T 25: Higgs-Boson (assoziierte Produktion) II

Zeit: Montag 16:45–19:00 Raum: VMP5 HS B1

T 25.1 Mo 16:45 VMP5 HS B1

ttH Coupling Measurements in ATLAS and Combined Results of 8 TeV Data — •Andre Sopczak[1], Babar Ali[1], Simonetta Gentile[2], Marine Kuna[2], Simone Monzani[2], and Frank Seifert[1] — [1]IEAP CTU in Prague — [2]Universita di Roma, La Sapienza, INFN

After the discovery of a Higgs boson, the measurements of its properties are now at the forefront of research. The measurement of the associated production of a Higgs boson and a pair of top quarks is of particular importance as the ttH Yukawa coupling is large, and thus a probe for physics beyond the Standard Model.

For the first time the ttH production was analysed in the final state with two same-sign light leptions (electrons or muons) and a hadronically decaying tau lepton: ttH $\rightarrow 2\ell + 1\tau_{\text{had}}$. The analysis was based on data taken by the ATLAS experiment recorded from 8 TeV proton-proton collisions. It contributed significantly to the combined ATLAS results of the five multi-lepton final states. These results were further combined with other ATLAS ttH analyses where H $\rightarrow \gamma\gamma$ and H $\rightarrow$ b$\bar{\text{b}}$. The combined results are consistent with the Standard Model (SM) expectation allowing models beyond the SM to be constrained.

T 25.2 Mo 17:00 VMP5 HS B1

Search for the production of the Higgs boson in association with a pair of top quarks in the 3 leptons final state at 13 TeV in ATLAS — •Nello Bruscino, Markus Cristinziani, Mazuza Ghneimat, Sebastian Heer, Vadim Kostyukhin, Liza Mijović, Andrea Sciandra, and Kaven Yau Wong — Physikalisches Institut, Universität Bonn

The observation of the Higgs boson in association with a top-quark pair will open a window to the direct study of the Yukawa couplings of the top quark, which is the fermion expected to couple most strongly to the Higgs boson. Thanks to the LHC upgrade to 13 TeV $t\bar{t}H$ events are produced with a significantly higher cross section than at 8 TeV. Final states with high light leptons multiplicity, targeting the $H \rightarrow WW^*/\tau\tau/ZZ^*$ decay channels, can consequently be exploited to research the presence of a Standard Model (SM) Higgs boson.
The 3 leptons analysis includes exactly 3 light leptons with total charge equal to ± 1. To suppress the $t\bar{t}$ + jets and $t\bar{t}V$ backgrounds, selected events are required to include either at least 4 jets of which at least one must be b-tagged, or exactly 3 jets of which at least 2 b-tagged. The $t\bar{t}H$ to 3 light leptons final state is dominated by the $H \rightarrow WW^*$ decay: either 2 leptons originate from the Higgs decay and an additional one from top, or 1 lepton from Higgs and 2 leptons from tops. Further 3 leptons configurations are thinkable, making it harder to pursue this final state. A Pseudo Matrix Element (P.M.E.) approach is developed and used in order to identify signal-like events by partially reconstructing resonances and recognizing peculiar kinematic variables.

T 25.3 Mo 17:15 VMP5 HS B1

Background Estimation in the Associated Higgs Boson Top-Quark Production Channel ttH $\rightarrow 2\ell + 1\tau_{\text{had}}$ at $\sqrt{s} = 13$ TeV with ATLAS — •Babar Ali[1], Simonetta Gentile[2], Marine Kuna[2], Simone Monzani[2], Frank Seifert[2], and Andre Sopczak[1] — [1]IEAP CTU in Prague — [2]Universita di Roma, La Sapienza, INFN

The measurement of the associated production of a Higgs boson with a pair of top quarks is a direct determination of the top-Yukawa coupling at tree-level, which can be compared with the indirect determination in the loop-production via gluon-gluon fusion. The decay channel of the system with several leptons (multi-lepton channel) and jets gives high sensitivity. The focus of the analysis is the sub-channel with two same-sign light leptons (electrons or muons) and a hadronically decaying tau lepton: ttH $\rightarrow 2\ell + 1\tau_{\text{had}}$. In particular the background estimate from top-antitop reactions is discussed. The analysis uses the data set recorded by ATLAS in 2015 from the first LHC Run-II 13 TeV proton-proton collisions.

