

EMVA 1288 Datasheet

This datasheet describes the specification according to the standard 1288 Standard for Characterization and Presentation of Specification Data for Image Sensors and Cameras of European Machine Vision Association (EMVA) (See www.standard1288.org).

Vendor	Teledyne IIS	Overlap capabilities	Yes
Model	Dragonfly S DR-U3-50S4C	Maximum readout rate	46.08
Firmware	2511.1.11.0	Dark current compensation	Yes
Data type	Single, typical	Interface type	USB3
Sensor type	CMOS	Light source	Integrating sphere
Diagonal	8.89	Light source non uniformity	< 0.16%
Lens category	C-Mount	Irradiation calibration accuracy	3%
Resolution	2448x2048 pixels	Standard version	4.0
Pixel size	2.74x2.74 μm		
Shutter type	Global Shutter		

Operation Point: **Red channel** (Page 3)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	627.7 nm
Exposure minimum	42.0 us
Exposure maximum	9438.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Operation Point: **GreenRed channel** (Page 12)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	523.0 nm
Exposure minimum	42.0 us
Exposure maximum	7598.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Operation Point: **GreenBlue channel** (Page 21)

Camera setting

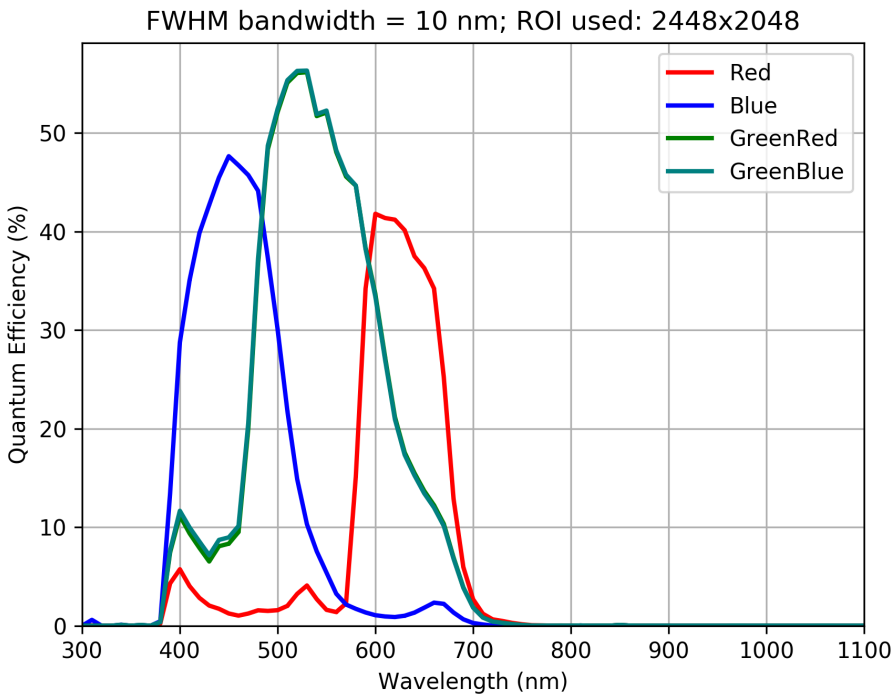
Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	523.0 nm
Exposure minimum	42.0 us
Exposure maximum	7598.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Operation Point: **Blue channel** (Page 30)

Camera setting		Operation point parameters	
Pixel Format	BayerRG16	Wavelength	456.9 nm
High Conversion Gain	Off	Exposure minimum	42.0 us
Gain	0.0	Exposure maximum	8576.0 us
Black level	0.10	Exposure steps	50
ADC bit depth	12	Variation of Irradiation	Constant illumination with variable exposure time
Device Temperature	49.38 °C		



Summary sheet for Operation Point: **Red channel** (@627.7 nm wavelength)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	627.7 nm
Exposure minimum	42.0 us
Exposure maximum	9438.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Performance

Quantum efficiency

η 33.31 %

System gain

K 6.669 DN/e⁻
1/K 0.150 e⁻/DN

Temporal dark noise

σ_d 2.708 e⁻
 $\sigma_{y.dark}$ 18.065 DN

Signal-to-Noise Ratio

SNR_{max} 97
39.74 dB
6.6 bit
 SNR_{max}^{-1} 1.030 %

Absolute sensitivity threshold

$\mu_{p.min}$ 9.633 p
 $\mu_{p.min.area}$ 1.283 p/ μm^2
 $\mu_{e.min}$ 3.209 e⁻
 $\mu_{e.min.area}$ 0.427 e⁻/ μm^2

Saturation Capacity

$\mu_{p.sat}$ 28292 p
 $\mu_{p.sat.area}$ 3768.397 p/ μm^2
 $\mu_{e.sat}$ 9424 e⁻
 $\mu_{e.sat.area}$ 1255 e⁻/ μm^2

Dynamic Range

DR 2937
69.4 dB

Spatial Nonuniformities

$DSNU_{1288}$ 0.5 e⁻
 $DSNU_{1288.row}$ 0.3 e⁻
 $DSNU_{1288.col}$ 0.0 e⁻
 $DSNU_{1288.pixel}$ 0.3 e⁻
 $PRNU_{1288}$ 0.6 %
 $PRNU_{1288.row}$ 0.3 %
 $PRNU_{1288.col}$ 0.2 %
 $PRNU_{1288.pixel}$ 0.5 %

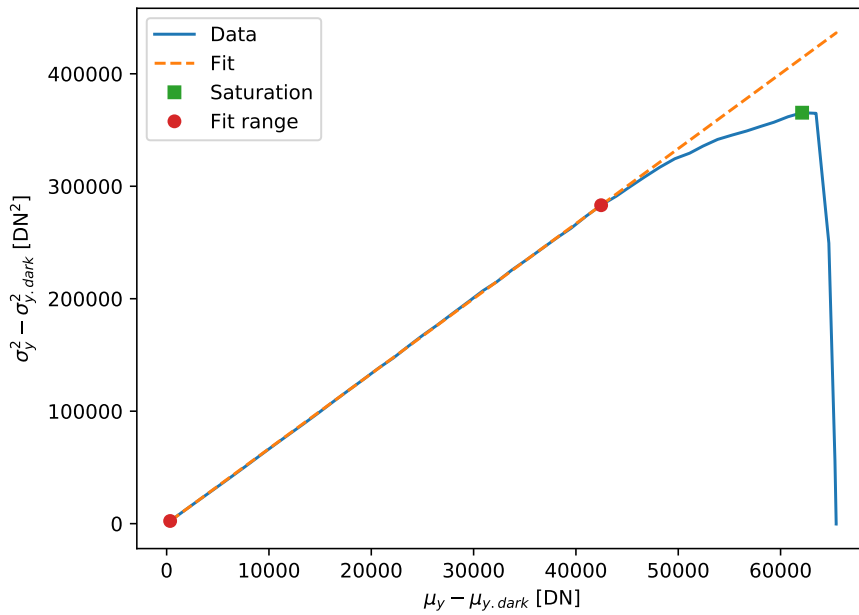
Linearity error

LE_{min} -0.598 %
 LE_{max} 0.148 %

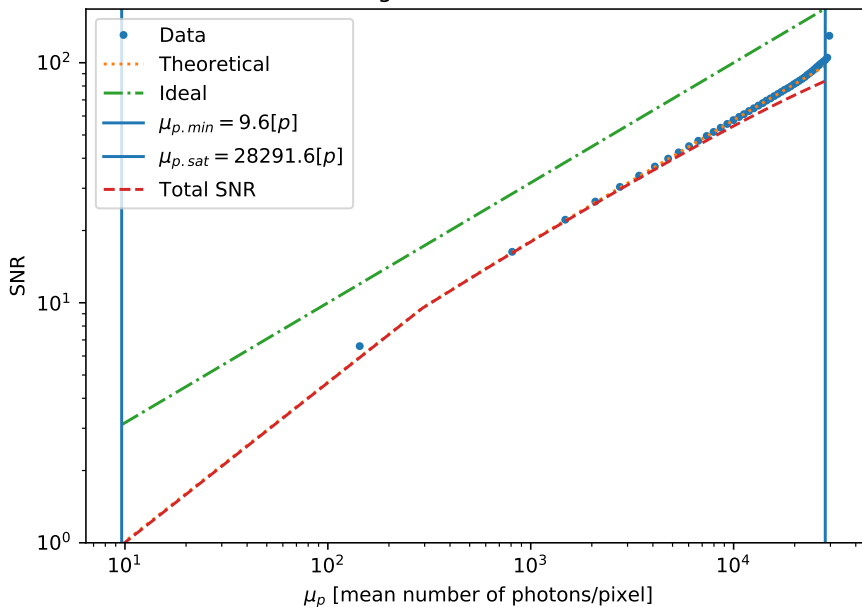
Dark current

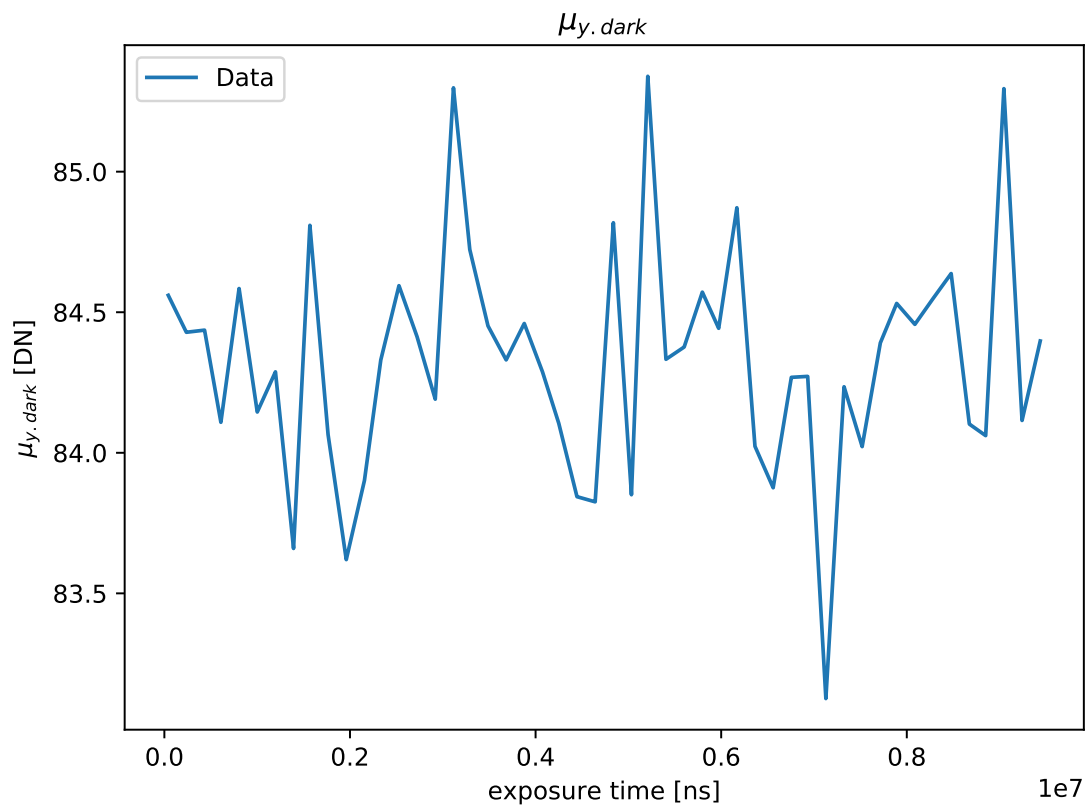
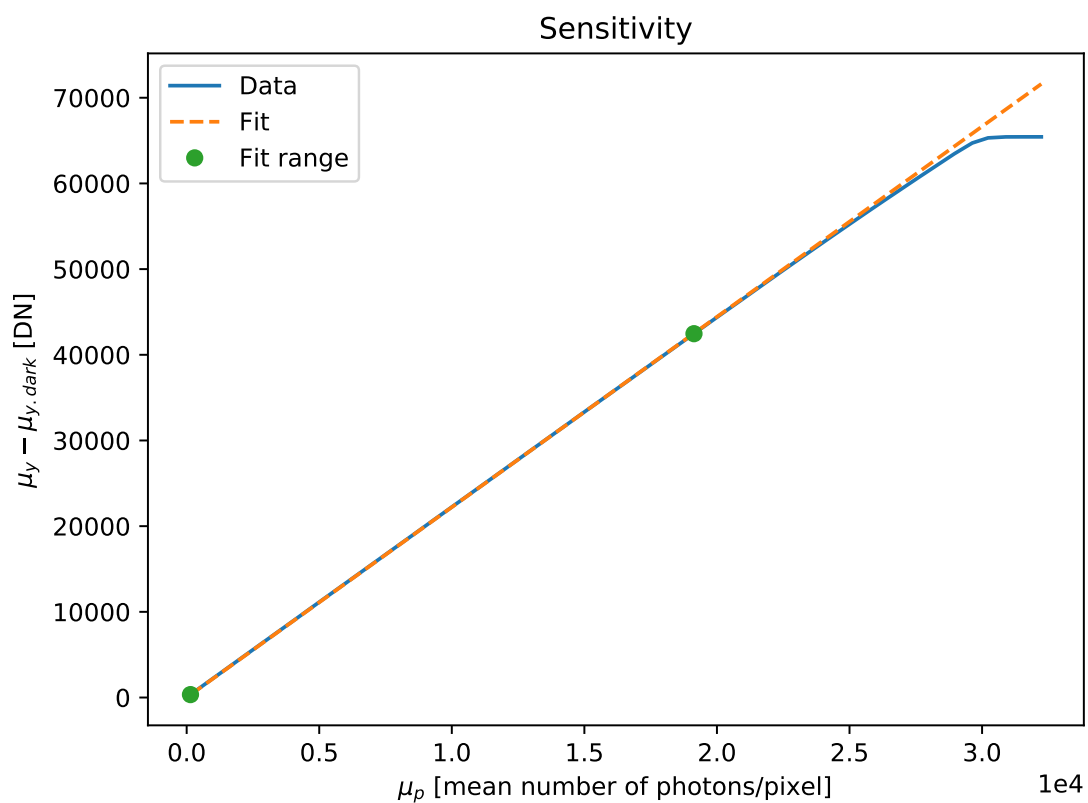
$\mu_{I.mean}$ 0.855 e⁻/s
5.701 DN/s
 $\mu_{I.var}$ -0.002 e⁻/s
-0.011 DN/s

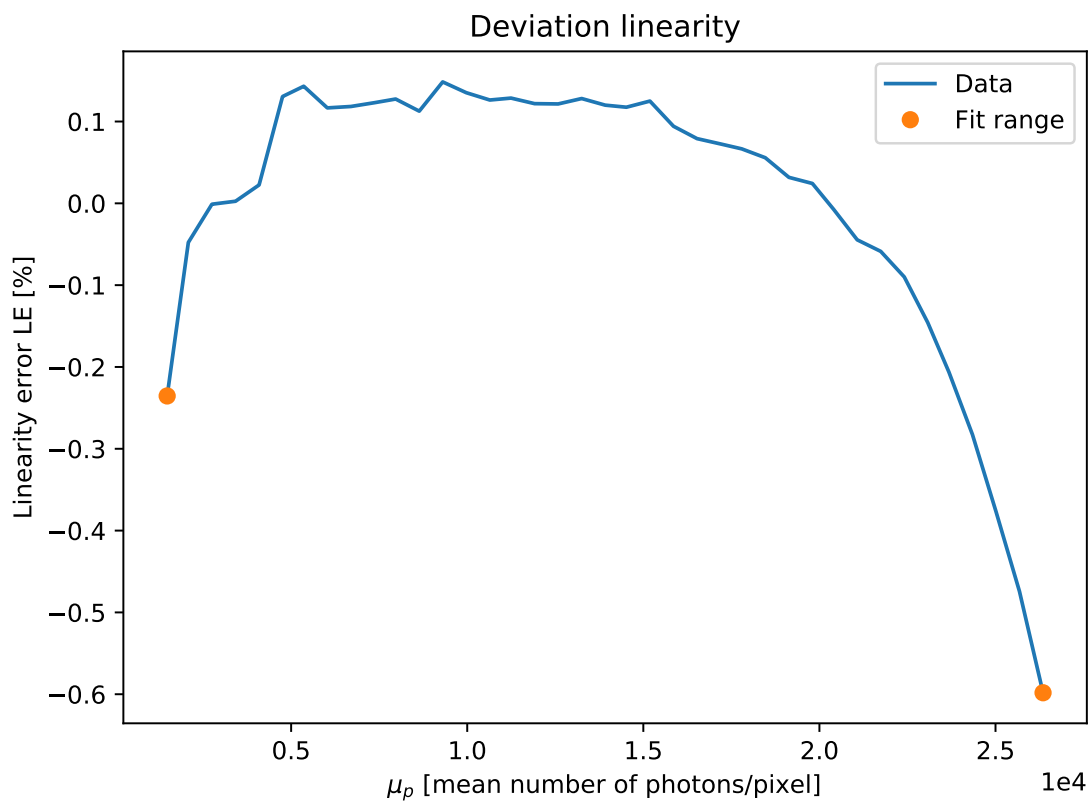
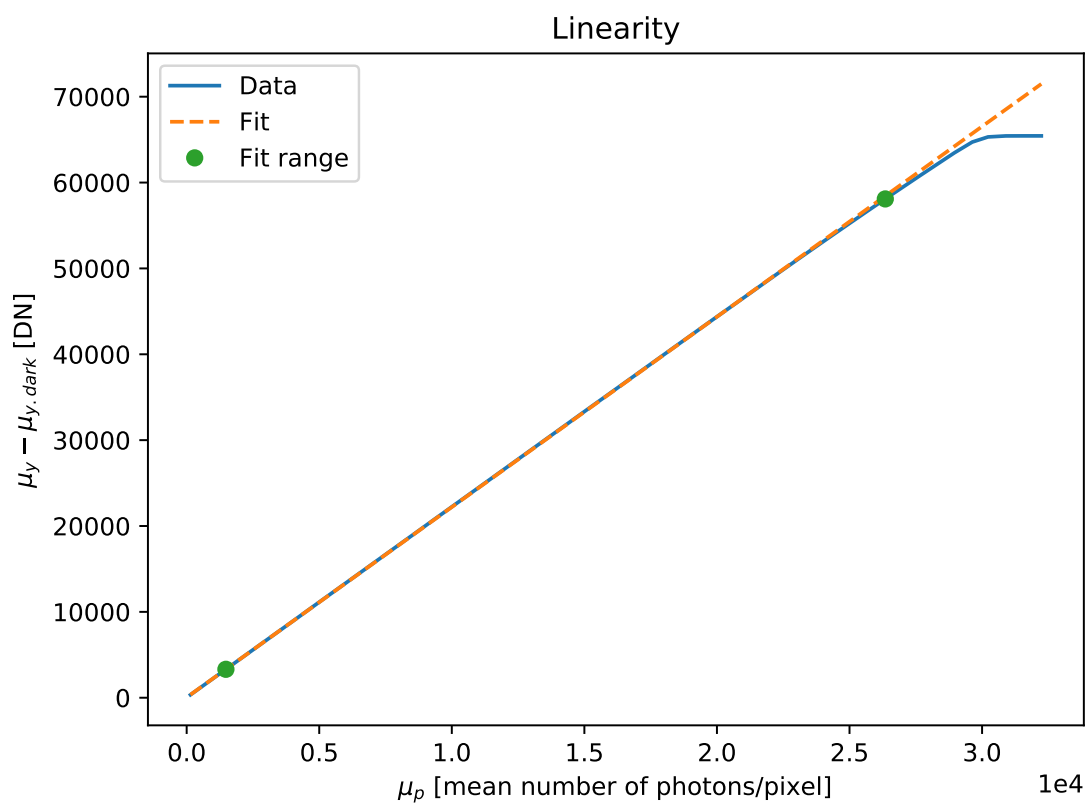
Photon Transfer

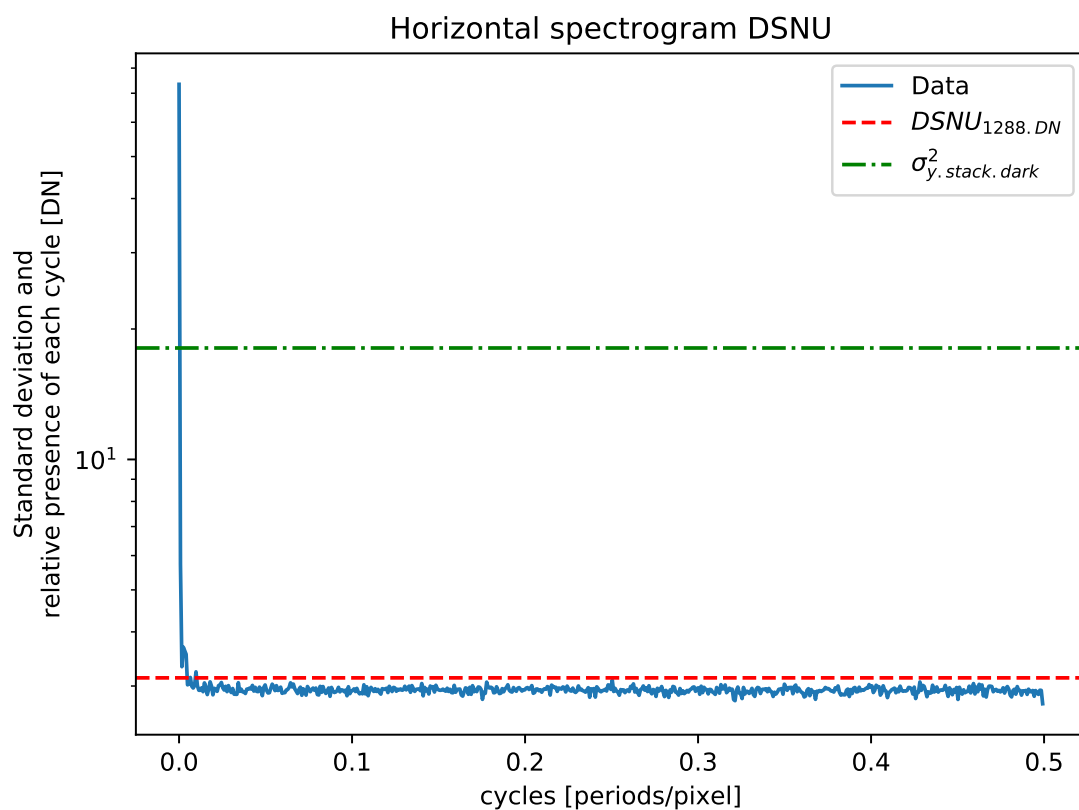
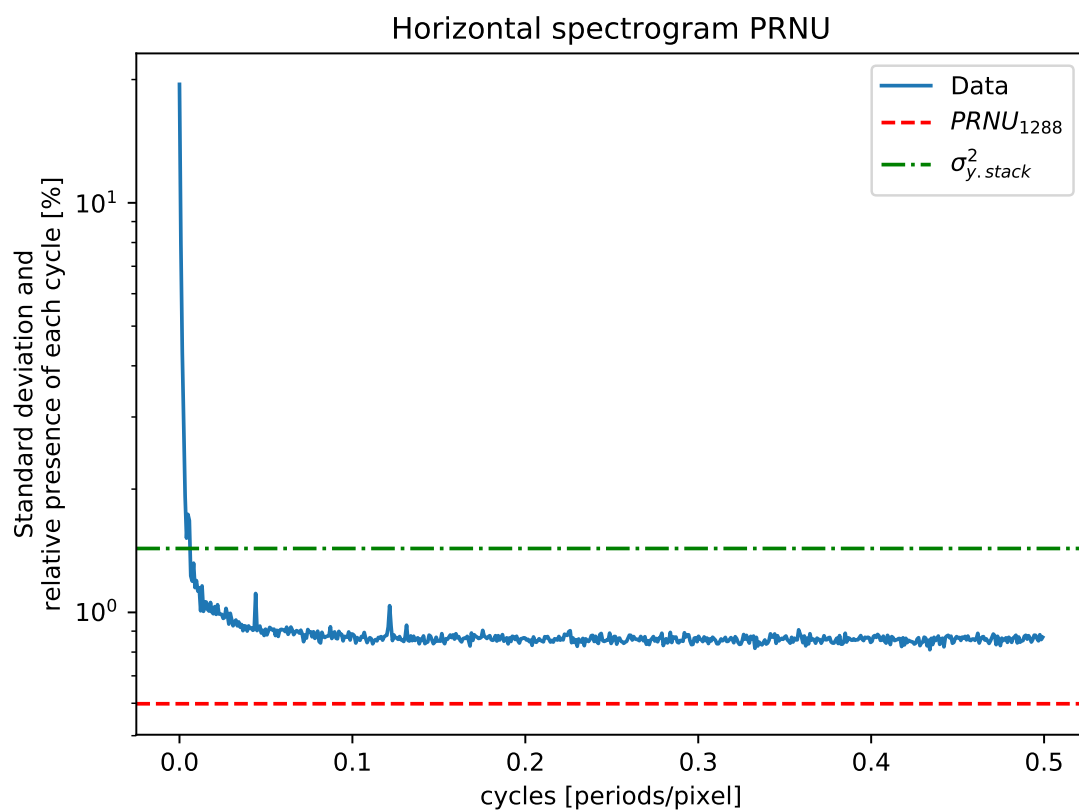


