WFC3 Technical Instrument Report 2009-03

Changes to CDBS expansion and selection criteria for WFC3 UVIS bias reference files

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ABSTRACT

To handle WFC3 UVIS bias reference file selection correctly and efficiently, we have revised the CDBS rule which expands CCDAMP and added an additional keyword, APERTURE, to the selection criteria and expansion rules. This will improve the bias calibration for subarray modes and minimize the number of copies of the routine standard UVIS bias reference files that must be generated, delivered, and tracked with CDBS.

Introduction

The original WFC3 selection criteria in the Calibration Database System (CDBS) chose an appropriate WFC3 UVIS bias reference file for a given image based on the header keywords DETECTOR, CCDAMP, CCDGAIN, BINAXIS1, BINAXIS2, and USEAFTER date. These criteria were sufficient for data taken with a nominal readout: the full field of view, that is, two chips read out through four amps (CCDAMP=ABCD, BINAXIS*=1) as well as for the full field of view binned modes (CCDAMP=ABCD, BINAXIS*=2 or 3). The bias reference file images for these modes contain serial physical overscan columns to the left and right of the field, serial virtual overscan columns separating the quadrants of each chip, and parallel virtual overscan rows on either side of the gap.

WFC3 UVIS subarrays, both predefined and custom, are required to read out in unbinned mode through a single amp. The previous CDBS rules for selecting a bias file were sufficient as long as the subarray was limited to one quadrant *and* that an extra copy of the superbias, with an appropriate CCDAMP value, had been generated and delivered into CDBS. For example, a bias for a subarray within quadrant A and read out through A, such as UVIS1-C512A-SUB, would require a superbias file with the CCDAMP header keyword set to A; the contents of that superbias

would be the same as the contents in the A-quadrant of the full-frame four-amp superbias. The situation was analagous for amps B, C, and D. By modifying CDBS to also use the APERTURE keyword during the reference file selection process, CDBS can now point to the full-frame four-amp superbias: calwf3 is already capable of picking out the section it needs from the specified reference file (via the LTV1 and LTV2 keywords, which define the location of the first 'live' detector pixel in each image). This update to CDBS will obviate the generation, population and tracking of four extra superbias copies each time a new full-frame four-amp superbias is generated.

Subarrays that span both quadrants of a chip, such as images taken via the predefined *M512-SUB and 2K4-SUB apertures, can not simply use a full-frame four-amp superbias because of format differences between such a science image and the full-frame four-amp reference file. These subarrays require a superbias without any virtual overscan bisecting the quadrants. Most importantly, that superbias should be constructed from biases taken in the same readout mode (i.e., the entire chip is read out through the designated single amp), as the bias level varies depending upon which amp is in use. Other reference files for subarrays, like darks and flats, do not need changes, as there is no format incompatibility (overscans are removed) and the reference file characteristics do not depend upon amp as they do with the bias file.

The changes to CDBS have been implemented and tested in early 2009 – this avoids a switch of the CDBS rules after WFC3 is already on-orbit. The TV3-based bias reference files (Borders et al., in prep.) have been generated and delivered following the requirements documented in this TIR; any necessary placeholder superbiases have also already been generated and installed into CDBS. The existing Servicing Mission Ground Test data (SMGT) were used to provide an end-to-end test: it contains a large number of the supported aperture/ccdamp combinations as test images, including a number of non-standard combinations. This report summarizes the changes made to the CDBS rules, the new requirements for bias reference file deliveries, and the files delivered.

