KAF16200 Charge Trapping Maximum Practical Exposure Limit

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Oct 8, 2019

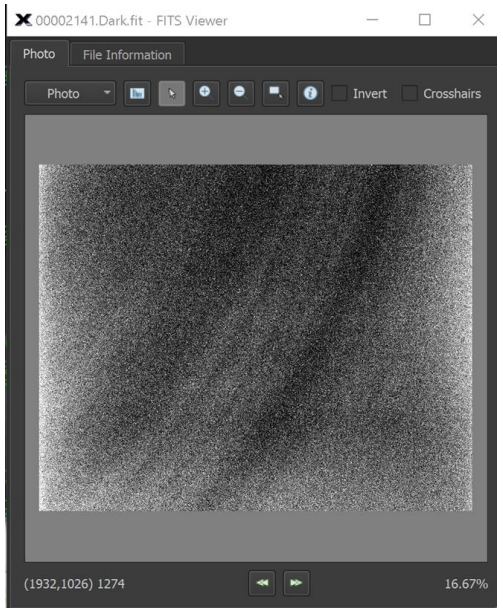
KAF16200 #1 (Striebeck sensor)

- 450 second darks binned 2x2 at -30C sensor temp
- Frame differenced identical pairs: one taken with RBI flooding, another taken w/o RBI flooding*
- 10,000 DN added to Minuend prior to subtraction
- A 100 x 100 region located at 2050X, 850Y was cropped & examined for both data sets

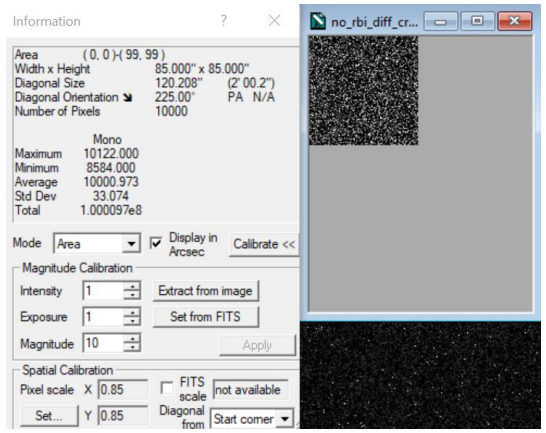
*because FLI camera flashes LED upon power-up charge trapping is avoided by using a warm, room temperature camera when power was applied. Any charge trapped during the power-on transient is allowed to decay over the next ten minutes with the cooler OFF. Only then is the cooler enabled allowing the sensor to be cooled down.

Empirical Results

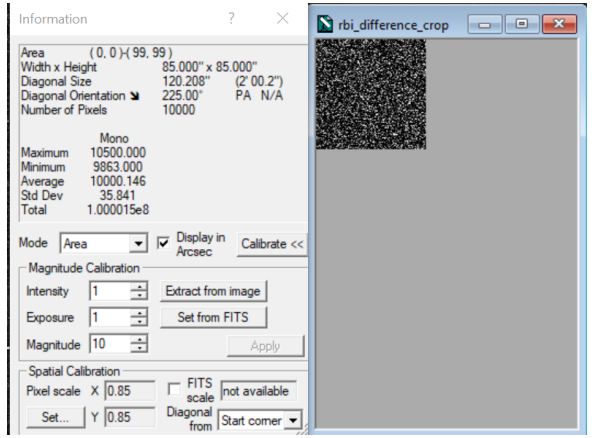
sensor	StDev (no flood)	StDev (with flood)
KAF16200 #1 (M.S.)	33.074 DN	35.841 DN



Light-flooded dark:
450 sec, 2x2 binning, -30C



Mark Striebeck data



Mark Striebeck data

Detailed Analysis -30C Sensor #1 (M.S.)

Noise Component	Value	unit
Read Noise	7.4	e-
Thermal Dark Shot	12.88	e-
Trap Leakage Dark Shot	6.20	e-

Parameter Name	value	units	notes
full well	41000	e-	datasheet
offset	1000	DN	guess, camera design spec
Full well	65535	DN	camera design spec
gain	1.574024	DN/e-	calculated, camera design spec
Kadc	0.635314	e-/DN	calculated, camera design spec
std RBI	35.841	DN	measured
std noRBI	33.074	DN	measured
total noise RBI flood	16.10103	e-	calculated
total noise noRBI flood	14.858	e-	calculated
read noise	7.4	e-	guess, needs to be measured
total dark shot w/light flood (noise)	14.29976	e-	calculated
total dark shot noLight flood (noise)	12.8841	e-	calculated
delta (trap leakage)	1.41566	e-	calculated
total dark signal w/light flood	204.4832	e-	calculated
total dark signal noLight flood	166.0001	e-	calculated
Trap leakage RBI	**38.4831**	**e-**	**calculated**
Trapped leakage as % of thermally generated	23.18%	percentage	calculated
Noise due to Trap Leakage	6.203475	e-	calculated
Noise due to thermally generated dark signal	12.8841	e-	calculated
exp time	450	sec	setting
binning	2	x&y	setting
measured dark signal/pixel/sec noLight flood	**0.092222**	**e-/pix/sec**	**calculated**
dark current spec	112	e-/sec/pixel	datasheet
dark current temperature	60	C	datasheet
operating temp	-30	C	measured
spread	90	C	calculated
doubling temperature	11	C	datasheet
number of doublings to reach op temp	8.181818	dimensionless	calculated
dark temp scaling factor to reach op temp	290.384	dimensionless	calculated
Spec dark signal at op temp	**0.385696**	**e-/pix/sec**	**calculated from spec**
Actual Device Dark Signal % of spec	**23.91%**	**percentage**	**calculated**
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, no light flood)			
Total dark signal permissible	54.76	e-	definition of M.P.E.L.
time to reach max dark signal @ -30C	593.7829	seconds	calculated from measured data
time to reach max dark signal @ -30C	9.896381	minutes	calculated from measured data

With 450 sec dark, 2x2 binning& and -30C operation, this sensor is exceeding the practical exposure limit:
(Read Noise < Total Dark Shot Noise)

This is equivalent to a 1x1 binned 30 minute exposure

Practical exposure limit at -30C for this sensor with 1x1 binning and no light flood is 9.9 minutes (594 seconds)

