

IR feedback

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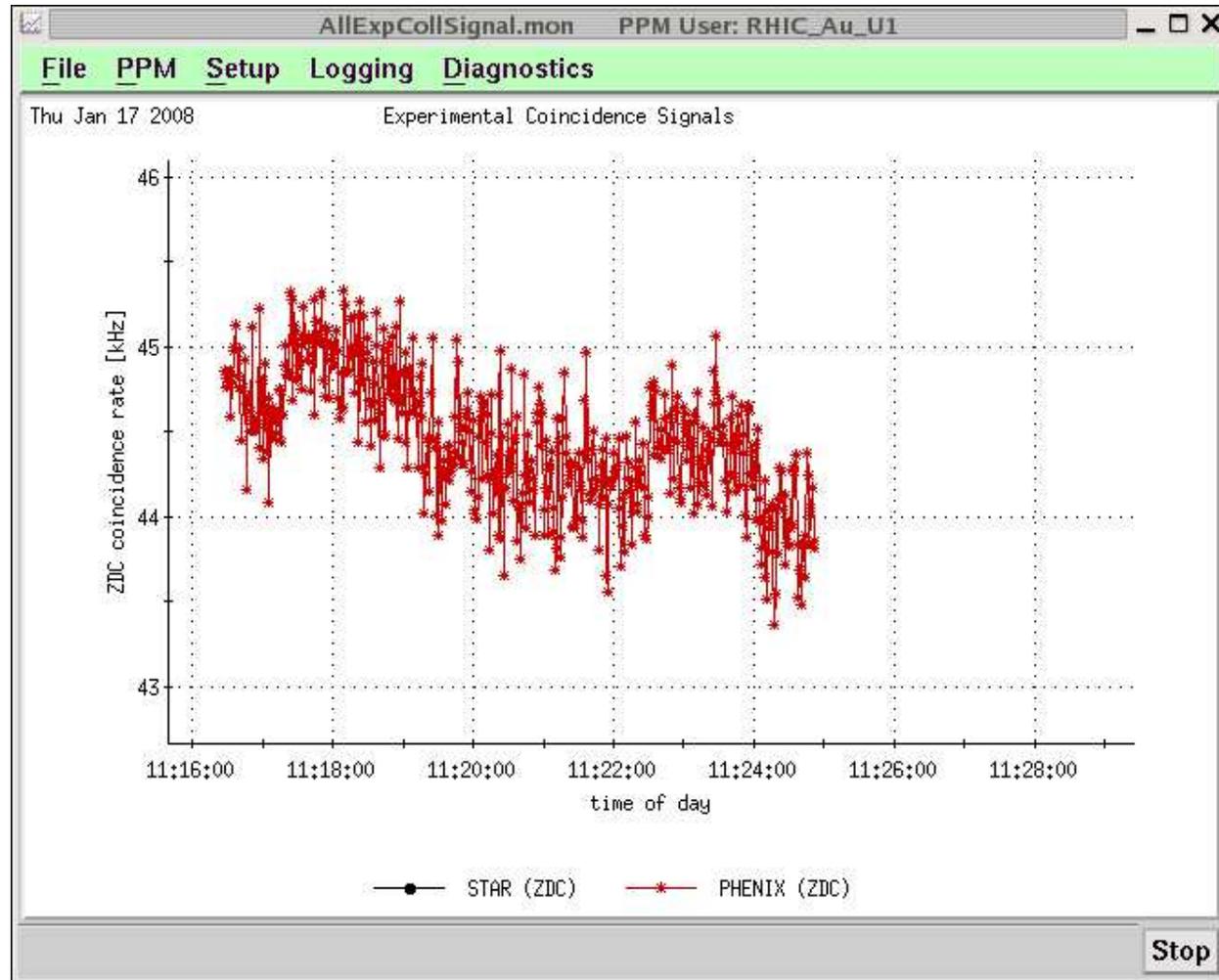
Beam dynamics effects of 10 Hz oscillations

- Emittance growth due to modulated beam-beam non-linearity, causing reduced luminosity lifetime (not yet observed).
- Enhanced background levels, as observed with near-integer tunes in Run-8. Cannot be cured by existing IP position feedback.
- Luminosity reduction due to (modulated) beam-beam offset Δx ,

