WFC3 Instrument Science Report 2016-13:

WFC3 Cycle 23 Proposal 14373: UVIS Gain

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ABSTRACT

Here we present the UVIS Cycle 23 gain results for each quadrant using internal unbinned, 2x2 binned, and 3x3 binned flat field data with nominal gain setting, 1.5 e-/DN. This report includes two epochs of data, including one from Cycle 23 December 2015 and one from Cycle 23 June 2016. The December 2015 epoch of data has unbinned gain measurements of 1.57, 1.56, 1.59, and 1.57 e-/DN for quadrants A, B, C, and D, respectively. The June 2016 epoch of data has unbinned gain measurements of 1.57, 1.56, 1.59, and 1.58 e-/DN for quadrants A, B, C, and D, respectively. For the data from all the epochs covered in this report, the gain measurements are the same as or within 1-2% of previous values from TV3 through Cycle 23 and thus they remain stable.

1 Introduction

CCD gain, whether for the WFC3 UVIS CCD or otherwise, is the measurement of the accumulation of charge (excited electrons) needed to register as one count (DN) by the detector. WFC3 UVIS gain measurements utilize internal flat fields with a default calibration tungsten lamp. This gain measurement, as it is a fundamental parameter of the CCD, is used to aid in monitoring the health of the UVIS detector over time. If large variations in the gain measurement were to occur, this would be an indication of possible changes in the electronic signal chain of the CCD. Furthermore, as stated in previous UVIS gain ISRs, any changes in the gain would effect other important measurements of the detector such as the read-noise and the photometric zero points.

This report summarizes the gain measurements and results of Cycle 23 from epoch one in December 2015 and epoch two in June 2016. For results from previous epochs

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and more details relating to UVIS gain measurements see Martlin et al. 2016; Gunning 2015; Gunning et al. 2014; Gunning et al. 2013; Borders et al. 2011; or Baggett 2008.

2 Data

The unbinned data for Program 14373 (PI: Gunning) are made up of 12 full-frame internal flat fields taken through the F645N filter using the default tungsten lamp. All flat fields were taken in pairs with various exposure times set to acquire exposure levels between $\sim$ 500 and 50,000 e-/pixel. As seen in Figures 1-8, the statistical variance at the lower end of the mean signal of the unbinned data, or below 10,000 e-/pixel, is more linear. The gain is measured from that linear end of the mean signal and therefore we can obtain a better sample if we add more exposures to the unbinned data. Following the procedure used in Cycles 22 and 21's analysis, we attempt to reduce systematics by sampling the exposures over many visits and mixing the order of exposure times. In addition, each visit began with a 60-second subarray exposure to warm up the tungsten lamp to ensure lamp flux stability across all of the flat field exposures. All data used are included below in Table 5 and Table 8.

Program 14373, like the two previous programs 14007 and 13561, also obtained sets of 2x2 and 3x3 binned data. Each dataset has 8 full-frame F645N internal flat fields that were acquired with a range of exposure times to ensure the exposure level values match that of unbinned data. The 2x2 and 3x3 data are listed below in Table 6 and Table 9, and Table 7 and Table 10, respectively.

3 Method

An automated pipeline was developed previous to the Cycle 22 gain results to improve the consistency of the analysis and to help mitigate errors caused by performing the analysis steps manually. Therefore we are able to use the exact same methods for this cycle, Cycle 23, that were used for Cycle 22.

This is the second time we calculated the gain using both non-CTE-corrected data and all the CTE-corrected data. For all of the non-CTE-corrected and CTE results, as seen in Tables 1 through 4, the raw data are reduced through the new CALWF3 Version 3.3 pipeline, which is now available through OPUS from the new CALWF3 release that occurred in Spring 2016. All of the raw data in the non-CTE-corrected and CTE-corrected sets are the same. For more information on the new CTE corrected pipeline please see the newest reference guide (Ryan et al. 2016).

The process of data preparation includes data quality inspection, overscan correction, and a subtraction of bias and dark files. Furthermore, to ensure the exclusion of cosmic rays, all data are processed with a specific cosmic ray rejection table (**CR-REJTAB**) with values **SKYSUB** = mean, **CRRADIUS** = 2.1 pixels, **CRTHRESH** = 0.5555, **CRSIGMAS** = (6.5, 5.5, 4.5), **SCALENSE** = 3.0.

The resulting cosmic ray flags (with values of 8192 in the data quality (DQ) extensions) were compared with the image data in the science extensions (SCI). As a conservative measure, we also excluded any pixels with a DQ value other than 0 (e.g. bad detector pixels (DQ=4) and charge traps (DQ=1024)). Further information on the DQ arrays for the WFC3 instrument can be found in the WFC3 Data Handbook Section 2.2.3 (Deutstua 2016).

