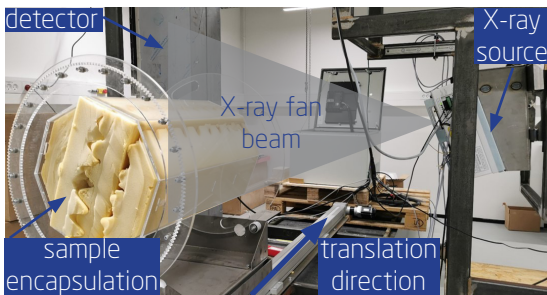


Optimising new geometries for cabin luggage scanning

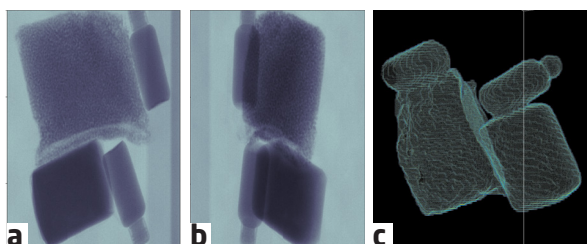
The company Exruptive works in aviation industry and aims at improving the process of X-ray scanning of cabin luggage - both by redesigning the current cabin luggage scanning process, and by raising the security level. The scanning system under development does not require passengers to divest liquids or electronics as it uses X-ray dispersive energy detectors. Using these detectors, different materials can be differentiated easier than with the currently used detectors, which goes along with a better detection performance. Furthermore, the stress of the security experience for passengers can be decreased, while the the flow through security can be increased. In order to develop such a new cabin luggage scanner, the individual components, as well as the setup, need to be validated. Therefore, Exruptive got in contact with the 3D Imaging Centre at DTU, such that Exruptive could build a test setup at the 3D Imaging Centre at DTU to be used to optimise different geometries and to verify the performance of the system.



Schematic representation of the security solution offered by Exruptive. A trolley is loaded with the cabin luggage and passes its way through the scanner system, while the passengers have the security check. There is no need for divesting the luggage.



Photograph of the test setup. The samples are kept in a Plexi Glass cylinder which can be translated through the X-ray beam.



2D projections of the transmitted X-rays passing through 4 samples recorded from different angles (a and b). 3D images of these segmented samples (c).

Challenge

State of the art security scanners are adaptations of medical computed tomography scanners in which the X-ray source and the detector are moved around an object while images, so-called "projections", are recorded. Nowadays, 1000's of projections are used to reconstruct the final 3D image, but with improved reconstruction algorithms, energy dispersive detectors and modified scanner geometries, it is possible to reduce the number of projections to 12, thus increasing the scanning speed dramatically. In this project different scanner geometries were tested in order to optimise the geometries of new scanners.

Collaboration

In this project, the 3D Imaging Centre at DTU supported Exruptive's work by both being an active sparring partner and by providing laboratory space and equipment for setting up and testing the new instrumentation developed at Exruptive. This collaboration was part of the LINX project in which researchers at leading Danish universities collaborate with scientists in industry to solve industry relevant problems using advanced neutron and X-ray techniques.

Results

By modifying different angles of the X-ray source and detector with respect to the sample, and by also changing their distances, Exruptive modelled and tested more than 250 different scanner geometries. For evaluation, the penetration of X-rays into a steel sample, as well as the image resolution and accuracy of the reconstruction were analysed. The results allowed Exruptive to perform "virtual prototyping" of different scanner designs, thus saving massive costs otherwise required to manufacture and test potential scanner designs.

Perspectives

With the help of this project, an optimised design for a new cabin luggage scanner could be obtained. The application of such new scanners will help to improve the passenger experience and fasten the security checking process at airports without compromising quality.

Imaging Industry Portal

The Imaging Industry Portal is a part of the 3D Imaging Centre at DTU and assists companies in using and implementing 3D Imaging in research, development and production. The portal offers research-based 3D Imaging services and provides companies with the latest equipment and the most advanced knowledge within 3D Imaging and data analysis. The Imaging Industry Portal works as a gateway to ESS and MAX IV, as well as other large scale facilities.

www.imaging.dtu.dk/Industry-Portal

DTU 3D Imaging Centre

