

HEALTH-CODE implements an advanced monitoring and diagnostic tool for μ -CHP and backup PEM fuel cell systems. O_2 -fed and air-fed stacks are used. Such a tool is able to infer on FC current status to support stack failures detection and to infer on the residual useful lifetime.

Five failure modes are detected

- ✓ fuel starvation
- ✓ flooding
- ✓ poisoning (sulphur and CO)
- ✓ air starvation
- ✓ drying

Several algorithms are considered relying on on-board measurements of the fuel cell stack impedance (EIS). Moreover, low-cost diagnostic concepts are also considered for a straightforward implementation on FCS controllers.

EIS board cost \leftarrow 500 €(3% of TCO)

MAIN PROJECT OBJECTIVES:

1 Enhancement of EIS based diagnosis

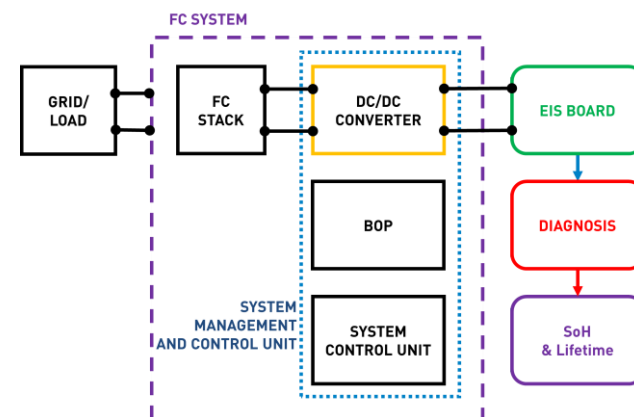
2 Development of a monitoring and diagnostic tool for state-of-health assessment, fault diagnosis and lifetime inference.

3 Reduction of experimental campaign time and costs. Improvement of power electronics for FC is also considered

DEVELOPED PROJECT
STARVATION TOOL
DIAGNOSTIC
ADVANCED TRL FC FAILURES
LOW-COST DETECTION LIFETIME FCS
HEALTH-CODE
FAULT CELL IMPROVEMENT
LEVEL EIS
DIAGNOSIS FUEL CELLS
IMPEDANCE ELECTRONICS
REDUCTION EXPERIMENTAL

The achievement of HEALTH-CODE is guaranteed by the proper exploitation of Electrochemical Impedance and voltage response through the implementation of the following concepts:

1. EIS-based monitoring
2. Faults diagnosis
3. Lifetime extrapolation
4. Industrial application
5. Enhanced power electronics



HORIZONTAL ACTIVITIES

Communication:

- 6 Conferences and Public Events
- 2 Flyers & 3 FCH JU Posters
- 2 Research Posters

Dissemination:

- 2 Technical Joint Workshops
- 3 Published Papers (2 under submission)
- 5 Public deliverables

Exploitation:

- 1 Impact Assessment
- 1 Exploitation Plan by SSERR
- 1 I-Catapult Pitch presentation

Education:

- 2 Phd Students
- 6+ Bachelor and Master Students



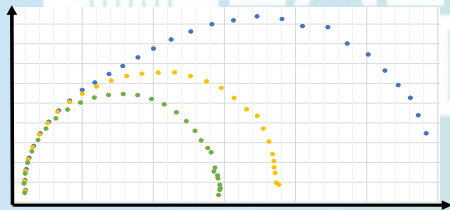
ACHIEVEMENTS

EIS module (proto 2) is enclosed into an aluminum box containing the **Analog Front End** board (for the acquisition of the Voltage and Current measurements) and **Embedded-Boards** (for storing and processing the acquired data).

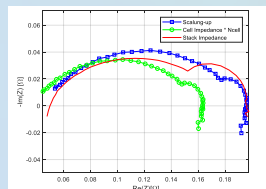
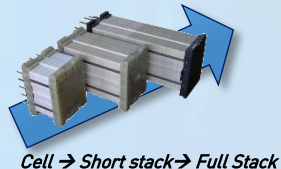


The complete set of about **2200+ spectra** (25% in normal and 75% in faulty conditions) on single cells (90%) and stacks (10%) have been acquired and used for algorithms development. New acquisition are running on the systems coupled with the EIS board.

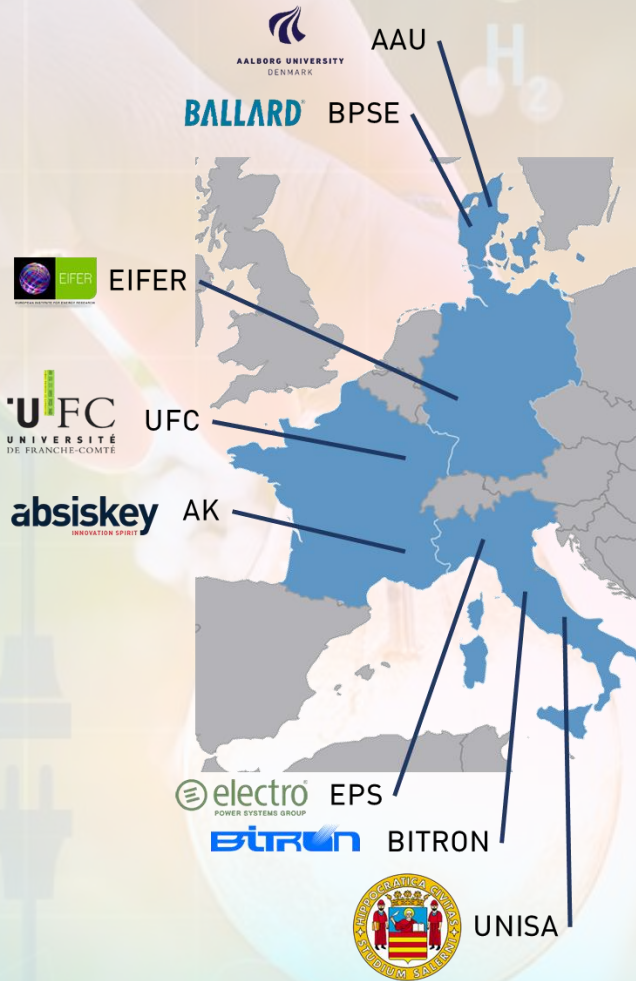
Spectra acquired on EPS sytem with EIS board and adapted converter



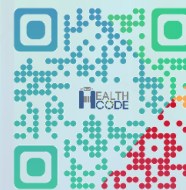
A novel **scaling-up** algorithm has been developed; it is able to extrapolate full stack performance and impedance behavior from single cell, single repeating unit or short stack data.



HEALTH-CODE PARTNERS



<http://pemfc.health-code.eu/>



THIS PROJECT HAS RECEIVED FUNDING FROM THE FUEL CELLS AND HYDROGEN JOINT UNDERTAKING (FCH JU) UNDER GRANT AGREEMENT NO 671486.



REAL OPERATION PEM FUEL CELLS
HEALTH-STATE MONITORING AND
DIAGNOSIS BASED ON DC-DC
CONVERTER EMBEDDED EIS



<http://pemfc.health-code.eu/>

