KSETA Doctoral Report 2016

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To Whom It May Concern,

this report summarizes the progress of my work as a PhD student at the Institute of Theoretical Physics of Karlsruhe Institute for Technology (ITP, KIT) under the supervision of PD Dr. Stefan Gieseke since November 2015 until present day.

At the beginning of my PhD contract I have been finalizing work on validation of inclusive jet and dijet data delivered by Herwig++/Matchbox framework, which was the main subject of my short term MCnet studentship. This studentship also took place at ITP, KIT under the supervision of PD Dr. Stefan Gieseke since 1 st May, 2015 until 31st October 2015. Herwig++/Matchbox framework was successfully utilized to generate jet events with the use of both MC@NLO and POWHEG matching schemes. Generation technique designed to enhance the statistics at high p_T jet region and comparison of the Monte Carlo jet events with ATLAS data was done. The comparison was carried out with the strong focus on statistical correctness using Rivet analysis for Inclusive jet and dijet cross-section at 7 TeV (Rivet analysis: ATLAS_2012_I1082936, arXiv: 1112.6297v2). The results of Herwig++/Matchbox framework were successfully validated.

Previous short term MCnet studentship was very beneficial as an introduction into Monte Carlo event generator physics and advanced quantum chromodynamics. I utilized the skills and knowledge that were gained during this studentship and I was able to contribute to Herwig collaboration with scientific work already at the beginning of my PhD studies. In cooperation with other Herwig group members and with guidance by PD Dr. Stefan Gieseke, we have delivered NLO QCD calculations of $t\bar{t}H$ production interfaced with parton shower using Herwig 7 and Matchbox interface for Large Hadron Collider (LHC). These results were discussed with CERN $t\bar{t}H/tH$ working group and were later published in Handbook of LHC Higgs cross sections: 4. Deciphering the nature of the Higgs sector (arXiv:1610.07922)

My current work is focused on research which will be relevant to my PhD thesis. Using Herwig 7 Monte Carlo event generator, we study jet production and jet topology at LHC. Jets, which are footprint of parton hard scattering, are not independent but rather exhibit behavior related to the color charge of scattered partons. Such an effect is called color coherence and can be further studied. Monte Carlo event generator give us unique possibility to study origin of jets on parton level. For this purpose, jet tagging technique has to be developed. Distinguish between quark or gluon jet origin allows us to restrict kinematic regions relevant for specific subprocess and study these regions further.

With regards,
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