Observations and Modeling of Beam-Beam Effects at the Tevatron Collider

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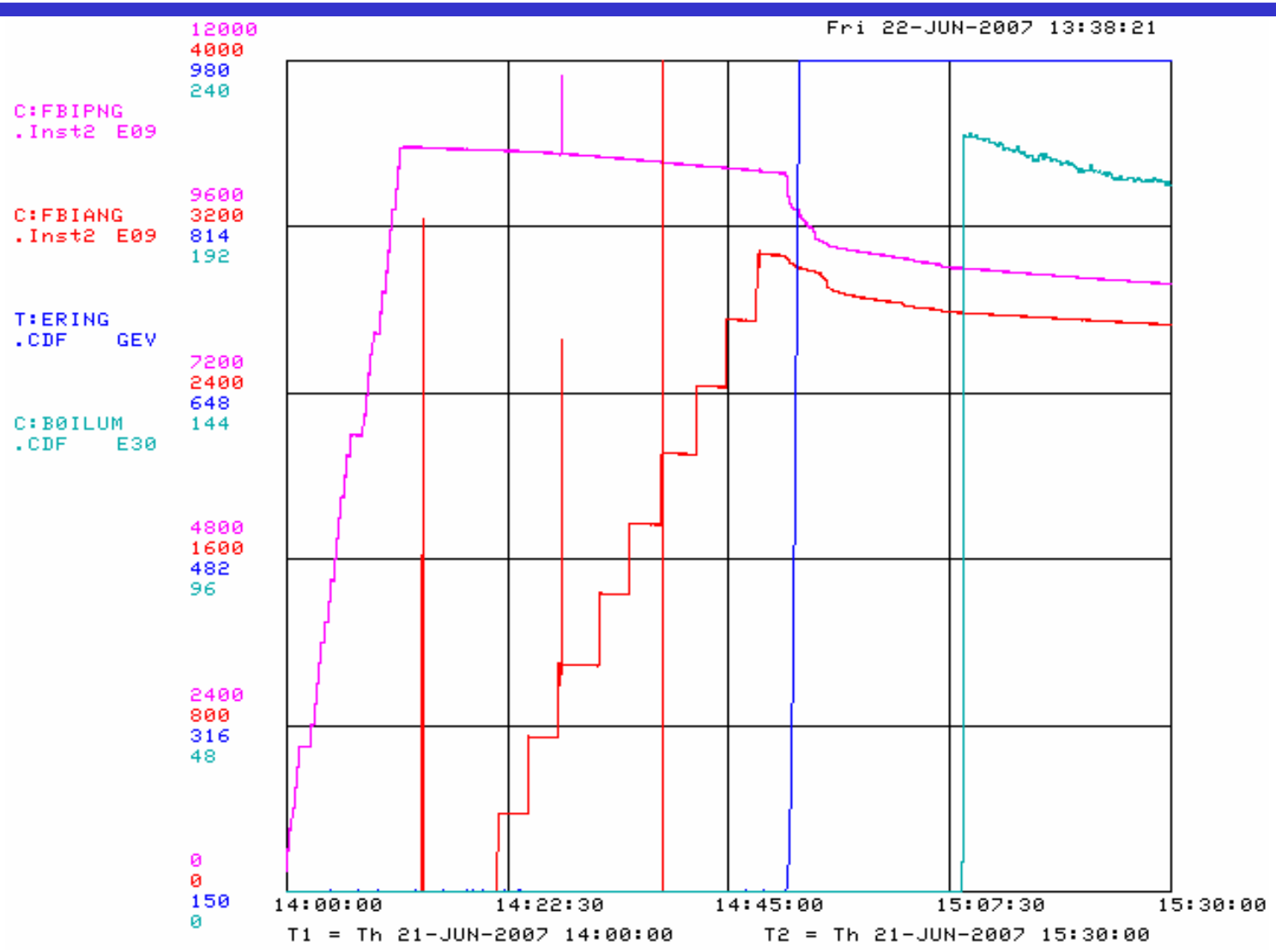
Outline

- Overview of Beam-Beam Effects
- New Collision Helix
- Second Order Chromaticity Correction
- Results and Summary

