

# OMC Commissioning of the LHC Linear Optics So Far

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On Behalf of the OMC Team

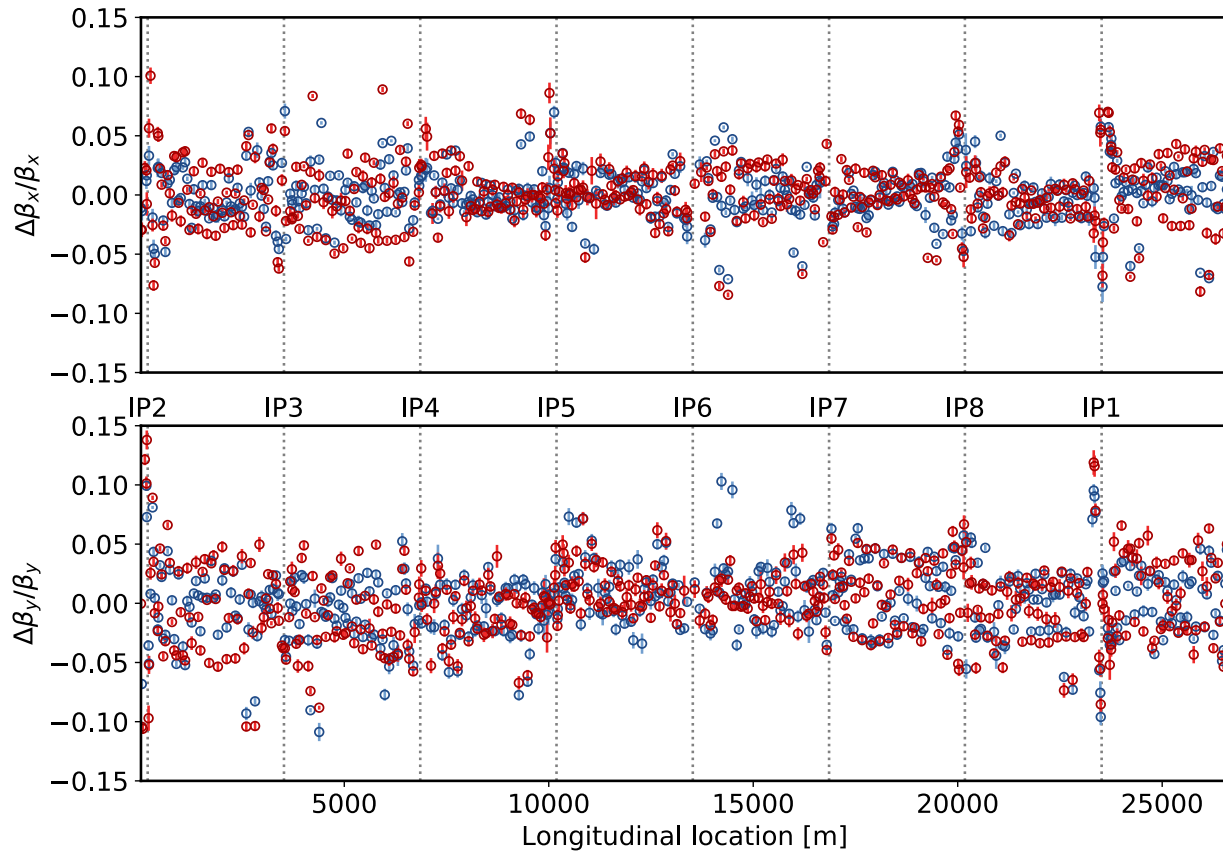
# Linear Optics so Far – Overview

- The correction for injection optics that were determined in the 2021 beam tests were re-used from the start of commissioning.
- Measurements were done on Saturday by OMC to confirm the injection linear optics.
- Measurements were done on Monday during the ramp and at flat-top to probe the 6.8TeV optics.

