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NIRSpec Technical Note
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# NIRSpec Archive and Database

## Abstract:

This document provides a description of the structure of the NIRSpec data archive and the database. For the database, a brief description of its user interface is also given.

## 1 THE ARCHIVE

All data acquired during NIRSpec calibration campaign are stored in the NIRSpec Archive. This is simply a directory structure where all the exposure data are stored. The name of the top-level directory of this directory-tree is *'Archive'*; in the directory *Archive*, all exposures are organized in subdirectories named according to the number of the day in the year when those exposures were taken — for example, all exposures taken on 20th February 2011 will be in the Archive directory named '*Day2011051*'.

Besides the *'Day…'* subdirectories, *Archive* contains also a basic 00README file and three subdirectories named *DHAS_TREE*, *HTML_FILE*S, and *l*og:

- *DHAS_TREE* contains the input telemetry files for each exposure (files with extension .csv). These files are also available in the exposure directory itself (see Sect. 1.1), but in DHAS_TREE the exposures directory-tree is organized as originally in the DHAS system used for acquisition during the Calibration campaign.

- *HTML_FILES* contains the HTML version of the configuration spreadsheet files where configuration parameters for each test procedure are described. During the tests, the HTML files were updated with information on the exposures that were actually taken and their time-stamps.

- The *log* directory contains the text files logged by the calibration scientists during the performance and calibration tests. Log files are named according to the day when they were generated (e.g *2011051a.log*) with the additional letter (a, b, or c) indicating the shift during which the data were taken (typically there were three 8-hours shifts per day).

## 1.1 The exposure directories

Within a '*Day'* subdirectory, all exposures are themselves organized in subdirectories; the names of the exposure subdirectories reflect the name of the test procedure for which those data ware acquired (see naming convention specified in JWST-ICD-004747). This directory name also contains the unique number (NID) identifying that particular NIRSpec exposure. For example, the data from a Dark exposure taken as part of test procedure 'MON-DET-DARK-SHORT' (on 20 Feb. 2011) are stored in Subdirectory *NRS_MON-DET-DARK-SHORT-01_2_5203_JW1_jlab85_20110220T124546_20110220T130213/*
(of directory *Day2011051*). Note the number 5203 in the directory name, which provides the NID for this exposure.

Each exposure directory such as *NRS_MON-DET-DARK-SHORT-01_2_5203_JW1_...* contains 16 files. Twelve of these are generated by the DHAS acquisition system when acquiring a new exposure. These are:

- The two FITS files containing the exposure data for the two SCAs, these files have extension *'.fits'*

- Two text files containing a dump of the FITS headers in the two exposure files above. These files have extension *.fits.txt*.

- Four files with log information from the the FITS writer. These are the two files with extension *.ssr.log*, file *'SSR_....???.log'*, and file '*..._pipeline_statistics.csv*'

- Input telemetry information is recorded in file '*NRS_MON-DET-DARK-SHORT....JW1.csv'* and file *'NRS_MON-DET-DARK-SHORT ....log'* contains log-information from the telemetry writer

- the two log files *input_status.log* and *exposure_status.log* contains some basic log information over the exposure telemetry input file and exposure output FITS files

The other four files within the exposure directory are generated by the quick-look analysis tool and the processing pipeline that converts the raw detector data in count-rate images. These are:

- Two FITS files containing the count-rate images from the two SCAs (see description of count-rate files format in NTN-2011-004 for more details on the format of these files)

- A PDF file with the output from the quick-look analysis tool (named *SQUAT_NID_xxx.pdf*)

- A binary file, containing an IDL structure with basic information about that exposures (part of which is written in the PDF file). This file has extension *.str*

Fig. 1 provides an example of how an exposure directory looks and illustrates the content of the most important files.