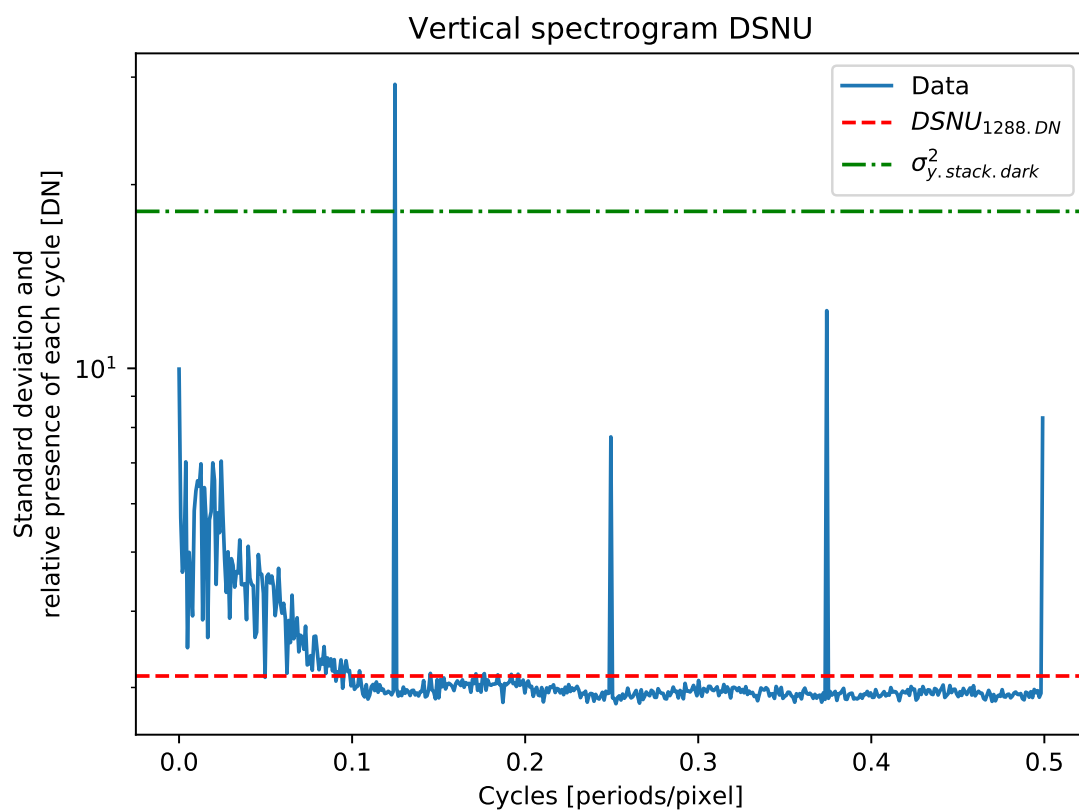
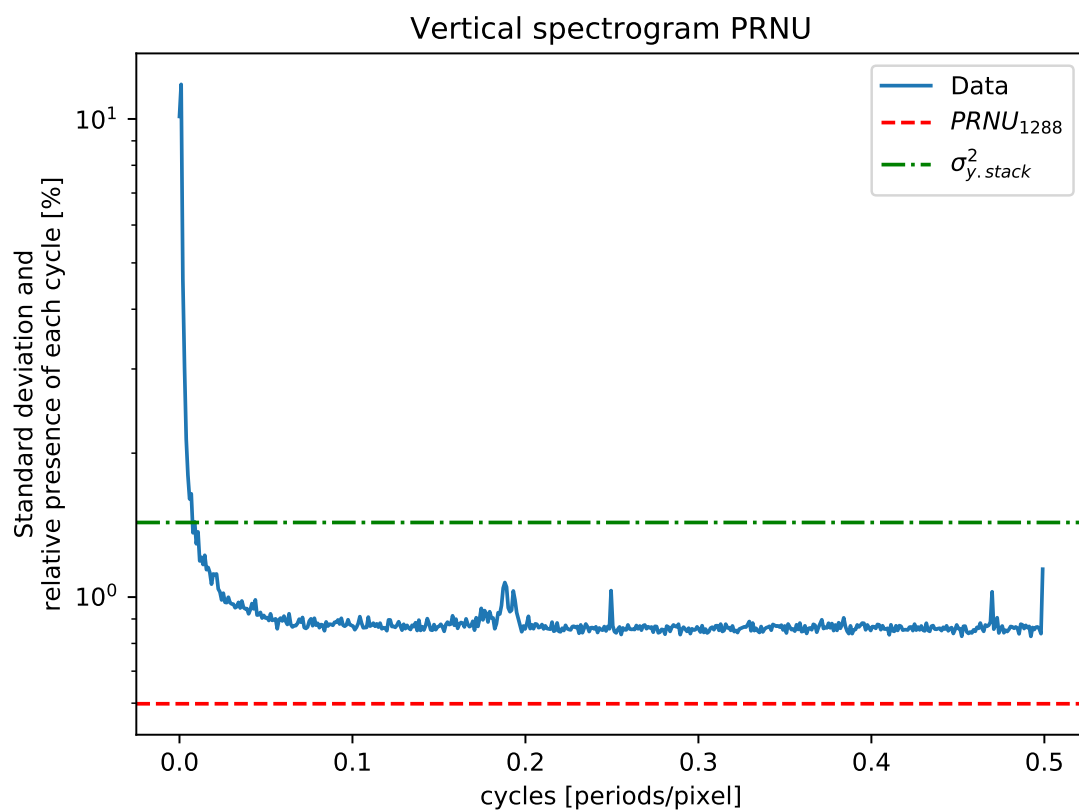
Signal to Noise Ratio

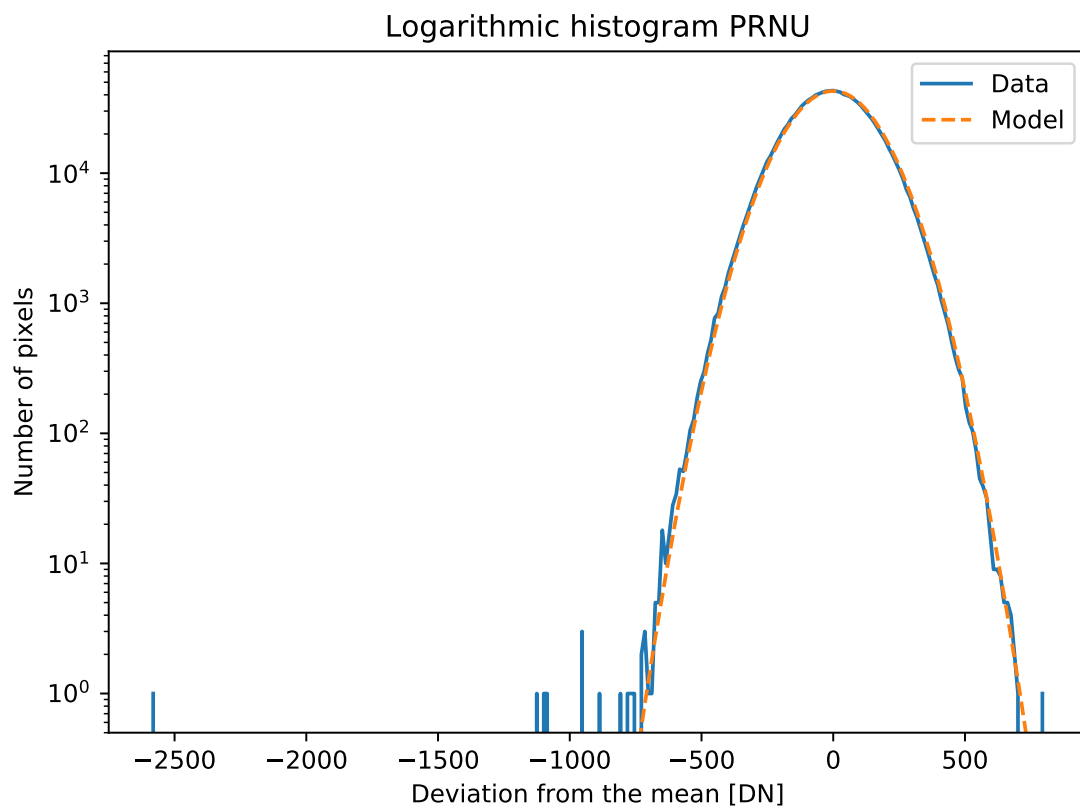
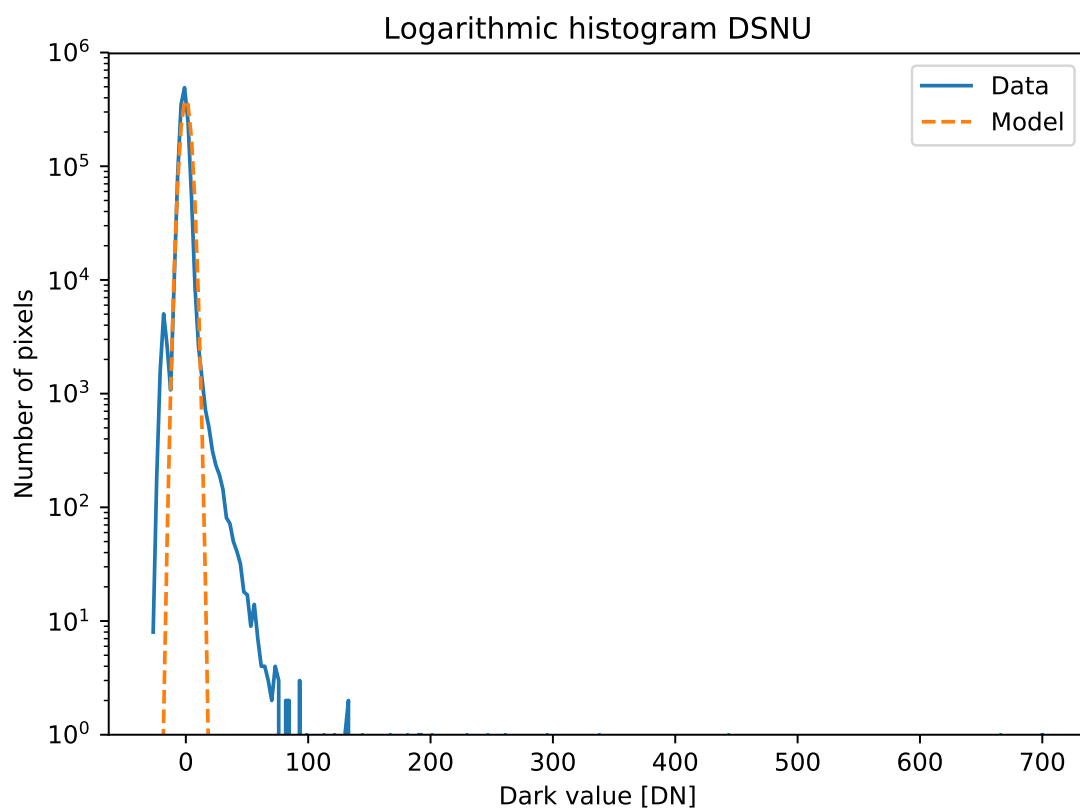


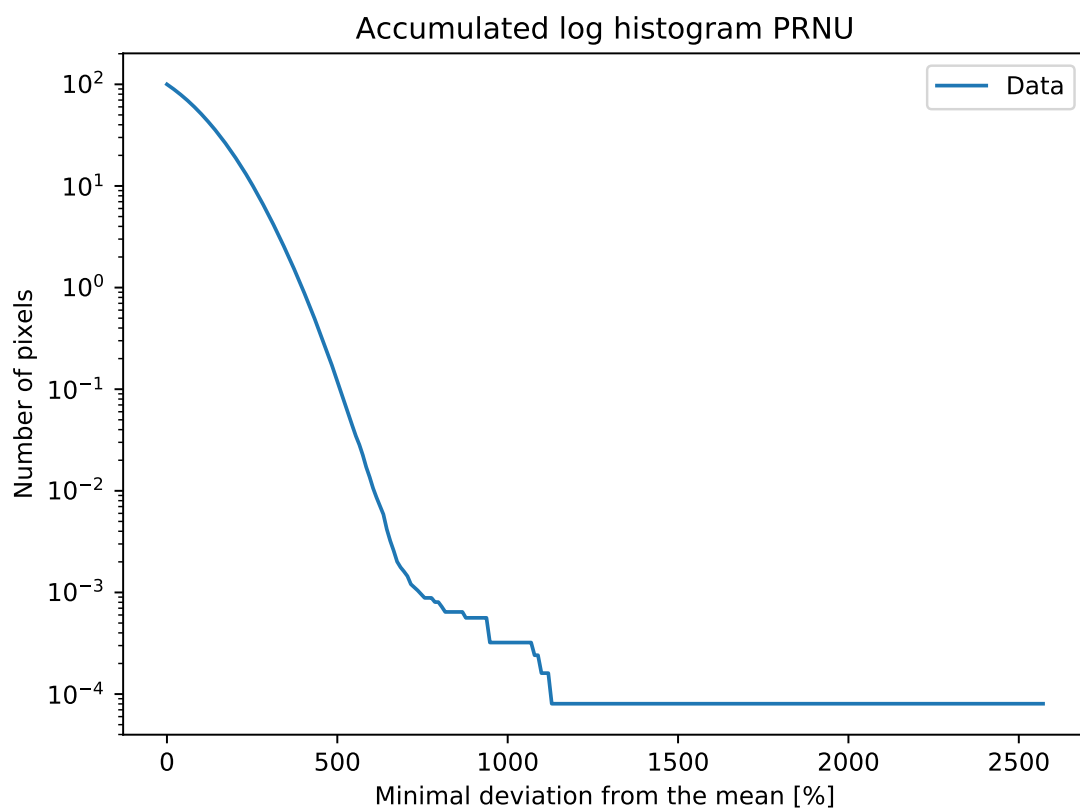
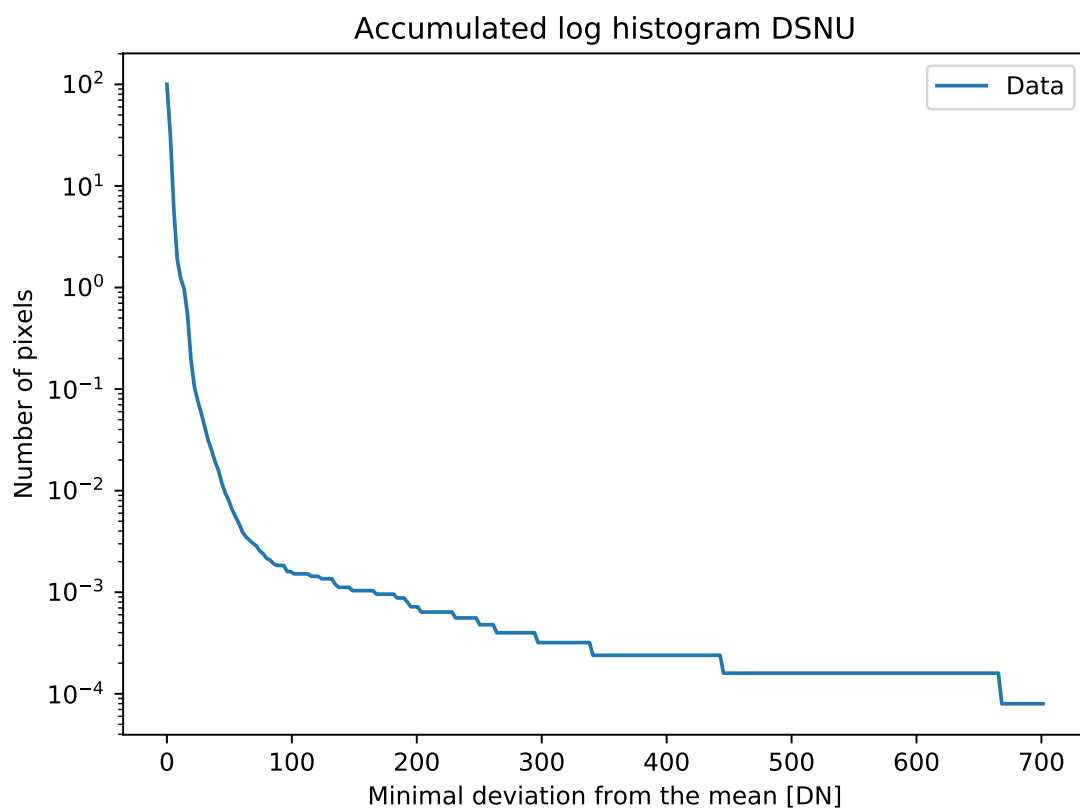


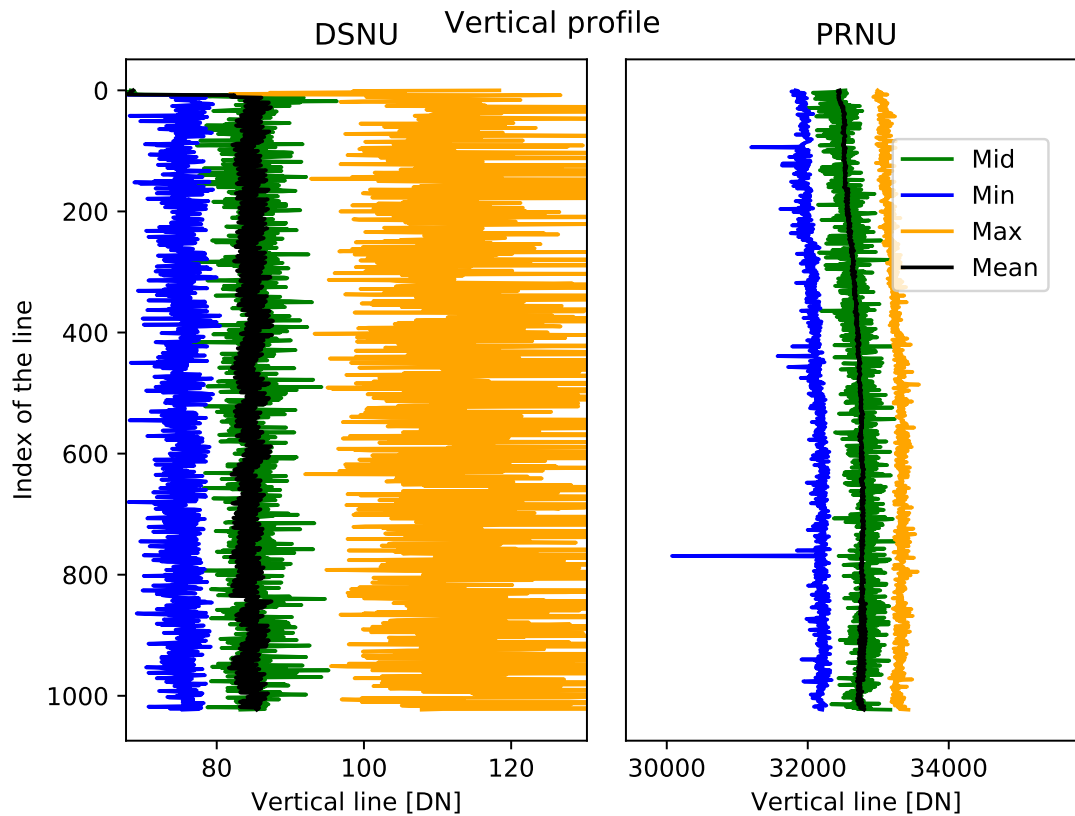
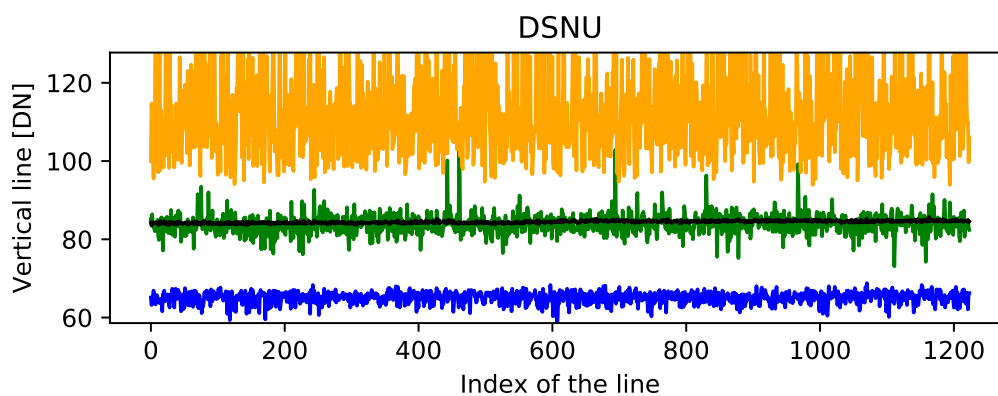
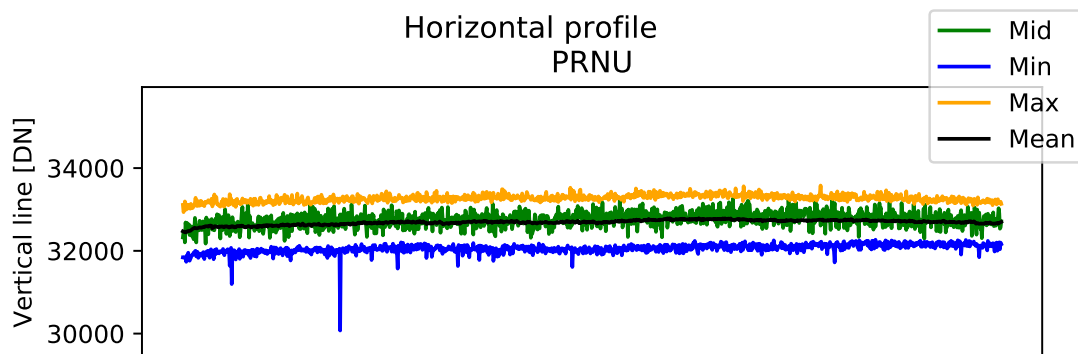


