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The X-IFU Gazette

In the news:

Editorial

Everybody knows that Athena is a large project. With the phase A progressing, we know better now the technical issues and consequently we also better know the resources we need. They are huge and we realize we have to join forces to climb together the mountain.

That is particularly true for the activities concerning the Science Instrument Module (SIM) which is at "System" crossroad, in term of mass impact but also in term of Integration, Test and Verification.

Then, the X-IFU Consortium is fully involved in the system engineering activities led by ESA, in order to define and specify the SIM and associated X-IFU interfaces.

We have also proposed an approach of the X-IFU Integration & Test activities which shall allow to optimize the whole I & T sequence with a target which is twofold: to minimize the technical risk and to reduce significantly the cost.

The other main topic is the design-to-mass exercise we are doing based on the inputs from Δ–MCR review. It is a somewhat painful but mandatory process and we are fully committed to it.

Mass saving requires challenging the existing design and forces us to go out of our "confort zone".
More difficult to do than to say!

In practice, we favour the innovative solutions and technologies in the cryo-chain (disconnecting straps, more efficient/powerful coolers) and the readout electronics (more integration) and in parallel, we challenge our system viewing angle (needs, margins, mission profile).

We are in the perspective of closing the phase A by the end of this year (PRR) and beyond the technical aspects, we prepare intensively the programmatics which shall be also useful for the preparation of the AO.

Thien Lam-Trong

Status of the X-ray Recovery Mission

The **X-ray Astronomy Recovery Mission** (**XARM**) is a collaboration between JAXA and NASA to replace the soft X-ray capabilities of Hitomi, which were lost when the observatory went into a destructive spin on 26 March 2016.

The new spacecraft will carry a soft X-ray telescope and the X-ray micro-calorimeter; a replica of Hitomi's SXS flagship instrument to take high resolution spectra of extended sources. This gives a total range of 0.3 - 13keV (up to 20keV for bright sources).

XARM's estimated launch is early 2020s. A major interest will be the Hitomi observation of low levels of turbulence within the Perseus Cluster, suggesting an alternative form of gas support.

It is homework that XARM is hoping to solve.

Elizabeth Tasker
ISAS, JAXA

Science Impact of Mass Saving Option (SIMO)

Facing an issue on the mass budget for Athena at the delta-Mission Consolidation Review (ΔMCR) held in December 2016, the science impact of mass saving options for the scientific payload (instruments and mirror) was evaluated by the Athena Science Advisory Structure (Topical Panels and Science Working Groups).

Reducing the effective area of the mirror (one outer row, two outer rows, one inner row), the field of views of the two instruments by about 20%, removal of the WFI fast detector were amongst the descope options evaluated.

Removing the outer row of the mirror was found by the ESA project team to meet the 7 ton requirement of Ariane 6, with the two instruments set to their mass allocation (795 kg for the X-IFU, including a 10% margin), and was concluded by the ASST as the least damaging option for the Athena science.

It was however decided that the study will continue with the mirror unchanged until a decision point to be determined by ESA (later in 2017 or early 2018, e.g. the Ariane 6 CDR) at which time, if the system mass non-compliance persists, the mirror will be cut.

This means that the design-to-mass/power approach should be actively pursued on the X-IFU, with the objective to bring our mass/power budget below its current allocation. This would be key to maintain the effective area of the mirror, as being the most critical parameter that will enable Athena to achieve its scientific objectives

Didier Barret

CONSORTIUM MEETING N°5

March 21 - 23 Toulouse

This 5th CM kept its promises: after an intense phase of work since the last edition:

- the presentations of the plenary session were the opportunity to share with all members the obstacles overcome (the size of the mirror remains intact!) and the challenges faced by the project team (mass saving, more and more…).
- taking advantage of the presence of a large number of foreign partners, no less than 20 splinters allowed to exchange on technical subjects (filter contamination, cold sequence, increasingly bulky harnesses and EMC constraints, etc.).

We will not forget Xavier's humorous messages and his recommendations for building strong and cohesive team and the tribute (no less humorous) given to him by our PI!

Xavier Barcons

Since 1999 I have been uninterruptedly involved in the development of a future European large X-ray observatory. Ideas started with an ISS-assisted version of XEUS, evolving into a standalone observatory at L2 when there was confidence that the light-weight Si pore optics had a chance to succeed.

XEUS managed to become part of ESA's Cosmic Vision 2015-2025 programme in 2007, developing into an ESA/NASA/JAXA incarnation called IXO. Back to ESA-only concepts, Athena was born in its first flavour in 2011, while the successfully selected version consolidated during 2014.

Along all these years, I spent significant effort in defining the science of this observatory mission, while acting as focal point to nucleate a Spanish participation. The latter took shape around the X-IFU, where I served as X-IFU Science Advisory Team chair and as ex-officio member of the Consortium Management Team.

The X-IFU Calibration Team

The calibration of the X-IFU is essential to deliver the data required for the Athena science goals. The X-IFU calibration team (**XCaT**) addresses this task. Composed of 10 people (*) and led by the Instrument Scientist (**), the XCaT activities were kicked off on December 20th 2016. The team meets every two months.

(*) *Edoardo Cucchetti (IRAP, France), Megan Eckart (NASA-GSFC, USA), Dominique Eckert (UniGe, Switzerland), Philippe Ferrando (CEA, France), Jean-Michel Mesnager (CNES, France), Lorenzo Natalucci (IAPS, Italy), François Pajot (IRAP, France, lead), Philippe Peille (CNES, France), Jelle de Plaa (SRON, Netherland), Etienne Pointecouteau (IRAP, France, XSAT link)*

With its unprecedented 2.5 eV energy resolution, large effective area, and large number of microcalorimeters operated at 50 mK, the X-IFU calibration represents a real challenge. The proper motion of the gas in clusters of galaxies or in Active Galactic Nuclei outflows shifts the observed energy of lines emitted by the gas by Doppler effect. Measuring these velocities to better than 20 km/s at 7 keV requires the calibration of the absolute energy of the photons to almost 1/20 000 of their value for the 3840 pixels along the mission life.

Another challenging example is the determination of the gas turbulence which widens emission lines in clusters of galaxies. Measuring the widening created by a 20 km/s turbulent velocity requires the calibration of the energy resolution to 0.15 eV.

The XCaT first identified the requirements applying to the X-IFU calibration, in coordination with the system team, by the analysis of the X-IFU requirements and the Athena calibration requirements. Writing the X-IFU calibration plan comes next.

It includes the calibration strategy from component to instrument characterization and in-flight observations. It proposes implementation sequences, identifies ground calibration sources and other resources needed, including time.

A consolidated plan will be delivered at the end of phase A.

François Pajot (**)

Know more about: X-IFU Activities led by Spain …

IFCA, the current institute of Xavier Barcons, has taken responsibility – under the lead of Dr. Maite Ceballos – to develop the on-board event processing algorithms that will later be coded in the DRE-EP. A variety of pulse reconstruction algorithms are being developed and tested through their integration in the end-to-end simulator. In later study phases, trade-offs between performance and required on-board resources will need to be done.

It is envisaged that the IFCA team will participate in the testing of the EP during the development phase and also during operations.

A more voluminous contribution from Spain has been agreed with INTA under the lead of Dr. Miguel Mas-Hesse, whereby Spain will develop and provide the cryostat for the X-IFU, in close partnership with CNES.

Other activities in Spain currently include the development of Mo/Au based TES pixels. It is also foreseen that IFCA and University of Alicante will contribute in the future to the X-IFU Instrument and Science Centre, by supporting ground-based science data handling activities.

Xavier Barcons

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