ALICE luminosity range and trims
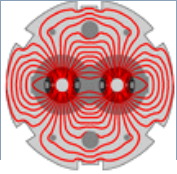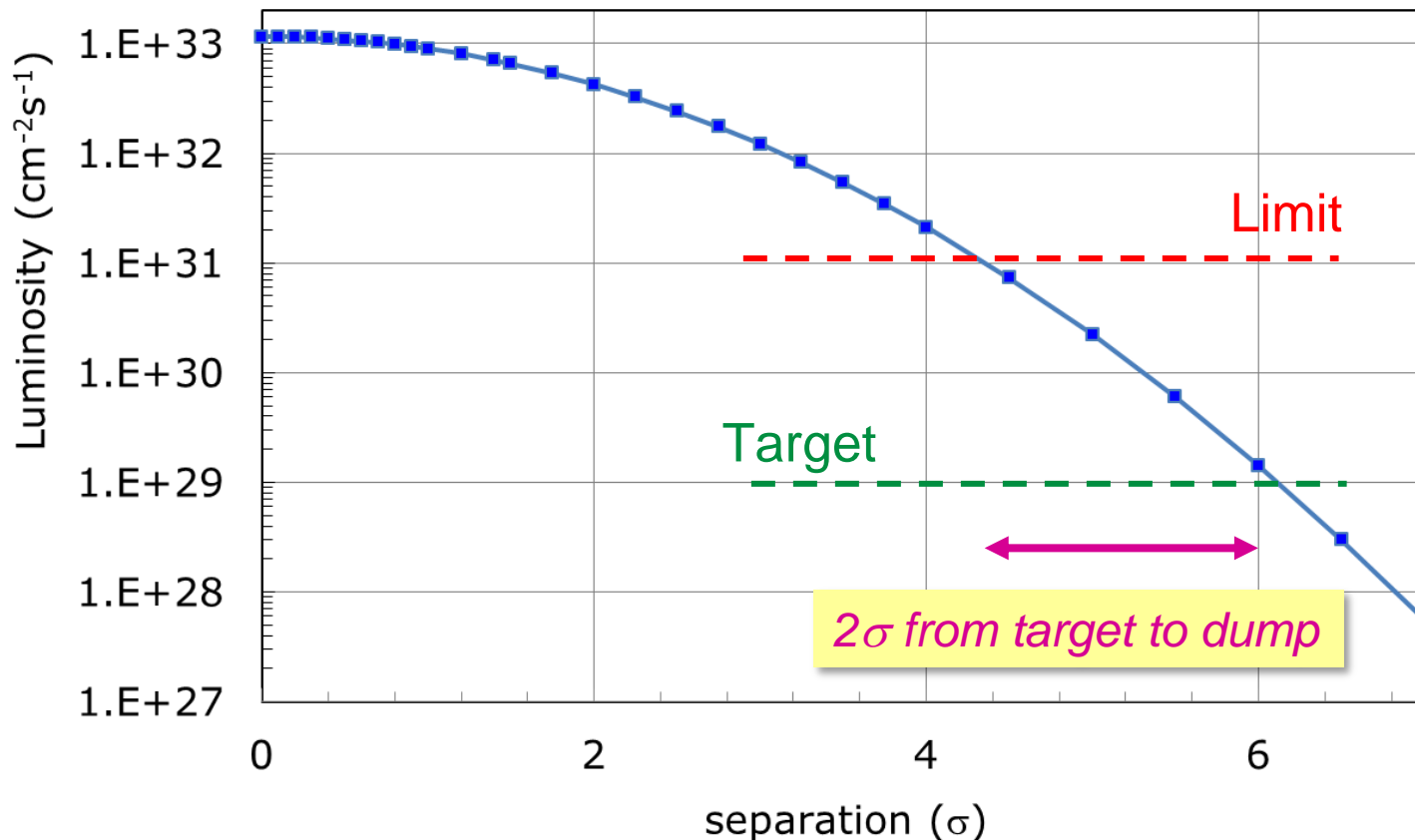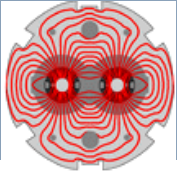
J. Wenninger

❑ Luminosity in ALICE versus total separation of the 2 beams, 6.5 TeV.

