

# Creating WFPC2 Weekly Dark Reference Files & Hot and Warm Pixel Tables

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## ABSTRACT

*This TIR describes the procedure for creating weekly dark reference files and hot and warm pixel tables which are used in the calibration of WFPC2 data.*

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## Introduction

As part of the WFPC2 calibration plan five dark images are taken once weekly (as well as just prior to and just after every decontamination of the detectors) and these weekly *dark images* are combined to create a weekly *dark file* of higher quality. This dark file is used in conjunction with the previous year's superdark to create the best calibration file for all WFPC2 observations taken during that week. The superdark, created with 120 of the individual dark images from the previous year, provides the base of the new dark files, while the combination of the five weekly dark images replace pixel values that vary rapidly and differ from the superdark by five sigma or more.

As time passes the number of pixels with dark current greater than  $0.02 \text{ e-/s-1}$ , called warm or hot pixels, increases. A decontamination of the detectors, where the camera temperature is increased for a number of hours in a largely successful attempt to return these high dark current pixels to normal levels, is carried out approximately once per month. The warm and hot pixels present in the time between two decontaminations can be identified and lists made available to users in order to help with data analysis.

The detailed procedures used in creating these calibration products are described below. The weekly darks are used in the HST calibration pipeline and the hot and warm pixel tables are made available on the WFPC2 webpages. More detailed descriptions of the need for, and use of, these reference files are available in the WFPC2 Data and Instrument Handbooks.

## Products to be Created

The first product to be created is a weekly dark file that is a combination of the previous year's superdark and a CTE corrected and averaged dark created from five dark images with gain=7, serials=off. This gain 7, serial off weekly dark is used to create copies for all combinations of gain=7,15 and serials=on,off. The second goal is to produce tables identifying warm and hot pixels for the period of time between two decontaminations of the detector.

A summary of the procedure for creating the weekly dark files is included in the HISTORY section of the image headers. An example of a history is attached as Appendix A.

The main program used to identify hot and warm pixels and create lists of marked pixels is an IDL task called warmpixtab.pro. The description of its procedure as given within the script text is attached as Appendix B.

## Procedure

Most of the tasks involved in this procedure can be accomplished in either IRAF or Pyraf, but there are some steps which may result in errors from Pyraf. IDL will be called for an intermediate masking step and will also be needed for creating the pixel tables.

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### 1.) Request the calibrated dark images from the archive:

# Start Starview and select the following from the pull-down menu: Searches, HST, Instruments, WFPC2, WFPC2 Instrument.<sup>1</sup>

*starview*

# Using the following criteria, search for data:

---

1. Herein “#” indicates non-command lines or comments. Lines in *italics* indicate commands to be typed.

Exposure Length = 1800  
Start Time = mm/dd/yy..mm/dd/yy or >mm/dd/yr  
Image Type = dark  
Serials = off

# Verify that five darks per date have been found and retrieve the data, choosing the *Show Override* option. Type in “c0f” and select the *Fetch only listed extensions* box.

# You should receive five fits images, each with a slightly different rootname and a c0f.fits ending and they should be calibrated versions of these files.

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## 2.) In IRAF, convert fits files to geis files:

```
set imtype=hhh  
strfits *
```

#The result will be 5 data sets with 2 extensions per rootname (.c0d,.c0h).

---

## 3.) Create a directory structure and select parameters for the task *dodark.cl*:

# Make a directory for the data taken on a particular date in your darks working directory (named, for example nv08). Create a directory called *infiles* within the weekly directory. Move the .c0d and .c0h files for that week into the *infiles* directory. You can delete the fits files at this point if you want to or move them to another directory. They should not be in the directory where you run *dodark*.

```
cd /darks  
mkdir nv08  
cd nv08  
mkdir infiles  
mv *c0d *c0h infiles  
mv *fits ../fits  
cd infiles
```

DIRECTORY TREE:

```
darks/  
darks/nv08/  
darks/nv08/infiles/  
darks/nv08/infiles/u9490701m.c0d  
u9490801m.c0d u9490901m.c0d u9490a01m.c0d u9490b01m.c0d  
u9490701m.c0h u9490801m.c0h u9490901m.c0h u9490a01m.c0h  
u9490b01m.c0h
```

