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Problem

Many knowledge generated in industry and science **is irrevocably lost** because we **lack suitable tools** for sustainable and complete documentation.

In addition, **generated data** can only be structured and **made accessible to AI** with a **great deal of additional effort**.

AI itself is a **complex process** that requires a **precise description** for its **understanding** and **reproducibility**

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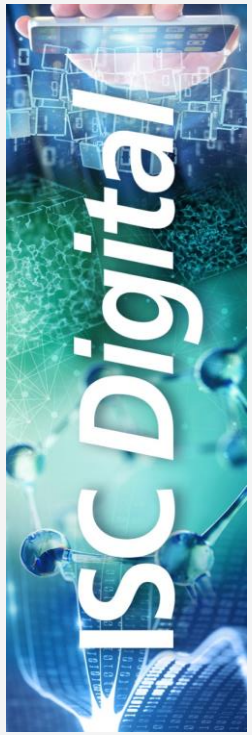

Cloud connection and international cross-linking

Hybrid information systems

Industry 4.0 (Lab & Fab)

Ontologies and semantic data spaces

Open Semantic Lab

AI, ML & Modeling

Human operable

IoT / OPC UA

Automation & Robotics

Manual Tasks

Automatized production of nano particles

Automatized production and test of medicals

Fully automatic Glas-Screening-Unit

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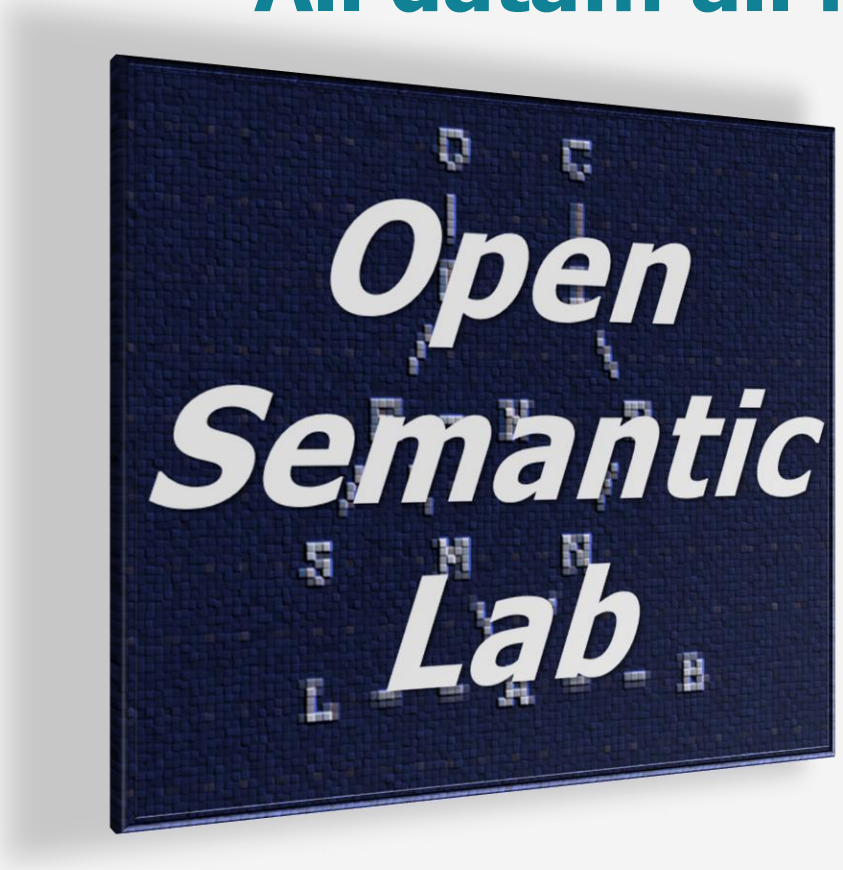
Solution

All data… all ideas… linked in one platform



- Central Meta Platform Solution
- Machine / AI Readable
- Open Source
- Highly Adaptable

https://github.com/OpenSemanticLab

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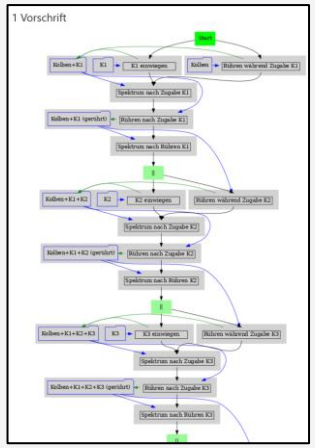
Open Semantic Lab

Holistic cloud-connected and multiuser web platform

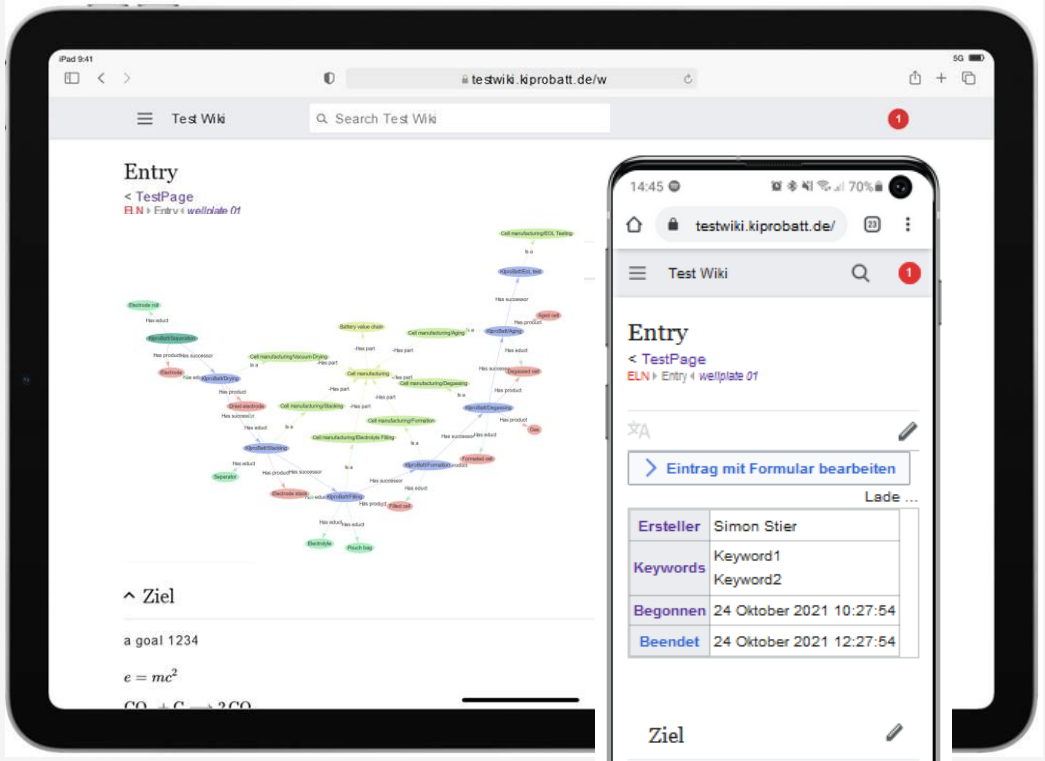
G1	
Anzeigename	G1
Vollständiger Name	Gerät131452
Gerätetyp	Gerätetyp1
Seriennummer	12345678
Verantwortung	
Geräteverantwortlicher	Esefsef, Test Person, Max Muster
Standort	H.1.1

