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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION.

Barcelona, Spain
17th-20th November 2013

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VALIDATION OF THE METHODOLOGY FOR LITHIUM-ION BATTERIES LIFETIME PROGNOSIS

E. Sarasketa-Zabala*, I. Laresgoiti, I. Alava, M. Rivas, I. Villarreal, F. Blanco

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In collaboration with EVAAP EDTA

Supported by European Commission

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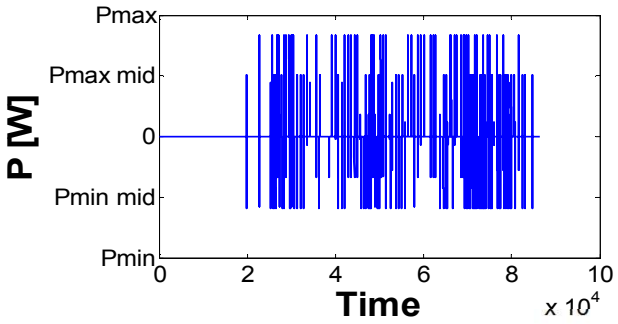
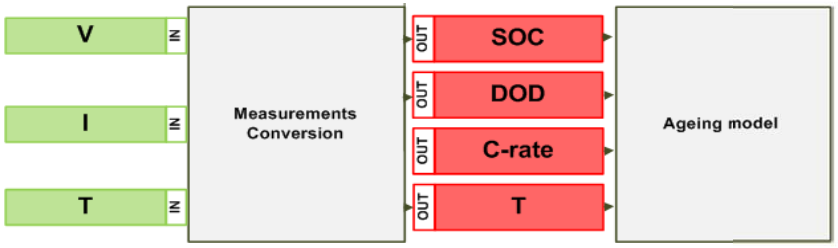
Motivation



Cycleability and storage

Measurable factors & Simple models

Any application



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Agenda

1. Introduction

2. Lifetime prediction methodology

3. Towards reliable predictions

4. Summary and conclusions. Future work

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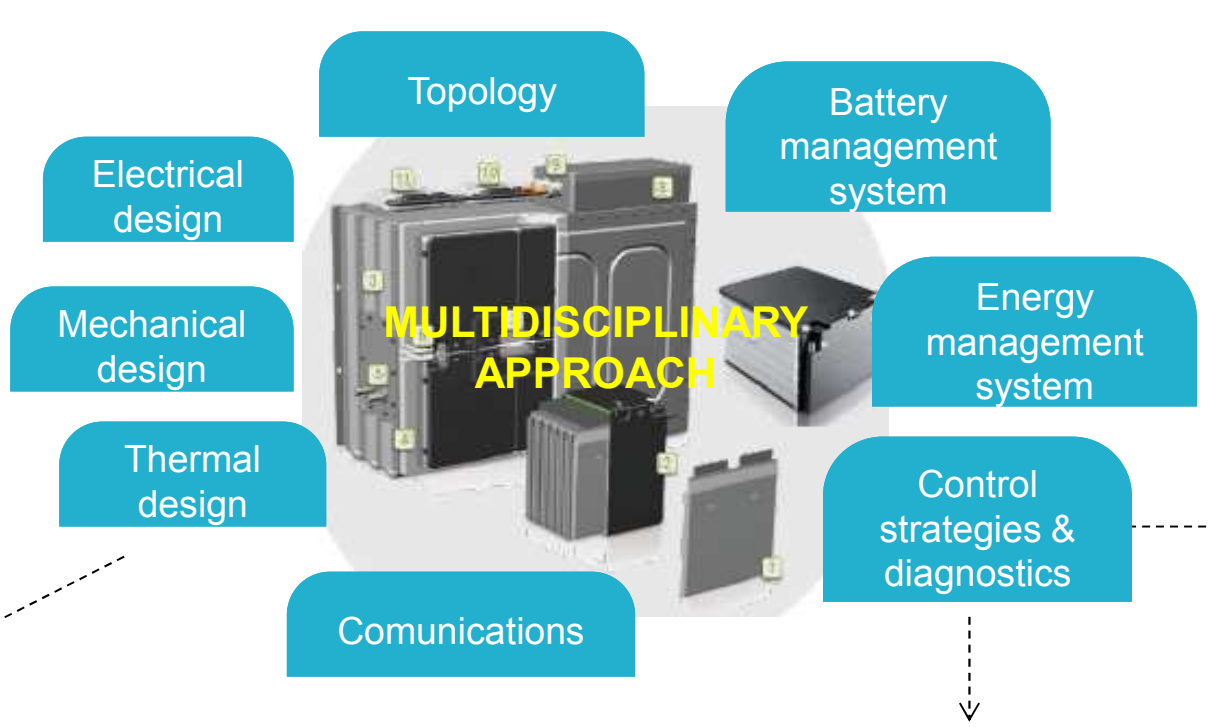
Introduction

IK4-Ikerlan: ESS solutions developer

Session 1B: Monday 2013-11-18, 15:15-16:35
MODELLING OF Li-ION BATTERIES DYNAMICS USING IMPEDANCE SPECTROSCOPY AND PULSE FITTING: EVS APPLICATION
G. Pérez et al. (U. Viscarret)



Dialogue session: Monday 2013-11-18, 13:00-15:00
THERMAL MANAGEMENT SYSTEMS' DESIGN METHODOLOGY FOR TRANSPORT APPLICATIONS
N. Nieto et al.

Session 7B: Wednesday 2013-11-20, 09:00-10:20
PROPOSAL AND VALIDATION OF A SOC ESTIMATION ALGORITHM OF LiFePO4 BATTERY PACKS FOR TRACTION APPLICATIONS
M.Garmendia et al.

