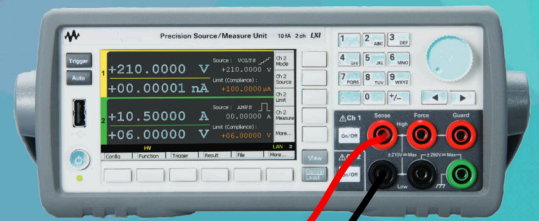


EU Project

# Nano Bat



A nano-tech solution to optimize battery testing for cost- and time-efficient production applied to the automotive industry

H2020 financed project  
April 2020 - March 2023  
Coordinator: Keysight Technologies

Battery production for clean energy, waste and CO<sub>2</sub> reduction

EU "Industrial Policy Strategy" for efficient battery production

Cost efficiency and large scale production

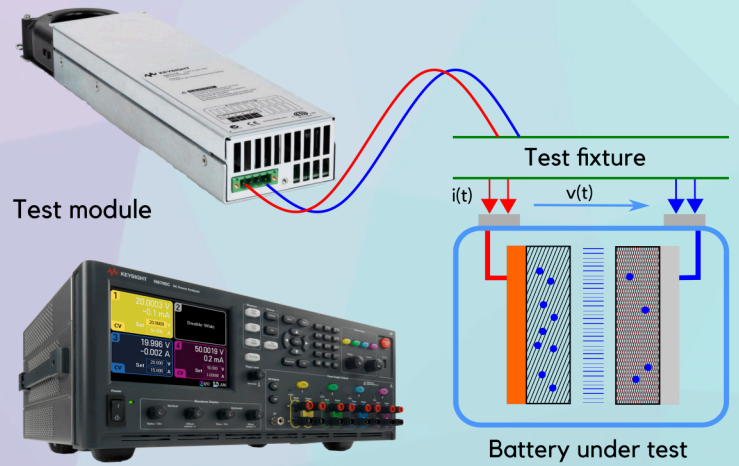
## NanoBat

EU battery market demands at least 20 Giga-Factories

Battery market potential of € 250 billion/year after 2025

# Summary

- Nanoscale imaging of battery surfaces
- High frequency techniques, up to GHz
- Advanced studies for battery measurements
- Tests in pilot lines and automotive batteries
- Higher efficiency in battery production



# Objectives

## Science & Technology

- Impedance spectroscopy (EIS)
- Self discharge current
- GHz & electrochemical microscopy
- Dielectric resonators & scanners for energy materials

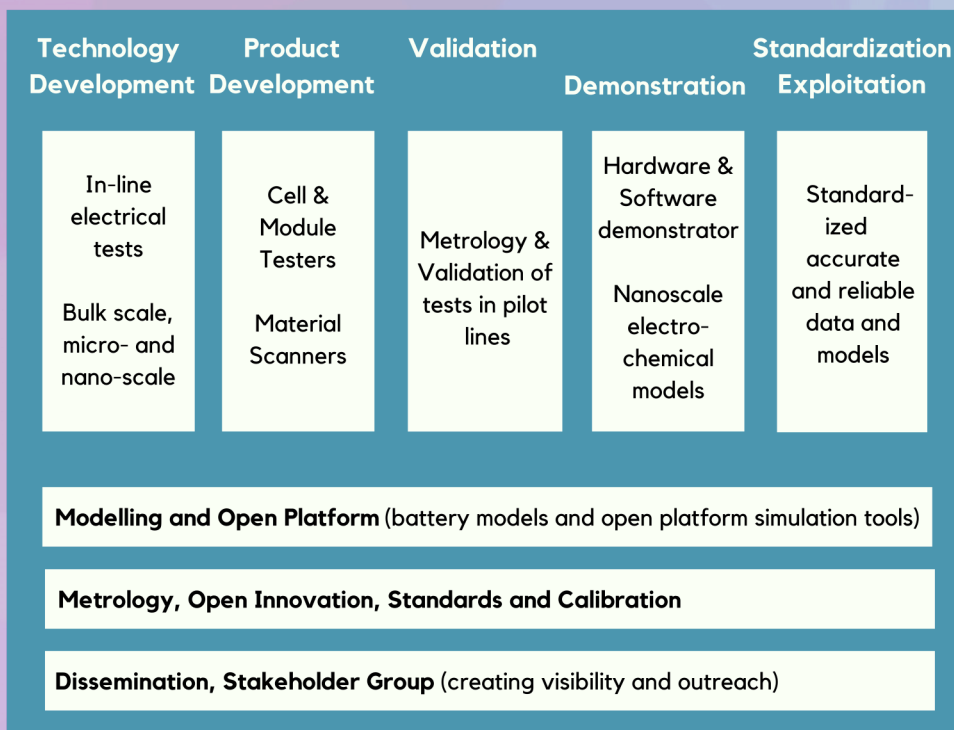
## Calibration, Modelling & Data Analytics

- Nonlinear & physical models
- Advanced impedance calibration & standards
- Automated battery classification in pilot lines
- GHz materials testing

## Industry & Open Innovation

- Battery manufacturing pilot lines
- New GHz materials instruments & demos
- Public outreach events
- Standardization documents for materials & modelling

# Value Chain



- EU battery industry support & development
- International standards & metrology
- Adjacent markets in GHz materials
- Modelling software & open innovation
- Increasing the market share of European SMEs