For a first run, you must have a copy of the previous week's directory, including the initial files and those created, and a copy of the dark\_ar.pro.

```
#From within the new week's infiles directory run dodark
```

```
epar dodark
```

**a) If a normal run of *dodark* was completed for the previous week and there has not been a decontamination, only the *cw* parameter needs to be updated.**

```
# update the parameter cw (current working directory), i.e. cw = nv08  
# dodark should have updated the parameter lst (previous week dark directory) i.e. lst =  
nv01.  
# dodark should also have updated the pf (previous file) parameter with the rootname of  
the previous week's images. To identify the previous file name for pf do the following in  
the main directory (not infiles or INFILES) for the previous week's data:
```

```
hselect *r3h "rootname,atodgain,serials" yes
```

```
# the correct pf value will be the rootname of the renamed image with gain=7 and  
serials=off.
```

**b) Following a decontamination the *ht* (hotpix directory) parameter in *dodark* will need to be updated. You will create a new directory where your weekly dark files are stored (i.e. /data/snap4/mrichard/hotpix/wkdarks/\*) and change the *ht* name to your new directory. The directories in *wkdarks* have been named after the month when the first post-decontamination darks (i.e. "oct" for the nv08 darks because of the Oct 23rd post-decontamination darks).**

```
#You will also need to create new hot and warm pixel tables (see Section 8 of this report)
```

**c) In the case of an interrupted dodark run, a resetting of dodark parameter, or using dodark for the first time:**

# you will need to fill in the *cw*, *lst*, *pf* parameters (procedure for identifying *pf* given above).

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**4) Run *dodark.cl*:**

# Add lines to your IRAF login.cl file defining the tasks for making darks, replacing /data/classic2/wfpc2 with your own location:

```
task $mksuper="/data/classic2/wfpc2/darkpros/mksuper.cl"
task $dodark="/data/classic2/wfpc2/darkpros/dodark.cl"
```

# Your *darkpros* directory should contain the following files (or the parallel file for an appropriate year):

*cd darkpros*

```
calcheck.cl  dowfstat.cl  hist_2003    super2004.r3d  wf_img.x0d*
check_delivery* files_in*    hist_2004    super2004.r3h  wf_img.x0h*
dodark.cl*   files_out*  hist_add2    superdqf.cl    wfarith.cl
dodeliver.cl* hist_1999   hist_add3*   superimg.cl    wkdark.cl
dodqfqs.cl  hist_2000* mksuper.cl  web/
doheader.cl  hist_2001   super2004.b3d wf_img.d0d*
dohedit.cl* hist_2002   super2004.b3h wf_img.d0h*
```

*cd web*

```
doweb.src*      wfpc2_Tab1.html    wfpc2_Tab3.html
wfpc2_Dark.awk* wfpc2_Tab2.html    wfpc2_darks_tab.html
wfpc2_FTP.src*  wfpc2_Tab2a.html
```

# The *dodark.cl* calls a package named *mksuper.cl* that calls a number of additional tasks:

```
task dodark    =/data/classic2/wfpc2/darkpros/dodark.cl
package mksuper =/data/classic2/wfpc2/darkpros/
task wkdark    = mksuper$wkdark.cl
```

```
task superimg = mksuper$superimg.cl
task superdqf = mksuper$superdqf.cl
task dowfstat = mksuper$dowfstat.cl
task dohedit  = mksuper$dohedit.cl
task doheader = mksuper$doheader.cl
task dodqfqs  = mksuper$dodqfqs.cl
task calcheck = mksuper$calcheck.cl
task dodeliver = mksuper$dodeliver.cl
task wfarith  = mksuper$wfarith.cl
task dodark   = mksuper$dodark.cl
```

From the infiles directory, run dodark.cl:

```
epar dodark
```

```
:g
```

# An IDL window will open by itself when the CTE masking is being done. The whole program should take no longer than a couple minutes to complete.

