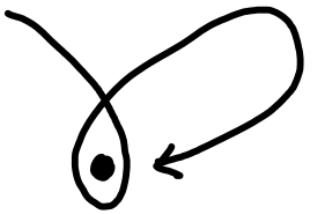
I. Intro: Resummation and the LHC Precision Program

II. The Problem

III. Physics of LL Resummation



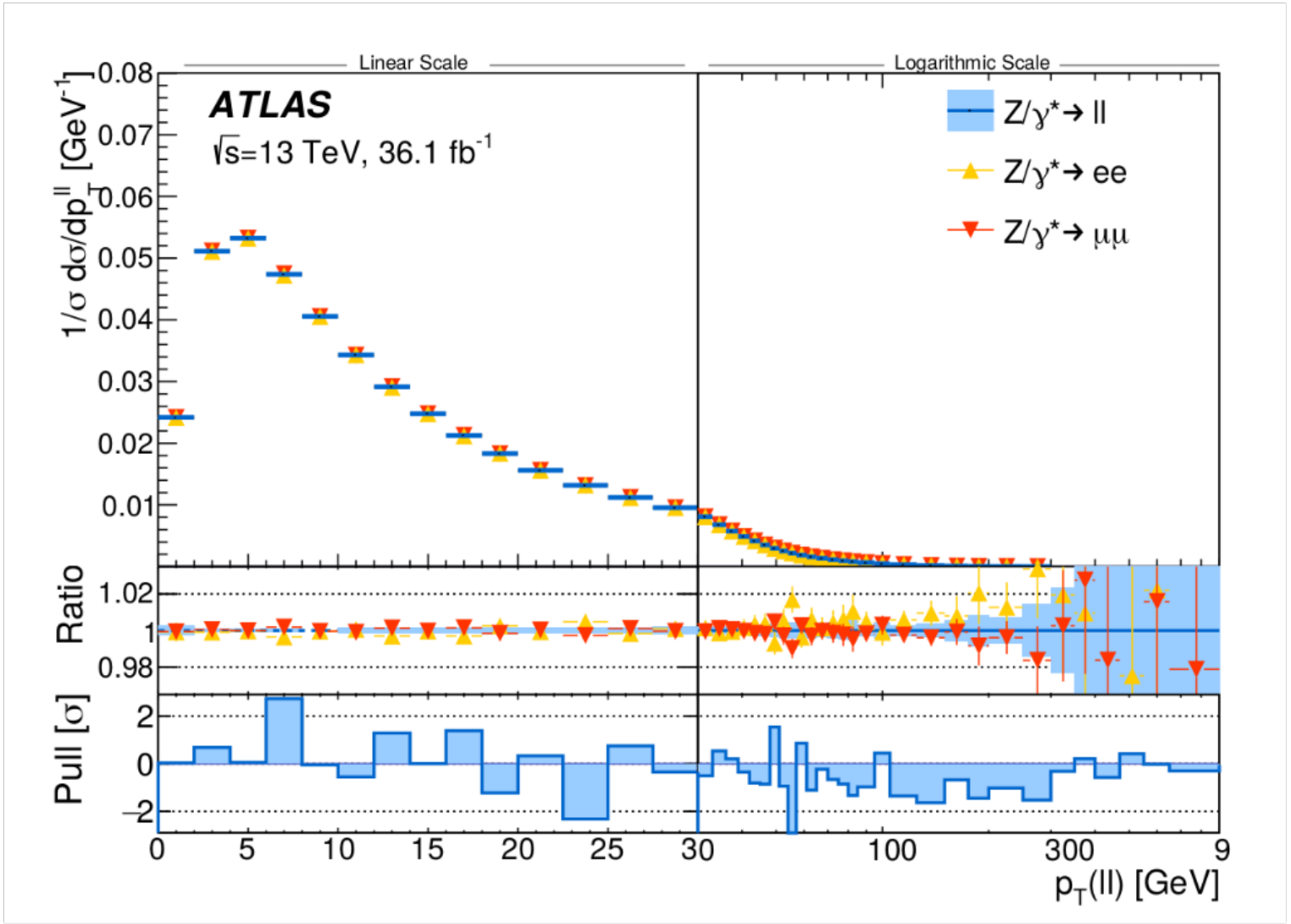
