Standpoint

of **Prof. Anelia Klisarova, MD, PhD, DMSc**

Head of the Department of Imaging, Interventional Radiology and Radiotherapy

Faculty of Medicine

Medical University "Prof. Dr. Paraskev Stoyanov – Varna

on the dissertation work for the acquisition of an educational scientific degree

"Doctor of Philosophy"

Yanka Ivanova Baneva

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Faculty of Medicine

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Thesis by:

Innovative breast phantoms for studying image quality in modern mammographic techniques

Dear members of the scientific jury,

By written order of the Rector of MU-Varna No. P-109-338/05.08.2022 I have been appointed to be the chair of the Scientific Jury of the aforementioned thesis. In accordance with protocol No. 1 of 16.08.2022, I have been appointed to provide a standpoint for the defence of the dissertation work of Yanka Baneva.

1. Significance of the problem and formulation of the goal and tasks

The relevance and significance of the problem is determined by the need for early diagnosis of breast cancer. The earlier the malignant finding is detected, the greater the patient's chances of a complete cure. Timely detection and diagnosis of breast cancer depends to a large extent

on the quality of the mammographic image obtained by the X-ray equipment used. This quality is ensured by periodic testing with tissue-equivalent phantoms designed specifically for X-rays.

The objective is clearly stated and concerns the creation, validation, and use of innovative computerized phantoms to investigate the image quality of modern x-ray mammography techniques, such as tomosynthesis and contrast-enhanced mammography (CEM), which have the potential to be used for early screening and diagnosis of tumors of the mammary gland. The number of tasks set in the dissertation is 6. They are precisely outlined and meet the purpose of the study.

2. Structure of the dissertation

The structure of the dissertation is a classic one. The volume of the dissertation is 105 pages and contains nine sections: *Introduction* - 28 pages, *Objective* - 1 page, *Mammary gland models for X-ray examination* - 8 pages, Methods - 7 pages, *Development and use of computer models of mammary gland for tomosynthesis* - 13 pages, *Influence of mammographic spectra and characteristics of computer models of the mammary gland on the characteristics of mammographic images* - 10 pages, *Computer models of the mammary gland with contrast agents* - 11 pages, *Conclusion* - 2 pages, *Contributions of the dissertation* – 2 pages, *Publications* – 2 pages and *References* – 10 pages. The dissertation contains 19 tables and 49 figures. I would like to point out that each of the parts of the dissertation work follows the logic of the set tasks and purpose. Further, the conclusions naturally arise from the own results, the statistical processing of the data and the discussions.

3. Literary awareness of the dissertation student

The literature review of the dissertation work is presented within 28 pages, where the PhD student thoroughly analyzes the types of mammary gland tumor formations, the methods of screening and diagnosis of the mammary gland, the advantages and disadvantages of these methods, their sensitivity and precision. In addition, an 8-page analysis of existing mammary gland computer models is presented. 133 literary sources were analyzed, of which 10 are in Cyrillic. The later confirms the need for such research in Bulgaria.

4. Methodological level and research design

For the purposes of scientific research, three main studies have been carried out, including certain specific tasks of creating, analyzing and validating computer models for different mammographic techniques: mammography, tomosynthesis and contrast-enhanced spectral

mammography. Four specialized software applications were used to (a) design these computer models, (b) obtain X-ray images from the computer models, (c) reconstruct X-ray images and obtain tomographic sections, and (d) analyze by extracting descriptors from the obtained x-ray images. The research methods chosen by the dissertation have enabled the achievement of the set goal, and the tasks set to be solved have received an adequate response.

5. Consistency between the objective, the results and the conclusions

There is a logical correspondence between the objective, the results obtained, the discussion and the conclusions drawn. Own results and discussion are detailed in the dissertation and presented with tables, figures and statistical analyses. The presented data show the in-depth and detailed analysis between quantitative and subjective evaluation of real and simulated planar and tomographic images from computational phantoms.

6. Analysis of conclusions and

The dissertation ends with very detailed conclusions on the set tasks and the corresponding contributions to them. I accept the contributions according to the author's self-assessment, as I want to emphasize that the dissertation work is the first study in our country in connection with the creation of a physical phantom for the purposes of contrast-enhanced spectral mammography (CESM), and a methodology for CESM modeling and obtaining of simulated X-ray images.

7. Nature of critical remarks and recommendations

I have no critical remarks in respect to the methods, the evidence, the discussion of the results obtained, and the conclusions drawn. The developed models and methods are a prerequisite for further research of the PhD student in the field of quality control in imaging diagnostics.

8. Publications and scientific events

The results of the doctoral student's research on the topic were presented at 5 conferences - 4 international and 1 national, and were published in 4 full-text publications and 2 abstracts.

Personal impressions of the candidate:

Asst. Yanka Baneva has been an assistant at the Department of Physics and Biophysics since 2008. She is one of the colleagues who is constantly developing and showing interest not only in the daily work, but also in the novelties in the field of medical physics. This interest of hers

is the reason why Assistant Professor Yanka Baneva ensures the control of the X-ray machines in the University Hospital UMBAL "St. Marina", which makes it possible to implement the methods developed in the dissertation work in the practice of the dissertation student as a medical physicist.

9. Conclusion

Bearing in mind the scientific merits of the dissertation, namely: relevance of the problem and the obtained results, significant conclusions and contributions of the dissertation, I strongly recommend to the members of the esteemed scientific jury to award the educational scientific degree "doctor" to Yanka Ivanova Baneva for the dissertation: "Innovative breast phantoms for studying image quality in modern mammographic techniques".

26.09.2022

Варна

Prof. Anelia Klisarova, MD. PhD, DMSc