Overview of Beam-Beam Effects



Beam Intensities in Store 5506

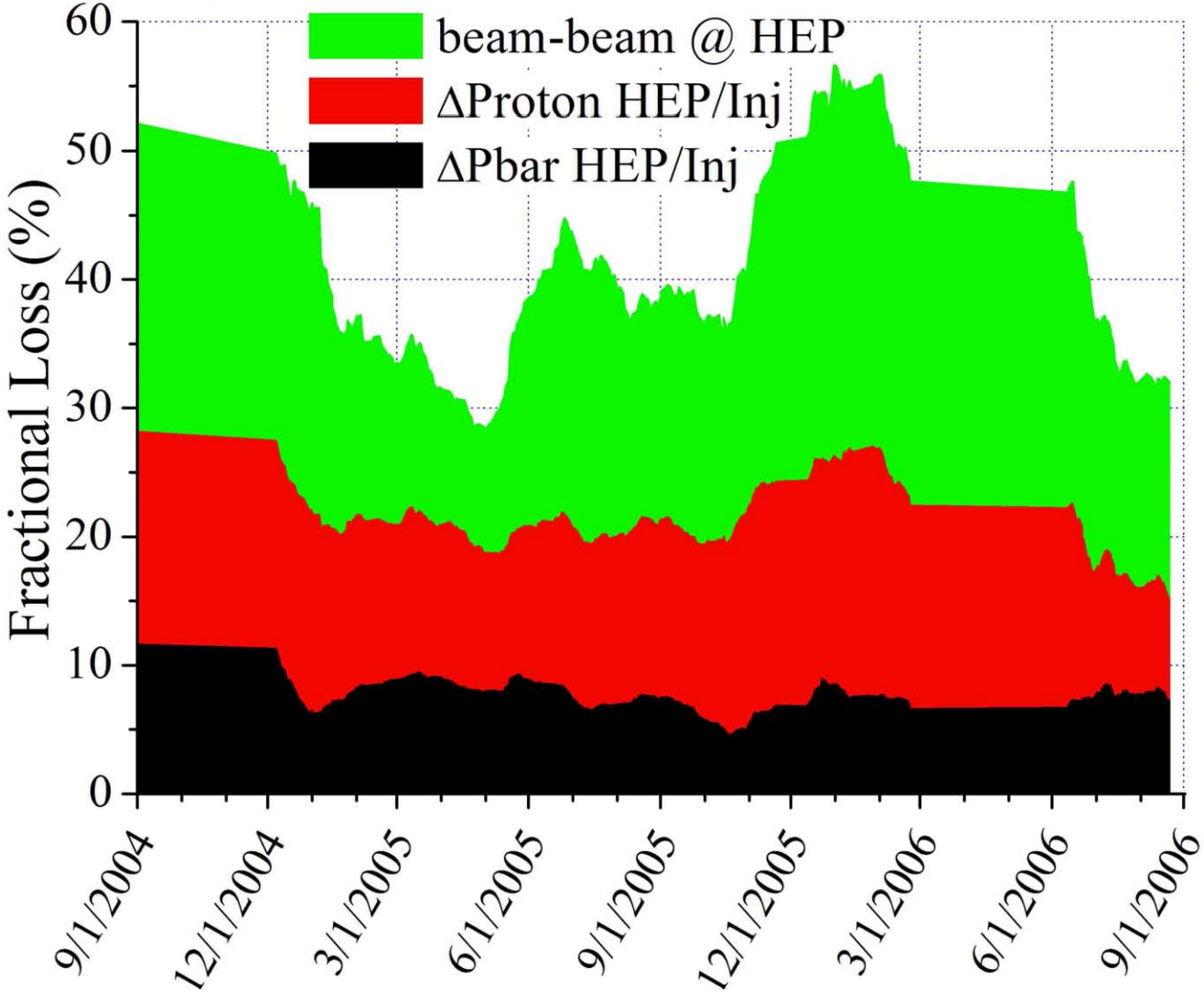
Luminosity and Luminosity Integral

$$L = \frac{3\gamma\ f_0\ B\ N_{\bar{p}} N_p}{\pi\beta^*\left(\varepsilon_p + \varepsilon_{\bar{p}}\right)} H\left(\sigma_l / \beta^*\right)$$

