Posudek vedoucího na bakalářskou práci

Student: Jakub Juračka
Title: Coherent photoproduction of rho in oxygen–oxygen collisions
Supervisor: prof. Guillermo Contreras
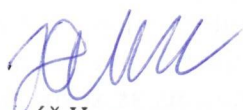**Consultant**: Ing. Tomáš Herman
Grade: A (výborně)

According to current planning, in 2024 the LHC will deliver collisions of oxygen ions. This data set will be unique and will allow us to explore some of the currently most pressing questions in QCD at high energies. Of particular interest for this work is the mass-number dependence of the coherent vector meson photoproduction cross section and its approach to the black disc limit. In this work, Jakub developed a first analysis framework to study one of the key processes to be explored with the new data set, namely the coherent photoproduction of rho vector mesons as seen with the ALICE detector. The main result of the thesis, obtained with the developed framework, was a first selection of data and the corresponding study of the acceptance and efficiency of the detector. This was developed within O^2, the new system of data processing in ALICE. Note that this system is still under development.
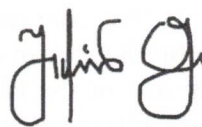
The work is structured in 6 chapters, in addition to a preface and a summary. There is also one appendix and a bibliography including 39 references. Chapter 1 introduces some fundamental quantities used in high energy physics and gives a brief overview of the Standard Model. Chapter 2 deals with basic concepts of QCD needed to understand the motivation of the proposed measurement. Chapter 3 describes the technique used to perform the measurement, namely ultra-peripheral collisions, and describes the STARlight Monte Carlo generator used to generate the synthetic data set that was analysed. Chapter 4 briefly describes CERN, LHC, and the ALICE detector systems of interest for this thesis. It also describes the new scheme of ALICE data acquisition which relies on continuous readout. Chapter 5 summarises two previous measurements of the ALICE Collaboration in this field, setting the scene for the main contribution of this thesis, presented in Chapter 6: the analysis of two sets of synthetic data that were passed through a detailed simulation of the detector. It is important to remark that the level of writing, both from the literary as well as from the scientific point of view, is extraordinary. It was a rare pleasure to read such a well written document.

The work required to learn a data processing system still in development as well as to face a new paradigma of data analysis, where the basic unit is not anymore an event, but a time-frame containing the signals from many collisions simultaneously. Jakub developed himself his analysis program and performed the full the analysis on his own. This was not easy, considering the constantly changing state of the O^2 system. The analysis framework, and the insight that Jakub developed on the problematic of measuring a process requiring vetoes in a continuous readout environment, place him in an ideal position to analyse the oxygen data as soon as they are available and write the corresponding paper.

In summary, Jakub has fulfilled all the instructions from the *zadání* with an exceptionally high quality. He has developed a first framework to perform a new measurement with the ALICE detector once the data is delivered by the LHC. He will be in a position of writing a paper for the ALICE Collaboration during his M. Sc. studies. This is quite an achievement for a bachelor student. For these reasons, the note we assign to this thesis is **A (výborně).**

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