T 46: Top: Boosted b-tagging, single top

Zeit: Dienstag 16:45–19:00 Raum: L.09.31 (HS 11)

T 46.1 Di 16:45 L.09.31 (HS 11)

Kalibrierung des MVb-Taggers mit Hilfe von $t\bar{t}$-Zerfällen — •Dominik Duda und Peter Mättig für die ATLAS-Kollaboration — Bergische Universität Wuppertal

Mit zunehmender Schwerpunktsenergie $\sqrt{s}$ steigt der Anteil der $t\bar{t}$-Zerfälle, in denen die Zerfallsprodukte stark geboostet sind und somit nur kleine Abstände voneinander aufweisen oder gar überlappen. Der Überlapp eines b-Jets mit einem weiteren Zerfallsprodukt des Top-Quarks wirkt sich stark negativ auf die Performance der gängigen b-Tagging Algorithmen des ATLAS-Experiments aus.
MVb ist ein neuentwickelter b-Tagger, der speziell in geboosteten Topologien zum Einsatz kommen soll und entsprechend wenig sensitiv auf zusätzliche Jet-Aktivität in der Umgebung der b-Jets ist. Zudem zeichnet sich der MVb Tagger durch eine signifikant verbesserte Performance für Jets mit hohem Transversalimpuls aus. In diesem Vortrag wird eine erste Kalibrierung dieses b-Taggers mit Hilfe von Messdaten des ATLAS-Detektors vorgestellt. Während dieser Kalibrierung werden die entsprechenden Skalierungsfaktoren nicht nur wie sonst üblich als Funktion des Transversalimpulses oder der Pseudorapidität der selektierten Jets gemessen, sondern auch als Funktion von physikalischen Größen, die stark empfindlich sind bezüglich zusätzlicher hadronischer Aktivität nahe der untersuchten Jets.

T 46.2 Di 17:00 L.09.31 (HS 11)

High-p_T B-tagging and Top-Tagging with Variable-R Jets in ATLAS — •Katharina Behr — Sub-department of Particle Physics, University of Oxford, Denys-Wilkinson Building, Keble Road, Oxford OX1 3RH, United Kingdom

Variable-R jets, whose effective size is inversely proportional to their transverse momentum, are a versatile tool for object reconstruction across the large transverse momentum regime accessible during Run 2 of the LHC. I will discuss the performance of Variable-R jets in two different contexts:

1) Boosted top-tagging. The separation between the decay products of highly energetic top quarks decreases with p_T^{top} causing them to overlap and merge into a single jet. Taggers relying on large fixed-R jets overestimate the real size of the top jet in the highly boosted regime and are more susceptible to the effects of pile-up. Variable-R jets are studied as the basis for more natural taggers which may not even require grooming.

2) B-tagging. The b-tagging performance in boosted topologies suffers in the presence of close-by jets. This limits the sensitivity of many searches such as those in boosted $hh \to 4b$ final states. New b-taggers relying on track jets with smaller sizes than the traditional $R = 0.4$ to better isolate the b-hadron decay show significant improvements in highly boosted scenarios but perform worse at low transverse momenta where they fail to capture the full b-jet. Variable-R track jets provide a unified approach to b-tagging in both p_T regimes.

T 46.3 Di 17:15 L.09.31 (HS 11)

Measurement of the double-vertex reconstruction efficiency of the Inclusive Vertex Finder with accidentally overlapping b-jets in ttbar events — Ivan Marchesini, Dominik Nowatschin, Jochen Ott, Alexander Schmidt, and •Heiner Tholen — University of Hamburg

In LHC Run II, CMS b-tagging algorithms will employ a new core algorithm, named Inclusive Vertex Finder (IVF). The IVF is designed to perform decay vertex reconstruction of long-lived particles, such as B hadrons. Using only tracks from the silicon tracker, it does not depend on jet clustering and allows for higher reconstruction efficiency of decay vertices, which particularly applies to topologies with two or more decay vertices at low distance. Thus, the IVF will offer increased sensitivity for SM measurements (e.g. angular correlations), but also for the search of BSM physics (e.g. final states with boosted Higgs bosons decaying into b-quarks).

