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Exploring the possibility of radiography in emission mode at higher energies: Improving the visualization of the internal structure of paintings

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We demonstrated in previous investigations that the internal structure of paintings can be visualized with conventional radiography in transmission mode when paintings have the proper stratigraphy. Unfortunately, there are many paintings that do not result in useful images. This problem can be solved by using radiography in emission mode. With this technique, the painting is irradiated with high energetic X-rays originating from an X-ray tube operating at 100 keV –320 keV while inside the painting low energetic signals such as photoelectrons or characteristic photons are being generated. These signals escape from the top 10 μm of the painting and are able to illuminate the imaging plate. However, this technique has also some disadvantages. One of them is that it is not able to visualize underlying paintings. In this study, we explored the possibility to enhance the information depth by increasing the energy of the photon source from 100 keV up to 1.3325 MeV (i.e., Co60 source). At the same time, we also studied the impact of the energy on the contrast between pigments and on the lateral resolution. For this, we used mathematical simulation of particle transport in matter to understand the relation between input particle (particle type such as photon, electron or positron and the energy of the particle), the material being irradiated (element from which it is composed, thickness) and the output signal (generated particle types, energy, dispersion). Finally, we will show that it is possible to image paintings using a Co60 source.

Author: Dr SCHALM, Olivier (University of Antwerp & Antwerp Maritime Academy, Belgium.)

Co-authors: Ms LEYVA PERNIA, Diana (University of Antwerp, Belgium & CEADEN, Cuba.); Dr WILLEMS, Peter (GE Sensing & Inspection Technologies, Belgium.); Dr CABAL RODRIGUEZ, Ana E. (University of Antwerp, Belgium & CEADEN, Cuba.); Prof. VAN ESPEN, Piet (University of Antwerp, Belgium.)

Presenter: Dr SCHALM, Olivier (University of Antwerp & Antwerp Maritime Academy, Belgium.)

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