

T 134: Higgs, Di-Higgs IV

Time: Thursday 17:30–19:00

Location: HSZ/0105

T 134.1 Thu 17:30 HSZ/0105

Differential measurement of the $H \rightarrow \tau\tau$ cross-section in the VBF production mode — ●LENA HERRMANN, CHRISTIAN GREFE, PHILIP BECHTLE, and KLAUS DESCH — Physikalisches Institut, Universität Bonn

Precision measurements of the Higgs boson properties are promising to show evidence of BSM physics. One aspect of interest is the Yukawa-interaction which can be directly investigated by the cross-section measurement of the di- τ final state. Detailed studies are performed in a combined maximum-likelihood fit of the di- τ mass in different p_T^H bins using the "Simplified Template Cross Section" framework (STXS). Orthogonal control regions are used to determine and to validate the contribution of important background processes. Multi-jet events which are misidentified as visible τ 's (fakes), play an important role apart from the dominant $Z \rightarrow \tau\tau$ events. The fraction of fake events depends on the decay-mode of the hadronically decaying τ and has a less prominent contribution if no neutral pions are involved in the final state. In past analysis efforts, the estimated fake background events were only differentiated by 1- and 3-prong events which is why a more accurate, now decay-mode dependent fake background estimation is developed. It enables a loosened event selection for decay-modes without neutral pions and thus, an increased selection efficiency of signal events.

The method as well as the influence of the improved background estimation on the sensitivity of the measurement in different STXS bins will be discussed.

T 134.2 Thu 17:45 HSZ/0105

Charge-asymmetry measurement in WH($\tau\tau$) events — ●RALF SCHMIEDER, NICCOLO TREVISANI, NILS FALTERMANN, MARKUS KLUTE, ROGER WOLF, XUNWU ZUO, SEBASTIAN BROMMER, MAXIMILIAN BURKART, and GÜNTER QUAST — Karlsruher Institut für Technologie, Karlsruhe, Deutschland

At the LHC, an asymmetry in W^+H and W^-H production is expected as the parton distribution functions (PDFs) favour the production of positively-charged W bosons in proton-proton collisions. The measurement of the WH charge asymmetry provides a consistency test for the Standard Model (SM), as it is sensitive to enhanced Yukawa couplings to the first and more so to second generation quarks like the c quark. The production of an H in association with a W boson can happen through the exchange of a c quark in the t channel. Experimentally, the WH charge asymmetry measurement is independent of any challenging c jet tagging algorithms. This talk reports the status of this measurement in the channel where the Higgs boson decays into a pair of τ leptons.

T 134.3 Thu 18:00 HSZ/0105

Improved event cleaning for the τ -embedding method of CMS — ●CHRISTIAN WINTER, SEBASTIAN BROMMER, ARTUR GOTTMANN, ROGER WOLF, and GÜNTER QUAST — ETP, Karlsruhe Institute of Technology, Karlsruhe, Germany

In $H \rightarrow \tau\tau$ analyses a major source of background are genuine tau leptons, mostly originating from $Z \rightarrow \tau\tau$ decays. The τ -embedding method is a method to estimate this background from data, by replacing muons in an selected-event in data with simulated τ -decays. For this purpose, the muon signatures have to be removed from the original event record. This talk will focus on an improved cleaning, which takes electromagnetic muon showering in the muon detectors into account.

T 134.4 Thu 18:15 HSZ/0105

Measuring Higgs boson production cross sections in its decays into two tau leptons with the ATLAS detector — ●BAKTASH AMINI, CHRISTOPHER YOUNG, KARSTEN KÖNEKE, and KARL JAKOBS

for the ATLAS-Collaboration — Albert-Ludwigs-Universität Freiburg, Freiburg, Germany

Since the Higgs boson discovery, probing the properties of it is an important physics program of the LHC. The significance of these studies originates from the fact that the Higgs boson is the only fundamental, point-like scalar which has been observed, and the precision measurement of the couplings of the Higgs boson through the production mechanisms and the decay modes might lead us to new physics. In this talk, the latest advances in Higgs boson measurements in its decays into two tau leptons, using data collected by the ATLAS detector, will be discussed.

T 134.5 Thu 18:30 HSZ/0105

Sensitivity to Triple Higgs Couplings via Di-Higgs Production in the 2HDM at the (HL-)LHC — FRANCISCO ARCO^{1,2}, SVEN HEINEMEYER², MARGARETE MUHLLEITNER³, and ●KATERYNA RADCHENKO⁴ — ¹UAM, Spain — ²IFT (UAM-CSIC), Spain — ³KIT, Germany — ⁴DESY, Germany

The reconstruction of the Higgs potential is a major goal for experimental particle physics. This can be accomplished via the precise measurement of the Higgs mass and its self interactions. The first process that provides access to the trilinear self-coupling is Higgs pair production, which at the LHC happens dominantly through gluon fusion. In this context, models with extended Higgs sectors are theoretically and experimentally allowed and can accommodate large deviations of the trilinear Higgs couplings while providing explanations to some of the shortcomings of the Standard Model.

We study the sensitivity to the triple Higgs couplings involved in Higgs pair production via gluon fusion in the framework of the Two Higgs Doublet Model. In particular, we focus on the contribution of the resonant diagram involving a heavy CP-even Higgs boson exchange to the total production cross section as well as the invariant mass distribution of two Higgses in the final state. We show that for the benchmark scenarios where the resonant production is dominant, there is significant sensitivity to the parameters of the extra scalar. Finally, we discuss the effects of experimental uncertainties by applying smearing and binning to our results.

T 134.6 Thu 18:45 HSZ/0105

A model-independent analysis of interference effects in the $t\bar{t}$ final state at the LHC involving two CP-mixed Higgs bosons — HENNING BAHL¹, ●ROMAL KUMAR², and GEORG WEIGLEIN^{2,3} — ¹University of Chicago, Department of Physics and Enrico Fermi Institute, 5720 South Ellis Avenue, Chicago, IL 60637 USA — ²Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany — ³II. Institut für Theoretische Physik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

Various extensions of the Standard Model predict the existence of additional Higgs bosons. If these additional Higgs bosons are sufficiently heavy, an important search channel is the di-top final state. In this channel interference contributions between the signal and the corresponding QCD background process are expected to be important. If more than one heavy Higgs boson is present, besides the signal-background interference effects associated with each Higgs boson also important signal-signal interference effects are possible. We perform a comprehensive model-independent analysis of the various interference contributions within a simplified model framework considering two heavy Higgs bosons that can mix with each other, taking into account large resonance-type effects arising from loop-level mixing between the scalars. The interference effects are studied both in an analytic way at the parton level and with Monte Carlo simulations for proton-proton collisions at the LHC. The mapping of the general approach to a specific model is demonstrated for the case of a complex Two-Higgs Doublet Model.