T 77: Higgs Physics VIII

Time: Thursday 16:15–18:15 Location: KH 02.013

T 77.1 Thu 16:15 KH 02.013

ttH Analysis with Two Light Leptons and One Hadronically Decaying Tau Lepton with Run-2 ATLAS Data — Ephrem Alemu, •David Erwin, and André Sopczak — CTU in Prague

The latest results of the ttH analysis in the 2lSS1tau channel are presented with focus on machine learning using ATLAS Run-2 data.

T 77.2 Thu 16:30 KH 02.013

Mass-decorrelated jet-particle assignment for ttH(bb) events in dileptonic and semileptonic final states using Run 3 CMS Simulation — •Philipp Nattland[1], Kai Adamowicz[1], Lutz Feld[1], Danyer Perez Adan[1], Valeria Botta[1], Matin Torkian[2], Maria Aldaya Martin[2], and Daina Leyva Pernia[2] — [1]RWTH Aachen — [2]DESY

The associated production of a top-quark pair with a Higgs boson (ttH) directly probes the top-Higgs Yukawa coupling in the Standard Model. This study examines the ttH(bb) channel in the semileptonic and dileptonic final states, using Run 3 CMS simulation data. For a robust, data-driven estimation of the dominant tt+bb background the final state is reconstructed using advanced machine learning techniques for jet assignment. To use the invariant mass of jets assigned to the Higgs candidate as an unbiased fit variable, the reconstruction is decorrelated from the Higgs mass.

T 77.3 Thu 16:45 KH 02.013

Mass-decorrelated signal versus background classification for ttH(bb) events in single- and dileptonic final states using Run 3 CMS Simulation — •Kai Adamowicz[1], Lutz Feld[1], Valeria Botta[1], Danyer Perez Adan[1], Philipp Nattland[1], Matin Torkian[2], Maria Aldaya Martin[2], and Daina Leyva Pernia[2] — [1]RWTH Aachen University — [2]DESY

The ttH process provides a direct probe of the top-Higgs Yukawa coupling, an important parameter of the Standard Model. Due to a large and difficult to accurately model ttbb background, its measurement in the H -> bb channel has proven challenging in previous attempts by the CMS and ATLAS collaborations. Using the transformer based neural network architecture "SPANet", the prospect of a mass decorrelated kinematic reconstruction of the final states and event classification is studied on Run 3 CMS simulation. This way, the invariant mass of the jets assigned to the Higgs candidate may be used as an unbiased fit variable.

T 77.4 Thu 17:00 KH 02.013

Analysis of tH(bb) production with ATLAS Run-2 data — •Filip Rucka and André Sopczak — CTU in Prague

The latest results of the analysis tH(bb) are presented with focus on machine learning using ATLAS Run-2 data.

T 77.5 Thu 17:15 KH 02.013

Higgs-to-Bottom Decays at next-to-leading order in the Sherpa Event Generator — •Lea Baumann[1], Frank Siegert[1], Mareen Hoppe[1], and Marek Schönherr[2] — [1]TUD Dresden University of Technology, Institute of Nuclear and Particle Physics — [2]University of Durham, Institute for Particle Physics Phenomenology

Monte Carlo event generators play a central role in particle collider data analysis by providing accurate theoretical predictions of complex scattering processes. Event generators like Sherpa use the narrow-width approximation to describe short-lived resonances as on-shell particles, allowing the factorisation of production and decay of these "hard" particles.

Until now, Sherpa's hard decays have been implemented only at leading order in perturbative quantum chromodynamics (QCD). In this talk, the next-to-leading order (NLO) QCD calculation for the decay of a Higgs boson into a bottom-antibottom pair within the hard-decay framework will be presented. The computation includes the evaluation of virtual loop corrections, real-emission contributions, and the cancellation of infrared singularities using subtraction terms. The resulting NLO matrix element can later be matched to parton shower programmes. This NLO implementation improves the precision of Higgs-decay simulations within Sherpa and enables more accurate modelling of processes.

T 77.6 Thu 17:30 KH 02.013

Search for the Higgs boson decay into charm-anticharm quark pairs in the vector boson associated production mode with the CMS Experiment — •Valentyn Vaulin, Alexander Schmidt, Andrey Pozdnyakov, Patrick Kersten, Pedro Gouveia Pinto Da Costa, Ishmeet Kaur Vohra, Jan Terörde, and Arnd Meyer — III. Physics Institute A, RWTH Aachen University, Aachen, Germany

The most sensitive channel to constrain the Higgs-charm quark coupling is the Higgs boson decay into charm-anticharm quarks in the associated production with vector bosons, the so called VH (H → cc) channel. Results on the searches in this approach have been published by CMS using data from LHC Run 2. This talk will give an overview of the ongoing developments and expectations for this analysis. Highlights include a new analysis framework which provides improved sensitivity using machine learning methods. The analysis now also probes the VH (H → cc) and VH (H → bb) channels at the same time. Preliminary results with data from LHC Run 3 will be shown.

T 77.7 Thu 17:45 KH 02.013

Integration of the PAIReD Tagger for the Higgs-boson Decay into Charm - Anticharm Quark Pairs in Vector-Boson Associated Production with the CMS Experiment — •Ishmeet Kaur Vohra, Alexander Schmidt, Arnd Meyer, Andrey Pozdnyakov, Valentyn Vaulin, Pedro Gouveia Pinto Da Costa, Patrick Kersten, and Jan Terörde — III. Physics Institute A, RWTH Aachen University, Aachen, Germany

Reconstructing hadronically decaying heavy particles at low to moderate boosts is challenging when using only small-radius jets. The PAIReD and PAIReDEllipse approaches address this by forming jet candidates from pairs of small-radius jets and in the elliptical variant, by including all particles inside an extended elliptical region in the η - ϕ plane. Their performance has been studied for Higgs boson decays into bottom-antibottom (bb) and charm-anticharm (cc) quark pairs produced in association with a vector boson (V), using ParticleTransformer-based algorithms for jet regression and classification. The methods show improved reconstruction efficiency and background separation in the lowboost regime compared to standard AK4 techniques, while remaining competitive at higher boosts. This contribution covers the integration of the PAIReD Tagger into the analysis of the VH(H → cc) channel, including an initial investigation of the related systematic uncertainties.

T 77.8 Thu 18:00 KH 02.013

Investigation on the use of multiclass BDTs in the search for the Higgs boson decay to a charm-anticharm pair in vector boson associated production mode at CMS in Run 3 — •Pedro Gouveia Pinto da Costa, Alexander Schmidt, Andrey Pozdnyakov, Valentyn Vaulin, Patrick Kersten, Ishmeet Kaur Vohra, Jan Terörde, and Arnd Meyer — III. Physikalisches Institut A, RWTH Aachen University

The most sensitive channel to search for the decay of the Higgs boson into charm quarks is the vector boson associated production mode (VH channel) in which the Higgs boson is produced along with a W or Z boson. Analyses targeting this channel use multiple different machine learning models to help distinguish between signal and background events. Among the main backgrounds are W/Z plus jet production and top quark pair production. Events are classified into several categories with different signal and background compositions to facilitate a multi-parameter fit. This talk presents a study in which the potential of a multiclass boosted decision tree (BDT) is investigated in comparison to the previously used binary classification.