3rd year PhD Report

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Reasearch activity

During the third year as a PhD student my research activity continued both on the data analysis and on the Ring Imaging Cherenkov (RICH) detector development in particular of the Detector Control System (DCS) for the LHCb/RICH upgrade.

Concerning data analysis I am finalising the search for CP violation in the $B^0 \to p\bar{p}K^+\pi^-$ channel using triple product asymmetries [**1**]. In particular, my activity focused mainly on the measurement of CP asymmetry in different regions of the decay phase-space where the rich resonant structure of four-body decays can enhance CP violation.

I presented the progresses of my analysis on a regular basis at the LHCb Charmless Working Group (BnoC WG) meetings and I recently presented also at the LHCb Analysis and Software week held in February 2020. The Analysis and Software weeks are a week-long meetings held every three months where the status of different analysis are presented to the entire collaboration. The analysis is in an advanced state and it has recently entered the review process internal to the collaboration before the submission to the journal. In addition I continued my work as a stripping liason for the BnoC WG.

In parallel, since January 2020, I have been actively involved in the development of the DCS for the upgraded RICH detector. The role of the DCS is multifold: it monitors the conditions of the entire detector including the Cherenkov radiator status (temperatures, voltages, currents, pressures, ...) and collects and archives trending plots that monitor the stability of the system. The DCS also takes automatic actions meant to ensure the safety of the detector whenever a certain critical condition is met (recovering automatically critical situations, switching off the detector in case of emergency). The DCS sofware is being developed within the JCOP framework[**2**]. The JCOP framework, which is based on the WinCC-OA Supervisory Control And Data Acqui- sition (SCADA) tool, provides common tools and guidelines for the development of the LHC control systems. A preliminary version of the DCS software has been recently successfully tested with the hardware and it is ready to be installed on the machines that run the experiment. I am currently continuing to work on the improvement of the software by adding further functionalities.

In addition, I also continued the work on the characterization of silicon photomultipliers (SiPM) and completed the analysis of the first data taken at low temperatures of a particular SiPM manufactured by Hamamatsu. The experience gained with these preliminary measurements will be very useful as we are continuing the characterization of other SiPMs with an improved and more performing acquisition system. These measurements provided to be very useful to tune the parameter of the simulation, which I developed, that aims at evaluating the impact of these nuisance parameters on the performance of a future SiPM-based RICH detector for the HL-LHC phase in 2030.

Conference Presentations

Talk given at 40th International Conference on High Energy Physics, Prague, 28 July-6 August 2020:
"Searches for CP violation in charmless b-baryon decays at LHCb"

Internation schools attended
ISOTDAQ 2020-International school of trigger and data acquisition, Valencia, 13-22 January 2020

Publications

[1] Roel Aaij et al. "Amplitude analysis of the $B^+ \to \pi^+\pi^+\pi^-$ decay". In: *Phys. Rev. D* 101.1 (2020), p. 012006. DOI: 10.1103/PhysRevD.101.012006. arXiv: 1909.05212 [hep-ex].

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