Changes to CDBS

Two updates to the CDBS were implemented: the expansion based on the value of the bias reference file's CCDAMP keyword was modified so as to only cover certain applicable readout modes and a new expansion rule based on the reference file APERTURE keyword was implemented. With the addition of APERTURE to the current CDBS expansion rules and selection criteria for WFC3 bias files, only a small set of superbiases need to be generated for each routine bias update: a) full-frame four-amp readouts in unbinned and binned (2x2, 3x3) modes and b) one single-chip one-amp readout through amp B. These routine biases, along with the proposed CDBS selection criteria, provide a superbias calibration for all the WFC3 supported modes. Note that the new CDBS selection and expansion rules also cover all unsupported modes but the superbiases for these, while present, are populated with placeholder data only and no further updates are expected at this time (see the engineering version of the Phase II Proposal Instructions for more details about supported and unsupported modes). The mapping of the WFC3 observation aperture and readout combinations to one of the superbiases is summarized in Table 1 for unbinned modes and Table 2 for binned modes. The first columns in both tables describe the observing mode of the data to be calibrated (aperture, read out amps, description of the field) while the remaining columns

describe the necessary reference file attributes (data format, values required for bias file CCDAMP and APERTURE header keywords, and an identifier). Specifically, the WFC3 bias reference files are assigned as follows; the binned modes are described first, as those rules are simplest. The full set of rules now in place in CDBS are captured in Appendix A.

When the science image is **binned 2x2 or 3x3**, no subarrays are possible. The delivered binned superbias, with header keywords CCDAMP=ABCD, BINAXIS* =2 or =3, applies to any full-frame four-amp readout in binned mode with an aperture name not including 'SUB'. During the delivery of the superbias file, CDBS expands the applicable apertures to include all the aperture names listed in rows 1-10 in Table 2 (UVIS, UVIS-FIX, etc). Binned mode can also be used in conjunction with the available but unsupported mode of full-frame two-amp readouts (observations with CCDAMP=AC, AD, BC, or BD). In these cases, the aperture of the delivered superbias is not expanded, i.e., CDBS chooses the superbias whose DETECTOR, CCDAMP, BINAXIS, and APERTURE keyword values exactly match those in the header of the science data. Eight separate superbias placeholder files were delivered to cover the four amp combinations (AC, AD, BC, and BD) and the two binning settings (2x2 and 3x3). For completeness, we note that the CCDGAIN in these placeholder superbiases files was set to "-1", taking advantage of an already-existing CDBS expansion rule: the same file is applied to all possible gains.

When **binning =1**, subarrays are possible and the selections become more involved. The file assignments can be broken into several groups. The primary unbinned full-frame four-amp superbias is appropriate for any science image with CCDAMP=ABCD and aperture name which does not include 'SUB', i.e., aperture names from rows 1-9 and row 15 in Table 1. This same reference file can also be used for the quad subarrays (APERTURE=UVIS-QUAD-SUB) as well as any of the corner subarrays (APERTURE=UVIS*-C512*-SUB, rows 13-14 and 18-19 in Table 1) but to accommodate this, the CCDAMP must be expanded to include individual amps A, B, C, and D (i.e., a subarray science observation is only read out through 1 amp). To implement this without requiring significant changes to the underlying structure of how CDBS performs expansions, two copies of the same unbinned full-frame four-amp bias must be delivered: one with the superbias APERTURE set to FULLFRAME_4AMP (which expands to cover all non-SUB apertures) plus CCDAMP set to the standard ABCD and one with the superbias APERTURE set to QUAD_CORNER_SUBARRAYS (expands to cover *C512* and *QUAD-SUB apertures, i.e., the subarrays) and CCDAMP set to SINGLE_AMP (expands to cover ccdamps of A, B, C, or D).