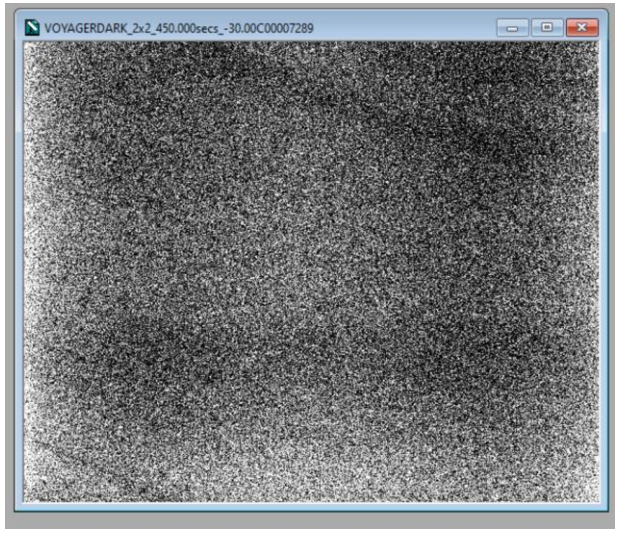
This is your measured dark signal/pixel/sec

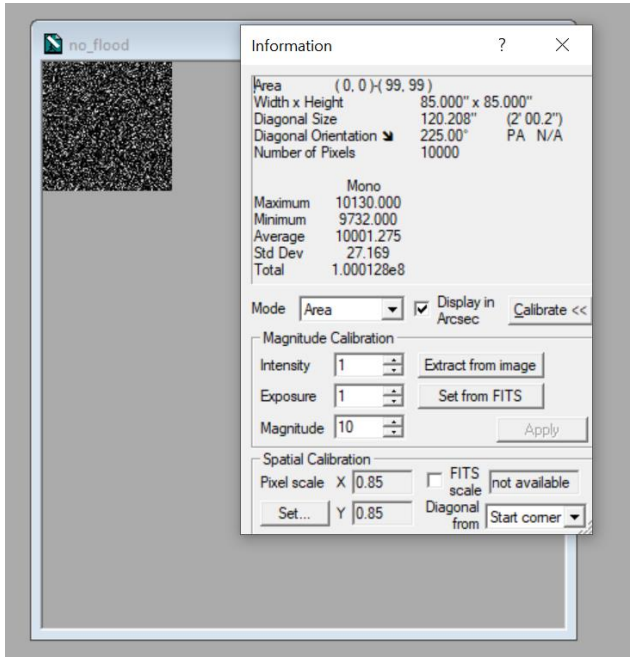
This what ON-Semi specifies for dark signal/pixel/sec

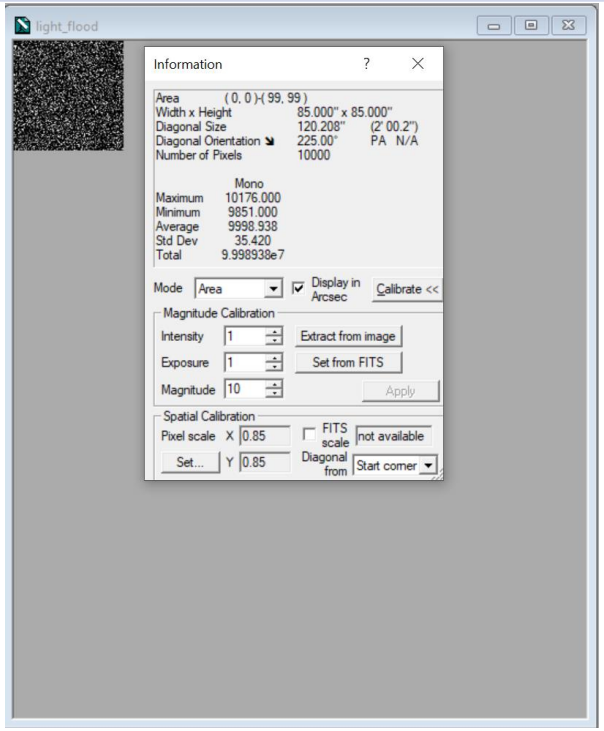
This is your measured dark signal vs ON-Semi Spec ratio for dark signal/pixel/sec

Empirical Results (Sensor #2: B.L.)

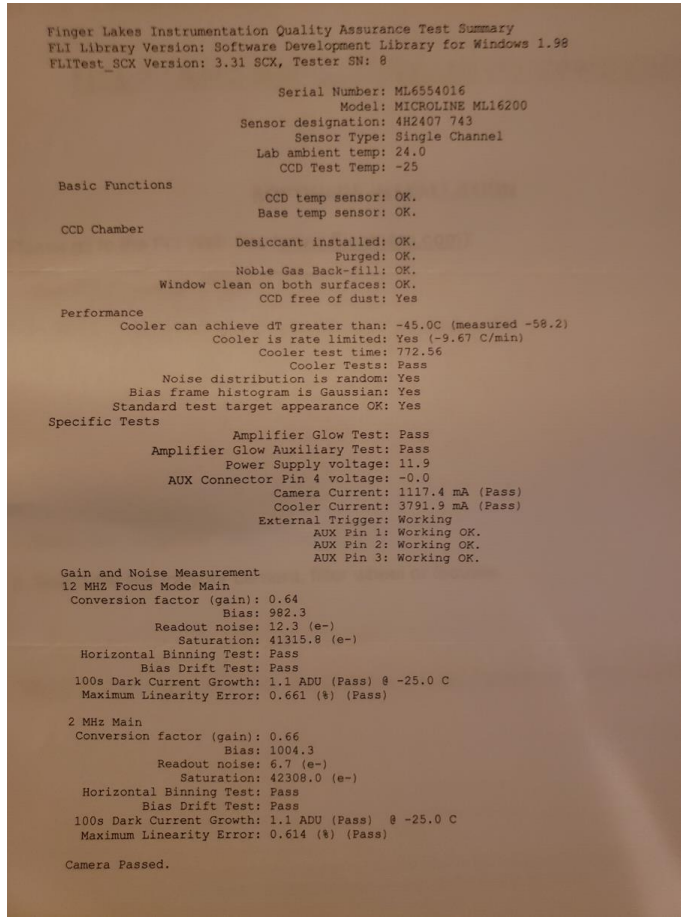
sensor	StDev (no flood)	StDev (with flood)
KAF16200 #2 (B.L.)	27.169 DN	35.420







FLI Test Data for Sensor #2 (B.L.)



