AGILE	ITE

DOCUMENT TYPE:	**SUBSYSTEM SPECIFICATION**		
TITLE:	**AGILE PAYLOAD TE & EGSE SUBSYSTEM SPECIFICATIONS**		
DOCUMENT Ref. No.:	AGILE-ITE-SS-003 Te.S.R.E. Report 302/00	**N° OF PAGES:**	i-iii, 41
ISSUE No.:	01	**DATE:**	31 January 2001
PREPARED BY:	M. TRIFOGLIO/F. GIANOTTI/J. B. STEPHEN		
INPUT BY:	M. PREST/E.VALLAZZA/C.LABANTI/M.FEROCI		
CHECKED BY:			
SUBSYSTEM MANAGER:	M. TRIFOGLIO	**DATE:**	

APPROVED BY:		
SUBSYSTEM LEADER:	G. DI COCCO	**DATE:**
PRINCIPAL INVESTIGATOR:	M. TAVANI	**DATE:**
PROGRAM MANAGER:	M. CONTE	**DATE:**
PAPM:	R. A. BERNABEO	**DATE:**

CONFIGURATION:	B. FALCONI	**DATE:**

DISTRIBUTION LIST

POS.	NAME	DEPT.	N° OF COPIES	FULL COPY
1	M. Tavani	IFC MI	1	1
2	M. Conte	AST	1	1
3	G. Barbiellini	INFN TS	1	1
4	M. Prest	INFN TS	1	1
5	G. Di Cocco	TESRE BO	1	1
6	E. Costa	IAS ROMA	1	1
7	F. Perotti	IFC MI	1	1
8	A. Bonati	LABEN	1	1
9	G. Cafagna	LABEN	1	1

CHANGE RECORD

ISSUE	DATE	PAGE	DESCRIPTION OF CHANGES	RELEASE
Draft 00/A	18/12/2000		First draft circulated to Agile Team and Laben	
Draft 00/B	30/01/2001		Modified the PDHU TE section on the basis of the input provided by ITS (E.Vallazza, M.Prest), and IAS (M.Feroci), and the meeting with LABEN held on 24/01/2001. Chapter 5 has been circulated and discussed on 26/01/2001 (MOM AGILE-AST-049). (A vertical bar on the right side identifies text modification respects to the previous version)	
Draft 00/C	05/02/2001		Revised the PDHU TE section, as agreed in MOM AGILE-AST-051, in LABEN on 31/01/2001; added PDHU schemes provided by ITS (E.Vallazza, M.Prest). Plus other minor changes. (A vertical bar on the right side identifies text modification respects to the previous version)	
Issue 1	05/02/2001		Reformatted the whole document using the AST Template. First Issue. (A vertical bar on the right side identifies text modification respects to the previous version, without considering the reformatting)	

TABLE OF CONTENTS

1 INTRODUCTION

1.1 SCOPE OF THE DOCUMENT

This document presents the requirement specification of some of the TEs (Test Equipments) and of the EGSE (Electrical Ground Support Equipment) to be provided by the Industry for the AGILE payload AIV and calibration activities, namely:

- the Test Equipment for the Calorimeter CsI-Bars Characterisation (CAL-CsI TE), to support the activities to be carried out at the CsI-Bars manufacturer premises and at the Calorimeter manufacturer premises; the procurement of two complete CAL-CsI TE configurations shall be required in order to be able to perform these tests in parallel.
- the Gamma Source Positioning System (GSPS); the procurement of two GSPS, to be used in conjunction with the two CAL-CsI TEs, shall be required in order to automate the positioning of the gamma ray-sources along the CsI Bars.
- the Test Equipment for the Calorimeter Subsystem AIV and calibration (CAL-DFE TE), to support the AIV and calibration activities to be carried out on the Minicalorimeter Subsystem before integration with the Payload Data Handling Unit (PDHU) and the other payload components;
- the Payload Data handling Unit TE (PDHU TE), to support the AIV activities on the PDHU Subsystem before integration with the other Payload and Spacecraft Subsystems.
- the Instrument Electrical Ground Support Equipment (Instrument EGSE), to support the AIV and calibration activities on the AGILE instrument before integration with the Spacecraft.

The present document identifies each of the above subsystems in terms of functional, performance, operational, interface, resource, quality, maintainability and safety requirements.

It is noted that the TE for the Agile Power Subsystem Unit (PSU) is not mentioned in the present document as it is assumed that the PSU AIV shall be supported by using test jigs and laboratory standard instrumentation already available in the industry procuring the PSU.

As far as the Interface Requirements are concerned, precedence is given to the applicable Subsystem Specifications Document of the MCAL, the PDHU, and the other external systems the above TEs and EGSE items shall be interfaced.

For further details on the software requirements and the output data format, the present document refers to the applicable User Software Requirement documents of the CAL-CsI Host Computer and the CAL-DFE Host Computer.

For the test sequences to be implemented on the EGSE CCOE, this document refers to the applicable Payload AIV documentation.

1.2 ACRONYMS

AC	Anti-coincidence auxiliary subsystem
CAL-CsI TE	Test Equipment for Calorimeter CsI-Bars Characterisation
CAL-DFE-TE	Test Equipment for Calorimeter Subsystem AIV and calibration
Calibration MGSE	Calibration Mechanical Ground Support Equipment
CCOE	Central Checkout Equipment
Detectors SIM FEE	Detectors Simulator Front End Equipment
EGSE	Electrical Ground Support Equipment
GSE	Ground Support Equipment
Instrument SC	Instrument Science Console
MCAL	Mini-calorimeter detector
PD	Photo Diode
PDHU	Payload Data handling Unit
SA	X-Ray detector named Super-AGILE
SCOE	Specific Check-Out Equipment
SIS	Spacecraft Interface Simulator
SIS & GSTS SCOE	Spacecraft Interface Simulator, GPS, and Star Tracker SCOE
ST	Silicon Tracker gamma-ray detector
TBC	To Be Confirmed
TBD	To Be Defined
TC	Telecommand
TE	Test Equipment
TM	Telemetry

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS

AD1 AGILE Data Handling Requirements, AGILE-DWG-SS-002, Issue 2
AD2: AGILE Anticoincidence AC-PMT Assembly Specification, AGILE-IFC-SS-001, Issue 2
AD3 AGILE PSU Subsystem Specification, AGILE-AST-SS-003, Issue 2
AD4: AGILE Mechanical Requirement Specification, AGILE-AST-SS-002, Issue 2
AD5: AGILE MCAL Subsystem Specification, AGILE-ITE-SS-001, Issue 2
AD6: AGILE ST FTB Subsystem Specification, AGILE-ITS-SS-001, Issue 2
AD7: AC-PMT Assembly Specification, AGILE-AST-SS-001, Issue 2
AD8: AC-HV Distribution Box Specification, Issue 2
AD9: AGILE Prototyping Specifications, AGILE-AST-SS-004, Issue 2
AD10: AGILE Anticoincidence AC-PMT Assembly Specification, AGILE-IFC-SS-001, Issue 2
AD11: User Software Requirements for the Host Computer of the Agile Minicalorimeter Cal-CsI Test Equipment, AGILE-ITE-SR-001.
AD12: User Software Requirements for the Host Computer of the Agile Minicalorimeter Cal-DFE Test Equipment, TBW.
AD13: AGILE Payload High Level AIV Plan, AGILE-AST-PL-002, Issue 1

2.2 REFERENCE DOCUMENTS

RD1 AGILE Phase A Report, Oct. 1988
RD2 AGILE Phase B Presentation to ASI (Nov. 30, 1999)
RD3 AGILE Payload TE and EGSE design Concept TL 16369
RD4 M.Trifoglio, F.Gianotti, J.B.Stephen, "AGILE Payload GSE Design Concept, Utilisation Plan and System Requirements, AGILE-ITE-SG-002, Rev. 1.1, Nov. 1999, CNR/ITESRE.
RD5 M.Trifoglio *et al,* " Preliminary design concept and system requirements of the MGSE for the calibration of the AGILE detector at test beam facilities", AGILE-ITE-SG-003, Issue 2.1, November 1999.

2.3 DOCUMENT PRIORITY

A priority in the applicability of documents is established as follows:

1. AGILE Scientific Requirements
2. P/L System Requirements
3. Current Document
4. Applicable Documents
5. Minutes of Meeting

In case of conflict among technical material contained in these documents, the highest rank document shall have the precedence.

3 CAL-CSI TE REQUIREMENTS

3.1 GENERAL OVERVIEW

The main aim of the CAL-CsI TE is to support the characterisation of the Calorimeter CsI Bars integrated with the read out and front end electronics (CAL-CsI Electronics) simulating the burst branch (which is self triggering) of the Minicalorimeter flight electronics.

This chapter presents the requirements related to the following two items of the CAL-CsI TE to be provided by the Industry, namely:

- the Power SCOE**;**
- the Host Computer.

The user software requirements on the Host Computer are detailed in AD11.