A full, chip #1, single amp readout superbias is applicable to both a UVIS1-2K4-SUB aperture science image as well as a smaller subarray UVIS1-M512-SUB science image straddling the amp boundaries. Currently, commanding has these two chip #1 subarrays reading out through amp B by default; a nominal single amp superbias will be constructed for this amp and there are plans to obtain data in Cycle 17 for updating this bias reference file. To allow for the possibility that this might change in the future, a placeholder superbias file has been generated for the amp A mode. The APERTURE keyword in both these superbias files is set to CHIP1_SUB_NOCORNERS, which CDBS expands into the two subarrays (UVIS1-2K4-SUB, UVIS1-M512-SUB). Similarly, a full, chip #2, single amp superbias is applicable to the UVIS2-2K4-SUB aperture as well as the smaller subarray straddling the amp boundaries on chip, UVIS2-M512-SUB. Both these apertures

are available to observers but not supported so there are currently only placeholders for CCDAMP=D and CCDAMP=C cases. The APERTURE keyword in the superbiases is set to CHIP2_SUB_NOCORNERS, so that the files are applied to the two subarrays as needed. Note that these full-chip single-amp readout biases would be appropriate for the *C512* and *QUAD-SUB subarrays as well but the full-frame four-amp readout is preferred since only it and the full-chip B-readout biases are planned to be regularly updated on-orbit. Three of the four full-chip single-amp readout biases cover unsupported modes and there are currently no plans to update those on-orbit.

The full-frame apertures (aperture names excluding 'SUB', rows 20-26 in Table 1) can also be read out via two amps instead of four. These are restricted modes, so a set of four placeholder biases have been constructed to cover the cases of CCDAMP=AC, AD, BC, and BD. A CDBS expansion rule on CCDAMP was not developed, since real superbiases for these formats are not interchangeable; this allows for the possibilty of populating these modes, if necessary, with real data in the future.

Finally, there are the custom subarrays, which, as noted in the Phase II Proposal Instructions, are available but unsupported modes (there is at least one Cycle 17 calibration proposal, #11935, that will use these). For custom subarrays, the CDBS rules involve not only checks of the science data APERTURE and CCDAMP keyword values but also the SUBARRAY keyword. Specifically, if the SUBARRAY keyword in the science image header is set to 'T' *and* the value of APERTURE does not include 'SUB' in its name (i.e., the science image APERTURE keyword is one of those listed in column 2 and rows 1-9 or 15 in Table 1), then the subarray is a custom subarray. As for all subarrays, predefined or custom, the CCDAMP in the science image header will always be a single amp (A, B, C, or D)

The delivered superbiases appropriate for custom subarrays have their APERTURE header keyword set to CUSTOM_SUBARRAYS, which CDBS expands to the aperture list noted above; the CCDAMP in the superbias header will be A, B, C, or D and thus match the science data CCDAMP value. In practice, the data contents of these biases for custom subarrays is the same as the contents of the full chip single amp superbias read out through A, B, C, or D. As mentioned earlier, there will be a routine bias generated for the supported chip (#1, as read out through amp B); the other three have placeholders only.

Reference files required

In addition to improving the bias file selection for subarrays, the changes to CDBS will simplify future routine delivery of bias reference files to CDBS. The last column in Table 1 summarizes the files needed to cover all unbinned modes, supported and unsupported and a full set of files has been generated and delivered using the new CDBS rules (Borders et al., in prep). However, future routine deliveries based on on-orbit data will be provided only for the modes in the 'supported' sections of the tables (rows 1-15 in Table 1, rows 1-10 in Table 2). The CCDAMP and APERTURE columns in Table 1 specify the required settings of these keywords in the reference file headers in order for CDBS to perform the desired expansions.

In summary, the files delivered to support the new expansion rules for unbinned modes are listed below; those expected to be routinely updated on-orbit (i.e., supported modes) are underlined. All placeholder files are delivered with GAIN=-1, to cover the off-nominal gains.

1) Two copies of the full-frame, four-amp bias, gain 1.5, listed as 'Main (FF,4A)' and 'Main (FF,4Ac2) in Table 1. The data values will be the same in both superbiases, only the header keywords will differ: one needs APERTURE set to FULLFRAME_4AMP and CCDAMP set to ABCD while the other needs APERTURE set to QUAD_CORNER_SUBARRAY and CCDAMP set to SINGLE_AMP. A separate placeholder file was delivered to cover full-frame off-nominal gains.

