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The X-IFU Gazette

In the news:

Editorial: Fitting Athena within the bill

Athena in its current baseline configuration is estimated by the ESA project team to be about 20% above its 1.05 G€ envelope. Science immune options to reduce the Athena cost, such as offloading some Science Instrument Module (SIM) activities from the industrial Primes are being investigated.

CNES has identified the resources required to integrate the X-IFU engineering and flight models on the SIM, leading by itself to an already significant cost saving to Athena.

In parallel, some more dramatic cost saving options, directly impacting the science throughput of Athena, are also being considered. Those include reducing the mirror size, removing the deployable sun shield and the Solar Array Drive Mechanisms, reducing the operation costs (by reducing the mission lifetime from 5 to 4 years and de-scoping the target of opportunity support), reducing the number of ESA provided X-IFU coolers…

The Athena Science Study Team has thus launched an exercise with the Athena Science Advisory Structure 1) to define a revised scientific program that can be accomplished by the cost-constrained (CC) mission 2) to identify the science gain with the current baseline mission concept compared to the CC mission.

This exercise will lead to a report to be evaluated by the ESA advisory structure in October, in time for the November meeting of the ESA Science Program Committee.

At the same time, the X-IFU team is also looking at alternative cryogenic chain architectures, as a way to optimize the overall system and improve its performance, with the potential benefits to reduce the number of ESA provided coolers, and hence accomplishing a further cost saving. All these parallel activities should lead to the definition of a new mission baseline to be carried out for the remaining of the phase A/B1.

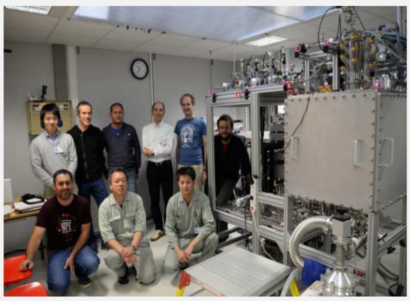
Didier Barret (PI)

Demonstration of the 300 K – 50 mK cryocooler chain

Cryostat 1

The design and validation of flight compatible cryostat, providing temperature as low as 50 mK with minimal perturbation to the detectors is a complicated endeavor. To prepare for this important task for X-IFU, ESA is funding a Core Technology Program (CTP), awarded to CNES/CEA and partners from X-IFU consortium (SRON, JAXA, INTA, ALAT, RAL, IRAP).

As part of this CTP called Detector Cooling System (DCS), design, manufacturing and test of a cryostat including existing space coolers will be done. In addition to the validation of thermal performance, a FPA demonstrator from SRON will be integrated and its performances characterized. This is a unique opportunity to validate crucial issues of the cryogenic design and the integration of such sensitive detectors.



Franco-Japanese team

To study gradually the difficulties and validation of such cryostat, a first step concentrates on the validation of the cooler operation themselves. For this, the cryocoolers are coupled together and validated in the so called *cryostat 1*. This cryostat uses ground coolers for shield and structure cooling to let us focus on the pure cryocooler operations. It has been designed and manufactured in CEA Grenoble and integrates already coolers from Japan and France.

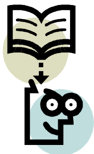
JAXA, is providing 2 Joule Thomson (JT) coolers, operating at respectively 4.5 Kelvin (K) and 1.7 K. For the first time the 2K JT cooler from JAXA is coupled to a 15 K pulse tube (PT) cooler from Air Liquide. This coupling demonstrates the good cooperation across the continent.

As a first step, the cryostat itself has been validated, with active control of the thermal shields and cooling with the ground based cooler. Then the 4K JT from JAXA, coupled to its Stirling cooler has been integrated and performs as predicted. Now, the assembly of the 2K JT and 15K PT cooler is being tested. Finally, the addition of the 50 mK hybrid cooler from CEA will form an autonomous cryogenic chain from 300 K to 50 mK. This full validation is planned for this fall.

The *cryostat 1* is built in a modular way making it possible to test alternative coolers and cooling chain and as such, the 2K JT from RAL could be tested as well. The validation of the cryochain will bring valuable data and validation before the integration of these coolers in the final DCS cryostat. To our eyes, on top of gathering technical data, a great understanding and appreciation of the team from two different continents is a major output of this work.

Jean-Marc Duval (CEA)

INTEGRATED PROGRESS MEETING N°2



Week of 14th of June Toulouse

The quarterly Integrated Progress Meeting (IPM) is the special encounter for the managers to discuss matter on X-IFU concerns and to report progress on all the sub-systems.

Organized in Toulouse (CNES), and alternating with the Consortium Meetings, it offers also the opportunity for partners to talk about specific topics (management or technics) through dedicated parallel or technical splinter meetings.

During the last session that occurred in June (the 14th for the plenary session, splinters for the days around), technical team dealt with Instrument contamination, Anticoincidence, Avionics, detection chain, etc. concerns.

As well as Consortium Meetings, the Integrated Progress Meetings are the opportunity for each of us to better know its counterparts, working together in face-to-face meetings but also to share some fun-filled moments.

