COLLEGE OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY

Alexei N Safonov
Professor

TEXAS A&M UNIVERSITY

November 25, 2018

Prof. Ben Kilminster
Physics Institute
University of Zurich
Winterthurerstrasse 190
CH-8057 Zurich

Dear Prof. Kilminster,

At your request, I am attaching my assessment of the dissertation draft that is being submitted by Ms. Camilla Galloni as part of her fulfillment of the requirements for a Ph.D. at the University of Zurich.

The dissertation focuses on the search for the evidence of resonant production of pairs of Higgs bosons using the data collected by the CMS experiment at the Large Hadron Collider. After the discovery of the Higgs boson in 2012 and key measurements that have demonstrated that the newfound boson is compatible with the characteristics of the predicted in Standard Model Higgs boson, searches for the di-higgs production have emerged as a new "hot topic" in searches at the LHC. These searches are potentially sensitive to the Higgs self-coupling that is critical to understanding of the Higgs mechanism and, possibly, its origin. It also could lead to new discoveries as Higgs has a special place in the SM that makes it a particularly good probe to possible higher scale new physics and even potential connection with gravity. As potential signals of new physics are expected to be small, it is very important to analyze all of the major decay channels that could contribute to global sensitivity of the LHC to possible anomalies in the di-higgs production. The dissertation presented focuses on the analysis of the data to search for signs of new physics in one of these important decay channels.

The dissertation includes an introduction, theoretical introduction to the Standard Model and several well motivated models of new physics, description of the apparatus and the even reconstruction techniques, followed by the chapters describing detailed data selections, analysis and statistical interpretation of the results. The balance of the material, including the part related to the original work, and the depth of the description is appropriate for a Ph.D. dissertation.

The main original parts of this work that are of particular importance include the development of the boosted di-tau reconstruction technique (Sec. 5.3.7), and the data analysis of Run 1 (Chapter 6) and Run 2 (Chapter 7) LHC data. The value of these original contributions is significant and certainly meets the criteria for awarding a Ph.D. degree to the author. The di-tau reconstruction is a technically challenging areas and the developments presented in this dissertation have impact extending beyond the analysis of the data collected in Run 1 and Run 2 used in the search for the resonant di-higgs production presented in this dissertation, and the limits presented as a result of the data analyses are contributing to the global sensitivity of the LHC experiments to this important seach channel.

As noted, the dissertation overall clearly meets criteria typically set for a Ph.D. dissertation in experimental particle physics. I believe the dissertation would benefit from less specialized language in the introductory parts of the dissertation, more consistent use of citations and occasional textual imperfectness. I noted a number of specific textual recommendations, which I am attaching separately. None of these are serious enough to affect the content or the conclusions presented in this work, however.

Based on the above observations, I endorse this dissertation and believe the quality of the presented work meets the criteria for a Ph.D. degree.

Should you have any questions or if I can help in any way, please do not hesitate to contact me.

Alexei N Safonov

Mitchell Institute for Fundamental Physics (MIST), #319
4242 TAMU
College Station, TX 77843-4242

Telephone 979.845.1479
Fax 979.845.2590
Email: safonov@tamu.edu
http://people.physics.tamu.edu/safonov