MD6924: Slow beam degradation from incoherent electron cloud effects – preparation

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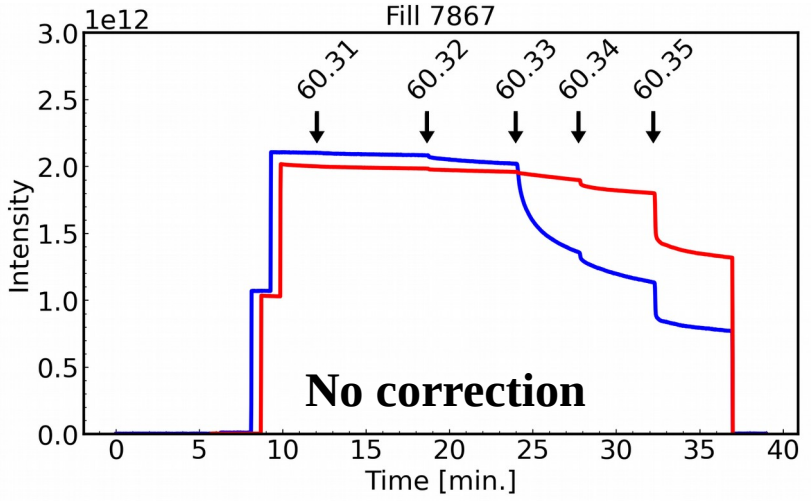
Y. Papaphilippou, G. Rumolo, K. Shing Bruce Li, M. Solfaroli, G. Trad, J. Uythoven

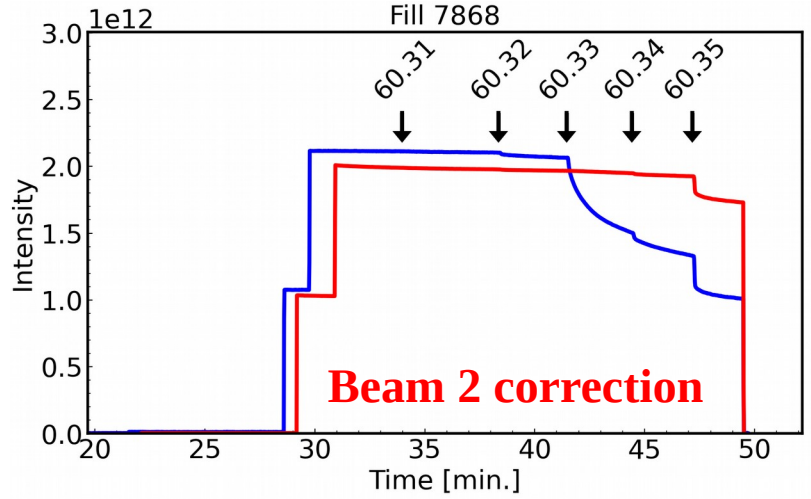
LSWG
21 July 2022

Purpose of this part of MD was to demonstrate the control of the 3Qy resonance and test it with nominal individual bunches before trying high-intensity trains.

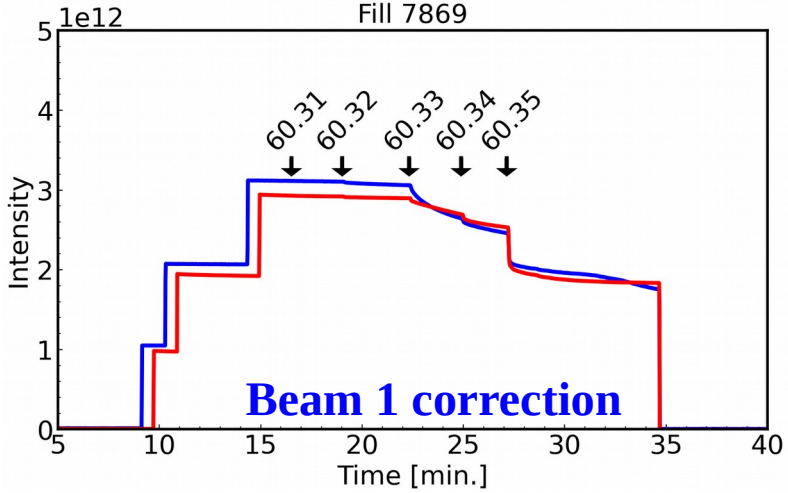
Ultimate goal is to benchmark with e-cloud simulations in order to **improve the modeling of e-cloud incoherent effects**.