Focus on the X-IFU sub-system Warm Electronics (WE)

The Warm Electronics (WE) is the warm part of the reading chain of the X-IFU sensors, directly connected to the cold part of the detection chains, those of both main detectors and anti-coincidence (AC) detectors. In order to implement this function, several units are needed:

- For the main detector chain, 1) the WFEE (Warm Front End Electronics) transmits to the cold electronics the Bias and the Feedback signals provided by the Digital Readout Electronics (DRE), provides the needed polarization currents to the Focal Plan Assembly (FPA) and amplifies the science signal received from the cold electronics before transmitting it to the DRE.

2) The DRE controls the frequency multiplexed readout of the FPA (96 channels x 40 pixels), linearizes the detection chains, detects the events and measures the photon energy.

- For the AC chain: 1) The CryoAC WFEE controls individually the 4 pixels in DC-mode (no multiplexing); then, transmits the sensed pulse signals to the 2) CryoAC WBEE (Warm Back End Electronics) which digitizes and pre-processes the background measured.

- The added *service* functions: 1) The Remote Terminals Units (RTU) offer high level services for items that cannot integrate these services as data bus interface for TM/TC exchange with the Instrument Control Unit (ICU) and Housekeeping (HK) commanding, acquisition and conditioning. 2) Power conversion from the S/C 50 V into secondary power lines.

Aimed to provide elaborated data to the ground, the WE is not directly interfaced with it: data are routed by data busses to the ICU, then transmitted to the spacecraft Data Management System before reaching the Spacecraft radio transmission then the High Gain Antenna. The WE subsystem also distributes the power to the sub-units thanks to the Power Distribution Unit (PDU).

ICU and PDU are the main items of the **avionics** architecture, including also the data buses, the HK management, and, generally, the interfaces between the electronics boxes.

Obviously, the tasks on the WE interfaces and those on the Avionics architecture are strongly interconnected. During the last months the definition of these tasks made some significant progress even if some more work is still needed; but the phase A is not yet finished...

***Bernard Pontet** CNES WE sub-system manager*

Thien Lam-Trong

After a university course via prepatory classes and a *grande ecole* in Aeronautics, I spent my first business years with civil airplanes in the Airbus Industrie company (Flight Dynamics). Then, I joined CNES for an adventure which is still going on. I discovered the Space as Operations Manager for the Launch and Early Orbit Phases of Telecommunication satellites; then, the world of Projects in different domains, the Human Flight (HERMES Command/Control, the European Space Shuttle), the Earth Observation (Electrical Architect and Payload Manager of SPOT-4), the Space Exploration (Project Manager of MSRO, the Orbiter of the CNES/NASA Mars Sample Return Mission, stopped after the phase B), the Astrophysics (Project Manager of COROT, the pioneer mission seeking for extra-solar planets). Surviving to projects, I got some jobs during a decade in a more Management-oriented domain (Deputy-Head of Balloons, Chairman of the ECSS Technical Authority, Head of CNES Management System within the CNES General Inspection, Head of the Electrical Systems Department). Finally, the projects were missing me and here I am the Athena Project Manager in CNES.

Know more about: CNES involvment in X-IFU

The Athena CNES Project Team is part of the Science Division of CNES, in Toulouse. This Division regroups all the projects in different domains: Astrophysics, Planetary science, Heliophysics, Fundamental Physics, Exobiology and Sciences in microgravity.

Athena is a big challenge for CNES and because of the complexity of the mission and the X-IFU instrument, the required resources are huge and the organization is a very large one with Space Agencies and labs from all around the world.

Athena is a breakthrough Cosmic Vision Large mission in which CNES is not only in support of French laboratories but is directly in the front line and then takes high risks for its success. In Athena, we are fully integrated in the X-IFU Consortium and are leading the Engineering activities at System level but also at subsystem level (i.e. Dewar and Warm Electronics).

Already strongly involved, CNES recently decided to increase the level of its involvement by increasing significantly the budget of the Athena mission, including the available manpower. We shall indeed integrate and test in-house 2 full models (EM and FM) before delivery to ESA. That shall allow us to strongly mitigate the risk to discover major anomalies at the satellite level, which shall mean a better control of schedule and budget.

CNES has not a large experience in the X-ray detection but we are humbly learning. The CNES added value is a large experience in complex and difficult space projects as well solid resources, a large spectrum of skills and efficient Engineering and Quality Assurance processes which allow us to apply a strong System approach. These experience and skills are available for the whole Consortium and ESA and, in this current lean period where each euro counts, it is mandatory to join our forces and to hunt any duplicate task within the Consortium and between the Consortium and ESA.

Far beyond the matter of leadership, CNES wants mainly to support the Athena community to make this mission a great success.

Thien Lam-Trong

Contact us ....
Editorial board: Thien.Lam-Trong@cnes.fr, dbarret@irap.omp.eu - **X-IFU Science:** dbarret@irap.omp.eu, Etienne.Pointecouteau@irap.omp.eu—**Instrument:** Thien.Lam-Trong@cnes.fr, Francoise.Douchin@cnes.fr
System: Jean-Michel.Mesnager@cnes.fr, Francois.Pajot@irap.omp.eu - **DCS (Detector Cooling System):** Michel.Ledu@cnes.fr, Alice.Pradines@cnes.fr