



Single bunch stability threshold

2015 – 2016 – 2017

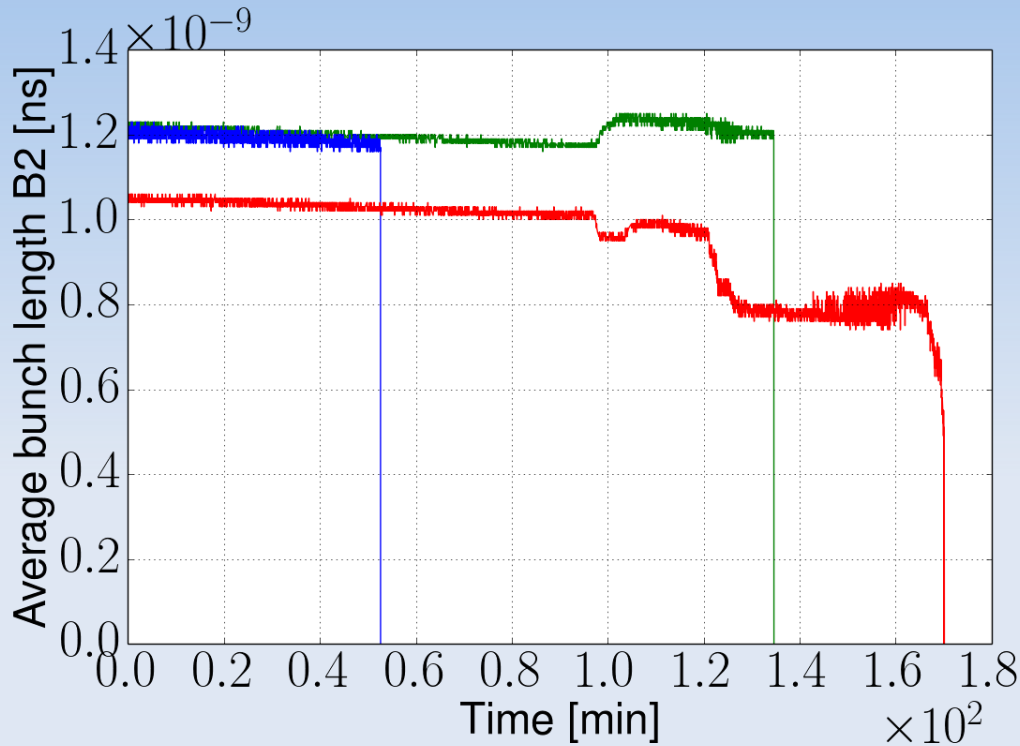
X. Buffat, M. Schenk, many thanks to E. Maclean



- Could Q'' have hidden a discrepancy between modeled and measured instability threshold in 2015 and 2016 ?
 - No
- Could the observed latency in the onset of beam instabilities explain the discrepancy observed in 2017 and its absence in 2015 – 2016
 - ... maybe



Second order chromaticity



- 2015 octupole scan, VRF = 10 MV
- 2016 octupole scan, VRF = 12 MV
- 2017 octupole scan, VRF = 12 MV

$$\langle \Delta Q \rangle = \sigma_z^2 \frac{Q''}{4} \frac{qV\omega_{RF}}{c^2 p_0 \eta C}$$

