T 95: Experimental methods V

Time: Friday 11:00–12:45 Location: H-HS VI

T 95.1 Fri 11:00 H-HS VI

Plasma lensing: A new idea for focussing Positrons at the source — •Niclas Hamann[1], Manuel Formela[2], Gudrid Moortgat-Pick[3], Klaus Floettmann[4], and Sabine Riemann[5] — [1]Universität Hamburg — [2]Universität Hamburg — [3]Universität Hamburg, DESY Hamburg — [4]DESY Hamburg — [5]DESY Zeuthen

The Capturing and matching of positrons at high-luminosity e+ - e- - Colliders is a challenge. Usually there are involved optic matching devices (OMD) in place. In this talk we want to discuss a promising new idea which could be more efficient and eventually also be more flexible, the Plasma Lense. Since the Plasma Lense uses a different component of the B-Field, the focussing effect is expected to be much higher as in the conventional OMDs. With the code Astra by Klaus Floettmann we simulate potential Plasma Lenses and optimise the expected matching parameters.

T 95.2 Fri 11:15 H-HS VI

Compton Scanner Messungen an Germaniumdetektoren — •Felix Hagemann für die GeDet-Kollaboration — Max-Planck-Institut für Physik, München, Deutschland

Der Einsatz von Germaniumdetektoren bei der Suche nach neutrinolosen Doppelbetazerfällen verlangt das bestmögliche Verständnis ihrer Eigenschaften. Seit Mitte 2019 betreibt die GeDet Gruppe am Max-Planck-Institut für Physik in München einen Compton Scanner zur Untersuchung von Germaniumdetektoren. Dieser vollständig automatisierte Aufbau kann zusätzlich zu den gemessenen Pulsformen Informationen über den Ort der Energiedeposition im Detektor liefern. In der ersten Messreihe wurde ein vierfach segmentierter n-Typ Broad Energy Germaniumdetektor mit einer kollimierten ^{137}Cs-Quelle und einem pixelierten CdZnTe Kristall als Comptonkamera untersucht. Die Rekonstruktionsmethoden werden veranschaulicht und die Ergebnisse werden mit Simulationen verglichen.

T 95.3 Fri 11:30 H-HS VI

A test-setup for an electron-tagger for the neutrino mass experiment KATRIN — •Kevin Gauda, Volker Hannen, Patrick Oelpmann, Hans-Werner Ortjohann, Richard Salomon, and Christian Weinheimer for the KATRIN-Collaboration — Institut für Kernphysik, WWU Münster

KATRIN aims to directly measure the mass of the electron antineutrino. There, a windowless gaseous tritium source and a high-resolution MAC-E filter is used to analyze the endpoint region of the tritium beta-decay. The sensitivity on m_ν is targeted to reach 0.2 eV/c^2 with 90% C.L. after five years. Recently, a first limit was set to 1.1 eV/c^2 with 90% C.L. (M. Aker et al. (KATRIN Collaboration), Phys. Rev. Lett. 123 (2019) 221802).

The background in KATRIN is currently higher than originally planned, creating demand for new techniques of background reduction. An electron-tagger between pre- and main-spectrometer of KATRIN, which provides a trigger signal when a beta-decay electron passes, would allow to introduce delayed time-coincidence with the focal-plane detector signal and thereby to discard most background events. Developing such a device, which must not alter the electron energy much, is challenging and close to impossible and various low-temperature quantum detectors need to be tested. Such an electron-tagger could further enhance the sensitivity of KATRIN by applying time-of-flight spectroscopy (N. Steinbrink et al., New J. Phys. 15 (2013) 113020). This talk presents a first setup consisting of an electron-gun, a MAC-E-filter and a detector for testing such quantum devices.