IV. (Im)proving the LL result

i) Factorization

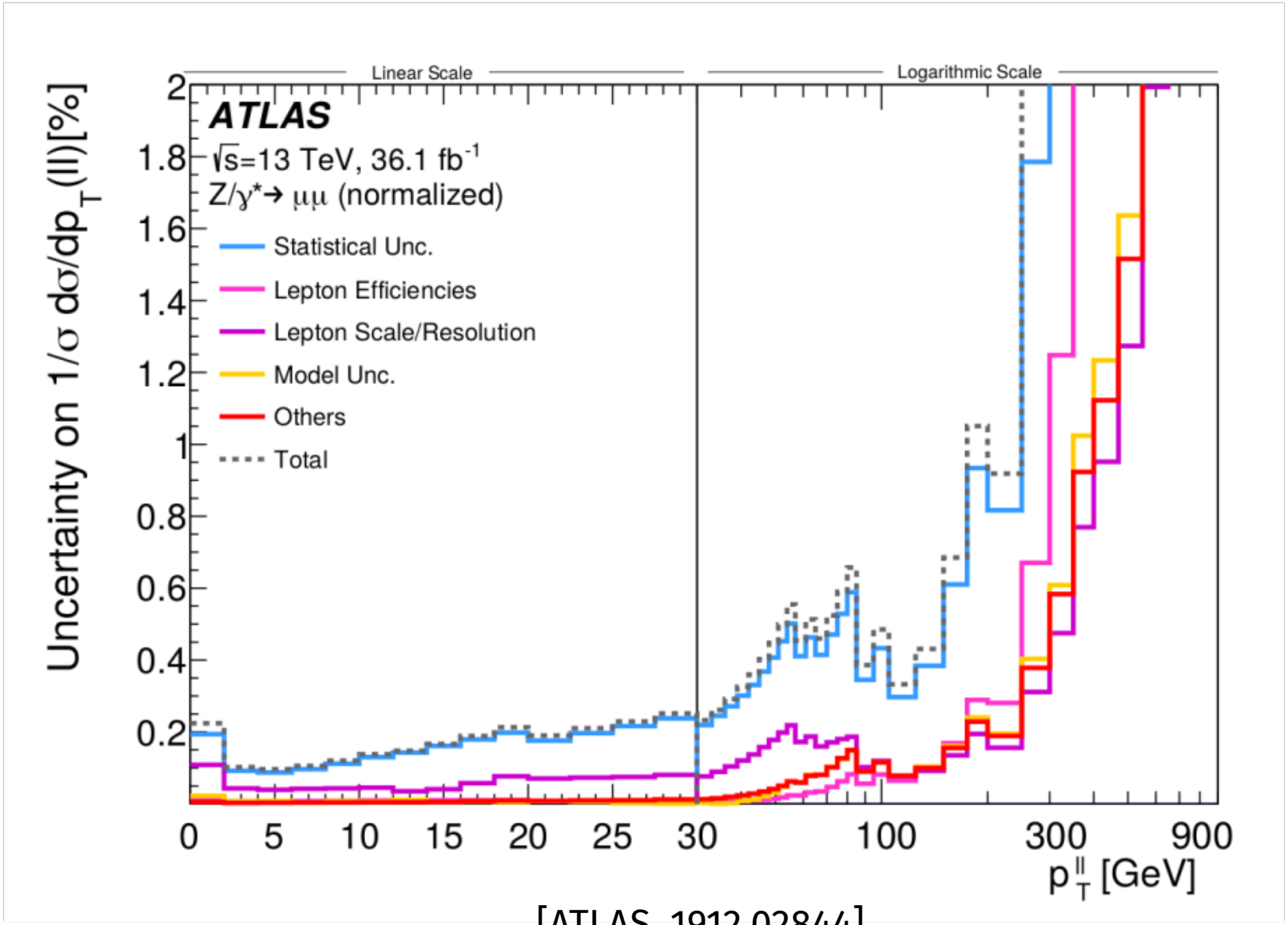
ii) Resummation from the RGE

iii) Resummation & Theory Nuisance Parameters

