5.1.11 LINEARITY

5.1.11.1 NAC FM LINEARITY CALIBRATION RESULTS

As reported in Reference 5.1.11.1-1

Reference 5.1.11.1-1 - IOM 388-PAG-CCA97-7, "NAC FM Calibration Results: Linearity", C. Avis, September 24, 1997

5.1.11.1.1 INTRODUCTION

The Narrow-angle Flight Model thermal/vacuum testing included the acquisition of a set of images for determination of the system gain. The image data was taken at a temperature of +25° and +5° C. This data set is also applicable to the derivation of the system linearity. The term 'linearity' describes how closely the camera response to light fits a linear function.

5.1.11.1.2 METHOD

For this camera system, the DN resulting from an exposure may be described by the following equation.

$$DN = VL(T - t_0) + DC_T + DN_0$$

where
- DN is the measured pixel value
- V is the system sensitivity (in DN/radiance_unit-milliseconds)
- L is the measured radiance (in arbitrary radiance_units)
- T is the commanded exposure time (in milliseconds)
- t_0 is the known shutter-offset (a function of image sample number, in msec)
- DN_0 is the bias level (in DN)
- DC_T is the dark-current level (a function of exposure time, in DN)

Analysis so far of DC_T indicates that for the exposure used here (maximum of 1000 msec), this value should be less than one DN. Therefore, the above equation is simplified to

$$DN = VL(T - t_0) + DN_0$$

Because the shutter-offset was previously derived, only V and DN_0 need to be solved for. DN_0 could be measured by zero-exposure images, but it falls out of the least-squares fit anyway.

Images at the same signal level are combined to produce signal and energy values at 100 small (20 pixel by 20 pixel) areas at all available signal levels. Energy values come from the product of the exposure time (corrected for shutter-offset) and the radiance of the source. Values for Sensitivity and the Bias level are then derived at each of these small areas independently. This is done by solving the above equation using least-squares.

The 100 derived values are then compared and any areas giving values more than 2 sigma from the mean are flagged as bad. Global values for V and DN_0 are then derived by averaging the values at the remaining good areas.

Using these best-fit V and DN_0, a calculated value DN' can be determined for each exposure time. The absolute deviation from linearity

$$A(T) = DN(T) - DN'(T)$$

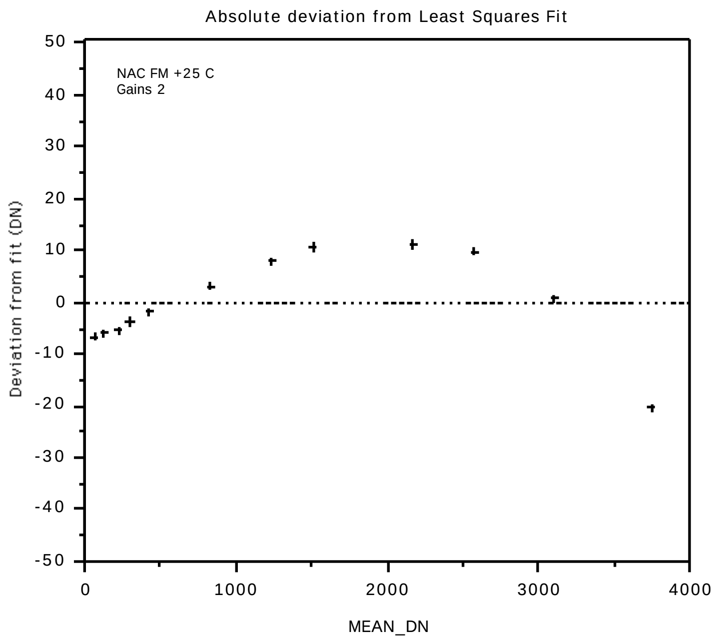
and the relative deviation from linearity

$$R(T) = \left(DN(T) - DN'(T)\right)/DN(T)$$

can be used as measures of linearity over the range of exposure times used.

5.1.11.1.3 RESULTS

The following plot shows a typical fit. The absolute deviation is plotted to illustrate how the Least Squares solution distributed the deviations over the range of DN.