These items, with the auxiliary use of laboratory standard equipment (e.g. pulse generator), shall allow to perform all the test activities required to develop and test the CAL-CsI Electronics, and its integration with the CsI Bars.

In addition, the Gamma Source Positioning System (GSPS) shall be provided by the Industry in order to automate the mechanical positioning of the gamma-ray sources during the CsI Bars characterisation tests.

Further activities required for the CsI Bars characterisation shall require the Science Console (CAL-CsI TE SC), which shall be provided by the AGILE Team.

The Science Console shall be interfaced to the Host Computer in order to acquire and archive in near real time the instrument H/K and Scientific data and perform on them the required on-line and off-line analysis tasks.

Due to time constraint, the CAL-CsI TE procurement will be staggered into two stages:

- a reduced model shall be procured in time for the CERN beam tests; this model shall provide a reduced front end and readout electronics and shall not include the functionality related to the GSPS system;
- then, the final model shall follow, providing all the functionality required in the present document.

3.2 FUNCTIONAL REQUIREMENTS

3.2.1 POWER SCOE

URS-3.2.2 The Power SCOE shall provide to the CAL-CsI Electronics the required electrical power.

3.2.3 HOST COMPUTER

3.2.3.1 OPERATIONAL MODALITIES

URS-3.2.3.1.1 It shall be possible to operate the Host Computer in two modalities:

- *Standalone mode*: in this mode the Science Console is not required;

- *Client Mode*: in this mode the Host Computer interfaces to the Science Console.

Unless explicitly stated, the following requirements apply to both the Standalone Mode and the Client Mode.

URS-3.2.3.1.2 The tests will consist of Measurements, each identified by a progressive number (measurement *Run ID*) and consisting of:

- an *Idle* period: the time interval preceding the start measurement command;

- a *Run* period: the time interval between two consecutive start/stop measurement command;

URS-3.2.3.1.3 A set of consecutive measurements will be identified as *Test Session*.

URS-3.2.3.1.4 For each measurement, the following sequence of operations will be required:

- if necessary, the CAL-CsI Electronics shall be reconfigured;

- any positioning operations shall be completed;

- on the Host Computer, the *start measurement* will be commanded, and a new measurement will begin;

- the Host Computer software will acquire and perform all the required functions on the forthcoming data;

- on the Host computer, the *stop measurement* will be commanded, and all the required functions on the current measurement will be completed.

URS-3.2.3.1.5 Before starting a Test Session, the operator shall decide how to operate on the Host Computer:

- in *manual mode*: the operator intervention shall be required in order to start/stop each measurement;

- in *automatic mode*: an automatism shall be used in order to provide automatically the start/stop measurement commands (note: the position is not changed) and the operator shall be required only in order to terminate the Test Session.

URS-3.2.3.1.6 When operated in conjunction with the GSPS, the Host Computer shall allow to perform in automatic mode also the positioning operations. Hence in this case it shall be possible to command the automatic execution of a number of consecutive measurements each consisting of the following steps:

- the Host Computer (without any manual intervention) commands the GSPS to perform the required positioning;

- once the positioning operations is completed, the Host Computer commands the start measurement, and a new measurement begins;

- the Host Computer acquires and performs all the required functions on the forthcoming data;

- once the predefined time period assigned to the measurement is lasted, the Host computer commands the stop measurement, and all the required functions on the current measurement are completed.

It is noted that the CAL-CsI Electronics configuration shall remain the same for the whole sequence of measurement.

3.2.3.2 INSTRUMENT COMMANDING, DATA ACQUISITION AND PROCESSING

URS-3.2.3.2.1 The Host Computer shall interface the CAL CsI Electronics as specified in the I/F requirement section.

URS-3.2.3.2.2 The CAL-CsI Electronics operative mode set up and configuration shall not require any commanding from the Host Computer (TBC).

URS-3.2.3.2.3 In near real time, the Host Computer shall be able to acquire all the data generated by the CAL-CsI Electronics.

URS-3.2.3.2.4 In near real time, the Host Computer with the acquired data shall generate Pseudo Telemetry (TM) packets (note: also in Standalone mode).

URS-3.2.3.2.5 The Pseudo TM packets shall have the same basic packet structure of the AGILE TM packets.

URS-3.2.3.2.6 The various Pseudo TM packets to be generated by the Host Computer are detailed in A11; they shall include:

- the Pseudo TM packets containing the CsI Bars Photo Diodes data in output from the CAL-CsI Electronics.

URS-3.2.3.2.7 Upon detecting a start/stop measurement command, the Host Computer shall generate a start/stop Pseudo Telecommand (TC) packet.

URS-3.2.3.2.8 The Pseudo TC packets shall have the same basic packet structure of the AGILE TC packets.

URS-3.2.3.2.9 The various Pseudo TC packets to be generated by the Host Computer are detailed in A11.

URS-3.2.3.2.10 For troubleshooting purposes, the Host Computer:

- shall be able to archive all the acquired data in their original format into an internal storage media;

- shall generate, for each measurement, one set of files identified by the same Run ID.

URS-3.2.3.2.11 For archiving purposes, the Host Computer:

- shall be able to archive all the generated pseudo TM/TC packets into an internal storage media;

- shall generate, for each measurement, one set of files identified by the same Run ID.

URS-3.2.3.2.12 In Client Mode, the Host Computer shall be able to distribute in near real time to the Science Console all the generated TM/TC pseudo packets.

3.2.3.3 DATA MONITORING

URS-3.2.3.3.1 The Host Computer shall provide on the screen a window with the basic information which allow the user to monitor the data acquisition

URS-3.2.3.3.2 If the Client mode is selected, the Host Computer shall provide on the same window of the data acquisition monitoring, the basic information which allows the user to monitor the interfacing with the Science Console.

3.2.3.4 DATA QUICK LOOK

URS-3.2.3.4.1 Upon starting a new measurement, the Quick Look shall start to accumulate in parallel one spectrum of 4096 channels (channel number ranging from 0 to 4095) for each of the 16 possible PDs.

URS-3.2.3.4.2 The Quick Look shall include a graphics window providing a plot of the accumulated spectrum seen by the PD (note: only one at a time) selected by the user.

URS-3.2.3.4.3 It shall be possible to archive on the local disk the accumulated spectra.

3.2.3.5 DATA RETRIEVAL

URS-3.2.3.5.1 It shall be possible to access an archived measurement for hexadecimal/ASCI display purposes.

URS-3.2.3.5.2 It shall be possible to retrieve the archived data through ftp.

3.2.4 GAMMA RAY SOURCE POSITIONING

URS-3.2.4.1 When operated in conjunction with the GSPS, the Host Computer shall provide to the operator the set of commands required to perform the various operations, e.g.: system configuration, system initialisation, relative and absolute translation of the available stages.

URS-3.2.4.2 When operated in conjunction with the GSPS, in near-real time, the Host Computer screen shall provide to the operator at least the following information:

- the current status of each GSPS stage (normal/failure);

- the decimal value (in mm) of the final reached position of each GSPS stage;

- the decimal value (in mm) of the commanded position of each GSPS stage;

URS-3.2.4.3 When is operated in conjunction with the GSPS, the Host Computer shall broadcast the positioning information on the LAN as follows:

- once the commanded position has been reached, the Host Computer shall generate an UDP (TBC) broadcast message including the current position value of all the available stages;

- as long as the position is not changed, periodically (every *n* configurable seconds) the Host Computer shall send the UDP (TBC) broadcast message on the Ethernet LAN;

- no message shall be sent during the positioning.

3.3 PERFORMANCE REQUIREMENTS

3.3.1 HOST COMPUTER

URS-3.3.1.1 The Host Computer shall be able to perform all the required functions having in input the maximum event rate of 16000 (TBC) event data/s, as given by considering that 1000 event-data/s are expected on each PD during characterisation with gamma ray sources.

URS-3.3.1.2 The Host Computer software shall be protected in order to avoid any hung due to event data acquisition rates too high with respect to the rate of the pseudo TM/TC forwarded to the Science Console

URS-3.3.1.3 The Host Computer shall include a local disk of at least 10 Gbytes for the local archiving of the PDs data.

3.4 OPERATIONAL REQUIREMENTS

3.4.1 HOST COMPUTER

URS-3.4.1.1 All the Host Computer operations shall be conducted from the Host Computer console.

URS-3.4.1.2 The Host Computer software shall allow to automate the execution of the positioning and start/stop measurements to be performed during the Characterisation tests.

URS-3.4.1.3 The Host Computer design shall take into account the transportability of the equipment.

URS-3.4.1.4 The Host Computer procurement shall include suitable reusable transportation container for the Host Computer itself.

URS-3.4.1.5 The Host Computer shall provide the user with a widget based MMI allowing:

- the Test Session Configuration;
- the Test Session Control;
- the Measurement Configuration;
- the Measurement Control.

