

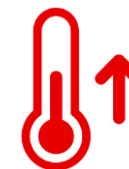
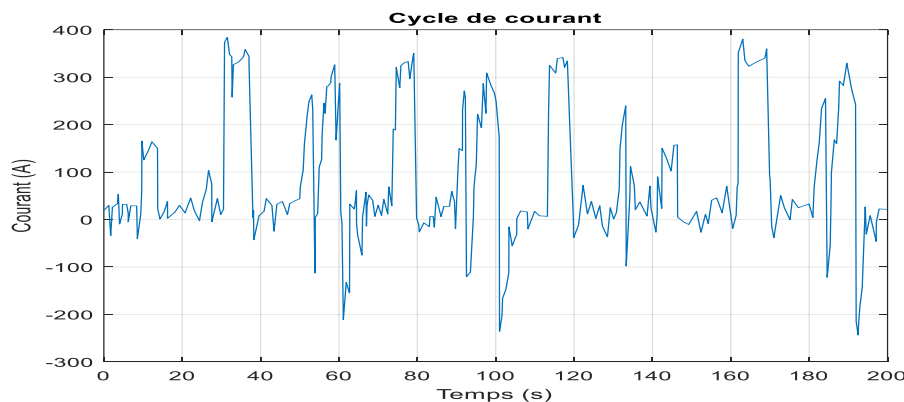
OPTHYSOURCE Presentation

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I. Observations

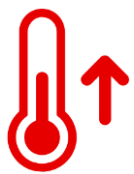
Observation 1 : Power requested (power peaks) decrease battery lifetime – ecological and durability issues



Temperature



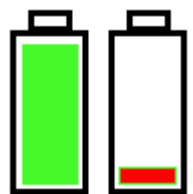
Battery lifetime



Temperature



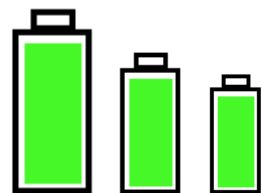
Current intensity



Depth of Discharge



Internal resistance



Capacity loss



→ Issue:

The acceleration of the battery ageing

I. Observations

Observation 2 : Li-ion Battery isn't simultaneously efficient in power and energy

