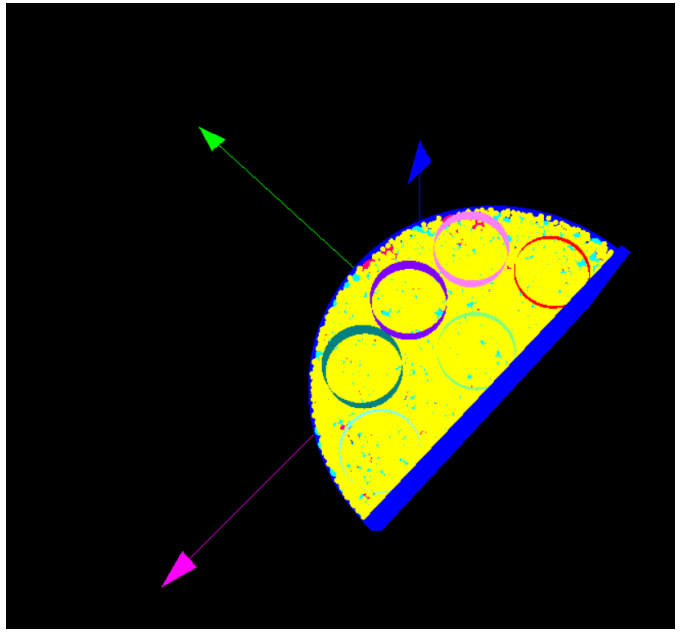

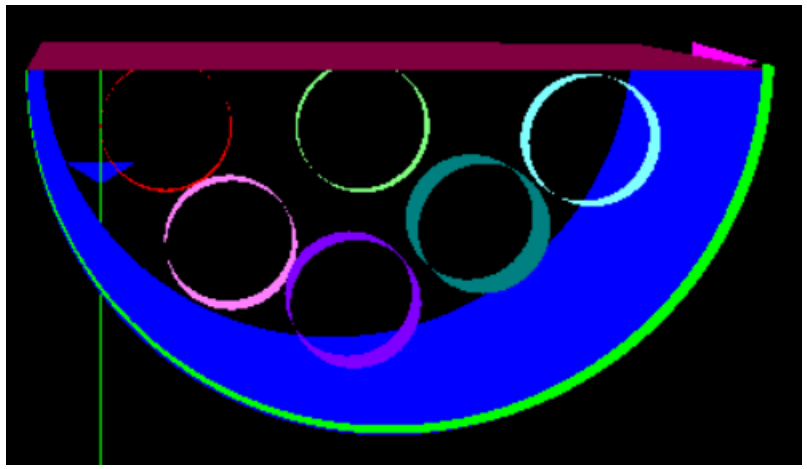

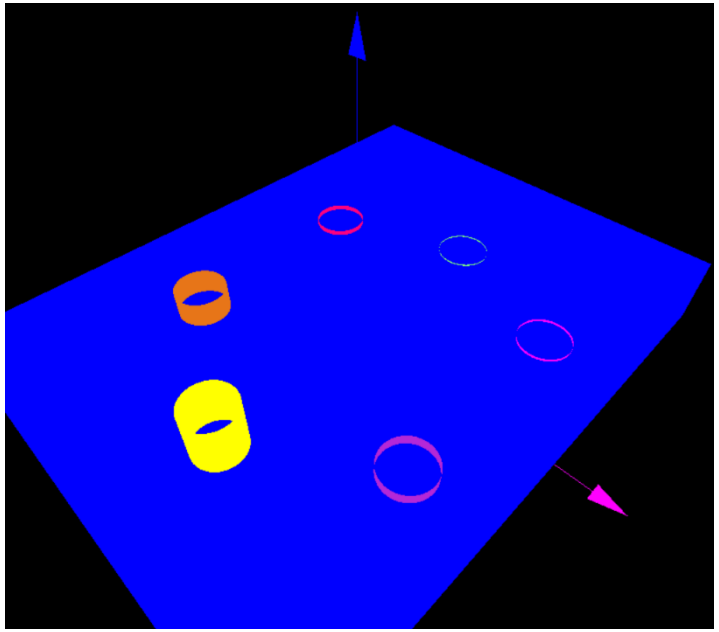

COMPUTATIONAL BREAST MODELS DEDICATED TO CONTRAST ENHANCED SPECTRAL MAMMOGRAPHY

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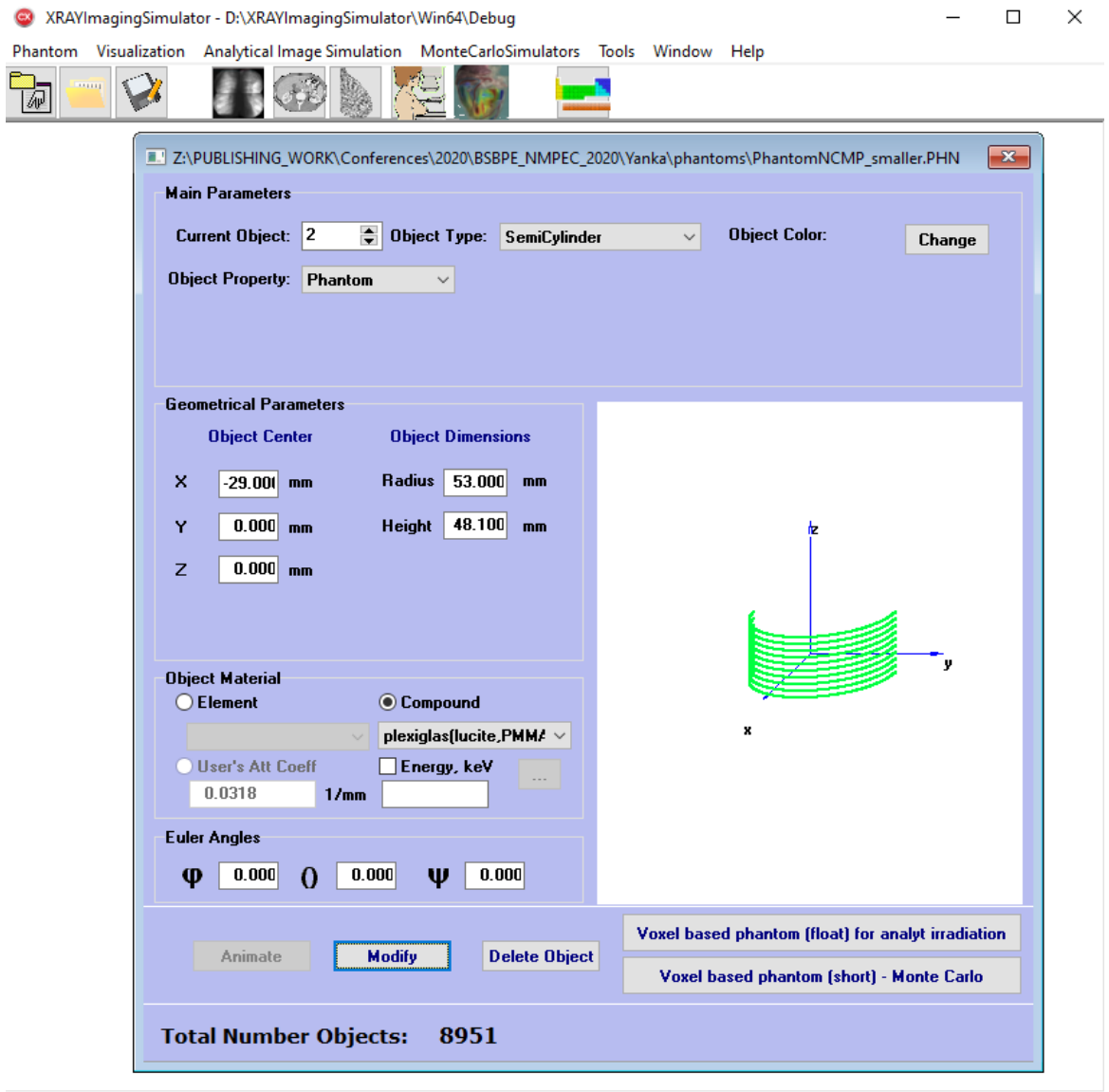
Aim of the study

- Physical phantoms for contrast-enhanced mammography are currently under constructions and thus not widely available.
- A preliminary step in the design of such physical phantom is the design of a computational prototype with characteristics closed to the characteristics of the real patient breast tissues.
- The purpose of this study is the design and evaluation of computational breast phantoms for contrast-enhanced spectral mammography.

