LHC Injectors Upgrade

Transverse Measurements with high intensity 25ns beam in the recent MDs in SPS

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LIU beam performance meeting, 31 July 2018

CERN

Overview

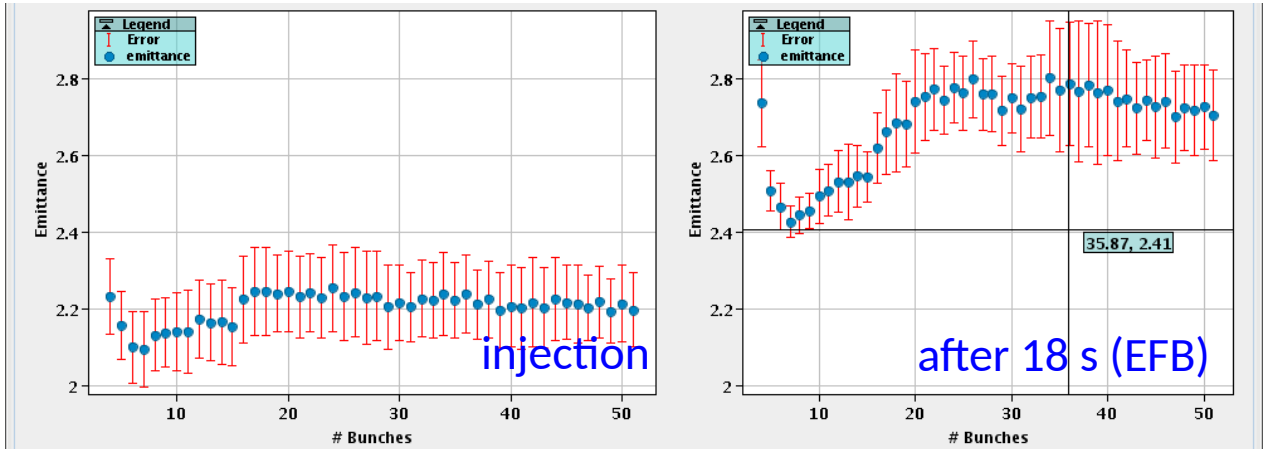
- **Evolution of the transverse blowup during 2/3 June mini scrubbing run**
  - Wirescans + BGI to investigate blowup evolution at flat-bottom
  - Blowup dependency on the horizontal chromaticity.

- **Thursday MDs in the past months with high intensity 25 ns BCMS beams**
  - MD on flat bottom for studying losses and instabilities
  - To study long-term evolution of emittance growth along long flat bottom for first 48 bunches
  - To study the evolution of transmission

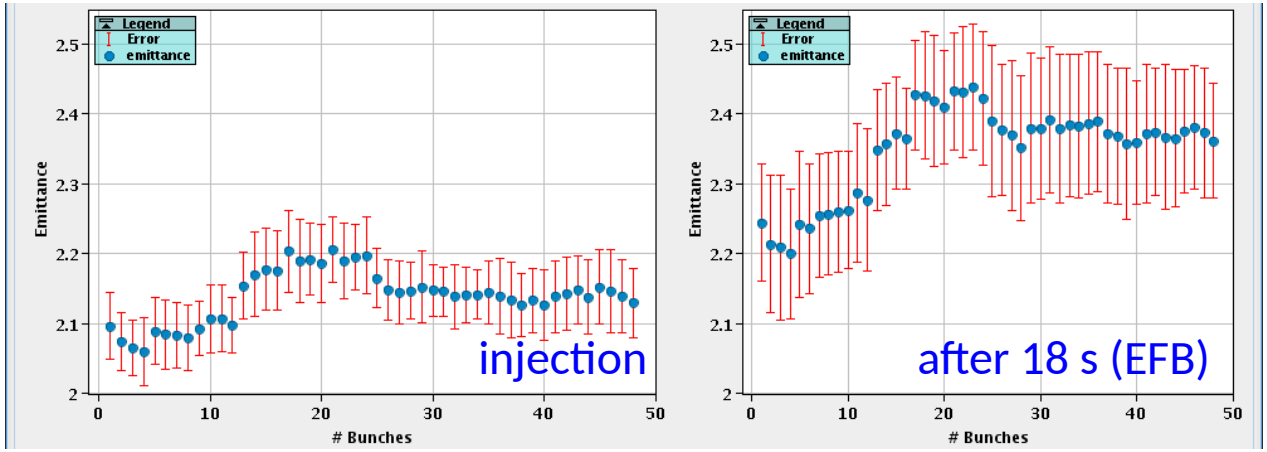
First emittance observations on long cycle

