

CZTI Noise Reduction Processing Document

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Installation :

1. Install the new version of pipeline in your system.
2. If you have the configured ~/.bashrc file for the old pipeline, then
 - Comment the old as1czt variable's path.
 - Add following line to ~/.bashrc file
export as1czt={Path up to the new pipeline folder}/czti_pipeline/czti/
3. Add following Path for Noise_Cleaning to ~/.bashrc file
export CZTNOISECLEAN=<noise_basedir>
export PATH="\$PATH:\${CZTNOISECLEAN}/bin/"
Example:
export CZTNOISECLEAN=/home/cztipoc/noise_codes/
export PATH="\$PATH:\${CZTNOISECLEAN}/bin/"
4. Execute following commands in terminal
source ~/.bashrc
cd \$as1czt
cd ../
./InstallLibs
cd \$as1czt
make
cd scripts
chmod +x cztpipeline
cd \$CZTNOISECLEAN
make

Prerequisite :

1. gcc compiler
2. cfitsio installation

All Threshold files will be available in config directory of noise_code

3. saaThreshold.txt
4. noiseReductionThreshold.txt
5. Det_thresholdlld.txt
6. pix_thresholdlld.txt
7. CALDB badpix file and CALDB lld file

(Path : /data2/czti/public_package/CALDB/data/as1/czti/bcf/)

For orbit data:

8. mkf file path :

/data2/czti/level2/<observationid_of_specific_orbit>/czti/orbit/<orbit_number>/ (.mkf)

9. Event file path :

/data2/czti/level2/<observationid_of_specific_orbit>/czti/orbit/<orbit_number>/modeM0/ (cztM0_level2.evt)

For merge data :

8. mkf file path : /data2/czti/level2/<observationid_of_specific_orbit>/czti/ (.mkf)

9. Event file path : /data2/czti/level2/<observationid_of_specific_orbit>/czti/modeM0/

(cztM0_level2.evt)

1.Data selection :

Input files -

1. MKF file
2. SAA configuration file(saaThreshold.txt)
3. Event file(Output event file of cztpa2energy)

Output files -

SAA removed event file/list of files(if orbit contain 2 SAA then number of output files will be 3 according to SAA position)

Output file name will be _0.evt , _1.evt etc.

How to compile -

```
gcc cztdataselection.c -o cztdataselection -I<path_of_the_cfitsio_include_directory>
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztdataselection.c -o cztdataselection -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
<cztdataselection executable file> mkf_file SAA_CONFIG_FILE event_file
```

Example :

```
cztdataselection AS1A02_174T04_9000000938_06835czt_level2.mkf saaThreshold
AS1A02_174T04_9000000938_06835cztM0_level2.evt
```

2.Noisy Pixel Cleaning :

Input files -

1. SAA removed event file (output of cztdataselection)
2. CALDB Badpix file
3. Configuration file (noiseReductionThreshold.txt)

Output files -

1. Noise Cleaned Level 2 event file(_0_nc.evt , _1_nc.evt etc.)
2. Bad pixel file(0_badpix_nc.fits)

How to compile -

```
gcc cztnoisypixclean.c -o cztnoisypixclean -I<path_of_the_cfitsio_include_directory>
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztnoisypixclean.c -o cztnoisypixclean -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
<cztnoisypixclean executable file> output_file_of_cztdataselection caldb_badpix_file bunch_file
CONFIG_FILE
```

Example :

```
cztnoisypixclean AS1A02_174T04_9000000938_06833cztM0_level2_0.evt AS1cztbadpix20160809v01.fits
noiseReductionThreshold.txt
```

3.Super Bunch Cleaning

Input files -

1. Noise Cleaned Level 2 event file(output of noisy pixel clean)
2. Bunch file
3. Livetime file(generated by bunchclean module of cztpipeline)

Output files -

1. Super bunch cleaned level 2 event file(_0_nc_sbc.evt , _1_nc_sbc.evt etc.)
2. Bad time interval file(_bti.fits)
3. Corrected livetime file(sbc_livetime.fits)

How to compile -

```
gcc cztsuperbunchclean.c -o cztsuperbunchclean -I<path_of_the_cfitsio_include_directory>
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztsuperbunchclean.c -o cztsuperbunchclean -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
< cztsuperbunchclean executable file> output_event_file_of_noisy_pix_clean bunch_file
livetime_file orbit_number
```

Example :

```
cztsuperbunchclean AS1A02_174T04_9000000938_06835cztM0_level2_0_nc.evt
AS1A02_174T04_9000000938_06833cztM0_level2_bunch.fits livetime.fits 06835
```

4.Heavy bunch cleaning

Input files -

1. Super bunch cleaned Level 2 event file(output of super bunch clean)
2. Bunch file
3. CALDB lld threshold file

Output files -

1. Heavy bunch cleaned level 2 event file(_0_nc_sbc_hbc.evt , _1_nc_sbc_hbc.evt etc.)

How to compile -

```
gcc cztheavybunchclean.c -o cztheavybunchclean -I<path_of_the_cfitsio_include_directory>
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztheavybunchclean.c -o cztheavybunchclean -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
< cztheavybunchclean executable file> output_file_of_super_heavy_bunch_clean bunch_file lld_file
```