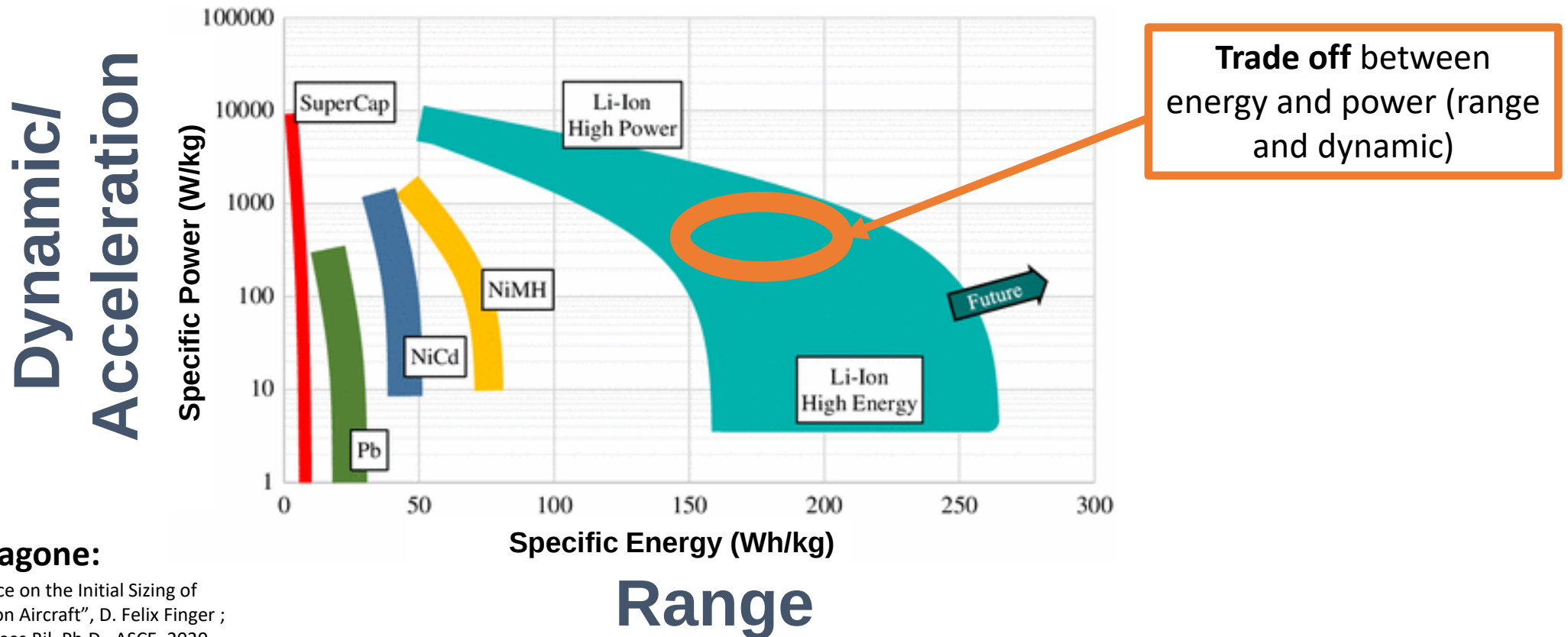


Diagramme de Ragone:

"Impact of Battery Performance on the Initial Sizing of Hybrid-Electric General Aviation Aircraft", D. Felix Finger ; Carsten Braun, Dr.Eng. ; and Cees Bil, Ph.D., ASCE, 2020

I. Observations

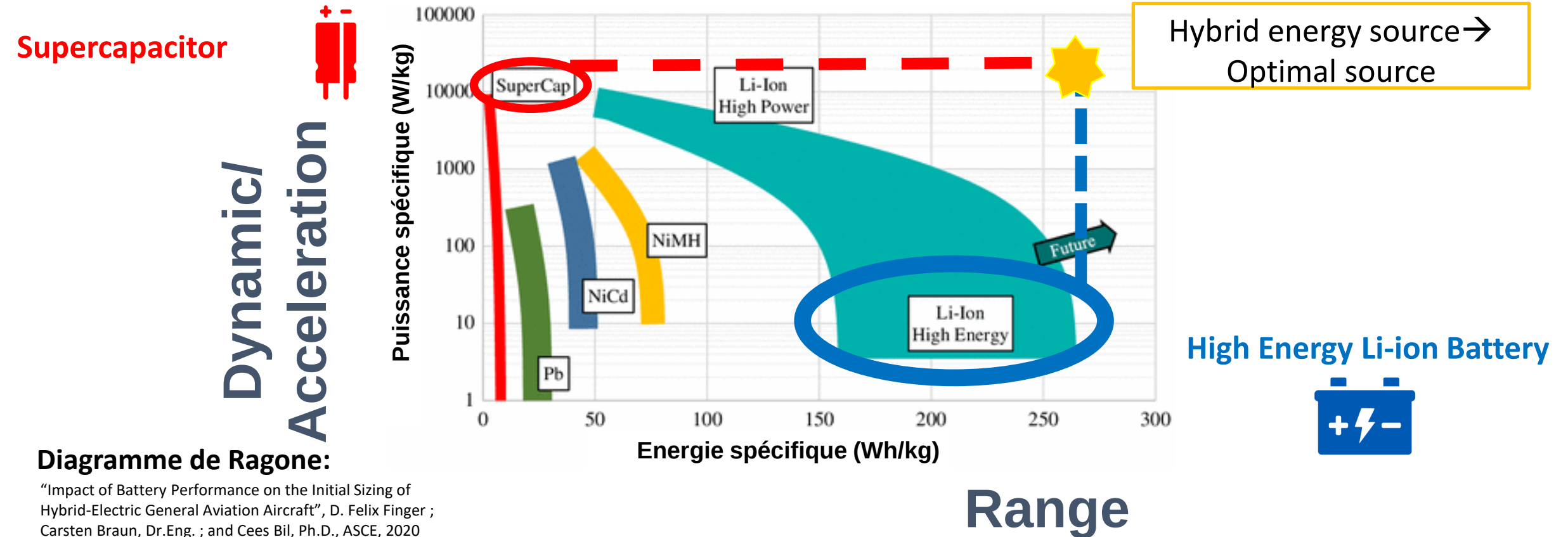
Observation 3 : Which leads to sub-optimal battery sizing

