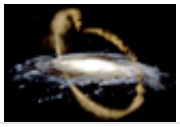

Jump:

PHOTRED - Photometric pipeline manual

by David Nidever Last Updated April 2008

Basic Explanation

PHOTRED is a photometric pipeline intended to produce final, calibrated, PSF photometry (with accurate coordinates) for data taken from any imager. You need final, flat images (i.e. overscan, trim, bias, domeflat, skyflat) already in order to use it. The IRAF CCDRED and MSCRED packages or Armin Rest's SuperMacho pipeline can be used for this. If you want calibrated photometry you need to supply a photometric transformation file.

Other useful manuals:
Nidever Mosaic Reduction Cookbook v2
Rachael's MOSAIC cookbook
Rachael's ALLFRAME cookbook
The NOAO Deep MOSAIC Reduction Notes
IRAF mscred help notes mscguide (or type "mscguide" at the cl> prompt)
Some more help on IRAF MOSAIC reduction from iraf.net

There is a separate cookbook for the Standard Star Reduction

STDRED - Standard Star Pipeline

There is a separate pipeline for the standard star reduction called STDRED. Run this first to get the photometric transformation equations.

Installation Instructions

1. Download the PHOTRED IDL programs

Download the PHOTRED IDL programs tar file (last updated 06/02/08). Copy this to your IDL directory (most likely ~/idl/) and unpack it:

```
gunzip photred_idl.tar.gz
tar -xvf photred_idl.tar
```

Let it **overwrite** any older programs by the same name. You **need** the new versions!

You will also need the IDL Astro User's Library. The programs are automatically available on UVa Astronomy. If you don't have the IDL Astro User's Library then you should download the programs from their download site (get "astron.tar.gz").

There can be a problems if you have older copies of the IDL Astro User's programs in your IDL directory or programs with the same name. I've included a program called "checkidlastro.sh" in the photred_idl.tar file that will print out the names of programs in your ~/idl/ directory (and subdirectories) that have the same name as programs in the IDL Astro User's Library (run it by typing "./checkidlastro.sh" in your ~/idl/ directory; it needs the file "idlastro.lst" which is also included). If it finds anything I would erase the offending program or rename it (e.g. proname.pro -> proname.pro.bak).

2. Download the PHOTRED scripts

Download the PHOTRED scripts tar file (last updated 06/02/08). Make a directory where these scripts will reside (i.e. ~/photred/), and copy the tar file to the directory and unpack it:

```
gunzip photred_scripts.tar.gz
tar -xvf photred_scripts.tar
```

There are two fortran codes (lstfilter.f and makemag.f) that need to be compiled. The tar file includes compiled versions that were compiled on a Linux system. If you are planning to run PHOTRED on a Sun machine or are having problems with the programs recompile them:

```
g77 lstfilter.f -o lstfilter
f95 makemag.f -o makemag
```

3. Make sure IDL/IRAF are available

PHOTRED needs IDL and IRAF run. If you don't have IDL then you might consider buying a license from ITT Visual Information Solutions. Student licenses are available and full licenses have come down in price. If these are too expensive, then you might consider installing the free version of IDL, the GNU Data Language. I have not tested PHOTRED on GDL, but I think GDL should have all of the functionality needed to run PHOTRED. However, some PHOTRED programs might need to be tweaked to work with GDL.

You can also download the IDL Virtual Machine for free and run IDL "sav"

files. I have made IDL sav files for the PHOTRED pipeline so they can be run with the IDL Virtual Machine. Download the tar file (last updated 05/12/08) and put them in your ~/idl/ directory. To run a program type "idl -vm=progname.sav".

IRAF is freely downloadable from iraf.net.

4. Make sure DAOPHOT/ALLFRAME is installed

Make sure that DAOPHOT/ALLSTAR/ALLFRAME and SExtractor are installed. Type:

```
which daophot
which allstar
which daomaster
which daogrow
which allframe
which sex
```

They should all return the name of the program. If you get an error then you will need to install that program.

Currently daophot and allstar are hardwired to /net/astro/bin/ in the daophot.sh and getpsf.sh scripts. If this is not where your version of daophot/allstar are located then change those lines or comment them out.

The newest version of ALLFRAME had an error in it that caused it to print out zero's for chi and sharp. The fixed version on the UVa Astro machines is called "/net/halo/bin/allframe.2004.fixed". This is currently hardcoded in photred_allframe.pro and allframe.pro. Make sure that this program exists.