Example :

```
cztheavybunchclean AS1A02_174T04_9000000938_06835cztM0_level2_0_nc_sbc.evt
AS1A02_174T04_9000000938_06833cztM0_level2_bunch.fits AS1cztlld20160517v01.fits
```

5.Flickering Pixel Cleaning :

Input files -

1. Heavy bunch cleaned level 2 event file (output of heavy bunch clean)
2. Badpix file(output badpix of noisy pix clean)

Output files -

1. Flickering pixel Cleaned Level 2 event file(_0_nc_sbc_hbc_fc.evt , _1_nc_sbc_hbc_fc .evt etc.)
2. Updated bad pixel file(0_badpix_nc_fc.fits)
3. Pixel BTI file(0_nc_sbc_hbc_fc.bti)

How to compile -

```
gcc cztflickpixclean.c -o cztflickpixclean -I<path_of_the_cfitsio_include_directory>  
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztflickpixclean.c -o cztflickpixclean -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
< cztflickpixclean executable file> output_event_file_of_heavy_bunch_clean  
output_badpix_file_of_noisypix_clean
```

Example :

```
cztflickpixclean AS1A02_174T04_9000000938_06833cztM0_level2_0_nc_sbc_hbc.evt  
AS1A02_174T04_9000000938_06833cztM0_level2_0_badpix_nc.fits
```

6.LLD cut off :

Input files -

1. Flickering pixel cleaned level 2 event file (output of flickering pixel clean)
2. CALDB lld threshold file
3. Detector threshold file(Det_thresholdlld.txt)
4. Pixel threshold file(pix_thresholdlld.txt)

Output files -

1. After lld cut off Level 2 event file(fc_lldcut.evt etc.)

How to compile -

```
gcc cztlldcutoff.c -o cztlldcutoff -I<path_of_the_cfitsio_include_directory>  
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc cztlldcutoff.c -o cztlldcutoff -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

```
< cztlldcutoff executable file> output_event_file_of_flickering_pix_clean lld_thresh_file Det_thresholdlld.txt  
pix_thresholdlld.txt
```

Example :

```
cztlldcutoff AS1A02_174T04_9000000938_06833cztM0_level2_0_nc_sbc_hbc_fc.evt  
AS1cztlld20160517v01.fits Det_thresholdlld.txt pix_thresholdlld.txt
```

7.Event seperation :

Input files -

1. Event file (output of lld cut off)

Output files -

1. Single Event file (_single.evt)
2. Double Event file (_double.evt)

How to compile -

```
gcc czteventsep.c -o czteventsep -I<path_of_the_cfitsio_include_directory>  
-L<path_of_the_cfitsio_lib_directory> -lcfitsio -lm
```

Example :

```
gcc czteventsep.c -o czteventsep -I$as1czt/include -L$as1czt/lib -lcfitsio -lm
```

How to run -

< czteventsep executable file> output_event_file_of_lld_cut_off

Example :

```
czteventsep AS1A02_174T04_9000000938_06833cztM0_level2_0_nc_sbc_hbc_fc_lldcut.evt
```

clean_data.sh

- You can run all the noise cleaning modules using **clean_data.sh** script.

The input files required for clean_data.sh are:

- i. MKF File with Path
- ii. saaThreshold text file with Path from config directory
- iii. Event File after pha2energy
- iv. Badpix file from CALDB directory
- v. Bunch fits file
- vi. noiseReductionThreshold file from config directory
- vii. LLD file from CALDB directory
- viii. Mkf threshold file

How to run clean_data.sh :

```
clean_data.sh {MKF File} {SAAThreshold File} {.evt file} {caldb_badpix file} {bunch.fits}  
{noiseReductionThreshold file} {caldb_lld file} {MKF threshold file}
```

Example:

```
clean_data.sh  
/data2/czti/level2/20170102_G06_135T03_9000000944_level2/czti/AS1G06_135T03_9000000944czt_level2.m  
kf /home/cztipoc/czti_svn/trunk/users/mayuri/noise_codes/config/saaThreshold.txt  
/data2/czti/level2/20170102_G06_135T03_9000000944_level2/czti/modeM0/AS1G06_135T03_9000000944czt  
M0_level2.evt /home/cztipoc/CALDB/data/as1/czti/bcf/AS1cztbadpix20160908v01.fits  
/data2/czti/level2/20170102_G06_135T03_9000000944_level2/czti/modeM0/AS1G06_135T03_9000000944czt  
M0_level2_bunch.fits  
/home/cztipoc/czti_svn/trunk/users/mayuri/noise_codes/config/noiseReductionThreshold.txt  
/home/cztipoc/CALDB/data/as1/czti/bcf/AS1cztlld20160517v01.fits  
/home/cztipoc/czti_svn/trunk/users/ajay/pipeline/CZTI/czti/paramfiles/mkfThresholds.txt
```