Losses:
63%
35%



Losses:
53%
14%



Losses:
38%
37%

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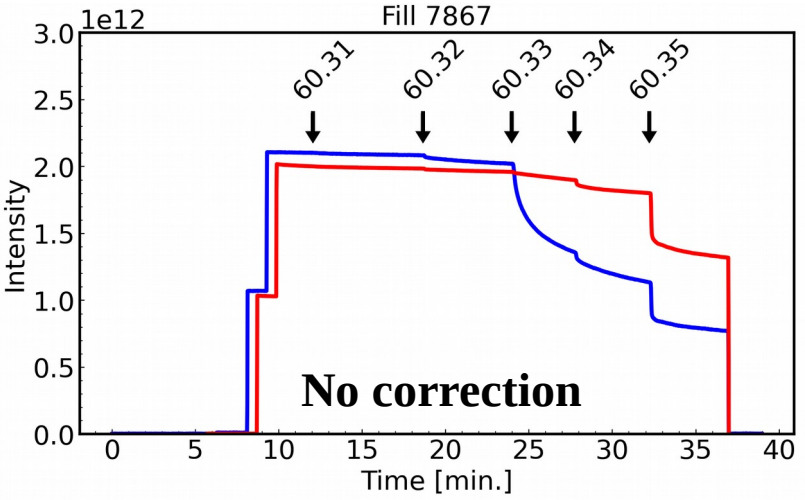
Three fills were made, **crossing the 3Qy resonance**:

1) No correction to the 3Qy Resonance Driving Term
2) Correction to the 3Qy RDT, **optimizing Beam 2**, expected to slightly improve Beam 1
3) Correction to the 3Qy RDT, **optimizing Beam 1**, expected to degrade Beam 2



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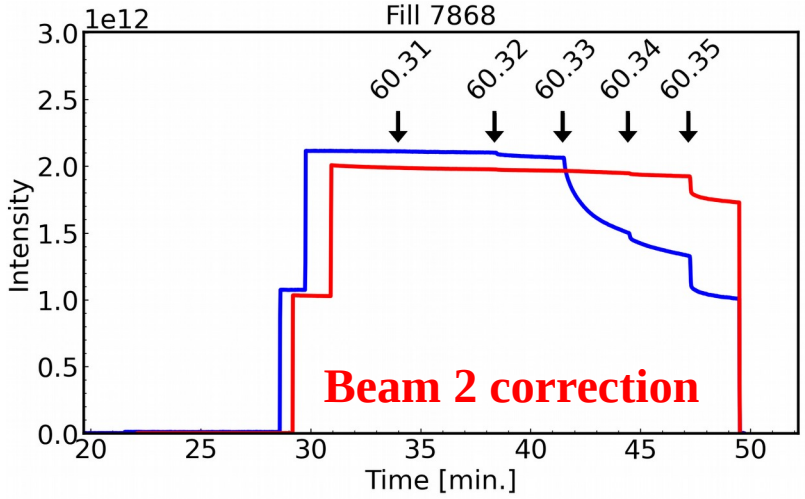

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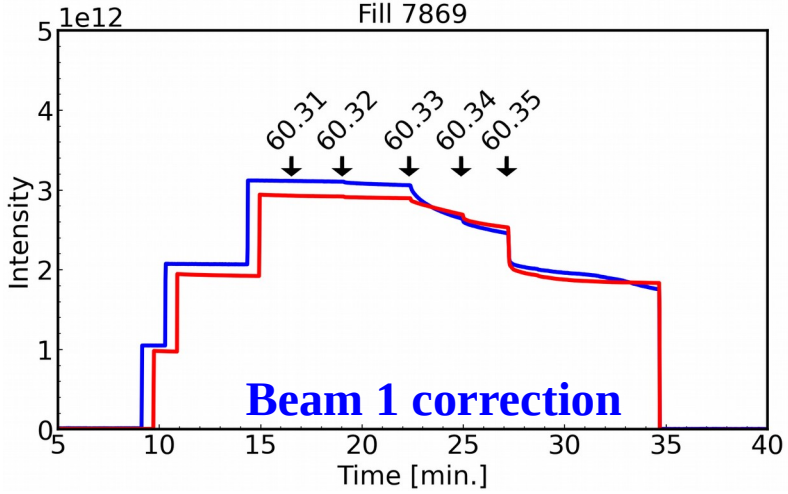

