White Paper: CNR Testing Report

NSI Variance Results of CNR Values in non-updated software versions versus updated versions spanning builds 2.0.1.0 – 2.4.2.1.

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Summary:

In the process of working to continually improve and validate North Star Imaging's (NSI's) efX-View and efX-DR software, its software team recently discovered an error in the methodology used to calculate CNR in accordance with ASTM E2737. Per ASTM E2737, the average pixel value of the area surrounding the measured T-hole shall be used as an input to the calculation. It was discovered that from software release 2.0.1.0 to 2.4.2.1, only a portion of the pixels surrounding the measured T-hole were factored into the resultant CNR value. NSI has subsequently fixed this software issue in release 2.4.2.2 and is working with its customers to install this update. Earlier software branches have also been updated in the following releases: 2.0.5.1, 2.1.8.2, 2.2.5.5, 2.3.7.5.

In order to assess if this error in CNR calculations has an effect on image quality, NSI has evaluated over 700 IQI images across multiple material, source and detector types and has evaluated quantitatively the maximum observed decrease in CNR between the software versions containing the error in the calculation and the revised software containing the corrected calculation methodology and correlated visually, in images with an equivalent decrease in CNR, if there is a discernible difference in the detectability of the applicable T-hole. For all NSI Systems with Software versions 2.0.1.0 – 2.4.2.1 integrated with Digital Detector Arrays excluding 100 µm and smaller pixel pitch detectors, the maximum observed decrease in CNR is 0.19 and there is no discernable difference in the visual detectability of the applicable T-holes in images displaying a decrease of the aforementioned amount.

**Evaluation Detailed Results:**

Methodology:

1. A technique was established for each material and available thickness, of AL, Ti, SS, and Ni that established IQI 2T CNR at just above a 2.5 CNR and just below a 2.5 CNR
2. The resultant images were measured in the software versions containing the error in the calculation and the revised software containing the corrected calculation methodology.
3. The difference in CNR value was calculated and plotted where Delta = CNR(corrected) – CNR(old)
4. Visually all IQI images, both above and below a 2.5 CNR were evaluated to observe if the 2T and 4T holes remained visible at a CNR below the industry accepted limit of 2.5 and no less than 2.0.

Results:

For all NSI Systems with Software versions 2.0.1.0 – 2.4.2.1 integrated with Digital Detector Arrays excluding 100 µm and smaller pixel pitch detectors

1. The maximum observed decrease in CNR observed between the software versions containing the error in the calculation and the revised software containing the corrected calculation methodology was 0.19
2. Visually all applicable T-holes were visible throughout the testing, with no discernible difference in T-hole visibility between images just above and just below the industry accepted limit of 2.5 CNR.

