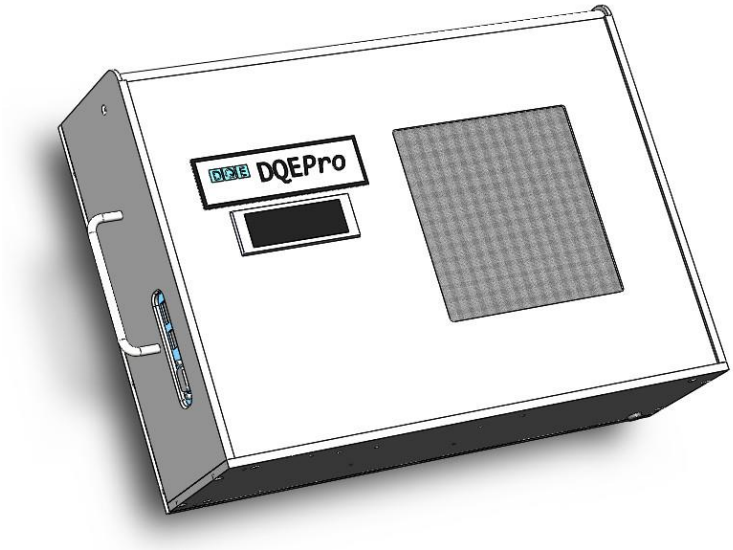
DQE instruments

DQE*Pro*

Radiography DQE Sample Report

- Wireless panel with poor performance due to short integration window
- Clinical-environment testing



DQE Instruments Inc., London, Canada
www.dqeinstruments.com

This report was generated automatically by DQE*Pro*. It summarizes the MTF and DQE performance of a clinical CsI-based flat-panel detector. The full DQE assessment was completed in 15 minutes in the x-ray room of a busy clinical department.

Observations:

1. The linearity test showed the system saturated at 75 μGy (8.6 mR), corresponding to a 1-sec exposure. This is a wireless detector with a preset integration window of 0.5 sec (a common value). The detector stops acquiring the image at 0.5 sec causing the pixel value to be flat (at 1290) even as the exposure continues. This is a serious problem with many wireless systems.

Conclusions:
Wireless detectors must be checked for adequate exposure window settings. In this example, the default window was too short, resulting in poor image quality and high patient exposures with large patients. This problem is particularly acute with low-mA generators. It can be avoided by increasing the exposure window setting.

Linearity Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

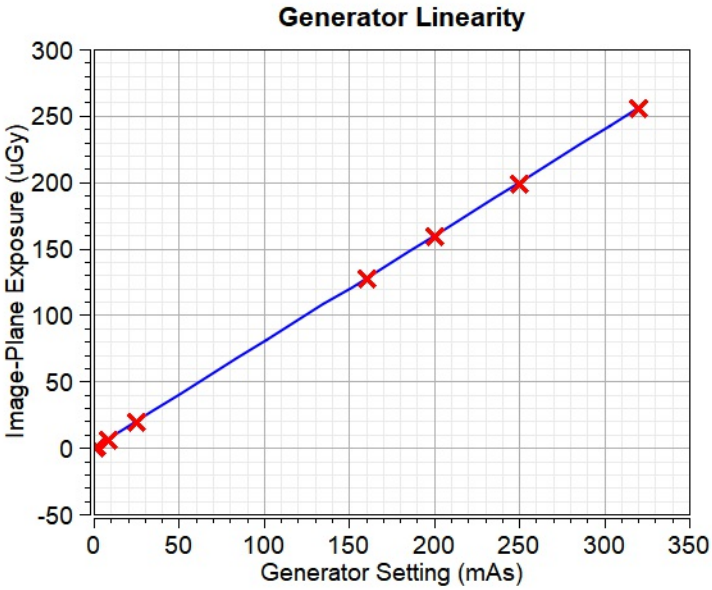
X-ray spectrum:
Half-value layer: 7.1 mm Al
Best fit: SaturatedLinear
Nominal image air KERMA, exposure: 1.05 uGy, 0.120 mR
Average open pixel value (DV): 0.0
Average dark pixel value (DV): DVd = 0.0
Estimated saturation exposure time: 0.9 sec
Estimated saturation exposure: 75.0 uGy 8.6 mR

