



# **CUPID User's Guide**

Customizable User Pipeline for IRS Data

**Spitzer Heritage Archive Documentation**

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## Chapter 1. Introduction

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The Customizable User Pipeline for IRS Data (CUPID) allows users to run the Spitzer IRS Pipelines to re-create Basic Calibrated data from the archived raw files. Users may wish to do this in order to apply a different flatfield or dark correction to their data.

If CUPID is run in the default mode, it will produce output results very similar to the directories and files in the [Spitzer Heritage Archive](#). Some of the ancillary files created in the *bcd/* directory may differ in minor ways as detailed in Section 1.2.

### 1.1 Running CUPID

CUPID is run on the command line with the following syntax:

```
unix% cupid <parameters> <options>
```

For a list of available parameters and further details about running the “cupid” command, either see Chapter 2, or run the “cupid” command with no parameters. For a list of available options, see §1.4.

In the nominal case, CUPID runs through the following steps: first the BCD pipeline produces *bcd* images, next the COADD pipeline produces *coadd* images and then the BKSUB pipeline produces background subtracted images. After this, there are three pipelines, BCDX, COADDX, and BKSUBX, which do spectral extractions on the images.

For a list of all pipelines and the steps in each, see Chapter 3. For a list of all modules and the parameters for each, see: Appendix C: The Modules.

You could run the 7 standard IRS pipelines on an AOR by doing the following:

1. Use the [Spitzer Heritage Archive](#) to download the desired AOR. Only the "raw" data is needed if you have the full CUPID package. If you have the “NOCAL” version, you will have to download both the “raw” and the “calibration” files from the [Spitzer Heritage Archive](#). (An AOR often contains 4 "processing directories", *ch0/*, *ch1/*, *ch2/*, and *ch3/*.) CUPID will attempt to create directories called *bcd/* and/or *pbcd/* (depending on which pipeline you run) alongside the downloaded *raw/* directory. Therefore, make sure that you do not have existing directories called *bcd/* and/or *pbcd/* alongside your *raw/*

directory. If you have downloaded bcd and/or pbcd files from the [Spitzer Heritage Archive](#), you will have to change the names of the default directories they are written into.

2. Run cupid with a command similar to the following, but pointed at your downloaded AOR:

```
unix% cupid /data/r1234567/ch*
```

## 1.2 Processing Directories

All of the pipelines are run in "processing directories". There can be four processing directories for each AOR, one per channel (*ch0/ ch1/ ch2/ ch3/*). The directories output by CUPID will look very similar to those downloaded from the [Spitzer Heritage Archive](#). Each processing directory will contain the following subdirectories:

*raw/* contains original "raw" DCE files (from the [Spitzer Heritage Archive](#)).

*bcd/* contains data files created by the single DCE pipelines. (BCD and BCDX) It also contains a .log file for each pipeline run. See "BCD Pipeline Description" document for details.

*pbcd/* contains data files created by the multi-DCE pipelines. (COADD, COADDX, BKSUB, BKSUBX). It also contains a .log file for each pipeline run.

*cal/* contains all calibration files used.

*cdf/* contains all "control data files" (namelists) used.

### Note:

The *bcd/* directory files in CUPID and [Spitzer Heritage Archive](#) differ in the following ways:

1. The *\*.pline* files in the Archive are the pipeline log files. These are named *\*.log* in CUPID, one for each pipeline.
2. The *\*full.fits* in the Archive have fully processed pixels but no final header updates. These are named *\*flatap.fits* in CUPID.

3. The *\*spec2.tbl* in the Archive is the extraction from the non-straycross processed files. These may be obtained by using the *\*spect.tbl* files in CUPID run with the SKIP.STRAYCROSS option.

### 1.3 Status and Log Files

Every step run in CUPID returns a status. If a step returns a  $\geq 64$  then processing is halted immediately. The meaning of status levels is as follows:

- 0 = completely nominal
- 1 = processing skipped because file is wrong type (not a problem)
- 2 - 31 = something happened out of the ordinary, but no problem
- 32 - 63 = something happened that may be a problem, processing continues
- 64 - 255 = something happened that is a problem, processing terminated

There is a log file for each pipeline run output subdirectory. The location of the log file is shown as the first line while running a pipeline. The log file contains pipeline run information and any error messages.

In addition, there is a STATUS file in the output subdirectory, which summarizes the status of the most recent run of each pipeline.

### 1.4 Options

CUPID can be called on the command line with a number of options, listed below. Note that the "SET" option uses module names but other options use STEP names. Also note, these options apply to the BCD pipeline unless they are prefixed with "X/", in which case they apply to all of the extraction pipelines (BKSBX, COADDX and BCDX).

#### **SET (override parameter value):**

This is used to set the value for a parameter when particular module is called. Each override specifier has the form:

```
SET.<module>-<parameter_flag>=<value>.
```

For example, a new flat file could be specified with:

```
SET.flatap-f=/urs/joe/data/newflat_1.fits
```

Or the following to specify 100.0 as the estimated readnoise when creating the uncertainty file:

```
SET.snest_irs-readnoise=100.0
```

**START (start processing at a specified step):**

This will cause the first step(s) to be skipped over. The specified step where processing will have the input files just as if the preceding steps had been run. This means that the pipeline must have been run from the first step at least once. For example, to begin processing at the CUBESUB step (using inputs from a previously run DARKBASE step), specify the following:

```
START.CUBESUB
```

**STOP (stop processing after a specified step):**

This will cause the the pipeline to stop processing after running the specified step. For example, to stop processing after the FLATAP step, specify the following:

```
STOP.FLATAP
```

**SKIP (skip a step):**

This will cause the the pipeline to skip the specified step. The following step will take its inputs from the preceding step. (This is true even if a previous pipeline run has produced data files for the skipped step.) For example, to skip the STRAYCROSS step, specify the following:

```
SKIP.STRAYCROSS
```

(In this case the following FLATAP step will use inputs from the DROOPRES step.)

**DO.AFTER (move a step):**

This will cause the the pipeline to execute the first specified step after the second specified step. The first specified step must precede the second specified step in the nominal processing order. For example, to swap the order of CUBESUB and DARKBASE, specify the following:

```
DO.DARKBASE.AFTER.CUBESUB
```

The full command to produce "unstraycross" BCDs if the pipeline has already been run would be the following. Note that it starts with the FLATAP step to avoid needlessly re-running the first few steps.

```
unix% cupid BCD r123456/ch1 START.FLATAP SKIP.STRAYCROSS
```

The "SKIP.STRAYCROSS" option here will cause FLATAP to get its input from the DRROPRES output files rather than from the STRAYCROSS ones.

## 1.5 Verbose

The default level of output should be sufficient in most cases, but there may be cases where more or less output is desired. There are environment variables to control the amount of information output.

### 1.5.1 Screen Output (*CUPID\_SHOW* environment variable):

The default value of CUPID\_SHOW is 2. It can be set to a lower value to reduce the clutter on the users terminal. As each pipeline runs, the default is to display the following:

- the output log file location;
- step-by-step status (if CUPID\_SHOW >= 1);
- final status.

After all pipelines have run, a summary is displayed at the end (if CUPID\_SHOW >= 2).

### 1.5.2 Log Files (*CUPID\_LOG* environment variable)

The default value of CUPID\_LOG is 2. The optional contents are as follows:

- the actual command line call used to process a step (if CUPID\_LOG >= 1);
- values of FITS words read from file (if CUPID\_LOG >= 2);
- information about fetching cal and cdf files (if CUPID\_LOG >= 2);
- values explicitly set environment variables (if CUPID\_LOG >= 2);
- values of defaulted environment variables (if CUPID\_LOG >= 3);
- timing summary per step (if CUPID\_LOG >= 3).



## 1.6 Fetching *cal* or *cdf* Files

Whenever a module needs a calibration file (*cal*) or control data file (*cdf*), CUPID must decide which file to use. Here is the logic used:

1. If the file is already there in the local *cal/* or *cdf/* directory, it is used and no actual "fetch" is required. A file is considered "there" if:
  - a. it has the correct root file name, and
  - b. it has the correct channel number (b0\_ b1\_ b2\_ b3\_), and
  - c. if it is a dark, it must have the correct exposure time designator (r6\_ r14\_ etc.)

The SCLK range in the file name is not considered.

2. If the file is not in the local directory, it will be "fetched" (copied) from the CAL or CDF archive directory. The file fetched will be the one that is qualified as follows:
  - a. it has the correct root file name, and
  - b. it has the correct channel number (b0\_ b1\_ b2\_ b3\_), and
  - c. if it is a dark, it must have the correct exposure time designator (r6\_ r14\_ etc.);
  - d. it has a SCLK range that covers the data being processed.

If more than one file qualifies, the one with the smallest SCLK range will be used.

### 1.6.1 *Alternate cal or cdf Archives*

If you have a directory with an alternate *cal/* or *cdf/* archive, it can be used by setting the CUPID\_CAL\_ARCHIVE or CUPID\_CDF\_ARCHIVE environment variables.

## 1.7 CUPID Directory Structure

The *CUPID/* directory contains the following files and subdirectories:

<i>cupid</i>	the main CUPID command script
<i>HELP</i>	user information in plain text format
<i>HMTL</i>	user information in webpage format (point your browser here)
<i>VERSION</i>	information about this specific version of CUPID
<i>wrappers/</i>	pipeline "wrapper" scripts (called by cupid command, not directly by users)

*cal/*        archive of calibration files  
*cdf/*        archive of "control data files" (primarily namelists)  
*bin/*        executable modules  
*include/*    "include" files used by executable modules  
*lib/*        "lib" (subroutines) files used by executable modules

## 1.8 Wrapper Scripts

The actual pipeline processing logic is in wrapper scripts in the CUPID *wrappers/* subdirectory. These wrappers specify the pipeline "steps" and module calls for each pipeline. Parameters passed to modules are specified as follows:

**IN**    input data files
 

- may not override
- are prepended with prefix (e.g. SPITZER\_12345678\_S3\_0003\_0001\_)
- may use wrapper variable (e.g. <FLUX>) as filename
- may also set wrapper variable (e.g. <FLUX:ALT>) to the filename

**OUT**   output data files
 

- may not override
- are prepended with prefix (e.g. SPITZER\_12345678\_S3\_0003\_0001\_)
- may set wrapper variable (e.g. <FLUX>) to the filename

**UPD**   updated data files (data files which are input AND updated)
 

- may not override
- are prepended with prefix (e.g. SPITZER\_12345678\_S3\_0003\_0001\_)

**CAL**   calibration files (input, in *cal/* subdirectory)
 

- may override
- are in the *cal/* subdirectory if not overridden
- fetched from CUPID cal archive if not there already

**CDF**   control data files (namelists; input, in *cdf/* subdirectory)
 

- may override
- are in the *cdf/* subdirectory if not overridden
- fetched from CUPID cdf archive if not there already

**V**     values (numeric or string)

- may override
- no special handling

## Chapter 2. The “cupid” Command

---

How to run the “cupid” command, type:

```
cupid PROCESSING_DIRECTORY(s) [OPTION(s)]
```

### A PROCESSING DIRECTORY (at least one is required)

Generally each processing directory will contain a *raw/* subdirectory. Output files will be created in the *bcd/* and *pbcd/* subdirectories. [Spitzer Heritage Archive](#) downloads often contains 4 processing directories (*ch0/ ch1/ ch2/ ch3/*)

### PIPELINE SELECTION options:

The default is to run the following 7 pipelines:

1. BCD
2. COADD
3. BKSUB
4. BKSUBX
5. COADDX
6. BCDX
7. CUTOOUT

A pipeline specifier is of the following form:

```
PIPE/p1
```

or

```
PIPE/p1.p2.p3 . . . .
```

where the pN can be any of the following:

```
BCD      - run the BCD image pipe line
COADD    - run the COADD image pipe line
BKSUB    - run the background subtraction image pipe line
BKSUBX   - run the BKSUB extraction pipe line
COADDX   - run the COADD extraction pipe line
BCDX     - run the BCD extraction pipe line
```

CUTOUT - run the CUTOUT image pipeline  
 BCDACQ - run the BCDACQ image pipeline  
 DARK - run the DARK image pipeline  
 1 - run: BCD  
 2 - run: BCD COADD  
 3 - run: BCD COADD BKSUB  
 4 - run: BCD COADD BKSUB BKSUBX  
 5 - run: BCD COADD BKSUB BKSUBX COADDX  
 6 - run: BCD COADD BKSUB BKSUBX COADDX BCDX  
 7 - run: BCD COADD BKSUB BKSUBX COADDX BCDX CUTOUT  
 8 - run: BCD COADD BKSUB BKSUBX COADDX BCDX CUTOUT BCDACQ

e.g. PIPE/3 or PIPE/BCD or PIPE/BCD.COADD.BKSUBX

**PARAMETER options** will override a parameter for a module in the BCD pipeline:  
 (default is to run with the same parameters as operational pipeline)

SET.[module]-[flag]=[value] (sets param to value for module), e.g.:

SET.droopop-a=0  
 (sets the "a" parameter to 0 for the droopop module)

**FLOW options** will change the which STEPS are run in the BCD pipeline:  
 (default is to run with the same steps as the operational pipeline)

START.[STEP] to start processing of at specified step, e.g.

