
GANIL

SMART Project

Progress, TAS milestone and next steps

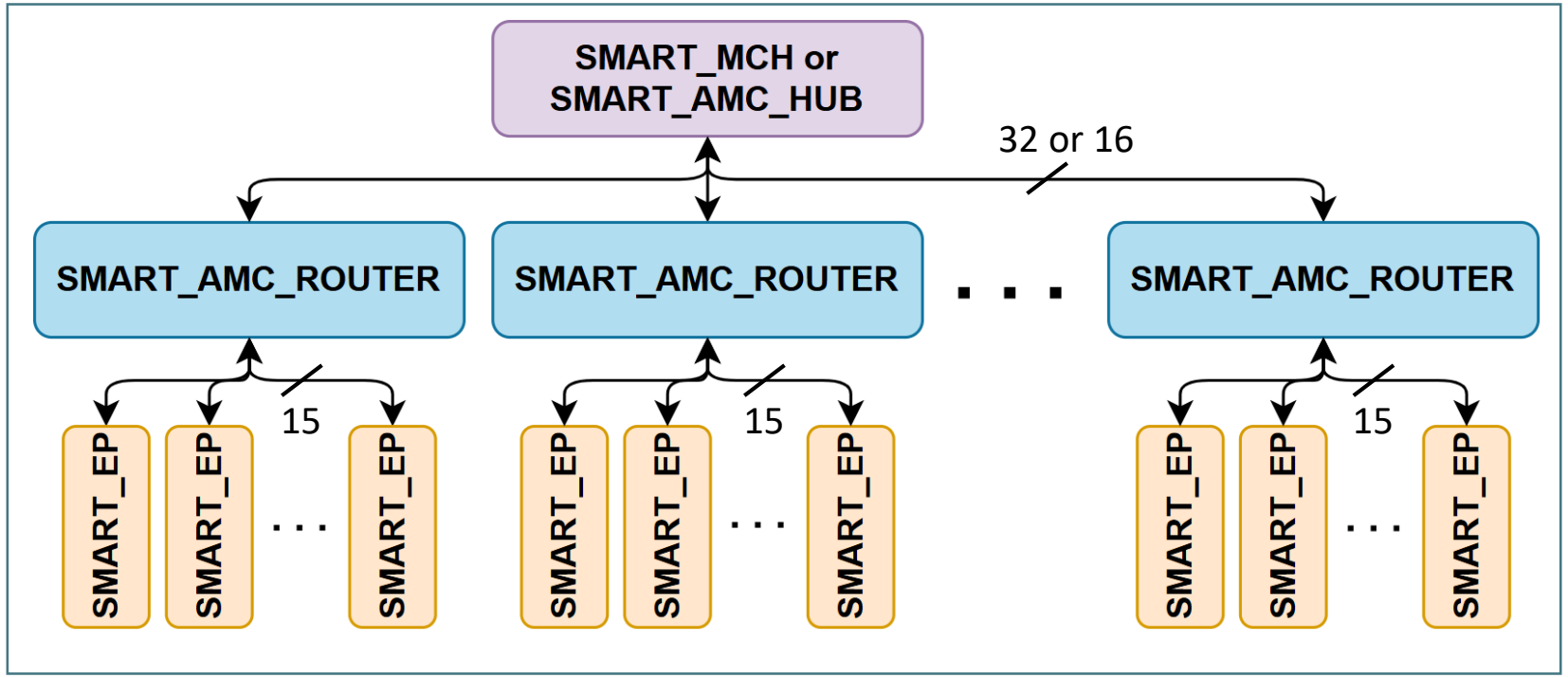
Presentation overview

“This review covers the current SMART status, the TAS milestone achieved in 2026, the remaining work and the roadmap towards the next integrations.”