3.5 INTERFACE REQUIREMENTS

3.5.1 HOST COMPUTER/CAL-CSI ELECTRONICS I/F

URS-3.5.1.1 The Host Computer shall interface the CAL CsI TE front end and read out electronics through a digital parallel interface providing 4 bytes which can be configurable for either input or output operations.

URS-3.5.1.2 For each ADC conversion:

- the CAL CsI TE electronics:

  - shall make available the corresponding data on the Digital Interface;

  - shall generate a strobe signal;

- the Host Computer:

  - upon receiving the strobe signal, shall acquire the data from the Digital Interface.

URS-3.5.1.3 On the CAL CsI TE electronic panel an input connector shall be available for the Measurement Control (TTL) signal which shall be used to set/reset the Measurement Control flag (MC) included in the input data with the following aims:

- **in both the manual acquisition mode and in automatic acquisition mode**, only the data having this flag set shall be processed by the Host Computer;

- **in automatic acquisition mode**, the flag changes shall be used to automate the start/stop measurement actions to be taken by the Host Computer without any intervention of the operator;

hence, **it is noted that** in case the instrument does not generate any data during the idle period, the CAL-CsI TE electronics shall generate dummy strobes at regular interval (e.g. every 10 s) in order to allow the Host Computer to identify the MC flag changes.

URS-3.5.1.4 For the trigger commanding the ADC conversion, two different modalities are foreseen:

- Internal trigger configuration (i.e. during CsI Bars characterisation test), where the trigger is generated by the CAL CsI TE itself on the basis of the discriminator logic. It is noted that:

- in the **reduced model** the CAL CsI TE shall include only one discriminator logic chain, hence at each trigger, only the one PD (either PD0 or PD15) shall be converted, producing 1 (32 bit) word to be read by the Host Computer through the digital interface;

- in the **nominal model**, the CAL CsI TE shall include one discriminator logic chain for each of the CsI Bars; in this case, at each trigger, the two PDs of each discriminated bar shall be converted, producing a variable number (2*[number of discriminated bars]) of 32 bit words to be read by the Host Computer through the digital interface.

- External trigger configuration (e.g. during beam test at CERN), the trigger signal is generated by a source which is external to the CAL-CsI TE.

3.5.2 HOST COMPUTER/SCIENCE CONSOLE I/F

URS-3.5.2.1 The Host Computer and the Science Console shall be interfaced through a Fast Ethernet (10/100baseT) LAN.

URS-3.5.2.2 A TCP/IP link shall be established between the Host Computer (Client) and the SC (Server) for the Pseudo TM/TC packets.

URS-3.5.2.3 The Host Computer shall broadcast the GSPS stages position using UDP messages.

4 GSPS REQUIREMENTS

4.1 GENERAL OVERVIEW

The GSPS shall be provided by the Industry in order to add to the CAL-CsI TE the capabilities required, during the CsI Bars characterisation tests, in order to host, collimate and position the relevant gamma ray sources in front of a CsI plane consisting of up to 8 CsI Bars.

In order to reduce the overall measurement time, the collimator width shall be grater than the CsI plane width. This shall allow to illuminate all the bars by commanding movements of the collimator only along the CsI Bars length.

4.2 FUNCTIONAL REQUIREMENTS

URS-4.2.1 The GSPS shall provide the mechanical collimator which hosts the gamma-ray sources in order to produce the required gamma-ray spot.

URS-4.2.2 The GSPS shall be able to position the collimator at any point along the whole CsI plane length.

URS-4.2.3 The GSPS shall include the motor required to drive the translation stage and suitable control devices to perform motion control with the required performances.

URS-4.2.4 The CAL-CsI Host Computer, as specified in the CAL-CsI Requirements section shall control the movements of the available stages.

URS-4.2.5 In addition, the GSPS shall allow the operator to control the movements of the available stages from a dedicated panel or joystick located in the GSPS itself.

4.3 PERFORMANCE REQUIREMENTS

URS-4.3.1 The collimator shall provide a gamma-ray spot with the following dimensions:

height: 1.5 mm

width: grater than the (8 bars) CsI plane width.

URS-4.3.2 The stroke of the translation stage shall allow to scan with the gamma-ray spot the whole CsI bars length.

The performances of the translation stage shall be:

- translation range > 500 mm;
- accuracy > 0.1 mm;
- speed = 0 ÷ 2.5 cm/s ± 1% ; accel. = 10 cm/s^2 .

4.4 OPERATIONAL REQUIREMENTS

URS-4.4.1 The GSPS shall be fully operable from a distance of at least 5 m.

URS-4.4.2 The GSPS shall be designed to work correctly at atmospheric pressure and in daily or artificial light.

URS-4.4.3 The GSPS components subject to performance degradation or wrong behaviour when exposed to high energy photons/particles, shall be adequately shielded.

URS-4.4.4 The GSPS components shall present no performance degradation or wrong behaviour when subject to the radiated electromagnetic fields reported in the detector EMC requirements.

URS-4.4.5 The GSPS components shall not radiate electromagnetic field in excess to the levels reported in the detector EMC requirements.

URS-4.4.6 The GSPS design shall take into account the transportability of the equipment.

URS-4.4.7 The GSPS procurement shall include suitable reusable transportation container for the GSPS itself.

4.5 INTERFACE REQUIREMENTS

URS-4.5.1 TBD

4.6 RESOURCE REQUIREMENTS

URS-4.6.1 The use of commercial available hardware which has world-wide service support is recommended.

4.7 QUALITY REQUIREMENTS

URS-4.7.1 The GSPS design shall be performed following structured methodologies. During the design phase, CAD tools shall be used to develop hardware and software.

4.8 MAINTAINABILITY REQUIREMENTS

URS-4.8.1 The GSPS shall be designed in such a way to allow maintenance, assembly/disassembly, inspection and replacement/substitution of its components.

4.9 SAFETY REQUIREMENTS

URS-4.9.1 The GSPS shall include limit switches to detect when linear moving parts reach the begin and the end of the stroke.

URS-4.9.2 The GSPS shall be designed in such a way that a failure in the GSPS shall not propagate to the item under test.

URS-4.9.3 The GSPS design shall be such that any failure occurring during any test configuration or maintenance operation shall not result in hazards for the users of the GSPS itself.

URS-4.9.4 The GSPS shall include emergency push buttons to activate the emergency procedure. shall be of RED colour and shall be easy accessible and identified.

URS-4.9.5 The GSPS should provide TBD grounding.

5 CAL-DFE TE REQUIREMENTS

5.1 GENERAL OVERVIEW

The main aim of the CAL-DFE TE is to support the integration, the functional, performance, environmental and calibration tests to be performed, before integration with the PDHU and the remaining AGILE payload components, on the Calorimeter subsystem consisting of:

- the Detector unit, formed by the CsI bars;
- the Front End Electronics (MCAL FEE), which interfaces the Detector Unit to the PDHU.

This chapter presents the requirements related to the items of the CAL-DFE TE to be provided by the Industry, namely:

- the Power Supply Unit**;**
- the Interface Adapter Box;
- the Host Computer.

The user software requirements on the Host Computer are detailed in AD12.

These items, with the auxiliary use of laboratory standard equipment (e.g. pulse generator with both fixed and random frequency), shall allow to perform all the test activities required to develop and test the MCAL FEE, and to carry out its integration with the Detector Unit.

Further test and calibration activities on the integrated Minicalorimeter system shall require the Science Console (CAL-DFE TE SC), which shall be provided by the AGILE Team.

The Science Console shall be interfaced to the Host Computer in order to acquire and archive in near real time the instrument H/K and Scientific data and perform on them the required on-line and off-line analysis tasks.

At this test level, no Test Equipment tool is required to position the gamma ray sources.

5.2 FUNCTIONAL REQUIREMENTS

5.2.1 POWER SUPPLY UNIT

URS-5.2.1.1 The Power Supply Unit shall provide to the CAL-FEE the required electrical power.

5.2.2 INTERFACE ADAPTER BOX

URS-5.2.2.1 The Interface Adapter Box shall allow the interfacing of the MCAL FEE and the Host Computer.

5.2.3 HOST COMPUTER

5.2.3.1 OPERATIONAL MODALITIES

URS-5.2.3.1.1 It shall be possible to operate the Host Computer in two modalities:

- *Standalone mode*: in this mode the Science Console is not required;

- *Client Mode*: in this mode the Host Computer interfaces to the Science Console.

Unless explicitly stated, the following requirements applies to both the Standalone Mode and the Client Mode.

URS-5.2.3.1.2 The tests will consist of Measurements, each identified by a progressive number (measurement *Run ID*) and consisting of:

- an *Idle* period: the time interval preceding the start measurement command;

- a *Run* period: the time interval between two consecutive start/stop measurement command;

URS-5.2.3.1.3 A set of consecutive measurements will be identified as *Test Session*.

