

STATEMENT OF ACADEMIC OPINION

by prof. eng. Anton Slavchev Georgiev, DSc,

Medical University – Varna

regarding the materials submitted for participation in a competition for the academic position of "associate professor" in professional field 5.2. Electrical Engineering, Electronics and Automation, specialty "Biomedical Equipment and Technologies", announced in the State Gazette No. 15/21.02.2025, for the needs of the Department of Medical Equipment, Electronic and Information Technologies in Healthcare of the Medical University - Varna

In the competition for associate professor, announced in the State Gazette, issue 15/21.02.2025 and on the website of the Medical University – Varna, for the needs of the Department of Medical Equipment, Electronic and Information Technologies in Healthcare, at the Faculty of Public Health, the only candidate participating is Chief Assistant Professor eng. Nikolay Tinkov Dukov, PhD member of the Department of Medical Equipment, Electronic and Information Technologies in Healthcare.

1 Brief biographical data

From 2008 to 2012, Nikolay Dukov was a student at the Technical University of Varna and in 2012 he graduated as an electronics engineer, with a Bachelor's degree.

From 2012 to 2014, Nikolay Tinkov Dukov was a student at the Technical University of Varna and in 2014 he graduated as a Master of Engineering in Electronics, with the degree of Master of Science.

From 2022 to 2025, Nikolay Tinkov Dukov was a student at Plovdiv University "Paisii Hilendarski" and in 2025 he graduated as a physicist, medical radiation physics and technology, with an educational degree of "Master".

From 2014 to 2019, eng. Nikolay Tinkov Dukov was a doctoral student at the Department of Electronics and Microelectronics of the Technical University – Varna, doctoral studies in - professional field 5.2 Electrical Engineering, Electronics, Automation, specialty Electronization.

From 2014 to 2017, eng. Nikolay Dukov was a part-time lecturer at the Technical University – Varna, and from 2017 to 2020 he held the academic position of assistant.

From 2020 to the present, eng. Nikolay Tinkov Dukov has successively held the academic positions of assistant professor and chief assistant professor at the Medical University - Varna, Department of Medical Equipment, Electronic and Information Technologies in Healthcare.

2 General description of the materials presented

The candidate, Chief Assistant Nikolay Dukov, participated in the competition with 29 scientific publications, of which:

- Scientific publications from category B4 – 11;
- Scientific publications from category G7 – 18.

The candidate, Chief Assistant Engineer Nikolay Dukov, also presents 4 scientific publications, beyond the minimum scientometric requirements.

According to **their significance**, I classify the presented publications as:

- Articles in publications with Impact Factor – 10 [B4.2, B4.3, B4.6, B4.7, B4.8, B4.9, B4.10, B4.11, G7.9, G7.14];
- Articles in refereed and indexed publications – 29 [B4.1, B4.2, B4.3, B4.4, B4.5, B4.6, B4.7, B4.8, B4.9, B4.10, B4.11, G7.1, G7.2, G7.3, G7.4, G7.5, G7.6, G7.7, G7.8, G7.9, G7.10, G7.11, G7.12, G7.13, G7.14, G7.15, G7.16, G7.17, G7.18];

In accordance with **the place of publication**, the publications presented are:

- Articles in foreign journals – 10 [B4.2, B4.3, B4.6, B4.7, B4.8, B4.9, B4.10, B4.11, G7.9, G7.14];
- Reports in proceedings of international scientific conferences abroad – 15 [B4.1, B4.4,

B4.5, G7.3, G7.5, G7.6, G7.7, G7.8, G7.10, G7.12, G7.13, G7.15, G7.16, G7.17, G7.18];

- Reports in proceedings of international scientific conferences in Bulgaria – 4 [G7.1, G7.2, G7.4, G7.11];

All publications are presented in English.

By **number of co-authors**, for the presented publications it can be noted:

- Single author – 1;
- With one co-author – 0;
- With two co-authors – 4;
- With three co-authors – 8;
- With four or more co-authors – 16.

The candidate, Chief Assistant Nikolay Dukov, participated in the competition with 5 citations in scientific publications in refereed and indexed publications, according to indicator D12.

The candidate, Chief Assistant Nikolay Dukov, also presents 2 citations, beyond the minimum scientometric requirements.

3 Reflection of the candidate's scientific publications in the literature (known citations)

Scopus database shows that Chief Assistant Professor eng. Nikolay Dukov, PhD has:

- indexed articles 48;
- citations 160, in 94 documents;
- h-index: 7.

Google database reference *Scholar*, Chief Assistant Professor eng. Dukov, PhD has:

- indexed scientific publications 63;
- citations 203;
- h-index: 7;
- i10-index: 7.

Researchgate database, Chief Assistant Professor eng. Nikolay Dukov, PhD has:

- indexed scientific publications 57.
- citations 183;
- h-index: 7;

4 General characteristics of the candidate's activities

4.1. Educational and pedagogical activities

The candidate's teaching activity can be summarized through the training of students in the following academic disciplines:

- Programming Part II;
- Medical electronics;
- Computer processing of medical signals and images;
- 3D printing;
- R statistics and statistical analysis software.

He is the author and co-author of 7 curricula.

He has taught in foreign language in 1 subject.

4.2. Scientific, applied scientific activity and implementation activity

Chief Asst. Prof. Eng. Nikolay Dukov, PhD has participated in 16 research projects from various scientific programs and funds in the period 2014–2025:

- under the NI fund of universities – 7 pcs.
- under the National Fund for NI – 2 pcs.
- under other national programs – 4 pcs.
- under international programs – 3 pcs.