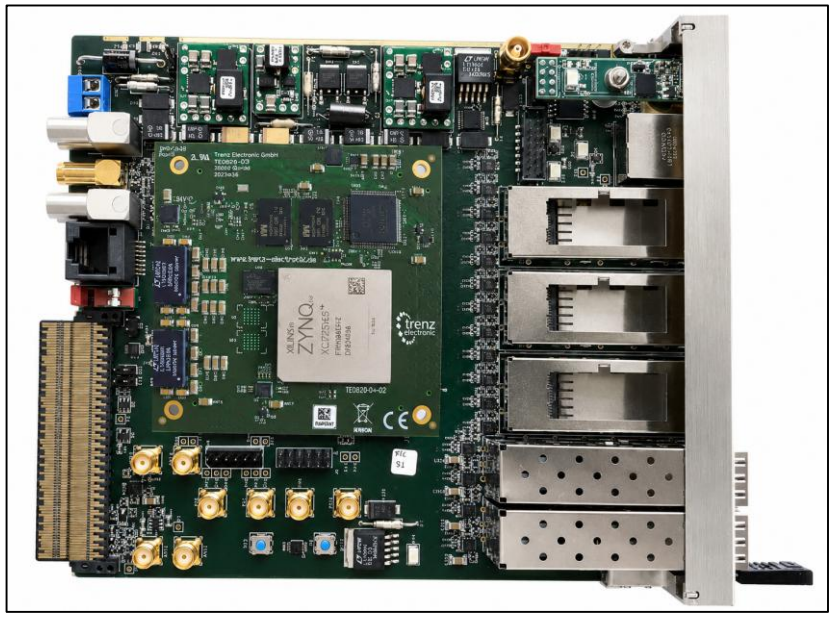
Slide n°	Slide title	Topic
4	**SMART at a glance**	Architecture and main building blocks
5	**Project roadmap**	From development to experimental validation and deployment
6	**Progress since AGATA Week 2025**	Main achievements and changes in project status
7	**TAS setup: SMART integration overview**	SMART interfaces across the TAS experimental setup
8	**SMART developments for TAS**	Four key challenges to move from lab validation to TAS deployment
9	**TAS validation: what has been demonstrated**	Experimental validation of the SMART building blocks
10	**Next milestones & deployments**	From TAS validation to the next experimental deployments
11	**Risk Assessment**	Key challenges towards deployment and integration
12	**Conclusions & next steps**	From a validated concept to a scalable acquisition infrastructure

SMART at a glance

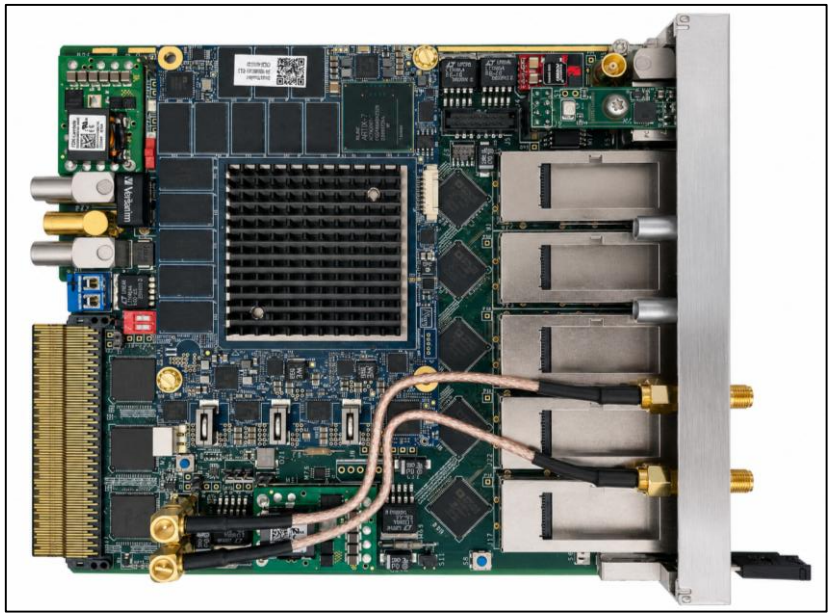
Overview of the SMART architecture and main building blocks



