Digital Solutions to Accelerate Battery Testing

HEU DigiBatt Project 2024 – 2026

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TwinBatt webinar, online, 5/5/25

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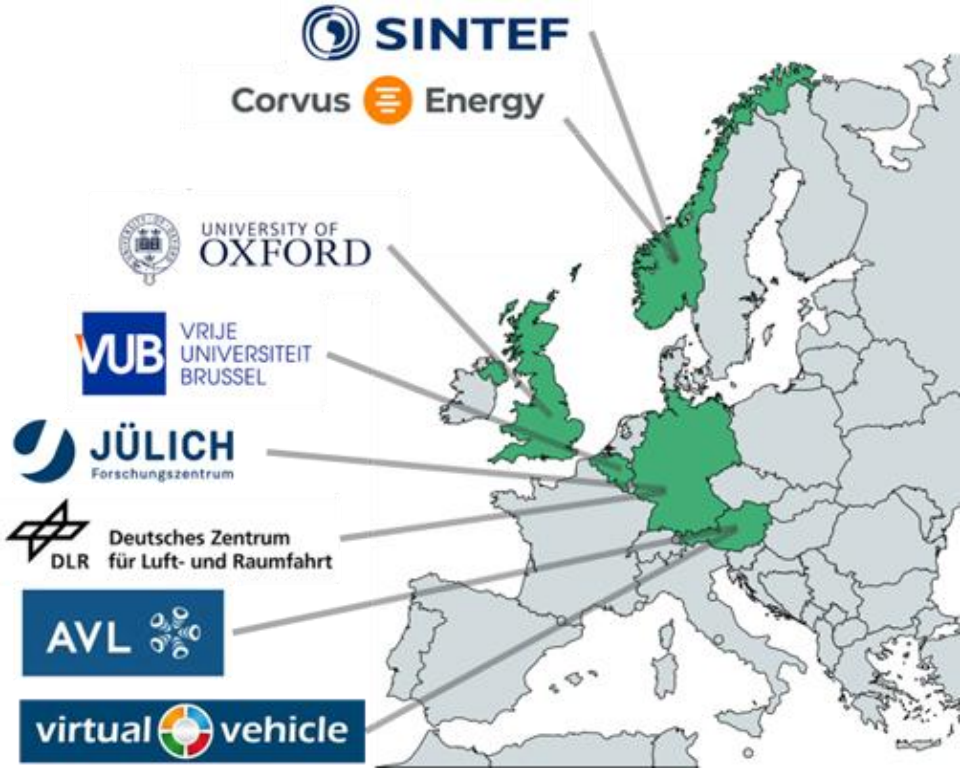
The DigiBatt Consortium

The DigiBatt consortium is comprised of a wide range of stakeholders from researchers, battery manufacturers, battery testers and battery system integrators.

It brings together world-leading institutions, who have the capacity to make the DigiBatt vision a reality.



Consortium:

SINTEF (coordinator), AVL, Corvus Energy, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Forschungszentrum Juelich (FZJ), Oxford University, Virtual Vehicle Research GmbH (ViF), Vrije Universiteit Brussel (VUB)

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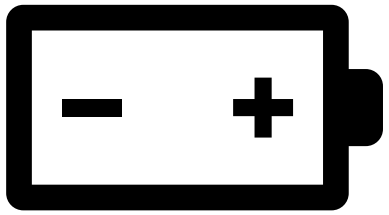
Digital solutions to accelerate battery testing

DigiBatt is a 3 year Horizon Europe project which will combine **traditional battery testing methods** with **state-of-the-art digital techniques.**

We aim to make battery testing **faster, cheaper** and **more accurate** by creating tools which allow us to extract **more value from fewer tests.**

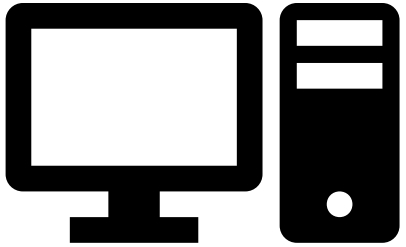
DigiBatt targets a **30% reduction in the time** and **20% reduction in the cost** of battery development.