  ○ *Parameters: N=1.2×10^{11} p, ε = 2 μm, β* = 10 m $\Rightarrow$ σ = 54 μm*

ALICE offset levelling

Limit

Target

2σ from target to dump

- ❑ With $\sigma \sim 50 \ \mu$m the 2σ margin between the target and the dump luminosity corresponds to a movement of 1σ for each beam.
  - ○ *Trims are always symmetric (+ most pessimistic for protection).*
  - ○ *A trim of 50 μm / beam brings us to the limit !!*

- ❑ Those numbers are based on Gaussian profiles, and we know that 'out there' the tails are overpopulated.
  - ○ *In practice the margin smaller !!*

- ❑ The game is complicated further by the fact that as the lumi decays during a fill, we must move the beams closer (and not dump !).
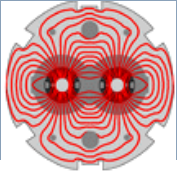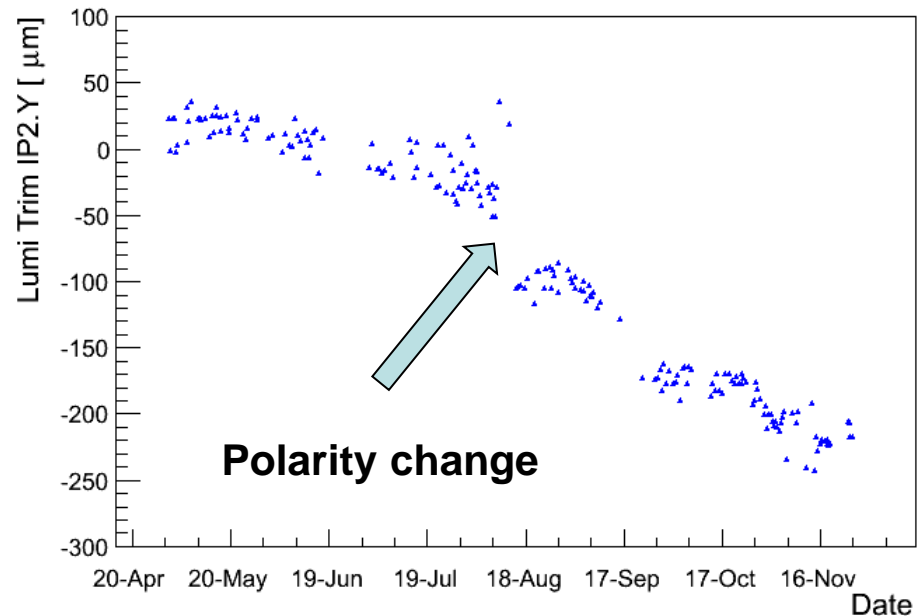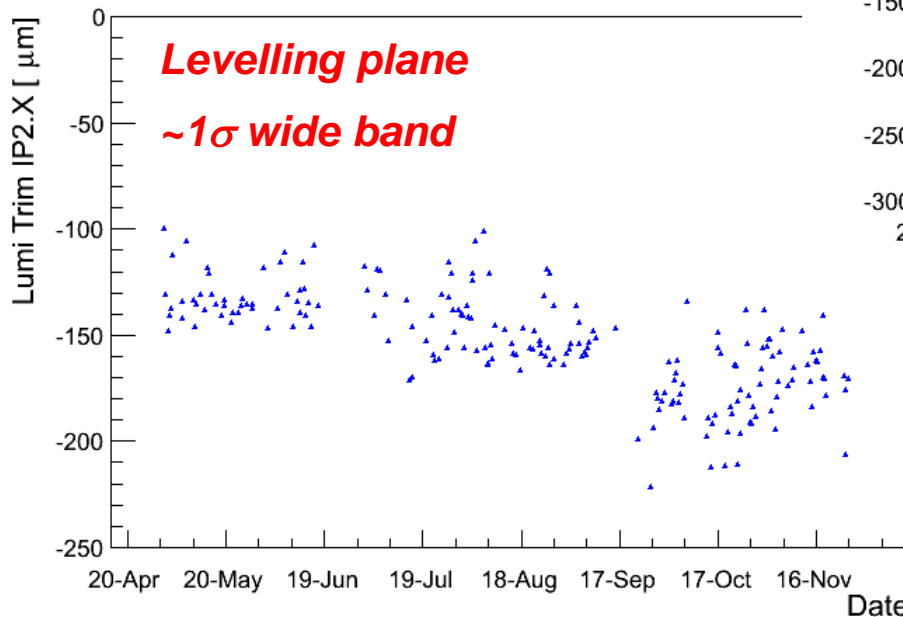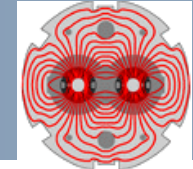
❑ Evolution of the luminosity knob settings in 2012, σ ~ 40 mm, β^* 3 m.
  o *In some periods L was leveled (H plane !).*
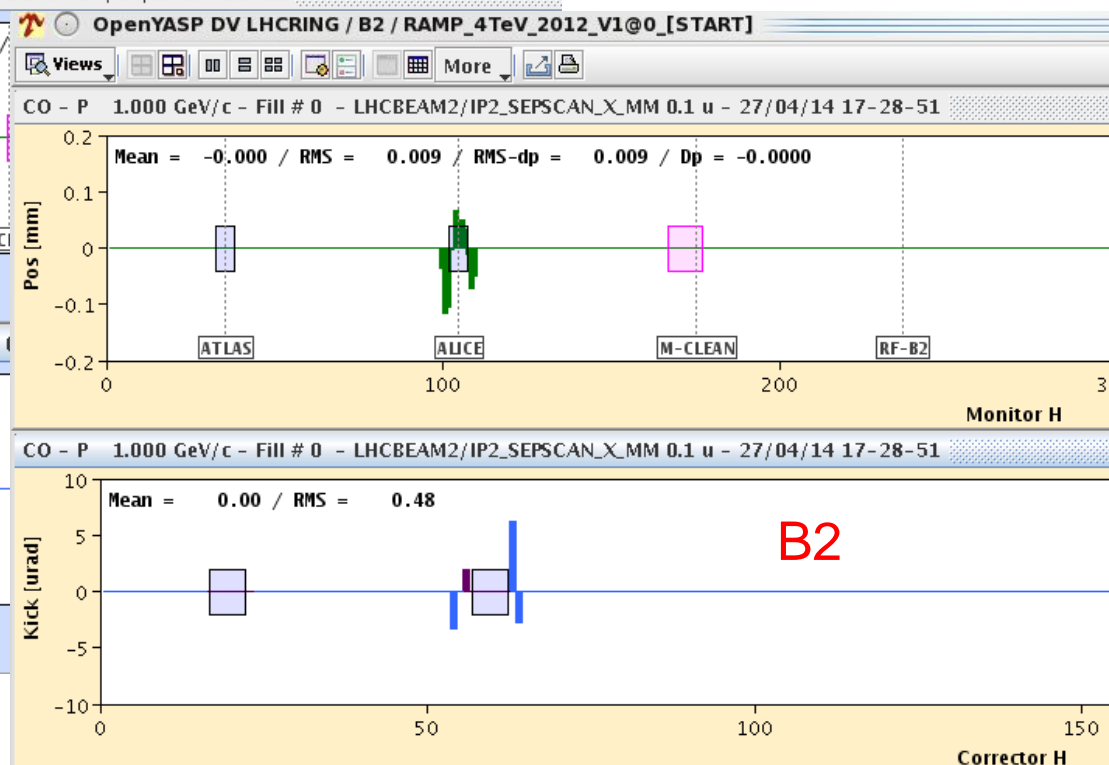 o *Target L was not always the same.*

