The BSMPE made big efforts to endorse these specialists in appropriate medical units but without any success: most of the medical units hire incompetent persons without the necessary qualification.

Our opinion is that BSMPE should put the question for the professional realization of such specialists in the right places, and to propose changes in the legislation providing in this direction.

The first step should be changes in the definition of *medical physicist*according to the broader definition of IOMP. Next, the legislation should include requirements for qualification of medical sanitary physicists and engineers for working in hospitals, medical/cosmetics/SPA centres, physiotherapy, NMR, occupational health services, control bodies of health, environment, labour ministries, accredited laboratories, occupational safety bodies, administration (ecological evaluation).

This requirement is set, also in EU Directives 2013/35/EC and 2010/25/EC for protection of workers exposed to electromagnetic fields and optical radiation.

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Channelized Hotelling Observers and their application in measuring human performance

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The main goal of this work is to demonstrate how a Channelized Hotelling Observer works, to show its application and value in the field of medical physics and also, to highlight its advantages over other observers. Channelized Hotelling Observers are a variation of the Model Observers, which are applicable with 3D tomography for detection of masses. During image quality assessment, the classifier needs to make a decision concerning that specific image. This decision can be most likely one of two possible cases – "signal absent" and "signal present". These decisions represent the result, generated as a response to the input image. For this purpose, the widely used 4-Alternative Four Choice (4AFC) algorithm is applied, where one trial consists of a batch of four images – one from "signal present" and three more from "signal absent". If the system has correctly classified the image as "present", this is counted as a "hit", otherwise it is a "miss". This way, the final success rate of the observer is computed as the number of hits over the number of trials. These observers also have a channel mechanism, which reduces the dimensionality of the explored images. However, there is a need to be a tuning phase for the channels, with regard to the task. The next phase of the implementation is training. Here, an expected signal is compared to the covariance of the images, which results in a signal template. Due to the lack of a sufficient number of images, often they are used in both training and evaluation phases. The final "reading" phase (evaluation) involves two main features – observer reproducibility for various lesions and dose level estimation.

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Creating a prototype of a robotic human hand for people with permanent disabilities

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Robotics is the technology of designing, constructing and exploiting robots with major applications. One such application is to use robots in assisting people with physical disabilities. The goal of this work is to create a prototype of a robotic human hand. The basic components used in designing the hand prototype are Arduino UNO based on ATMEL microcontroller development board, breadboard for easy assembly of electronic circuits, jumper cables, 3D printed components from PLA and ABS, servo motors, reinforced cord, linking elements and other elements for stability of the prototype. For printing the 3D hand model, a 3D fused-deposition modelling printer with two plastic printing materials, PLA and ABS, was used. The software solution for controlling the fingers and the basic safety of overturning/under-turning the fingers is C-based. The program was compiled and uploaded using the built-in IDE for Arduino. The project was completed in a 2-months period time. The result is a working and anatomically correct prototype of the human hand. Presently, the prototype can simulate normal contraction and relaxation of the fingers digitus quartus manus and digitus minimus manus, also known as the ring and pinky finger. This initial development is used as a base for a large scale project for creating a modern and functional design of robotic human hand. Depending on the patient needs, an individual model will be designed, allowing customization, depending on the patient's age, size and other factors, and will be produced.

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Skin dose color mapping system in interventional radiology and cardiology

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The interventional radiology is among the fast-developing medical imaging modalities. There is an increase in the number of performed interventional procedures and the radiation-induced skin reactions became a concern. The type and degree of skin reaction depends of the absorbed skin dose. The National Cancer Institute (NCI) has established a skin reaction grading system, which classifies them according to the severity of the skin reaction, ranging from 1 to 4, with 1st grade being the least severe and 4th the most severe. The purpose is to (1) present the benefits and the limitations of available dose monitoring quantities to predict the skin reactions and to measure the peak skin dose (PSD), in terms of kerma area product (KAP), cumulative dose (CD) and fluoroscopy time (FT); (2) to survey the cumulative dose distribution of different interventional cardiology procedures in Bulgaria, and (3) to present a methodology for real time skin dose color mapping system during interventional procedures. The review of the available literature shows that there is poor correlation between FT and the other dose metrics. A substantial correlation between KAP or CD and PSD is reported. The better real-time dose indicator for skin reactions is KAP or CD. CD typically overestimates PSD and provides a conservative clinical skin-dose management tool. Real-time PSD measurement is the preferred methodology. Data for more than 500 interventional cardiology procedures was collected from three hospitals in Bulgaria and the CD values distribution was surveyed. The results show that 72% of the CD values are lower than 2 Gy; 12.5% are within the range (2–5) Gy; 3.8%: (5–10) Gy; 0.9%: (10–15) Gy and for 0.2%: CD >15 Gy. The dose ranges were selected in agreement with the NCI skin reaction grading system. Although the percentage of patients with CD values exceeding 5 Gy is not high, all kind of efforts to support medical staff avoiding such dose levels should be launched. A color mapping system, following the NCI Skin reaction grading system, will be useful tool for easy and fast orientation of the medical staff, according to the expected degree of complexity of the skin reactions.

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Criteria for acquiring and maintaining the title "Medical Physics Expert" in Bulgaria

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The Council Directive 2013/59/EURATOM requires medical physics experts (MPE) to be recognized at governmental level and their continuity of expertise to be ensured. In 2014 European Guidelines on Medical Physics Expert, Radiation Protection No 174 (RP174) was published. This document provides comprehensive description of educational and training schemes, as well as knowledge, skills and competences that should be possessed by MPE. As of 2005 Bulgarian ordinance was issued, harmonizing Bulgarian legislation with the requirements of the European Union, stating the role of MPE in medical practice. According to this document a physicist should have Medical Radiological Physics specialty and five years of professional experience in some of the fields of medical physics, in order to become MPE. In 2018 modification of the ordinance required implementation of a scheme for continuous professional development (CPD) of MPE. The Bulgarian Society of Biomedical Physics and Engineering is responsible to elaborate guidelines for CPD. A working group (WG) with representatives from all areas (radiation therapy, diagnostic radiology and nuclear medicine) and with experience in education and training was created for that purpose. The WG prepared a draft of guidelines for CPD based on RP174 and EFOMP Policy Statement No. 10.1: Recommended Guidelines on National Schemes for Continuing Professional Development of Medical Physicists. According to the prepared guidelines the MPE is recognized separately in each of the three fields. Credit points are assigned for activities related to education, practical or scientific activities, lecturing and publications. Educational activities include participation in courses, lectures, conferences, defense of PhD, etc. Practical or scientific activities are participation in projects, introduction of new technologies, development of new methods, elaboration of technical protocols, conduction of educational activities at the working place, visits of other hospitals and others. A total of 250 credit points must be collected for a 5 years period.

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