# Injection - Beta-Beating

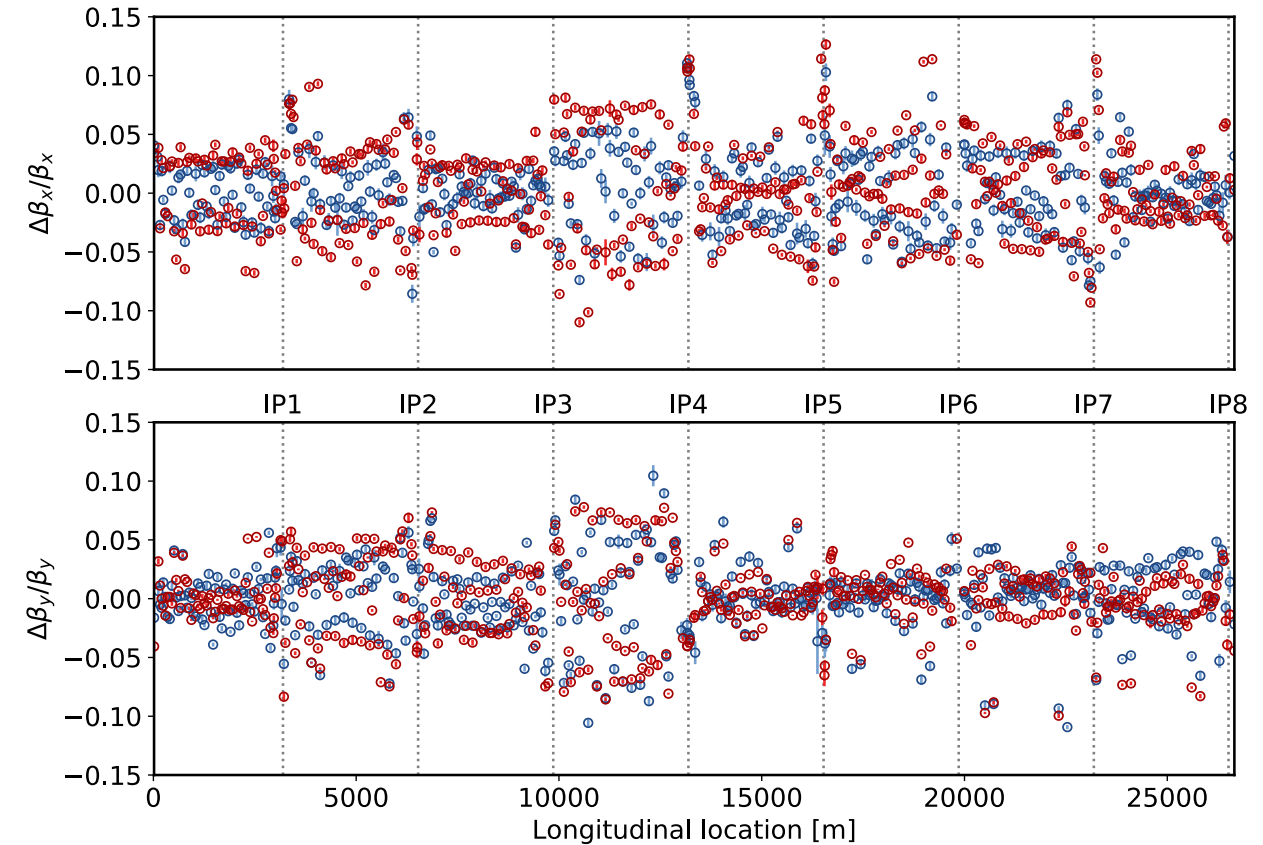
## BEAM 1

◊ B1\_2021\_Beam\_Test    ◊ B1\_2022\_Commissioning



## BEAM 2

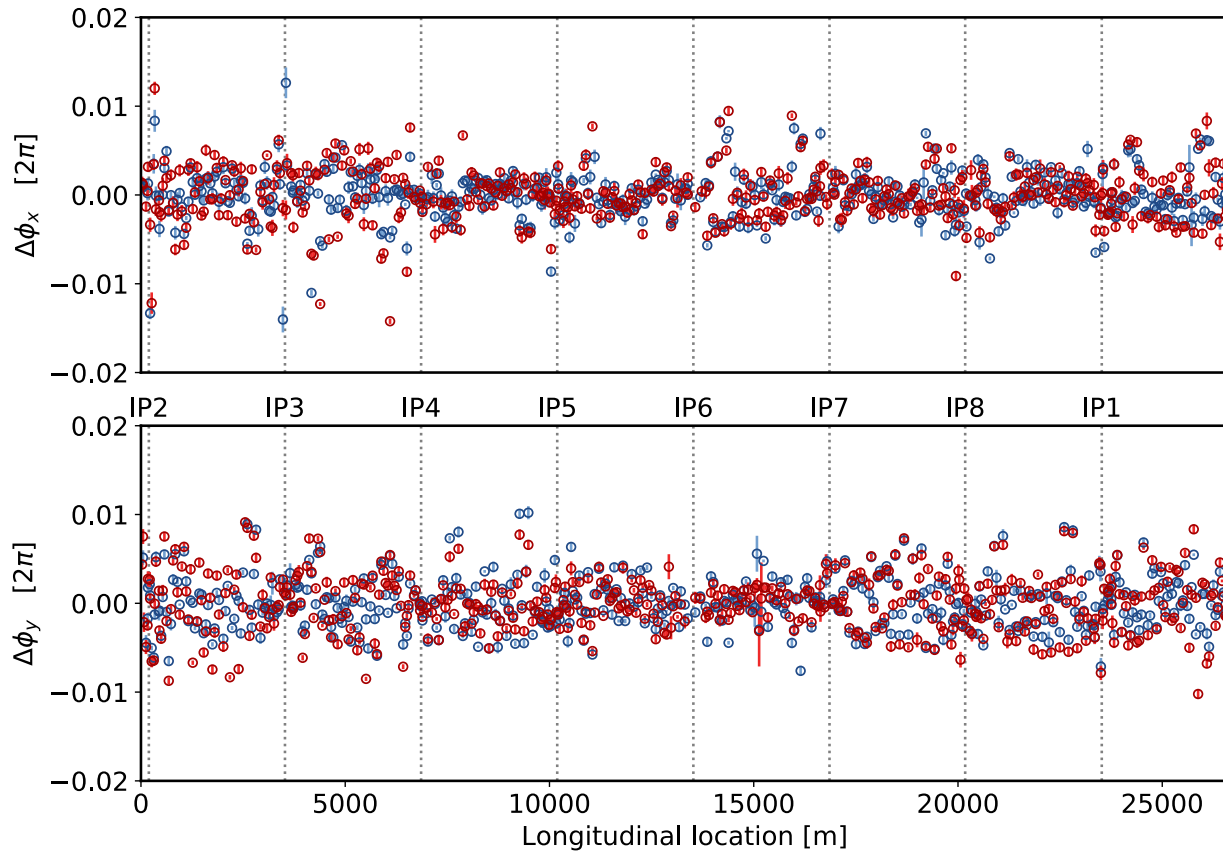
◊ B2\_2021\_Beam\_Test    ◊ B2\_2022\_Commissioning