# Note: the *mkdark* parameters used for creating WFPC2 weekly darks were changed starting with August 2004 data. Over-correction of CTE was resulting in negative pixels. For this reason the *mkdark* parameters were changed from:

```
sigmas =      4,4,3,2
radius =      0
pfactor =     0
hotthres=    4096.
minval =     -99
```

to:

```
sigmas =      4,4,3,2
radius =      1.5
pfactor =     0.5
hotthres=    4096.
minval =      0.
```

# The CTE-correction parameters were not changed. NB: the CTE-corrected images are saved and used in the yearly superdark. Negative pixels in the superdark are corrected separately when *mkdark* is run to create the superdark.

---

## 5) Check your results.

# If *dodark* has run successfully the numbers in *stat.dat* and a visual inspection will be your main checks on the quality of the new darks. Make sure that the statistics for the new darks are similar to those for past weeks, paying particular attention to the medians and standard deviations. You should also check the *calchk.log* for any errors.

*more stat.dat*

#After a successful run of *dodark*, you will have with the following directories and files:

On your local or working system:

darks/nv08

darks/nv08/infiles/

darks/nv08/INFILES

/

*cd nv08*

INFILES/    oba0829cu.lod oba0829du.lod oba0829eu.lod oba0829fu.lod

infiles/    oba0829cu.r3d oba0829du.r3d oba0829eu.r3d oba0829fu.r3d

junk        oba0829cu.r3h oba0829du.r3h oba0829eu.r3h oba0829fu.r3h

oba0829cu.b3d oba0829du.b3d oba0829eu.b3d oba0829fu.b3d stat.dat

oba0829cu.b3h oba0829du.b3h oba0829eu.b3h oba0829fu.b3h

# INFILES- directory created by *dodark*

# infiles- directory you created to start

# junk- intermediate copies of the final b3d,b3h,r3d,r3h,lod files produced by *dodark*

# oba0829\*b3d,\*b3h,\*r3d,\*r3h are the final weekly darks, made from the combination of the superdark and the CTE masked, averaged darks (four sets of data; one each for gain=7,15 and serials=on,off combinations)

# oba0829\*lod are the load files needed for the task (*sendit*) which sends files to OPUS.

# *stat.dat* has image statistics (min,max,med,etc.) for the current week, plus a number of past weeks for comparison.

*cd infiles*

dark.info    u9490701m.c0d u9490801m.c0h u9490a01m.c0d

u9490b01m.c0h dark\_ar.pro\* u9490701m.c0h u9490901m.c0d

u9490a01m.c0h input u9490801m.c0d u9490901m.c0h u9490b01m.c0d

# *dark.info* is a list of the input files and the observation start date and time

# dar\_ar.pro is a program called during dodark and must be present in the previous week's directory for the program to run

# input is a list of the input files (all the \*c0h you started with)

# c0d and c0h are the original five calibrated weekly dark images from the archive, unchanged by *dodark*.

*cd ../INFILES*

calchk.log out.chk u9490801m.c0d u9490a01m.c0h weekly.r3d  
ob41636ku.b3d out.mm u9490801m.c0h u9490b01m.c0d weekly.r3h  
ob41636ku.b3h stats.check u9490901m.c0d u9490b01m.c0h  
ob41636ku.r3d u9490701m.c0d u9490901m.c0h weekly.b3d  
ob41636ku.r3h u9490701m.c0h u9490a01m.c0d weekly.b3h

# calchk.log is a log of messages produced by the task "calwp2"

# ob41636ku\* are the files for the CTE corrected, and averaged gain=7,serials=off weekly dark for the LAST week

# out.chk has names, minimums, and maximums for intermediate images

# out.mm has statistics calculated by calcheck.cl

# stats.check has image statistics for intermediate images

# u9490\*c0h,\*c0d are CTE corrected versions of the original five dark images

# weekly\*b3d,b3h,r3d,r3h is the average of the 5 CTE corrected weekly darks with gain=7,serials off

On snap4 or other storage system:

/data/snap4/mrichard  
/data/snap4/mrichard/hotpix  
/data/snap4/mrichard/hotpix/wkdarks  
/data/snap4/mrichard/hotpix/wkdarks/mth