Visual Acuity Example between image containing a 2.37 2-T CNR (Left) and 2.55 2-T CNR (Right)
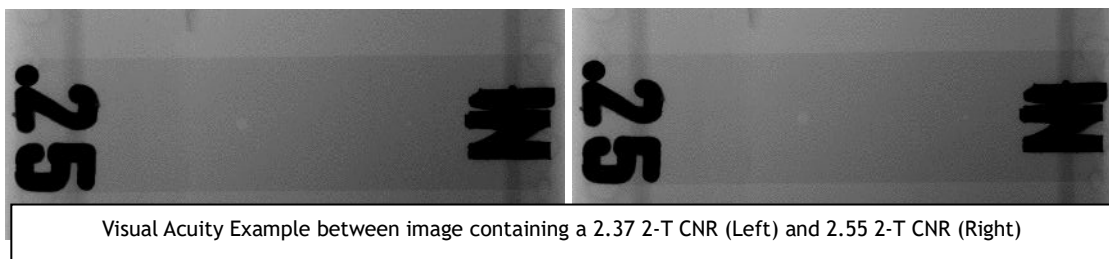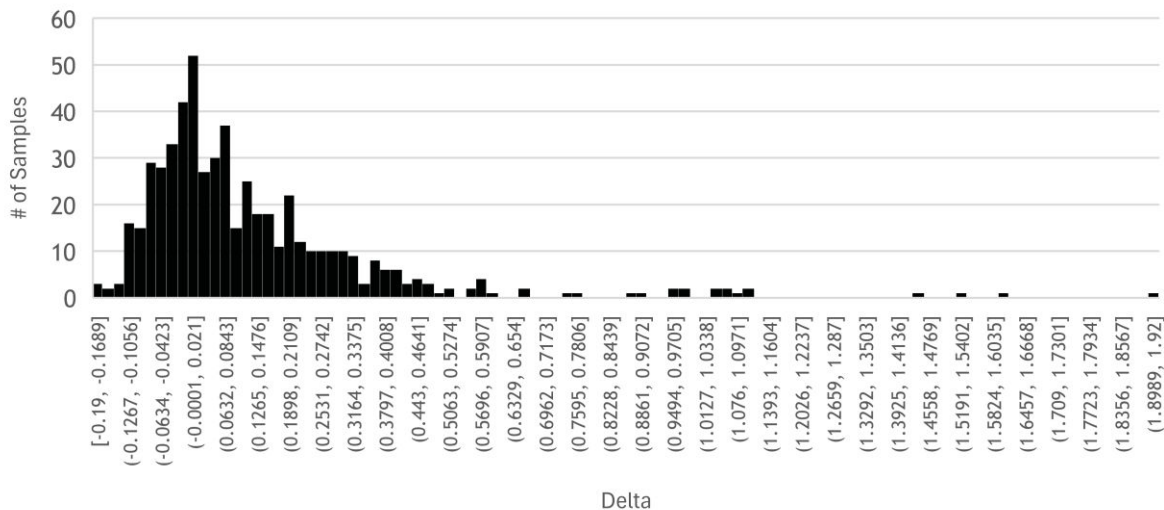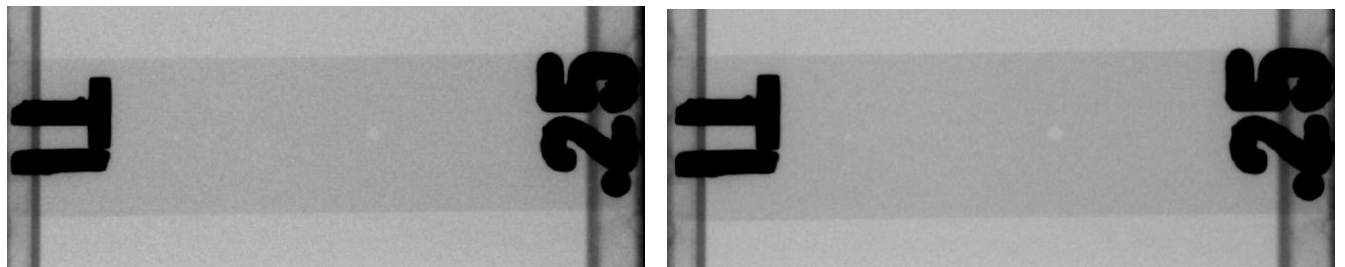
For NSI Systems with Software versions 2.0.1.0 – 2.4.2.1 integrated with the Varex 1611 Digital Detector Array (100 μm pixel pitch detector), the following is an example variance

1. The maximum decrease in CNR observed between the software versions containing the error in the calculation and the revised software containing the corrected calculation methodology was 1.06.
2. Visually all applicable T-holes were visible throughout the testing, there is a discernible difference in T-hole visibility between images of Ni with a measured CNR just above and just below a 2.5 CNR and no less than 2.0. There was not a discernable difference in T-hole visibility between images just above and just below a 2.5 CNR and no less than 2.0 CNR for all other tested materials.

