

MPP proposal for bunch length interlocking

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Motivation of an interlock on bunch length

- **Bunch lengths < 0.8 ns** with several **hundreds** of bunches could lead to **onset of damage** in non-conformities and not interlocked equipment **due to heating**
- With current impedance & bunch intensities bunch length **stabilizes ~0.9 ns at 6.5 TeV**
- → bunch length should only be **interlocked during the ramp**
- Heating processes are rather **slow** → **software interlock with delay** to avoid spurious dumps due to missing BQM data
- If longitudinal blow-up does not start at the beginning of the ramp **fill cannot be saved** → later activation of blow-up complicated

Proposal

SIS interlock

- Beam mode: RAMP
- Beam Intensity: $> 500b$ OR $> 5 \times 10^{13}$ p
- Bunch length < 0.8 ns OR no data from BQM for > 90 s

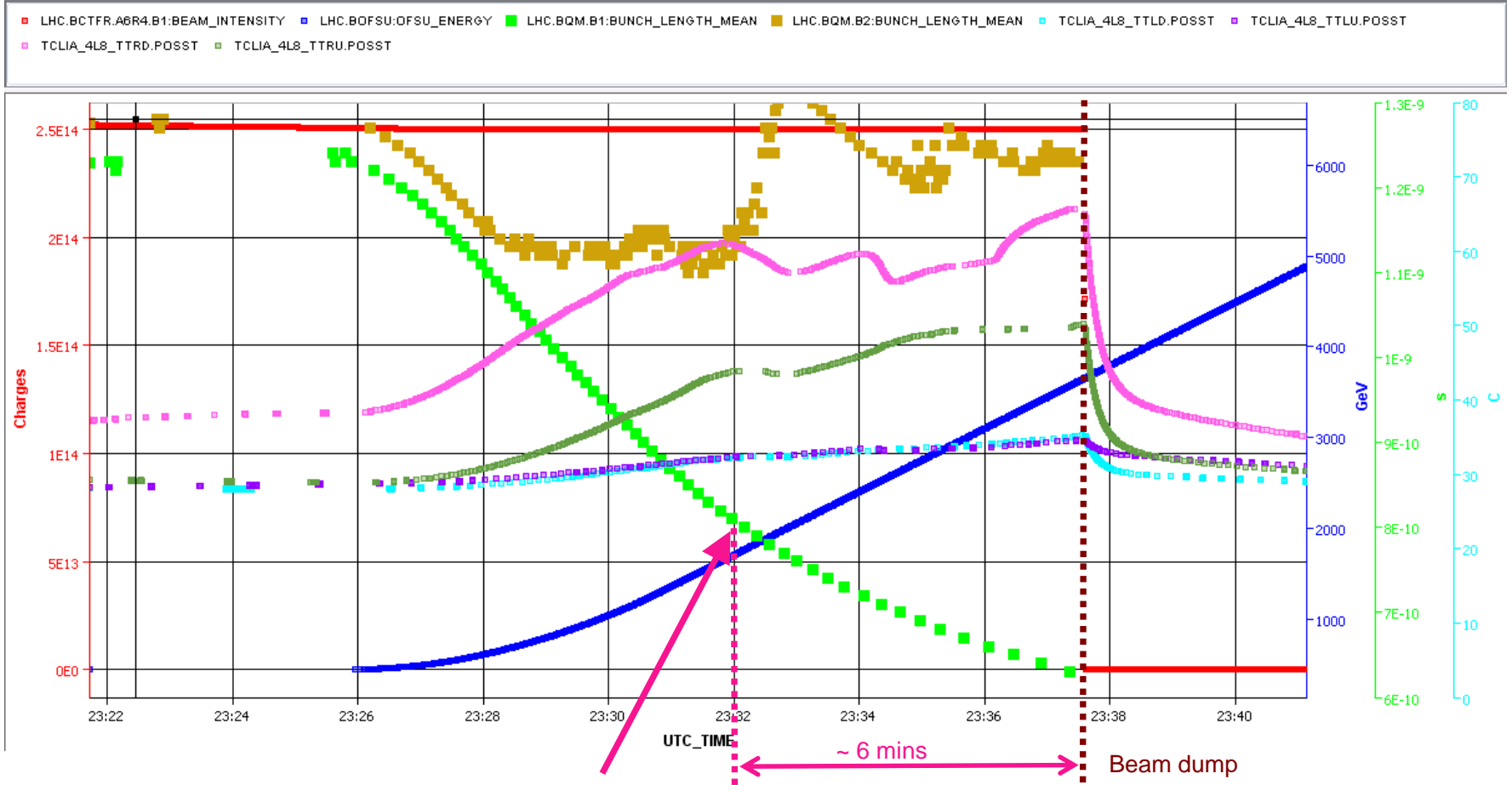
Note: A SIS - announcer for bunch length < 0.8 ns (without delay) has been active during the past month(s) \rightarrow to be discontinued

Re-cap of 2017 situation

- **4 fills** with non working longitudinal blow-up during ramp in 2017:
 - Fill 5859 (2317b, B1, dumped by TCLIA.4L8)
 - Fill 5874 (2b + pilots, B1+B2, no dump)
 - Fill 6116 (1740b, B2 phase loop problem, no dump)
 - Fill 6122 (2220b, B1, dumped by TCLIA.4L8)
- Dumps usually (but not always) triggered by temperature probe of TCLIA (two beam collimator - probably EMC).

Example: Fill 6122 – 23.08.2017

Timeseries Chart between 2017-08-20 07:16:00.000 and 2017-08-24 08:16:00.000 (UTC_TIME)



Bunch length interlock at 0.8 ns, would have dumped beam ~6 min earlier than the TCLIA temperature interlock.

Conclusion

- **Onset of damage** in non-conformities and non-interlocked equipment due to heating expected for **bunch lengths < 0.8 ns** with several hundreds of bunches
 - Longitudinal blow-up **not working a couple of times per year** \rightarrow events mostly **caught by EMC** of collimator temperature interlock
- \rightarrow Proposal: **SIS interlock** during RAMP in case of bunch lengths < 0.8 ns (> 500 b)



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