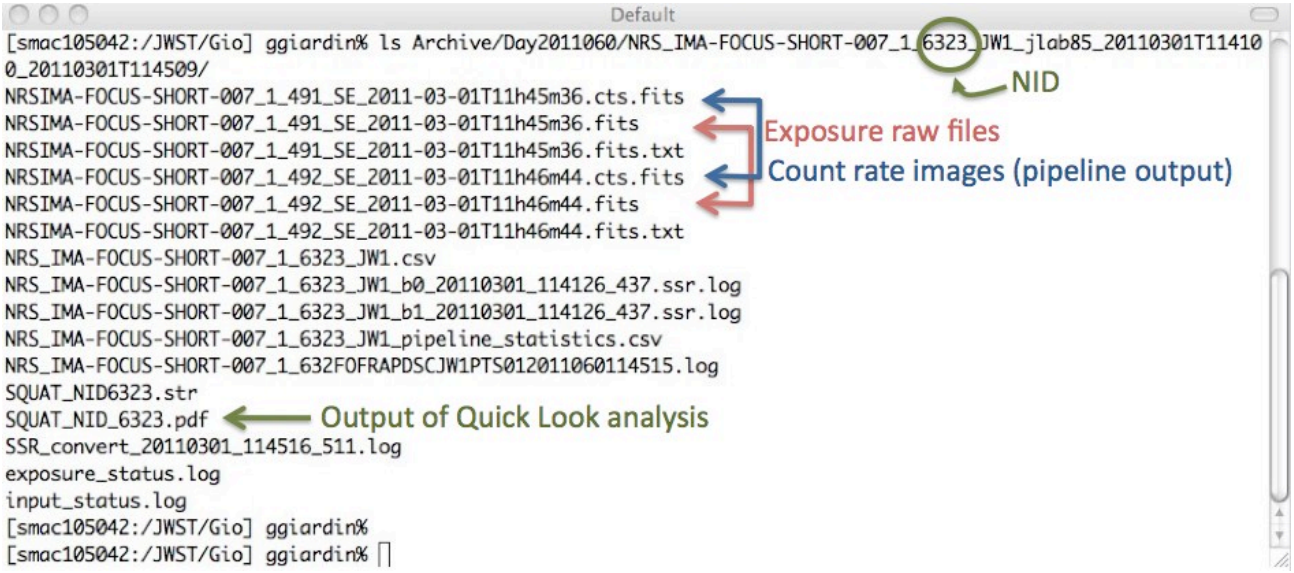


**Figure 1** Listing of an exposure directory in the NIRSpec archive.

In the case of a multi-integration exposure, the exposure directory contains also the FITS files containing the data cube for each integration ramp extracted from the original multi-integration raw files by the Quick-Look analysis software and the count-rate images computed by the pre-processing pipeline for each integration. The single integration files have the same root-name as the raw (multi-integration) files acquired by the DHAS, but they have extension '.singleintxxxx.fits', where xxxx is the integration number in the sequence. So, for a n-integration exposure, in addition to the 2 orginal raw fits files (one for each SCAs), there are also 2n single-integration 'raw' fits files and 2n count-rate image files, these last ones with extension '.singleintxxxx.cts.fits'.

# 2 THE DATABASE

The content of the Archive is mapped into an IDLAstro Database named *nar_log*. The database software and data content are located in the *JWST_IDL* directory of the NIRSpec software directory tree, whose top-level directory is named *Software*; the database access and acquisition software is located in subdirectory *'../Software/JWST_IDL/lib/nirspec'*, while the database structure and metatdata content are stored in files *nar_log.dbd*, *nar_log.dbf*, *nar_log.dbh*, and *nar_log.dbx*, in subdirecory *'../Software/JWST_IDL/var'*.

For every raw FITS file of an exposure, a set of metadata is stored in the database; most of these metadata corresponds, in name and value, to the FITS header keywords, the others provide additional information not available in the file header, such as the observation NID, the Julian date or the file path. All these meta-information can be retrieved from the database by specifying various search parameters.

The main interface to the database is a Graphical User Interface, named *nar_find*. To access this interface, the user must start IDL with the right set-up by invoking the shell script *start_nirspec (*in directory *'../Software/JWST_IDL/bin')*, properly configured. This will start IDL with the right set-up and prompt 'NIRSpec>'; in here, typing the command *nar_find* will bring up the database GUI pictured in Fig. 2.

Using this GUI, the user can select various search criteria and perform a database search by pressing the button **Search** at the top left of the GUI. The number of entries matching the search criteria will be displayed in the bottom-left panel of the GUI and printed on the terminal. Buttons **List** and **Print**, also at the GUI top, allow the list of matching entries to be printed on the terminal or to a file, respectively. With button '**Select Print Items**', the user can specify the metadata value that should be printed out when listing the matching entries. In this case the user should select '*selected*' from the options provided by the **List** and **Print** buttons.
At the top-right, button **Retrieve** allows the list of exposures files matching the searching criteria to be transferred from the Archive to the user local disk. This button provides a pull-down menu with which the user can select whether to retrieve an exposure complete directory, or rather the exposure raw FITS files or count-rate images only.