2) Four single-chip, single-amp biases, one per amp (SingleA, SingleB, SingleC, SingleD in the table); APERTURE in the superbiases will be CHIP1_SUB_NOCORNERS for CCDAMPs A and B and CHIP2_SUB_NOCORNERS for C and D. Only the single-chip, gain 1.5, single-amp B-readout is needed for calibration of supported modes. All four of these files will be placeholders (GAIN=-1) until the single-amp B-readout data are taken in Cycle 17.

3) Four single-chip, single-amp biases, one per amp; these are the same biases as in the previous item except that the APERTURE is set to CUSTOM_SUBARRAYS (CCDAMP is set to A, B, C, or D).

4) Full-chip, two-amp biases, one per amp-pair combination (AC, AD, BC, and BD); as these are unsupported modes, the reference files are placeholders as well. The superbias APERTURE keyword is set to FULLFRAME_2AMP and CCDAMP is set to the various 2-amp combinations.

For binned modes, the following files are needed.

1) Two full-frame, four-amp gain 1.5 biases, one each of the 2x2 and 3x3 binned settings. The superbias APERTURE is set to ANY and the CCDAMP to ABCD. Separate placeholder files were delivered for the off-nominal gains (GAIN=-1).
2) A full-chip, two-amp bias for each of the four amp-pair combination, for each binned setting (2x2 and 3x3), i.e., a total of 8 files. Since these cover unsupported modes, only placeholder files will be delivered and there are no plans to routinely update these files on-orbit. The superbias APERTURE is set to ANY, the CCDAMP to the various amp-pair combinations (AC, AD, BC, or BD), and the GAIN set to -1.

As a check of the new rules, Appendix C provides a table of the superbiases, with their CCDAMP and APERTURE keywords settings, mapped onto the WFC3 science modes.

Status of reference files predating the revised CDBS rules

Any reference files that existed prior to the CDBS changes described in this report have been removed from the CDBS database. They do, however, remain available in the STScI Data Archive and for completeness, are listed in Appendix B. This cleanup of the CDBS database was done primarily to minimize any confusion for users in the longterm: none of the earlier files will ever be picked up by OPUS or the pipeline for calibration (because their APERTURE keywords weren't

populated). Some of the files were dummy files used for pre-launch testing while others were generated with older versions of software and have since been superseded.

Conclusion

This report documents the changes made in early 2009 to the CDBS file selection criteria and expansion rules for WFC3 UVIS biases. The modifications improve the bias calibration for subarray modes as well as streamline the set of future routine bias reference files (summarized in the previous section) that will require generation and installation into CDBS.

References

HST Phase II Proposal Instructions for Cycle 17, Engineering Version 17.0, May 2008 **http://www.stsci.edu/ftp/documents/p2pi/p2pi_ENG.pdf**

The WFC3/UVIS Reference Files: 2. Biases and Darks, Martel, A., Baggett, S., Bushouse, H., and Sabbi, E., Feb 02,2009, WFC3 2008-42. **http://www.stsci.edu/hst/wfc3/documents/ISRs/WFC3-2008-42.pdf**

WFC3 UVIS Biases and Darks, Borders, T., et al., in prep., to be posted at **http://www.stsci.edu/hst/wfc3/documents/ISRs**

Revision History

Version 1, published Apr 12,2009. Subsequent testing of the rules devised at that time revealed that there remained an issue with bias file selection for custom subarrays (the fullframe 4-amp readout bias was erroneously being applied to custom subarrays and effectively overwriting any files delivered for the custom subarrays.).

Version 2, updated May 3,2009. Supersedes Version 1. Tables and text have been updated to reflect the fix necessary for custom subarrays.

Table 1.Mapping of aperture and readout amp configuration into bias reference files for *unbinned* modes.

