



THE X-IFU GAZETTE

EDITORIAL: THE 7TH CONSORTIUM MEETING

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XIFUSIM:

The X-IFU simulator

The alpha release of xifusim was announced during the 7th consortium meeting.

This simulator aims at offering a detailed representation of the full X-IFU detection chain: from the individual photon impacts on the pixels to the final calibrated event list.

It will serve as a tool for performance studies and instrument verification throughout the project. Building on the generic TES model tessim, it will be developed following a modular approach to gradually incorporate the different subsystem contributions.

The development team, led by ECAP and coordinated by CNES, gladly welcomes the consortium to use the simulator and participate to its development and validation!

Please contact athena-xifusim-request@lists.fau.de for more information and software download.

Philippe Peille (CNES)
Joern Wilms (ECAP)

The second X-IFU week was held in APC - AstroParticule & Cosmologie laboratory - Paris from March 19 to 23, 2018.

This, also called, 7th Athena X-IFU consortium meeting has gathered 140 scientists and engineers to discuss the status of the X-IFU instrument.

The week began with splinters addressing topics as X-IFU Science, Filters, Contamination, Instrument baseline, Detection chain, Interface Control Unit, End to end simulations, Event processors, Ground segment and Project management.

On Wednesday and Thursday morning, the plenary session took place in the large Buffon auditorium of Paris Diderot University, right next to the APC. One and a half days of presentations were focussing on the revised current baseline configuration of the instrument as well as recent progress in technology. Notably, Luciano Gottardi has reported the very promising TES results: 10 pixels FDM demonstration and a 2.5 eV resolution measured at 4.7 MHz.

Many other aspects have been addressed, as the new mechanical and thermal architecture dis-

cussed by the CNES team and a very interesting overview of the physics of galaxy clusters given by Edoardo Cucchetti.

On Wednesday evening, 80 participants were present at the social dinner in one of the historical place of the Bouillon, founded by the Chartiers in 1906. In the 6th district of Paris, between Odéon and the Sorbonne, the Art Nouveau style restaurant surrounded by mirrors, was an opportunity to continue discussions in an enchanting setting.

We did not escape PI jokes! ☺

On Thursday afternoon, the splinters took over with Calibration plan, Target of opportunity, Micro vibrations, Consortium Board and Detector Cooling System. On Friday, this busy week ended with the background and the door splinters.

Once again, the X-IFU consortium meeting has shown a dynamic collaboration, with a lot of novelties that augurs well for the success of the Athena mission.

Damien Prêle (APC)

The Critical Items Demonstration Plan

The technology readiness is a key factor for the adoption of the Athena mission in 2021.

From the beginning of the phase A, a lot of "Demonstration" activities have been funded and initiated without a strong coordination. Are they going to meet the needs of demonstration for the Adoption?

That is the question!

The need is above all to mitigate the risk by addressing all the feasibility issues before the adoption of the mission. But a demonstration by only increasing the Readiness Level (TRL) cannot only be a kind of mantra.

There are several traps we must avoid, the most dramatic one being the will to develop too quickly some Demonstration Models to the detriment of the design (poor requirements, level of trade-offs, definition of interfaces and understanding of the drivers).

The Mission Adoption Review should not become a CDR before the CDR itself which is planned to take place in September 2024...

That been said, we have proposed to ESA a detailed Demonstration Plan of critical items, by separating clearly the critical technologies from the critical design with the following segments: the cooling chain, the FPA, the readout electronics, the thermal filters, the Aperture Cylinder, the EMI/EMC and micro-vibrations.

Beyond that, a particular attention has been paid in the Plan to the demonstration of the performance. We shall not to try to demonstrate an end-to-end performance but mainly the major contributors of the budget.

This Plan has been well received by ESA and is available to everyone.

Thien Lam-Trong
(CNES Project manager)



**NEWS FROM
CONSORTIUM BOARD
AND
AGENDAS:**

We are inviting four new X-IFU Science Advisory Team (XSAT) members to cover more extensively the Hot Universe science theme, which is driving most of the key performance parameters of the X-IFU. These are S. Etori (IT), J. Kaastra (NL), P. Mazzota (IT) and A. Simionescu (NL). Welcome in the X-IFU team to all of them. In addition, several XSAT members are reaching the end of the current term. The renewal process is undergoing.

Five additional X-IFU co-investigators are also being nominated: one each for France, Germany, Japan, Netherlands and the United States. At the time of this writing, E. Costantini (SRON, NL) and L. Duband (CEA-SBT, FR) have already been appointed. Congratulations to all of them.

Agenda:

- **Integrated Progress Meeting (IPM#4):**
June 27th - 28th in Toulouse (CNES)
- **Next Consortium Meeting: CM #8 (X-IFU week #3):**
September 10th to 14th in Geneva (UoG)

Damien Prêle

Damien Prêle received his Ph.D. from the Université Pierre et Marie Curie in Paris in 2007.