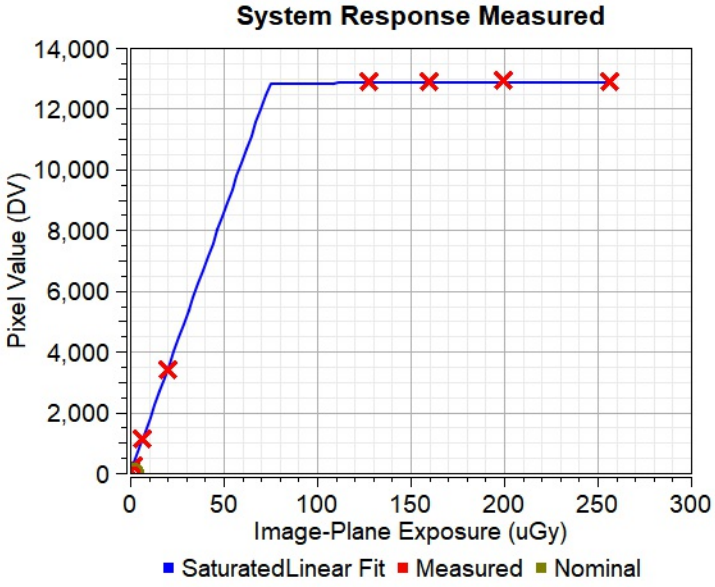
This system has a saturated linear response. Linearization is not possible.

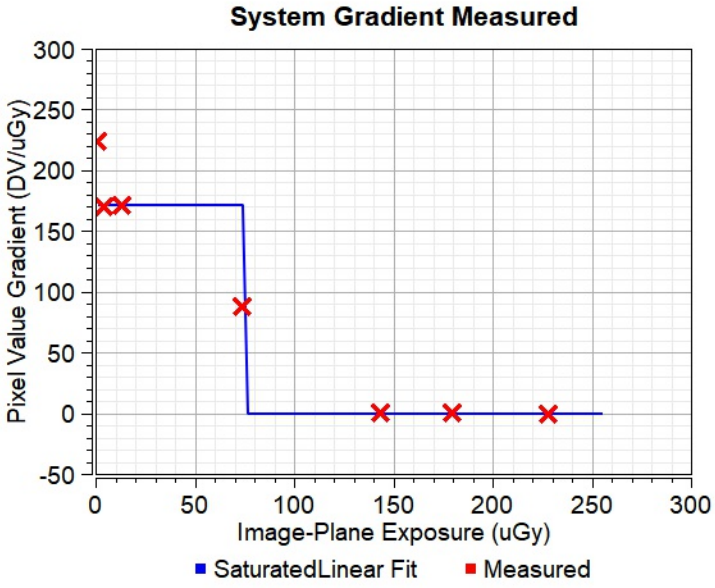
Linearization accuracy will be improved by modifying the protocol to ensure at least three exposure levels are below the nominal exposure (0.12 mR, 1.0 uGy).

The measured slope (gradient) of the system response is neither all positive nor all negative. This generally means non-linear post-processing such as auto windowing or histogram equalization has been applied to the image.

Detector output saturates at approximately 0.9 sec of exposure (75.0 uGy, 8.55 mR). This may be due to inadequate detector integration window and will prevent correct operation with large patients. DQE cannot be determined. Increasing integration window to 3.3 sec or more may solve this problem.







Quantum Noise Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

X-ray spectrum:
Half-value layer: 7.1 mm Al
Number of ignored pixels in ROI signal calculation: 0 of 860160
Dark noise variance from analysis: 0.0
Dark noise variance from analysis if linearized: 0.0
Quantum-noise limit exposure: could not be determined

This system saturated (overexposure) and therefore the quantum-noise limit can not be determined.

Two or more images were acquired at only 0 different non-zero mAs settings in the linearity test. This is too few to complete the quantum noise analysis. Two or more images must be acquired at each of at least 5 different non-zero mAs settings.

The quantum-noise limit could not be determined because no dark images were acquired. To determine the quantum noise limit, ensure at least 2 dark images or 2 x-edge images are acquired.

The quantum limit analysis could not be completed because dark image pixel variance is zero.

The quantum-noise limit can not be determined because measured dark noise is greater than the lowest-mAs noise. This is not physical and could be caused by detector instability or some other problem with image data.

Quantum noise limit could not be determined. Be sure your images are free of artifacts and at least two images are acquired at each exposure level.