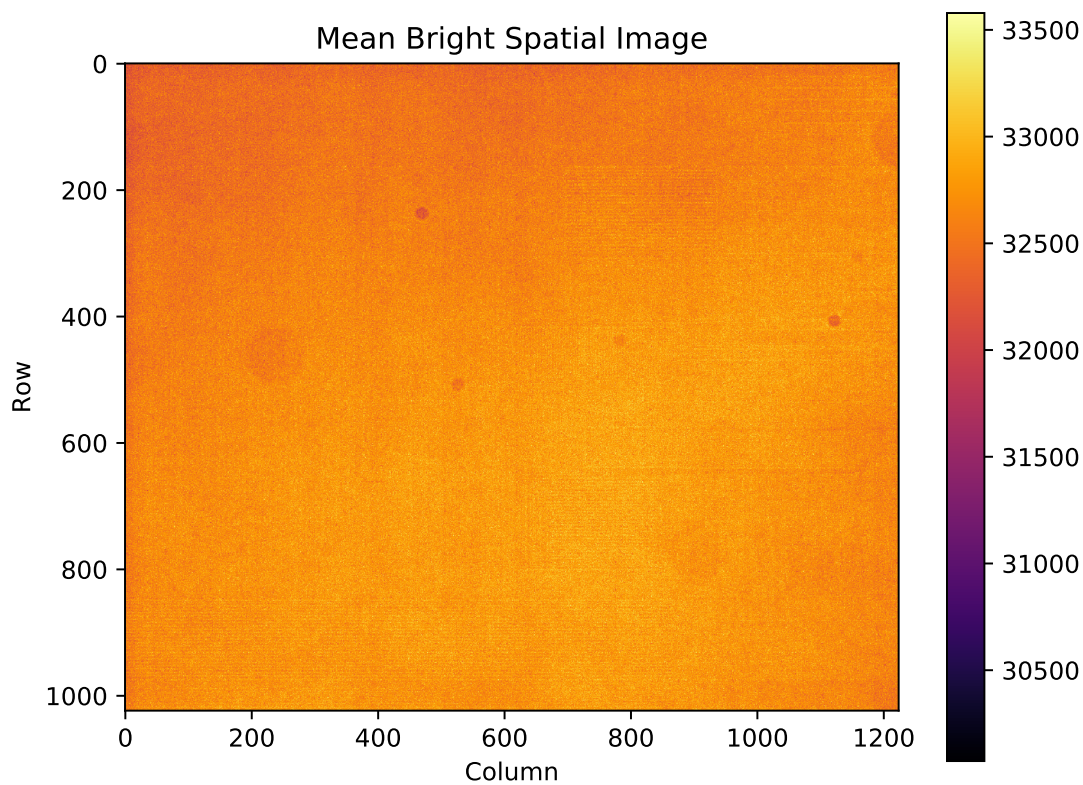
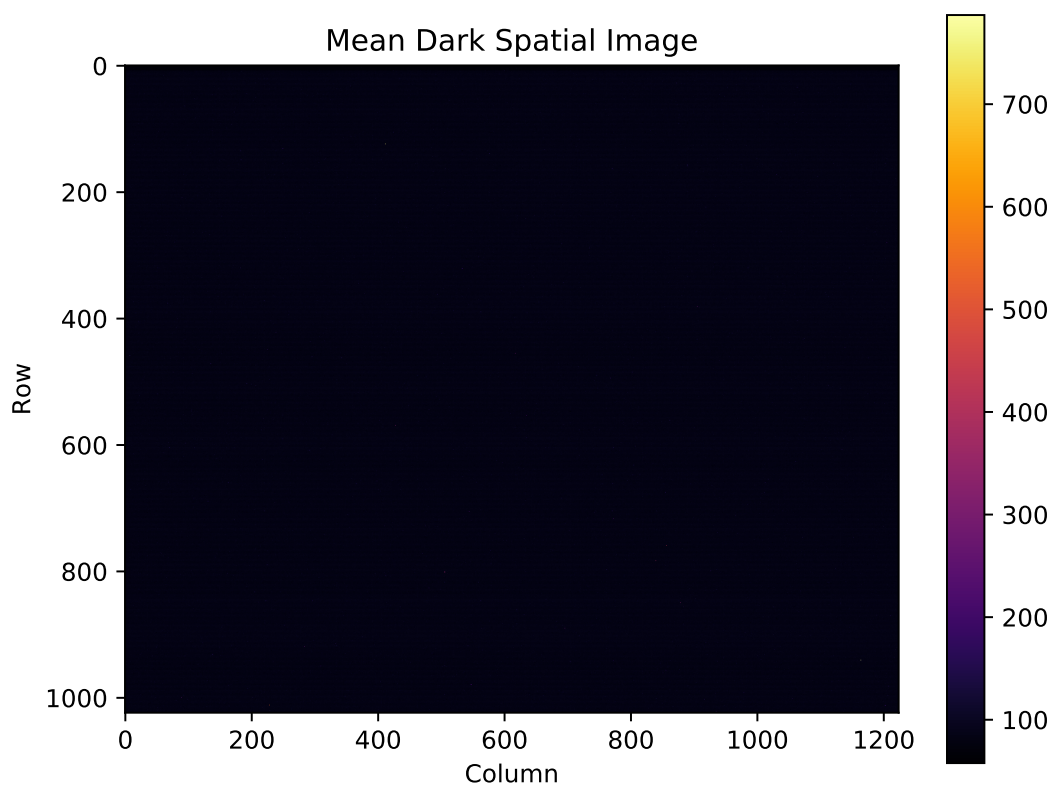












Summary sheet for Operation Point: **GreenRed channel** (@523.0 nm wavelength)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	523.0 nm
Exposure minimum	42.0 us
Exposure maximum	7598.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Performance

Quantum efficiency

η 52.54 %

System gain

K 6.668 DN/e⁻
1/K 0.150 e⁻/DN

Temporal dark noise

σ_d 2.753 e⁻
 $\sigma_{y.dark}$ 18.361 DN

Signal-to-Noise Ratio

SNR_{max} 98
39.82 dB
6.6 bit
 SNR_{max}^{-1} 1.021 %

Absolute sensitivity threshold

$\mu_{p.min}$ 6.193 p
 $\mu_{p.min.area}$ 0.825 p/ μm^2
 $\mu_{e.min}$ 3.254 e⁻
 $\mu_{e.min.area}$ 0.433 e⁻/ μm^2

Saturation Capacity

$\mu_{p.sat}$ 18260 p
 $\mu_{p.sat.area}$ 2432.166 p/ μm^2
 $\mu_{e.sat}$ 9593 e⁻
 $\mu_{e.sat.area}$ 1278 e⁻/ μm^2

Dynamic Range

DR 2948
69.4 dB

Spatial Nonuniformities

$DSNU_{1288}$ 0.5 e⁻
 $DSNU_{1288.row}$ 0.3 e⁻
 $DSNU_{1288.col}$ 0.0 e⁻
 $DSNU_{1288.pixel}$ 0.4 e⁻
 $PRNU_{1288}$ 0.5 %
 $PRNU_{1288.row}$ 0.2 %
 $PRNU_{1288.col}$ 0.2 %
 $PRNU_{1288.pixel}$ 0.4 %

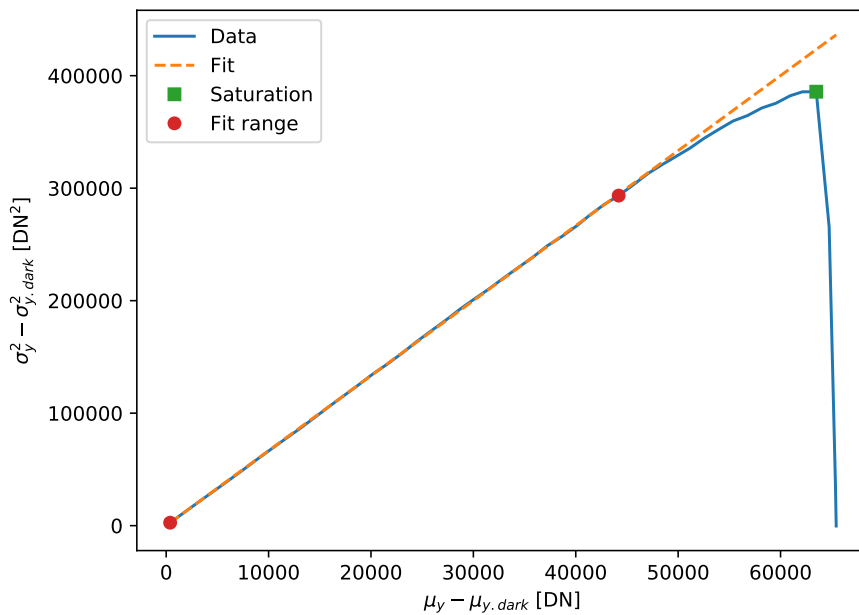
Linearity error

LE_{min} -0.410 %
 LE_{max} 0.152 %

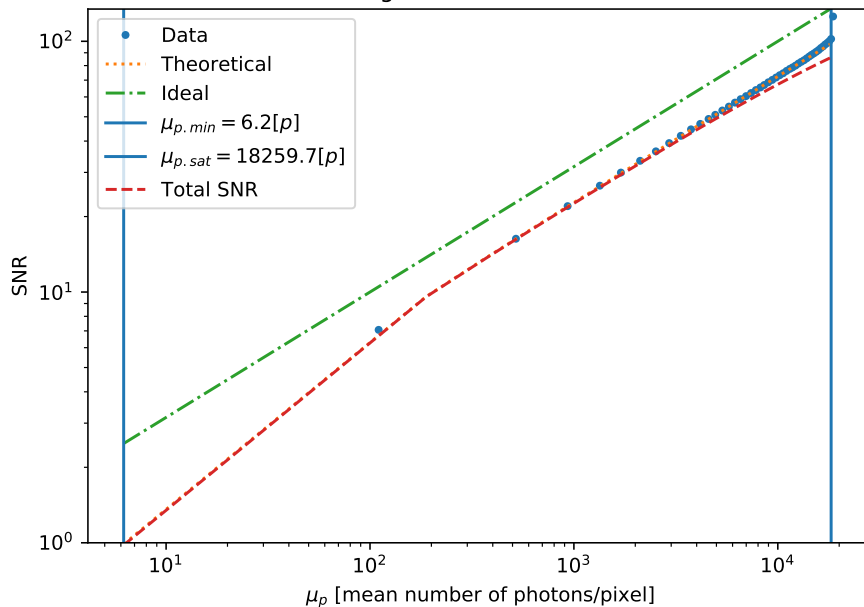
Dark current

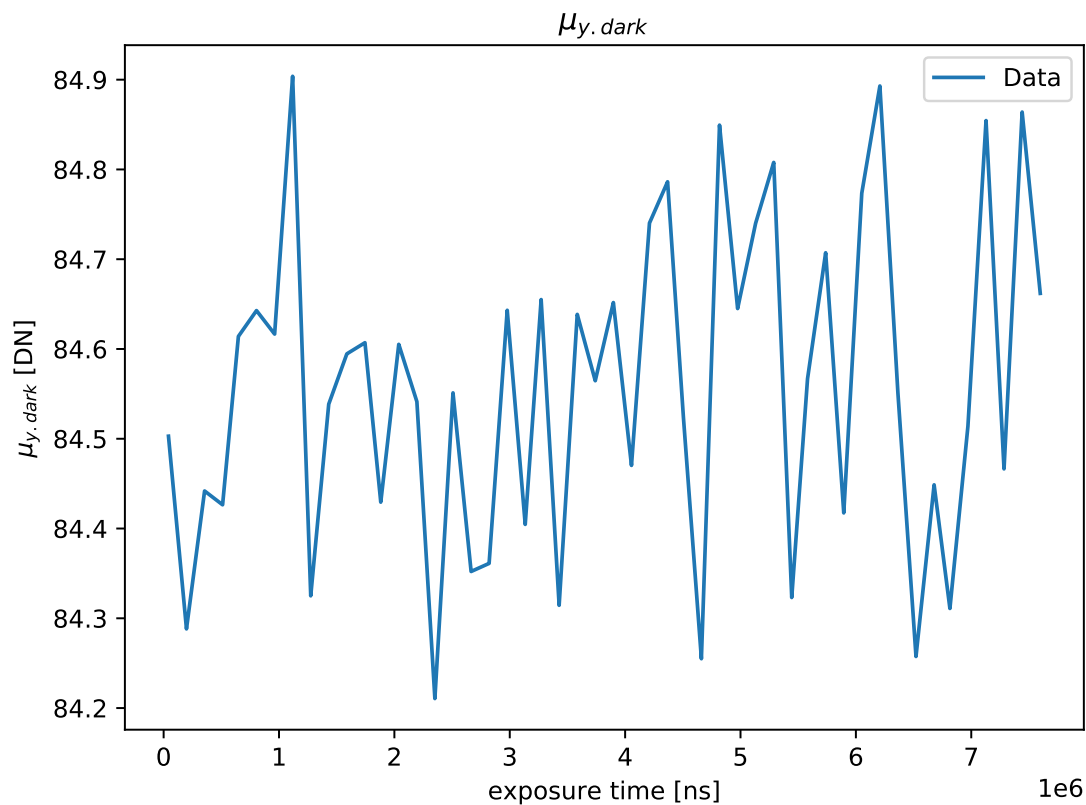
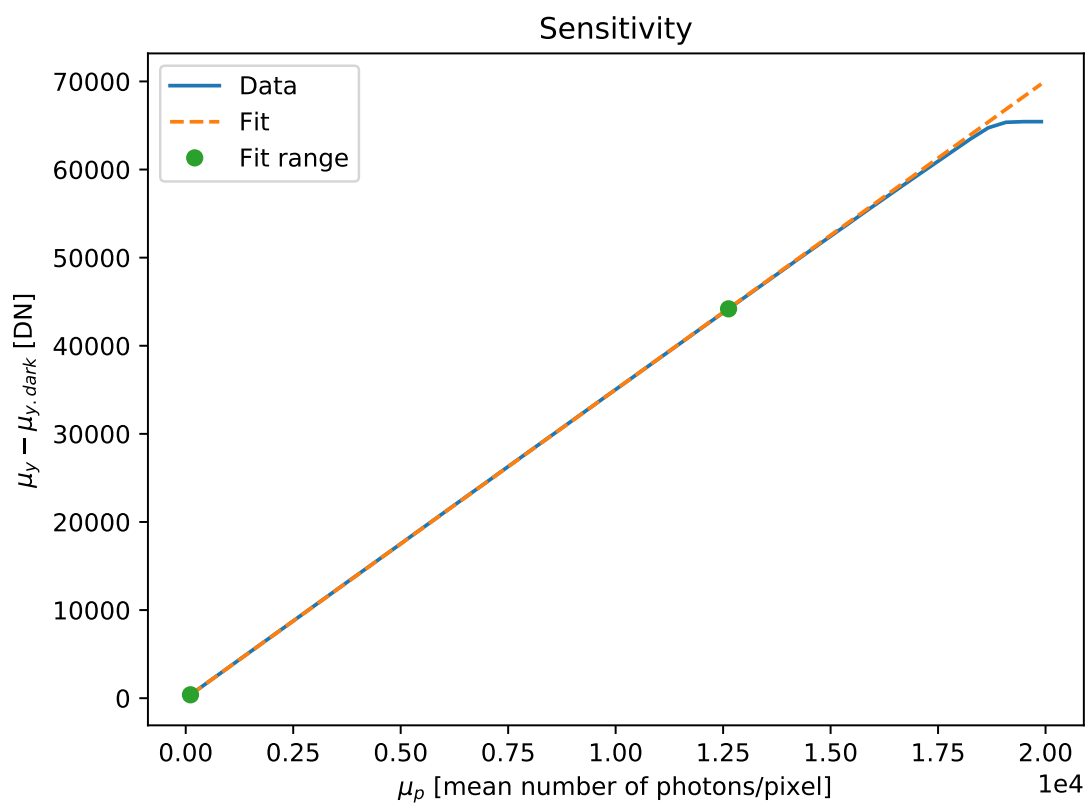
$\mu_{I.mean}$ 0.903 e⁻/s
6.024 DN/s
 $\mu_{I.var}$ -0.005 e⁻/s
-0.034 DN/s

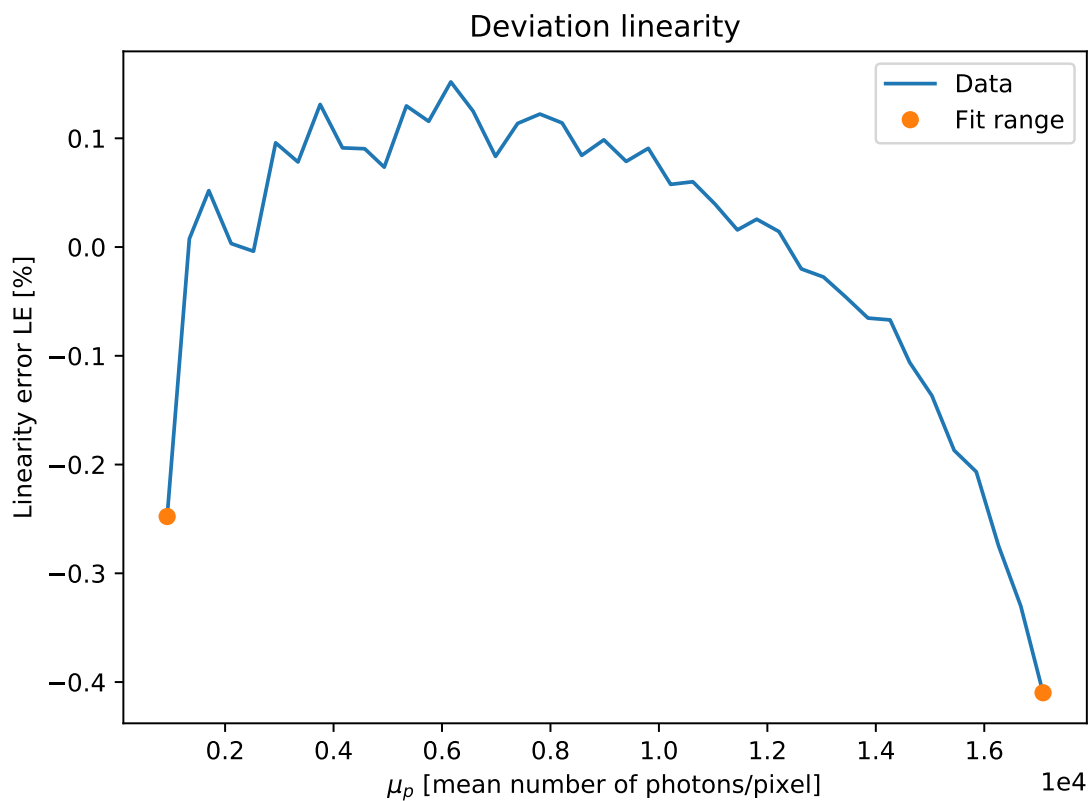
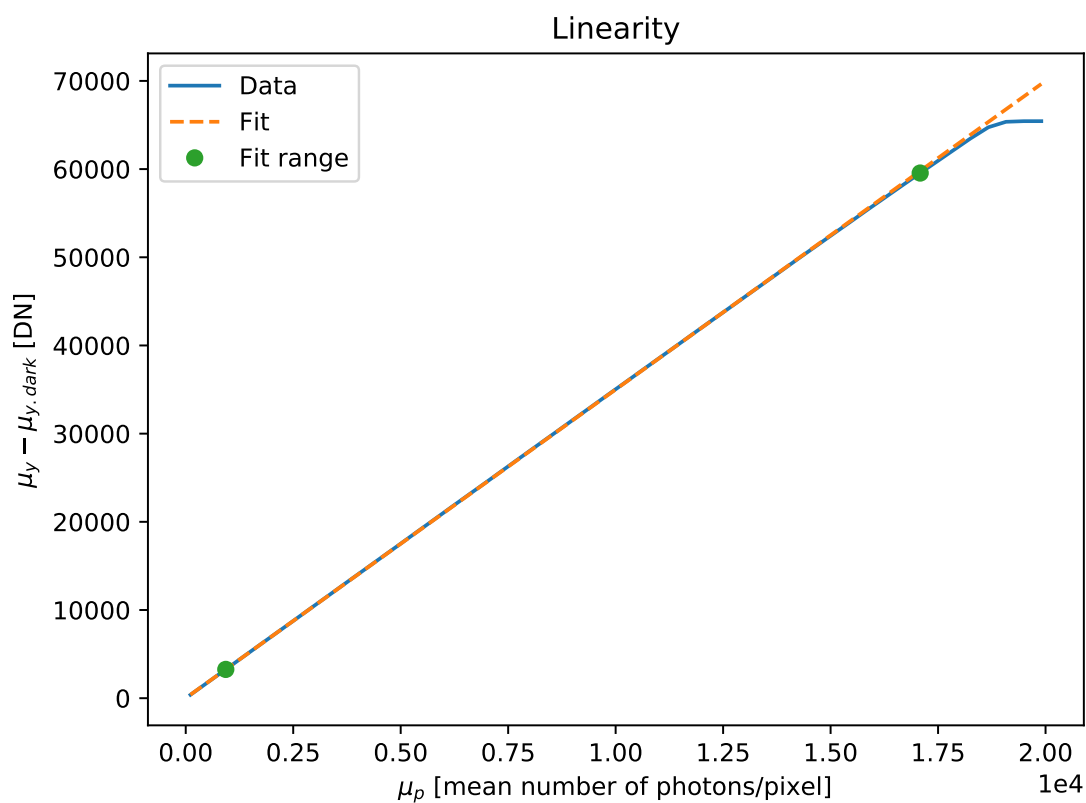
Photon Transfer



