Q'(t) Studies during the Ramp

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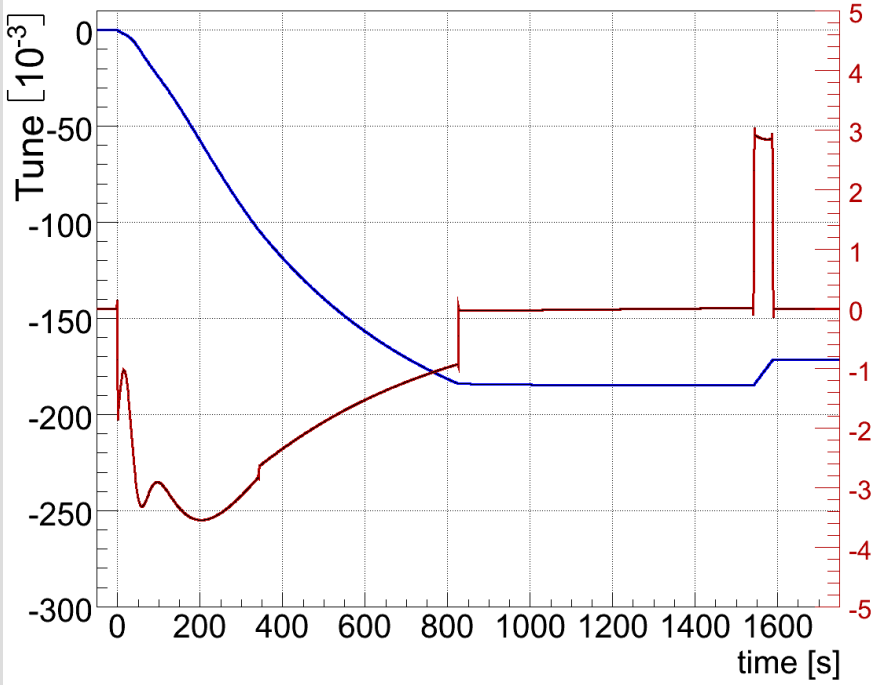
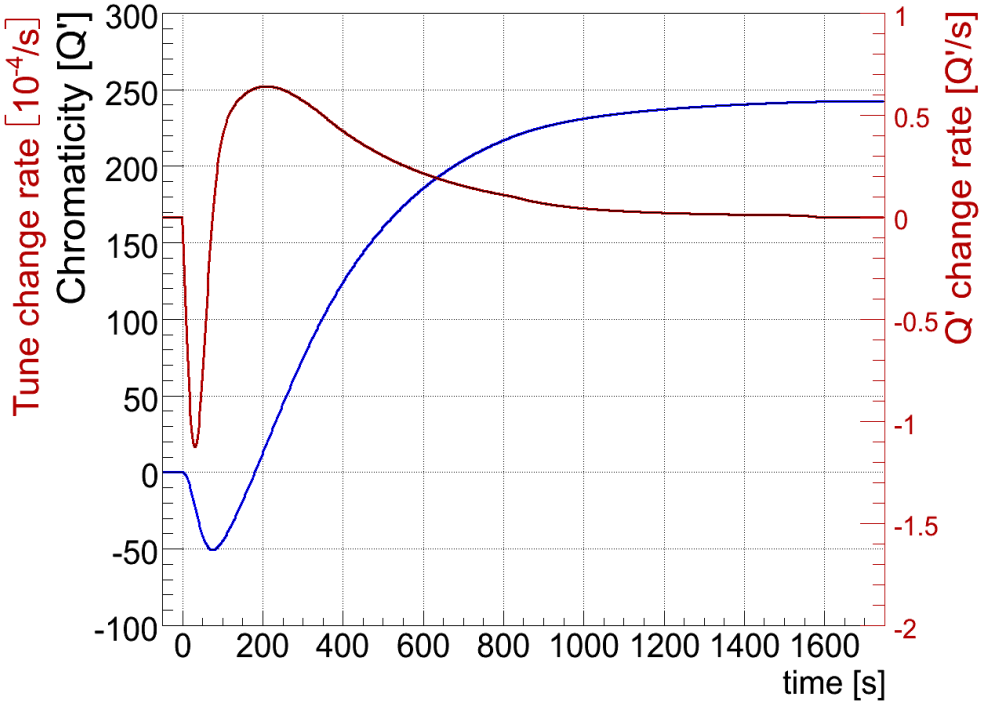
Special thanks to: G. Arduini, M. Gasiorand the OP crew