T 25.4 Mo 17:30 VMP5 HS B1

Higgs production in association with top quarks in the final state with $2\ell 1\tau_{\text{had}}$ at ATLAS — •David Hohn, Jürgen Kroseberg, Thomas Schwindt, Birgit Stapf, and Norbert Wermes — Physikalisches Institut, Universität Bonn

The coupling between the Higgs boson and fermions can be studied in its decay e.g. $H \rightarrow \tau\tau$ and in its production e.g. in association with top quarks. Both methods can be combined by looking at events with two leptons, one hadronic tau and many jets which is sensitive to the process $t\bar{t}H \rightarrow \tau\tau$ and thus allows the measurement of Higgs fermion couplings entirely at tree level.

For the analysis of the new 13 TeV data taken with the ATLAS detector at LHC new methods have been developed to improve the sensitivity that was reached in Run 1. Further improvements can be achieved by the addition of a new event category.

It will be shown how the dominant $t\bar{t}$ background can be effectively suppressed using multivariate techniques and event reconstruction with kinematic likelihood functions.

T 25.5 Mo 17:45 VMP5 HS B1

Techniken und Methoden für die Suche nach dem Higgs-Boson in assoziierter Produktion mit einem Top-Quark-Antiquark-Paar am CMS-Experiment — Karim El Morabit, Marco A. Harrendorf, Ulrich Husemann, Hannes Mildner, Andrej Saibel, Matthias Schröder, •Korbinian Schweiger und Shawn Williamson — Institut für Experimentelle Kernphysik (IEKP), KIT

Durch die Untersuchung der Higgs-Boson-Produktion in Assoziation mit einem Top-Quark-Antiquark-Paar (t$\bar{\text{t}}$H) ist eine modellunabhängige Messung der Top-Higgs-Yukawa-Kopplung möglich. Mit Hilfe der Daten, welche der CMS-Detektor während des LHC-Run 2 aufnimmt, soll dieser Produktionsprozess weiter untersucht werden, da eine Verbesserung der Sensitivität erwartet wird.

In diesem Vortrag wird der Zerfall des Higgs-Bosons in ein b$\bar{\text{b}}$-Paar sowie des t$\bar{\text{t}}$-Paares in ein geladenes Lepton, ein Neutrino und mehrere Teilchenjets betrachtet. Da die t$\bar{\text{t}}$H-Produktion einen kleinen Wirkungsquerschnitt hat und der betrachtete Zerfallskanal einen großen t$\bar{\text{t}}$-Untergrund aufweist, stellt die Suche nach diesem Produktionskanal eine große Herausforderung dar. Deshalb sind spezialisierte Methoden nötig, um t$\bar{\text{t}}$-Paare und Higgs-Bosonen sowie deren Zerfallsprodukte zu identifizieren und analysieren. In diesem Vortrag werden Techniken und Methoden vorgestellt, die in der Analyse verwendet werden.

T 25.6 Mo 18:00 VMP5 HS B1

Search for the ttH (H->bb) Process Using the ATLAS detector — •Nedaa Asbah, Judith Katzy, and John Keller — Deutsches Elektronen-Synchrotron (DESY)

The measurement of the Higgs boson production in association with top quarks (ttH) is an important goal of the LHC Run-II physics program as it allows a direct measurement of the top quark Yukawa coupling. In Run1, this measurement suffered from a relatively low cross section at $\sqrt{s} = 8$ TeV and will benefit greatly from the higher luminosity and energy of Run II at $\sqrt{s} = 13$ TeV. A search for ttH production with the ATLAS detector at $\sqrt{s} = 13$ TeV will be presented. This study focuses on the search channel with the Higgs boson decaying to bb^- and the tt^- pair decaying semi-leptonically. A data-driven method for determining the background from events with mis-identified leptons has been developed.

T 25.7 Mo 18:15 VMP5 HS B1

Uncertainties related to Higgs production in association with a pair of top quarks — •Tim Michael Heinz Wolf — Nikhef, Amsterdam, Netherlands

The production of a Higgs boson in association with a pair of top quarks ($t\bar{t}H$) is one of the processes which raises the most interest for LHC run-2. The process is very interesting since the Higgs boson couples directly to the top quark so an extraction of the top-Yukawa coupling is feasible. The top-Yukawa coupling is an important quantity in the discussion of the validity of the standard model (SM) it self since it drives the Higgs self-coupling to negative values rendering the SM incomplete. The exact value of the top-Yukawa coupling determines whether the universe is in a stable, meta-stable or unstable phase.

