



RUBY Project **RUBY**

Robust and reliable general management
tool for performance and durability
improvement of fuel cell stationary units

DESCRIPTION OF PROJECT RUBY

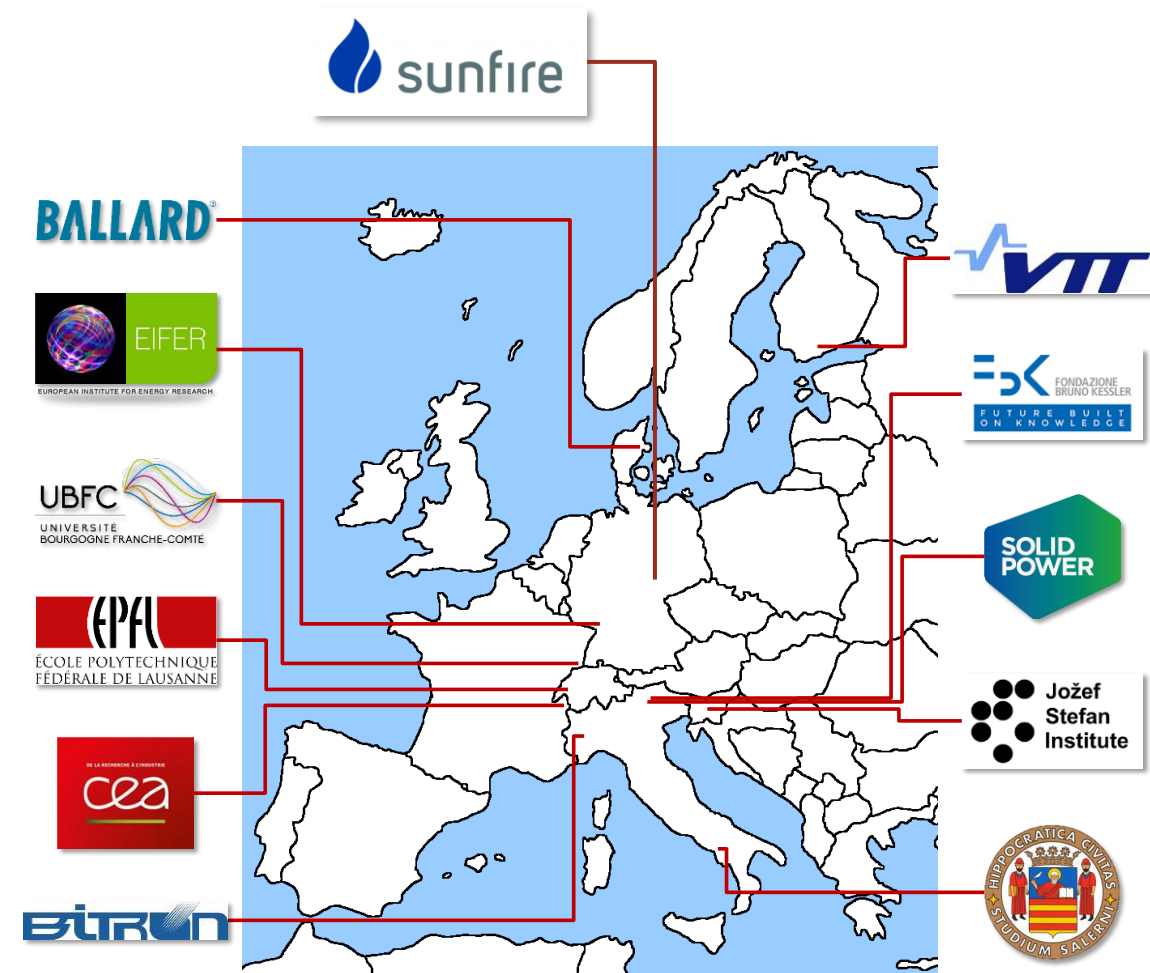
PRESENTER: PIERPAOLO POLVERINO (UNIVERSITY OF SALERNO)

5TH JULY 2022 – LUCERNE (CH)