- Oversized battery to ensure power and energy
→ High cost and high volume/weight
- Undersized battery at the expense of the the power or the energy
→ Acceleration of battery ageing (through power peaks and frequent charging),
negative impact on battery performance (ex: regenerative phases)

Weight, Cost, Volume, Ageing

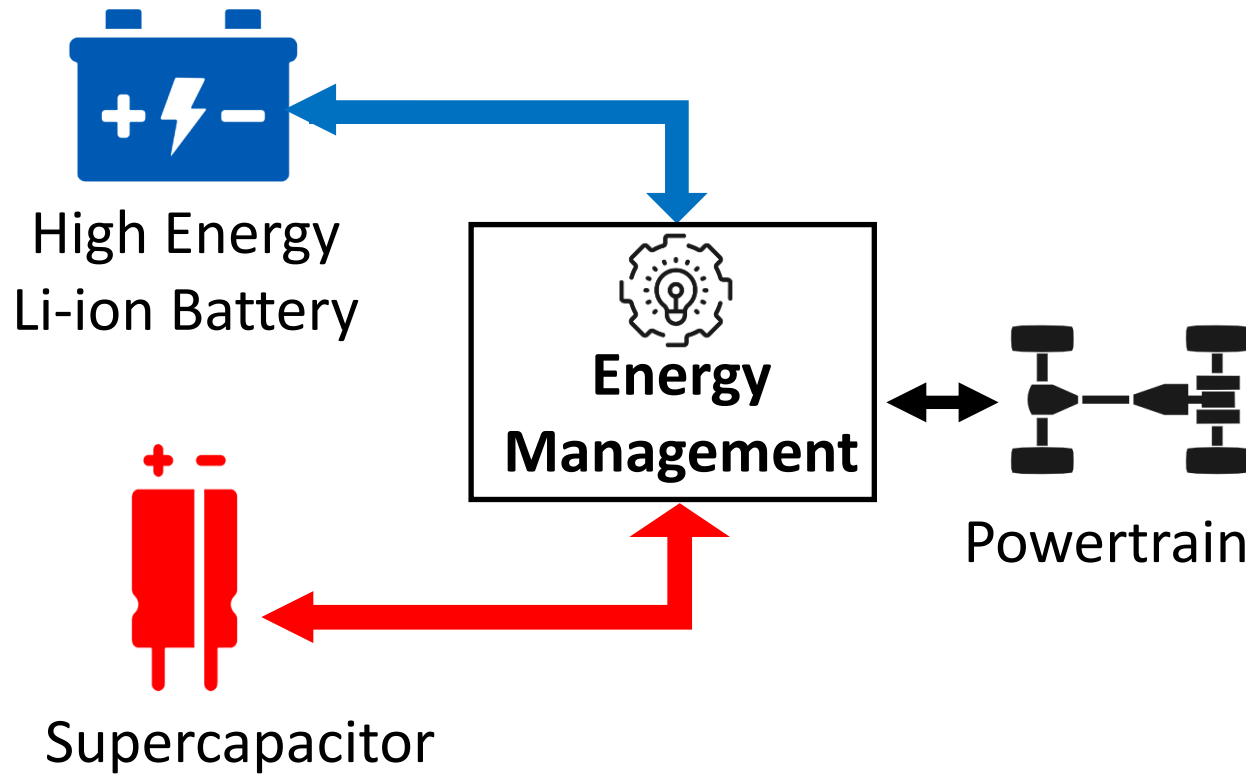
II. Activity and Solution

Li-ion Battery / Supercapacitor Hybrid Energy Storage System



II. Activity and Solution

Hybrid Energy Storage System: Li-ion Battery, Supercapacitor, DC/DC Converter, Algorithm