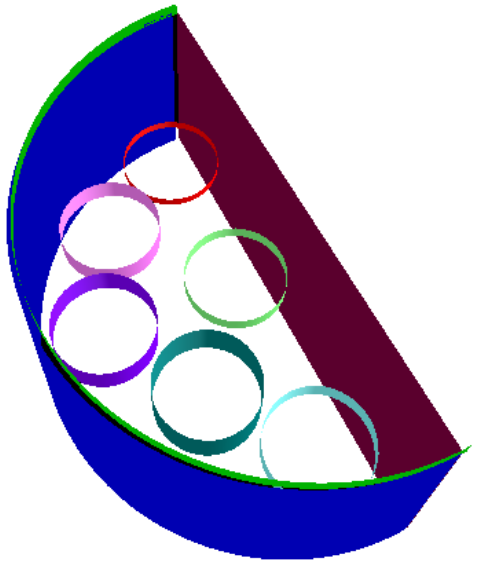
Materials and methods



- XRAYImagingSimulator[1] is used.
- It is a software tool for
  - creation of computational phantoms and
  - generation of x-ray projection images.

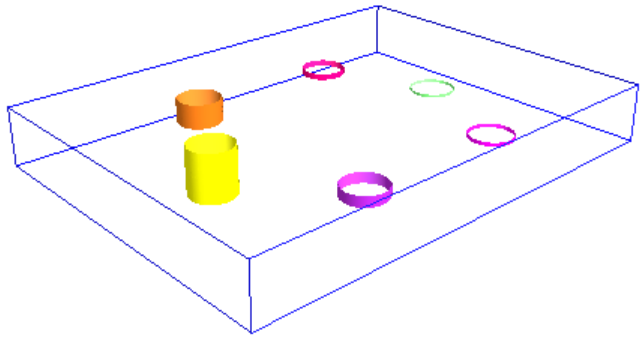
[1] 1. Bliznakova K, Speller R, Horrocks J, Liaparinos P, Kolitsi Z, Pallikarakis N. Experimental validation of a radiographic simulation code using breast phantom for X-ray imaging. Comput Biol Med. 2010;40(2):208-14.

Materials and methods



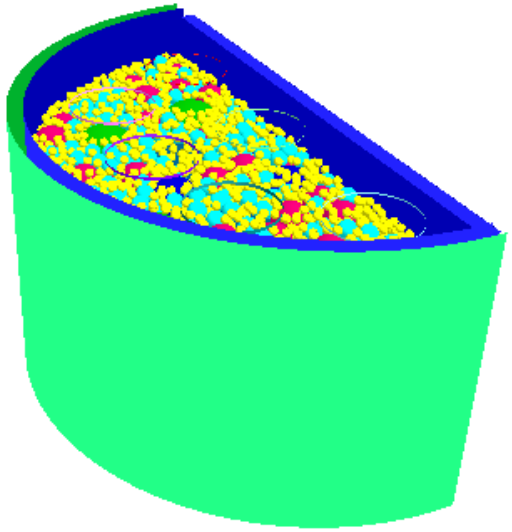
Phantom 1

- Semi-cylinder: radius = 50 mm, height = 45 mm
- Six iodinated inserts with radius of 9.5 mm and height of 2-8 mm