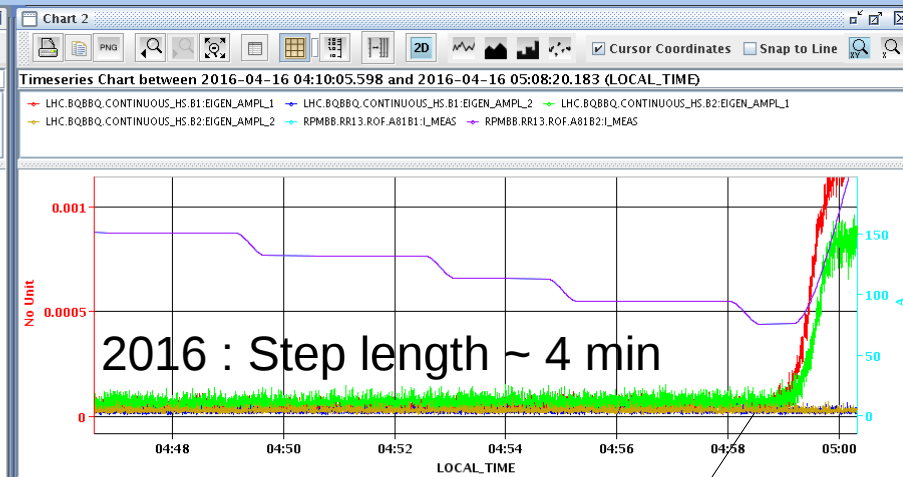
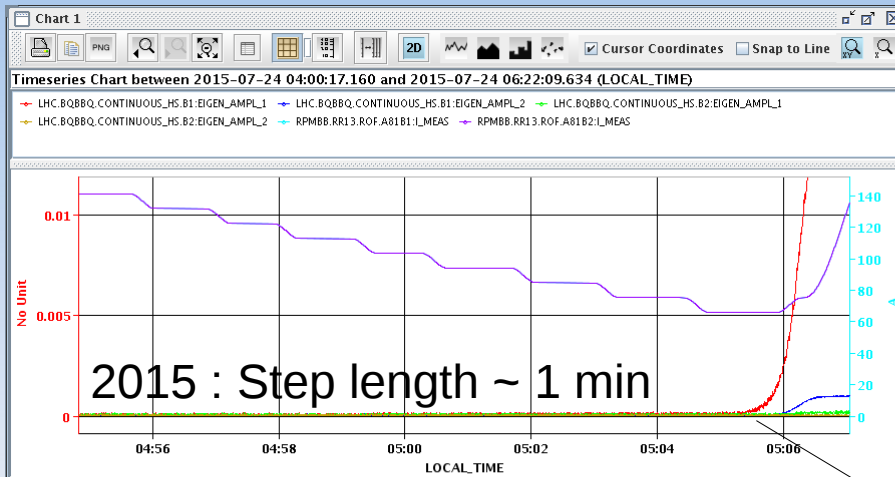
+8% with the ATS



- The tune spread generated by Q'' was reduced by 29% in 2017 w.r.t. to 2016 and 9% w.r.t. 2015
- For the nominal 11m, 3m and the ATS 1m optics at flat top the contribution of the octupole is similar
 - Instabilities in 2015/2016 were observed at $I_{\text{oct}} \sim 70 \text{ A} \rightarrow Q''_{\text{H}} \sim 3\text{k}, Q''_{\text{V}} \sim -1\text{k}$
 - Instabilities in 2017 were observed at $I_{\text{oct}} \sim 300 \text{ A} \rightarrow Q''_{\text{H}} \sim 16\text{k}, Q''_{\text{V}} \sim -5\text{k}$



