# Complex smart system monitoring based on versatile mixed architecture

S4M

LAAS CNRS

**Team Smart Sensing and SyStems Monitoring**

Technology & Instrumentation for the Monitoring of Complex Systems

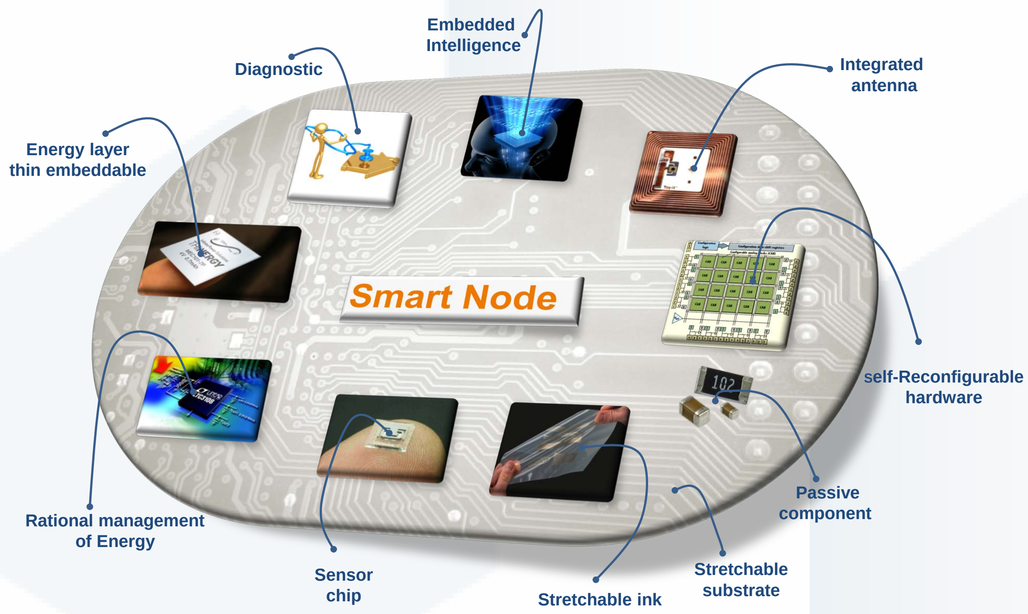
## OBJECTIVES

- Search/validation of fragility marker
- Self-reconfigurable mixed architecture
- Integration of MEMS and embedded intelligence
- Instrumentation for multi-sensors

## CHALLENGES

- Inside or above smart sensors (non-intrusive instrumentation)
- Reversible mechanical transduction between sensor and structural
- Monitoring of dynamic and static structural systems

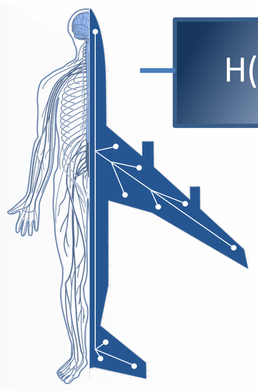
## Approach: From methodology to integration




## Problematic

A shock, a fall, transient phenomenon Tau: 1*ms* to 0,1*ms* + Duration observation 1*year* = 3,154e+7*s* = 1 chance/3e+10 → Fragility as a Marker after a few *ms* ou month?

## Our approach




Assimilate the system to be instrumented as a transfer function H(s) for which the response has been modified by the appearance of system fragility

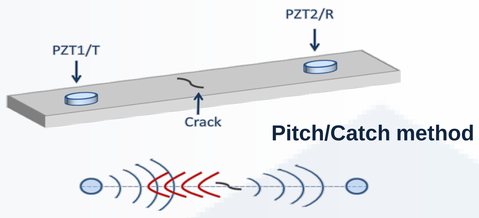
$H_1(s)$ Electronic — $H_2(s)$ Sensor — $H_{23}(s)$ Interface — $H_3(s)$ Structure

## Vibrations/waves propagation analysis to to determinate fragility signature observables

1) Observe the mechanical waves
- Accelerometers
- Gauges
- Piezo
  - Sensor
  - Actuator