In accordance with previous WFC3 UVIS gain measurements (Martlin et al. 2016, Gunning 2015, Gunning & Baggett 2014, Gunning et al. 2013, Borders 2011, Baggett & Borders 2009, Baggett 2008) we use the standard mean-variance technique. This technique derives the instrumental gain from the reciprocal of the slope in a mean-variance plot (see Gunning et al. 2013 and references within). In order to complete this procedure the exposures are taken in an uninterrupted sequence and an average and difference image is created for each chip at the varying exposure levels. Using IRAF tlinear task, we obtain a linear fit to the mean-variance data, giving more weight to the lower illumination levels. This fit is completed using the IRAF *tlinear* task. By weighting the lower illumination levels we are reducing potential effects to the gain measurement from non-linearity. The mean signal levels of the data are measured using IRAF *imstat* task on the average images. The variance, i.e. the standard deviation squared and divided by 2, is measured from the difference images. While the binned data are clipped with an NCLIP = 3.0, there are no clipping of the unbinned data. The statistics for each quadrant are based on 25 equal-sized regions that has a size respective to the quadrant itself.

Table 1, Table 2 and Table 3 summarize the gain results for the unbinned, 2x2, and 3x3 binned data, respectively, for all on-orbit data through Cycle 23. Figures 1 - 8, listed at the end of this report, contain all Cycle 23 mean-variance plots.

Quadrant	A	B	C	D
Cy23 Jun	1.57	1.56	1.59	1.58
Cy23 Dec	1.57	1.56	1.59	1.57
Cy22 Jun	1.57	1.56	1.59	1.57
Cy22 Dec	1.57	1.55	1.58	1.57
Cy21 Jun	1.57	1.56	1.58	1.57
Cy21 Dec	1.56	1.55	1.58	1.57
Cy20 Jun	1.56	1.55	1.58	1.57
Cy20 Dec	1.56	1.55	1.58	1.57
Cy19	1.56	1.56	1.58	1.57
Cy18	1.55	1.55	1.57	1.56
Cy17	1.54	1.54	1.56	1.55
SMOV	1.56	1.56	1.58	1.57
TV3	1.56	1.56	1.58	1.57

Table 1. Unbinned gain values for Cycle 23 through TV3 testing.

Quadrant	Cy23 Jun	Cy23 Dec	Cy22 Jun	Cy22 Dec	Cy21 Jun	Cy21 Dec	Cy19	TV3
A	1.57	1.57	1.56	1.57	1.56	1.56	1.56	1.56
B	1.56	1.56	1.57	1.56	1.56	1.56	1.56	1.55
C	1.58	1.58	1.58	1.58	1.58	1.58	1.57	1.58
D	1.58	1.58	1.58	1.57	1.59	1.57	1.57	1.57

Table 2. 2x2 binned gain values for TV3 testing through Cycle 23.

Quadrant	Cy23 Jun	Cy23 Dec	Cy22 Jun	Cy22 Dec	Cy21 Jun	Cy21 Dec	Cy19	TV3
A	1.56	1.56	1.55	1.55	1.55	1.56	1.55	1.55
B	1.55	1.56	1.55	1.55	1.55	1.55	1.54	1.55
C	1.57	1.57	1.57	1.57	1.57	1.57	1.56	1.56
D	1.57	1.57	1.56	1.57	1.57	1.56	1.56	1.56

Table 3. 3x3 binned gain values for TV3 testing through Cycle 23.

Quadrant	Cy23 Jun	Cy23 Dec	Cy22 Jun	Cy22 Dec
A	1.56	1.56	1.56	1.56
B	1.55	1.55	1.55	1.55
C	1.58	1.58	1.58	1.58
D	1.57	1.57	1.57	1.56

Table 4. CTE-corrected unbinned gain values for Cycle 23.

4 Results and Conclusions

A complete summary of the measured gain values for Cycle 23 can be found in Tables 1 to 4. As in previous gain studies for WFC3 UVIS, we can propagate the error from the uncertainties of the linear weighted fit to find an uncertainty of $\sim$ 0.001 e-/DN for each gain measurement. Due to gain measurements gathered using smaller image subsections, we actually estimate the true uncertainties to be slightly higher, $\sim$ 0.01 e-/DN.

We once again point out, as we did in Martlin et al. 2016, Gunning 2015, and Gunning 2013, the previously mentioned systematic deviation from the weighted fit seen at the higher illumination levels of the unbinned figures but not in the binned modes. We continue to account for this systematic by including additional data at the $<$ 10,000 e-/pixel level to ensure a greater weighting in the lower end of the mean signal regime. Having previously ruled out the cause of this being due to variations in the lamp output or shutter-shading effects (Gunning 2015), we are still investigating whether this effect may be due to charge diffusion or migration as reported in Downing et. al (2006) and described in Gunning (2015).

For the second cycle in a row we are also reporting the CTE-corrected data as seen in Table 4. We see no variation from the Cycle 22 CTE-corrected gain measurements. We do see differences on the order of $\sim$0.01 e-/DN from the non-CTE-corrected data; however, they fall within the magnitude of fluctuations seen previously across cycles and are therefore not concerning.