WORKSHOP JOINTLY ORGANIZED BY H2020 PROJECTS AD ASTRA AND RUBY

Consortium

- P01 – UNISA: Università degli Studi di Salerno (IT) **COORDINATOR**
- P02 – CEA: Commissariat à l'énergie atomique et aux énergies alternatives (FR)
- P03 – SP: SolidPower S.p.A. (IT) **(TERMINATED)**
- P04 – BPSE: Ballard Power Systems Europe AS (DK)
- P05 – BITRON: Bitron S.p.A. (IT)
- P06 – IJS: Institut Jozef Stefan (SI)
- P07 – VTT: Teknologian Tutkimuskeskus VTT Oy (FI)
- P08 – EIFER: EIFER Europaisches Institut für Energ. (DE)
- P09 – UBFC: Communauté d'universités et établissements Université Bourgogne - Franche - Comte (FR)
- P10 – EPFL: École Polyt. Fédérale de Lausanne (CH)
- P11 – FBK: Fondazione Bruno Kessler (IT)
- P12 – SUN: Sunfire GmbH (DE)

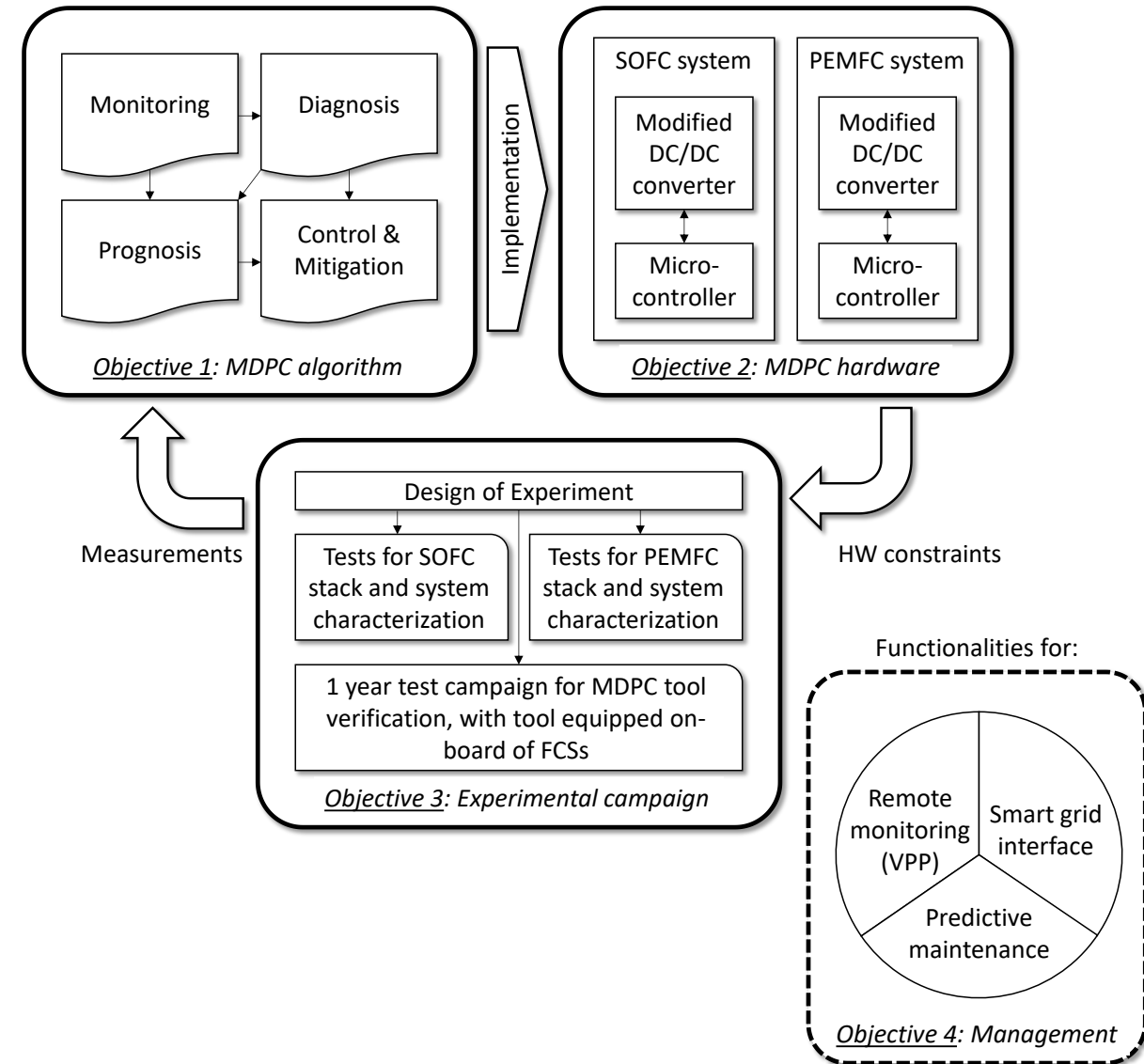


Objective 1: Improve FCS performance and durability by implementing an advanced algorithm that combines monitoring, diagnosis, prognosis, control and mitigation actions for both SOFC and PEMFC systems.

