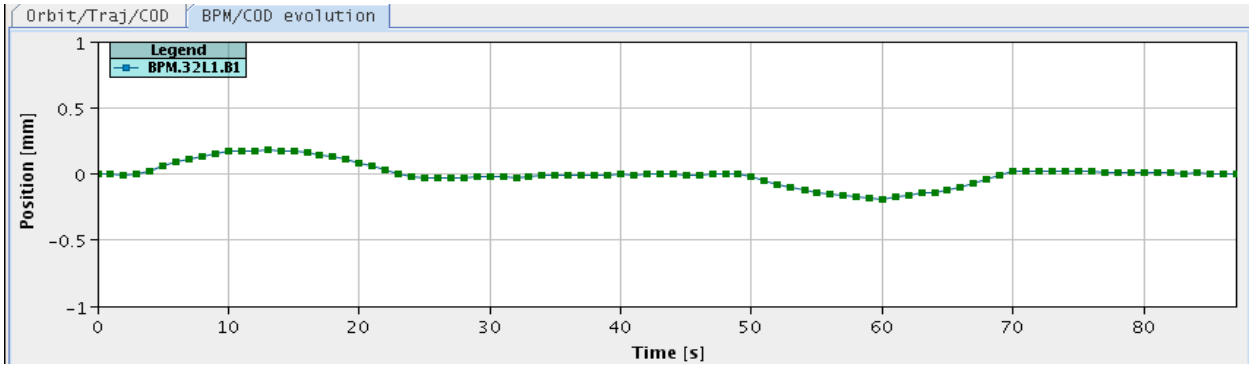
  - e.g. RPLB.UA27.RCBCVS5.R2B2 at 0.1 A/s

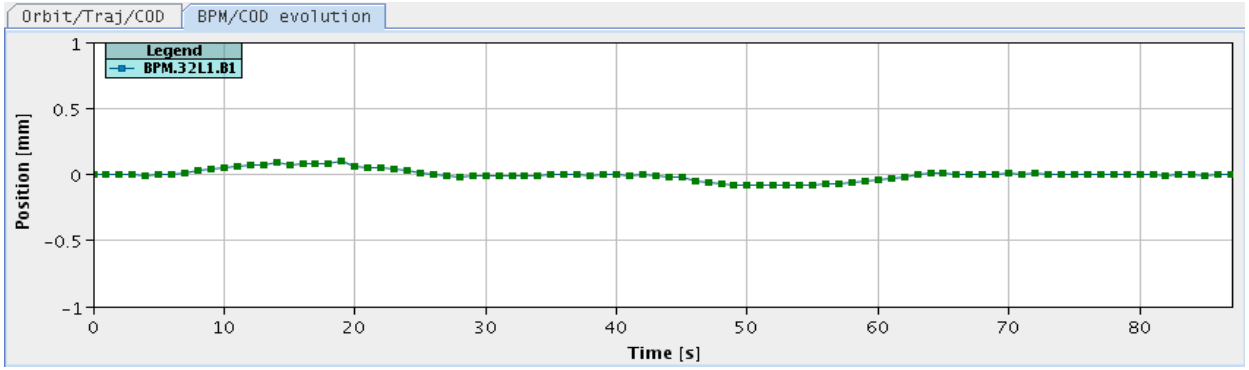


OFB Bandwidth – Pre-Flight Checks @ 3.5 TeV

- Closed-loop kick response measured/compatible with design:







Default Bandwidth:

Setup: OL BW = 10 Hz @ 5µm/s

→ CL BW = 0.025 Hz@3.5 TeV

Measured:

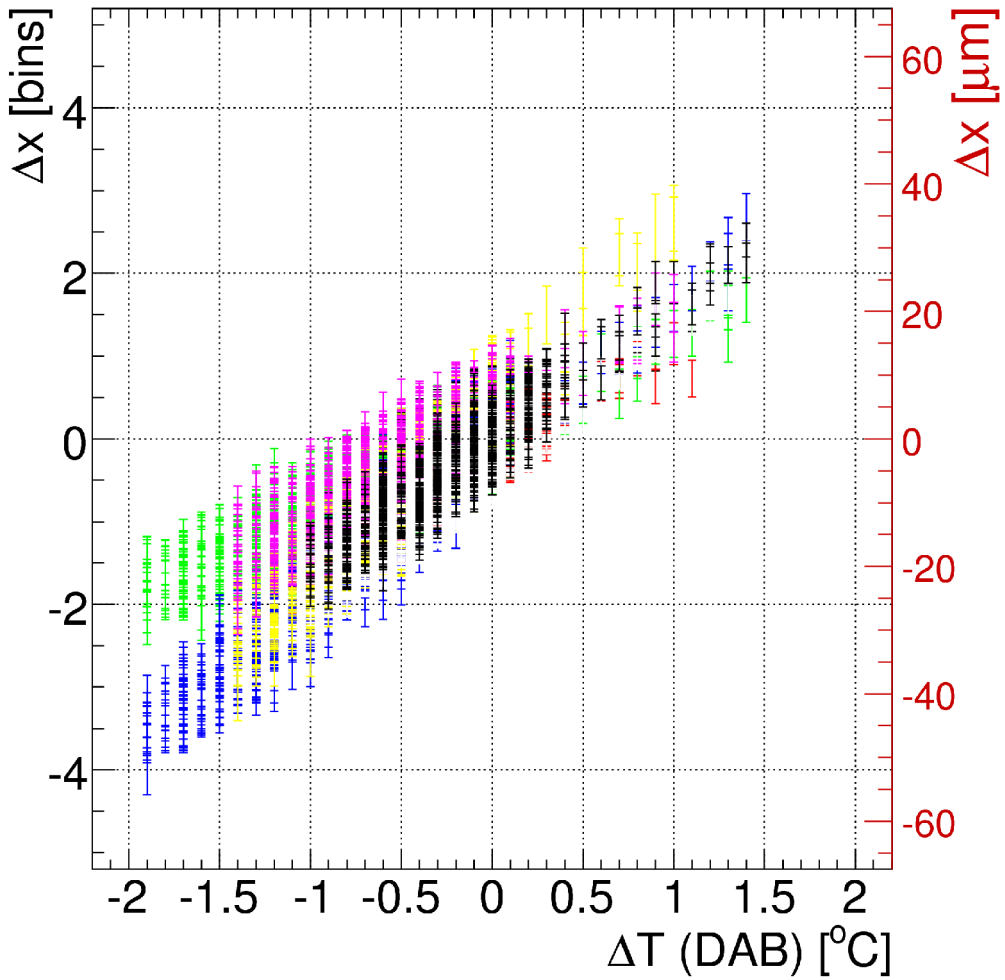
$tr_{10\text{-}90\%} \approx 15s \leftrightarrow BW \approx 0.023$ Hz

CL Bandwidth x 5

CL Bandwidth x 10

+ linear increase
+ no sign of ringing
→ there is some margin!!

N.B. IR 1+5 @1m, IR 8 @ 3 m


Δx [bins]
Δx [μm]
ΔT (DAB) [°C]
4
2
0
-2
-4
60
40
20
0
-20
-40
-60
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2