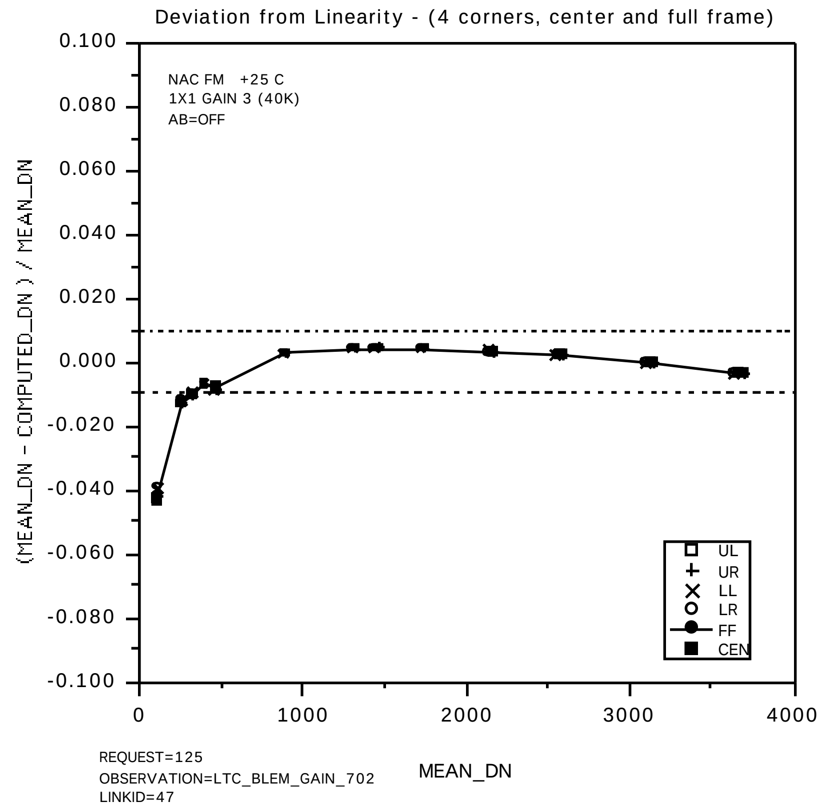


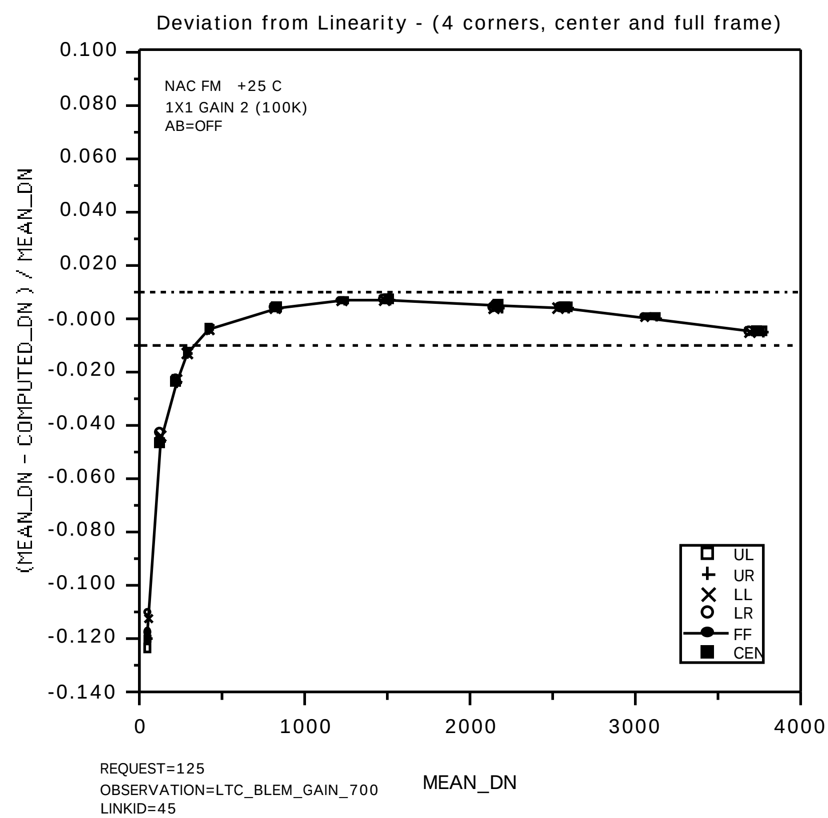
Generating the relative deviation from the absolute deviation distorts the symmetry of the absolute deviation curve by dividing by small mean DN numbers on one end and by large ones on the other. This typically yields a plot with worse relative deviations at the low DN range.

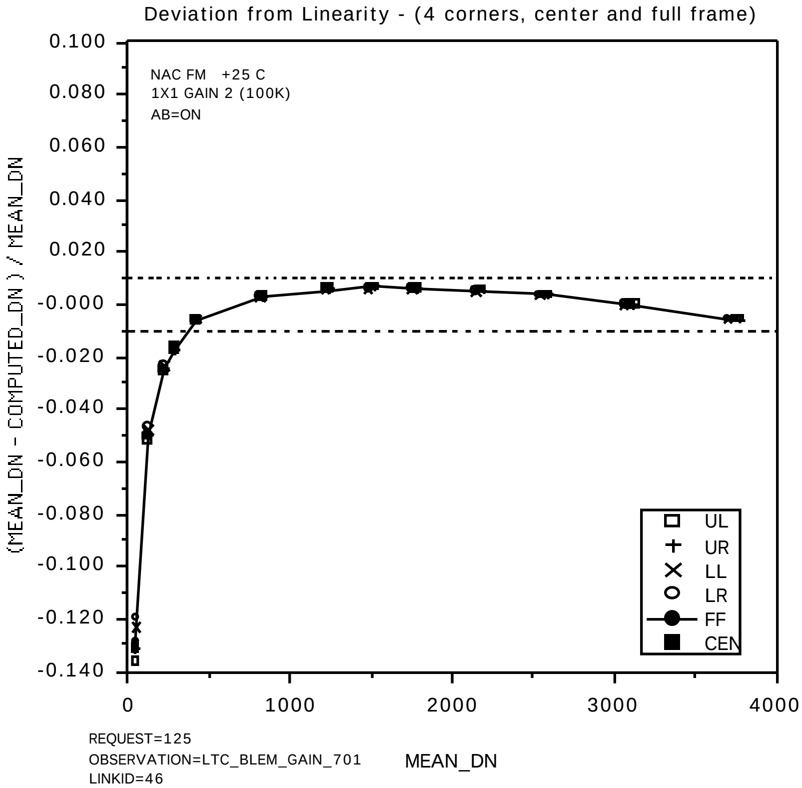
The plots which follow show the deviation from linearity for each Gain state. The deviation is shown as a function of signal level for the corner regions, the center and for the whole frame. Points for each region are plotted and the line connects the points for the entire frame. The dashed lines indicate ±1 % deviation.

