T 100: Higgs-Boson 8 (BSM-Zerfälle)

Zeit: Donnerstag 16:45–19:05 Raum: JUR 3

Gruppenbericht T 100.1 Do 16:45 JUR 3

Search for Higgs bosons decaying into pairs of τ-leptons in the context of the MSSM — Artur Akhmetshin, •René Caspart, Andrew Gilbert, Günter Quast, Roger Wolf, and Sebastian Wozniewski — Institut für Experimentelle Kernphysik, Karlsruher Institut für Technologie (KIT)

The discovery of a Higgs Boson at the LHC in the year 2012 was an important milestone in the field of particle physics. However the question remains if additional Higgs bosons which for example are predicted in the Minimal Supersymmetric Standard Model exist. With the restart of the LHC in 2015 at an increased center of mass energy of 13 TeV the reach of searches for these Higgs bosons is increased significantly.

The search for additional heavy neutral Higgs bosons decaying into a pair of τ-leptons is the most sensitive one in a large class of extensions of the Standard Model. In this talk the search for these Higgs bosons using data recorded by the CMS experiment at 13 TeV will be shown.

T 100.2 Do 17:05 JUR 3

Search for Neutral MSSM Higgs Bosons $H/A \to \tau_l\tau_h$ at ATLAS — •Verena Muckhoff, William Davey, and Jochen Dingfelder — Physikalisches Institut Universität Bonn

The Minimal Supersymmetric Standard Model (MSSM) is an extension of the Standard Model (SM) that is able to adress problems of the SM such as the hierarchy problem, gauge coupling unification and the existence of dark matter. Its Higgs Sector consists of two charged, $H^{\pm}$, and three neutral Higgs bosons, h, H, A. For a large parameter space (large $\tan\beta$), the couplings of H and A to down-type fermions are enhanced with respect to the SM, resulting in increased branching fractions to τ leptons and b-quarks. This has motivated a variety of searches of MSSM Higgs bosons decaying into $\tau\tau$ final states.

In this talk, a search for neutral MSSM Higgs Bosons decaying into a τ lepton pair is presented in the channel where one τ decays leptonically, the other τ decays hadronically, respectively. The final selection is split into a b-tagged and a b-veto region to optimize the sensitivity for different production processes (e.g. b-associated production).

In this talk, the results of the current update of the $H \to \tau\tau$ analysis based on 36.47 fb^{-1} proton-proton collision data collected with the ATLAS detector in 2015 and 2016 at a centre-of-mass energy of $\sqrt{s}$ = 13 TeV are presented. The focus will be on the background estimation.

T 100.3 Do 17:20 JUR 3

Sensitivity enhancement for the MSSM analysis in the $H \to \tau\tau$ channel — René Caspart, Andrew Gilbert, Günter Quast, Roger Wolf, and •Sebastian Wozniewski — Institut für Experimentelle Kernphysik, Karlsruhe, Germany

In 2012 a Higgs boson was discovered at the LHC which represents an important contribution to the Standard Model. But is it the only one? For example the Minimal Supersymmetric Standard Model (MSSM) predicts the existence of four further Higgs bosons. Therefore searches are performed across a broad mass range for these particles.

The analysis referred to in this talk is looking for additional heavy neutral Higgs Bosons decaying into τ pairs. The talk deals with the sensitivity enhancement for this analysis involving Boosted Decision Trees as a machine learning method.

T 100.4 Do 17:35 JUR 3

BDT based search for neutral MSSM Higgs bosons in the fully hadronic τ-pair final state with ATLAS — •Max Märker, Dirk Duschinger, Wolfgang Mader, Lorenz Hauswald, Arno Straessner, and Sebastian Wahrmund — IKTP TU Dresden, Dresden, Germany

The Minimal Supersymmetric Standard Model (MSSM) extends the Higgs sector with an additional doublet leading to the prediction of five Higgs bosons, two charged and three neural bosons. At tree level the Higgs sector is fully described by the mass of the CP-odd Higgs boson, m_A, and the ratio of the vacuum expectation values of the two Higgs doublets, $\tan\beta$. At large values of $\tan\beta$ the couplings to b quarks or τ leptons are significantly enhanced.

In this talk, a new multivariate analysis based on boosted decistion trees (BDT) in the search for heavy, neutral Higgs bosons in the fully hadronic $H \to \tau^+\tau^-$ channel is presented. The dominant background processes are QCD multi-jet, Drell-Yan and W+jets production. To separate the signal from these backgrounds, two independent event categories are introduced, and the description of the multi-jet background is taken directly from data. Using the BDT analysis, an improved expected signal significance is observed when compared to a traditional cut-based analysis.

T 100.5 Do 17:50 JUR 3

Search for BSM H$\to \tau\tau$ in the dihadronic decay channel with ATLAS — •Lino Gerlach, Michel Janus, and Stan Lai — II. Physikalisches Institut, Georg-August-Universität Göttingen

In 2012, a scalar boson was found at CERN that is consistent with the properties of the Higgs boson predicted by the Standard Model of particle physics. Some theories, in particular supersymmetric models, also predict the existence of additional heavier neutral Higgs bosons. The decays of these hypothetical particles to a pair of τ leptons can have higher branching ratios compared to decays to other leptons because of the high mass of the τ lepton and additional effects of two-Higgs-doublet models that can enhance the coupling to the third generation of leptons.