Gerätetyp1	
Anzeigename	GT1
Vollständiger Name	Gerätetyp1
Hersteller	Bosch
Typenbezeichnung	Bürogerät
Gerätekategorie	Kategorie:KatGerät, Kategorie:TestGerät

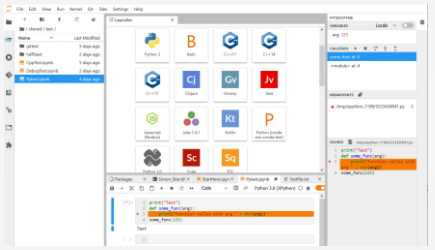
Inventory Management



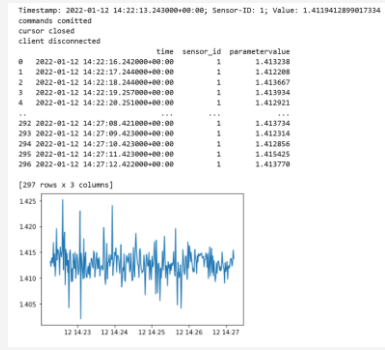
SOPs



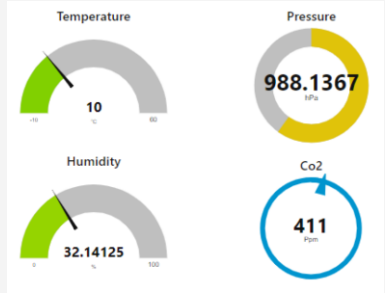
KB & ELN



Data Analytics



Machine Interfaces



Dashboards

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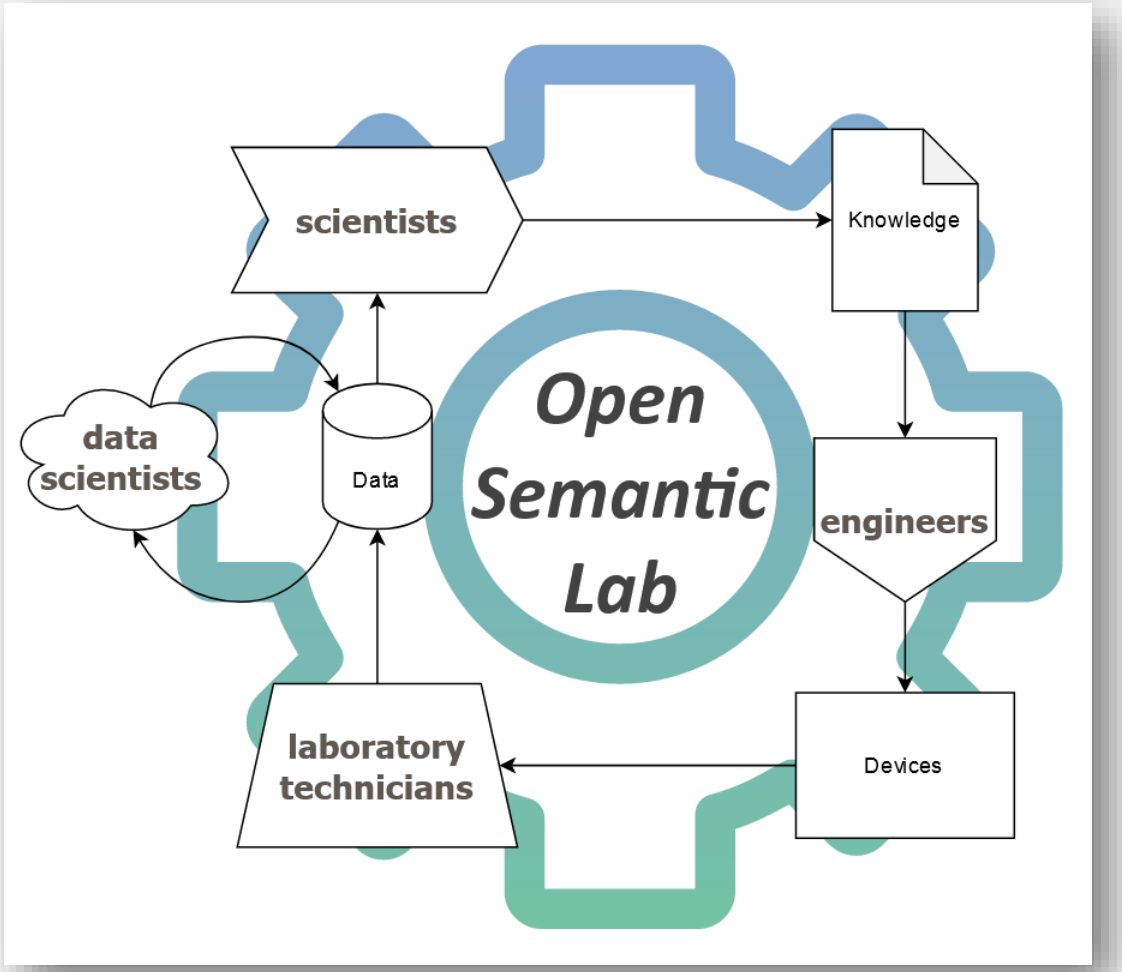
Multi-Perspective



Laboratory technicians, scientists, engineers, data scientists

– Everybody who's dealing with complex processes and data

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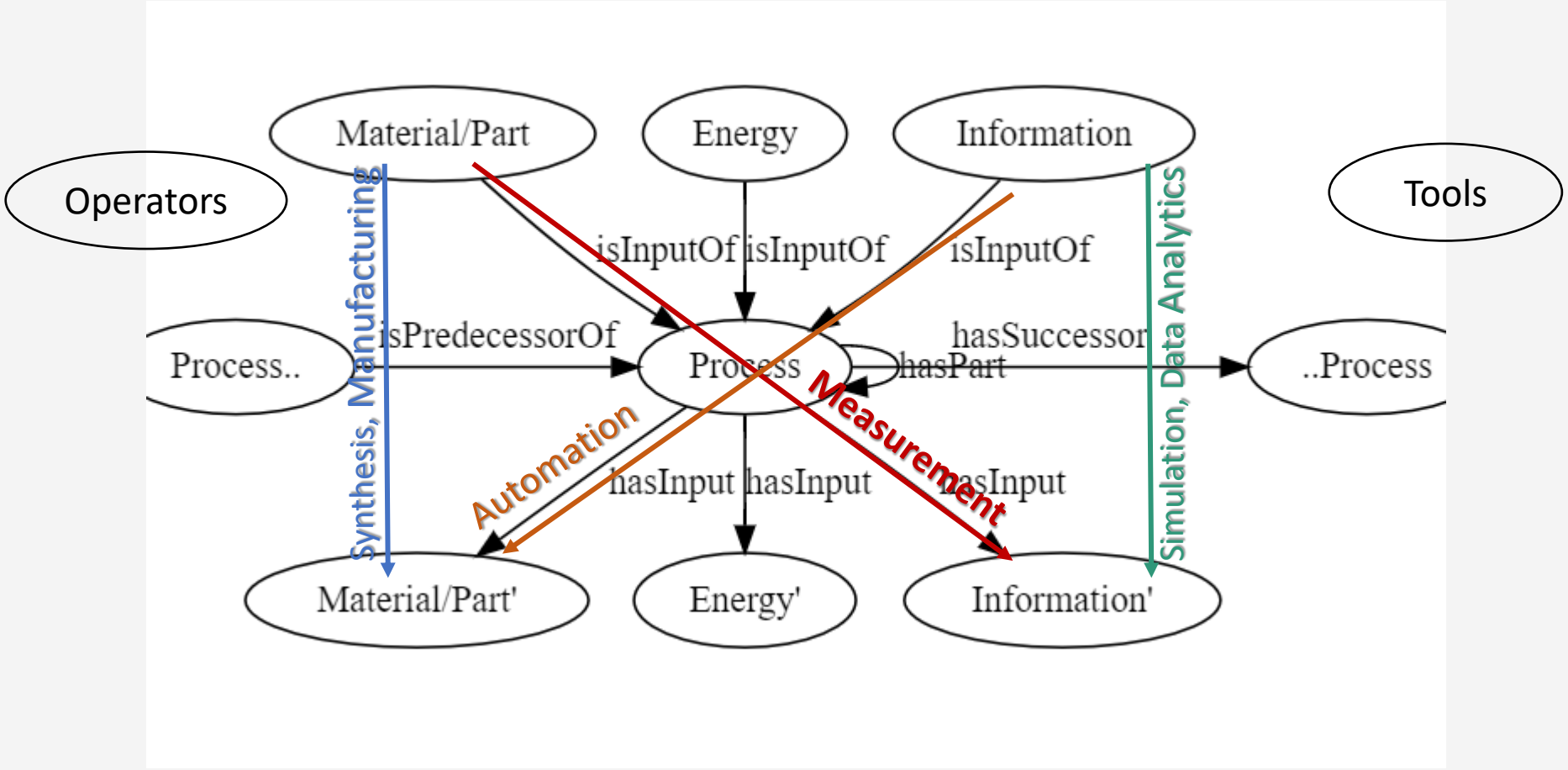
Process-Centric