Objective 2: Design and engineer the hardware required for MDPC algorithms application, with attention to sensors reduction issues and the specific constraints imposed by stack technologies and systems applications towards industrial scalability.

Objective 3: Perform dedicated experimental campaigns for stacks and system characterization and MDPC tool prototype validation embedded on FCSs running in operational environment.

Objective 4: Develop an advanced FCS management strategy (supervisory level), with functionalities integrated with remote monitoring, for future smart-grid interaction and predictive maintenance application.

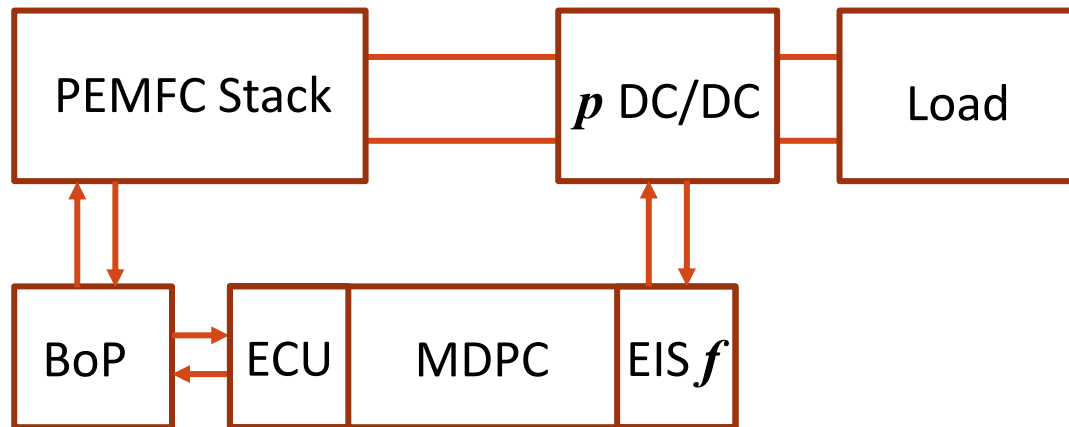


Key concept: on-field EIS

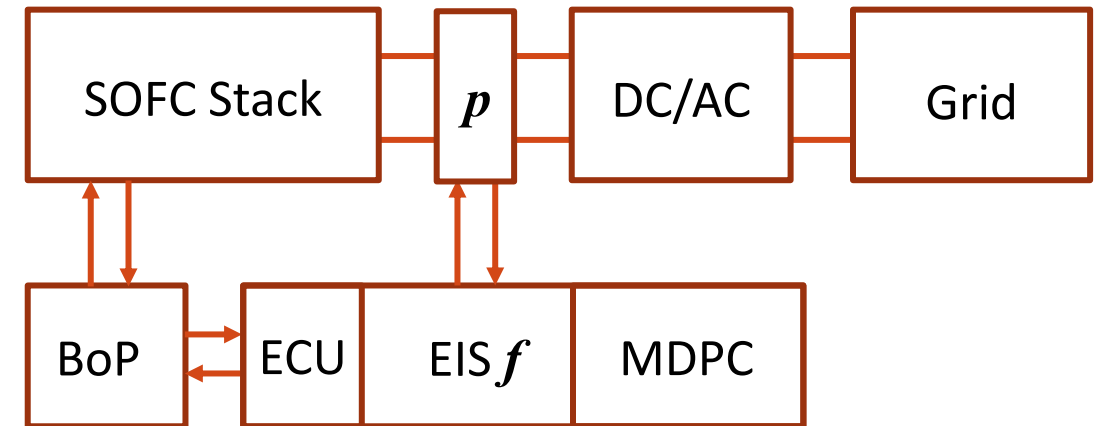
EIS on field has been conceptualized in previous projects and tested before by HEALTH-CODE and INSIGHT consortia leading to a Monitoring & Diagnostic Tool.