Row	Aperture (as specified via APT)	Readout amp(s)	Description of field	Description of CDBS file	CCDAMP keyword in superbias	APERTURE keyword in superbias	Superbias ID
	Supported						
1	UVIS	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
2	UVIS-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
3	UVIS-CENTER	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
4	UVIS1	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
5	UVIS1-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
6	UVIS2	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
7	UVIS2-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
8	UVIS-QUAD	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
9	UVIS-QUAD-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
10	UVIS-QUAD-SUB	A, B, C, or D	Single quadrant subarray	Full-frame, four-amp	SINGLE_AMP	QUAD_CORNER_ SUBARRAYS	Main (FF,4Ac2)
11	UVIS1-2K4-SUB	Default: B	One CCD (4142x2050)	Full chip, B readout Placeholder for A readout	A or B	CHIP1_SUB_NOCORNERS	SingleB SingleA
12	UVIS1-M512-SUB	Default: B	Middle subarray (512x512)	Full chip, B readout Placeholder for A readout	A or B	CHIP1_SUB_NOCORNERS	SingleB SingleA
13	UVIS1-C512A-SUB	A	Corner subarray (536x512)	Full-frame, four-amp	SINGLE_AMP	QUAD_CORNER_ SUBARRAYS	Main (FF,4Ac2)
14	UVIS1-C512B-SUB	B	Corner subarray (536x512)	Full-frame, four-amp	SINGLE_AMP	QUAD_CORNER_ SUBARRAYS	Main (FF,4Ac2)
15	G280-REF	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	FULLFRAME_4AMP	Main (FF,4A)
	Available but unsupported						
16	UVIS2-2K4-SUB	Default: D	One CCD (4142x2050)	Placeholders for C & D readouts	C or D	CHIP2_SUB_NOCORNERS	SingleD SingleC
17	UVIS2-M512-SUB	Default: D	Middle subarray (512x512)	Placeholders for C & D readouts	C or D	CHIP2_SUB_NOCORNERS	SingleD SingleC
18	UVIS2-C512C-SUB	C	Corner subarray (536x512)	Full-frame, four-amp	SINGLE_AMP	QUAD_CORNER_ SUBARRAYS	Main (FF,4Ac2)

19	UVIS2-C512D-SUB	D	Corner subarray (536x512)	Full-frame, four-amp	SINGLE_AMP	QUAD_CORNER_ SUBARRAYS	Main (FF,4Ac2)
20	UVIS	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
21	UVIS-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
22	UVIS-CENTER	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
23	UVIS1	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
24	UVIS1-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
25	UVIS2	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
26	UVIS2-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four placeholders, one per CCDAMP combo	AC, AD, BC, or BD	FULLFRAME_2AMP	FullAC, FullAD FullBC, FullBD
27	Custom subarray: can have any non-SUB specific aperture	A,B,C,D	Any size	Full chip Readout A, B, C, or D	A, B, C, or D	CUSTOM_SUBARRAYS	SingleAc2, SingleBc2, SingleCc2, SingleDc2

Table 2.Mapping of aperture and readout amp configuration into bias reference files for *binned* modes (applies to both 2x2 and 3x3).

Row	Aperture (as specified via APT)	Readout amp(s)	Description of field	Description of CDBS file	CCDAMP keyword in superbias	APERTURE keyword in superbias	Superbias ID
	Supported						
1	UVIS	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
2	UVIS-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
3	UVIS-CENTER	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
4	UVIS1	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
5	UVIS1-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
6	UVIS2	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
7	UVIS2-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
8	UVIS-QUAD	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
9	UVIS-QUAD-FIX	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
10	G280-REF	ABCD	Two-CCD mosaic	Full-frame, four-amp	ABCD	ANY	Binned Main(FF,4A)
	Available but unsupported						
11	UVIS	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
12	UVIS-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
13	UVIS-CENTER	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
14	UVIS1	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC,

