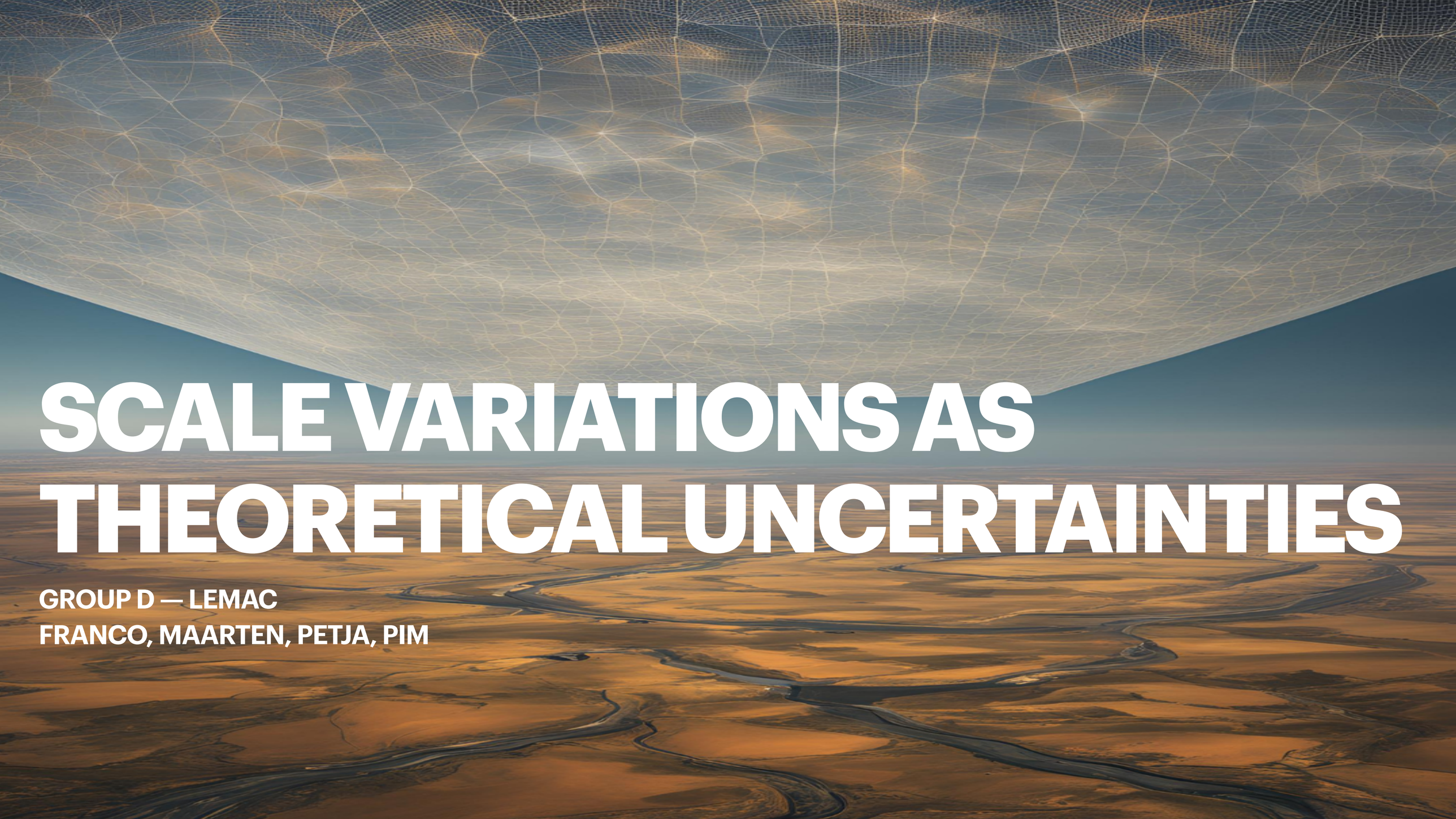


SCALE VARIATIONS AS THEORETICAL UNCERTAINTIES

GROUP D — LEMAC
FRANCO, MAARTEN, PETJA, PIM

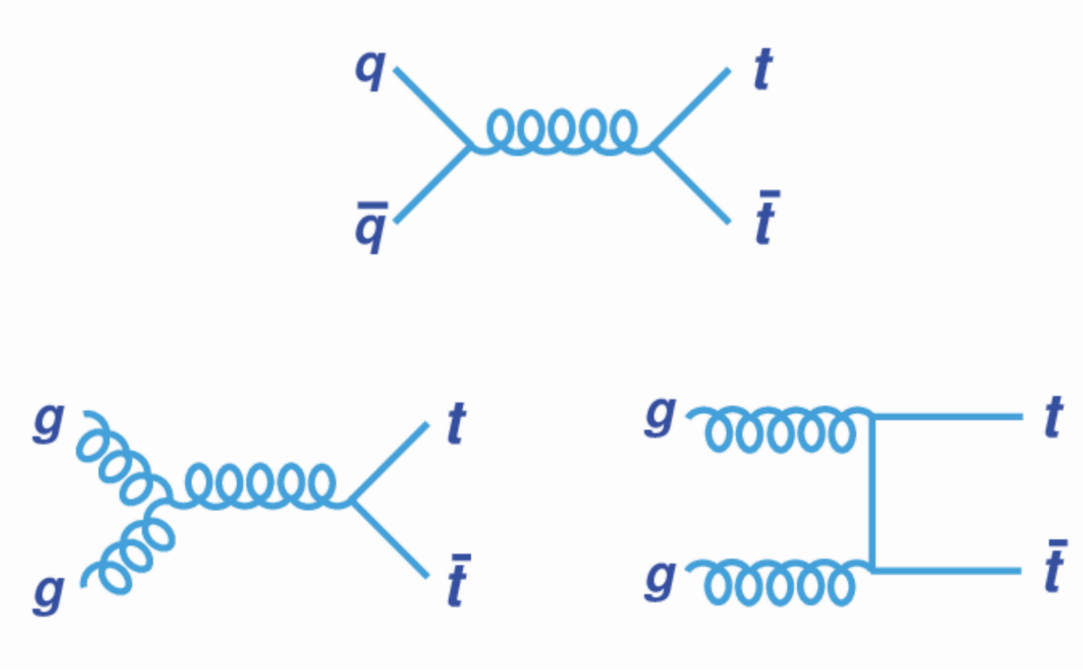
THE PROJECT

$t\bar{t}$ production in pp collisions at 13 TeV

Compute distributions with MATRIX