RUBY continues the development of EIS Stack monitoring for Prognostics and Control (MDPC tool) and includes mitigation functions as well as BoP diagnostics.

Ballard Backup System



Sunfire μ -CHP System

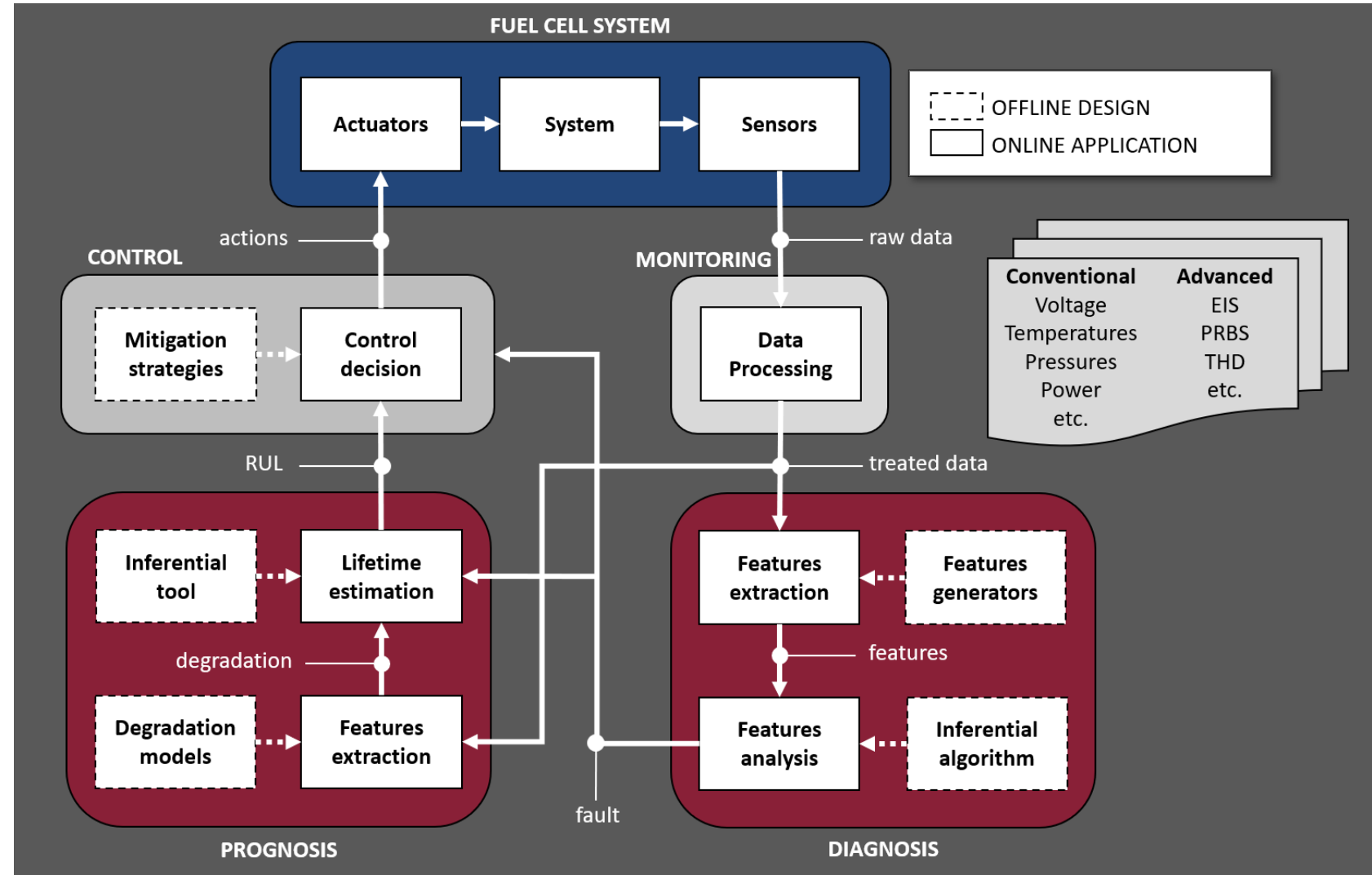


Main schemes of Ballard Backup System (left) and Sunfire μ -CHP System (right) with the EIS perturbation (p) and control functions (f).

