MD9551: E-cloud heat load with high intensity at injection (25 ns)

L. Mether and K. Paraschou

with input from C. Zannini and G. Rumolo

rMPP meeting
20 September 2024

MD9551: Heat load with high bunch intensity at injection

Motivation:

- Improve estimates of cell-by-cell heat loads for the HL-LHC era
  - Direct measurements give reliable data for selecting half-cells for BST and defining cryo margins in Run 4

Setup:

- Inject fills with varying intensity and number of bunches in trains of 2x48 bunches (96 bpi):
  - A fill with bunch intensity 2.3e11 p/b and 12b + 10 times 2x48b (972b)
  - A fill with bunch intensity 1.9e11 p/b and 12b + 12 times 2x48b (1164b)
  - A fill with bunch intensity 1.5e11 p/b and 12b + 16 times 2x48b (1548b)
  - A fill with bunch intensity 1.1e11 p/b and 12b + 22 times 2x48b (2124b)
- Store beams for ~30 minutes for heat load measurement; Dump & refill

Procedure:

- Adapt RF & ADT settings, if necessary for the bunch intensity
- Inject probes; Correct coupling, chromaticity and tunes; Set octupole current and chromaticity
- Inject 12 bunches (at 1.6e11 p/b) + N times 2x48b (at selected intensity)
- Retract the TDIS; Wait for measurement

rMPP questions

- **Comment on requested bunch intensities, number of bunches, and bunch length**

  - The bunch intensities are defined to sample the heat load vs bunch intensity curve up to HL-LHC intensity
  - The number of bunches is driven by the need for a sufficiently high heat load to minimize the impact of intrinsic fluctuations in the measurement (therefore the requested number of bunches is bunch-intensity dependent)
  - No special request for the bunch length, standard bunch length as in operation

2022 MD results and fits



Measurement with ~800b at 1.8e11 p/b during 2022 MD
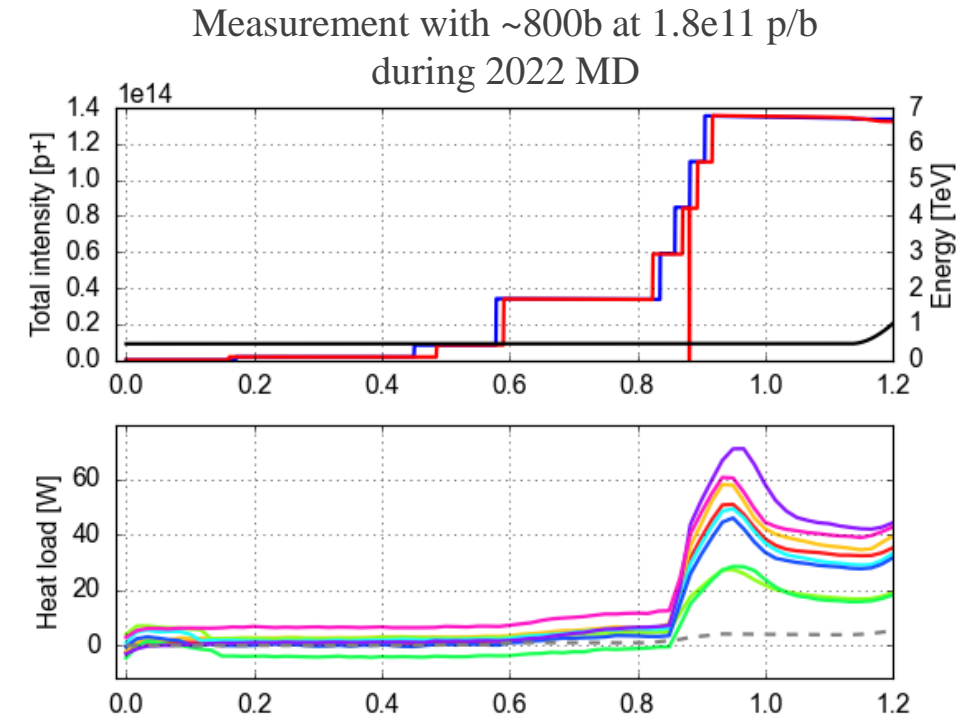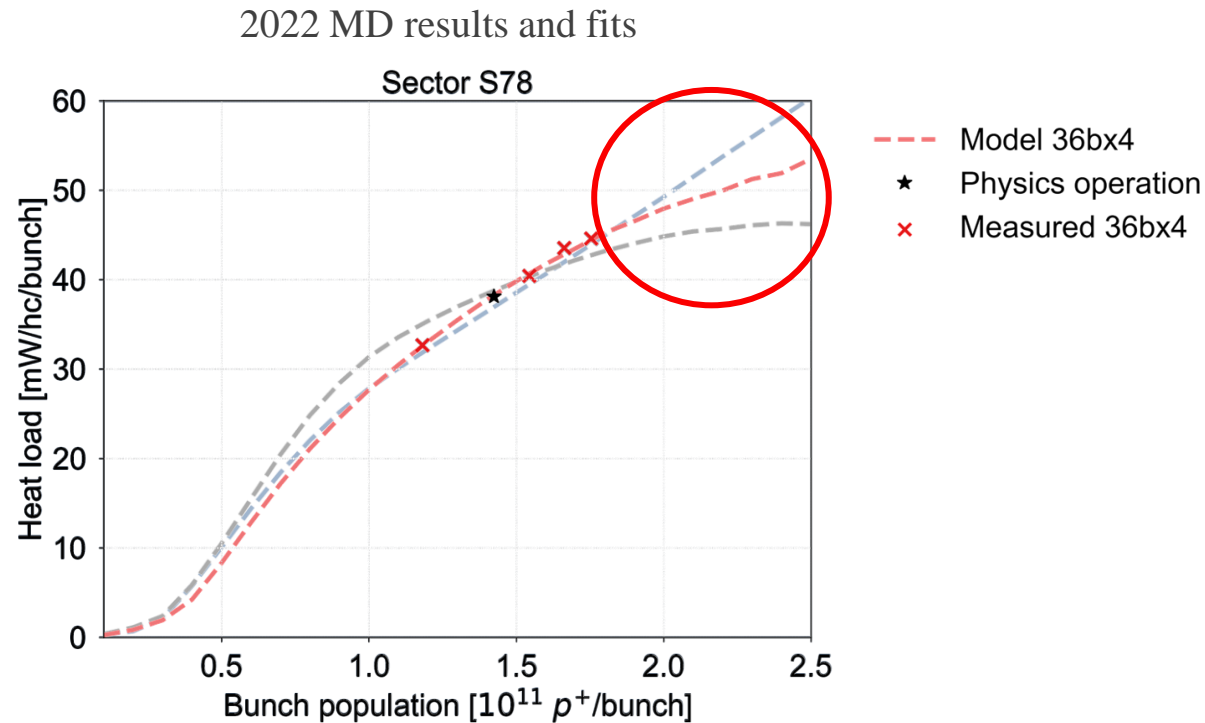
rMPP questions

