Measurement of inclusive decay rates and lepton angle θ

Inclusive b-hadron decays $H_b \to X\mu^+\mu^-$ with $H_b \in \{B^\pm, B^0, B_s, \Lambda_b, \ldots\}$.

Fractions: $B^\pm \sim 30\%$, $B^0 \sim 30\%$, $B_s \sim 10\%$, $\Lambda_b \sim 20\%$, rest – small.

Theory: $\Gamma(H_b \to X\mu^+\mu^-) = \Gamma(b \to X^p\mu^+\mu^-) + \Delta\Gamma^{\rm nonpert}$.

Good news: $\Delta\Gamma^{\rm nonpert}$ scales like $\mathcal{O}\left(\frac{\Lambda^2}{m_b^2}\right)$ when:

- **Long-distance contributions from the four-quark operators are neglected [arXiv:0902.4446].**
- **One integrates over the lepton pair energy and angle for fixed q^2. Integrating over the angle seems unavoidable when the H_b rest frame remains unknown.**

Problems:

- **Charm loops from four-quark operators at large q^2? At small q^2 with extra gluons?**
- **Need for cuts on lepton energy for small q^2? TH: Analogy to $B \to X_s\gamma$, EXP: Frame?**
- **Backgrounds for large q^2 (e.g., semileptonic $b \to c$ followed by semileptonic $c \to s, d$)?**
- **Extra backgrounds for small q^2 (e.g., $J/\psi \to \mu^+\mu^- X$ with BR at the $\sim 10^{-4}$ level)?**
- **EXP: Normalization?**