Annual KSETA report 2014

Work in CMS

Study of Pileup Removal Algorithms for jets

The topic of my thesis is WW-scattering in the CMS experiment, which is particularly interesting in the context of the recent discovery of the Higgs boson. The Higgs mechanism unitirizes WW-scattering. Therefore studying WW-scattering is a direct test of the mechanism of spontaneous symmetry-breaking. This analysis will be done for Run II of the LHC (13 TeV center-of-mass energy). In the Run II of the LHC instantaneous luminosity would increase which will result in large number of pileup interactions. In this context pileup mitigation tools are very important as contamination from pileup degrades the ability to reconstruct jet observables.

During 2014 I was involved in the analysis "Study of Pileup Removal Algorithms for jets" in the CMS experiment. The analysis in general was focused on several pileup mitigation tools. I have contributed to studying of grooming algorithms, in particular, we looked whether mass, mass resolution, mass response and mass response resolution (for different grooming algorithms and for different set of parameters) are stable against pileup. The studies were done using standard Particle Flow objects, Particle Flow objects with charge hadron subtraction, and the so called PUPPI collection. (PUPPI is a quite recent algorithm in CMS, which assigns every particle a weight of how un-pileup-like it is and reweights 4-vector of the particle). A Physics Analysis Summary (PAS) for this analysis has become public in August 2014 and can be found here: JME-14-001 (https://cds.cern.ch/record/1751454/).

Preparing software for Run II analysis

Starting from October 2014 I have started to prepare software for WW-analysis. The goal is to setup the reconstruction of 2 W bosons (one decaying leptonically, and the other decaying hadronically). This work implies writing configuration and several modules in the CMS software framework. The important thing here is that since the LHC is moving towards higher energies the object like W boson becomes boosted. This means that W boson should

be reconstructed not as 2 jets, but as a single "fat" jet. And this is the place where grooming algorithms come into place. In order to get the reconstructed W boson mass closer to 80 GeV and to improve resolution we use pruned jet mass. To select events we use cut on pruned jet mass which gives higher signal efficiency compared to cut on the raw jet mass. Another thing that was implemented is lepton ID.

Work as core-admin

Since July 2014 I have started to work as a core-admin in the Institut für Experimentelle Kernphysik. This work implies keeping the computer infrastructure of the institute running properly.

Teaching

I was a tutor for Teilchenphysik I Praktikum for winter semester 2014/2015.

Conferences, workshops

I have participated in the following conferences and workshops during 2014:

- tutorial "Using the Physics Analysis Toolkit (PAT) in your analysis" at CERN, 30 June – 4 July.
- KSETA Doktoranden Workshop, 21-23 July. Talk "What is a particle?"
- GridKa School 2014 – Big Data, Cloud Computing and Modern Programming, 1-5 September 2014, KIT Campus North, FTU.
- FSP CMS Workshop at RWTH Aachen University, September 10-12, 2014. Talk "Grooming techniques for jets".
- 8th Annual Helmholtz Alliance Workshop on "Physics at the Terascale" at DESY, Hamburg,1-3 December 2014. Talk "Jet-substructure tools and boosted hadronic boson identification in CMS".

KSETA courses

I have participated in the following KSETA courses during 2014:

- Multivariate methods of data analysis

- Parallel Software Design for Scientists
- Scientific writing - publications
- Introduction into the concepts of theoretical particle physics for experimental physicist

German course

I have participated in German course by Studienkolleg A 1.8 and have passed examination in February 2015 successfully (86 points of 100).