# Injection - Phase Beating

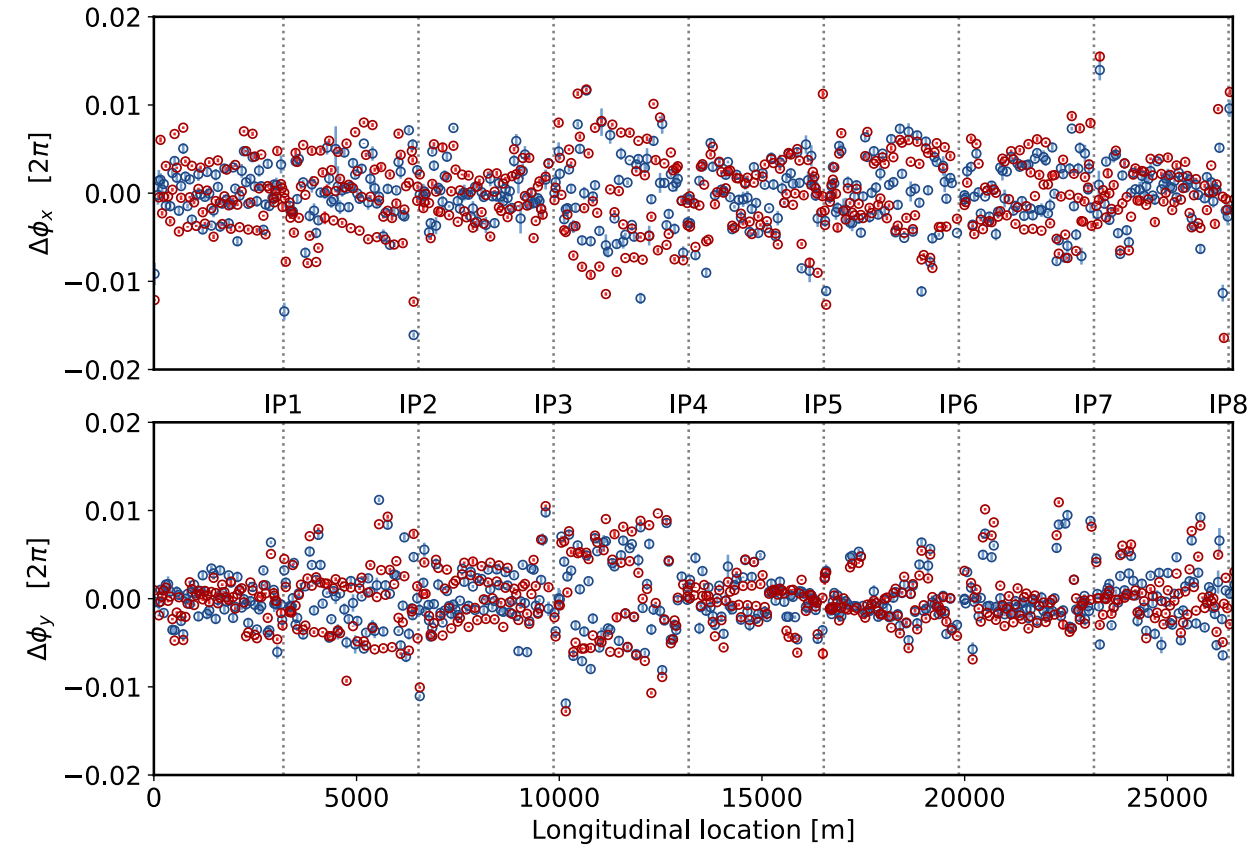
## BEAM 1

B1\_2021\_Beam\_Test    