Do runs using different scale choices

Compare LO/NLO/NNLO results for each scale with data from CMS



THE PROJECT

$t\bar{t}$ production in pp collisions at 13 TeV

CMS:

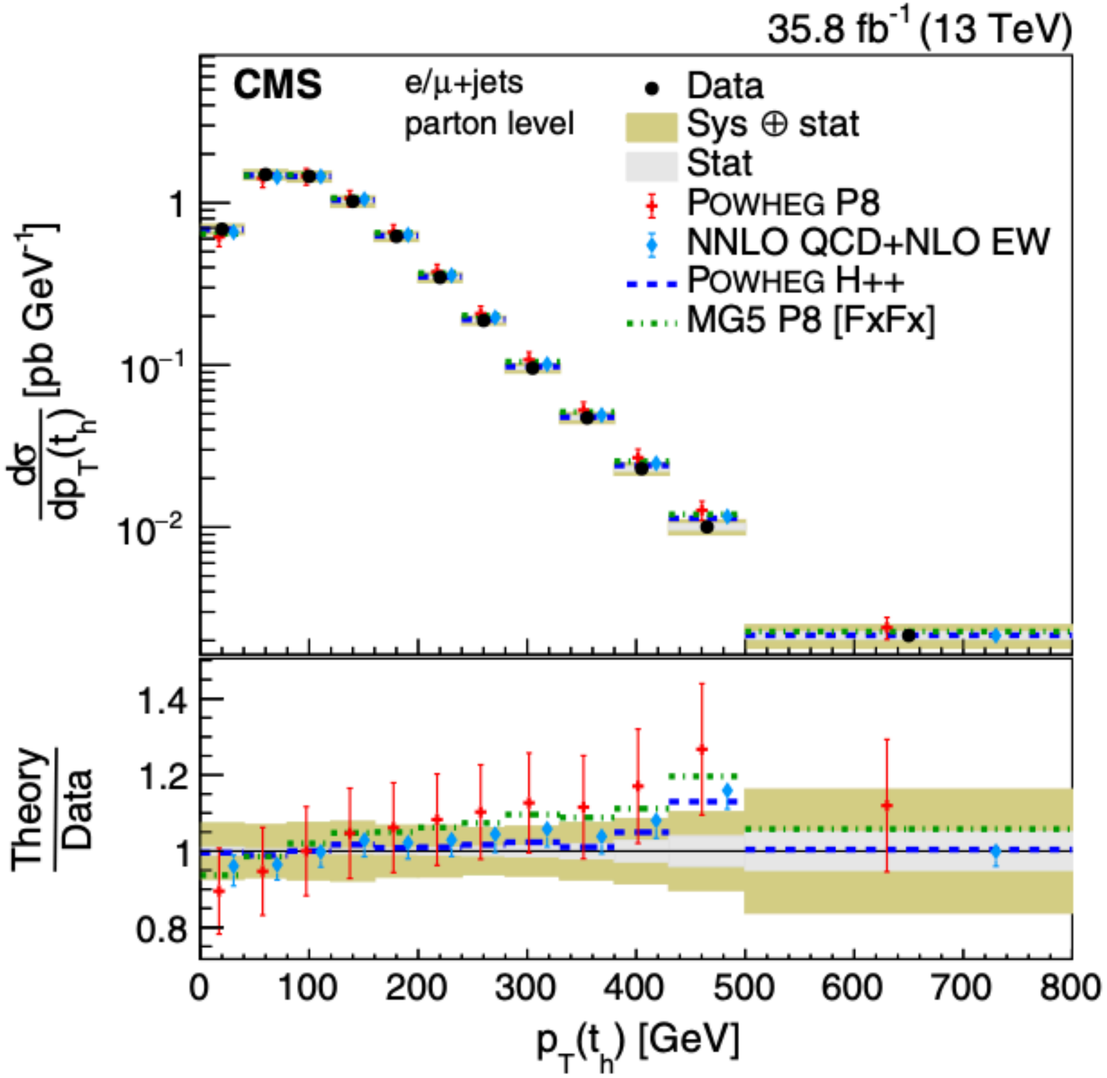
- transverse momentum of top
- (μ/e)+jet channel