The search parameters can be specified using the pull-down menus and buttons of the GUI. These are organized in three main areas in the GUI window. The top-part (subdivided in four columns) allows instrument and test-setup parameters to be specified. In the middle part, the user can specify a date interval. In the bottom-area the user can specify an interval of values for any of the keyword indexed by the database, for up to three keywords (combined with logical AND) for an individual search. Pressing the '**Select Item'** button will bring up the list of all the indexed keywords from where the user can select the desired item. The desired search-interval can be specified at the right of the '**Select Item'** button.

Note that the ‘Min’ and ‘Max’ value are intended as included, so the search is always conducted for a parameter in the interval: Min <= x <= Max. This means that if one wishes to search for the exact value y of a given keyword x one should perform a search for interval y<=x<=y. For example if one wishes to find all the exposures that were taken as part of test procedure 'MON-DET-DARK-SHORT', one should select keyword 'ROOTNAME' from the ‘**Select Item’** list and specify, as Max and Min value for the search, the value 'MON-DET-DARK-SHORT'.

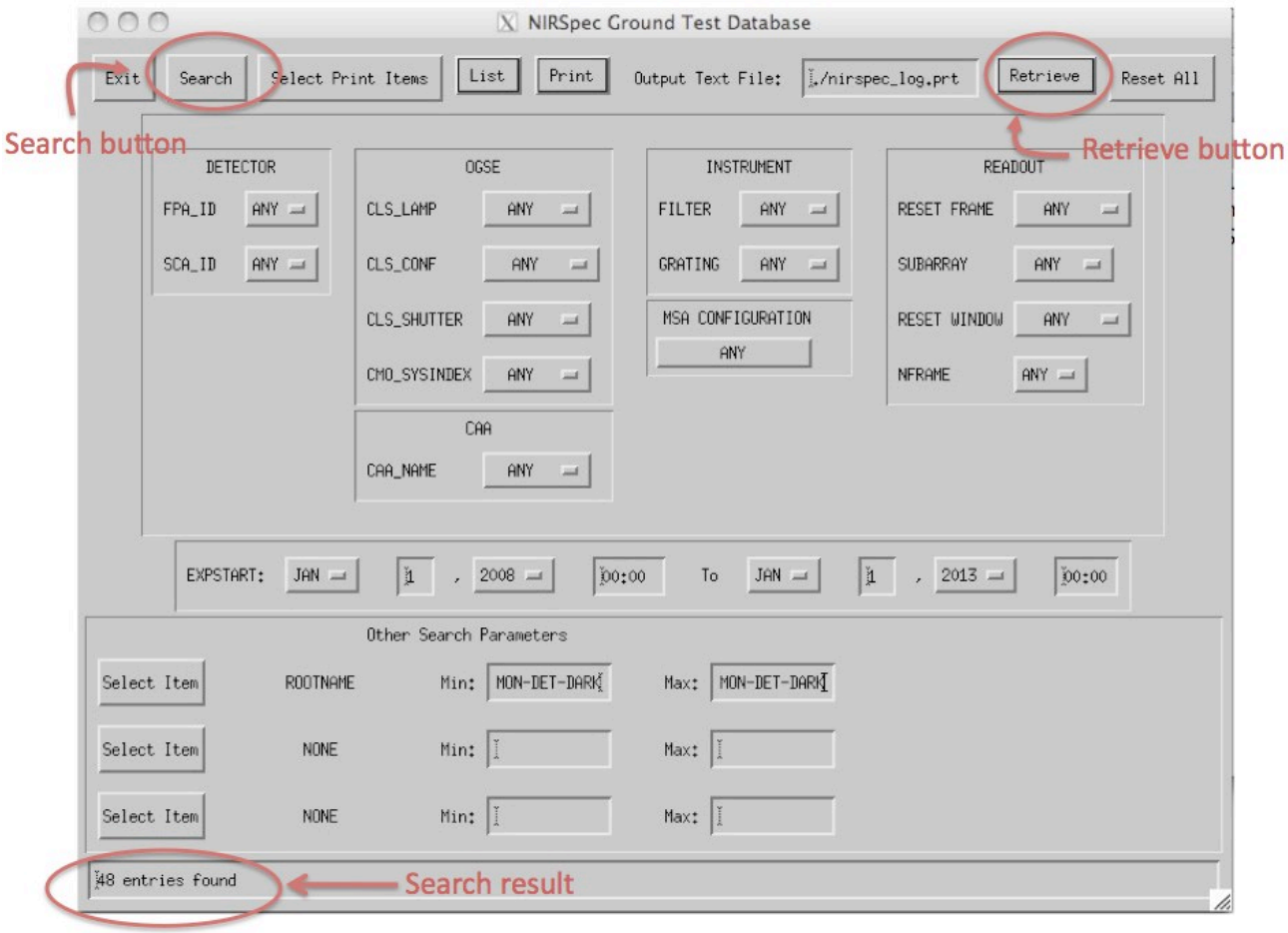


**Figure 2** The database GUI. To start the GUI type command ‘*nar_find’*, in NIRSpec IDL environment.

## 2.1 Other useful database commands

The NIRSpec database is implemented by the IDLAstro Database System therefore all the default IDLAstro Database commands (e.g. *dbopen*, *dbfind*, *dbval*, etc.) can be invoked within the IDL NIRSpec environment — see the documentation for the IDLAstro Database System (http://idlastro.gsfc.nasa.gov/).
In addition, within IDL NIRSpec, there are a few extra commands that can be used to access the NIRSpec exposures via the exposure NID. These are briefly documented below:

- **cd_nid ,** gotonid [, oldir]

Change IDL working directory to that of exposure with given NID
*Examples:*
cd_nid, 3995
cd_nid, 3995, here

- **display_nid**, nid

Launches ds9 display of the properly oriented count-rate images for both SCAs of the exposure corresponding to the given NID
*Examples:*
display_nid, 4771

- **get_ctr,** nid, nsca [, hdr, intn=intn]

Function to get one of the count-rate images (sca_id 491 or 492) from NID number