URS-5.2.3.1.4 For each measurement, the following sequence of operations will be required:

- any positioning operations shall be completed;

- on the Host Computer, any command required to configure the MCAL FEE shall be generated and sent to the MCAL FEE, and the correct execution of the commands shall be verified;

- on the Host Computer, the start measurement will be commanded, the relevant command shall be sent to the MCAL FEE, and a new measurement will begin;

- the Host Computer software shall acquire the data in output from the MCAL FEE, and perform on them all the required functions;

- on the Host computer, the stop measurement will be commanded, the relevant command shall be sent to the MCAL FEE, and all the required functions on the current measurement will be completed.

URS-5.2.3.1.5 Before starting a Test Session, the operator shall decide how to operate on the Host Computer:

- in *manual mode:* the operator intervention shall be required in order to start/stop each measurement;
- in *automatic mode*: an automatism shall be used in order to provide automatically the start/stop measurement commands (note: the position is not changed) and the operator shall be required only in order to terminate the Test Session.

5.2.3.2 INSTRUMENT COMMANDING, DATA ACQUISITION AND PROCESSING

URS-5.2.3.2.1 The Host Computer shall interface the MCAL FEE as specified in the I/F requirement section.

URS-5.2.3.2.2 The Host Computer shall be able to set up and configure all the operative modes of the MCAL FEE.

URS-5.2.3.2.3 In near real time, the Host Computer shall be able to acquire all the data generated by the MCAL-FEE

URS-5.2.3.2.4 In near real time, the Host Computer with the acquired data shall generate Pseudo Telemetry (TM) packets (note: also in Standalone mode).

URS-5.2.3.2.5 The Pseudo TM packets shall have the same basic packet structure of the AGILE TM packets.

URS-5.2.3.2.6 The various Pseudo TM packets to be generated by the Host Computer are detailed in A12; they shall include the following Pseudo TM packets:

- the packets containing the MCAL data in output from the GRID branch;
- the packets containing the MCAL data in output from the BURST branch;
- the packet containing the MCAL burst fast ratemeters data.

URS-5.2.3.2.7 Upon detecting a start/stop measurement command, the Host Computer shall generate a start/stop Pseudo Telecommand (TC) packet.

URS-5.2.3.2.8 The Pseudo TC packets shall have the same basic packet structure of the AGILE TC packets.

URS-5.2.3.2.9 The various Pseudo TC packets to be generated by the Host Computer are detailed in A12.

URS-5.2.3.2.10 For troubleshooting purposes, the Host Computer:

- shall be able to archive all the acquired data in their original format into an internal storage media;

- shall generate, for each measurement, one set of files identified by the same Run ID.

URS-5.2.3.2.11 For archiving purposes, the Host Computer:

- shall be able to archive all the generated pseudo TM/TC packets into an internal storage media;

- shall generate, for each measurement, one set of files identified by the same Run ID.

URS-5.2.3.2.12 In Client Mode, the Host Computer shall be able to distribute in near real time to the Science Console all the generated TM/TC pseudo packets.

5.2.3.3 DATA MONITORING

URS-5.2.3.3.1 The Host Computer shall provide on the screen a window with the basic information which allow the user to monitor the data acquisition

URS-5.2.3.3.2 If the Client mode is selected, the Host Computer shall provide on the same window of the data acquisition monitoring, the basic information which allows the user to monitor the interfacing with the Science Console.

5.2.3.4 DATA QUICK LOOK

URS-5.2.3.4.1 Upon starting a new measurement, the Quick Look shall start to accumulate in parallel one spectrum of 4096 channels (channel number ranging from 0 to 4095) for each of the 64 possible PDs.

URS-5.2.3.4.2 The Quick Look function shall be performed on only a fraction of the data.

URS-5.2.3.4.3 The Quick Look shall include a graphics window providing a plot of the accumulated spectrum seen by the PD (note: only one at a time) selected by the user.

URS-5.2.3.4.4 It shall be possible to archive on the local disk the accumulated spectra.

URS-5.2.3.4.5 TBD.

5.2.3.5 DATA RETRIEVAL

URS-5.2.3.5.1 It shall be possible to access an archived measurement for hexadecimal/ASCI display purposes.

URS-5.2.3.5.2 It shall be possible to retrieve the archived data through ftp.

5.3 PERFORMANCE REQUIREMENTS

5.3.1 HOST COMPUTER

URS-5.3.1.1 The Host Computer shall be able to perform all the required functions having in input the maximum event rate of 64000 (TBC) event data/s, as given by considering that 1000 event-data/s are expected on each PD during characterisation with gamma ray sources.

URS-5.3.1.2 The Host Computer shall be able to perform the *Data Quick Look* functions with the following performances:

- in Stand-alone mode:

  - the accumulation shall be performed on at least 30-50% of the acquired data, depending on the input rate;

  - the screen shall be updated automatically either every at least 10s-30s (user configurable), or on user request , depending on the input rate;

- in Client mode:

  - the accumulation shall be performed on at least 10-20% of the acquired data, depending on the input rate;

  - the screen shall be updated on user request.

URS-5.3.1.3 The Host Computer software shall be protected in order to avoid any hung due to event data acquisition rates too high with respect to the rate of the pseudo TM/TC forwarded to the Science Console

URS-5.3.1.4 The Host Computer shall include a local disk of at least 10 Gbytes for the local archiving of the PDs data.

5.4 OPERATIONAL REQUIREMENTS

5.4.1 HOST COMPUTER

URS-5.4.1.1 All the Host Computer operations shall be conducted from the Host Computer console.

URS-5.4.1.2 The Host Computer software shall allow to automate the execution of the start/stop measurements.

URS-5.4.1.3 The Host Computer design shall take into account the transportability of the equipment.

URS-5.4.1.4 The Host Computer procurement shall include suitable reusable transportation container for the Host Computer itself.

URS-5.4.1.5 The Host Computer shall provide the user with a widget based MMI allowing:

- the Test Session Configuration;
- the Test Session Control;
- the Measurement Configuration;
- the Measurement Control.

5.5 INTERFACE REQUIREMENTS

5.5.1 HOST COMPUTER/MCAL FEE I/F

URS-5.5.1.1 The Host Computer shall provide to the MCAL FEE all the electrical interfaces provided by the PDHU.

5.5.2 HOST COMPUTER/SCIENCE CONSOLE I/F

URS-5.5.2.1 The Host Computer and the Science Console shall be interfaced through a Fast Ethernet (10/100baseT) LAN.

URS-5.5.2.2 A TCP/IP link shall be established between the Host Computer (Client) and the SC (Server) for the Pseudo TM/TC packets.

URS-5.5.2.3 The Host Computer shall broadcast the GSPS stages position using UDP messages,

6 PDHU TE REQUIREMENTS

6.1 GENERAL OVERVIEW

The main aim of the PDHU TE is to support the integration, the functional, performance, environmental and calibration tests to be performed on the PDHU subsystem, before integration with the remaining AGILE payload components

The following items of the PDHU TE shall be provided by the Industry:

- the Power Front End Equipment (Power FEE)**;**
- the Interface Adapter Box;
- the Detectors Simulator Front End Equipment (Detectors SIM FEE), which provides proper simulation of the three Payload detectors (ST, MCAL, SA), and of the two Payload auxiliary subsystems (AC, PDHU);
- the Spacecraft Interface Simulator, GPS, and Star Tracker SCOE (SIS & GSTS SCOE), for the simulation of the S/C, the GPS and the Star Tracker, which shall be reused in the Instrument EGSE;
- the Central Checkout Equipment (CCOE), which shall be reused in the Instrument EGSE.

This chapter presents the requirements of the Power Front End Equipment (Power FEE), the Interface Adapter Box, and the Detectors SIM FEE.

The requirements of the SIS & GSTS SCOE and the CCOE are given in the Instrument EGSE requirements section.

In addition, the Agile Team shall provide the Science Console (PDHU TE SC) in order to inspect the instrument scientific data. This SC shall be reused in the Instrument EGSE.

The Science Console shall be interfaced to the CCOE in order to acquire and archive in near real time the instrument H/K and the Scientific data and perform on them the required on-line and off-line analysis tasks. Interface requirements among the Science Console and the CCOE are given in the Instrument EGSE requirement section.

The above items, with the auxiliary use of available laboratory standard equipment, shall allow to perform all the PDHU AIV activities.

6.2 FUNCTIONAL REQUIREMENTS

6.2.1 GENERAL

URS-6.2.1.1 The PDHU TE, with the auxiliary use of laboratory standard equipment, shall allow to access and verify individually from the electrical and functional point of view all the PDHU Interfaces (power lines, clocks, analogue lines, digital lines).

URS-6.2.1.2 The PDHU TE shall allow to verify from the electrical and functional point of view all the general functions of the PDHU, e.g.:

a) management of the commands;

b) management of the analog signals from the various subsystems;

c) management of the digital data from the various subsystems at the proper bit rate;

d) build-up of the scientific and functional rate meters of the various subsystems

e) management of the scientific, HK and calibration data;

f) preparation of the telemetry packets for scientific, HK and calibration data and rate meters of the various subsystems;

URS-6.2.1.3 The PDHU TE shall allow to test the functions of the PDHU which are specific to each subsystem operated alone.

