

T 34: Extended Higgs models I

Time: Tuesday 16:00–18:00

Location: Ti

T 34.1 Tue 16:00 Ti

Suche nach unsichtbaren Zerfällen des Higgs-Bosons in Ereignissen mit einem hadronisch zerfallenden Vektorboson mit dem ATLAS-Detektor — ●JOHANNES BALZ, VOLKER BÜSCHER, ANDREAS REISS und DUC BAO TA — Institut für Physik, Johannes Gutenberg-Universität Mainz

Eines der gegenwärtig größten Ziele für das ATLAS Experiment ist neben der präzisen Vermessung des Standardmodells (SM) die Suche nach Physik jenseits des SM.

In diesem Vortrag geht es um die Suche nach unsichtbaren Zerfällen des Higgs-Bosons jenseits des Standardmodells. Beim untersuchten Kanal wird das Higgs-Boson über die assoziierte Produktion mit einem Vektorboson erzeugt, wobei das beteiligte Vektorboson im weiteren Verlauf hadronisch zerfällt und das Higgs-Boson in für den Detektor unsichtbare Teilchen, zum Beispiel Dunkle Materie, zerfällt. Daher werden Ereignisse mit hohem fehlendem Transversalimpuls und einem großflächigen Jet selektiert, der als W/Z-Jet klassifiziert ist. Dadurch kann der Hauptuntergrund $Z \rightarrow \nu\nu$ bereits stark unterdrückt werden. Eine weitere Untergrundunterdrückung ist mithilfe von Jetsubstrukturvariablen der W/Z- und der Quark-Gluon-Klassifizierung möglich.

Im Vortrag wird der aktuelle Stand der Analyse bei einer Schwerpunktsenergie von $\sqrt{s}=13$ TeV vorgestellt.

T 34.2 Tue 16:15 Ti

Identification of highly boosted W and Z Bosons with the ATLAS detector — JOHANNES BALZ, VOLKER BÜSCHER, ●KIRA KÖHLER, CHRISTIAN SCHMITT, and DUC BAO TA — Johannes Gutenberg-Universität Mainz

The ATLAS detector at the LHC is used for the search for invisible decays of the Higgs Boson beyond those predicted by the Standard Model in the associated production channel. The signature in this search is a high momentum large-area jet from the hadronically decaying W/Z recoiling against the invisible decay products of the Higgs Boson. The large-area jet can be distinguished from a background jet due to the particular structure given by the hadronic W/Z decays.

This identification is conventionally done by applying cuts on jet observables from the calorimeter. By using a Neural Network and additional observables from the high resolution tracking detector it was possible to significantly improve the identification of W/Z - jets with high transverse momenta in the multi-TeV region. This talk will give an overview of the new identification method and a comparison to the cut-based identification tool.

T 34.3 Tue 16:30 Ti

Exotic Higgs Decays: ATLAS Analysis of Asymmetric Higgs Decays to Two Light Scalars — ●JUDITH HÖFER, CLAUDIA SEITZ, RICKARD STRÖM, PRISCILLA PANI, and BEATE HEINEMANN — DESY, Hamburg, Germany

Extensions of the SM Higgs sector featuring one or several singlet scalar fields are realised in many BSM models. While several searches have been performed targeting decays of the SM Higgs boson to two light scalars of the same mass, the asymmetric decay to two new spin-zero particles of different mass is largely unexplored. The successive decays of these particles can give rise to spectacular high-multiplicity collider signatures, including so-called cascade decays, where the heavier of the scalars decays into the lighter one.

The talk discusses the progress of an analysis studying these asymmetric decays with the ATLAS experiment at the Large Hadron Collider, CERN. The analysis focuses on the VH production mode and the channel where the scalars decay to b-quarks, resulting in a challenging low-pT jet final state. These signatures profit largely from the experiences gained with the equivalent symmetric analysis and motivate the use of novel reconstruction techniques.

T 34.4 Tue 16:45 Ti

Search for heavy Higgs bosons decaying to top quark pairs using the CMS experiment — AFIQ ANUAR, ALEXANDER GROHSJEAN, ●JONAS RÜBENACH, DOMINIC STAFFORD, and CHRISTIAN SCHWANENBERGER — DESY, Hamburg, Germany

A key ingredient in shedding light on dark matter and the validity of proposed supersymmetric theories, such as the minimal supersymmetric standard model, is the existence of additional Higgs bosons.

Using data collected by CMS at the LHC at $\sqrt{s} = 13$ TeV, corresponding to a luminosity of 137 fb^{-1} , a search is performed for scalar and pseudoscalar, electrically neutral bosons decaying predominantly to top quark pairs, which are assumed to further decay dileptonically. The challenges connected to this particular search, such as interference with the standard model background and unknown quantities resulting from neutrino momenta, are tackled by a full reconstruction of the top quark system and the utilization of multi-dimensional distributions arising from mass and spin information.