Our calculation:

$$\frac{d\sigma}{dp_T} \times \underbrace{\mathrm{Br}[t\bar{t} \to (\mu/e) + \text{jets}]}_{=0.29}$$

1. Averaged top anti-top
2. Diferent scales and orders

Hadronic top



THE PROJECT

$t\bar{t}$ production in pp collisions at 13 TeV

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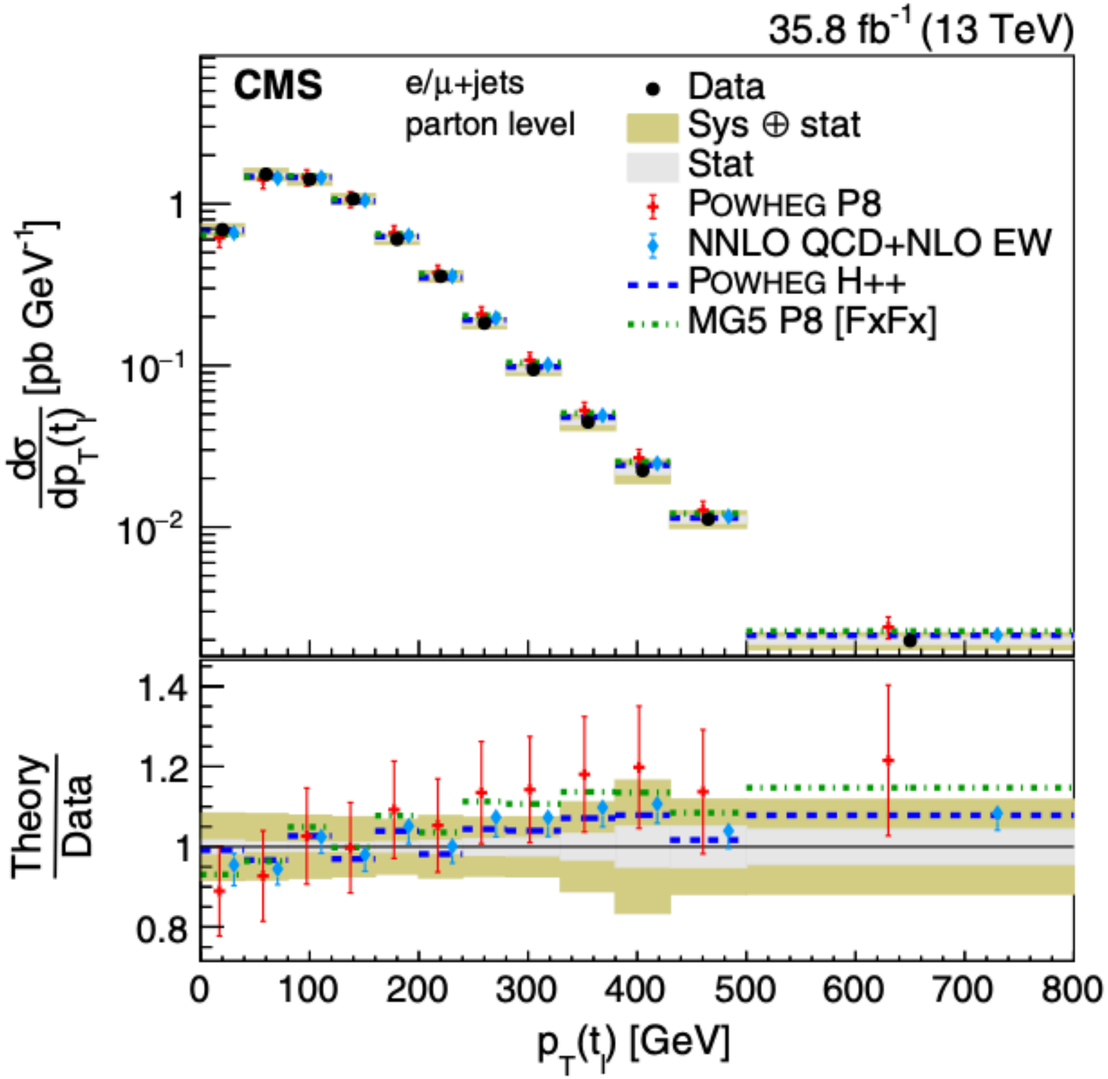
Leptonic top