*cd /data/snap4/mrichard/hotpix/wkdarks/oct/*  
04Nov8.b3d 04Nov8.b3h 04Nov8.r3d 04Nov8.r3h

# a copy of the average of the five weekly darks (like /INFILES/weekly.\* but **not** CTE corrected) with gain=7 serial off: saved for warm and hot pixel table creation

/data/snap4/mrichard  
/data/snap4/mrichard/2002\_darks  
/data/snap4/mrichard/2002\_darks/mmdd

```
cd /data/snap4/mrichard/2002_darks/nv08/  
u9490701m.c0d u9490801m.c0d u9490901m.c0d u9490a01m.c0d  
u9490b01m.c0d u9490701m.c0h u9490801m.c0h u9490901m.c0h  
u9490a01m.c0h u9490b01m.c0h
```

# \*c0d and \*c0h are CTE corrected versions of the original 5 dark images for gain=7,  
serial off: saved for superdark creation

---

**6) Deliver the darks to OPUS. Starting in May 2005 the CDBS group took over the delivery of reference files for all instrument groups. A description of the process and requirements is given by the CDBS TIR 2005-01 on “Assessment and Delivery of Reference Files”:**

<http://www.stsci.edu/hst/observatory/cdbb/documents/TIR-CDBS-2005-01.pdf>

The procedures used prior to the creation of the CDBS group are described by the WFPC2 TIR 2005-02 on “Delivering Weekly WFPC2 Dark Reference Files to the Archive”.

The main steps required of the WFPC2 group are verification of the reference file quality and delivery of the CDBS template to [cdbs@stsci.edu](mailto:cdbs@stsci.edu).

```
hselect *r3h "proposid,pedigree,useafter,comment,descrip" yes  
more stat.dat  
/data/cdbb1/tools/bin/certify *h *lod  
display ....
```

---

**7) After you are notified of a successful delivery you should update the web page. From within the weekly directory (nv08) and in IRAF run *doweb.src*:**

```
cd /data/classic2/wfpc2/darks/nv08  
cl < /data/classic2/wfpc2/darkpros/web/doweb.src
```

# The web page that you are updating is:

[http://www.stsci.edu/instruments/wfpc2/Wfpc2\\_memos/wfpc2\\_darks\\_tab.html](http://www.stsci.edu/instruments/wfpc2/Wfpc2_memos/wfpc2_darks_tab.html)

# The following is an example of what you will add to the page by running this script:

200411 8 full on 7 oba0829fu | pipeline dark: 120 frame superdark with hot-pixels from 08/11/2004

200411 8 full on 15 oba0829du | pipeline dark: 120 frame superdark with hot-pixels from 08/11/2004

200411 8 full off 7 oba0829eu | pipeline dark: 120 frame superdark with hot-pixels from 08/11/2004

200411 8 full off 15 oba0829cu | pipeline dark: 120 frame superdark with hot-pixels from 08/11/2004

The programs and templates are stored in the *web* subdirectory of the *darkpros* directory and were listed in Section 4.

-----

**8) After a decontamination, you will need to create new hot pixel and warm pixel tables that will be appropriate for all data taken between the previous two decontaminations.**

**a) Setup:**

# in your .setenv file add:

```
set warmpixtab = /data/snap4/mrichard/hotpix/
```

# or keep a copy of *warmpixtab.pro* in the working directory, i.e. *data/snap4/mrichard/hotpix/wkdarks/oct*

Your directory structure should be as follows:

```
/data/snap4/mrichard/hotpix  
/data/snap4/mrichard/hotpix/com  
/data/snap4/mrichard/hotpix/vary  
/data/snap4/mrichard/hotpix/wkdarks
```

# And necessary file locations are:

```
cd /data/snap4/mrichard/hotpix  
com/      vary/      warmpixtab.pro* wkdarks/
```

```
cd /data/snap4/mrichard/hotpix/com
```