5. Schlegel Maps

PHOTRED uses the Schlegel maps to deredden the photometry. The FITS files can be downloaded from here. On the UVa Astro machines the files are located here: /net/grass/catalogs/reddening/

You need to update your ".cshrc" file to set the Unix environment variable "DUST_DIR" to the directory where the Schlegel dust maps are located (actually one directory up in the directory tree). At UVa Astro this is the line you should add to your ".cshrc" file:

```
setenv DUST_DIR /net/grass/catalogs/reddening/
```

Now test that it works (you must already have installed the PHOTRED IDL files):

```
mycomputer % idl
IDL>print,dust_getval(10,10)
      0.472163
```

If you get an error here, then there is a problem. Check that all the files and required programs are there.

6. Setup Your IRAF Login File

PHOTRED calls some IRAF programs. In order for this to work you need to edit your IRAF "login.cl" file so that it doesn't print out any messages to the screen. Comment out the 9 lines following "# Set the terminal type." near the top of the file, and possibly also the 4 lines following "# Delete any old MTIO lock (magtape position) files." (these give problems on the Pleione cluster). If that still doesn't work, create a blank file called ".hushiraf" in your iraf directory.

```
touch .hushiraf
```

Start IRAF by typing "cl" in your IRAF directory and see what happens. Nothing should be written to the screen except "cl>" or maybe "ecl>". If it's still printing other things to the screen, then you'll need to comment out more lines from the "login.cl" file.

Running Instructions

1. Data

Start by putting all the final flat frames in their nights directory. Process them with IRAF's CCDRED, MSCRED or Armin Rest's SuperMacho pipeline to get final flat images. PHOTRED only runs on one night's worth of data. If you have 5 nights of data then you will need to run PHOTRED 5 times (they can be running simultaneously in separate directories).

FIX BAD PIXELS!!!. Make sure to fix any bad pixels or columns in the images because otherwise they might get detected as "sources" and mess up WCS, DAOPHOT, MATCH, and ALLFRAME.

2. Transformation Equations

In order to do calibration step (CALIB) PHOTRED needs the photometry transformation equations which means doing the standard star reduction. There is a separate pipeline for the standard star reduction called STDRED that you should run first to get the transformation equations for the entire run. You can run all of the PHOTRED stages before CALIB (which include the cpu intensive DAOPHOT and ALLFRAME stages) without the transformation equations, and then do the final stages once you have transformation equations.

The transformation file needs to be in this format. Each filter gets two lines. The first line should contain: filter, color, nightly zero-point term, airmass term, color term, airmass*color term, color^2 term. The second line gives the uncertainties in the five terms. Normally the last two terms (airmass*color and color^2 are 0.0000).

n1.trans

```
M    M-T  -0.9990    0.1402     -0.1345    0.0000   0.0000
          1.094E-02  5.037E-03  2.010E-03  0.0000   0.0000
T    M-T  -0.0061    0.0489     0.0266     0.0000   0.0000
          6.782E-03  3.387E-03  1.374E-03  0.0000   0.0000
D    M-D  1.3251     0.1403     -0.0147    0.0000   0.0000
          1.001E-02  5.472E-03  2.653E-02  0.0000   0.0000
```

3. Setup File

PHOTRED needs a "photred.setup" file to run. This file specifies a few important parameters. Here's an example of a "photred.setup" file. The various parameters are described below.

```
##### REQUIRED #####
scriptsdir  /net/home/dln5q/daophot/
irafdir     /net/home/dln5q/iraf/
telescope   Blanco
instrument  MOSAIC
observatory CTIO
nmulti      1
filtref     M
trans       blanco.trans
##### OPTIONAL #####
keepmef     0
redo        0
#skipwcs     0
#wcsup      N
#wcsleft    E
#pixscale   0.50
#wcsrefname USNO-B1
#searchdist 60
#wcsrmslim  1.0
#hyperthread 1
psfcomsrc   1
#mchmaxshift 10.0
finditer    2
#alfdetprog  sextractor
#ddo51radoffset  1
todered     M,T,D,M-T,M-D
#toextadd    M,T,D,M-T,M-D
keepinstr   1
avgmag      1
avgonlymag  0
#cmd2cdaxes  M,M-T,M-D
##### STAGES #####
rename
split
wcs
daophot
```

```
match
allframe
apcor
astrom
calib
combine
deredden
save
html
```