B1\_2022\_Commissioning

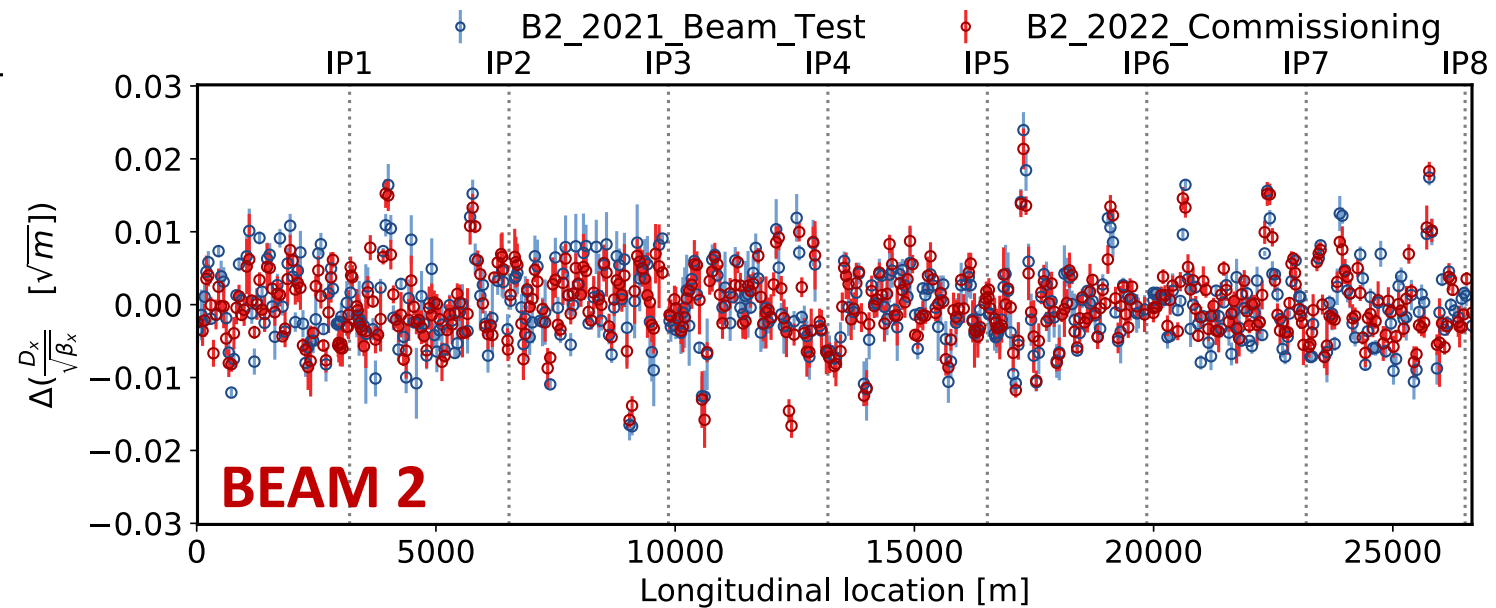
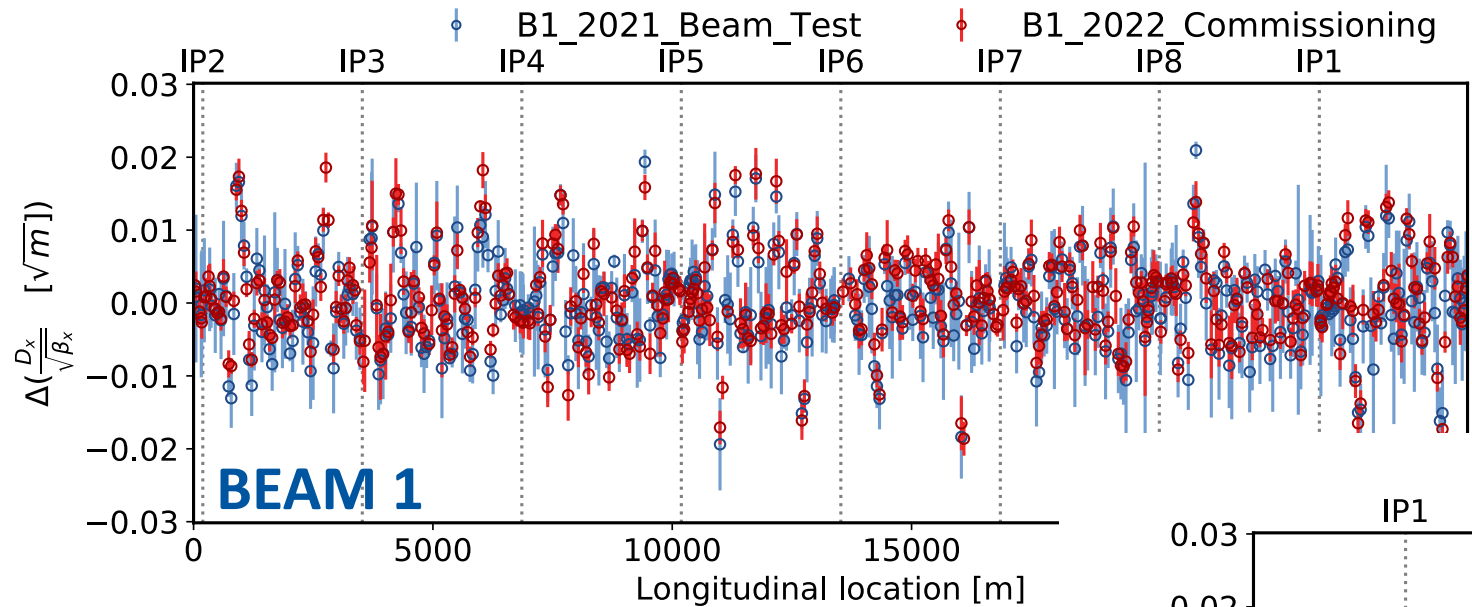