https://github.com/General-Process-Ontology/ontology

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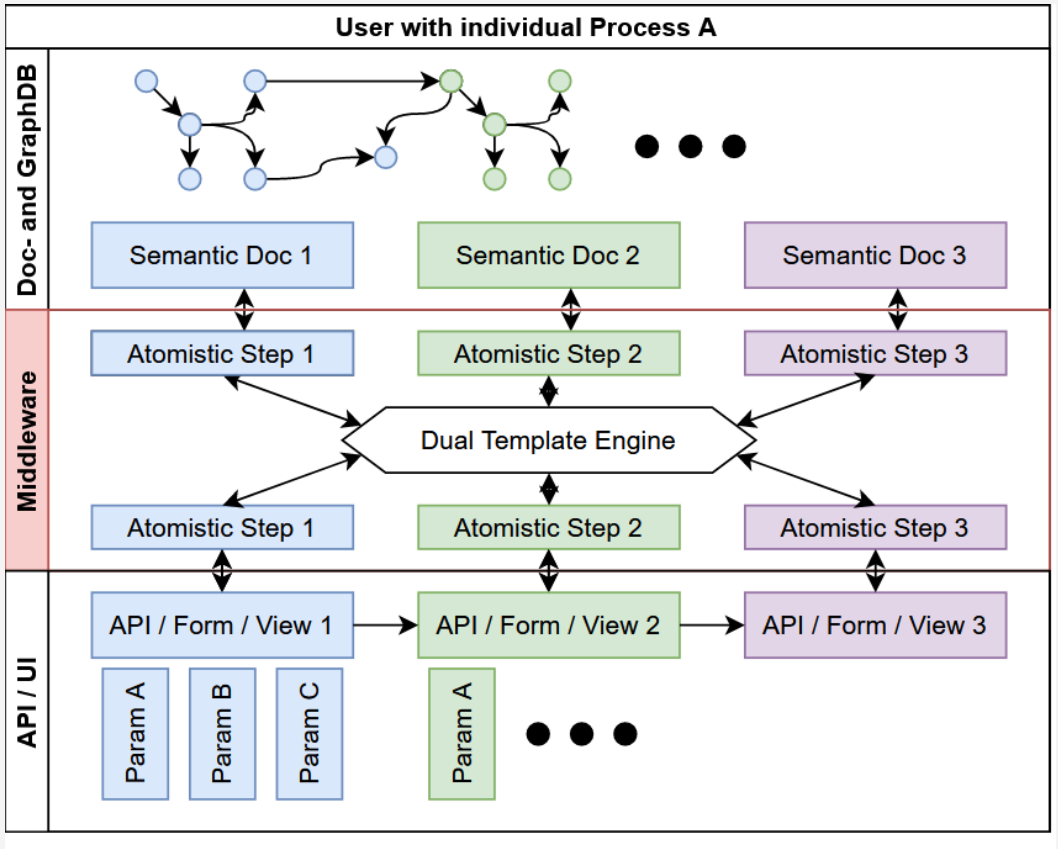
Shareable Building-Blocks

Common Process Ontology



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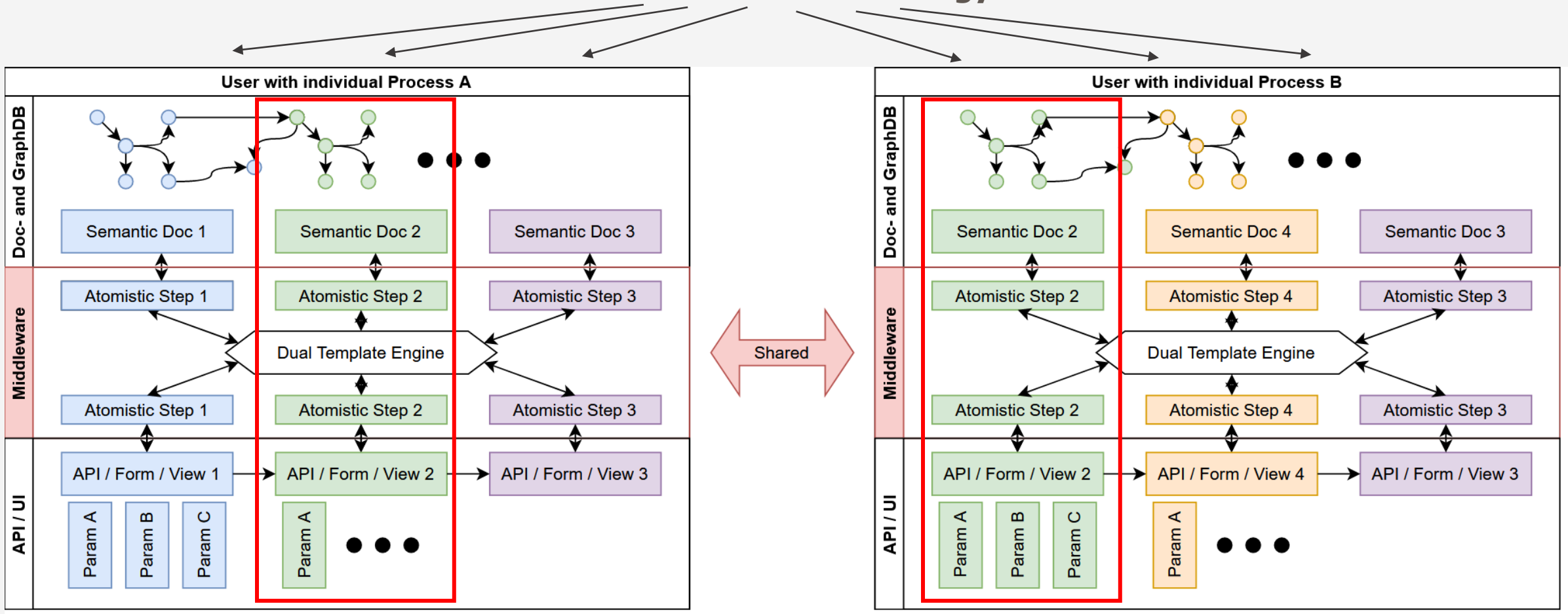
Shareable Building-Blocks