Phantom 2

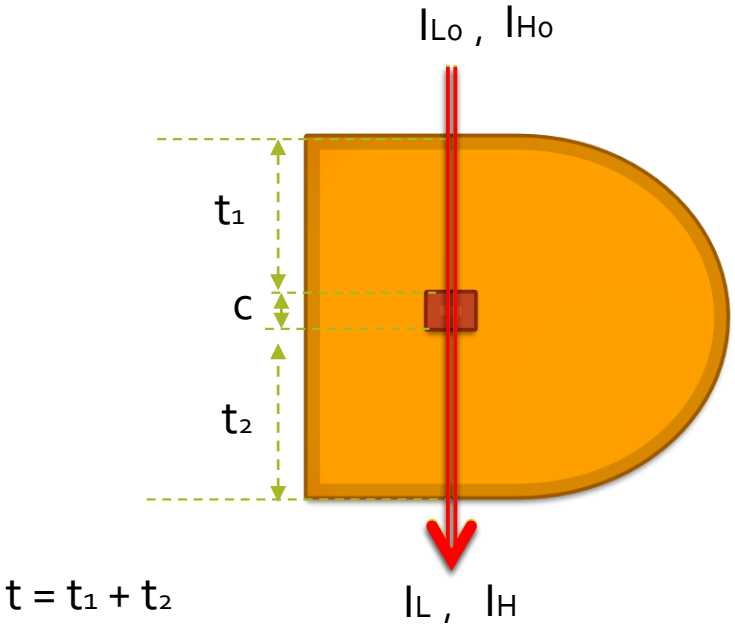
- Container: 203 mm x 152 mm
- Thickness: 25 mm
- Six iodinated inserts with radius of 9.5 mm and height of 0.5-20 mm



Phantom 3

- Semi-cylinder: radius = 50 mm, height = 48 mm
- Six inserts from Omnipaque with radius of 8 mm and height of 0.1-0.6 mm