START . SATCOR

STOP.[STEP] to stop processing after specified step, e.g.

STOP . FLATAP

SKIP.[STEP] to skip a step, e.g.

SKIP . STRAYCROSS

DO.[STEP2].AFTER.[STEP1] to run STEP2 immediately after STEP1, e.g.

```
DO.CUBESUB.AFTER.DARKBASE
```

### OPTIONS for the other pipelines:

The "PARAMETER" and "FLOW" options above apply to the BCD pipeline. However, these same options may be used for other pipelines if prepended appropriately. Use:

```
X/      for all of the extraction pipelines (BKSUBX COADDX BCDX)
COADD/ for the COADD pipeline
DARK/   for the DARK pipeline
```

e.g.

```
X/SET.extract-nanDrop=1
X/STOP.IRS_TUNE
X/SKIP.TBL2FITS
COADD/SET.coad2d-cf=0.25
DARK/SET.darkest-r=22.0
```

#### 2.1.1 Examples

- `unix% cupid /scr/r33776128/ch0`  
runs the 7 standard pipelines in `/scr/r33776128/ch0`  
(on all *raw.fits* files in `/scr/r33776128/ch0/raw`)
- `unix% cupid /scr/r33776128/ch0 PIPE/BCD`  
runs the BCD pipeline in `/scr/r33776128/ch0`  
(on all *raw.fits* files in `/scr/r33776128/ch0/raw`)
- `unix% cupid /scr/r33776128/ch0 PIPE/8`  
runs all 8 pipelines in `/scr/r33776128/ch0`  
(BCD COADD BKSUB BKSUBX COADDX BCDX CUTOUT BCDACQ)  
(on all *raw.fits* files in `/scr/r33776128/ch0/raw`).
- `unix% cupid /scr/r33776128/ch0 PIPE/BCD.DARK STOP.DARKBASE`  
runs BCD pipeline up through DARKBASE to produce individual cubes, and then co-adds the cubes together to make a single dark file.  
(This is how a custom DARK file is commonly produced.)

- `unix% cupid /scr/r33776128/ch0 PIPE/BCD.COADD.BKSUB`  
runs pipelines BCD, COADD, and BKSUB in `/scr/r33776128/ch0`  
(on all *raw.fits* files in `/scr/r33776128/ch0/raw/`)
- `unix% cupid /scr/r33776128/ch* PIPE/6`  
runs the first 6 standard pipe lines for all channels  
(in `/scr/r33776128/ch0`, `/scr/r33776128/ch1`,  
`/scr/r33776128/ch2` and `/scr/r33776128/ch3`)
- `unix% cupid /scr/r33776128/ch1 PIPE/COADDX X/STOP.IRS_TUNE`  
does extractions on the coadds but stops after IRS\_TUNE (does not produce FITS table files)
- `unix% cupid /scr/r33776128/ch0 PIPE/BCD SKIP.STRAYCROSS  
SET.snest_irs-gain=6.0`  
runs BCD pipeline in `/scr/r33776128/ch0` but:  
for `snest_irs` module set "-gain" parameter to 6.0 and  
skip over the STRAYCROSS step.
- `unix% cupid /scr/r33776128/ch3 PIPE/BCD  
DO.DROOPRES.AFTER.STRAYCROSS`  
runs entire BCD pipeline but runs DROPPRES step after STRAYCROSS step.
- `unix% cupid /scr/r33776128/ch2 PIPE/BCD START.STRAYCROSS`  
runs BCD pipeline starting at STRAYCROSS  
i.e. runs just steps: STRAYCROSS, FLATAP, FPGEN

## Chapter 3. The CUPID Pipelines

---

The following pipelines are available in CUPID:

- 1. BCD --- Make BCD images from raw images.
- 2. COADD --- Make coadd images from BCD images.
- 3. BKSUB --- Make background subtracted images from coadd images.
- 4. BKSUBX --- Make spectral extractions of BKSUB images.
- 5. COADDX --- Make spectral extractions of COADD images.
- 6. BCDX --- Make spectral extractions of BCD images.
- 7. CUTOOUT --- Make blue and red cutout images from ch0 BCD images.
- 8. BCDACQ --- Make BCD cutouts from peakup uisition (2D) raw images.
- D. DARK --- Make composite dark cube image from individual dark cube images.

### 3.1 BCD Pipeline

This pipeline makes BCD images from raw images. Details about the function of the modules called in this pipeline may be found in the IRS Instrument Handbook. The logic for this pipeline is in *wrappers/wrapper\_BCD.pl*

Input datafiles come from the *raw/* subdirectory. All *(3D)\*\_raw.fits* datafiles will be processed.

Output datafiles will be written to the *bcd/* subdirectory.

Parameter overrides may be selected with: `SET.module-flag=value`.

Pipeline STEP flow options may be selected with any of the following:

```
START.step
STOP.step
SKIP.step
DO.step1.AFTER.step2
```

This pipeline runs the following STEPs:

- CVTI2R4 --- convert pixels from integer to floating point  
(module calls: `remove_file cvti2r4`)



- ADDKWDS --- update FITS header keywords  
(module calls: hdrupd8 hdrupd8)
- SNEST\_IRS --- compute uncertainty file  
(module calls: copy\_file basecal snest\_irs)
- DNTOFLUX --- convert FLUX and UNC files from DN to electrons  
(module calls: dntoflux dntoflux)
- SATCOR --- perform saturation correction  
(module calls: radhit imagest)
- DROOPOP --- correct for global droop  
(module calls: droopop)
- ROWDROOP --- correct for droop per row  
(module calls: rowdroop)
- SNEST\_IRS2 --- compute final uncertainty file  
(module calls: snest\_irs2)
- DARKBASE --- zero the dark baseline  
(module calls: copy\_file darkbase)
- CUBESUB --- subtract the dark  
(module calls: cubesub)
- LINEARIZ --- correct for non-linearity  
(module calls: lineariz)
- RADHIT --- flag rahhits (in DMASK file)  
(module calls: radhit)
- DARKDRIFT --- remove "jail bars"  
(module calls: darkdrift)
- SLOPE\_FINDER --- compute slope estimates of ramps  
(module calls: slope\_finder)

- DROOPRES --- remove residual droop  
(module calls: copy\_file droopres)
- STRAYCROSS (ch0) --- remove stray light  
(module calls: copy\_file slremov)
- STRAYCROSS (ch1&ch3) --- remove crosstalk  
(module calls: crosstalk)
- STRAYCROSS (ch2) --- just copy files  
(module calls: copy\_file copy\_file)
- FLATAP --- apply FLAT  
(module calls: flatap)
- FPGEN --- run 'final product generator' and add velocity keywords  
(module calls: velocity remove\_file fpgen)

## 3.2 COADD Pipeline

This pipeline makes coadd images from BCD images. The logic for this pipeline is in *wrappers/wrapper\_COADD.pl*

Input datafiles come from the *bcd/* subdirectory. All *\*\_bcd.fits* datafiles will be processed (plus associated *\*\_func.fits* and *\*\_bmask.fits* datafiles).

Output datafiles will be written to the *pbcd/* subdirectory.

Parameter overrides may be selected with: `COADD/SET.module-flag=value`

Pipeline STEP flow options are not available for this pipeline.

This pipeline runs the following STEPs:

- COADD2D --- Create coadded image  
(module calls: coadd2d)

### 3.3 BKSUB Pipeline

This pipeline makes background subtracted images from coadd images (only for ch0 and ch2 data). The logic for this pipeline is in *wrappers/wrapper\_BKSUB.pl*

Input datafiles come from the *pbcd/* subdirectory. All *(ch0,ch2)\*\_coa2d.fits* datafiles will be processed (plus associated *\*\_c2unc.fits* and *\*\_c2msk.fits* datafiles)

Output datafiles will be written to the *pbcd/* subdirectory.

Parameter overrides are not available for this pipeline.

Pipeline STEP flow options are not available for this pipeline.

This pipeline runs the following STEPs:

- IMSUBTRACT--- Create background subtracted image  
(module calls: *imsubtract*)

### 3.4 BKSUBX Pipeline

This pipeline makes spectral extractions of BKSUB images. The logic for this pipeline is in *wrappers/wrapper\_X.pl*

Input datafiles come from the *pbcd/* subdirectory. All *\*\_bksub.fits* datafiles will be processed (plus associated *\*\_bkunc.fits* and *\*\_bkmsk.fits* datafiles).

Output datafiles will be written to the *pbcd/* subdirectory.

Parameter overrides may be selected with: `X/SET.module-flag=value`

Pipeline STEP flow options may be selected with any of the following:

```
X/START.step
X/STOP.step
X/SKIP.step
X/DO.step1.AFTER.step2
```

This pipeline runs the following STEPs:

- PROFILE --- get a cross scan profile of flux in all orders  
(module calls: profile)
- RIDGE --- locate the source (max of profile)  
(module calls: ridge)
- EXTRACT --- extract spectrum  
(module calls: extract)
- IRS\_TUNE --- apply flux conversion and minor tuning corrections  
(module calls: irs\_tune)
- TBL2FITS --- create FIS binary table  
(module calls: tbl2fits)

### 3.5 COADDX Pipeline

This pipeline makes spectral extractions of COADD images. The logic for this pipeline is in *wrappers/wrapper\_X.pl*

Input datafiles come from the *pbcd/* subdirectory. All \*\_*coa2d.fits* datafiles will be processed (plus associated \*\_*c2unc.fits* and \*\_*c2msk.fits* datafiles).

Output datafiles will be written to the *pbcd/* subdirectory.

Parameter overrides may be selected with: `X/SET.module-flag=value`

Pipeline STEP flow options may be selected with any of the following:

X/START.step  
X/STOP.step  
X/SKIP.step  
X/DO.step1.AFTER.step2

This pipeline runs the following STEPs:

- PROFILE --- get a cross scan profile of flux in all orders  
(module calls: profile)
- RIDGE --- locate the source (max of profile)  
(module calls: ridge)
- EXTRACT --- extract spectrum  
(module calls: extract)
- IRS\_TUNE --- apply flux conversion and minor tuning corrections  
(module calls: irs\_tune)
- TBL2FITS --- create FITS binary table  
(module calls: tbl2fits)

### 3.6 BCDX Pipeline

This pipeline makes spectral extractions of BCD images. The logic for this pipeline is in *wrappers/wrapper\_X.pl*

Input datafiles come from the *bcd/* subdirectory. All \*\_*bcd.fits* datafiles will be processed (plus associated \*\_*func.fits* and \*\_*bmask.fits* datafiles).

Output datafiles will be written to the *bcd/* subdirectory.

Parameter overrides may be selected with: X/SET.module-flag=value

Pipeline STEP flow options may be selected with any of the following:

```
X/START.step
X/STOP.step
X/SKIP.step
X/DO.step1.AFTER.step2
```

This pipeline runs the following STEPs:

- PROFILE --- get a cross scan profile of flux in all orders

(module calls: profile)

- RIDGE --- locate the source (max of profile)  
(module calls: ridge)
- EXTRACT --- extract spectrum  
(module calls: extract)
- IRS\_TUNE --- apply flux conversion and minor tuning corrections  
(module calls: irs\_tune)
- TBL2FITS --- create FIS binary table  
(module calls: tbl2fits)

### 3.7 CUTOOUT Pipeline

This pipeline makes blue and red cutout images from ch0 BCD images. These cutouts include WCS information and can be used in MOPEX.

