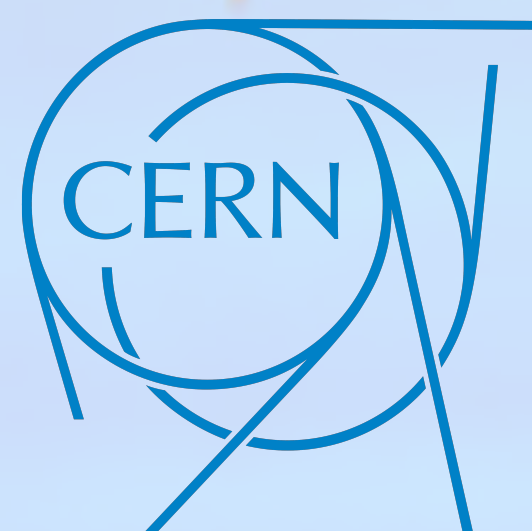




Measurement of electrons from beauty-hadron decays in pp collisions at $\sqrt{s} = 13$ TeV with ALICE

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on behalf of ALICE Collaboration



ALICE



Quark Matter 2022 Krakow, Poland

Heavy-flavour production in pp collisions

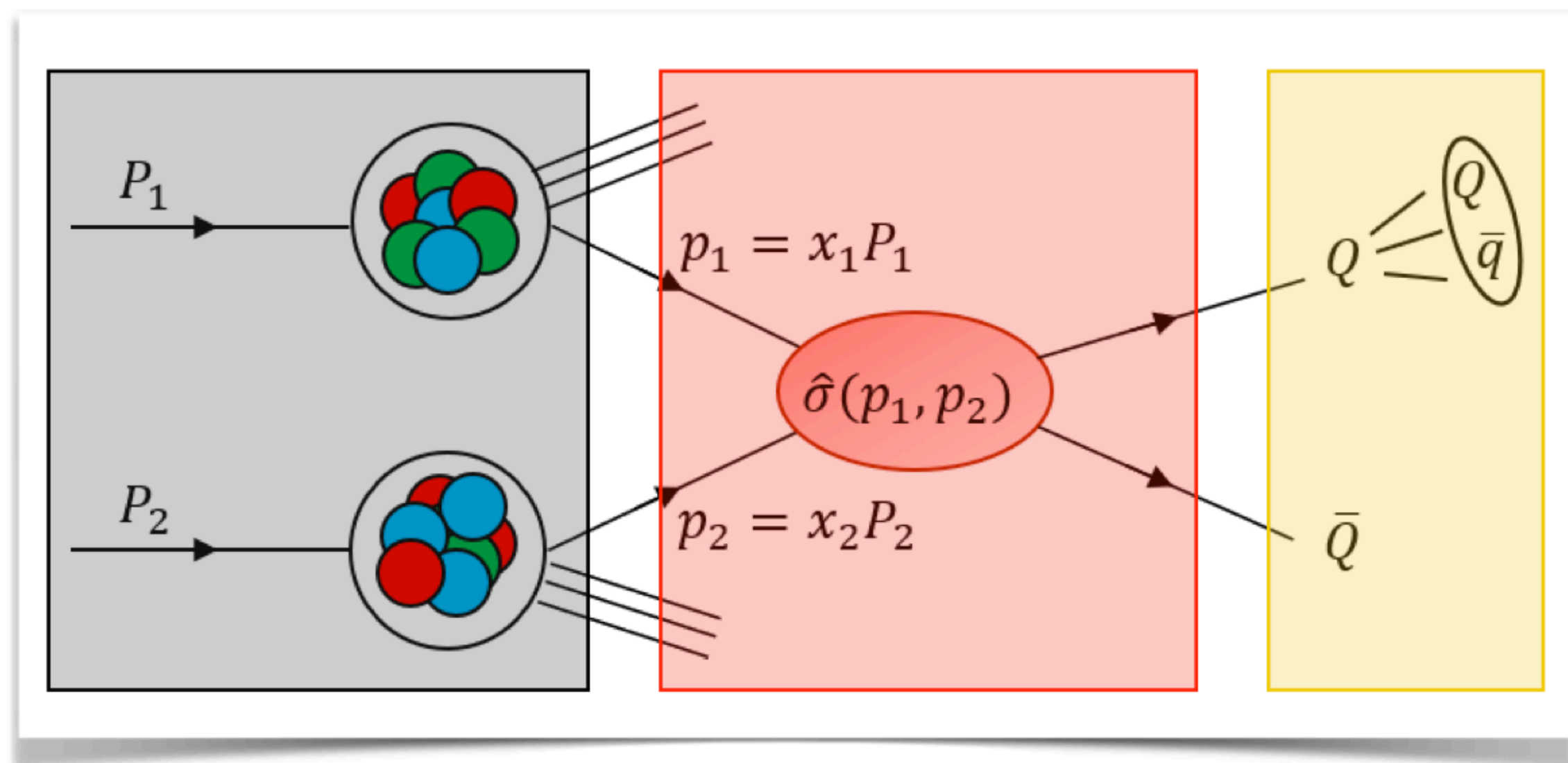
- ▶ Heavy quarks are produced in initial hard scattering processes
- ▶ Heavy quark production cross section → test of pQCD calculations