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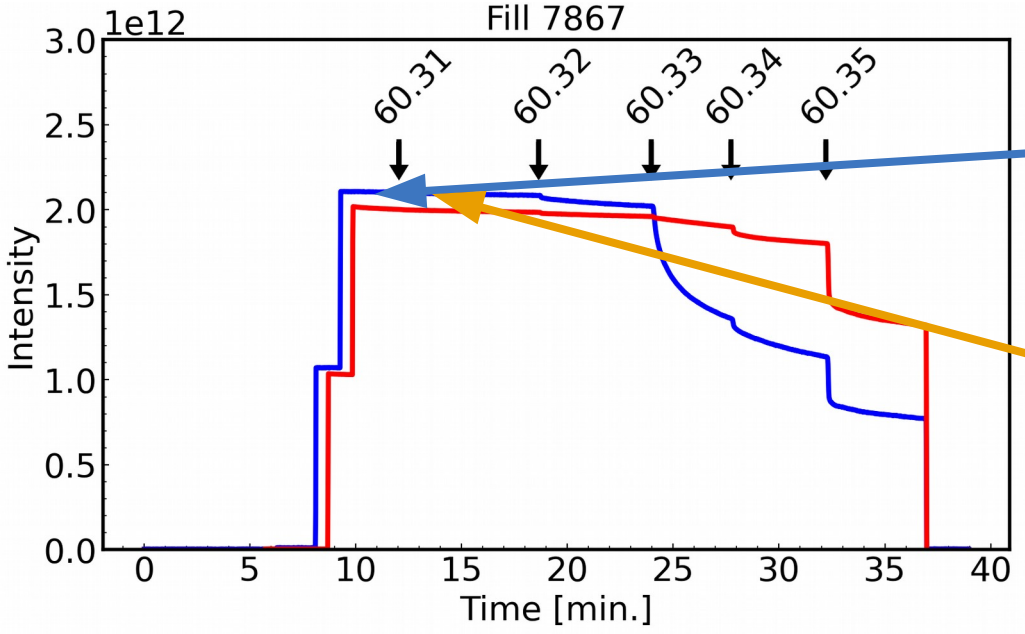
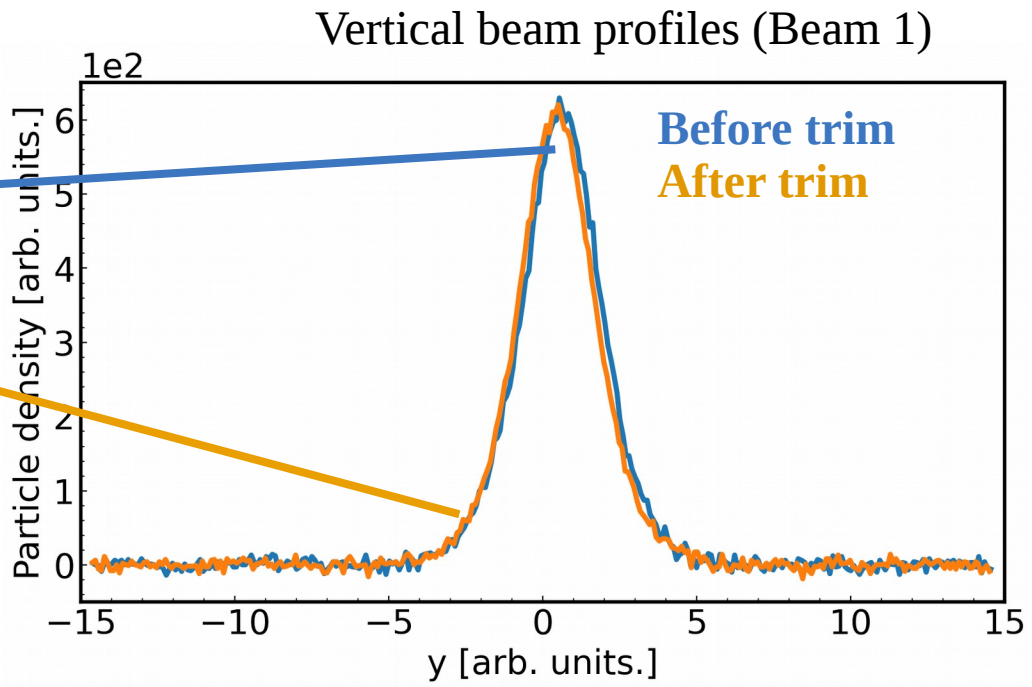
Several delays piled up.
Total duration was 2 hours.
Many thanks to OP team for letting us use some of the turnaround time!