Goals:

- Battery is used to ensure the vehicle range
- While supercapacitor handle power peaks (dynamics)
 - Supercapacitors act like buffers

III. Value proposition

OptHySource project:

Goals :

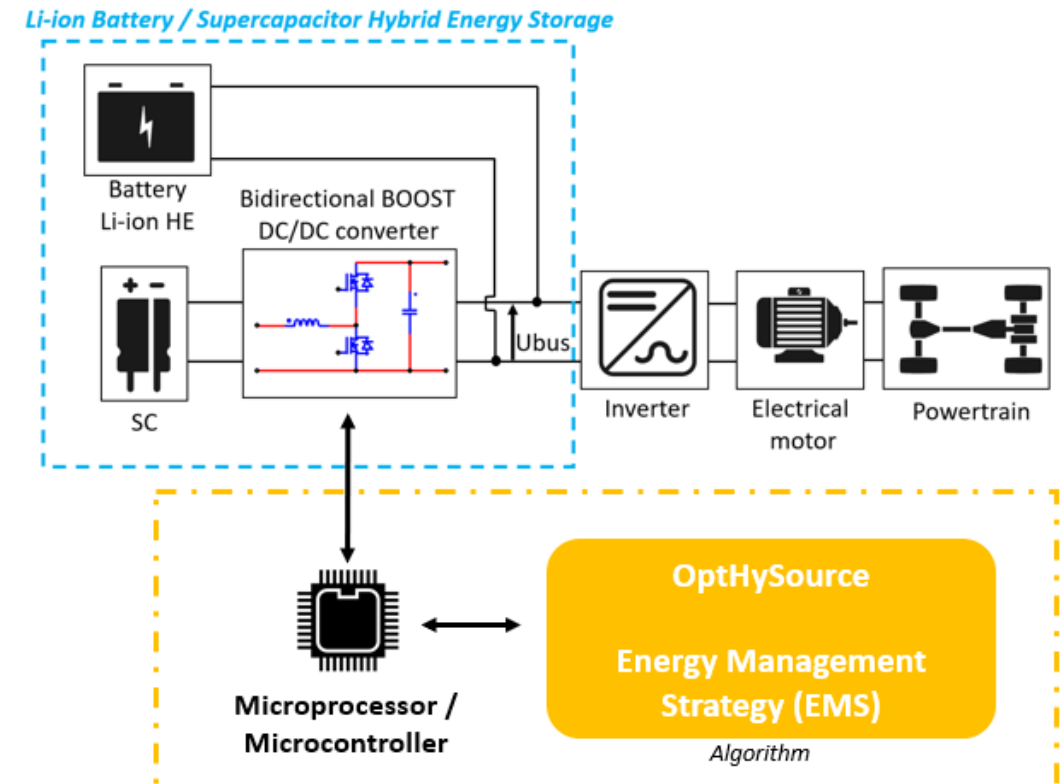
- Li-ion battery / Supercapacitor is an **obvious** technology
- Our goal is to make it **accessible**
- Improve **electric mobility**

III. Value proposition

OptHySource project:

1. Software:

1. A Sizing Algorithm for Hybrid Energy Storage System
2. A Real-Time Energy Management Strategy (EMS) using optimization tools