In our continuing effort to monitor the health of the WFC3 UVIS detector we endeavor to complete yearly evaluations of the relative changes of the gain using the same techniques as in previous cycles. The goal of this report was to announce the results of our most recent investigation of the Cycle 23 gain. We once again have found the gain values for all quadrants have remained stable to within 1-2% of previously calculated values.

5 Acknowledgements

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6 References

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Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p04ijq	2015-12-01	105.0	1	29352.91	2476.05	29511.52	32090.73	2768.96	32054.94
id0p04ikq	2015-12-01	105.0	1	29419.45	2482.05	29577.62	32163.90	2774.47	32127.61
id0p05iwq	2015-12-01	80.0	1	22361.88	1913.89	22481.75	24427.66	2139.91	24398.00
id0p05ixq	2015-12-01	80.0	1	22413.35	1918.91	22532.52	24484.39	2144.71	24455.35
id0p06j7q	2015-12-01	45.0	1	12558.91	1086.06	12625.68	13701.35	1214.98	13683.09
id0p06j9q	2015-12-01	45.0	1	12588.26	1089.51	12655.25	13733.44	1215.45	13715.06
id0p06jbq	2015-12-01	1.0	1	280.51	139.36	280.45	305.18	57.13	304.00
id0p06jcq	2015-12-01	1.0	1	280.41	49.22	280.57	305.53	81.98	304.11
id0p07rvq	2015-12-03	12.0	1	3339.74	280.39	3357.94	3637.49	318.12	3631.64
id0p07rwq	2015-12-03	12.0	1	3345.03	281.57	3363.37	3643.39	322.55	3637.20
id0p07ryq	2015-12-03	5.0	1	1401.41	136.00	1408.26	1526.30	178.07	1522.10
id0p07rzq	2015-12-03	5.0	1	1401.06	137.66	1407.84	1525.46	147.16	1521.69
id0p07s1q	2015-12-03	7.0	1	1969.61	182.36	1979.65	2144.62	199.69	2140.01
id0p07s2q	2015-12-03	7.0	1	1971.98	173.02	1982.40	2147.73	246.77	2142.82
id0p08suq	2015-12-03	25.0	1	6978.49	585.71	7016.01	7605.09	660.63	7594.34
id0p08svq	2015-12-03	25.0	1	6996.18	589.66	7033.88	7624.84	663.05	7614.06
id0p08sxq	2015-12-03	2.0	1	561.11	67.07	563.12	610.72	63.14	608.56
id0p08syq	2015-12-03	2.0	1	563.34	95.01	565.25	612.86	62.64	610.75
id0p09tuq	2015-12-03	0.48	1	136.70	170.27	135.78	148.22	34.07	147.35
id0p09tvq	2015-12-03	0.48	1	136.02	42.97	135.60	148.16	35.49	147.21
id0p09txq	2015-12-03	1.5	1	423.20	56.93	424.24	460.57	64.57	458.46
id0p09tyq	2015-12-03	1.5	1	419.96	64.54	420.87	457.25	81.09	455.28
id0p09u0q	2015-12-03	3.5	1	985.46	95.95	989.97	1072.85	112.92	1070.04
id0p09u1q	2015-12-03	3.5	1	986.35	136.90	990.69	1073.69	105.15	1071.00

Table 5. Files for binning 1 for December Cycle 23.

Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p01eaq	2015-12-01	6.0	2	6733.58	563.22	6774.48	7344.96	647.19	7341.94
id0p01ebq	2015-12-01	17.0	2	19136.01	1607.66	19250.15	20910.82	1826.59	20906.66
id0p01ecq	2015-12-01	17.0	2	19145.52	1606.82	19260.02	20921.64	1827.04	20919.13
id0p01edq	2015-12-01	0.48	2	543.32	150.08	544.81	591.48	93.99	589.75
id0p01eeq	2015-12-01	0.48	2	543.50	104.98	545.41	592.55	95.19	590.51
id0p01e9q	2015-12-01	6.0	2	6725.60	566.75	6766.43	7335.99	647.25	7332.71
id0p01efq	2015-12-01	30.0	2	33895.12	2937.23	34094.46	37096.19	3279.15	37094.62
id0p01egq	2015-12-01	30.0	2	33917.13	2942.07	34117.15	37119.30	3280.48	37119.12
id0p02gtq	2015-12-01	11.0	2	12366.85	1028.80	12441.30	13501.70	1188.20	13498.32
id0p02guq	2015-12-01	11.0	2	12392.46	1030.08	12467.11	13529.51	1185.90	13525.64
id0p02gvq	2015-12-01	1.0	2	1126.32	104.37	1132.38	1227.62	121.17	1224.87
id0p02gwq	2015-12-01	1.0	2	1128.68	132.88	1134.61	1229.69	120.65	1227.34
id0p02gxq	2015-12-01	2.0	2	2250.44	194.37	2263.81	2453.15	221.43	2450.09
id0p02gyq	2015-12-01	2.0	2	2256.34	229.23	2269.25	2459.41	236.65	2455.88
id0p02gzq	2015-12-01	24.0	2	27152.28	2323.92	27313.43	29697.94	2609.65	29697.76
id0p02h0q	2015-12-01	24.0	2	27159.40	2323.87	27320.83	29706.90	2613.42	29705.41

Table 6. Files for binning 2 for December Cycle 23.

Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p03h9q	2015-12-01	5.0	3	12659.83	1026.66	12728.62	13821.63	1187.12	13810.80
id0p03haq	2015-12-01	5.0	3	12662.41	1026.86	12731.54	13825.90	1186.50	13816.10
id0p03hbq	2015-12-01	1.0	3	2537.27	221.85	2550.94	2766.12	247.79	2761.38
id0p03hcq	2015-12-01	1.0	3	2536.24	221.98	2549.71	2765.94	360.83	2760.65
id0p03hdq	2015-12-01	7.0	3	17776.49	1442.27	17871.98	19421.05	1657.37	19410.84
id0p03heq	2015-12-01	7.0	3	17778.24	1440.30	17873.84	19424.23	1667.10	19412.02
id0p03hfq	2015-12-01	3.0	3	7605.79	621.07	7647.00	8297.83	716.61	8290.90
id0p03hgq	2015-12-01	3.0	3	7606.20	627.32	7647.42	8297.95	716.97	8292.24
id0p03hhq	2015-12-01	0.48	3	1222.51	173.61	1227.98	1332.71	158.45	1329.23
id0p03hiq	2015-12-01	0.48	3	1222.17	129.46	1227.68	1332.05	137.34	1328.89
id0p03hjq	2015-12-01	9.0	3	22921.47	1856.70	23043.87	25060.95	2129.27	25047.00
id0p03hkq	2015-12-01	9.0	3	22911.40	1857.00	23034.06	25049.22	2128.89	25034.25
id0p03hlq	2015-12-01	2.0	3	5081.05	434.73	5108.58	5541.09	484.88	5536.26
id0p03hmq	2015-12-01	2.0	3	5082.52	418.36	5110.51	5543.91	487.83	5538.70
id0p03hnq	2015-12-01	11.0	3	28049.11	2276.64	28198.32	30683.47	2599.08	30666.23
id0p03hoq	2015-12-01	11.0	3	28036.76	2274.16	28187.49	30671.62	2601.21	30654.28
id0p03hpq	2015-12-01	13.0	3	33170.13	2694.55	33344.61	36301.66	3064.47	36281.43
id0p03hqq	2015-12-01	13.0	3	33169.84	2693.65	33346.94	36301.59	3063.58	36281.21

Table 7. Files for binning 3 for December Cycle 23.

Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p13ojq	2016-06-01	105.0	1	29631.21	2499.28	29792.11	32395.27	2790.54	32359.55
id0p13okq	2016-06-01	105.0	1	29695.58	2502.93	29857.25	32467.24	2796.09	32431.92
id0p14ooq	2016-06-01	80.0	1	22522.15	1926.08	22643.31	24601.65	2152.26	24572.27
id0p14opq	2016-06-01	80.0	1	22559.63	1929.03	22681.19	24644.34	2155.49	24614.70
id0p15osq	2016-06-01	45.0	1	12640.47	1092.81	12708.14	13789.82	1219.81	13771.27
id0p15ouq	2016-06-01	45.0	1	12666.27	1095.02	12734.10	13818.47	1221.50	13800.09
id0p15owq	2016-06-01	1.0	1	281.87	48.45	282.44	306.82	47.24	305.66
id0p15oxq	2016-06-01	1.0	1	281.54	44.44	282.18	306.52	41.64	305.15
id0p16plq	2016-06-01	12.0	1	3365.78	282.36	3383.96	3665.80	320.56	3659.38
id0p16pmq	2016-06-01	12.0	1	3376.48	290.48	3394.84	3677.50	323.16	3671.06
id0p16poq	2016-06-01	5.0	1	1413.42	155.06	1420.07	1538.95	145.77	1534.92
id0p16ppq	2016-06-01	5.0	1	1414.49	126.85	1421.38	1540.40	140.02	1536.84
id0p16prq	2016-06-01	7.0	1	1986.50	173.42	1996.90	2163.39	192.24	2159.07
id0p16psq	2016-06-01	7.0	1	1987.16	171.65	1997.64	2164.25	194.98	2159.75
id0p17p1q	2016-06-01	25.0	1	7013.83	589.45	7051.53	7643.93	665.67	7632.60
id0p17p2q	2016-06-01	25.0	1	7028.75	600.16	7066.14	7660.29	665.18	7649.20
id0p17p4q	2016-06-01	2.0	1	563.69	79.75	565.59	613.59	75.88	611.59
id0p17p5q	2016-06-01	2.0	1	563.92	56.09	565.96	613.79	73.51	611.56
id0p18q4q	2016-06-01	0.48	1	134.80	30.84	134.54	146.70	25.80	145.90
id0p18q5q	2016-06-01	0.48	1	135.13	27.16	134.98	147.15	34.99	146.42
id0p18q7q	2016-06-01	1.5	1	423.83	76.20	424.75	461.49	51.87	459.60
id0p18q8q	2016-06-01	1.5	1	424.24	62.12	425.46	461.88	52.38	459.89
id0p18qaq	2016-06-01	3.5	1	993.34	127.37	997.83	1081.26	103.60	1078.50
id0p18qbq	2016-06-01	3.5	1	993.93	98.72	998.50	1082.10	103.03	1079.25

Table 8. Files for binning 1 for June Cycle 23.

Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p10m6q	2016-06-01	6.0	2	6778.08	574.51	6818.90	7393.37	655.88	7389.48
id0p10m7q	2016-06-01	6.0	2	6782.50	570.22	6823.64	7397.74	654.08	7394.00
id0p10m8q	2016-06-01	17.0	2	19248.23	1617.06	19363.93	21033.12	1836.63	21029.41
id0p10m9q	2016-06-01	17.0	2	19244.00	1619.20	19359.59	21027.59	1832.48	21022.99
id0p10maq	2016-06-01	0.48	2	543.40	94.88	545.34	592.38	85.60	590.29
id0p10mbq	2016-06-01	0.48	2	543.75	96.05	545.65	592.52	72.87	590.38
id0p10mcq	2016-06-01	30.0	2	34047.45	2950.03	34250.39	37262.05	3289.77	37261.30
id0p10mdq	2016-06-01	30.0	2	34058.55	2952.08	34261.77	37274.05	3290.44	37273.11
id0p11ngq	2016-06-01	11.0	2	12411.63	1032.51	12486.37	13549.38	1184.53	13546.10
id0p11nhq	2016-06-01	11.0	2	12439.02	1041.96	12513.74	13580.15	1185.98	13577.02
id0p11niq	2016-06-01	1.0	2	1132.84	134.71	1138.22	1234.19	134.35	1231.77
id0p11njq	2016-06-01	1.0	2	1128.11	125.25	1133.69	1229.39	122.99	1227.02
id0p11nkq	2016-06-01	2.0	2	2259.60	213.62	2272.74	2462.60	226.70	2458.44
id0p11nlq	2016-06-01	2.0	2	2259.91	203.03	2272.86	2463.01	230.43	2459.75
id0p11nmq	2016-06-01	24.0	2	27225.98	2329.20	27389.36	29779.26	2615.67	29778.09
id0p11nnq	2016-06-01	24.0	2	27227.54	2330.67	27390.64	29780.99	2614.51	29780.36

Table 9. Files for binning 2 for June Cycle 23.

Image Name	**Obs Date**	**Exp time**	**Binning**	**Chip 1** Mean	**Chip 1** Std Dev	**Chip 1** Median	**Chip 2** Mean	**Chip 2** Std Dev	**Chip 2** Median
id0p12nvq	2016-06-01	5.0	3	12717.22	1031.48	12787.50	13883.97	1189.22	13875.64
id0p12nwq	2016-06-01	5.0	3	12722.86	1031.68	12793.65	13890.77	1189.80	13880.38
id0p12nxq	2016-06-01	1.0	3	2534.83	219.81	2548.31	2762.82	257.90	2758.30
id0p12nyq	2016-06-01	1.0	3	2556.61	227.70	2569.83	2786.82	273.29	2781.72
id0p12nzq	2016-06-01	7.0	3	17852.17	1448.66	17949.65	19504.74	1661.50	19494.16
id0p12o0q	2016-06-01	7.0	3	17880.50	1451.60	17978.73	19536.63	1670.08	19525.44
id0p12o1q	2016-06-01	3.0	3	7645.11	622.20	7687.58	8341.31	718.74	8335.09
id0p12o2q	2016-06-01	3.0	3	7655.92	624.33	7697.31	8351.96	721.49	8344.33
id0p12o3q	2016-06-01	0.48	3	1224.42	128.78	1230.18	1335.35	165.60	1332.07
id0p12o4q	2016-06-01	0.48	3	1224.05	139.90	1229.22	1334.77	292.75	1329.38
id0p12o5q	2016-06-01	9.0	3	22999.04	1865.20	23125.15	25144.77	2135.60	25131.00
id0p12o6q	2016-06-01	9.0	3	23022.02	1865.46	23147.06	25170.54	2138.19	25158.34
id0p12o7q	2016-06-01	2.0	3	5112.94	427.60	5140.83	5575.93	490.09	5570.48
id0p12o8q	2016-06-01	2.0	3	5112.91	418.78	5141.42	5579.23	630.69	5571.10
id0p12o9q	2016-06-01	11.0	3	28160.75	2285.90	28312.67	30804.97	2606.65	30785.18
id0p12oaq	2016-06-01	11.0	3	28160.34	2285.37	28311.42	30805.23	2606.10	30785.48
id0p12obq	2016-06-01	13.0	3	33305.96	2703.92	33484.62	36451.06	3073.78	36430.80
id0p12ocq	2016-06-01	13.0	3	33319.38	2705.14	33497.72	36464.42	3075.90	36445.24

Table 10. Files for binning 3 for June Cycle 23.