SMART Tree topology



SMART_AMC complete module



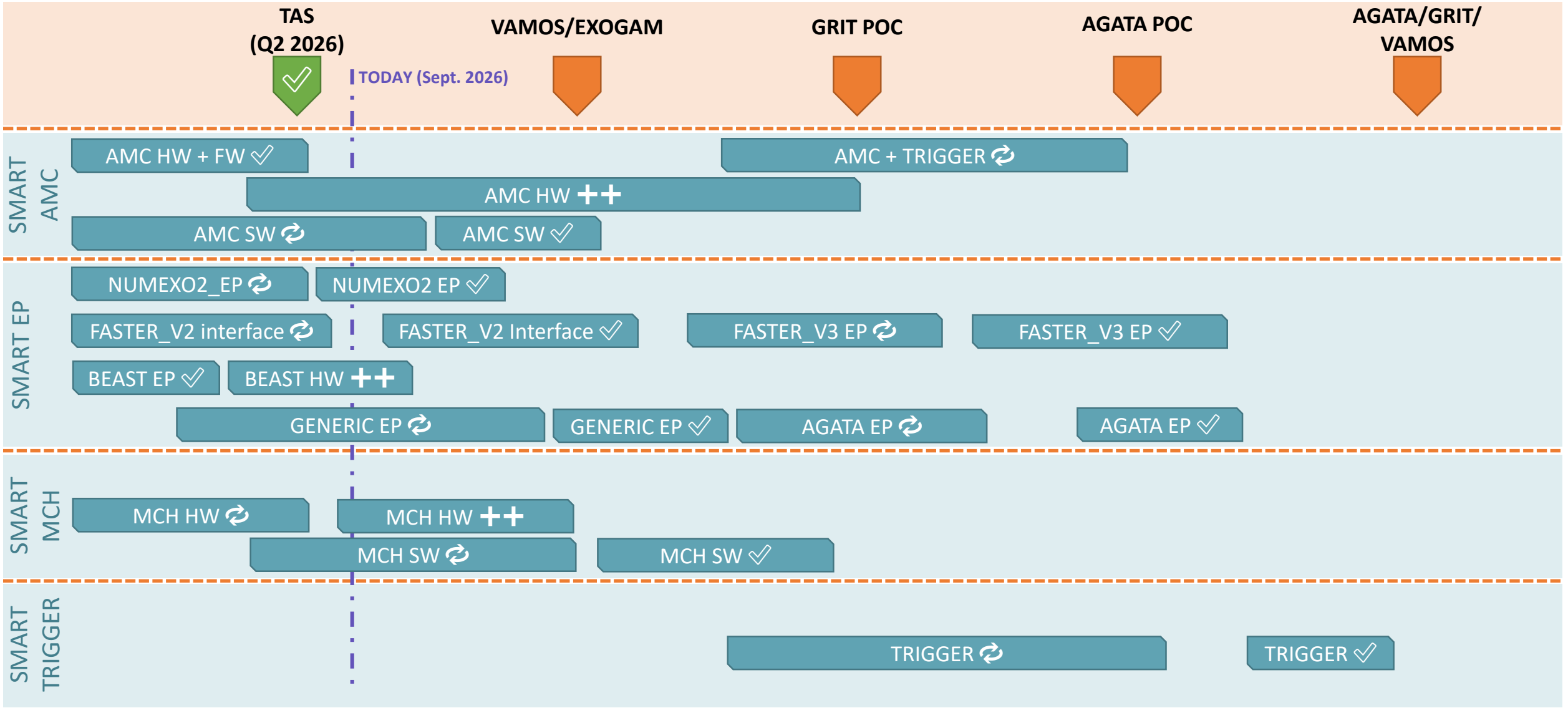
SMART_MCH complete module

Based on a scalable **µTCA architecture**, SMART supports up to 16 **AMC_ROUTER** per **AMC_HUB** and 32 per **MCH**, with up to 15 **SMART_EP** per AMC_ROUTER — corresponding to **240 EP in AMC_HUB mode** and **480 EP in MCH mode**.