- **Thursday MD block on May 31st**
  - 20 s flat bottom cycle (“scrubbing cycle”)
  - 48 bunches of BCMS beam with 1.9e11 p/b injected
  - Clear transverse emittance growth along flat bottom with **e-cloud pattern** along the batch

Horizontal:



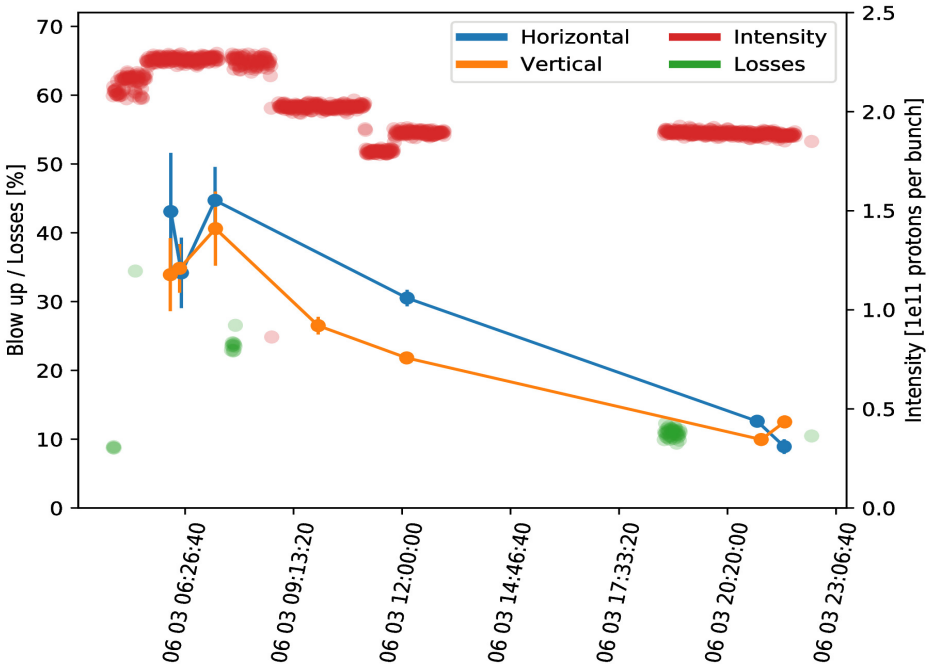
Vertical:



