T 124: BSM Higgs 5 (charged Higgs bosons)

Time: Friday 9:00–10:15 Location: Geb. 30.41: HS 3

T 124.1 Fri 9:00 Geb. 30.41: HS 3

Searches for charged Higgs bosons in $H^\pm \to W^\pm h$ decays with the ATLAS detector — Dominik Duda[2], •Simon Grewe[1], Sandra Kortner[1], and Hubert Kroha[1] — [1]Max Planck Institut for Physics — [2]University of Edinburgh

Many theories beyond the Standard Model predict the existence of charged Higgs bosons. The main production mode of these new particles depends on their mass. For large masses ($m(H^\pm) > m(t) + m(b)$), the dominant mode of production is in association with a top quark and a bottom quark ($tbH^\pm$). In the alignment limit of the Two-Higgs-Doublet Model (2HDM), heavy charged Higgs bosons decay almost exclusively via $H^\pm \to tb$. In other models such as the Georgi-Machacek model, however, significant branching ratios for $H^\pm \to W^\pm h$ are possible. This decay has so far not been studied by ATLAS or CMS.

A search for charged Higgs bosons in $H^\pm \to W^\pm h$ decays produced in association with a top and bottom quark is presented, based on the full Run-2 dataset of the ATLAS experiment. The analysis targets boosted $h \to bb$ decays in final states with at least one large-radius jet and a charged lepton. The decay of the neutral Higgs boson h is reconstructed via a large-radius jet, the W boson is reconstructed either from an additional large-radius jet or the lepton and missing transverse momentum. A neutral network is trained to distinguish between signal and backgrounds. Selection criteria based on the neutral network output are used to define signal and control regions. Upper limits on $\sigma(pp \to tbH^\pm) \times BR(H^\pm \to W^\pm h)$ are obtained by a maximum likelihood fit of the reconstructed H+ mass spectrum.

T 124.2 Fri 9:15 Geb. 30.41: HS 3

Search for the charged Higgs production at high transverse momenta in the $H^\pm \to Wh(h \to b\bar{b})$ channel — •Leila Hamdan, Jochen Dingfelder, and Tatjana Lenz — Bonn University

The discovery of the Higgs boson in 2012 at the LHC triggered large interest in searches for additional Higgs bosons beyond the SM. Several BSM theories, for example the two-Higgs doublet model and the next-to-two-Higgs doublet model, predict an existence of a charged Higgs boson. This talk focuses on the charged Higgs boson search in the $H^+ \to Wh$, $h \to b\bar{b}$ decay channel, where h is the SM-like Higgs boson with the mass of 125 GeV. The search focuses on charged Higgs boson masses above 800 GeV, resulting in highly boosted decay products. The analysis strategy is developed using the simulated samples for signal with charged Higgs boson masses between 800-3000 GeV and the main $t\bar{t}$ background. The analysis strategy is introduced and preliminary results will be presented.

T 124.3 Fri 9:30 Geb. 30.41: HS 3

Search for a charged Higgs boson decaying to cs in the low mass region with the ATLAS detector at $\sqrt{s} = 13$ TeV — Jochen Dingfelder, Tatjana Lenz, and •Christian Nass — Physikalisches Institut, Universität Bonn, Deutschland

In the Standard Model (SM) electroweak symmetry breaking (EWSB) is introduced by a single complex scalar field. The consequence is the prediction of a scalar, neutrally charged particle, the Higgs boson, which was discovered in 2012 at the LHC. A simple extension of the SM is to introduce EWSB through two complex scalar fields. Such two-Higgs doublet models (2HDM) are attractive because they offer the opportunity to include additional CP violation to the SM, which is needed for explaining baryogenesis. 2HDMs feature 3 neutral and 2 charged Higgs bosons. An observation of such a charged scalar particle would be a striking signal of physics beyond the SM.

In the low mass region, $m_H^\pm < m_t$, the dominant production mode is by a $t\bar{t}$ pair with one t-quark decaying to $H^\pm b$ and the search for $H^\pm \to cs$ decays is suggested in several theory papers. This talk presents the search of $H^\pm \to cs$ decays in the full Run-2 ATLAS pp-collision dataset. That includes background estimation, signal extraction, and expected as well as observed sensitivities.

T 124.4 Fri 9:45 Geb. 30.41: HS 3

tbH^+ analysis with multileptons with Run-2 ATLAS data — •Martin Rames and Andre Sopczak — Czech Technical University in Prague

The latest results with Run-2 ATLAS data are presented for the search tbH^+ in the multilepton channel.

T 124.5 Fri 10:00 Geb. 30.41: HS 3

Exploring Higgs Triplet Models - Georgi-Machacek Model's Unique Dynamics — •Saurav Bania[1], Sara Chopra[2], Gudrid Moortgart Pick[3], and Sven Heinemeyer Heinemeyer[4] — [1]Universität Hamburg — [2]Universität Hamburg — [3]Universität Hamburg — [4]Consejo Superior de Investigaciones Científicas (CSIC)

In our focused research, we navigate the intricate realm of sum rules within the Higgs Triplet Model, specifically spotlighting the Georgi-Machacek Model. Our analysis hones in on the distinctive dynamics of doubly charged Higgs particles, unraveling nuanced alterations in unitarity sum rules induced by their intriguing presence.

Beyond mere exploration, our investigation aims to provide profound insights into the existence and potential energy ranges associated with these doubly charged Higgs particles. This work contributes valuable implications for theories extending Beyond the Standard Model, representing a significant stride in unraveling the complex behavior of Higgs Triplet Models, particularly at high energies.

As we traverse this scientific terrain, our research not only advances our understanding of the intricacies within the Georgi-Machacek Model but also marks a crucial contribution to the evolving landscape of particle physics. Each revelation in our study lays the groundwork for future discoveries, emphasizing the transformative potential within the study of Higgs Triplet Models and their unique features.