Plan for 2018 optics commissioning

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on behalf of

the **O**ptics **M**easurement and **C**orrection (**OMC**) Team

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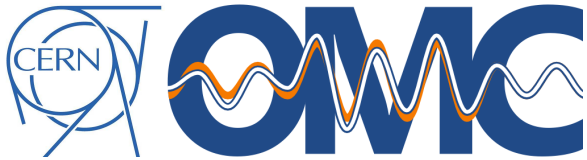
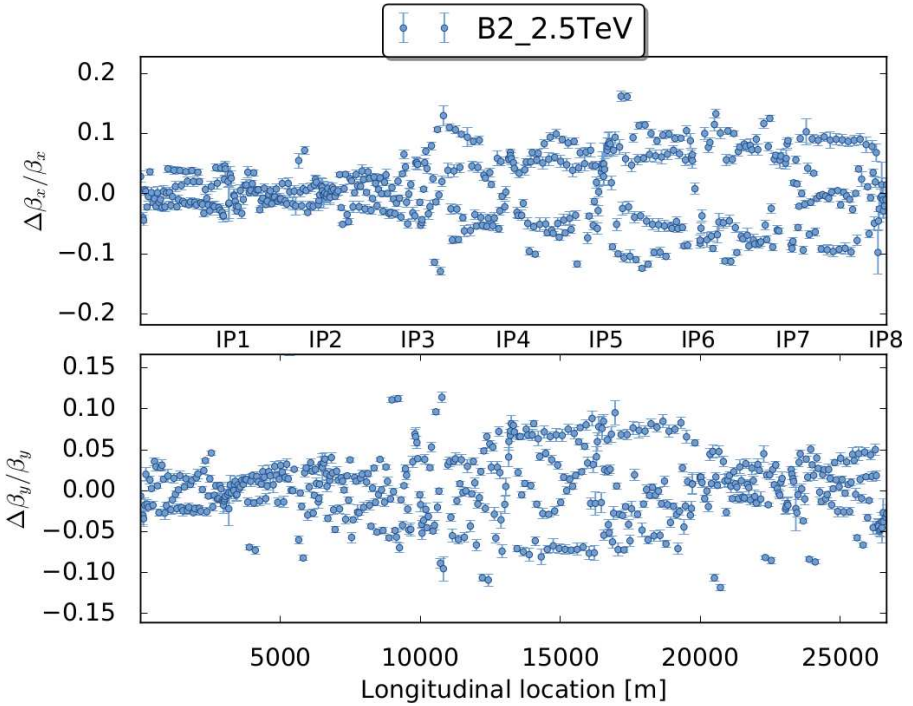


Injection/Ramp

- **Normally optics correction @ inj' trimmed out linearly to end-of-ramp**
- **2.5TeV commissioning had good $\Delta\beta/\beta$ above $2\,\mathrm{TeV}$ without correction**



- Start with existing corrections incorporated:

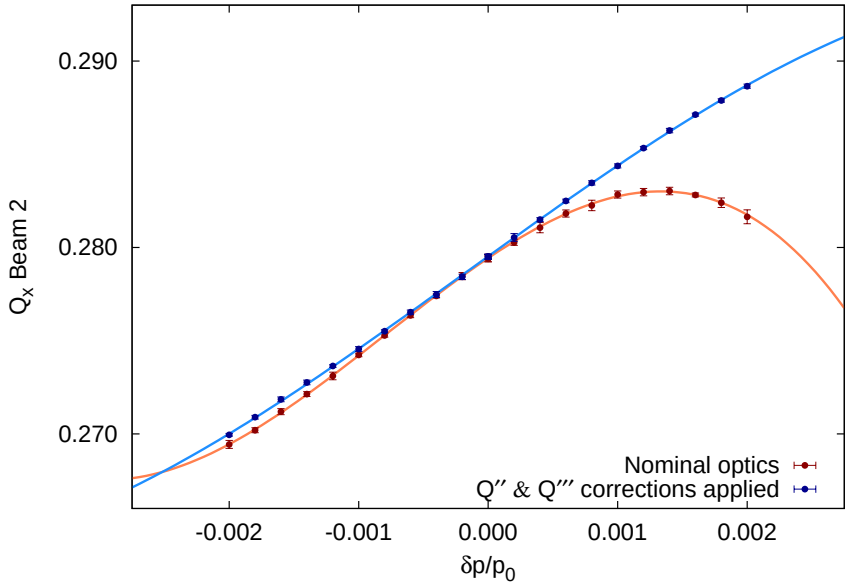
  LHCBEAM/B[1,2]_ATS_2016_injection_globcorr

  (*2017 re-used injection correction from 2016*)

- **Injection corrections to be trimmed out at $2\,\mathrm{TeV}$**
- Only iterate if observe large beta-beat at injection

Injection/Ramp → Proposal to stop using MCO circuits

- Beam-based correction for Q'' & $\frac{\partial Q}{\partial J}$ implemented @ inj' since 2015
- Clear deterioration in 2016-2017 as MCO circuits lost