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Finger Lakes Instrumentation Quality Assurance Test Summary
FLI Library Version: Software Development Library for Windows 1.98
FLITest_SCX Version: 3.31 SCX, Tester SN: 8

                          Serial Number: ML6554016
                                  Model: MICROLINE ML16200
                     Sensor designation: 4H2407 743
                            Sensor Type: Single Channel
                        Lab ambient temp: 24.0
                           CCD Test Temp: -25
 Basic Functions
                        CCD temp sensor: OK.
                        Base temp sensor: OK.
 CCD Chamber
                      Desiccant installed: OK.
                                  Purged: OK.
                     Noble Gas Back-fill: OK.
               Window clean on both surfaces: OK.
                          CCD free of dust: Yes
 Performance
          Cooler can achieve dT greater than: -45.0C (measured -58.2)
                       Cooler is rate limited: Yes (-9.67 C/min)
                            Cooler test time: 772.56
                               Cooler Tests: Pass
              Noise distribution is random: Yes
           Bias frame histogram is Gaussian: Yes
         Standard test target appearance OK: Yes
Specific Tests
                        Amplifier Glow Test: Pass
              Amplifier Glow Auxiliary Test: Pass
                      Power Supply voltage: 11.9
                AUX Connector Pin 4 voltage: -0.0
                           Camera Current: 1117.4 mA (Pass)
                           Cooler Current: 3791.9 mA (Pass)
                        External Trigger: Working
                               AUX Pin 1: Working OK.
                               AUX Pin 2: Working OK.
                               AUX Pin 3: Working OK.
  Gain and Noise Measurement
  12 MHZ Focus Mode Main
   Conversion factor (gain): 0.64
                       Bias: 982.3
              Readout noise: 12.3 (e-)
                 Saturation: 41315.8 (e-)
    Horizontal Binning Test: Pass
          Bias Drift Test: Pass
   100s Dark Current Growth: 1.1 ADU (Pass) @ -25.0 C
    Maximum Linearity Error: 0.661 (%) (Pass)

  2 MHz Main
   Conversion factor (gain): 0.66
                       Bias: 1004.3
              Readout noise: 6.7 (e-)
                 Saturation: 42308.0 (e-)
    Horizontal Binning Test: Pass
          Bias Drift Test: Pass
   100s Dark Current Growth: 1.1 ADU (Pass)  @ -25.0 C
    Maximum Linearity Error: 0.614 (%) (Pass)

