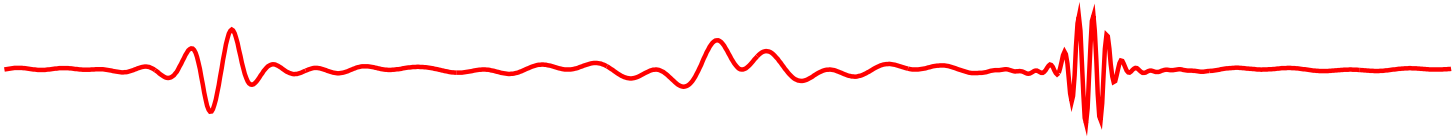
First thoughts on triplet BPM requirements for optics measurements in HL-LHC



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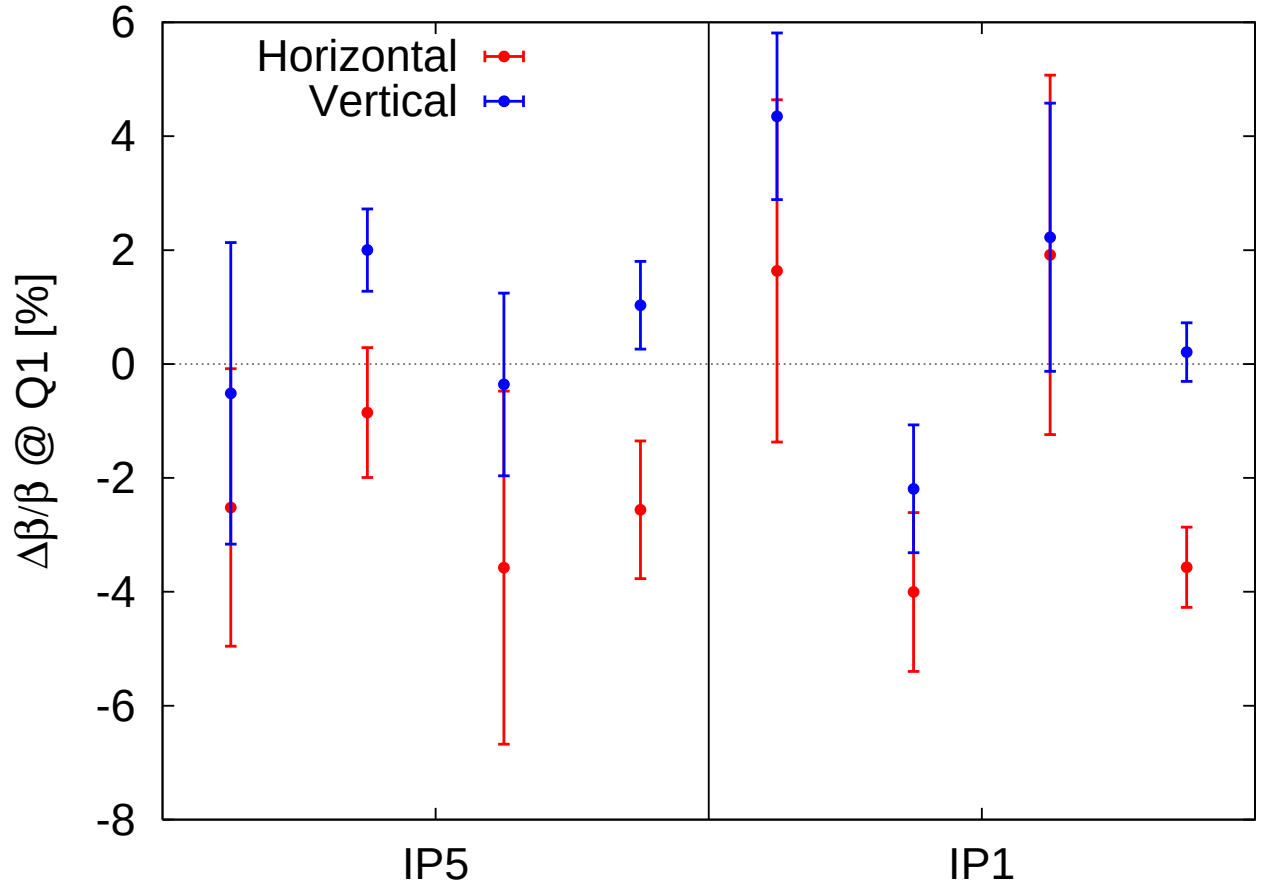
LHC triplet optics measurements

