

Quicklook (QL) pipeline summary

Aims:

Produce instrument feedback as rapidly as possible, skipping data if necessary

How:

- Calculates noise properties from first 10 s of timeseries
- Displays focal-plane mosaic of noise properties
- Performs simple quality assurance (QA) tests
- Produces images from Pointing and Focus data ONLY

Things to note:

- Data from QL are used by the JOS for pointing, focus and QA
 - results communicated via files in ORAC_DATA_OUT
 - flag file: `.sYYYYMMDD_MMMM.ok`
 - index file: `index.noise` (or `flat`)
- Performs its own **independent** estimate of pointing and focus offsets
- Every input file is processed if possible
 - => feedback within 30 s of data recorded

Where:

- 450 um: sc2dr1
 - `/jcmtdata/reduced/dr1/scuba2_450/YYYYMMDD`
- 850 um: sc2dr3
 - `/jcmtdata/reduced/dr3/scuba2_850/YYYYMMDD`

SETUP

- Process fastflat, display results
- Process following noise, display results
- Write filenames to flag file

POINTING

- Process initial dark noise
- Process fastflat, display results

- Process on-sky data
 - uses specialized `makemap` config file
 - display image
 - calculate pointing solution (written into data file as initial guess for JOS)
 - write flag file
- Process final noise (if possible)

FOCUS

- Process initial dark noise
- At each SMU position:
 - process fastflat, display results
 - process on-sky data, using specialized `makemap` config file
- Create cube (Az-El-SMU)
 - display map at each SMU position
 - write flag file
 - pipeline performs independent estimate of best-fit SMU position
- Process final noise (if possible)

SCIENCE

- Process initial dark noise
- Process fastflat, display results
- For on-sky data:
 - calculate RMS (demand – actual) azimuth in arcsec
 - calculate noise properties of first 10 s of data
 - display focal-plane mosaic of noise properties
 - perform noise, NEP & bolometer QA

Monitoring the pipeline

- Important/useful results in **green** (some in **yellow**)
 - number of bolometers from flatfield
 - noise properties (noise, NEP)
 - pointing/focus estimates
 - NEFD
- Warnings in **cyan**
 - indicates something unexpected but not necessarily bad occurred (e.g. pointing source not found, especially at 450 μm)
- Errors in **red**
 - all errors are important, but not all errors are fatal

- pipeline will attempt to deal with errors and continue
- Watch for:
 - large changes in the number of bolometers
 - zero bolometers in fastflats (very bad)
 - QA failures (very bad)
 - blank pixels at the source centre (pointing/focus - very bad)
 - FCFs wildly different from defaults and/or discrepant effective beam areas

QA

- RMS (demand – actual) azimuth in arcsec
 - **green** if < 5 arcsec
 - **cyan** if between 5 and 15 arcsec
 - **red** if > 15 arcsec
- Noise, bolometers, weighted NEP
 - white on green if passed: **passed**
 - white on red if failed: **failed**

Output files

Images

- gsYYYYMMDD_N_XXX_foc.sdf
 - output cube from focus observations (Az-El-SMU, viewable in Gaia)
- gsYYYYMMDD_N_XXX_mos.sdf
 - coadded map for pointing source
- sYYYYMMDD_NNNNN_XXX_cal.sdf
 - most recent calibrated map of pointing source
- sYYYYMMDD_NNNNN_XXX_mf.sdf
 - above map processed with matched filter

Noise/flatfield data

- sYYYYMMDD_NNNNN_SSSS_XXX_respmos.sdf
 - responsivity focal-plane mosaic (flatfield)
- snxYYYYMMDD_NNNNN_SSSS_flat.sdf
 - flatfield solution (1 per subarray)
- snxYYYYMMDD_NNNNN_SSSS_rawflat.sdf
 - raw flatfield for use in processing (1 per subarray)
- snxYYYYMMDD_NNNNN_SSSS_noimos.sdf
 - noise focal-plane mosaic
 - NEP focal-plane mosaic is an NDF extension within this file:
snxYYYYMMDD_NNNNN_SSSS_noimos.more.smurf.nepmos

where:

- YYYYMMDD = current UT date (e.g. 20120730)
- NNNNN = zero-padded observation number (e.g. 00021)
- N = non-zero-padded observation number (e.g. 21)
- SSSS = zero-padded subscan number (e.g. 0001)
- XXX = wavelength (either 850 or 450)
- snx = subarray identifier (e.g. s8a)

