

# Improving PHM methods for Li-Ion batteries



Topic: Application of PHM approaches to structural batteries

**TITLE:** Offering an achievable and advanced **health monitoring strategy for structural batteries**

## RESEARCH BACKGROUND:

With the higher demands of performances in the **automotive** and **aeronautical** fields, more battery cells are required for the higher power and energy of the pack. The trade-off between the **power and weight** is an open research problem. **Structural battery** packs potentially offer a compromise whose multifunctional materials serve both for energy storage and load bearing. However, for SB on aeronautic applications, the maintenance and replacement are complex, which might rely more on an efficient PHM system

## RESEARCH ACTIVITIES:

1. Implementation and development of a **multi-physics digital twin (DT)** of a structural battery at increasing levels of detail, including electrochemical, thermal and **mechanical dynamics** capable of simulating healthy, main **degradation and ageing process** in **MATLAB, Simulink and COMSOL**.
2. Development of a **fast filtering-based algorithms** (e.g., **Extended Kalman Filter**) which include **new possible measurements** for more accurately estimating the health state of the batteries.
3. Processing of **thermal, electrical and mechanical signals** with **machine learning algorithms** trained mainly based on data simulated offline through the **accurate numerical model** for structural battery diagnosis and prognosis.
4. Additionally, **fusion of the PHM and SHM** (more detailed combined electrical and structural assessments) will be required.

**METHODOLOGY:** Numerical – (Experimental)

**DURATION:** 7-9 months

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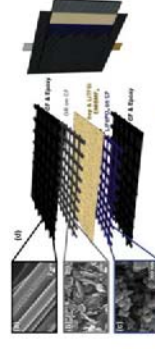
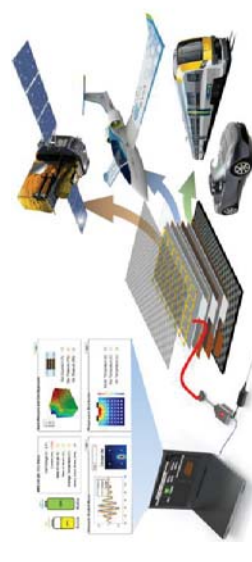


Figure 8. Example of a type B structural battery (SB).



**POSSIBLE COLLABORATIONS:**

To be defined