Validation of the methodology for lithium-ion batteries lifetime prognosis ***E. Sarasketa-Zabala et al.***

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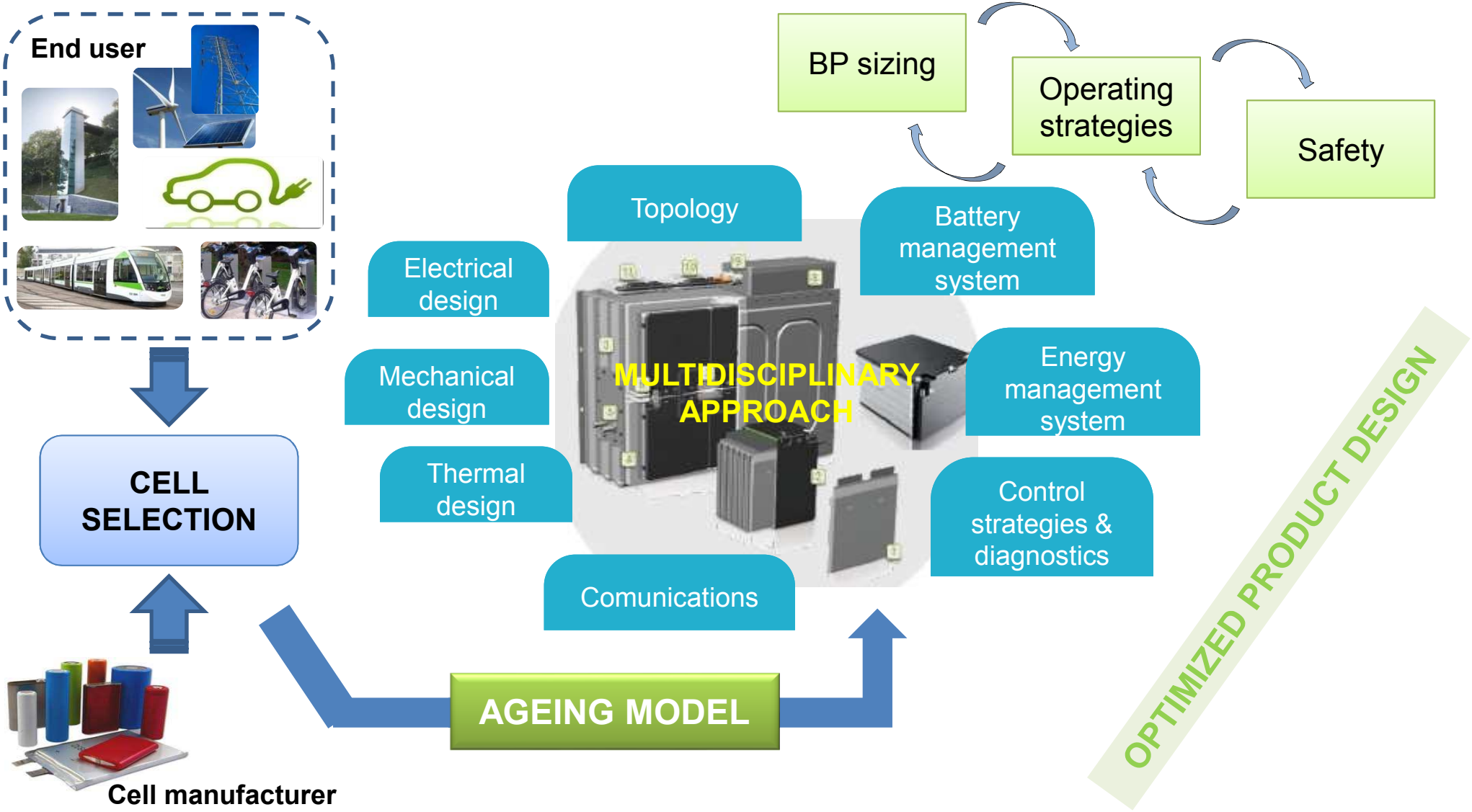
Introduction

IK4-Ikerlan: ESS solutions developer



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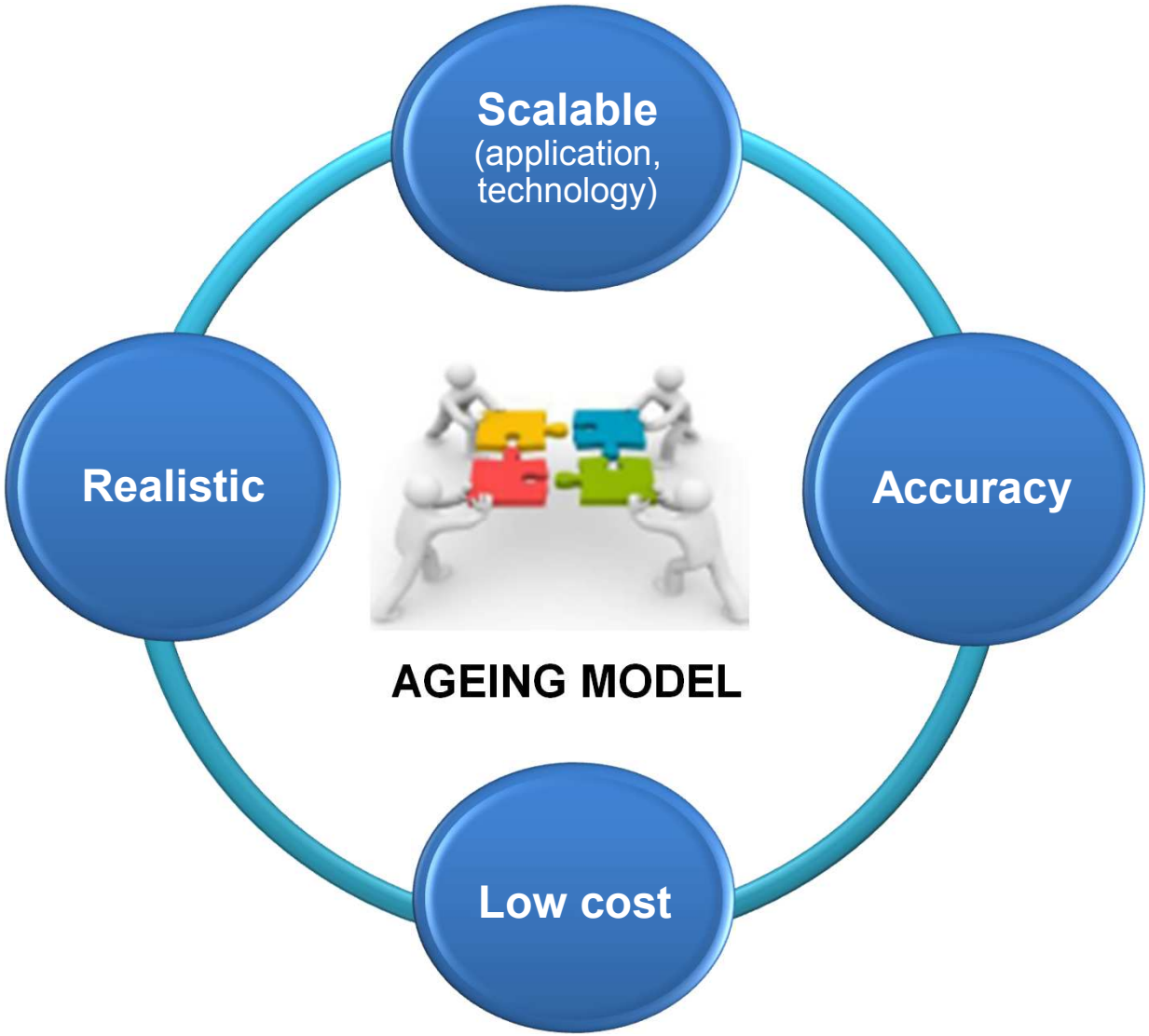
Introduction