## BEAM 2

B2\_2021\_Beam\_Test    B2\_2022\_Commissioning



# Injection - Normalized Dispersion

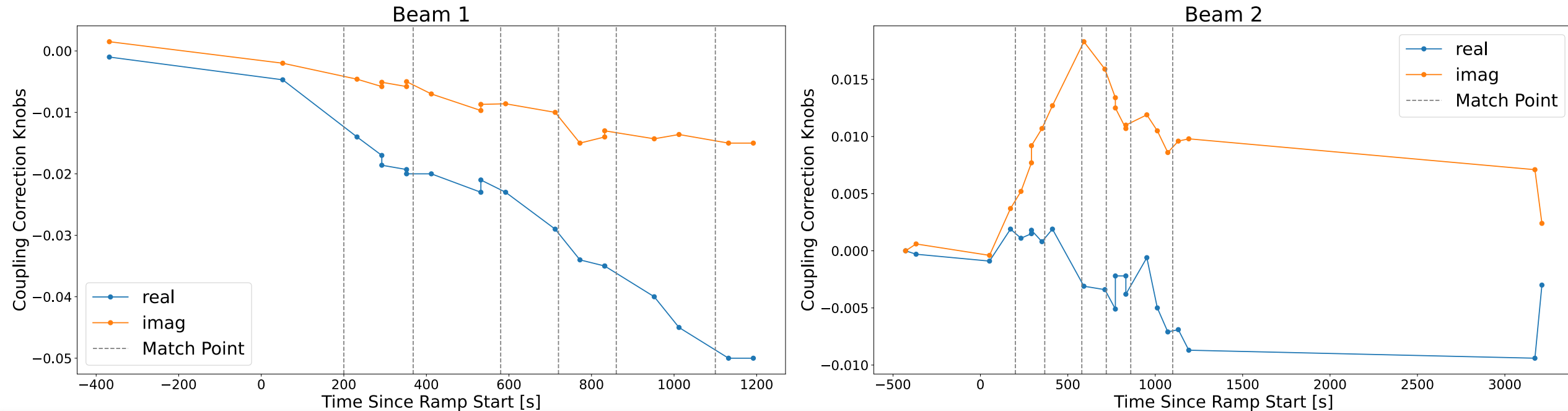


# Injection – Overall Takeaway

- Optics at injection have been relatively stable since 2021, and previous corrections keep the machine in within safety limits.
- The beta-beating and phase-beating post-corrections are a bit higher than last year, more so for Beam 2.
- Possible reasons for the observed difference:
  1. We were using different tune knobs than in 2021.
  2. The machine had been at injection for ~35h, there could be some b2 decay from the dipoles affecting the optics.