Common Process Ontology



Community-wide sharing of **Functional Building Blocks**

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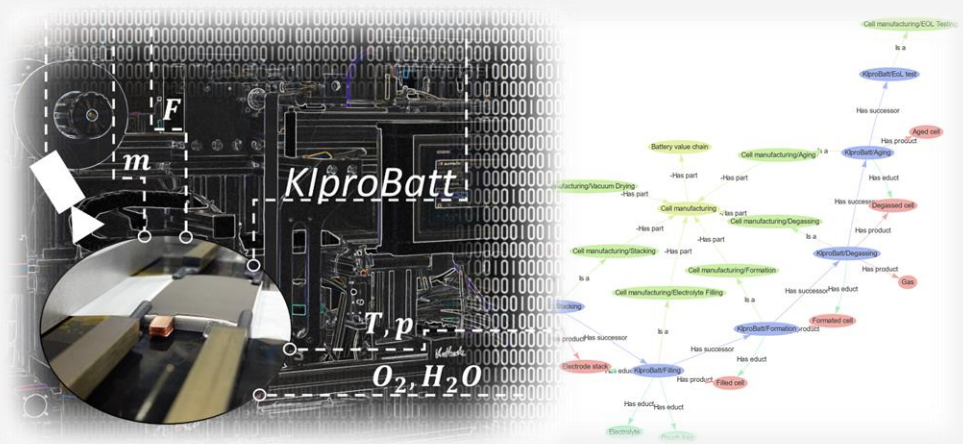
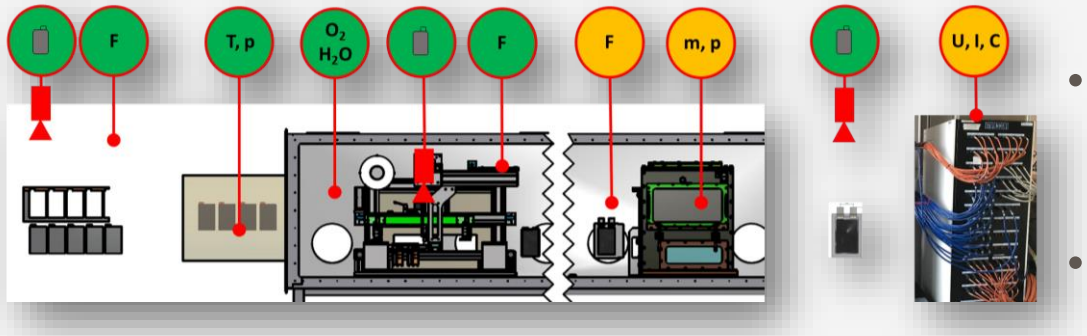
Usecase: Battery Research





KIproBatt - *Intelligent battery cell manufacturing with AI-supported process monitoring based on a generic system architecture.* https://kiprobatt.de

- Researcher can define a **machine readable process specification**, including materials, devices and parameters
- Lab operators are **guided interactively** by a **specification-generated workflow**
- (Semi-)automated machines **retrieve parameters** from the same workflow and **push back** their **data**
- Resulting **consistent knowledge graph** can be **accessed** and **extended** by **Machine Learning & AI**

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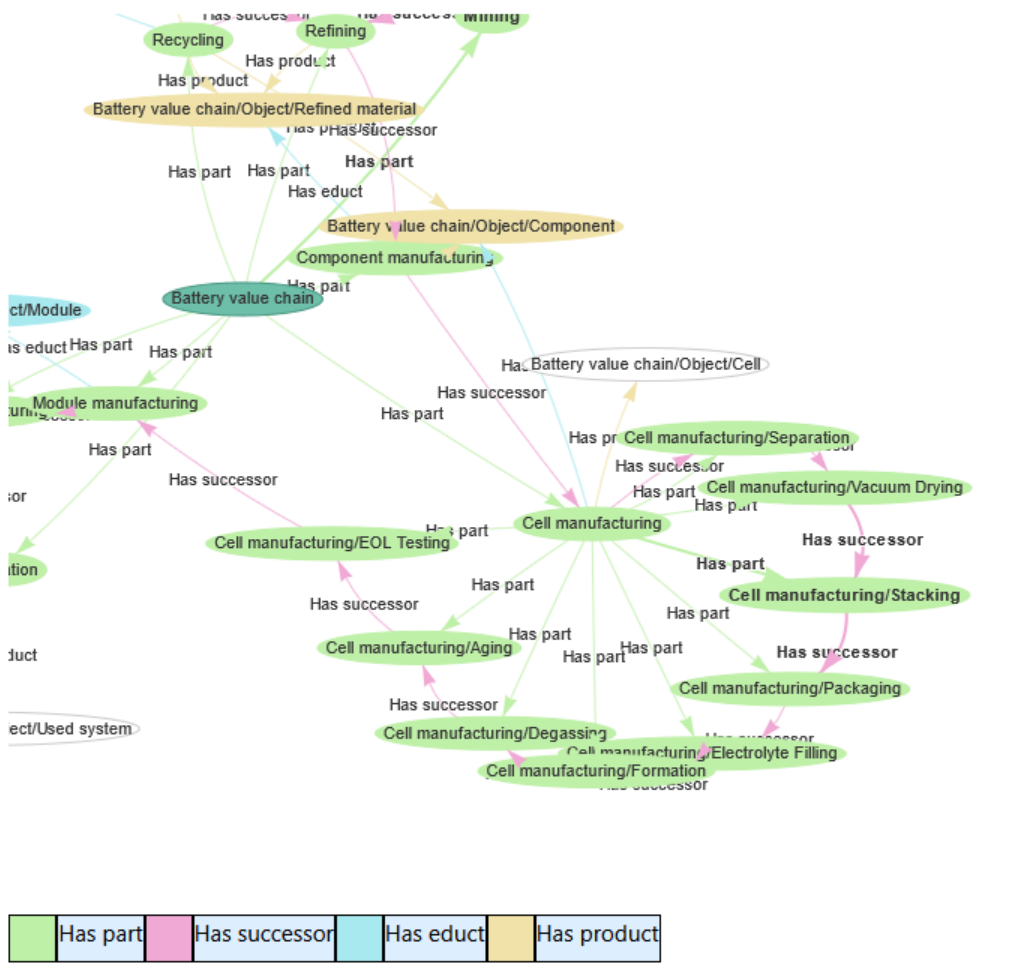
Define Processes…



Cell manufacturing/Stacking

Description

Production process

- Separated electrode sheets are stacked in a repeating cycle of anode, separator, cathode, separator, etc.
- Classic variant of stacking is the so-called Z-folding
- Anode and cathode sheets are inserted alternately from the left and right into the z-shaped folded separator; separator is used as endless tape and cut off after the stacking process is completed
- Finalized cell stack is fixed with adhesive tape
- Sheets are transported and positioned by vacuum grippers
- Depending on cell specification, the cell stack consists of a specific number of individual layers