Project roadmap

From development to experimental validation and deployment

🔁 Development iteration
✓ Final release / validated
++ New production batch



Progress since AGATA Week 2025

Main achievements and changes in project status

Work Package	Item	2025	Today (sept. 2026)	Next steps
SMART_AMC	Hardware	1st production validated on testbench (baremetal)	1st production ✓ Validated on TAS	Full deployment 2nd Production
	Firmware	Clock & Timestamp distribution version validated on testbench (baremetal)	Clock & Timestamp distribution version ✓ Validated on TAS	Next release (add debug & monitoring) Start Trigger version development
	Software	Linux POC & SMARTree under development	Linux & SMARTree ✓ Validated on TAS	Complete SMARTree development Next release (add debug & monitoring)
SMART_MCH	Hardware	Prototype module under development	Prototype module validated on testbench (baremetal)	Module production
	Firmware	Clock & Timestamp distribution under development	Clock & Timestamp distribution version validated on testbench (baremetal)	Start Trigger version development
	Software	o	Linux POC under development	Linux POC & testbench validation
SMART_EP	BEAST	Clock & Timestamp distribution validated on testbench (baremetal)	Clock & Timestamp distribution ✓ Validated on TAS	Final version & full deployment
	NUMEXO2	NUMEXO2_EP under development	Clock & Timestamp distribution ✓ Validated on TAS	Final version & full deployment
	FASTER V2	FASTER_EP under development	Clock & Timestamp distribution ✓ Validated on TAS	Final version & full deployment
	GENERIC	o	GENERIC_EP Under development	GENERIC_EP POC & testbench validation
	AGATA	o	o	Start AGATA_EP development

TAS setup: SMART integration overview

SMART interfaces across the TAS experimental setup

E891_23 – 06/07 to 17/07 – 30 UT – D6 experimental area

TAS (Total Absorbtion Spectrometer) acquisition :

- 80 DSSD channels
  → **5 NUMEXO2**
- 16 $LaBr_3$ + 12 BaF_2 channels
  → **12 FASTER** modules for ADC/QDC processing

SMART interface for TAS

- 5 SMART_EP embedded in NUMEXO2
- 1 SMART_EP embedded in MASTER_A10 box
  → T_0 & CLK distribution to FASTER