- **At injection effect of removing MCO correction $\sim 10\%$ of MO tunespread used in 2017**
- **Expect MCO give a few percent of MO tunespread at $6.5\,TeV$**
- **Plan to operate without MCO at injection. Remove MCO entirely?**

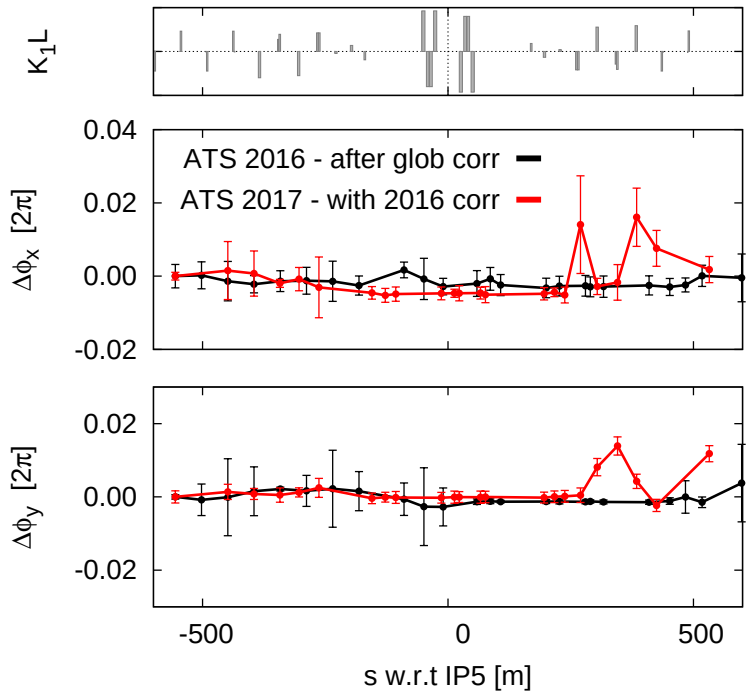
→ NL-chromaticity & amplitude detuning measurements at injection/end-of-ramp to provide validate & provide baseline to HSC

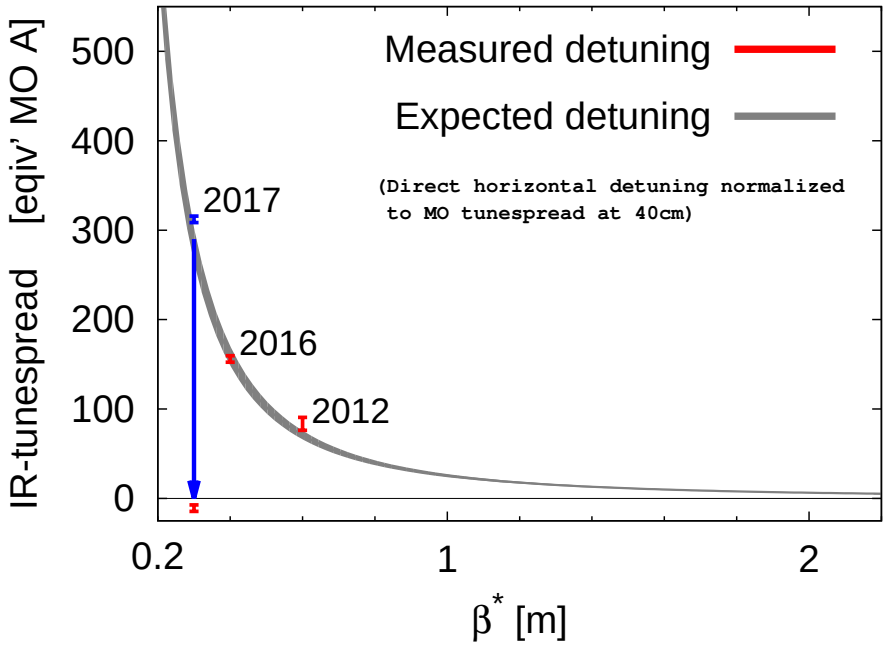
Injection/Ramp $\longrightarrow$ 1-shift

Squeeze

Exact strategy depends on what we find during the squeeze, but basic principles:

- Propose to start with crossing-angles applied
- Start with all linear and nonlinear corrections from 2017 incorporated
  (*except* **LHCBEAM/2017_NL_IR1_30cm_kcssxr1**, *to be incorporated as other IRNL knobs*)
- Aim to avoid touching $\beta^* \geq 30cm$ unless absolutely necessary