T 34.5 Tue 17:00 Ti

Search for heavy Higgs bosons in the $Z+t\bar{t}$ final state — ●YANNICK FISCHER, KSENIA DE LEO, JOHANNES HALLER, ROMAN KOGLER, and MATTHIAS SCHRÖDER — Institut für Experimentalphysik, Universität Hamburg

Since its discovery in 2012 the properties of the Higgs boson at 125 GeV have been subject of various analyses. Within the uncertainties all results suggest a standard model like behaviour. However, the observed boson might well be part of an extended Higgs sector, which is predicted in various scenarios of new physics beyond the standard model. Two Higgs Doublet Models (2HDM) provide a generic description of the phenomenology arising in models with a second Higgs doublet. In this talk we will investigate the hypothetical decay chain $A \rightarrow ZH$ with $H \rightarrow t\bar{t}$, where H is a CP even and A a CP odd heavy Higgs boson. This channel has not yet been studied at the LHC. We will give a phenomenological overview of the expected branching ratios depending on the free parameters of the model. Furthermore, first studies of the properties of the signal events are presented.

T 34.6 Tue 17:15 Ti

Search for additional Higgs bosons decaying to a pair of W bosons in the semi-leptonic final state with the CMS detector using full Run 2 data — OLENA HLUSHCHENKO, SVEN KRAUSSE, WOLFGANG LOHMANN, DENNIS ROY, HALE SERT, ●SEBASTIAN SIEBERT, ACHIM STAHL, and ALEXANDER ZOTZ — RWTH Aachen University - Physics Institute III B, Aachen, Germany

During Run 2 of the LHC, an integrated luminosity of 137 fb^{-1} at $\sqrt{s} = 13$ TeV was recorded by the CMS detector. Apart from measuring properties of known particles more precisely, it is also expected that new particles might be discovered with such a large dataset. Additional heavy Higgs bosons are predicted by many theories beyond the standard model. The high mass $H \rightarrow WW$ analysis investigates gluon-gluon fusion and vector-boson fusion as Higgs production mechanisms. The analysis aims to find Higgs boson like resonances in the mass region from $115 \text{ GeV}/c^2$ to $5000 \text{ GeV}/c^2$ or set exclusion limits in the context of two-Higgs-doublet and in different MSSM benchmark scenarios. This talk presents the status and future plans related to the semi-leptonic channel.

T 34.7 Tue 17:30 Ti

Search for additional Higgs bosons decaying into W^+W^- in the di-leptonic final state with CMS using full Run 2 data — OLENA HLUSHCHENKO, SVEN KRAUSSE, WOLFGANG LOHMANN, ●DENNIS ROY, HALE SERT, SEBASTIAN SIEBERT, ACHIM STAHL, and ALEXANDER ZOTZ — RWTH Aachen University - Physics Institute III B, Aachen, Germany

Using proton-proton collision data, corresponding to an integrated luminosity of 137.1 fb^{-1} recorded by CMS during Run 2, searches for new particles are performed with unprecedented sensitivity. The high mass $H \rightarrow WW$ analysis aims to search for resonances at masses up to 5 TeV. Their origin might be an additional Higgs boson, such as one expected in extended Higgs sectors, e.g. the Two Higgs Doublet Model (THDM) and a more specific case, the Minimal Supersymmetric Standard Model (MSSM). In case no signal is found, new limits on THDM and MSSM scenarios are set. This analysis is performed in the semi-leptonic and the di-leptonic final state. The status of the full Run 2 analysis in the di-leptonic final state is presented in this talk.

T 34.8 Tue 17:45 Ti

Generator level study of di-Higgs decaying to the $b\bar{b}\tau^+\tau^-$ final state — ●ANJALI KRISHNAN, ANDRÉ SCHÖNING, and TAMASI KAR — Physikalisches Institut, Universität Heidelberg

In the search for new physics, the understanding of the Higgs field plays an important role. Measurement of the different coupling constants associated with the Higgs field is crucial to answer some of the very fundamental questions in particle physics. One such coupling constant is the C_{2V} coupling constant, that measures the coupling between a pair of vector bosons and a pair of Higgs. The C_{2V} can be uniquely determined in the process of di-Higgs production via Vector Boson Fusion (VBF).

This talk aims to present a generator level study to optimise the sen-

sitivity to measure C_{2V} in the process of di-Higgs decaying to $b\bar{b}\tau^+\tau^-$ via VBF for the High Luminosity LHC phase-II upgrade scenario. The $b\bar{b}\tau^+\tau^-$ final state in di-Higgs production is particularly interesting because it can be triggered using various trigger objects compared to other decay channels, allowing for a wide phase space coverage. Various kinematic distributions, for instance, the transverse momentum, invariant mass, eta for this decay channel will be presented for a range of C_{2V} values with an integrated luminosity of 300fb^{-1} .