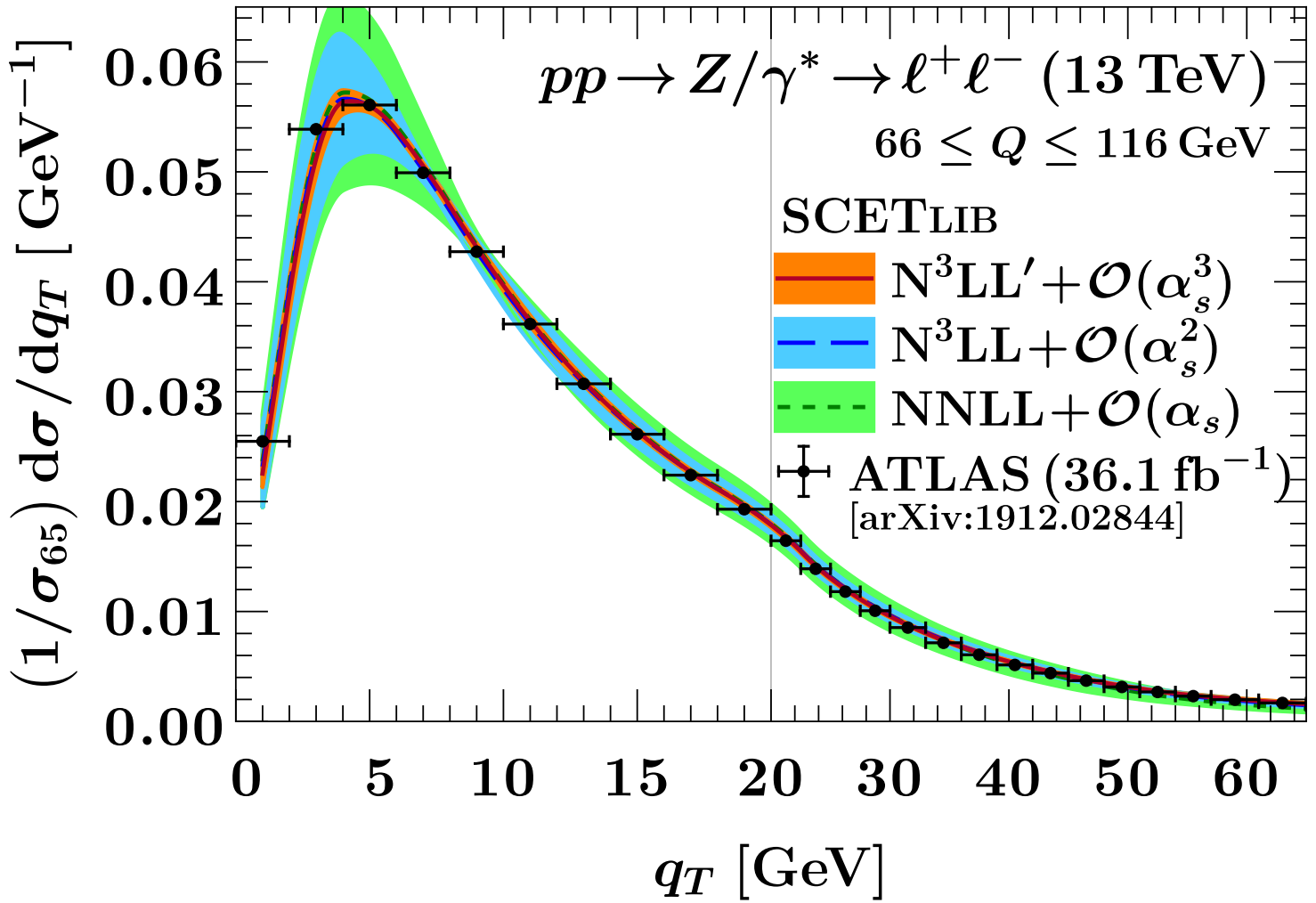
iv) Bonus: Matching & nonp. physics



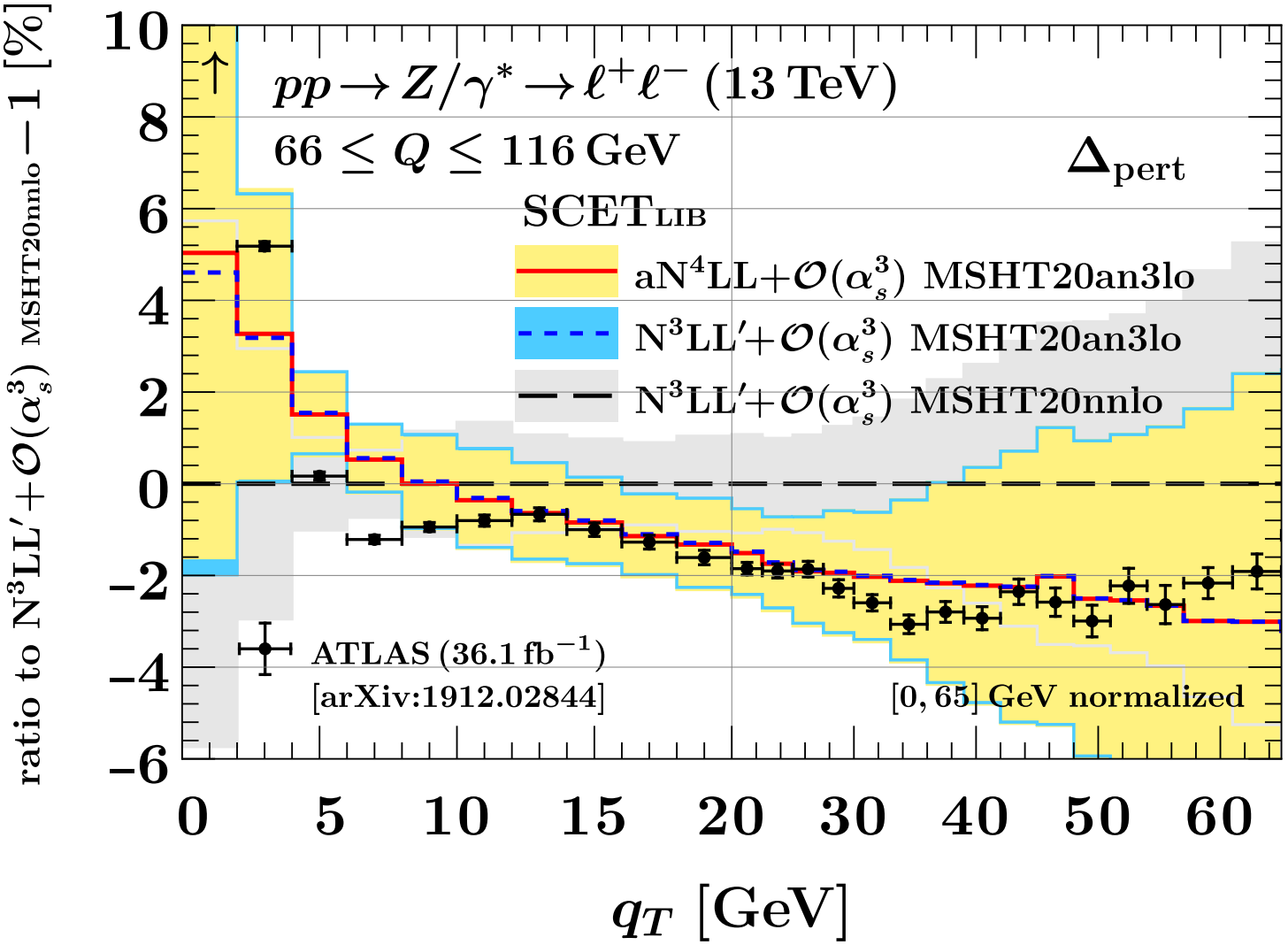
[ATLAS, 1912.02844]