$$\sigma_{AB \rightarrow h}^{\text{hard}} = \text{PDF}(x_a, Q^2) \text{PDF}(x_b, Q^2) \otimes \sigma_{ab \rightarrow c}^{\text{hard}}(x_a, x_b, Q^2) \otimes D_{c \rightarrow h}(z = p_h/p_c, Q^2)$$

Parton distribution function (PDFs)

Hard scattering cross section (pQCD)

Fragmentation function (hadronization)



- ▶ Description in pp collisions based on factorization approach
- ▶ Baseline for measuring nuclear modification in nucleus-nucleus collisions

Electrons from beauty-hadron decays

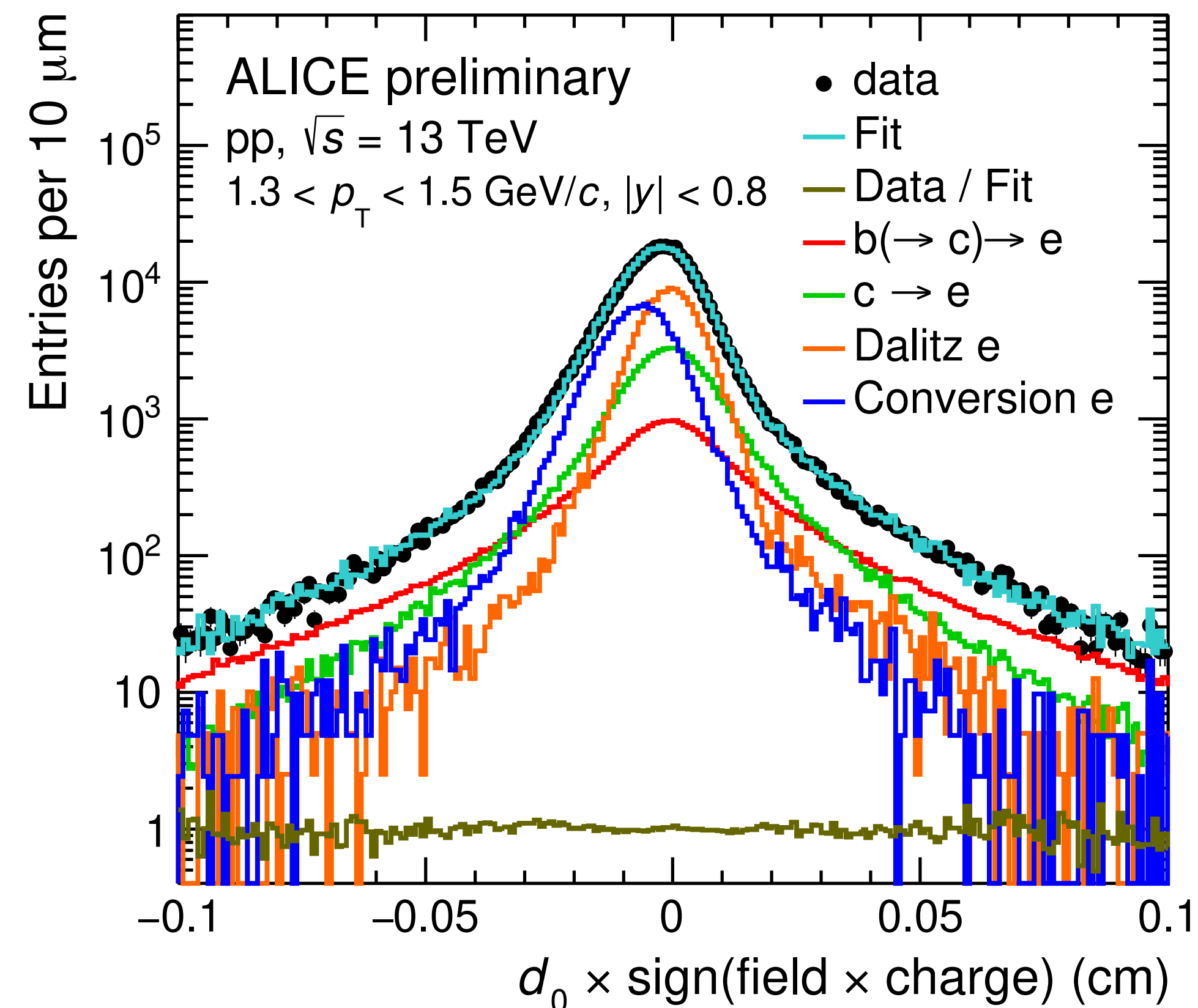
- ▶ Substantial branching ratio of semi-leptonic decays of beauty hadrons ($\sim 10\%$)
- ▶ Sizable decay length ($c\tau \approx 450\mu\text{m}$) of beauty hadrons \rightarrow **large impact parameter**
- ◆ Impact Parameter : distance of closest approach (d_0) in transverse plane
- ▶ Stochastic extraction using the **impact parameter fit** * *Comput. Phys. Commun.* 77, 2 (1993) 219—228
- ▶ **Importance of MC templates to have realistic behavior** based on data and model predictions

$$\log L = \sum_{\text{bin}} \text{data}(\text{bin}) \cdot \log \text{fit}(\text{bin}) - \text{fit}(\text{bin})$$

Likelihood for weighted sum of expectation values to data

$$+ \sum_{\text{bin}} \sum_{\text{source}} N_{\text{source}}(\text{bin}) \cdot \log A_{\text{source}}(\text{bin}) - A_{\text{source}}(\text{bin})$$