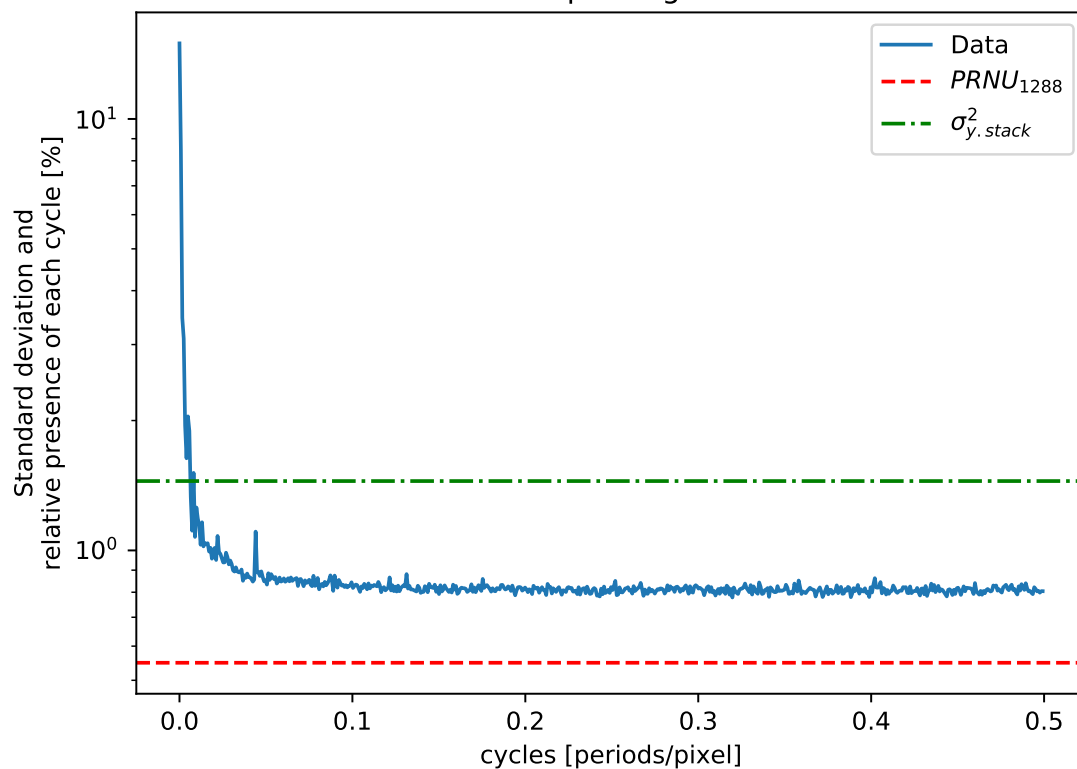
Signal to Noise Ratio



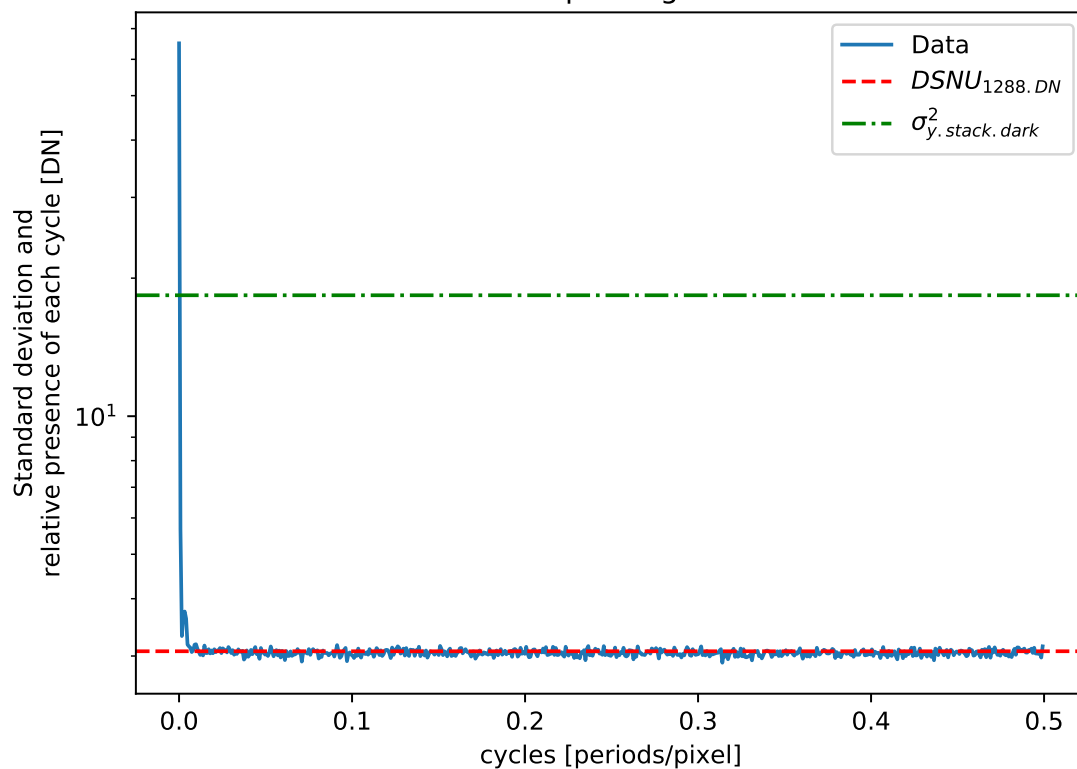


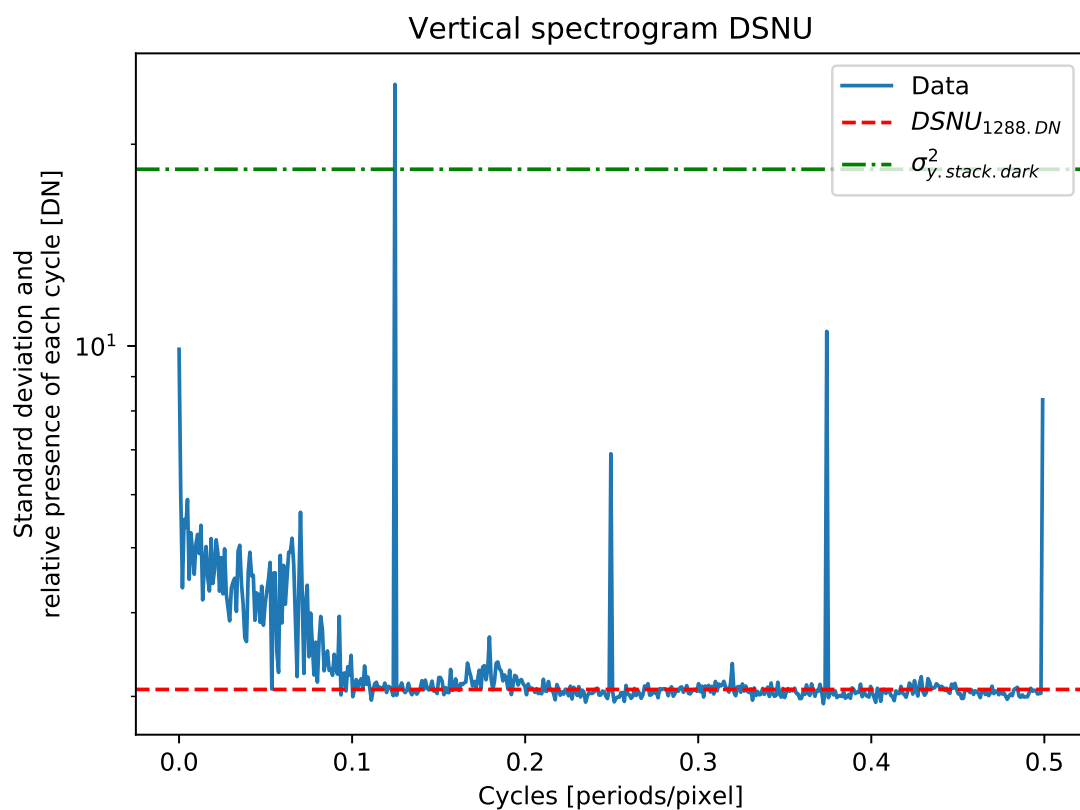
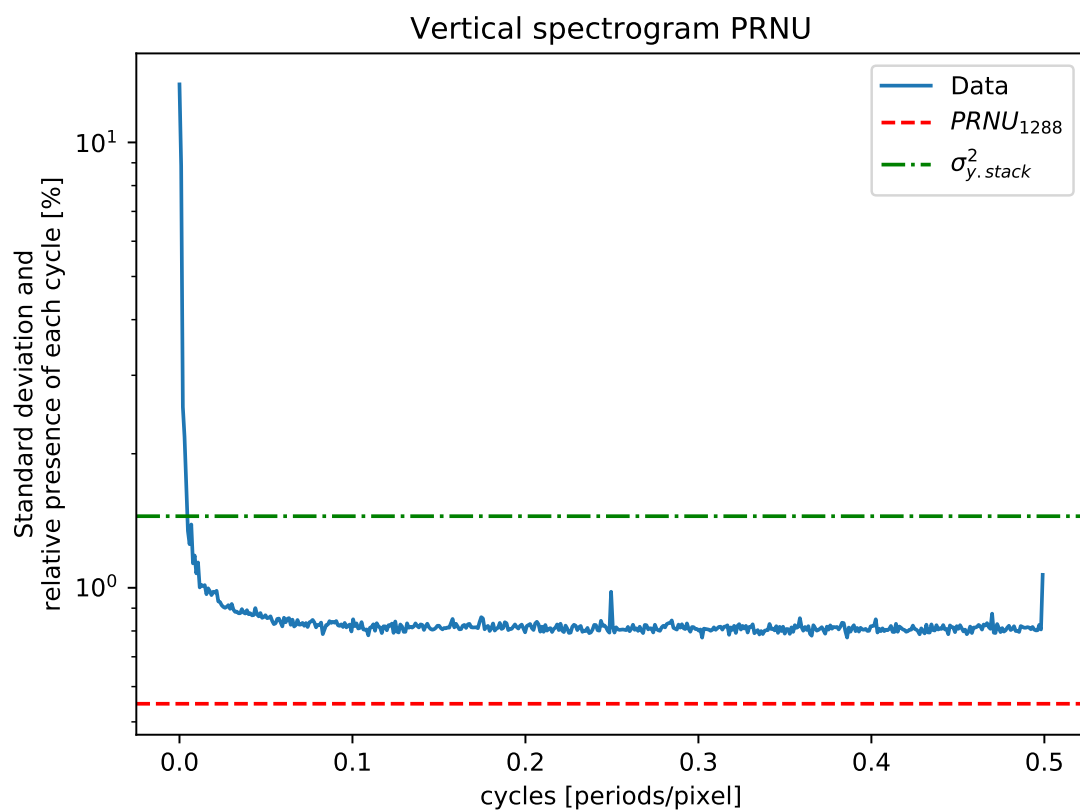


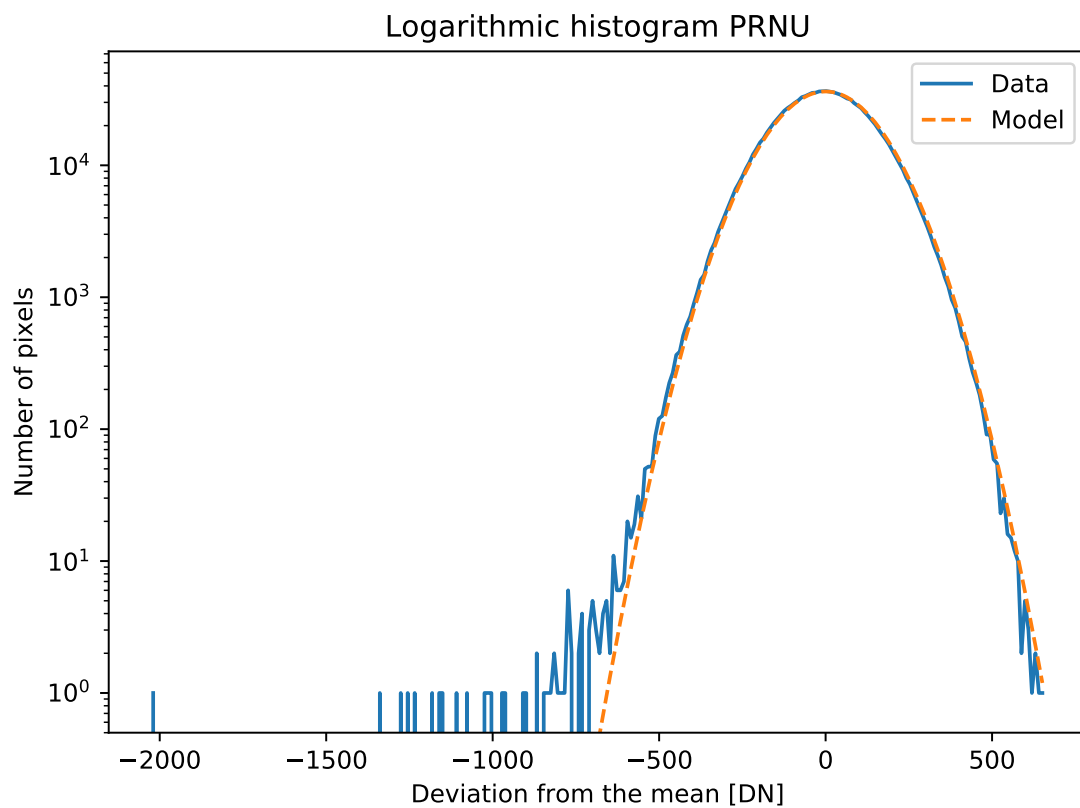
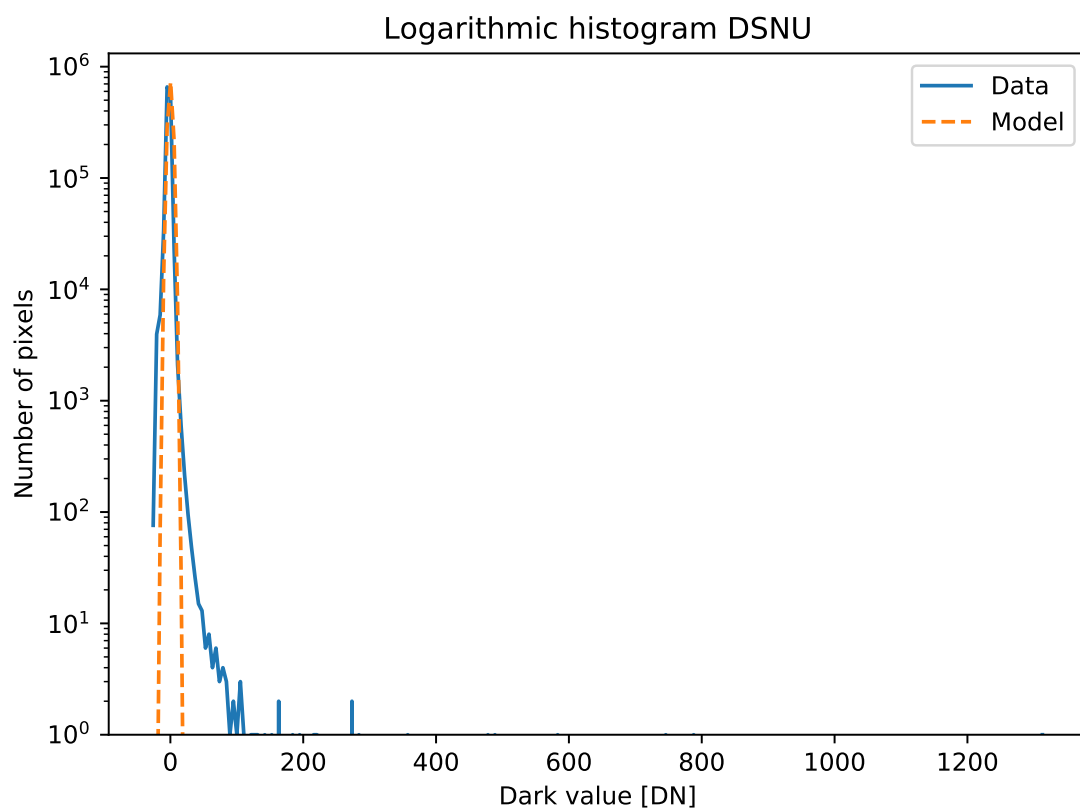
Horizontal spectrogram PRNU



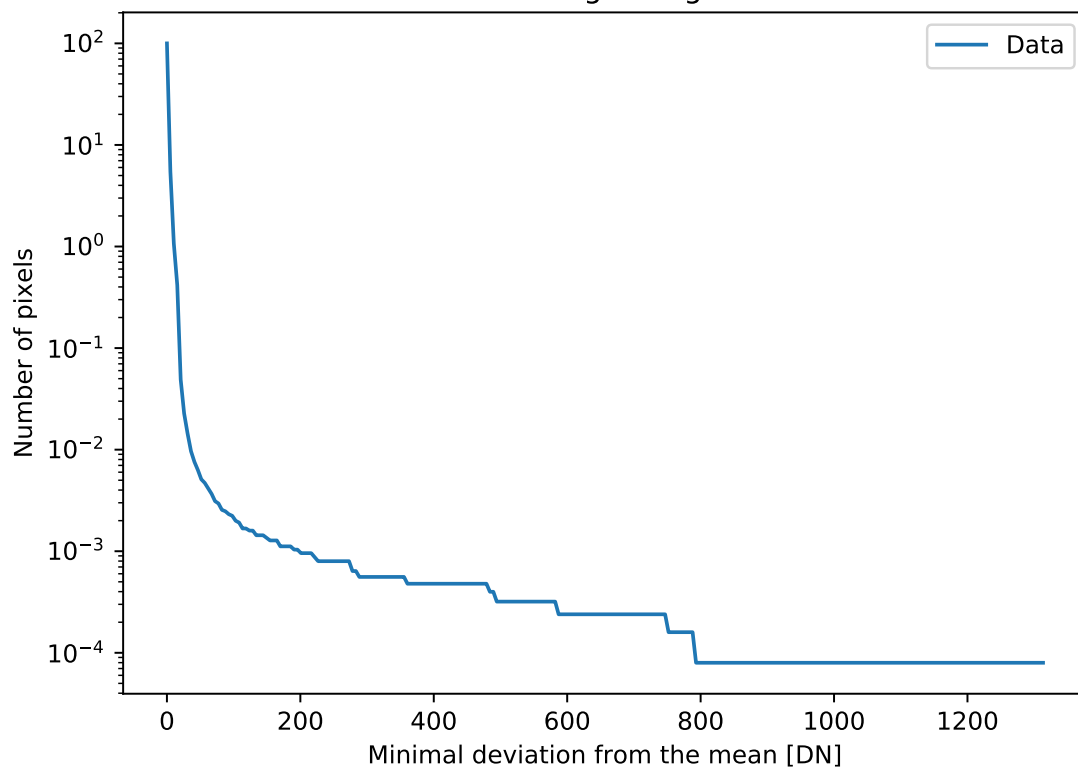
Horizontal spectrogram DSNU



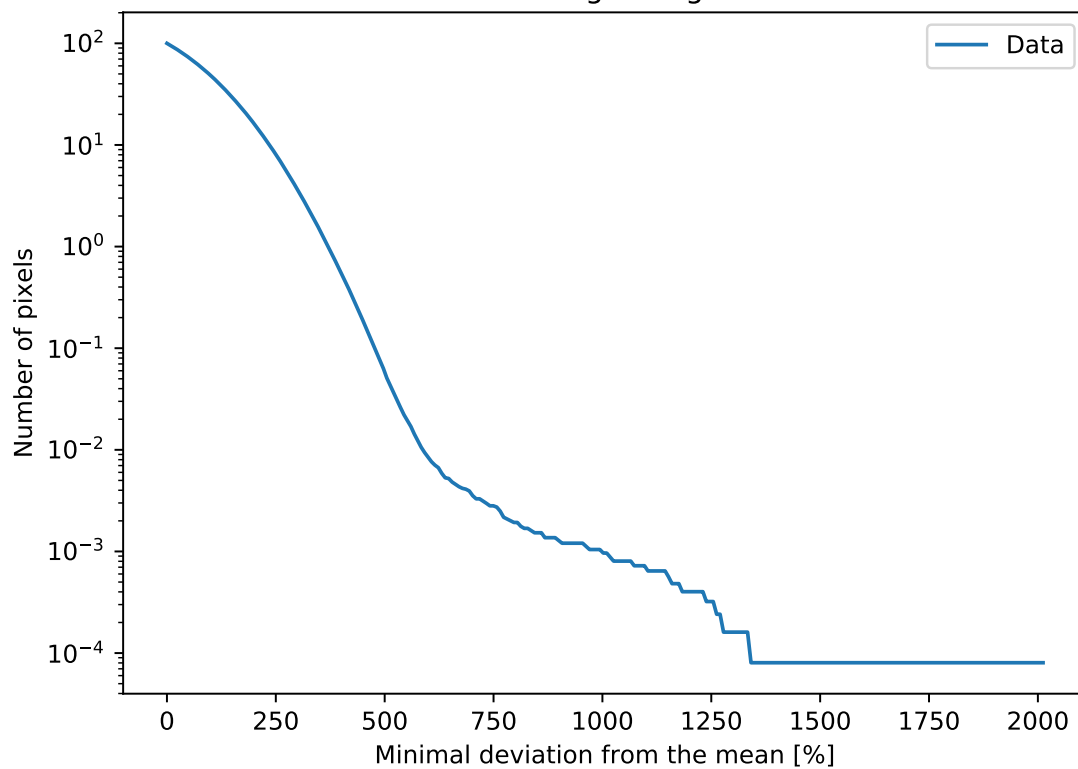


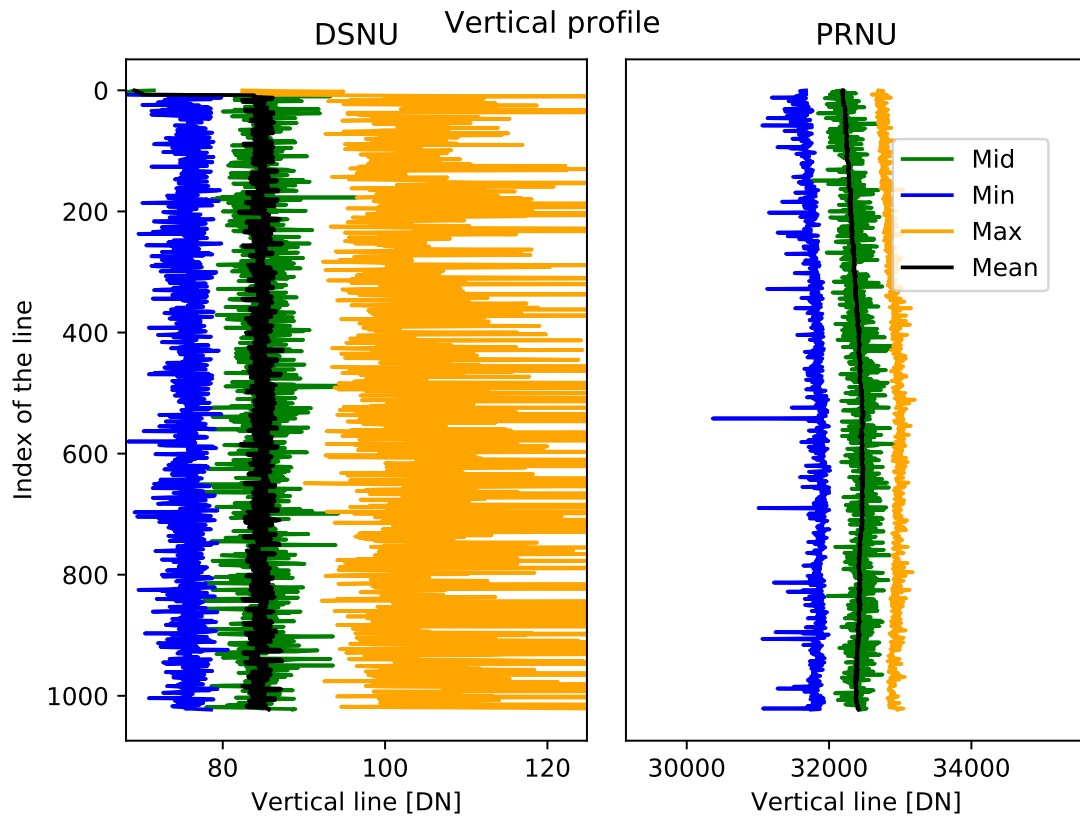
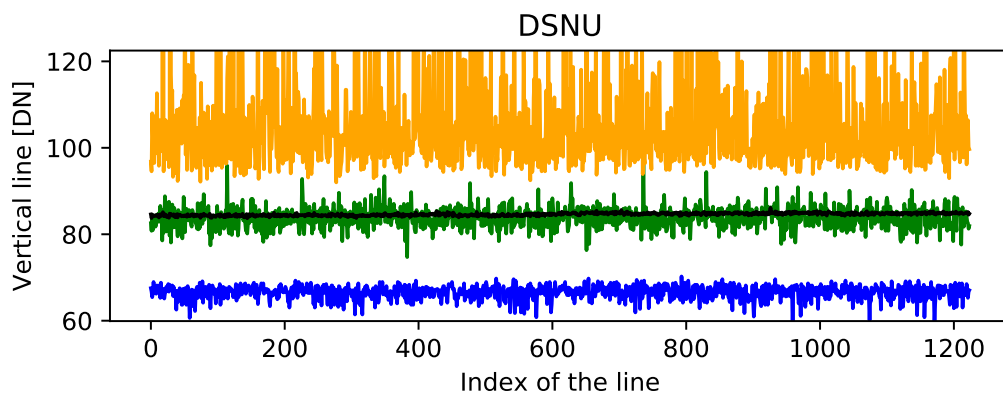
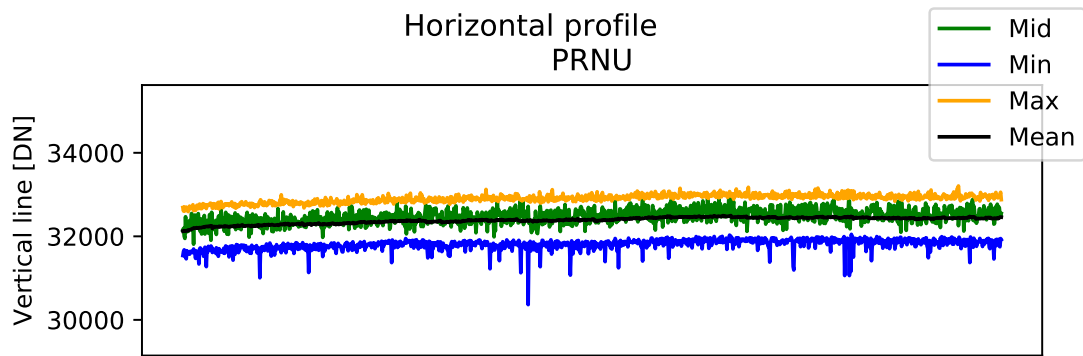