scriptsdir	The absolute path to the directory that contains the PHOTRED scripts (i.e. daophot.sh, etc.)
irafdir	The absolute path to your IRAF directory (that contains your login.cl file)
telescope	The name of the telescope (e.g. Blanco, Swope)
instrument	The name of the instrument (e.g. MOSAIC)
observatory	(OPTIONAL) The name of the observatory. This is needed if the header does not contain the AIRMASS and it needs to be calculated from the date, ra/dec and observatory location.
nmulti	The number of processors PHOTRED should use for the DAOPHOT and ALLFRAME stages (only relevant if on the Pleione cluster).
filtref	The shortname of the filter (specified in the "filters" file) to be used as the reference frame (e.g. the M frame). If there are multiple observations in this filter then the longest exposure in this filter will be used.
trans	The name of the file that contains the photometric transformation equations.
keepmef	OPTIONAL. Multi-extension files (MEF) are split by PHOTRED. Do you want PHOTRED to keep the MEF files: YES=1, NO=0 (i.e. erase them).
redo	OPTIONAL. PHOTRED will NOT reprocess files that have already been processed unless "redo" is set. This can also be set as a keyword on the command line (i.e. IDL>photred,/redo).
skipwcs	OPTIONAL. Set this if your images already have correct WCS in their headers and you don't want the WCS to be refit in the WCS stage.
wcsup	OPTIONAL. What cardinal direction (i.e. N, S, E or W) is "up" in the image? This is only used for non-standard setups.
wcsleft	OPTIONAL. What cardinal direction (i.e. N, S, E or W) is "left" in the image? This is only used for non-standard

	setups.
pixscale	The plate scale in arcseconds/pixel. This is ONLY used for non-"standard" imagers (i.e. not MOSAIC, IMACS, LBC or Swope) where the pixel scale cannot be determined from the image headers.
wcsrefname	OPTIONAL. The name of the WCS reference catalog to use. The two options are 'USNO-B1' and '2MASS-PSC'. USNO-B1 is the default. The astrometric accuracy of the 2MASS catalog is better (~0.170 arcsec) than USNO-B1 (~0.270 arcsec), but it does not go as deep (R~18) as USNO-B1 (R~20). So if you have deep images then **definitely** use USNO-B1, but if you have moderately deep images then 2MASS-PSC is probably better (and faster).
searchdist	OPTIONAL. This sets the search distance (in arcmin) for WCS fitting (PHOTRED_WCS). Normally this is not needed. The default is 2*image size > 60 arcmin (i.e. whichever is greater). This is normally sufficient. If the WCS isn't fitting correctly then try setting "searchdist" to a larger value.
wcsrmslim	This is the maximum RMS (in arcseconds) allowed for an acceptable WCS fit. The default is 1.0 arcseconds. Normally the RMS values are ~0.2-0.3 arcseconds.
hyperthread	This allows multiple jobs to be running (daophot and allframe only) on a computer (such as halo or stream) that has multiple processors. It's similar to running it on a cluster.
psfcomsrc	If this is set to 1 then only sources detected in other frames of the same field are used as PSF stars. This makes sure that your PSF stars are not contaminated by cosmic rays or other junk. **HIGHLY RECOMMENDED**.
mchmaxshift	OPTIONAL. This sets a maximum constraint on the X/Y shifts found in the MATCH stage. **WARNING**, only use this if you **ABSOLUTELY** known that your frames are well aligned already.
finditer	The number of times to iteratively find sources in ALLFRAME (allfprep). The default is 2.
alfdetprog	OPTIONAL. The program to use for source detection in the ALLFRAME stage (allfprep). The options are "sextractor" and "daophot". The default is "sextractor". SExtractor is generally better at finding faint sources and

allstarprog	returns a stellaricity probability value which is very useful. HOWEVER, SExtractor fails in VERY crowded regions. It's best to use DAOPHOT for very crowded images.
ddo51radoffset	OPTIONAL. There is a photometric offset in the DDO51 filter that depends on the radial distance from the center of the field. Currently this is only observed in the CTIO+MOSAIC data. Setting this parameter will remove this offset (done in CALIB). If you use this make sure to also use it in STDRED.
keepinstr	OPTIONAL. CALIB should keep the instrumental magnitudes in the final output file.
avgmag	OPTIONAL. CALIB should calculate average magnitudes in filters that were observed multiple times. The individual magnitudes are also kept.
avgonlymag	OPTIONAL. Same as "avgmag" but only keeps the average magnitudes.
todered	OPTIONAL. The magnitudes and colors the DEREDDEN stage should deredden. The short names of the filters and colors should be used (i.e. M, T, M-T). The dereddened magnitudes and colors will have the same names but with a "0" (zero) after it (i.e. M0 for M). The dash is removed for the color names.
toextadd	OPTIONAL. The extinction and reddening values to add. The short names of the filters and colors should be used (i.e. M, T, M-T). The extinctions will have the same name as the magnitude but with an "A" at the beginning (i.e. AM for M), and the reddening values will have the same name as the color names but with the dash removed and an "E" at the beginning (i.e. EMT for M-T).
cmd2cdaxes	The magnitudes and colors to use for the CMD and 2CD plots in PHOTRED_HTML.PRO. It should be in this format: MAG, MAG1-MAG2, MAG3-MAG4, i.e. M,M-T,M-D. For this example the CMD would be M vs. M-T and the 2CD would be M-D vs. M-T. The CMD and 2CD will be connected (CMD on top, 2CD on bottom) and will share the x-axis which be the first color. The magnitude will also be used for other plots (i.e. error vs. magnitude, chi vs. magnitude, etc).

