T 55: Monte Carlo, Partonschauer, QCD (Theorie)

Zeit: Dienstag 16:45–19:00 Raum: VMP8 SR 105

T 55.1 Di 16:45 VMP8 SR 105

Monte Carlo solution of the DGLAP evolution equation and extraction of TMD densities — •Aleksandra Lelek[1], Hannes Jung[1], and Francesco Hautmann[2] — [1]DESY, Hamburg, Germany — [2]University of Oxford, Oxford, United Kingdom

The Sudakov form factor, with its simple physical interpretation as a probability of evolving from one scale to another without any resolvable branching, is a basic tool to solve the evolution equation with a Monte Carlo method.

We present results for the full quark and gluon parton densities obtained with uPDFevolv code. We demonstrate that this method gives an exact solution of the evolution equation by a comparison with the results from the QCDnum package. We also show that higher order splitting functions can be included in a straight forward manner. The MC methods provides a direct method to obtain transverse momentum dependent (TMD) parton densities.

T 55.2 Di 17:00 VMP8 SR 105

Parton Shower Matching for Electroweak Corrections — Michael Krämer, Alexander Mück, and •Lennart Oymanns — RWTH Aachen, Institut für Theoretische Teilchenphysik und Kosmologie

The POWHEG method is widely used to match next-to-leading order (NLO) QCD calculations with standard parton shower programs. It is also possible to use the POWHEG method to match electroweak (EW) corrections with parton showers. We present how the POWHEG method can be extended to handle EW corrections, including photon radiation, and we use it to investigate the Drell-Yan process ($pp \to \mu^+\mu^-$). Our implementation is compared to an existing implementation in the POWHEGBOX and to NLO calculations for QCD and EW corrections.

T 55.3 Di 17:15 VMP8 SR 105

Automation of soft-gluon resummation in Sherpa — •Piero Ferrarese and Steffen Schumann — II. Physikalisches Institut Georg-August-Universitaet Goettingen

We present a fully automated NLL resummation of soft-gluons in global event-shape distributions at hadron colliders, for generic QCD processes. In general, for non-additive variables, the single logarithmic piece of the resummed distribution involves integrals that are not analytically solvable. We present a new algorithm to evaluate such integral, based on Monte Carlo methods. For this purpose we employ the parton-shower formalism, as implemented in the SHERPA event generator, to efficiently generate points in the multiple emission phase space. We discuss the general layout of our approach and present exemplary results.

T 55.4 Di 17:30 VMP8 SR 105

Fast evaluation of theoretical uncertainties with Sherpa and MCgrid — •Enrico Bothmann[1], Marek Schönherr[2], and Steffen Schumann[1] — [1]II. Physikalisches Institut, Georg-August-Universität Göttingen — [2]Physik-Institut, Universität Zürich

The determination of theoretical error estimates and PDF/α_s-fits requires fast evaluations of cross sections for varied QCD input parameters. These include PDFs, the strong coupling constant α_S and the renormalization and factorization scales. Beyond leading order QCD, a full dedicated calculation for each set of parameters is often too time-consuming, certainly when performing PDF-fits. In this talk we discuss two methods to overcome this issue for any QCD NLO calculation: The novel event-reweighting feature in Sherpa and the automated generation of interpolations grids using the recently introduced MCgrid interface. For the Sherpa event-reweighting we present the newly added support for the all-order PDF dependencies of parton shower emissions. Building on that we discuss the sensitivity of high precision observables to those dependencies.

T 55.5 Di 17:45 VMP8 SR 105

Validation of aMC@NLO & Herwig++ for Processes Involving Top Quarks — •Daniel Rauch and Judith Katzy — DESY, Notkestraße 85, 22607 Hamburg

Measurements of top-associated Higgs production are among the flagship analyses of the second run of the LHC with the process $pp \to t\bar{t}H$ giving access to the Yukawa coupling of the Higgs particle to the top quark. The process $pp \to t\bar{t}b\bar{b}$ forms an irreducible background not only to these measurements but also to other searches investigating charged Higgs and SUSY models. From a theoretical perspective processes with such a large number of massive particles and different mass scales are quite challenging and typically suffer both from large theory uncertainties as well as modelling uncertainties regarding the treatment of masses and the splitting of the gluon into pairs of heavy quarks.