SCALE CHOICE

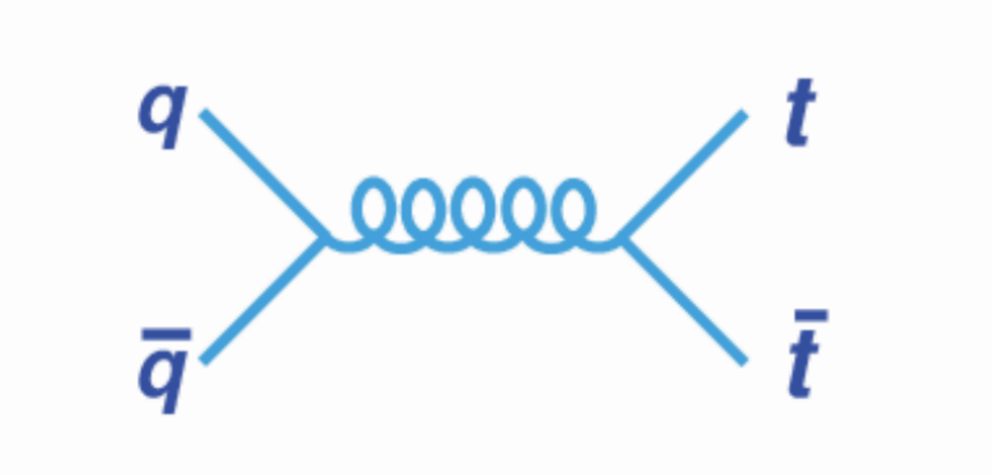
RENORMALISATION AND FACTORISATION SCALE

$H_T/2$ and $H_T/4$, where $H_T = m_{T,t} + m_{T,\bar{t}}$,

$m_{T,t} = \sqrt{m_t^2 + p_{T,t}^2}$

We want to measure $p_{T,t}$ of the (anti-)top → we want a scale that matches the energy in interactions