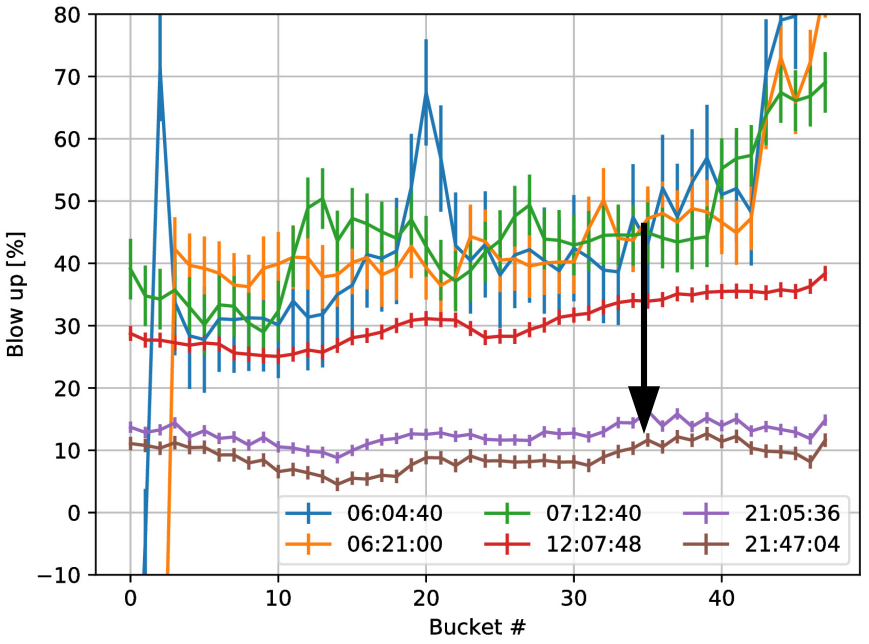
Mini scrubbing run over the weekend

- **Alternating high intensity BCMS beam with 4 batches with other activities**
- **Regular emittance measurements for 48 bunches for monitoring evolution**
  - Clear improvement observed

Average blowup:



BBB horizontal blowup:



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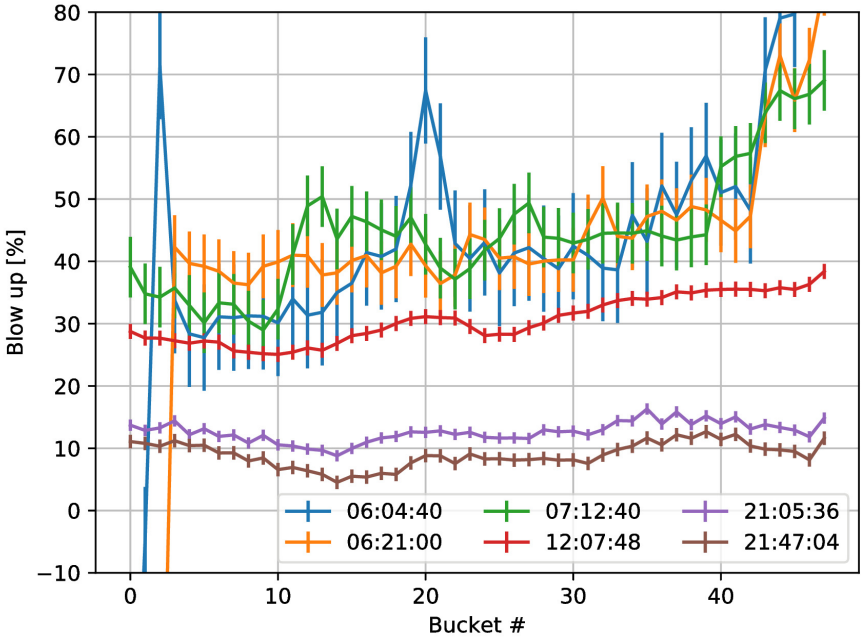
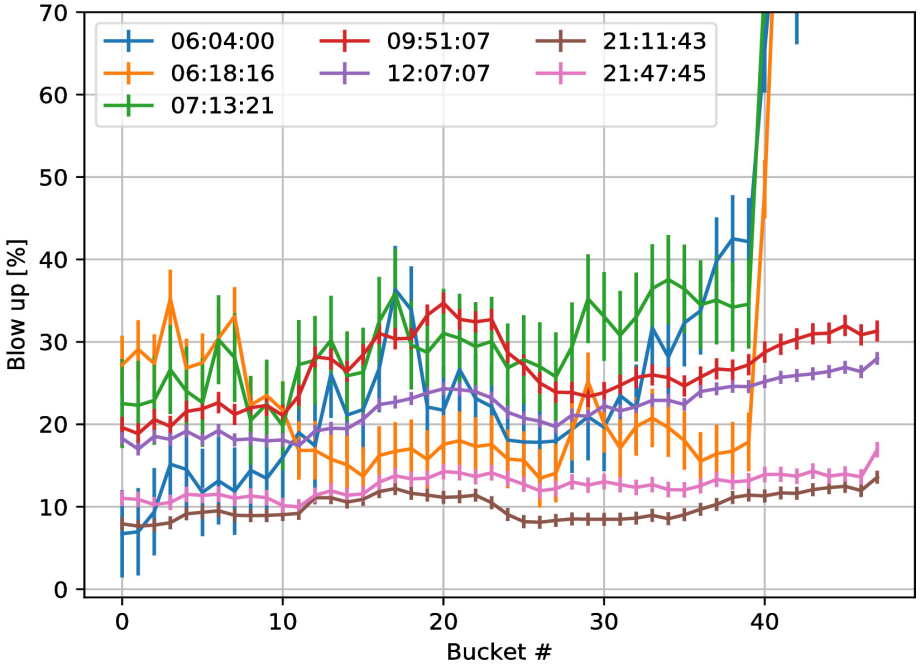
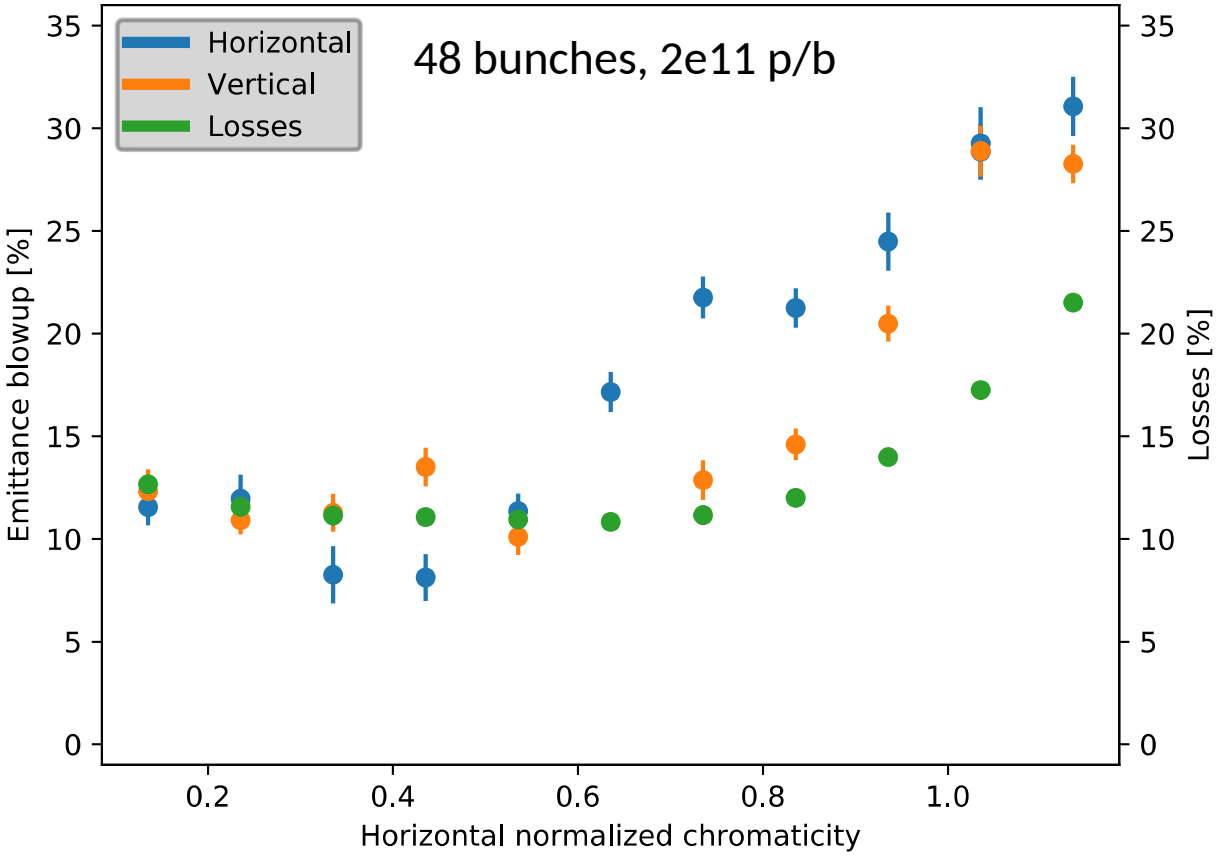


BBB vertical blowup:



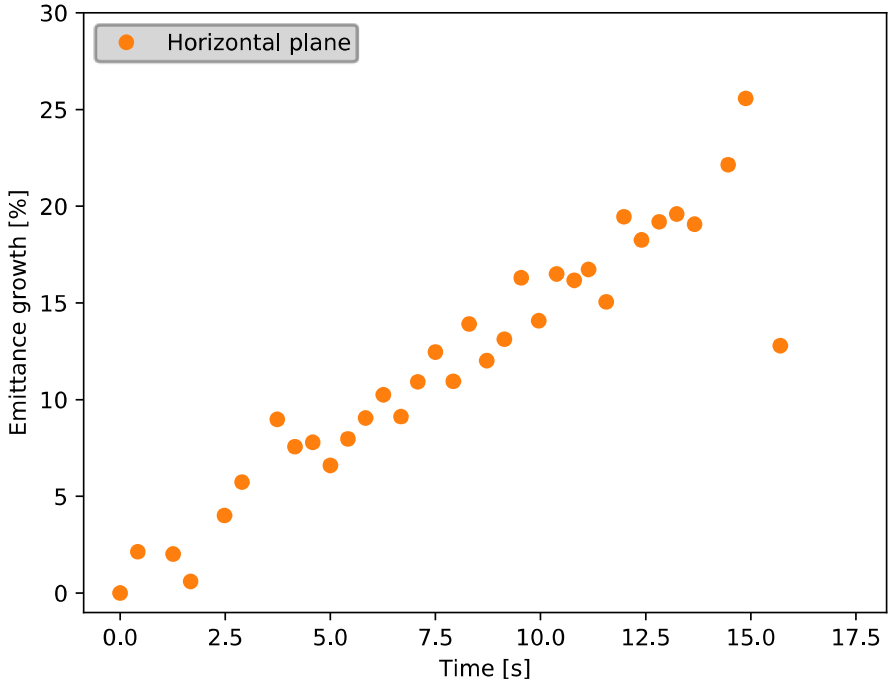
Dependence on horizontal chromaticity

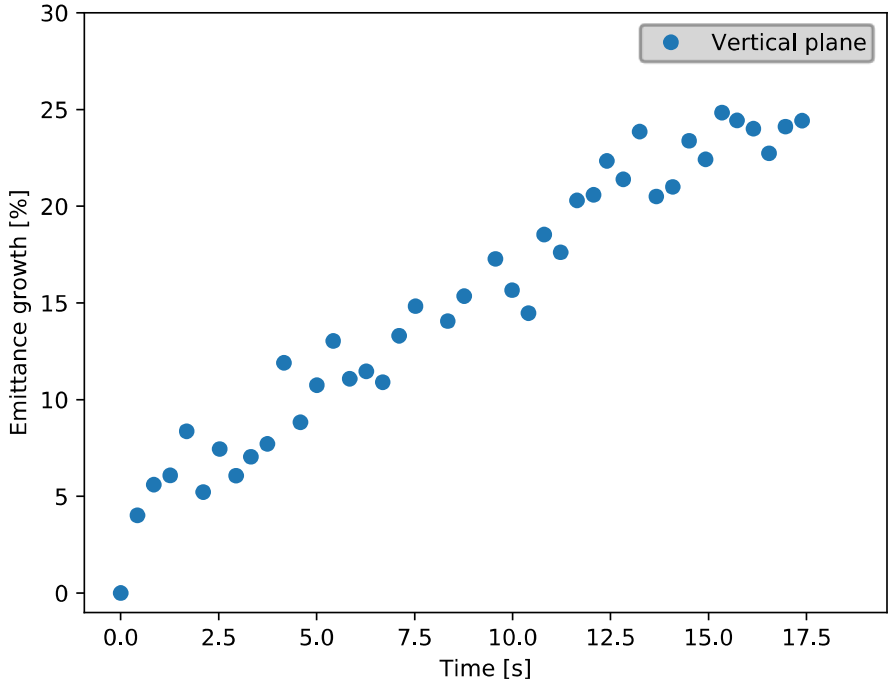
- **Horizontal chromaticity has clear impact on**
  - losses (as seen in the past)
  - transverse emittances in both planes – to be understood