Testing and parameterisation



Physical testing

Destructive testing



Simulation

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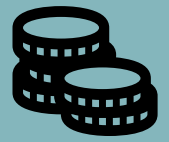
Testing problems

Fragmented:

- Lots of data
- No common language
- Difficult to reuse

Time consuming:

- Long test duration - lifecycle and safety data



Expensive:

- Many tests
- Not always useful
- Destructive testing destroys cells!

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Standardise, automate, accelerate!

The DigiBatt philosophy:

Standardised data formats which are readable by human and machine

Automatic triggering of virtual and physical tests

Accelerated virtual testing methods and intelligent design of experiments

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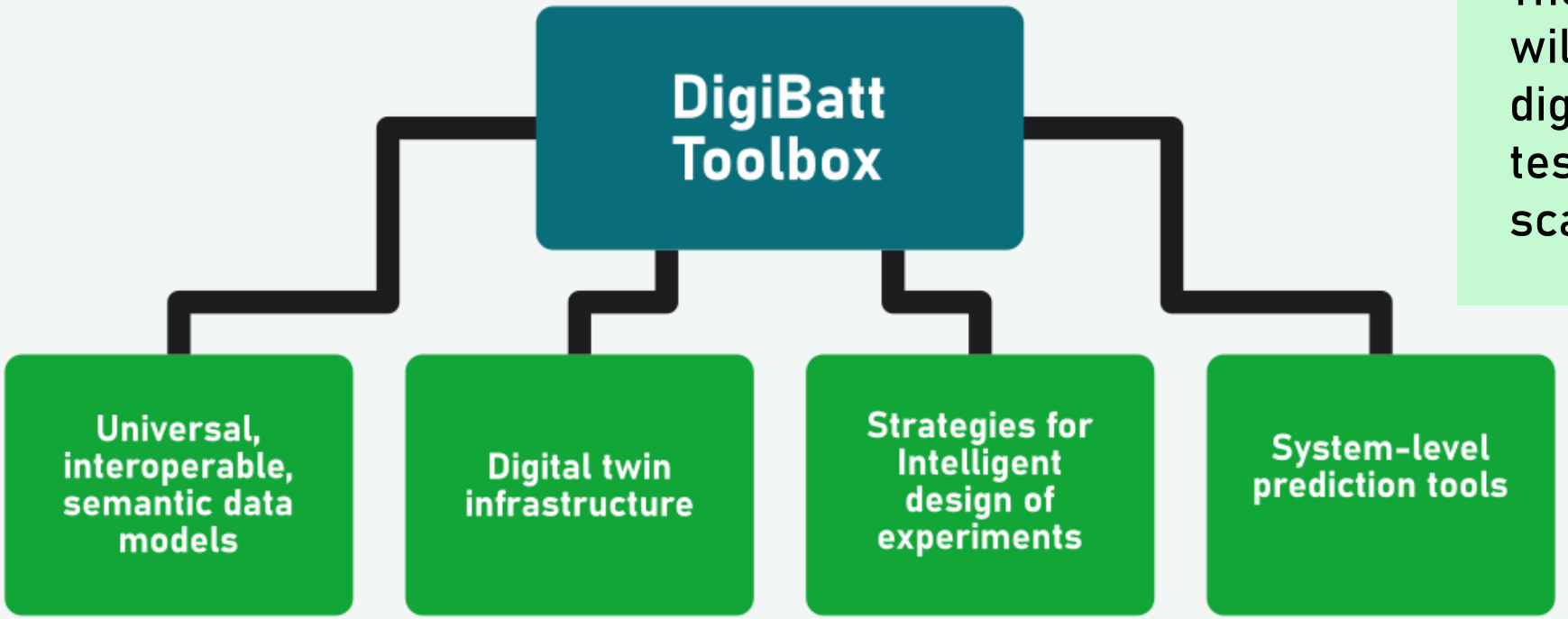
An open-source battery testing toolbox



The main output from DigiBatt will be a an open-source, digital toolbox for battery testing. For cell to system scales.