In both plots → B1 trims

B2 trim = - B1 trim

Levelling plane

~1σ wide band

Polarity change

ALICE luminosity issues

5/15/2014

4

A 50 μm trim…

❏ A 50 μm trim of the lumi-scan knobs at β* 10 m corresponds to:
  o *Max orbit excursion ~0.12 mm.*   *2012 interlock at ± 0.6 mm*
  o *Max deflection ~6 μrad*   *2012 interlock at ±15 μrad*

ALICE luminosity issues
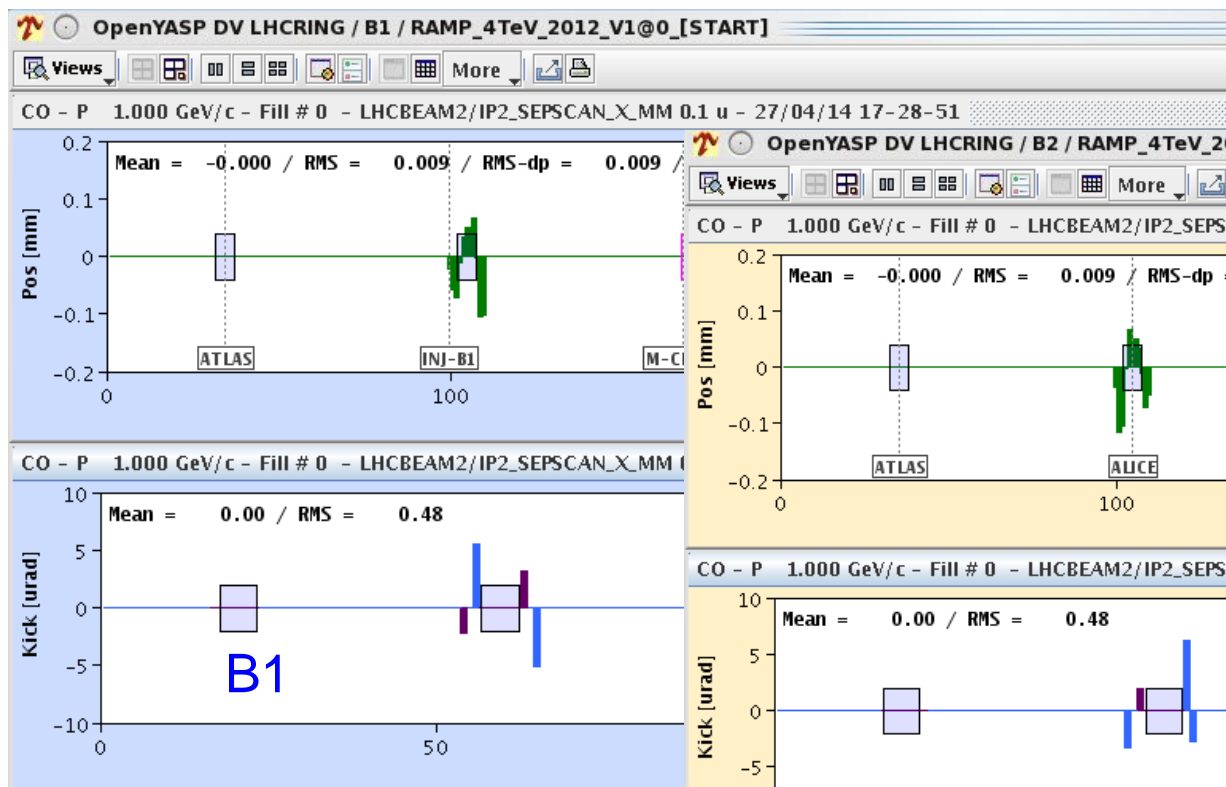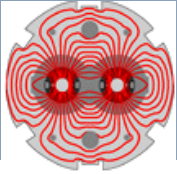
- ❑ The fill-2-fill fluctuations of the orbit corrector settings (OFB corrections) require a margin of ~6-10 μrad.
  - o *→ defines the ~±15 μrad corrector margins used in 2012.*
  - o *Margin depends in practice on the location in the ring, more stable in non-squeezed and arc regions → could be good for ALICE.*
- ❑ With an interlock set to 12 μrad one can protect against L values larger than ~10^{32} cm^{-2}s^{-1}.
  - o *Maybe a bit high, but better than nothing – for L scan knobs.*
  - o *With some (good) experience one could possibly tighten…*
  - o *Cannot protect against all global orbit corrections.*
  - o *Cannot protect against features appearing on the orbit when going into collision as pattern of corrector changes may not hit the limit.*
- ❑ Going into collision could be 'protected' by applying a large initial offset (to 6-8 sigma) and then moving back gently until some L found.
  - o *Will cost ALICE some time in a fill.*
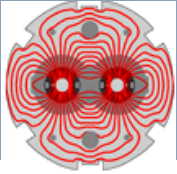
❑ Once the typical range is know, one can also set limits within LSA on the trim range of the lumi scan knobs.

  ○ *But this is a soft protection.*

  ○ *This will also prevent VdM scans and special fills etc → expert intervention is required before and after!*

  ○ *I do not really recommended this.*

❑ Once the leveling has started on a given fill it is of course possible to set a limit on trims.

  ○ *Does not cover going into collisions.*

ALICE luminosity issues

5/15/2014

Summary
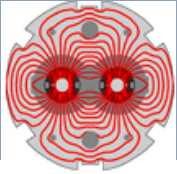
❑ Some protection possible (but not for all cases) with limits on the leveling, large offsets when colliding at the start of the fill and interlocks on correctors.

❑ An interlock on the BCMs should nevertheless be in place to cover more thoroughly the phase space.

ALICE luminosity issues

5/15/2014