T 52: Higgs-Zerfälle in Fermionen II

Zeit: Mittwoch 16:00–18:15 Raum: H04

T 52.1 Mi 16:00 H04

Kombinierte Messung der Higgs-Boson-Produktionsmechanismen und -Zerfälle mit dem ATLAS Detektor — •Théo Megy und Karsten Köneke — Albert-Ludwigs-Universität Freiburg

Seit der Entdeckung des Higgs-Bosons im Jahr 2012 werden dessen Eigenschaften durch mehrere Analysen erforscht. Beim ATLAS Experiment werden diese Eigenschaften sowohl in bosonischen ($H \to ZZ^*, \gamma\gamma, WW^*$) als auch in fermionischen ($H \to \tau\tau, b\bar{b}$) Kanälen vermessen.
Die Kombination dieser Analysen erlaubt eine erhöhte Präzision der Messungen und ermöglicht eine unabhängige Bestimmung der Wirkungsquerschnitte der Produktionsmechanismen und der Verzweigungverhältnisse der Zerfallkanäle. Deswegen erlaubt sie ein genaueres Prüfen der Natur des Higgs-Bosons, insbesondere durch den sogenannten Simplified-Template-Cross-Sections-Formalismus (STXS) oder durch eine Reinterpretation im Rahmen des κ-Frameworks.
In diesem Vortrag wird das Kombinierungsverfahren der Higgs-Boson-Analysen in ATLAS diskutiert werden, mit einem Schwerpunkt auf der Messung der Wirkungsquerschnitte und Verzweigungverhältnisse. Die Behandlung der Ergebnisse der einzelnen Analysen sowie die Parametrisierungen für die verschiedenen Messungen werden erläutert werden. Darüberhinaus werden die STXS und κ-Framework Formalismen diskutiert werden.

T 52.2 Mi 16:15 H04

Search for boosted Higgs decays to pairs of heavy quarks with the CMS Experiment — •Andrzej Novak, Xavier Coubez, Luca Mastrolorenzo, Spandan Mondal, and Alexander Schmidt — RWTH Aachen, Aachen, Germany

The Higgs boson decay into bottom quarks has the highest branching fraction of all decay modes. Among the not yet observed decays, the branching fraction to charm quarks is the second highest. This talk presents a search for the Higgs boson in the gluon fusion production mode with high Lorentz boosts, decaying to a pair of bottom quarks. The analysis has been published in 2018 and was sensitive enough to observe the boosted Z boson decay into b quarks for the first time. Given the recently developed deep learning based tools for identification of bottom and charm flavor jets in such topologies, the natural next step is an analogous search for the decay to a pair of charm quarks. Probing this channel is not only important for completeness and studying the Higgs couplings to the second generation of fermions, but it could also be sensitive to potential beyond Standard Model corrections.

T 52.3 Mi 16:30 H04

Search for Higgs boson pair production and constraints on Higgs couplings in the $b\bar{b}\tau^+\tau^-$ final state with 36.1 fb^{-1} of pp collisions data at $\sqrt{s} = 13$ TeV with the ATLAS detector — •Alessandra Betti, Florian Beisiegel, Christopher Deutsch, Tatjana Lenz, Alexander Melzer, and Norbert Wermes — Physikalisches Institut, Universität Bonn

In the SM Higgs boson pairs can be produced via gluon-gluon fusion through top-quark loops and the Higgs triple self-interaction. The study of this process can therefore allow to probe the structure of the Higgs potential by measuring the Higgs self-coupling λ_{HHH}. Although the SM cross-section for Higgs pair production is very small, modifications to the top-quark Yukawa coupling or to the Higgs self-coupling, could enhance the di-Higgs production rate and show hints of possible new physics in this process. It is therefore interesting to set constraints on these couplings with the 2015+2016 dataset collected by ATLAS even without yet having the sensitivity to observe the SM process. Moreover, many BSM theories predict heavy resonances that could decay into a pair of Higgs bosons, such as a neutral scalar heavy Higgs in two-Higgs doublet models or spin-2 Kaluza-Klein excitations of the graviton in the bulk Randall-Sundrum model. In the assumption of SM Higgs bosons with m=125 GeV, the $b\bar{b}\tau^+\tau^-$ channel of the di-Higgs decay has the third largest branching fraction (7.4%). The results of the search for Higgs boson pair production in the $b\bar{b}\tau^+\tau^-$ final state obtained with 36.1 fb^{-1} of pp collisions data at $\sqrt{s} = 13$ TeV with the ATLAS detector will be presented in this talk.

T 52.4 Mi 16:45 H04

Modelling of the W+jets background in the 1-lepton channel for the VH, H → bb analysis — •Simona Gargiulo, Stephen Jiggins, and Christian Weiser — Albert-Ludwigs-Universität Freiburg

The observation of the decay of the Higgs boson into a $b\bar{b}$ pair produced in association with a W or Z boson with the ATLAS detector is presented. The analysed dataset corresponds to an integrated luminosity of 79.8 fb^{-1} collected in proton-proton collisions in Run 2 of the Large Hadron Collider at a centre-of-mass energy of 13 TeV. Final states with 0-, 1- and 2 charged leptons are considered targeting the decay channels $Z \to \nu\nu$, $W \to l\nu$ and $Z \to l^+l^-$.

The W+jets process is one of the leading backgrounds in the 1-lepton channel and its uncertainty contributes significantly to the overall systematic uncertainty on the signal strength. The focus of this talk will be on the estimation of the systematic uncertainties of the theoretical prediction of the W+jets background in the 1-lepton channel. This estimation relies on generator studies with varied settings and on the comparison between different generators.

