APPLICATION NOTE

Fixed Pattern Noise Correction on Alvium G5 Cameras

Scope

This document explains what fixed pattern noise (FPN) is and how the fixed pattern noise correction (FPNC) is calibrated on Alvium G5 cameras.

What is fixed pattern noise?

Some pixels on a sensor produce brighter intensities than the neighboring pixels. This spatial non-uniformity is called fixed pattern noise. It becomes visible on images acquired in the dark. Inaccuracies in the pixel geometry and the sensor electronics create this effect.

FPN is a high-frequency signal overlaying the image signal. It increases with temperature and exposure time. Though non-uniformities can occur on any individual pixel, issues apply typically to columns, due to readout and amplification. Different sensors have individual characteristics. FPN divides into:

Illumination	Defect	Description
Dark image	Dark signal non-uniformity (DSNU)	Spatial variation of the dark signal
Bright image	Photo response non-uniformity (PRNU)	Spatial variation of the sensitivity

Example images

The following images show an ideal image (1), column noise and row noise (2), and pixel noise (3):
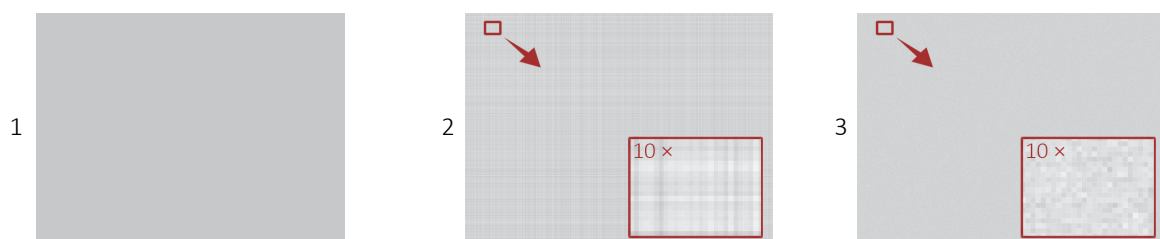

Figure 1: Ideal image and images with noise

How are Alvium G5 cameras calibrated for FPNC?

The FPNC on Alvium G5 cameras strives to correct FPN without damaging image details. All Alvium G5 cameras are factory calibrated using the following workflow. Depending on the dominant FPN of the sensor, either row or column noise is being corrected. The following example relates to columns.

For all calibration steps, numerous images are averaged to compensate for temporal noise. In reality all columns of a sensor are corrected, the example shows the photo response of two averaged columns:
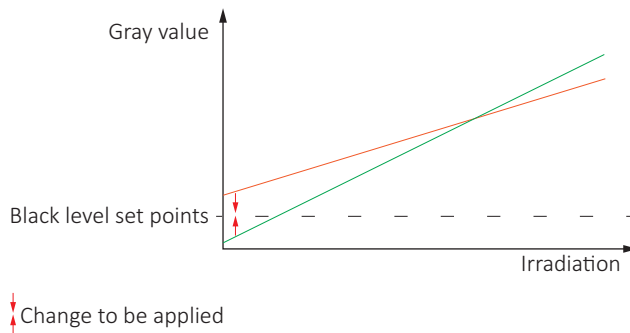

Figure 2: Image before correction with two columns. Black level and slope differ.

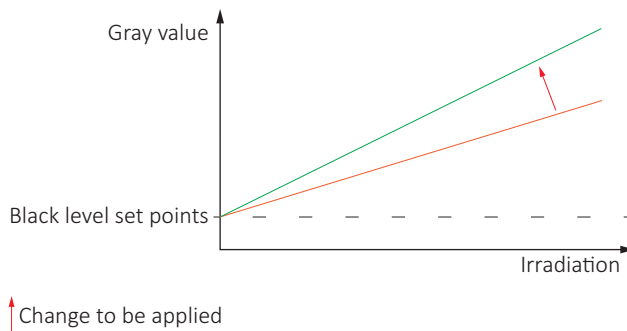1. Dark image: DSNU parameters are calculated.

Figure 3: DSNU corrected image. Black level has been aligned, slope differs.

2. Bright image: PRNU parameters are calculated.
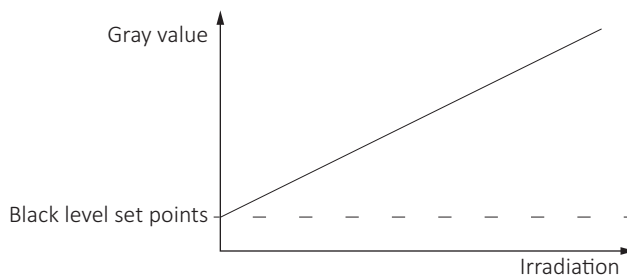3. The corrections align different black levels and slopes.

Figure 4: PRNU corrected image. The columns show equal photo response.

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