15	UVIS1-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullBD BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
16	UVIS2	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
17	UVIS2-FIX	AC, AD, BC, BD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
18	UVIS-QUAD	ABCD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
19	UVIS-QUAD-FIX	ABCD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD
20	G280-REF	ABCD	Two-CCD mosaic	Full-frame, two-amp four combos x two binnings = 8 placeholders	AC, AD, BC, or BD	ANY	BinnedFullAC, BinnedFullAD BinnedFullBC, BinnedFullBD

Appendix A. CDBS expansion rules

Below is a copy of the CDBS expansion rules as they apply to UVIS bias reference files as of April 2009; that is, for every delivered bias reference file, CDBS performs the following checks and expands the parameter space addressed by the file accordingly. The "||" symbol signifies an "OR" operation. For example, the first block of statements designates that if the bias reference file has the header keyword CCDAMP set to the value ANY, the bias is appropriate for use with science data whose CCDAMP values are A or B or C or D or AC, etc. Similarly, the second block of statements marks a bias file with header keyword CCDAMP set to SINGLE_OR_ALL as applicable to science data containing CCDAMP of A or B or C or D or ABCD. Expansions on the CCDGAIN and APERTURE values are done as well, as dictated by the remaining statement blocks. As a group, these rules provide a way to assign the same bias reference file to multiple science observing modes without requiring a new file for each mode.

The result of running these rules is a database table containing a list of bias reference file names that are appropriate for the various unique combinations of DETECTOR, CCDAMP, CCDGAIN, BINAXIS1, BINAXIS2, and APERTURE possible with WFC3. The OPUS pipeline assigns the reference file which matches these six keywords in the science data keyword values and possesses a USEAFTER date closest in time preceding the science observation date.

#
CCDAMP = ANY =>
CCDAMP = A || CCDAMP = B || CCDAMP = C || CCDAMP = D ||
CCDAMP = AC || CCDAMP = BC || CCDAMP = AD || CCDAMP = BD ||
CCDAMP = ABCD;

CCDAMP = SINGLE_AMP =>
CCDAMP = A || CCDAMP = B || CCDAMP = C || CCDAMP = D;
#
DETECTOR = UVIS && CCDGAIN = -1. =>
CCDGAIN = 1.0 || CCDGAIN = 1.5 || CCDGAIN = 2.0 || CCDGAIN = 4.0 ;
DETECTOR = UVIS && CCDGAIN = -1 =>
CCDGAIN = 1.0 || CCDGAIN = 1.5 || CCDGAIN = 2.0 || CCDGAIN = 4.0 ;
#
DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&
APERTURE = FULLFRAME_4AMP =>
APERTURE = UVIS || APERTURE = UVIS-FIX || APERTURE = UVIS-CENTER ||
APERTURE = UVIS1 || APERTURE = UVIS1-FIX || APERTURE = UVIS2 ||
APERTURE = UVIS2-FIX || APERTURE = UVIS-QUAD || APERTURE = UVIS-QUAD-FIX ||
APERTURE = G280-REF;

DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&

APERTURE = QUAD_CORNER_SUBARRAYS =>
APERTURE = UVIS-QUAD-SUB || APERTURE = UVIS1-C512A-SUB ||
APERTURE = UVIS1-C512B-SUB || APERTURE = UVIS2-C512C-SUB ||
APERTURE = UVIS2-C512D-SUB;

DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&
APERTURE = CHIP1_SUB_NOCORNERS =>
APERTURE = UVIS1-2K4-SUB || APERTURE = UVIS1-M512-SUB;

DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&
APERTURE = CHIP2_SUB_NOCORNERS =>
APERTURE = UVIS2-2K4-SUB || APERTURE = UVIS2-M512-SUB;

DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&
APERTURE = FULLFRAME_2AMP =>
APERTURE = UVIS || APERTURE = UVIS-FIX || APERTURE = UVIS-CENTER ||
APERTURE = UVIS1 || APERTURE = UVIS1-FIX || APERTURE = UVIS2 ||
APERTURE = UVIS2-FIX;

