Explanation of the coherence/non-coherence of the experimental results obtained

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Relation between the peak voltage difference and the image quality

The experiment 1 and 2 are useful to show the relationship between peak voltage difference and the image quality, which is quantified by the contrast and the signal to noise ratio.

The first experiment shows that the contrast, instead of being improved by the increment of the peak voltage difference, got worse. This is because that the linear attenuation coefficient of the water and the soft tissue decrease with the increment of effective energy, but the difference of the new ones is approximately a hundred times smaller than the one of the originals. This directly affect the difference between the number of photons received by the detector in both areas, producing an image with a poor contrast.

In the other hand, the signal to noise ratio got improved by the increment of contrast. This happens because the increment of effective energy increase the number of photons that get to the detector. The variance of the Poisson distribution grow slower than his mean, this makes the signal to noise ratio grow with the increment of photons in the image.

The values of the results of the first two experiments are coherent with this reasoning.

Relation between the number of photons per unit area and the image quality

The experiments 1 and 3 display the effect of the increment of the number of photons per unit area and the quality of the image.

In terms of contrast the quality of the image got improved. The linear attenuation coefficients still being the same of the first experiment because the effective energy is not affected by this parameter. Therefore, with the same difference in grow rate but with more photons per unit area, the difference in the number of photons that gets to the detector is bigger, increasing the contrast between two region with different materials.

The signal to noise ratio also improve in this case, because, like in the previous example, the number of photons that gets to the detector is bigger, and this metric is improved by that.

The values of the first and last experiments are coherent with this reasoning