  Camera Passed.
```

Detailed Analysis -30C Sensor #2 (B.L.)

Noise Component	Value	unit
Read Noise	6.761	e-
Thermal Dark Shot	10.72	e-
Trap Leakage Dark Shot	10.61	e-

Parameter Name	value	units	notes
full well	42308	e-	FLI provided test data
offset	1004.3	DN	FLI provided test data
gain	1.515152	DN/e-	calculated from FLI test data
Kadc	0.66	e-/DN	FLI provided test data
std RBI	35.42	DN	measured from frame differenced identical darks: data input
std noRBI	27.169	DN	measured from frame differenced identical darks: data input
total noise, Light flood	16.53018	e-	calculated from frame differenced identical darks: data input
total noise, no Light flood	12.67951	e-	calculated from frame differenced identical darks: data input
read noise	6.761	e-	FLI provided test data
total dark shot w/light flood (noise)	15.08428	e-	calculated
thermal dark shot no Light flood (noise)	**10.72655**	**e-**	**calculated**
quadrature delta (Trap Leakage Shot Noise)	**10.6055**	**e-**	**calculated**
total dark signal w/light flood	227.5356	e-	calculated
Thermal dark signal no Light flood	115.0589	e-	calculated
Trap leakage Light Flood (Signal)	**112.4767**	**e-**	**calculated**
Trapped leakage as % of thermally generated	97.76%	percentage	calculated
Noise due to thermally generated dark signal	10.72655	e-	calculated
exp time	450	sec	setting
binning	2	x&y	setting
measured dark signal/pixel/sec noLight flood	**0.063922**	**e-/pix/sec**	**calculated from dark shot noise measurements**
dark current spec	112	e-/sec/pixel	On Semi datasheet
dark current temperature	60	C	On Semi datasheet
operating temp	-30	C	measured
spread	90	C	calculated
doubling temperature	11	C	On Semi datasheet
number of doublings to reach op temp	8.181818	dimensionless	calculated
dark temp scaling factor to reach op temp	290.384	dimensionless	calculated
Inferred Data Sheet Spec dark signal at op temp	**0.385696**	**e-/pix/sec**	**calculated from On Semi Datasheet Spec**
Actual Device Measured Dark Signal % of spec	**16.57%**	**percentage**	**calculated**
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, no light flood)			
Total dark signal permissible	45.71112	e-	definition of M.P.E.L.
time to reach max dark signal @ -30C	715.1119	seconds	calculated from measured data
time to reach max dark signal @ -30C	11.91853	minutes	calculated from measured data
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, with light flood)			
time to reach max dark signal @ -30C	361.6138	seconds	calculated from measured data
time to reach max dark signal @ -30C	6.026897	minutes	calculated from measured data
FLI Dark Signal Test Data Reconciliation			
exposure time	100	seconds	FLI test conditions measurement specification*
100s total dark signal (no light flood)	6.392163	electrons	calculated from shot noise measurements
100s total dark signal (no light flood)	9.685096	DN	calculated from shot noise measurements

*there are different ways to measure this. In this case a shot noise analysis is made based on frame-differenced identical darks of known duration.

With 450 sec dark, 2x2 binning& and -30C operation, this sensor is exceeding the practical exposure limit:
(Read Noise < Total Dark Shot Noise)

This is equivalent to a 1x1 binned 30 minute exposure

Practical exposure limit at -30C for this sensor with 1x1 binning and no light flood is 11.91 minutes (715.1 seconds)

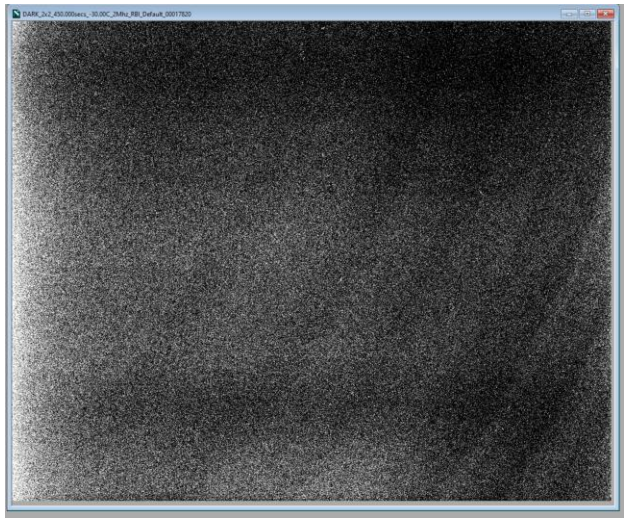
This is your measured dark signal/pixel/sec

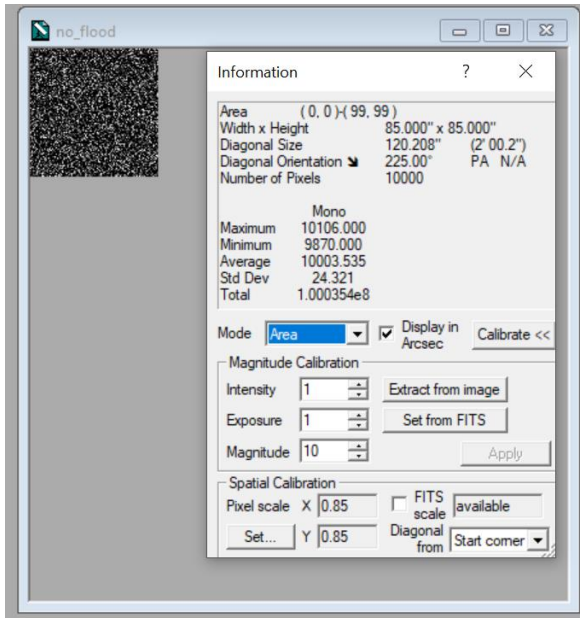
This what ON-Semi specifies for dark signal/pixel/sec

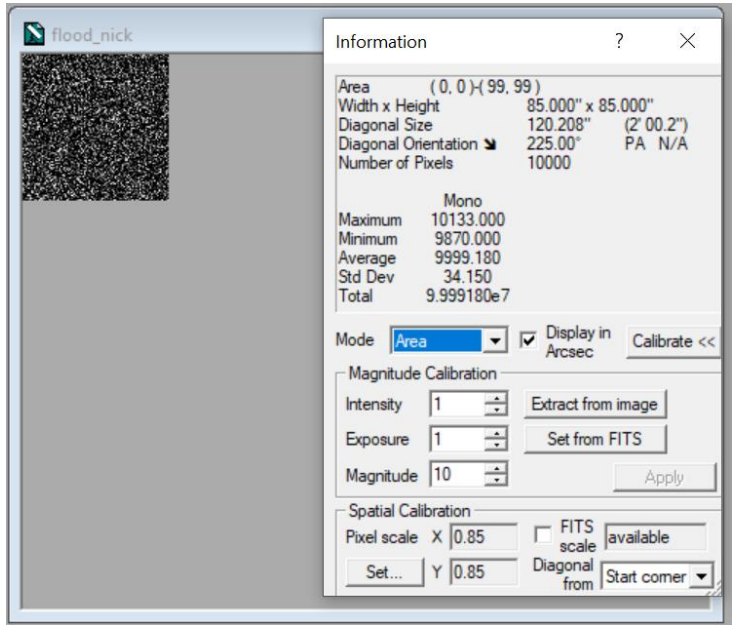
This is your measured dark signal as a percentage of ON-Semi Spec

Empirical Results (Sensor #3: N.S.)

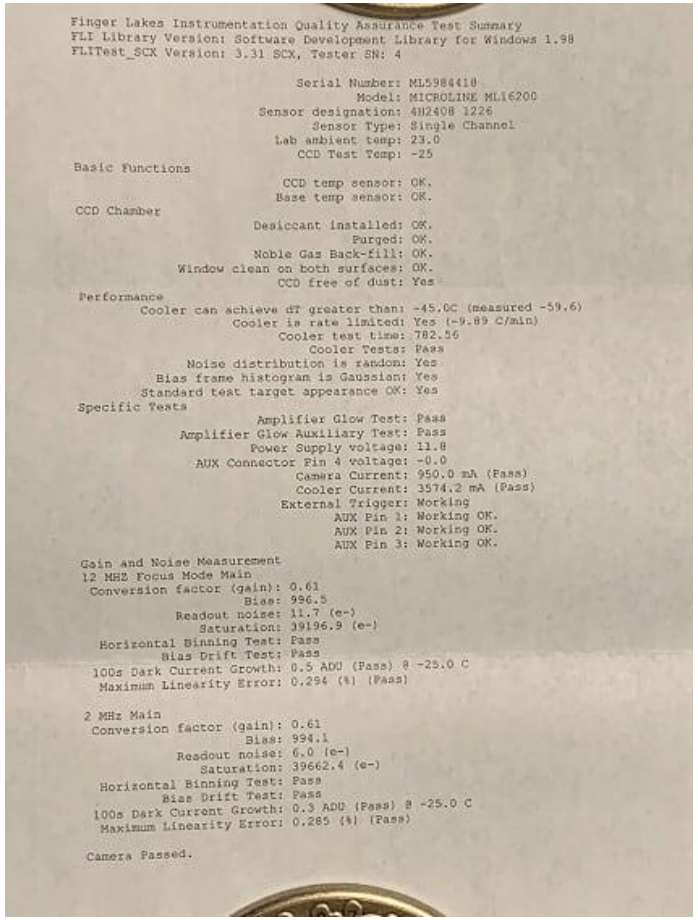
sensor	StDev (no flood)	StDev (with flood)
KAF16200 #3 (N.S.)	24.321 DN	34.150







FLI Test Data for Sensor #3 (N.S.)



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Finger Lakes Instrumentation Quality Assurance Test Summary
FLI Library Version: Software Development Library for Windows 1.98
FLITest_SCX Version: 3.31 SCX, Tester SN: 4

                          Serial Number: ML5984418
                                  Model: MICROLINE ML16200
                     Sensor designation: 4H2408 1226
                            Sensor Type: Single Channel
                       Lab ambient temp: 23.0
                         CCD Test Temp: -25
Basic Functions
                        CCD temp sensor: OK.
                       Base temp sensor: OK.
CCD Chamber
                     Desiccant installed: OK.
                                  Purged: OK.
                     Noble Gas Back-fill: OK.
          Window clean on both surfaces: OK.
                        CCD free of dust: Yes
Performance
      Cooler can achieve dT greater than: -45.0C (measured -59.6)
                 Cooler is rate limited: Yes (-9.89 C/min)
                        Cooler test time: 782.56
                            Cooler Tests: Pass
          Noise distribution is random: Yes
        Bias frame histogram is Gaussian: Yes
      Standard test target appearance OK: Yes
Specific Tests
                       Amplifier Glow Test: Pass
           Amplifier Glow Auxiliary Test: Pass
                     Power Supply voltage: 11.8
          AUX Connector Pin 4 voltage: -0.0
                        Camera Current: 950.0 mA (Pass)
                        Cooler Current: 3574.2 mA (Pass)
                     External Trigger: Working
                           AUX Pin 1: Working OK.
                           AUX Pin 2: Working OK.
                           AUX Pin 3: Working OK.

Gain and Noise Measurement
12 MHZ Focus Mode Main
 Conversion factor (gain): 0.61
                     Bias: 996.5
            Readout noise: 11.7 (e-)
               Saturation: 29196.9 (e-)
  Horizontal Binning Test: Pass
        Bias Drift Test: Pass
 100s Dark Current Growth: 0.5 ADU (Pass) @ -25.0 C
  Maximum Linearity Error: 0.294 (%) (Pass)

2 MHz Main
 Conversion factor (gain): 0.61
                     Bias: 994.1
            Readout noise: 6.0 (e-)
               Saturation: 39662.4 (e-)
  Horizontal Binning Test: Pass
        Bias Drift Test: Pass
 100s Dark Current Growth: 0.3 ADU (Pass) @ -25.0 C
  Maximum Linearity Error: 0.285 (%) (Pass)

Camera Passed.
```