(Very) Early Estimates prior to First Beam
Tune and Chromaticity Drifts during LHC ramp





[...] maximum drift rates are expected to be slow in the LHC

- Tune: $\Delta Q/\Delta t|_{max} < 10^{-3}\ s^{-1}$
- Chromaticity: $\Delta Q'/\Delta t|_{max} < 2\ s^{-1}$ ← the critical/difficult parameter

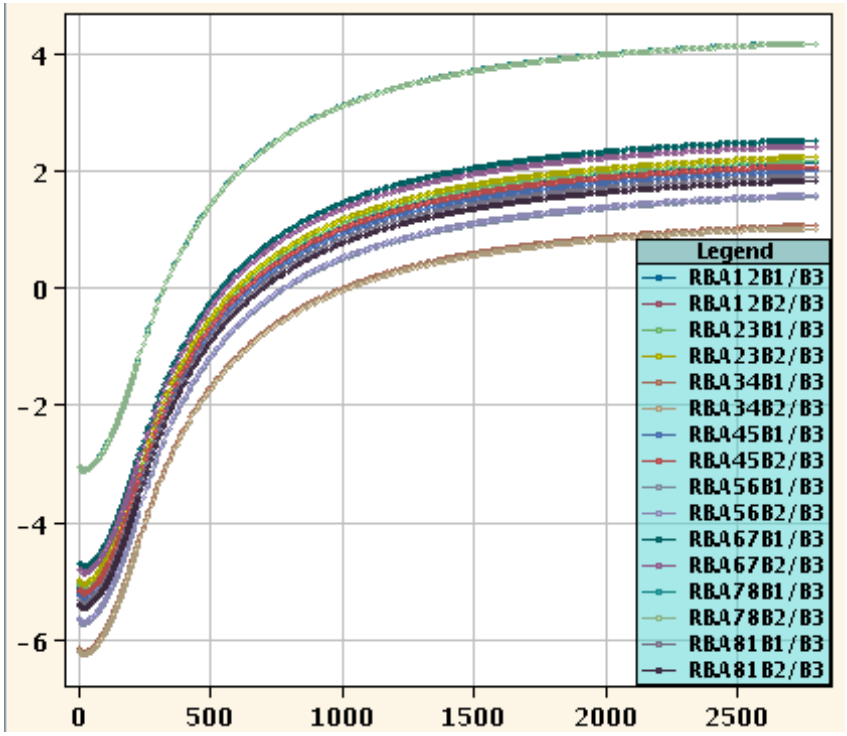
- Requires active control relying on beam-based measurements

- Initial estimate assumed no feed-forward correction!

Initial Q' Feed-Forward Correction

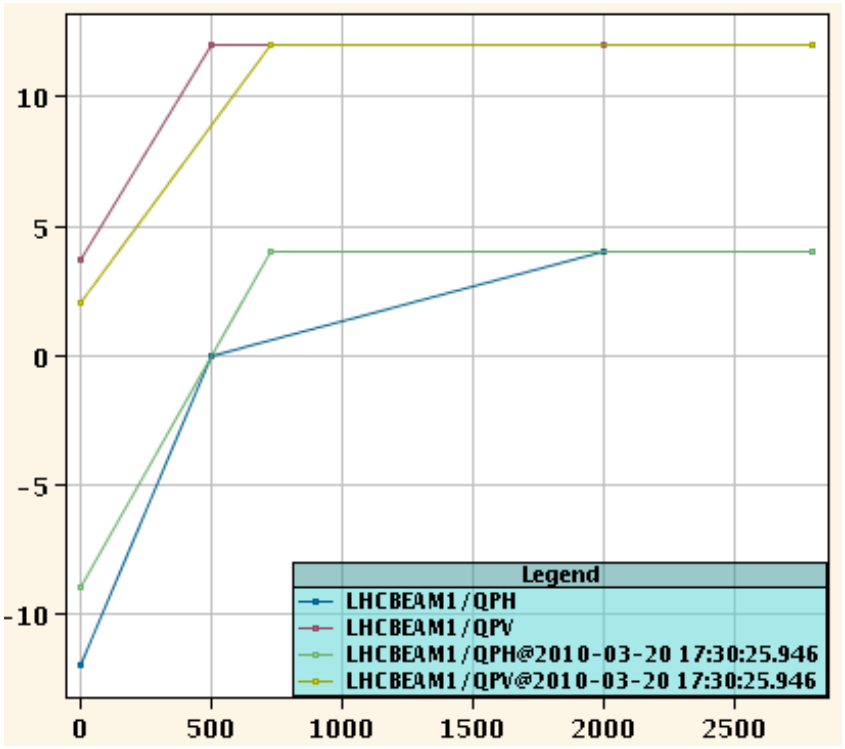
- B based on FIDEL prediction, initial MCS correction of about $\Delta b3 \approx 7$ units
- After initial Q' measurement at 450 GeV and 3.5 TeV
  - added linear compensation of $\Delta Q' \approx 12$
    → fixes start and end point to the same Q'