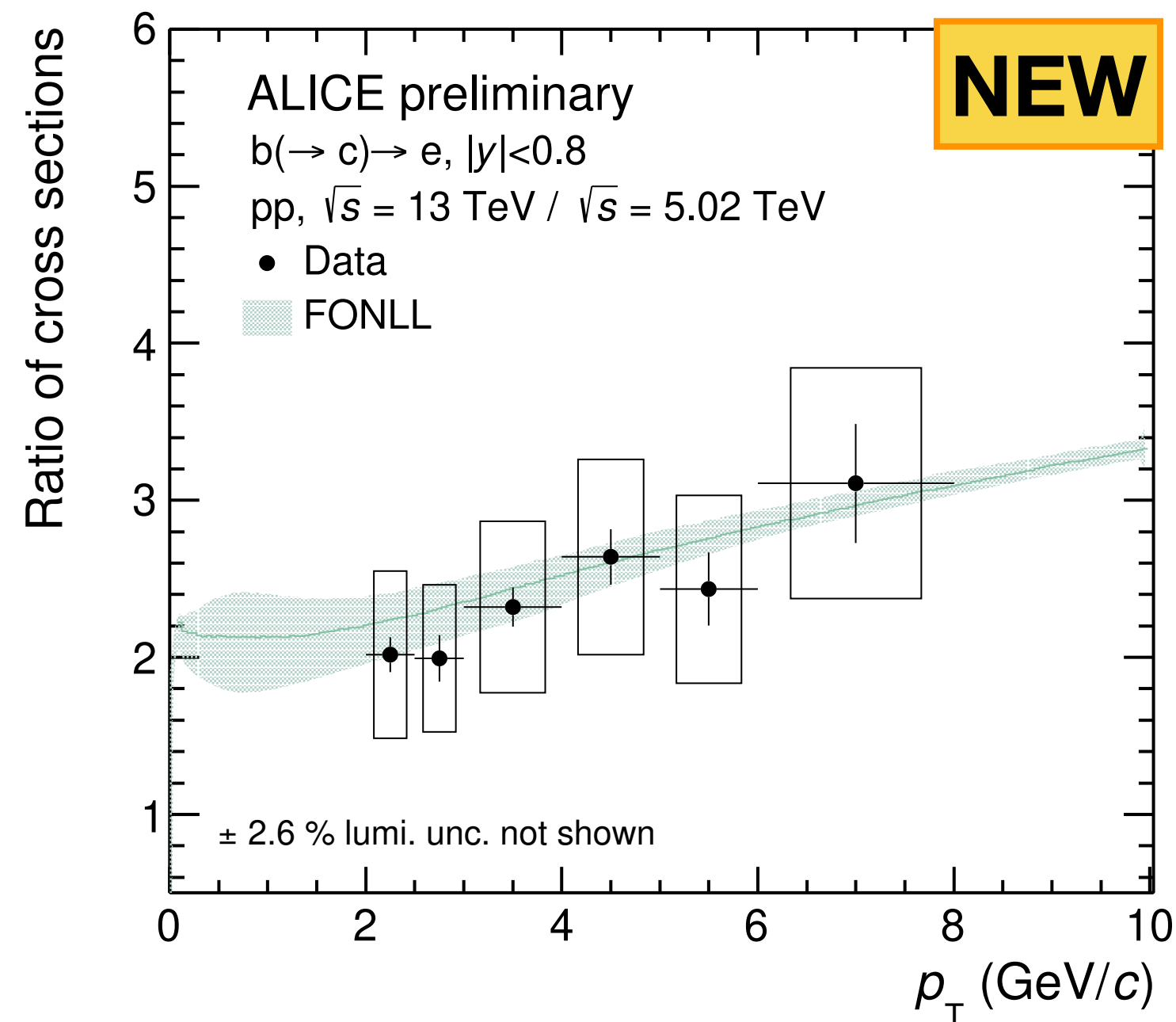
Likelihood for expectation values to MC templates