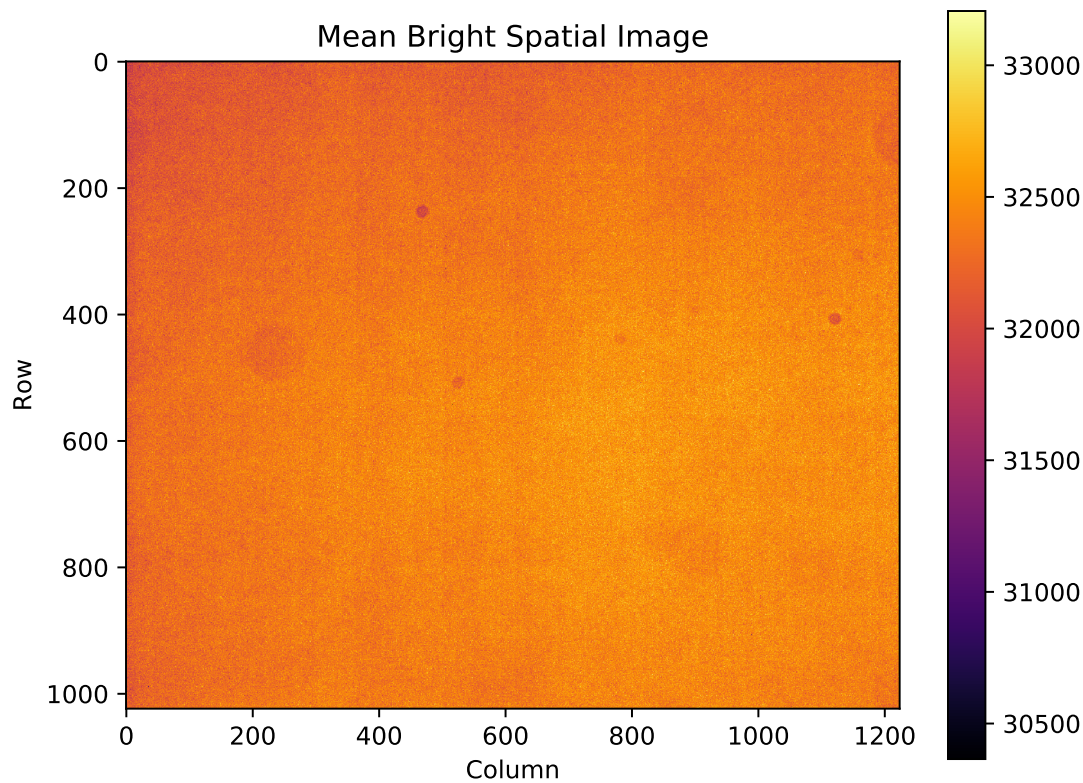
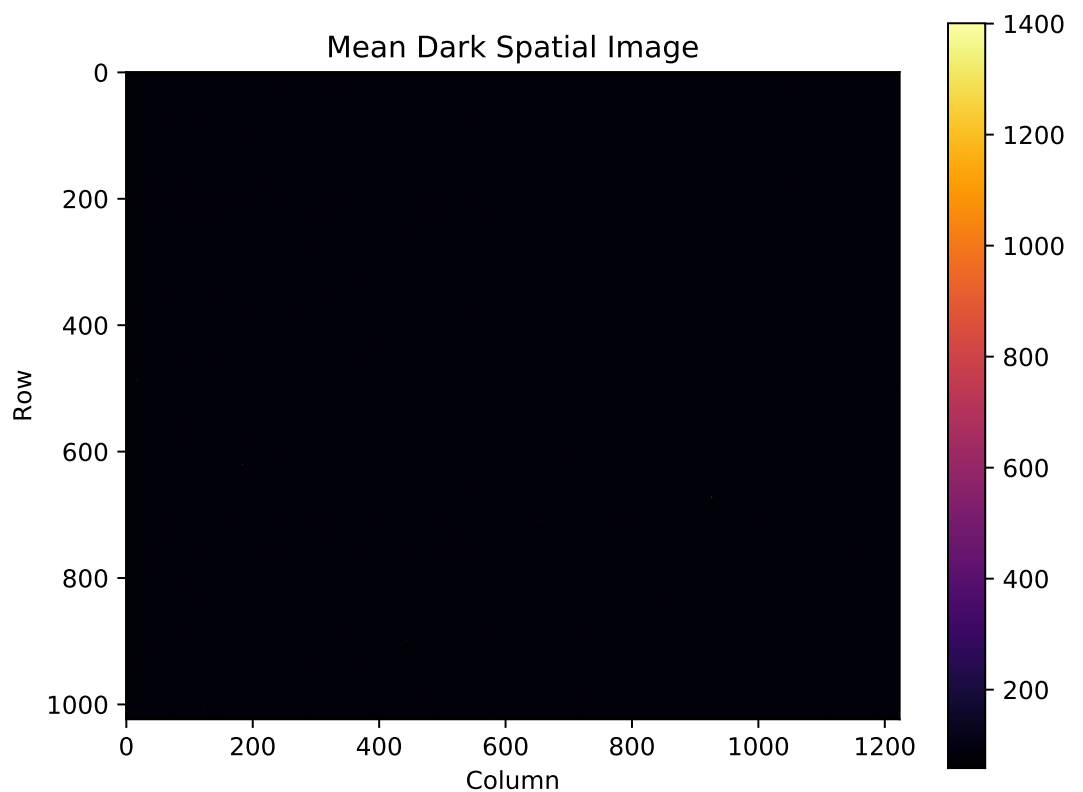
Accumulated log histogram DSNU



Accumulated log histogram PRNU







Summary sheet for Operation Point: **GreenBlue channel** (@523.0 nm wavelength)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	523.0 nm
Exposure minimum	42.0 us
Exposure maximum	7598.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Performance

Quantum efficiency

η 52.73 %

System gain

K 6.665 DN/e⁻
1/K 0.150 e⁻/DN

Temporal dark noise

σ_d 2.768 e⁻
 $\sigma_{y.dark}$ 18.452 DN

Signal-to-Noise Ratio

SNR_{max} 98
39.83 dB
6.6 bit
 SNR_{max}^{-1} 1.020 %

Absolute sensitivity threshold

$\mu_{p.min}$ 6.199 p
 $\mu_{p.min.area}$ 0.826 p/ μm^2
 $\mu_{e.min}$ 3.268 e⁻
 $\mu_{e.min.area}$ 0.435 e⁻/ μm^2

Saturation Capacity

$\mu_{p.sat}$ 18245 p
 $\mu_{p.sat.area}$ 2430.192 p/ μm^2
 $\mu_{e.sat}$ 9620 e⁻
 $\mu_{e.sat.area}$ 1281 e⁻/ μm^2

Dynamic Range

DR 2943
69.4 dB

Spatial Nonuniformities

$DSNU_{1288}$ 0.3 e⁻
 $DSNU_{1288.row}$ 0.2 e⁻
 $DSNU_{1288.col}$ 0.0 e⁻
 $DSNU_{1288.pixel}$ 0.3 e⁻
 $PRNU_{1288}$ 0.6 %
 $PRNU_{1288.row}$ 0.2 %
 $PRNU_{1288.col}$ 0.2 %
 $PRNU_{1288.pixel}$ 0.4 %

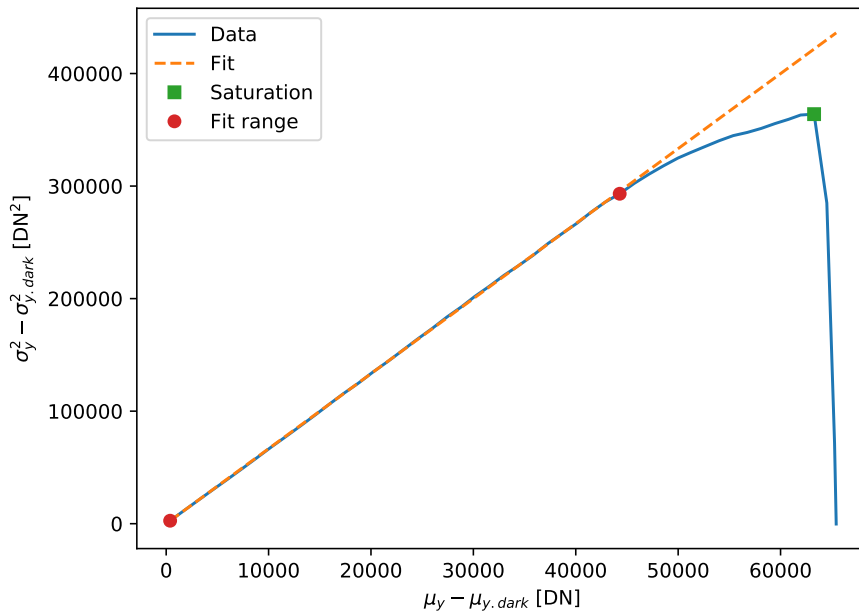
Linearity error

LE_{min} -0.755 %
 LE_{max} 0.186 %

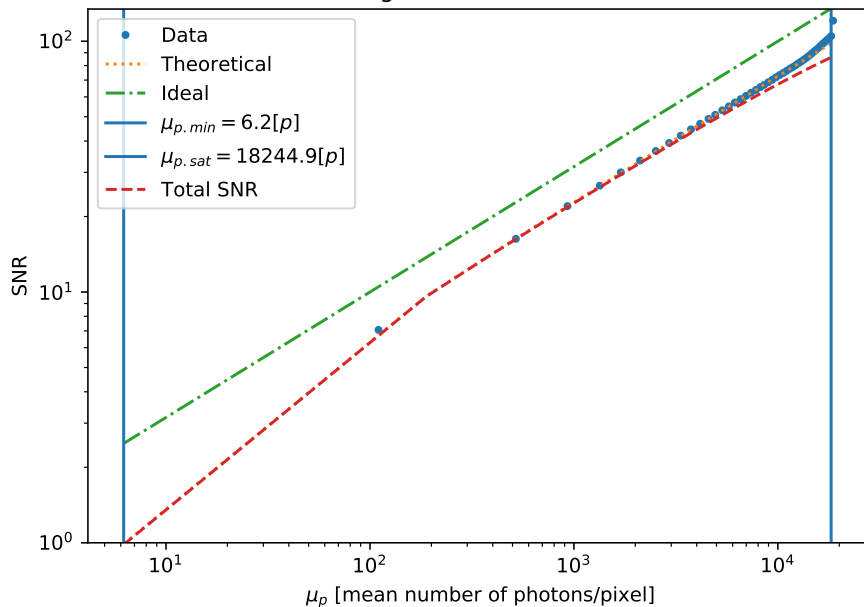
Dark current

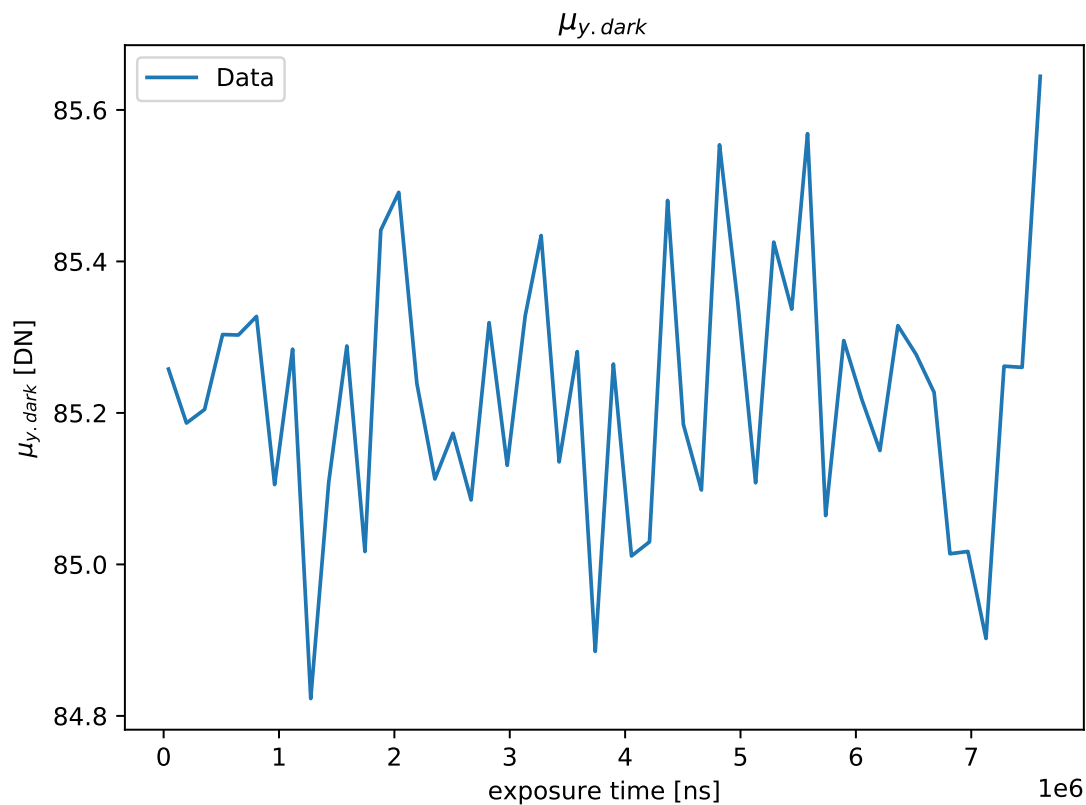
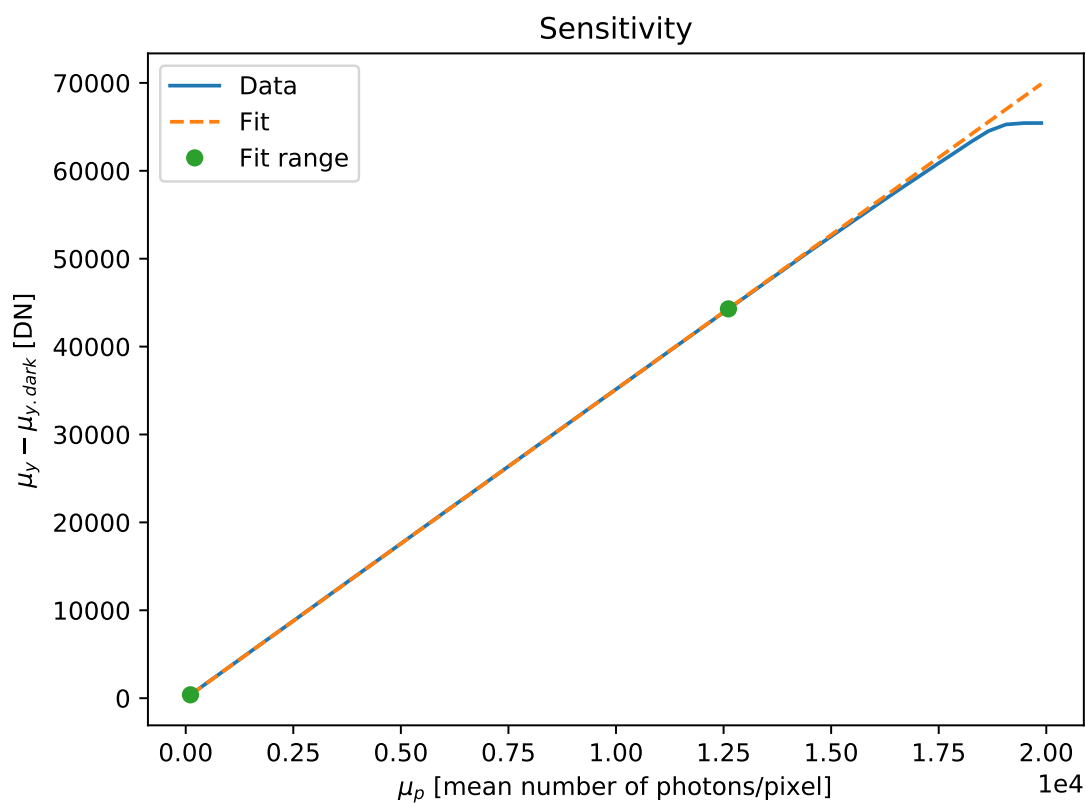
$\mu_{I.mean}$ 0.909 e⁻/s
6.061 DN/s
 $\mu_{I.var}$ -0.001 e⁻/s
-0.009 DN/s

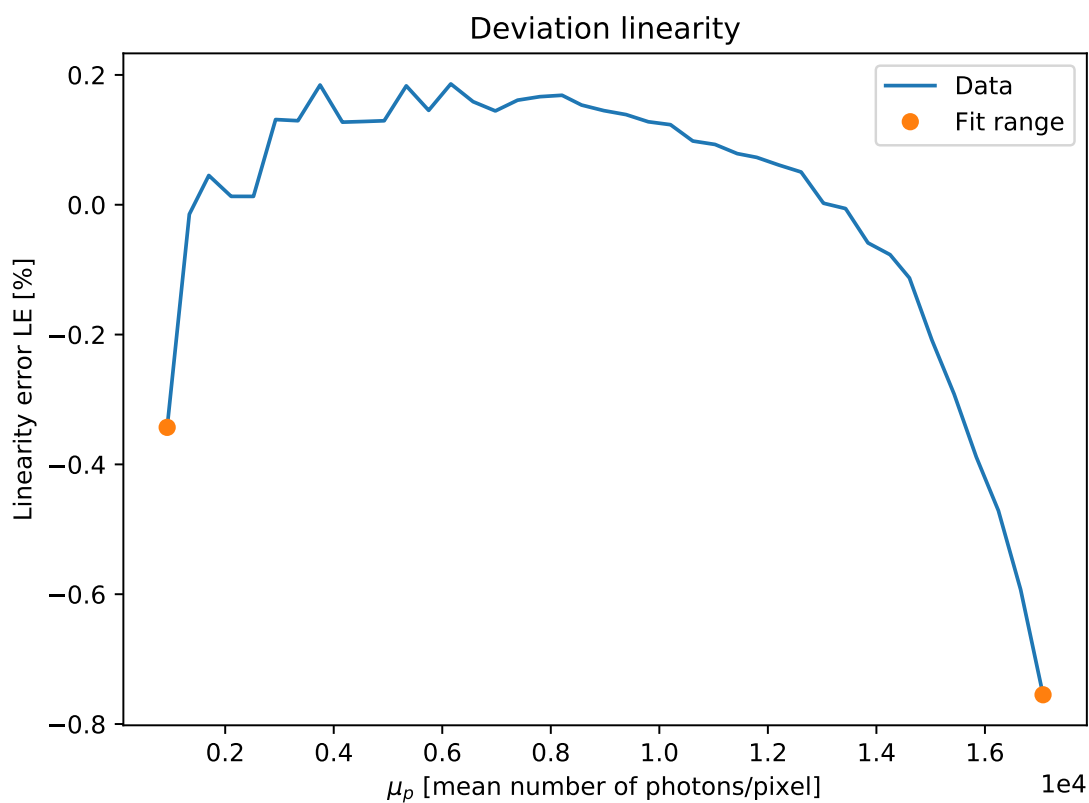
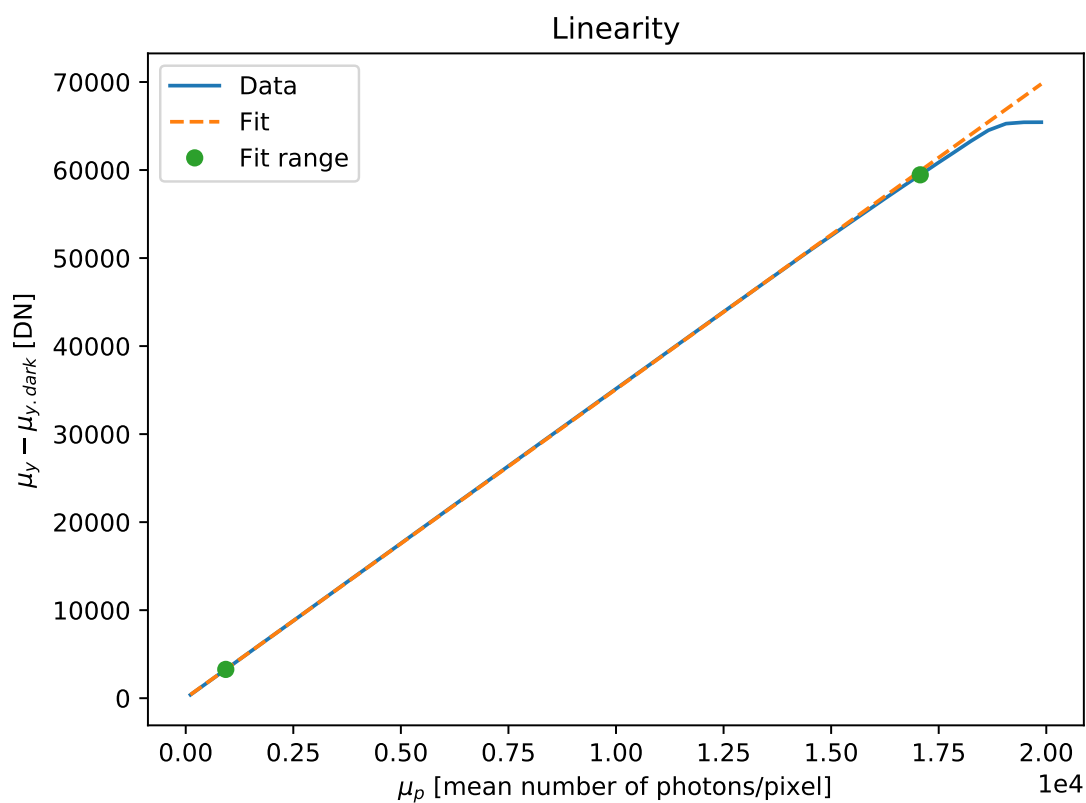
Photon Transfer