MASTER\_hot.cl\*  
hotpix.inst\*  
hotpix.website\*  
junk.txt\*  
warmpixtab.pro

```
cd /data/snap4/mrichard/hotpix/vary
```

```
# (empty before pixel tables are created, except for directories for old tables that you may  
want to save)
```

```
# after:
```

```
041210_050125.table.Z      vary_041209_050125_1.dat.Z  
decon_041210_050125.fits.Z  vary_041209_050125_2.dat.Z  
decon_041210_050125.tab.Z  vary_041209_050125_3.dat.Z  
tabstyle*                 vary_041209_050125_4.dat.Z
```

```
# the tabstyle file needs to be present when creating these files. It can be found in
```

```
# directories from prior warmpixel work and copied here.
```

```
# The rest of these compressed files are the warm and hot pixel files that are made
```

```
# available on the web
```

## **b) Running warmpixtab.pro**

Get the exact MJD decontamination dates from the decon web site:

[http://www.stsci.edu/instruments/wfpc2/Wfpc2\\_memos/wfpc2\\_decon\\_dates.html](http://www.stsci.edu/instruments/wfpc2/Wfpc2_memos/wfpc2_decon_dates.html)

Go to the directory on *snap4* containing your weekly darks for the pre-decontamination period:

```
cd /data/snap4/mrichard/hotpix/wkdarks/oct
```

```
# Determine the appropriate dates for decon1, decon2, and outfile name
```

```
# decon1= the previous decontamination date (MJD)
```

```
# decon2= the most recent decontamination date (MJD)
```

```
# outfile = your directory/vary_yrmmdd_yrmmdd (vary_decon1_decon2)
```

```
# in IDL execute the following commands with the updated decon and outfile values:
```

```
warmpixtab,decon1=53301.2436,decon2=53348.7917,thresholds=[5,4,3,4],$  
outfile='/data/snap4/mrichard/hotpix/vary/vary_041023_041209',chip=1
```

```
warpixtab,decon1=53301.2436,decon2=53348.7917,thresholds=[5,4,3,4],$  
outfile='/data/snap4/mrichard/hotpix/vary/vary_041023_041209',chip=2
```

```
warpixtab,decon1=53301.2436,decon2=53348.7917,thresholds=[5,4,3,4],$  
outfile='/data/snap4/mrichard/hotpix/vary/vary_041023_041209',chip=3
```

```
warpixtab,decon1=53301.2436,decon2=53348.7917,thresholds=[5,4,3,4],$  
outfile='/data/snap4/mrichard/hotpix/vary/vary_041023_041209',chip=4
```

### c) Checking and compressing results

# start an IRAF or Pyraf session and move to the hotpix/vary directory where results from *warpixtab.pro* will appear:

```
cd /data/snap4/mrichard/hotpix/vary
```

# convert these files to table format, delete unneeded text files, and compress results:

```
!cat vary*.txt > decon_010810_010905.txt  
tcreate decon_010810_010905.tab tabstyle decon_010810_010905.txt  
tprint decon_010810_010905.tab showrow=no > 010810_010905.table  
stwfits decon_010810_010905.tab decon_010810_010905.fits
```

```
del *.txt
```

```
!compress -f *.table
```

```
!compress -f *.fits
```

```
!compress -f *.tab
```

```
!compress -f *.dat
```

```
del *.txt
```

**d) Send out an E-mail for notification and web update based on the following template, using `ls -l` to fill in the file names and information:**

\*\*\*\*\*

To: heyer,biretta

Subject: New WFPC2 warm and hot pixel tables

Date: *Month Day, Year*

Instrument:WFPC2

File\_type(s): WARM & HOT PIX TABLES

Directory where data is found: */data/snap4/mrichard/hotpix/vary/*

```
-rw-r--r-- 1 mrichard 3848967 Jan 5 14:40 decon_010810_010905.tab.Z
-rw-r--r-- 1 mrichard 4430459 Jan 5 14:41 010810_010905.table.Z
-rw-r--r-- 1 mrichard 4293425 Jan 5 14:43 decon_010810_010905.fits.Z
-rw-r--r-- 1 mrichard 525659 Jan 5 14:33 vary_041023_041209_1.dat.Z
-rw-r--r-- 1 mrichard 597489 Jan 5 14:34 vary_041023_041209_2.dat.Z
-rw-r--r-- 1 mrichard 641914 Jan 5 14:35 vary_041023_041209_3.dat.Z
-rw-r--r-- 1 mrichard 514017 Jan 5 14:36 vary_041023_041209_4.dat.Z
```