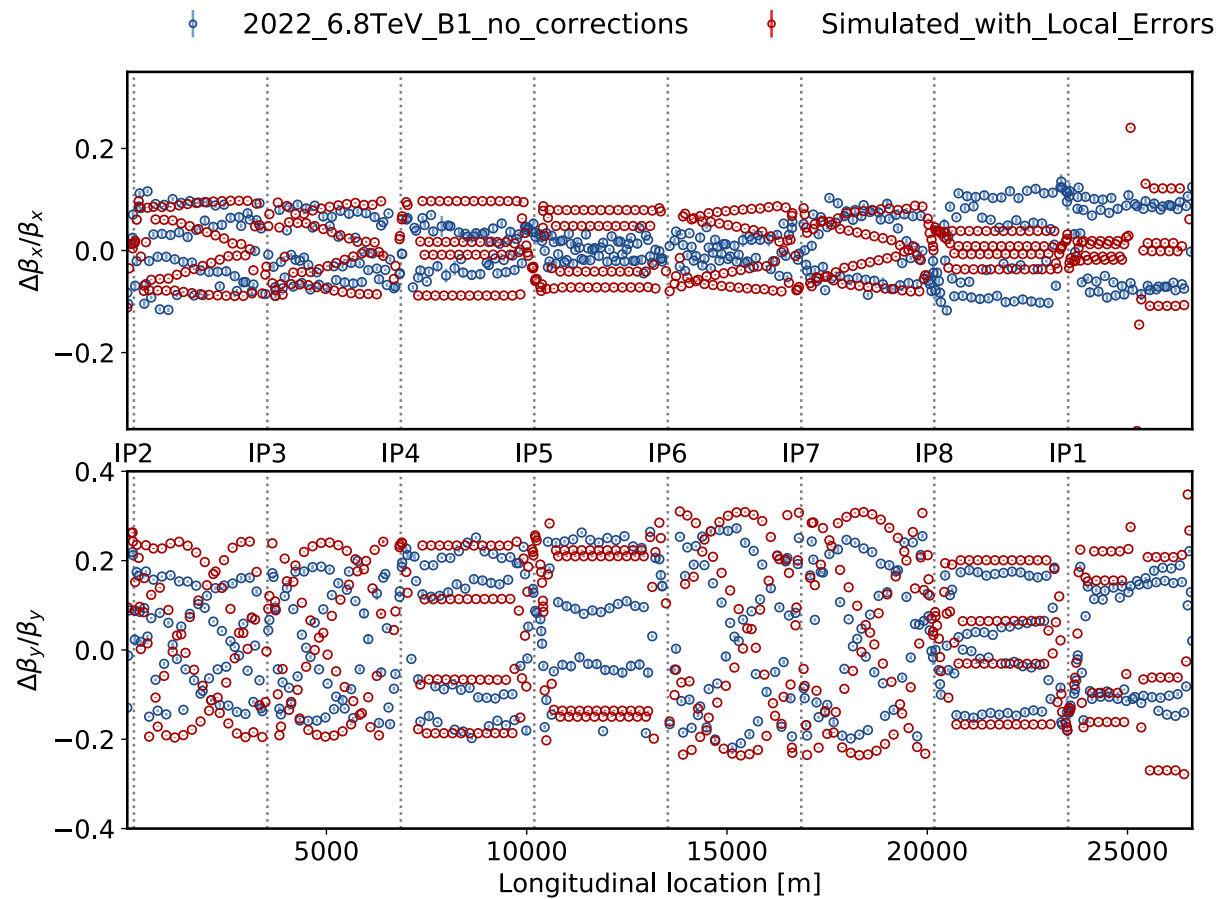
# Monday Ramp-Ups – Coupling in the Ramp

- On Monday we took some kicks in the first ramp and calculated coupling corrections.
- These were trimmed in for subsequent ramps where the measured  $|C^-|$  stayed  $\leq 5 \cdot 10^{-3}$ .