Process parameters & requirements



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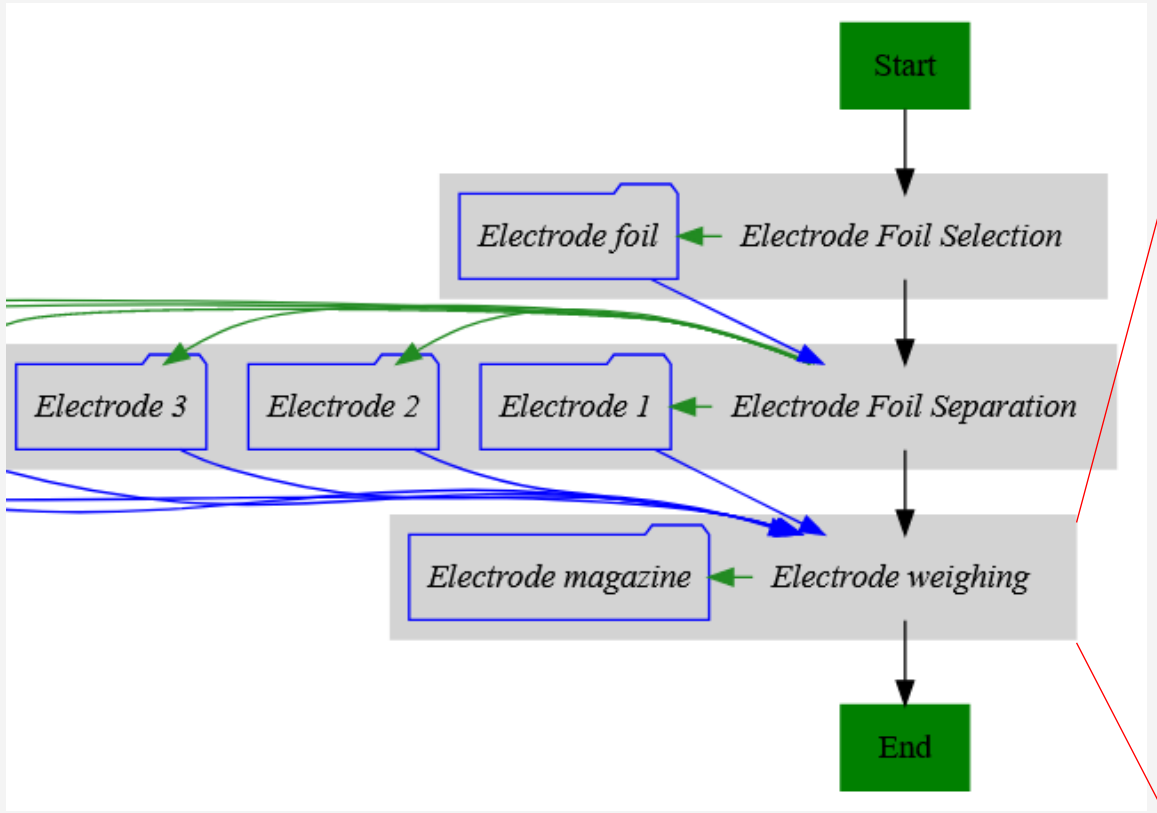
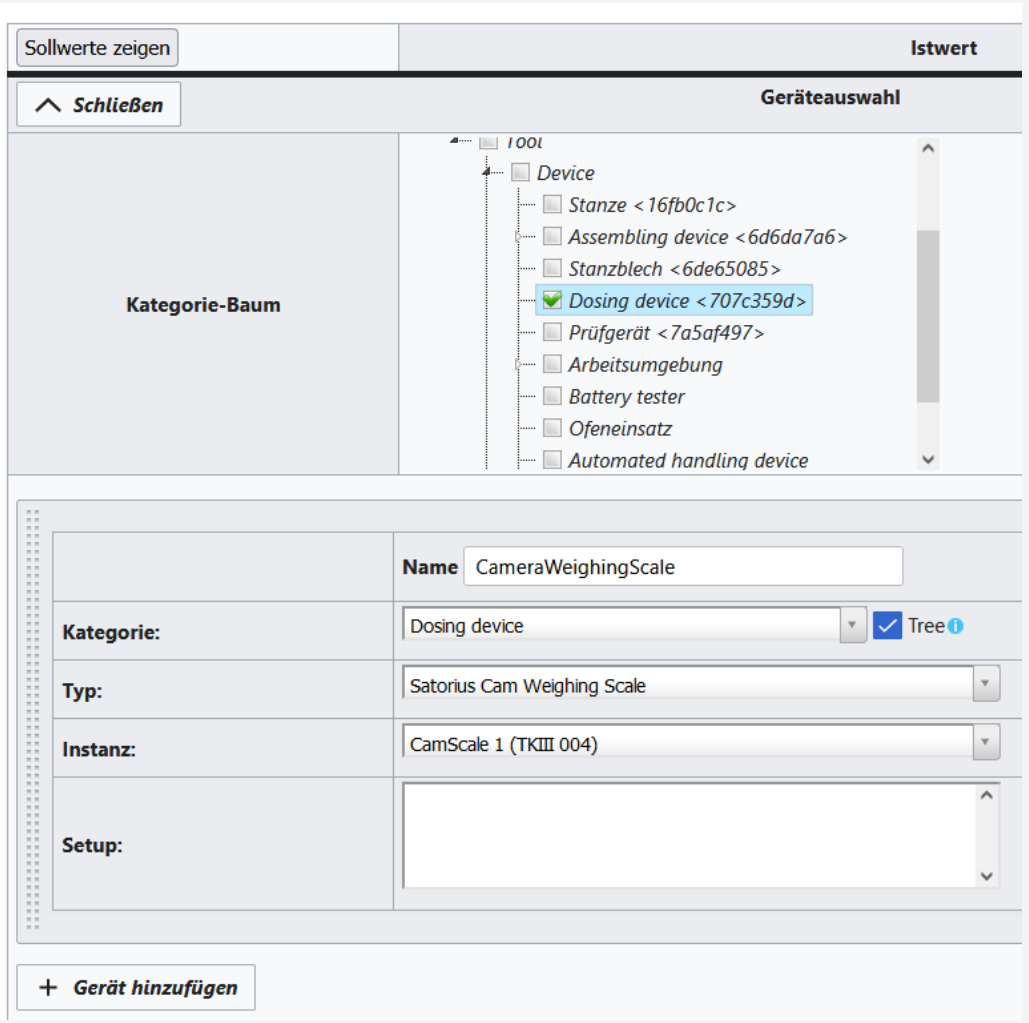
… run guided manual…