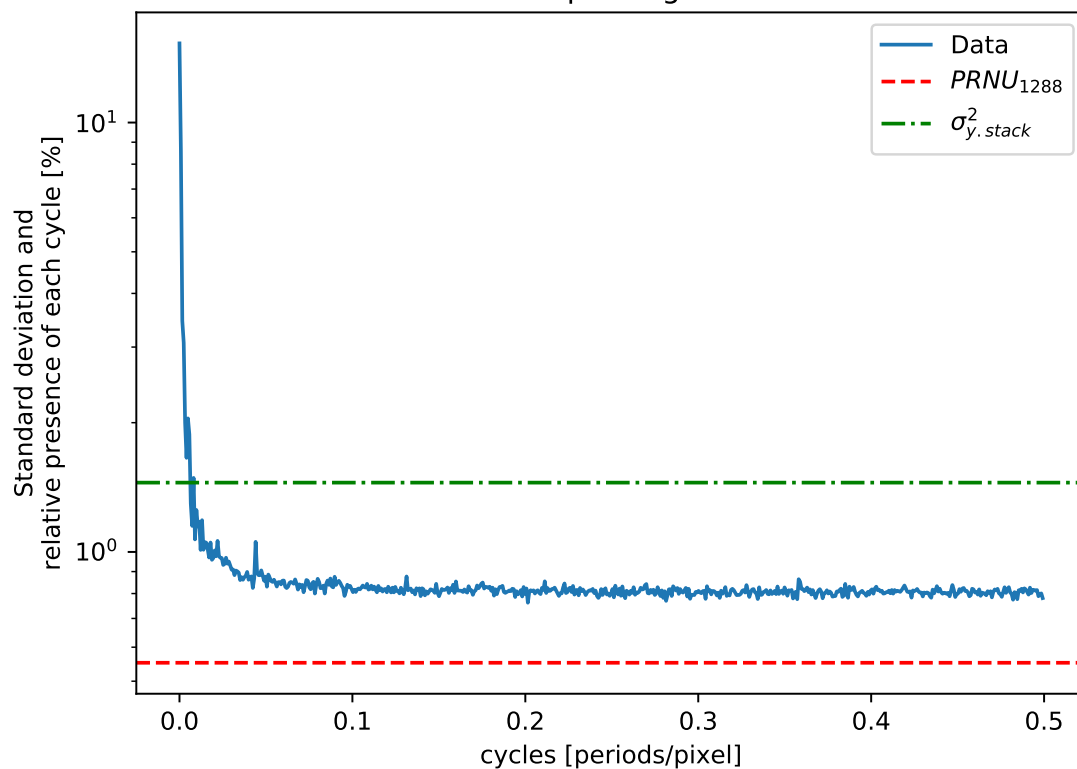
Signal to Noise Ratio



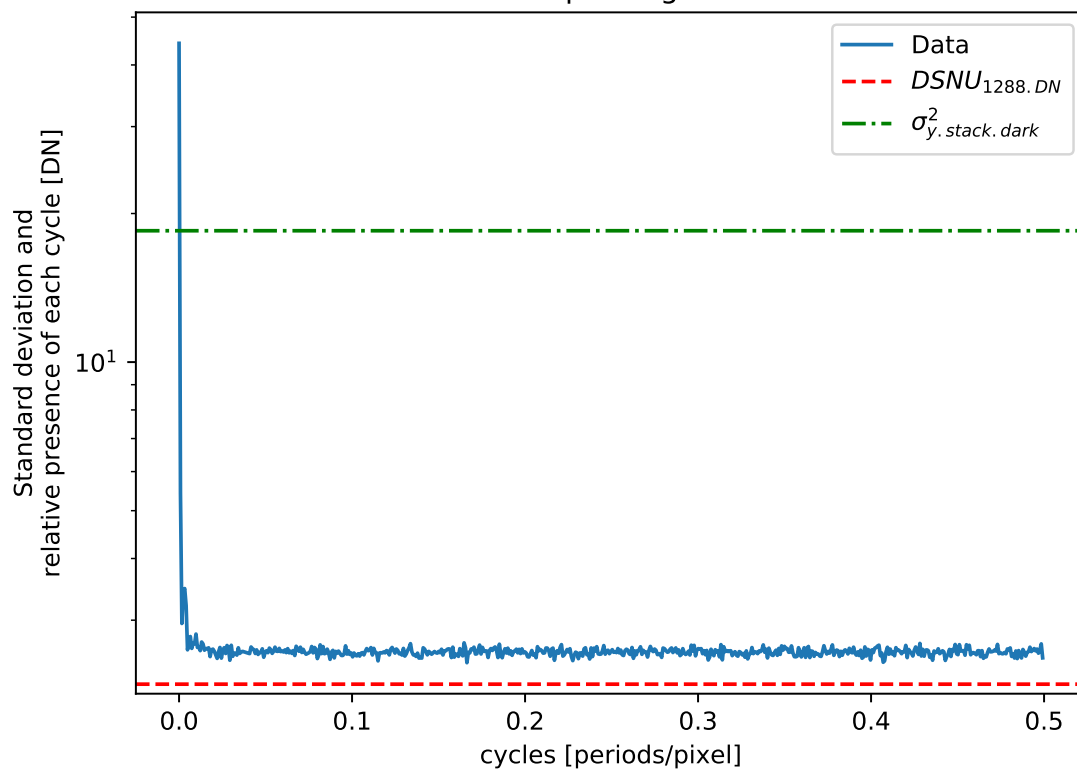


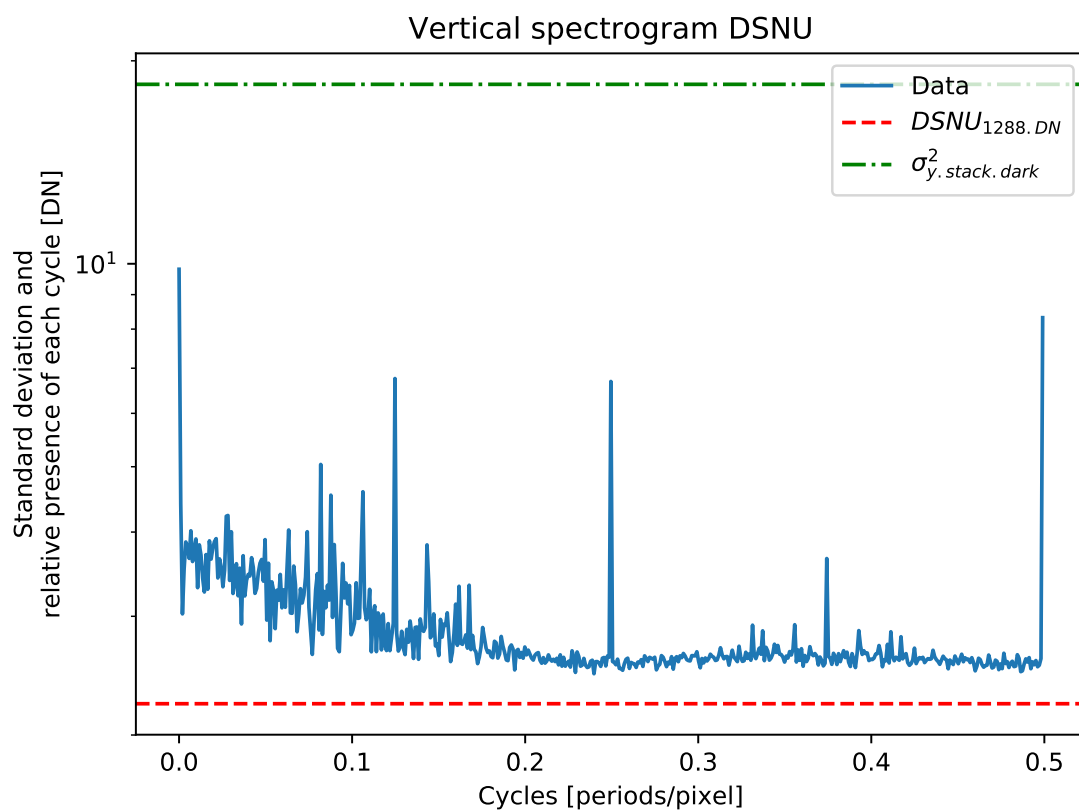
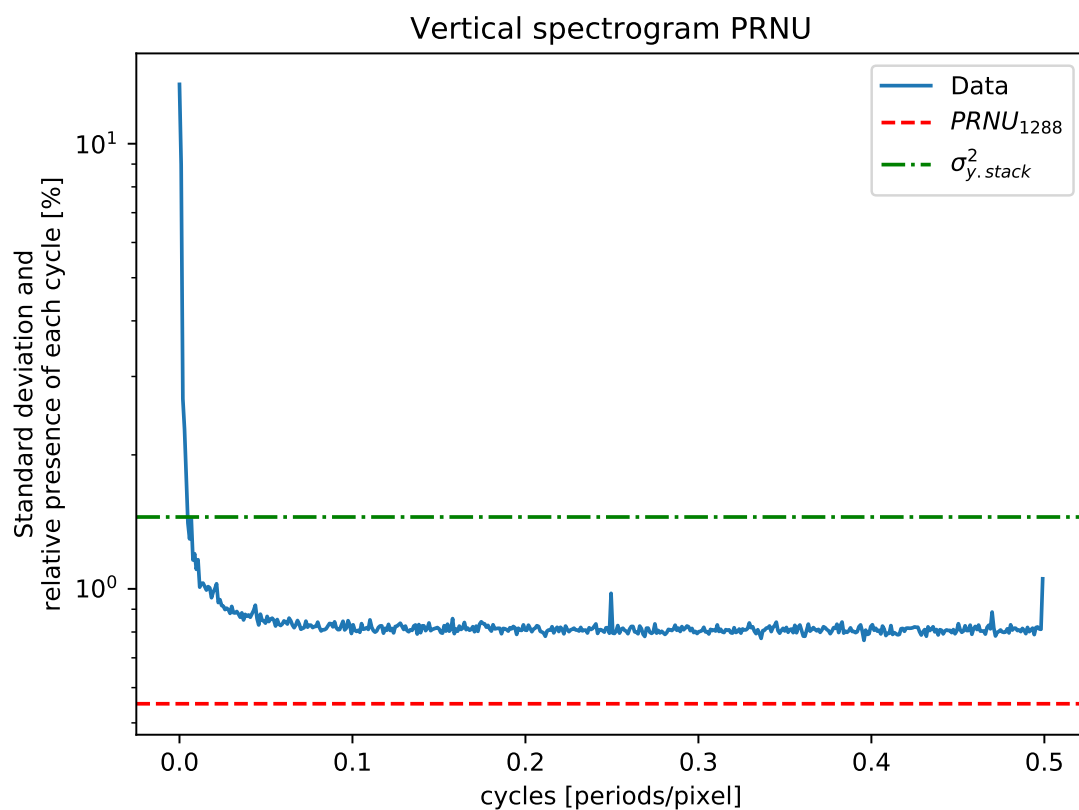


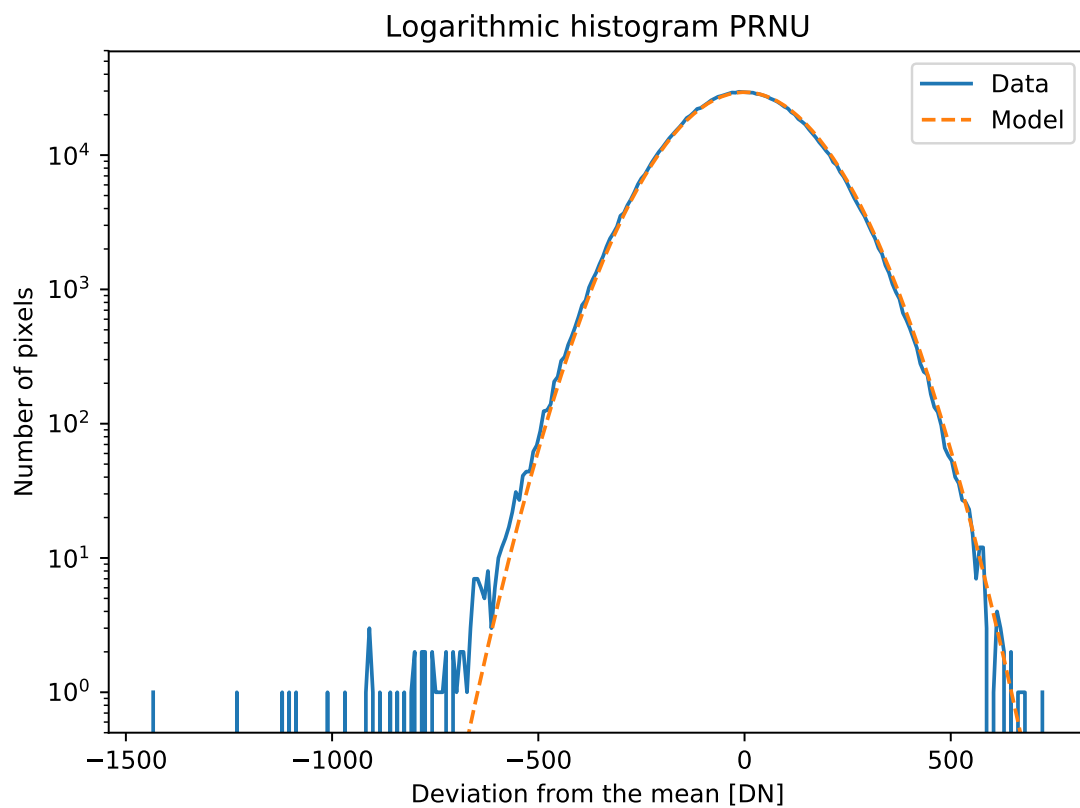
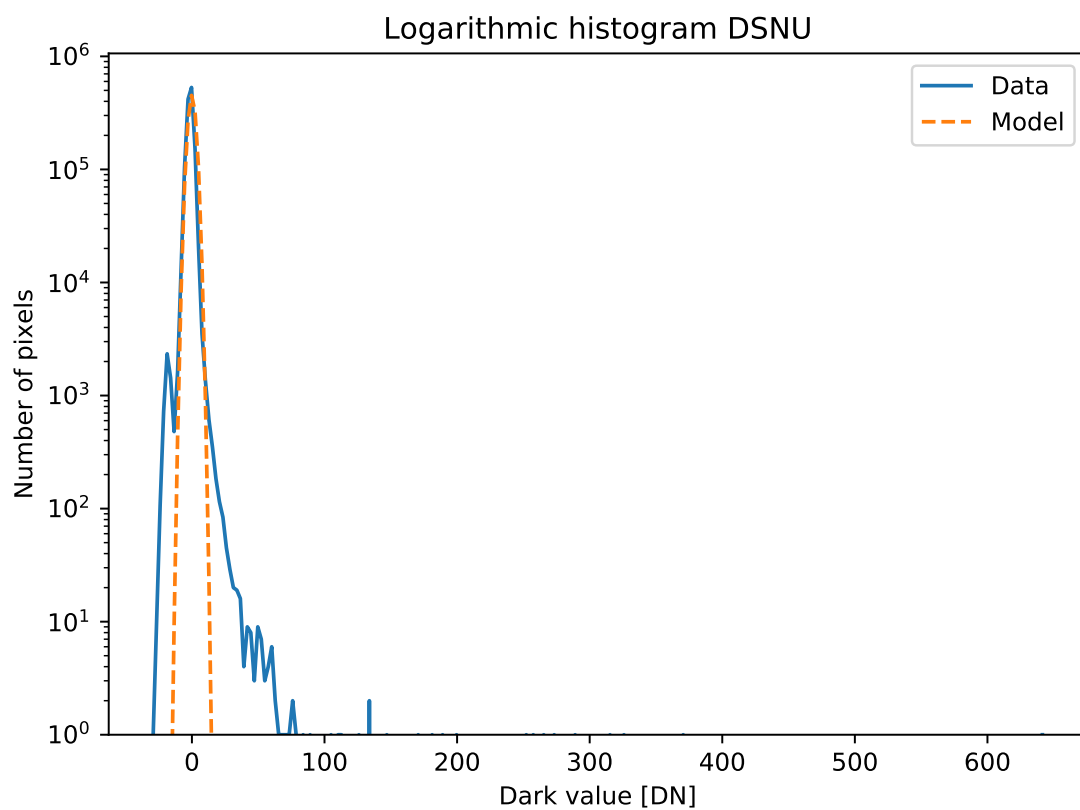
Horizontal spectrogram PRNU