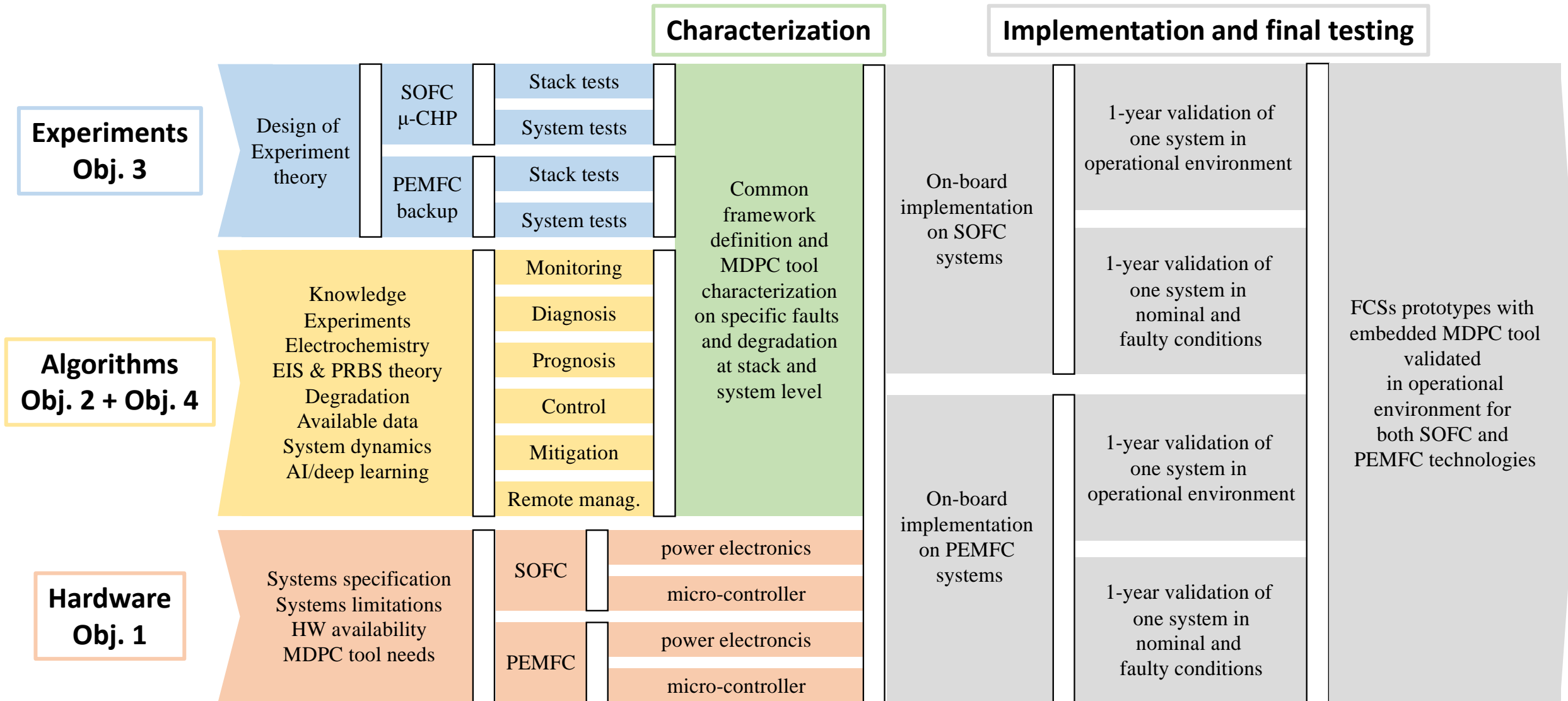
Unique Value Proposition

RUBY MDPC Tool main concepts:

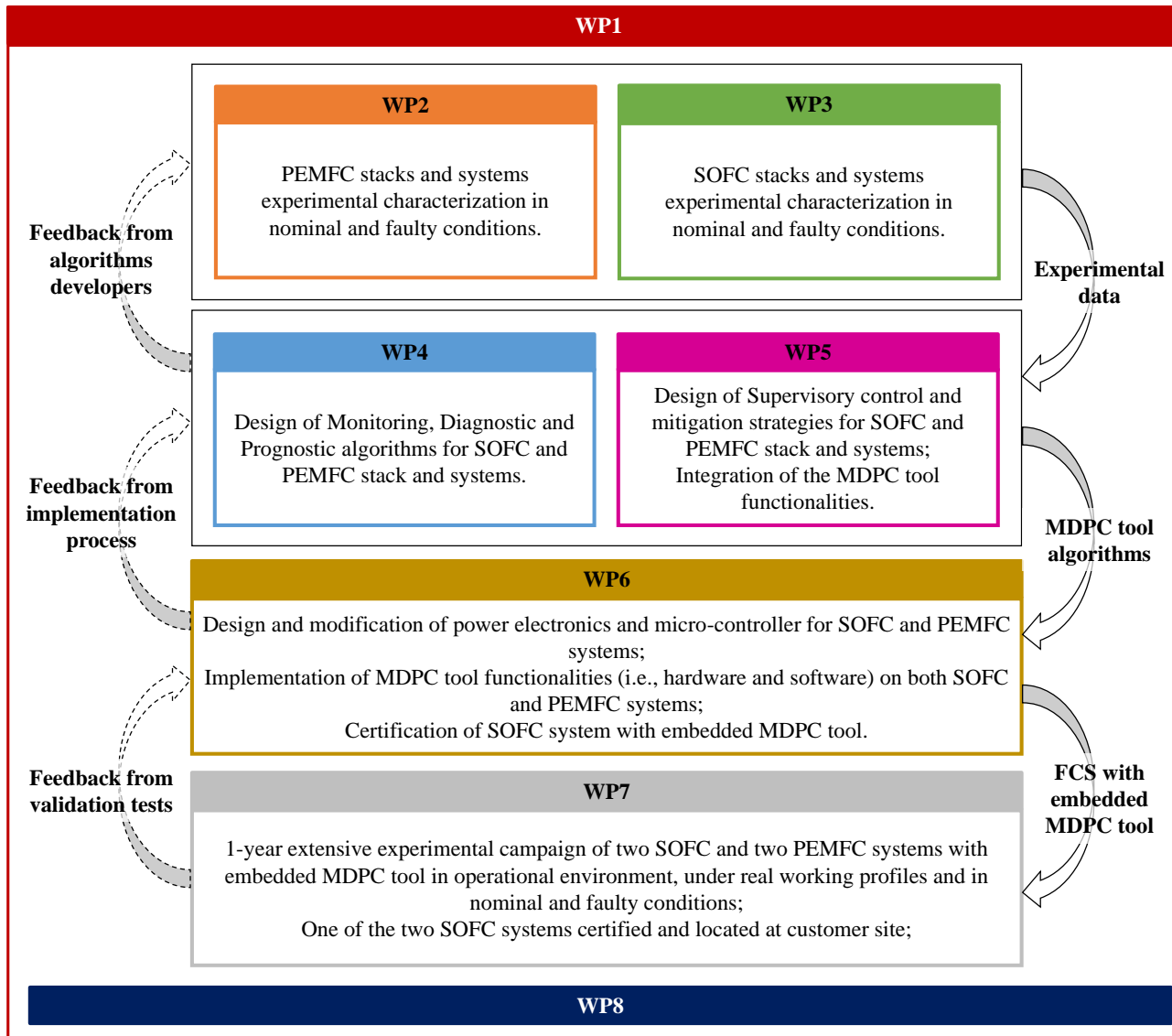
1. Advanced stack Monitoring via Electrochemical Impedance Spectroscopy.
2. Stack diagnostics via EIS.
3. BoP component Condition Monitoring.
4. BoP Fault Detection and Isolation.
5. Prognostics of stack for Remaining Useful Life.
6. Real Time Optimization control.
7. Mitigation.