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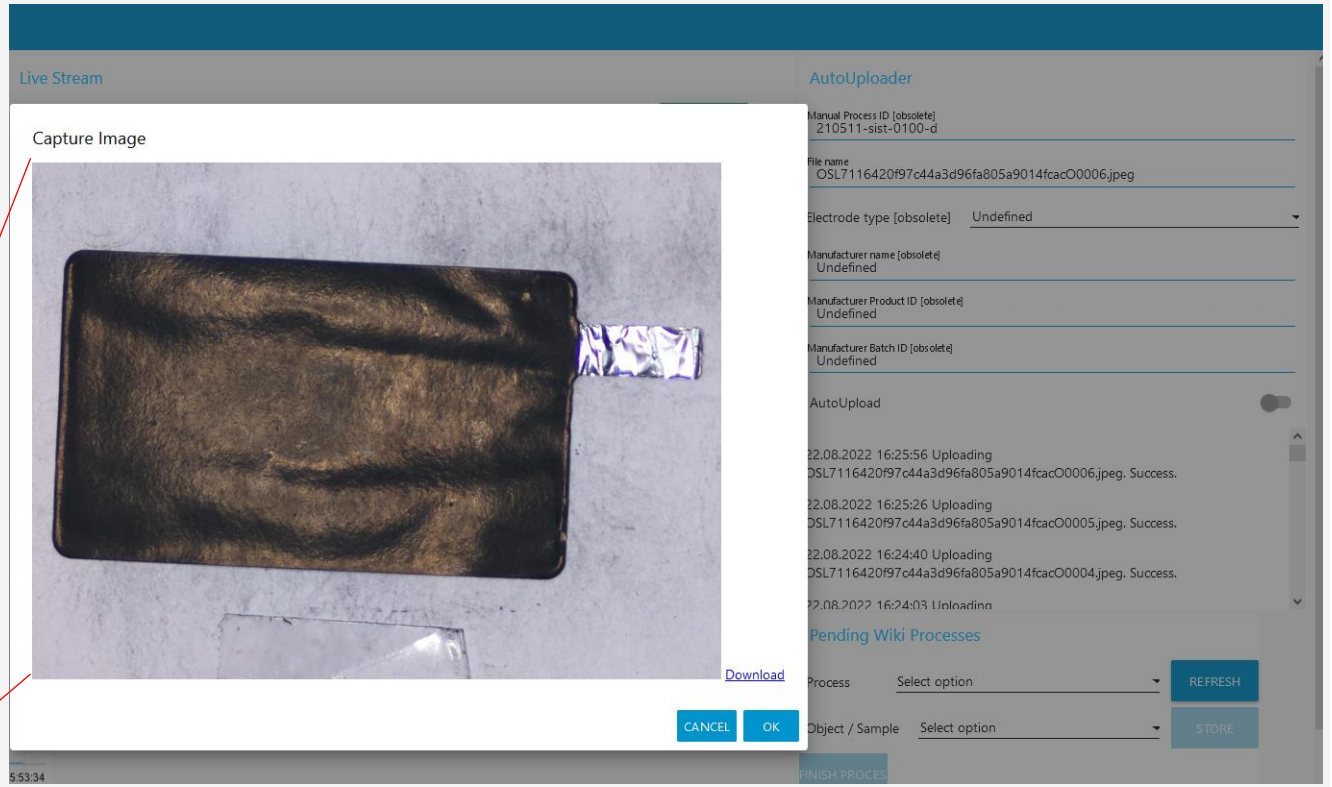
… and machine-assisted data acquisition

Parameter

	Objekt	Name	Wert
Selected camera weighing scale		CameraWeighingScale	Sartorius Cam Weighing Scale CamScale 1 (TKIII 004)
Electrode image 1	Electrode 1	ElectrodeImage1	
Electrode image 2	Electrode 2	ElectrodeImage2	
Electrode image 3	Electrode 3	ElectrodeImage3	
Electrode image 4	Electrode 4	ElectrodeImage4	
Electrode image 5	Electrode 5	ElectrodeImage5	
Electrode image 6	Electrode 6	ElectrodeImage6	
Predrying mass 1	Electrode 1	PredryingMass1	0.4013 g
Predrying mass 2	Electrode 2	PredryingMass2	0.4025 g
Predrying mass 3	Electrode 3	PredryingMass3	0.4065 g
Predrying mass 4	Electrode 4	PredryingMass4	0.4161 g
Predrying mass 5	Electrode 5	PredryingMass5	0.4118 g
Predrying mass 6	Electrode 6	PredryingMass6	0.4125 g



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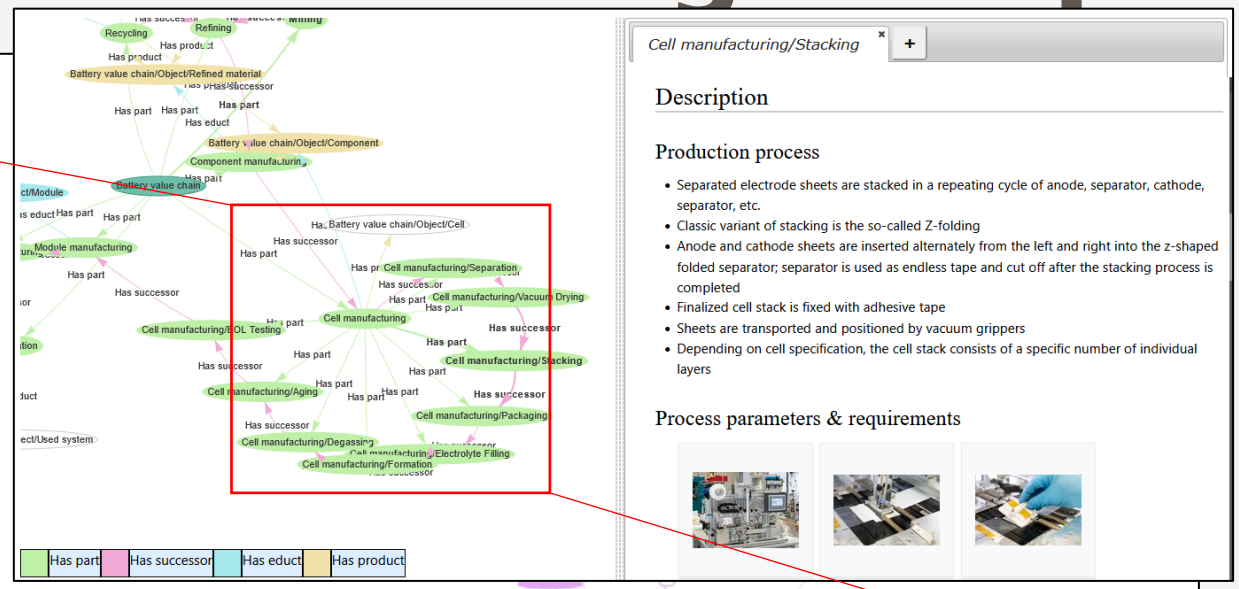
… to retrieve a holistic Knowledge Graph