Objectives and approach



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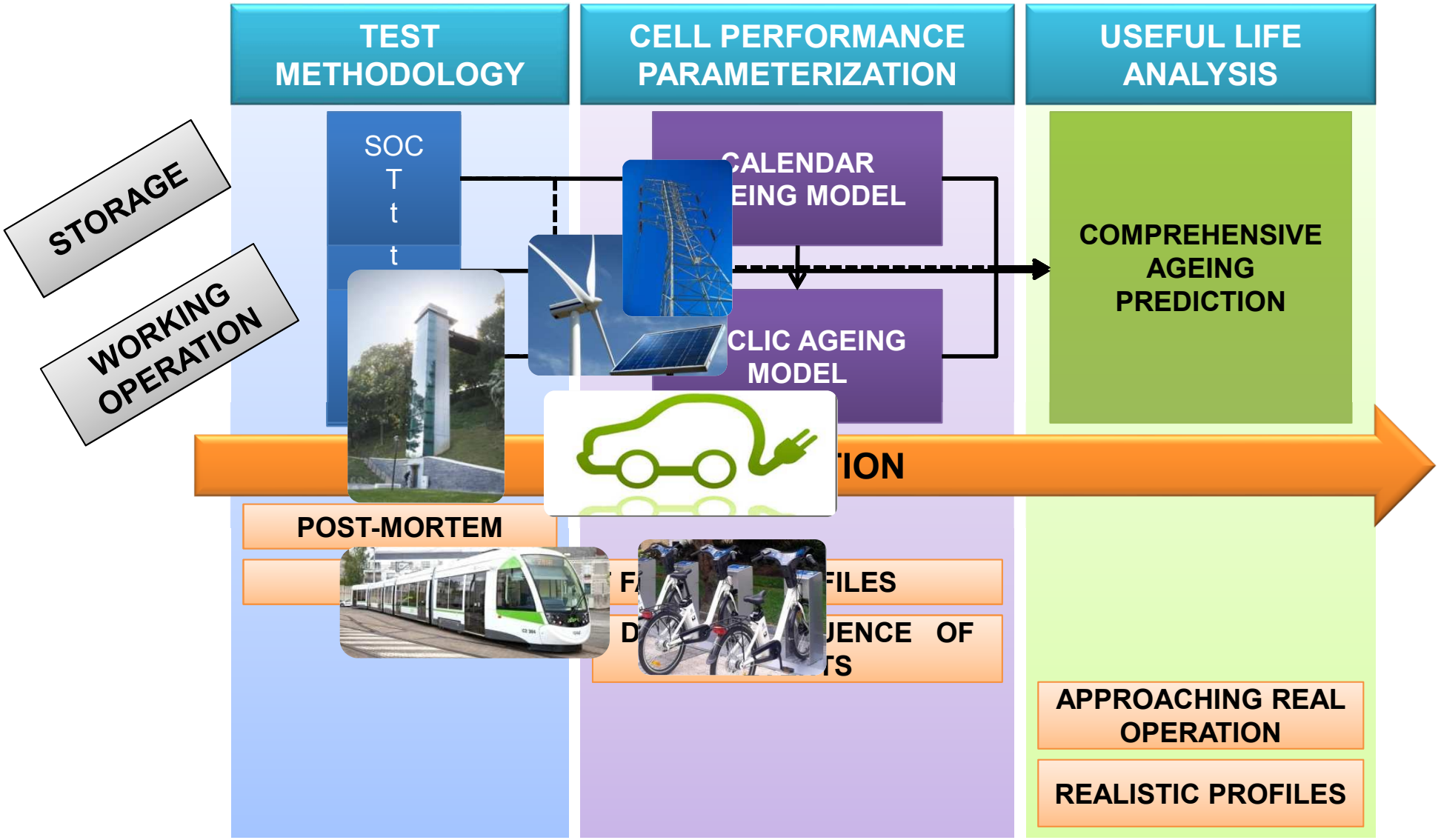
Lifetime prediction methodology



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Agenda

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Towards reliable predictions

- 2.3Ah LFP/graphite 26650-size cell
- Ageing metrics (SOH): capacity (C) and internal resistance (IR)
- Impact factors effect analysis

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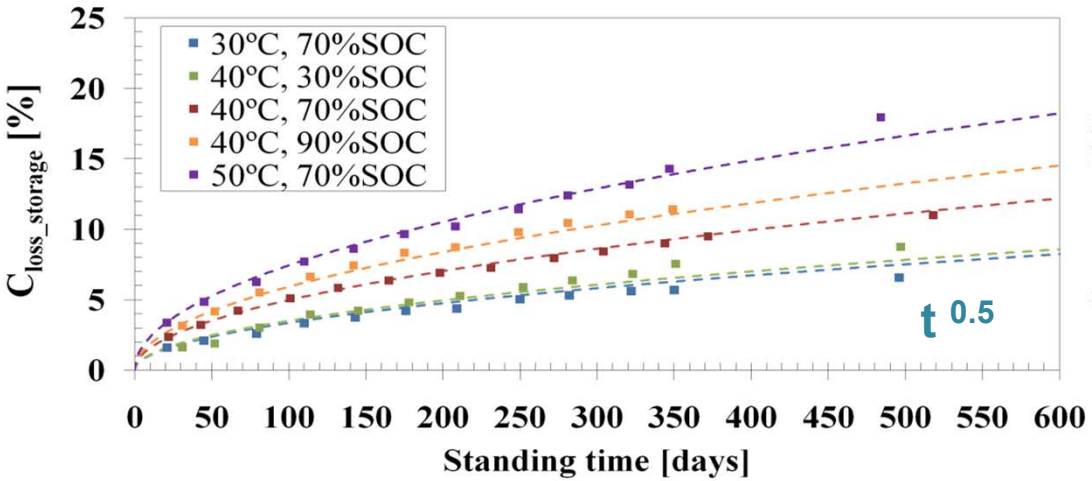
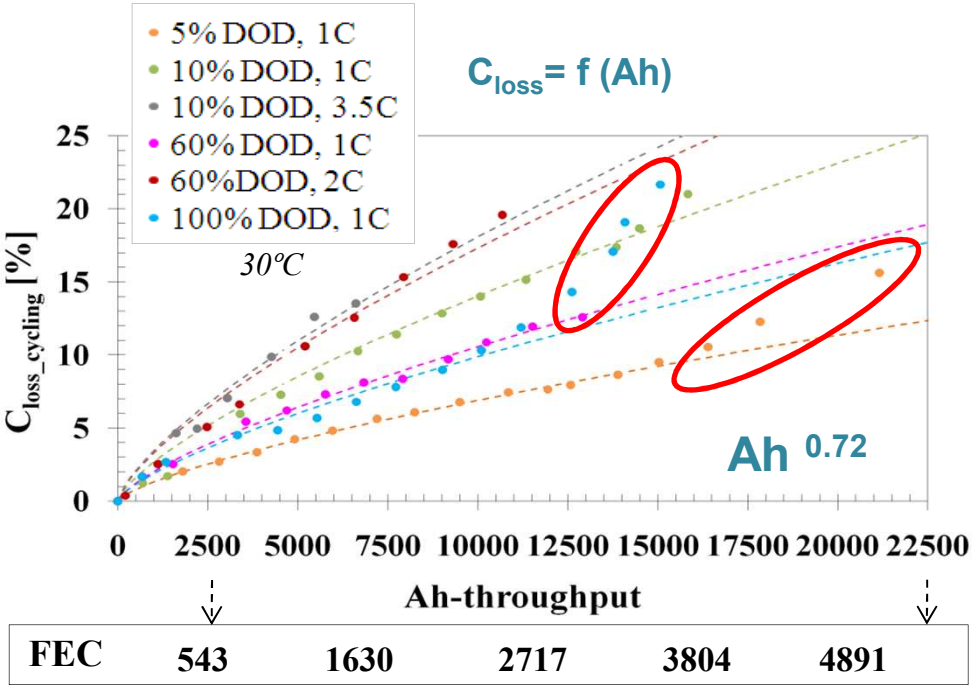
Towards reliable predictions

