

Flat Panel X-Ray Detector with Improved Attenuation Accuracy and Dynamic Range

Applications:

- Industrial CT
- Medical radiography and CT with reduced dose to patients
- Quantitative density measurements by CT

Benefits:

- Dynamic range is increased, allowing measurement of higher attenuations.
- Either contrast resolution can be increased or exposure can be reduced.
- Significant errors in the x-ray signal can be avoided.
- Density calculations can be flattened using more accurate beam hardening corrections.

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Summary:

Digital radiographs (DRs) done using commercially available flat panel detectors (panels) reveal significant errors in the measured attenuation fields. When the DRs are used for CT scans, these errors make it difficult to correct for beam hardening effects. Even when beam-hardening is corrected using supposedly accurate attenuation measurements, a cupping artifact is still present, as shown in the figure (top right).

Researchers at Los Alamos National Laboratory (LANL) have identified the main cause of this problem and developed a method to fix it by minimizing interactions between the panel and the x-rays being measured. A redesigned panel shows significant reduction of attenuation errors and increased dynamic range. The dynamic range should benefit medical applications by enabling reduced dose exposure to patients without sacrificing contrast.

The two figures at right show experimental edge profile plots generated using two detectors, a commercial panel and the Laboratory's preliminary design. The improvement in dynamic range, i.e., being able to measure image values closer to zero, is readily apparent. Further improvement is likely with additional proposed design changes.

Development Stage:

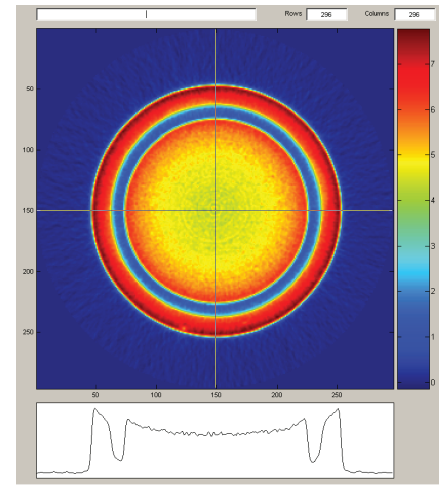
The LANL concept has been tested with excellent results. Implementing the additional design changes will require collaboration with a panel fabricator. LANL is seeking a partner to construct a prototype and potentially to commercialize this product.

Patent Status:

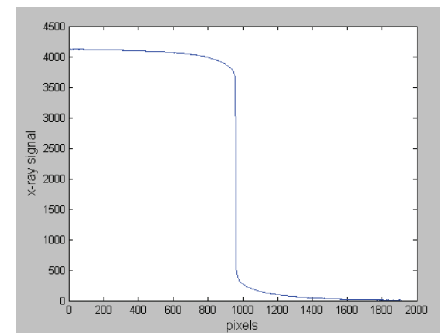
Patent pending

Licensing Status:

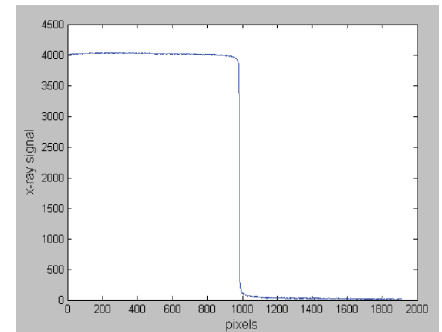
Los Alamos is seeking commercial partners to co-develop this product. The technology is available for exclusive or non-exclusive licensing.



A representative density profile of a CT scan using a flat panel detector.



Commercial panel



LANL's preliminary design