4.4.2 SPECTRAL SENSITIVITY

Reference 4.4.2-1- Design File Memorandum # 323-GJ-96-617, "Calibration Report - Cassini ISS CCD UV/Visible Quantum Efficiency", dated September 5, 1996, prepared by G. K. James

Reference 4.4.2-2 - CCD 220 (NAC FM) Notebook, CCD QE data measured by J. Janesick (et al)

Reference 4.4.2-3 - CCD 361 (WAC FM) Notebook, CCD QE data measured by J. Janesick (et al)

The quantum efficiency (QE) of a charge-coupled device (CCD) is defined as the number of electrons (e) produced for each incident photon ($h\upsilon$), where

$$QE = e/ h\upsilon$$

Two sets of data were used to determine the quantum efficiency (QE) of the packaged flight CCDs. The first set of data (Reference 4.4.2-1) acquired by G. K. James, provided ultraviolet (UV) and visible (VIS) data for the spectral range from 1648 to 6500 Å, with a controlled CCD temperature of -90 °C +/- 1°C. The second set of data (Reference 4.4.2-2 and Reference 4.4.2-2) was obtained by J. Janesick (et al) covering the spectral range of 2540 to 10500 Å, taken with the CCD at -90 °C. Refer to Table 4.4.2-1.

The raw data sets were combined and weighted as follows :

SPECTRAL RANGE	WEIGHTED DATA	COMMENTS
Range 1 :	1* (GJ DATA) + 0 * (JJ DATA)	
Range 2 :	[1* (GJ DATA) + 1*(JJ DATA)]/2	
Range 3 :	1* (JJ DATA)	(No GJ data in this range)

where the ranges are defined as

CCD #	RANGE 1	RANGE 2	RANGE 3
220	200 - 477 nm	4780-0650 nm	651 - 1050 nm
361	200 - 543 nm	544 - 650 nm	651 - 1050 nm

and, "GJ DATA" is data reported in Reference 4.4.2-1, and "JJ DATA" is data reported in Reference 4.4.2-2 (NAC) or Reference 4.4.2-3 (WAC).

Note that Geoff James' data for the lower spectral range (Range 1) is considered the more reliable of the two sets of data, and therefore has a unity weighting. The UV performance of the test system used (Acton 1-meter monochromator system) was extensively tested. Verification testing included a baseline test which was performed on a Wide Field/Planetary Camera II flight spare CCD which was compared to test data taken on another system 2 years earlier. The data agreed to within 5%.

The graphs of the interpolated raw data and the weighted interpolated data are shown in Figure 4.4.2-1 and Figure 4.4.2-1. Table 4.4.2-2 shows a condensed version of the the weighted interpolated data. The complete electronic files of all data discussed here have been archived (refer to Appendix E).

Wavelength (nm)	QE CCD 220 GJ DATA (NAC FM)	QE CCD 361 GJ DATA (WAC FM)	Wavelength (nm)	QE CCD 220 JJ DATA (NAC FM)	QE CCD 361 JJ DATA (WAC FM)
164.8	0.0352	0.0893	**254.0**	0.107	0.111
175.0	0.1165	0.13183	**313.0**	0.092	0.087
187.9	0.1285	0.12728	**365.0**	0.109	0.134
200.0	0.1199	0.11655	**405.0**	0.112	0.121
213.8	0.1182	0.11617	**440.0**	0.112	0.126
229.6	0.1235	0.12056	**481.0**	0.146	0.157
253.7	0.1351	0.1323	**528.0**	0.243	0.237
270.0	0.1309	0.12769	**545.5**	0.262	0.287
290.0	0.1348	0.12723	**600.5**	0.344	0.321
310.0	0.1415	0.1379	**640.0**	0.363	0.326
340.0	0.146	0.1428	**680.5**	0.354	0.334
360.0	0.1428	0.1408	**751.0**	0.359	0.345
380.0	0.129	0.1356	**800.0**	0.27	NO DATA
400.0	0.1356	0.1313	**852.0**	0.177	0.186
420.0	0.1359	0.1338	**900.3**	0.112	0.114
450.0	0.1393	0.1373	**950.1**	0.056	0.06
460.0	0.1369	0.1338	**1000.0**	0.023	0.02
470.0	0.1376	0.1354	**1050.0**	0.003	0.003
480.0	0.1567	0.1524			
500.0	0.2287	0.1979			
520.0	0.2713	0.2317			
540.0	0.3177	0.2832			
560.0	0.3571	0.3244			
580.0	0.3854	0.3457			
600.0	0.378	0.3365			
650.0	0.388	0.3535			

