T 56: Searches EW I

Time: Wednesday 15:50–17:20 Location: HSZ/0403

T 56.1 Wed 15:50 HSZ/0403

Search for charged Higgs bosons in $H^+ \to Wh$ decays with the ATLAS detector — •Shubham Bansal, Jochen Dingfelder, and Tatjana Lenz — Physikalisches Institut, University of Bonn, Germany

After the discovery of the Higgs boson at a mass of 125 GeV, the last missing piece of the Standard Model (SM) was presumably found. However, various theories beyond the SM predict additional Higgs bosons, one of which could be the observed Higgs boson at 125 GeV. One such example is the Two-Higgs-Doublet Model (2HDM) that features an extended scalar sector including the existence of charged Higgs bosons (H^+). The H^+ production mechanism depends on its mass (m_{H^+}) and for $m_{H^+} > m_t + m_b$, the leading H^+ production mode is the associated production with a top and a bottom quark via $gg \to tbH^+$. In the alignment limit for 2HDM, the dominant decay mode is $H^+ \to tb$. However, in models like N2HDM and the Georgi-Machacek (GM) model, it is possible to obtain a sizable branching ratio for $H^+ \to Wh$.

This talk presents a search for charged Higgs bosons in $H^+ \to Wh(\to b\bar{b})$ decays. The analysis strategy is presented and a focus is put on the data-driven improvements of the modelling of the main background from $t\bar{t}$ production, the event classification technique to separate the leptonic and hadronic decay modes of the W boson from the H^+ decay. Finally, the fit model is discussed to derive the first estimate of the expected sensitivity for the full Run-2 ATLAS dataset.

T 56.2 Wed 16:05 HSZ/0403

Constraints on spin-0 dark matter mediators and invisible Higgs decays using ATLAS 13 TeV pp collision data with two top quarks and missing transverse momentum in the final state. — •Marco Rimoldi for the ATLAS-Collaboration — DESY, Hamburg, Germany

Results of a statistical combination of searches targeting final states with two top quarks and invisible particles, characterised by the presence of zero, one or two leptons, at least one jet originating from a b-quark and missing transverse momentum are presented.

The analyses are searches for phenomena beyond the Standard Model consistent with the direct production of dark matter in pp collisions at the LHC, using 139 fb^{-1} of data collected with the ATLAS detector at a centre-of-mass energy of 13 TeV.

The results are interpreted in terms of simplified dark matter models with a spin-0 scalar or pseudoscalar mediator particle. In addition, the results are interpreted in terms of upper limits on the Higgs boson invisible branching ratio, where the Higgs boson is produced according to the Standard Model in association with a pair of top quarks.

T 56.3 Wed 16:20 HSZ/0403

Search for a charged Higgs boson decaying to cs in the low mass region with the ATLAS detector at $\sqrt{s} = 13$ TeV — Jochen Dingfelder, Tatjana Lenz, and •Christian Nass — Physikalisches Institut, Universität Bonn, Deutschland

In the Standard Model (SM) electroweak symmetry breaking (EWSB) is introduced by a single complex scalar field. The consequence is the prediction of a scalar, neutrally charged particle, the Higgs boson, which was discovered at the LHC in 2012 at the LHC. A simple extension of the SM is to introduce EWSB through two complex scalar fields. Such two-Higgs doublet models (2HDM) are attractive because they offer the opportunity to include additional CP violation in the SM, which is needed for explaining baryogenesis. 2HDMs feature 3 neutral and 2 charged Higgs bosons. An observation of such a charged scalar particle would be a striking signal of physics beyond the SM.

In the low mass region, $m_H^{\pm} < m_t$, the dominant production mode is by a $t\bar{t}$ pair with one t-quark decaying to $H^{\pm}b$. At low masses, the search for $H^{\pm} \to cs$ decays is promising, as suggested in several theory papers. This talk presents the analysis strategy to define signal-enriched and -depleted regions as well as the expected sensitivity for the $H^{\pm} \to cs$ search, including a complete set of systematics uncertainties, with the full Run-2 ATLAS dataset.

T 56.4 Wed 16:35 HSZ/0403

Search for $A \to ZH \to \ell\ell t\bar{t}$ at $\sqrt{s} = 13$ TeV with the ATLAS detector — •Roman Kuesters, Tetiana Moskalets, and Spyros Argyropoulos for the ATLAS-Collaboration — University of Freiburg, Freiburg im Breisgau, Germany

The generation of the existing matter-antimatter asymmetry in the observable universe is one of the biggest open questions that cannot be explained with the standard model and therefore requires physics beyond the standard model.

Many models suggest that electroweak symmetry breaking can generate the matter-antimatter asymmetry, however an extended Higgs sector is needed to satisfy the conditions for baryogenesis.One of the simplest extensions are models with two Higgs doublets, which give rise to 5 Higgs bosons. In these models a large mass splitting between the heavy CP-odd boson A and the CP-even boson H is required for successful baryogenesis.

The analysis, which will be presented, searches for the decay of the A boson into a heavy H boson and a Z boson. The heavy H boson subsequently decays into two top quarks, while the Z boson decays leptonically. This final state will allow us to probe the the parameter space with $m_H > 350$ GeV, which remains so far unexplored. In the presentation the analysis optimisation and the setup for the statistical analysis will be shown. Finally the expected exclusion limits will be presented.

T 56.5 Wed 16:50 HSZ/0403

Search for photon-induced semileptonic WW production at the ATLAS Experiment — •Varsiha Sothilingam for the ATLAS-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

Due to the non-abelien nature of the electroweak sector of the Standard Model of Particle Physics (SM), direct interactions between gauge couplings are possible. Measurements of the cross sections of these interactions allow for validation of the SM and potential deviations from it opens possibilities for physics beyond the SM. This talk will focus on the coupling between W bosons and photons where the W bosons decay semileptonically. They interact via the triple ($\gamma \to WW$) and quartic ($\gamma\gamma \to WW$) gauge couplings of the SM. This process can be produced via Centrally Exclusive Production at the LHC, where non-colliding protons produce a non-linear electromagnetic field which creates a photon pair. The photons couple to the W bosons, providing the signal of interest while the protons remain intact. These protons can be detected using the ATLAS Forward Proton (AFP) spectrometers, which are located around 200m away from the ATLAS detector, on both sides. This talk will provide insight to the measurement of this rare process and the methods used to optimise its signal. It will provide an insight to the different models of the final state which take advantage of the boosted topology of such events.

T 56.6 Wed 17:05 HSZ/0403

Probing the use of advanced observables for measuring the electromagnetic dipole moments of the tau lepton — •Kartik Bhide, Valerie Lang, and Markus Schumacher — Albert-Ludwigs-Universität Freiburg

Precise measurements of the anomalous magnetic moments (a_ℓ) and the electric dipole moments (d_ℓ) of leptons are strong tests of the predictions of the Standard Model (SM), and can be used to constrain theories beyond the SM. Recent measurements of a_τ by the ATLAS and CMS Collaborations demonstrate the ability to perform such measurements in ultra-peripheral lead-lead collisions, via the $\gamma\gamma \to \tau\bar{\tau}$ process. Improving future measurements of a_τ and d_τ can be done by exploiting advanced observables instead of simple kinematic distributions. In this work, the use of observables inspired by matrix element methods is explored for measuring the electromagnetic moments of the tau lepton, in Monte Carlo events produced by the gamma-UPC event generator integrated with MadGraph5. Studies of the performance of these advanced observables at particle level, in particular regarding the extraction of a_τ will be presented.