



NIRSpec Technical Note NTN-2011-001

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Overview of the NIRSpec first cryogenic testing campaign (CYCLE1)

Abstract:

This report provides an overview of the timeline and contents of the first cryogenic campaign of the JWST/NIRSpec instrument that took place from the end of January 2011 to the beginning of March 2011.

Change log		
Version	Date	Description
0.1	13.10.2011	First internal release for review by the SOT.
1.0	27.10.2011	First issue for delivery to STScI

1 INTRODUCTION – USE HEADING 1 LEVEL

The instrument-level cryogenic testing of the flight model of the JWST/NIRSpec instrument consists in two cryogenic test campaigns. The first of these two campaigns took place in early 2011. This 1.5-2 month long campaign was the first opportunity to test the fully integrated flight model of the instrument at operating temperature. It included a variety of tests aiming at characterising the behaviour and performance of the instrument. In this report, we will first provide an overview of the test campaign (labelled cycle 1) and then a detailed timeline for the phases where performance testing was performed.

2 OVERVIEW OF THE FIRST CRYOGENIC TEST CAMPAIGN (CYCLE1)

2.1 Important limitations

Just prior to the start of the CYCLE1 cryogenic test campaign, particulate contamination of the NIRSpec micro-shutter array (MSA) was discovered. Small fibres with a diameter of a few tens of microns and a length up to a few millimetres were discovered during an inspection of the MSA. The problem was investigated and it was concluded that operating the MSA while these fibres were present could damage the MSA.

As everything was ready for CYCLE1, it was then decided that removal of the fibres would take place after CYCLE1. As a consequence it was forbidden to operate the MSA (i.e. open and close the micro-shutters) during CYCLE1 and all the procedures were updated to take into account this limitation. Note that, it was however possible to use the NIRSpec fixed-slits and integral-field unit (IFU).

The CYCLE1 testing only covered the FIXED-SLIT and IFU modes of the instrument. It was not possible to configure the MSA (i.e. to open/close micro-shutters).

The second important limitation is related to the NIRSpec detectors. In 2010, it became obvious that the NIRSpec flight model detectors (labelled FPA104) were degrading and were not meeting some key performance requirements. It was therefore decided to prepare the flight spare detectors (labelled FPA105) in order to swap them. However, the FPA105 detectors could not be ready on time for CYCLE1 and it was decided to go ahead with the FPA104 detectors even if they were likely to be replaced later on.

The CYCLE1 testing has been performed with the FPA104 detectors that are planned to be replaced by the FPA105 detectors before the next cryogenic test campaign (CYCLE2).

3 OVERVIEW

The CYCLE1 campaign was divided into different phases (see Figure 1). From the performance point of view, the key phases were the preparation, calibration and confirmation ones (in yellow in Figure 1). However, some calibration / characterisation test sequences were inserted in other phases when time was available (see Figure 2).

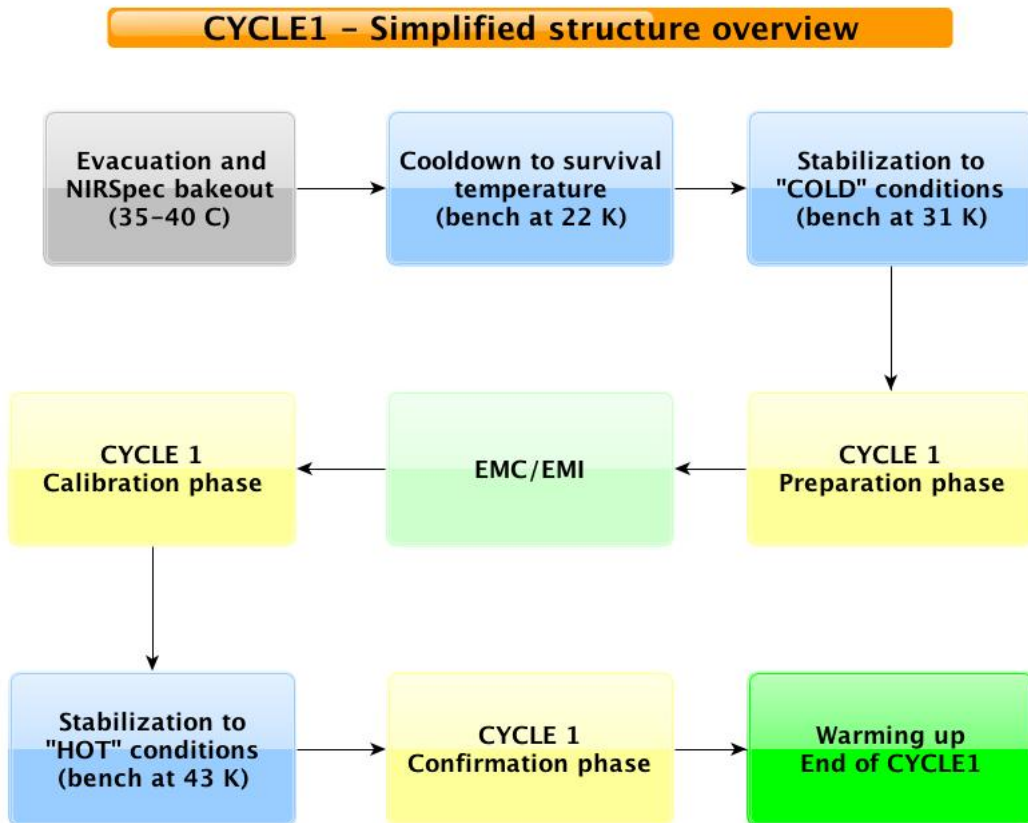


Figure 1: simplified overview of the CYCLE1 structure.

