T 61: Experimentelle Methoden II

Zeit: Mittwoch 16:30–19:00 Raum: Z6 - SR 1.013

T 61.1 Mi 16:30 Z6 - SR 1.013

Jet energy scale corrections in the CMS experiment in pp collisions at 13 TeV — Johannes Haller, Anastasia Karavdina, Arne Reimers, and •Jens Multhaup — Institut für Experimentalphysik, Universität Hamburg

For almost all data analyses in CMS, a precise knowledge of the jet energies is of high importance. In this talk an overview is given of the jet energy calibration (JEC) procedure employed in CMS, which factories into pile-up, detector response and residual corrections. Emphasis is given on the residual corrections obtained for pp-collision data recorded by CMS during 2016.

T 61.2 Mi 16:45 Z6 - SR 1.013

Jet Resolution Correction with 2017 Di-Jet Data at CMS — •Christoph Garbers, Anastasia Karavdina, Jens Multhaup, Arne Reimers, and Peter Schleper — Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany

For most CMS analysis precise knowledge of the jet energies is of high importance. This is achieved by calibration of the reconstructed jet energies in different detector parts. The calibration is done with simulation as well as with data. In this talk the relative residual correction with di-jet events for the CMS pp-collision data recorded during 2017 is presented. The preparation of data for the analysis and tools introduced for monitoring of residual corrections are discussed in detail.

T 61.3 Mi 17:00 Z6 - SR 1.013

Measuring the Jet Energy Resolution with the Bisector Method in ATLAS — •Tanja Holm and Ian C. Brock — Physikalisches Institut Universität Bonn, Bonn, Germany

Jets play an important role in many physics processes at the LHC. Therefore a precise knowledge of its jet energy resolution (JER) is important. It is defined as the width of the energy distribution of a reconstructed jet with respect to its true energy.

The bisector method is one way of estimating the JER. It is a geometric approach to separate particle-level from detector-level contributions to the transverse momentum imbalance in dijet events. Particle-level imbalances mostly originate from initial-state radiation and therefore are expected to be isotropic in the transverse plane. Detector-level imbalances only occur in the direction of the jets. For this reason the imbalance vector is decomposed into a perpendicular and a parallel component with respect to the average direction of the jets ("jet axis"). The resolution perpendicular to the jet axis (particle level) is subtracted quadratically from the resolution parallel to the jet axis (particle + detector level), remaining therefore with the resolution originating from the detector. This talk will discuss the bisector method and its implementation for Run 2 of the LHC at ATLAS, where especially the enlarged number of pile-up events has to be considered.

T 61.4 Mi 17:15 Z6 - SR 1.013

Kalibrierung der Jet-Energie mit Z+Jet-Ereignissen am CMS-Experiment — Thomas Berger, Christoph Heidecker, •Daniel Savoiu und Klaus Rabbertz — Institut für Experimentelle Teilchenphysik, Karlsruher Institut für Technologie (KIT)

Viele Physikanalysen erfordern eine genaue Vermessung von Teilchenjets. Insbesondere bei der Messung der Jet-Energie tritt dabei eine Vielzahl von Störeffekten auf, die eine Korrektur erforderlich machen.

Als letzter von mehreren Schritten werden am CMS-Experiment Korrekturen der Jet-Energie aus dem Vergleich zu einem präzise rekonstruierten Objekt bestimmt. Durch die Auswahl von Ereignissen, bei denen ein Jet transversal gegen ein Z-Boson balanciert wird, kann die absolute Jet-Energieskala kalibriert werden.

In diesem Vortrag wird der aktuelle Status der Jet-Energie-Kalibrierung vorgestellt. Betrachtet werden dabei die in den Jahren 2016 und 2017 bei einer Schwerpunktsenergie von 13 TeV aufgezeichneten Daten, die aufgrund der hohen Ereigniszahlen eine präzise Bestimmung der Jet-Energie ermöglichen. Eine zentrale Herausforderung bildet dabei die vergrößerte Anzahl von Pile-Up-Ereignissen, verursacht durch die erhöhte instantane Luminosität.

T 61.5 Mi 17:30 Z6 - SR 1.013

Jet mass scale calibration for large-radius jets and variable-radius jets in ATLAS — •Xuanhong Lou[1], Johannes Balz[2], and Katharina Behr[1] — [1]Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607 Hamburg — [2]Johannes Gutenberg Universitaet Mainz, Saarstraße 21, 55122 Mainz

Jets are widely used in ATLAS physics analyses and a proper jet calibration is essential in the case of both high-precision measurements of known particles and searches of new physics. During the calibration, the Monte Carlo based correction factors are used to correct, on average, the reconstructed jet properties to particle-level and account for various detector effects. The Jet Mass Scale (JMS) calibration is carefully studied and efforts have been made to improve the mass response closure for groomed large-radius jets and variable-radius jets. A dedicated framework is developed and will be used to derive the official recommendation of calibration factors for the upcoming release 21 analyses.

T 61.6 Mi 17:45 Z6 - SR 1.013

Extrapolation of in-situ calibrations of large-radius jets to high p_T at ATLAS — •Eftychia Tzovara, Lucia Masetti, and Peter Berta — Institute of Physics, JGU Mainz, Germany

Data-based, so called "in-situ", methods are used to correct the jet energy and mass calibrations and to determine their systematic uncertainties. A very successful technique for extracting the jet mass scale and resolution, from resonance decays (e.g. W/Z, H, top) reconstructed in a single large-radius jet, is the "forward-folding" method. It is used to extract the relative difference in the jet mass response between data and simulation, by using non-parametric shapes for both the particle-level distribution and the response function, derived from the simulation. In order to use this method to set a systematic uncertainty on the jet mass scale and jet mass resolution for beyond Standard Model searches, an extrapolation to high p_T regions is necessary.