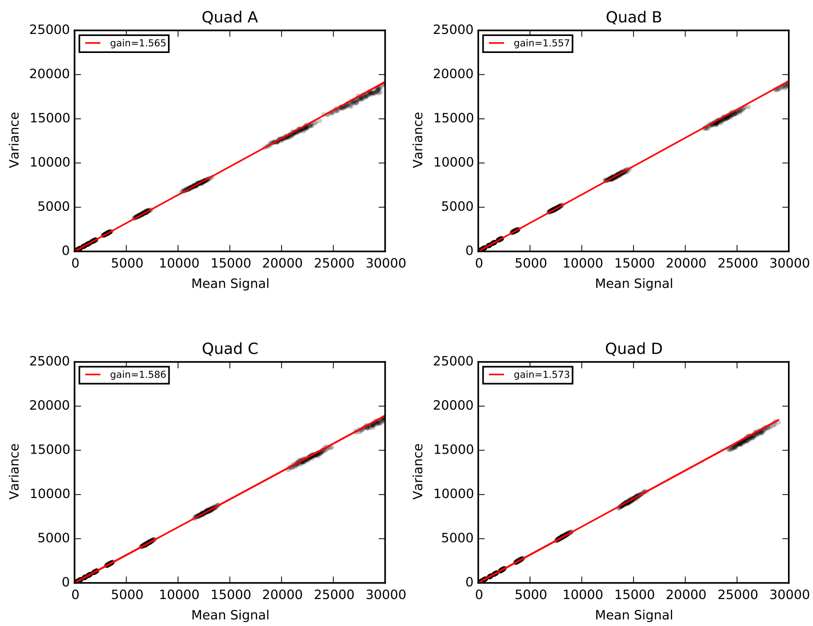

Figure 1. Variance as a function of the mean for the unbinned Cycle 23 data obtained in December 2015, PID 14373. Errors ~ 0.01 e-/DN.

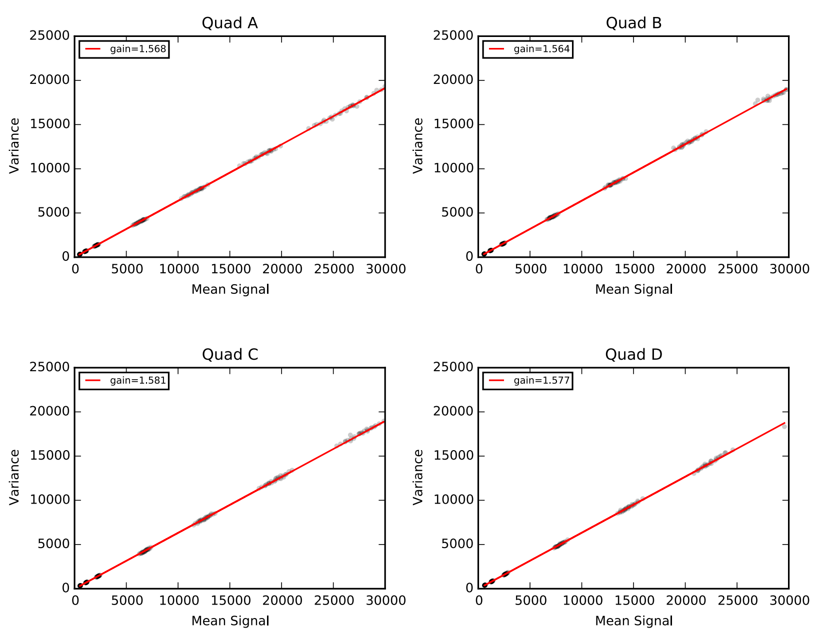

Figure 2. Variance as a function of the mean for the 2x2 binned Cycle 23 data obtained in December 2015, PID 14373. Errors ~ 0.01 e-/DN.

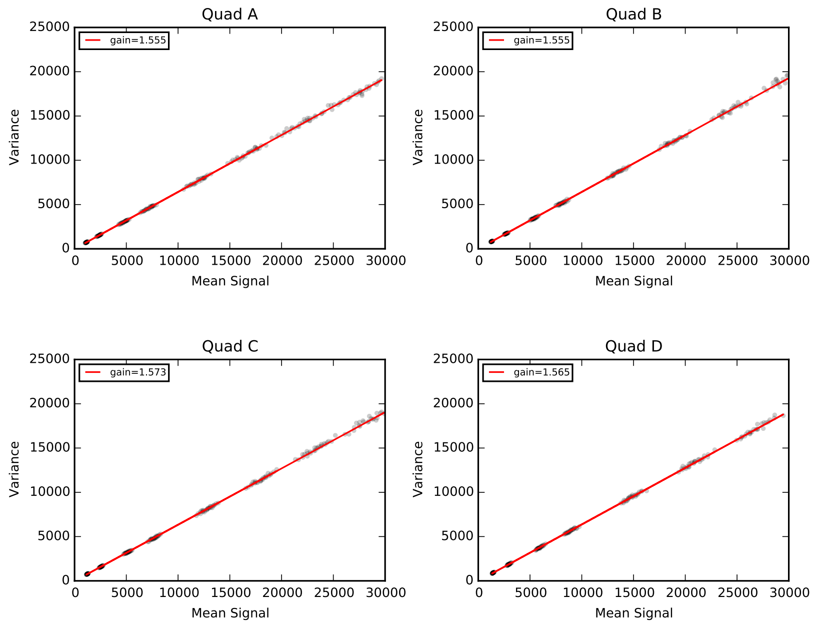

Figure 3. Variance as a function of the mean for the 3x3 binned Cycle 23 data obtained in December 2015, PID 14373. Errors $\sim$ 0.01 e-/DN.

