

Higgs Boson Pair Production at NNLO in the Large- M_t Expansion

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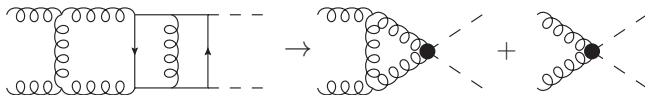
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Exact results available at NLO:

[Borowka, Greiner, Herinrich, Jones, Kerner, Schlenk, Zirke '16],

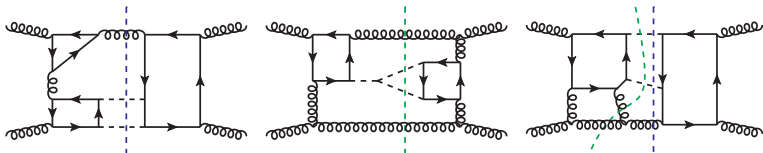
[Baglio, Campanario, Glaus, Mühlleitner, Spira, Streicher '18]

At NNLO current predictions are based on HEFT or the LME

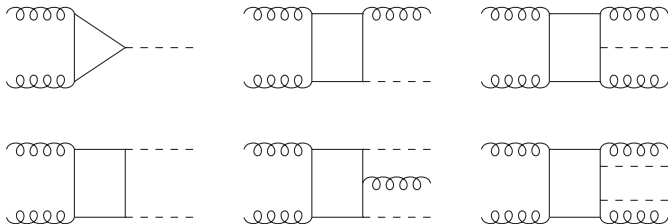


- HEFT [de Florian, Mazzitelli '13], [Grigo, Melnikov, Steinhauser '14]
- $1/m_t^2$ corrections for virtual parts [Grigo, Hoff, Steinhauser '14],[Davies, Steinhauser '19]
- HEFT for virtual parts combined with exact real radiation where available [Grazzini, Heinrich, Jones, Kallweit, Kerner, Lindert, Mazzitelli '18]

Goal: compute total cross-section at NNLO in the LME



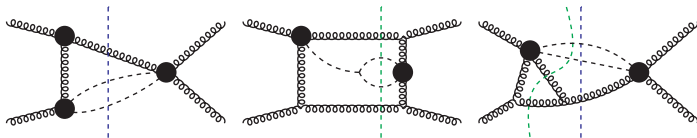
Perform a Taylor expansion of all possible one loop building blocks:



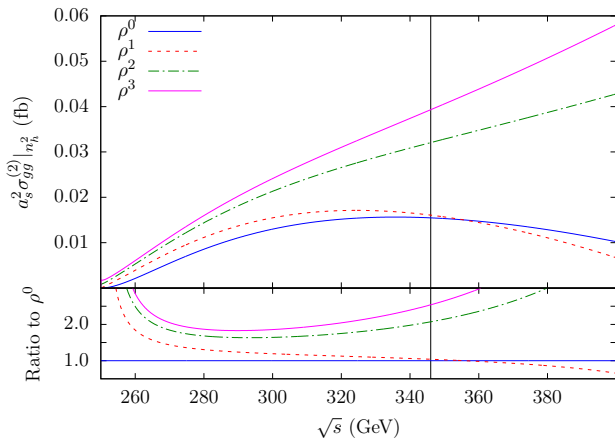
$$F^{\mu\nu}(q_1, q_2, m_t) \rightarrow f_{00} \left(\frac{q_i \cdot q_j}{m_t^2} \right) q_1 \cdot q_2 g^{\mu\nu} + f_{kl} \left(\frac{q_i \cdot q_j}{m_t^2} \right) q_k^\mu q_l^\nu$$

→ Pre-compute all building blocks in LME, insert them in amplitudes

Replace top loops by building blocks:

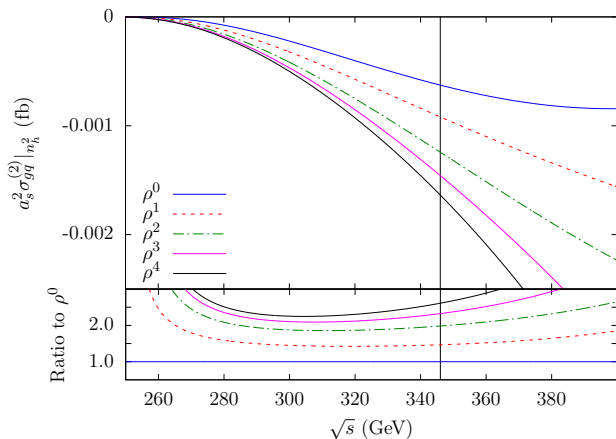


Remaining integrals only depend on $m_h^2/s \rightarrow$ compute them using differential equations

4 expansion terms for gg channel

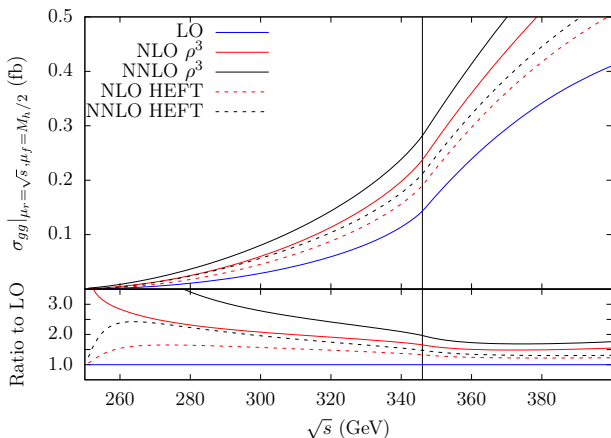
Non-convergence near threshold due to logarithms of $1 - 4 \frac{m_h^2}{s}$

5 expansion terms for all other channels



Sizeable corrections to HEFT

Using exact LO:



Sizeable corrections to HEFT

- We obtained NNLO corrections to the total partonic cross-sections in the LME [Davies, Herren, Mishima, Steinhauser '19,'21]
- Mass corrections sizeable
- We plan to study the impact on the total hadronic cross-section
- Results can be used as input to Padé approximant based methods