THE X-IFU GAZETTE

January 15, 2017 N°2

On behalf of the X-IFU consortium, we would like to wish you a happy, healthy and peaceful New Year. In the clearly difficult times we are going through, developing education, promoting culture and improving human knowledge should remain priorities for those intending to make Earth a better place to live. This is why your contribution to the development of the X-IFU is very important, as it will eventually lead to breakthroughs in our understanding of the whole Universe. ***Didier and Thien***

Breaking news: *Xavier Barcons has been appointed as the next ESO Director General. Congratulations to Xavier and thanks for his outstanding contribution in setting up the X-IFU consortium organization, and for leading with great efficiency and dedication the X-IFU Science Advisory Team (XSAT). As of March 1st, Xavier will progressively quits the X-IFU sphere. At this stage, Massimo Cappi (Bologna, Italy) will replace Xavier to become Chair of the XSAT. Welcome to Massimo. The next issue of the Gazette will come back to Xavier Barcons.*

In the news:

BE ALWAYS AWARE ...

A web calendar is being set-up to inform you about important dates (regular meetings, specific meetings, project milestones, review dates, ...) relevant to the X-IFU Consortium. Different calendars are proposed and you may subscribe to the ones you like (and receive notifications, synchronize it with your own calendar...). There is currently one calendar for the system team, one for the instrument team, one for the DCS team, one for the management team, one for the Athena Science Study Team, and one reporting various Conferences & co. of relevance to Athena and X-IFU. The tool is based on teamup and is available at the URL: *http://x-ifu.irap.omp.eu/resources-for-users-and-x-ifu-consortium-members/* and then select « Team calendar ».

EDITORIAL - *X-IFU: THE KEY ISSUES*

The 1st Integrated Progress meeting in Toulouse was an important step in the progress of the phase A. The objective was twofold, to improve the communication within the project and to have the big picture of where we are in the Phase A. More than 50 persons did attend this meeting and shared a dense set of information.

The lack of definition concerning the interfaces between the X-IFU and the satellite was one major outcome of the Mission Consolidation Review (MCR) before the summertime.

During the fall of last year, some concurrent engineering activities have been done with the ESA engineering team, in the frame of 5 Concurrent Design Facility (CDF) sessions. Thanks to that, we have now a first definition and configuration of the FPM (renamed now SIM, Science Instruments Module) in which the two instruments (WFI and X-IFU) are accommodated. Is it a good new? **Yes and No…**

Yes because the FPM matter clearly fell through the net of the pre-phase A studies and everybody is happy now to have a definition of the FPM to work with (teams of the instruments and the satellite).

No, because of the short-lived nature of the concurrent approach leading to deliver a snapshot in term of results and certainly not an optimized configuration.

We need precisely to optimize, again and again, probably up to the CDR (end of phase C). Athena is a difficult and ambitious mission and is very challenging for the design of the instruments and the spacecraft.

The way is long before getting workable interface requirements which are flexible enough (allocations of volumes, mass and balance, etc.) to allow all the parties to work autonomously but also precise enough (knowledge of mutual constraints) to allow a whole optimization. Another major topic not addressed yet is to define the sequence of AI&V of the instruments in the SIM (FPM) in term of activities and responsibilities.

Thien Lam-Trong

LARGE PIXEL ARRAY (LPA) CONFIGURATION

LPA2 pixels are two time slower than LPA1 ones, which translates into a capability in dealing with a maximum high countrate at high spectral resolution divided by two (45 ct/s/pixel for LPA2).

X-IFU observations that require high-throughput and nominal spectral resolution of high count-rate point sources (e.g., black hole binary winds) will still be achievable with some defocusing of the mirror to spread the counts on several pixels and sometimes the addition of a thick Beryllium filter to lower the load of low energy photons.

This configuration however looses the imaging capability of the X-IFU. The cases where both high-throughput high-spectral resolution spectroscopy of bright point sources and spectroscopic imaging of extended emission are needed are extremely rare, and the science cases can still be met by doing two observations, one in focus for the imaging, and one out of focus for the high-resolution spectroscopy of the bright point source.

Therefore there is no showstopper from the X-IFU scientific objectives point of view to switch from LPA1 to LPA2 in the baseline configuration.

LPA2 pixels may enable an increase in the multiplexing rate (so far, set at 40), reducing the number of read-out chains to the same extent and thus, could lead to mass savings. Moreover, the power available at 50 mK could be distributed over fewer SQUIDs, providing margins in favor of either a longer operating duty cycle of the cooler, or an improvement of the SQUIDs performances, or a reduction of the sub-Kelvin cooler mass.