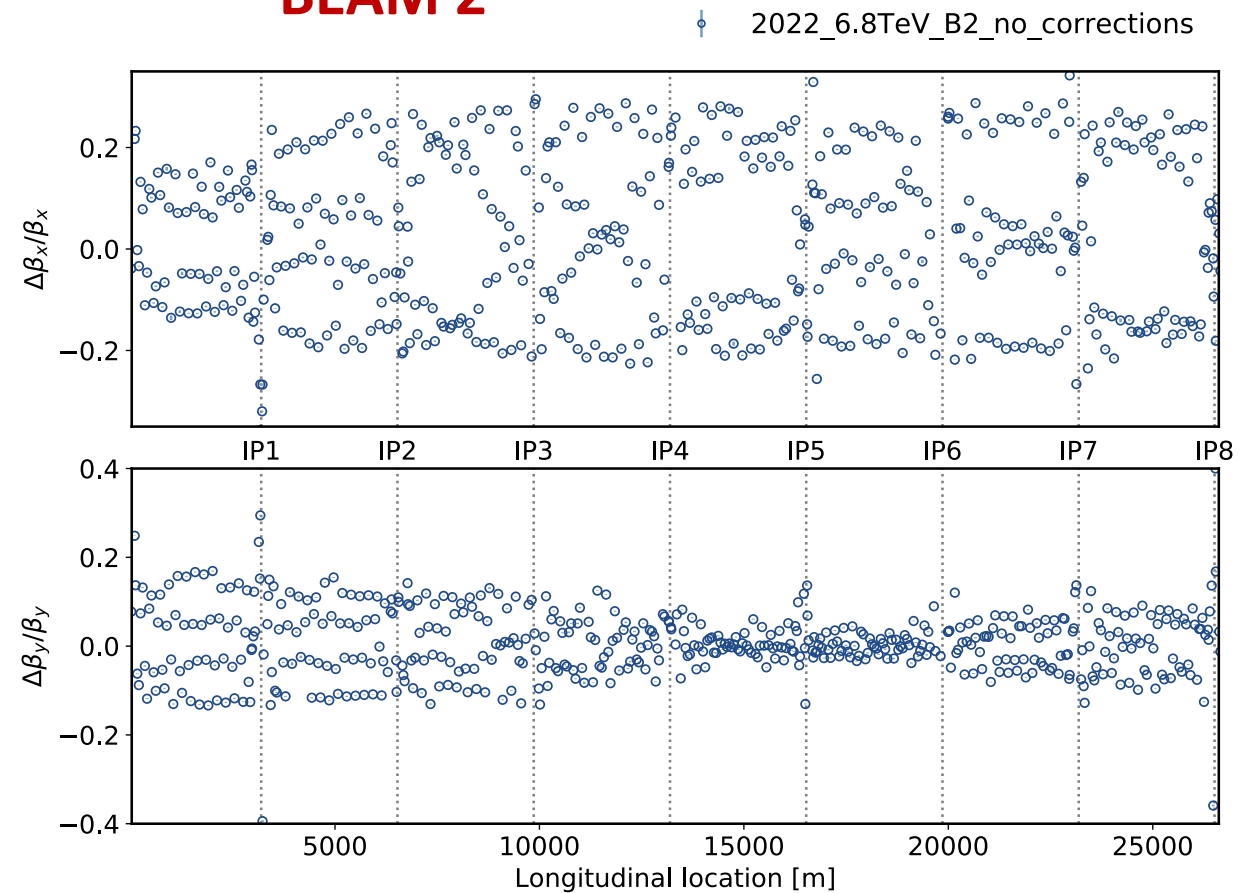


# Beta-Beating – 6.8TeV Flat Top

## BEAM 1



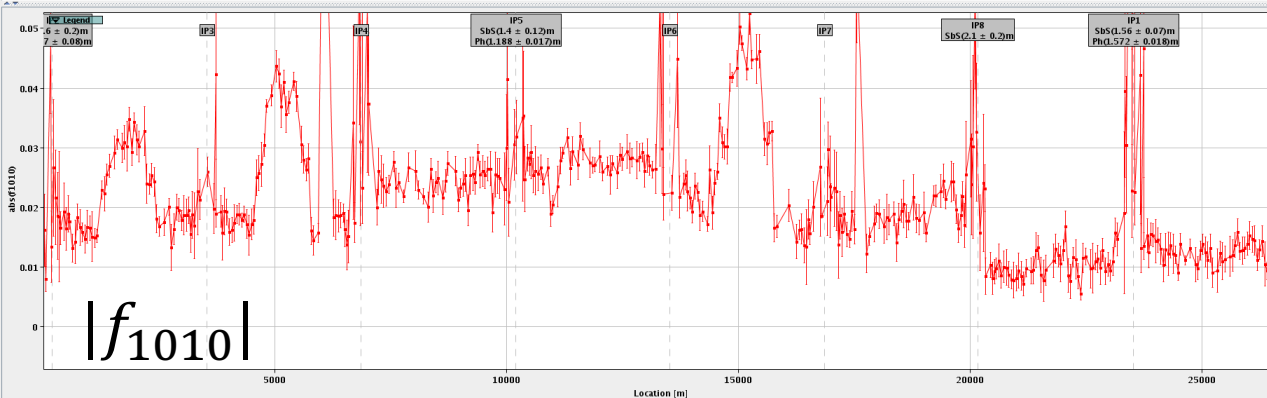
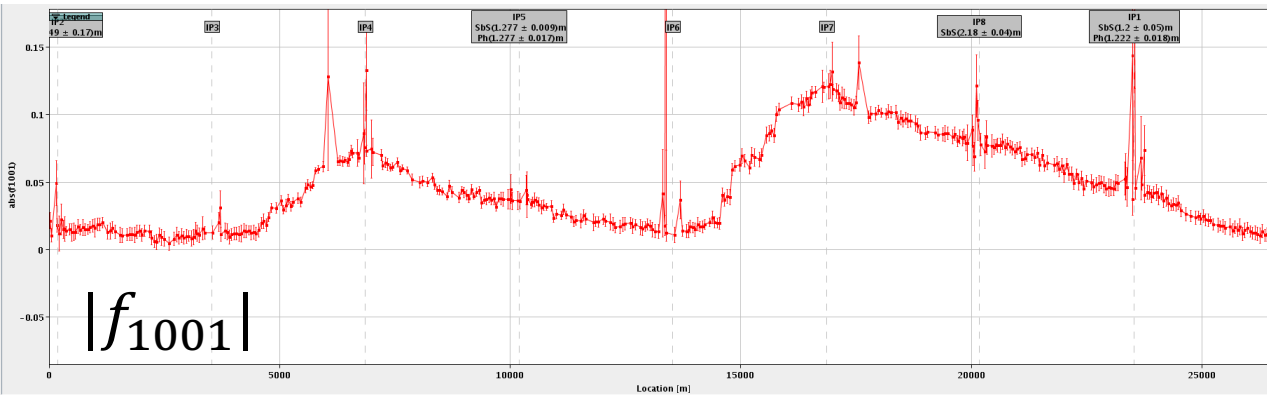
## BEAM 2