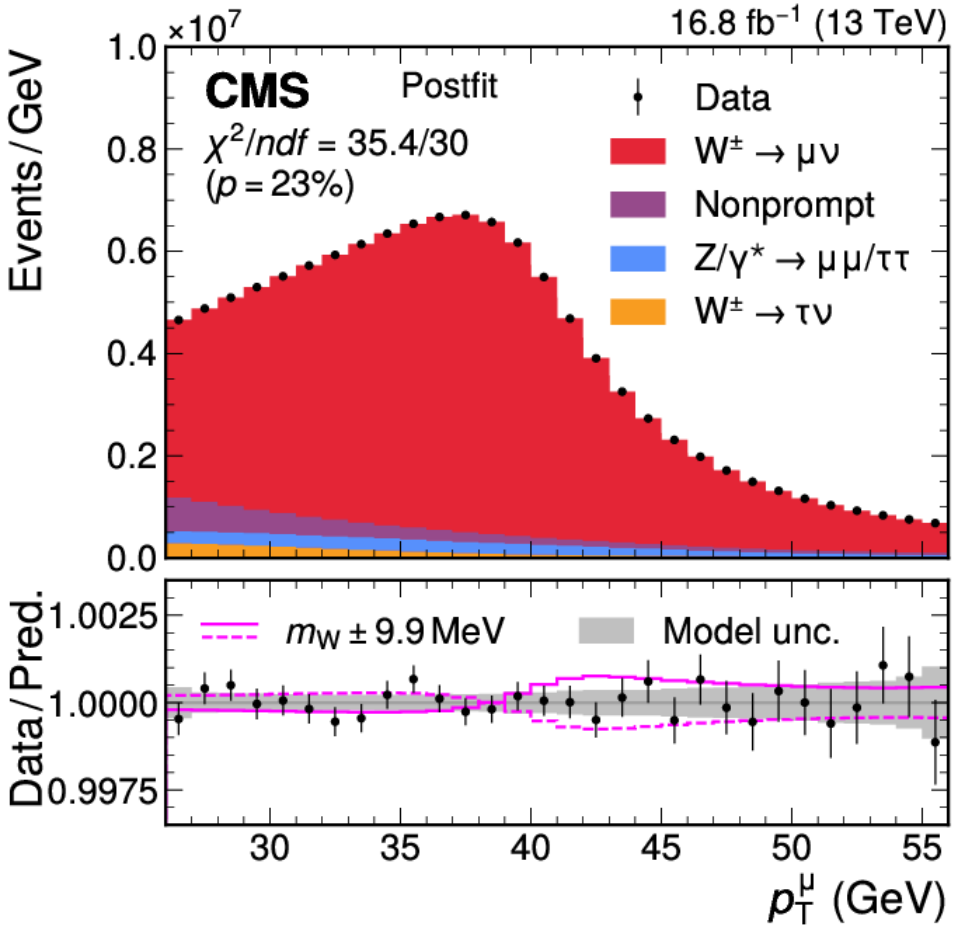
[ATLAS, 1912.02844]