Waveform Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

Data folder: \Users\DQE\data

These waveforms show x-ray exposure profiles measured by DQEPro. Green line segments correspond to identified exposure pulses. Leading and trailing baselines are dark blue and inter-pulse baselines are light blue. The first pulse should start at 0 sec. Ensure pulses are correctly identified and free of undesirable artifacts that may indicate problems with the x-ray generator or tube. Exposure values correspond to image plane based on Pro-image distance entered on panel. Double-click on any waveform to open a review window.

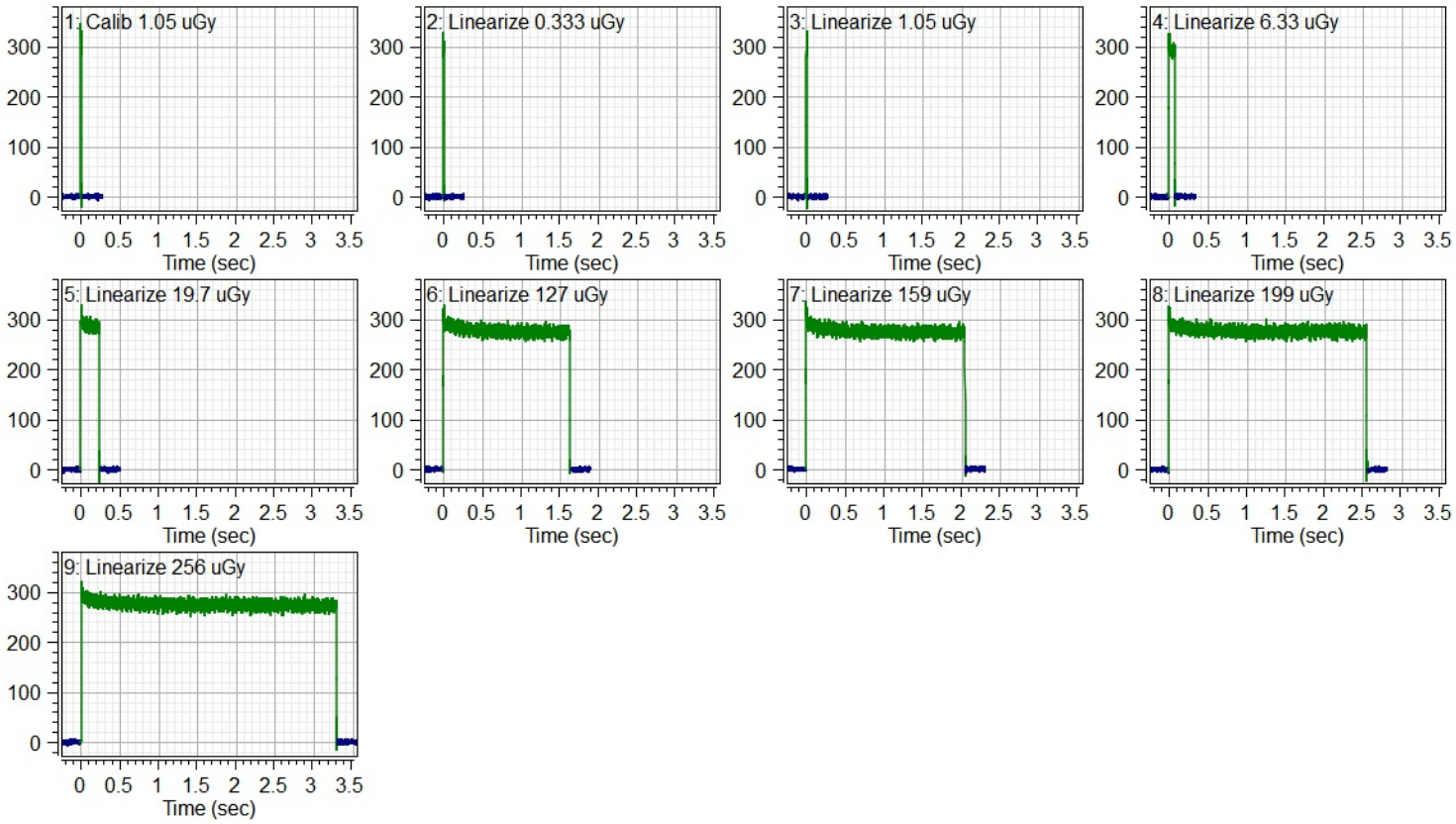


Image Details Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

Image data folder: \Users\DQE\data\images

	FileName	Format	Width	Height	Depth	bits	kV	mA	msec	mAs	SID	Pixel um
1:	11__45_212.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
2:	11__45_213.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
3:	11__45_214.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
4:	11__45_215.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
5:	11__45_216.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
6:	11__45_217.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
7:	11__45_218.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]
8:	11__45_219.raw	vw2560x307	[2560	3072	1]	0	0	0	0	0.0	0	[0 0]