Etienne Pointecouteau, Xavier Barcons, Françoise Douchin

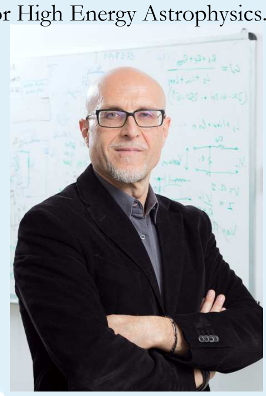
1ST X-IFU PROGRESS MEETING

November 2016
24 & 25 CNES

The scope of the meeting was to present to all sub-system, local/national project managers, members of the system and engineering teams, a progress report on the activities as carried out since the last consortium meeting: MCR recommandation of reducing the instrument mass, on-going CDF run on the Focal Plane Module, system activities on the TES array, management, planning, model philosophy issues. We also had a general discussion on the preparation of the instrument AO.

Luigi Piro

X-IFU co-PI, Luigi Piro is director of research at IAPS, INAF in Rome. After his graduation at University of Rome, he won a research staff position in X-ray and gamma ray astrophysics in IASF, Bologna, (EXOSAT data and development of Beppo-SAX) then moved to Japan as visiting scientist in RIKEN (GINGA). Back in Rome, as ASI project scientist of Beppo-SAX, he directed its scientific activities, in particular on GRBs, was awarded the Rossi and the Descartes Prizes. He leads the development of TES for X-ray Astrophysics and the Athena Consortium in Italy and he is the coordinator of the AHEAD H2020 EU infrastructure project for High Energy Astrophysics.



THE NEW BASELINE FOR THE CRYOGENIC CHAIN

The design of the Dewar assembly is very challenging. We have to define the thermo-mechanical assembly able to support the FPA (Focal Plane Assembly) of the instrument in an adequate environment (temperature, magnetic and electrical fields, microvibration level, etc.).

In order to limit the heat loads on the low temperature levels, it is mandatory to use a Dewar with several thermal shields and stages. All these levels are cooled down with different technologies of cooler in cascade.

The new baseline of the Dewar is mainly driven by the optimization of the mass.

Our first choice was to limit the size of the Dewar by limiting its diameter. We limited the number of three thermal shields (Outer Cryogenic Shield (OCS), Inner Cryogenic and 4K Shields).

The second choice was to limit the number of cryocoolers (including the number of cooler driving electronics) not only for mass reduction purpose but also for limiting the constraints on the design and during AIT.

We proposed then to have a common *platform* for the four JT coolers (two units of respectively 4K and 2K) and the cooling of harness using only three precoolers. This is possible using high capacity 15K PT coolers.

Another advantage of using this cooler is that we can take benefit of the high cooling power available at the first stage to cool also the OCS and then having a higher level of redundancy on this stage with the two other 15K PT coolers dedicated for shield cooling.

Thanks to this configuration, we can obtain a temperature in the range [90K - 110K] and so have reasonable thermal loads on Inner Cryogenic shield (above 30K).

The new baseline appears as a very *light and compact* solution but our optimization leads to have important heat loads on each stage of coolers so we have now to consolidate thermal budgets.

Jerôme André - Christophe Daniel

KNOW MORE ABOUT: INAF-IAPS LAB.

IAPS, Institute of Astrophysics and Planetology in Space, an institute of **INAF**, has a long tradition in the design, realization of space instrumentation and theoretical interpretation, primarily on high energy Astronomy and Solar System bodies.

With more than 200 research and technical staff, **IAPS** has led several experiments in X-ray and Gamma-ray astronomy, dating back from the first sounding rockets and balloon borne experiments, to BeppoSAX (Project scientist office) and Integral and Agile PI-ships.

High resolution X-ray spectroscopy with TES microcalorimeters was recognized in early 2000's as the key venue in X-ray Astronomy, initiating the development of such detectors, in collaboration with the University and **INFN** group in Genova, that already pioneered this technology for fundamental physics applications.

IAPS leads the Italian Athena consortium (**INAF** institutes and observatories in Milan, Turin, Bologna, Roma, Palermo, **CNR/IFN** in Rome and **INFN/University in Genova**) that has the responsibility of background simulations, Cryogenic Anti-Coincidence (CryoAC) system, ICU, cryogenic filters and the Science Innovation Center for X-IFU, with support by **ASI**.

The core of **IAPS X-IFU** contributions is on the background simulation, CryoAC and the X-IFU Instrument Science Center. Background activities, based on a large international team, are concentrating on the various facets needed to pin down the background, improve the instrument design to reduce the background and evaluate the particle environment in L2 vs L1.

The CryoAC, placed underneath the TES array, is based on a novel large area multi-TES detector that has reached the proper level of maturity towards requirements with its 8th generation sensor development.

It works in the a-thermal phonon regime, delivering a fast veto signal needed to reject particle-induced background events. The CryoAC requires its own cold and warm front end and back end electronics.

The activities are now focusing on the delivery of the demonstration model, to be integrated with the TES array.

Luigi Piro