- **Assessment from ABP regarding beam-induced heating for these intensities?**

  o The number of bunches stay below 80% of the allowed number of bunches for every intensity
     → Heating lower than during operational fills
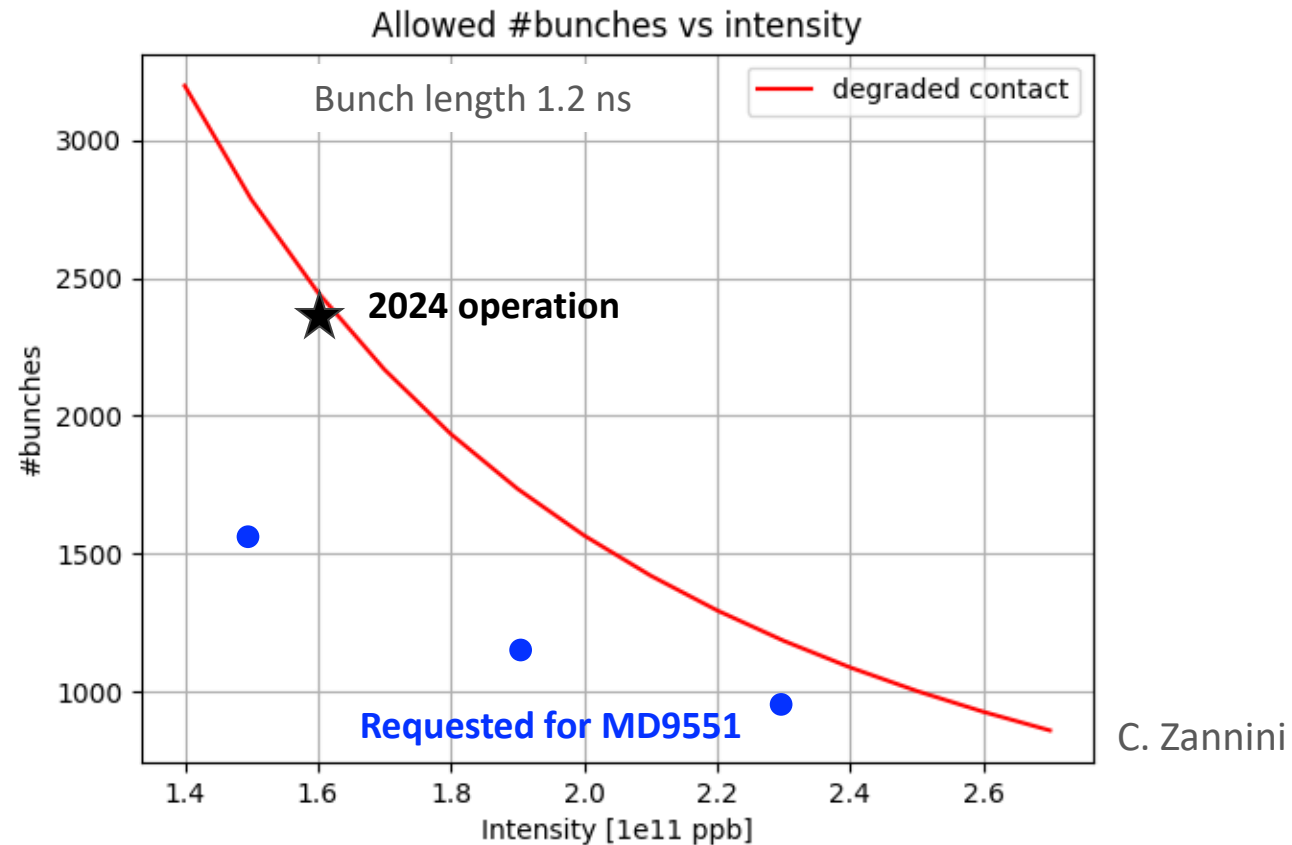
rMPP questions