\*\*\*\*\*

The locations where these files are listed are linked from this page:

[http://www.stsci.edu/instruments/wfpc2/wfpc2\\_hotpix.html](http://www.stsci.edu/instruments/wfpc2/wfpc2_hotpix.html)

## Conclusions

The procedures described in this report will result in weekly dark files for the HST WFPC2 calibration pipeline, as well as warm and hot pixel tables. These files can be found in the HST archive and on the WFPC2 website respectively, and are described in more detail in the WFPC2 Data and Instrument Handbooks.

## Recommendations

When creating weekly dark files or pixel tables for the first time, the directory structure, will need to be replicated and appropriate files and scripts copied into a new working directory. The new user will need to add information to the login.cl and .setenv files and a number of hard coded references will need to be changed in the programs before they are used (a search for system and user names in all the programs in the darkpros directory will show where to make these changes to the code). Once the initial setup is complete the script can be trusted to create dark files of consistent quality ready for ingestion into the archive, however, changes in data quality due to changing dark current levels, levels of CTE, and other long term variations needs to be monitored so that appropriate changes to the programs can be made.

## **Acknowledgements**

Previous work by S. Gonzaga, V. Platais and other Data Analysts was used in writing this TIR.

## **References**

“Creating WFPC2 Dark Reference Files,” J. Mack and M.S. Wiggs, Instrument Science Report WFPC2 2001-1, [http://www.stsci.edu/instruments/wfpc2/Wfpc2\\_isr/wfpc2\\_isr0101.html](http://www.stsci.edu/instruments/wfpc2/Wfpc2_isr/wfpc2_isr0101.html)

*HST Data Handbook for WFPC2*, eds. S. Baggett and M. McMaster, 2002.

*WFPC2 Instrument Handbook*, eds. I. Heyer and J. Biretta, 2004.

As of July 6, 2005, directories with files related to weekly dark and pixel table creation:

/data/classic2/wfpc2/darkpros (programs run when creating darks)

/data/classic2/wfpc2/darkpros/web (files needed for updating the WFPC2 dark web site)

/data/classic2/wfpc2/darks (working directories used for weekly darks)

(NB: the above files can also be found in /data/snap4/mrichard/wfpc2)

/data/snap4/mrichard/hotpix (program and weekly dark files used for creating pixel tables)

/data/snap4/mrichard/2002\_darks (CTE corrected dark images saved for superdark creation)