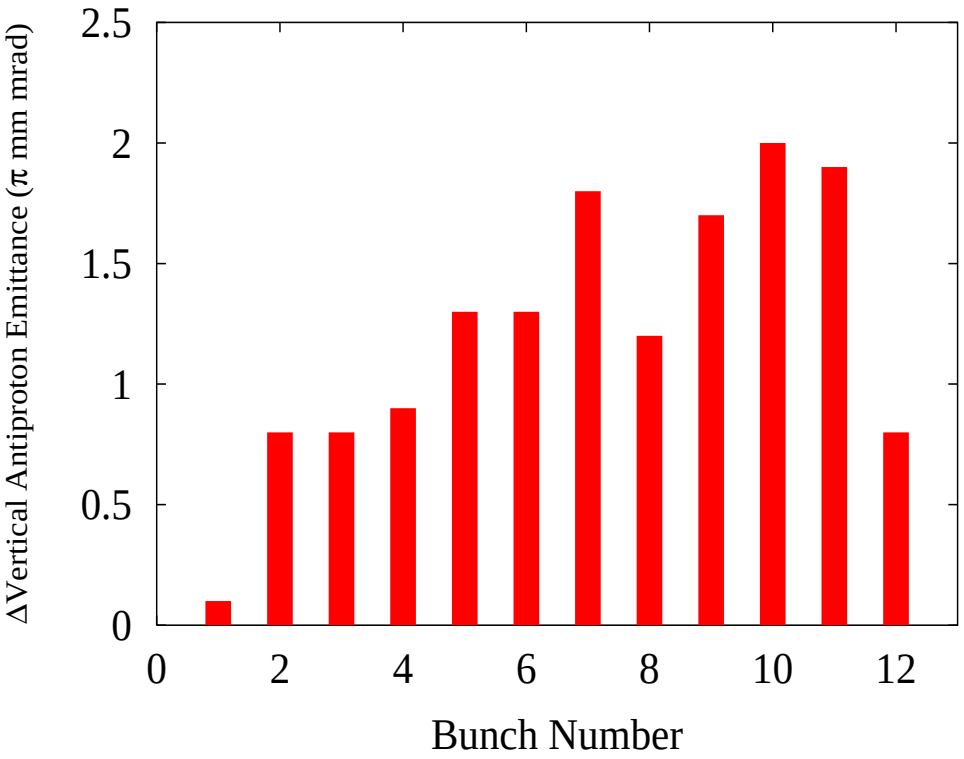
$$I = \int L dt \cong N_{stores}\tau_L L_0 \ln(1 + T/\tau_L)$$

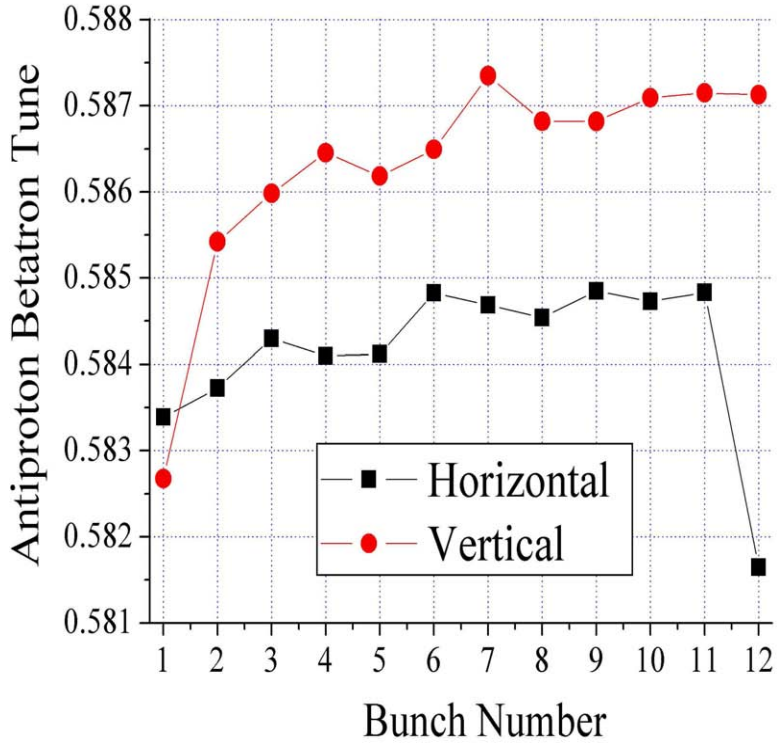
- Luminosity Integral: primary factors
  - Beta* at IP and bunchlength: H(x)/beta^*
  - Emittances $\varepsilon_p\ \varepsilon_{pbar}$
  - Number of protons: N_p
  - Number of antiprotons: BN_{pbar}
  - Lumi-lifetime: τ_L
  - Number Stores: $N_{stores} \sim T_{week}/(T + t_{setup})$

Sources of Luminosity Loss in Tevatron



Bunch-by-Bunch Effects





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