# Key Actions

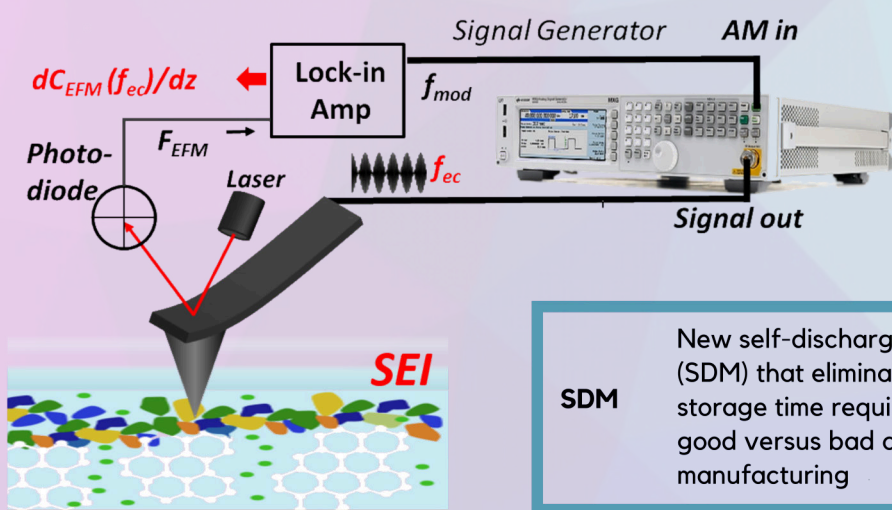
Nanoscale SEI (solid electrolyte interface) for battery test in pilot lines

High-Impact scientific articles on battery SEI performance and modelling

Pilot line quality gates based on cyber-physical system and data driven models with machine learning

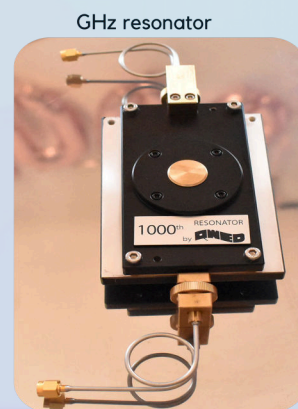
A public e-car rally organized by Kreisel under supervision of FIA with battery modules tested by NanoBat

# Key Technologies



**EIS** Metrology graded and calibrated in-line electrochemical impedance spectroscopy (EIS)

**SDM** New self-discharge measurement (SDM) that eliminates weeks of cell storage time required to discern good versus bad cells in battery manufacturing



**High throughput pilot line**

- Multi-scale high-frequency toolbox tested for pilot line quality control
- Real-time EIS integrated in pilot lines and high throughput quality test
- 30.000 cells/day are tested for automotive applications

**RF-nanoscale broadband techniques**

New nanoscale broadband GHz techniques to measure local SEI electrochemical activity and impedance changes, at large electrical bandwidth (milli Hz to Giga Hz), high temporal (<1 nano-second) and lateral (1-20 nano-meter) resolutions

**Software**

Teaching kits, open software, and data analytics packages are provided including multi-physics models of battery surfaces and nanoscale processes



# Facts

- **Call:** H2020-NMBP-TO-IND-2019
- **Activity:** DT-NMBP-08-2019
- **Work Programme:** Real-time nano-characterisation technologies (RIA)
- **Grant Agreement No.:** 861962
- **Proposal Acronym:** NanoBat
- **Start Date:** 1st April 2020
- **Duration:** 36 months
- **Total Grant:** 4,966,912.5 €

# Partners

- **Industry:** Keysight (AT) - Coordinator
- **SMEs:** QWED (PL), PLEIONE-ENERGY (GR), KREISEL (AT), EURICE (DE)
- **R&E:** JKU (AT), TUBS (DE), RUB (DE)
- **RTOs:** METAS (CH), IMDEA-ENERGY (ES), AIT (AT), CRF (IT)

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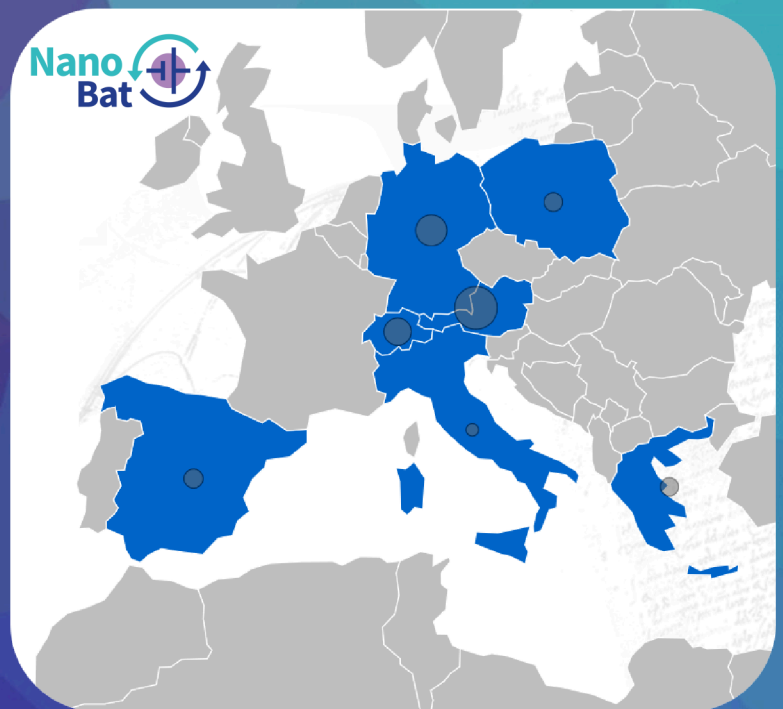
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