T 95.4 Fri 11:45 H-HS VI

Reconstruction performance of low-p_{T} muons with the ATLAS experiment — •Johannes Junggeburth[1], Ferdinand Krieter[2], Davide Cieri[1], and Hubert Kroha[1] — [1]Max-Planck Institut für Physik München — [2]Ludwig-Maximilians-Universität München

The large LHC Run-2 dataset comprising 140 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 the 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 $J/\psi \to \mu\mu$ resonances where the latter is used for low-p_{T} muons. These muons have become more interesting in the recent time since they open the gate to extensions of the Standard Model predicting compressed spectra of new heavy particles, where only little energy is available for the lepton from the heavy particle decay. This talk presents the recent developments to identify low-p_{T} muons down to 3 GeV and to measure their reconstruction efficiency at a precision level of less than 1% with the ATLAS experiment.

T 95.5 Fri 12:00 H-HS VI

Scale factor measurement for the DeepTau tau lepton identification algorithm of CMS — •Maximilian Burkart, Günter Quast, and Roger Wolf — Karlsruhe Institute of Technology, Wolfgang-Gaede-Str. 1, 76131 Karlsruhe, Germany

Analyses of final states involving hadronically decaying tau leptons suffer from large backgrounds stemming from misidentified jets, electrons or muons. A new identification algorithm for hadronically decaying tau leptons exploiting deep learning techniques has been developed by the CMS Collaboration to suppress these backgrounds. This algorithm combines low and high-level variables to simultaneously distinguish hadronic tau lepton decays, quark or gluon jets, electrons and muons.

In the first part of the talk this newly developed identification algorithm will be shortly introduced. The second part of the talk covers the measurement of scale factors correcting for efficiency differences of the algorithm in data and simulation.

T 95.6 Fri 12:15 H-HS VI

Classifying tau lepton decay modes using Deep Neural Networks at the ATLAS Experiment — •Hoang Nguyen, Klaus Desch, Philip Bechtle, Christian Grefe, Peter Wagner, Michael Hübner, and Lara Schildgen — Physialisches Institut, Uni Bonn, Deutschland

The tau lepton as the heaviest lepton in the Standard Model and plays an important role in many studies regarding Higgs physics or physics beyond the Standard Model. Of its decay modes, about two third occur hadronically.

The decay products of the tau lepton are difficult to distinguish from each other and other particles originating from jet and gluon interaction. A better knowledge of this could improve background suppression, help with studies of CP eigenstates and, furthermore, reconstruction accuracy will get better as well.

Latest studies indicate that the use of the predictive power of deep neural networks (DNN) yields better results than current likelihood or BDT based methods. In this presentation, a recurrent neural network with the aim to improve classification of tau decays is presented. Results obtained via this way are compared to https://arxiv.org/pdf/1512.05955.pdf.

T 95.7 Fri 12:30 H-HS VI

Implementation of a new b-tagging algorithm for ATLAS — Vadim Kostyukhin[1], •Ö. Oğul Öncel[2], and Markus Cristinziani[2] — [1]Universität Bonn — [2]now at Sheffield University

Correctly identifying b-quark initiated jets (b-tagging) at large transverse momentum ($p_{\mathrm{T}} > 1$ TeV) will become increasingly important as ATLAS accumulates more data. Currently used b-tagging algorithms distinguish b-jets against light-jets. This approach is effective for low- and medium-p_{T} jets, but results in performance degradation at high p_{T}, where fragmentation dominates.

Instead of distinguishing two sets of tracks, the b-tagging performance can be improved by introducing explicitly the most important track categories and classifying tracks before the b-tagging step itself. A newly developed b-tagging algorithm in ATLAS uses classified tracks in a jet and based on this information creates a b-tagging score. Classification of tracks is accomplished through a multi-class multivariate discriminator that classifies tracks into one of the following three categories: heavy flavour, fragmentation or hadronic interactions and pile-up. It is found to be enhancing the b-tagging performance, particularly in the high-p_{T} regime, in comparison to currently used b-taggers. The implementation will be described and comparative performance studies will be presented.