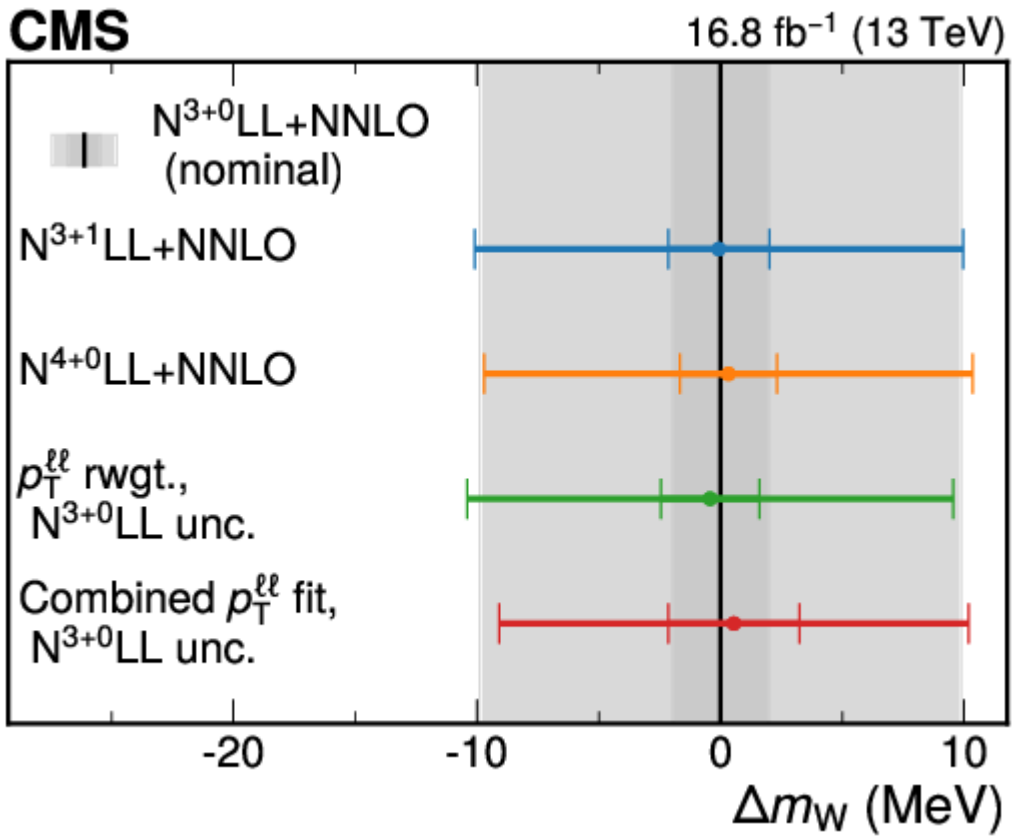


[Billis, JKLM, Tackmann, 2411.16004]

