

THE X-IFU GAZETTE

XCMT MEETING RECENT DECISIONS

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Athena Instrument Consortia Consolidation (ICC)

ESA is proceeding towards the instrument consortia consolidation (ICC). The process started on July 13th and is expected to end on October 1st. The data package will include a general introductory document about the X-IFU, including its science objectives, its science requirements... a system engineering plan, a technology development plan and finally a project management plan.

Earlier issues of the latter three documents were issued for the mission consolidation review (MCR) and will need to be updated. Since those documents are part of the IPRR data pack, ESA accepts them in advanced draft form for the ICC.

Letters of endorsements from ESA member state agencies involved in X-IFU will be requested on October 22nd. It is expected that the process will be completed by the November 2018 ESA Science Program Committee meeting.

A first teleconference of the X-IFU consortium board was held on July 12th to discuss about the content of the call.

Didier Barret

The X-IFU Consortium Management Team together with key members of the system and instrument teams met at IAPS (Roma) on May 28th. The objective of the meeting was to discuss on the consolidation of the X-IFU baseline in view of the Instrument Preliminary Requirement Review (IPRR) to be held around the end this year.

A few important actions were identified and some executive decisions taken.

First, the detection chain team was tasked to perform an iteration on the TES parameters (e.g. speed, size) in view of defining a new baseline configuration for the TES array, preserving the field of view, while relaxing the constraints on the readout electronics and enabling to reduce either the multiplexing factor or the number of readout channels.

Another important decision that was taken was not to consider the lateral anti-coincidence detector in the baseline presented to the IPRR. The reason was two-fold. First the latest state of the art background GEANT-4 simulations, assuming the highest flux of particle background to be met by X-IFU in orbit, indicated that the non X-ray background requirement can be met, although with a small margin of about 10%. Second, adding a lateral cryogenic detector would increase the overall complexity of the focal plane assembly, likely implying its mass and volume to grow, with a snow-ball effect on the overall Dewar.

The Digital to Analogue converters (DAC) had been previously identified as a critical of the Frequency Domain Multiplexing readout.

Recent results contained by SRON, and confirmed subsequently and independently by IRAP, indicate that a state-of-the-art commercial DAC, although non space qualified, meets the requirements of the readout chain. Hence it was decided that such a DAC would be selected as the baseline for the IPRR. Space qualification of the component is underway. A customized development is also considered.

We also discussed on the filter wheel configuration, requesting that it holds 7 positions, if affordable within its current mass allocation. In particular, this will enable to accommodate two optical filters.

On the programmatic front, it was decided that a meeting of the lead funding agencies of the X-IFU should be organized, with two main objectives. The first one is to draw attention to our funding agencies that significant money should be spent from now on until adoption, in order to carry out our technology demonstration activities, as required to pass adoption. The second objective will be to consolidate our response to the Instrument Consortia Confirmation call issued by ESA on July 13th.

Our response should list precisely all the contributions expected from each country, and this should be consistent with what the agencies are expecting to fund. This will be coordinated with the X-IFU Consortium Board.

Didier Barret
(IRAP, X-IFU PI)

X-IFU on the SIM (Science Instrument Module)

Intensive exchanges are going on between X-IFU and SIM regarding the Dewar heat, volume and mass budgets, and their compatibility with the SIM capacity.

The Dewar baseline at CM#7, showing a satisfactory level of cryo margins, was based on a 200 K Outer Vessel cooled via the SIM, combining the functions of radiative shielding, mechanical support for warm equipment units, vacuum enclosure and Faraday cage.

After confrontation of the SIM radiative cooling power at 200 K, and the Outer Vessel heat budget, the feasibility appeared marginal, and a derived configuration is now under study.

Based on an additional passive shield at 200K, it decouples the mechanical and thermal functions and reduces the 200 K budget, but with a mass and volume penalty still being assessed at Dewar and SIM levels.