Then add all the stage names that you want to process from the following list: rename, split, wcs, daophot, match, allframe, apcor, calib, astrom,

combine, deredden, and save

The number of ALLFRAME iterations can be set in the "allframe.opt" file, the MA parameter. The default is 50.

4. Make sure your Imager is in the "imagers" file

There is an "imagers" file in your scripts directory. If the imager you are using is not in the list then add it at the end. You need the telescope name, instrument names, observaotry name (as found in the OBSERVATORY.PRO IDL program), the number of amplifiers, and the separator character (only necessary for multi-amplifier imagers). The TELESCOPE and INSTRUMENT names in your "photred.setup" file needs to match the ones in the "imagers" file.

```
# TELESCOPE   INSTRUMENT  OBSERVATORY  NAMPS  SEPARATOR
blanco        mosaic      CTIO         16     _
mayall        mosaic      KPNO         8      _
baade         imacs       LCO          8      c
lbt           lbc         MGIO         4      _
swope         ccd         LCO          1
```

The case is not important. The separator character is used to separate the amplifier number from the main frame name for multi-amplifier images (i.e. "obj1034_1.fits" is the filename of the first amplifier FITS file of the "obj1034" image). The separator character is almost always the underscore "_". The only exception (for now) is IMACS which uses a "c". If your images are in the multi-extension format (MEF) then they will be split up into amplifier files in the SPLIT stage of PHOTRED with the IRAF task MSCSPLIT which uses the underscore as the separator character.

5. Check "filters" file

PHOTRED uses short names for filters, and these are stored in the "filters" file. One is provided in the scripts tar file. This is what it looks like:

```
'M Washington c6007'    M
'M Washington k1007'    M
'M'                     M
'I c6028'               T
'I Nearly-Mould k1005'  T
'T'                     T
'T2'                    T
'DDO 51 c6008'          D
'D51 DDO c6008'         D
'D51 DDO 51 c6008'      D
'D51 DDO 51 k1008'      D
'D'                     D
'D51'                   D
'DDO51'                 D
'DDO-51'                D
'DDO_51'                D
```

```
'DDO 51'                D
'51'                    D
'T1'                    T1
'C'                     C
'B Harris c6002'        B
'B-BESSEL'              B
'B'                     B
'V'                     V
'R-BESSEL'              R
'R'                     R
```

The first column is the text that is found in the FILTER keyword in the FITS header. The second column is the shortname. These can be repeated because different observatories have different names for the same filter. These shortname will be used in the transformation file and the "extinction" file.

Make sure that your filters appears in the list (leading/trailing spaces are not important. If they don't then PHOTRED will make a new entry in the "filters" file for your filter and make a new shortname. This is **NOT** desirable because the shortname probaby won't match what you have in your transformation file or in the "extinction" file.

Here's a way to double-check if your filter is in the "filters" file. Copy the "filters" file from your scriptsdir to the directory where your data is. Then run PHOTRED_GETFILTER on one FITS file per filter. Change the shortname to a single capital letter if possible.

```
IDL>print,photred_getfilter('ccd1001.fits')
D
```

PHOTRED_GETFILTER will print out the shortname of the filter. It will tell you if it didn't find the filter in the "filters" file and what new entry it added. It's preferable to have the most up to date "filters" file in the scriptsdir directory so that it can be used for the next run. PHOTRED uses the "filters" file in the main directory (where "photred.setup" and the data are located) if there is one, otherwise it will copy the "filters" file from the scriptsdir directory.

6. Check "extinction" file

If you want your photometry dereddened then PHOTRED needs to know what extinction value to use for each filter. This is stored in the "extinction" file. The first column has the filter shortname and the second column A(filter)/E(B-V) for that filter. The reddenings for colors can be derived from these values, so no entries for colors are needed.

```
# Filter    A(filter)/E(B-V)
M           3.43
T           1.83
```

```
D            3.37
```

Make sure your filter and its appropriate extinction value appears in this file. Try to update the "extinction" As with the "filters" file PHOTRED uses the "extinction" file in the data directory if there is one, otherwise it will copy the "extinction" file from the scriptsdir directory.