ROI Thumbnail Report

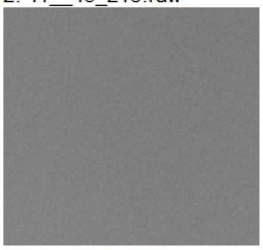
DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

Image data folder: \Users\DQE\data

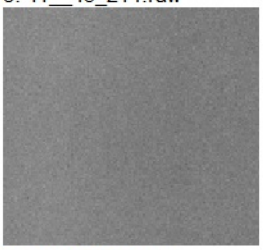
These images are thumbnail illustrations of each image. For dynamic systems, only the first few images are shown for each exposure. Ensure each image is free of undesirable artifacts that may indicate problems with the x-ray system. Double-click on thumbnail to open review window.

1: 11__45_212.raw

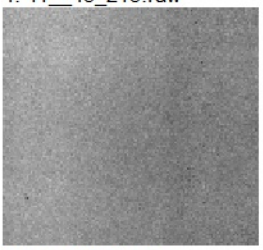
2: 11__45_213.raw



3: 11__45_214.raw



4: 11__45_215.raw



5: 11__45_216.raw

6: 11__45_217.raw

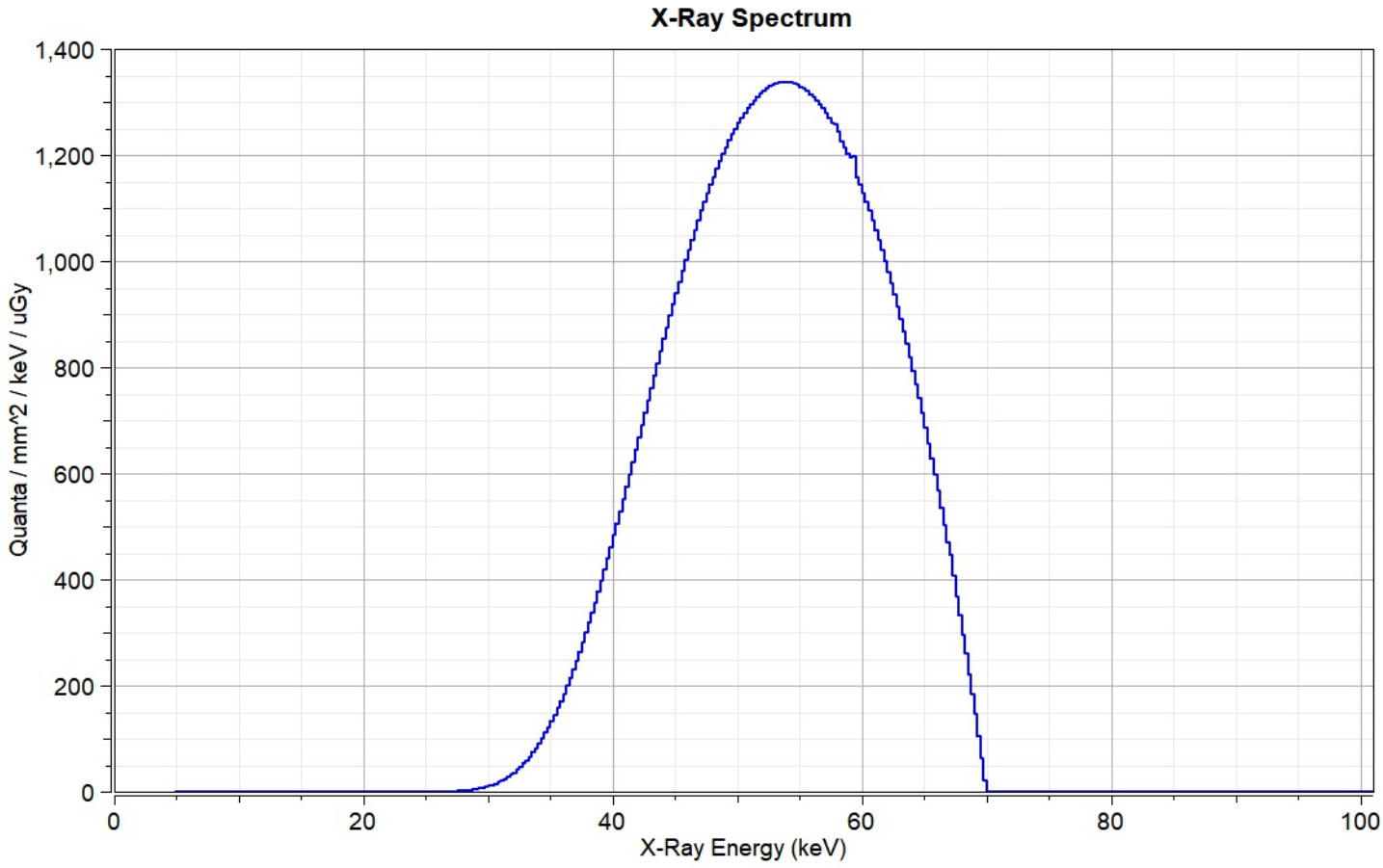
7: 11__45_218.raw

8: 11__45_219.raw

X-Ray Spectrum Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

X-ray spectrum: Radiography, RQA-5 (70 kV)
Target material: W
Set kV: 74
Set mAs: 1.25
Half-value layer: 7.1 mmAl
Mean photon energy: 53.1 keV
Spectrum Q_o: 30.2 q/mm^2/nGy



Message Summary Report

DQEPro 4.7.0-rc7 00000000
DQE Instruments
Study: Fri 07 Dec 2018 11:46:59
Analysis: Fri 07 Dec 2018 11:47:08

Study comment: Sample study
DQEPro acquistion version: 4.3.4-rc1, Mac64 10.8 (Mountainlion) hostname username
DQEPro analysis version: 4.7.0-rc7, Windows-64bit Windows 10 Cunningham-spectre icunning
DQEPro hardware version: 2.3, 000000
DQEPro firmware version: 2.18.5
Grid:
X-ray spectrum: Radiography, RQA-5 (70 kV)
Half-value layer: 7.1 mmAl
Set technique: 74 kV, mA not specified, 1.3 mAs
Air Temperature and Pressure: 24.9 C, 103.8 kPa
Waveform sampling rate: 4.0 kHz
Image-plane exposure, air KERMA: 0.120 mR, 1.05 uGy
Source-image distance: 143.0 cm (DQEPro)
Specified DQEPro-image distance: 1.0 cm
DQEPro-image distance: 1.0 cm (Specified by user)
Pixel size from image headers, x y: NA
System response: SaturatedLinear
Data Folder: \Users\DQE\data
Image Folder: \Users\DQE\data\images

Warnings:
1: Linearization accuracy will be improved by modifying the protocol to ensure at least three exposure levels are below the nominal exposure (0.12 mR, 1.0 uGy).