1611 Delta
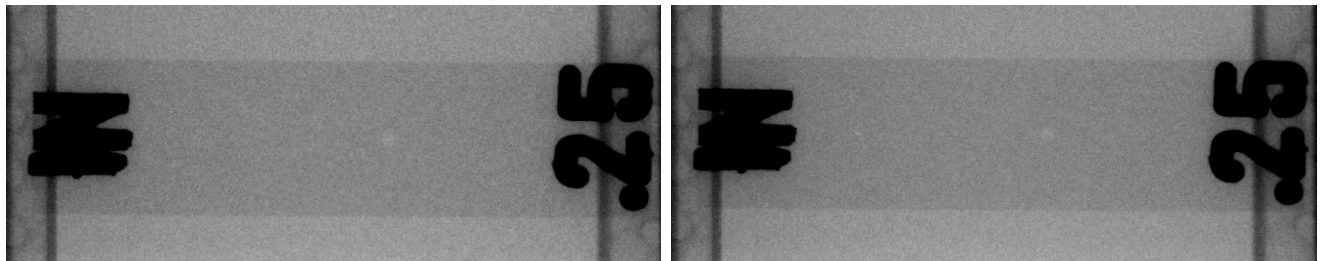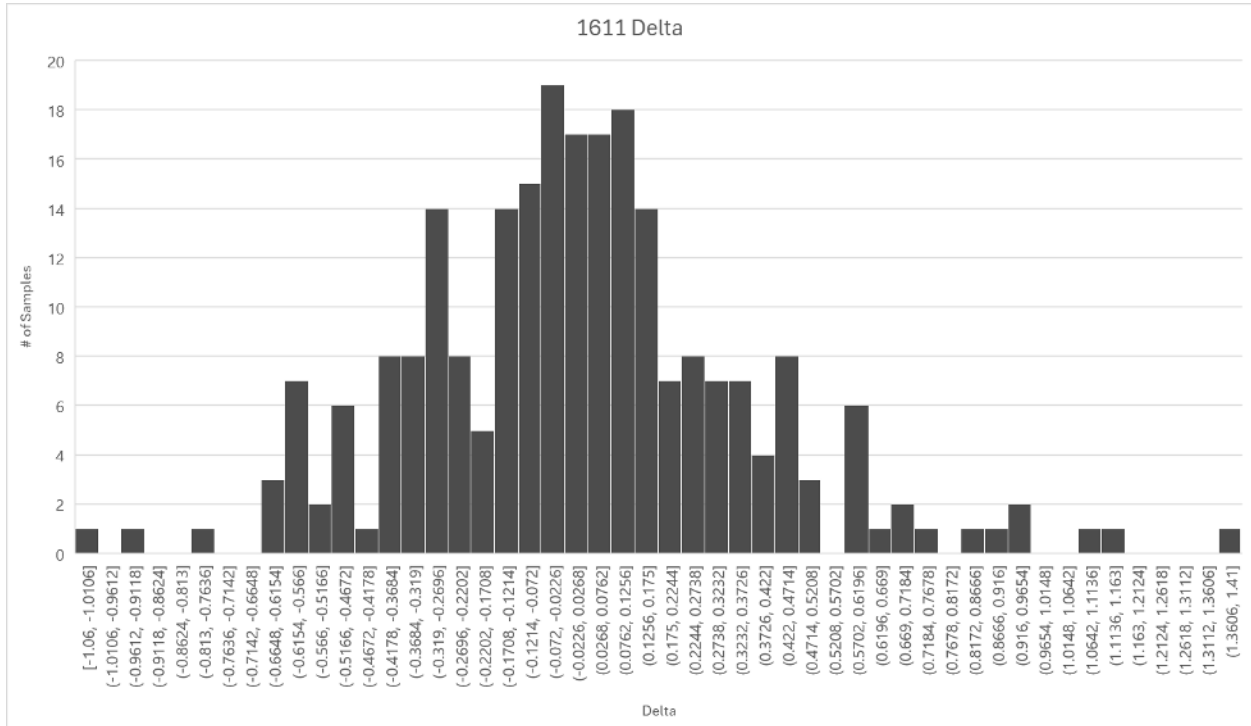
Visual Acuity Example between image containing a 2.18 2-T CNR (Left) and 3.34 2-T CNR (Right)

Visual Acuity Example between image containing a 2.17 2-T CNR (Left) and 2.57 2-T CNR (Right)