T 74: Experimentelle Methoden II

Zeit: Mittwoch 16:45–18:30 Raum: VMP8 SR 105

T 74.1 Mi 16:45 VMP8 SR 105

Jet energy resolution measurement at CMS — Roman Kogler, •Marek Niedziela, Christian Sander, and Hartmut Stadie — Institute of Experimental Physics, Luruper Chaussee 149, D-22761 Hamburg, Germany

At the LHC, the collision of coloured particles are often producing many jets in the final state. Precise measurements and searches for deviations from predictions of the Standard Model require a precise understanding of these objects. In particular, the jet energy resolution is of great importance. It has to be measured for jets as a function of their kinematic properties, such as the transverse momentum p_T and the pseudorapidity η. At 7 and 8 TeV, measurements of jet resolutions have been carried out using the transverse momentum balance of γ+jets or di-jet events. In this presentation, the first jet energy resolution measurements from CMS at 13 TeV, applying the same technique, will be presented.

T 74.2 Mi 17:00 VMP8 SR 105

Studies of the misidentification probability of electrons as photons at $\sqrt{s} = 13$ TeV with the CMS experiment — •Ralf Meyer, Lutz Feld, and Maximilian Knut Kiesel — 1. Physikalisches Institut B, RWTH Aachen University

In high energy proton-proton collisions, several processes lead to final states containing at least one photon. These are of particular interest in many analyses, for example searches for physics beyond the Standard Model. A possible source of backgrounds are objects misreconstructed as photons. To accurately estimate the contribution of these objects to a photon sample, the origin of reconstructed photons has to be investigated. This presentation focuses on electrons which are misidentified as photons. The propability of an electron being reconstructed as a photon is described by the so called "fake rate".

The fake rate is studied in data and simulation at a center-of-mass energy of 13 TeV with the CMS experiment. As a clean electron source, the Z-boson decay to electrons is used. The dependency of the fake rate on several observables is studied and compared to earlier results.

T 74.3 Mi 17:15 VMP8 SR 105

Identification of Hadronic Tau Decays at the ATLAS Detector Using Artificial Neural Networks — Dirk Duschinger, Stefanie Hanisch, Wolfgang Mader, •Nico Madysa, and Arno Straessner — Institut für Kern- und Teilchenphysik, TU Dresden, Germany

One of the primary goals of the ATLAS experiment at the LHC is the search for physics beyond the Standard Model. The efficient identification of hadronically decaying tau leptons is crucial for this as they comprise the final states of several decay channels sensitive to new physics. (e. g. Higgs boson decays $H \to \tau_{\text{had}}\tau_{\text{had}}$) The identification algorithm currently applied at ATLAS utilizes multi-variate methods and reconstructed particle properties to discriminate against QCD jets, which constitute an important background.

This talk presents a new neural-network-based approach to hadronic tau decay identification and investigates its dependence on hyperparameters such as the network topology or number of training cycles. Ensembling is presented as a technique to improve classifier performance and robustness against overtraining. The resulting classifier is compared to the current approach based on Boosted Decision Trees. The study is based on 2012 data taken at the ATLAS detector at a center-of-mass energy of $\sqrt{s} = 8\,\text{TeV}$.

T 74.4 Mi 17:30 VMP8 SR 105

Track reconstruction in hadronic tau decays — •Dirk Duschinger, Arno Straessner, and Wolfgang Mader — IKTP, TU Dresden

Tau leptons often play an important role in searches for new physics. Not only because the Higgs decay probability into two tau leptons is of magnitudes larger than that for decays into muons and electrons, but also physics beyond the standard model can introduce enhanced couplings to tau leptons. However, the small decay length of 87μm makes it hard to detect tau leptons directly. In fact, tau decays in the ATLAS detector at the LHC often take place before any detector component. The decay of taus into hadrons and an additional neutrino makes up 65% of all decays. The correct classification of hadronic tau decay products plays a crucial role in ATLAS tau reconstruction in terms of rejection against QCD jets and electrons. This relies on the correct selection of charged particles.

Several changes have been applied to the ATLAS detector during the first long shutdown phase of the LHC. This requires a revision of the track selection criteria applied for hadronic tau decays used for the first run of the LHC. Performance of the former track selection is presented as well as a new approach using multivariate techniques is presented. The focus is set on improving efficiency to reconstruct the correct number of tracks for each hadronic tau decay. For this purpose correlations of track quality criteria as a function of the transverse momentum of the tau are also considered to account for conditions at different p_{T} regions.

