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Methods for the characterization of the long-term behaviour of X-ray detectors

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Computed tomography (CT) is a non-destructive imaging method that is able to visualize the entire test specimen including inner structures. Its image quality depends on the accuracy of the system components, especially the X-ray detector, X-ray source and the manipulation system. Only the knowledge of characteristics of the components and their influence on image quality allows conclusions about the repeatability of the accuracy of the measurement data. This knowledge is used to ensure the stability of a CT-system as an experimental mould and measurement instrument.

In this contribution we will present methods for the characterization of the long-term stability of X-ray detectors. These methods are compared upon their usability on photon counting and charge integrating detectors. For integrating industrial detectors, well-known characterization procedures as the ASTM standards already exist. Some of these methods (e.g. dark current behaviour) cannot be applied to photon counting detectors because of the very different working principles of the detectors.
For these new detector technologies, new application fields can be made accessible according to lower energies and lower intensities. Therefore using the standardized spectra required by the ASTM standard for industrial X-ray detectors may not be reasonable. Spectra that are relevant for practical applications of the respective detector have to be chosen for characterization measurements. Other characteristics for photon counting detectors i.e. MTF and efficiency are in contrast to the integrating detectors also functions of the threshold level.
Additionally, small active areas of the X-ray detectors may require modified test specimens and expirations.

Adapted characterization methods of the long-term behaviour of integrating and photon counting X-ray detectors and their comparison will be presented and discussed in terms of their practicability on different types of detectors and significance to image quality.

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