Detailed Analysis -30C Sensor #3 (N.S.)

Noise Component	Value	unit
Read Noise	6.00	e-
Thermal Dark Shot	8.605	e-
Trap Leakage Dark Shot	10.34	e-

Parameter Name	value	units	notes
full well	39662.4	e-	FLI provided test data
offset	994.1	DN	FLI provided test data
gain	1.639344	DN/e-	calculated from FLI test data
Kadc	0.61	e-/DN	FLI provided test data
std RBI	34.15	DN	measured from frame differenced identical darks: data input
std noRBI	24.321	DN	measured from frame differenced identical darks: data input
total noise, Light flood	14.73009	e-	calculated from frame differenced identical darks: data input
total noise, no Light flood	10.4905	e-	calculated from frame differenced identical darks: data input
read noise	6	e-	FLI provided test data
total dark shot w/light flood (noise)	13.45272	e-	calculated
thermal dark shot no Light flood (noise)	**8.605268**	**e-**	**calculated**
quadrature delta (Trap Leakage Shot Noise)	**10.34046**	**e-**	**calculated**
total dark signal w/light flood	180.9757	e-	calculated
Thermal dark signal no Light flood	74.05063	e-	calculated
Trap leakage Light Flood (Signal)	**106.9251**	**e-**	**calculated**
Trapped leakage as % of thermally generated	144.39%	percentage	calculated
Noise due to thermally generated dark signal	8.605268	e-	calculated
exp time	450	sec	setting
binning	2x&y		setting
measured dark signal/pixel/sec noLight flood	**0.041139**	**e-/pix/sec**	**calculated from dark shot noise measurements**
dark current spec	112	e-/sec/pixel	On Semi datasheet
dark current temperature	60	C	On Semi datasheet
operating temp	-30	C	measured
spread	90	C	calculated
doubling temperature	11	C	On Semi datasheet
number of doublings to reach op temp	8.181818	dimensionless	calculated
dark temp scaling factor to reach op temp	290.384	dimensionless	calculated
Inferred Data Sheet Spec dark signal at op temp	**0.385696**	**e-/pix/sec**	**calculated from On Semi Datasheet Spec**
Actual Device Measured Dark Signal % of spec	**10.67%**	**percentage**	**calculated**
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, no light flood)			
Total dark signal permissible	36	e-	definition of M.P.E.L.
time to reach max dark signal @ -30C	875.077	seconds	calculated from measured data
time to reach max dark signal @ -30C	14.58462	minutes	calculated from measured data
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, with light flood)			
time to reach max dark signal @ -30C	358.0591	seconds	calculated from measured data
time to reach max dark signal @ -30C	5.967652	minutes	calculated from measured data
FLI Dark Signal Test Data Reconciliation			
exposure time	100	seconds	FLI test conditions measurement specification*
100s total dark signal (no light flood)	4.113924	electrons	calculated from shot noise measurements
100s total dark signal (no light flood)	6.744137	DN	calculated from shot noise measurements

With 450 sec dark, 2x2 binning& and -30C operation, this sensor is exceeding the practical exposure limit:
(Read Noise < Total Dark Shot Noise)

This is equivalent to a 1x1 binned 30 minute exposure

Practical exposure limit at -30C for this sensor with 1x1 binning and no light flood is 14.58 minutes (875.1 seconds)

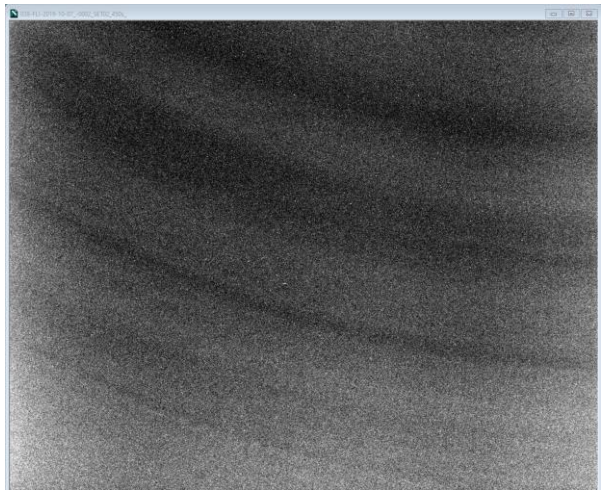
This is your measured dark signal/pixel/sec