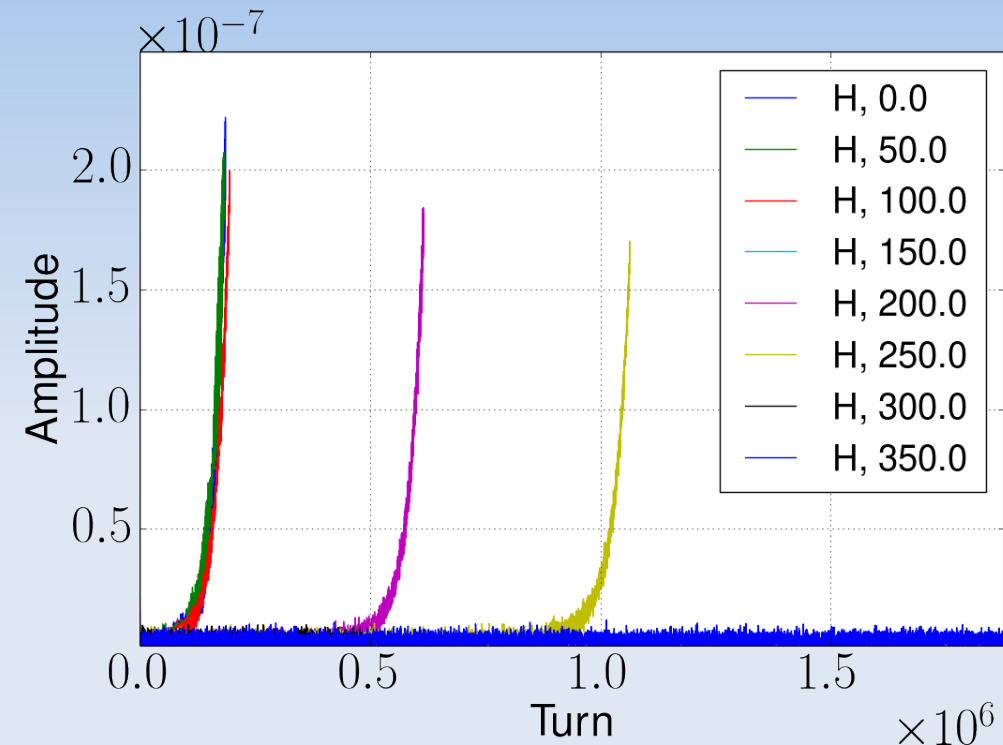
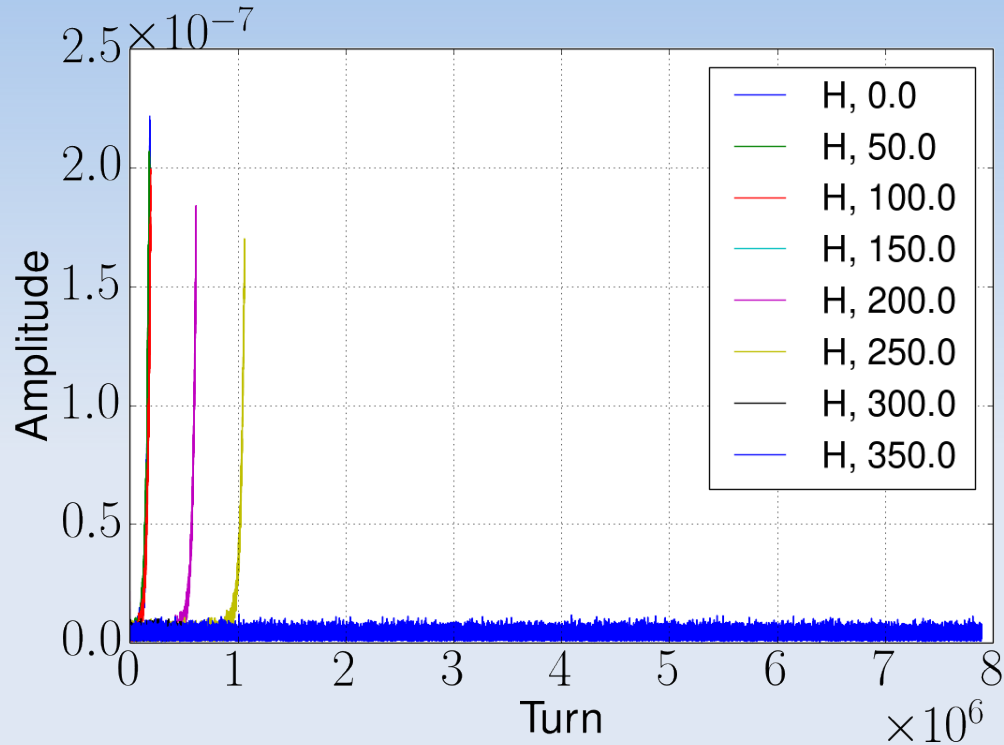
Instability latency



- The instability started within 30s after the octupole change
 - Good agreement with DELPHI
- The instability started 4 minutes after the octupole current change
 - Disagreement with DELPHI

■ A latency from few to 45 minutes were observed last year with $I_{oct} = 301$ A at flat top

→ Need to understand the latency to adjust our experimental procedures accordingly



- With an external noise of relative amplitude $1E-4$, $Q' = 15$ and a damping time of 50 turns (close to operational settings), we find that the linearly unstable configuration (~ 150 A) become unstable without latency
 - Instabilities with a latency are observed with up to at least 250 A (In these conditions instabilities were observed during the commissioning in B1H at 301A)
 - Many checks to be performed to confirm this result (convergence, parametric studies)