Activity workflow



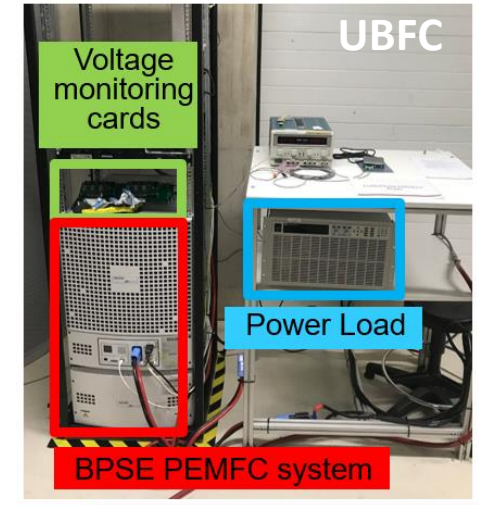
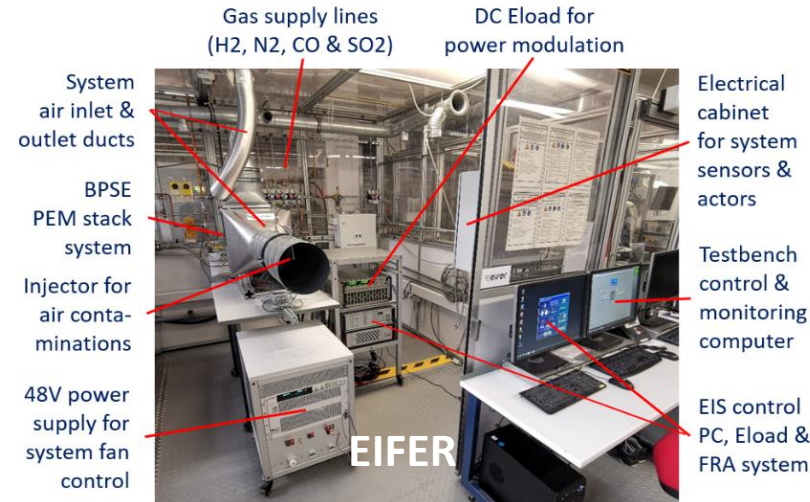
WPs activity breakdown



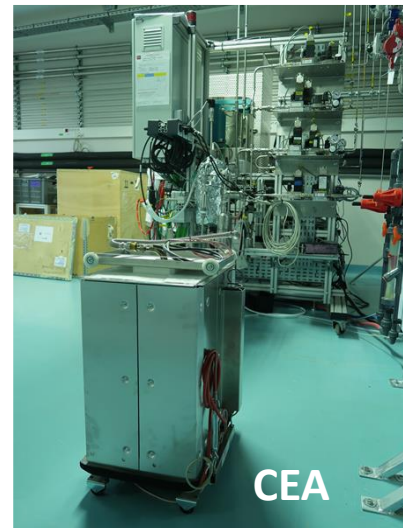
WP	Related workflow activity
2	Experiments
	Characterization
3	Experiments
	Characterization
4	Algorithms
	Characterization
5	Algorithms
	Characterization
6	Hardware
	Implementation
7	Final testing

1. Experimental test protocols closed for stacks & systems characterization.
2. PEMFC stack & systems installed on test rigs under testing.
3. SOFC stacks at lab premises experiments under setting.
4. SOFC systems connected to instrumentations, one on testing.
5. Methodologies identified for MDPC functions.
6. EIS board for Backup system ready.
7. Preliminary tests for monitoring and prognostics algorithms for both PEM and SOFC.