The logic for this pipeline is in *wrappers/wrapper\_CUTOOUT.pl*

Input datafiles come from the *bcd/* subdirectory. All *(ch0)\*\_bcd.fits* datafiles will be processed.

Output datafiles will be written to the *bcd/* subdirectory.

Parameter overrides are not available for this pipeline.

Pipeline STEP flow options are not available for this pipeline.

This pipeline runs the following STEPs:

- BLUE --- do BLUE cutout  
(module calls: cropfits2 cropfits2 cropfits dntoflux)
- RED --- do RED cutout  
(module calls: cropfits2 cropfits2 cropfits dntoflux)

### 3.8 BCDACQ Pipeline

This pipeline makes BCD cutouts from 2D peakup acquisition (PUA) raw images. The DCENUM=3 files are not processed since they are not normal peakup acquisition frames. The logic for this pipeline is in *wrappers/wrapper\_BCDACQ.pl*.

Input datafiles come from the *raw/* subdirectory. All *(2D)\*\_raw.fits* datafiles except for DCENUM=3 will be processed.

Output datafiles will be written to the *bcd/* subdirectory.

Six BCD peakup cutouts are produced by this pipeline, three each at the acquisition and sweet spot positions (see IRS Data Handbook sec. 2.3 for details on peakup acquisition observations). For a successful peakup, the target should be centered on pixel 23,26 (*acq\_b.fits*) or 22,30 (*acq\_r.fits*). The peakup acquisition cutouts are calibrated to have pixel units of MJy/sr. The BCDACQ pipeline makes use of the DCS mode flat and darks, which have not previously been released. However, unlike other IRS BCD data products, no uncertainty image is available because peakup acquisition uses DCS mode instead of SUR. Users are advised to estimate the uncertainty based on the dispersion of the six cutouts.

Parameter overrides may be selected with: `BCDACQ/SET.module-flag=value`

Pipeline STEP flow options may be selected with any of the following:

```
BCDACQ/START.step
BCDACQ/STOP.step
BCDACQ/SKIP.step
BCDACQ/DO.step1.AFTER.step2
```

This pipeline runs the following STEPs:

- CVTI2R4 --- convert pixels from integer to floating point  
(module calls: remove\_file cvti2r4)
- ADDKWDS --- update FITS header keywords  
(module calls: hdrupd8 hdrupd8)
- DNTOFLUX --- convert from DN to electrons/sec  
(module calls: dntoflux)
- IMSUBTRACT --- Subtract the dark

- (module calls: imsubtract)
- DARKDRIFT --- remove "jail bars"  
(module calls: darkdrift)
- FLATAP --- apply FLAT  
(module calls: flatap)
- FPGEN --- run 'final product generator' and add velocity keywords  
(module calls: velocity remove\_file fpngen)
- BLUE --- do BLUE cutout  
(module calls: cropfits2 cropfits dntoflux)
- RED --- do RED cutout  
(module calls: cropfits2 cropfits dntoflux)

### 3.9 DARK Pipeline

This pipeline will make composite dark cube image from individual dark cube images. The logic for this pipeline is in *wrappers/wrapper\_DARK.pl*

Input datafiles come from the *bcd/* subdirectory. All *\*\_darkbase.fits* datafiles will be processed (plus associated *\*\_darkbase\_unc.fits* and *\*\_dmask.fits* datafiles).

Output datafiles will be written to the *pbcd/* subdirectory.

Parameter overrides may be selected with: `DARK/SET.module-flag=value`

Pipeline STEP flow options are not available for this pipeline.

This pipeline runs the following STEPs:

- DARKEST --- Coadd the bcd image cubes  
(module calls: darkest)



## Chapter 4. The Modules

---

The following modules are available in CUPID:

- `basecal` --- perform baseline calibration
- `coadd2d` --- coadd a number of 2D images into one using trimmed averaging
- `copy_file` --- copy a file
- `crofits` --- cut out a subimage
- `crosstalk` --- remove crosstalk
- `cubesub` --- subtract the dark
- `cvti2r4` --- convert from integer to floating point
- `darkbase` --- zero the dark baseline
- `darkdrift` --- remove "jail bars"
- `darkest` --- combine a number of dark cube images into one
- `dntoflux` --- convert from DN to electrons
- `droopop` --- correct for global droop
- `droopres` --- remove residual droop
- `extract` --- extract a 1D spectrum table
- `flatap` --- apply FLAT
- `fpgen` --- generate final product
- `hdrupd8` --- update header keywords
- `imagest` --- correct saturated values
- `imssubtract` --- subtract two images
- `irs_tune` --- convert spectrum from e-/sec to Jy and align orders
- `lineariz` --- correct for non-linearity
- `profile` --- generate a wavelength-collapsed average spatial profile table
- `radhit` --- flag radhits
- `remove_file` --- delete a file
- `ridge` --- output a table containing the x,y positions of the peak
- `rowdroop` --- correct for droop per row
- `slope_finder` --- compute slope estimates of ramps
- `slremov` --- remove stray light
- `snest_irs` --- compute uncertainty file
- `tbl2fits` --- create a FITS binary table from an ASCII IPAC table
- `velocity` --- add velocity header keywords

## 4.1 basecal Module

This module performs baseline calibration.

The module is used in the following pipelines: BCD

### Constant values:

- b Output baseline image  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
  
- m maximum pixel value to use  
DEFAULT: 9.9E9  
OVERRIDES ALLOWED:  $X > 0.0$
  
- p pmask file  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
  
- r RSS baseline and input sigmas  
DEFAULT: no  
OVERRIDES ALLOWED: yes | no
  
- u Input uncertainty data cube  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
  
- v Output uncertainty data cube  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
  
- x number of samples to skip  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$

### Pipeline calibration files:

- z Input umask file

DEFAULT: appropriate *umask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

-n NAMELIST file  
 DEFAULT: appropriate *basecal.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

-i Input data cube  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

-o Output data cube  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

-d Input dmask file  
 [pipeline datafile --- override not allowed]

## 4.2 coadd2d Module

This module coadds a number of 2D images into one using trimmed averaging.

The module is used in the following pipelines: COADD

**Constant values:**

-D Debugging mode: adds debugging data  
 DEFAULT: 0  
 OVERRIDES ALLOWED:  $N \geq 0$

-HELP Print out an example NAMELIST file  
 DEFAULT: normal run  
 OVERRIDES ALLOWED: [not to override]

- V      Verbose mode: more functional info  
           DEFAULT: 0  
           OVERRIDES ALLOWED:  $N \geq 0$
  
- ag      Pixels with fewer data points than this value are marked in AMASK file.  
           DEFAULT: 1  
           OVERRIDES ALLOWED:  $N \geq 0$
  
- bf      BMASK fatal bits  
           DEFAULT: 28928  
           OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
  
- cf      Clip at most this fraction of the data (0.0 == no trimming)  
           DEFAULT: 0.2  
           OVERRIDES ALLOWED:  $0.0 < X < 100.0$
  
- cm      Clip above Multiple of MedAbsDev  
           DEFAULT: 5.0  
           OVERRIDES ALLOWED:  $X > 0.0$
  
- h1      Propagate \*all\* the headers from the first file in input FLUX files  
           DEFAULT: yes  
           OVERRIDES ALLOWED: [cannot override]
  
- ls      Input files lists 0 = in separate files; 1 = in namelist  
           DEFAULT: 0  
           OVERRIDES ALLOWED: 0 or 1
  
- pf      PMASK fatal bits  
           DEFAULT: 18176  
           OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
  
- pm      List of input (FITS) PMASK files  
           DEFAULT: (none)  
           OVERRIDES ALLOWED: user list of PMASK files
  
- wt      Calculate weighted statistics? (0=no 1=yes)  
           DEFAULT: 0 if no FMASK file, else 1  
           OVERRIDES ALLOWED: 0 or 1

**Pipeline calibration files:**

- fm FMASK (FOV Mask) calibration file (FITS)  
 DEFAULT: appropriate *fovmask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Namelist File  
 DEFAULT: appropriate *coadd2d.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- bm List of (FITS) BMASK files  
 [pipeline datafile --- override not allowed]
- di List of input (FITS) FLUX files  
 [pipeline datafile --- override not allowed]
- si List of input (FITS) UNC files  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- am Output AMASK file (FITS)  
 [pipeline datafile --- override not allowed]
- do Output FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- so Output UNC file (FITS)  
 [pipeline datafile --- override not allowed]
- wo Output ASCII file of weights and filenames  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

### 4.3 copy\_file Module

This module copies a file.

The module is used in the following pipelines: BCD

**Constant values:**

(none)

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

-i        Input file (any type)  
          [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

-o        Output file (any type)  
          [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

### 4.4 cropfits Module

This module cuts out a subimage.

The module is used in the following pipelines: BCDACQ; CUTOUT

**Constant values:**

- a Ancillary file path  
DEFAULT: current directory  
OVERRIDES ALLOWED: (not used)
  
- b Print debug statements  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
  
- h height  
DEFAULT: 56  
OVERRIDES ALLOWED:  $1 \leq N \leq \text{image size}$
  
- il start i (from 1)  
DEFAULT: blue=87 red=86  
OVERRIDES ALLOWED:  $1 \leq N \leq \text{image size}$
  
- jl start j (from 1)  
DEFAULT: blue=4 red=66  
OVERRIDES ALLOWED:  $1 \leq N \leq \text{image size}$
  
- l Log filename  
DEFAULT: stdout  
OVERRIDES ALLOWED: name of user's log file
  
- m Pixel orientation map  
DEFAULT: (none)  
OVERRIDES ALLOWED: user output filename
  
- t IPAC table filename  
DEFAULT: (none)  
OVERRIDES ALLOWED: user output filename
  
- v Verbose output  
DEFAULT: 1  
OVERRIDES ALLOWED: 0 or 1
  
- vv SuperVerbose output  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1

- w width  
DEFAULT: 41  
OVERRIDES ALLOWED:  $1 \leq N \leq \text{image size}$
- z Data plane to process (1=all, 2=first, 3=last; Default is all)  
DEFAULT: 1  
OVERRIDES ALLOWED: 1, 2 or 3

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

- n Namelist file  
DEFAULT: appropriate *cropfits\_r.nl* file in *../cdf/*  
OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i Input image (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o Output image (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.5 cropfits2 Module

This module will cut out a subimage, and update WCS info.

The module is used in the following pipelines: CUTOOUT BCDACQ



**Constant values:**

- color which peakup array  
DEFAULT: blue='b' or red='r'  
OVERRIDE ALLOWED:
- v verbosity - level of printed messages  
DEFAULT: 1  
OVERRIDE ALLOWED:
- x0 starting X coordinate  
DEFAULT: blue=87 red=86  
OVERRIDE ALLOWED:
- xn number of pixels in X direction  
DEFAULT: blue=4 red=66  
OVERRIDE ALLOWED:
- y0 starting Y coordinate  
DEFAULT: blue=41 red=41  
OVERRIDE ALLOWED:
- yn number of pixels in Y direction  
DEFAULT: blue=56 red=56  
OVERRIDE ALLOWED:

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

- n Namelist file  
DEFAULT: appropriate cropfits2\_r.nl file in ../cdf/  
OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i Input image (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o Output image (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.6 crosstalk Module

This module removes crosstalk.

The module is used in the following pipelines: BCD

**Constant values:**

- a0 Value of initial guess for Lorentzian-like slope alpha  
DEFAULT: 4.3  
OVERRIDES ALLOWED: floating point value
- fb BMASK fatal bitmask  
DEFAULT: 24576 (bits 13,14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- o1 Output file (FITS) not corrected for cross-talk  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
- t Threshold signal, in units of standard deviation, to apply correction  
DEFAULT: 2.0  
OVERRIDES ALLOWED: floating point value
- v Level of verbose output (higher for more output)  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$
- w0 Value of initial guess for order shape width (HWHM)  
DEFAULT: 1.5

OVERRIDES ALLOWED: floating point value

**Pipeline calibration files:**

- i3 Input Omask (spectral order regions) file (FITS)  
 DEFAULT: appropriate *omask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Namelist file  
 DEFAULT: appropriate *crosstalk.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i1 Input FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- i2 Input UNC file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o2 Output FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- o3 Output residual file (FITS) for amount of cross-talk correction that is subtracted.  
 [pipeline datafile --- override not allowed]
- o4 Output UNC file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- b Input BMASK file (FITS)  
 [pipeline datafile --- override not allowed]

## 4.7 cubesub Module

This module subtracts the dark.