Electrode foil

Separation

Drying

Filling

Formation

AI Image Segmentation

Stacking

Battery cell

EoL-Test

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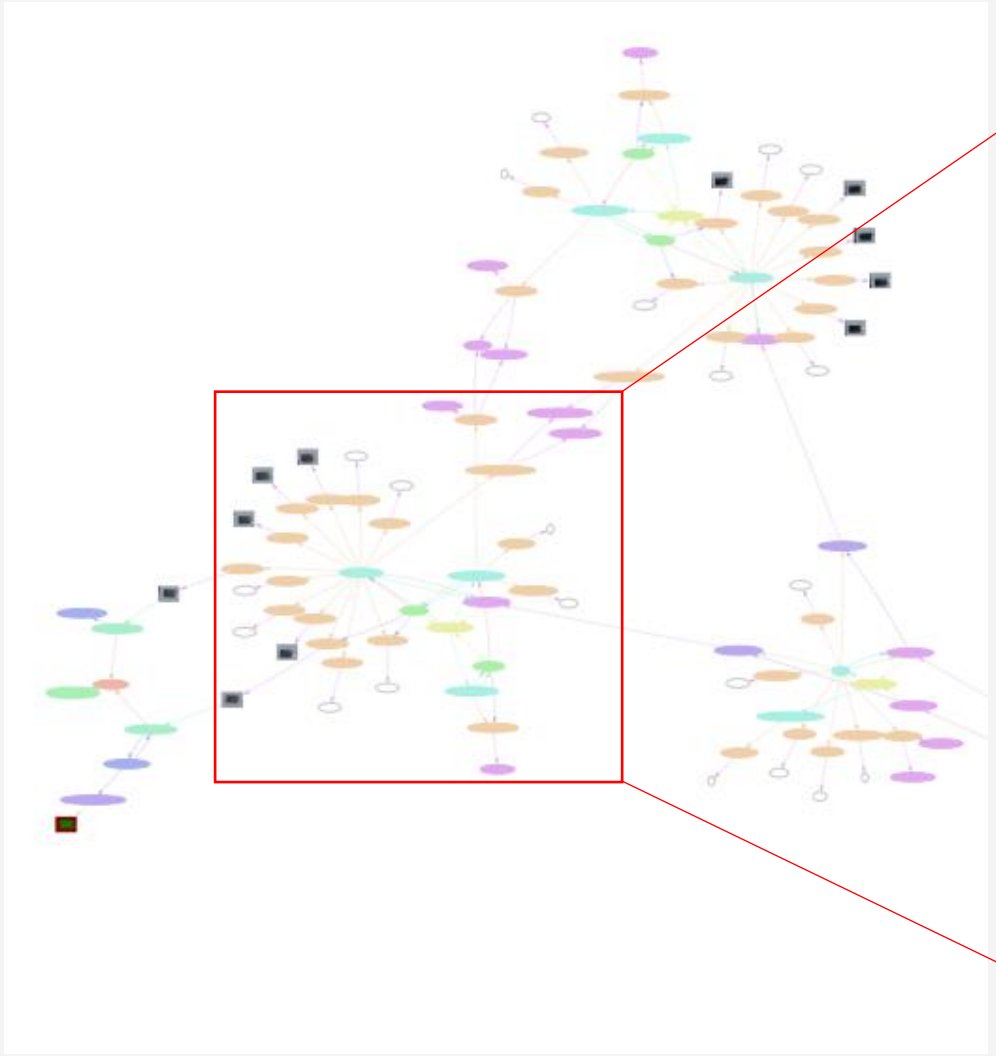
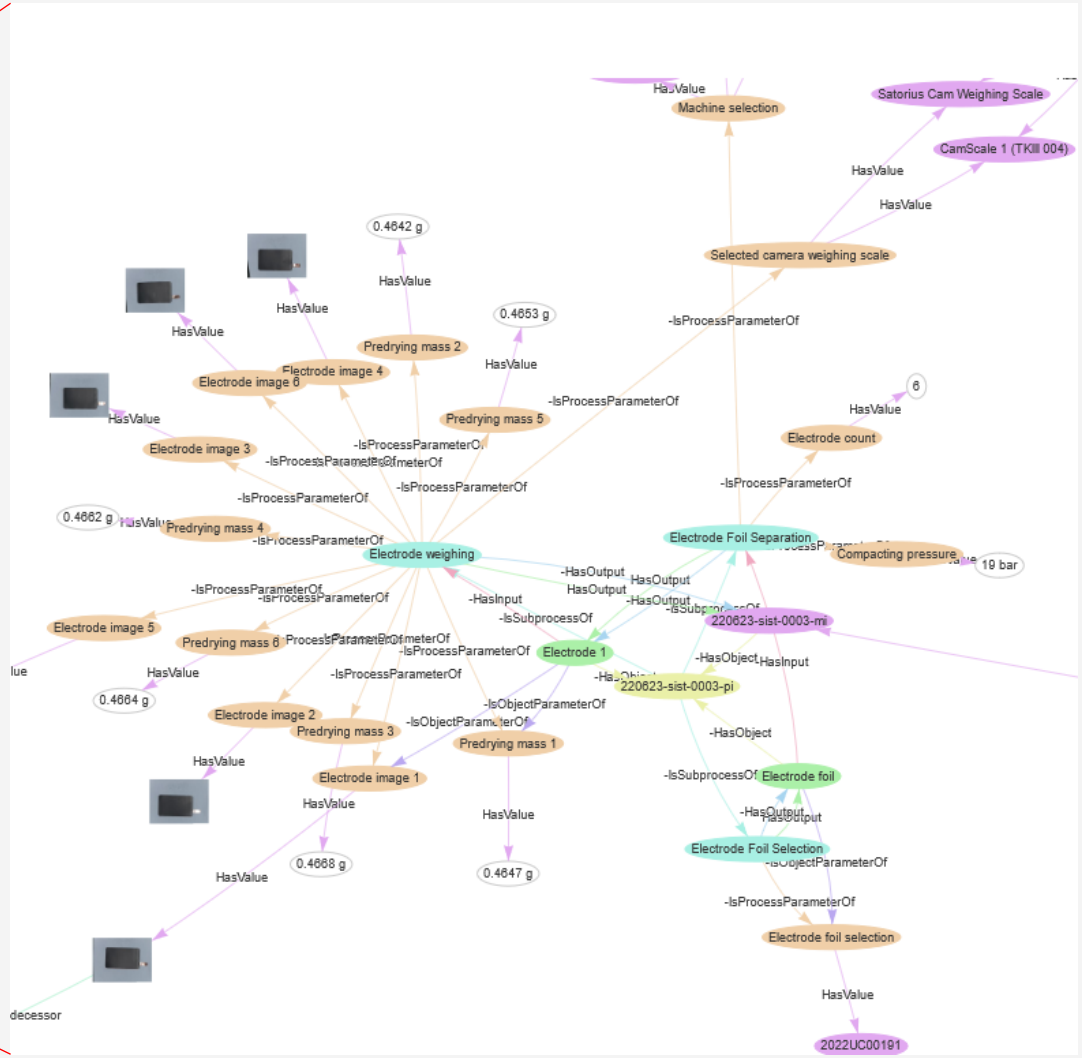
… to retrieve a holistic Knowledge Graph





