Opponent‘s assessment of Dissertation Thesis

Thesis title: Study of photoproduction at ALICE
Author: Ing. Tomáš Herman
Opponent: Mgr. Martin Rybář, Ph.D.

Thesis assessment

Tomas Herman's dissertation on the "Study of photoproduction at ALICE" presents a comprehensive analysis of coherent photonuclear production of J/ψ in ultra-peripheral Pb–Pb collisions. The study leverages data obtained by the ALICE detector, shedding light on the behavior of this process at a center-of-mass energy per nucleon pair of 5.02 TeV. The work has been already published in the Journal of High Energy Physics.

One of the notable strengths of this thesis is the meticulous examination of the cross-section as a function of electromagnetic dissociation (EMD) of Pb. By delving into the energy dependence of the process within a broad range, from 17 GeV to 920 GeV, theses provides valuable insights into the behavior of this phenomenon across different energy regimes. Additionally, the exploration of the cross section corresponding to a wide range of Bjorken-x values further enriches the understanding of the underlying physics.

Moreover, Herman's investigation into the nuclear suppression factor reveals the effects of nuclear shadowing on the gluon distribution within Pb nuclei. This finding not only contributes to the body of knowledge on quantum chromodynamics (QCD) at high energies but also enhances our comprehension of the fundamental properties of nuclear matter.

Furthermore, the author made significant contributions both to the operation of the ALICE experiment as well as to the ALICE upgrade for LHC Run3. The author's involvement in the development of the quality control (QC) software for the muon forward tracker and in the subsequent role of the MFT QC coordinator highlights his dedication to enhancing the operational efficiency of the MFT detector. His coordination of the MFT QC team's efforts and regular reporting on progress demonstrate effective leadership and communication skills crucial for collaborative projects of this scale.

The thesis is logically divided into four chapters, a short preface, a section listing the author's contribution, and a conclusion. Three attachments include the author's publications and a list of runs used in the analysis. The number of factual errors is minimal; the work is of great quality in terms of graphics and language. The thesis is written in very good English, facilitating the use of the results and text later on. The first two theoretical chapters include a description of the ALICE detector and a brief but clear introduction to the physics of UPC collisions with a particular focus on aspects relevant to the thesis. The third chapter is rather technical and discusses the muon forward tracker and data quality assessment in details. The fourth chapter describes the measurement of photonuclear production of J/ψ.

It is clear that the author has done a non-trivial amount of work that makes a substantial contribution to the field by offering a detailed analysis of photoproduction processes. Herman's technical activities complement his research efforts, showcasing his multidisciplinary expertise and invaluable contributions to the ALICE collaboration. Thus, the present thesis meets the demands placed on the dissertation thesis, and I can highly recommend to award of the Ph.D. degree to Ing. Tomas Herman.

Questions for the discussion:

- Would it be possible to provide more details on the author‘s contribution to the QC software described in 3.2.7?
- Is the trigger limitation preventing the combination of the 2018 and 2015 datasets being present only for the central data sample or also for the forward one?
- Is there a specific reason why ZDC is not used for triggering and only for event classification?
- Did you also check the per-run luminosity normalized yield of J//ψ?
- Is there a reason that you estimate the acceptance and efficiency correction as the ratio of reconstructed over truth distribution, i.e., „a bin-by-bin correction“ rather than a corection for a fraction of distributions of truth events that are lost? Could you double-count for the some effects discussed later on?
- For fits to invariant mass distribution or pT spectra, is it usual to show the pull or some other variable demonstrating the fit quality. Did you check quality of your fits?
- For some corrections (EMD, detector veto, etc.), it would be nice to quote typical sizes.
- 4.8.2. how large are the migrations between classes? Could you show some migration matrix?
- Have you done a direct cross-check/comparison to ALICE results from [36]?

V Praze dne 29.2.2024

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