- 2.3Ah LFP/graphite 26650-size cell
- Ageing metrics (SOH): capacity (C) and internal resistance (IR)
- **Impact factors effect analysis**

C_{loss}= f (SOC, T, t)



C_{loss}= f (Ah)



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Towards reliable predictions

- 2.3Ah LFP/graphite 26650-size cell
- Ageing metrics (SOH): capacity (C) and internal resistance (IR)
- Impact factors effect analysis
  - EoL definition
  - Predictive models limitations and precision evaluation

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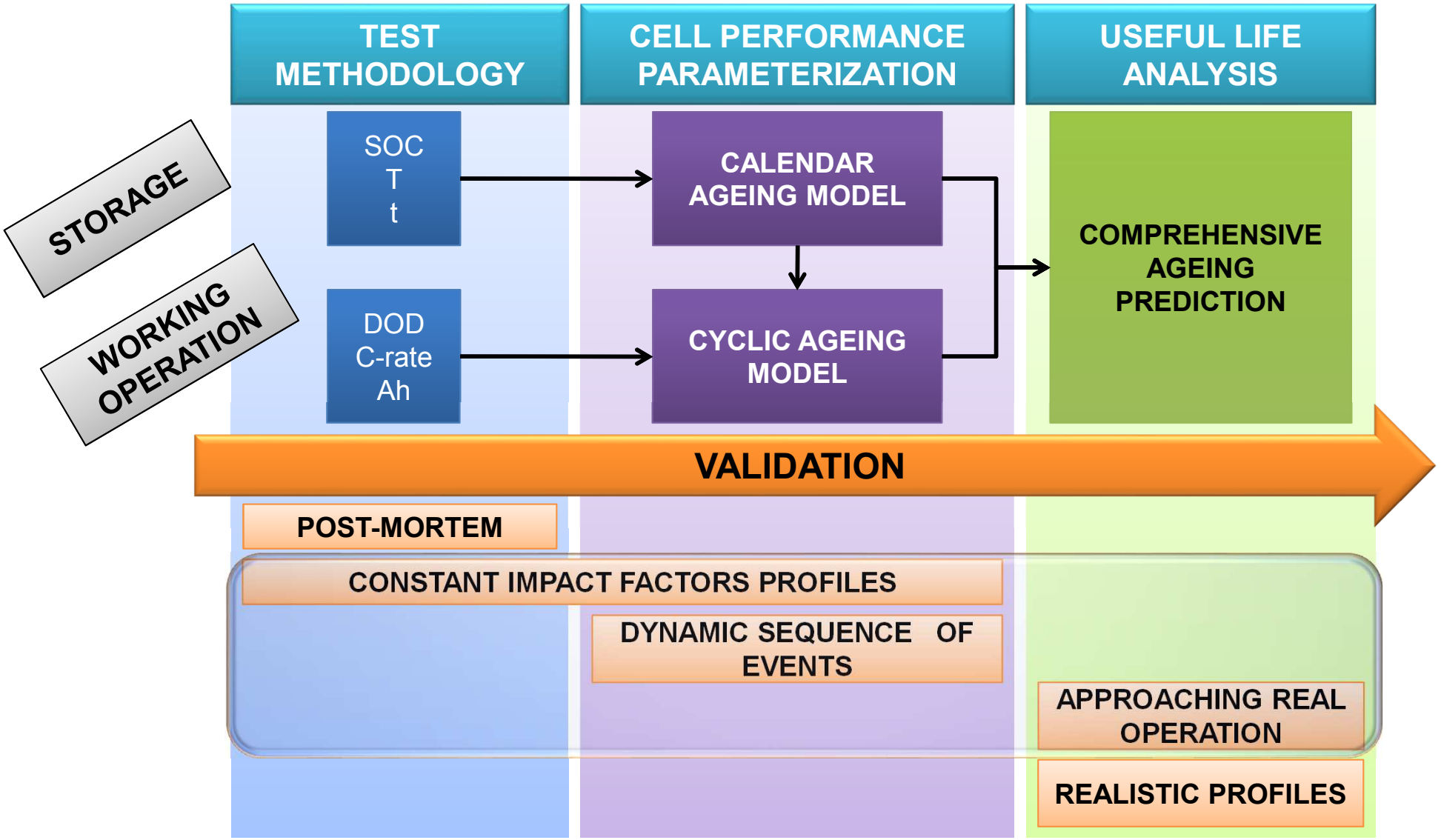
Towards reliable predictions



