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Chapter 1

Research Activities – Theory

1.1 Novel computational techniques in particle physics and phenomenological applications

(Director: Prof. Dr. G. Zanderighi)

Introduction of the group.

1.1.1 Event generators at the Large Hadron Collider

Section for predictions matched with parton shower in hadron-hadron colliders.

1.1.1.1 B-hadron and jet algorithms

(R. Gauld, A. Ratti, M. Wiesemann, G. Zanderighi)

1.1.1.2 Charm-quark pair production and netrino physics

(R. Gauld, T. Giani, A. Mahr, A. Ratti, M. Wiesemann, G. Zanderighi)

1.1.1.3 A new class of NNLO+PS predictions with bbZ

(M. Wiesemann)

1.1.1.4 Higgs production in association with a bottom-quark pair: a flavour-scheme study

(C. Biello, A. Sankar, M. Wiesemann, G. Zanderighi)

Example of citation [1] or ref. [1]. Example of a figure in figure **??**.

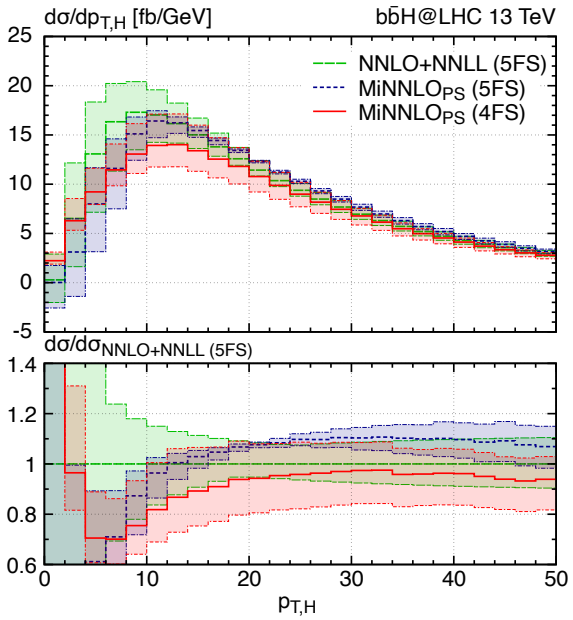

Figure 1.1: Example plot.

1.1.1.5 Off-shell effects in top-quark pair production

(C. Biello, C. Signorile-Signorile, M. Wiesemann, G. Zanderighi)

1.1.1.6 Off-shell studies in tt(+X) processes

(G. Pelliccioli)

1.1.1.7 N-jettines formulation of MiNNLOPS

(M. Ebert, M. Wiesemann, G. Zanderighi, S. Zanoli)

1.1.1.8 EW NLO+PS

(G. Pelliccioli, M. Wiesemann, G. Zanderighi, S. Zanoli)

1.1.1.9 Polirised NLO+PS predictions and quantum info

(G. Pelliccioli, G. Zanderighi)

1.1.1.10 Di-Higgs production

(F. Garosi, M. Wiesemann, G. Zanderighi)

References

[1] Christian Biello et al. "Higgs boson production in association with massive bottom quarks at NNLO+PS". In: (Dec. 2024). arXiv: 2412.09510 [hep-ph].

1.1.2 Pushing the precision in Higgs studies

Space for a nice introduction.

1.1.2.1 VBF $H \to b\bar{b}$ production

(A. Behring, G. Zanderighi)

1.1.2.2 Two-loop amplitudes for Higgs plus jet

(U. Haisch, M. Niggetiedt)

1.1.2.3 Exact top-quark mass dependence in Higgs production

(M. Niggetiedt)

1.1.2.4 Higgs predictions with bottom-quark mass effects

(M. Niggetiedt)

1.1.2.5 Next-to-soft threshold in $b\bar{b}$H

(A. Sankar)

1.1.2.6 Rapidity distribution of pseudoscalar Higgs

(A. Sankar)

1.1.3 Tools and methods for higher-order predictions

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1.1.3.1 New formulation of Nested Soft-Collinear Subtraction Scheme

(C. Signorile-Signorile)

1.1.3.2 LASS: a new subtraction scheme method at NNLO

(G. Pelliccioli, A. Ratti, C. Signorile-Signorile)

1.1.3.3 Strongly-ordered infrared counterterms from factorisation

(C. Signorile-Signorile)

1.1.3.4 Soft function at N3LO

(M. Delto, C. Wang)

1.1.3.5 Reclassifying Feynman Integrals as Special Functions

(C. Wang)

1.1.3.6 Four-loop renormalisation of pseudoscalar operators

(M. Niggetiedt)

1.1.4 Not only proton-proton collisions

Space for a nice introduction and give me a better title for sure.

1.1.4.1 NNLO+PS prediction for di-jet production at lepton colliders

(F. Koenig, R. Schorer, M. Wiesemann, G. Zanderighi)

1.1.4.2 NLO+PS predictions for charged-lepton and neutrino induced DIS

(R. Gauld, G. Zanderighi)

1.1.4.3 Strong-coupling constant determination

(P. Nason, G. Zanderighi)

1.1.4.4 Time-like matching conditions at the threshold

(C. Biello)

1.1.4.5 Mass power corrections for fragmentation functions

(F. Ahmadova, R. Gauld)

1.1.4.6 Tetraquarks

(C. Wang)

1.1.4.7 Neutrino content of the muon

(F. Garosi)

1.1.5 Beyond Standard Model seaches

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1.1.5.1 Polarised NLO+PS predictions in SMEFT

(J. Linder, G. Pelliccioli, M. Wiesemann, G. Zanderighi)

1.1.5.2 Z+jet SMEFT

(R. Gauld, U. Haisch, J. Weiss)

1.1.5.3 NNLO+PS VH

(R. Gauld, L. Schnell, U. Haisch)

1.1.5.4 New collider proposal for dark matter studies

(R. Gauld)

1.1.5.5 $b \to s\gamma$ corrections for the physical value of the charm mass

(M. Niggetiedt)