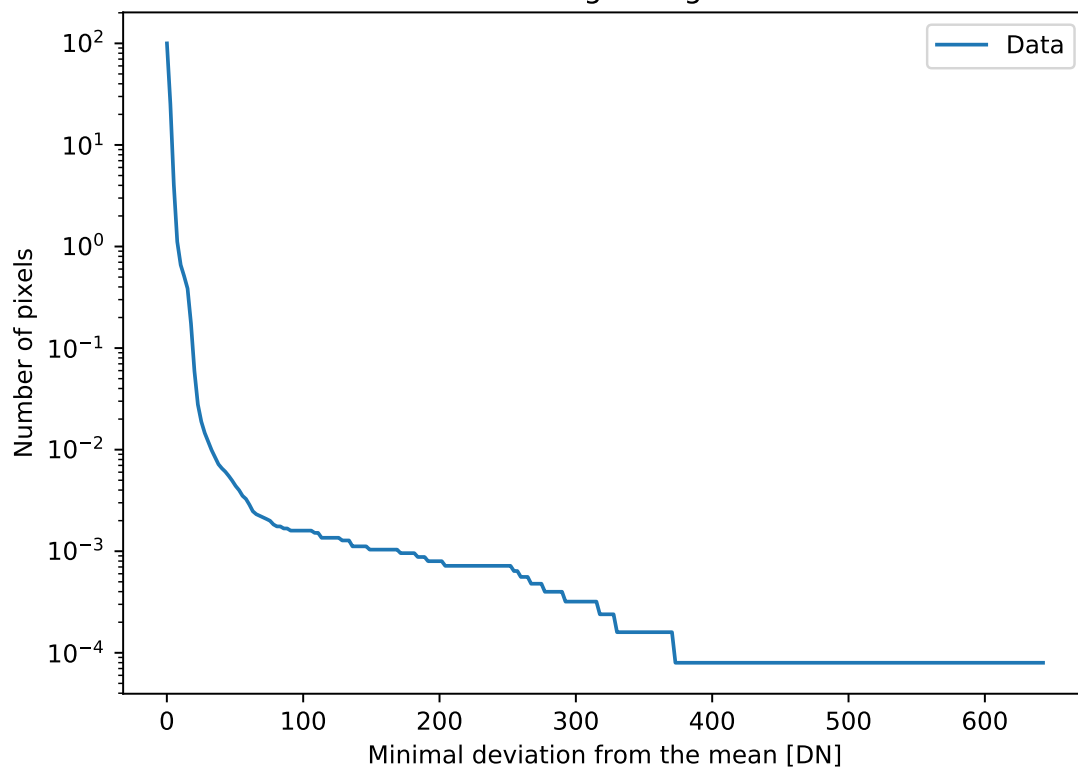
Horizontal spectrogram DSNU



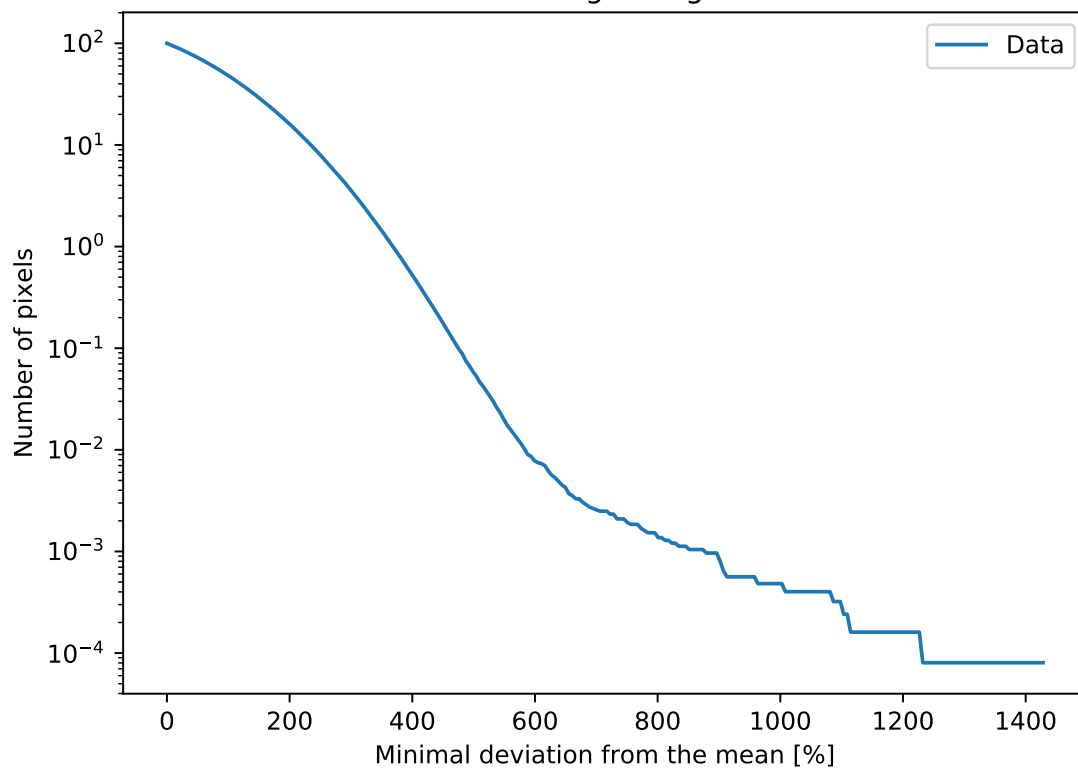


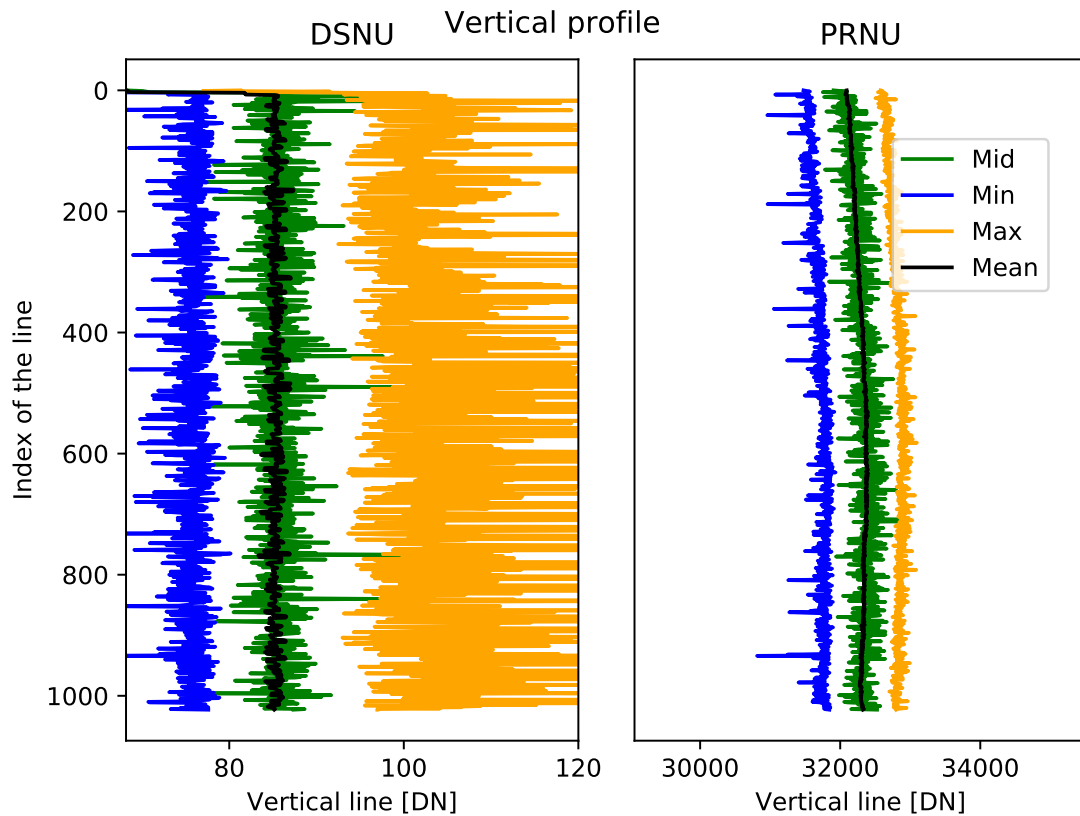
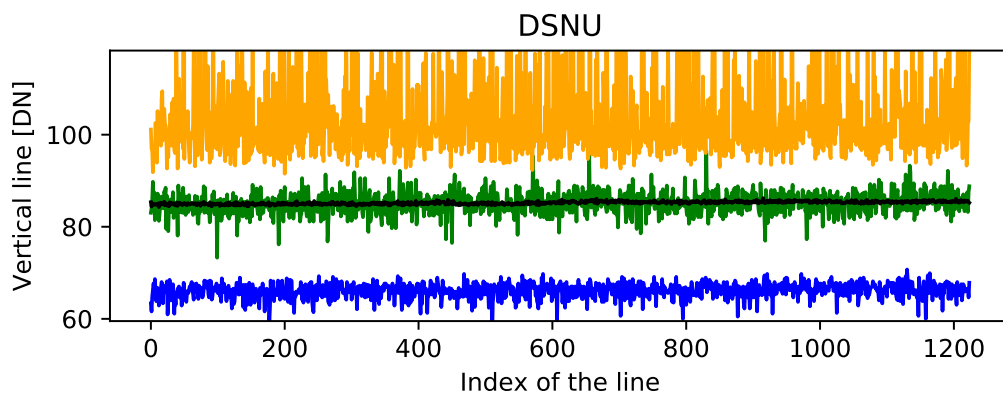
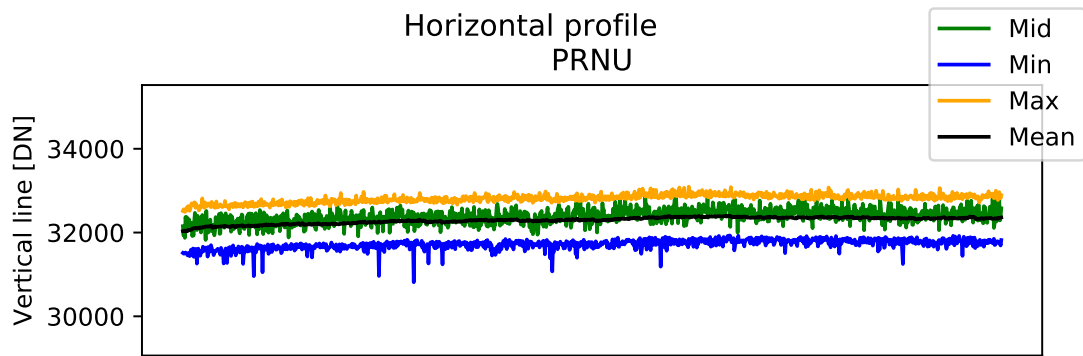


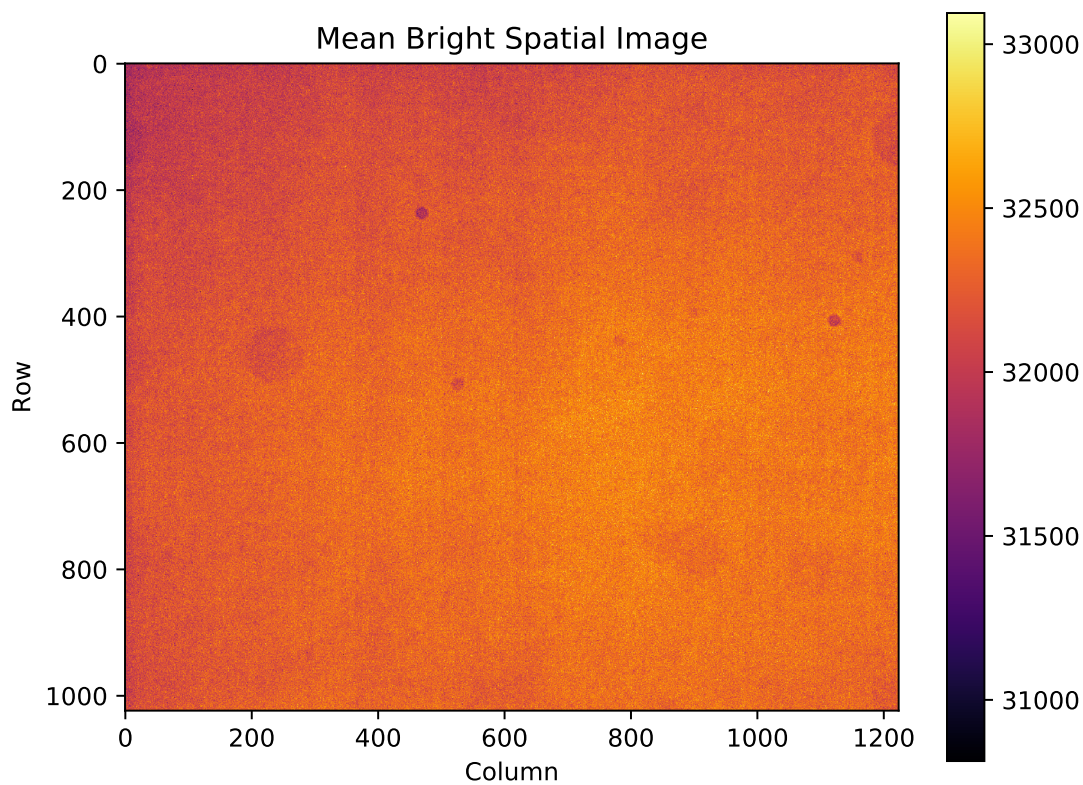
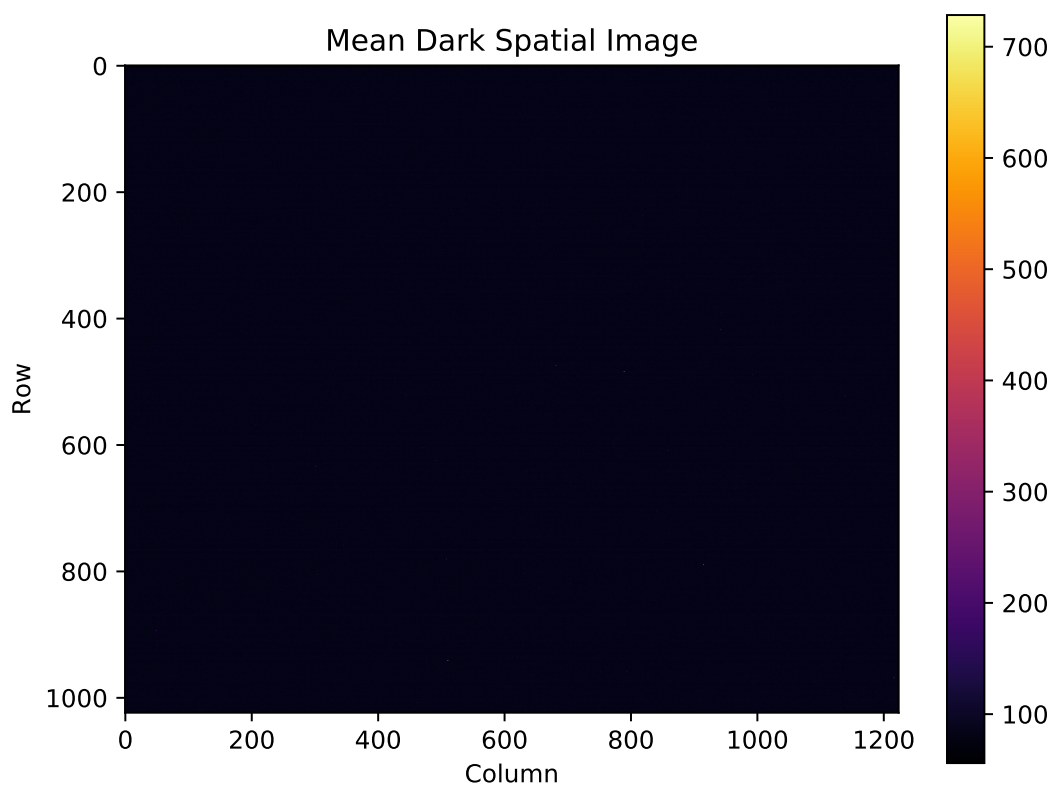
Accumulated log histogram DSNU



Accumulated log histogram PRNU







Summary sheet for Operation Point: **Blue channel** (@456.9 nm wavelength)

Camera setting

Pixel Format	BayerRG16
High Conversion Gain	Off
Gain	0.0
Black level	0.10
ADC bit depth	12
Device Temperature	49.38 °C

Operation point parameters

Wavelength	456.9 nm
Exposure minimum	42.0 us
Exposure maximum	8576.0 us
Exposure steps	50
Variation of Irradiation	Constant illumination with variable exposure time

Performance

Quantum efficiency

η 45.03 %

System gain

K 6.676 DN/e⁻
1/K 0.150 e⁻/DN

Temporal dark noise

σ_d 2.788 e⁻
 $\sigma_{y.dark}$ 18.612 DN

Signal-to-Noise Ratio

SNR_{max} 97
39.73 dB
6.6 bit
 SNR_{max}^{-1} 1.032 %

Absolute sensitivity threshold

$\mu_{p.min}$ 7.302 p
 $\mu_{p.min.area}$ 0.973 p/ μm^2
 $\mu_{e.min}$ 3.288 e⁻
 $\mu_{e.min.area}$ 0.438 e⁻/ μm^2

Saturation Capacity

$\mu_{p.sat}$ 20860 p
 $\mu_{p.sat.area}$ 2778.537 p/ μm^2
 $\mu_{e.sat}$ 9392 e⁻
 $\mu_{e.sat.area}$ 1251 e⁻/ μm^2

Dynamic Range

DR 2857
69.1 dB

Spatial Nonuniformities

$DSNU_{1288}$ 0.6 e⁻
 $DSNU_{1288.row}$ 0.2 e⁻
 $DSNU_{1288.col}$ 0.0 e⁻
 $DSNU_{1288.pixel}$ 0.5 e⁻
 $PRNU_{1288}$ 0.6 %
 $PRNU_{1288.row}$ 0.3 %
 $PRNU_{1288.col}$ 0.3 %
 $PRNU_{1288.pixel}$ 0.5 %

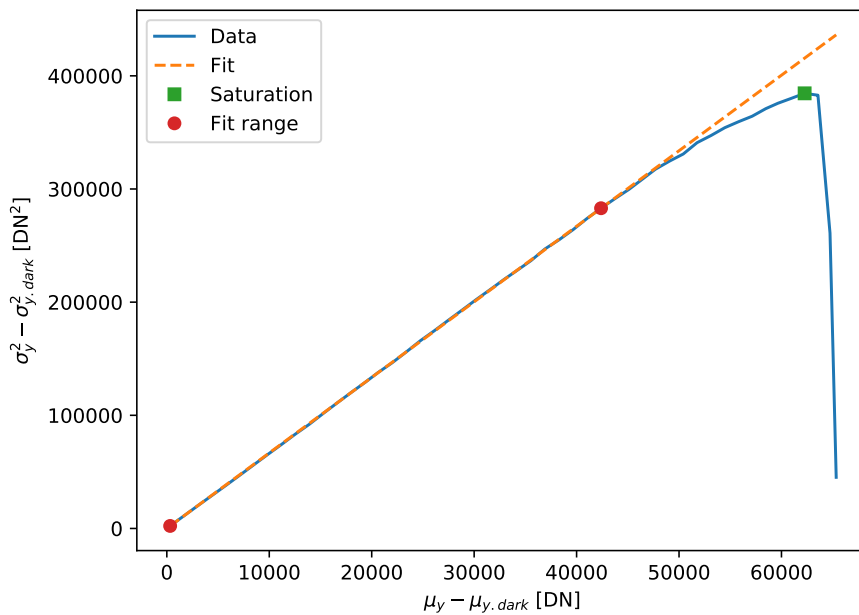
Linearity error

LE_{min} -0.378 %
 LE_{max} 0.123 %

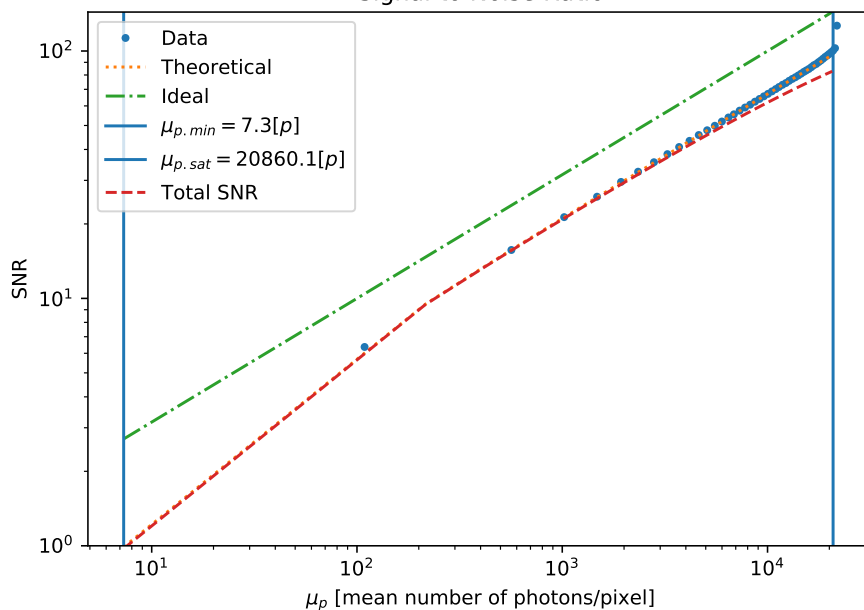
Dark current

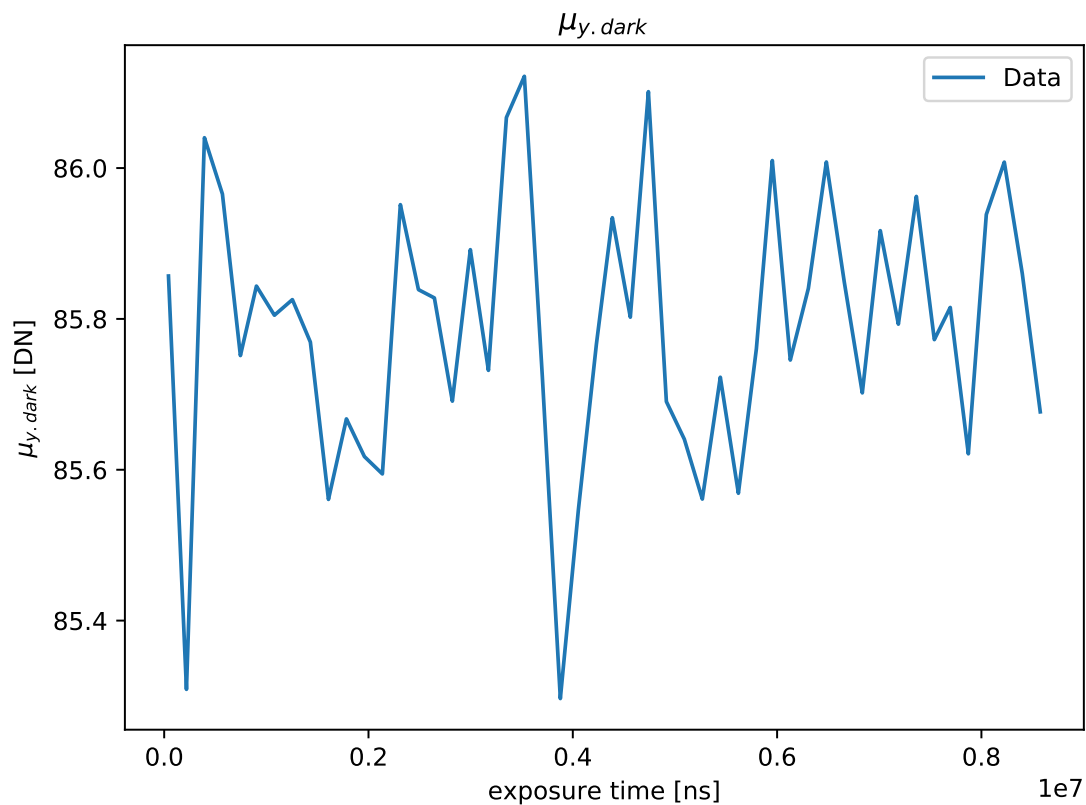
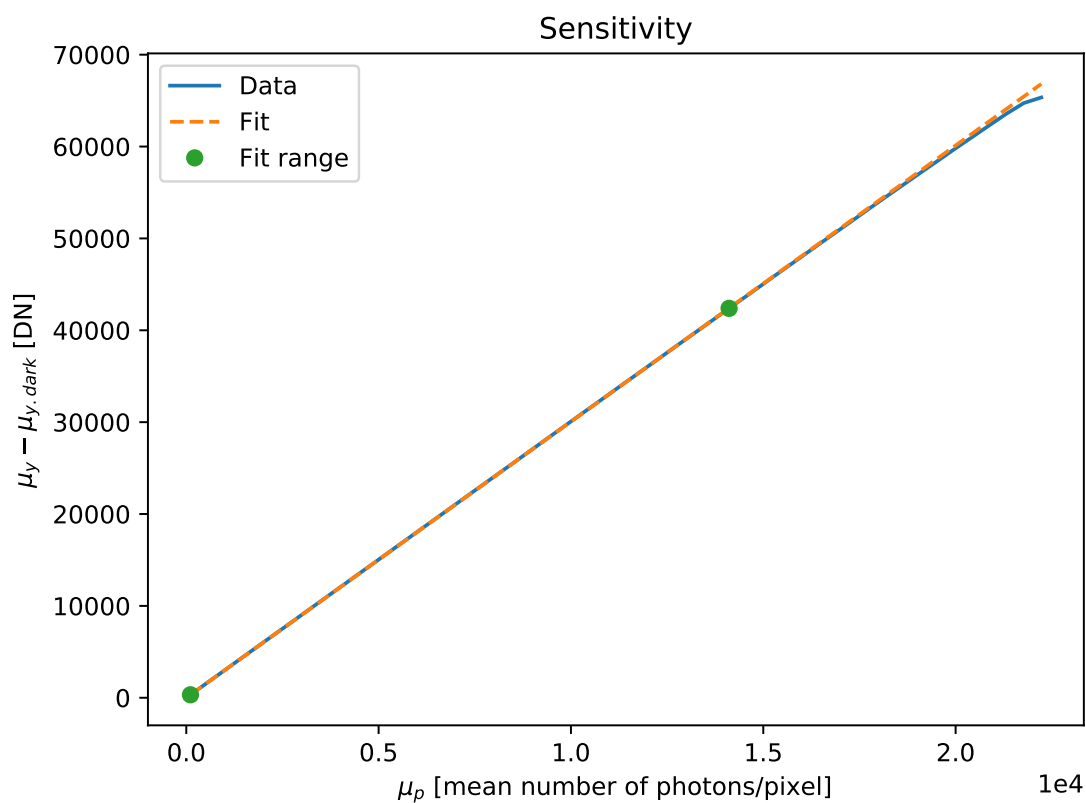
$\mu_{I.mean}$ 0.878 e⁻/s
5.861 DN/s
 $\mu_{I.var}$ -0.001 e⁻/s
-0.005 DN/s