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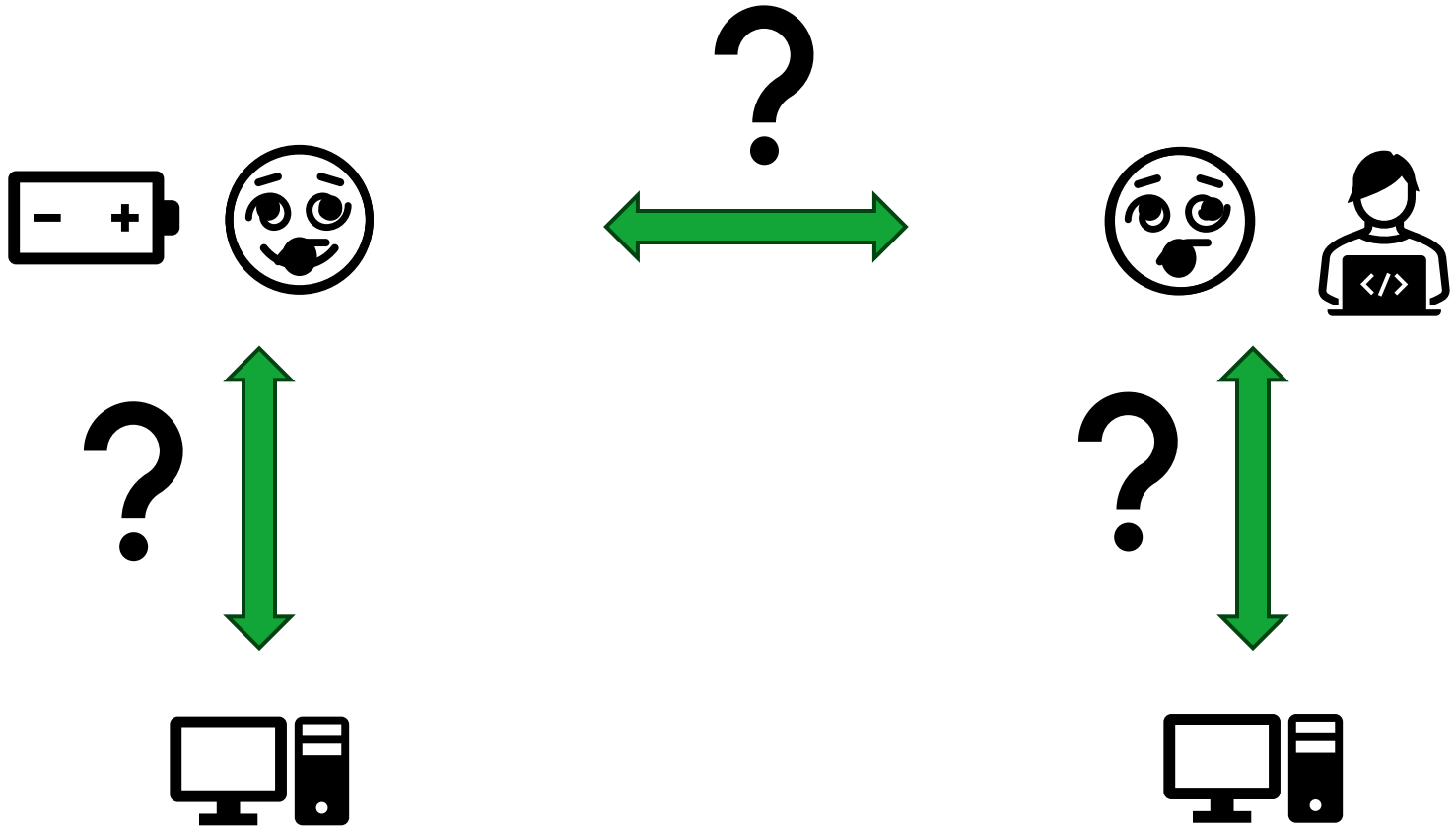
Standardise

Universal, interoperable, semantic data models



We need a common language

Readable by humans and machines!

