G3-ANCL04-V1: Genie Nano-CL Application Note

In-Camera Flat Line & Lens Shading Correction Calibration Procedure

Part numbers: G3-CM10-M4095, G3-CM10-M5105 & G3-CM10-M510550
(using any firmware version — 10-Tap/8-Tap/3-Tap)

Overview

This application note for Genie Nano-CL Camera Link cameras (16M and 25M models using OnSemi Python sensors) describes the procedures for Flat Line calibration and Block Lens Shading calibration, which are performed by the user in the field.

The user calibrated set of correction coefficients is used then to provide a consistent automatic correction to sensor or lens deficiencies. Flat Line correction coefficients mathematically smooth out pixel variations and even replace dead pixel data to provide improved overall sensor quality.

These two procedures use Sapera LT and the CamExpert tool provided. A Teledyne DALSA Camera Link frame grabber was used to control and capture image data from the Nano-CL. The camera used for screen shots is the Nano-CL 25M (5120x5120).

Flat Line Correction Overview

Camera sensors pixel columns have slight signal differences due to inherent electrical variations in the column readout circuits, even when exposed to perfectly uniform illumination. This procedure samples a center horizontal band of the sensor to analyze the column variations and produce a Flat Line correction coefficients set.

Lens Shading Correction Overview

The term "shading" describes the characteristic of a lens which typically reduces the amount of light transmission towards the edges of an image relative to the center of the image. A simple example would be lens vignetting when a lens image circle is too small for the sensor, but also includes cases where a lens of lessor quality does not transmit light equally through its edges as compared to its center. Shading correction coefficients mathematically equalize sensor data, compensating for any lens errors.

Preparations before executing the Calibration Procedures

- Install Sapera LT, a Teledyne DALSA frame grabber and a Nano-CL.
- Update the frame grabber driver and Nano firmware if required.
- Start CamExpert, configure the frame buffer size, sensor geometry and apply power to the Nano.
- Test with a live acquisition. Refer to Nano-CL or CamExpert documentation if required.
1. Calibration Procedure for Flat Line Correction

This procedure sets the active acquisition area to a band of rows across the center of the sensor to eliminate possible lens shading effects in the corners of the rectangular sensor.

**Camera & Frame Grabber Setup**

- Set the camera Image Format Controls to the following values and also set the Frame Grabber Buffer Format to match.
  (Horizontal Offset=0, Width=5120, Height=1696, Vertical Offset=1696).
• Disable the Lens Shading Correction feature at this time. This must be off for Flat Line calibration.

**Flat Line Correction Calibration**

The Flat Field Correction category as shown in the following screen capture has the features required for a dark and bright calibration.

• Set the Flat Field Correction Mode feature to Calibration.
• Set the Flat Field Correction Current Active Set feature to User Flatfield1.
• Clear the flat line coefficients by clicking the Button Reset Calibration.
• Reduce the exposure time, close the lens iris and cover the lens with a lens cap to ensure that no light reaches the sensor.
• Execute the Flat Field Correction Calibration Dark function with a click of the button.
• Remove the lens cap and aim the camera at white paper or a white wall that’s evenly lit. Adjust the iris and exposr time for a bright image acquisition, that’s around 80% saturation (about 0xCC pixel value over most of the image). A clean lens and sensor is required for proper calibration.
• Set the Flat Field Calibration Target to 204DN.
• Execute the Flat Field Correction Calibration Bright with a click of the button.
• Click on Save Calibration to store the coefficients in User FlatField1.
• Return the frame grabber image buffer and camera acquisition settings back to the full sensor size of the camera used (in this example 5120x5120).
• Set the Flat Field Correction Mode feature to Active. The user can choose either the User Flatfield1 or factory coefficients, as required.
2. Calibration Procedure for Lens Shading Correction

This procedure sets the active acquisition area to the complete sensor acquisition area (in this example the Nano-CL 25M is 5120x5120).

**Camera & Frame Grabber Setup**

- Set the camera Image Format Controls to the following values and also set the Frame Grabber Buffer Format to match.
Before performing the shading correction calibration, verify that the Flat Field Correction Mode feature is Active.

Lens Shading Correction Calibration

The Lens Shading Correction category as shown in the following screen capture has the features required for a dark and bright calibration.

- Set the Lens Shading Correction Mode feature to Calibration.
- Set the Lens Shading Correction Current Active Set to User Shading Coefficients 1.
- Clear the Lens Shading Coefficients by clicking the Button Reset Coefficients.
- Reduce the exposure time, close the lens iris and cover the lens with a lens cap to ensure that no light reaches the sensor.
- Execute the Lens Shading Correction Calibration Dark function with a click of the button.
- Remove the lens cap and aim the camera at white paper or a white wall that's evenly lit. Adjust the iris and exposor time for a bright image acquisition, that’s around 80% saturation (about OxCC pixel value over most of the image). A clean lens and sensor is required for proper calibration.
- Execute the Lens Shading Correction Calibration Bright with a click of the button.
• Click on *Save Calibration* to store the coefficients in *User Shading Coefficients 1 (or 2)*

• To enable the *Lens Shading Correction Mode* feature select the *Active mode*. The user can then choose either the *User Shading Coefficients 1 or 2* or factory coefficients, as required.