EIS HEALTH-CODE

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

Five failure modes are detected:
- ✓ change in fuel composition
- ✓ air starvation
- ✓ fuel starvation
- ✓ sulphur poisoning
- ✓ flooding and dehydration

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.

MAIN PROJECT OBJECTIVES:

1 The enhancement of electrochemical impedance spectroscopy (EIS) based diagnosis

2 The development of a monitoring and diagnostic tool for state-of-health assessment, fault detection and isolation as well as degradation level analysis for lifetime extrapolation

3 The reduction of experimental campaign time and costs. Moreover, the improvement of power electronics for FC is also considered

The achievement of HEALTH-CODE objectives 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**

The figure shows the scheme of the monitoring and diagnostic tool and the links with the fuel cell system.
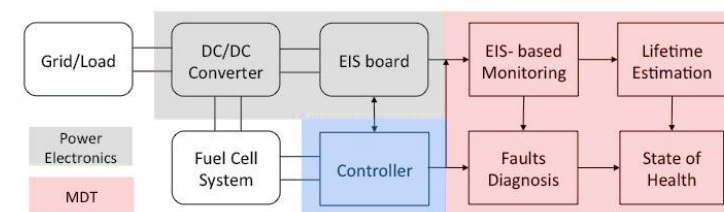
ACHIEVEMENTS

The **first prototype** of the **EIS module** is fitted into an aluminum box that contains the Analog Front End board (for the acquisition of the Voltage and Current measurements) and a Beagle Board (for storing and processing the acquired data).
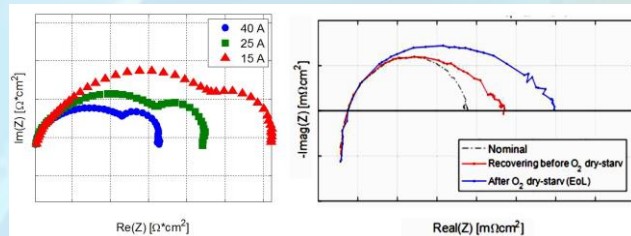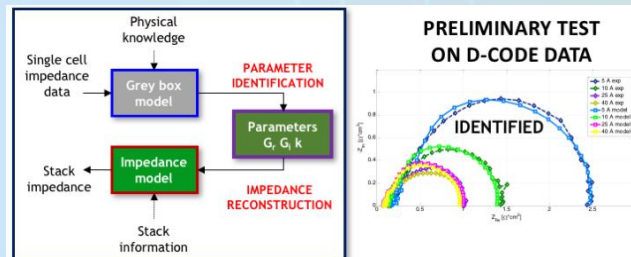
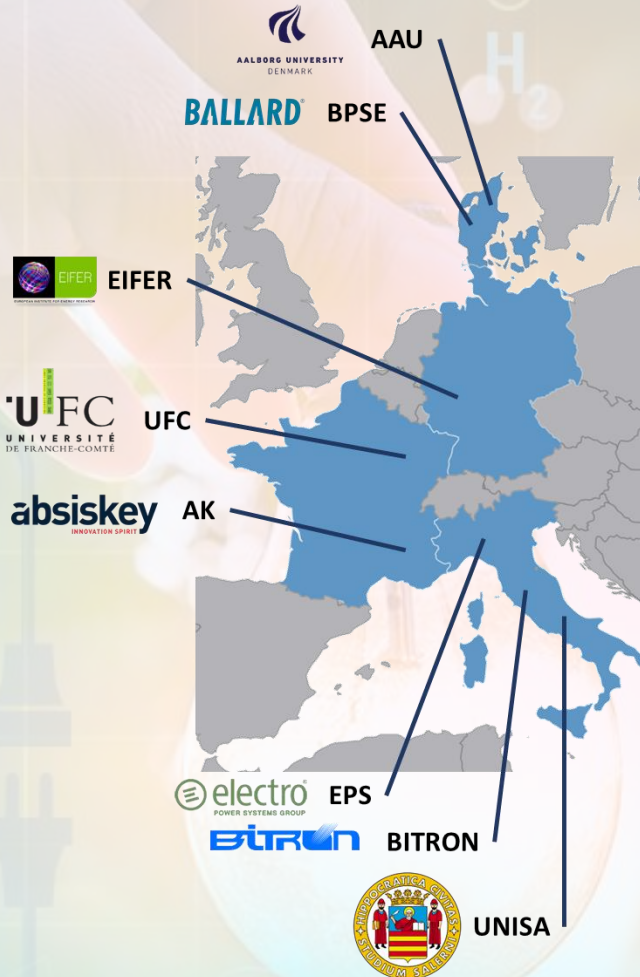| EIS box	AFE (bottom)	Communication board

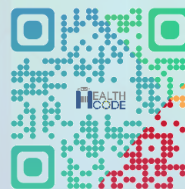A first set of results with about 1200 spectra (800 of which in faulty conditions) have been delivered.

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

AAU

BPSE

EIFER

UFC

AK

EPS

BITRON

UNISA

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

HEALTH CODE

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

EPS stack experiment @ UFC

Ballard stack experiment @ AAU

Ballard stack experiment @ EIFER

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

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