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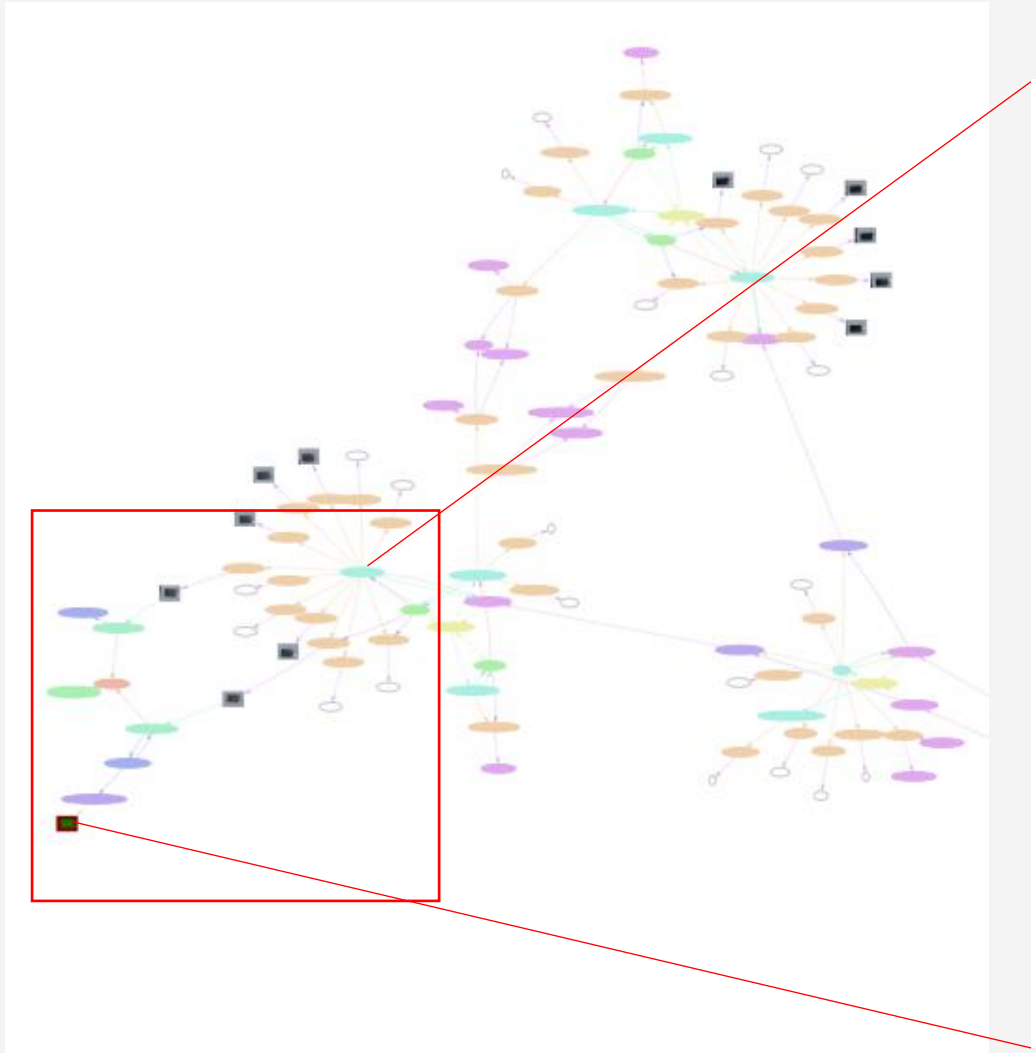
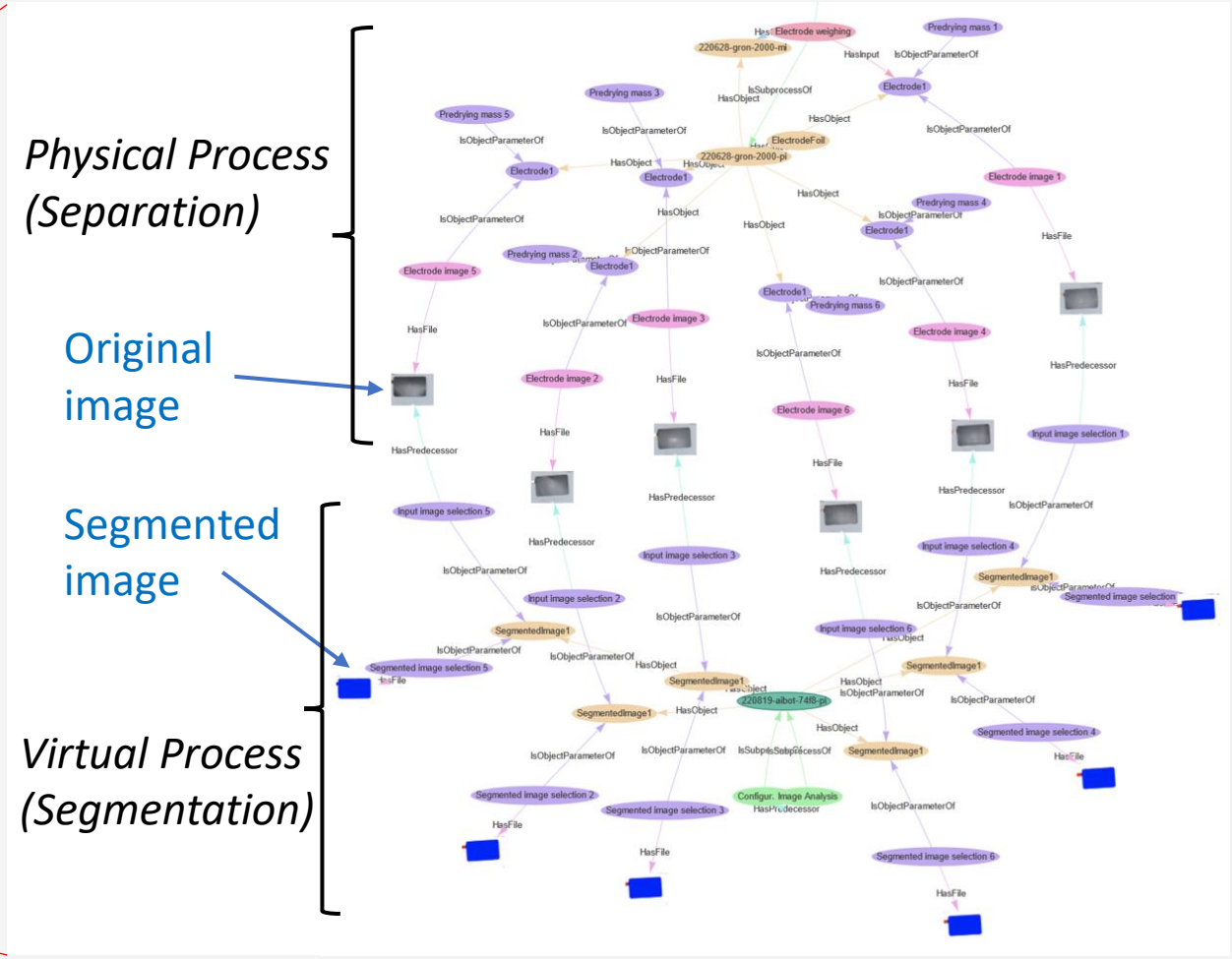
… including connected AI workflows





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Why Open Semantic Lab?

- Feature rich, well maintained open-source base: (semantic) mediawiki
- Open-Source & Domain-agnostic
- Multi-Lang, Multi-User, User-Rights and –Roles, Discussion-Boards
- Visual, Form and Graph Editing
- Multimedia-Content: Images, Videos, Diagrams, Chem / Math Formulas, …
- Templates, Version Control, Diff-Tools, Suggest & Accept
- JSON-WebAPI, SPARQL-Endpoint, RDF-Export, Python Tools-Set
- Plugin-Architecture: Easy Integration with external APIs and Tools
- …under development @ https://github.com/OpenSemanticLab

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Conclusion

Ontologies are key to standardize ***everything***…

…but **tools** are needed to make ontologies ***applicable*** in everyday research.

Open Semantic Lab is an holistic and community driven platform to fulfill this role…

… and links **people** (knowledge), **machines** (data) and **algorithms** (AI) ***equally.***

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Thank you for your attention!

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Fraunhofer ISC, Neunerplatz 2, Würzburg

More Information: isc.fraunhofer.de/digitale-transformation