T 74.5 Mi 17:45 VMP8 SR 105

B-tagging in CMS at 13 TeV — Ivan Marchesin, Alexander Schmidt, and •Svenja Schumann — Universität Hamburg

At the LHC the CMS experiment investigates high energy p-p-collisions to study the Standard Model (SM) of particles physics and to search for physics beyond the Standard Model (BSM). The collisions of protons often result in processes with b quarks which hadronize in jets. The identification of these jets from b quarks is very important for BSM searches and SM measurements because it can reduce the background a lot. Based on the characteristics of b hadrons, such as long life time or presence of soft leptons, CMS has various algorithms to select jets form b quarks. The tracking system, the lepton identification and the segmented calorimeters of the CMS detector are excellent to identify jets from b quarks (b-tagging). The efficiencies of the different algorithms and the scale factors are measured with the 13 TeV data which will be shown in this talk. The commissioning of b-tagging in boosted topologies at 13 TeV will also be presented.

T 74.6 Mi 18:00 VMP8 SR 105

Calibration of the light-jet fraction in b-tagging algorithms for the ATLAS detector in Run 2 of the LHC — Alexander Mann and •Balthasar Schachtner — LMU München

B-tagging algorithms have, depending on the working point used, a small probability to tag a light jet as a b-jet. This mistag-rate can be determined using the "negative-tag method" and allows to derive data-to-Monte-Carlo scale factors.

To tag jets originating from b-quarks, ATLAS has developed a new multivariate algorithm (MV2c20) for Run 2. The input variables are designed to exploit the finite decay length of b-hadrons and the event kinematics. Assuming that light jets are tagged as b-jets mainly due to the finite resolution of the detector, lifetime-based variables used in the algorithm will be symmetric with respect to the primary vertex. A "negative" version of the algorithm with all lifetime-based variables inverted is defined to obtain an estimate of the fraction of light jets tagged as b-jets due to resolution effects.

For the calculation of the data-to-Monte-Carlo scale factors, corrections need to be applied and are derived from Monte Carlo. The correction factors account for the heavy-flavour contribution and asymmetries in the positive and negative tagging due to decays of long-lived particles and conversions in the detector.

T 74.7 Mi 18:15 VMP8 SR 105

Messung der B-Tagging-Effizienz in $\sqrt{s} = 13$ TeV ATLAS-Daten mit p_T^{rel} — •Ingo Burmeister, Reiner Klingenberg, Claus Goessling und Kevin Kroeninger — TU Dortmund, Experimentelle Physik IV

Bei vielen Analysen am ATLAS-Experiment spielen b-Quarks eine wichtige Rolle. Für solche Analysen ist die Fähigkeit Jets zu identifizieren, welche ein B-Hadron enthalten eine wichtige Vorraussetzung. Dazu existieren verschiedene Flavour-Tagging-Algorithmen. Diese Algorithmen verwenden bestimmte Arbeitspunkte mit einer in Simulationen bestimmten Effizienz. Diese Effizienz stimmt nicht exakt mit der Tagging-Effizienz in Daten überein. Somit ist die möglichst genaue Messung der Effizienz dieser Flavour-Tagging-Algorithmen von großer Bedeutung für alle Analysen, die Flavour-Tagging verwenden. Die p_T^{rel}-Methode misst die B-Tagging-Effizienz anhand von B-Hadronen, bei deren Zerfall ein Myon entsteht. Dazu wird der Transversalimpuls p_T^{rel} des Myons relativ zur Jet+Myon-Achse gemessen. Dabei wird ausgenutzt, dass Myonen, die aus einem B-Hadron-Zerfall kommen, tendenziell einen höheren Wert für p_T^{rel} aufweisen. Ein Vergleich der Effizienzen, die sowohl in Daten und Simulationen bestimmt werden, erlaubt die Berechnung von Skalierungsfaktoren, die dann in Analysen als Korrekturfaktoren benutzt werden. Diese Faktoren werden erstmals für ATLAS-Daten bei einer Schwerpunktsenergie von $\sqrt{s} = 13$ TeV mit der p_T^{rel}-Methode bestimmt.