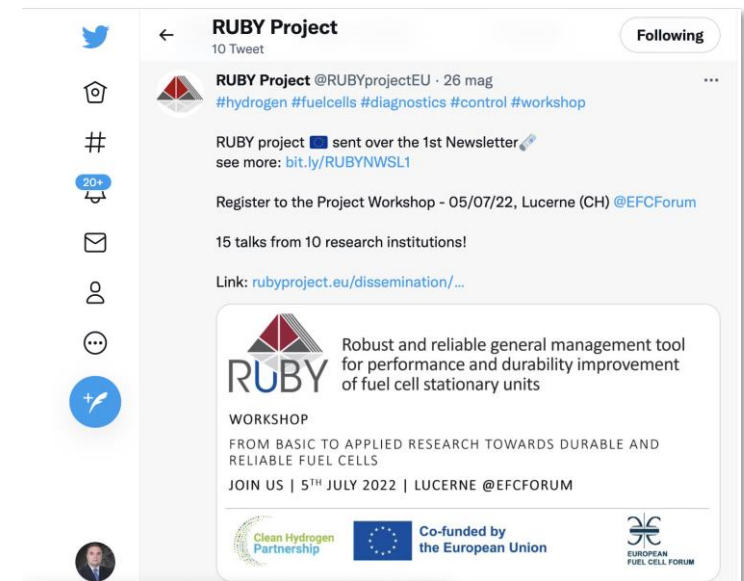
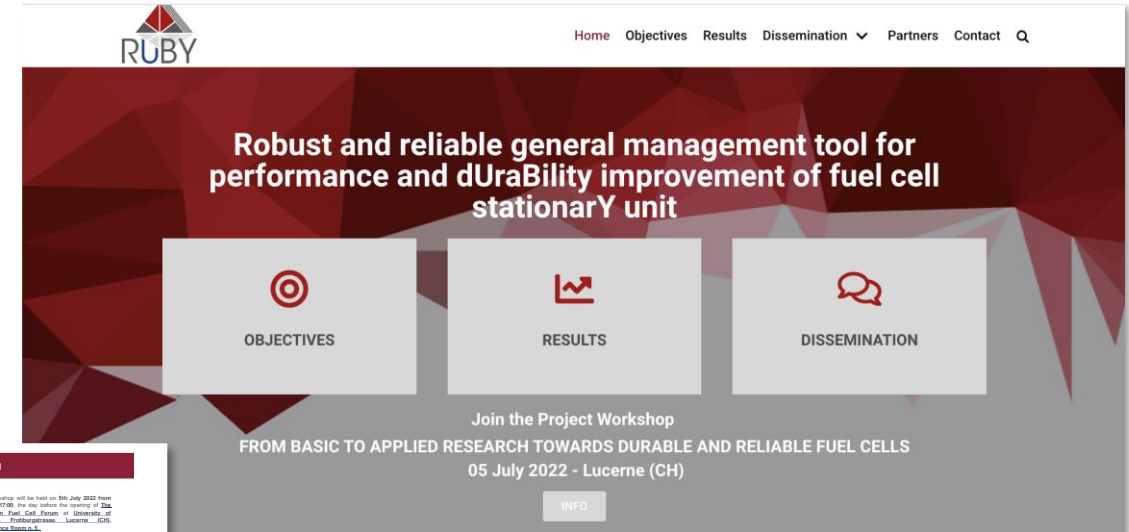
BPSE PEMFC STACK & SYSTEM



SUNFIRE SOFC STACK & SYSTEM



1. Website www.rubypoint.eu
2. Newsletter (audience of about 700 people)
 1. 1+2 issues (April, May and June)
 2. TBD – 3rd to be sent over before/after Workshop
3. Twitter (8 tweets sent)
4. LinkedIn page



THANK YOU FOR YOUR KIND ATTENTION!



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