Emittance growth along flat bottom

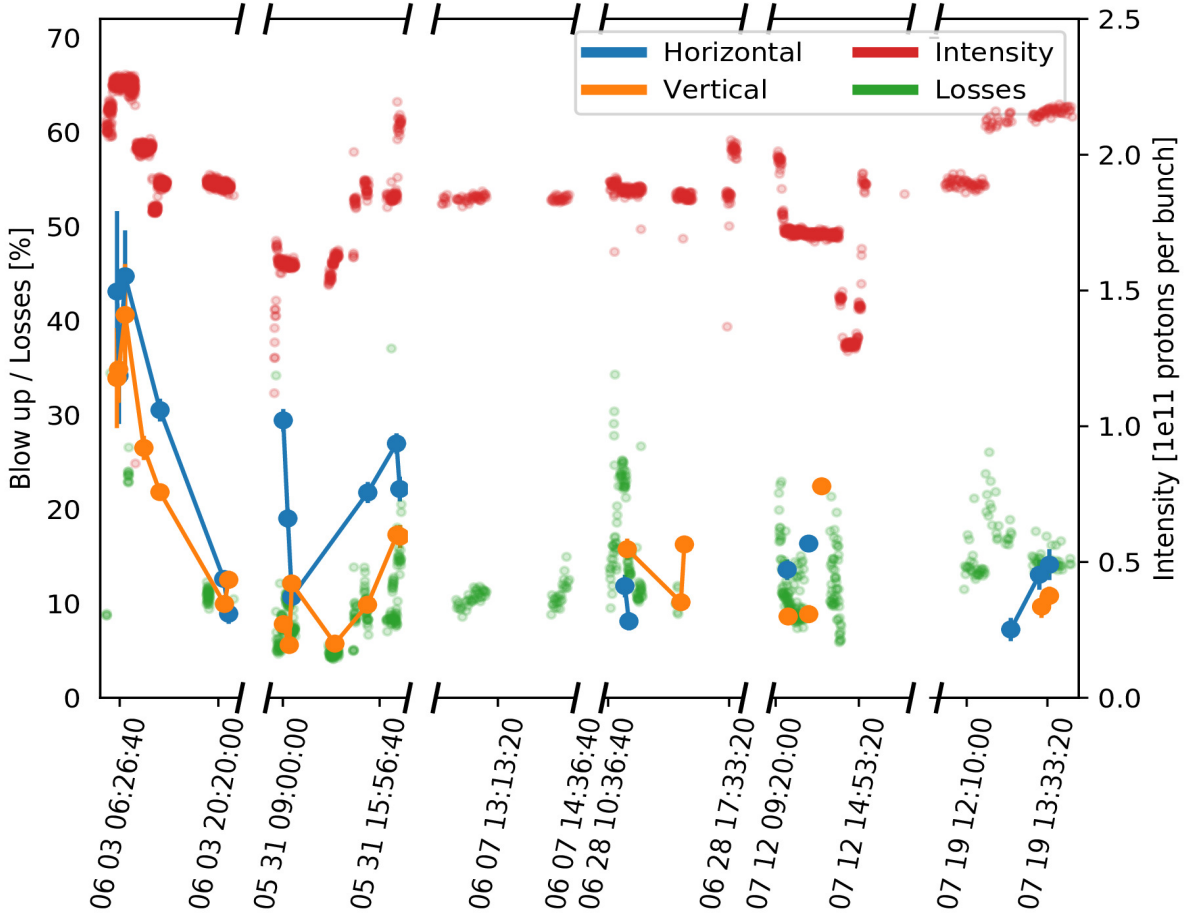
- **First results from BGI**
  - Measurement example for ~2e11 p/b injected
  - Emittance growth appears to be continuous
  - Optimization of BGI settings with BI expert ongoing