***Appendix A: A Sample History for Weekly Dark File***

HISTORY This is a PIPELINE WEEKLY DARK FILE.  
HISTORY It was created using a SUPERDARK created from an average  
HISTORY of 120 input darks. The input darks were from the date  
HISTORY range of Aug 2003 through Aug 2004 and were:  
HISTORY  
HISTORY u8gxx302m u8tz0n01m u8tz2k01m u8tz4t01m u8tz6w01m  
HISTORY u8gxx304m u8tz0q01m u8tz2p01m u8tz4v01m u8tz6y01m  
HISTORY u8gxha01m u8tz0s01m u8tz2q01m u8tz4w01m u8tz7101m  
HISTORY u8gxha03m u8tz1101m u8tz2s01m u8tz5101m u8tz7201m  
HISTORY u8gxha05m u8tz1701m u8tz2x01m u8tz5701m u8tz7401m  
HISTORY u8gxx301m u8tz1801m u8tz3101m u8tz5b01m u8tz7501m  
HISTORY u8gxx303m u8tz1901m u8tz3301m u8tz5d01m u8u5ba02m  
HISTORY u8gxx304m u8tz1a01m u8tz3701m u8tz5g01m u8u5c303m  
HISTORY u8gxka01m u8tz1b01m u8tz3b01m u8tz5k01m u8u5ca05m  
HISTORY u8gxka02m u8tz1e01m u8tz3d01m u8tz5p01m u8u5d303m  
HISTORY u8gxka04m u8tz1l01m u8tz3e01m u8tz5s01m u8u5d304m  
HISTORY u8gxka05m u8tz1q01m u8tz3g01m u8tz5t01m u8u5da02m  
HISTORY u8gzb401m u8tz1s01m u8tz3k01m u8tz5v01m u8u5da04m  
HISTORY u8gzb501m u8tz1t01m u8tz3l01m u8tz5w01m u8u5e402m  
HISTORY u8gzc501m u8tz1w01m u8tz3m01m u8tz5z01m u8u5e404m  
HISTORY u8gzd401m u8tz1x01m u8tz3p01m u8tz6101m u8u5ea01m  
HISTORY u8gze401m u8tz1z01m u8tz3q01m u8tz6301m u8u5ea04m  
HISTORY u8gze501m u8tz2101m u8tz3x01m u8tz6a01m u8u5f302m  
HISTORY u8tz0101m u8tz2201m u8tz4d01m u8tz6b01m u8u5fa01m  
HISTORY u8tz0301m u8tz2401m u8tz4e01m u8tz6e01m u8u5g301m  
HISTORY u8tz0401m u8tz2501m u8tz4m01m u8tz6k01m u8u5g302m  
HISTORY u8tz0701m u8tz2b01m u8tz4n01m u8tz6q01m u8u5g305m  
HISTORY u8tz0j01m u8tz2d01m u8tz4p01m u8tz6s01m u8u5ga03m  
HISTORY u8tz0m01m u8tz2h01m u8tz4q01m u8tz6v01m u8u5ga04m  
HISTORY  
HISTORY All the datasets were calibrated using CALWP2.1.3.5.2,  
HISTORY utilizing the most up-to-date reference files, including  
HISTORY the new superbias (n9a14385u) where appropriate.  
HISTORY  
HISTORY CTE trails were removed and the CTE-corrected images were

HISTORY combined to create the final superdark file, which was  
HISTORY normalized to an exposure time of 1.0 second. Mkdark  
HISTORY parameters used were:  
HISTORY sigmas = 4,4,3,2  
HISTORY radius = 1.5  
HISTORY pfactor = 0.5  
HISTORY hotthres= 4096.  
HISTORY minval = 0.  
HISTORY  
HISTORY The associated DQF file was computed in the following manner:  
HISTORY  
HISTORY If more than 60 of the 120 input files are valid and the dark  
HISTORY current is  $\leq 0.02$  DN/s, then the pixel value is 0 (valid data).  
HISTORY  
HISTORY If more than 60 input files are valid and the dark current  
HISTORY is  $> 0.02$  DN/s, then the pixel value is 512 (uncorrectable  
HISTORY warm pixel).  
HISTORY  
HISTORY If  $\leq 60$  input files are valid, the pixel value to the  
HISTORY "bitwise-OR" of all input masks (any flag set in any of the  
HISTORY input files is set on the mask).  
HISTORY  
HISTORY If none of the input files are valid, set the pixel value to  
HISTORY the "bitwise-AND" of all input masks (bad pixel).  
HISTORY  
HISTORY The files used in the WEEKLY update portion of the dark are:  
HISTORY u9490701m u9490801m u9490901m u9490a01m u9490b01m  
HISTORY  
HISTORY The mean of this resultant weekly dark, excluding values deviating  
HISTORY by more than  $3 \times \text{sigma}$ , was saved to a file, with one mean value for  
HISTORY each chip. This was done for 3 iterations and the final means and  
HISTORY sigmas were used in conjunction with the weekly dark and the  
HISTORY superdark, to generate the pipeline dark: each pixel was compared  
HISTORY to the chip statistics, to determine whether it exceeded a  
HISTORY threshold based on average and sigma.  
HISTORY  
HISTORY That is, if  $\text{abs value}(\text{weekly dark} - \text{superdark}) > 5 \times \text{sigma}$  then  
HISTORY pixel value of weekly is used in the pipeline dark. If the  
HISTORY pixel value of the weekly dark did not exceed the threshold,  
HISTORY the pixel value of superdark is used for the pipeline dark.