2: The measured slope (gradient) of the system response is neither all positive nor all negative. This generally means non-linear post-processing such as auto windowing or histogram equalization has been applied to the image.

3: Detector output saturates at approximately 0.9 sec of exposure (75.0 uGy, 8.55 mR). This may be due to inadequate detector integration window and will prevent correct operation with large patients. DQE cannot be determined. Increasing integration window to 3.3 sec or more may solve this problem.

4: This system saturated (overexposure) and therefore the quantum-noise limit can not be determined.

5: Two or more images were acquired at only 0 different non-zero mAs settings in the linearity test. This is too few to complete the quantum noise analysis. Two or more images must be acquired at each of at least 5 different non-zero mAs settings.

6: The quantum-noise limit could not be determined because no dark images were acquired. To determine the quantum noise limit, ensure at least 2 dark images or 2 x-edge images are acquired.

7: The quantum limit analysis could not be completed because dark image pixel variance is zero.

8: The quantum-noise limit can not be determined because measured dark noise is greater than the lowest-mAs noise. This is not physical and could be caused by detector instability or some other problem with image data.

9: Quantum noise limit could not be determined. Be sure your images are free of artifacts and at least two images are acquired at each exposure level.

10: Images were saved in a non-dicom format. This means we cannot confirm "For Processing" or "Raw" images are used and that only linear post processing has been applied to image data according to NEMA standard XR 27-2012. The user must ensure only linear processing has been used to ensure IEC accuracy in results. In particular, noise-suppresion algorithms and lossy compression may cause unpredictable results and must not be used.