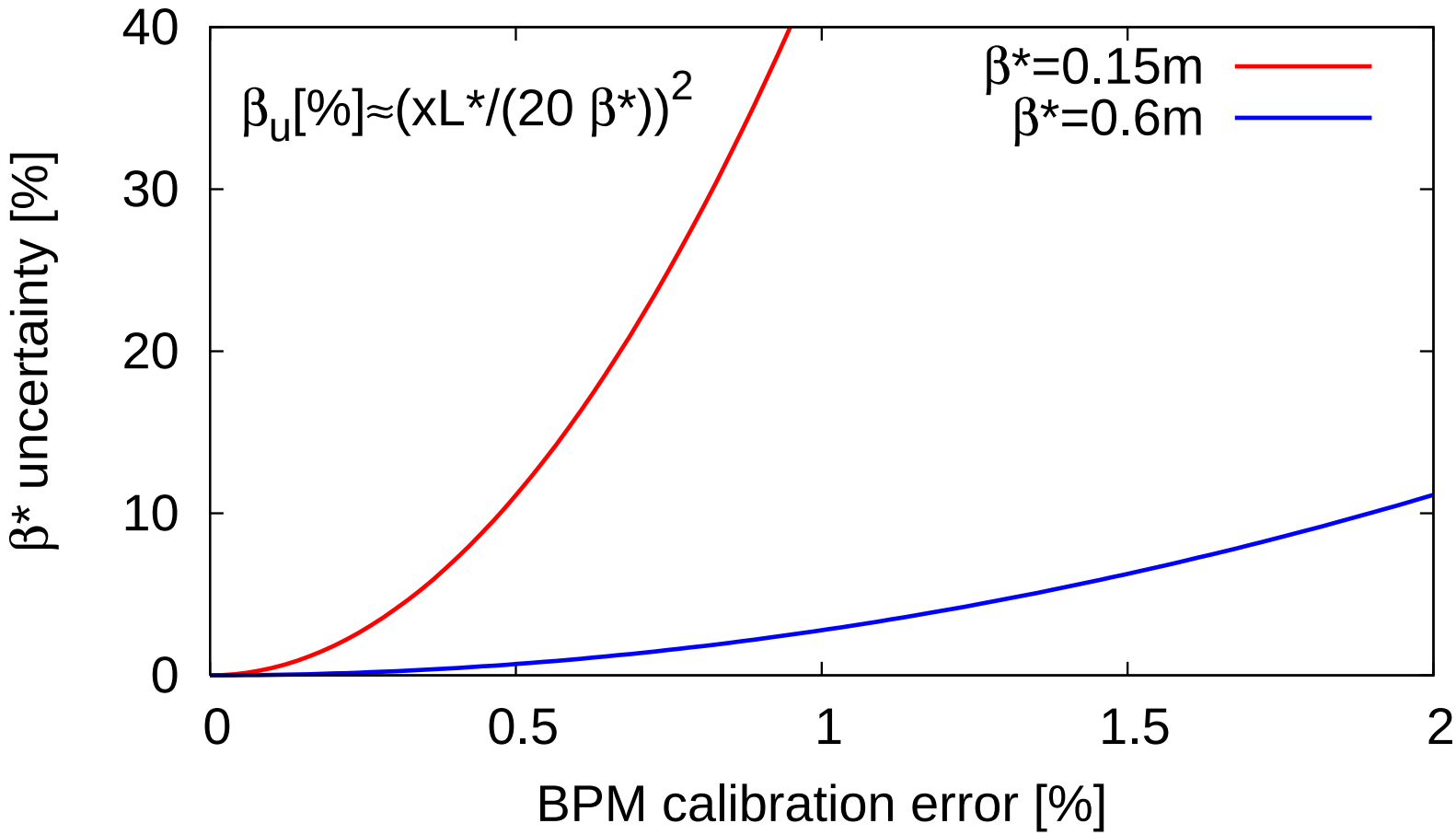
- Currently the triplet BPMs are not used for optics corrections since:
  1. Amplitude calibration is not reliable enough.
  2. Phase advance is insensitive to β variations and errors in the triplet for $\beta^* \lesssim 1$m.
- K-modulation provided β functions at Q1s, but resolution was not good enough for β^* determination

K-modulation in Q1 quads (β^*=60cm)



β-beating below 5% at Q1s. Resolution of few % is not enough for a β^* measurement (IP1/IP5 luminosity imbalance $\approx$0).

β^* uncertainty using BPMs



Approximation assuming no correlation between the two BPMs next to IP.

Summary - Measurement

- For BPMs to be usable for triplet β measurement a caibration error of 1-2% is needed
- Advantage of using BPMs is measurement speed compared to K-modulation
- BPM suggested locations:
  1. in between Q2a-Q2b and non-IP side of Q3 for aperture optimization
  2. in IP side of Q1 for β^* measurements
  3. in between Q1 and Q2 and Q2b-Q3 for statistics (not critical)

Summary - Correction

- Goal is to reach β^*=0.15m
- Simulations with realistic imperfections and given BPM set-up should validate correction methods (LHC Run I, β^* knobs, etc.)
- Experimental tests:
  1. Exploit DOROS in Run II
  2. Fast K-modulation
  3. β^* knobs
- Synnergies and/or conflict with LHC OP request to investigate efficient corrections in β^* leveling modes