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Impact on luminosity of longitudinal oscillations

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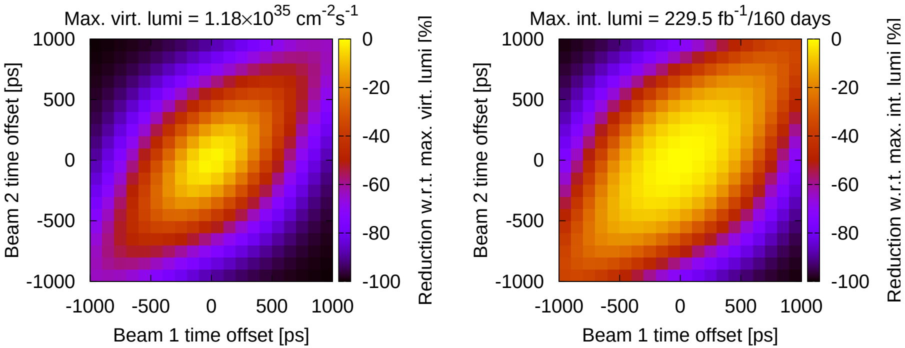
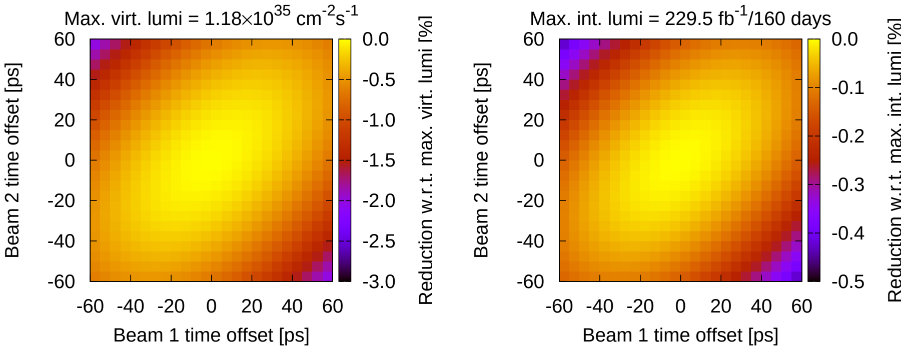
Virtual/integrated luminosity: effect of bunch time offset



$$\mathcal{L} = \mathcal{L}_0 \int\int \rho_s[s_1 - (ct + ct_{0,1})]\rho_s[s_2 + (ct + ct_{0,1})]K_{x,y}(s, ct)\, \mathrm{d}s\, \mathrm{d}(ct)$$

- Reduction of virtual and integrated luminosities as function of a systematic **time offset** in beams 1 and 2 for the current **baseline**
  - $\beta^* = 20\,\mathrm{cm}$, 2 CCs, 9 cm Gaussian RMS bunch length

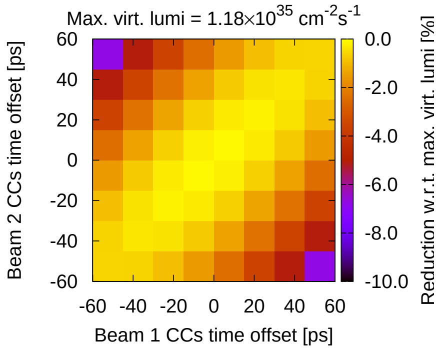
Virtual/integrated luminosity: effect of bunch time offset

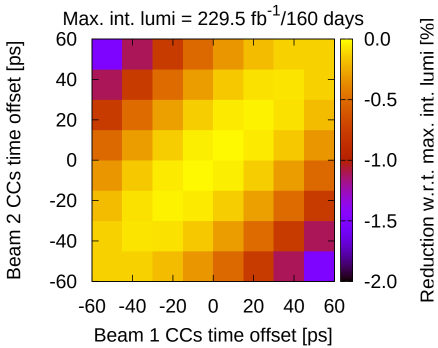


$$\mathcal{L} = \mathcal{L}_0 \int\int \rho_s[s_1 - (ct + ct_{0,1})]\rho_s[s_2 + (ct + ct_{0,1})]K_{x,y}(s, ct)\, \mathrm{d}s\, \mathrm{d}(ct)$$

- Reduction of virtual and integrated luminosities as function of a systematic **time offset** in beams 1 and 2 for the current **baseline**
  - $\beta^* = 20\,\mathrm{cm}$, 2 CCs, 9 cm Gaussian RMS bunch length
- **Negligible reduction** for offsets $\lesssim 30\,\mathrm{ps}$ w.r.t. the case $t_{0,1} = t_{0,2} = 0\,\mathrm{s}$

Virtual/integrated luminosity: effect of CC time offset





$$\mathcal{L} = \mathcal{L}_0 \int\int \rho_s(s_1)\rho_s(s_2) K_{x,y}(s, ct, ct_{0,1}^{CC}, ct_{0,2}^{CC})\, \mathrm{d}s\, \mathrm{d}(ct)$$

$$K_{x,y} = \frac{f_y(s, ct)}{\sqrt{1 + (s/\beta_x^*)^2}} \exp\left[- \frac{\left\{ \frac{1}{k_x} \sin\left[k_x\left(s + \frac{1}{2}(ct_{0,2}^{CC} - ct_{0,1}^{CC})\right)\right] \cos\left[k_x\left(ct + \frac{1}{2}(ct_{0,2}^{CC} + ct_{0,1}^{CC})\right)\right] \sin\frac{\theta_x}{2} - s \sin\frac{\theta}{2} \right\}^2}{\sigma_x^{*\,2}[1 + (s/\beta_x^*)^2]} \right]$$

- Effect of systematic time offsets in the CCs (the same in both IPs): stronger effect than that of time offsets in the bunch position