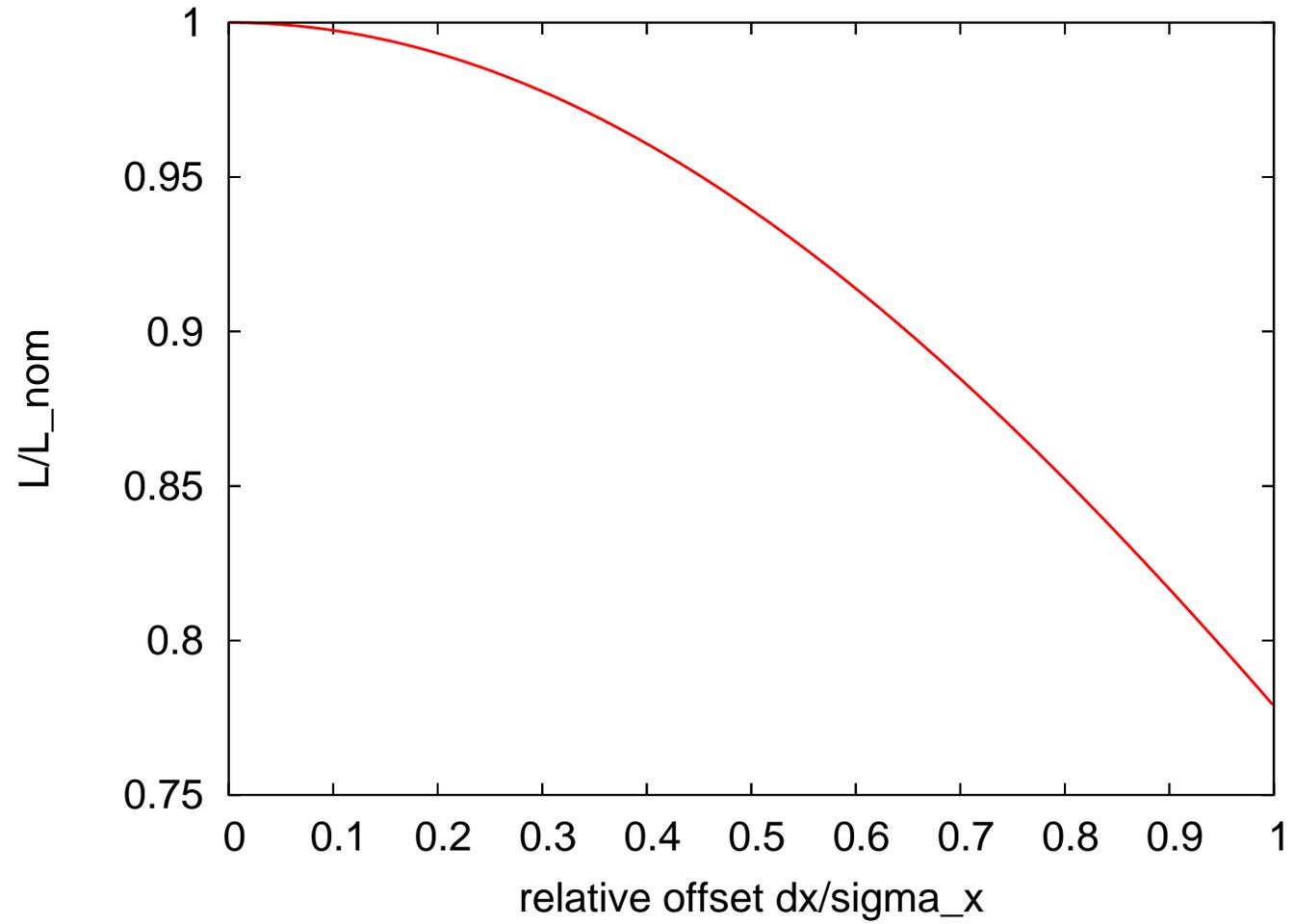
$$\frac{L}{L_{\text{nom}}} = \exp\left(-\frac{\Delta x^2}{4\sigma_x^2}\right)$$

Few percent effect observed in Run-8 (d-Au); good indicator of problems with feedback

Luminosity reduction observed with d-Au in Run-8



Luminosity reduction due to beam-beam offset



Luminosity reduction due to beam-beam offset

With

$$\epsilon_n = 15 \pi \text{ mm mrad},$$

$$\gamma = 267,$$

$$\beta^* = 0.7 \text{ m},$$

$$\sigma_x = 50 \mu\text{m}$$

the luminosity reduction factor becomes

$$\frac{L}{L_{\text{nom}}} = 0.90$$

⇒ IP orbit feedback will be needed to recover this 10 per-cent loss!

(Note: At 100 GeV and $\beta^* = 1 \text{ m}$, reduction factor is 0.98)

Plans for (parasitic) beam experiments

- Low-frequency cut-off has been changed from 1 Hz to 1/20 Hz
- IR orbit feedback will be running during regular stores
- Turn off feedback to measure luminosity reduction factor (short-term)
- Turn off feedback for a few regular physics stores to determine emittance growth effect (from luminosity lifetime) of modulated offset (long-term)