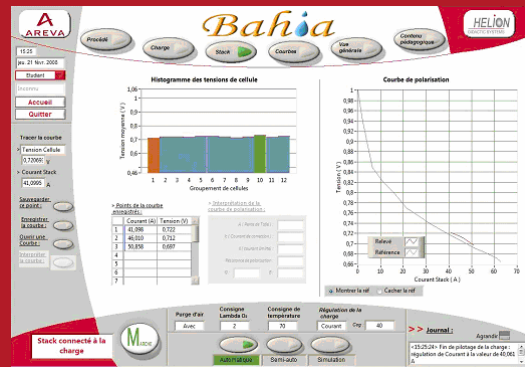


# BAHIA didactic fuel cell system

**HELION, an AREVA subsidiary, provides a fuel cell didactic system for higher education, developed in partnership with teachers from IUT of Marseille (technicians level), Ecole Polytechnique and Ecole des Mines (engineers and researchers level).**

- > An industrial didactic bench based on a 1 kWe and 1 kWth fuel cell,
- > A fuel cell system simulator,
- > Training materials and typical practical works.



## >> BAHIA overview

« BAHIA is an EC-certified didactic bench, integrating a PEM (Proton Exchange Membrane) fuel cell stack, rated to 1 kW electrical power and 1 kW thermal power, enabling micro cogeneration investigation. Fully equipped, it allows to carry out a large variety of experiments in a safe mode, meeting higher education requirements. »

### Technical characteristics:

#### Dimensions

- Height: 1 m
- Length: 0.6 m
- Width: 0.55 m
- Process module weight: 51 kg
- Electrical module weight: 38 kg

#### Performances

- > Electrical Power:
  - 400 W (U=18,4 V - I=22 A) to 1200 W (U=15 V - I=79 A)
- > Thermal power:
  - up to 1 kWth
- > Compact and robust fuel cell stack operating:
  - in dead-end mode on H<sub>2</sub> side (stoichiometry H<sub>2</sub> = 1.07)
  - in circulating mode on air side (stoichiometry O<sub>2</sub> = 1.5 to 2.5)
- > H<sub>2</sub> consumption
  - 3.9 NI/min at 400 W
  - 11.3 NI/min at 1000 W
- > N<sub>2</sub> consumption
  - 11 NI/stop, i.e. 200 stops with a B11 (2.1 m<sup>3</sup>) bottle
- > Start up time lower than 1 minute



### Installation

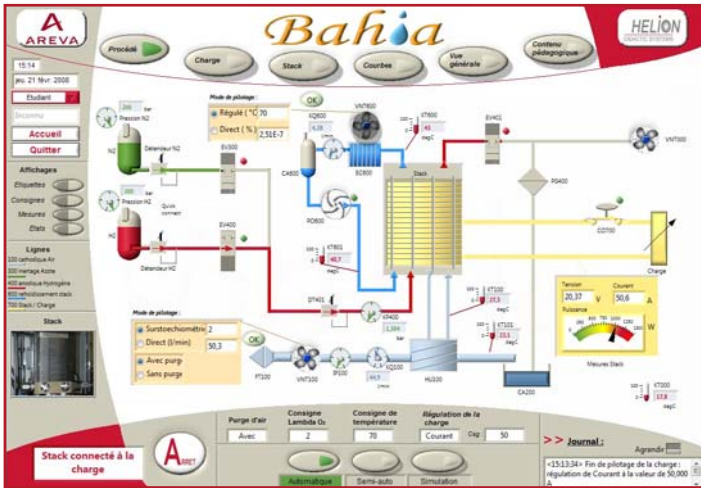
- > H<sub>2</sub> and N<sub>2</sub> at 4 bar pressure (H<sub>2</sub> and N<sub>2</sub> quick connect plug)
- > Electrical grid supply: 230 VAC - 50 Hz

### > The didactic bench BAHIA allows to carry out numerous practical works:

- theoretical applications: IV curves as a function of parameters,...
- fuel cell system study: stack and auxiliaries to optimize the overall system operation
- fuel cell applications: programming of miscellaneous profiles corresponding to different usages such as cogeneration applications, fuel cell backup power systems, transport, renewable energy sources for decentralised energy production, underwater applications,...

**Functions and instrumentation:**

> BAHIA offers a wide range of functionality to study and investigate fuel cells operation.



Process view

Variable parameters	Measured values	Calculated values
<ul style="list-style-type: none"> <li>- Current, voltage, resistance and power profile</li> <li>- FC stack temperature profile</li> <li>- Air flow profile (stoichiometry)</li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Temperatures</li> <li>- H<sub>2</sub> pressure</li> <li>- Water flow</li> <li>- Stack voltage / current</li> <li>- Power of auxiliaries</li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- H<sub>2</sub> flow</li> <li>- Thermal and electrical powers</li> <li>- Gross, net and electrochemical efficiencies</li> <li>- ...</li> </ul>

> 3 operating modes are available during practical works and experiments:

- Simulation: allowing simulation of the fuel cell system operation from any computer
- Semi automatic mode: enabling students to break up the different system starting steps and launch miscellaneous profiles
- Automatic mode: automatic system operation (start/load profiles/stop) based on parameters defined by the user.

> 1 programming mode for educators which allows to configure the practical works parameters

**>> Graphical User Interface (GUI) integrating a simulator and training materials for practical works**

**Process:**

Interactive process control and monitoring

**Curves:**

Real time display of calculated and monitored data

**Load:**

Programming different electronic load profiles

**System overview:**

Input and output system data record as well as efficiency and statistics calculations

**Stack:**

FC stack performances control and run, post-analyse to determine electrochemical parameters (the Tafel constant, limiting current, polarization resistance...)

**Pedagogical content:**

Database of practical works and courses that can be customized by instructors and teachers



**>> A safe modular system**

The system is EC certified, ensuring safe operation by non experienced users.

**HELION**

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