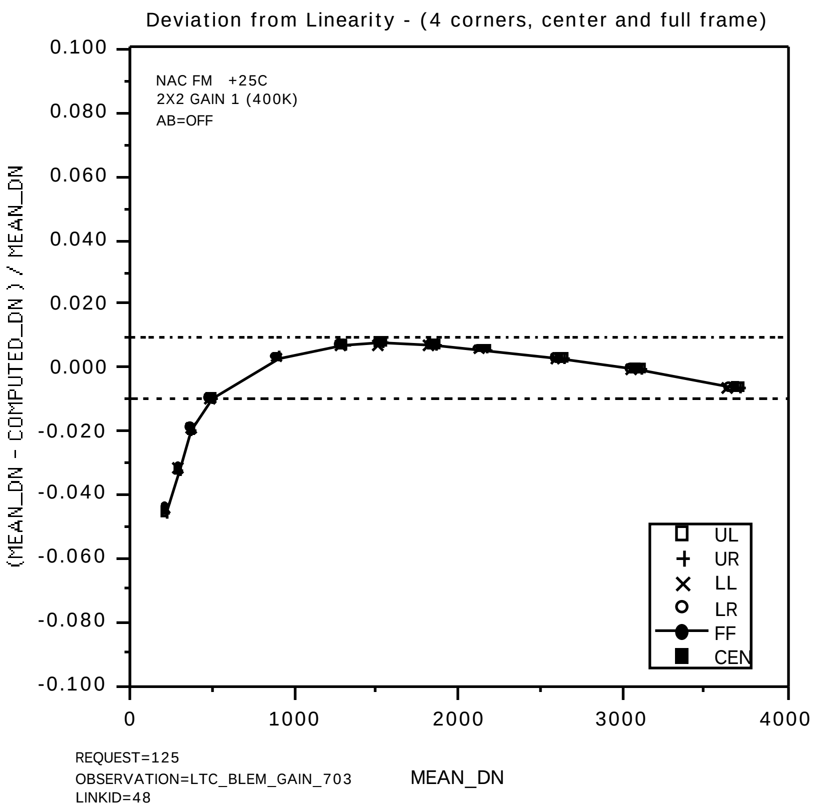
Note:

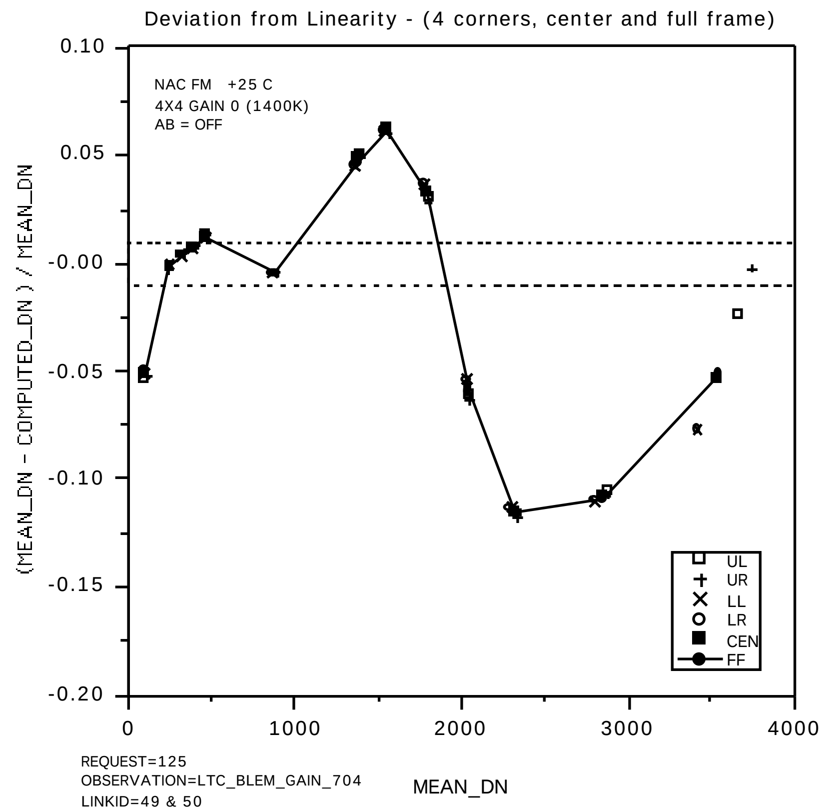
1. Due to linearity problems, the best-fit V and DN_0 for Gain 0 were calculated using exposure times of 0 to 80 milliseconds only.

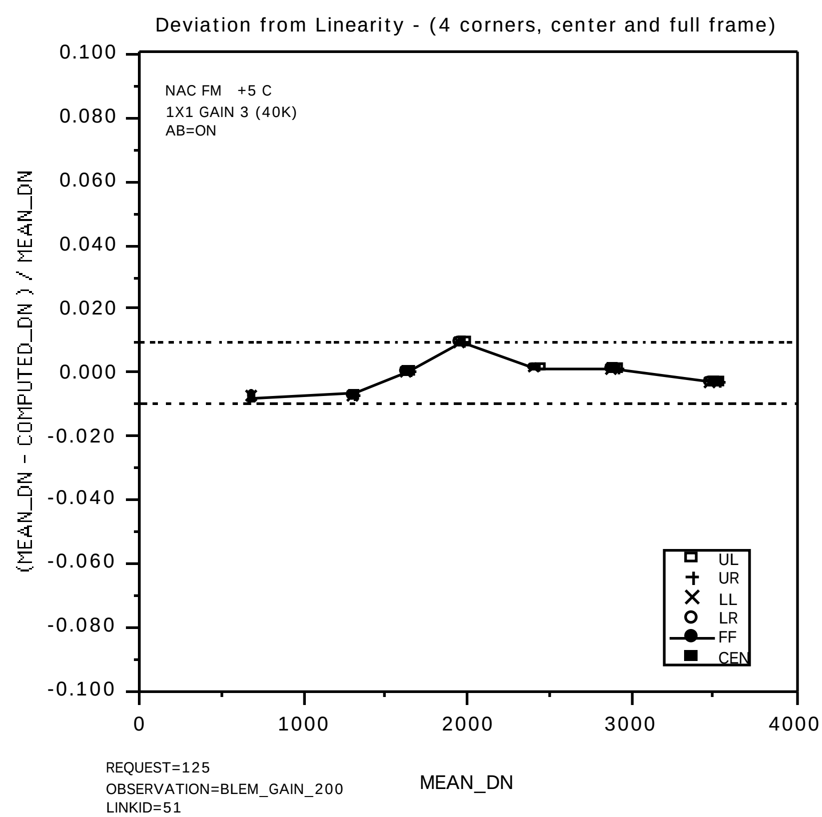

Deviation from Linearity - (4 corners, center and full frame)
NAC FM +25 C
1X1 GAIN 3 (40K)
AB=OFF
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=LTC_BLEM_GAIN_702
LINKID=47
MEAN_DN