Table 4.4.2-1 - CCD QE Raw Data

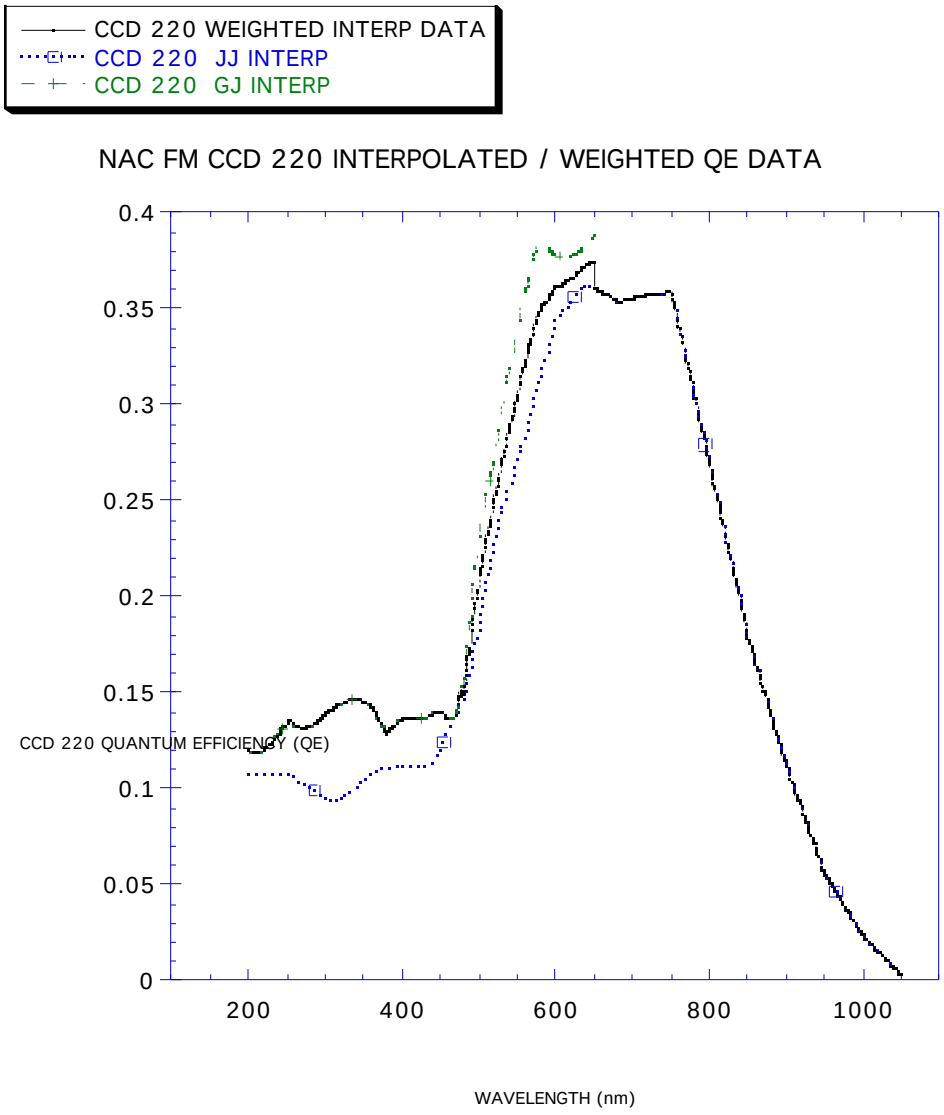

Figure 4.4.2-1 - NAC FM CCD 220 QE Data

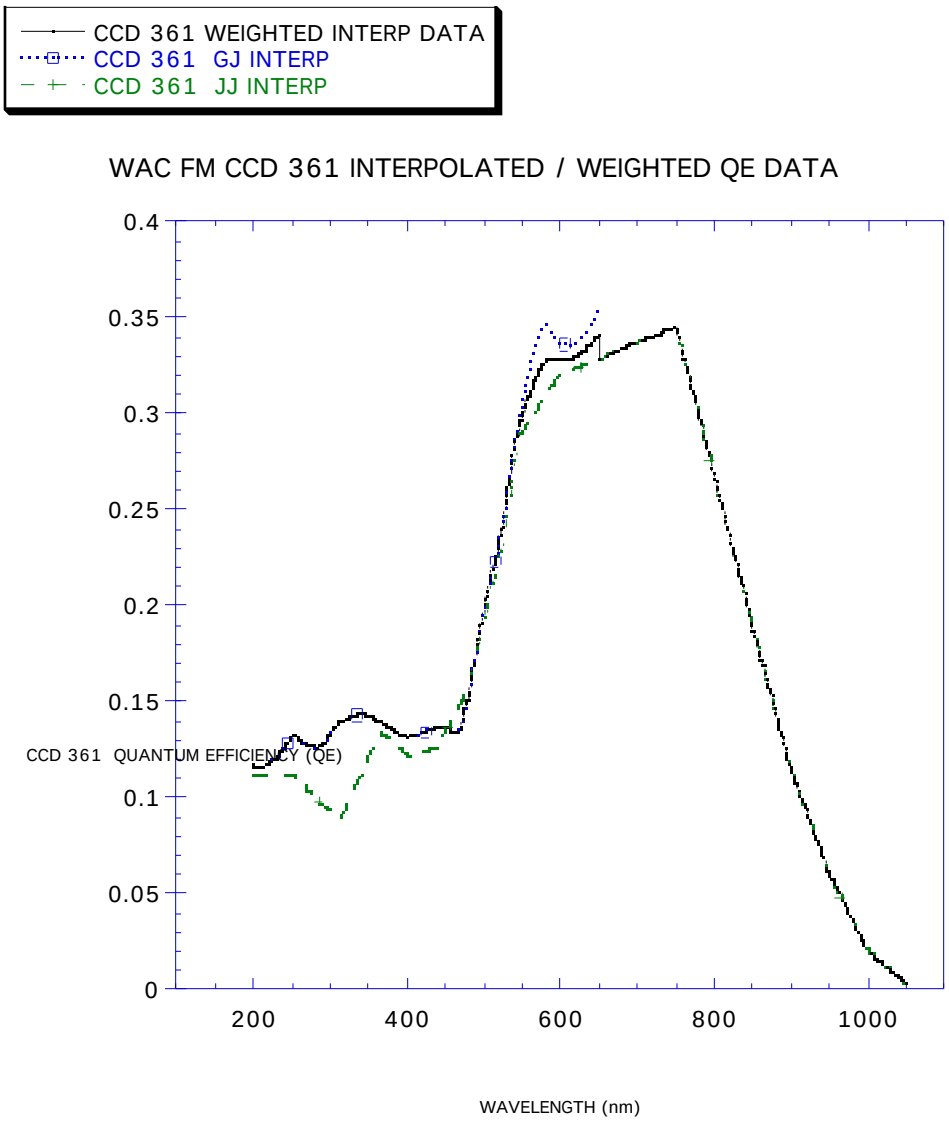

Figure 4.4.2-2 - WAC FM CCD 361 QE Data

Wavelength (nm)	QE CCD 220 (NAC FM) WEIGHTED INTERPOLATED DATA	QE CCD 361 (WAC FM) WEIGHTED INTERPOLATED DATA
200	0.11998	0.11681
250	0.13372	0.131
251	0.13415	0.13141
300	0.13816	0.13255
350	0.14522	0.14224
400	0.1356	0.13131
450	0.13921	0.13704
500	0.20655	0.19769
550	0.303565	0.297595
600	0.360655	0.32864
650	0.37439	0.34074
700	0.35538	0.33704
750	0.35893	0.34484
800	0.27	0.26786
801	0.26821	0.26629
850	0.18058	0.18915
900	0.1124	0.11445
950	0.056112	0.060108
1000	0.023	0.02
1050	0.003	0.003

Table 4.4.2-2 - CCD QE Weighted Interpolated Data (Condensed)