Transverse emittance blow-up evolution

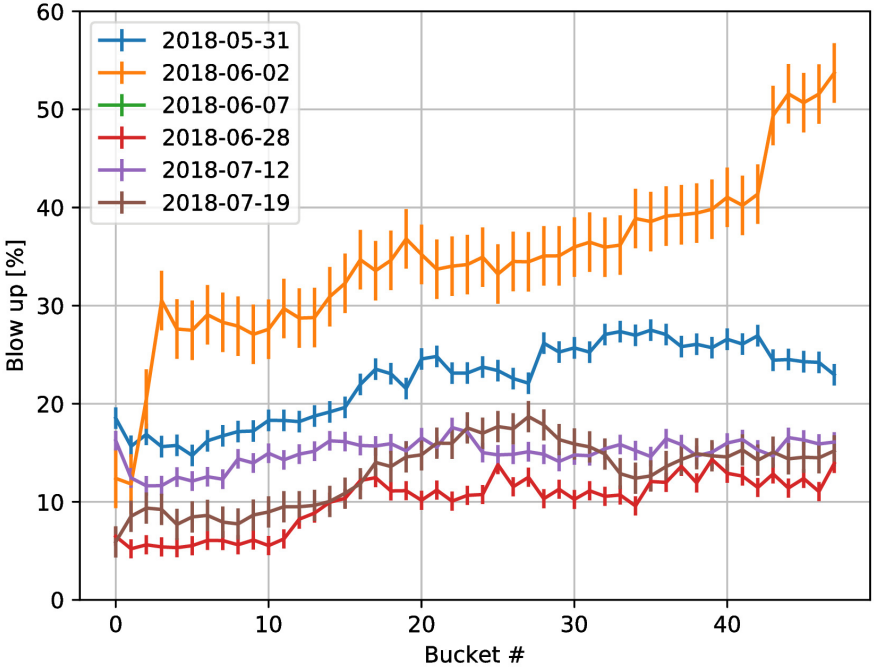
- Only first injection (48 bunches) of BCMS beams selected for blowup
- Only BCMS 48 bunches beam selected for losses



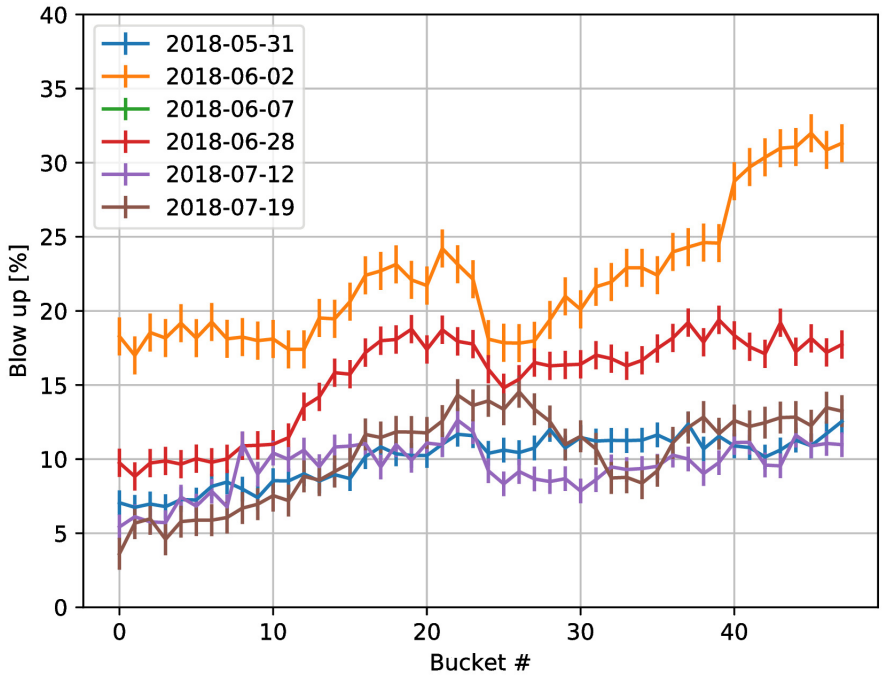
Transverse bunch-by-bunch blow-up evolution

- **Averaged over all the measurement acquired during the same MD**
- **A electron-cloud like pattern is visible in the early MD**