Monte Carlo (MC) simulations can be used to extrapolate the large-radius jet forward-folding results from the phase space region where it is performed (e.g. at low p_T), to regions that are inaccessible to the measurement in data. Particular attention is given to the MC modeling systematics that are expected to dominate the total uncertainty. In this talk, results from the extrapolation of the large-radius jet calibrations and their uncertainties to high p_T, at ATLAS for a center-of-mass energy of 13 TeV, are presented.

T 61.7 Mi 18:00 Z6 - SR 1.013

Performance of pileup mitigation in jets using Constituent Subtraction at the ATLAS experiment — •Peter Berta and Lucia Masetti — Institut für Physik, JGU Mainz, Staudingerweg 7, Mainz, Germany

The ability to correct jet kinematics and substructure for simultaneous proton-proton interactions (pileup) largely determines the precision of measurements and searches at the Large Hadron Collider.

In this talk, the performance of the Constituent Subtraction method for pileup mitigation in jets at the ATLAS experiment will be presented. This novel method corrects the jet inputs from the whole event before jet clustering based on the average pileup density in the event. Phenomenological studies showed potential for sizable improvements in performance for small- and large-radius jets compared to the previously used methods. Large-radius jets are particularly interesting when they contain highly boosted hadronic decays of W bosons and top quarks. They can be recognized using jet substructure variables whose performance is also expected to profit from the new method.

T 61.8 Mi 18:15 Z6 - SR 1.013

Measurement of the Photon Identification Efficiency in the ATLAS Experiment using the Electron Extrapolation Method — •Früd Braren — DESY, Hamburg

The detection and identification of photons in high-energy collisions is important for the physics program of the ATLAS experiment at the Large Hadron Collider. Photons produced in collisions in the ATLAS detector are relevant as a probe of QCD and the Standard Model processes in general, as well as the decay of the Higgs boson to a pair of photons. Also signatures of physics beyond the Standard Model may include photons. For measurements and searches involving photons it is vital to know the efficiency with which photons are being identified as such with high precision. The identification of photons is based on the shape of the electromagnetic shower in the calorimeter and its ef-

ficiency needs to be measured using collision data. One of the three currently employed methods for measuring the photon identification efficiency is based on electrons from Z-boson decays using a Tag-and-Probe method. The electron showers, which are subsequently transformed into photon-like objects using shower-shape information from electron- and photon Monte-Carlo samples, can be used to measure the photon identification efficiency in the transverse-momentum range from about 25 GeV to about 150 GeV. This contribution presents the method and results of this measurement, using data corresponding to an integrated luminosity of 79.9 fb^{-1}, collected at a center-of-mass energy of $\sqrt{s} = 13$ TeV.

T 61.9 Mi 18:30 Z6 - SR 1.013

Optimization of the photon identification in the ATLAS experiment — •Jan-Hendrik Arling — Deutsches Elektronen-Synchrotron DESY, ATLAS group, Hamburg — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, Dortmund

A key ingredient for the physics program of the ATLAS experiment at the Large Hadron Collider is the efficient reconstruction and identification of photons in the high-energy *pp* collisions.
Photons play an important role in many measurements, such as the production of photons in Standard Model processes or Higgs boson decays into two photons ($H \to \gamma\gamma$), and searches for physics beyond the Standard Model. In each of these, it is important to identify photons with a high efficiency while keeping the number of misidentified photons at a low rate.
Photons are identified by defining independent requirements on variables describing the shape of electromagnetic showers inside the ATLAS calorimeter. This approach can be challenged by more sophisticated methods, such as machine learning algorithms, to improve the identification performance further. A newly developed framework helps to study these multivariate-analysis techniques and compare the performance between different tuning approaches.
This talk will show the current development stage of the optimization framework for the photon identification in the ATLAS experiment.

T 61.10 Mi 18:45 Z6 - SR 1.013

Studien zur Optimierung der Photon-Identifikation am ATLAS-Experiment mithilfe eines tiefen neuronalen Netzwerkes — •Marius Nagel, Gregor Gessner, Isabel Nitsche, Johannes Erdmann, Olaf Nackenhorst und Kevin Kröninger — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, Otto-Hahn-Straße 4 a, 44227 Dortmund

Bei den am Large Hadron Collider stattfindenden Proton-Proton-Kollisionen entstehen unter anderem Photonen, die aus elementaren Streuprozessen stammen. Solche Photonen werden am ATLAS-Experiment aus Informationen aus dem inneren Detektor und dem elektromagnetischen Kalorimeter rekonstruiert. Die Aufgabe von Photonidentifikationsalgorithmen ist es dabei, zwischen Photonen aus den elementaren Streuprozessen, den Signalphotonen, und fehlerhaft als Photonen rekonstruierten Objekten zu unterscheiden.

Bei der Photonidentifikation werden Variablen zur Charakterisierung von Photonen untersucht, welche zur Unterscheidung zwischen Signalphotonen und fehlerhaft rekonstruierten Objekten dienen. Im Vergleich zu den typischerweise verwendeten multidimensionalen Schnitten auf diese Variablen können tiefe Neuronale Netzwerke auch komplexe nicht lineare Zusammenhänge dieser Variablen lernen und somit die Klassifizierung verbessern. Im Vortrag werden Studien zur Optimierung der Photonidentifikation mithilfe eines tiefen neuronalen Netzwerkes vorgestellt.