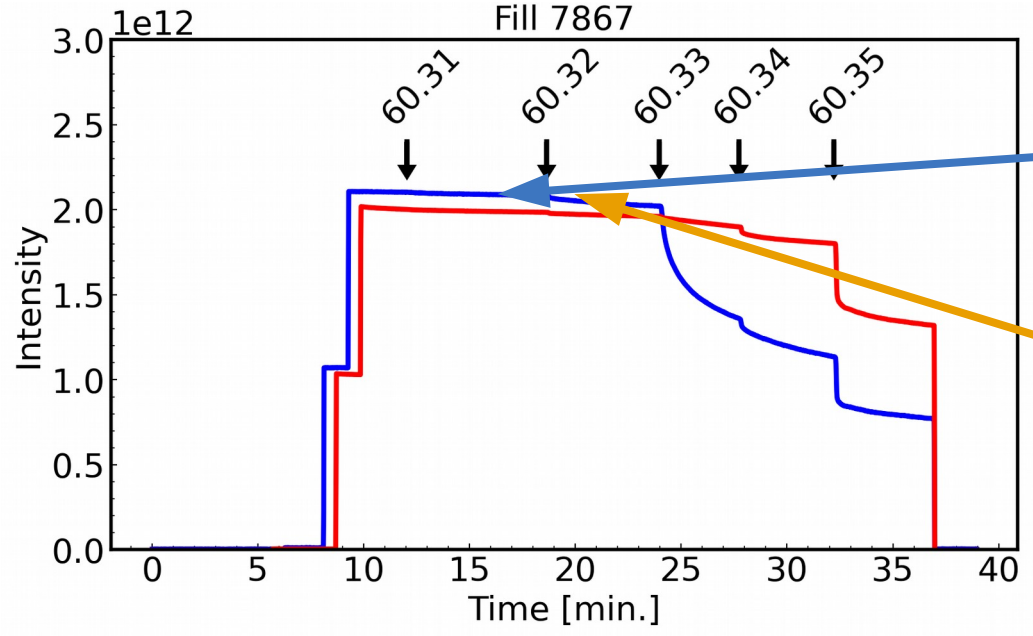
Effect on the beam distribution

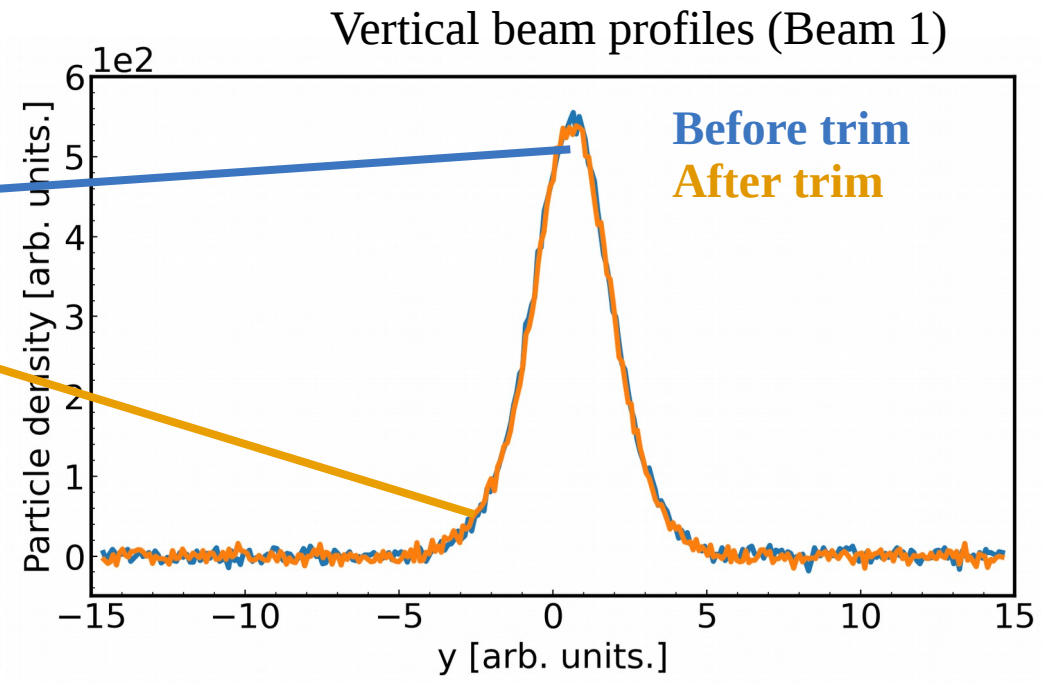




- Trim to 60.31. No effect.