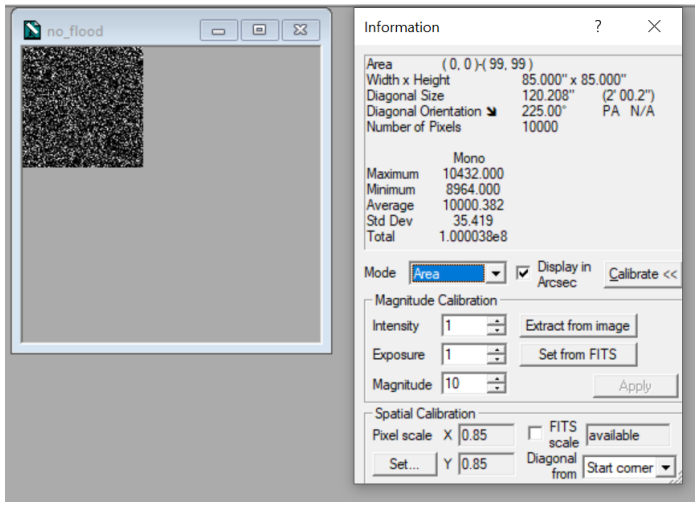
This what ON-Semi specifies for dark signal/pixel/sec

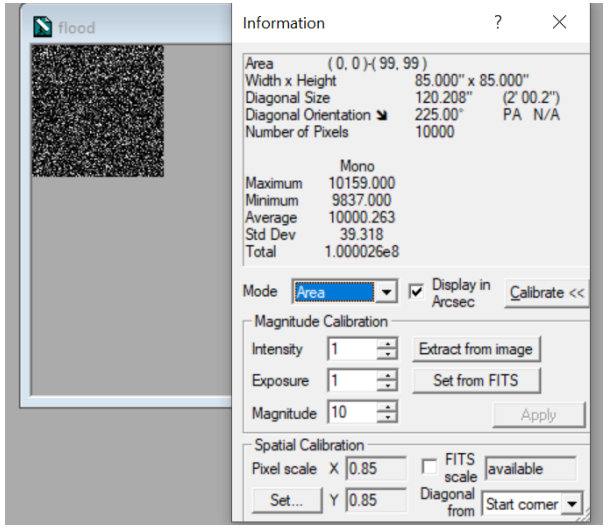
This is your measured dark signal vs ON-Semi Spec ratio for dark signal/pixel/sec

Empirical Results (Sensor #4: B.K.)

sensor	StDev (no flood)	StDev (with flood)
KAF16200 #4 (B.K.)	35.419	39.318







FLI Test Data for Sensor #4 (B.K.)

2019-05-10

FLI ML16200 Returned Today
New PCB's and Sensor
Starting Diagnostics

Things to do:
New DTC / PTC
Establish Gain and Bias
Dark Current Masurements

FLI Measurements Documented
2 MHz

Gain	0.64 e-/ADU
Bias:	1002.3 ADU
Read Noise	6.8 e-
Saturation	41415.4 e-
	64711.5625 ADU
100s Dark Current Growth:	2.9 ADU @ -25C
Max Linearity Error:	0.157%

Detailed Analysis -30C Sensor #4 (B.K.)

Noise Component	Value	unit
Read Noise	6.8	e-
Thermal Dark Shot	14.51	e-
Trap Leakage Dark Shot	7.73	e-

Parameter Name	value	units	notes
full well	41415	e-	FLI provided test data
offset	1002.3	DN	FLI provided test data
gain	1.5625	DN/e-	calculated from FLI test data
Kadc	0.64	e-/DN	FLI provided test data
std RBI	39.318	DN	measured from frame differenced identical darks: data input
std noRBI	35.419	DN	measured from frame differenced identical darks: data input
total noise, Light flood	17.7933	e-	calculated from frame differenced identical darks: data input
total noise, no Light flood	16.02881	e-	calculated from frame differenced identical darks: data input
read noise	6.8	e-	FLI provided test data
total dark shot w/light flood (noise)	16.44267	e-	calculated
thermal dark shot no Light flood (noise)	**14.51491**	**e-**	**calculated**
quadrature delta (Trap Leakage Shot Noise)	**7.725195**	**e-**	**calculated**
total dark signal w/light flood	270.3614	e-	calculated
Thermal dark signal no Light flood	210.6827	e-	calculated
Trap leakage Light Flood (Signal)	**59.67863**	**e-**	**calculated**
Trapped leakage as % of thermally generated	28.33%	percentage	calculated
Noise due to thermally generated dark signal	14.51491	e-	calculated
exp time	450	sec	setting
binning	2	x&y	setting
measured dark signal/pixel/sec noLight flood	**0.117046**	**e-/pix/sec**	**calculated from dark shot noise measurements**
dark current spec	112	e-/sec/pixel	On Semi datasheet
dark current temperature	60	C	On Semi datasheet
operating temp	-30	C	measured
spread	90	C	calculated
doubling temperature	11	C	On Semi datasheet
number of doublings to reach op temp	8.181818	dimensionless	calculated
dark temp scaling factor to reach op temp	290.384	dimensionless	calculated
Inferred Data Sheet Spec dark signal at op temp	**0.385696**	**e-/pix/sec**	**calculated from On Semi Datasheet Spec**
Actual Device Measured Dark Signal % of spec	**30.35%**	**percentage**	**calculated**
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, no light flood)			
Total dark signal permissible	46.24	e-	definition of M.P.E.L.
time to reach max dark signal @ -30C	395.0585	seconds	calculated from measured data
time to reach max dark signal @ -30C	6.584308	minutes	calculated from measured data
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, with light flood)			
time to reach max dark signal @ -30C	307.8546	seconds	calculated from measured data
time to reach max dark signal @ -30C	5.130911	minutes	calculated from measured data
FLI Dark Signal Test Data Reconciliation			
exposure time	100	seconds	FLI test conditions measurement specification*
100s total dark signal (no light flood)	11.7046	electrons	calculated from shot noise measurements
100s total dark signal (no light flood)	18.28843	DN	calculated from shot noise measurements

*there are different ways to measure this. In this case a shot noise analysis is made based on frame-differenced identical darks of known duration.

