T 65: Experimentelle Methoden II

Zeit: Mittwoch 16:00–18:30 Raum: S01

T 65.1 Mi 16:00 S01

Performance of the ATLAS- Muon spectrometer in Run-II — •Johannes Junggeburth[1], Hubert Kroha[1], Nicolas Koehler[1] und Maximilian Goblirsch-Kolb[2] — [1]Max-Planck Institut für Physik, München — [2]Brandeis University, USA

The large LHC Run-2 dataset comprising 150 fb^{-1} marks the beginning of an era where precision measurements increasingly become limited by systematic uncertainties. This necessitates improved precision in the understanding of detector performance in both collision data and simulation. The muon reconstruction efficiency is measured using a so-called tag&probe method exploiting the $Z \to \mu\mu$ and J/ψ resonances. This talk presents the latest developments in the $Z \to \mu\mu$ muon efficiency measurement allowing to reach a precision below 0.1%. The evolution of the ATLAS Muon spectrometer performance during the Run-2 data-taking is discussed in addition.

T 65.2 Mi 16:15 S01

Tau Trigger Efficiency Measurements using $Z \to \tau\tau$ Events at ATLAS — •Kieran Amos, Serhat Ördek, Michel Janus, and Stan Lai — II. Physikalisches Institut, Georg-August-Universität Göttingen

Experiments with the ATLAS detector involving tau leptons in the final state use the tau trigger system for the online selection. This trigger system must accommodate the high instantaneous luminosity achieved during the LHC's run in 2018. In this talk, the $Z \to \tau\tau$ tag and probe analysis used to determine the tau trigger efficiency will be dicussed. For each event a single muon (tag) is required, and the tau trigger efficiency is then calculated from the fraction of events where the accompanying hadronic tau decay candidate (probe) passes the trigger. The dependency of the efficiency on the transverse momentum and the pseudorapidity of the tau candidate as well as the average number of interactions per bunch-crossing is presented. The talk discusses the challenges involved in implementing the method as well as possible future improvements.

T 65.3 Mi 16:30 S01

Particle Flow jets in the $H \to ZZ^* \to 4\ell$ analysis at ATLAS for optimizing kinematical reconstructio — •Tobias Klingl, Philip Bechtle, and Klaus Desch — Universität Bonn

In the LHC Run-II, the Higgs simplified template cross sections (STXS) framework was developed to provide signal strength measurements in kinematical distributions of Higgs Boson production and decay. About 2.5 % of Higgs Bosons with a mass of $m_H = 125\,\text{GeV}$ produced at the LHC decay into a real and virtual Z boson. The further decay into two lepton pairs provides a clear final state with high reconstruction efficiency and good access to the underlying Higgs Boson kinematics. On top of the four final state leptons an event can contain additional jets. New physics at high energy scales might influence the properties of the extra jets, therefore their precise reconstruction is of high importance. These jets were typically reconstructed using topological cell clustering. In this study we aim to optimize the STXS bins by switching to particle flow jets which have demonstrated superior momentum and spatial resolutions, especially at low energies.

T 65.4 Mi 16:45 S01

Identification of hadronically decaying tau leptons in CMS and determination of their energy corrections — Jordy Degens, Günter Flügge, •Olena Hlushchenko, Wolfgang Lohmann, Thomas Müller, Dennis Roy, Hale Sert, Achim Stahl, and Alexander Zots — III. Physikalisches Institut B, RWTH Aachen University

In this talk, the identification of tau leptons decaying into hadrons in the CMS experiment will be explained and the performance of the latest multivariate discriminators will be presented. To calculate the mass of a particle decaying into tau leptons, any bias in the energy measurement or reconstruction of the tau lepton decay products must be determined and corrected for. The energy scales are determined to treat the charged and neutral components of the tau separately and are compared to the energy scale obtained without this separation. The dedicated energy scale measurement for the electrons faking tau leptons are discussed as well in the context of $H \to \tau\tau$ analysis.

T 65.5 Mi 17:00 S01

Calibration of the measured $p_{\text{T}}^{\text{miss}}$ recoil of CMS using MVA regression techniques — Artur Gottmann[1], Tanja Kopf[1], Günter Quast[1], Roger Wolf[1], and •Stefan Wunsch[1,2] — [1]Karlsruhe Institute of Technology — [2]CERN

The measured $p_{\text{T}}^{\text{miss}}$ is a sum of genuine $p_{\text{T}}^{\text{miss}}$, carried e.g. by neutrinos, emerging from a high energy physics collision and miss measurements of the $p_{\text{T}}^{\text{miss}}$ recoil in the detector. A calibration method of the $p_{\text{T}}^{\text{miss}}$ recoil is performed to minimize the resolution of the measured $p_{\text{T}}^{\text{miss}}$. This calibration is formulated as an MVA regression task. It is obtained from $\text{Z} \to \mu\mu$ events in data which can be assumed to be free of genuine $p_{\text{T}}^{\text{miss}}$. The calibrated recoil in turn can be used as an estimator of the genuine $p_{\text{T}}^{\text{miss}}$ for events with resonances, where a recoil can be defined. The application on W+Jets events will be presented.