FIDEL b_3 trims

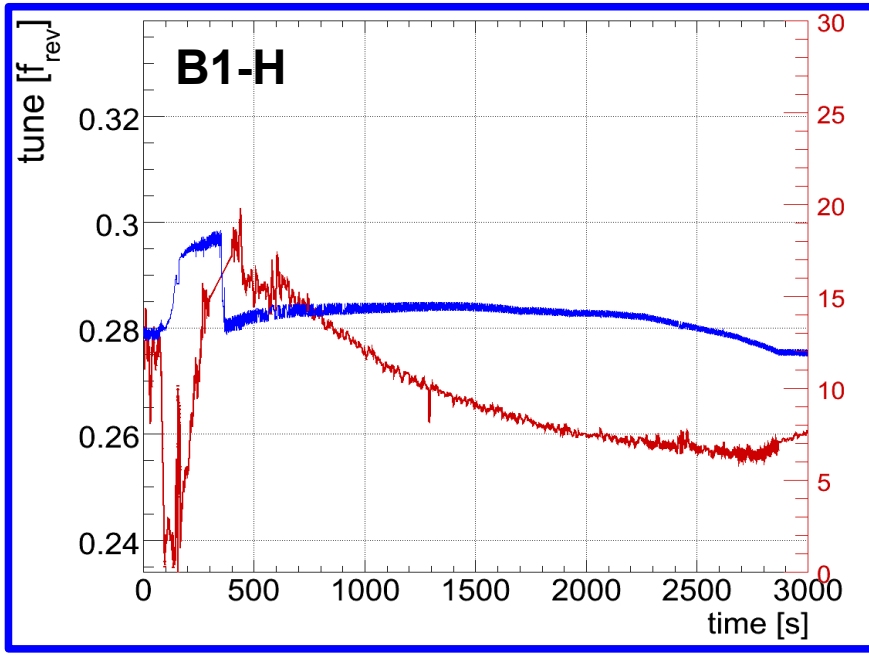


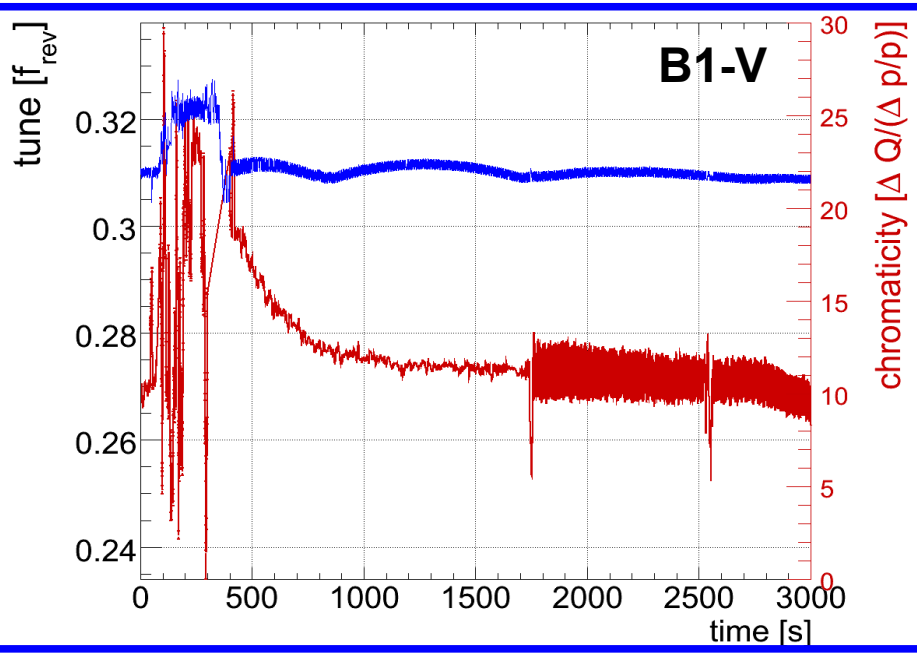
+

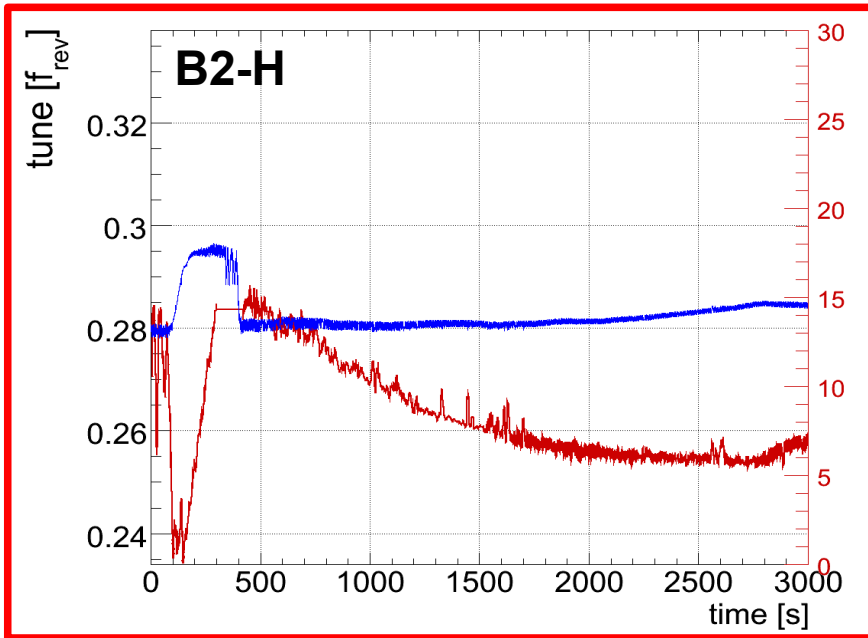
Q' measurement "inspired" trims

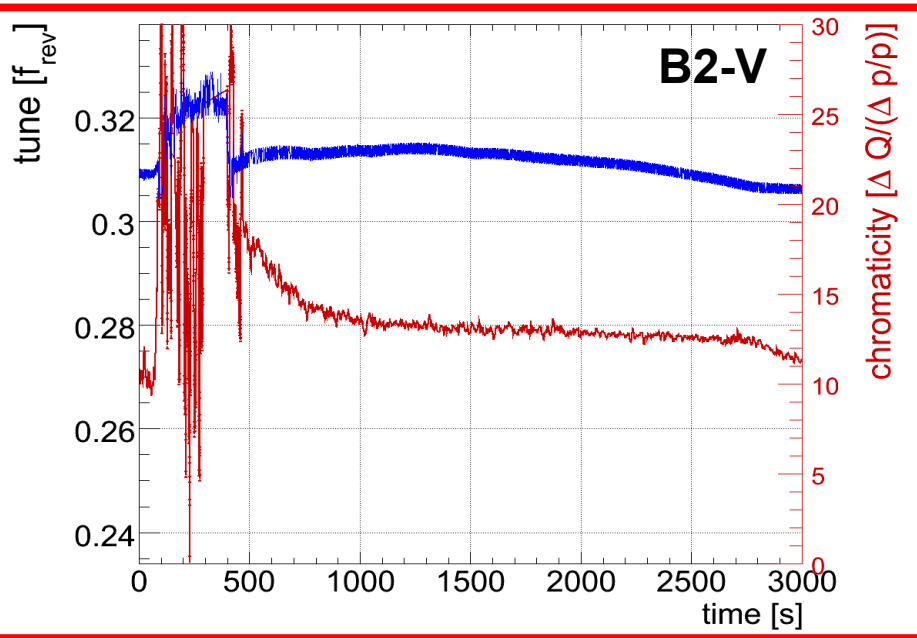