7. Run PHOTRED_RENAME

Okay, now you're ready to PHOTRED. PHOTRED has 13 stages and there is a separate IDL program for each stage (e.g. PHOTRED_DAOPHOT). Each stage can be run on it's own. The PHOTRED program is actually just a giant wrapper for the 13 stages (and the ones specified in the "photred.setup" file) run in the correct order. If you ever want to just run ONE stage then it's probably easier to just run that stage at the command line instead of editing the "photred.setup" file and running photred.

It's preferable to run the very first stage, PHOTRED_RENAME, by itself from the command line and double-check the results. This stage prepends a string to each FITS filename that indicates what field it is (i.e. obj1101.fits -> F1-obj1101.fits), and it creates a "fields" file that has the actual field name for each field "shortname". This is information that PHOTRED_MATCH needs to match up the various ALS files for each field/chip group. It's **very** important that the files are renamed **properly**. So check closely the text that is output. PHOTRED_RENAME uses the first "word" in the OBJECT FITS keyword as the field name. Any zero/flat/twilight/sky/pointing/focus/test frames and standard star frames (SA98, SA110, SA114 and NGC3680) are moved to a "calib/" directory.

It's a good idea to run PHOTRED_RENAME in "testing" mode, so you can see how it will rename files without it actually doing anything. Just type "photred_rename,/testing". The first thing PHOTRED_RENAME does is check that all of the FITS header parameters can be found (readnoise, gain, ut-time, filter, exposure time, ra, dec, date, and airmass). If any of these cannot be found then it will spit out errors. Watch for these! Check that the actual field names (not the "shortnames") in "fields" are correct. This information is not used until PHOTRED_SAVE renames the final photometry files. **Make sure to change the "fields" file ONLY AFTER running PHOTRED_RENAME in the NORMAL mode**. In testing mode PHOTRED_RENAME will write the field information to "fields.testing" instead of "fields".

If the files were not renamed properly, rename them by hand and update the "fields" file. Also, update the "logs/RENAME.outlist" file. It might be

easiest to delete the "logs/RENAME.outlist" file and remake it by typing "ls F*.fits > logs/RENAME.outlist".

8. Run PHOTRED

Now run PHOTRED. Start idl, type "photred" and you're off!!

You can also run PHOTRED in the background. Make a batch file called "photred.batch" that has a single line with "photred". You can then run this batch file with idlbatch or idlbatchn (a "niced" version). The "idlbatch" programs will run the IDL job in the background and create a log file called "photred.batch.log". Make sure to put the "idlbatch" programs in your ~/bin/ directory and that ~/bin/ is also in your path (check your .cshrc file).

Double check (in the logfile) that the WCS is being fit correctly. The Total RMS should be around 0.2-0.4 arcsec. If it's not working properly check that the images have RA/DEC or CRVAL1/CRVAL2 in them and that the pixel scale is correct. If it still isn't working then you can try setting "searchdist" larger (the default is 2*image size > 60 arcmin). You can also set the maximum acceptable RMS with "wcsrmslim" in the "photred.setup" file.

You can use PHOTRED_SUMMARY (run it in the same directory) to get an update on the progress of PHOTRED. Most of the stages update their respective lists and so the number of files in the inlist/outlist/success/failure lists will tell you what's going on. However, the DAOPHOT and ALLFRAME stages update their lists after all files have finished, so for these two stages PHOTRED_SUMMARY checks to see which files have the expected output (i.e. .als or .mag files). This information is listed in the "COMPLETED" column. If you are redoing some files then these numbers won't be accurate.

Adding new imagers

PHOTRED currently works on data from KPNO+MOSAIC, CTIO+MOSAIC (Blanco), Swope CCD, IMACS, and LBT Camera (LBC). New imagers can be added, but there are a couple of things that need to be double-checked:

- Make sure to add your imager to the "imagers" file in the scripts directory.
- Make sure that PHOTRED_GETUTTIME.PRO, PHOTRED_GETFILTER, PHOTRED_GETEXPTIME.PRO, PHOTRED_GETGAIN.PRO, PHOTRED_GETRDNOISE.PRO, PHOTRED_GETDATE.PRO and PHOTRED_GETAIRMASS.PRO return the proper values. PHOTRED_RENAME.PRO checks that all of the appropriate keywords

are in the FITS headers. Run PHOTRED_RENAME in /testing mode and see if you get any errors. If there are errors then the above programs might need to be modified to deal with the new data type.
- Add the necessary filters to the "filters" file
- Make sure that PHOTRED_WCS.PRO can properly process the images. PIXSCALE might need to be specified in the "photred.setup" file.