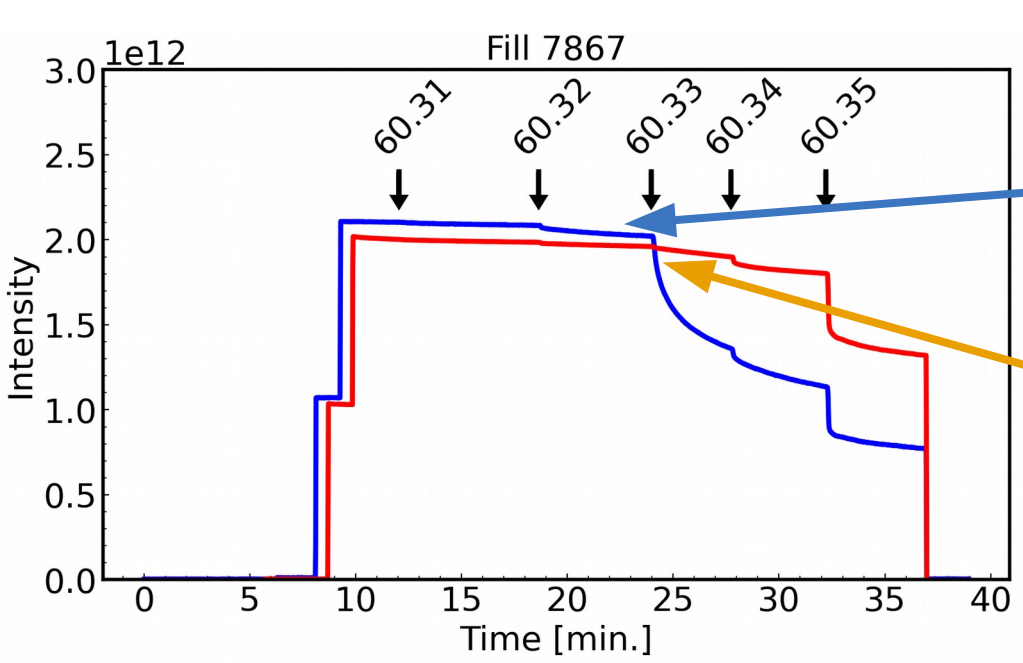
Effect on the beam distribution

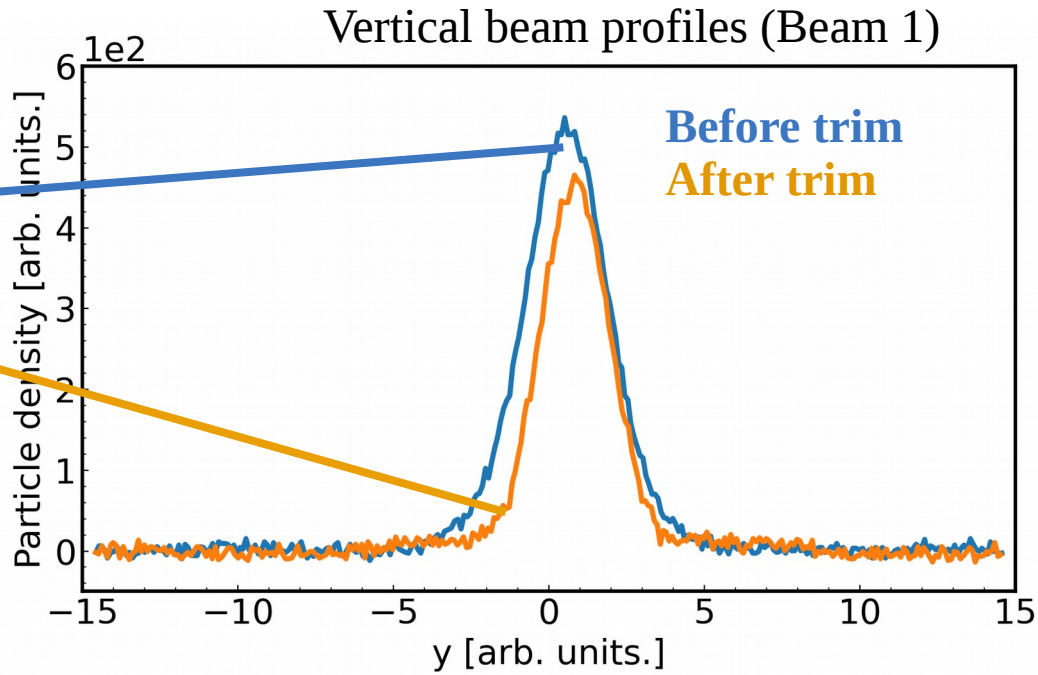




- Trim to 60.31. No effect.
- Trim to 60.32. No effect.