The module is used in the following pipelines: BCD

### Constant values:

- b     Input BMASK file (FITS)  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: name of user file
  
- fb    BMASK fatal bitmask  
        DEFAULT: 0  
        OVERRIDES ALLOWED: integer bitmask value
  
- fc    CMASK fatal bitmask  
        DEFAULT: 8192 (bit # 13)  
        OVERRIDES ALLOWED: integer bitmask value
  
- fd    DMASK fatal bitmask  
        DEFAULT: 16392 (bits # 3,14)  
        OVERRIDES ALLOWED: integer bitmask value
  
- fp    PMASK fatal bitmask  
        DEFAULT: 18176 (bits # 8,9,10,14)  
        OVERRIDES ALLOWED: integer bitmask value
  
- q     Flag for outputting Quality Assessment header keywords. Include in the command  
        line, without argument, to output the keywords.  
        DEFAULT: no  
        OVERRIDES ALLOWED: "-" (minus) for yes
  
- s     Operation mode: 1 = no scaling, 2 = scale dark by 1/GAIN, 3 = scale dark by  
        T\_INT\*plane\_number/GAIN  
        DEFAULT: 1  
        OVERRIDES ALLOWED: 1 <= N <= 3
  
- v     Flag for verbose mode. Include in the command line, without argument.  
        DEFAULT: no

OVERRIDES ALLOWED: "-" (minus) for yes

### Pipeline calibration files:

- c     Input CMASK (dark calibration status) file (FITS)  
        DEFAULT: appropriate *dark\_cmask.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file
  
- e2     Input uncertainty of dark calibration file (FITS) Currently set to zero in the file  
        (FITS)  
        DEFAULT: appropriate *dark\_unc.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file
  
- i2     Input dark calibration file (FITS)  
        DEFAULT: appropriate *dark.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file
  
- p     Input PMASK file (FITS)  
        DEFAULT: appropriate *pmask.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file

### Pipeline namelist files:

- n     Namelist file  
        DEFAULT: appropriate *cubesub.nl* file in *../cdf/*  
        OVERRIDE ALLOWED: name of user's namelist file

### Pipeline input datafiles:

- d     Input DMASK file (FITS)  
        [pipeline datafile --- override not allowed]
  
- e1     Input UNC file (FITS)  
        [pipeline datafile --- override not allowed]
  
- i1     Input FLUX file (FITS)  
        [pipeline datafile --- override not allowed]

### Pipeline output datafiles:

- o1     Output FLUX file (FITS)

[pipeline datafile --- override not allowed]

- o2 Output UNC file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.8 cvti2r4 Module

This module converts from integer to floating point.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

- a Offset to add to all input samples (in DN)  
DEFAULT: 32768  
OVERRIDES ALLOWED: an integer
- b Input sample value indicating "missing data"  
DEFAULT: -1  
OVERRIDES ALLOWED: an integer
- f "no" disables forcing ".fits" onto following FITS file names.  
DEFAULT: yes  
OVERRIDES ALLOWED: no | yes
- g Output Ge BMASK file --- not used for CUPID.  
DEFAULT: (none)  
OVERRIDES ALLOWED: filename
- k DMASK output bit to set for input saturated samples  
DEFAULT: 3  
OVERRIDES ALLOWED: an integer mask value
- m Whether input "missing data" are in rows or columns  
DEFAULT: row

- OVERRIDES ALLOWED: row | col
- n Input namelist file --- not used for CUPID.  
DEFAULT: (none)  
OVERRIDES ALLOWED: filename
  - q "yes" enables MIPS24 0 -- NaN processing -- Not used for CUPID.  
DEFAULT: no  
OVERRIDES ALLOWED: no | yes
  - r Number of planes to remove from bottom of the data cube.  
DEFAULT: 0  
OVERRIDES ALLOWED: integer
  - s Input sample value indicating saturation.  
DEFAULT: 32767  
OVERRIDES ALLOWED: an integer
  - t "no" disables 2's-complement data conversion.  
DEFAULT: yes  
OVERRIDES ALLOWED: no | yes
  - x [p#,bit#] Set, at plane number specified by p#, DMASK bit# specified by bit# ---  
not used for CUPID  
DEFAULT: (none)  
OVERRIDES ALLOWED: p#,bit# (no blanks at comma)

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

- i Input raw file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- d Output DMASK file (FITS)  
[pipeline datafile --- override not allowed]
- o Output FLUX file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.9 darkbase Module

This module zeros the dark baseline.

The module is used in the following pipelines: BCD

**Constant values:**

- b Input BMASK file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: name of user's file
- c Input CMASK file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: name of user's file
- fb BMASK fatal bitmask  
DEFAULT: 0  
OVERRIDES ALLOWED: integer bitmask
- fc CMASK fatal bitmask  
DEFAULT: 0  
OVERRIDES ALLOWED: integer bitmask
- fd DMASK fatal bitmask.  
DEFAULT: 16392 (bits # 3, 14)  
OVERRIDES ALLOWED: integer bitmask



- fp PMASK fatal bitmask  
DEFAULT: 18304 (bits # 7,8,9,10,14)  
OVERRIDES ALLOWED: integer bitmask
- o2 Output UNC file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: name of user's file
- t1 Trim fraction for averaging. For instance 0.8 means that 0.2 of values are discarded to obtain the mean. Half of discarded samples are the largest, and half are the smallest of the set.  
DEFAULT: 0.80  
OVERRIDES ALLOWED:  $0.00 < X \leq 1.00$
- t2 Trim fraction for standard deviation  
DEFAULT: 0.80  
OVERRIDES ALLOWED:  $0.00 < X \leq 1.00$
- v Flag for verbose mode.  
DEFAULT: non-verbose  
OVERRIDES ALLOWED: "-" (minus) for verbose

**Pipeline calibration files:**

- p Input PMASK file (FITS)  
DEFAULT: appropriate *pmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file
- u Input Umask file (FITS) Defines unilluminated region(s)  
DEFAULT: appropriate *umask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Namelist file  
DEFAULT: appropriate *darkbase.nl* file in *../cdf/*  
OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i1 Input FLUX file (FITS)

[pipeline datafile --- override not allowed]

- i2 Input UNC file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o1 Output FLUX file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- d Input DMASK file (FITS)  
[pipeline datafile --- override not allowed]

## 4.10 darkdrift Module

This module removes "jail bars".

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

- a Path for ancillary files. Specified directory contains error code files and some libraries needed for normal execution  
DEFAULT: (none)  
OVERRIDES ALLOWED: path to anc. files
- c Readout channel to exclude: 0 = None.  
DEFAULT: 0  
OVERRIDES ALLOWED: N >= 0
- d Flag for printing debug statements: 0 = Do not print; 1 = Print  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
- f1 Trim fraction for averaging. (0.0 = compute median)  
DEFAULT: 0.0  
OVERRIDES ALLOWED: 0.0 >= X >= 1.0

- f2 Trim fraction for standard deviation. (e.g. 0.9 means that 0.1 of values are discarded to obtain the standard deviation. Half of discarded samples are the largest, and half are the smallest of the set.)  
 DEFAULT: 0.9  
 OVERRIDES ALLOWED:  $0.0 \leq X \leq 1.0$
  
- g Flag for applying additive or multiplicative correction: 0 = Additive; 1 = Multiplicative.  
 DEFAULT: 0  
 OVERRIDES ALLOWED: 0 or 1
  
- ia Input dark calibration subsequent to input file (FITS)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: users filename
  
- ib Input dark calibration preceding input file (FITS)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: users filename
  
- ic Input canonical dark calibration file (FITS) Required if preceding and subsequent darks are specified.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: users filename
  
- ig Input GMASK file (FITS)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: users GMASK file
  
- l Name of log file  
 DEFAULT: STDOUT.  
 OVERRIDES ALLOWED: user filename
  
- mg Threshold Gmask level. See -ig above. Pixels exceeding threshold are ignored in darkdrift computations  
 DEFAULT: (not used)  
 OVERRIDES ALLOWED: X
  
- o2 Output file with amount of correction to subtract from input file (FITS)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: users filename

- p Data plane to compute amount of correction: 1 (current default) = All; 2 = First plane; 3 = Last plane  
DEFAULT: 1  
OVERRIDES ALLOWED: 1, 2, 0r 3
- t Flag for transposing input file: 1 = Do not transpose input; 2 = Transpose input.  
DEFAULT: 1  
OVERRIDES ALLOWED: 1 or 2
- te Temperature of uision of input data  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- tea Temperature of uision of dark subsequent to data  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- teb Temperature of uision of dark preceding data  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- ti Relative time of uision of input data. 8-byte decimal scalar  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- tia Relative time of uision of dark subsequent to data. 8-byte decimal scalar  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- tib Relative time of uision of dark preceding data. 8-byte decimal scalar  
DEFAULT: (not used)  
OVERRIDES ALLOWED: X
- v Flag for verbose output: 0 = No; 1 = Yes  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
- vv Flag for superverbose output: 0 = No; 1 = Yes  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

- n      Namelist file  
           DEFAULT: appropriate *darkdrift.nl* file in *../cdf/*  
           OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i      Input FLUX file (FITS)  
           [pipeline datafile --- override not allowed]
- iu     Input UNC file (FITS)  
           [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o1     Output FLUX file (FITS)  
           [pipeline datafile --- override not allowed]
- o3     Output table: trim mean, standard deviation, amount of correction, and uncertainty of  
           correction at each read-out channel and each plane  
           [pipeline datafile --- override not allowed]
- ou     Output UNC file (FITS)  
           [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.11 darkest Module

This module combines a number of dark cube images into one.

The module is used in the following pipelines: DARK

**Constant values:**

- ac Abnormal file indexes in input list; separated by comma (no space) and increasing  
DEFAULT: (none)  
OVERRIDES ALLOWED: [untested option]
- ap Abnormal plane indexes with abnormal input file; separated by comma (no space) and increasing  
DEFAULT: (none)  
OVERRIDES ALLOWED: [untested option]
- c Input CMASK filename (Calibration image status)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's CMASK file
- e Factor of median distance for unsymmetrical trim  
DEFAULT: 5.0  
OVERRIDES ALLOWED:  $X > 0.0$
- fc CMASK fatal bit templates; separated by comma (no space)  
DEFAULT: (none)  
OVERRIDES ALLOWED: [untested option]
- fd DMASK fatal bit templates; separated by comma (no space)  
DEFAULT: (none)  
OVERRIDES ALLOWED: [untested option]
- fp PMASK fatal bit templates; separated by comma (no space)  
DEFAULT: (none)  
OVERRIDES ALLOWED: [untested option]
- p Input PMASK filename (hardware status)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's PMASK file
- q QA FITS header writer 0=off 1=on  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1

- r     Read noise per pixel  
        DEFAULT: 30.0  
        OVERRIDES ALLOWED:  $X \geq 0.0$
  
- t1    Fraction for symmetrical trim-average  
        DEFAULT: 1.0  
        OVERRIDES ALLOWED:  $0.0 \leq X \leq 1.0$
  
- t2    Symmetrical trim fraction for standard deviation  
        DEFAULT: 1.0  
        OVERRIDES ALLOWED:  $0.0 \leq X \leq 1.0$
  
- u     Fraction for unsymmetrical trim; default  
        DEFAULT: 0.0  
        OVERRIDES ALLOWED:  $0.0 \leq X \leq 1.0$
  
- v     Flag for verbose mode.  
        DEFAULT: (no)  
        OVERRIDES ALLOWED: - (minus sign) for yes

#### **Pipeline calibration files:**

(none)

#### **Pipeline namelist files:**

- n     Namelist file  
        DEFAULT: appropriate *darkest\_offline.nl* file in *../cdf/*  
        OVERRIDE ALLOWED: name of user's namelist file

#### **Pipeline input datafiles:**

- d     File with list of input DMASK files (DMASK = 'DCE pixel status')  
        [pipeline datafile --- override not allowed]
  
- i1    File with list of input FLUX images  
        [pipeline datafile --- override not allowed]
  
- i2    File with list of input UNC images  
        [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o1        Output FLUX file (FITS)  
          [pipeline datafile --- override not allowed]
- o2        Output UNC file (FITS)  
          [pipeline datafile --- override not allowed]
- o3        Output CMASK file (FITS)  
          [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.12 dntoflux Module

This module converts from DN to electrons.