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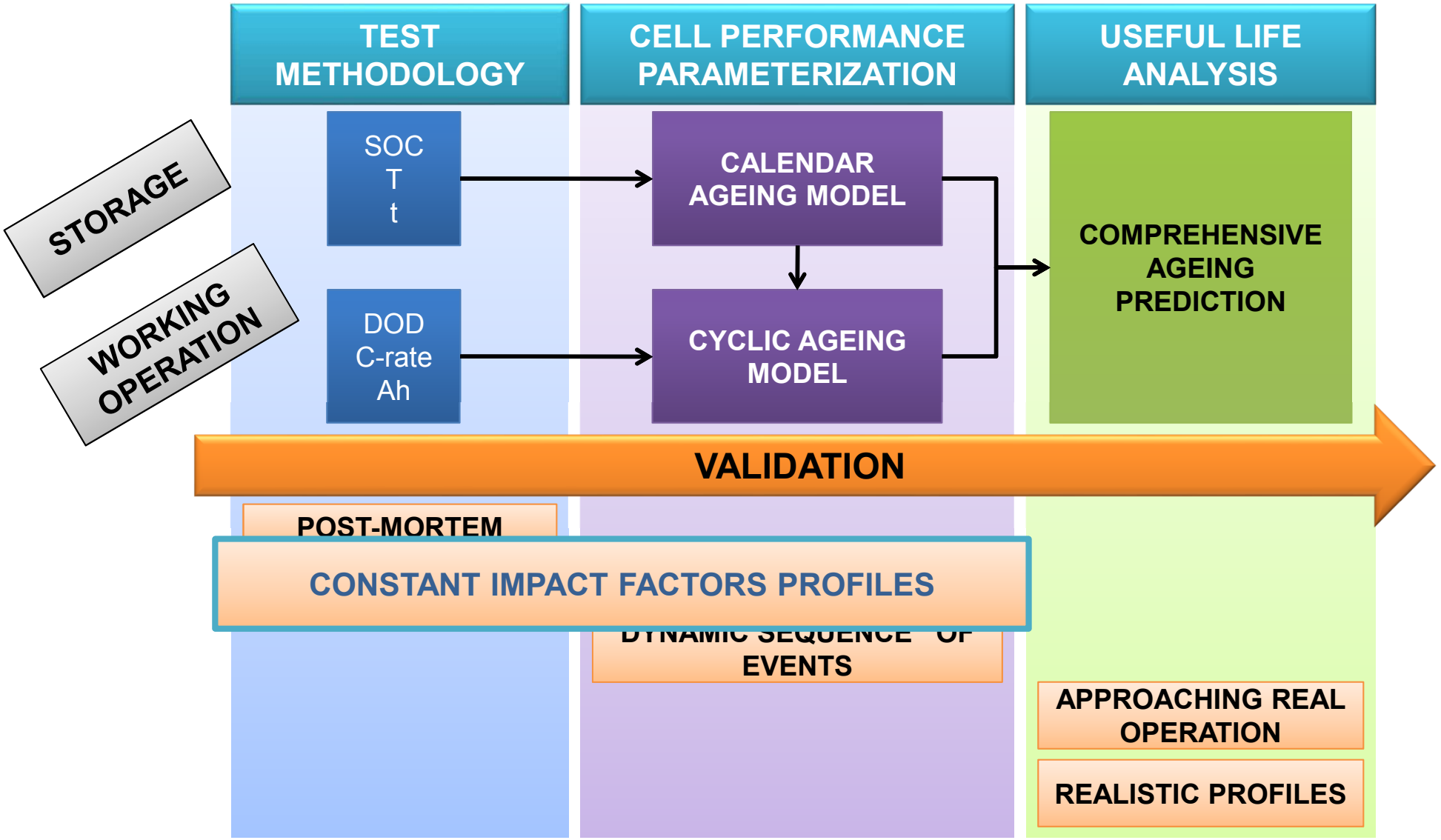
Towards reliable predictions



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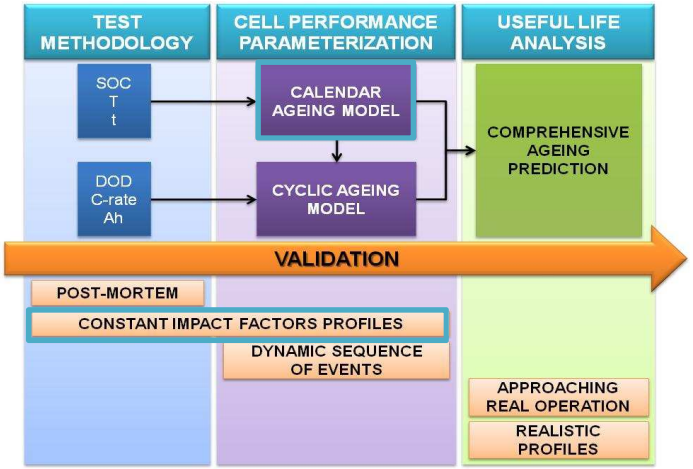
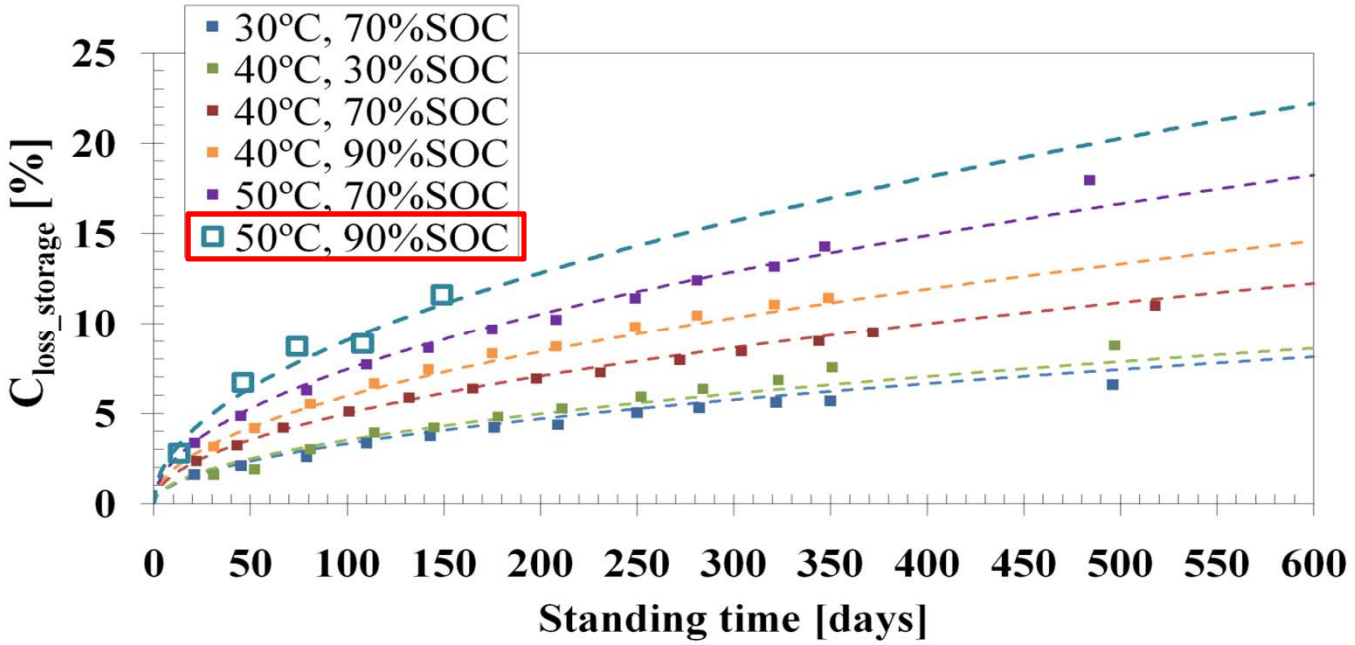
Towards reliable predictions



