Progress Report

FAPESP–Texas Tech University Call

São Paulo Research and Analysis Center

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Texas Tech University

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1. Introduction

The spirit of collaboration lies at the very heart of the endeavor of science. Extensive international collaborations open the way for comprehensive, large-scale experiments and facilities, which have the potential to become true milestones of their fields. The Large Hadron Collider (LHC) is one of those facilities: a particle collider hosted by the European Organization for Nuclear Physics (CERN) that furnishes proton-proton, proton-ion and ion-ion collision at unprecedented energies and rates of interaction. To record, study and interpret those collisions, large particle detection experiments have been setup at the LHC. The Compact Muon Solenoid (CMS) is one of those experiments; again, an international collaboration of physics institutes, counting around 3000 physicists, is dedicated to the construction, operation and upgrade of CMS. The collision data collected by CMS allow us to investigate the deepest structure of matter; one of the greatest achievements of the collaboration until now was the discovery of the Higgs Boson, a new fundamental particle predicted by the standard model of particles and fields (SM).

Both Texas Tech University (TTU) and the São Paulo Research and Analysis Center (SPRACE-UNESP) are members of the CMS Collaboration. The two institutions host research groups which are active in the Collaboration, leading analysis efforts in the field of physics beyond the standard model (BSM physics). It is expected that, after the discovery of the Higgs Boson, the attention of the community will shift to this direction. The TTU and SPRACE groups have interests in common: the search for dark matter candidates, a new kind of particle which would help explain current cosmological observations, and searches for new resonances, predicted by many classes of BSM physics models. In view of this convergence, we believe that a closer collaboration between the two groups would be very productive from a scientific point of view.

2. Achievements in this Period

During the period of this report the TTU team and the SPRACE team established a strong collaboration. Starting on May 2015 we maintained biweekly meetings via video conferences. Dr. Chang-Seong Moon visited Texas Tech University from July 6th to August 8th in 2015. He worked together with people at TTU for the first Run 2 data analysis at 13 TeV, developing our common analysis framework for the analysis of the 2015 data collected by CMS.

The TTU-SPRACE teams have been members of the CMS monojet analysis group for dark matter searches. At the end of 2015 the monojet group produced a public report- Physics Analysis Summary[1] on the dark matter search with the data collected in 2015. Due to the low integrated luminosity collected during that period the sensitivity of this search was not competitive with the Run 1 result; therefore, CMS decided to not proceed to a paper publication. The expectation is that we will probe new regions of the parameter space in many dark matter models with the high statistic 2016 data.

Prof. Shuichi Kunori visited the SPRACE group from May 20th to May 27th in 2016 and worked with the group to develop plans to explore future dark matter searches.

CMS started a new data taking in May 2016 and already collected data five times more than the 2015 data. Both teams are currently extremely busy to analyze the new data and plan to report preliminary results at summer conferences this year and to complete the analysis of all data collected in 2016 early next year.

References

[1] CMS Collaboration. Search for dark matter with jets and missing transverse energy at 13 TeV. *CMS PAS EXO-15-003*, 2015.