The module is used in the following pipelines: BCDACQ; BCD; CUTOUT

**Constant values:**

- a        Path for ancillary files. Specified directory contains error code files and some libraries needed for normal execution.  
          DEFAULT: (none)  
          OVERRIDES ALLOWED: user's path
- bd       Threshold for DMASK fatal masking. --- not used for CUPID.  
          DEFAULT: (not used)  
          OVERRIDES ALLOWED:  $N \geq 0$
- bp       Threshold for PMASK fatal masking. --- not used for CUPID.  
          DEFAULT: (not used)  
          OVERRIDES ALLOWED:  $N \geq 0$
- c        Factor for scaling whole array, if operation code = 0  
          DEFAULT: (not used)  
          OVERRIDES ALLOWED:  $X > 0.0$



- c1 Factor for scaling read-out channel 1, if operation code = 1;  
DEFAULT: 4.6 (from FITS keyword)  
OVERRIDES ALLOWED:  $X > 0.0$
- c2 Factor for scaling read-out channel 2, if operation code = 1;  
DEFAULT: 4.6 (from FITS keyword)  
OVERRIDES ALLOWED:  $X > 0.0$
- c3 Factor for scaling read-out channel 3, if operation code = 1;  
DEFAULT: 4.6 (from FITS keyword)  
OVERRIDES ALLOWED:  $X > 0.0$
- c4 Factor for scaling read-out channel 4, if operation code = 1;  
DEFAULT: 4.6 (from FITS keyword)  
OVERRIDES ALLOWED:  $X > 0.0$
- co Operation code: 0 = Scale array by a single factor; 1 = Scale each read-out channel  
by a unique factor.  
DEFAULT: 1  
OVERRIDES ALLOWED:  $0 \leq N \leq 1$
- d Flag for printing debug statements: 0 = Do not print; 1 = Print.  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
- ip Input PMASK file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's PMASK file
- l 1 Log file;  
DEFAULT: STDOUT  
OVERRIDES ALLOWED: output log file
- o2 Output file (FITS) where fatally masked pixels or samples in the PMASK or  
DMASK are set to NaN.  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's output file
- p Code for data plane to process: 1 = All; 2 = First; 3 = Last.  
DEFAULT: 1

OVERRIDES ALLOWED:  $1 \leq N \leq 3$

- s    Specification of output units. **REQUIRED.** Output is written in the BUNIT header keyword as a character string.  
       DEFAULT: e-  
       OVERRIDES ALLOWED: a character string
  
- t    Code for normalization by the value of header keyword EXPTIME: 0 = Do not normalize; 1 = Normalize.  
       DEFAULT: 0  
       OVERRIDES ALLOWED: 0 or 1
  
- u    Input uncertainty of scaling factor. Required if operation = 0 and -ou option is specified.  
       DEFAULT: (not used)  
       OVERRIDES ALLOWED:  $X > 0.0$
  
- u1   Input uncertainty of scaling factor for read-out channel 1. Required if operation = 1 and -ou option is specified.  
       DEFAULT: (not used)  
       OVERRIDES ALLOWED:  $X > 0.0$
  
- u2   Input uncertainty of scaling factor for read-out channel 2. Required if operation = 1 and -ou option is specified.  
       DEFAULT: (not used)  
       OVERRIDES ALLOWED:  $X > 0.0$
  
- u3   Input uncertainty of scaling factor for read-out channel 3. Required if operation = 1 and -ou option is specified.  
       DEFAULT: (not used)  
       OVERRIDES ALLOWED:  $X > 0.0$
  
- u4   Input uncertainty of scaling factor for read-out channel 4. Required if operation = 1 and -ou option is specified.  
       DEFAULT: (not used)  
       OVERRIDES ALLOWED:  $X > 0.0$
  
- v    Flag for verbose output: 0 = No; 1 = Yes.  
       DEFAULT: 0  
       OVERRIDES ALLOWED: 0 or 1

- vv Flag for superverbose output: 0 = No; 1 = Yes.  
 DEFAULT: 0  
 OVERRIDES ALLOWED: 0 or 1

### Pipeline calibration files:

(none)

### Pipeline namelist files:

- n Input namelist file  
 DEFAULT: appropriate *dntoflux\_r.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

### Pipeline input datafiles:

- i Input FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- id Name DMASK file (FITS)  
 [pipeline datafile --- override not allowed]
- iu Input UNC file (FITS)  
 [pipeline datafile --- override not allowed]

### Pipeline output datafiles:

- o1 Output FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- ou Output UNC file (FITS)  
 [pipeline datafile --- override not allowed]

### Pipeline datafiles updated:

(none)

## 4.13 droopop Module

This module corrects for global droop.

The module is used in the following pipelines: BCD

### Constant values:

- a Flag for resetting saturation-corrected samples: 0 = Do not reset; 1 = Reset to the value specified in -sv.  
DEFAULT: 1  
OVERRIDES ALLOWED: 0 or 1
  
- b Input BMASK file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's file
  
- c Input CMASK file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user's file
  
- e Uncertainty of droop coupling constant for entire array.  
DEFAULT: ch0=0.45, ch1=0.49, ch2=0.20, ch3=0.19  
OVERRIDES ALLOWED:  $N > 0.00$
  
- fb BMASK fatal bitmask.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $0 < N < 32767$
  
- fc CMASK fatal bitmask.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $0 < N < 32767$
  
- fd DMASK fatal bitmask.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $0 < N < 32767$
  
- fp PMASK fatal bitmask.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $0 < N < 32767$

- g     Flag for computing amount of droop from the first plane of data cube (or first plane of reference cube, if present).  
        DEFAULT: (no)  
        OVERRIDES ALLOWED: - (minus sign) for yes
  
- j1    Input reference FLUX file (FITS) Amount of droop is computed from this file, and is then subtracted from main input file.  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user's FLUX file
  
- j2    Input reference UNC file (FITS)  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user's UNC file
  
- q     Flag for outputting Quality Assessment header keywords. Include in the command line, without argument, to output the keywords.  
        DEFAULT: (yes)  
        OVERRIDES ALLOWED: (cannot override)
  
- r     Droop coupling constant for entire array (not per pixel)  
        DEFAULT: ch0=0.068, ch1=0.074, ch2=0.030, ch3=0.028  
        OVERRIDES ALLOWED:  $N > 0.0$
  
- sb    DMASK bit indicating saturation. Used for resetting saturation-corrected samples.  
        DEFAULT: 4  
        OVERRIDES ALLOWED:  $0 < N < 32767$
  
- sv    Output saturation value. Samples that were corrected for saturation by SATCOR are reset to this value, if option -a is used.  
        DEFAULT: 300,000  
        OVERRIDES ALLOWED:  $N > 0.0$
  
- v     Flag for verbose mode.  
        DEFAULT: (no)  
        OVERRIDES ALLOWED: - (minus sign) for yes

**Pipeline calibration files:**

- p     Input PMASK file (FITS)  
        DEFAULT: appropriate *pmask.fits* file in *../cal/*

OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n     Namelist file  
        DEFAULT: appropriate *droopop.nl* file in *../cdf/*  
        OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i1     Input FLUX file (FITS)  
        [pipeline datafile --- override not allowed]
- i2     Input UNC file (FITS)  
        [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o1     Output FLUX file (FITS)  
        [pipeline datafile --- override not allowed]
- o2     Output UNC file (FITS) --- Note that the uncertainty of droop correction is not  
        propagated; it is written as a header keyword.  
        [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- d     DMASK file to update (FITS)  
        [pipeline datafile --- override not allowed]

## 4.14 droopres Module

This module removes residual droop.

The module is used in the following pipelines: BCD

**Constant values:**

- c     Input CMASK file (FITS)

- DEFAULT: (none)  
OVERRIDES ALLOWED: user CMASK file
- fb BMASK fatal bitmask  
DEFAULT: 16384 (bit 14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fc CMASK fatal bitmask  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fd DMASK fatal bitmask  
DEFAULT: 16392 (bits 3,14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fp PMASK fatal bitmask  
DEFAULT: 18304 (bits 7,8,9,10,14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- t1 Trim fraction for averaging. (e.g. 0.8 means that 0.2 of values are discarded to obtain the mean. Half of discarded samples are the largest, and half are the smallest of the set.)  
DEFAULT: 0.8  
OVERRIDES ALLOWED:  $0.0 < X \leq 1.0$
- t2 Trim fraction for standard deviation  
DEFAULT: 0.8  
OVERRIDES ALLOWED:  $0.0 < X \leq 1.0$
- v Flag for verbose mode  
DEFAULT: (not verbose)  
OVERRIDES ALLOWED: "-" (minus) for verbose

### Pipeline calibration files:

- p Input PMASK file (FITS)  
DEFAULT: appropriate *pmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file
- u Input UMASK file (FITS) (defines unilluminated region)  
DEFAULT: appropriate *umask.fits* file in *../cal/*

OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Namelist file  
 DEFAULT: appropriate *droopres.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- b Input BMASK file (FITS)  
 [pipeline datafile --- override not allowed]
- d Input DMASK file (FITS)  
 [pipeline datafile --- override not allowed]
- i1 Input FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- i2 Input UNC file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o1 Output FLUX file (FITS)  
 [pipeline datafile --- override not allowed]
- o2 Output UNC file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.15 extract Module

This module extracts a 1D spectrum table.

The module is used in the following pipelines: BCDX; COADDX; BKSUBX



**Constant values:**

- f Fatal bits for BMASK  
DEFAULT: 16384  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
  
- fix This controls if the NaNs should be replaced with approximated values before doing extraction. A value of 0 means "don't replace", while an integer, N, means that for each NaN pixel, the N rows above and N rows below are averaged column by column within the order, and then a line is fit to these column averages to approximate the NaN.  
DEFAULT: 2  
OVERRIDES ALLOWED:  $N \geq 0$
  
- full Extraction type; 0 = sub\_slit and 1 = full\_slit.  
DEFAULT: 0 if all of the following are true: (a) the "-w" flag is not explicitly set, (b) this is a LO-RES observation, (c) this is not a LO-RES center position observation  
OVERRIDES ALLOWED: 0 or 1
  
- height1 Sets the wavsamp height. Set to 1 to force the wavsamp height to be 1 pixel; set to 0 to use actual height.  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
  
- l Reference wavelength (in microns) of the aperture width specified with the "-w" flag. A value of 0 selects a constant width extraction aperture.  
DEFAULT: use value in psf\_fov  
OVERRIDES ALLOWED:  $0.0 \leq X \leq 50.0$
  
- nanDrop Wavelength bins with NaNs will be removed from the output spectrum. 0 = set flux to -9999; 1 = drop row from output table  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
  
- norm Normalize the fluxes  
0 = no normalization  
1 = divide by height of wavsamp rectangle  
2 = divide by area of wavsamp rectangle  
DEFAULT: ch0,ch2,ch3=1 ch1=0

OVERRIDES ALLOWED: 0 1 2

- ord      This refers to the spectral order, and is used for low-resolution extractions only.  
 You can set this to:  
           0 = (as targeted)  
           1 = 1  
           2 = (2+bonus)  
           99 =(1+2+bonus)  
 DEFAULT: 0  
 OVERRIDES ALLOWED:  $0 \leq N \leq 3$
- over     Output overlay file (used by SPICE)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of overlay file to write
- p        The calibration table that codes the order to be extracted for each FOVID, the  
 default ridge location, and the extraction aperture width at a fiducial wavelength.  
 DEFAULT: ch0, ch2 = *../cal/psf\_fov.tbl*; ch1, ch3 = (none)  
 OVERRIDES ALLOWED: user's *psf\_fov.tbl* file
- v        Level of verbosity  
 DEFAULT: 1  
 OVERRIDES ALLOWED:  $N \geq 0$
- w        Width (pixels) of the extraction aperture at the reference wavelength  
 DEFAULT: ch0, ch2 = use the value given in the *psf\_fov*; ch1, ch3 = use full  
 width of order  
 OVERRIDES ALLOWED:  $X > 0.0$