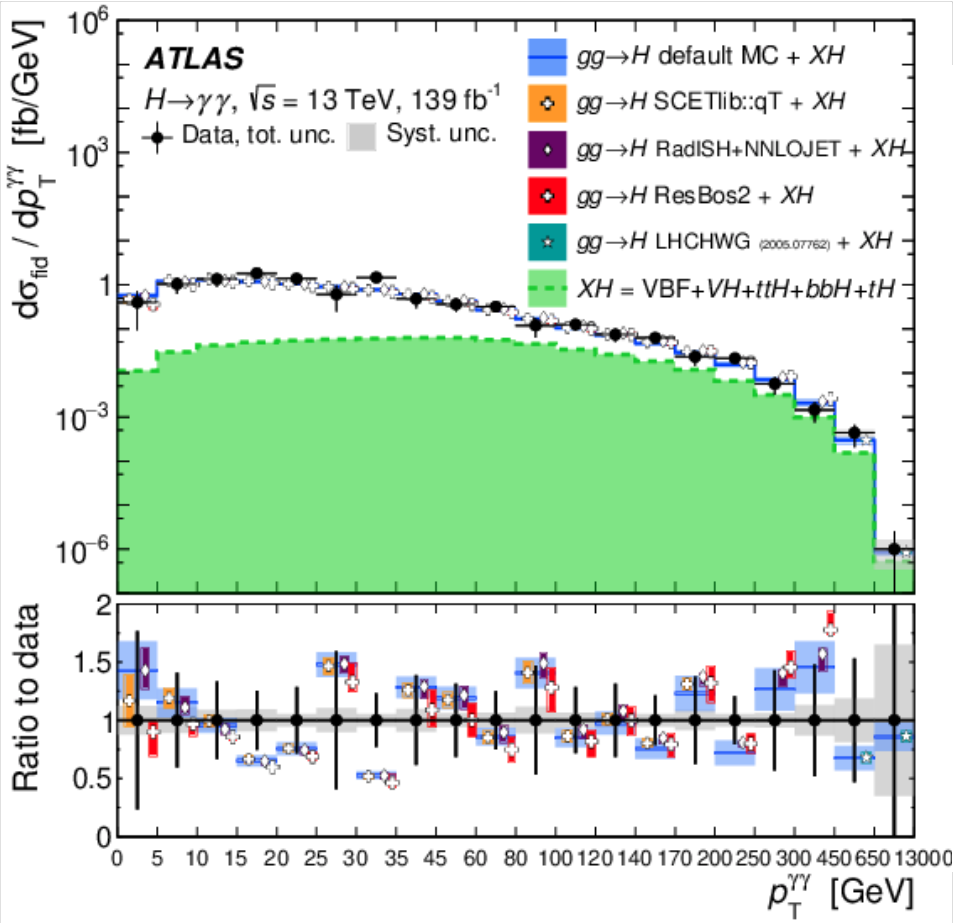


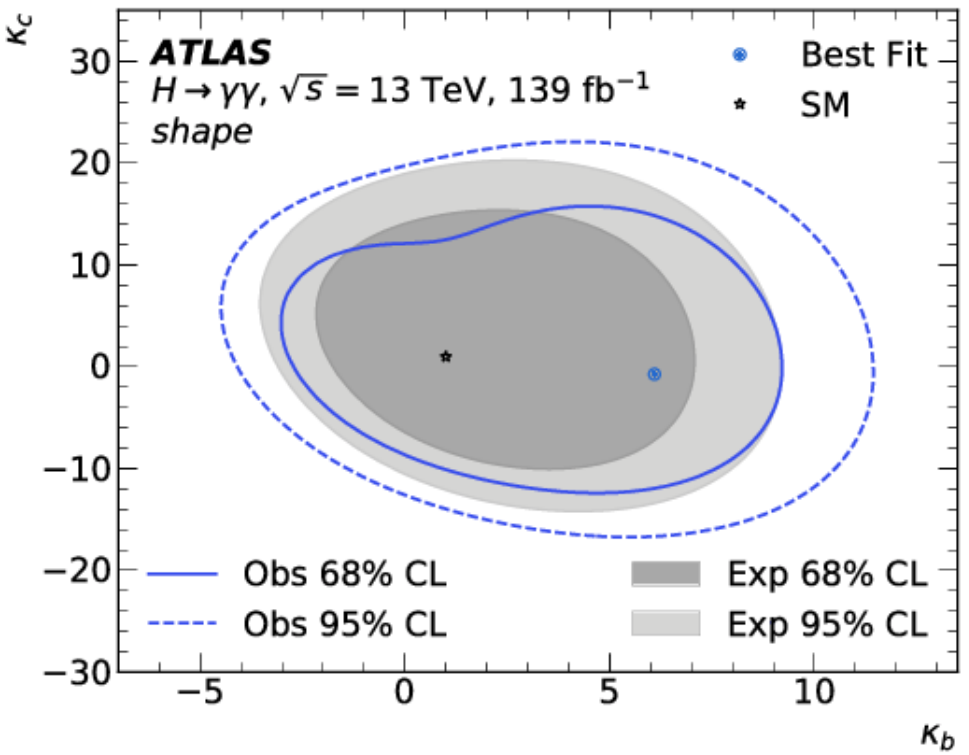
[Billis, JKLM, Tackmann, 2411.16004]



