T 60: Various topics in elementary particle physics

Time: Wednesday 16:30–18:45 Location: L-2.017

T 60.1 Wed 16:30 L-2.017

Test of isospin symmetry bz measuring $\Upsilon(4S) \to B^0\overline{B^0}$ at *Belle* — •Pascal Schmolz and Thomas Kuhr for the Belle II-Collaboration — Ludwig-Maximilians-Universität München

In contrast to hadron colliders, B-factories allow for the determination of absolute branching fractions. The *Belle* experiment as well as its successor, *Belle II*, examine decays of $\Upsilon(4S)$ to pairs of either neutral or charged B mesons.
The calculation of the production rate for B mesons is often based on the assumption of strong isospin symmetry, i.e. charged and neutral pairs would be produced with the same probability. Quark masses and electromagnetic interaction, however, are responsible for slightly breaking isospin symmetry. In most of the previous measurements of $f_{00} = Br(\Upsilon(4S) \to B^0\overline{B^0})$ isospin is assumed. We present an analysis that bypasses this bias with a sophisticated method, first applied by the *BABAR* collaboration for such a measurement, that avoids any assumption on isospin.

T 60.2 Wed 16:45 L-2.017

Inclusive b-jet measurement at 13 TeV with 2016 CMS data and prospects for BBar jets measurement — •Luis Ignacio Estevez Banos and Patrick Connor — DESY

An inclusive b-jet measurement in pp collisions at a center-of-mass energy of 13 TeV will be presented. The analyzed dataset was recorded with the CMS detector during 2016 corresponding to an integrated luminosity of about 36 fb-1. The inclusive b-jet fraction is measured double differentially, and we compare the results with MC predictions at NLO matched with Parton Showers (PS), including Parton Branching (PB) TMDs (Transverse Momentum Dependent PDFs). In this talk I will also introduce the new measurement of BBar jets and associated jets production in CMS at 13 TeV, and will show some phenomenological studies and MC predictions at NLO interfaced with Parton Showers (PS) and also with PBTMDs.

T 60.3 Wed 17:00 L-2.017

Reconstruction of tau lepton decay planes for analysing the Higgs CP at CMS — Mate Farkas, Olena Hlushchenko, Wolfgang Lohmann, Dennis Roy, Hale Sert, Sebastian Siebert, Achim Stahl, •Lucas Wiens, and Alexander Zotz — III. Physikalisches Institut B, RWTH Aachen University, Germany

One of the three Sakharov conditions states that CP violation is needed to explain the matter-antimatter asymmetry in our universe. In order to find more occurances of CP violation, the Higgs Boson is now being investigated, so one can find out whether or not it is the CP-even Higgs Boson of the Standard Model or if it is in a mixed state of CP-even and CP-odd and a gateway to new physics.

By reconstructing the decay planes of tau leptons, one can perform the measurement of the CP mixing angle. This requires the use of impact parameters and thus it is vital for the analysis to properly determine and select well reconstructed impact parameters.

T 60.4 Wed 17:15 L-2.017

Search for decays of boosted Higgs bosons to pairs of charm quarks with the CMS Experiment — •Andrzej Novak, Xavier Coubez, Luca Mastrolorenzo, Spandan Mondal, Andrey Pozdnyakov, and Alexander Schmidt — RWTH Aachen

The Higgs boson decay into charm quarks has the highest branching fraction of the yet unobserved decays. Moreover, it is predicted to be the strongest coupling to the second generation of fermions which as of now remains unconfirmed. This talk presents a search for the Higgs boson in the gluon fusion production mode with high Lorentz boosts, decaying to a pair of charm quarks. The analysis is modeled on a previous analysis of decays to pairs of bottom quarks and is enabled by recent developments in deep learning based tools for jet identification in such topologies. Probing this channel is not only important for completeness, but it could also be sensitive to potential beyond Standard Model corrections.

T 60.5 Wed 17:30 L-2.017

Identification of boosted Higgs bosons decaying into a pair of b-quarks using multivariate analysis techniques with the ATLAS detector at $\sqrt{s} = 13$ TeV — Jochen Dingfelder, Tatjana Lenz, and •Christian Nass — PI Universität Bonn, Bonn, Germany

Studying properties of the Higgs Boson is crucial for testing the Higgs-mechaism. Prerequisite is the identification of Higgs Boson candidates. High transverse momentum Higgs Bosons are of special interest, as those may arise from new heavy resonances. The final state looked at is the decay into a pair of b-quarks ($H \to b\bar{b}$), since it has the largest Standard Model branching ratio. The main backgrounds are QCD-events and hadronic t-decays. Large-$R = 1.0$ calorimeter-jets are used to reconstruct the collimated Higgs Boson candidate decay products. The ATLAS default Higgs Boson identification algorithm (Higgs-tagger) uses the jet mass and the number of $R = 0.2$ track-jets associated to the large-R jet and identified as b-jets in order to identity Higgs boson candidates.

A new multivariate algorithm is developed based on b-jet identification, jet kinematic and jet substructure informations. An increase in performance by a factor of 1.5 - 2.5 and 2 - 5 for QCD and hadronic t-events, respectively, is achieved over the whole signal efficiency range compared to the default ATLAS analysis. The Higgs-taggers are calibrated in 15.4/fb of 2016 data $g \to b\bar{b}$. The extrapolation to $H \to b\bar{b}$ is done using Monte Carlo simulations. This talk presents the new Higgs-tagger and its calibration.