URS-6.2.1.4 The PDHU TE shall allow to test the functions of the PDHU which are specific to the various Payload subsystems operated together.

6.2.2 POWER FEE

URS-6.2.2.1 The Power FEE shall provide to the PDHU the required electrical power.

6.2.3 INTERFACE ADAPTER BOX

URS-6.2.3.1 The Interface Adapter Box shall allow the interfacing of the PDHU and the Detectors SIM FEE.

6.2.4 DETECTORS SIM FEE

URS-6.2.4.1 The Detectors SIM FEE shall simulate from the electrical, functional and performance point of view the I/F with the PDHU of the following Payload subsystems:

- ST
- MCAL
- SA
- AC

URS-6.2.4.2 The Detectors SIM FEE shall be able to provide in input to the PDHU the various simulated analogue signals and the various simulated digital data, as required to stimulate and verify all the PDHU operating modes, with particular regards to:

- the PDHU functionality implemented by hardware;

- the PDHU functionality which operates simultaneously on the data/signals generated by the various subsystem, e.g. GRID mode, Zombie Mode, Burst modes;

- the PDHU functionality which are affected by the rate/time tag/content of the simulated data, e.g. burst detection;

- the PDHU functionality which shall not be possible to verify during the AIV at System Level, e.g. Zombi mode, burst mode;

URS-6.2.4.3 The Detectors SIM FEE shall be able to generate and make available to the PDHU the simulated event of each single payload subsystems, in parallel, on the basis of the operational scheme sketched in fig. 6-1 below.

URS-6.2.4.4 The Detectors SIM FEE shall allow the operator to define the event to be simulated event by means of modifiable Timing Sequences and modifiable Data Buffers associated to each subsystem.

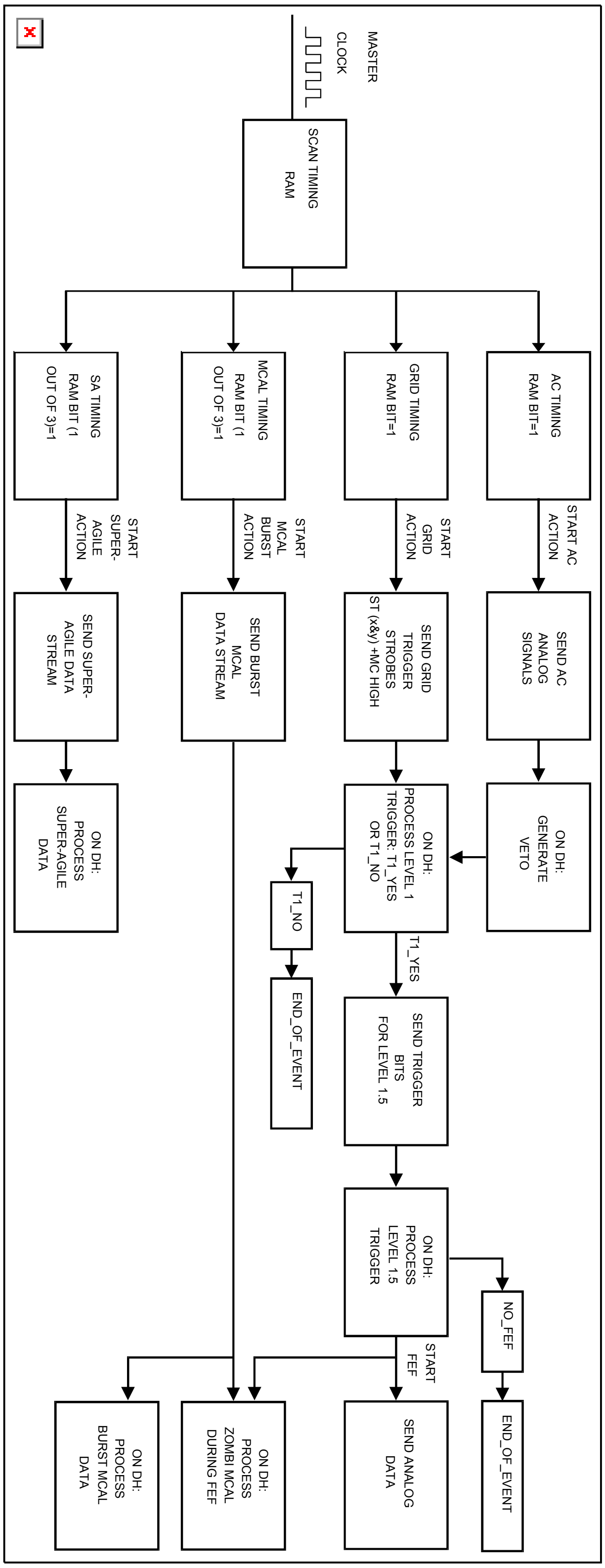

Fig. 6-1 Detectors SIM FEE operational scheme

URS-6.2.4.5 **Timing Sequences of the simulated events**

URS-6.2.4.5.1 The Detectors SIM FEE shall provide the following number of Timing Sequences:

- N.1 Timing Sequence for the AC subsystem;
- N.1 Timing Sequence for the GRID (ST and the MCAL/GRID) subsystem;
- N.3 Timing Sequences for the MCAL/Burst subsystem;
- N.3 Timing Sequence for the SA subsystem.

URS-6.2.4.5.2 Each Timing Sequence shall consist of 1 million of time slots.

URS-6.2.4.5.3 Each Timing Sequence shall define for each time slot whether an event shall be generated or not.

URS-6.2.4.5.4 The values to be assigned to each Timing Sequence, shall be modifiable by the operator before starting the test.

URS-6.2.4.5.5 The time frequency at which the events of two consecutive time slot shall be generated shall correspond to the frequency of the Master Clock generated by the Detectors SIM FEE at one of the following values:

- 2.5 MHz;
- 1 MHz;
- 100 KHz;
- 10 KHz;
- 1 KHz.

URS-6.2.4.5.6 The frequency value to be assigned to the Master Clock shall be defined by the operator before starting the test.

URS-6.2.4.5.7 The Detectors SIM FEE shall derive the Master Clock from the 5MHz clock provided by the PDHU.

URS-6.2.4.5.8 The Master Clock shall be used to scan in parallel one Timing Sequence for each Subsystem.

URS-6.2.4.5.9 Once started, the Detectors SIM FEE shall iterate on the available Timing Sequences as follows:

- AC: the whole AC Timing Sequence shall be iterated continuously;

- GRID: the whole GRID Timing Sequences shall be iterated continuously;

- MCAL/Burst: at each iteration, the Timing Sequence to be used for the MCAL/Burst shall be selected among the 3 available MCAL/Burst Timing Sequences on the basis of the scheme sketched in fig. 6-2 below, where:

    i. before starting the test, the operator shall define the MCAL/Burst Timing Sequence ID Buffer, containing 256 (TBC) values, which identify the ID (1/2/3) of the Timing Sequence to be used for each iteration;

    ii. at each iteration, an 8 (TBC) bit ID Counter shall be incremented in order to address the next value in the MCAL/Burst Timing Sequence ID Buffer, which shall determine the Timing Sequence for the next iteration being started;

- SA: at each iteration, the Timing Sequence to be used for the SA shall be selected among the 3 available SA Timing Sequences on the basis of the scheme specified above for the MCAL/Burst.

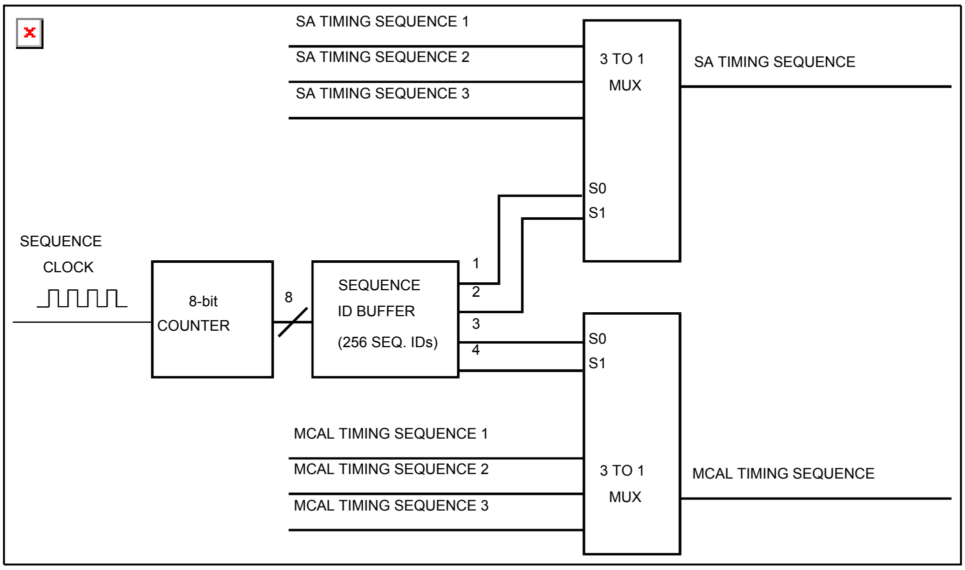

Fig. 6-2 SA and MCAL/Burst Timing Sequence selection scheme

URS-6.2.4.5.10 The AC Timing Sequence shall be associated to the Data Buffer defined hereafter for the AC events.