Ontologies

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Standardise

SINTEF Industry, & Virtual Vehicle (Austria). (2024). Application Ontologies. Zenodo. https://doi.org/10.5281/zenodo.15336642

- **We are developing standard ontologies to describe battery test data.**
- **Common language** to describe terms relevant to battery testing:
  - battery-testing.ttl
  - battery-cell-geometry.ttl

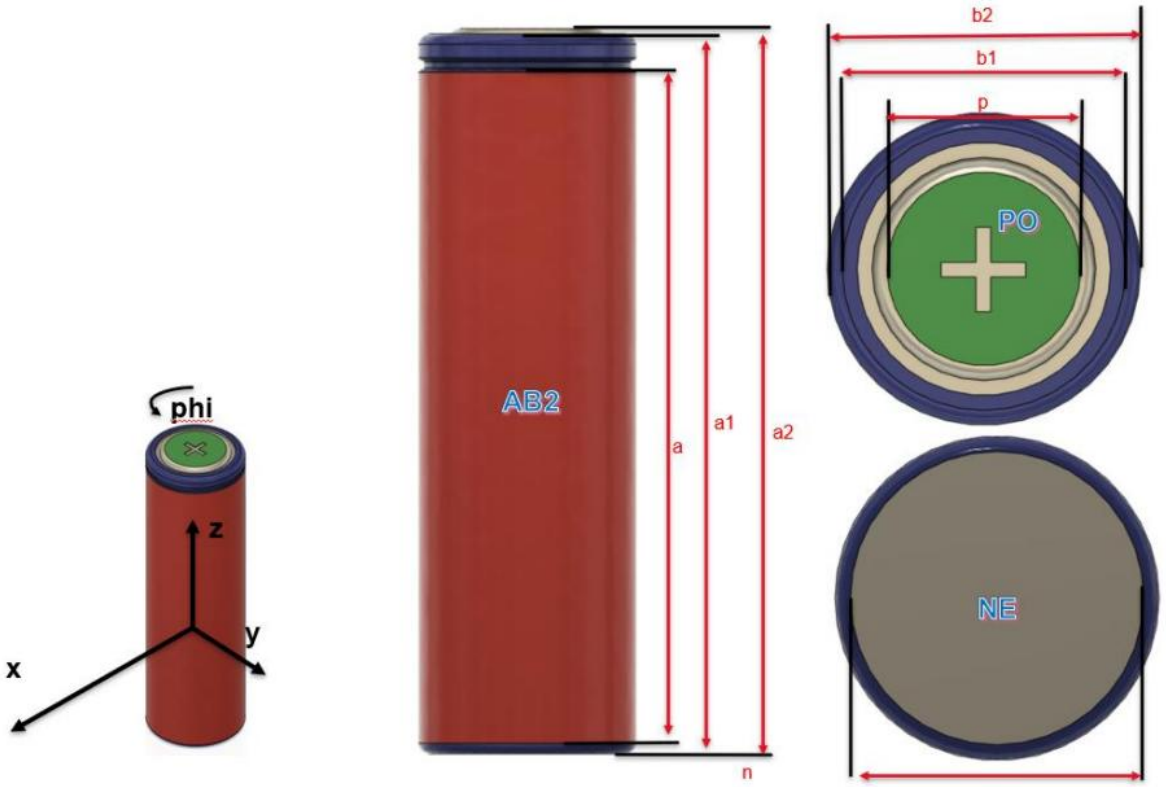

Figure 8. Overview of the cell geometry surface and length definitions for an opposite terminal cylindrical cell

https://github.com/emmo-repo/domain-battery

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Standardise

Universal, interoperable, semantic data models

Ontologies described used JSON-LD

SINTEF Industry. (2025). Digital Twin Framework. Zenodo. https://doi.org/10.5281/zenodo.15336706

```
{
    "@context": "https://w3id.org/emmo/domain/battery/context",
    "@type": "CR2032",
    "hasProperty": [
        {
            "@type": "Diameter",
            "hasNumericalPart": {
                "@type": "Real",
                "hasNumericalValue": 0.02
            },
            "hasMeasurementUnit": {
                "@type": "Metre"
            }
        },
        {
            "@type": "Thickness",
            "hasNumericalPart": {
                "@type": "Real",
                "hasNumericalValue": 0.0032
            },
            "hasMeasurementUnit": {
                "@type": "Metre"
            }
        }
    ],
    "hasNegativeElectrode": {
        "@type": "LithiumBasedElectrode"
    },
    "hasPositiveElectrode": {
        "@type": "ManganeseDioxideElectrode"
    },
    "hasElectrolyte": {
        "@type": "OrganicElectrolyte"
    },
    "hasCase": {
        "@type": "R2032"
    }
}
```