Basic Explanation

Photred is meant to be run on one night's data at a time. The standard star reduction should already have been done and the transformation equation put in the directory.

The pipeline is split into stages and the files are "shuttled" from stage to stage via lists of files. Each stage has an INLIST and OUTLIST. The INLIST is the list of files to process, and the OUTLIST is the list of files output. Normally the INLIST of files is moved over from the OUTLIST of the previous stage. The INLIST files that are successfully processed are removed from the INLIST file, and are added to the SUCCESS list. INLIST files that are NOT successfully process are **left** in the INLIST file and are added to the FAILURE list.

Each stage has several log files associated with it:
- **INLIST** The list of files to process. These are normally moved over from the OUTLIST of the previous stage.
- **OUTLIST** The files successfully output from the stage. These might be in a different format from the INLIST files.
- **SUCCESS** The files in INLIST that were successfully processed
- **FAILURE** The files in INLIST that were NOT successfully processed
- **LOG** A running log of what the stage has done

The main interface and logistical work of PHOTRED is done in IDL. Most of the heavy processing is done by Peter Stetson's photometric codes DAOPHOT, ALLSTAR, DAOMATCH, DAOMASTER, ALLFRAME and DAOGROW. Some IRAF tasks, such as MSCCMATCH, are also used.

PHOTRED has the built-in capability to run multiple DAOPHOT or ALLFRAME processes at the same time on Pleione (i.e. our beowulf cluster). You have to be logged in to Pleione and be able to access the data in order to take advantage of the multi-plexing capability. The maximum number of processes that will be allowed to be in the PBS queue at any given time is set by the NMULTI parameter in the photred.setup file (NMULTI=8 is a good value to use).

STAGES

RENAME

Basic Explanation

This program renames object fits files so that it includes their field information. For example, ccd1001.fits gets renamed to F1.ccd1001.fits. Any calibration frames (zero, dflat, sflat, etc.) get moved to the "calib/" directory without getting renamed.

Lists

It will create the inlist from all fits files in the directory Outlist will be of all files that aren't zero, dflat, sflat, etc. and were successfully put in a "field". It also creates the "fields" file. Files are renamed: F1.obj1023.fits, F2.obj1045.fits, etc.

INLIST (fits) - Creates it itself from fits files in directory

Single-Chip	Split Multi-chip	Multi-chip (MEF)
zero1001.fits	zero1001_1.fits	zero1001.fits
ccd1012.fits	ccd1012_2.fits	ccd1012.fits
ccd1024.fits	ccd1024c3.fits	ccd1024.fits
ccd1053.fits	ccd1053c5.fits	ccd1053.fits

OUTLIST (fits) - The renamed **object** files

Single-Chip	Split Multi-chip	Multi-chip (MEF)
F1.ccd1012.fits	F1.ccd1012_2.fits	F1.ccd1012.fits
F2.ccd1024.fits	F2.ccd1024c3.fits	F2.ccd1024.fits
F3.ccd1053.fits	F3.ccd1053c5.fits	F3.ccd1053.fits

SPLIT

Basic Explanation

This splits multiple-extension files (MEF) into separate files for each amp/chip. Non-MEF files are not affected.

Lists

All the files in rename.outlist are put in split.inlist. All non-MEF (single chip) files automatically go to split.outlist. All successfully split files (not original MEF files) are put in split.outlist

INLIST (fits) - Copied from rename.outlist

Single-Chip	Split Multi-chip	Multi-chip (MEF)
F1.ccd1012.fits	F1.ccd1012_2.fits	F1.ccd1012.fits
F2.ccd1024.fits	F2.ccd1024c3.fits	F2.ccd1024.fits
F3.ccd1053.fits	F3.ccd1053c5.fits	F3.ccd1053.fits

OUTLIST (fits) - All split files that are split okay, or single-chip files

Single-Chip	Split Multi-chip	Multi-chip (MEF)
F1.ccd1012.fits	F1.ccd1012_2.fits	F1.ccd1012_1.fits, F1.ccd1012_2.fits, ...
F2.ccd1024.fits	F2.ccd1024c3.fits	F2.ccd1024_1.fits, F2.ccd1024_2.fits, ...
F3.ccd1053.fits	F3.ccd1053c5.fits	F3.ccd1053_1.fits, F3.ccd1053_2.fits, ...

From now on the "Split Multi-chip" and "Multi-chip" files will "look" the same, since now the MEF files have been split.

WCS

Basic Explanation

This program gets the correct WCS for images.

Lists

It takes all files from split.outlist and puts them into wcs.inlist. All files that succeeded get put in wcs.outlist.