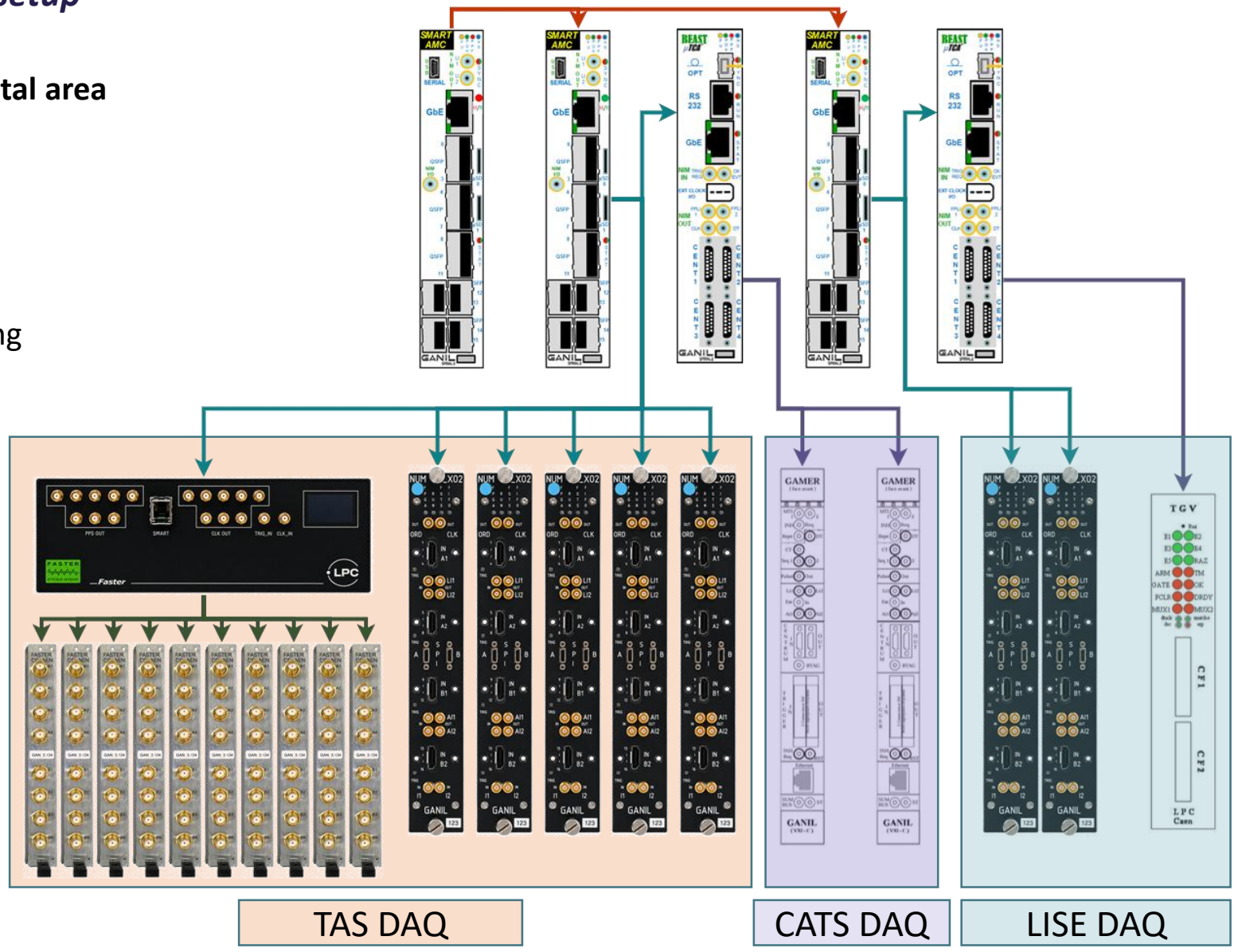
TAS detector is coupled with **CATS** and **LISE**.

SMART interface for CATS

- VXI QDC interface via BEAST / GAMER

SMART interface for LISE

- 2 SMART_EP embedded in NUMEXO2
- CAVIAR VME interface via BEAST / TGV



SMART developments for TAS

Four key challenges to move from lab validation to TAS deployment

From individual building blocks to an integrated system — four key developments made the TAS deployment possible.

NUMEXO2_EP

UPDATE TO SMART

- CLK Synchronization
- Timestamp reception
- Timestamp monitoring
- Setup update in GECO
- DAQ compatibility & no regression

MASTER_A10 Box

FASTER INTERFACE

- CLK synchronization
- Timestamp reception & monitoring
- MASTER_A10 integration
- DAQ compatibility & no regression

SMARTree

CONTROL & OPERATION

- Baremetal → Linux migration
- Network management
- Acquisition alignment sequence
- User interface
- Sanity & integration tests