STATIC VALIDATION



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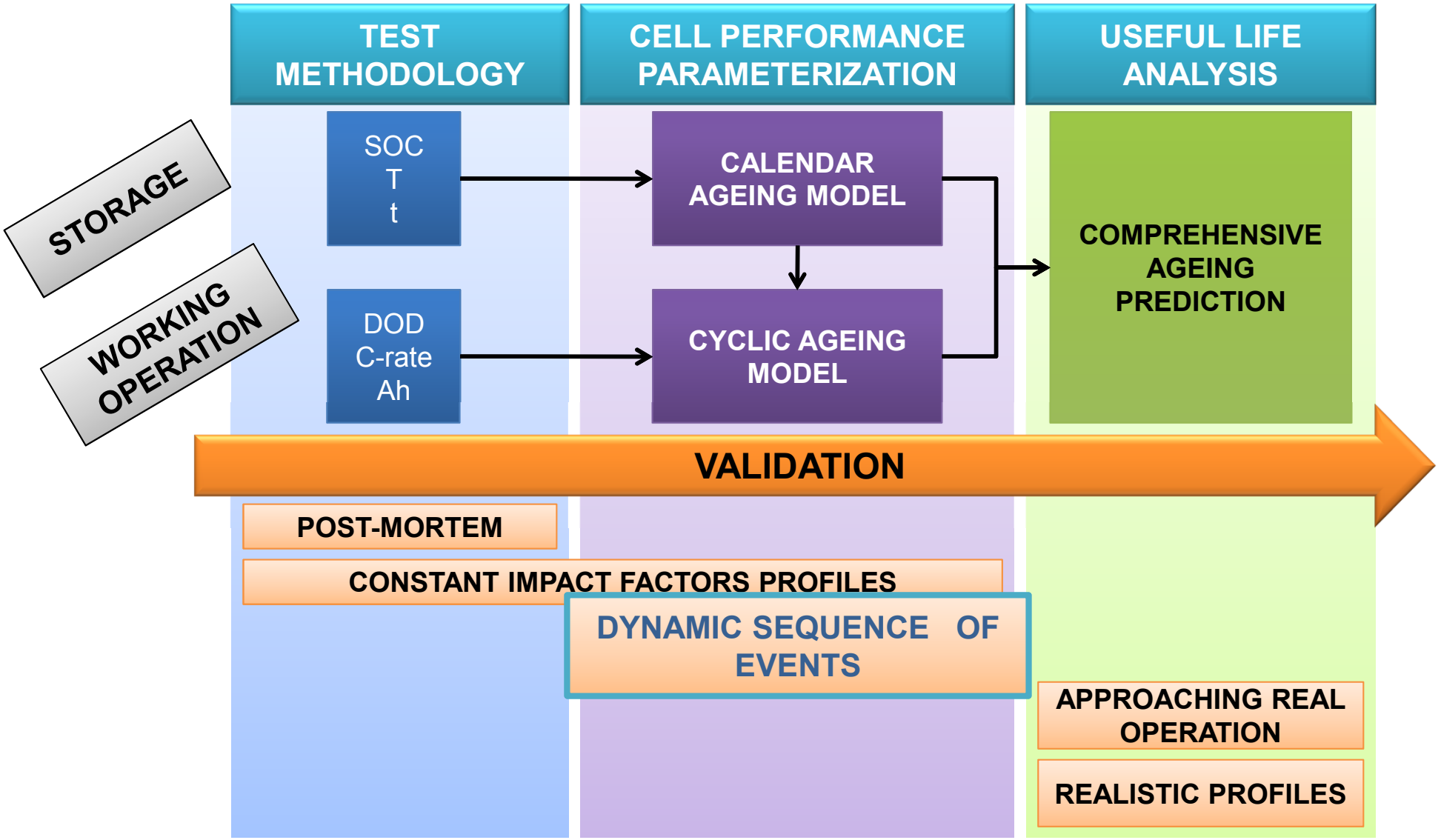
Towards reliable predictions



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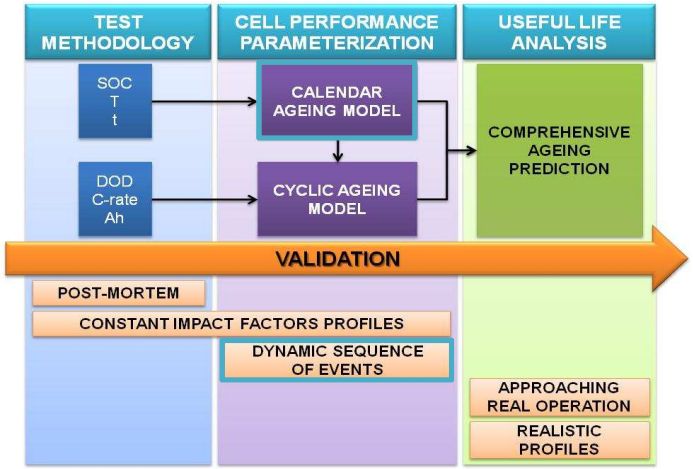
Towards reliable predictions

