T 35: Electroweak Physics I (Weak Mixing Angle, Tau Production)

Time: Tuesday 16:15–17:45 Location: VG 2.103

T 35.1 Tue 16:15 VG 2.103

How to Extract the Weak Mixing Angle using Full Run2 ATLAS Experiment Data — •Lukas Bayer[1], Wells Craig[2], and Ludovica Aperio Bella[3] — [1]DESY, Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]DESY, Hamburg, Germany

The full Run 2 data set from the ATLAS experiment provides sufficient statistics to measure the Drell-Yan cross-section four-fold differential in invariant mass, Z-boson rapidity and decay angles. It can be determined in the full solid angle by making use of an analytical decomposition of the final-state lepton's angular distribution. This does not only allow to probe the underlying quantum chromodynamics of Z-boson production, but also to extract the electroweak sector weak mixing angle from the forward-backward asymmetry, induced by parity violation in the neutral weak current. Sensitivity to the forward-background asymmetry is enhanced in events featuring one lepton in the forward part of the detector and correspondingly high Z-boson rapidity. Therefore, this talk will showcase recent work on forward electron performance at ATLAS, with focus on the determination of identification efficiency. Furthermore, it will present projections of the resulting sensitivity to the weak mixing angle.

T 35.2 Tue 16:30 VG 2.103

The weak mixing angle at the Belle II experiment — •Lukas Grussbach[1,2], Stephan Paul[1], and Daniel Greenwald[1] — [1]Technical University Munich — [2]Max Planck Institute for Physics

The weak mixing angle is known precisely only at high energies around the Z^0 mass. At much lower energies, NuTeV measured a value deviating from the standard-model prediction. At Belle II, we want to measure the weak mixing angle at a similar energy using the process $e^+e^- \to \mu^+\mu^-$.
I present concepts of such a measurement at Belle II.
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T 35.3 Tue 16:45 VG 2.103

Determination of the tau polarization in fully leptonic $Z \to \tau^+\tau^-$ decays from pp collisions at the ATLAS detector — •Florian Harz, Adrián Álvarez Fernández, and Stefan Tapprogge — Institut für Physik, Johannes Gutenberg-Universität, Mainz, Germany

The Z boson arises from the unification of the electromagnetism and weak forces, coupling differently to left- and right-handed particles as indicated by the effective weak mixing angle. Precisely measuring the tau polarization in $Z \to \tau^+\tau^-$ decays provides a mean to extract the weak mixing angle. The study considers the fully leptonic final state of the $Z \to \tau^+\tau^-$ decay channel and assesses its sensitivity to the tau polarization. This is accomplished by fitting templates to the visible mass derived from decays of purely left-handed or right-handed taus. This method can be verified using simulated samples. The status of these studies is presented, highlighting their potential application to real data, particularly focusing on proton-proton data collected at the ATLAS detector.

T 35.4 Tue 17:00 VG 2.103

Prospects of measuring quantum entanglement in $\tau\tau$ final states at the LHC and future colliders — •Cedric Breuning, Philip Bechtle, Klaus Desch, and Christian Grefe — Physikalisches Institut, Rheinische Friedrich-Wilhelms Universität Bonn, Nussallee 12, 53115 Bonn, Germany

We introduce a method to test quantum entanglement at colliders in the $\tau\tau$ final state. The prospects to perform these measurements in e^+e^- collisions at future colliders like the FCC-ee are evaluated using simulated events with a fast detector simulation. We will present two dedicated analyses using either $Z \to \tau\tau$ or $H \to \tau\tau$ at e^+e^- at centre of mass energies of $\sqrt{s} = 91.2\,\text{GeV}$ and $\sqrt{s} = 240\,\text{GeV}$, respectively. Prospects and limitations of doing similar measurements at the LHC will be shown. Finally, we will discuss loopholes and collider specific problematics, which influence the interpretation of the result.

T 35.5 Tue 17:15 VG 2.103

Theoretical predictions for tau-pair production in ultraperipheral hadron collisions — Stefan Dittmaier, Tim Engel, •Jose Luis Hernando Ariza, and Mathieu Pellen — University of Freiburg

The anomalous magnetic moments of the electron and the muon have been measured with remarkable precision. On the other hand, there is no precise measurement for the magnetic moment of the tau-lepton. A promising approach is to measure it via the tau-pair production in ultraperipheral collisions of lead ions at the LHC. In this talk, I will present state-of-the-art theoretical predictions for photonic tau-pair production including leptonic tau-decays. In particular, the impact of spin correlations between the tau-leptons and next-to-leading-order electroweak corrections will be discussed.

T 35.6 Tue 17:30 VG 2.103

Differential measurements of $\gamma\gamma \to \tau\tau$ and constraints on τ-lepton electromagnetic moments in ultra-peripheral Pb+Pb collisions with ATLAS — •Weronika Stanek-Maslouska — Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

At the Large Hadron Collider (LHC), relativistic heavy-ion collisions produce a significant flux of equivalent photons, enabling photon-induced interactions. By studying the production of tau lepton pairs in these processes, constraints can be placed on the anomalous magnetic dipole moment (g-2) and electric dipole moment (EDM) of the tau lepton. Building on the observation of this process with ATLAS, which analyzed muonic decays of tau leptons in conjunction with electrons and particle tracks, we perform first unfolded differential cross section measurements. Additionally, new measurements of the tau lepton electromagnetic moments are performed. These results represent a substantial advancement in measuring photon-induced tau lepton pairs and probing the electromagnetic properties of the tau lepton using heavy-ion collisions.