

- Furthermore, less than half of the participants' measurement results have a valid uncertainty statement.

Results document that traceability of CT dimensional measurements is still a major challenge, even for expert users. In order to enhance the current industrial CT practice, international standards are needed to establish proper procedures for uncertainty evaluation and metrological performance verification of CT systems.

Further details on CT Audit may be found in the two following publications:

1. Carmignato S. "Accuracy of industrial computed tomography measurements: Experimental results from an international comparison". CIRP Annals (2012), <http://dx.doi.org/10.1016/j.cirp.2012.03.021>.
2. Carmignato S., et al., "First international interlaboratory comparison on computed tomography for dimensional metrology". Submitted to Precision Engineering.

NEXIM - a new strategic research project

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Using the collaboration in CIA-CT as a springboard, the consortium partners from NBI and DMRI have started a new research project called "New X-ray Imaging Modalities for Safe and High Quality Food (NEXIM)", together with the Department of Informatics and Mathematical Modelling at DTU and the Department of Food Science at KU. Several companies are associated with the project including Arla, Danish Crown, Toms, Daloon, Tican, Lantmannen/Schulstad, Bisserup Havbrug, Foss and InnospeXion.

The project has received nearly 20 million DKK in funding from the Strategic Research Council. It aims to develop new imaging techniques for on-line inspection of food products as well as application of X-ray CT in high-resolution studies of food products for developing high quality food.

One of the promising aspects is to use new X-ray imaging modalities for detection of hard-to-find foreign bodies in food products. Refraction- and scattering-based contrast principles can be used to detect pieces of paper or insects in food as complementary to conventional absorption contrast which is used already today for detection of glass, metal or stones. Figure 5 shows an example of a piece of minced meat where the pieces of glass are seen using absorption contrast (middle) and the paper is detected using scattering contrast (bottom).

Another aim is determination of the distribution of ingredients in the product. These can be for instance nuts or berries in chocolate bars or the holes in cheese, which are important quality parameters for the consumers. The idea is to apply X-ray imaging using several modalities to obtain a quantitative measure for the distribution. These two kinds of inspections are performed using radiography yielding 2D images. In another area of the project, the aim is to perform CT studies using synchrotron radiation facilities for studying food products at high resolution.

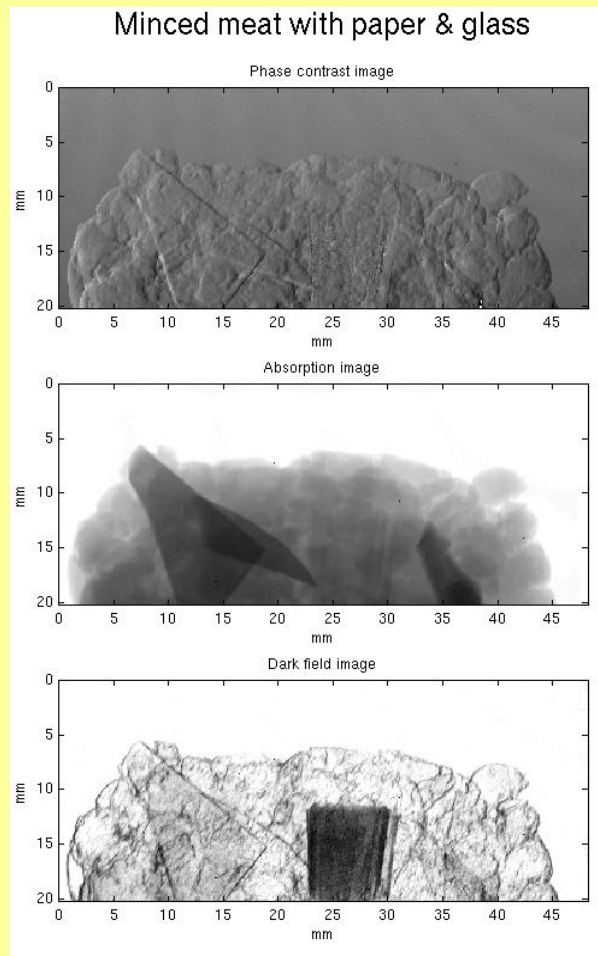


Figure 5: A piece of minced meat containing pieces of glass (left and right) and paper (middle) imaged using three X-ray modalities: Refraction, absorption and scattering

A possible CT-study can be the interaction of fat and water-soluble proteins in meat emulsions which are used for e.g. sausages. Healthier food could be obtained by replacing animal fat with vegetable oils but it is known not much about the difference in terms of interactions on small-scale. Another investigation can be the interaction between filling and chocolate in chocolate bonbons which is a complicated heterogenic system. As seen in Figure 6, the use of several imaging modalities are also useful for the study of chocolates with filling. The next step would be to replace the radiography study presented in Figure 6 with a CT scan.

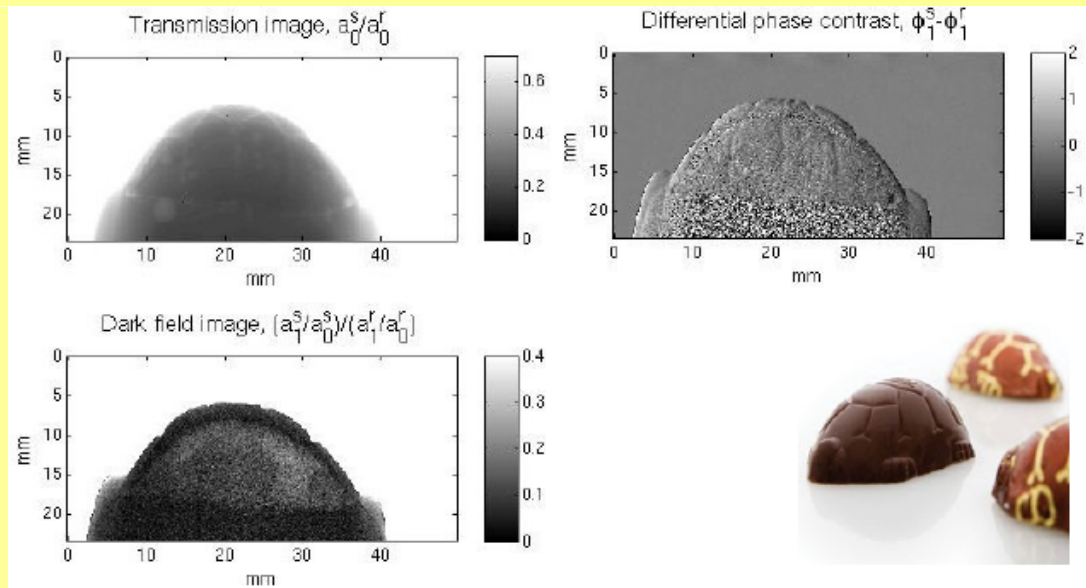


Figure 6: Radiograms of a "Toms skildpadde" chocolate with filling using absorption- (upper left), refraction- (upper right) and scattering-based contrast. The contrast between filling and chocolate is largest using the scattering contrast.

The NEXIM project had an official kick-off meeting the 22nd of February and is scheduled to run for four years.