Effect on the beam distribution





- Trim to 60.31. No effect.
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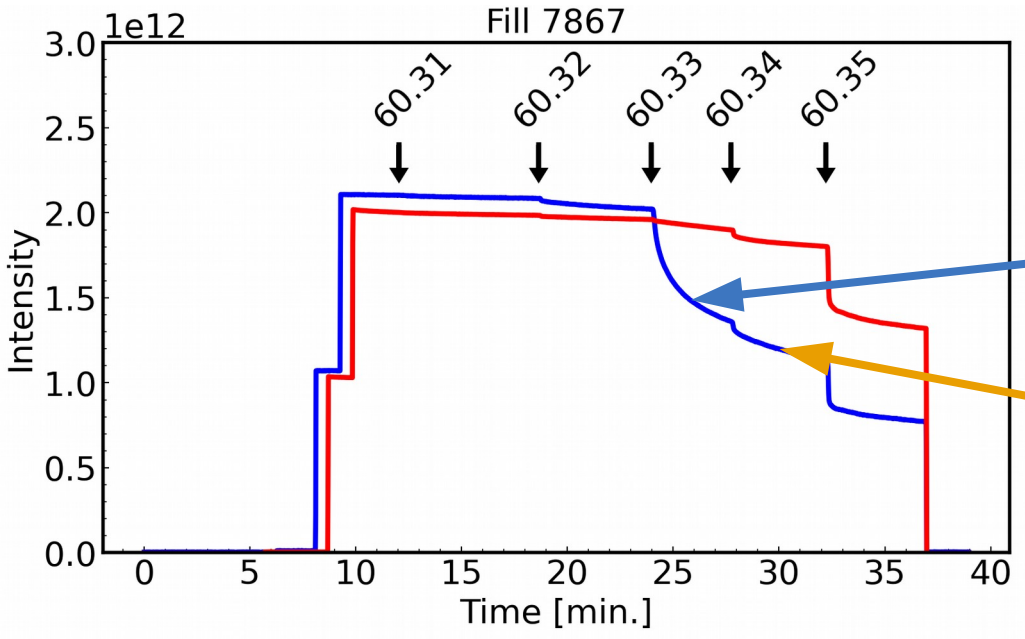
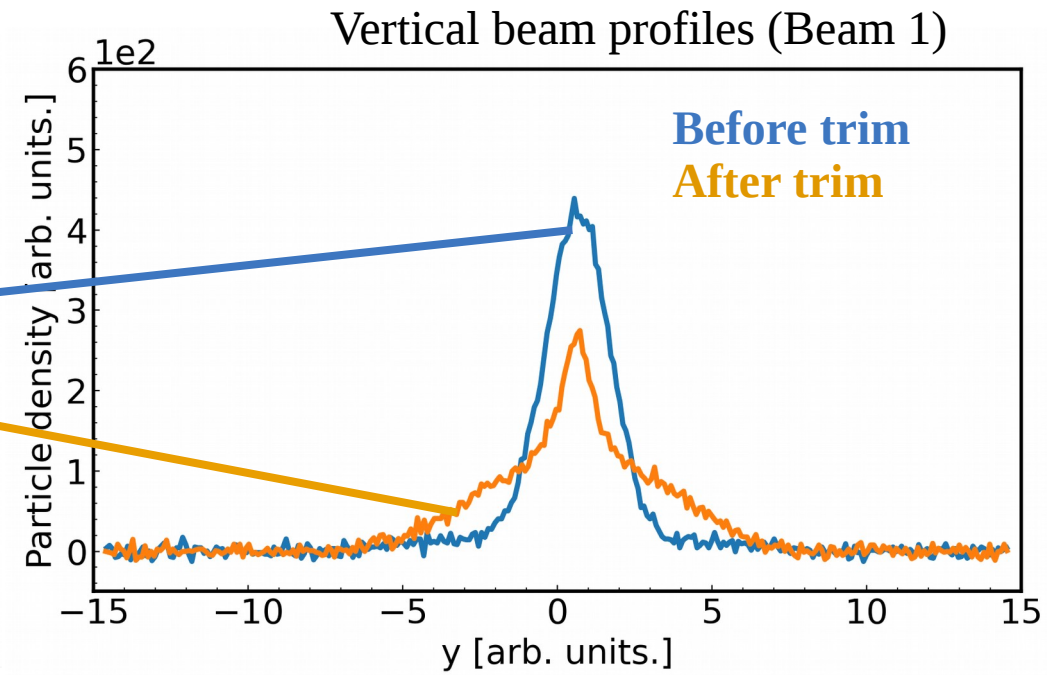
- Trim to 60.33. Slow losses, profile stays gaussian.