- **How to guarantee needed bunch length?**

  o In physics fills, bunches are injected at ~1.2 ns and the bunch length grows with time

  o By the time that ~1000 bunches are injected, the average bunch length is > 1.25 ns

  o No reason to expect a smaller growth in bunch length with time for higher intensity beams

Fill 10119
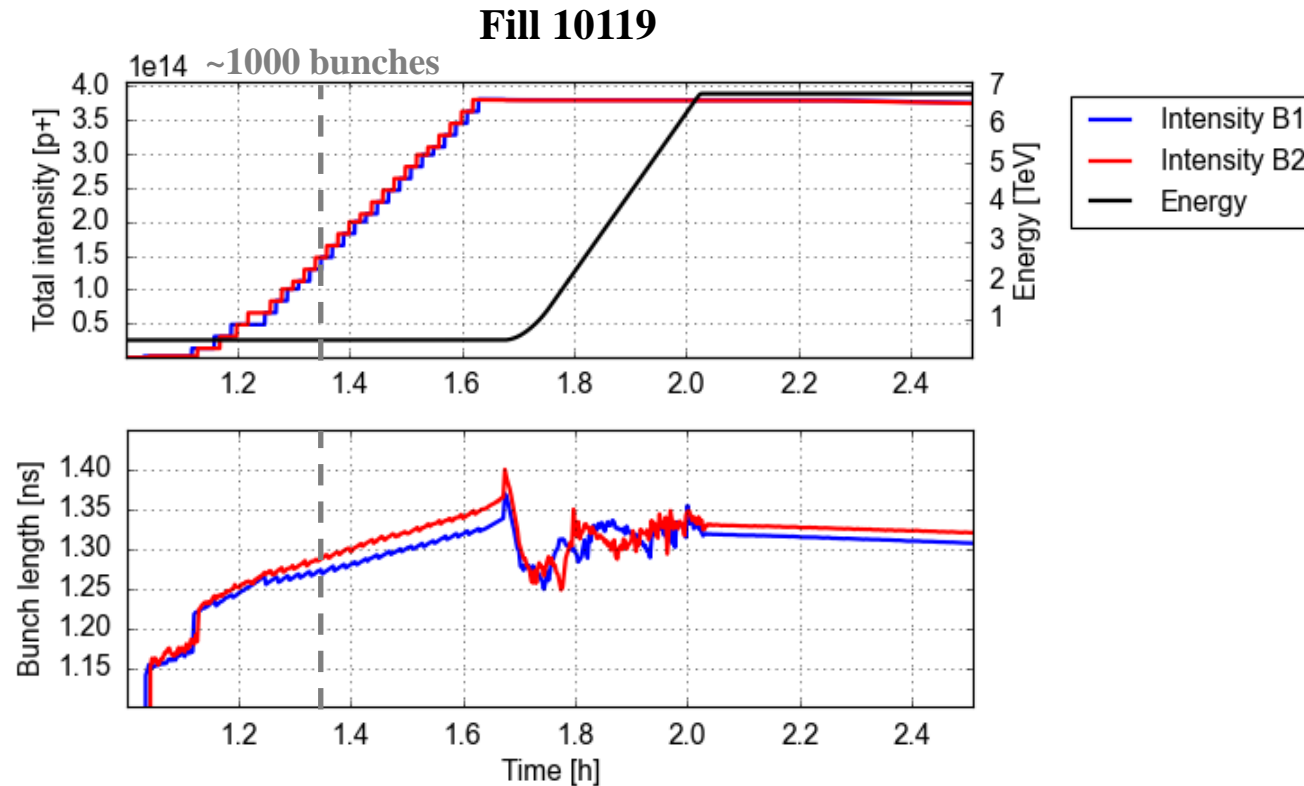
Allowed number of bunches vs bunch length

- From C. Zannini, LBOC, March 5th 2024

Allowed number of bunches at reference heating with 2.3e11 p/b