Review of master thesis

Author of the thesis: student of Saint Petersburg State University

03.04.02 «Physics»

«Neutron and synchrotron physics» profile

Moroz Anton Ruslanovich

Title of the thesis: **«Beryllium target optimization for a compact neutron source with proton energy of 10-13 MeV»**

The topic of the Master thesis, "Beryllium target optimization for a compact neutron source with proton energy of 10-13 MeV" is dedicated to a relevant issue in condensed matter physics concerning the demand for neutron source pool expansion. Compact neutron sources (CNS) are destined to complete low and medium power reactors, opening way for new neutron scattering laboratories creation in scientific and educational facilities. With target being one of the primary CNS components, its design development requires a complex scientific approach with solving a multitude of optimization problems.

In the first chapter, the primary neutron generation mechanisms, neutron source types and CNS work scheme are considered. Attention is drawn to target-moderator-reflector (TMR) assembly typical design.

Following up, the second chapter touches on numerical simulation principles used for the research, being Monte-Carlo method and its implementation in PHITS particle transport simulation code.

The next chapters describe the search for optimal target characteristics step by step. Suggestions presented for the required neutron-generating material, incoming proton energies, target geometry and existing limitations for design choices. Energy deposition in target is calculated and cooling system options offered coupled with their own neutronic characteristics.

As a result of the research, requirements for the optimal target and cooling system

constructions are presented. The conclusion summarizes all of the optimal parameters, needed for effective CNS operation at proton energy of 13 MeV.

The obtained results undoubtedly pose a practical value, as they make up a part of a large CNS development project for DARIA source net in Russia, and will be considered in the proceeding research activities.

The work is not free of drawbacks, which in no way diminish its value. The main ones are following:

1) The cooling system's mechanical properties have not been evaluated on subject of resistance to the required water pressure.
2) As neutron current is used for neutron generation effectiveness evaluation, it is not immediately clear as to how to compare the developed design to some existing ones, as they usually use the full neutron yield value.

The reviewed master qualification thesis leaves a good impression not only by means of wholesome topic research, but also by the way the results are shaped and presented (the convincing argumentation, clear delivery and use of 3D graphics). The research uses high levels of physics knowledge.

Despite the mentioned shortcomings, the thesis represents a high-level scientific search for the results that have some definite value. The thesis should be admitted to the defense. In my opinion, the work should be granted the highest score, and Moroz A.R. deserves Master's degree in Physics (03.04.02) and due to the research quality is advised to continue his studies at a PhD program.

Reviewed 05.24.2022 by:

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/A.D. Rogov/

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