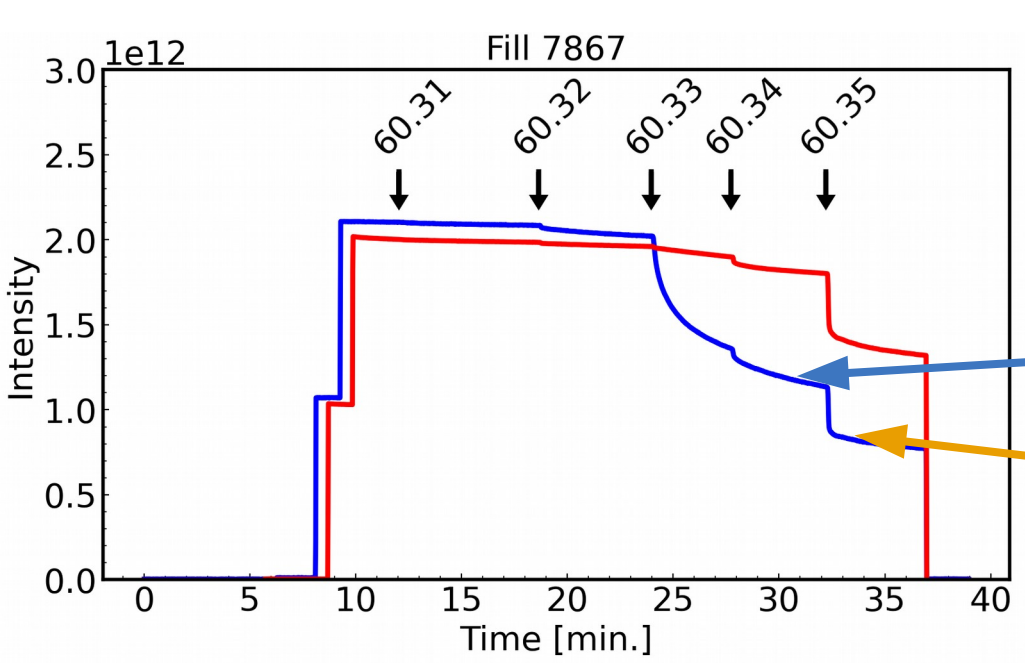
Effect on the beam distribution

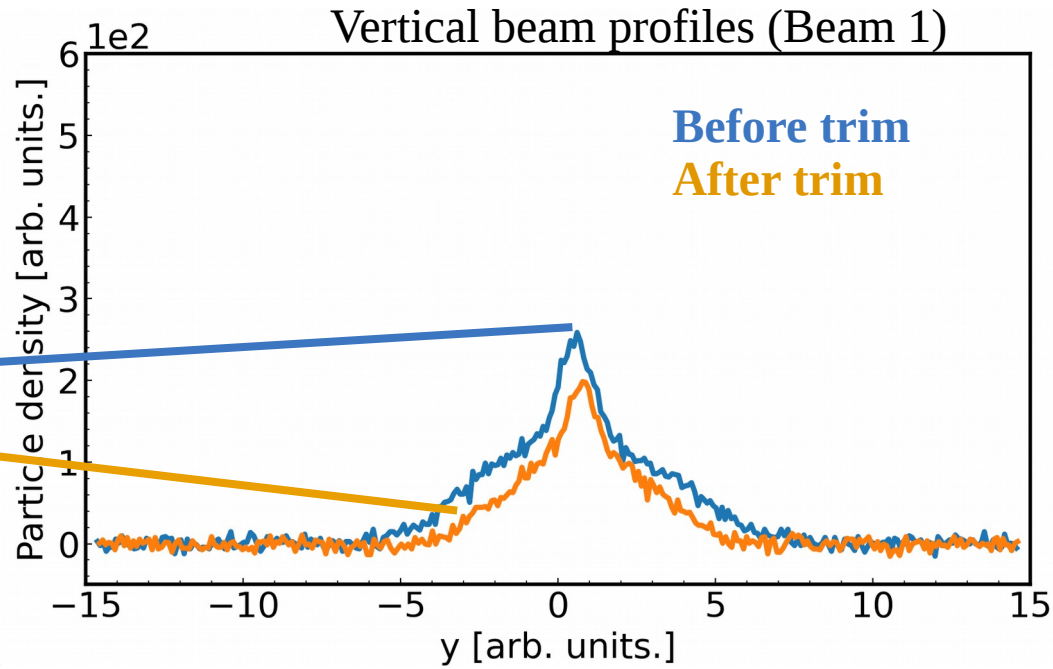




- Trim to 60.31. No effect.
- Trim to 60.32. No effect.
- Trim to 60.33. Slow losses, profile stays gaussian.
- Trim to 60.34. Fast losses and clear interaction with resonance. **Profile heavily distorted.**

Effect on the beam distribution





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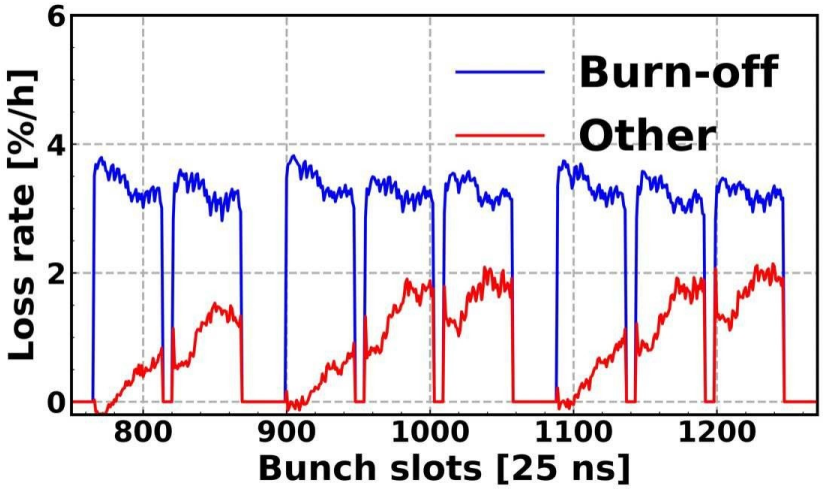
- Trim to 60.33. Slow losses, profile stays gaussian.
- Trim to 60.34. Fast losses and clear interaction with resonance. **Profile heavily distorted.**
- Trim to 60.35. Fast losses, vertical profile remains distorted.

Discussion and Conclusion:

- **MD was success!**
- Good control of the 3Qy resonance with **OMC techniques**.