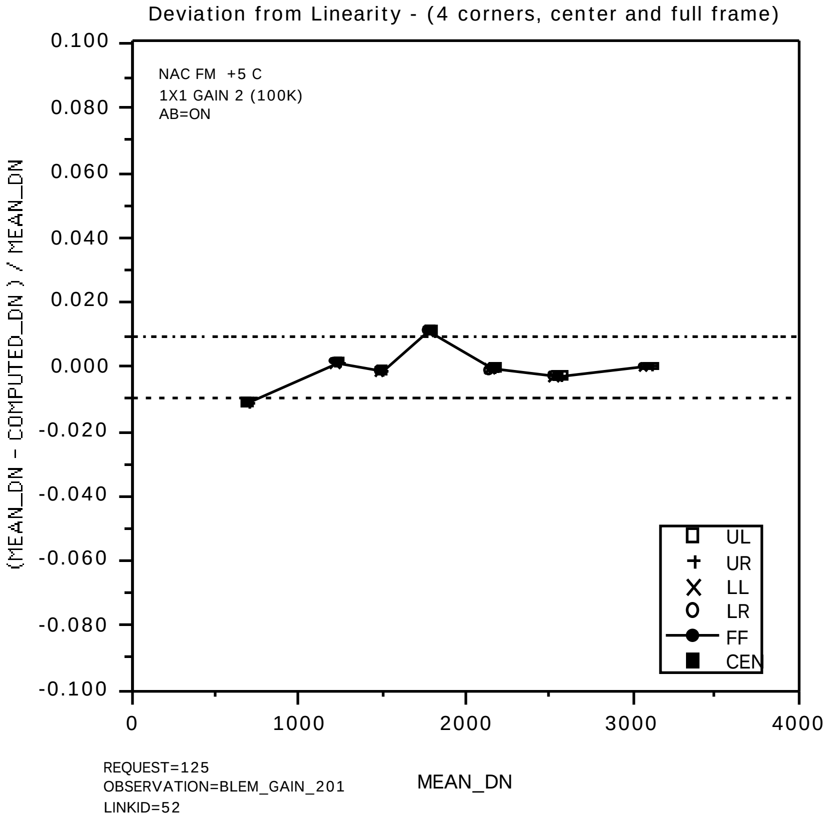

Deviation from Linearity - (4 corners, center and full frame)
NAC FM +25 C
1X1 GAIN 2 (100K)
AB=OFF
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
-0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=LTC_BLEM_GAIN_700
LINKID=45
MEAN_DN

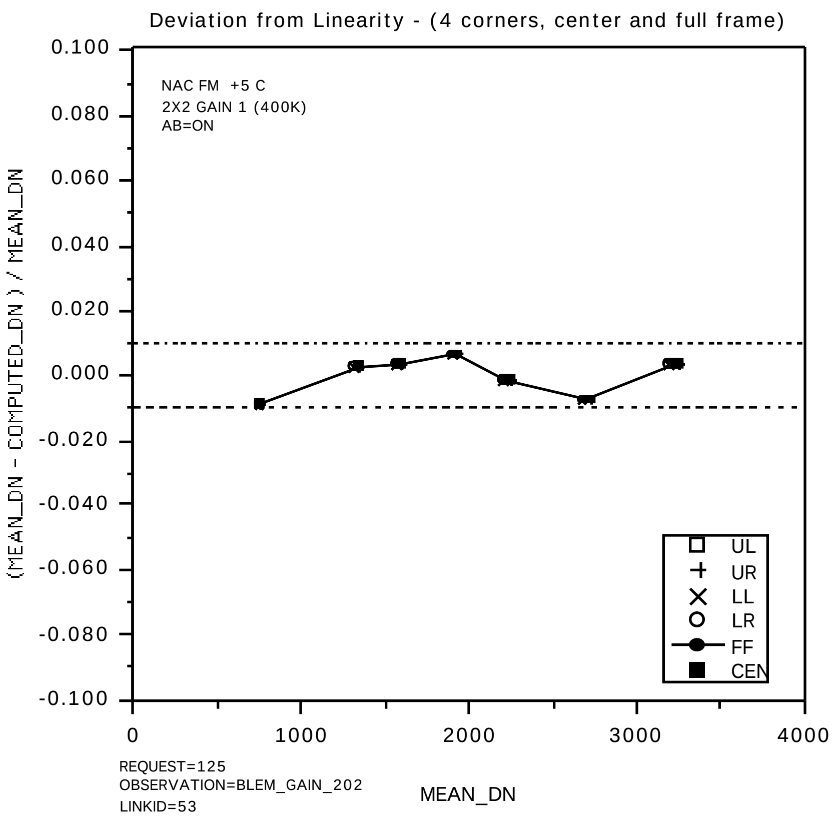

Deviation from Linearity - (4 corners, center and full frame)
NAC FM +25 C
1X1 GAIN 2 (100K)
AB=ON
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
-0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=LTC_BLEM_GAIN_701
LINKID=46
MEAN_DN