2) Define an architecture and design a Node
- Measurement
- Diagnostic
- Communication/ Energy management

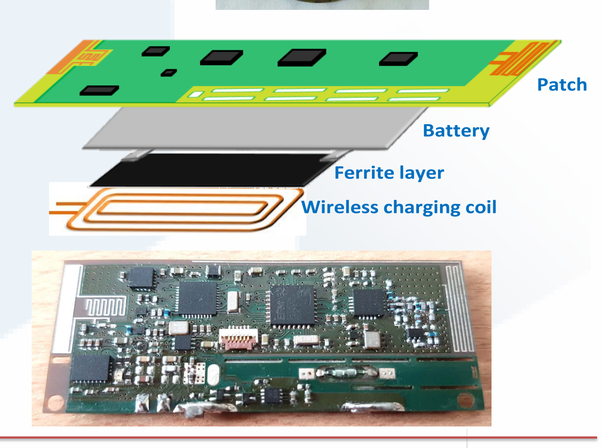
3) Integrate and assemble




## Integration: patch architecture

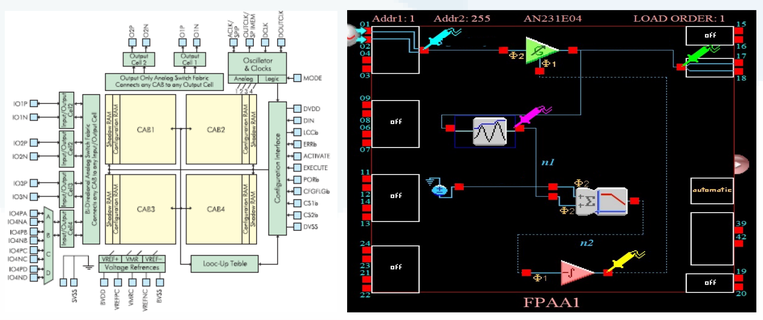
Cleanroom used for the production of patch

Made with LAAS-TEAM Service

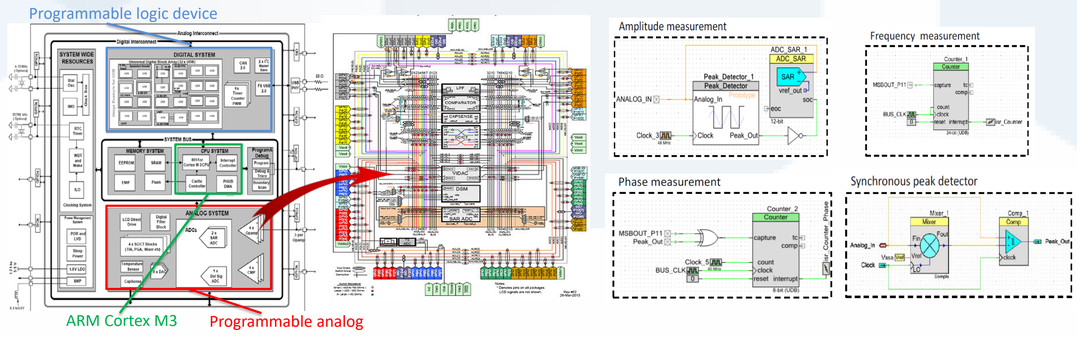



## Versatile architectures for embedded algorithm

FPAA: Field Programmable Analog Arrays anadigm




PSOC: Programmable System On Chip CYPRESS




## PARTNERS & FUNDINGS

## REFERENCES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- B. Hajjine, C.Escriba, D. Médale, J.Y. Fourniols ; « Design, integration and characterization of a tracking patch: application to elderly monitoring », E-Health Telecommunication Systems and Networks, pp.57-74, (2016)
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LAAS-CNRS
/ Laboratoire d'analyse et d'architecture des systèmes du CNRS

**cescriba@laas.fr**

Laboratoire conventionné avec l'Université Fédérale Toulouse Midi-Pyrénées