Especially the $H \rightarrow b\bar{b}$ final state is interesting since it yields the highest branching ratio among all final states. The QCD uncertainties related to the background of the $t\bar{t}H(b\bar{b})$ final state are large which makes precise assessment of the uncertainties important. I am going to present and quantify the uncertainties coming from gluon splitting in the parton shower as well as the uncertainties coming from dif-

ferent renormalisation and factorisation choice. These findings might provide a more accurate assessment of the uncertainties for the search of $t\bar{t}H(b\bar{b})$ in LHC run-2 with the Atlas detector.

T 25.8 Mo 18:30 VMP5 HS B1

Monte-Carlo-Simulation des $t\bar{t}H$- und des $t\bar{t}$-Prozesses in nächstführender Ordnung am LHC — Karim El Morabit, Marco A. Harrendorf, Ulrich Husemann, Hannes Mildner, •Andrej Saibel, Matthias Schröder, Korbinian Schweiger und Shawn Williamson — Institut für Experimentelle Kernphysik (IEKP), KIT

Anhand des $t\bar{t}H$-Prozesses kann die Top-Higgs-Yukawakopplung direkt gemessen werden. Dazu ist es wichtig, den Prozess selbst sowie den wichtigsten Untergrundprozess $t\bar{t}$ möglichst genau simulieren zu können. Dabei kommen verstärkt Ereignisgeneratoren in nächstführender Ordnung (next-to-leading order, NLO) zum Einsatz, die genauere Vorhersagen über die Prozesse ermöglichen.

In diesem Vortrag wird auf die Generierung von Ereignissen mit einem Higgs-Boson in Assoziation mit einem Top-Quark-Antiquark-Paar ($t\bar{t}H$) und dem dazu wichtigsten Untergrundprozess mit einem Top-Quark-Antiquark-Paar ($t\bar{t}$) mit Hilfe von NLO-Generatoren eingegangen. Dazu werden verschiedene Studien vorgestellt, die die modernen NLO-Generatoren und deren Konfigurationen vergleichen.

T 25.9 Mo 18:45 VMP5 HS B1

Multivariate Analyse für die Suche nach dem Higgs-Boson in assoziierter Produktion mit einem Top-Quark-Antiquark-Paar am CMS-Experiment — •Karim El Morabit, Marco A. Harrendorf, Ulrich Husemann, Hannes Mildner, Andrej Saibel, Matthias Schröder, Korbinian Schweiger und Shawn Williamson — Institut für Experimentelle Kernphysik (IEKP), KIT

Eine Analyse des Wirkungsquerschnittes für die Higgs-Boson-Produktion in Assoziation mit einem Top-Quark-Antiquark-Paar ($t\bar{t}H$) ermöglicht eine direkte Messung der Top-Higgs-Yukawa-Kopplung. Für die erhöhte Schwerpunktsenergie des LHC-Run-2 wird ein deutlicher Anstieg der Produktionsrate dieses Prozesses und somit eine höhere Präzision der Messung erwartet.

In der vorgestellten Analyse werden Ereignisse mit einem semileptonisch zerfallenden $t\bar{t}$-Paar und einem in ein $b\bar{b}$-Paar zerfallenden Higgs-Boson aus den vom CMS-Experiment aufgenommenen Daten selektiert. In Ereignissen, in denen Top-Quarks und Higgs-Bosonen mit hohen Transversalimpulsen auftreten, werden spezielle *Fat-Jet*- und Substruktur-Algorithmen zur Rekonstruktion und Identifikation der Higgs-Bosonen und hadronisch zerfallenden Top-Quarks verwendet. Den größten Untergrund nach der Selektion stellen $t\bar{t}$-Ereignisse mit zusätzlichen Jets dar. Zur Identifikation dieser Untergrundereignisse werden multivariate Methoden verwendet.

Dieser Vortrag stellt eine multivariate Analyse mit *Boosted Decision Trees* zur Klassifikation von Ereignissen als Untergrund- oder Higgs-Boson-Ereignisse vor.