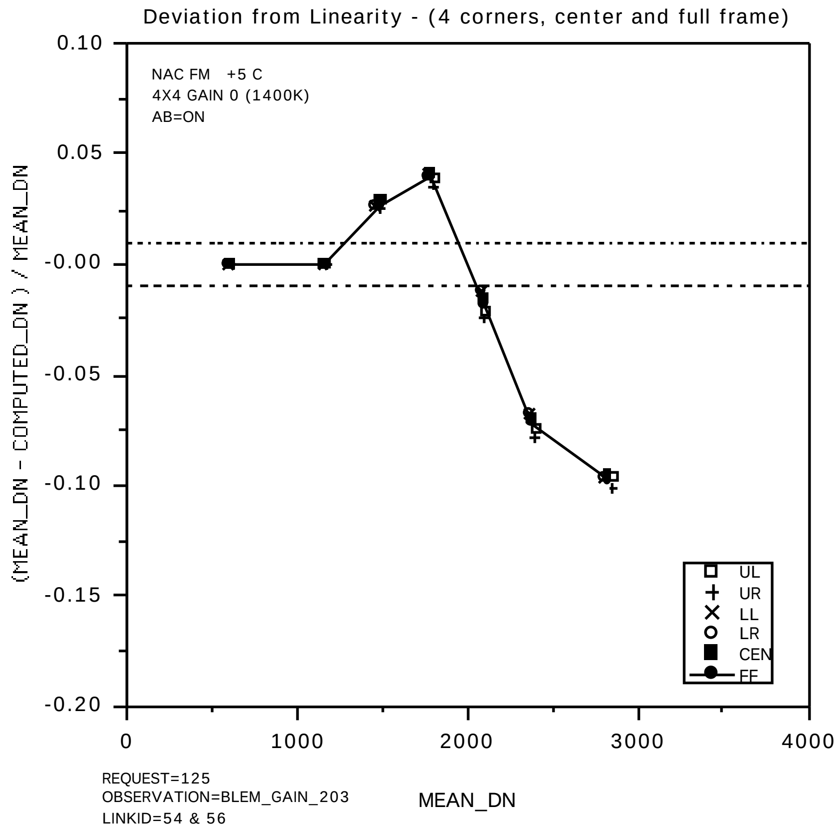

Deviation from Linearity - (4 corners, center and full frame)
NAC FM +25C
2X2 GAIN 1 (400K)
AB=OFF
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=LTC_BLEM_GAIN_703
LINKID=48
MEAN_DN


Deviation from Linearity - (4 corners, center and full frame)
NAC FM +25 C
4X4 GAIN 0 (1400K)
AB = OFF
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
0
1000
2000
3000
4000
UL
UR
LL
LR
CEN
FF
REQUEST=125
OBSERVATION=LTC_BLEM_GAIN_704
LINKID=49 & 50
MEAN_DN


Deviation from Linearity - (4 corners, center and full frame)
NAC FM +5 C
1X1 GAIN 3 (40K)
AB=ON
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=BLEM_GAIN_200
LINKID=51
MEAN_DN


Deviation from Linearity - (4 corners, center and full frame)
NAC FM +5 C
1X1 GAIN 2 (100K)
AB=ON
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=BLEM_GAIN_201
LINKID=52
MEAN_DN


Deviation from Linearity - (4 corners, center and full frame)
NAC FM +5 C
2X2 GAIN 1 (400K)
AB=ON
(MEAN_DN - COMPUTED_DN) / MEAN_DN
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
0
1000
2000
3000
4000
UL
UR
LL
LR
FF
CEN
REQUEST=125
OBSERVATION=BLEM_GAIN_202
LINKID=53
MEAN_DN



5.1.11.1.4 CONCLUSIONS

1. Except for 4x4 Gain=0, all gains and summation modes remained linear (within ±1 percent) over the entire dynamic range (excluding deviations at the extreme low end).
2. In 4x4 Gain=0, linearity breaks down at about 1000 DN at both temperatures.
3. The 25° C data was much more well-behaved than the 5° C data. The derived deviations at 5° C were acceptable but contained more scattered.
4. Antiblooming had no significant effect on the linearity results.