For the first time, the dependence of the IVF reconstruction efficiency on the distance of vertices in the $\eta - \phi$ plane is investigated with a data-driven approach. We use a clean set of top quark pair events, selected from data recorded in 2012 in pp-collisions at 8 TeV with the CMS detector, and perform a template fit to a 2D-distribution of the masses of the vertices in an event. Correction factors are derived for the application to simulated events. We conclude that our technique will enable precise calibration of double vertexing with the IVF in the LHC Run II.

T 46.4 Di 17:30 L.09.31 (HS 11)

Boosted-Top Tagging within busy environments with HEPTopTagger — Elin Bergeaas Kuutmann[1], Janet Dietrich[2], •Geoffrey Herbert[2], and Heiko Lacker[2] — [1]Uppsala Universitet — [2]Humboldt Universität zu Berlin

Several new physics models predict the existence of high mass particles capable of being produced at the LHC. Many of these particles could have decay topologies involving top quarks. These top quarks can be produced with high momentum (dependent on parent particle mass) and can become "boosted". Boosted-top tagging techniques are now well established within high energy particle physics, however their use up to now has primarily been within fairly clean decay environments (e.g. Z' resonance searches relying on two top quarks being produced with a large angle of separation between them. New physics particles with busy production and decay topologies (multiple particles, small angular separation) are a relatively new challenge for boosted-top tagging techniques. In this talk a new method of object reconstruction based on HEPTopTagger is explored to optimise a search strategy in busy environments. An analysis strategy conducted in ATLAS is presented.

T 46.5 Di 17:45 L.09.31 (HS 11)

Messung des Wirkungsquerschnittes der elektroschwachen Einzel-Top-Quark-Erzeugung im t-Kanal mit dem ATLAS Experiment — •Phillipp Tepel, Dominic Hirschbühl und Wolfgang Wagner — Bergische Universität Wuppertal

Die elektroschwache Erzeugung einzelner Top Quarks wird am LHC vom Austausch eines virtuellen W-Bosons im t-Kanal dominiert. Das W-Boson wird typischerweise von einem Valenzquark der kollidierenden Protonen abgestrahlt. Ziel dieser Analyse ist eine möglichst präzise Messung des t-Kanal Produktionswirkungsquerschnitts mit dem ATLAS-Detektor und einer Datenmenge von 20.3 fb^{-1}. Die Messung des Produktionswirkungsquerschnitts, bei einer Schwerpunktsenergie von $\sqrt{s} = 8$ TeV, ermöglicht es, das CKM-Matrixelement $|V_{tb}|$ zu bestimmen, ohne die Unitarität der CKM-Matrix vorauszusetzen.
In dieser Analyse wird das Signal, nach einer schnittbasierten Vorselektion, mittels multivariaten Analysemethoden (Neuronale Netze) von den Untergrundprozessen getrennt. Der Wirkungsquerschnitt wird bezogen auf den zugänglichen Phasenraum gemessen (fiducial cross-section) und zusätzlich auf den gesamten Phasenraum extrapoliert (total cross-section). Vergleiche mit den Vorhersagen verschiedener Generatoren werden vorgenommen.

T 46.6 Di 18:00 L.09.31 (HS 11)

Measurements of differential cross-sections for t-channel single top-quark production in proton-proton collisions at $\sqrt{s}$ = 8 TeV using the ATLAS detector — •Pienpen Seema[1], Ian Brock[1], Dominic Hirschbühl[2], Phillipp Tepel[2], and Wolfgang Wagner[2] — [1]University of Bonn — [2]University of Wuppertal

Differential cross sections for single top quarks produced in the t-channel are measured as a function of their transverse momentum and their absolute value of rapidity. The measurements are performed in the lepton+jets final state using 20.3 fb^{-1} of proton-proton collisions at a center-of-mass energy of $\sqrt{s} = 8$ TeV with the ATLAS detector. A neural network is used to discriminate between the t-channel signal and its backgrounds. A cut on the neural network discriminator is further applied in order to enhance a purity of t-channel signal sample. The transverse momentum and the absolute value of rapidity of the top quarks and top anti-quarks are unfolded using an iterative Bayesian method, that is used to correct detector effects. Hence, their true distributions are obtained and can be directly compared to theoretical predictions.