### Pipeline calibration files:

(none)

### Pipeline namelist files:

- n        Namelist file  
 DEFAULT: appropriate *extract.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

### Pipeline input datafiles:

- b Input BMASK file (FITS)  
[pipeline datafile --- override not allowed]
- e Input UNC file (FITS)  
[pipeline datafile --- override not allowed]
- i Input FLUX file (FITS)  
[pipeline datafile --- override not allowed]
- r Output table from running the RIDGE module in the previous step.  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o Output spectrum table (IPAC table file)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.16 flatap Module

This module applies FLAT.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

- cm CMASK fatal bitmask  
DEFAULT: 444 (bits 2,3,4,5,7,8)  
OVERRIDES ALLOWED: N >= 0 bitmask value
- ct Input CMASK for Transmission calibrator flatfield file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
- dm BMASK or DMASK fatal bitmask  
DEFAULT: 28672 (bits 12,13,14)

OVERRIDES ALLOWED:  $N \geq 0$  bitmask value

- l     Output log file  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user logfile name
  
- n     Namelist file  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user namelist
  
- pm    PMASK fatal bitmask  
        DEFAULT: 18176 (bits 8,9,10,14)  
        OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
  
- t     Input Transmission calibrator flatfield file (FITS). Flatfield is multiplied pixel-by-pixel by this file before applied.  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user filename
  
- v     Flag for verbose mode  
        DEFAULT: (not verbose)  
        OVERRIDES ALLOWED: "-" (minus) for verbose

#### **Pipeline calibration files:**

- c     Input CMASK (flatfield calibration status) file (FITS)  
        DEFAULT: appropriate *flatfield\_cmask.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file
  
- f     Input flatfield calibration file (FITS)  
        DEFAULT: appropriate *flatfield.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file
  
- p     Input PMASK file (FITS)  
        DEFAULT: appropriate *pmask.fits* file in *../cal/*  
        OVERRIDE ALLOWED: name of user's calibration file

#### **Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

- i        Input FLUX file (FITS)  
          [pipeline datafile --- override not allowed]
- ui       Input UNC file (FITS)  
          [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o        Output FLUX file (FITS)  
          [pipeline datafile --- override not allowed]
- uo       Output UNC file (FITS)  
          [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- d        Input BMASK or DMASK file (FITS)  
          [pipeline datafile --- override not allowed]

## 4.17 fpgen Module

This module generates the final product.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

- b        Remove blocks of blanks (0=no 1=yes)  
          DEFAULT: 1  
          OVERRIDES ALLOWED: 0 or 1
- h        Copy HISTORY lines too (0=no 1=yes)  
          DEFAULT: 1  
          OVERRIDES ALLOWED: 0 or 1
- q        'Quiet' mode (0=normal 1=quiet)  
          DEFAULT: 1

OVERRIDES ALLOWED: 0 or 1

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

-t     Reformatting 'template' file  
        DEFAULT: appropriate *fpg.tpl* file in *../cdf/*  
        OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

-i     Input datafile  
        [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

-o     Output datafile  
        [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.18 hdrupd8 Module

This module updates header keywords.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

-d     File containing keywords to add or delete  
        DEFAULT: updates from CUPID  
        OVERRIDES ALLOWED: file with user updates instead

-n     Do not add a comment keyword to file

DEFAULT: not add

OVERRIDES ALLOWED: (cannot override)

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

(none)

**Pipeline output datafiles:**

(none)

**Pipeline datafiles updated:**

- File to be updated (FITS)  
[pipeline datafile --- override not allowed]

## 4.19 imagest Module

This module corrects saturated values.

The module is used in the following pipelines: BCD

**Constant values:**

- h Threshold to tag A/D saturation (equivalent function to cvti2r4) (practically never used in IRS)  
DEFAULT: 9.9e25  
OVERRIDES ALLOWED:  $X \geq 0.0$
- m Mode of operation: 1 = slope estimation; 2 = saturation correction  
DEFAULT: 2

OVERRIDES ALLOWED: 1 or 2

- w Maximum saturation-corrected value for mode 2.  
DEFAULT: 9.9e25  
OVERRIDES ALLOWED:  $X \geq 0.0$
- x Number of lower planes to skip.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $X \geq 0$
- z Number of samples after a radhit to skip  
DEFAULT: 0  
OVERRIDES ALLOWED:  $X \geq 0$

#### Pipeline calibration files:

- l Non-linearity calibration file (FITS)  
DEFAULT: appropriate *lincal\_satcor.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file
- p Input PMASK file (FITS)  
DEFAULT: appropriate *pmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file

#### Pipeline namelist files:

- n Namelist file  
DEFAULT: appropriate *satcor.nl* file in *../cdf/*  
OVERRIDE ALLOWED: name of user's namelist file

#### Pipeline input datafiles:

- i Input FLUX file (FITS)  
[pipeline datafile --- override not allowed]
- u Input UNC file (FITS)  
[pipeline datafile --- override not allowed]

#### Pipeline output datafiles:

- o Output FLUX file (FITS)



- [pipeline datafile --- override not allowed]
- s Output UNC file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- d Updated DMASK file (FITS). File is updated for samples corrected for saturation.  
[pipeline datafile --- override not allowed]

## 4.20 imsubtract Module

This module subtracts two images.

The module is used in the following pipelines: BKSUB; BCDACQ

**Constant values:**

- v verbosity of printed messages  
DEFAULT: 0  
OVERRIDES ALLOWED: N >= 0

**Pipeline calibration files:**

- i2 Input second image  
DEFAULT: appropriate *dcsdark.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

- i1 Input first image  
[pipeline datafile --- override not allowed]
- i1\_maskfirst Input mask file  
[pipeline datafile --- override not allowed]

- i1\_unc            Input uncertainty  
                  [pipeline datafile --- override not allowed]
- i2\_masksecond   Input mask file  
                  [pipeline datafile --- override not allowed]
- i2\_unc            Second Input uncertainty  
                  [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o                Output image  
                  [pipeline datafile --- override not allowed]
- o\_mask         Output mask file  
                  [pipeline datafile --- override not allowed]
- o\_unc          Output uncertainty  
                  [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.21 irs\_tune Module

This module converts spectrum from e-/sec to Jy and aligns orders.

The module is used in the following pipelines: BCDX; COADDX; BKSUBX

**Constant values:**

- a                Which tuning components to apply. 'Fluxcon' is the conversion factor from electrons per second to Jy, while 'tune' applies the remaining calibration factors. 1 = fluxcon, 2 = tune, 3 = both  
                  DEFAULT: 3  
                  OVERRIDES ALLOWED: 1 or 2 or 3

- m Tuning mode (tune\_up OR tune\_down). Virtually all users will wish to use the "tune\_down" option. The "tune\_down" value means to apply the fluxcon table in the normal way, dividing by the factors. The "tune\_up" value means to multiply by the factors. If you run irs\_tune with tune\_down on untuned data, you get tuned data. If you run irs\_tune with tune\_up on tuned data, you get the untuned data back.  
DEFAULT: tune\_down  
OVERRIDES ALLOWED: tune\_up | tune\_down
  
- noise0 Only for generating 'untuned' spectra for testing purposes. Sigma of offset noise to add.  
DEFAULT: 0.0  
OVERRIDES ALLOWED: X >= 0.0
  
- noise1 Only for generating 'untuned' spectra for testing purposes. Sigma of gain noise to add.  
DEFAULT: 0.0  
OVERRIDES ALLOWED: X >= 0.0
  
- recom Calls the IRS\_RETUNE module, which allows tuning for extended sources. Do not use this if you are tuning for point sources. The value of this option must be the full path to the irs\_retune executable.  
DEFAULT: (no retune command)  
OVERRIDES ALLOWED: (no override)
  
- reout Retune Output file. Only used when -recom is turned on.  
DEFAULT: (no retune output file)  
OVERRIDES ALLOWED: (no override)
  
- reout2 Second retune Output file. Only used when -recom is turned on.  
DEFAULT: (no retune file)  
OVERRIDES ALLOWED: (no override)
  
- retab Input retuning table. Only used when -recom is turned on  
DEFAULT: (no retune table)  
OVERRIDES ALLOWED: (no override)
  
- retab2 Second input retune table. Only used when -recom is turned on.  
DEFAULT: (no retune input table)  
OVERRIDES ALLOWED: (no override)
  
- v Verbosity level of printed messages

DEFAULT: 1  
 OVERRIDES ALLOWED:  $N \geq 0$

#### Pipeline calibration files:

-t Input tuning calibration table.  
 DEFAULT: appropriate *fluxcon.tbl* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

#### Pipeline namelist files:

-n Namelist file  
 DEFAULT: appropriate *irs\_tune.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

#### Pipeline input datafiles:

-i Input spectrum (IPAC table file)  
 [pipeline datafile --- override not allowed]

#### Pipeline output datafiles:

-o Output spectrum (IPAC table file) flux-calibrated, units of Jy.  
 [pipeline datafile --- override not allowed]

#### Pipeline datafiles updated:

(none)

## 4.22 lineariz Module

This module corrects for non-linearity.

The module is used in the following pipelines: BCD

#### Constant values:

-q Flag for outputting Quality Assessment header keywords  
 0 = No QA output (default).

- 1 = QA output written to header of output file (FITS)
- 2 = QA output written to header of output file (FITS) and to separate QA multi-plane file (FITS) The latter has, for each linearized ramp: Plane 1: Reduced chi-square of the linear fit. Plane 2: Linear correlation coefficient. Plane 3: Root-mean-square dispersion about the linear fit.
- 3 = QA output same as 1 with the addition of linear coefficients.
- 4 (current) = QA output same as 2 with the addition of linear coefficients. The coefficients are written in 3 additional planes: Plane 4: Linear fit slopes. Plane 5: Linear fit intercepts. Plane 6: Number of chi-square degrees of freedom in linear fit.

DEFAULT: 0

OVERRIDES ALLOWED:  $0 \leq N \leq 4$

- x Number of lower planes to skip in QA computations.  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$

#### Pipeline calibration files:

- c Input CMASK (non-linearity calibration status) file (FITS)  
DEFAULT: appropriate *lincal\_cmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file
- l Input non-linearity calibration file (FITS)  
DEFAULT: appropriate *lincal.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file
- p Input PMASK file (FITS)  
DEFAULT: appropriate *pmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file

#### Pipeline namelist files:

- n Namelist file  
DEFAULT: appropriate *lineariz.nl* file in *../cdf/*  
OVERRIDE ALLOWED: name of user's namelist file

#### Pipeline input datafiles:

- i Input FLUX file (FITS)  
[pipeline datafile --- override not allowed]

- u Input UNC file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o Output FLUX file (FITS)  
[pipeline datafile --- override not allowed]
- s Output UNC file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- m Input DMASK file (FITS)  
[pipeline datafile --- override not allowed]

## 4.23 profile Module

This module generates a wavelength-collapsed average spatial profile table.

The module is used in the following pipelines: BCDX; COADDX; BKSUBX

**Constant values:**

- c Number of "cuts". The profile module divides each pseudorectangle into this number of cuts and integrates the signal within each cut.  
DEFAULT: ch0 =1000, ch2 = 2000; ch1 , ch3 = 200  
OVERRIDES ALLOWED:  $2 \leq N \leq 2000$
- fb BMASK fatal bitmask  
DEFAULT: 18432  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- m Size of sliding median  
DEFAULT: 7  
OVERRIDES ALLOWED:  $1 \leq N \leq 21$  (must be ODD integer)
- ord This selects which orders are included

DEFAULT: all targeted orders

OVERRIDES ALLOWED: up to 14 comma-separated integers, no spaces

- t The calibration table that codes the order to be extracted for each FOVID, the default ridge location, and the extraction aperture width at a fiducial wavelength.  
DEFAULT: `ch0, ch2 = ../cal/psf_fov.tbl`; `ch1, ch3 = (none)`  
OVERRIDES ALLOWED: user's `psf_fov.tbl` file
- v Level of verbosity  
DEFAULT: 1  
OVERRIDES ALLOWED: `N >= 0`

### Pipeline calibration files:

- w The wavsamp file. This file specifies the location of the spectral orders on the array in x-y coordinates. It consists of pseudorectangles, which describe the fractional pixels that comprise each wavelength in the spectrum.  
DEFAULT: appropriate `wavsamp.tbl` file in `../cal/`  
OVERRIDE ALLOWED: name of user's calibration file

### Pipeline namelist files:

- n Namelist file  
DEFAULT: appropriate `profile.nl` file in `../cdf/`  
OVERRIDE ALLOWED: name of user's namelist file

### Pipeline input datafiles:

- b Input BMASK file (FITS)  
[pipeline datafile --- override not allowed]
- i Input FLUX file (FITS)  
[pipeline datafile --- override not allowed]

### Pipeline output datafiles:

- o Output spectrum file (IPAC table file)  
[pipeline datafile --- override not allowed]
- q The Output qa file which tells you six things about the profile:  
    `profMaxFlux` - max value of dn for all cuts

profLocMaxFlux - location (%) of max dn cut  
 profMaxStdev - max value of stdev for all cuts  
 profLocMaxStdev - location (%) of max stdev cut  
 profMaxRStdev - max value of stdev/dn for all cuts  
 profLocMaxRStdev - location of max stdev/dn cut  
 [pipeline datafile --- override not allowed]

### Pipeline datafiles updated:

(none)

## 4.24 radhit Module

This module flags radhits.