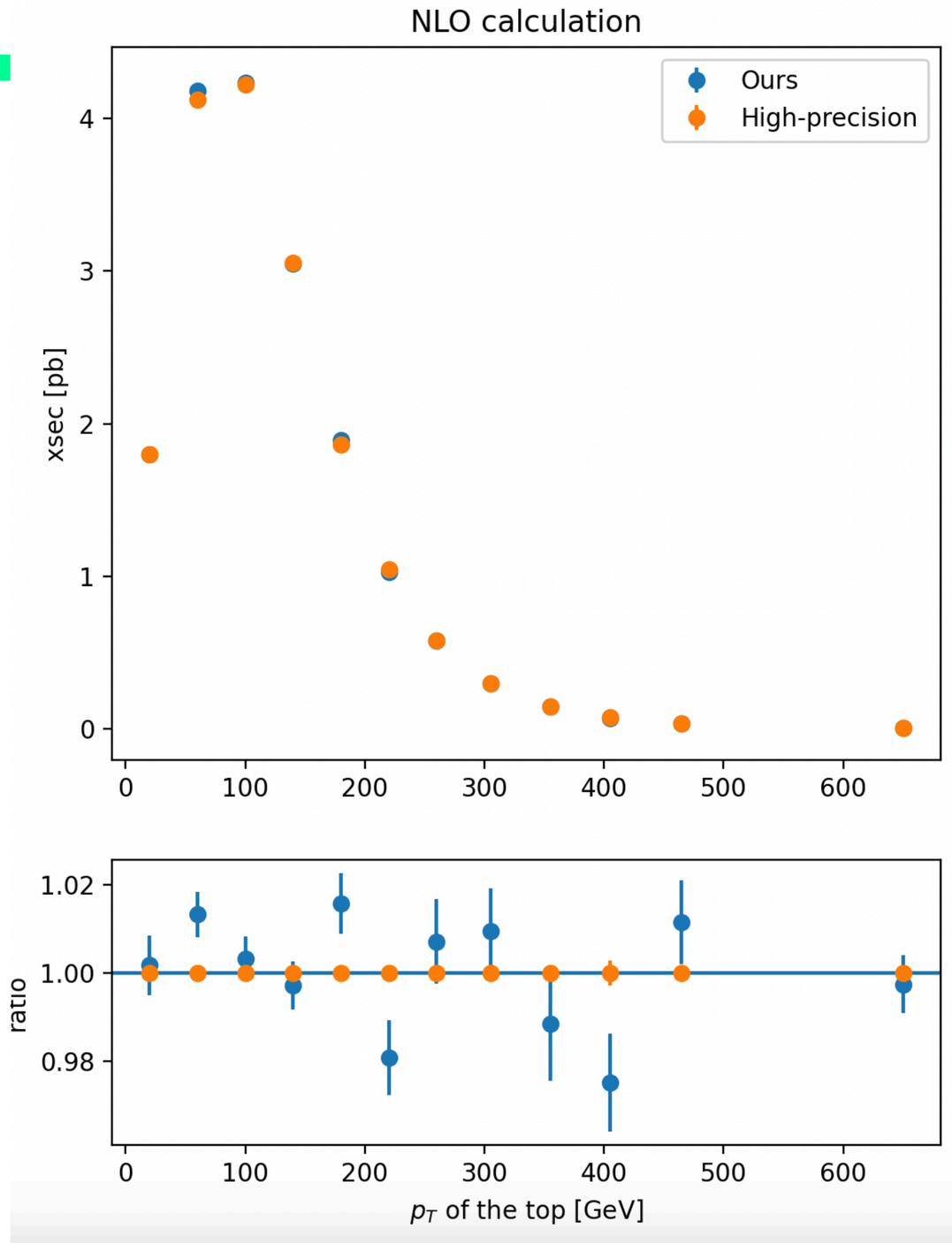
Running with two variations of the scale to see the effect on the result