URS-6.2.4.5.11 At each new iteration, the AC Data Buffer shall be accessed starting with the event data which follow the last event data generated during the previous iteration.

URS-6.2.4.5.12 The GRID Timing Sequence shall be associated to the Data Buffer defined hereafter for the GRID events.

URS-6.2.4.5.13 At each new iteration, the GRID Data Buffer shall be accessed starting with the event data which follow the last event data generated during the previous iteration.

URS-6.2.4.5.14 Before starting the test, the operator shall be able to define the association of each of the 3 MCAL/Burst Timing Sequences to one of the 2 MCAL/Burst Data Buffers defined hereafter.

URS-6.2.4.5.15 At any new iteration, each MCAL/Burst Data Buffer shall be accessed starting with the event data which follow the last event data generated during the previous iteration associated to that Data Buffer.

URS-6.2.4.5.16 Before starting the test, the operator shall be able to define the association of each of the 3 SA Timing Sequences to one of the 2 SA Data Buffers defined hereafter.

URS-6.2.4.5.17 At any new iteration, each SA Data Buffer shall be accessed starting with the event data which follow the last event data generated during the previous iteration associated to that Data Buffer.

URS-6.2.4.6 **Event data simulation**

URS-6.2.4.6.1 The Detectors SIM FEE shall allow the operator to define the content/value of the digital/analogue simulated events to be generated and make available to the PDHU for each single payload subsystems, in parallel, by setting the Data Buffers associated to each subsystems.

URS-6.2.4.6.2 The values to be assigned to each Data Buffer shall be modifiable by the operator before starting the test.

URS-6.2.4.6.3 The simulation the GRID events shall require the following Data Buffers, which shall be able to contain the data of 100 GRID events and which shall be operated on the basis of the scheme sketched in fig. 6-3 below:

- N.1 Event Info Buffer, capable of containing:

  - 3 (1 bit for ST-Trigger X, 1 bit for ST-Trigger Y, 1 bit for MCAL-Fast Trigger) * 100 (events) bit;

  this shall be used to generate, for each event required by the ST Timing Sequence, the Level 1 Trigger signals to be sent at the proper time to the PDHU, through 3 dedicated lines;

  - 5 (TBD bits for MGO, TBD bits for OVF SAIE, and TBD bits spare) * 100 (events) bits; which:

- shall simulate the output from the two SA-SAIE (same values for both the SAIE) to be sent to the PDHU, through the two serial lines, upon receiving the T1_YES signal;

- shall allow other TBD simulation.

- N.1 ST-Trigger Buffer, capable of containing 24 (bit per event) * 14 (FEB) * 100 (events) bits;

this shall be used to simulate the 14 ST-FEB trigger event data to be sent on the 14 serial lines upon receiving the T1_YES signal, at the time required by the PDHU Level 1.5 clock;

- N.14 ST-Data Buffers, each capable of containing 8 (max triggered TA1 chip per FEB) x 128 (channels per chip) x 16 (bit per channel) bits;

these shall be used to simulate, for each event, the strip readout data to be sent on 14 independent analogue lines upon receiving the Start FEF signal, at the time required by the PDHU readout clock;

- N.1 MCAL-Data Buffer, capable of containing 16 (bits per channel) * 64 (channels) * 100 (events) bit;

this shall be used to simulate, for each event, the digital stream corresponding to the readout of the 64 Photo Diodes Amplitude, to be sent to the PDHU upon receiving the Start FEF signal.

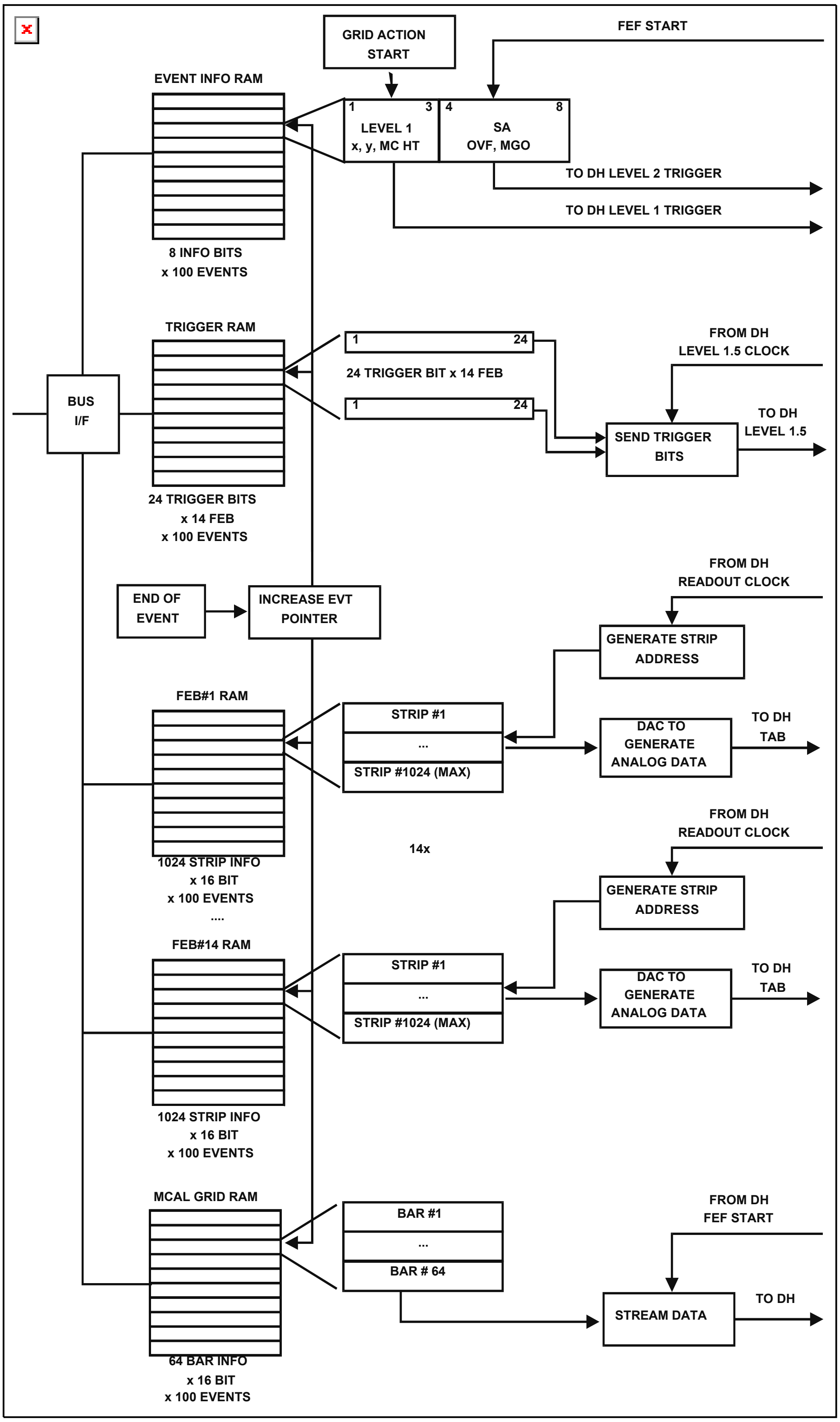

Fig. 6-3 GRID events simulation scheme

URS-6.2.4.6.4 The simulation the AC events shall require the following Data Buffer, which shall be able to contain the data of 10000 AC events and which shall be operated on the basis of the scheme sketched in fig. 6-4 below:

-N.1 AC-Data Buffer, capable of containing 16 (bits per event)* 10000 (events) bit;

this shall be used to generate, for each event required by the AC Timing Sequence, the 16 analogue pulses (having the low/high level, as defined by the 0/1 value of the corresponding bit value) to be sent at the proper time to the PDHU.

