nologies available on one mammography unit: full field digital mammography (FFDM), digital breast tomosynthesis (DBT) and contrast-enhanced spectral mammography (CESM).

Materials and methods: The study was performed on a Senographe Essential/SenoClaire/SenoBright (GE Healthcare) system. The methods recommended in the EUREF protocol were used. Patient data were retrospectively retrieved from PACS with dose tracking software Radimetrics (Bayer). Radiation output and half value layer were measured with X2 (Raysafe) instrument with appropriate calibrations for the spectra used. Incident air kerma (IAK) for patients and PMMA phantom (thicknesses from 20 up to 70 mm with additional spacers) was calculated from the measured data. Mean glandular dose (MGD) was calculated from IAK by applying relevant conversion coefficients.

Results: Data for 74 patients, 296 exposures (FFDM), 82 patients, 172 exposures (DBT), and 43 patients, 148 exposures (CESM) were collected and analysed. MGD varied from 0.87 mGy (FFDM), 1.01 mGy (DBT), 1.82 mGy (CESM) for 20 mm PMMA with 1 mm spacer, up to 2.36 mGy (FFDM), 2.77 mGy (DBT), 3.48 mGy (CESM) for 70 mm PMMA with 20 mm spacer respectively. Mean value of MGD ± standard deviation for the whole patient samples was 1.75 ± 0.72 mGy (FFDM), 1.87 ± 0.65 mGy (DBT), 2.54 ± 0.79 mGy (low energy component of CESM), and 3.16 ± 0.99 mGy (CESM, both energies). MGD from the low energy component of CESM was about 45% higher than MGD from FFDM. MGD from the total CESM exposure taking into account both low and high energy components was 80% and 69% higher than MGD from FFDM and DBT respectively.

Conclusions: Doses from FFDM and DBT are comparable, while from CESM are significantly higher. However, this is considered justified since CESM is used for symptomatic patients.

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Comparative evaluation of physical breast phantoms dedicated for mammography studies

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Introduction: In the presented paper we provide an evaluation of the properties of physical breast phantoms dedicated to x-ray breast imaging and study. The use of physical phantoms is a widely used approach for evaluation of new breast imaging techniques, control and calibration of imaging equipment and patient dose estimation.

Materials and Methods: The examined phantoms are created through combination of different components, which simulate different elements of the female breast (glandular tree, adipose compartments and skin), and manufactured using various materials (polylactic acid (PLA), Gray resin and Clear resin) and two different methods (fused deposition modelling and stereolithography). The phantoms are evaluated using statistical parameters – namely skewness, kurtosis, fractal analysis, power spectrum analysis (PSA), gray-level co-occurrence matrix contrast and energy, which are compared with the values obtained from real mammograms.

Results: The analysis of images from seven physical phantoms demonstrated that each material has different degrees of resemblance to real breast tissues. The phantoms that achieved results closest to these from real images consisted of PLA, clear resin and glycerol. In particular, the difference between the parameters of the real images and the phantom images is in the range of up to 30% for the best performing materials. Skewness was the parameter where highest differences between real and phantom images were observed.

*Conclusions:*The performed comparative evaluation shows that images, created using the manufactured phantoms have characteristics similar to the real mammograms.

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The endotoxin influence on the deformability of red blood cells. (in vitro)

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Experiments with endotoxin is an interesting direction for medical applications. It is known that certain abnormalities in the microcirculation in endotoxin shock are related to a reduction of the surface electrical charge and the deformability of red blood cells. The intravascular coagulation of blood cells or "sludge phenomenon" has been observed in endotoxin and other types of shock. To gain a more comprehensive insight into the effect of endotoxin on erythrocyte membranes an assessment was made of the light dispersion in electric field by erythrocyte suspension. Its adoption enables to investigate better the dynamics of endotoxin interaction with erythrocyte membranes, changes in deformability and the like.

In the latter case the biphasic effect became manifest at the very beginning. It was rather marked in the first minute, while ten minutes later it was no longer noted. The development of intravascular coagulation in shock is related to a lower deformability of the cell membranes.

A decrease of deformability has been established, although only qualitatively. The electro-optical method enables to estimate the quantitative alterations in deformability. From the values of the disorientation time for five of the samples was measured, a 37 percent average reduction of deformability was obtained. It is further more presumed that deformability modification is proportional to the change in relaxation time of disarrangement. This is a mean value of measurements performed during the first minute, when the changes in electro-optical effect are most significant. The reduction of deformability in individual subjects varies in the 30–50 percent range.

Key words: Electro-optical technique, Deformability of red blood cells, Endotoxin shock.
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Comparative study of Lanthanum halide scintillation detectors

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Introduction: Gamma ray and X-ray detectors are constructed and developed at the Faculty of Physics, Sofia University. They are extensively tested for future use in nuclear physics, astrophysics and nuclear medicine. The aim of this investigation is to perform a comparative study of two scintillation detectors based on Lanthanum halide scintillators - $LaBr_3$:Ce and $CeBr_3$. The study is ongoing. Preliminary results will be presented.