Test 0.7.11_12 Verify function and performance of PACS internal calibration sources

Objectives

Check the functionality and basic performance with regard to the fulfillment of the specification (PACS-ME-RS-010) of the focal plane calibration sources and the PCD requirements 2.5.1/2.5.3, including the PI optimization. Both CSs should be operational within/over the entire temperature regime and must generate HK data with nominal and diagnostic values. This has to be verified for the redundant mode, too.

Reflected requirements (at cryogenic temperature) according to PACS-ME-RS-010:

- the effective temperature of the source shall be adjustable between 50K $<$ T $<$ 100K;
- the heater should be adjusted to within 5% (TBC) of the final temperature within 30 min. (TBC) after switch-on;

Related features to check:

- DMC accepts and executes CS trigger commands, CS's reaction is nominal;
- DMC can read-out CS temperature sensor values;
- DMC can generate CS HK;
- DMC can generate CS diagnostic HK at least at readout frequency;

Degraded (failure) mode operations:

- heat-up in open loop;

Priority

A (on ground)

When performed / frequency

CQM-ILT
EQM-IMT
PFM-ILT
EQM-IST
PFM-IST

Inputs, prerequisites

PACS should be switched on (primary setup mode), setup for spectroscopy or photometry selected. The current TIP assumes spectroscopy setup. But if the spectroscopy default mode is selected, it has to be ensured that the calibration sources are not switched-on/enabled. Thus, a modified version of the spectroscopy set-up has to be prepared.

Characterization of the FM CSs on module level would be helpful, e.g. to know the exact conversion between current, resistor and temperature (see for an example Fig. 16 in PACS-ME-TR-011).

Interconnections

A. Fulfilled By

B. Fulfilling

PCD req. 2.5.1 and req. 2.5.3;

OGSE Setup, astr. sources, OBSW Compr./Red.

not needed;

Test Implementation Procedure (TIP)

During FM ILT step 1 of the test procedure will be carried out twice. The first time the cool-down will be done over night down to the minimum temperature T$\sim$ 0 K (setpoint 0), see step 1.04 option a). Based on the result of the first performance if necessary the PI parameter will be updated/optimized. For the second time the cool-down will be done for one hour with a target temperature of T=50 K (Setpoint: 390000), see option b). For open loop operation the controller of the CSs has to be disabled.

Step #	Test Implementation Procedure	OGSE Setup	Products Online Analysis	Pass/Fail & Remarks
	FM ILT TIP for req. 0.7.11 & 0.7.12 Verify function and performance of PACS internal calibration sources			
	Default Setup for this PTD			
0.01	Switch on PACS (if not already done).			
0.02	Setup modified spectroscopy mode (if not already done). Default parameters of a modified version of setting spectroscopy mode: CS controller not switched on and not enabled otherwise setup spectroscopy default parameters. This will only be done in step 1.01.			
0.03	Set diagnostics HK for calibration sources Diag HK list: 213 DMC_CS1_CTRL_STA 214 DMC_CS2_CTRL_STA 445 DMC_CS1_RES_VALUE 446 DMC_CS1_OUTPUT 459 DMC_CS1_TARGET 447 DMC_CS2_RES_VALUE 448 DMC_CS2_OUTPUT 460 DMC_CS2_TARGET 526 DMC_CS1_VOLT_SG 527 DMC_CS1_VOLT_BG 528 DMC_CS1_CUR_SG 529 DMC_CS1_CUR_BG 542 DMC_CS2_VOLT_SG 543 DMC_CS2_VOLT_BG 544 DMC_CS2_CUR_SG 545 DMC_CS2_CUR_BG		check during the test procedure the CSs diagnostic housekeepings; check output threshold: changing from heating mode to reading mode (cooling);	
	Step 1: Verify function and performance of PACS internal Calibration Source			

1.01	Setting-up the internal calibration sources heat control SWITCH ON CS 1 CONTROLLER ENABLE CS1 CONTROLLER SWITCH ON CS2 CONTROLLER ENABLE CS2 CONTROLLER			
1.02	First Heat-Up SET THE TEMPERATURE OF CS 1 = 70.5 K (Setpoint: 800000) SET THE TEMPERATURE OF CS 2 = 76.0 K (Setpoint: 920000) WAIT 60 minutes		monitor calibration source resistance;	is stable behaviour achieved within 30 (TBC) min.?
1.03	Second Heat-Up SET THE TEMPERATURE OF CS 1 = 72.8 K (Setpoint: 850000) SET THE TEMPERATURE OF CS 2 = 78.4 K (Setpoint: 970000) WAIT 30 minutes			

1.04	Cool-Down Option a) SET THE TEMPERATURE OF CS 1 = 0 K (Setpoint: 0) SET THE TEMPERATURE OF CS 2 = 0 K (Setpoint: 0) WAIT 60 minutes Option b) SET THE TEMPERATURE OF CS 1 = 50.5 K (Setpoint: 390000) SET THE TEMPERATURE OF CS 2 = 50.5 K (Setpoint: 390000) WAIT 60 minutes			
	Step 2: Degraded Mode			
2.01	Switch to open loop (Switch CSs Controller on but do not enable them!) SWITCH ON CS 1 Controller SWITCH ON CS 2 Controller			
2.02	Repeat step 1 in degraded mode (heat-up's and cool-down) For open loop voltages are commanded directly. Thus, we use the command DMC_SET_BB_1(2)_VOLTAGE. The commands will be carried out manually. Reaching the desired temperature plateau is a two-step process like ballistic heating. At first, we will command the maximum voltage of 10V. When close to the desired temperature we will command the voltage corresponding to the desired temperature plateau.			
	Step 3: End of Test			

3.01	Set PACS in default starting mode. stop diagnostic housekeeping set PACS back to its default starting mode set CSs temperature to default values (TBC)		

Estimated time needed

60 min for first heat-up and first plateau stabilization + 30 min second heat-up and second plateau stabilization + 60 min for cool-down (option b) = 150 min total test time; if using for cool-down option a) then test lasts overnight (almost one day);

Success criteria, required accuracy

basic functions of the internal calibration sources have to work; fulfillment of specification of the internal calibration sources according to PACS-ME-RS-010;

Test Analysis Procedure (TAP)

The analysis relies on HK data only. The resistor value of the internal calibration sources will be plotted versus time. The heat-up, stabilization and cool-down time has to be derived. Furthermore, the temperature stability at the two temperature plateaux per calibration source.

Coding Strategy

Version number

$Revision$: 1.3