5.1.11.1.5 IMAGES USED IN LINEARITY ANALYSIS

image	day	time	observation	gain	mode	expos	radiance
Temp = +25° C							
134579	213	0:48:4.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	0	800.00
134581	213	0:51:3.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	0	800.00
134621	213	2:14:23.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	0	800.00
134582	213	0:52:32.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	5	800.00
134583	213	0:54:1.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	5	800.00
134584	213	0:55:30.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	5	800.00
134585	213	0:57:11.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	15	800.00
134586	213	0:58:40.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	15	800.00
134587	213	1:0:10.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	15	800.00
134588	213	1:1:39.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	30	800.00
134589	213	1:3:8.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	30	800.00
134591	213	1:6:12.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	40	800.00
134592	213	1:7:41.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	40	800.00
134622	213	2:15:59.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	40	800.00
134594	213	1:10:40.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	60	800.00
134595	213	1:12:9.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	60	800.00
134596	213	1:13:38.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	60	800.00
134597	213	1:15:13.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	120	800.00
134598	213	1:16:42.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	120	800.00
134599	213	1:18:12.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	120	800.00
134600	213	1:19:41.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	180	800.00
134601	213	1:21:10.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	180	800.00
134602	213	1:22:39.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	180	800.00
134603	213	1:24:14.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	220	800.00
134604	213	1:25:43.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	220	800.00
134605	213	1:27:13.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	220	800.00
134609	213	1:33:15.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	320	800.00
134611	213	1:36:14.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	320	800.00
134624	213	2:44:38.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	320	800.00
134612	213	1:37:43.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	380	800.00
134613	213	1:39:12.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	380	800.00
134614	213	1:40:41.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	380	800.00
134615	213	1:42:16.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	460	800.00
134616	213	1:43:45.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	460	800.00
134618	213	1:46:44.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	560	800.00
134619	213	1:48:13.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	560	800.00
134620	213	1:49:42.0	LTC_BLEM_GAIN_700	2 (100K)	FULL	560	800.00
134625	213	3:34:21.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	0	800.00
134626	213	3:41:28.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	0	800.00
134627	213	3:42:58.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	0	800.00
134628	213	3:44:27.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	0	800.00
134629	213	3:45:56.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	5	800.00
134630	213	3:47:25.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	5	800.00
134631	213	3:48:54.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	5	800.00
134632	213	3:50:30.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	15	800.00
134633	213	3:51:59.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	15	800.00
134634	213	3:53:28.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	15	800.00
134635	213	3:54:57.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	30	800.00
134636	213	3:56:26.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	30	800.00
134637	213	3:57:55.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	30	800.00
134639	213	4:1:0.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	40	800.00
134640	213	4:2:29.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	40	800.00
134668	213	5:2:56.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	40	800.00
134641	213	4:3:58.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	60	800.00
134643	213	4:6:56.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	60	800.00
134669	213	5:4:25.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	60	800.00
134644	213	4:8:32.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	120	800.00
134645	213	4:10:1.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	120	800.00
134646	213	4:11:30.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	120	800.00
134647	213	4:12:59.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	180	800.00
134649	213	4:15:57.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	180	800.00
134670	213	5:6:1.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	180	800.00
134650	213	4:17:38.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	220	800.00
134651	213	4:19:7.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	220	800.00
134652	213	4:20:36.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	220	800.00
134653	213	4:22:5.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	260	800.00
134654	213	4:23:34.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	260	800.00
134655	213	4:25:3.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	260	800.00
134656	213	4:26:39.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	320	800.00
134657	213	4:28:8.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	320	800.00
134658	213	4:29:37.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	320	800.00
134659	213	4:31:6.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	380	800.00
134661	213	4:34:4.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	380	800.00
134671	213	5:7:37.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	380	800.00
134662	213	4:35:41.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	460	800.00
134663	213	4:37:10.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	460	800.00
134666	213	4:41:37.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	560	800.00
134667	213	4:43:6.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	560	800.00
134672	213	5:9:13.0	LTC_BLEM_GAIN_701	2 (100K)	FULL	560	800.00
134678	213	5:34:27.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	0	800.00
134679	213	5:35:56.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	0	800.00
134680	213	5:37:25.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	0	800.00
134681	213	5:38:54.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	5	800.00
134682	213	5:40:23.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	5	800.00
134683	213	5:41:52.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	5	800.00
134684	213	5:43:28.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	15	800.00
134685	213	5:44:57.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	15	800.00
134686	213	5:46:26.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	15	800.00
134687	213	5:47:55.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	20	800.00
134688	213	5:49:24.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	20	800.00
134689	213	5:50:53.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	20	800.00
134690	213	5:52:29.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	25	800.00
134691	213	5:53:58.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	25	800.00
134692	213	5:55:27.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	25	800.00
134693	213	5:56:56.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	30	800.00
134695	213	5:59:54.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	30	800.00
134720	213	6:52:17.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	30	800.00
134696	213	6:1:30.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	60	800.00
134697	213	6:2:59.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	60	800.00
134698	213	6:4:28.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	60	800.00
134699	213	6:5:57.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	90	800.00
134700	213	6:7:26.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	90	800.00
134701	213	6:8:55.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	90	800.00
134702	213	6:10:31.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	100	800.00
134703	213	6:12:0.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	100	800.00
134704	213	6:13:29.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	100	800.00
134705	213	6:14:58.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	120	800.00
134707	213	6:17:56.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	120	800.00
134721	213	6:53:53.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	120	800.00
134708	213	6:19:32.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	150	800.00
134709	213	6:21:1.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	150	800.00
134710	213	6:22:30.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	150	800.00
134711	213	6:23:59.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	180	800.00
134712	213	6:25:28.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	180	800.00
134713	213	6:26:57.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	180	800.00
134714	213	6:28:33.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	220	800.00
134715	213	6:30:2.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	220	800.00
134716	213	6:31:31.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	220	800.00
134717	213	6:33:0.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	260	800.00
134718	213	6:34:29.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	260	800.00
134719	213	6:35:58.0	LTC_BLEM_GAIN_702	3 (40K)	FULL	260	800.00