In this talk, some details of the search for H$\to \tau\tau$ in the dihadronic channel will be presented. Data is taken at the ATLAS experiment with a centre-of-mass energy of $\sqrt{s}$ = 13 TeV. Special emphasis will be put on the mass reconstruction algorithms used and the calculation of so-called fake rates. These describe the probability of a jet to be falsely identified as a hadronically decaying τ lepton and are a crucial ingredient in estimating the background.

T 100.6 Do 18:05 JUR 3

Search for Minimal Supersymmetric Standard Model Higgs bosons H/A and for a Z' boson in the $\tau\tau$ final state at $\sqrt{s} = 13TeV$ with the ATLAS Detector — •Dirk Duschinger, Lorenz Hauswald, Wolfgang Mader, and Arno Straessner — Institut fuer Kern und Teilchenphysik, TU-Dresden

Searches for new heavy resonances decaying to tau-lepton pairs are both theoretically and experimentally well motivated. Extensions of the Standard Model often include additional particles, such as the Minimal Supersymmetric Standard Model (MSSM) introducing new heavy neutral higgs bosons A and H. Many other models commonly include heavy neutral Z' bosons, some of them predicting preferred couplings to third-generation fermions.

The search for high-mass resonances decaying into $\tau^+\tau^-$ final states with the ATLAS detector is presented. The data were recorded in proton-proton collisions at $\sqrt{s} = 13$ TeV produced by the Large Hadron Collider. The $\tau_{\text{had}}\tau_{\text{had}}$, $\tau_\mu\tau_{\text{had}}$ and $\tau_{\text{e}}\tau_{\text{had}}$ channels are analyzed. The results are interpreted for the MSSM in the hMSSM and m_h^{mod} scenarios. Theories including Z' bosons are studied in the sequential standard model as well as in the non-universal G(221) model.

T 100.7 Do 18:20 JUR 3

Search for massive (pseudo)scalar states A/H decaying to $t\bar{t}$ with interference at the ATLAS experiment — Katharina Behr, •Yu-Heng Chen, Klaus Mönig, and Jike Wang — DESY, Germany

The search for new neutral TeV scale (pseudo)scalar particles is well-motivated by a wide range of theories beyond the Standard Model (BSM) which include an extra Higgs doublet such as the Minimal Supersymmetric Standard Model (MSSM). Final states with a top-antitop-quark pair ($t\bar{t}$) provide good sensitivity especially for low values of $\tan\beta$ (the ratio of the vacuum expectation values of the two Higgs fields), a parameter range that is not accessible by most searches in other final states.

However, strong interference effects between the signal and the Standard Model $t\bar{t}$ background distort the signal shape from a simple Breit-Wigner peak to a peak-dip structure and reduce the sensitivity of established search strategies for $t\bar{t}$ resonances; therefore, a new strategy has to be adopted. We present the first search with interference effects taken into consideration. We describe the search strategies adopted for the analyses of proton-proton collisions at $\sqrt{s}$ = 8 TeV and 13 TeV. The results are interpreted in terms of a type-II 2HDM model.

T 100.8 Do 18:35 JUR 3

Optimierung einer Suche nach geladenen Higgs-Bosonen

mit dem ATLAS-Experiment hinsichtlich des b-Tagging-Arbeitspunktes — •Sebastian Bannmann, Heiko Lacker, Janet Dietrich und Francesco Peri — Humboldt Universität, Berlin, Deutschland

Geladene Higgs-Bosonen, H^+, treten in verschiedenen Erweiterungen des Standardmodells auf. Bei großen H^+-Massen ist der dominante Produktionsprozeß am Large Hadron Collider $pp \to H^+\bar{t}b$ und der dominante Zerfall $H^+ \to t\bar{b}$.

Der Vortrag diskutiert die Optimierung einer bereits existierenden ATLAS-Datenanalyse bei einer Proton-Proton-Schwerpunktsenergie von 13 TeV, die Endzustände mit einem Lepton und hoher (b-)Jet-Multiplizität verwendet, hinsichtlich der Wahl des besten b-Tagging-Arbeitspunktes für den Massenbereich zwischen 250 und 2000 GeV mit Hilfe simulierter Ereignisse.

T 100.9 Do 18:50 JUR 3

Developments in the search for a heavy charged Higgs boson — •Francesco Peri, Heiko Lacker, and Janet Dietrich — HU-Berlin

Many Beyond-the-Standard Model (BSM) scenarios predict charged Higgs bosons ($H^{\pm}$). In particular, an additional Higgs doublet naturally appears in the Minimal Supersymmetric Standard Model (MSSM). The production mechanisms and decays of such particles strongly depend on their mass. This presentation focuses on heavy charged Higgs bosons, with a mass larger than the top-quark mass, whose predicted production cross section at the Large Hadron Collider is not negligible. In this case, the dominant production mode is in association with a top quark, while the decay is into a top-bottom pair. In this talk, the current status of a search for $tbH^{\pm}$ production with the ATLAS experiment is presented. The latest public results are summarised, showing upper limits on the production cross section times the decay branching fraction, and proposing possible improvements.