Alice Pradines (CNES Dewar manager)



AGENDAS

- Next Consortium Meeting: CM #8 (X-IFU week #3): September 10th to 14th in Geneva (UoG)
- Next ASST meeting: 27th (afternoon) and 28th September in conjunction with the Athena conference in Palermo
- Instrument Preliminary Requirement Review (IPRR): 10th to 12th of December 2018

Agata Róžańska

Dr. hab. Agata Róžańska from CAMK PAN is leading a group of Polish scientists and engineers who actively participate in design and construction of the X-IFU instrument.

Polish scientists are members of international working groups of Athena mission. Within the X-IFU consortium, they work in the following topics: evolution and formation of SMBH, physics of accretion, close environment of SMBH including our Galactic Center, AGN wind and star formation regions, warm absorbers, warm hot intergalactic medium and neutron star atmospheres.

Dr. hab. Agata Róžańska, works on those subjects since many years. Her specialization is to search warm ionized outflows observed in active galactic nuclei (AGN). Furthermore, she works on X-ray image of Sgr A* in Galactic Center and hot atmospheres of accretion disks and neutron stars.

Poland is ESA member since 5 years. This will be the fourth PRODEX project in our country, and the first lead by CAMK PAN.

END OF THE TDM WORKING GROUP ACTIVITY

On June the 7th and the 8th in Boulder (Colorado), took place the last face to face meeting on the back-up solution time-division multiplexing mode of the Detection and Read-out chain. Hosted by the NIST team, this meeting was the opportunity to review the report by the working group. This comprehensive and detailed report defines the design of each part of the Instrument detection and read-out chain (focal plane array, cold harness, front and back end electronics), presents the associated energy resolution budget, the compatibilities / incompatibilities between the TDM chain and the baseline architecture based on FDM (possibilities to plug and play functions), the risks associated with these architectures and final-

ly, the budgets (mass and power). An entire chapter is devoted to a similar exercise based on another alternative design with Code-Division Multiplexing mode (CDM).

Although it remains to complete the report with some residual comments and make some improvements following the meeting, we can consider that the group has completed its mission by submitting this report. It will be included in the data package of the IPRR review by the end of the year.

On the advice of our colleagues from NIST, some of the French attendees took the opportunity to go for a hike in the Rocky Mountains (almost 4 000 m!)



TDM Working group



KNOW MORE ABOUT: THE CAMK PAN CONTRIBUTION

Polish technical team consists in engineers from CBK PAN and Astronika company and is responsible for two X-IFU components:

The **Dewar Door (DD)** for X-IFU Dewar cylinder, for which door is needed to provide vacuum conditions. The Door will be open in space once a suitable outgassing period will be completed. The main objective of the door designed by Astronika for is to maintain a vacuum inside the Dewar container holding the X-IFU measuring instruments. Aside from preserving the vacuum, the Door is also required to enable measurements, which means it will need to allow for X rays of a designated energy spectrum to pass through. Finally, the Door will also need to allow for a direct calibration of the sensors situated inside the Dewar without the need of unsealing the whole system.

Due to volume constraints, it is crucial that the Door opens on a plane parallel to the surface of the aperture to be sealed. This action requires the use of a novel solution, one which can later be replicated for the purposes of various other space missions. The Door will be locked into position with the use of a special wire, which will be melted to release the mechanism and to uncover the measurement devices.

(*) together for EM, FM and FS

The maintenance of the vacuum inside the Dewar and the Door opening process were recognized as a very crucial for X-IFU.

The **Power Distribution Unit (PDU)** is a system for power distribution to all X-IFU instrument subsystems. Total amount of distributed power is around 3 kW.

According to existing requirements and functional design requests the most critical element identified in the PDU design is Latch-up Current Limiter (LCL). Between 40-60 of such LCLs are required per PDU unit, giving a total need of around 200 LCLs (*). Therefore a single mistake in its design may lead to a critical situation for the whole project. At the same time, this gives a huge opportunity to create a self-standing product that could be offered by Polish industry.



Dr. hab. Agata Róžańska (CAMK PAN), leader of the Polish scientists and engineers team

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