HISTORY

HISTORY The values of  $5 \times \sigma$  used to make this dark are (for the PC,  
HISTORY WF2, WF3, and WF4, respectively):

HISTORY 0.0015195

HISTORY 0.0012565

HISTORY 0.0015175

HISTORY 0.0013485

HISTORY

HISTORY (Files created using the STSDAS MKDARK task at  
HISTORY STScI, 9 Jun 2005)

HISTORY

HISTORY The values in the pipeline dark DQF (\*.b3h) reflect whether a pixel  
HISTORY value comes from the weekly dark or from the superdark, and whether it  
HISTORY has changed recently. That is, the following values are used:

HISTORY

HISTORY 2 if pixel came from weekly dark and was generated from 3 or less  
HISTORY of the 5 input frames for that week

HISTORY

HISTORY 512 if the pixel value comes from the weekly dark, and did vary  
HISTORY substantially with respect to the previous week's pipeline dark  
HISTORY (an "unfixable" pixel in stsdas task warmpix).

HISTORY

HISTORY 1024 if the pixel value comes from the weekly dark, and did not vary  
HISTORY substantially with respect to the value in the previous week  
HISTORY (considered a "fixable" pixel in warmpix).

HISTORY

HISTORY Calwp2 will bit-wise OR any pipeline DARK DQF values with the values  
HISTORY from any of the other DQF files used in the calibration processing and  
HISTORY place results in c1h file.

HISTORY ndark7.r3h renamed to p6910424u.r3h on Jun 9 2005

## ***Appendix B: Description of warmpixtab.pro***

```

Pro warmpixtab, decon1 = decon1, decon2 = decon2, chip = chip, $
  darkdir = darkdir, extension = extension, thresholds = thresholds, $
  outfile = outfile, staticmask = staticmask, files = files
;
; New, cleaned-up version of "warmpixtab"
;
; Input parameters:
; Name   type default   explanation
; chip   INT   1       Which chip to use (1 for single-group data)
; darkdir STR   ""      Directory where darks are located
; extension STR  "r3h"   Default extension for the file search
; thresholds FLT(4) [5.,3.,4.,3.] Thresholds to be used to select "varying" pixels (see below)
; outfile STR  "varytable" Name of output file (extension .txt added)
; staticmask STR  ""      Name of static mask file to be applied
; decon1  LNG  none     Start time of selection
; decon2  LNG  none     End time of selection
; files   STR(n) none    Vector with dark filenames (overrides EXTENSION if given)
;
; WARMPIXTAB generates an ASCII table of pixel positions and dark current values
; for "variable" pixels in a list of darks. Variable pixels are those that satisfy
; at least one of the following conditions:
;   Maximum dark current value > maxmax_value
;   Average dark current value > avemax_value
;   Rms variation of dark current > rmsmax_value
;   (Maximum-Minimum) dark current > difmax_value
; These thresholds can either be set to an exact value or be rescaled
; with the mean and rms dark current of all pixels (after 3-sigma clipping).
; Their value is computed from the input values (maxmax, avemax, rmsmax, difmax)
; as follows:
;   If the input value is negative, then its absolute value is an actual threshold
;   If the input value is positive, then it is interpreted as a multiplier for the
;   measured rms dark current, as follows:
;   maxmax_value = mean_current + maxmax * rms_current
;   avemax_value = mean_current + avemax * rms_current
;   rmsmax_value =          rmsmax * rms_current
;   difmax_value =          difmax * rms_current
; (rmsmax_value and difmax_value do not use the mean_current value since
; they only test variations)
; The default values are: maxmax=5, avemax=3, rmsmax=3, difmax=4
;
; Other relevant points:
;
; - Takes the dates for each dark from header parameter EXPSTART
; - Takes into account a "static mask" file if given
; - Produces the old-fashioned ascii files as well as the STSDAS tables
;   required by warmpix
; - Uses internally units of mADU/s; input data are converted to mADU/s

```

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; from the "default" ADU/s, and the output table - which requires ADU/s -  
; is converted back  
; STSDAS tables must have one line per pixel per epoch, and the following  
; columns: chip (short int), x (short int), y (short int), epoch (MJD,  
; double), and dark current value (float), the latter in ADU/s - not mADU/s  
; At the moment the task still deals with separate tables for each chip.