COLD

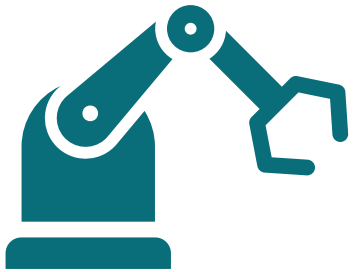
```python
# Instantiate data model
my_cr2032 = cold.CR2032()

# Assign properties
my_cr2032.hasProperty = [cold.NominalVoltage(3.2, "Volt")]

# Serialize to JSON-LD
json_ld = my_cr2032.to_jsonld()
print(json.dumps(json_ld, indent=4))
```

Automate

SINTEF Industry. (2025). Digital Twin Framework. Zenodo. https://doi.org/10.5281/zenodo.15336706

Universal, interoperable, semantic data models

- What can we do with an ontology?
  - Automatically parse data files and write JSON files using correct ontology terms. (GLEANED – see deliverable)
  - Convert generic specifications to specific input formats



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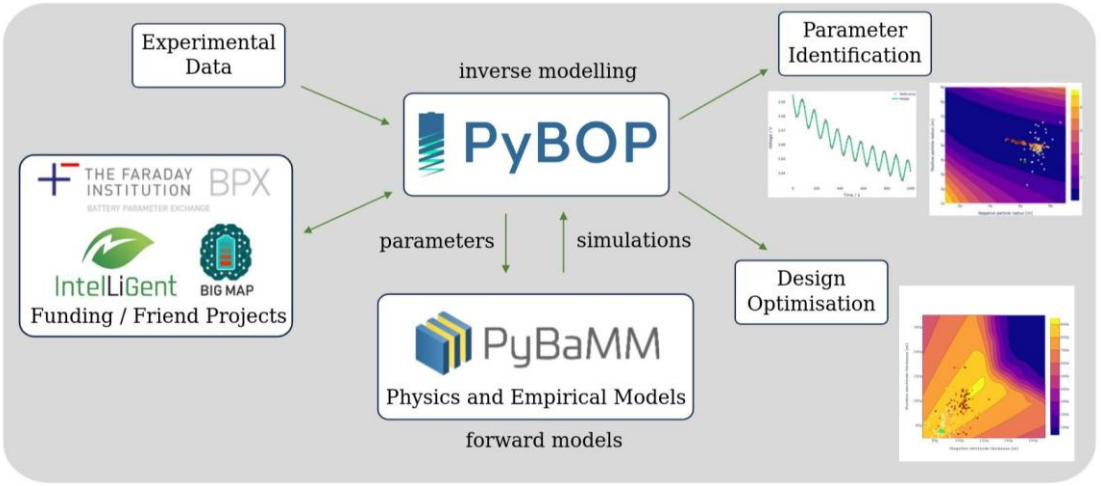
Accelerate

Digital twin infrastructure

- Improved numerical simulation tools
  - Streamlined simulators – faster, more accurate simulation, optimisation, parameterisation:



Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR), SINTEF Industry, & Forschungszentrum Jülich. (2025). Development of computational framework for non-invasive parameterization of physics-based models. Zenodo. https://doi.org/10.5281/zenodo.15336745

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Accelerate

Digital twin infrastructure

- Improved numerical simulation tools
  - Data-driven methods
    - Identify patterns in operational data and testing data
    - Predict safety and lifetime characteristics at cell level and in full systems based on previous usage (a ship, a car)
    - Test the most important use cases at a system level with virtual testing platforms and hardware in the loop, for whole systems.