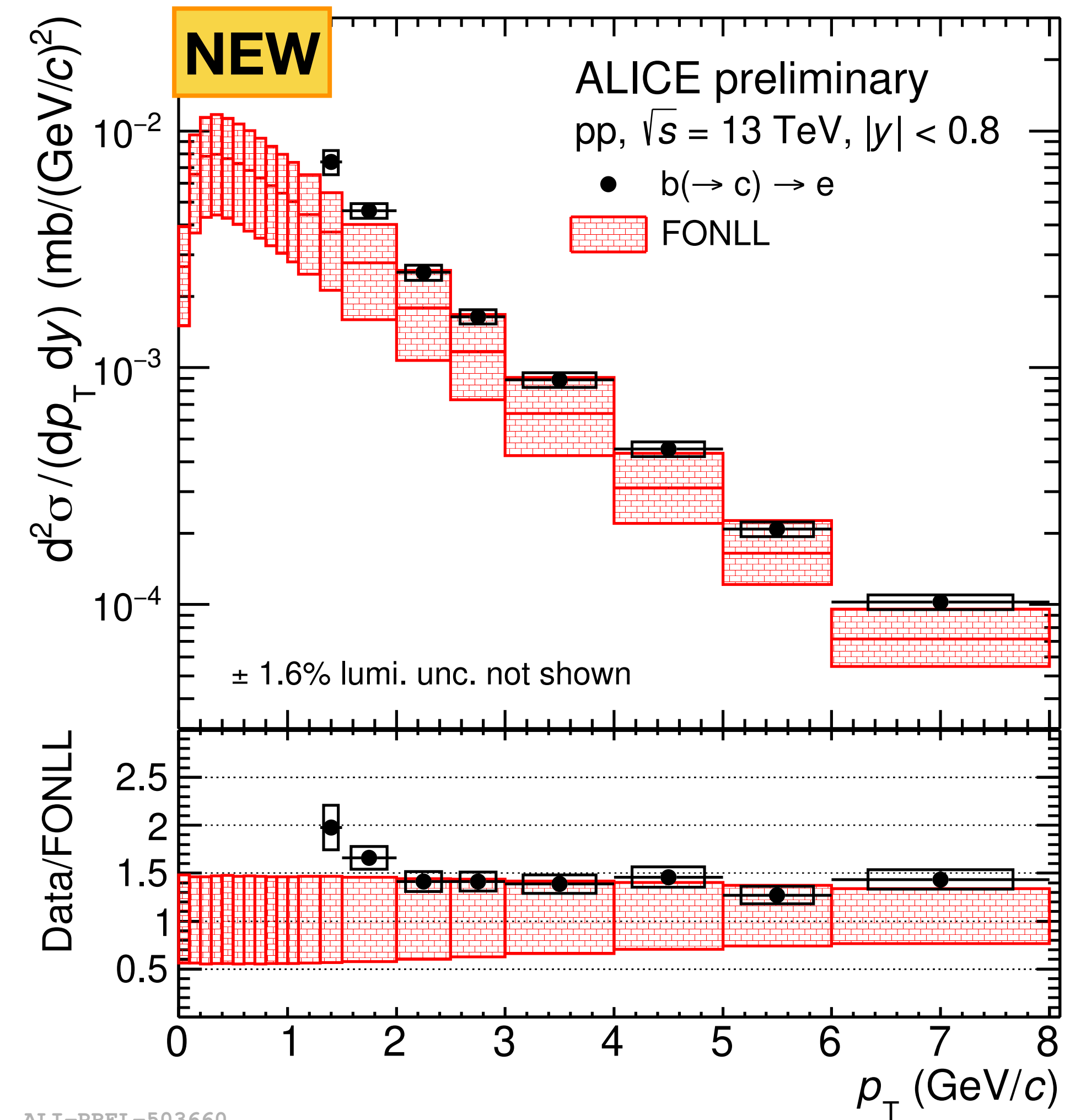
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Electrons from beauty-hadron decays in pp @ $\sqrt{s} = 13$ TeV

- ▶ Production cross section described by FONLL
 - ◆ Smaller uncertainties w.r.t model calculations dominated by factorization and renormalization scales
 - ◆ PDF uncertainties : data can constraint the pQCD models