DETECTOR = UVIS && BINAXIS1 = 1 && BINAXIS2 = 1 &&
APERTURE = CUSTOM_SUBARRAYS =>
APERTURE = UVIS || APERTURE = UVIS-FIX || APERTURE = UVIS-CENTER ||
APERTURE = UVIS1 || APERTURE = UVIS1-FIX || APERTURE = UVIS2 ||
APERTURE = UVIS2-FIX || APERTURE = UVIS-QUAD || APERTURE = UVIS-QUAD-FIX ||
APERTURE = G280-REF;

DETECTOR = UVIS && BINAXIS1 = 2 && BINAXIS2 = 2 &&
APERTURE = ANY =>
APERTURE = UVIS || APERTURE = UVIS-FIX || APERTURE = UVIS-CENTER ||
APERTURE = UVIS1 || APERTURE = UVIS1-FIX || APERTURE = UVIS2 ||
APERTURE = UVIS2-FIX || APERTURE = UVIS-QUAD || APERTURE = UVIS-QUAD-FIX ||
APERTURE = G280-REF ;

DETECTOR = UVIS && BINAXIS1 = 3 && BINAXIS2 = 3 &&
APERTURE = ANY =>
APERTURE = UVIS || APERTURE = UVIS-FIX || APERTURE = UVIS-CENTER ||
APERTURE = UVIS1 || APERTURE = UVIS1-FIX || APERTURE = UVIS2 ||
APERTURE = UVIS2-FIX || APERTURE = UVIS-QUAD || APERTURE = UVIS-QUAD-FIX ||
APERTURE = G280-REF ;

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Appendix B. Bias reference files removed from CDBS database

As discussed in this report, bias reference files which predate the new CDBS rules have been removed from the CDBS database but remain available from the STScI Data Archive if needed.

Pre-launch pipeline testing and containing dummy or low-quality data only.

o1920122i_bia.fits	s191848fi_bia.fits	s191848gi_bia.fits	
s191848hi_bia.fits	s7813544i_bia.fits	s7813545i_bia.fits	s7813546i_bia.fits

First generation of bias files generated from thermal-vacuum level (TV3) ground tests. These were the initial set of reference files intended for use in the event that WFC3 was installed in an Oct 2008 Hubble servicing mission. They are described in detail in ISR 2008-42 (Martel et al., 2009).

s9c1451pi_bia.fits	s9c1451qi_bia.fits	s9c1451ri_bia.fits	s9c1451si_bia.fits
s9c1451ti_bia.fits	s9c14520i_bia.fits	s9h15405i_bia.fits	s9h15406i_bia.fits
s9h15407i_bia.fits	s9h15408i_bia.fits	s9h15409i_bia.fits	s9h1540ai_bia.fits
s9h1540bi_bia.fits	s9h1540ci_bia.fits	s9j1552ti_bia.fits	s9j15530i_bia.fits

Second generation of bias files generated from thermal-vacuum level (TV3) ground tests. These files have been generated with an improved version of software. They are effectively identical to what is in the current, active superbias file set intended for use after the upcoming HST servicing mission (planned for May 2009) but were lacking the necessary keyword settings needed for the CDBS changes. Details of the improvements over the first generation set will be provided in an upcoming ISR (Borders et al., 2009).

t2r1933bi_bia.fits	t2r1933ci_bia.fits	t2r1933di_bia.fits	t2r1933ei_bia.fits
t2r1933fi_bia.fits	t2r1933gi_bia.fits	t2r1933hi_bia.fits	t2r1933ii_bia.fits

Appendix C. Biases mapped onto observing modes by the CDBS expansions rules (see App.A).