With 450 sec dark, 2x2 binning& and -30C operation, this sensor is exceeding the practical exposure limit:
(Read Noise < Total Dark Shot Noise)

This is equivalent to a 1x1 binned 30 minute exposure

Practical exposure limit at -30C for this sensor with 1x1 binning and no light flood is 6.58 minutes (395.05 seconds)

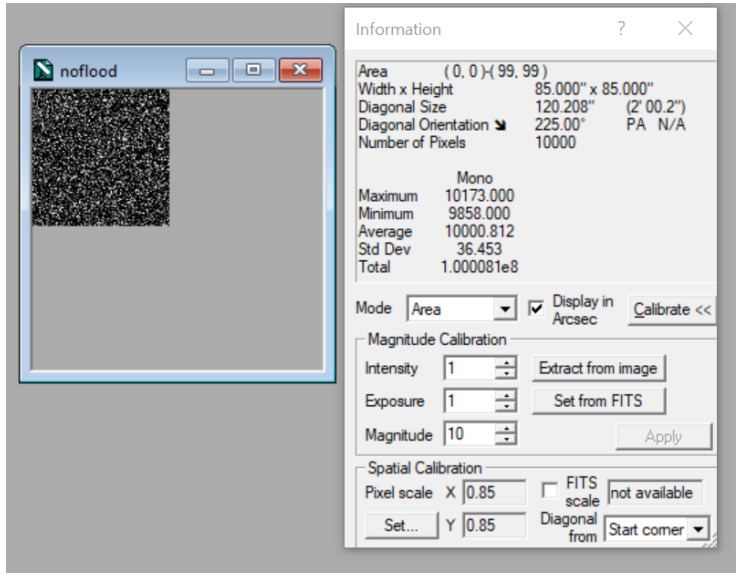
This is your measured dark signal/pixel/sec

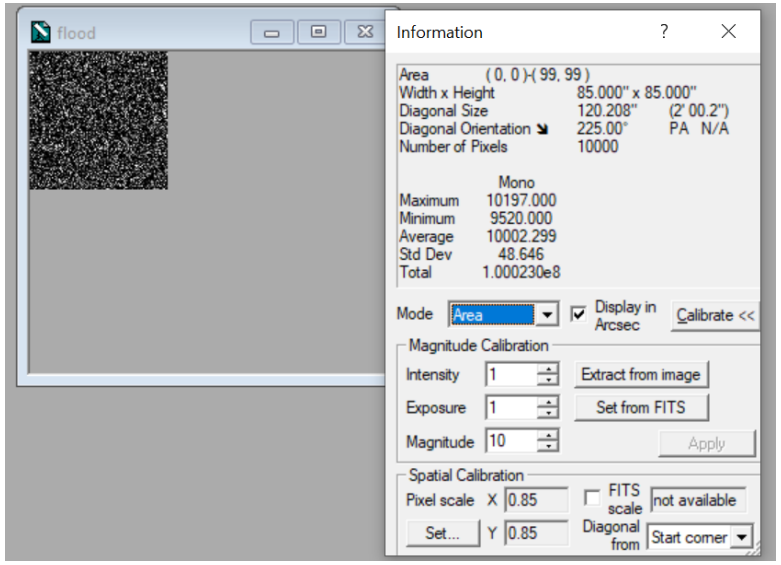
This what ON-Semi specifies for dark signal/pixel/sec

This is your measured dark signal vs ON-Semi Spec ratio for dark signal/pixel/sec

Empirical Results (Sensor #5: T.K.)

sensor	StDev (no flood)	StDev (with flood)
KAF16200 #5 (T.K.)	36.453	48.646





FLI Test Data for Sensor #5 (T.K.)

- Still need this

Detailed Analysis -30C Sensor #5 (T.K.)

Noise Component	Value	unit
Read Noise	6.44	e-
Thermal Dark Shot	15.829	e-
Trap Leakage Dark Shot	15.103	e-

Parameter Name	value	units	notes
full well	42019	e-	FLI provided test data
offset	1000	DN	FLI provided test data
gain	1.508296	DN/e-	calculated from FLI test data
Kadc	0.663	e-/DN	FLI provided test data
std RBI	48.646	DN	measured from frame differenced identical darks: data input
std noRBI	36.453	DN	measured from frame differenced identical darks: data input
total noise, Light flood	22.80582	e-	calculated from frame differenced identical darks: data input
total noise, no Light flood	17.0896	e-	calculated from frame differenced identical darks: data input
read noise	6.44	e-	FLI provided test data
total dark shot w/light flood (noise)	21.87765	e-	calculated
thermal dark shot no Light flood (noise)	**15.82974**	**e-**	**calculated**
quadrature delta (Trap Leakage Shot Noise)	**15.10136**	**e-**	**calculated**
total dark signal w/light flood	478.6318	e-	calculated
Thermal dark signal no Light flood	250.5807	e-	calculated
Trap leakage Light Flood (Signal)	**228.0511**	**e-**	**calculated**
Trapped leakage as % of thermally generated	91.01%	percentage	calculated
Noise due to thermally generated dark signal	15.82974	e-	calculated
exp time	450	sec	setting
binning	2	x&y	setting
measured dark signal/pixel/sec noLight flood	**0.139212**	**e-/pix/sec**	**calculated from dark shot noise measurements**
dark current spec	112	e-/sec/pixel	On Semi datasheet
dark current temperature	60	C	On Semi datasheet
operating temp	-30	C	measured
spread	90	C	calculated
doubling temperature	11	C	On Semi datasheet
number of doublings to reach op temp	8.181818	dimensionless	calculated
dark temp scaling factor to reach op temp	290.384	dimensionless	calculated
Inferred Data Sheet Spec dark signal at op temp	**0.385696**	**e-/pix/sec**	**calculated from On Semi Datasheet Spec**
Actual Device Measured Dark Signal % of spec	**36.09%**	**percentage**	**calculated**
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, no light flood)			
Total dark signal permissible	41.4736	e-	definition of M.P.E.L.
time to reach max dark signal @ -30C	297.9179	seconds	calculated from measured data
time to reach max dark signal @ -30C	4.965299	minutes	calculated from measured data
Maximum Practical Exposure Limit Calculation (M.P.E.L.) (1x1 binning, with light flood)			
time to reach max dark signal @ -30C	155.9706	seconds	calculated from measured data
time to reach max dark signal @ -30C	2.59951	minutes	calculated from measured data
FLI Dark Signal Test Data Reconciliation			
exposure time	100	seconds	FLI test conditions measurement specification*
100s total dark signal (no light flood)	13.92115	electrons	calculated from shot noise measurements
100s total dark signal (no light flood)	20.99721	DN	calculated from shot noise measurements