DEPLOYMENT

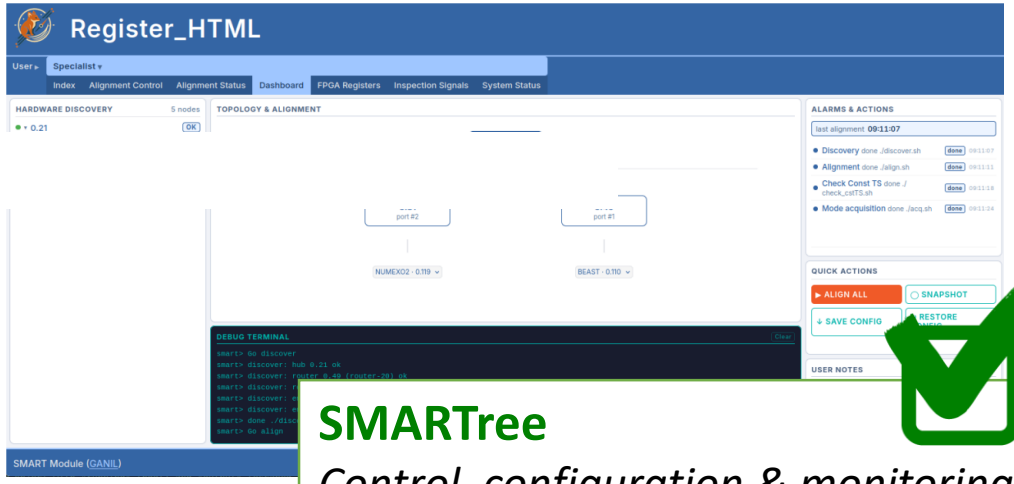
FROM LAB TO EXPERIMENT

- Module production / upgrade
- User documentation
- Deployment in experimental area
- Pre-experiment validation
- Monitoring during experiment

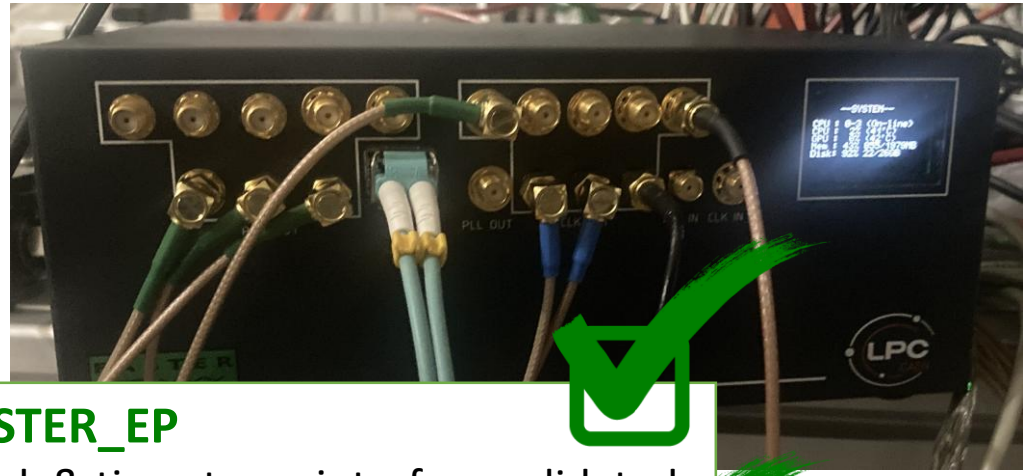
TAS validation: what has been demonstrated

Experimental validation of the SMART building blocks

The key SMART building blocks are now validated in a real experimental setup.