In this talk the Monte Carlo event generation with aMC@NLO matched at next-to-leading order to the Herwig++ parton shower will be studied for processes involving top quarks that are relevant in measurements of top-associated Higgs production in the second run of the LHC. Following up on the findings from Run 1 different radiation and scale settings will be evaluated and compared to results obtained during the 2015 data taking period at a center-of-mass energy of 13 TeV.

T 55.6 Di 18:00 VMP8 SR 105

FeynCalc 9 — •Vladyslav Shtabovenko[1], Rolf Mertig[2], and Frederik Orellana[3] — [1]Technische Universität München, Physik-Department T30f, James-Franck-Str. 1, 85747 Garching, Germany — [2]GluonVision GmbH, Bötzowstr. 10, 10407 Berlin, Germany — [3]Technical University of Denmark, Anker Engelundsvej 1, Building 101A, 2800 Kgs. Lyngby, Denmark

We present the new version 9 of the Mathematica package FeynCalc, a useful tool for symbolic evaluation of Feynman diagrams and algebraic calculations in QFT. This talk will provide examples for using FeynCalc in heavy quarkonium physics, focussing on matching calculations between QCD and non-relativistic QCD (NRQCD), a well established effective field theory of QCD that is used to describe production and decay of heavy quarkonia. We will show that despite of being a high energy physics tool, FeynCalc is also well suitable for situations, where in the matching the manifest Lorentz covariance of QCD must be broken, such that one has to explicitly distinguish between temporal and spatial components of Lorentz tensors. Such calculations are important for obtaining higher order relativistic corrections to the NRQCD cross-sections and decay rates where the covariant projector approach is not always applicable.

T 55.7 Di 18:15 VMP8 SR 105

NLO event generation with the (MC)^3 sampling algorithm — •Rene Poncelet[1], Steffen Schumann[2], and Kevin Kröninger[3] — [1]Institut für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen — [2]II. Physikalisches Institut, Universität Göttingen — [3]Experimentelle Physik IV, TU Dortmund

For precise predictions in high energy physics perturbative calculations within numerical approaches like Monte Carlo event generation are the state of the art. The sampling from complicated phase spaces arising in higher order calculations need to be handled. Multi-Channel Importance Sampling methods are the commonly used algorithms for phase space sampling, but suffer from inefficiencies for complicated target functions. The new sampling method Multi-Channel Markov Chain Monte Carlo (MC)^3 is a promising alternative regarding sampling efficiency. In this talk, the generalisation of the (MC)^3 implementation in Sherpa to next-to-leading order event generation as well as the validity and performance measurement of the (MC)^3 sampling algorithm is discussed. Also, the study on the influence of parameters steering the sampling with (MC)^3 will be outlined. It will be shown that (MC)^3 can produce samples of equally weighted events with statistical properties comparable to unweighted importance sampling in only a fraction of the time.

T 55.8 Di 18:30 VMP8 SR 105

Towards the automatized evaluation of Feynman integrals with differential equations — •Christoph Meyer and Peter Uwer — HU Berlin, Berlin, Germany

In the past years the method of differential equations has proven itself to be a powerful tool for the computation of multi-loop Feynman integrals. This method relies on the choice of a basis of master integrals in which the dependence on the dimensional regulator factorizes. We will present an algorithm which automatizes the transformation to such a basis, starting from a given reduction basis. The algorithm only requires some mild assumptions about the basis. It applies to problems

with multiple scales of which we will present some examples.

T 55.9 Di 18:45 VMP8 SR 105

Automation of calculations in Soft-Collinear Effective Theory — Guido Bell[2], •Rudi Rahn[1], and Jim Talbert[1] — [1]Rudolf Peierls Centre for Theoretical Physics, University of Oxford, United Kingdom — [2]Theoretische Physik 1, Universität Siegen, Germany

In this talk we will focus on the evaluation of 2-loop dijet soft functions, which are crucial for NNLL resummation in SCET, and an algorithmic approach, suitable for automation and numerical treatment of a wide range of soft functions will be presented. We will show an implementation of this algorithm using the publicly available program SecDec, and various results for e+e- and hadron collider soft functions derived with it.