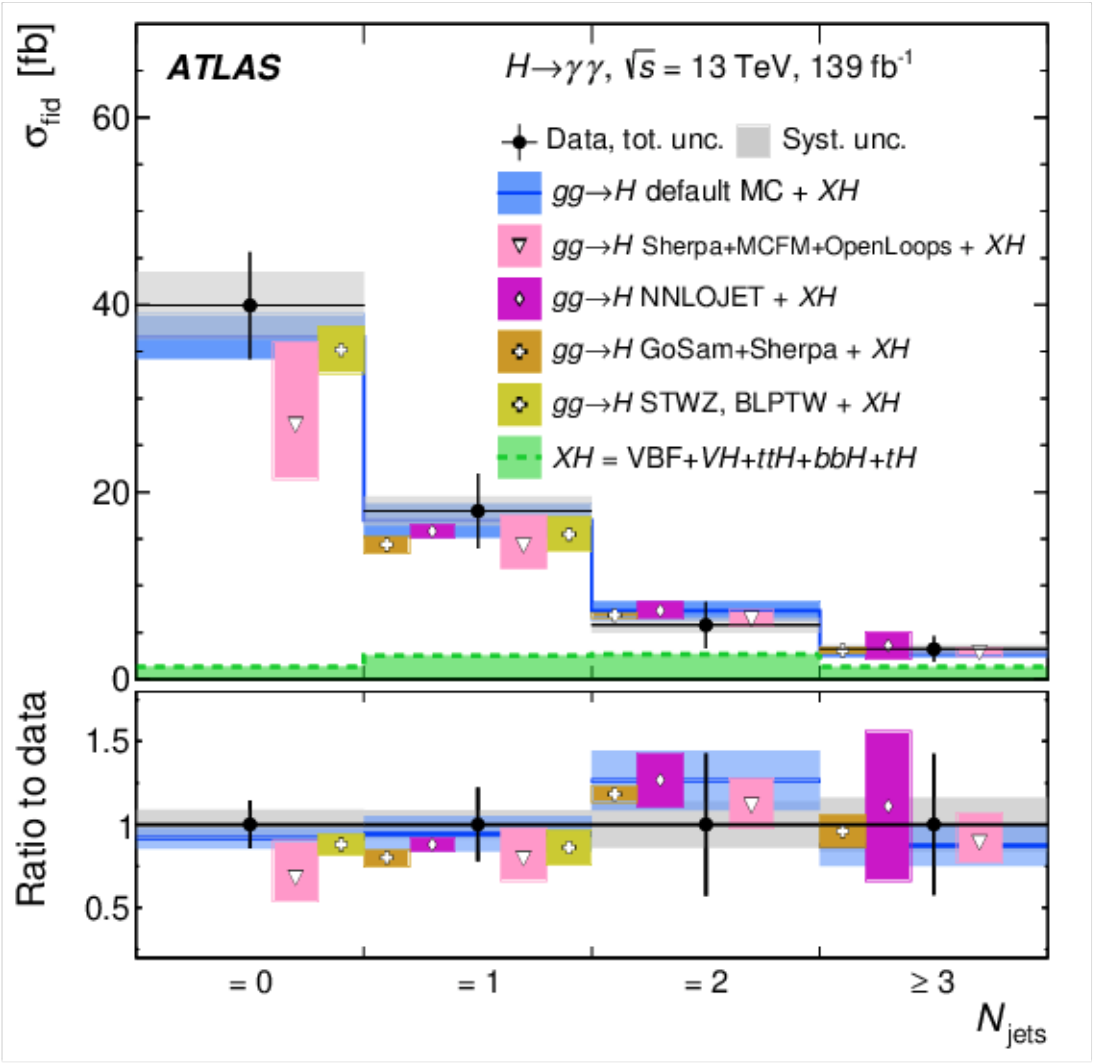


[CMS, 2412.13872]