T 65.6 Mi 17:15 S01

Bremsstrahlung finding at Belle II — Florian Bernlochner[1], Nils Braun[1], •Patrick Ecker[1], Torben Ferber[2], and Thomas Hauth[1] — [1]ETP, KIT, Karlsruhe — [2]DESY, Hamburg

For the physics studies that will be performed at the Belle II experiment in Tsukuba, Japan, a precise reconstruction of charged particle trajectories is of the utmost importance. Electron tracks are highly relevant here, as such are used in many new physics analyses or Standard Model parameter measurements. The quality of the reconstruction of electron tracks is however affected by energy losses due to bremsstrahlung processes. Therefore a new algorithm for identifying bremsstrahlung photons during the reconstruction, using the combined information from the track reconstruction and the electromagnetic calorimeter of the Belle II detector, was developed and tested. This talk presents the concept of the algorithm along with first results to what extent the resolution of the extracted parameters of the electron tracks can be improved.

T 65.7 Mi 17:30 S01

Track propagation for different detector and magnetic field setups in Acts — •Fabian Klimpel[1,2], Andreas Salzburger[2], and Stefan Kluth[3] — [1]TU München — [2]CERN — [3]MPI für Physik

Track finding and fitting are amongst the most complex part of event reconstruction in high-energy physics, and dominates usually the computing time in high luminosity (HL) environment. A central part of track reconstruction is the transport of a given track parameterisation (i.e. the parameter estimation and associated covariances) through the detector, respecting the magnetic field setup and the traversed material. While a track propagation in a sparse environment (e.g. a tracking detector) can be sufficiently good approximated by considering discrete interactions, the propagation in a material dense environment (e.g. calorimeters) is better served by a continuous application of material effects. Recently, a common Tracking software project (Acts) born initially from the Common Tracking code of the ATLAS experiment has been developed in order to preserve the algorithmic concepts from the LHC start-up era and prepare them for the HL era of the LHC and beyond. The software is designed in an abstract, detector independent way and prepared to allow highly parallelised execution of all involved software modules. Therefore the propagation algorithm needs to be as flexible and adjustable which will be the main focus of this talk. The implemented solution for using a fourth order Runge-Kutta-Nystrom integration and its extension with continuous material integration and eventual time propagation is presented, such as the navigation through different geometry setups involving different environments are shown.

T 65.8 Mi 17:45 S01

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. Additionally out-of-cone mis-measurements of the jet energy due to the jet recon-

struction algorithm are subtracted. 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 effects perpendicular to the jet axis (particle level) are removed from the resolution effects parallel to the jet axis (particle + out-of-cone effects + detector level). The resolution of the out-of-cone effects gets evaluated in Monte Carlo samples and is subtracted quadratically, remaining therefore with the resolution originating from the detector. This talk will discuss the bisector method, its implementation and improvements for Run 2 of the LHC at ATLAS.

T 65.9 Mi 18:00 S01

Studies for the calibration of a strange tagger in ATLAS using full Run-2 data — Johannes Erdmann, •Egor Evsenin-Gutschank, Kevin Kröninger, and Sonja Zeissner — TU Dortmund, Lehrstuhl für Experimentelle Physik IV

Up to date, the measurement of the CKM matrix element $|V_{ts}|$ relies on indirect methods. A major obstacle for the development of a direct measurement method is the absence of a reliable way to distinguish between jets originating from strange quarks and jets from other light quarks. Studies to discriminate between strange and up/down jets using multivariate methods are ongoing. This talk presents studies for calibrating such a strange tagging algorithm, which is still under development. Full ATLAS Run-2 data were used for studies to measure the efficiency of the tagging algorithm.

T 65.10 Mi 18:15 S01

Reconstruction of heavy flavour jets for Higgs physics at future e^+e^- colliders — •Yasser Radkhorrami[1,2] and Jenny List[1] — [1]DESY, Hamburg, Germany — [2]University of Hamburg, Hamburg, Germany

The reconstruction of heavy flavour jets plays an important role in precision measurements of the Higgs boson. $H \to b\bar{b}$ is the most frequently occuring decay mode of the Higgs boson. Furthermore, measuring the $H \to c\bar{c}$ decay mode will be possible for the first time at an e^+e^- collider. The International Large Detector proposed for the International Linear Collider is designed for particle flow reconstruction and optimised to achieve a jet energy resolution of 3-4% for light-flavour jets. Due to harder fragmentation functions and presence of semi-leptonic decays, heavy-flavour jets are expected to behave differently. In this study, b- and c-jets are for the first time included in the evaluation of the jet reconstruction performance. Different strategies for correcting the b- and c-jet energy based on the identification of leptons in the jets will be presented and their impact on the jet energy resolution will be evaluated.