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Accelerate

Strategies for Intelligent design of experiments

- Digital tools to intelligently decide which tests to run and reduce testing effort
  - I have **data A**, I want to know **B**, what tests (virtual / physical) do I need to run?
  - Automatically trigger the tests which are needed with the help of standardised tools!

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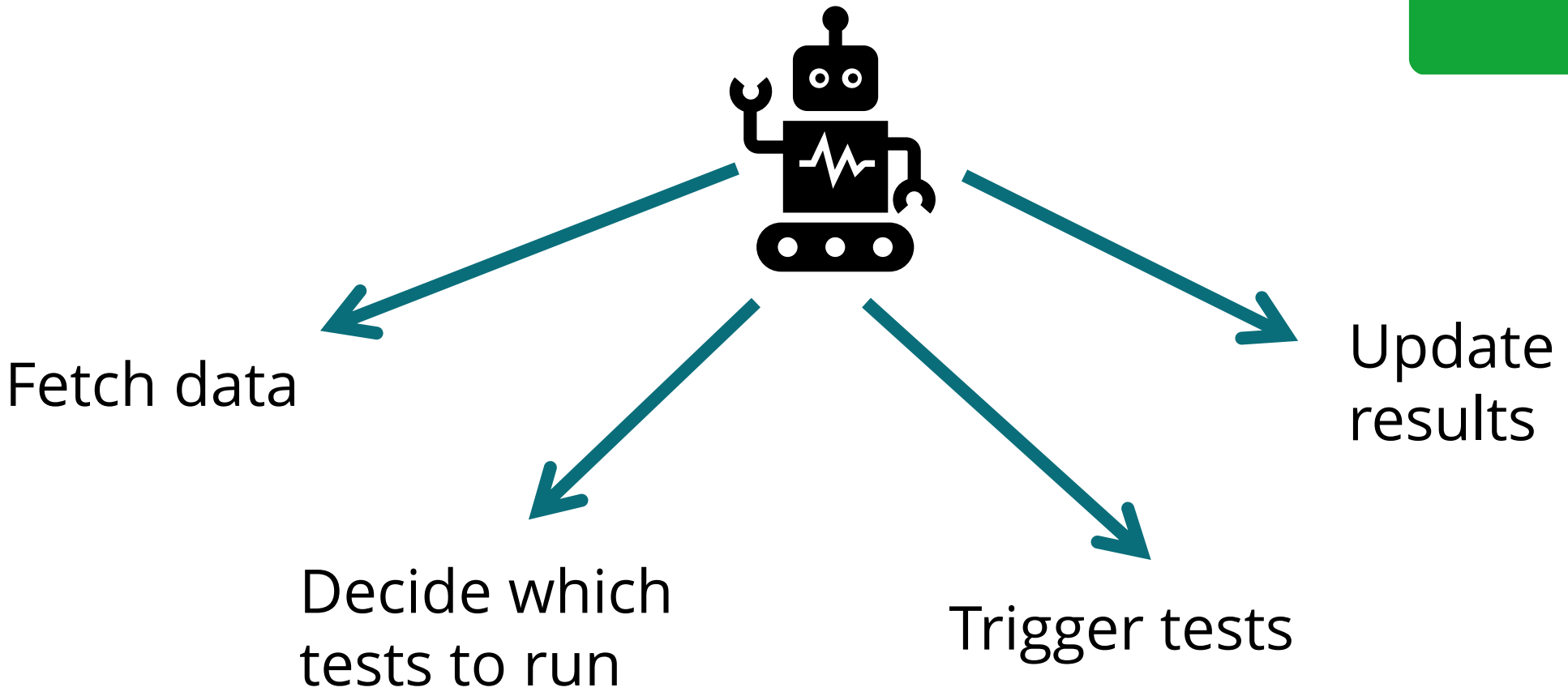
Automate

SINTEF Industry. (2025). Digital Twin Framework. Zenodo. https://doi.org/10.5281/zenodo.15336706

Digital twin infrastructure



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Our Software

www.digibattproject.eu/software

DigiBatt will use and build upon open-source software being developed by DigiBatt partners:

PyBaMM BatEst

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Find out more

Timeline: Jan 2024 – Dec 2026

Grant Number: 101103997

Contact:

- www.digibattproject.eu
- https://zenodo.org/communities/digibatt
- https://www.linkedin.com/company/digibatt
- Coordinator contact: Dr. Francesca Watson (francesca.watson@sintef.no)

www.digibattproject.eu

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Symposium on

Emerging and Digital Battery Technologies

Join us in the vibrant city of Oslo, Norway, for a symposium on Emerging and Digital Battery Technologies, hosted by the EU-funded projects Digibatt and IntelLiGent.