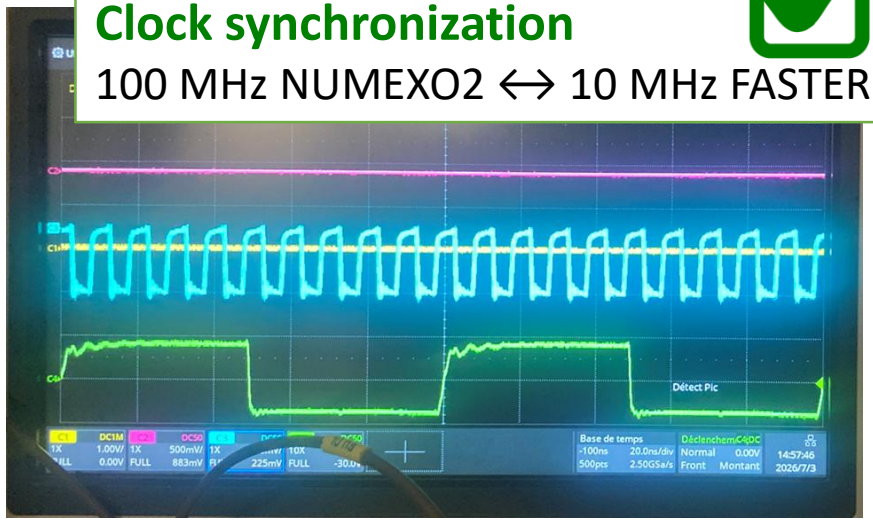


SMARTree
Control, configuration & monitoring

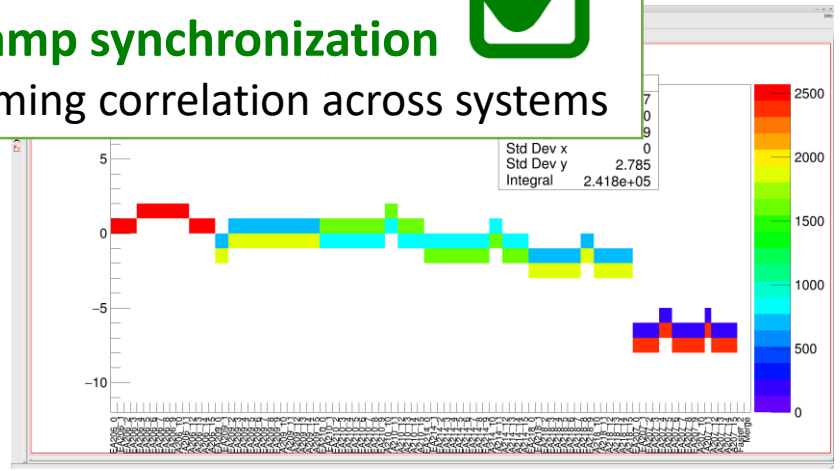


FASTER_EP
Clock & timestamp interface validated

Clock synchronization
100 MHz NUMEXO2 ↔ 10 MHz FASTER



Timestamp synchronization
Stable timing correlation across systems



Next milestones & deployments

From TAS validation to the next experimental deployments

TAS is the first proof point — now SMART must demonstrate its scalability across experiments and acquisition architectures.

Milestone 1 · VAMOS-EXOGAM

- Deploy SMART in the VAMOS-EXOGAM setup
  - ✓ *Validate NUMEXO2 + BEAST/VTC as a gateway to MESYTEC VME modules*

Milestone 2 · GRIT

- Integrate SMART_ENDPOINT into the GRIT acquisition
  - ✓ *Validate the GENERIC_EP implementation in FASTER_V3*

Milestone 3 · AGATA

- Integrate SMART_ENDPOINT into the AGATA PACE module
  - ✓ *Validate the final endpoint implementation for AGATA-GRIT-VAMOS*

Milestone 4 · Trigger

- Integrate trigger decision into the SMART system
  - ✓ *Prepare the system for trigger-based experimental operation*

Risk Assessment

Key challenges towards deployment and integration

Risk #1 : Loss of key expertise due to staff changes (M. BLAIZOT, G. WITTWER and S. COUDERT)

Two retirements and one staff move → knowledge transfer and succession planning

Risk #2 : SMART_TRIGGER development has **not yet started**

Freeze requirements before design, involvement of new staff in GANIL

Risk #3 : Software team workload and capacity for SMART_MCH

Careful resource allocation and SMART_MCH re-scheduling

Risk #4 : Endpoint integration depends on external collaboration

FASTER_V3 and AGATA PACE integration → reinforce collaboration and build redundancy within the GANIL team

Conclusions & next steps

From a validated concept to a scalable acquisition infrastructure

TAS has demonstrated that SMART can operate as an integrated acquisition infrastructure — the next challenge is to scale this approach across experiments and technologies.

TAS: a first operational proof

- SMART successfully integrated in a real acquisition environment
- NUMEXO2, FASTER and external DAQ interfaces validated
- Remaining developments focused on robustness, monitorring and integration

Next step: scale & diversify

- **VAMOS-EXOGAM** → validate another experimental environment
- **GRIT / AGATA** → extend endpoint coverage
- **SMART_TRIGGER** → introduce trigger-based operation

Thanks for your attention ! Questions ?