Furthermore, new techniques are explored to reduce the W+jets systematic on the vector boson transverse momentum, by making use of control regions that allow a better determination of kinematic properties in these events.

T 52.5 Mi 17:00 H04

Studies towards improving the Missing Mass Calculator at the ATLAS experiment — •Michael Hübner, Philip Bechtle, Klaus Desch, Christian Grefe, Lara Schildgen, Peter Wagner, and Martin Werres — Universität Bonn

The Missing Mass Calculator (MMC) is a well-established likelihood-based tool that is used in a variety of analyses studying particles decaying into two tau leptons, such as the $H \to \tau\tau$ coupling measurement. It reconstructs the invariant mass of the ditau system which can then be used to distinguish signal and background processes.

Developments in the tau reconstruction over the last years, e.g. the new possibility of hadronic tau decay mode classification, have been targeted to be propagated to the MMC. I will introduce the concepts behind this tool and what I have done in order to incorporate the aforementioned improvements in the tau reconstruction.

T 52.6 Mi 17:15 H04

An embedding technique to determine genuine $\tau\tau$ backgrounds from CMS data — Janek Bechtel, •Sebastian Brommer, Artur Gottmann, Guenter Quast, and Roger Wolf — Karlsruhe Institute of Technology, Karlsruhe, Germany

The τ-embedding technique is a data-driven method, where $\mu\mu$ events are selected from data, and the muons are replaced by simulated τ decays. In this way a hybrid event is created, which only relies on the simulation for the well understood τ decay. The remainder of the event, by construction, provides a better description of the data than full simulation, especially for challenging simulation tasks, such as the underlying event or multijet production.

The τ-embedding technique is actively used by CMS to estimate standard model backgrounds that contain genuine τ decays.

The current status, recent developments and improvements of the technique are presented.

T 52.7 Mi 17:30 H04

Suche nach der Produktion von Higgs-Paaren über Vektor-Boson-Fusion im 4b-Endzustand — Goetz Gaycken, Vadim Kostyukhin, Tatjana Lenz, •Alexander Melzer, Eckhard von Törne und Norbert Wermes — Rheinische Friedrich-Wilhelms-Universität Bonn

Mit der Entdeckung des Higgs-Bosons wurde 2012 das letzte vom Standard Modell vorhergesagte Teilchen gefunden. Seither werden auf der Suche nach Abweichungen vom Standrad Modell die Eigenschaften des Teilchens und seine Interaktionen mit andern Teilchen studiert. Der VBF Kanal ermöglicht es zum ersten Mal auf die Kopplung von zwei Vektorbosonen zu zwei Higgs-Bosonen (c2V) im nicht-resonanten Kanal ein Limit zu setzten. Der resonante Kanal bietet zusätzlich eine Möglichkeit für die Suche nach Teilchen jenseits des Standrad Modells. Begünstigt durch das das hohe Verzweigungsverhältnis des Higgs-Bosons zu b-Quark-Paaren wurde die Analyse im 4b-Endzustand

durchgeführt. Für die Analyse wurde der vollständige ATLAS Run-2 Datensetzen mit 149 inversen femtobarn bei 13TeV Schwerpunktsenergie verwendet.

T 52.8 Mi 17:45 H04

Search for Higgs boson decay to a pair of charm quarks at CMS. — •Andrey Pozdnyakov, Luca Mastrolorenzo, Xavier Coubez, and Alexander Schmidt — RWTH, Aachen, Germany

With more data accumulated by the CMS experiment in Run-2 it became possible to determine Higgs boson coupling to a bottom quark. With more data at High Luminosity LHC one can hope to be sensitive to Higgs boson coupling to charm quarks, or at least to put the most stringent limit on this coupling. This would require not only an increase in the integrated luminosity, but also a development of the advanced analysis techniques to control the background processes and efficiently tag c-quark flavored jets.

In this talk the first analysis of the H->cc search by CMS experiment is presented using 36/fb of data recorded in 2016. It shows the current sensitivity of the H->cc measurement and paves the way for the future advancements in this search.

T 52.9 Mi 18:00 H04

Search for a very light pseudoscalar boson produced in decays of the 125 GeV Higgs boson in final state with two muons and two tau leptons in pp collisions at $\sqrt{s}$ = 13 TeV — Somnath Choudhury[4], •Sandra Consuegra Rodríguez[1], Elisabetta Gallo[2], Alexis Kalogeropoulos[3], Danyer Pérez Adán[1], Alexei Raspereza[1], and Prabhat Solanki[4] — [1]DESY, Germany — [2]DESY and University of Hamburg, Germany — [3]Princeton University, USA — [4]Indian Institute of Science, India

The results of the study of the H(125) boson properties allow the branching fraction of H(125) into non-SM particles to be as high as 34%. A vast set of models containing two Higgs doublets plus one additional Higgs singlet complex field (2HD+1S) are consistent with SM measurements, constraints from additional Higgs bosons and searches for supersymmetry, as well as with the measured properties of the H(125) boson. The Higgs sector of the 2HD+1S models features seven physical states: three CP-even, two CP-odd and two charged bosons. The lightest pseudoscalar boson a_1 is potentially accessible in the H(125)$\rightarrow a_1 a_1$ decay, with sufficiently high rate to be detected at the LHC. A new search for a very light pseudoscalar higgs boson will be presented, investigating final states where one a_1 boson decays into a pair of muons and the other into a pair of tau leptons. The search is based on a dataset corresponding to an integrated luminosity of 35.9 fb^{-1}, collected with the CMS detector at $\sqrt{s}$=13 TeV, probing low mass a_1 region between 3.6 and 19 GeV.