Log files

- log.noise
 - estimate of noise (mJy/beam) in current group coadd
- log.nefd
 - estimate of NEFD, effective NEFD and extrapolated zenith NEFD (in mJy/beam. \sqrt{s}) from current map or noise or skydips
- .oracdr_PID.log
 - Pipeline log file (PID is the ORAC-DR process ID)
- log.fcf
 - Flux conversion factors derived from calibrators
- log.beam
 - Beam size derived from fits to calibrators
- log.posdiff
 - RMS actual-demand difference (arcsec)
- log.pointing
 - Pipeline estimate of pointing offsets (arcsec)
- log.focus
 - Pipeline estimate of best-fit SMU position
- log.bolonoise
 - Bolometer noise (in pA/ $\sqrt{\text{Hz}}$) and effective NEP (in W/ $\sqrt{\text{Hz}}$)
- log.flatfield
 - Responsivity statistics from flatfield solutions (A/W)

Flag files

- .sYYYYMMDD_NNNNN.ok
 - contains names of files for JOS to read (written by the pipeline for SETUPS, POINTINGs and FOCUS observations)
- .sYYYYMMDD.badbol
 - ASCII list of bad bolometers (written every subscan)
- .snoi_z.0_YYYYMMDD.ok
 - name of previous noise file to create difference image (z = 1 for open shutter, 0 for closed shutter - written every time noise images are created)

Error messages

Errors are rare in the pipeline and in most cases the pipeline is fully capable of dealing with those that occur. The list below shows some of the most common error messages and what they mean.

- ```
!! The returned fitted function from the Levenberg-Marquardt minimisation is
! orthogonal to the columns of the Jacobian. Try enlarging the fitting
! Area.
! BEAMFIT: Failed to fit to the beams.
!! KAP__LMFOJ: Levenberg-Marquardt fit function orthogonal Jacobian's columns
```

  - Not serious - fitting the (pointing or focus) source failed
  - May be seen a few times a night
- ```
!! Failed to invert the curvature matrix.
! BEAMFIT: Failed to fit to the beams.
!! PDA__FICMX: Failed to invert the curvature matrix to derive fit errors
```

 - As above
 - A few times a night
- ```
Unable to determine a FCF for this observation: source too weak to locate (S/N =
2.5)
```

  - Usually occurs at 450 um in poor weather or for blazar/quasar calibrators
  - Weather-dependent
- ```
!! smf_iteratemap: No good samples
!! SMF__INSMP: Insufficient samples for statistics
All data flagged bad: insufficient samples available for calculating statistics -
will not continue
```

 - Very bad - all the data were flagged as bad
 - Seen when making maps with the dome closed - can be ignored in this case
 - Very rare
- ```
!! SOCK__READSOCK: error on reading from socket
***** SMURF has crashed - aborting recipe *****
Recipe completed with error status = 2
Continuing but this may cause problems during group processing
```

  - Very bad - SMURF makemap has crashed
  - Very rare
- ```
!! No science frames supplied. Unable to make a map.
!! SMF__NOSCI: No science data found
```

 - None of the input files had science data - the observation was probably aborted
 - Very rare
- ```
!! There are too few values to compute ordered statistics.
! HISTAT: Error computing simple ordered statistics for an NDF's pixels.
!! KPG__HSTIV: Insufficient values to compute ordered statistics
Data may be too sparse: using stats but MODE will be undefined
```

- KAPPA histat is sometimes unable to deal with the distribution of values, so the pipeline traps the error and falls back on KAPPA stats, though this task is unable to calculate the MODE
- Should be exceedingly rare
- !! Unable to determine a quantile because the data are too sparse.  
! HISTAT: Error computing simple ordered statistics for an NDF's pixels.  
!! KPG\_\_SPARS: Data distribution is too sparse  
Data may be too sparse: using stats but MODE will be undefined
  - Same as above
  - Should be exceedingly rare

## Stripchart output

- Plots history of QL pipeline-derived values through the night
- Most values update every subscan
- 3x3 display covers
  - Number of bolometers
  - On-sky bolometer noise ( $\text{pA Hz}^{0.5}$ )
  - Effective NEP ( $\text{W s}^{0.5}$ )
  - RMS actual-demand azimuth and elevation (arcsec)
  - Dark bolometer noise ( $\text{pA Hz}^{0.5}$ )
  - Dark effective NEP ( $\text{W s}^{0.5}$ )
  - Focal-plane unit (FPU) temperature (mK)
  - Median responsivity ( $\text{A W}^{-1}$ )
  - Mean steptime (ms)

Example stripchart display (450  $\mu\text{m}$  display from 20120706):