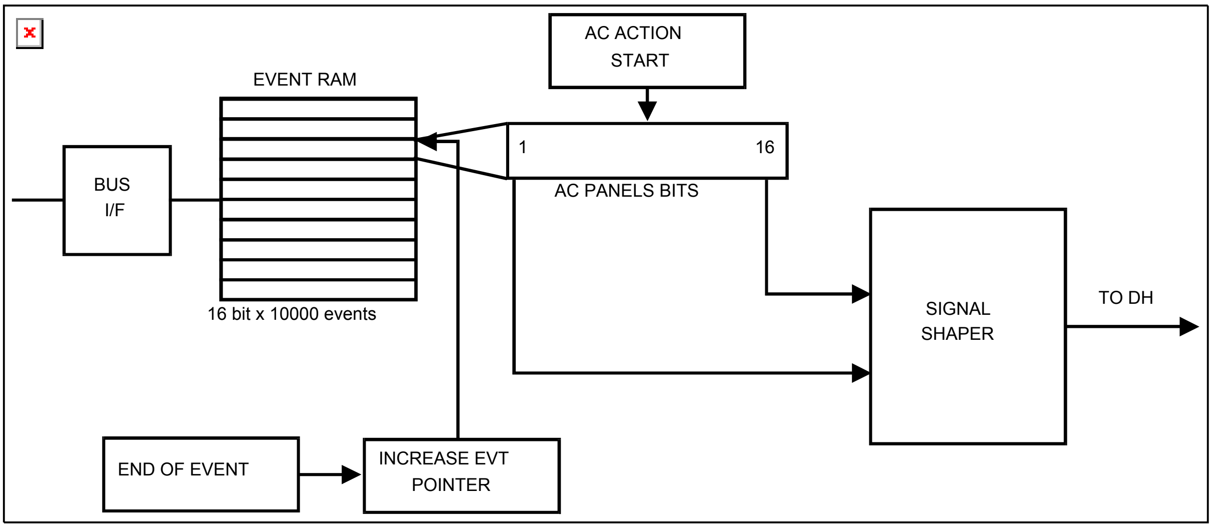

Fig. 6-4 AC events simulation scheme

URS-6.2.4.6.5 The following Data Buffers shall be required in order to define the content of up to 100000 SA background events, and up to 100000 SA source events:

- N.1 SA-Data Buffer for the background events, capable of containing 48 (bits per event, including the time tag) * 100000 (events) bit;

- N.1 SA-Data Buffer for the source events, capable of containing 48 (bits per event, including the time tag) * 100000 (events) bit.

As long as a Timing Sequence is active, that Data Buffer associated to the Timing Sequence shall be operated on the basis of the scheme sketched in fig. 6-5 below.

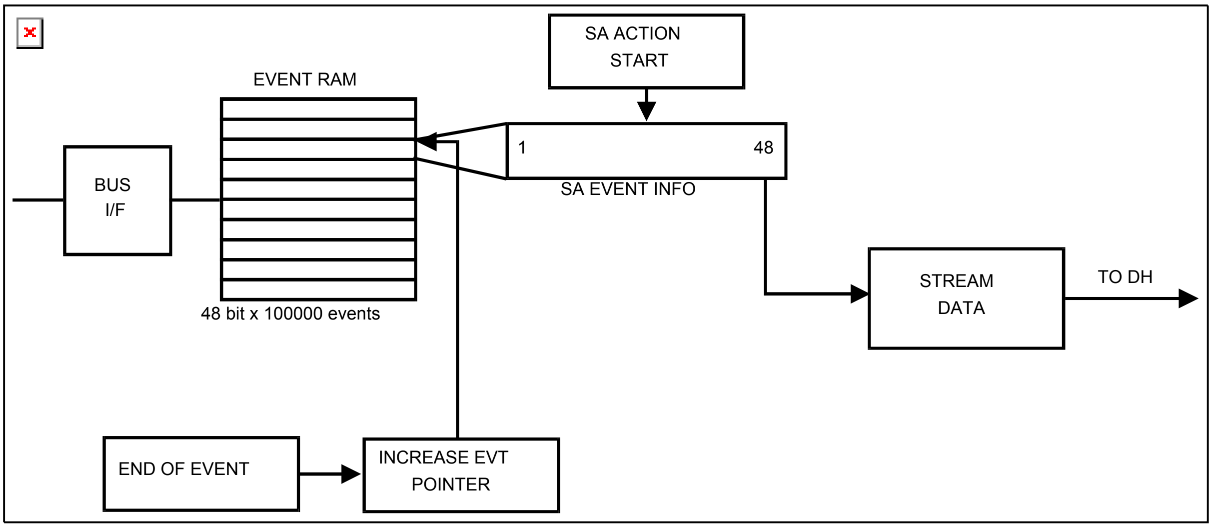

Fig. 6-5 SA events simulation scheme

URS-6.2.4.6.6 The following Data Buffers shall be required in order to define the content of up to 12000 MCAL/Burst background events, and up to 12000 MCAL/Burst source events:

- N.1 MCAL/Burst-Hit Bars Buffer for the background events, capable of containing 5 (event multiplicity) * 1000 (events) bit;
- N.1 MCAL/Burst-Data Buffer for the background events, capable of containing 48 (bits per event) * 12000 (events) bit;
- N.1 MCAL/Burst-Hit Bars Buffer for the source events, capable of containing 5 (event multiplicity) * 1000 (events) bit;
- N.1 MCAL/Burst-Data Buffer for the source events, capable of containing 48 (bits per event) * 12000 (events) bit;

As long as a Timing Sequence is active, that Hit Bars Buffer and that Data Buffer associated to the Timing Sequence shall be operated on the basis of the scheme sketched in fig. 6-6 below.

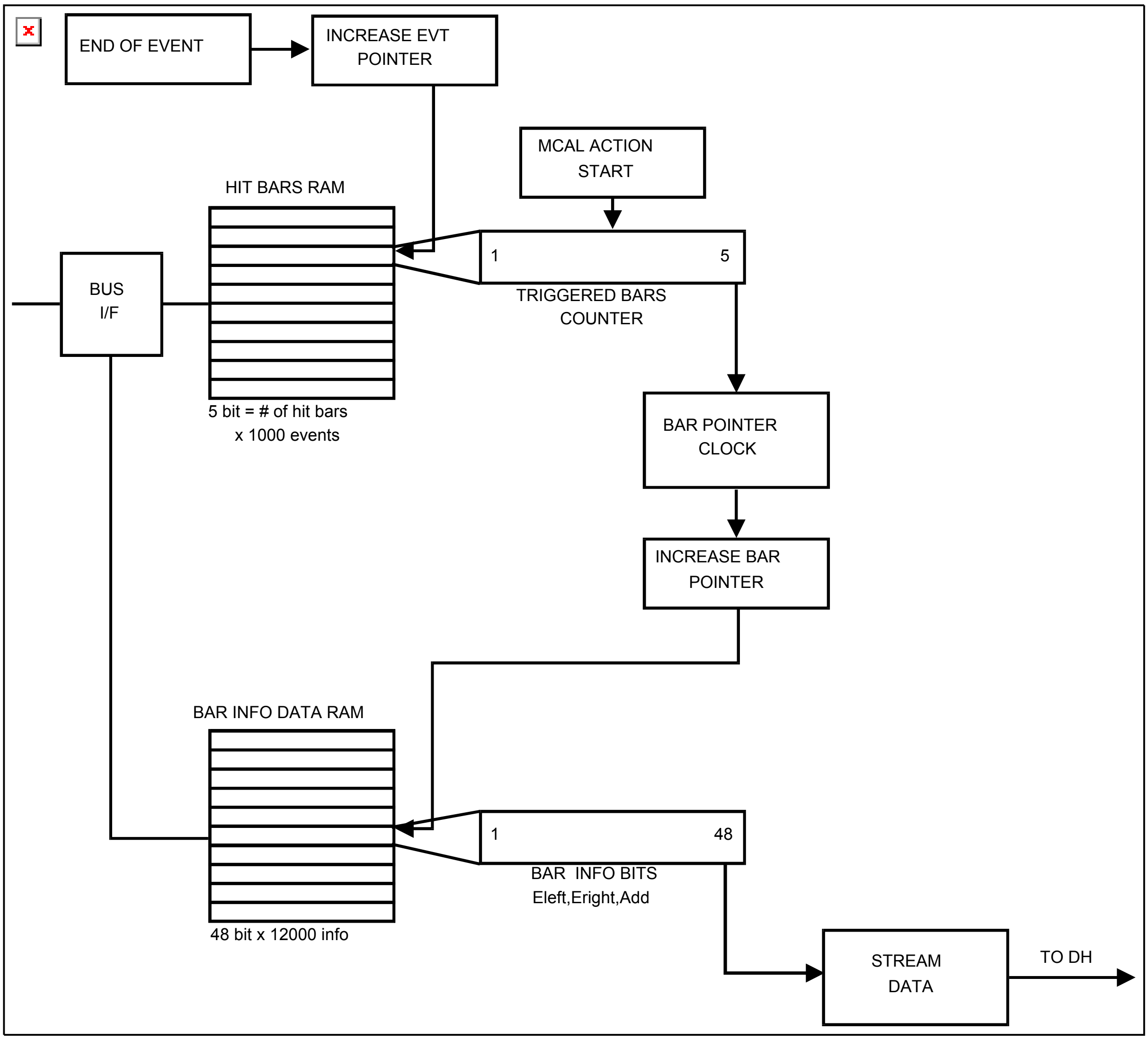

Fig. 6-6 MCAL/Burst events simulation scheme

URS-6.2.4.7 **Analogue HK simulation**

URS-6.2.4.7.1 The Detectors SIM FEE shall be able to generate simulated Analogue HK having proper modifiable discrete values or slopes, as required in order to verify the correctness of the operations performed on them by the PDHU.