NLO@$H_T/2$

Comparison of our NLO run (% level precision) to the fancy high precision run

> mostly within numerical uncertainty

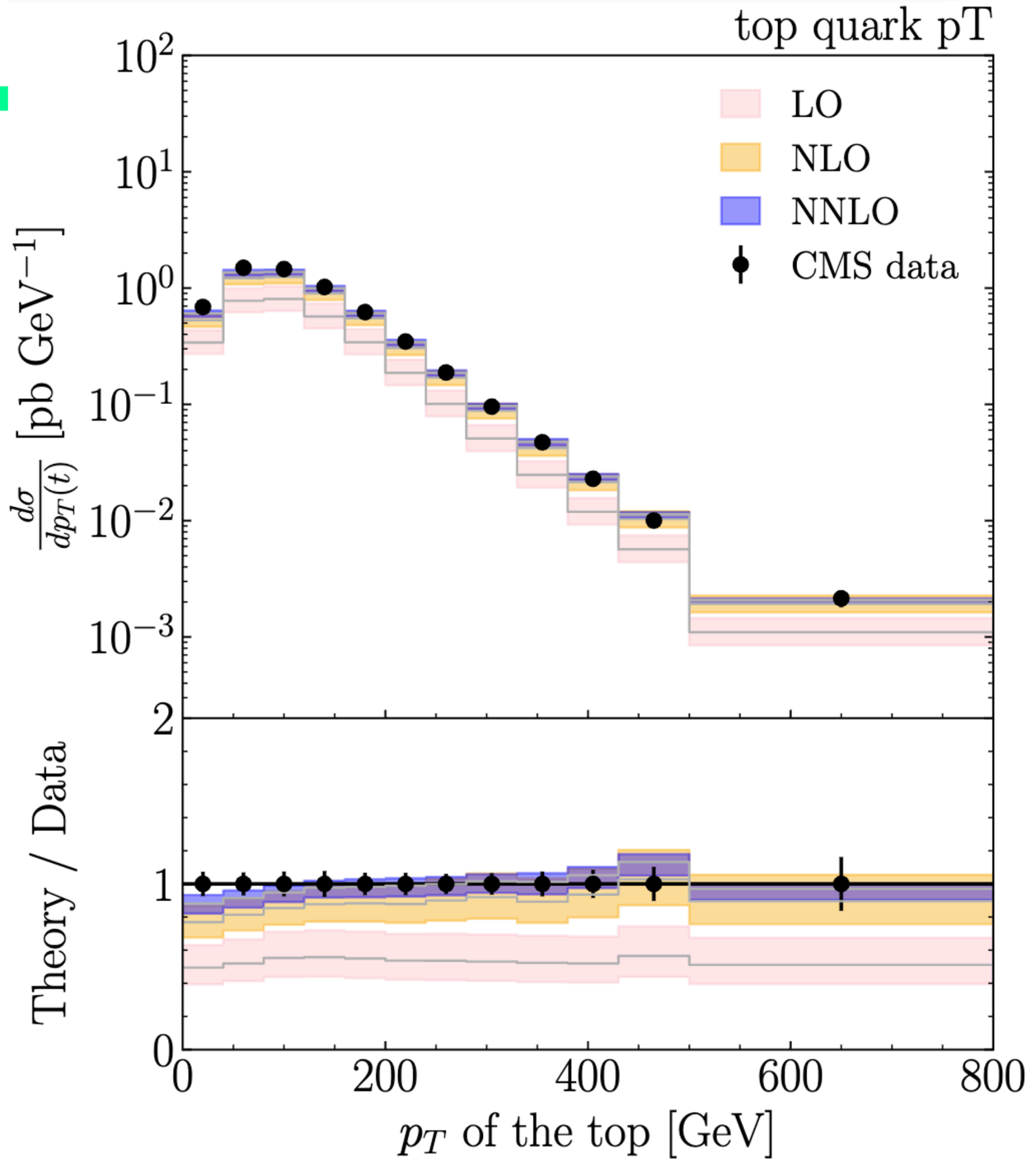