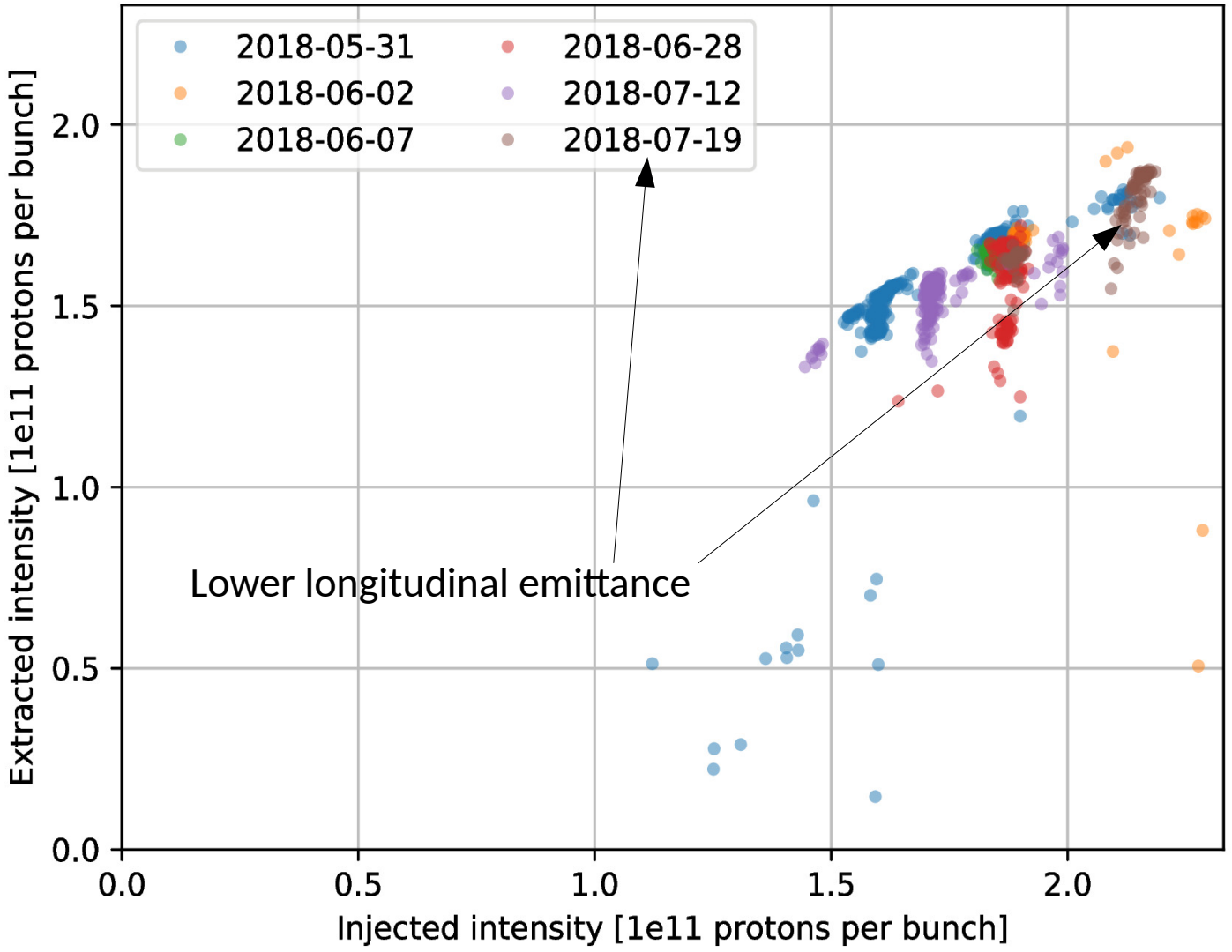
horizontal:



Vertical:



Extracted vs injected intensity



Summary & Outlook

- **Summary**
  - Initially very strong transverse emittance growth – significantly reduced after a weekend of scrubbing with 4 batches (“mini scrubbing run”)
  - Bunch-by-bunch wire-scanners observations suggest an electron-cloud like blowup mechanism
  - Horizontal chromaticity effect on transverse blowup has been confirmed
  - No major transverse blowup improvement observed during MDs after the initial mini-scrubbing run
  - Possible improvement in extracted intensity for lower longitudinal emittance beams