



FZU

Fyzikální ústav Akademie
věd České republiky
Institute of Physics of the
Czech Academy of Sciences

REVIEWER'S ASSESSMENT OF THE MASTER'S THESIS

Student: Bc. Vojtěch Zabloudil

Title: Performance of plastic scintillators in particle detection

Reviewer: Mgr. Pavla Federičová, Ph.D.

Grade: C (good)

The presented work includes the description of various components related to the ALICE experiment at CERN. Specifically, two components are discussed in detail: the Forward Diffractive Detector (FDD) and the Fast Interaction Trigger (FIT). While the FDD and FIT are discussed as part of the thesis, the main focus of the work revolves around custom-made scintillators containing CsPbBr₃. In total, the thesis consists of 114 pages and six chapters.

The first chapter serves an introduction to the ALICE experiment and its part the FDD and the FIT. The second chapter provides detailed information about scintillators in general. It contains an overview of both organic and inorganic scintillators, their properties and characteristics and also covers topics such as the mechanism of signal generation, the emission and absorption spectra of scintillator materials, and their advantages and disadvantages. In the third chapter, the focus shifts specifically to the production process of custom-made scintillators containing CsPbBr₃. This chapter is likely organized in a step-by-step manner, providing a detailed description of the fabrication techniques of scintillators containing CsPbBr₃ embedded in organic polystyren and silicon matrices. The fourth chapter of the thesis focuses on the setup of a test bench. It provides a detailed description of the experimental setup, including the instrumentation and components used in the test bench. The chapter also describes the use of cosmic muons as a source of radiation for testing the scintillators and discusses future possibilities for implementing laser calibration. The fifth chapter covers the data-taking process, data analysis techniques, and discussion of the final results obtained by cosmic muons. The sixth chapter of the thesis unexpectedly shifts focus to the commissioning of the FDD and its performance evaluation, and finally there is the "Summary and Outlook" summarizing the research conducted on the scintillators containing CsPbBr₃ and the commissioning and performance of the FDD.

Although this master's thesis is comprehensive by its quantity and by a good usage of English, the quality does not 100% meet the expected standards of academic writing. Many important concepts, methods, and statements are not explained in sufficient details or are explained confusingly which can mystify readers. Abbreviations are not properly defined and addressed. Many things, figures, and statements in this thesis are not cited. The first and sixth chapters seem to be disconnected from the rest. I also miss the information if the results obtained from the evaluation of the custom-made scintillators, which is the main focus of this thesis, will be published or presented in some ways beyond the work, such as conference presentations or publications and will have impact to the research community. The author's contributions is not explicitly stated and acknowledged throughout the thesis, so the author's contribution to this work is not clear. The only place where the author mentions his contribution to the work is in the chapter 3.2 "*...., during*

which I was shown how to work with the chemicals....". Next failure is the absence of an explicit discussion of systematic errors. These errors can have a significant impact on the accuracy and reliability of experimental results presented by this thesis and it is crucial to address them in scientific research. For all reasons mentioned above I assign this Master's thesis as C (good) and I have following questions and proposals for the discussion:

1) What is the author's contribution to this work?

2) The preparation of the cesium oleate solution is described in the chapter 3.1.1. Why the argon atmosphere is used? Why is not used nitrogen which can also provides a low reactivity safe atmosphere? When the mixture is heated up to 110 °C for an hour under vacuum, has the evaporation of the mixture some effect on the final product?

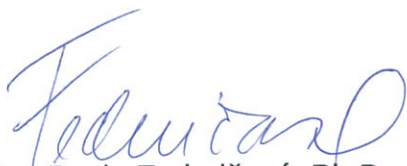
3) One type of custom-made scintillators that is studied in this thesis are composites with PPO (2,5-Diphenyloxazole). The author in section 3.2.6 mentions that PPO is a commercial organic scintillating material, which is added to organic bases of produce scintillators. Can the author provide more details about this compound? Why is it used? What is its function in produced scintillators? What is its emission spectrum?

4) In section 3.4, the author wrote that samples are covered by two layers of 0.2 mm thick teflon tape to keep produced scintillating light inside samples. Can the author specify why is the teflon tape used? Is there some dependence between the wavelength of produced light and the ability of the tape to keep light inside samples?

5) Can the author explain the difference between *bunches* vs. *bunch crossing*? These statements are used in the thesis in a confused way.

6) The total number of full bunches for the ALICE experiment in Run 3 is 2250 <http://cds.cern.ch/record/2790409/files/CERN-ACC-2021-0007.pdf?version=1>. Can the author explain why does he use in section 6.2.2 the number 3564 bunches for Run 3 instead of 2250?

7) Can the author identify potential sources of systematic errors and discuss their impact to the experimental results presented in this thesis?



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