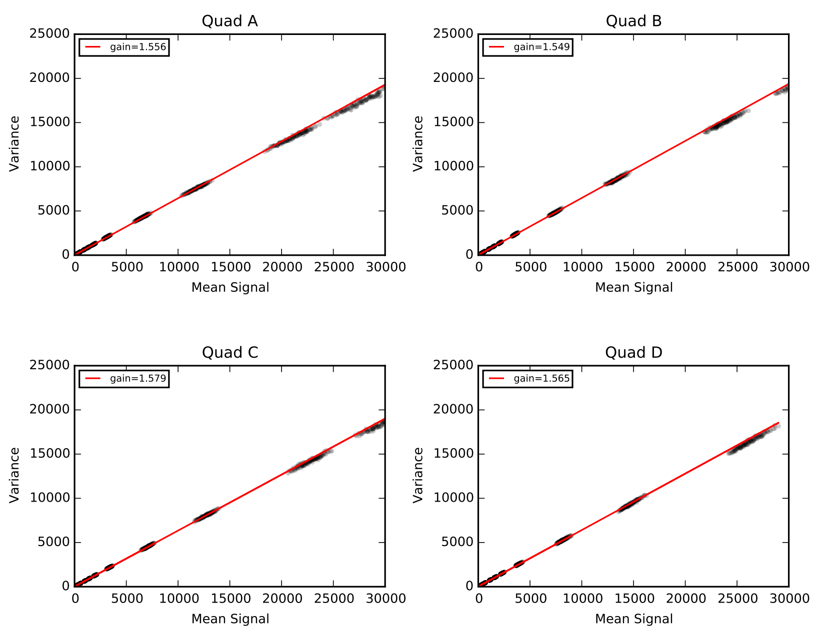

Figure 4. Variance as a function of the mean for the CTE corrected unbinned Cycle 23 data obtained in December 2015, PID 14373. Errors $\sim$ 0.01 e-/DN.

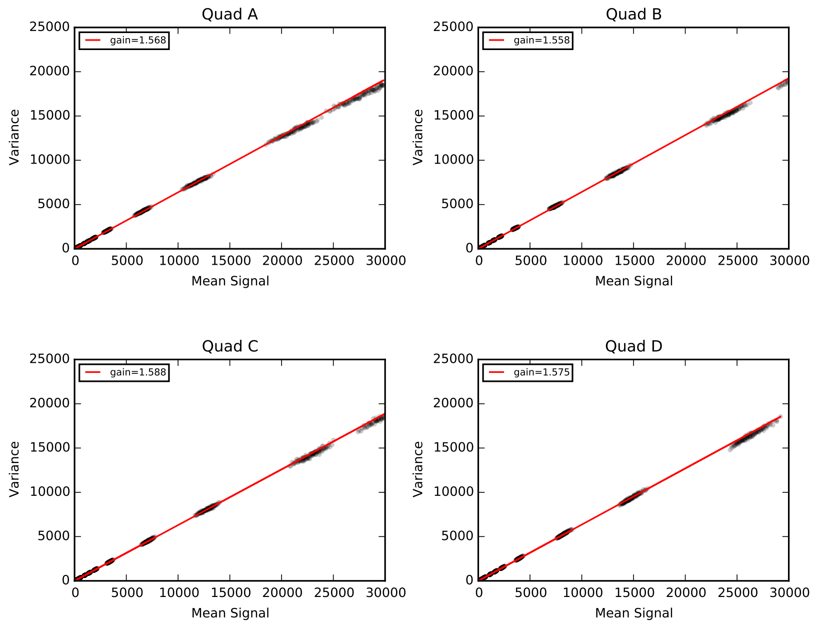

Figure 5. Variance as a function of the mean for the unbinned Cycle 23 data obtained in June 2016, PID 14373. Errors $\sim$ 0.01 e-/DN.