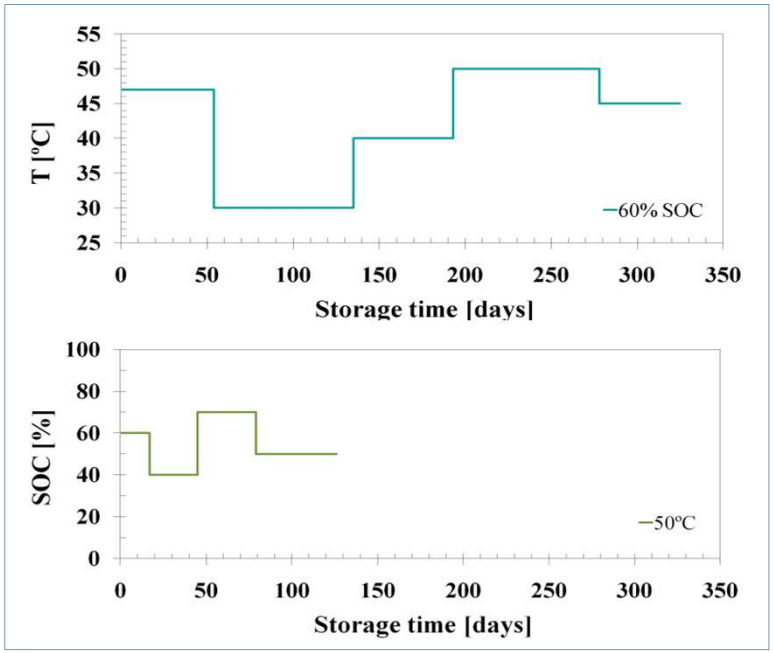


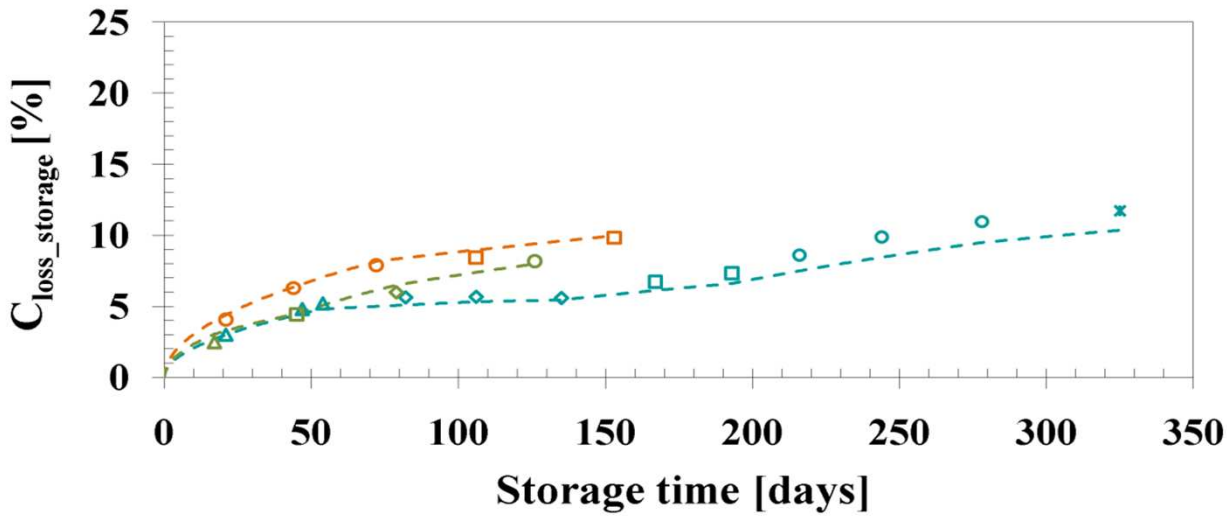
DYNAMIC VALIDATION

60% SOC: △ 47ºC ◇ 30ºC □ 40ºC ○ 50ºC × 45ºC

50ºC: △ 60%SOC □ 40%SOC ◇ 70%SOC ○ 50% SOC

90% SOC: ○ 50ºC □ 40ºC





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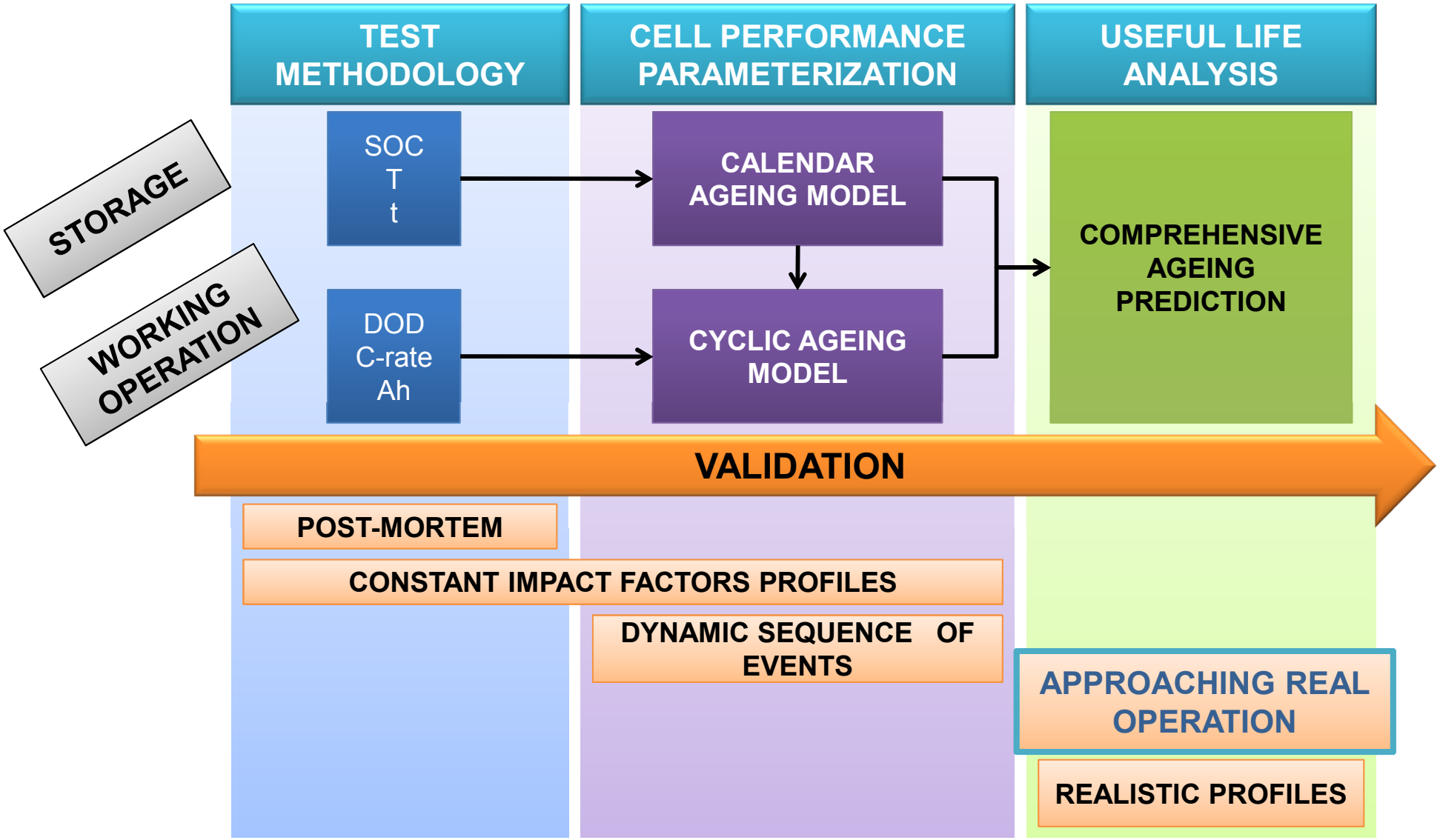