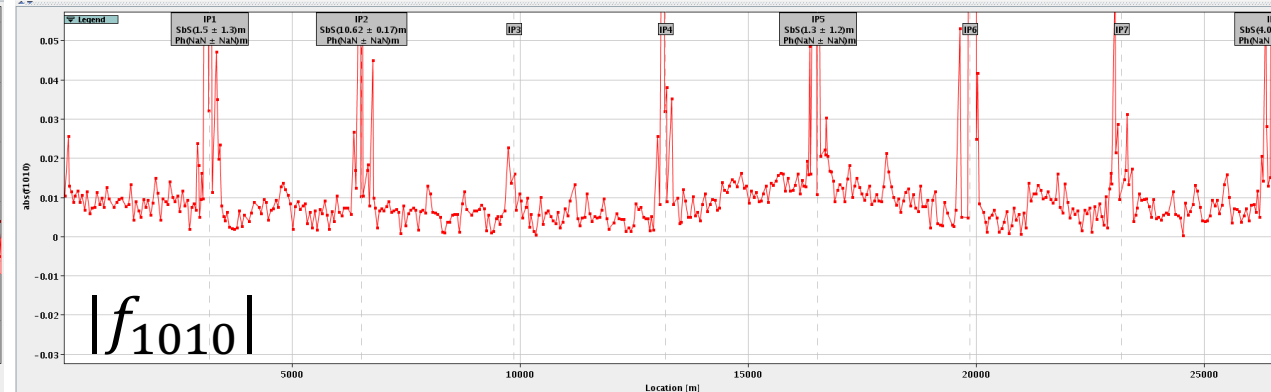
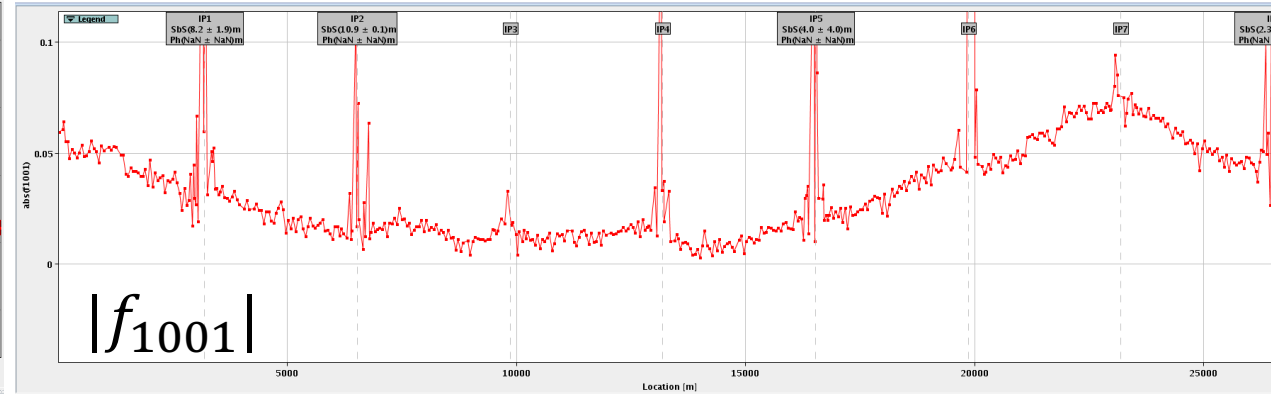


# Flat Top – Coupling RDTs

## BEAM 1



## BEAM 2



# Summary

- Optics at injection are ok!
  - Small differences could be investigated by measuring sooner after pre-cycle and reverting to old tune knobs (but purely out of academic interest).
- Coupling in the ramp is fine, could be fine-tuned when local corrections are in.
- Flat top beta-beating is as expected for un-corrected, but local errors seem different from 2018.
  - Cf. F. Carlier & J. Keintzel's presentation.