*Examples:*
im = get_ctr(3990, 1)
im = get_ctr(3990, 2, hdr)
im = get_ctr(3990, 2, intn=3) ;for multiple integration, requiring integration number 3

- **nar_text_log,** nid1 [, nid2]

Prints out basic information on exposures from NID1 to NID2
*Examples:*
nar_text_log, 3990, 3995

- **nid_to_log,** nid

Search and display log entry for given NID
*Examples:*
nid_to_log, 3990

- **nid_to_raw,** nid, nsca

Function to get the fits file name (with full path) for SCAs 491 or 492 from NID number
*Examples:*
file1 = nid_to_raw(3990, 1) ) ;returns sca_id=491
file2 = nid_to_raw (3990, 2) ;returns sca_id=492

- **read_ramp**, nid/infile, sca_id, cube

Returns the integration ramp into IDL variable 'cube', given an exposure NID or infile (fits file containing a data cube structure) and sca_id =1 or 491 for 491 or sca_id =2 or 492 for d92
*Examples:*
read_ramp, 3990, 1, cube

- **sort_by_nid,** inlist, outlist [, sortedinex=sortedindex, sortednid=sortednid]

Given a input list of NIRSPEC exposure directories (inlist), it returns the list sorted by NID (outlist). Optionally, it can return also the sorting indexing (sortindex) and the sorted list of NIDs.
*Examples:*
inflist=file_search('/JWST/Archive/Day2011051/NRS_MON-MSA-FPA-RAD-*')
sort_by_nid, inflist, outlist

- **squat,** nid/wdir [, print=print, nolin=nolin, lincube=lincube, ds=ds, oba=oba, noforce=noforce, norun=norun, ctr_slice=ctr_slice,fpa_id=fpa_id, temp=temp, dyndark=dyndark, tframe=tframe]

Launches quick look analysis tool on exposure with given NID or with directory path 'wdir'. By default this will also launch the pre-processing pipeline that generates the count-rate images. The SQUAT output is a PDF file containing a 2-page summary of the exposure parameters, histograms and images of first frame of the raw data (in the first page) and histograms and of the pre-processed count-rate images (in the second page).
*Examples:*
squat, 3990
squat, 3990, /norun

## 2.2 Other IDL NIRSpec commands

- **ds9**, image1 [, image2]

Launches ds9 from IDL command line, passing one (or two) array(s), or a data cube (or two).
*Examples:*
ds9, array1
ds9, array1, array2

# 3 REFERENCES

JWST-ICD-004747, Integrated Ground Support System (IGSS) External Interface Control Document

NTN-2011-004, Description of the NIRSpec pre-processing pipeline, S. Birkmann