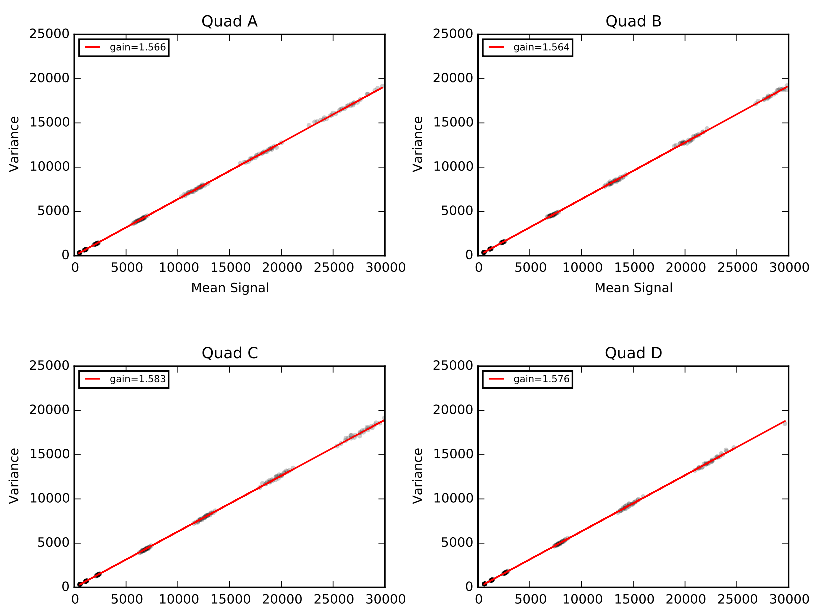

Figure 6. Variance as a function of the mean for the 2x2 binned Cycle 23 data obtained in June 2016, PID 14373. Errors $\sim$ 0.01 e-/DN.

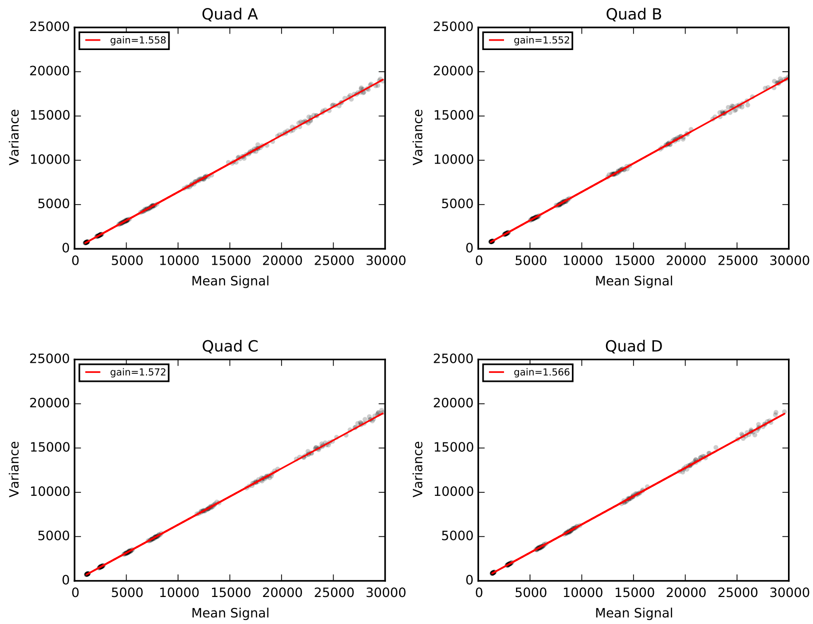

Figure 7. Variance as a function of the mean for the 3x3 binned Cycle 23 data obtained in June 2016, PID 14373. Errors $\sim$ 0.01 e-/DN

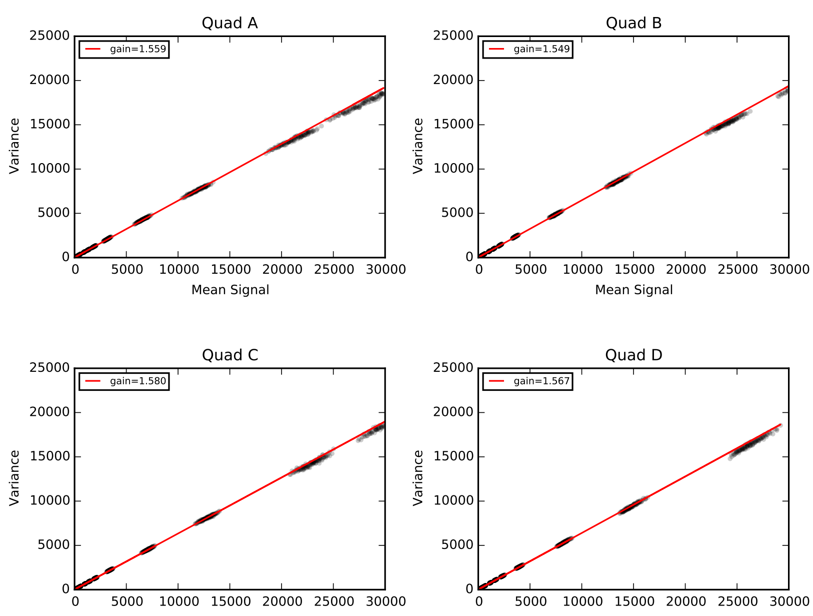

Figure 8. Variance as a function of the mean for the CTE corrected unbinned Cycle 23 data obtained in June 2016, PID 14373. Errors $\sim$ 0.01 e-/DN.