SCALE CHOICE: $H_T/2$

LO/NLO/NNLO COMPARISON

Comparison between LO, NLO and NNLO results, to CMS data

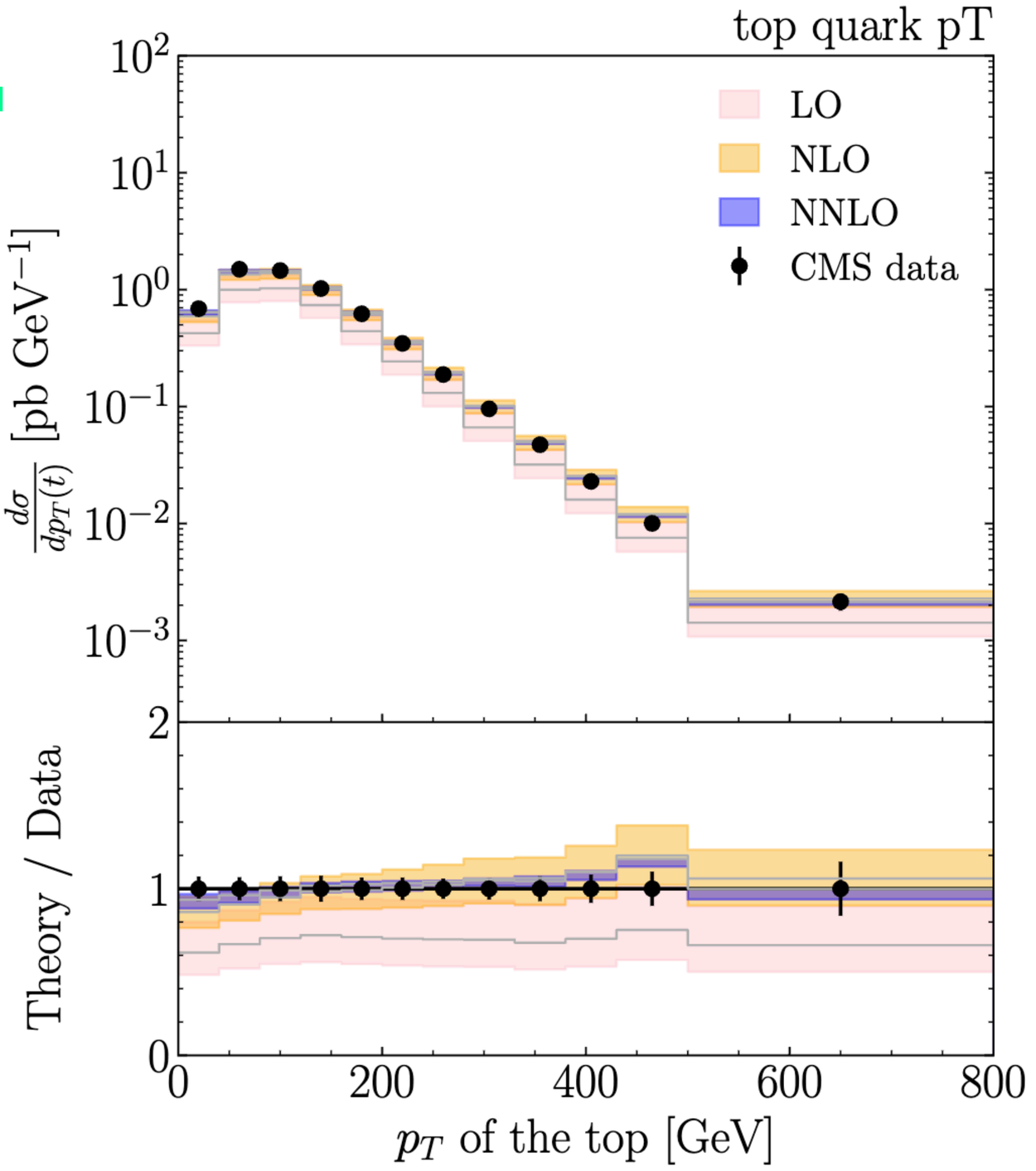
Slope at low momentum:
lack of parton shower?