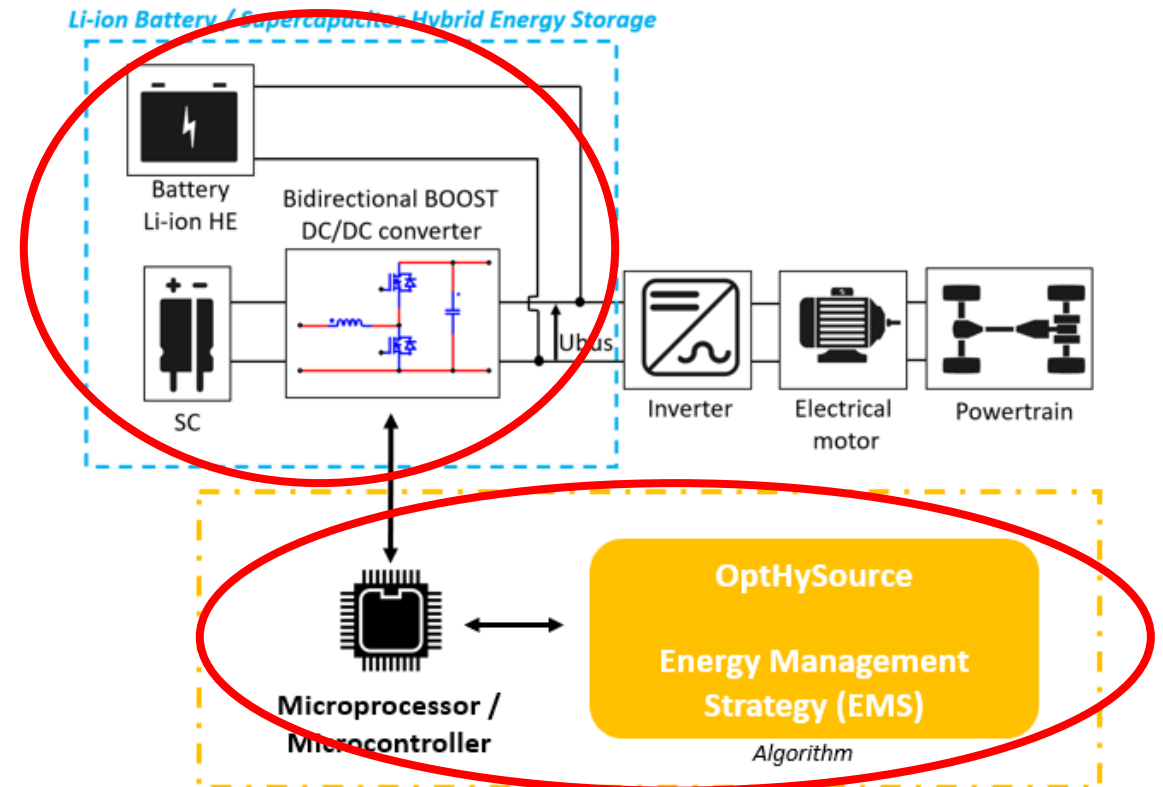


III. Value proposition

OptHySource project:

1. Hardware:

1. Proposition source hybride complète (Batterie + SC + DC/DC + Algo)

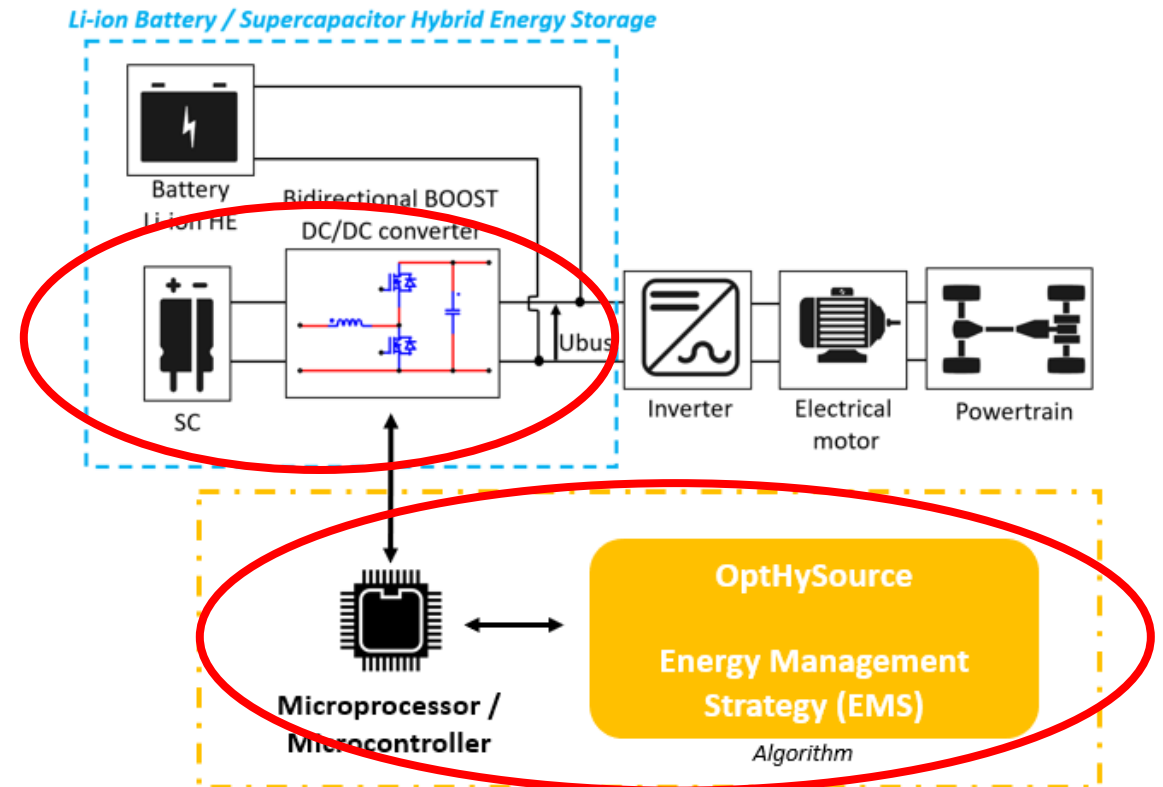


III. Value proposition

OptHySource project:

1. Hardware:

1. Proposition source hybride complète (Batterie + SC + DC/DC + Algo)
2. Proposition source hybride partielle (SC + DC/DC + Algo)