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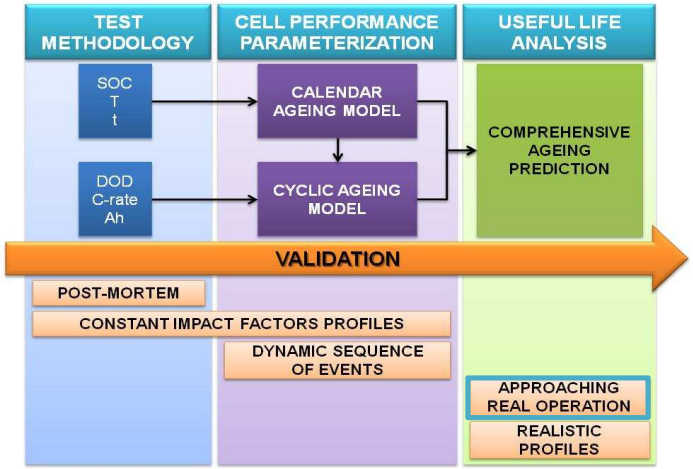
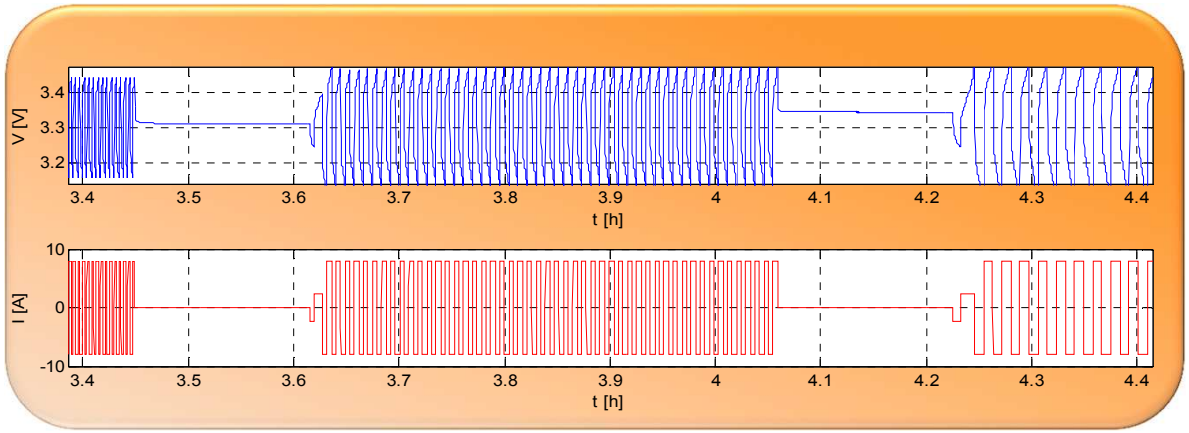
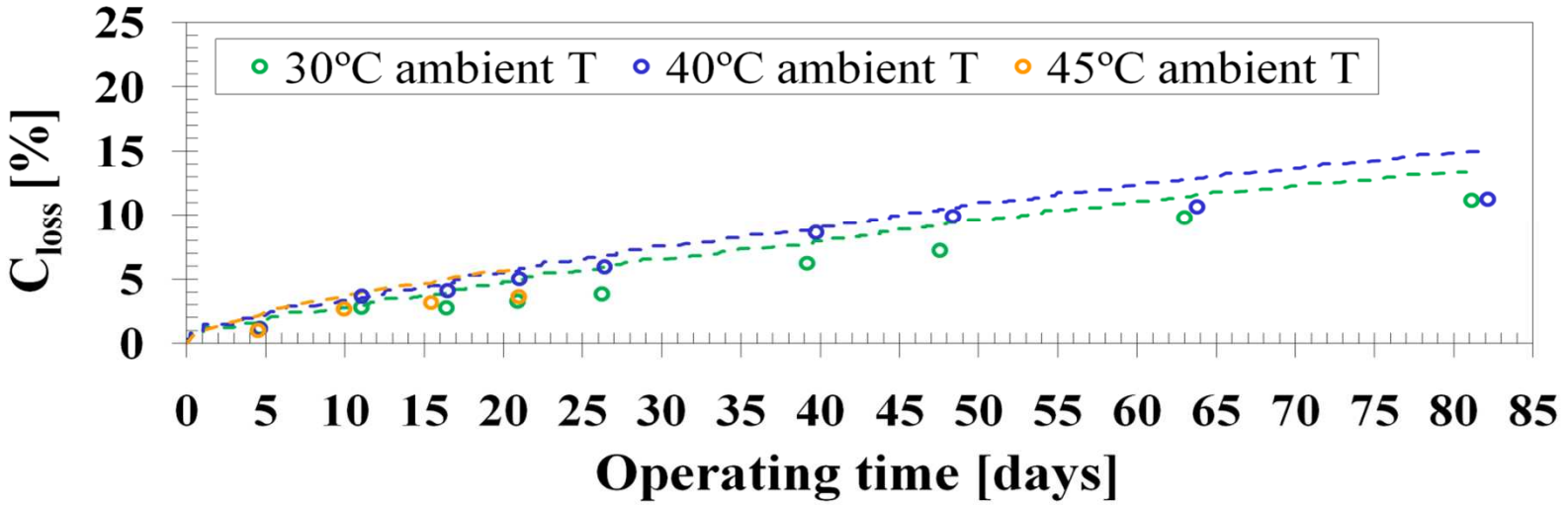




Dynamic DOD, C-rate, pauses, SOC and T



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Summary and conclusions Future work

Summary and conclusions

- Feasible to build ageing predictive models based on single cycling and calendar models
- A validation methodology was proposed. Validated calendar aging model
- Accurate calendar ageing model: EoT << EoL
  Accurate cyclic ageing model: EoT ≈ EoL

Future work

- Refine and optimise cyclic ageing model C_{loss} = f (DOD, C-rate, Ah)
- Application to realistic profiles
- Apply to other technologies to check methodology validation

Acknowledgement

I. Gandiaga, L.M. Rodriguez-Martinez

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