With 450 sec dark, 2x2 binning& and -30C operation, this sensor is exceeding the practical exposure limit:
(Read Noise < Total Dark Shot Noise)

This is equivalent to a 1x1 binned 30 minute exposure

Practical exposure limit at -30C for this sensor with 1x1 binning and no light flood is 4.96 minutes (297.9 seconds)

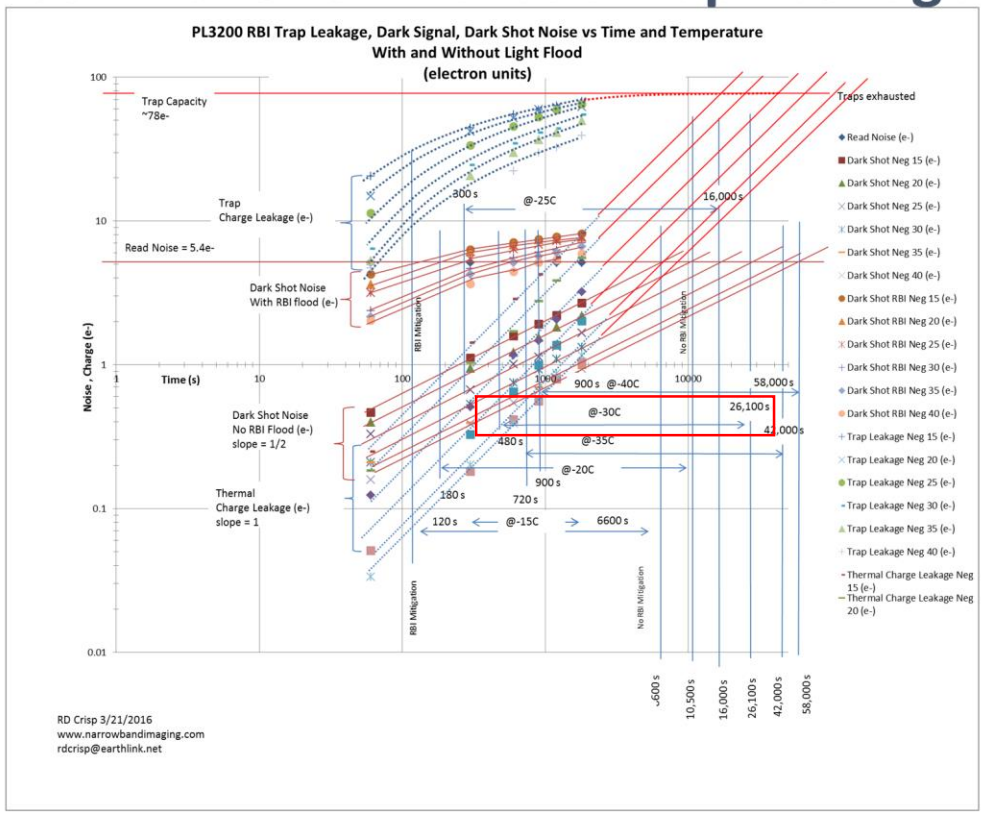
This is your measured dark signal/pixel/sec

This what ON-Semi specifies for dark signal/pixel/sec

This is your measured dark signal vs ON-Semi Spec ratio for dark signal/pixel/sec

M.P.E.L. From KAF3200 with(trap leakage case)/without light flood

KAF3200 With and Without Trap Leakage



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With light flood:
Max practical exposure limit for -30C operation is 480 sec

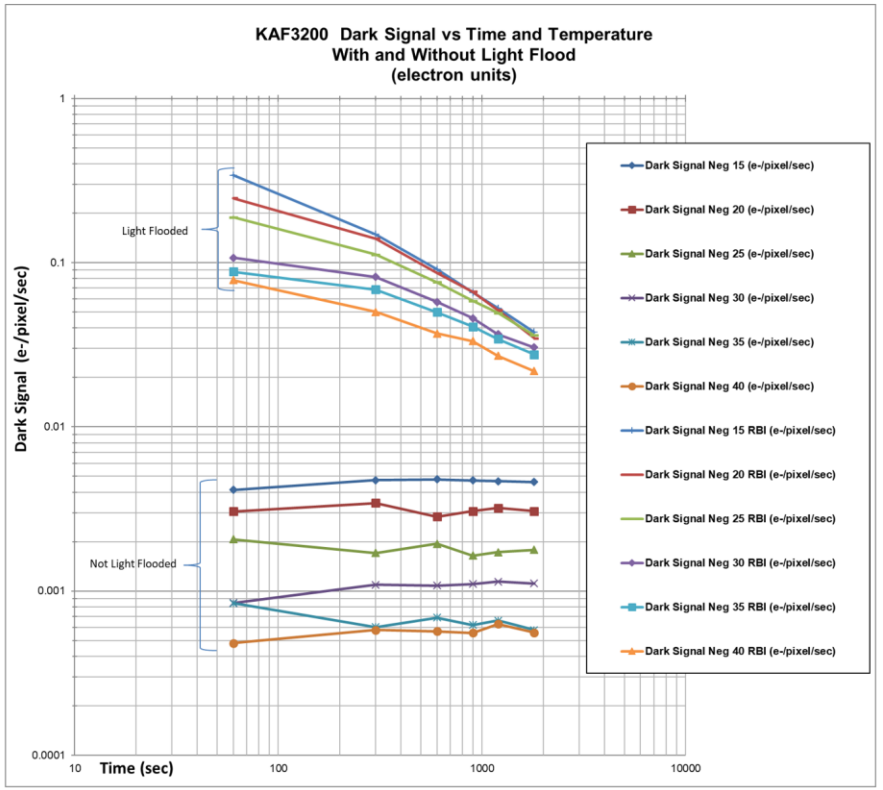
For no light flood:
Max practical exposure limit for -30C operation is 26,100 sec

Dark Signal From KAF3200

Dark Signal With and Without Trap Leakage

Dark signal component due to trap leakage is over an order of magnitude larger than thermally generated dark signal component for the KAF3200

The opposite is true for the KAF16200!



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