Dual energy (DE) algorithm



I_{Lo} - initial photon fluence

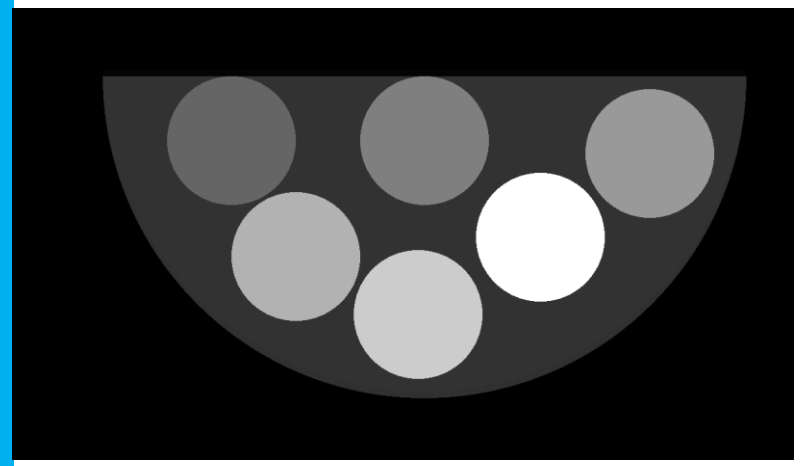
I_{Ho} - initial photon fluence

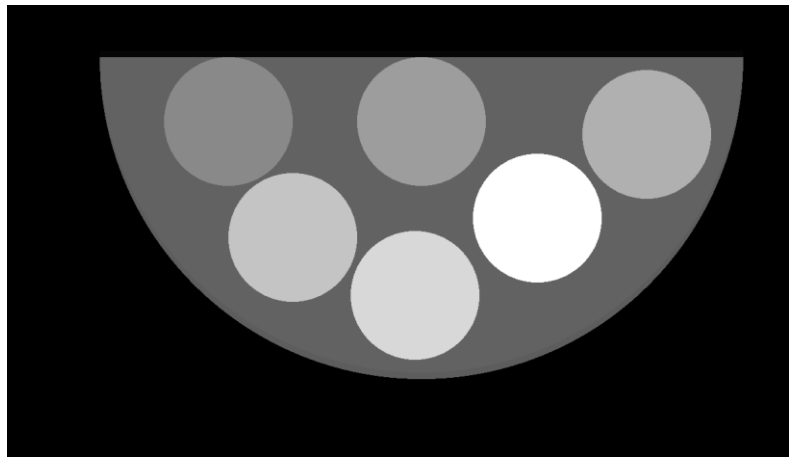
$$CI = ln[I_H] - Rln[I_L] + k$$

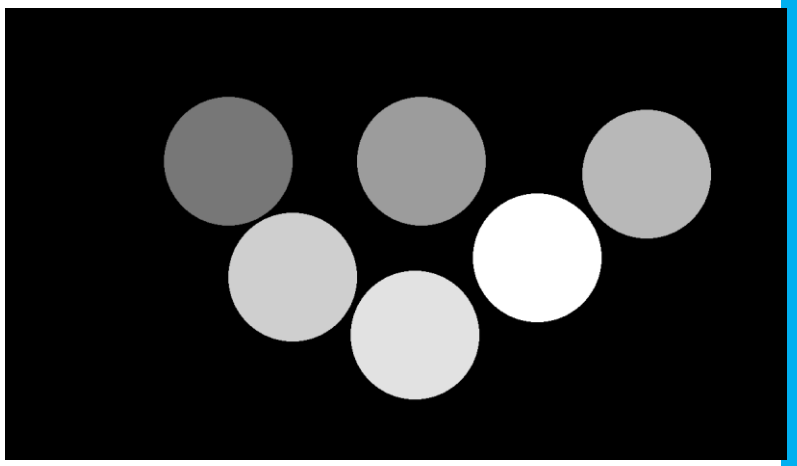
Results

Phantom 1

20keV	34keV	DE image



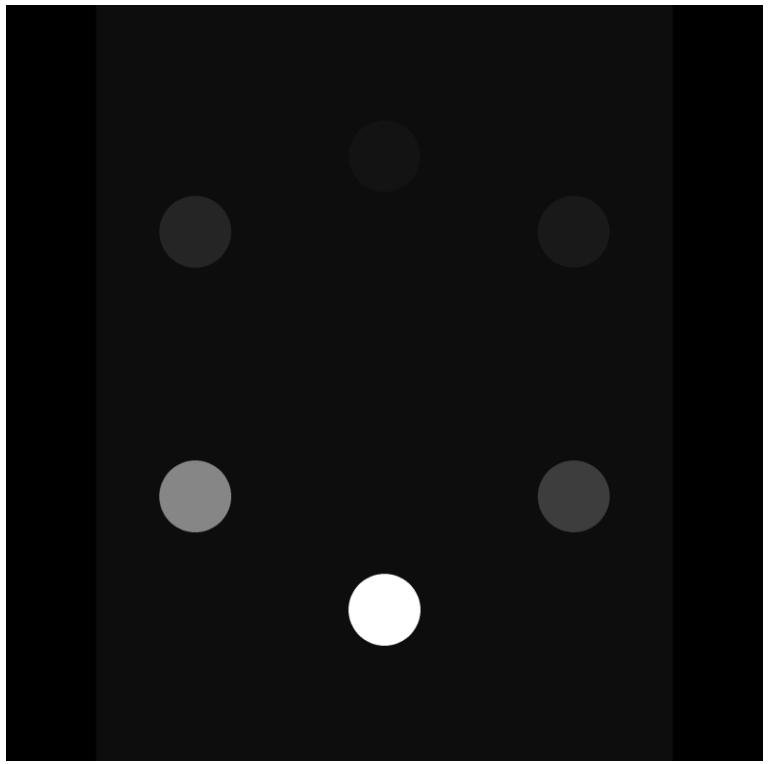


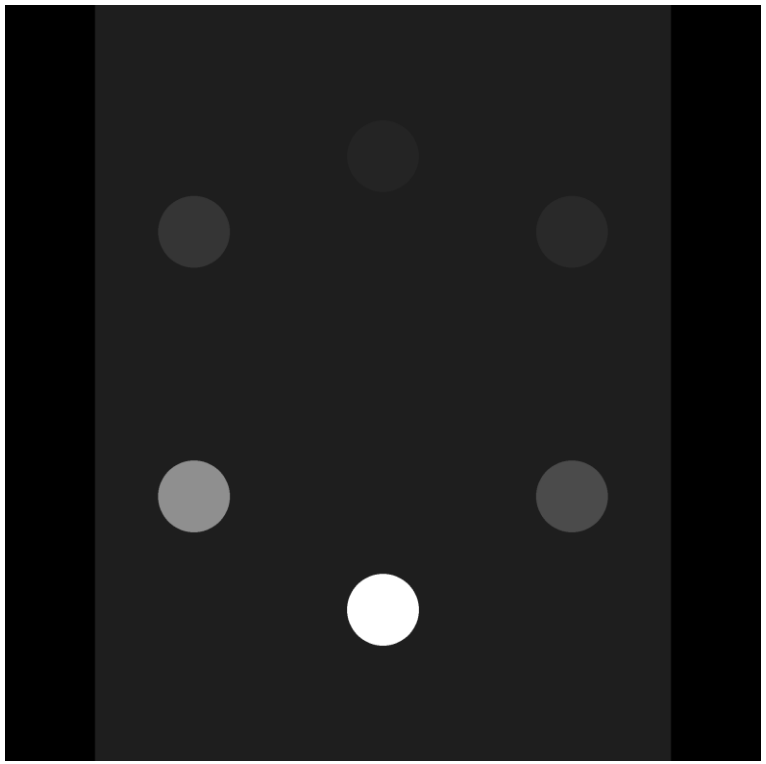


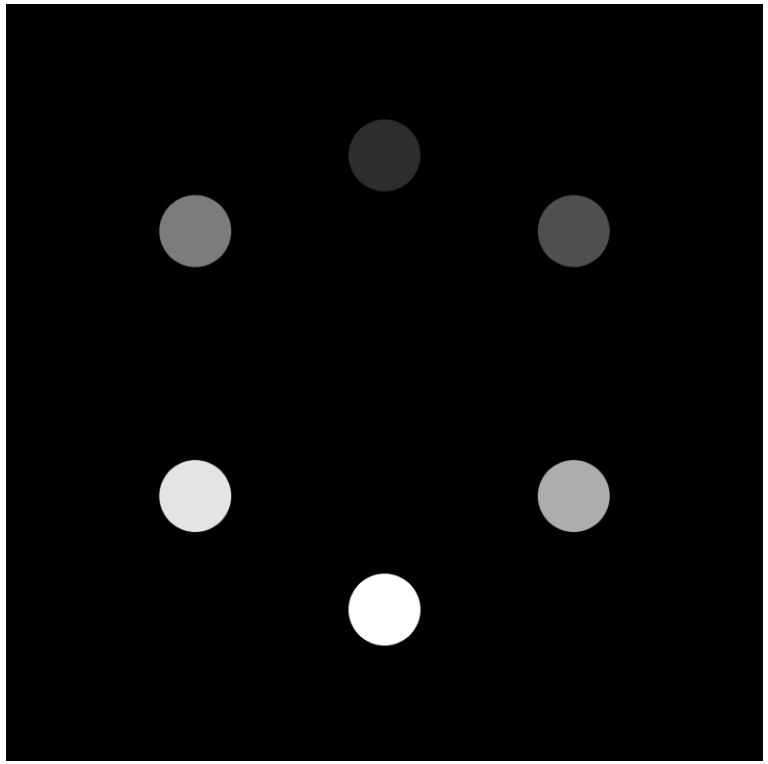
Results

Phantom 2

20keV	34keV	DE image



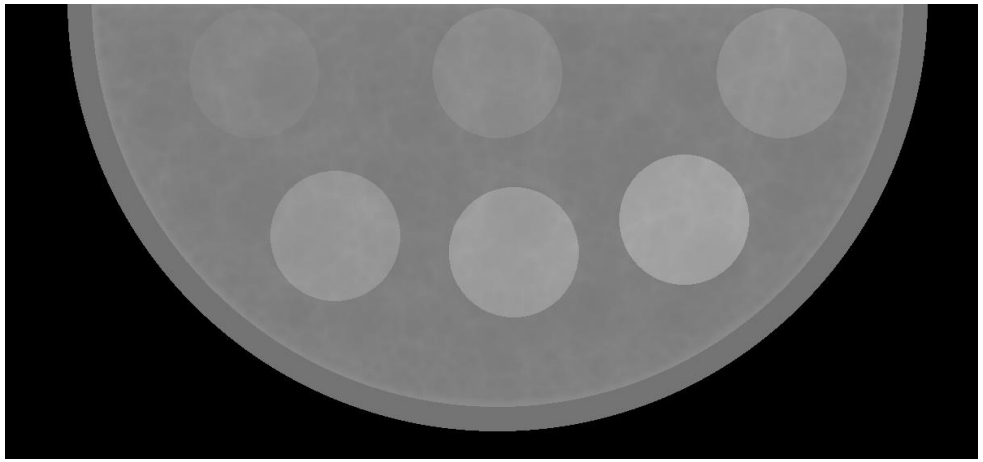