He joined the AstroParticle and Cosmology laboratory (APC) immediately thereafter continuing his work in the field of cryogenic low noise instrumentation.

Damien is primarily interested in the design of feedback systems, multiplexers, and in the theory and characterization of electronic noise.

At APC his work has been directed towards the development of TES readout chains, including SQUID multiplexers and Application Specific Integrated Circuits (ASIC).

Damien teaches electronics at the Paris-Diderot University and at Hanoi University.

Instrument co-Investigator for X-IFU and Project Manager for the Warm Front End Electronics (WFEE), since 2014, Damien develops ASICs for the front-end electronics. In particular, the ultra-low gain-drift and low noise amplifier is a key contribution to the X-IFU instrument.

X-IFU INSTRUMENT: THE NEW BASELINE

At CM#7, the revised X-IFU baseline configuration was presented.

The main changes compared to the previous follow from the assumption of a 200K temperature for the Dewar outer vessel and a refined estimate of the 2K dissipation. This enabled the thermal budgets at all temperature stages to have the requested 30% margins, even in the worse case of the failure of a 2K JT cooler. The cryogenic chain thus remains based on 5 15 Pulse Tubes (PT), 2 4K Joule Thomson, 2 2K JT and a last stage sorption-ADR.

The top-level performance requirements are preserved with the new baseline, most notably the numbers of readout chains (still 96).

Pursuing an aggressive design-to-mass, the mechanical interfaces of the Dewar have been revisited, revised mass allocations to driving subsystems have been agreed. This led to a revised mass budget for X-IFU, and a small non-compliance of less than 25 kg.

Mitigating micro-vibrations remains a priority and options to remove the compressors of the 15K PT are being investigated.

Specifications to key subsystems are now being iterated, still subject to optimization in terms of performance and mechanical accommodation (e.g. filters, MXS, filter wheel, etc.).

The avionic architecture, with the power distribution unit, the instrument control unit, the housekeeping management units, the harnesses has already reached a satisfactory level of definition.

Interfaces of the X-IFU with the SIM have yet to be studied in details, as a part of the global mechanical and thermal optimization of the SIM (e.g. warm harness routing). This activity will be steered by the Athena system engineering board, which is supported by the X-IFU team.

The new baseline will be further consolidated until the IPM#4 (June 27-28th), after which it will be temporarily frozen to produce the data-pack for the IPRR to be held mid-December.

Françoise Douchin & Didier Barret

KNOW MORE ABOUT: THE APC CONTRIBUTION

The AstroParticle and Cosmology Laboratory of Paris (APC), was founded in 2005 and is supported by the CNRS IN2P3, the University of Paris Denis Diderot, the CEA and the Observatory of Paris.

APC research activities span the domains of high-energy astrophysics, cosmology, particle and neutrino physics and gravitational wave astronomy, and are supported by a theory group. Its instrumental and software developments, including contributions to space projects, benefit from the technical departments of mechanics, informatics, instrumentation, electronics and microelectronics.

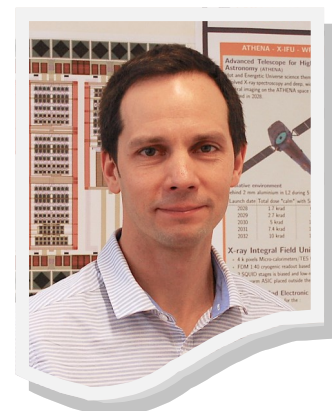
One of APC main domains of research is the high-energy astronomy of the violent and variable universe through observations with X-ray and gamma-ray telescopes from space and ground, associated to multi-wavelength and multi-messenger campaigns particularly in cosmic rays, neutrinos and gravitational waves.

APC scientists explore the high-energy phenomena in the galactic centre, supernova remnants, galactic compact objects and active galactic nuclei and these science programs along with the large cosmology surveys for the Cosmic Microwave Background (CMB) and galaxy clusters have motivated the involvement of APC in the Athena mission, with a project, led by D. Prêle (project manager) and A. Goldwurm (responsible scientist) and supported by CNES, for the development of the Warm Front End Electronics of the X-IFU instrument.

Indeed developing cryogenic detectors readout by using specific integrated circuits is one of the recognised know-how skills since more than 10 years at APC.

The lab benefit from well recognised cryogenic instrumentalist experts (as M. Piat, D. Prêle, F. Voisin) in bolometer arrays and associated readout. An original part of this development is the use of BiCMOS SiGe integrated circuit technology to design front-end and low-noise readout of such detection chain systems.

Already deployed for the CMB experiments (e.g. QUBIC), this same integrated circuit technology is currently considered for the WFEE of the X-IFU.



Damien Prêle (APC), Instrument co-Investigator for X-IFU and Project Manager for the Warm Front End Electronics (WFEE)

Contact us ...

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