The module is used in the following pipelines: BCD

### Constant values:

- S Radhit magnitude threshold for declaring post-radhit samples as bad. Should be capitalized in command line.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED:  $X > 0.0$
  
- d Flag for printing debug statements: 0 = Do not print; 1 = Print.  
 DEFAULT: 0  
 OVERRIDES ALLOWED: 0 or 1
  
- f Bitmask reset integer. Perform logical AND of DMASK samples and this value, to reset selected bits.  
 DEFAULT: 65019 in second instance of RADHIT (bits 4,9 reset to detect radhits anew)  
 OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
  
- g Gain (e-/DN).  
 DEFAULT: 1.0 (already in e-)  
 OVERRIDES ALLOWED:  $X > 0.0$
  
- h Maximum number of radhits detectable in a ramp.



- DEFAULT: 16  
OVERRIDES ALLOWED:  $N \geq 0$
- i4 Input readnoise (specified for each pixel) file (FITS) See parameter -r below as alternative.  
DEFAULT: (none)  
OVERRIDES ALLOWED: users file
- k Maximum segment length to store pseudoinverse.  
DEFAULT: (none)  
OVERRIDES ALLOWED:  $N \geq 0$
- m NominalRHMagn or threshold for ratio of signal jump to sample uncertainty to declare a radhit.  
DEFAULT: 80.0  
OVERRIDES ALLOWED:  $X \geq 0.0$
- p RHPriorProb or threshold for probability that a signal jump is a radhit.  
DEFAULT: 0.01  
OVERRIDES ALLOWED:  $X \geq 0.0$
- r Input readnoise, in electrons. One value specified for whole array.  
DEFAULT: ch0, ch1 = 26.0; ch2, ch3 = 46.0  
OVERRIDES ALLOWED:  $X \geq 0.0$
- t Probability threshold at which to declare that a radhit occurred.  
DEFAULT: 0.99  
OVERRIDES ALLOWED:  $X \geq 0.0$
- v Flag for verbose output: 0 = No; 1 = Yes  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
- vv Flag for superverbose output: 0 = No; 1 = Yes.  
DEFAULT: 0  
OVERRIDES ALLOWED: 0 or 1
- w Maximum segment length after decimation.  
DEFAULT: (none)  
OVERRIDES ALLOWED:  $N \geq 1$

- x Number of samples to skip at start of ramp for radhit detection.  
DEFAULT: ch2=1 others=0  
OVERRIDES ALLOWED:  $N \geq 0$
- xp Minimum number of ramp samples required for skipping.  
DEFAULT: 5 (no samples are skipped for 4-sample ramps)  
OVERRIDES ALLOWED:  $N \geq 0$

**Pipeline calibration files:**

- i3 Input PMASK file (FITS)  
DEFAULT: appropriate *pmask.fits* file in *../cal/*  
OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Number of post-radhit samples to declare bad.  
DEFAULT: appropriate *radhit.nl* file in *../cdf/*  
OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i1 Input FLUX file (FITS)  
[pipeline datafile --- override not allowed]
- i2 Input DMASK file (FITS)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- l Log file, listing input parameters.  
[pipeline datafile --- override not allowed]
- o1 Output radhit probability per sample file (FITS) 3-D cube.  
[pipeline datafile --- override not allowed]
- o2 Output sample number per pixel with declared radhits file (FITS) 2-D plane.  
[pipeline datafile --- override not allowed]
- o3 Output radhit magnitude per pixel file (FITS) 2-D plane.  
[pipeline datafile --- override not allowed]

- o4 Output slope per pixel file (FITS) Peculiarly written in two adjacent planes (where ramp was segmented) of a 3-D cube.  
[pipeline datafile --- override not allowed]
- o5 Output DMASK file (FITS) (same file as input DMASK)  
[pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

**4.25 remove\_file Module**

This module deletes a file.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

(none)

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

- File to be deleted (any type)  
[pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

(none)

**Pipeline datafiles updated:**

(none)

**4.26 ridge Module**

This module outputs a table containing the x,y positions of the peak.

The module is used in the following pipelines: BCDX; COADDX; BKSUBX

**Constant values:**

- c      Explicitly select the ridge position (position percent).  
           DEFAULT: search for peak  
           OVERRIDES ALLOWED:  $0.0 \leq X \leq 100.0$
  
- f      The calibration table that codes the order to be extracted for each FOVID, the default  
           ridge location, and the extraction aperture width at a fiducial wavelength.  
           DEFAULT: ch0, ch2 = *../cal/psf\_fov.tbl*; ch1, ch3 = (none)  
           OVERRIDES ALLOWED: users *psf\_fov.tbl* file
  
- g      The width, given in plus-or-minus percent of the array in the cross-dispersion  
           direction, to be searched for the peak, centered on expected position (for LO-RES  
           only). e.g. if you wish to include 25% of the array to either side of the targeted  
           position, giving you a total extraction width of 50% of the array, you would set a  
           value of 25.0.  
           DEFAULT: 25.0  
           OVERRIDES ALLOWED:  $0.0 < X \leq 100.0$
  
- ghi    Explicitly specify the high-end cutoff of peak search area  
           DEFAULT: ch1, ch3 = 75.0; ch0, ch2 use -g  
           OVERRIDES ALLOWED:  $glo < X \leq 100.0$
  
- glo    Explicitly specify the low-end cutoff of peak search area  
           DEFAULT: ch1, ch3 = 25.0; ch0, ch2 use -g  
           OVERRIDES ALLOWED:  $0.0 \leq X < ghi$
  
- m      Number of points to use for median filtering (LO-RES only)  
           DEFAULT: 5

OVERRIDES ALLOWED:  $N > 0$  (must be ODD integer)

- s The number of sigma to require the peak to be above the mean (LO-RES only)  
 DEFAULT: 3.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
- v Level of verbosity  
 DEFAULT: 1  
 OVERRIDES ALLOWED:  $N \geq 0$

**Pipeline calibration files:**

- i Wavsamp file  
 DEFAULT: appropriate *wavsamp.tbl* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n Namelist file  
 DEFAULT: appropriate *ridge.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- p Input profile file (IPAC ASCII table file)  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o Output ridge file (IPAC table file) (contains x,y position of the peak for each order and wavelength)  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.27 rowdroop Module

This module corrects for droop per row.

The module is used in the following pipelines: BCD

### Constant values:

- b     Input BMASK file (FITS)  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user's BMASK file
  
- c     Input CMASK file (FITS).  
        DEFAULT: (none)  
        OVERRIDES ALLOWED: user's CMASK file
  
- fb    BMASK fatal bitmask  
        DEFAULT: 0  
        OVERRIDES ALLOWED: integer bit mask
  
- fc    CMASK fatal bitmask  
        DEFAULT: 0  
        OVERRIDES ALLOWED: integer bit mask
  
- fd    DMASK fatal bitmask  
        DEFAULT: 0  
        OVERRIDES ALLOWED: integer bit mask
  
- fp    PMASK fatal bitmask  
        DEFAULT: 0  
        OVERRIDES ALLOWED: integer bit mask
  
- r1    Row droop coupling constant for read-out channel 1  
        DEFAULT: ch0 = 4.5E-5; others = 0.0  
        OVERRIDES ALLOWED:  $X \geq 0.0$
  
- r2    Row droop coupling constant for read-out channel 2  
        DEFAULT: ch0 = 4.5E-5; others = 0.0  
        OVERRIDES ALLOWED:  $X \geq 0.0$

- r3 Row droop coupling constant for read-out channel 3  
 DEFAULT:  $ch0 = 4.5E-5$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- r4 Row droop coupling constant for read-out channel 4  
 DEFAULT:  $ch0 = 4.5E-5$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- ru Output uncertainty in the amount of row droop. File (FITS)  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name for output file
  
- u1 Row droop coupling constant uncertainty for read-out channel 1  
 DEFAULT:  $ch0 = 6.8E-6$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- u2 Row droop coupling constant uncertainty for read-out channel 2  
 DEFAULT:  $ch0 = 6.8E-6$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- u3 Row droop coupling constant uncertainty for read-out channel 3  
 DEFAULT:  $ch0 = 6.8E-6$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- u4 Row droop coupling constant uncertainty for read-out channel 4  
 DEFAULT:  $ch0 = 6.8E-6$ ; others = 0.0  
 OVERRIDES ALLOWED:  $X \geq 0.0$
  
- v Flag for verbose mode. Include in the command line, without argument  
 DEFAULT: no  
 OVERRIDES ALLOWED: use minus (-) for verbose

### Pipeline calibration files:

- p Input PMASK file (FITS)  
 DEFAULT: appropriate *pmask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

### Pipeline namelist files:

- n Namelist file

DEFAULT: appropriate *rowdroop.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

#### Pipeline input datafiles:

- id     Input FLUX file (FITS)  
        [pipeline datafile --- override not allowed]
  
- iu     Input UNC file (FITS)  
        [pipeline datafile --- override not allowed]
  
- md     Input saturation-corrected file (FITS) Amount of row droop is computed from this  
        file, and is then subtracted from main input file.  
        [pipeline datafile --- override not allowed]
  
- mu     Input uncertainty for saturation-corrected file (FITS)  
        [pipeline datafile --- override not allowed]

#### Pipeline output datafiles:

- od     Output FLUX file (FITS)  
        [pipeline datafile --- override not allowed]
  
- ou     Output UNC file (FITS)  
        [pipeline datafile --- override not allowed]

#### Pipeline datafiles updated:

- d     Input DMASK file (FITS)  
        [pipeline datafile --- override not allowed]

## 4.28 slope\_finder Module

This module computes slope estimates of ramps.

The module is used in the following pipelines: BCD

#### Constant values:



- df0 DMASK fatal bitmask, for samples that are good, but where delta from previous sample is bad  
 DEFAULT: = 512 (bit 9)  
 OVERRIDES ALLOWED:  $N > 0$  bitmask value
- df1 DMASK fatal bitmask  
 DEFAULT: = 30728 (bits 3,11,12,13,14)  
 OVERRIDES ALLOWED:  $N > 0$  bitmask value
- dfX DMASK fatal bitmask for radhit samples  
 DEFAULT: = 512 (bit 9)  
 OVERRIDES ALLOWED:  $N > 0$  bitmask value
- gain Gain (e-/DN)  
 DEFAULT: 4.6  
 OVERRIDES ALLOWED:  $X \geq 0.0$
- m Mapping of bits from input DMASK to output BMASK. (e.g. 3:2+9:3+12:4+6:6+13:10+14:11 means DMASK bit 3 set yields BMASK bit 2 set; DMASK bit 9 yields BMASK bit 3, etc)  
 DEFAULT: 3:2+9:3+12:4+6:6+13:10+14:11  
 OVERRIDES ALLOWED: similar character string
- mr Minimum number of samples in a ramp or sub-ramp  
 DEFAULT: 2  
 OVERRIDES ALLOWED:  $N \geq 0$
- o2\_dual\_flux Output 2-plane file (FITS) with mean pair-wise slopes before and after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o2\_dual\_unc Output 2-plane file (FITS) with mean pair-wise slope uncertainties before and after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o2\_flux Output file (FITS) with mean pair-wise slopes after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file

- o2\_pre\_flux      Output file (FITS) with mean pair-wise slopes before outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o2\_pre\_unc      Output file (FITS) with mean pair-wise slope uncertainties before outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o2\_unc          Output file (FITS) with mean pair-wise slope uncertainties after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o\_dual\_flux      Output 2-plane file (FITS) with linear fit slopes before and after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o\_dual\_unc      Output 2-plane file (FITS) with linear fit slope uncertainties before and after outlier rejection. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o\_info\_outlier   Output file (FITS) with number of sample pairs or deltas: Plane 1 is before outlier rejection; Plane 2 is after 1 Outlier-rejection iteration; Plane 3 is after 2 iterations; etc. Value set to -1 when no outliers found. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o\_info\_radhit    Output file (FITS) with radhit and slope information: Plane 1 is size of delta at the radhit; Plane 2 is slope before radhit; Plane 3 is slope after radhit; Plane 4 is number of radhits in ramp. Use for debug purposes.  
 DEFAULT: (none)  
 OVERRIDES ALLOWED: name of user file
- o\_pre\_flux      Output file (FITS) with linear fit slopes before outlier rejection. Use for debug purposes.