B1 & B2 Tune and Chromaticity Evolution



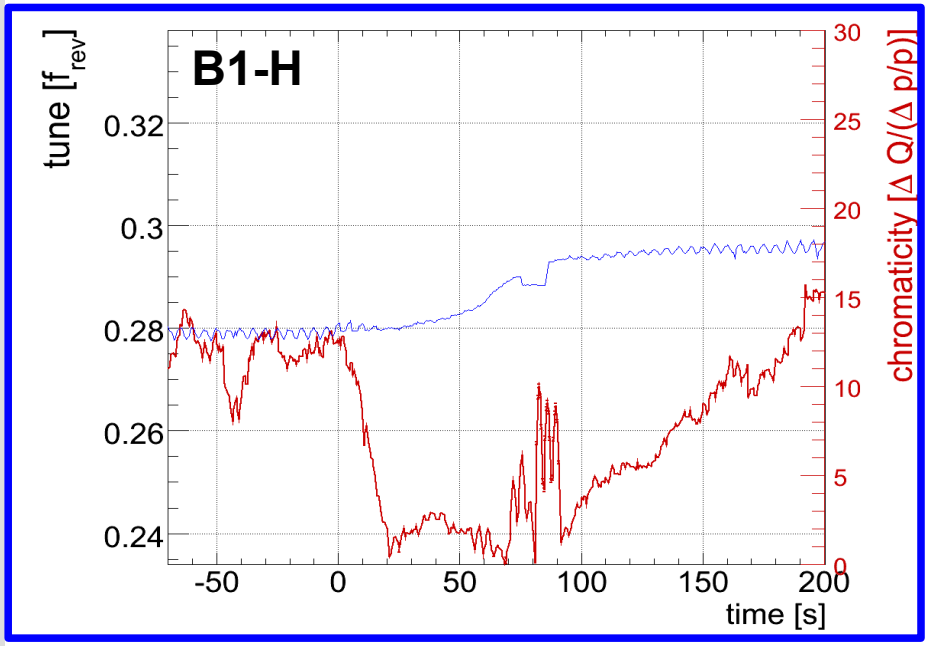


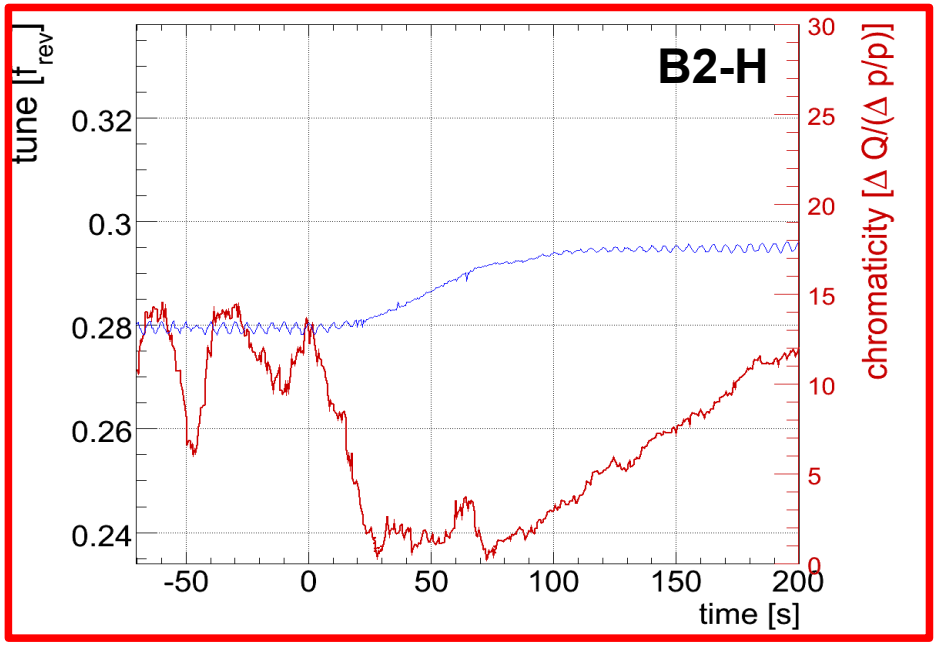




B1 & B2 Tune and Chromaticity Evolution – Zoom I/II

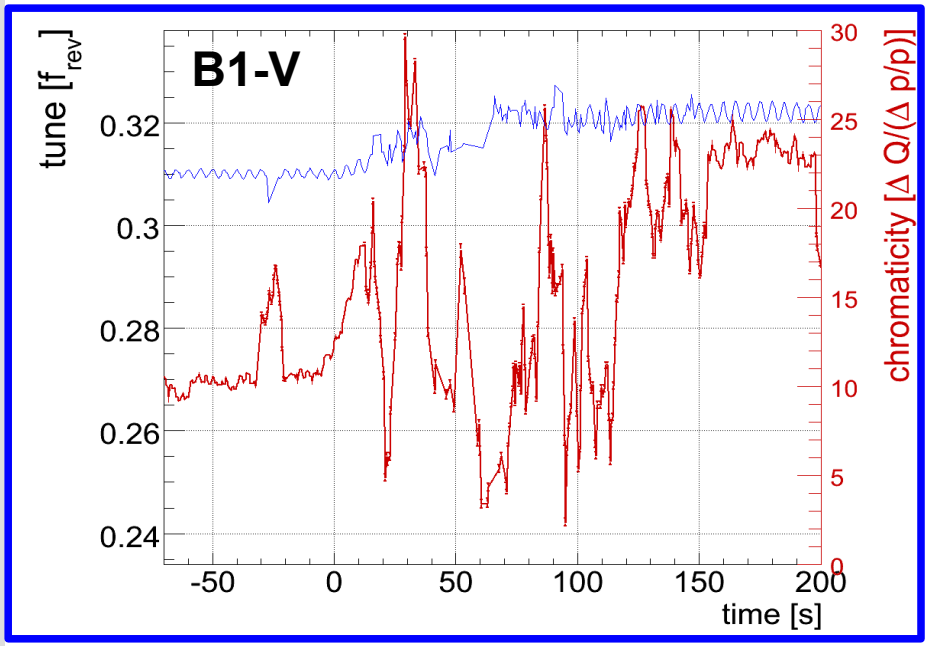
