Observations of instabilities in the LHC at top energy
Update 30.05.2016
X. Buffat for the instability team

- Summary
- Horizontal instability during the squeeze
- Vertical instability of the 12 non-colliding bunches during stable beam
- Vertical blowup during adjust / stable beam
- Next steps ?
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- Sharp losses from bunches at the end of the last train during the squeeze
- Coherent signal visible in the BBQ of both beams
- Puzzling dynamic variations of the BBQ spectrum
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- Octupole 190 → 470 A
- Chroma trim during the squeeze at fill 4919
Vertical instabilities of the 12 non-colliding bunches

- First 12 non-colliding bunches blow up and lose intensity in stable beam
- Coherent signal visible in the BBQ
  - No obvious correlation with other signals
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Vertical instabilities during adjust / stable beam

- Before the change of ADT settings from high-bandwidth to regular
- Blow up of selected bunches after hours in stable beam
Vertical instabilities during adjust / stable beam

- After the change of ADT settings from high-bandwidth to regular
- Blow-up mainly in adjust or at the very beginning of stable beam (OP scans ?)
- Blow up of selected bunches after hours in stable beam

Fill 1958
- No losses visible in the FBCT
Specific luminosity

- Selective blowup during the lumi-scans, but not only
Example: Vertical beam 1 during fill 4926

Coherent activity visible, but no clear instability signal
- Example: fill 4930, ADJUST
  - Strong coherent activity visible in both beams' horizontal plane \(\rightarrow\) but not blowup
  - Weak coherent activity observed in both beams's vertical plane \(\rightarrow\) blowup observed
Fill 4927 was a setup fill for VdM scans.

- 2 nominal bunches ramped to 6.5TeV with de-squeezed optics ($\beta^* = 19$ m).
- $Q' = 10/10$, Joct = 200A, $4\sigma_t = 0.9$ ns.
- Beam mode changed to adjust at 11:45.
- At 11:47, all planes become unstable.
Next steps?

- A lot of data analysis!
  - Find onset of the instabilities (BBQ amplitude and spectrograms are not always clear, using the spec. lumi. Signal looks promising)
    → Correlate with machine changes (orbit, lumi scans, IP2-8 leveling, …) or other observables
  - Need to understand BBQ signals
  - ...

- Machine tests:
  - Catch the instability with HT monitor / ADT ObsBox
  - Do we need a chroma measurement fill?
  - ...