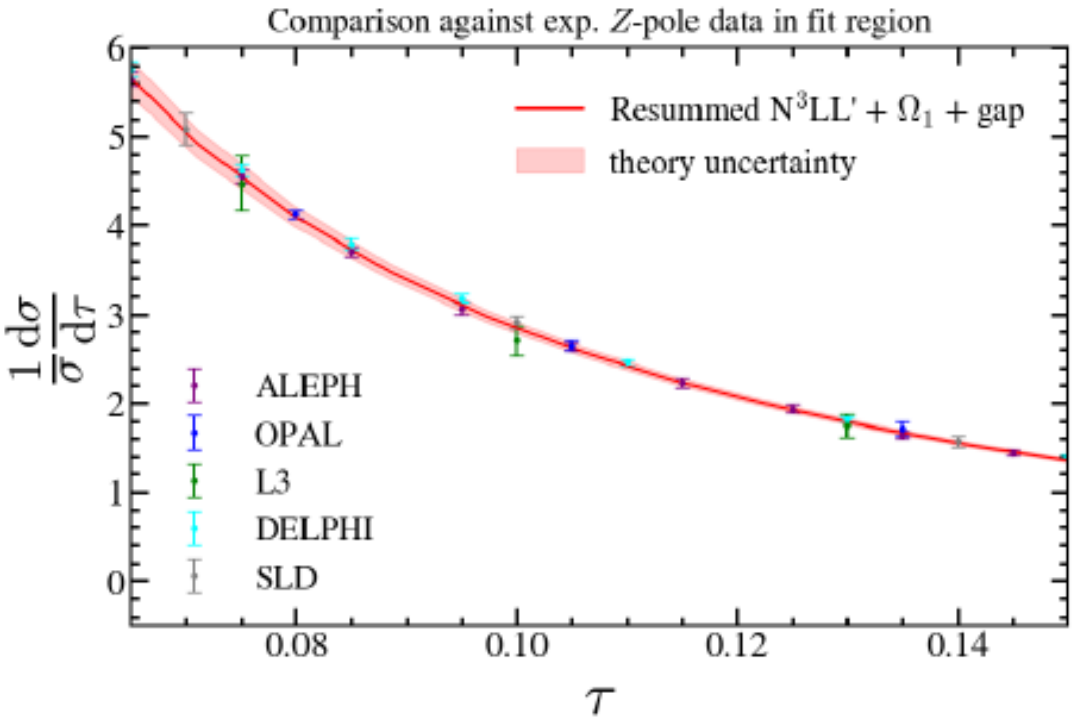


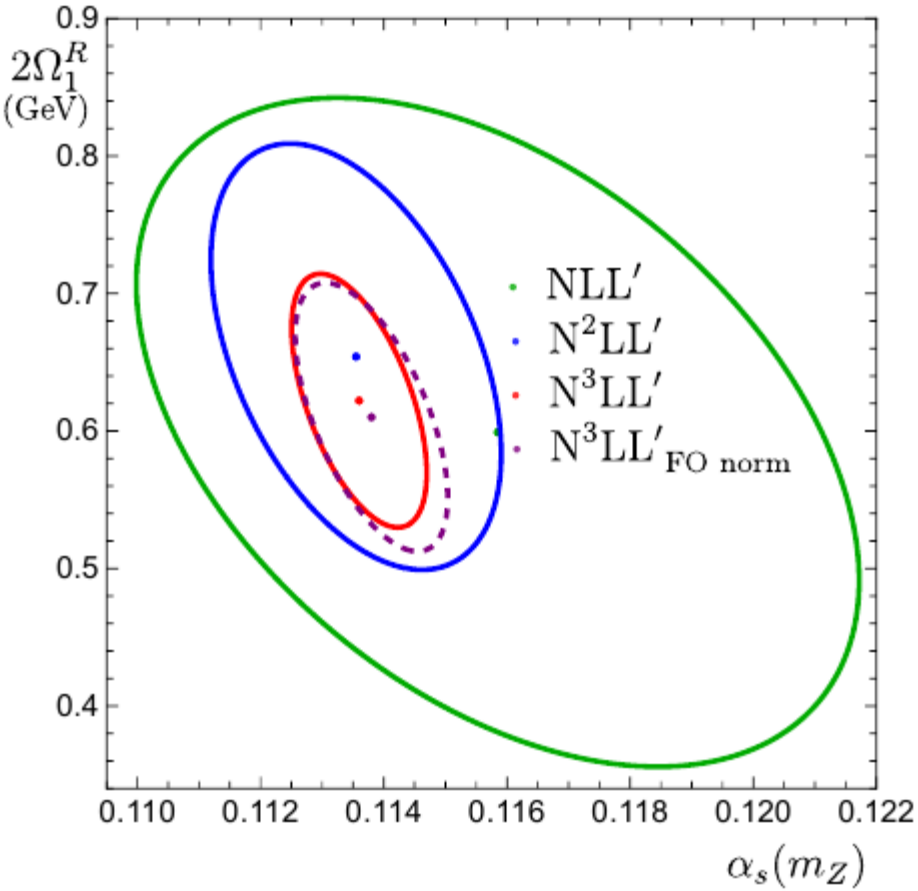


[ATLAS, 2202.00487]



[ATLAS, 2202.00487]





[Benitez, Hoang, Mateu, Stewart, Vita, 2412.15164]

Look back at the blackboard! :-)

$$\sigma(\tau < \tau_{cut}) = \sigma_{tree}\left[1 + \frac{\alpha_s}{\pi} f_1(\tau_{cut}) + \left(\frac{\alpha_s}{\pi}\right)^2 f_2(\tau_{cut}) + \dots\right]$$

$$\sigma(\tau < \tau_{cut}) = \sigma_{tree}\left[1 + \frac{\alpha_s}{\pi} f_1(\tau_{cut}) + \left(\frac{\alpha_s}{\pi}\right)^2 f_2(\tau_{cut}) + \ldots\right]$$

$$= \sigma_{tree} \sum_{n=0}^{\infty} \left(\frac{\alpha_s}{\pi}\right)^n \sum_{m=0}^{2n} C_{n,m} \ln^m \tau_{cut} + \mathcal{O}(\tau_{cut})$$

$$\sigma(\tau < \tau_{cut}) = \sigma_{tree}\left[1 + \frac{\alpha_s}{\pi} f_1(\tau_{cut}) + \left(\frac{\alpha_s}{\pi}\right)^2 f_2(\tau_{cut}) + \ldots\right]$$

$$= \sigma_{tree} \sum_{n=0}^{\infty} \left(\frac{\alpha_s}{\pi}\right)^n \sum_{m=0}^{2n} C_{n,m} \ln^m \tau_{cut} + O(\tau_{cut})$$

$$\frac{\sigma(\tau < \tau_{cut})}{\sigma} = \exp\left[-\frac{\alpha_s}{\pi} C_F \frac{1}{2} \ln^2 \tau_{cut}\right]$$