This event will bring together leading experts from research and industry to explore the latest advancements in battery testing, digitalization, and Li-ion battery research. Expect insightful discussions and best practices that will shape the future of battery development.

Location: Holmenkollen Park Hotell, Oslo, Norway
Date: June 11th - June 12th, 2025

Registration: www.batteryworkshop.eu

Contact: Francesca.Watson@sintef.no

Funded by the European Union

Confirmed Speakers:

Weihan Li
RWTH Aachen

Sajib Chakraborty
VUB

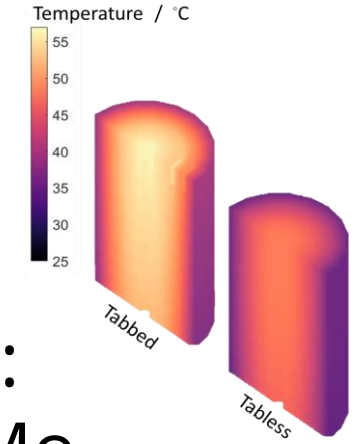
Lukas Gold
Fraunhofer ISC

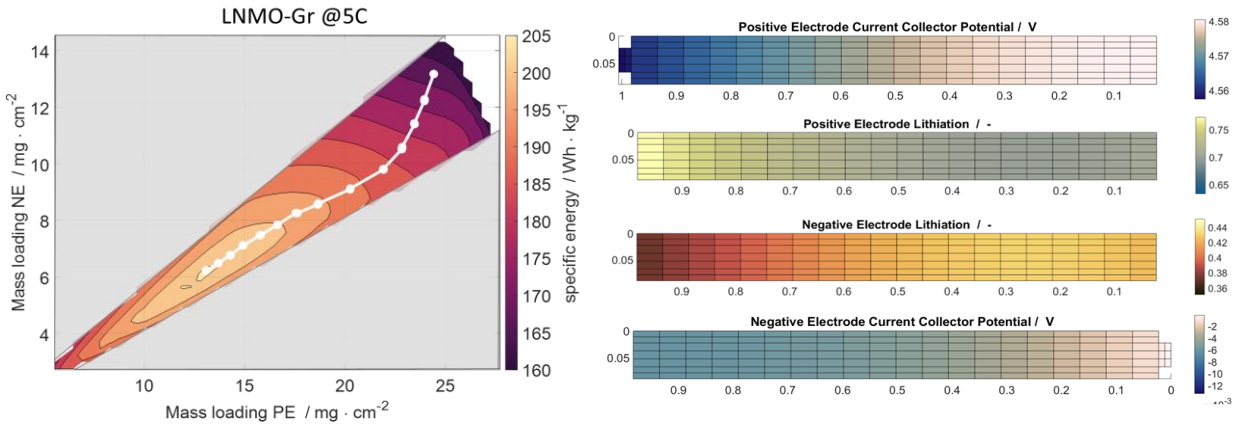
Lorena Hendrix
SINTEF

Thomas Traußnig
AVL

And more...

BattMo





Workshop June 2025: Introduction to BattMo

Want to know how BattMo can accelerate your digital battery activities?

Join us for a free hands-on workshop in Oslo, Norway to find out!

When: 13th June, 2025
Where: SINTEF Oslo
Cost: Free
Registration: https://batteryworkshop.eu/battmo

BattMo: a cutting-edge, open-source battery modelling and simulation framework specializing in:

- Large-format cell simulation in p4D
- Electrochemical-Thermal Simulations
- Gradient-Based Design Optimization

And much more…

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