Cooldown to survival temperature (bench at 22 K)	Dry-run of our test procedures while we cool-down (typically between 60 and 35 K). First exposures with limited detector performances
Stabilization to "COLD" conditions (bench at 31 K)	Dark exposures only once the detector temperature is stabilized and while we wait for the bench to stabilize.
CYCLE 1 Preparation phase	DS and MSS early performance checks - Setup of the OGSE Acquiring the preliminary data that will allow us to finalize the calibration phase procedures
EMC/EMI	Support for the analysis of the detector data. Some detector test sequences will be run during the nights.
CYCLE 1 Calibration phase	Main phase of the cycle calibration campaign
Stabilization to "HOT" conditions (bench at 43 K)	Monitoring of the instrument geometry and of the detector performances while we change the bench temperature
CYCLE 1 Confirmation phase	Quick check of the geometry and the performances of the instrument at a different bench temperature

Figure 2: Overview of the performance-related contents for the CYCLE1 phases.

3.1 Environmental conditions during the performance-related phases of CYCLE1

One important piece of information is the set of temperatures used during the different performance-related phases of CYCLE1. The key temperatures were the following:

- The temperature of the optical assembly (OA) radiative environment (to mimic the ISIM temperature).

- The temperature at the location of the NIRSpec OA kinematic mounts (no representative during the NIRSpec level testing).
- The temperature at the interface with the NIRSpec OA thermal strap.
- The temperature at the interface with the FPA/ASIC thermal strap (independent from the OA thermal strap).
- The detector temperature set point (active control loop for the SCA temperature).

The temperatures requested during CYCLE1 are listed in Table 1.

Table 1: List of the temperatures requested during CYCLE1 performance-related phases.

Phase	OA radiative environment	OA kinematic mounts	OA thermal strap	FPA/ASIC thermal strap	Detector temperature set point
Preparation phase	31 K (COLD)	n/a	31 K (COLD)	38.25 K (NOMINAL)	38.5 K (NOMINAL)
Calibration Phase	31 K (COLD)	n/a	31 K (COLD)	38.25 (NOMINAL)	38.5 K (NOMINAL)
Confirmation phase	49 K (HOT)	n/a	43 K (COLD)	38.25 (NOMINAL)	38.5 K (NOMINAL)

Note that the only a limited number of detector set point temperature are available and the actual set-point value is not exactly the requested one (but was kept stable). The exact value can be found in the FITS file headers.

4 CYCLE1 DETAILED TIMELINE

4.1 EXCEL table

The detailed time line of CYCLE1 is provided in the EXCEL table associated to this report. Each tab corresponds to a phase of the campaign.

Date	Start time	End time	Activities / Events	Status	Comments	CSV file(s)	Range of exposure IDs
ACTIVITIES CONDUCTED DURING THE CALIBRATION PHASE							
20.02.2011	10:52	12:58	MON-MSA-FPA-RAD #01 Monitoring exposures (limited scope for cycle1): failed-open map of the MSA; detector cross-hatching.	OK	Script ran without a problem. Quick-look performed on the 21/02/2011. Exposures are OK (including GWA-related keywords).		Day2011051/5190-5201
20.02.2011	12:21	15:20	MON-DET-DARK-SHORT #01 Sequence of 10 short dark exposures (88 groups).	OK	Script ran without a problem. Quick-look performed on the 21/02/2011.		Day2011051/5202-5206

Figure 3: Screenshot of the table column headers with 2 entries.

For each test sequence the table provides:

- Information on the date and time at which the test was conducted.
- A brief description of the test sequence.
- The status after execution of the test.
- Comments that were logged in the daily test summary at the time of the testing (this does NOT replace the actual testing logs).
- An hyperlink to the as-run CSV file if available. This CSV file contains the complete configuration information for each exposure of the test sequence (as commanded). Note that, for each individual exposure, this information is also available in the header of the FITS files.
- The range of exposure IDs corresponding to this test sequence as well as the corresponding archive folder name.

Important note: the directory tree CYCLE1-DHAS-TREE that contains the CSV files is provided as a ZIP file that should be unzipped in the same directory than the EXCEL table. The EXCEL table and the folder CYCLE1-DHAS-TREE folder must be in the same directory for the hyperlink to work.