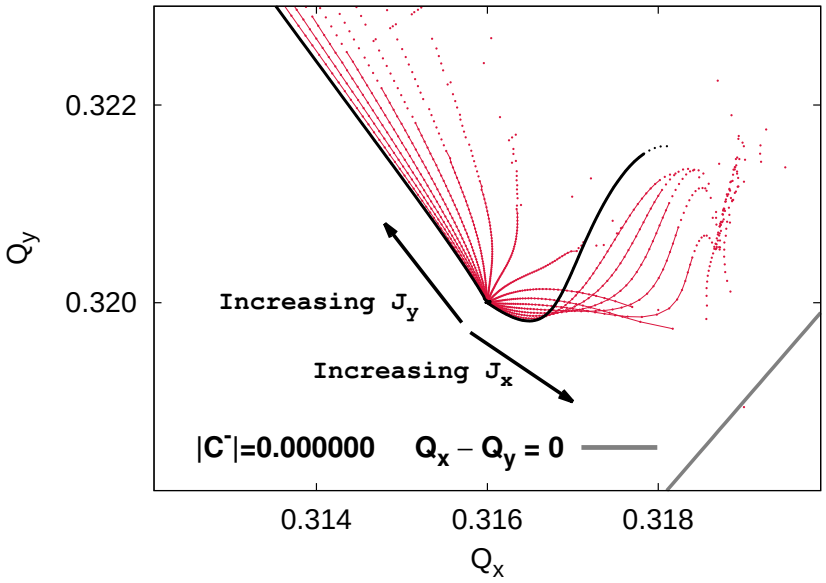


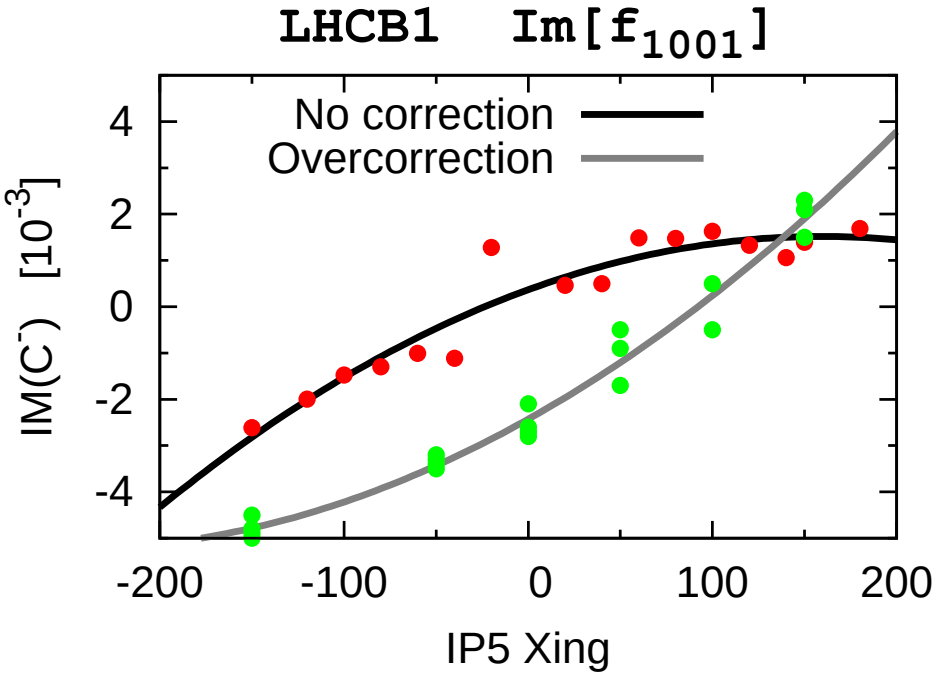


Some iteration of linear optics corrs may be necessary at 30cm or below

Squeeze

New for 2018: aim to correct $a_{3,4}$ in IR5





- **a_4 distorts footprint potentially affecting Landau damping**
  $\rightarrow$ Currently uncorrected in IR5

- **a_3 in IR5 feeds down to $|C^-|$**
  $\rightarrow$ Currently uncorrected in IR5
  $\rightarrow$ Expect up to 4×10^{-3} at 25cm (for $\Delta\theta = 150\mu rad$)

Squeeze → 5-shift (ideal case), 6-7 shift (with deterioration)

- **1-shift:** Linear revalidation of flattop to 30cm (with X'ing angles)
- **0.5-shift:** revalidation of existing NL-corrections at 30cm

  → *30cm aperture measurements can progress as soon as 30cm linear/nonlinear optics revalidated*

If 2017 state is preserved can progress to smaller β^*.

Otherwise +**1-2 shift @ 30cm** *to implement new local/global/NL- corrections*

(*comparable to time required for 2017*)

- **1-shift:** Linear commissioning at 27cm & 25cm with X'ing angles

  → *iteration of local/global corrs to be applied ontop of 30cm knobs*

- **1-shift:** Correction of a_4 in IR5. First measurement of a_3 in IR5

  →*1-2 day gap to analyse NL-data & find corrections*

- **0.5-shift:** Correction of a_3 in IR5

  Incorporation above 80cm. Can't be merged with next shift as need new cycle for coupling

- **1-shift:** Compensation of linear/chromatic coupling through cycle.
  Final optics checks/global corrections to 25cm with all NL-corrs

Final tasks: IR4 K-mod → 0.5-shift

OMC strategy & timeline will depend on what we observe at 30cm.

If good optics quality from 2017 is preserved can gain significantly.

Otherwise we will be in a situation comparable to 2017 commissioning.

Total (good 30cm config) $\longrightarrow$ 6.5-shift

Total (significant deterioration) $\longrightarrow$ 8.5-shift

Could incorporate AC-dipole aperture measurements into nonlinear shifts for RDTs and amplitude detuning if it helps gain time