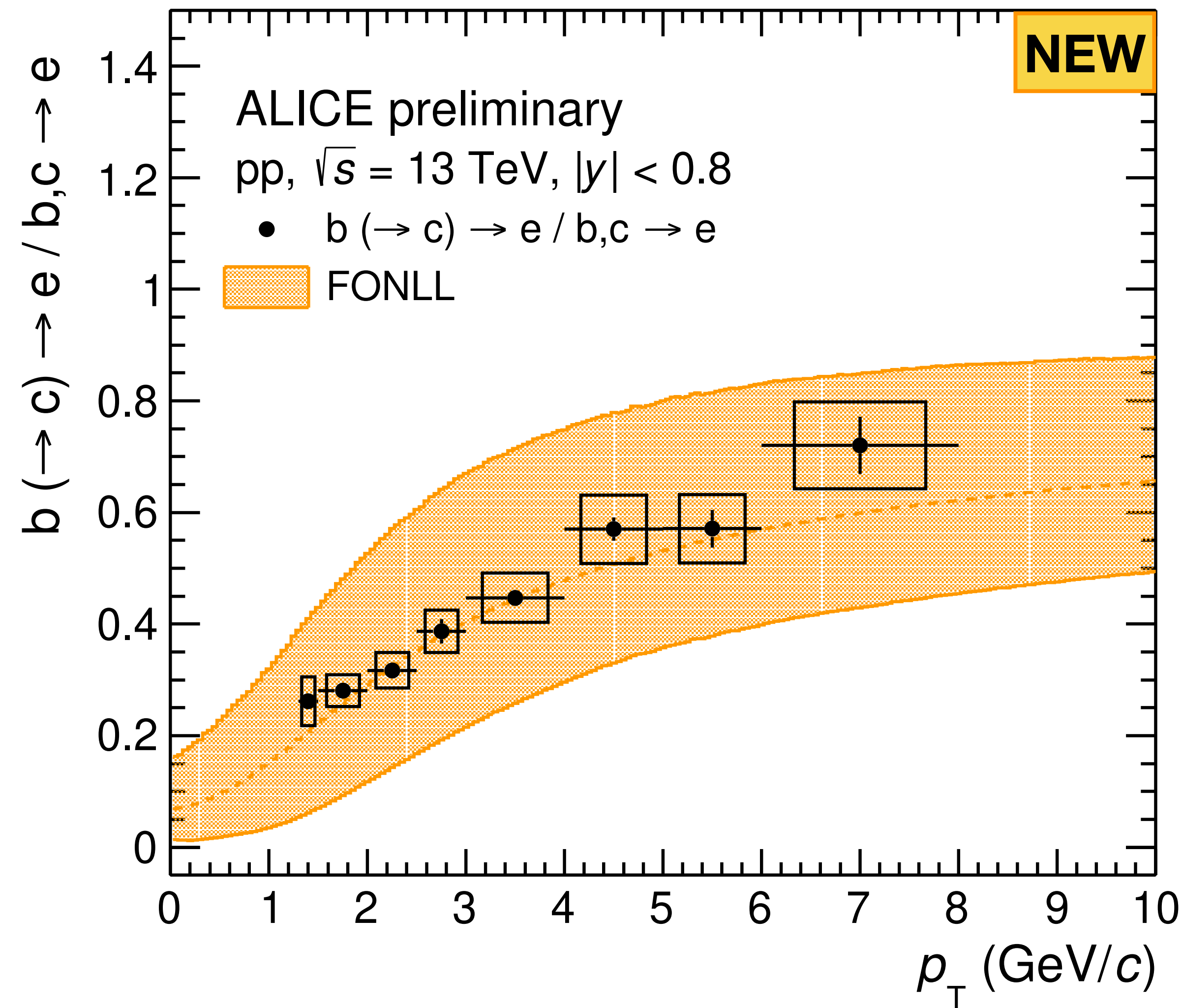


- ▶ Cross section ratios between different energies
 - ◆ FONLL uncertainties are reduced, due to correlations of parameters used in the pQCD calculations
 - ◆ More precise measurements at different energy will provide further constraints



Beauty production rate in pp @ $\sqrt{s} = 13$ TeV

- ▶ Fraction of beauty-decay electrons to inclusive heavy-flavor decay electrons
- ▶ Beauty contribution is dominant with increasing p_T
- ▶ Good agreement with FONLL pQCD predictions



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Summary & Outlook

- ▶ Measurement of electrons from beauty-hadron decays in pp collisions at 13 TeV based on track impact parameter (maximum likelihood fit approach)
- ▶ Production cross section and ratio of production at different energies in agreement with pQCD calculations
- ▶ Comparison of beauty decay electrons to heavy-flavour decay electrons
 - ◆ Beauty contribution is dominant at high p_T
- ▶ Extend at higher p_T with EMCAL detector
- ▶ B hadron measurements via full reconstruction from Run 3 data