SCALE CHOICE: $H_T/4$

LO/NLO/NNLO COMPARISON

Comparison between LO, NLO and NNLO results, to CMS data

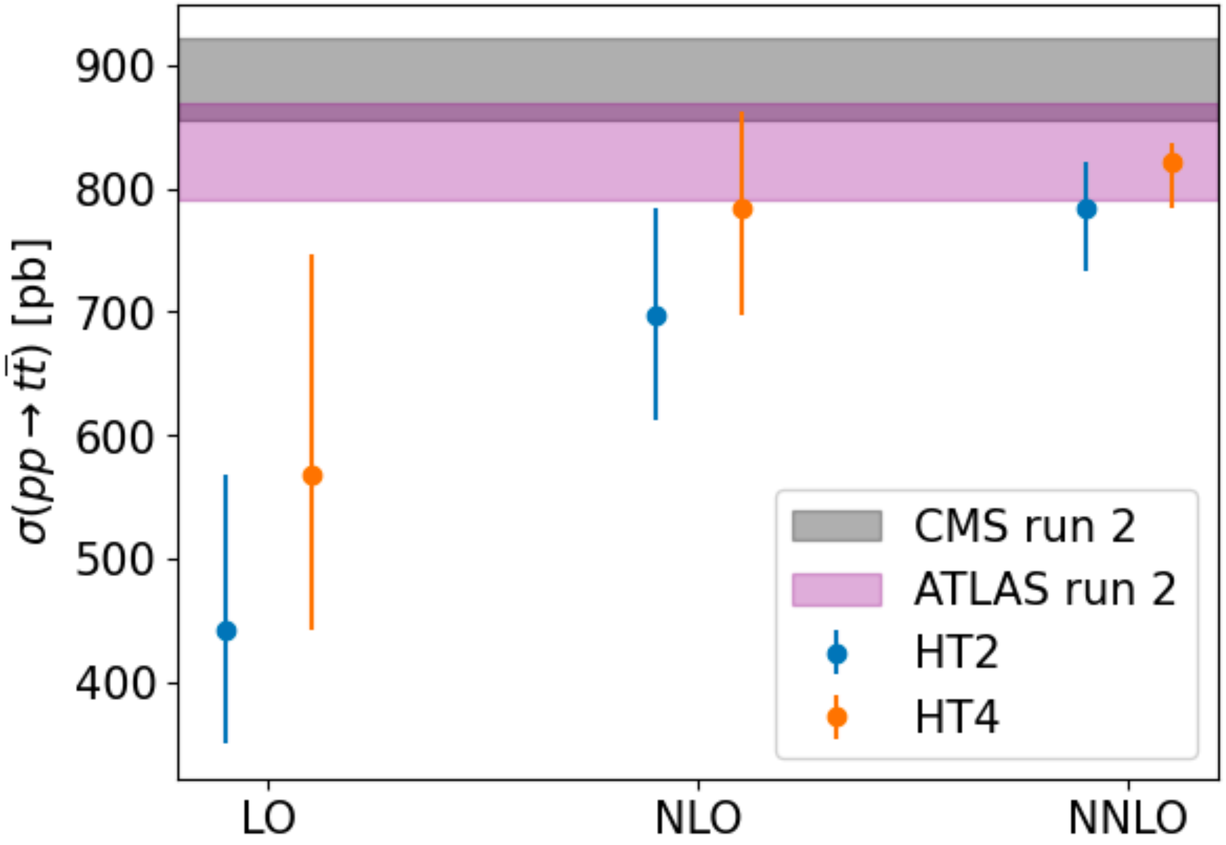


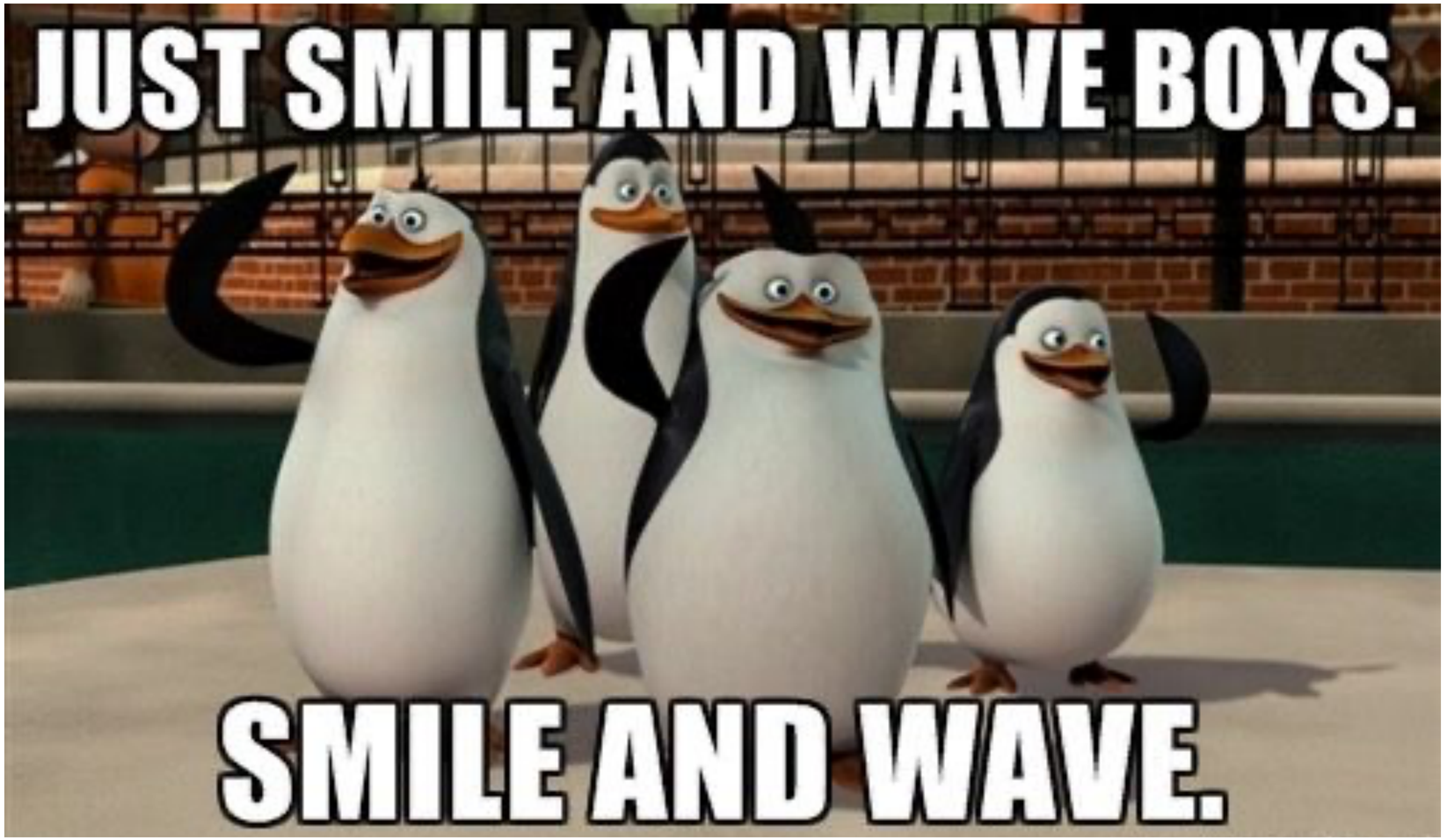
DISCUSSION

We’re trying to estimate the contributions of higher orders without calculating them

$H_T/4$ shows faster convergence and smaller error bands

$H_T/2$ has more symmetric error bands





This is where you clap