134725	213	7:15:57.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	0	800.00
134726	213	7:17:1.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	0	800.00
134727	213	7:18:5.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	0	800.00
134728	213	7:19:9.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	15	800.00
134729	213	7:20:13.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	15	800.00
134730	213	7:21:17.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	15	800.00
134731	213	7:22:26.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	25	800.00
134732	213	7:23:30.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	25	800.00
134733	213	7:24:34.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	25	800.00
134734	213	7:25:38.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	35	800.00
134735	213	7:26:42.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	35	800.00
134736	213	7:27:46.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	35	800.00
134737	213	7:28:59.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	50	800.00
134738	213	7:30:3.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	50	800.00
134739	213	7:31:7.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	50	800.00
134740	213	7:32:11.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	100	800.00
134741	213	7:33:15.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	100	800.00
134742	213	7:34:19.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	100	800.00
134743	213	7:35:28.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	150	800.00
134744	213	7:36:32.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	150	800.00
134745	213	7:37:36.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	150	800.00
134746	213	7:38:40.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	180	800.00
134747	213	7:39:44.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	180	800.00
134748	213	7:40:48.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	180	800.00
134749	213	7:42:1.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	220	800.00
134750	213	7:43:5.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	220	800.00
134751	213	7:44:9.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	220	800.00
134752	213	7:45:13.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	260	800.00
134753	213	7:46:17.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	260	800.00
134754	213	7:47:21.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	260	800.00
134755	213	7:48:34.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	320	800.00
134756	213	7:49:38.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	320	800.00
134757	213	7:50:42.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	320	800.00
134758	213	7:51:46.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	380	800.00
134759	213	7:52:50.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	380	800.00
134760	213	7:53:54.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	380	800.00
134761	213	7:55:5.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	460	800.00
134762	213	7:56:9.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	460	800.00
134763	213	7:57:13.0	LTC_BLEM_GAIN_703	1 (400K)	SUM2	460	800.00
134771	213	10:32:20.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	0	800.00
134772	213	10:33:11.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	0	800.00
134790	213	12:8:41.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	0	800.00
134774	213	10:34:53.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	5	800.00
134775	213	10:35:44.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	5	800.00
134776	213	10:36:35.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	5	800.00
134778	213	10:38:24.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	15	800.00
134779	213	10:39:15.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	15	800.00
134791	213	12:9:39.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	15	800.00
134780	213	10:40:6.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	20	800.00
134781	213	10:40:57.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	20	800.00
134782	213	10:41:48.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	20	800.00
134783	213	10:42:48.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	25	800.00
134784	213	10:43:39.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	25	800.00
134785	213	10:44:30.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	25	800.00
134786	213	10:45:21.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	30	800.00
134787	213	10:46:12.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	30	800.00
134788	213	10:47:3.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	30	800.00
134792	213	12:10:39.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	60	800.00
134793	213	12:11:30.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	60	800.00
134794	213	12:12:21.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	60	800.00
134795	213	12:13:12.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	90	800.00
134796	213	12:14:3.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	90	800.00
134797	213	12:14:54.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	90	800.00
134798	213	12:15:52.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	100	800.00
134799	213	12:16:43.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	100	800.00
134800	213	12:17:34.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	100	800.00
134801	213	12:18:25.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	120	800.00
134802	213	12:19:16.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	120	800.00
134803	213	12:20:7.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	120	800.00
134804	213	12:21:5.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	150	800.00
134805	213	12:21:56.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	150	800.00
134806	213	12:22:47.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	150	800.00
134807	213	12:23:38.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	180	800.00
134808	213	12:24:29.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	180	800.00
134809	213	12:25:20.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	180	800.00
134810	213	12:26:20.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	220	800.00
134811	213	12:27:11.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	220	800.00
134812	213	12:28:2.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	220	800.00
134813	213	12:28:53.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	260	800.00
134814	213	12:29:44.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	260	800.00
134815	213	12:30:35.0	LTC_BLEM_GAIN_704	0 (1400K)	SUM4	260	800.00
Temp = +5° C							
120325	140	1:59:58.0	BLEM_GAIN_200	3 (40K)	FULL	0	800.00
120326	140	2:1:27.0	BLEM_GAIN_200	3 (40K)	FULL	0	800.00
120327	140	2:2:56.0	BLEM_GAIN_200	3 (40K)	FULL	0	800.00
120328	140	2:4:25.0	BLEM_GAIN_200	3 (40K)	FULL	40	800.00
120329	140	2:5:54.0	BLEM_GAIN_200	3 (40K)	FULL	40	800.00
120330	140	2:7:23.0	BLEM_GAIN_200	3 (40K)	FULL	40	800.00
120331	140	2:8:29.0	BLEM_GAIN_200	3 (40K)	FULL	80	800.00
120333	140	2:11:27.0	BLEM_GAIN_200	3 (40K)	FULL	80	800.00
120421	140	4:16:26.0	BLEM_GAIN_200	3 (40K)	FULL	80	800.00
120334	140	2:12:56.0	BLEM_GAIN_200	3 (40K)	FULL	100	800.00
120335	140	2:14:25.0	BLEM_GAIN_200	3 (40K)	FULL	100	800.00
120336	140	2:15:54.0	BLEM_GAIN_200	3 (40K)	FULL	100	800.00
120337	140	2:17:0.0	BLEM_GAIN_200	3 (40K)	FULL	120	800.00
120338	140	2:18:29.0	BLEM_GAIN_200	3 (40K)	FULL	120	800.00
120339	140	2:19:58.0	BLEM_GAIN_200	3 (40K)	FULL	120	800.00
120340	140	2:21:27.0	BLEM_GAIN_200	3 (40K)	FULL	150	800.00
120341	140	2:22:56.0	BLEM_GAIN_200	3 (40K)	FULL	150	800.00
120342	140	2:24:25.0	BLEM_GAIN_200	3 (40K)	FULL	150	800.00
120343	140	2:25:31.0	BLEM_GAIN_200	3 (40K)	FULL	180	800.00
120344	140	2:27:0.0	BLEM_GAIN_200	3 (40K)	FULL	180	800.00
120345	140	2:28:29.0	BLEM_GAIN_200	3 (40K)	FULL	180	800.00
120346	140	2:29:58.0	BLEM_GAIN_200	3 (40K)	FULL	220	800.00
120347	140	2:31:27.0	BLEM_GAIN_200	3 (40K)	FULL	220	800.00
120348	140	2:32:56.0	BLEM_GAIN_200	3 (40K)	FULL	220	800.00
120349	140	2:34:4.0	BLEM_GAIN_201	2 (100K)	FULL	0	800.00
120350	140	2:35:33.0	BLEM_GAIN_201	2 (100K)	FULL	0	800.00
120351	140	2:37:2.0	BLEM_GAIN_201	2 (100K)	FULL	0	800.00
120352	140	2:38:31.0	BLEM_GAIN_201	2 (100K)	FULL	100	800.00
120353	140	2:40:0.0	BLEM_GAIN_201	2 (100K)	FULL	100	800.00
120354	140	2:41:29.0	BLEM_GAIN_201	2 (100K)	FULL	100	800.00
120355	140	2:42:35.0	BLEM_GAIN_201	2 (100K)	FULL	180	800.00
120356	140	2:44:4.0	BLEM_GAIN_201	2 (100K)	FULL	180	800.00
120357	140	2:45:33.0	BLEM_GAIN_201	2 (100K)	FULL	180	800.00
120358	140	2:47:2.0	BLEM_GAIN_201	2 (100K)	FULL	220	800.00
120359	140	2:48:31.0	BLEM_GAIN_201	2 (100K)	FULL	220	800.00
120422	140	4:17:32.0	BLEM_GAIN_201	2 (100K)	FULL	220	800.00
120361	140	2:51:19.0	BLEM_GAIN_201	2 (100K)	FULL	260	800.00
120362	140	2:52:48.0	BLEM_GAIN_201	2 (100K)	FULL	260	800.00
120423	140	4:18:38.0	BLEM_GAIN_201	2 (100K)	FULL	260	800.00
120364	140	2:55:46.0	BLEM_GAIN_201	2 (100K)	FULL	320	800.00
120365	140	2:57:15.0	BLEM_GAIN_201	2 (100K)	FULL	320	800.00
120366	140	2:58:44.0	BLEM_GAIN_201	2 (100K)	FULL	320	800.00
120367	140	2:59:50.0	BLEM_GAIN_201	2 (100K)	FULL	380	800.00
120368	140	3:1:19.0	BLEM_GAIN_201	2 (100K)	FULL	380	800.00
120369	140	3:2:48.0	BLEM_GAIN_201	2 (100K)	FULL	380	800.00
120371	140	3:5:46.0	BLEM_GAIN_201	2 (100K)	FULL	460	800.00
120372	140	3:7:15.0	BLEM_GAIN_201	2 (100K)	FULL	460	800.00
120424	140	4:19:44.0	BLEM_GAIN_201	2 (100K)	FULL	460	800.00
120373	140	3:8:23.0	BLEM_GAIN_202	1 (400K)	SUM2	0	800.00
120374	140	3:9:27.0	BLEM_GAIN_202	1 (400K)	SUM2	0	800.00
120375	140	3:10:31.0	BLEM_GAIN_202	1 (400K)	SUM2	0	800.00
120376	140	3:11:35.0	BLEM_GAIN_202	1 (400K)	SUM2	80	800.00
120377	140	3:12:39.0	BLEM_GAIN_202	1 (400K)	SUM2	80	800.00
120378	140	3:13:43.0	BLEM_GAIN_202	1 (400K)	SUM2	80	800.00
120379	140	3:14:48.0	BLEM_GAIN_202	1 (400K)	SUM2	150	800.00
120380	140	3:15:52.0	BLEM_GAIN_202	1 (400K)	SUM2	150	800.00
120381	140	3:16:56.0	BLEM_GAIN_202	1 (400K)	SUM2	150	800.00