- Snap-back at the start of the ramp visible:
  - time-constant about 50-70 seconds (gaussian decay) depending on fitting

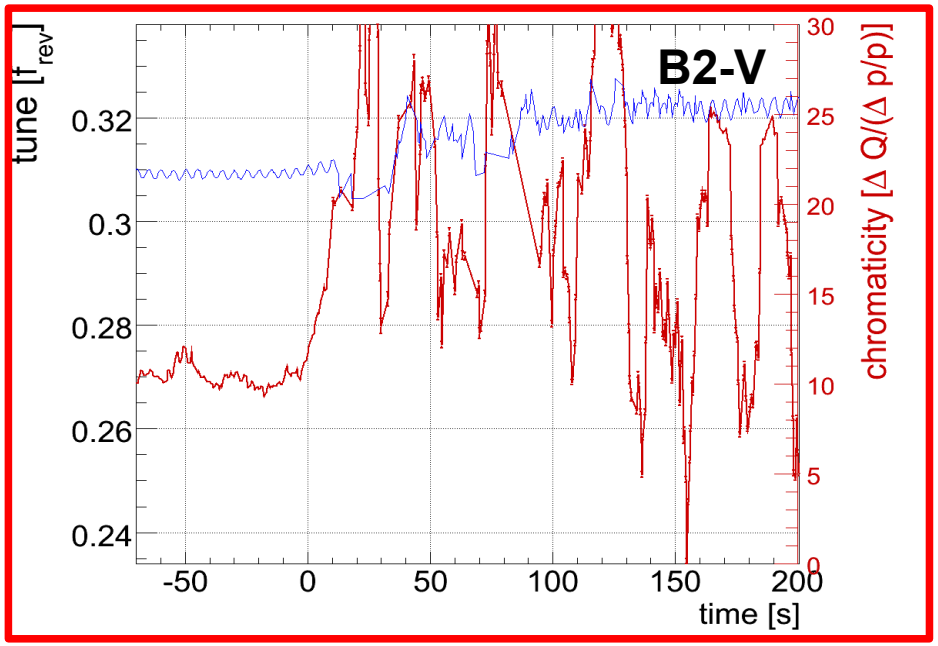




B1 & B2 Tune and Chromaticity Evolution – Zoom II/II

- Much noisier due to spurious/noisy peak detection
  - Partially due to large Q' (synchrotron side-bands)





- Should be fixed on the b_3 level (FIDEL on MCS)
  → feed-forward incorporators Mario and Mike