6.3 INTERFACE REQUIREMENTS

6.3.1 INTERFACE ADAPTER BOX

URS-6.3.1.1 TBD

6.3.2 DETECTORS SIM FEE

URS-6.3.2.1 The Detectors SIM FEE shall allow the user to specify the value to be loaded in the Timing Sequences and the Data Buffers, through a set of input files for each test to be performed.

URS-6.3.2.2 The format of the input files to be provided by Agile Team for the Timing Sequences and the Data Buffers files is TBD.

URS-6.3.2.3 The input files for the Timing Sequences and the Data Buffers files shall be transferred to the Detectors SIM FEE through ftp or NFS.

7 INSTRUMENT EGSE REQUIREMENTS

7.1 GENERAL OVERVIEW

The main aim of the Instrument EGSE is to support the test activities required to integrate the PDHU with the AGILE payload detectors (ST, MCAL, SA) and the AC auxiliary subsystem, and to perform on the resulting instrument complement the functional and environmental test and the calibration.

This chapter presents the requirements related to the items of the Instrument EGSE to be provided by the Industry, namely:

- the Spacecraft Interface Simulator, GPS, and Star Tracker SCOE (SIS & GSTS SCOE), which shall also used in the PDHU TE;
- the Power SCOE**;**
- the Central Checkout Equipment (CCOE), which shall also used in the PDHU TE.

These items shall allow to perform all the Instrument AIV activities which shall not require the inspection of the instrument scientific data.

Further Instrument AIV tests and the calibration of the instrument at beam facility shall require the following additional items which shall be provided by the AGILE Team, namely:

- the Science Console (Instrument SC), to be interfaced to the CCOE in order to acquire and archive in near real time the instrument H/K and Scientific data and perform on them the required on-line and off-line analysis tasks;
- the Calibration MGSE, to be interfaced to the CCOE in order to automate the positioning of the instrument during calibration at beam facilities.
- The Quick Look & Off-line workstations, to be interfaced to the Science Console in order to have access to the instrument H/K and Scientific data for further analysis of the instrument detectors (ST, MCAL, SA).

7.2 FUNCTIONAL REQUIREMENTS

7.2.1 SIS & GSTS SCOE

URS-7.2.1.1 The SIS & GSTS SCOE shall simulate from the electrical and functional point of view the missing elements related to:

- the Electrical Bus I/F listed in document A.1;
- the GPS and Star Sensor Electrical I/F listed in document A.1.

URS-7.2.1.2 The GPS and Star Sensor functionality provided by the SIS & GSTS SCOE shall include the generation of the signals/pulses/clocks/data as required to verify the AGILE instrument.

URS-7.2.1.3 The simulated Star Sensors and the GPS data shall be generated by the SIS & GSTS SCOE on the basis of input files provided by the Agile Team;

URS-7.2.1.4 The simulated Star Sensors and the GPS data shall be generated by the SIS & GSTS SCOE every 100 ms (TBC).

URS-7.2.1.5 The simulated GPS pulse per second signal shall be accessible by external equipment for synchronisation purposes (TBC).

URS-7.2.1.6 The SIS & GSTS SCOE shall be directly interfaced to the instrument, through the Survival Housekeeping lines (as defined in A.1) for health monitoring of the analogue channels.

URS-7.2.1.7 The SIS & GSTS SCOE shall simulate the OBDH bus and interface the instrument in order:

- to send commands to the instrument;
- to acquire from the instrument the whole telemetry source packets.

URS-7.2.1.8 The SIS & GSTS SCOE shall interface the CCOE in order:

- to acquire from the CCOE the commands to be sent to the instrument;
- to forward to the CCOE the telemetry received from the instrument.

7.2.2 POWER SCOE

URS-7.2.2.1 The Power SCOE shall provide to the payload the missing Spacecraft elements related to the electrical power supply.

7.2.3 CCOE

7.2.3.1 INSTUMENT SET UP AND COMMANDING

URS-7.2.3.1.1 The CCOE shall provide to the user the tools required to prepare, test, maintain and run the Test Sequences which implement the required Test Procedures.

URS-7.2.3.1.2 The Test Sequences running in the CCOE shall sequence the test by testing housekeeping values and telecommand reports and by sending predefined commands.

7.2.3.2 DATA ACQUISITION AND PROCESSING

URS-7.2.3.2.1 The CCOE shall acquire from the SIS & GSTS SCOE all the telemetry source packets performing on them all the processing required to verify their correctness at the level of packet header and checksum.

URS-7.2.3.2.2 The CCOE shall perform in near real time the health monitoring of the instrument by inspecting the relevant packets and performing on the relevant parameters the appropriate checks:

- limit check, the parameter is checked to be within a specific range;
- delta check, the rate of change of a parameter is checked to be inside certain bounds;
- status check, status parameters shall be checked against a pre-defined status;

URS-7.2.3.2.3 The CCOE shall be able to derive from the HK parameters additional data (derived parameters), which shall be added to the telemetry data and regarded as any other parameters for checking, displaying and filing purposes.

URS-7.2.3.2.4 The CCOE shall be able to convert any analogue parameter into engineering units using the associated calibration curve.

7.2.3.3 DATA ARCHIVING AND DISTRIBUTION

URS-7.2.3.3.1 The CCOE shall be able to archive all telecommands, the telemetry and the derived data into an internal storage media ("CCOE archive"), where they shall be available for further processing.

URS-7.2.3.3.2 During the whole Test Session, the CCOE shall be able to distribute in near real time to the Science Console the echo of all the TM packets produced by the Instrument and all the TC Packets sent to the instrument.

7.2.3.4 ON-LINE DATA PRESENTATION

URS-7.2.3.4.1 The CCOE shall allow the user to inspect, in near real time, the incoming TM by means of alphanumeric dumps of the TM packets, selected by their identifier parameters (e.g. APID).

URS-7.2.3.4.2 The CCOE shall be able to display, in near real time, the time profile (raw or engineering value) in graphic format of the parameters selected by the user.

URS-7.2.3.4.3 The CCOE shall provide to the user, in near real time, an immediate visualisation of the execution status of each started Test Sequence.

7.3 PERFORMANCE REQUIREMENTS

7.3.1 SIS & GSTS SCOE

URS-7.3.1.1 The SIS & GSTS SCOE shall be able to perform all the required functions having in input the maximum output rate foreseen for the PDHU (20Kbyte/s TBC).

7.3.2 CCOE

URS-7.3.2.1 The CCOE shall be able to perform all the required functions having in input the maximum Telemetry stream rate foreseen for the PDHU (20Kbyte/s TBC).

URS-7.3.2.2 The CCOE shall be able to perform the health monitoring functions on at least 1500 parameters at a time.

URS-7.3.2.3 The CCOE shall be equipped with an internal storage media capable of containing at least the TM, TC and derived data produced by 48 hours of measurements.

URS-7.3.2.4 The CCOE shall be able to run at least 20 Test Sequences at a time.

URS-7.3.2.5 The CCOE shall be able to perform in near real time:

- the time profile graphical display on up to 10 parameters represented with independent ranges;
- the time profile graphical display on up to 10 parameters represented on the same range;

7.4 OPERATIONAL REQUIREMENTS

7.4.1 SIS & GSTS SCOE

URS-7.4.1.1 During beam calibration, the SIS & GSTS SCOE shall be located at the distance of at least 20 m. from the CCOE.

URS-7.4.1.2 During beam calibration, the SIS & GSTS SCOE shall be unattended and operated from the CCOE.

7.4.2 CCOE

URS-7.4.2.1 The CCOE shall be the unique on-line source of all telecommands to the instrument.

URS-7.4.2.2 The CCOE shall allow the user to execute the Test Sequences either step by step or at once.

7.5 INTERFACE REQUIREMENTS

7.5.1 SIS & GSTS SCOE /CCOE I/F

URS-7.5.1.1 The SIS & GSTS SCOE and the CCOE shall be interfaced through an Ethernet (10/100 baseT) LAN.

URS-7.5.1.2 The format of the input files to be provided by the Agile Team for the simulation of the Star Sensors and the GPS data is TBD.

7.5.2 CCOE/SCIENCE CONSOLE I/F

URS-7.5.2.1 The CCOE and the Science Console shall be interfaced through a Fast Ethernet (10/100baseT) LAN.

URS-7.5.2.2 The TM/TC link shall be established between the CCOE (Client) and the SC (Server).

7.5.3 CCOE/CAL-MGSE COMPUTER I/F

URS-7.5.3.1 The CCOE and the CAL-MGSE shall be interfaced through a Fast Ethernet (10/100 baseT) LAN.

7.5.4 SCIENCE CONSOLE/QUICK LOOK & OFF LINE WORKSTATIONS I/F

URS-7.5.4.1 The Science Console and the Science Console shall be interfaced though a Fast Ethernet (100 baseT) LAN.