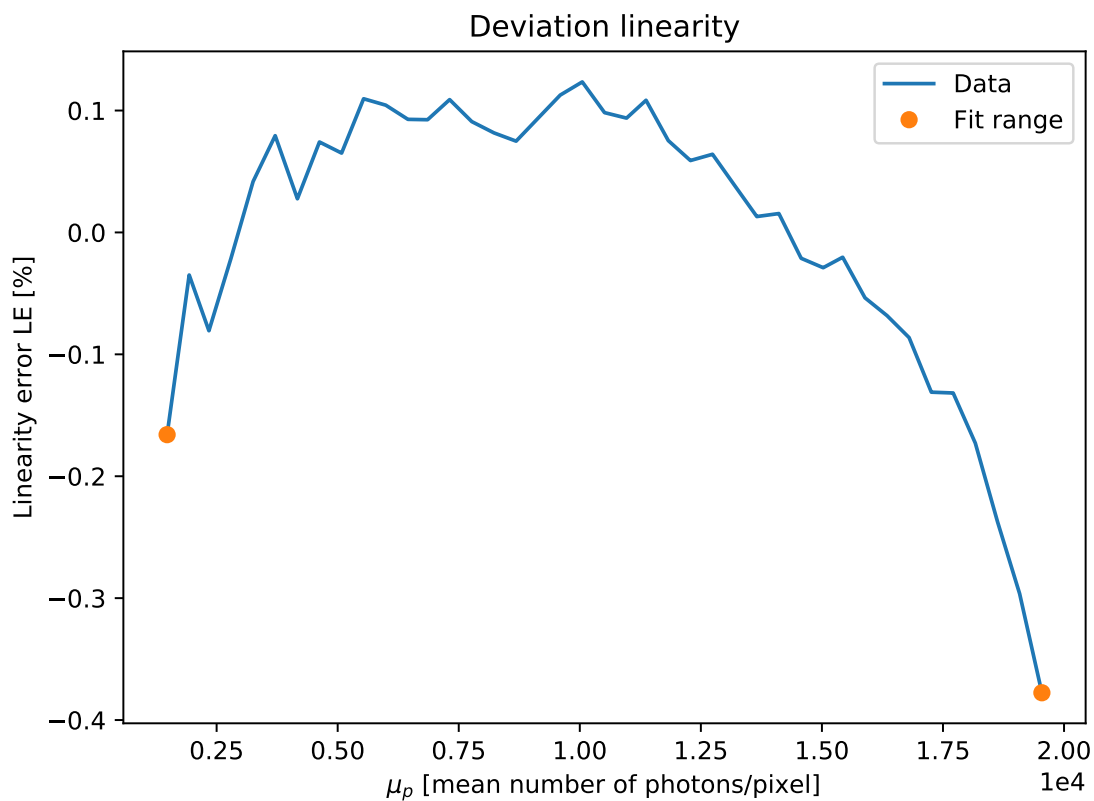
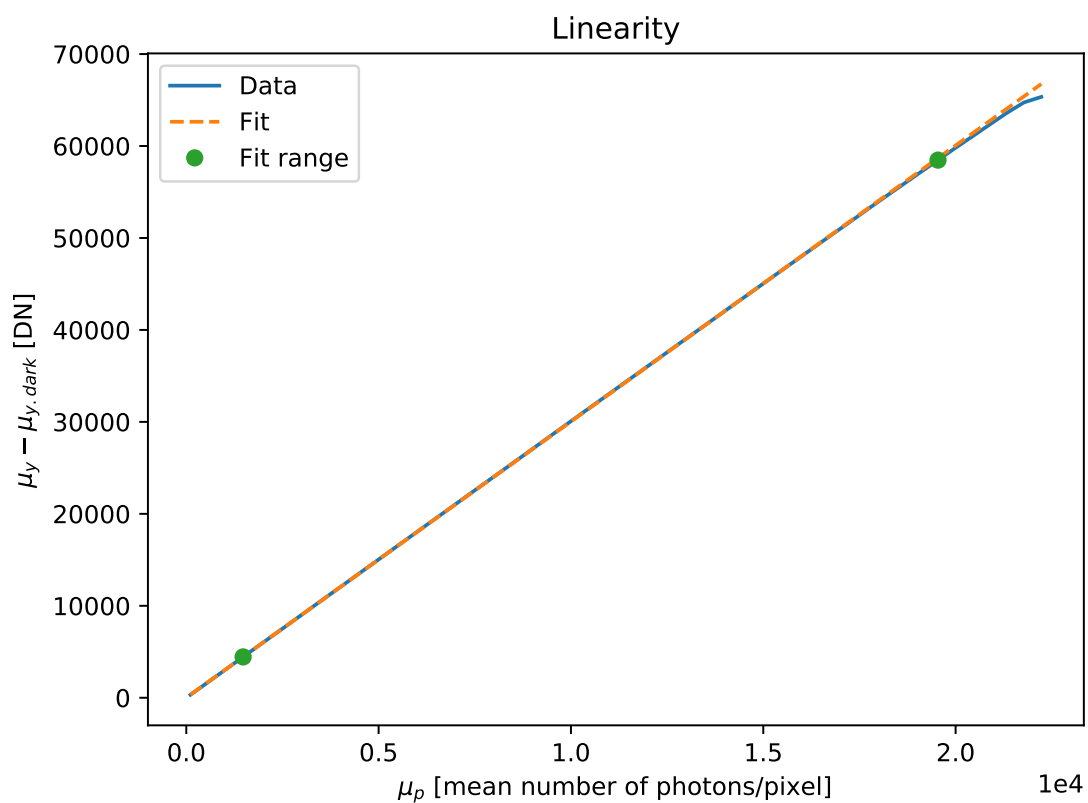
Photon Transfer



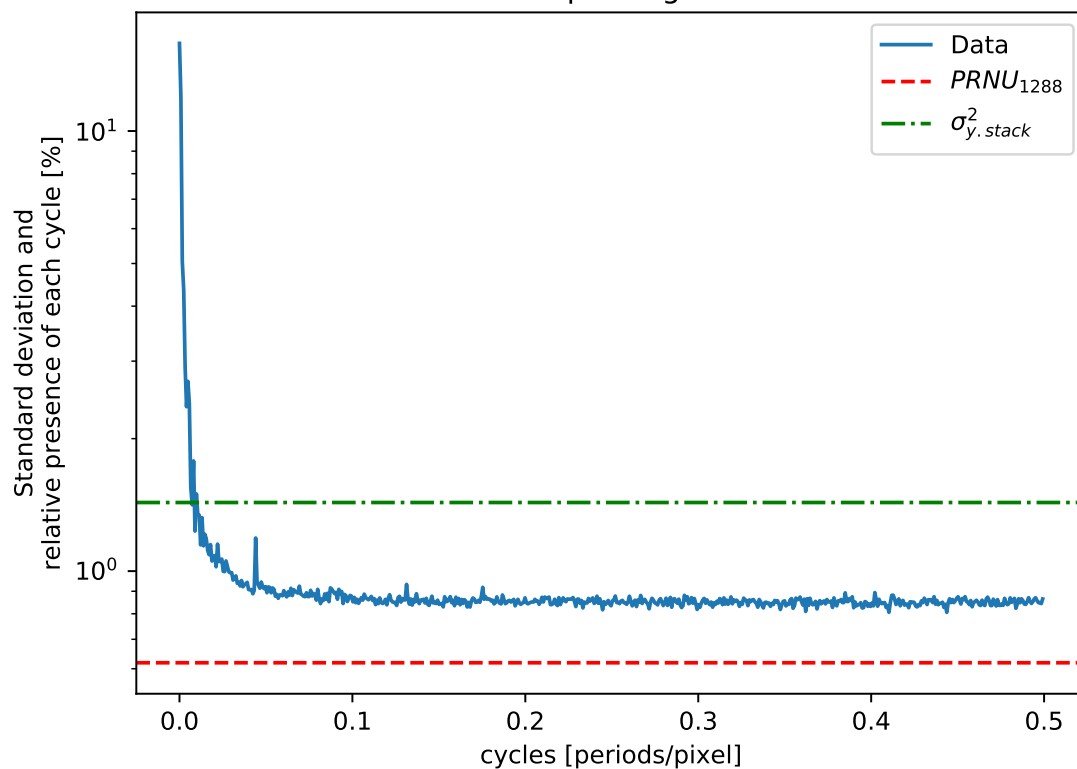
Signal to Noise Ratio



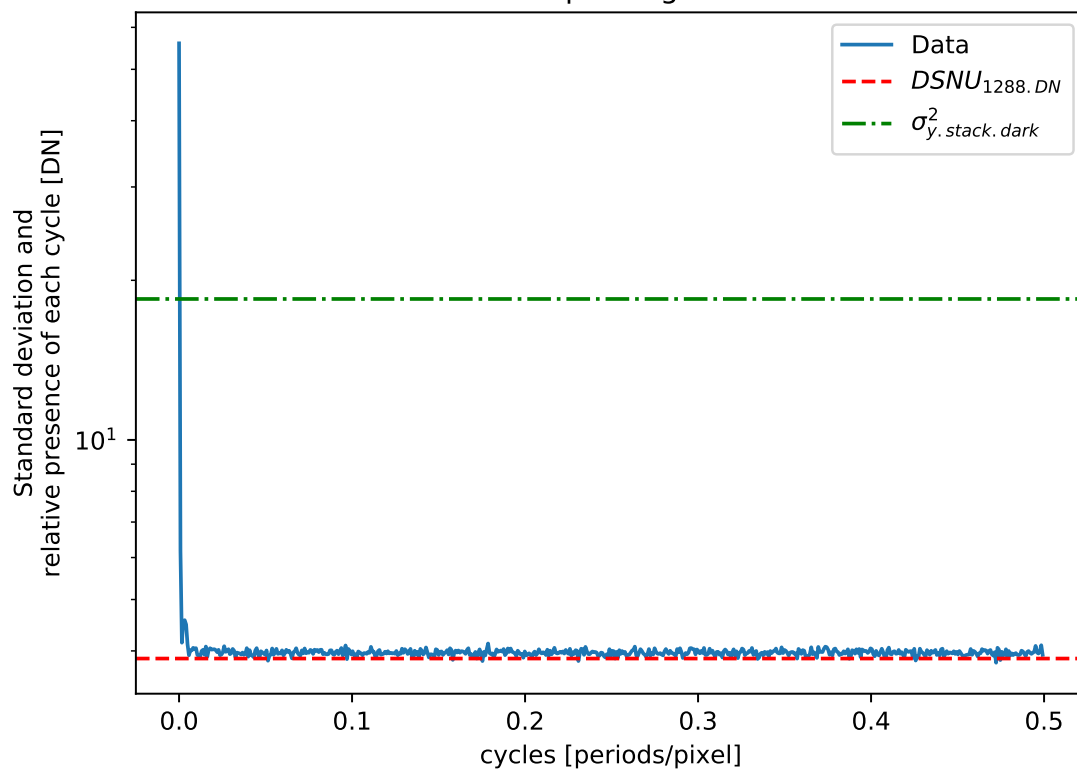


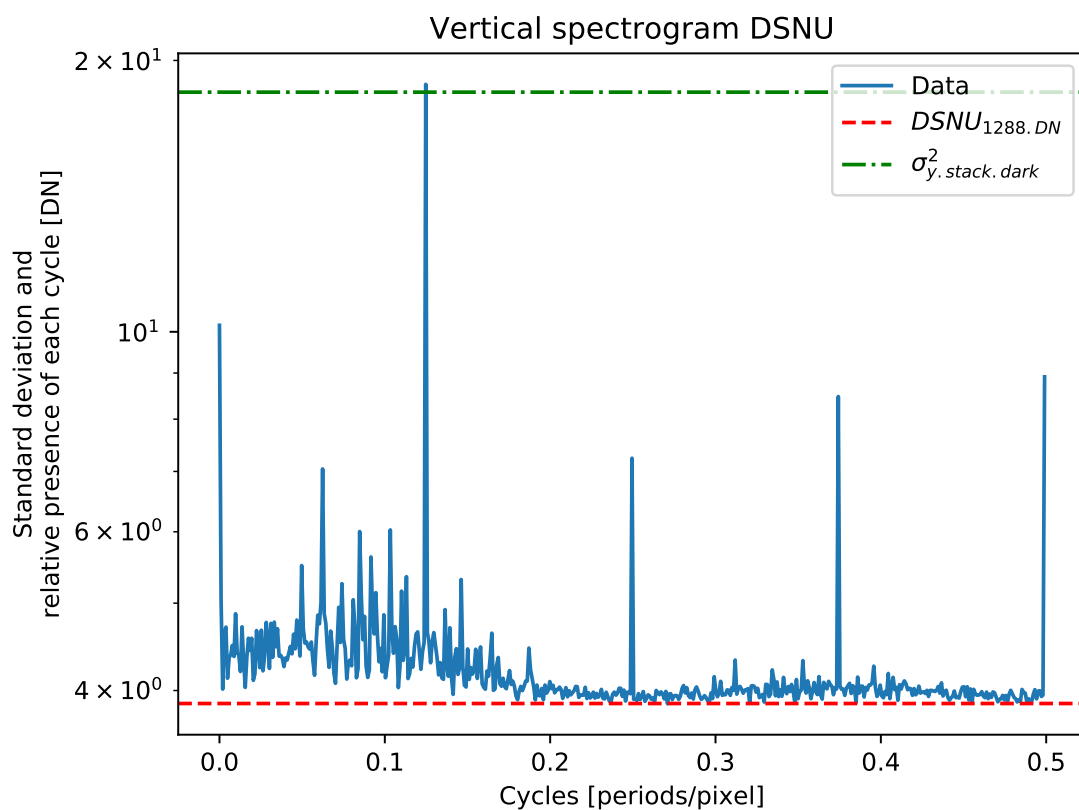
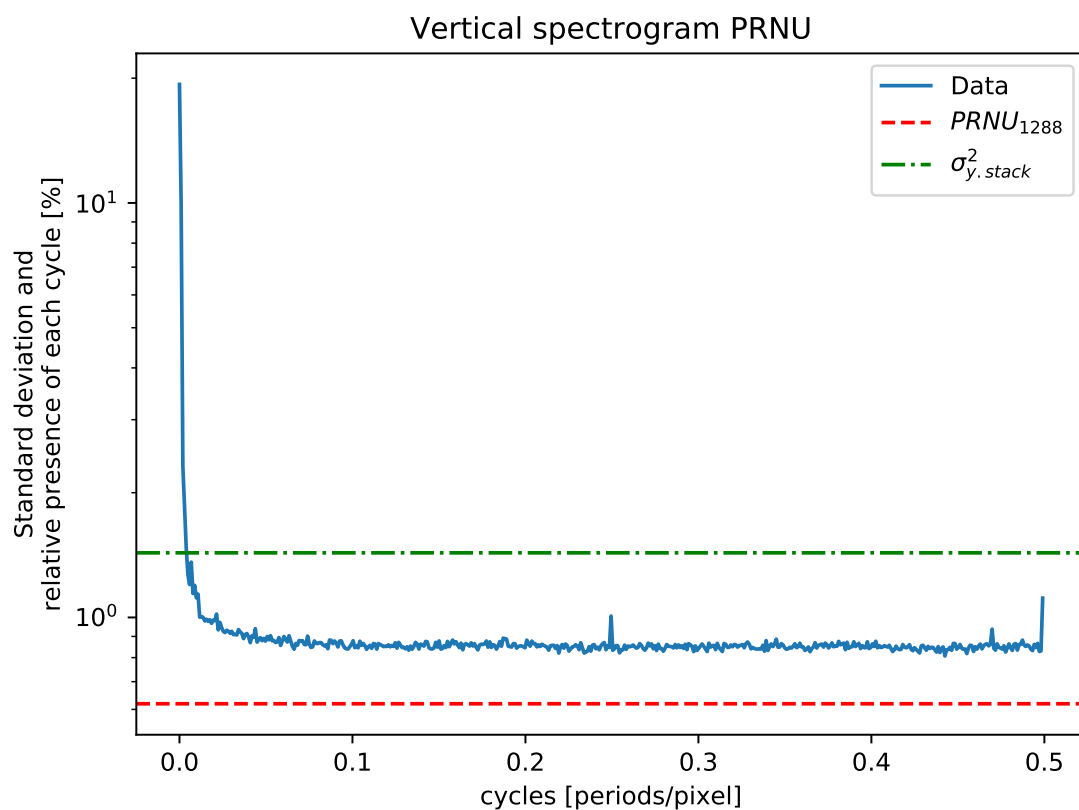


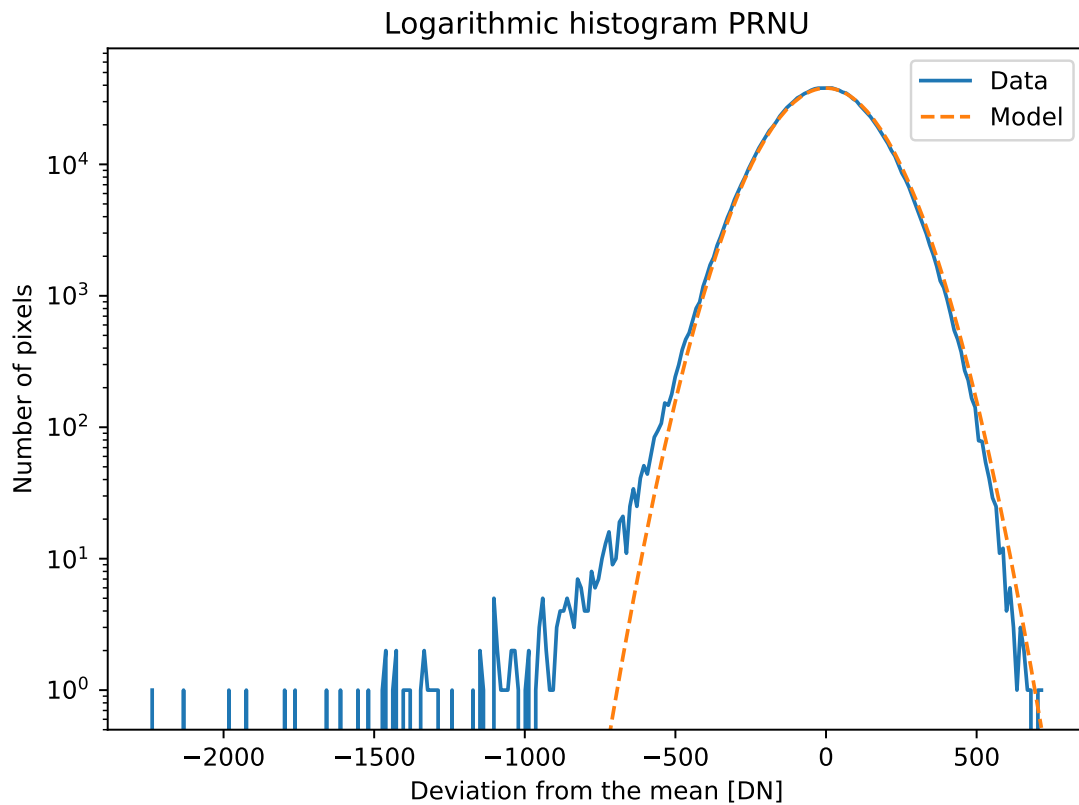
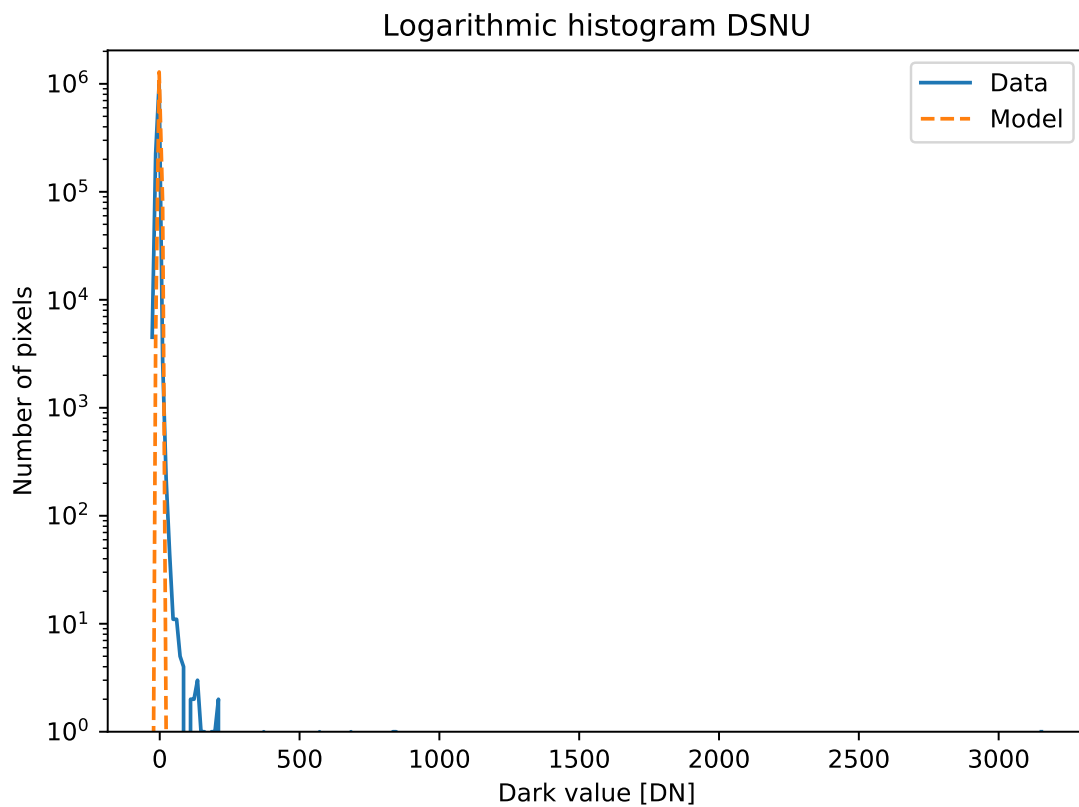
Horizontal spectrogram PRNU



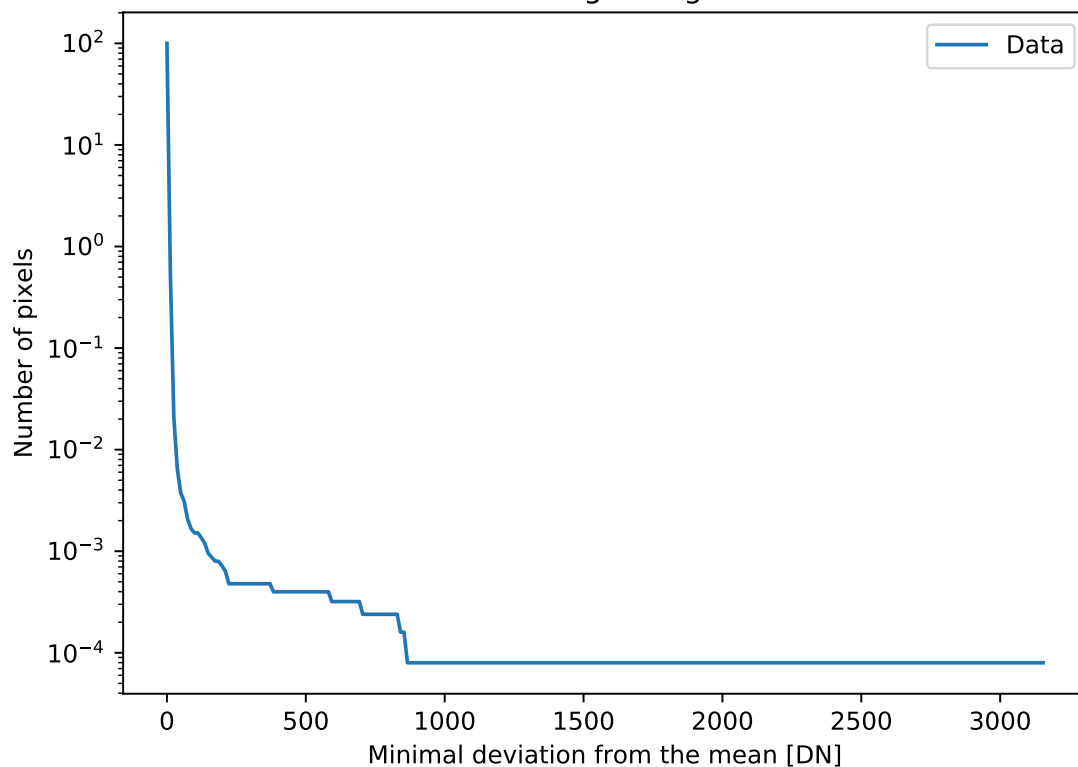
Horizontal spectrogram DSNU







Accumulated log histogram DSNU



Accumulated log histogram PRNU