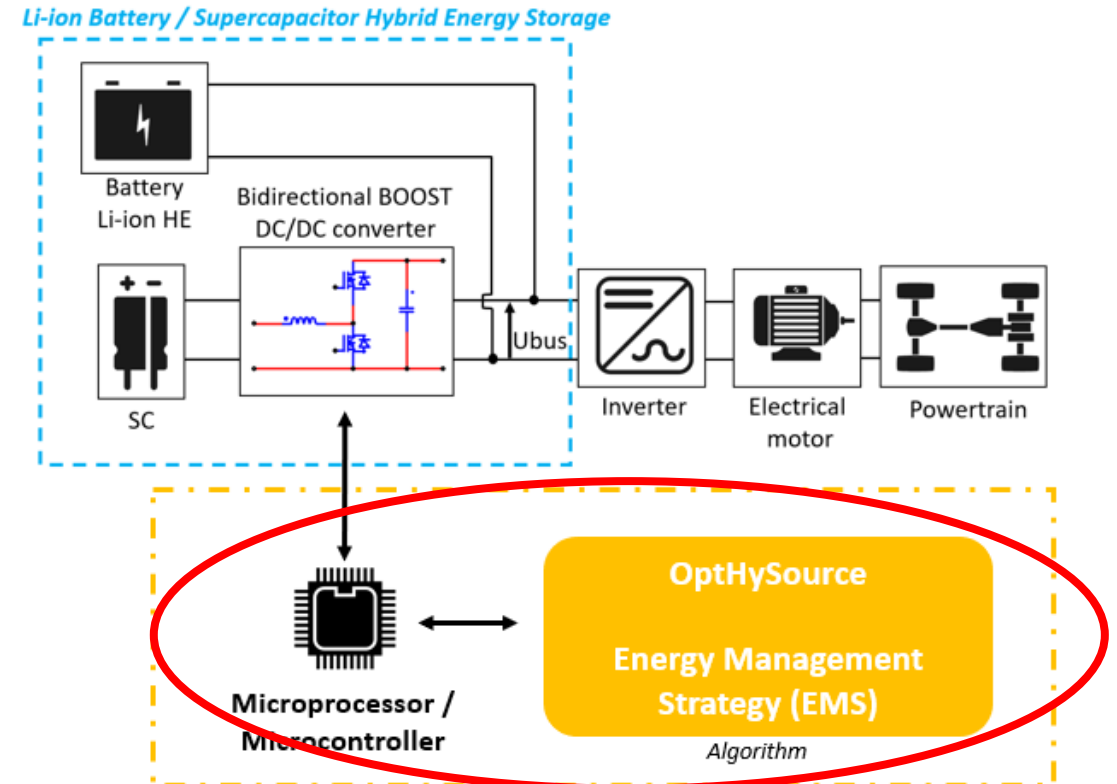


III. Value proposition

OptHySource project:

1. Hardware:

1. Proposition source hybride complète (Batterie + SC + DC/DC + Algo)
2. Proposition source hybride partielle (SC + DC/DC + Algo)
3. Proposition source hybride software (Algorithme)



III. Value proposition

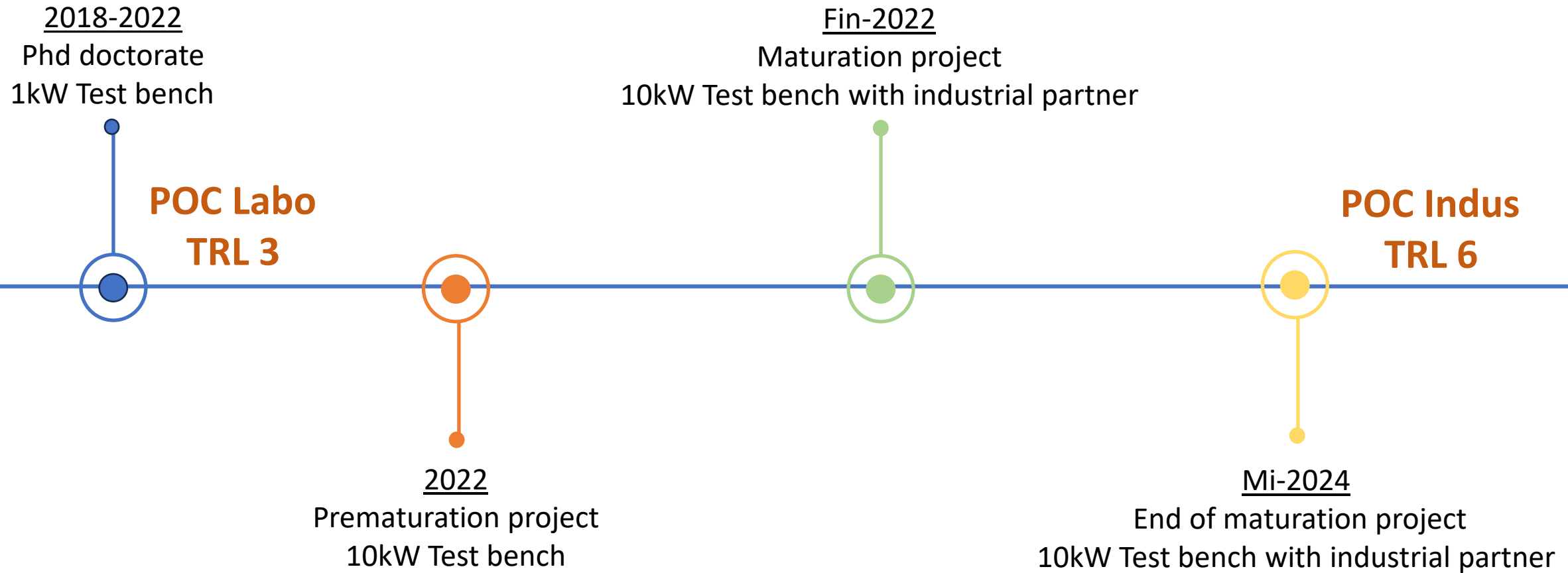
OptHySource project:

Benefits:

- Optimal Sizing
- Better performances (energy + power)
- 100% energy recovery during braking phases (losses)
- Total Cost of Ownership (TCO) improved

- Better ageing indicators compared to classic EMS
- Aim up to 20-30% improvement of battery lifetime

IV. Technical Roadmap



IV. Technical Roadmap

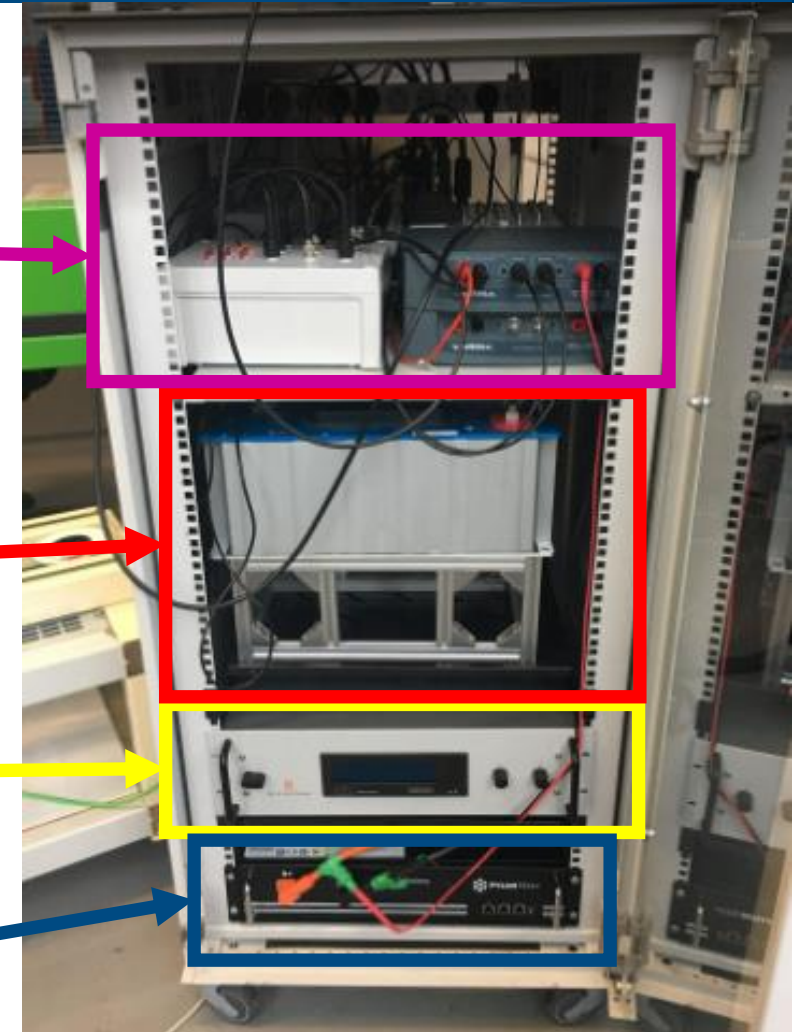
Banc de test d'1kW fonctionnel réalisé à l'INSA durant la thèse de Théophile PAUL

Dspace
(MicroLabBox) ,
capteurs de courant,
tension , étage
d'adaptation

Supercondensateurs
48V 165F +
Convertisseur DC/DC

Alimentation de
puissance 15kW

Batterie 48V 50Ah



IV. Discussions

- Interest?
- Need?
 - Sizing?
 - Performance?
 - Ageing?
- Collaboration?

IV. Discussions

To go further :

- Power cycles or Speed cycles
 - Sizing simulation
 - EMS simulation
- Spécification (Battery Voltage, max current,...)

Thank you for your attention!



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