Supervisor of 2 students successfully defended the Bachelor's degree and 6 students successfully defended the Master's degree.

4.3. Contributions (scientific, scientifically applied, applied)

The contributions to the candidate's scientific activity are divided into areas of scientific research and application. I accept the scientific, scientific-applied and applied contributions formulated by Chief Asst. Prof. N. Dukov, which are expressed in proving existing scientific problems with new means; creating new methods and technologies in the areas of application - development and evaluation of anthropomorphic phantoms for X-ray imaging diagnostics, segmentation and modeling of mammary gland lesions, development and characterization of materials and new contrast agents for imaging diagnostics and advanced methods for imaging diagnostics, validation systems and their implementation. I can summarize some of the more significant ones:

Contributions in the field of development and evaluation of anthropomorphic phantoms for X-ray imaging diagnostics

- Innovative techniques have been developed for computer modeling of breast phantoms, integrating 3D models from patient data, which allows for realistic simulations of mammography and tomosynthesis and supports the development of new diagnostic algorithms;
- Physical breast phantoms were created through 3D printing and alternative methods, validating materials and techniques for anatomical realism and X-ray applications, with potential for clinical use;
- Bone phantoms have been developed with new materials and 3D printing, optimized for radiological equivalence, providing tools for precise simulation and diagnostic studies of bone structures;
- The radiological characteristics of 3D-printed phantoms were evaluated, validating their effectiveness for mammography, tomosynthesis, and spectral diagnostics, which improves the quality and calibration of imaging systems;
- 3D-printed phantoms have been applied to training X-ray technicians, osteoporosis diagnosis, and quality control, providing practical tools for clinical and educational purposes;
- Knowledge of phantom technologies is synthesized, providing a comprehensive review and evaluation of materials that guides future innovations in X-ray imaging.

Contributions in the field of breast lesion segmentation and modeling

- New algorithms have been developed for segmenting breast lesions from clinical images, improving the accuracy and flexibility of 3D models for tomosynthesis, MRI and CT applications;
- Mathematical models of lesions have been created through algorithms and morphological operations, allowing realistic simulations without dependence on patient data;
- Lesion models have been validated and integrated into phantoms and databases, confirming their accuracy and practical utility for imaging diagnostics and optimization of mammography systems.

Contributions in the field of materials development and new contrast agents for imaging diagnostics

- 3D printing materials have been systematically characterized, establishing radiological profiles for tissue equivalence, aiding the design of realistic phantoms;
- New tissue-equivalent materials have been developed, optimized for radiological and structural compatibility with human tissues for X-ray applications;
- New and commercial contrast agents have been validated, improving visibility in X-ray images and optimizing CESM studies for diagnosis;
- Materials have been applied in the production of phantoms, confirming their radiological suitability and effectiveness for imaging diagnostics of tissues and bones.

Contributions in the field of advanced imaging methods, validation systems and their implementation

- A software module for phase-contrast X-ray imaging diagnostics has been developed, achieving significant contrast enhancement, which improves the detection of pathologies in

dense mammary glands;

- Contrast-enhanced X-ray diagnostic techniques using 3D-printed phantoms have been optimized, identifying optimal energy pairs and materials for better visualization of pathologies;
- Optical systems with a CMOS camera and a laser diode have been created to validate X-ray algorithms, providing a safe and precise alternative without ionizing radiation;
- Statistical and computational frameworks for validating simulation and imaging software have been established, increasing the reliability of radiological applications;
- Web-based platforms for evaluating X-ray images and health profiles have been developed, improving accessibility and data analysis;
- Research results are translated into educational tools, such as 3D-printed models and courses, enhancing the skills and readiness of medical and dental students.

After reviewing the articles describing the candidate's claimed contributions, I was convinced of their originality and significance. The claims for contributions are reasonable and completely justified, although they could be formulated in a more generalized form – uniting achievements that are closer in meaning.

5 Assessment of the candidate's personal contribution

The attached documents, provided by Chief Asst. Eng. Nikolay Dukov, participating in the procedure for occupying the academic position of "Associate Professor", show that the candidate meets the minimum national requirements of the Act on the Development of Academic Staff in the Republic of Bulgaria, set out in the Regulations for the implementation of the Act on the Development of Academic Staff in the Republic of Bulgaria, as well as the additional requirements of the Medical University – Varna in field 5 Technical Sciences, professional field 5.2. Electrical Engineering, Electronics and Automation, specialty "Biomedical Equipment and Technologies".

6 Critical notes

I have no comments on the materials presented by the candidate.

Recommendation to the Chief Assistant Professor, Eng. Nikolay Dukov, PhD is to use the accumulated experience and his in-depth knowledge in the field of electronics to create useful materials for student education: textbooks, manuals for seminar and/or laboratory exercises, tests and other teaching aids.

7 Personal impressions

I know Chief Assistant Professor Eng. Nikolay Dukov, PhD from his studies as a student. The opinion written here and the findings in it are the result of both my personal impressions of the candidate's work, as well as the data on the candidate's scientific achievements and information on his teaching activities attached to the competition documents.

8 Conclusion:

Considering the above, I propose that Chief Assistant Professor eng. **Nikolay Tinkov Dukov, PhD** be elected as "Associate Professor" in professional field 5.2. Electrical Engineering, Electronics and Automation, specialty "Biomedical Engineering and Technologies".

09.06.2025 Jury member:

Prof. eng. Anton Slavchev **Georgiev**, DSc

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