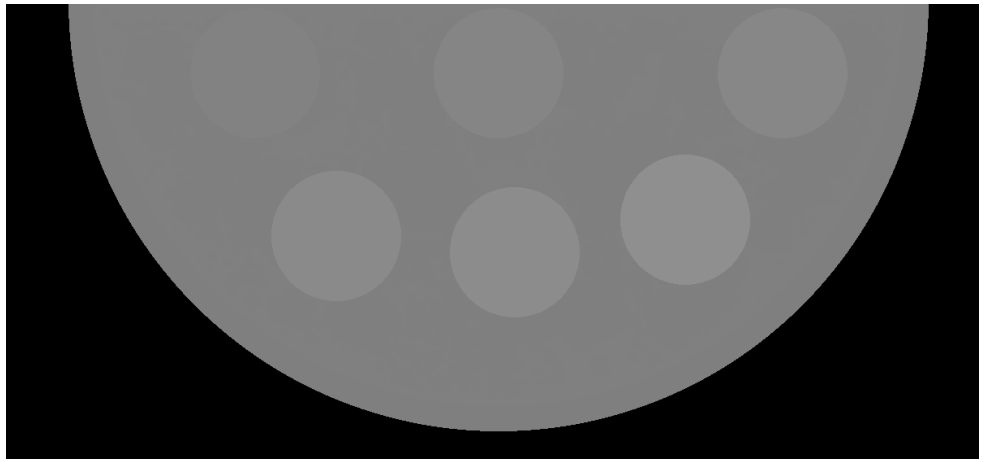
Results

Phantom 3

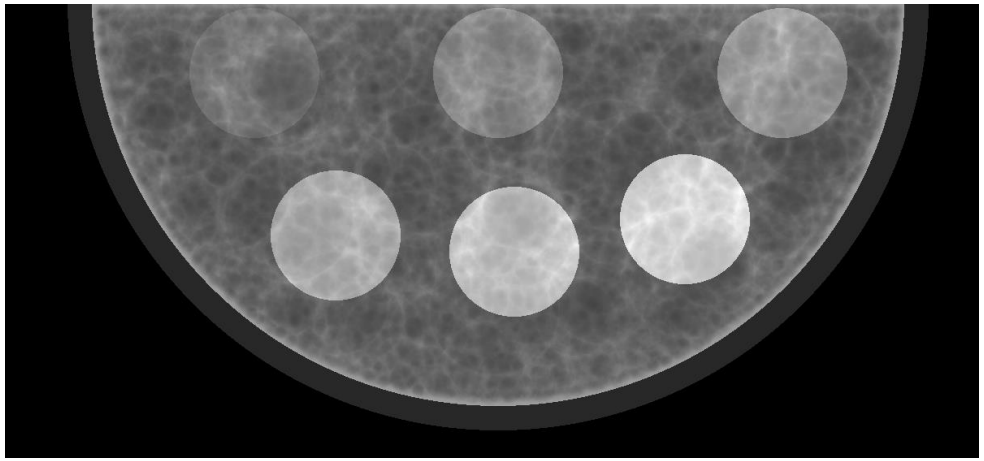
20keV



34 keV



DE image



Conclusions

- Simulated spectral images demonstrated improvement of the image quality compared to low-energy images of the phantoms.

- The simulations with the inhomogeneous model revealed that the heterogeneous background has been successively depressed while improving the visibility of the iodine inserts.

- The heterogenous breast phantom might be used as a reference tool for information about the needed iodine concentration to be inserted during the procedure to obtain significant enhancement in the suspicious area. Current work includes the construction of the physical breast phantoms and their thorough evaluation.

Future work

- Development of physical versions of the software phantoms.
- Experimental validation of the phantoms and the approach.

Thank you for your attention

Acknowledgement: This research is supported by the Bulgarian National Science Fund under grant agreement DN17/2.