T 46.7 Di 18:15 L.09.31 (HS 11)

Reduktion des QCD-Multijet-Untergrunds in der t-Kanal-Produktion von Single-Top-Quark-Ereignissen durch multivariate Methoden — •Sonja Bartkowski, Hendrik Esch, Reiner Klingenberg, Kevin Kröninger und Claus Gössling — TU Dortmund, Experimentelle Physik IV

Das Top-Quark ist das massereichste bekannte Elementarteilchen. Einzelne Top-Quarks werden in der Single-Top-Quark-Produktion erzeugt. In Single-Top-Ereignissen werden sowohl der Single-Top-Wirkungsquerschnitt als auch Eigenschaften des Top-Quarks gemessen. Um die Sensitivität dieser Messung zu verbessern, soll QCD-Multijet-Untergrund reduziert werden.

In diesem Vortrag werden Studien vorgestellt, welche die in Analysen verwendeten Schnitte durch die Nutzung von multivariaten Methoden ergänzen. Ein besonderes Augenmerk liegt dabei auf der Wahl der Eingangsvariablen vor dem Hintergrund der Verwendung eines Jet-Lepton-Modells zur Abschätzung des QCD-Untergrundes. Die dabei studierten Methoden sind neuronale Netze und Random Forests.

T 46.8 Di 18:30 L.09.31 (HS 11)

W-associated production of single top-quarks decaying into leptons and jets (ATLAS) — •Sebastian Mergelmeyer — Universität Bonn

Single top quark production accounts for $\sim 1/3$ of the overall top quark production cross-section at the LHC, opening a great opportunity to probe electroweak couplings. One important production mode in the Standard Model is the creation of a single top quark in association with a W boson (Wt mode). However, the close similarity of its final state to that of top quark pair production, which has a $\sim$10 times larger production cross-section, makes the measurement a challenging endeavour.

This analysis focuses on the channel where the Wt system decays into one lepton, three jets, one of which is a b-quark jet, and missing transverse energy. Multivariate techniques with carefully chosen inputs are used to discriminate between the Wt signal and its major backgrounds. So far no experiment has measured the Wt mode in this channel.

Results based on $20\,\text{fb}^{-1}$ of pp-collision data recorded with the ATLAS detector at $\sqrt{s} = 8\,\text{TeV}$ will be presented.

T 46.9 Di 18:45 L.09.31 (HS 11)

Single Top-Quark Production through Flavour Changing Neutral Currents — •Ozan Arslan[1], Ian C. Brock[1], and Dominic Hirshbuehl[2] for the ATLAS-Collaboration — [1]University of Bonn, Bonn, Germany — [2]University of Wuppertal, Wuppertal, Germany

Flavour Changing Neutral Current (FCNC) processes are highly suppressed in the Standard Model due to Glashow-Iliopoulos-Maiani (GIM) mechanism. However, in some extensions of the Standard Model such as supersymmetry (SUSY) and the 2-Higgs doublet model, the FCNC contributes at tree level, enhancing the branching ratio significantly. The FCNC are searched for in single top-quark production where a u(c)-quark interacts with a gluon, producing a single top-quark with no associated quark production. The data collected by the ATLAS detector during year 2012 is used with a center-of-mass energy of $\sqrt{s}$=8 TeV, corresponding to an integrated luminosity of $\sim$ 20 fb^{-1}. The candidate signal events are selected by requiring one lepton, muon or electron, missing transverse momentum and exactly one jet originating from a b-quark in the final state. The separation between the signal and background events is enhanced by using neural network algorithms. The cross section upper limit at 95% C.L. is calculated following frequentist statistical approach using a binned likelihood method calculated from the full neural network output.