INLIST (fits) - Moved from split.outlist

Single-Chip	Split Multi-chip	Multi-chip (MEF)
F1.ccd1012.fits	F1.ccd1012_2.fits	F1.ccd1012.fits
F2.ccd1024.fits	F2.ccd1024c3.fits	F2.ccd1024.fits
F3.ccd1053.fits	F3.ccd1053c5.fits	F3.ccd1053.fits

OUTLIST (fits) - All object files that are given a proper wcs.

Single-Chip	Split Multi-chip	Multi-chip (MEF)
F1.ccd1012.fits	F1.ccd1012_2.fits	F1.ccd1012.fits
F2.ccd1024.fits	F2.ccd1024c3.fits	F2.ccd1024.fits
F3.ccd1053.fits	F3.ccd1053c5.fits	F3.ccd1053.fits

DAOPHOT

Basic Explanation

This program runs DAOPHOT on all the images (using Tony's script).

Lists

If split.outlist exists then they are put into daophot.inlist. If split.outlist does NOT exist then the wcs.outlist is taken instead. All fits files that successfully run through daophot get put into daophot.outlist

INLIST (fits) - Moved from split.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.fits	F1.ccd1012_2.fits
F2.ccd1024.fits	F2.ccd1024c3.fits
F3.ccd1053.fits	F3.ccd1053c5.fits

OUTLIST (als) - All files in inlist that are succcessfully processed

Single-Chip	Split Multi-chip
F1.ccd1012.als	F1.ccd1012_2.als
F2.ccd1024.als	F2.ccd1024c3.als
F3.ccd1053.als	F3.ccd1053c5.als

MATCH

Basic Explanation

This program runs DAOMATCH and DAOMASTER on the ALS files which combines the photometry from the various filters.

Lists

It takes all the files from daophot.outlist and puts them into match.inlist. It uses the fields (from the filenames) to figure out which files to together and should be matched. All of the MCH files to in the match.outlist.

INLIST (als) - Moved from daophot.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.als	F1.ccd1012_2.als
F2.ccd1024.als	F2.ccd1024c3.als
F3.ccd1053.als	F3.ccd1053c5.als

OUTLIST (mch) - All files in inlist that were successfully matched (ALL??)

Single-Chip	Split Multi-chip

F1.ccd1012.mch	F1.ccd1012_2.mch
F2.ccd1024.mch	F2.ccd1024c3.mch
F3.ccd1053.mch	F3.ccd1053c5.mch

There won't be as many MCH files in the outlist as ALS files in the inlist. If there are 3 frames per field then there will be 3x as many ALS files as MCH files. The MCH files will have the names of the "reference" frame.

If any of the ALS files don't match then the entire "set" of images fails.

ALLFRAME

Basic Explanation

This program runs ALLFRAME on all of the MCH files. ALLFRAME does PSF fitting on images of all filters/bands similtaneously.

Lists

list of all mch files Takes the list of MCH files from the match.outlist and puts them in allframe.inlist. All fields that succeed, their MAG files get put into allframe.outlist.

INLIST (mch) - Moved from match.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.mch	F1.ccd1012_2.mch
F2.ccd1024.mch	F2.ccd1024c3.mch
F3.ccd1053.mch	F3.ccd1053c5.mch

OUTLIST (mag) - Every MCH file that was processed successfully by allframe and has a MAG file.

Single-Chip	Split Multi-chip
F1.ccd1012.mag	F1.ccd1012_2.mag
F2.ccd1024.mag	F2.ccd1024c3.mag
F3.ccd1053.mag	F3.ccd1053c5.mag

APCOR

Basic Explanation

This programs find the aperture correction for all the files using DAOGROW.

Lists

Takes all of the fits files from daophot.success(!!) and puts them into apcor.inlist. All fits files that have an aperture correction in the final apcor.lst get put into the apcor.outlist.

INLIST (fits) - COPIED from daophot.success

Single-Chip	Split Multi-chip
F1.ccd1012.fits	F1.ccd1012_2.fits
F2.ccd1024.fits	F2.ccd1024c3.fits
F3.ccd1053.fits	F3.ccd1053c5.fits

OUTLIST (fits) - Every FITS file that was successfully given an aperture correction in the final apcor.lst file

Single-Chip	Split Multi-chip
F1.ccd1012.fits	F1.ccd1012_2.fits
F2.ccd1024.fits	F2.ccd1024c3.fits
F3.ccd1053.fits	F3.ccd1053c5.fits

SUCCESS (fits) - Same as outlist.

ASTROMETRY

Basic Explanation

This program gets coordinates for all stars from the WCS in the reference image.