T 60.6 Wed 17:45 L-2.017

Messung der Top-Higgs-Kopplung im H → bb̄-Endzustand bei CMS — Ulrich Husemann, •Philip Keicher, Matthias Schröder, Jan van der Linden und Sebastian Wieland — Institut für Experimentelle Teilchenphysik (ETP), Karlsruher Institut für Technologie (KIT)

Die Kopplung des Higgs-Bosons an Fermionen ist von großer theoretischer Bedeutung, da ihre Messung ein guter Test des Standardmodells ist und Aufschluss über den Mechanismus zur Generierung der Fermionmassen geben kann. Dabei ermöglicht die assoziierte Produktion des Higgs-Bosons mit einem Top-Quark-Antiquark-Paar oder die Produktion eines einzelnen Top-Quarks in Assoziation mit einem Higgs-Boson eine direkte Messung der Top-Higgs-Kopplung.

Präsentiert wird eine multivariate Analyse mit Fokus auf den Endzustand mit einem Lepton und dem Zerfall des Higgs-Bosons in ein Bottom-Quark-Antiquark-Paar. Dabei werden die Analysestrategie, die wichtigsten Untergrundprozesse und Systematiken und eine multivariate Klassifikation mit beispielsweise neuronalen Netzen zur Trennung von Signal und Untergrund vorgestellt. Abschließend werden aktuelle Ergebnisse und ein Ausblick auf mögliche zukünftige Messungen präsentiert.

T 60.7 Wed 18:00 L-2.017

Software Compensation in a Highly Granular Calorimeter using Principal Component Analysis — •Jack Rolph[1] and Erika Garutti[1,2] for the CALICE-D-Collaboration — [1]Institute for Experimental Physics, Hamburg University, Luruper Chaussee 149, D-22761 Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron, Notkestraße 85, D-22607 Hamburg, Germany

Hadronic calorimeters are insensitive to 'invisible energy' (neutrons, binding energy). Large event-by-event fluctuations thereby worsen energy resolution. This effect may be corrected for by weighting events offline. This procedure is known as software compensation.

In this analysis, Principal Component Analysis (PCA) was used to study correlations between observables measurable by the CALICE Analogue Hadronic Calorimeter (AHCAL) steel prototype on both a cell-wise and calorimeter-wise basis using simulation. This was performed to assess the usefulness of these observables with respect to estimating the 'invisible energy' content of hadronic showers.

A weighting method was devised using PCA projections to measure the differences between a purely cell-wise method, independent of total measured energy and the state of the art for simulated 10 to 80 GeV negative pion showers. Relative to the control, the method was found to improve compensation by a maximum of 8.0 ± 0.9% and degrade compensation at by a maximum of 9.9 ± 1.2% at energies above and below 35 GeV respectively. Most significantly, edge effects observed in the state of the art due to limited statistics were found to be strongly suppressed by the use of purely local compensation.

T 60.8 Wed 18:15 L-2.017

Energy Deposition due to Synchrotron Radiation and Secondary Particles in Undulator Wall at ILC-250 GeV — •Khaled Alharbi[1,3,4], Sabine Riemann[3], Gudrid Moortgat-Pick[1,2], and Andriy Ushakov[1] — [1]University of Hamburg — [2]Desy, Hamburg — [3]Desy, Zeuthen — [4]KACST, Saudi Arabia

The positron source of the International Linear Collider (ILC) is based on a superconducting helical undulator passed by the high-energy electron beam to generate photons which hit a conversion target. Since the photons are circularly polarized the resulting positron beam is longitudinally polarized. At a center-of-mass energy of 250 GeV (ILC-250), the undulator with 231 m magnet length is needed to produce the required number of positrons. The power deposition in the undulator walls should be below the acceptable limit of 1W/m since it is a superconducting undulator and also to fulfill the vacuum requirements. The power deposition of the photon beam in undulator walls was studied and shown that the peak power deposition in the undulator walls is above 20 W/m. To keep the power deposition below the acceptable limit, 23 photon masks must be inserted in the undulator line. In this paper the design of photon masks for an ideal and non-ideal helical undulator is presented and the power deposition in the undulator walls is discussed.

T 60.9 Wed 18:30 L-2.017

Polarization of Photon Beam Generated in Helical Undulator at ILC-250GeV — •Khaled Alharbi[1,3,4], Sabine Riemann[3], Gudrid Moortgat-Pick[1,2], and Andriy Ushakov[1] — [1]University of Hamburg — [2]Desy, Hamburg — [3]Desy, Zeuthen — [4]KACST, Saudi Arabia

The positron source of the ILC is based on a superconducting undulator passed by the high-energy electron beam to generate polarized photons which hit a target to create electron-positron pairs. These pairs will inherit the photon polarization so that a polarized positron beam is generated. The degree of polarization depends on the photon energy and emission angle. Considering an ideal undulator, the collimation of the photon beam increases the polarization. In a real undulator, the parameters as K value and period vary within margin defined be the fabrication process. The resulting effective polarization differs from that expected by an ideal helical undulator. The photon spectra from non-ideal undulator can be simulated by the HUSR code by introducing errors in the helical undulator magnetic field map. This study presents a comparison of the ideal and realistic polarization distribution of the photon beam expected for ILC250. Further, 23 masks are inserted to protect the undulator wall along the 320m undulator line from power deposition by the photon beam. These masks collimate slightly the photon beam and modify the polarization. Also this effect is evaluated in the study.