- DEFAULT: (none)  
OVERRIDES ALLOWED: name of user file
- o\_pre\_unc      Output file (FITS) with linear fit slope uncertainties before outlier rejection. Use for debug purposes.  
DEFAULT: (none)  
OVERRIDES ALLOWED: name of user file
- pf              PMASK fatal bitmask  
DEFAULT: 32640 (bits 7,8,9,10,11,12,13,14)  
OVERRIDES ALLOWED:  $N > 0$  bitmask value
- radhit\_maxdel    Maximum number of samples to delete after a radhit  
DEFAULT: 16 (meaning all samples after radhit deleted)  
OVERRIDES ALLOWED:  $N \geq 0$
- radhit\_thresh    Maximum slope (e-/sec) for deleting samples after a radhit  
DEFAULT: 500.0 (samples after radhit are deleted only for faint pixels)  
OVERRIDES ALLOWED:  $X > 0.0$
- rej\_iter        Maximum number of outlier rejection iterations. Pair-wise slopes are averaged, and those differing from the mean by more than a factor of the standard deviation (see below) are rejected in one iteration.  
DEFAULT: 1  
OVERRIDES ALLOWED:  $N \geq 0$
- rej\_min         Minimum number of deltas or pair-wise sample differences, to perform outlier rejection iteration.  
DEFAULT: 2  
OVERRIDES ALLOWED:  $N \geq 0$
- rej\_nsig        Factor, in units of standard deviation of slope, for rejecting a pair-wise slope during slope-averaging and outlier rejection iteration.  
DEFAULT: 2.0  
OVERRIDES ALLOWED:  $X > 0.0$
- sat\_pct         Percent threshold of saturated pixels in either peakup array to reject entire plane (ch0 only)  
DEFAULT: 105.0 (entire planes are never rejected for this reason)  
OVERRIDES ALLOWED:  $X > 0.0$

- skip\_minramp    Minimum ramp size to skip samples at the start of a ramp  
                   DEFAULT: 9 (samples skipped at start only for 16 sample ramps)  
                   OVERRIDES ALLOWED:  $N \geq 0$
  
- skip\_n            Number of samples to skip at the start of a ramp  
                   DEFAULT: 1  
                   OVERRIDES ALLOWED:  $N \geq 0$
  
- t                 Output slope renormalization divisor (integration time in sec.)  
                   DEFAULT: FITS keywords GRPTIME + RAMPTIME  
                   OVERRIDES ALLOWED:  $X > 0.0$
  
- v                 Level of verbose output: 0 = No output; 1 = minimal; 2 = nominal; 3 =  
                   Print outlier info.; 4 = Print slopes before and after radhits; 5 = Print  
                   coordinates of radhit samples  
                   DEFAULT: 2  
                   OVERRIDES ALLOWED:  $0 \leq N \leq 5$

**Pipeline calibration files:**

- ip                Input PMASK file (FITS)  
                   DEFAULT: appropriate *pmask.fits* file in *../cal/*  
                   OVERRIDE ALLOWED: name of user's calibration file

**Pipeline namelist files:**

- n                Namelist file  
                   DEFAULT: appropriate *slope\_finder.nl* file in *../cdf/*  
                   OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i                Input FLUX file (FITS)  
                   [pipeline datafile --- override not allowed]
  
- id               Input DMASK file (FITS)  
                   [pipeline datafile --- override not allowed]
  
- iu               Input UNC file (FITS)  
                   [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o\_flux     Output FLUX file (FITS)  
            [pipeline datafile --- override not allowed]
- o\_unc     Output UNC file (FITS)  
            [pipeline datafile --- override not allowed]
- ob         Output BMASK file (FITS)  
            [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.29 slremov Module

This module removes stray light.

The module is used in the following pipelines: BCD

**Constant values:**

- c         Input CMASK file (FITS)  
            DEFAULT: (none)  
            OVERRIDES ALLOWED: user filename
- d         Input DMASK file (FITS)  
            DEFAULT: (none)  
            OVERRIDES ALLOWED: user filename
- e1        Output UNC file (FITS)  
            DEFAULT: (none)  
            OVERRIDES ALLOWED: user filename
- e2        Output UNC file (FITS) not corrected for stray-light.  
            DEFAULT: (none)  
            OVERRIDES ALLOWED: user filename

- fb BMASK fatal bitmask  
DEFAULT: 28672 (bits 12,13,14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fc CMASK fatal bitmask  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fd DMASK fatal bitmask  
DEFAULT: 0  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- fp PMASK fatal bitmask  
DEFAULT: 18304 (bits 7,8,9,10,14)  
OVERRIDES ALLOWED:  $N \geq 0$  bitmask value
- i2 Input UNC file (FITS)  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
- o2 Output file (FITS) not corrected for stray-light  
DEFAULT: (none)  
OVERRIDES ALLOWED: user filename
- s Critical signal-to-noise ratio to qualify a model fit  
DEFAULT: 0.0 (not used)  
OVERRIDES ALLOWED: X
- t Flag indicating no-pedestal-subtraction mode if = 1  
DEFAULT: 1  
OVERRIDES ALLOWED: 0 or 1
- u Column number separating peak-up arrays and spectral orders  
DEFAULT: 84  
OVERRIDES ALLOWED: N
- v Flag for verbose mode  
DEFAULT: (not verbose)  
OVERRIDES ALLOWED: "-" (minus) for verbose
- x Column number of the geometric center of Lmask regions

DEFAULT: 60  
 OVERRIDES ALLOWED: N

### Pipeline calibration files:

- a Input table file containing stray light decay constants.  
 DEFAULT: appropriate *slt\_coeffs.tbl* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file
- l Input Lmask file (FITS) Defines SL regions between orders where stray light correction is measured.  
 DEFAULT: appropriate *lmask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file
- p Input PMASK file (FITS)  
 DEFAULT: appropriate *pmask.fits* file in *../cal/*  
 OVERRIDE ALLOWED: name of user's calibration file

### Pipeline namelist files:

- n Namelist file  
 DEFAULT: appropriate *slremov.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

### Pipeline input datafiles:

- i1 Input FLUX file (FITS)  
 [pipeline datafile --- override not allowed]

### Pipeline output datafiles:

- o1 Output FLUX file (FITS)  
 [pipeline datafile --- override not allowed]

### Pipeline datafiles updated:

- b Input BMASK file (FITS)  
 [pipeline datafile --- override not allowed]

### 4.30 snest\_irs Module

This module will compute uncertainty file.

The module is used in the following pipelines: BCD

#### Constant values:

- a            Output file (FITS) adjusted by adding ramp offsets, unique to each ramp. This calculation is internal and not propagated. Currently not output for CUPID.  
               DEFAULT: (none)  
               OVERRIDES ALLOWED: filename
  
- confusion   Confusion noise, for use in this module only.  
               DEFAULT: 0  
               OVERRIDES ALLOWED: C >= 0.0
  
- d            Input DMASK file (FITS) --- Not used for CUPID.  
               DEFAULT: (none)  
               OVERRIDES ALLOWED: filename
  
- dmask\_fatal Fatal integer bitmask for DMASK --- not used for CUPID  
               DEFAULT: 30728 (bits #3, 11, 12, 13, 14)  
               OVERRIDES ALLOWED: integer bitmask
  
- gain        Gain factor, for noise calculation in this module only (electron/DN)  
               DEFAULT: 4.6  
               OVERRIDES ALLOWED: X >= 0.0
  
- nd         Multiple of "delta" (mean pairwise sample difference) for outlier rejection in a ramp. Internal calculation only, not propagated.  
               DEFAULT: 3.0  
               OVERRIDES ALLOWED: floating point number
  
- readnoise   Read noise, for use in this module only (electron)  
               DEFAULT: ch0 = 40.0, ch1 = 33.0, ch2 = 67.0, ch3 = 55.0  
               OVERRIDES ALLOWED: X > 0.0
  
- v            Verbose mode. Higher number means more detailed STDOUT.



DEFAULT: 1  
 OVERRIDES ALLOWED: integer

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

-n      Namelist file  
 DEFAULT: appropriate *snest\_irs.nl* file in *../cdf/*  
 OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

-i      Input FLUX file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

-o      Output UNC file (FITS)  
 [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

## 4.31 snest\_irs2 Module

This module will compute uncertainty file (updated outlier rejection logic).

The module is used in the following pipelines:    BCD

**Constant values:**

-a                      Output file (FITS) adjusted by adding ramp offsets, unique to each ramp.  
 This calculation is internal and not propagated. Currently not output for  
 CUPID.  
 DEFAULT: (none)

- OVERRIDE ALLOWED: filename
- confusion      Confusion noise, for use in this module only.  
                  DEFAULT: 0  
                  OVERRIDE ALLOWED: C >= 0.0
- dmask\_fatal    Fatal integer bitmask for DMASK --- not used for CUPID  
                  DEFAULT: 30728 (bits #3, 11, 12, 13, 14)  
                  OVERRIDE ALLOWED: integer bitmask
- dmask\_radhit   Bit used to flag radhit bit in DMASK  
                  DEFAULT: 512 (bit #9)  
                  OVERRIDE ALLOWED: integer bitmask
- gain           Gain factor, for noise calculation in this module only (electron/DN)  
                  DEFAULT: 4.6  
                  OVERRIDE ALLOWED: X >= 0.0
- readnoise      Read noise, for use in this module only (electron)  
                  DEFAULT: ch0=40.0, ch1=33.0, ch2=67.0, ch3=55.0  
                  OVERRIDE ALLOWED: X > 0.0
- v              Verbose mode. Higher number means more detailed STDOUT.  
                  DEFAULT: 1  
                  OVERRIDE ALLOWED: integer

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

- n              Namelist file  
                  DEFAULT: appropriate snest\_irs2.nl file in ../cdf/  
                  OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

- i              Input FLUX file (FITS)  
                  [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o            Output UNC file (FITS)  
              [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

- d            Input DMASK file (FITS) --- Not used for CUPID.  
              [pipeline datafile --- override not allowed]

## 4.32 tbl2fits Module

This module creates a FITS binary table from an ASCII IPAC table.

The module is used in the following pipelines: BCDX; COADDX; BKSUBX

**Constant values:**

- v            Level of printed messages  
              DEFAULT: 1  
              OVERRIDES ALLOWED: N >= 0

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

(none)

**Pipeline input datafiles:**

- i            Input ASCII table  
              [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

- o            Output FITS table  
              [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)

**4.33 velocity Module**

This module adds velocity header keywords.

The module is used in the following pipelines: BCDACQ; BCD

**Constant values:**

(none)

**Pipeline calibration files:**

(none)

**Pipeline namelist files:**

-t      velocity table  
           DEFAULT: appropriate *velocity.tbl* file in *../cdf/*  
           OVERRIDE ALLOWED: name of user's namelist file

**Pipeline input datafiles:**

-i      Input datafile  
           [pipeline datafile --- override not allowed]

**Pipeline output datafiles:**

-o      Output datafile  
           [pipeline datafile --- override not allowed]

**Pipeline datafiles updated:**

(none)