

5. PROSPECTS OF MOBILE COMPUTED TOMOGRAPHY

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Digital detectors as phosphor imaging plates (IP) and digital detector arrays (DDA) enable radiographic inspection with higher efficiency and improved image quality in comparison to the classic film technique. Their application also permits more complicated inspection arrangements as Computed Tomography, Computed Laminography and Tomosynthesis for in-field inspection. Industrial CT systems have been introduced during the last years in different NDT areas, as e.g. in casting and automotive industry. These are stationary devices and require adjusting the object for inspection in the CT device.

The mobile mechanised tomographic system TomoCAR (Tomographic Computer Aided Radiology) was developed first for inspection of circumferential welded seams of pipes. It consists of the manipulator based position control of an X-Ray tube at one side of the region to inspect and a Digital Detector Array (DDA) at the other side. Several hundred radiometric projections in small angle steps are acquired. The tomographic reconstruction allows the three-dimensional (3D) representation of the material structure and included defects. This is equivalent to a metallographic cross sectioning. The hardware design is based on a newly developed flat X-Ray tube with RTW RÖNTGEN – TECHNIK DR. WARRIKHOFF KG and a newly developed radiometric detector array with Oy AJAT Ltd. TomoCAR is applied for sizing of volumetric and planar defects. The physical pixel size of the detector amounts to $0.1 \times 0.1 \text{ mm}^2$. It allows the reliable detection of planar defects with openings larger than $25 \text{ }\mu\text{m}$ by subpixel resolution due to the achieved high signal-to-noise ratio. TomoCAR was successfully qualified as the result of a German pilot study on the basis of the ENIQ guidelines (European Network of Inspection and Qualification) for application in the nuclear power industry. Application examples are presented.

The TomoCAR design was modified for in situ inspection of large aircraft components under production conditions. A gantry gate based planar tomograph was constructed and tested for inspection of the integrity of large flat panel components. The TomoCAR geometry was modified and equipped with a specially designed X-Ray tube of COMET and a larger DDA of PerkinElmer. CFRP panels (Carbon Fibre Reinforced Polymers) of aircrafts of up to $3 \times 9 \text{ m}$ size were inspected. The integrity of imbedded stringers has been successfully observed. No alternative NDT method with similar detection rate has been found up to now. The technology was tested and qualified by airbus. Different trials were performed to prove the finding rate of cracks in embedded stringers, which will be presented and discussed.

The application of mobile tomography in civil engineering requires in most cases specialised solutions depending on the accessibility of the building elements. The inspection of concrete bridges was performed for measuring the position and diameter of steel reinforcements. Digital detectors as Imaging Plates and DDAs were used for inspection of concrete up to 400 mm thickness with Co-60. A hole was drilled into the bridge girder to position the radiation source. Special high-low pass filters were used for preprocessing. Tomosynthesis algorithms and filtered backprojection reconstruction algorithms were applied for 3D reconstruction.

A special CT transformation was developed for tangential pipe wall thickness measurements with digital detectors in industrial plants to enable exact wall thickness measurements from unsharp exposures. Applying this technique allows the time efficient testing of pipes with Ir-192 sources of low activity and with short distances between detector and source.