Lists

This takes all of the mag files from ALLFRAME.outlist or mch files from MATCH.outlist. All files that are successfully given coordinates are put into the ASTROM.outlist (with .ast endings). There will be a separate file for each field chip/amp.

INLIST (mag/mch) - Moved from ALLFRAME.outlist or if that does not exist, then from MATCH.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.mag	F1.ccd1012_2.mag
F2.ccd1024.mag	F2.ccd1024c3.mag
F3.ccd1053.mag	F3.ccd1053c5.mag

OUTLIST (ast) - Every MAG/MCH file that was processed successfully

Single-Chip	Split Multi-chip
F1.ccd1012.ast	F1.ccd1012_2.ast
F2.ccd1024.ast	F2.ccd1024c3.ast
F3.ccd1053.ast	F3.ccd1053c5.ast

CALIB

Basic Explanation

This uses the transformation equations to convert the instrumental magnitudes to calibrated magnitudes.

Lists

Get the list of all ast files from ASTROM.outlist. All files that are successfully calibrated are put into the calib.outlist (with .phot endings). There will be a .phot file for each field chip/amp.

INLIST (ast) - Moved from ASTROM.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.ast	F1.ccd1012_2.ast
F2.ccd1024.ast	F2.ccd1024c3.ast
F3.ccd1053.ast	F3.ccd1053c5.ast

OUTLIST (phot) - Every AST file that was successfully calibrated

Single-Chip	Split Multi-chip
F1.ccd1012.phot	F1.ccd1012_2.phot
F2.ccd1024.phot	F2.ccd1024c3.phot
F3.ccd1053.phot	F3.ccd1053c5.phot

COMBINE

Basic Explanation

This combines all the photometry from the various chips/amps for multi-chip data.

Lists

This combines all chips/amps of a multi-chip frame. It takes all the files in CALIB.outlist and puts them into COMBINE.inlist. All files that are

successfully combined are put into the COMBINE.outlist. There will be a separate output file for each field.

INLIST (phot) - Moved from CALIB.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.phot	F1.ccd1012_2.phot
F2.ccd1024.phot	F2.ccd1024c3.phot
F3.ccd1053.phot	F3.ccd1053c5.phot

OUTLIST (cmb) - All of the chips/amps get combined. For single-chip data the PHOT files are just copied over.

Single-Chip	Split Multi-chip
F1.ccd1012.cmb	F1.ccd1012.cmb
F2.ccd1024.cmb	F2.ccd1024.cmb
F3.ccd1053.cmb	F3.ccd1053.cmb

DEREDDEN

Basic Explanation

This program dereddens the magnitudes (and colors specified in the setup file) using the Schlegel maps.

Lists

This takes all the files in COMBINE.outlist and dereddens the magnitudes and colors. All files that are successful get put into DEREDDEN.outlist There will be a separate output file for each field with a .dered ending.

INLIST (ast) - Moved from combine.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.cmb	F1.ccd1012.cmb
F2.ccd1024.cmb	F2.ccd1024.cmb
F3.ccd1053.cmb	F3.ccd1053.cmb

OUTLIST (dered) - All of the files that were successfully dereddened.

Single-Chip	Split Multi-chip
F1.ccd1012.dered	F1.ccd1012.dered
F2.ccd1024.dered	F2.ccd1024.dered
F3.ccd1053.dered	F3.ccd1053.dered

SAVE

Basic Explanation

This renames the final photometry files with the field name.

Lists

Takes all of the files from deredden.outlist and renames them to have the field names with .final extensions. It also saves IDL save files of the final photometry structures.

INLIST (dered) - Moved from deredden.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.dered	F1.ccd1012.dered
F2.ccd1024.dered	F2.ccd1024.dered
F3.ccd1053.dered	F3.ccd1053.dered

OUTLIST (final/dat) - Rename the files with their field names. An IDL save file of the photometry structure is saved to FIELD.dat

Single-Chip	Split Multi-chip
FIELD1.final/dat	FIELD1.final/dat
FIELD2.final/dat	FIELD2.final/dat
FIELD3.final/dat	FIELD3.final/dat

HTML

Basic Explanation

This makes plots and summary HTML files for all the fields output by SAVE. The plots and HTML files will be put in the "html/" directory. The main index page is called "html/index.html"

Lists

Takes all of the files from SAVE.outlist and creates plots and HTML summary pages.

INLIST (dat) - Moved from SAVE.outlist

Single-Chip	Split Multi-chip
F1.ccd1012.dat	F1.ccd1012.dat

F2.ccd1024.dat	F2.ccd1024.dat
F3.ccd1053.dat	F3.ccd1053.dat

OUTLIST NO outlist at the moment.

-- DavidNidever - 20 Feb 2008

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