120382	140	3:18:0.0	BLEM_GAIN_202	1 (400K)	SUM2	180	800.00
120383	140	3:19:4.0	BLEM_GAIN_202	1 (400K)	SUM2	180	800.00
120384	140	3:20:8.0	BLEM_GAIN_202	1 (400K)	SUM2	180	800.00
120385	140	3:20:49.0	BLEM_GAIN_202	1 (400K)	SUM2	220	800.00
120386	140	3:21:53.0	BLEM_GAIN_202	1 (400K)	SUM2	220	800.00
120387	140	3:22:57.0	BLEM_GAIN_202	1 (400K)	SUM2	220	800.00
120388	140	3:24:1.0	BLEM_GAIN_202	1 (400K)	SUM2	260	800.00
120389	140	3:25:5.0	BLEM_GAIN_202	1 (400K)	SUM2	260	800.00
120390	140	3:26:9.0	BLEM_GAIN_202	1 (400K)	SUM2	260	800.00
120391	140	3:27:14.0	BLEM_GAIN_202	1 (400K)	SUM2	320	800.00
120392	140	3:28:18.0	BLEM_GAIN_202	1 (400K)	SUM2	320	800.00
120393	140	3:29:22.0	BLEM_GAIN_202	1 (400K)	SUM2	320	800.00
120394	140	3:30:26.0	BLEM_GAIN_202	1 (400K)	SUM2	380	800.00
120395	140	3:31:30.0	BLEM_GAIN_202	1 (400K)	SUM2	380	800.00
120396	140	3:32:34.0	BLEM_GAIN_202	1 (400K)	SUM2	380	800.00
120397	140	3:33:17.0	BLEM_GAIN_203	0 (1400K)	SUM4	0	800.00
120398	140	3:34:8.0	BLEM_GAIN_203	0 (1400K)	SUM4	0	800.00
120399	140	3:34:59.0	BLEM_GAIN_203	0 (1400K)	SUM4	0	800.00
120400	140	3:35:50.0	BLEM_GAIN_203	0 (1400K)	SUM4	40	800.00
120401	140	3:36:41.0	BLEM_GAIN_203	0 (1400K)	SUM4	40	800.00
120402	140	3:37:32.0	BLEM_GAIN_203	0 (1400K)	SUM4	40	800.00
120403	140	3:38:24.0	BLEM_GAIN_203	0 (1400K)	SUM4	80	800.00
120404	140	3:39:15.0	BLEM_GAIN_203	0 (1400K)	SUM4	80	800.00
120405	140	3:40:6.0	BLEM_GAIN_203	0 (1400K)	SUM4	80	800.00
120406	140	3:40:57.0	BLEM_GAIN_203	0 (1400K)	SUM4	100	800.00
120407	140	3:41:48.0	BLEM_GAIN_203	0 (1400K)	SUM4	100	800.00
120408	140	3:42:39.0	BLEM_GAIN_203	0 (1400K)	SUM4	100	800.00
120409	140	3:43:7.0	BLEM_GAIN_203	0 (1400K)	SUM4	120	800.00
120410	140	3:43:58.0	BLEM_GAIN_203	0 (1400K)	SUM4	120	800.00
120411	140	3:44:49.0	BLEM_GAIN_203	0 (1400K)	SUM4	120	800.00
120412	140	3:45:40.0	BLEM_GAIN_203	0 (1400K)	SUM4	150	800.00
120413	140	3:46:31.0	BLEM_GAIN_203	0 (1400K)	SUM4	150	800.00
120414	140	3:47:22.0	BLEM_GAIN_203	0 (1400K)	SUM4	150	800.00
120415	140	3:48:14.0	BLEM_GAIN_203	0 (1400K)	SUM4	180	800.00
120416	140	3:49:5.0	BLEM_GAIN_203	0 (1400K)	SUM4	180	800.00
120417	140	3:49:56.0	BLEM_GAIN_203	0 (1400K)	SUM4	180	800.00
120418	140	3:50:47.0	BLEM_GAIN_203	0 (1400K)	SUM4	220	800.00
120419	140	3:51:38.0	BLEM_GAIN_203	0 (1400K)	SUM4	220	800.00
120420	140	3:52:29.0	BLEM_GAIN_203	0 (1400K)	SUM4	220	800.00