Superbias	APERTURE In superbias	CCDAMP In superbias	Observing ccdamp + aperture modes covered	Comment
1x1 binning				
FF4A	ABCD	FULLFRAME_4AMP	ABCD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 4amp readout **regularly updated**
FF4Ac2	SINGLE_AMP	QUAD_CORNER_SUBARRAYS	A,B,C, or D + UVIS-QUAD-SUB, UVIS1-C512A-SUB, UVIS1-C512B-SUB, UVIS2-C512C-SUB, UVIS2-C512D-SUB	Copy 2 of FF4A but with noted CCDAMP/APERTURE keyword changes **regularly updated**
SingleA	CHIP1_SUB_NOCORNERS	A	A + UVIS1-2K4-SUB, UVIS1-M512-SUB	single chip single amp readout, placeholder (addresses unsupported modes only)
SingleB	CHIP1_SUB_NOCORNERS	B	B + UVIS1-2K4-SUB, UVIS1-M512-SUB	single chip single amp readout, currently a placeholder but **updated on-orbit**
SingleC	CHIP2_SUB_NOCORNERS	C	C + UVIS2-2K4-SUB, UVIS2-M512-SUB	single chip single amp readout, placeholder (addresses unsupported modes only)
SingleD	CHIP2_SUB_NOCORNERS	D	D + UVIS2-2K4-SUB, UVIS2-M512-SUB	single chip single amp readout, placeholder (addresses unsupported modes only)
FullAC	FULLFRAME_2AMP	AC	AC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX	fullframe 2amp readout, placeholder (addresses unsupported modes only)
FullAD	FULLFRAME_2AMP	AD	AD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1,	fullframe 2amp readout, placeholder (addresses unsupported modes only)

FullBC	FULLFRAME_2AMP	BC	UVIS1-FIX, UVIS2, UVIS2-FIX BC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1,	fullframe 2amp readout, placeholder (addresses unsupported modes only)
FullBD	FULLFRAME_2AMP	BD	UVIS1-FIX, UVIS2, UVIS2-FIX BD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX	fullframe 2amp readout, placeholder (addresses unsupported modes only)
SingleAc2	CUSTOM_SUBARRAYS	A	A + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX,UVIS2, UVIS2-FIX,UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	copy 2 of SingleA but with noted CCDAMP/APERTURE changes placeholder (addresses unsupported modes only)
SingleBc2	CUSTOM_SUBARRAYS	B	B + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX,UVIS2, UVIS2-FIX,UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	copy 2 of SingleB but with noted CCDAMP/APERTURE changes placeholder initially but updated on-orbit
SingleCc2	CUSTOM_SUBARRAYS	C	C + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX,UVIS2, UVIS2-FIX,UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	copy 2 of SingleC but with noted CCDAMP/APERTURE changes placeholder (addresses unsupported modes only)
SingleDc2	CUSTOM_SUBARRAYS	D	D + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX,UVIS2, UVIS2-FIX,UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	copy 2 of SingleD but with noted CCDAMP/APERTURE changes placeholder (addresses unsupported modes only)
2x2 binning				
BinnedFF4A	ANY	ABCD	ABCD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 4amp readout in binned mode **regularly updated**
BinnedFFAC	ANY	AC	AC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD,	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)

			UVIS-QUAD-FIX, G280-REF	
BinnedFFAD	ANY	AD	AD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
BinnedFFBC	ANY	BC	BC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
BinnedFFBD	ANY	BD	BD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
3x3 binning				
BinnedFF4A	ANY	ABCD	ABCD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 4amp readout in binned mode **regularly updated**
BinnedFFAC	ANY	AC	AC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
BinnedFFAD	ANY	AD	AD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
BinnedFFBC	ANY	BC	BC + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)
BinnedFFBD	ANY	BD	BD + UVIS, UVIS-FIX, UVIS-CENTER, UVIS1, UVIS1-FIX, UVIS2, UVIS2-FIX, UVIS-QUAD, UVIS-QUAD-FIX, G280-REF	fullframe 2amp readout in binned mode, placeholder (addresses unsupported modes only)