- Timescale of fills around 30mins → 20M turns, in reach of (XSuite) GPU simulations.
- Rich in information acquired on both “steady-state” effects (staying near a resonance) and dynamic effects (crossing a resonance).
- MD to be continued with trains of 144+ bunches in order to probe e-cloud effects.

- **Important for the validation of the incoherent e-cloud effect modeling.**
- **Validation necessary to make predictions HL-LHC.**



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- Good control of the 3Qy resonance with optics measurements.
- Timescale of fills around 30mins → 20M turns, in reach of (XSuite) GPU simulations.
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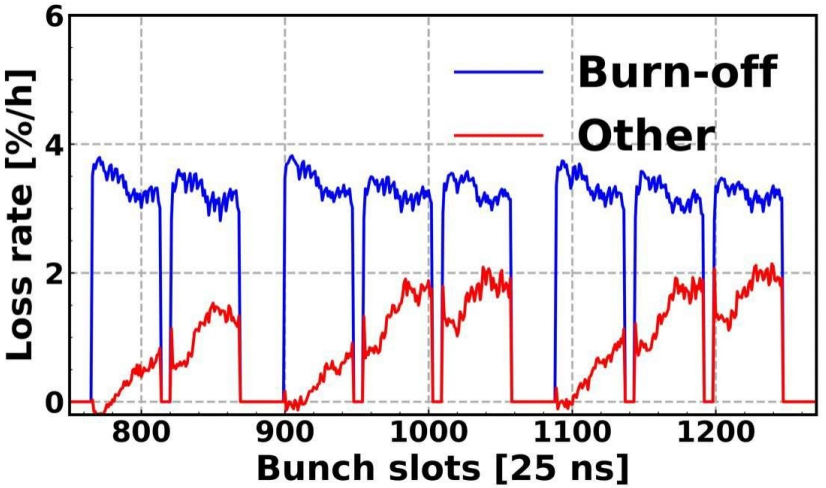

Thank you for your attention!