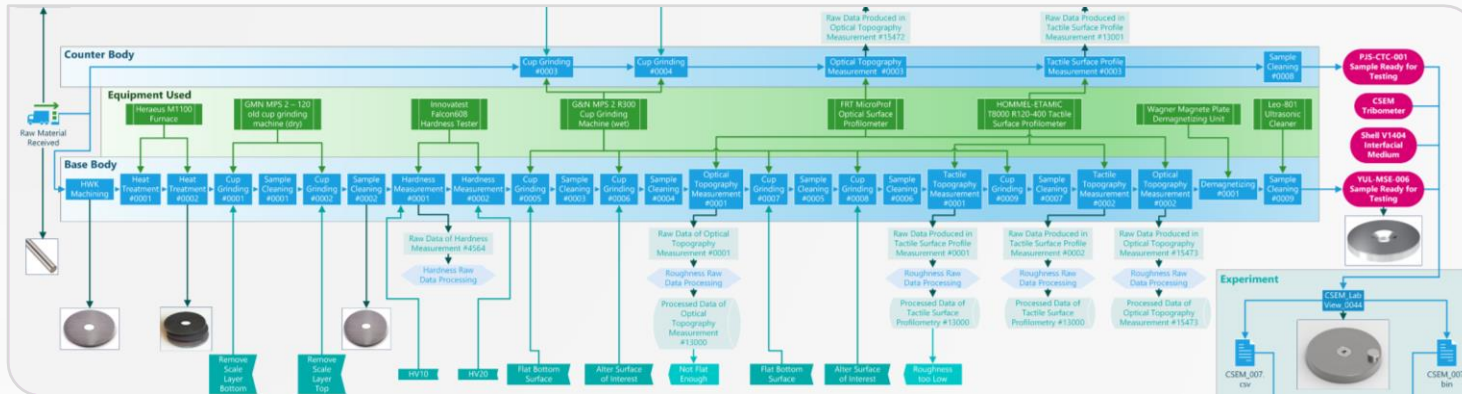
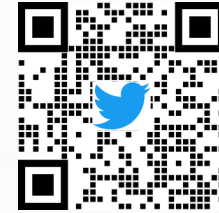




Collaborative Metadata Definition using Controlled Vocabularies, and Ontologies - FAIR Data Showcase in Experimental Tribology

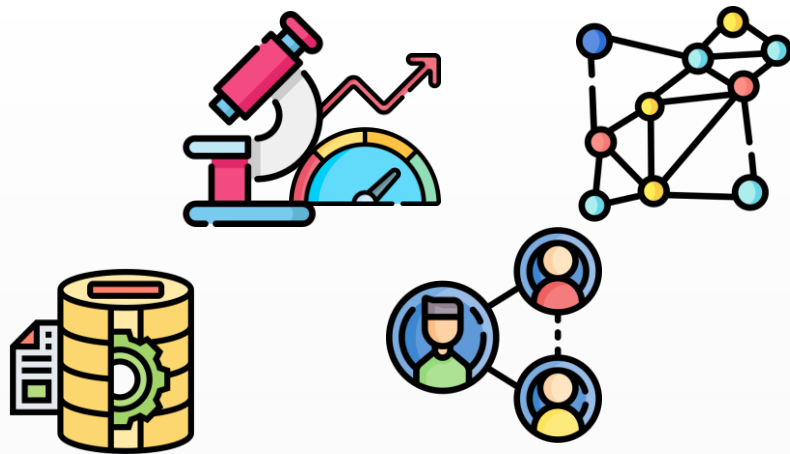
Nick Garabedian, Ilia Bagov, Christian Greiner



The Story

■ How to be a Next-gen Research Lab?

- Preserve Data
- Accelerate Lab Operations
- Share Data
- Run Machine Learning



FAIR Data

Findability

Accessibility

Interoperability

Reusability

■ Communication with Others Researchers

■ **Avoiding Wasting Scientific Resources** 

■ Machine-actionable Information

Presentation Outline

Part 1

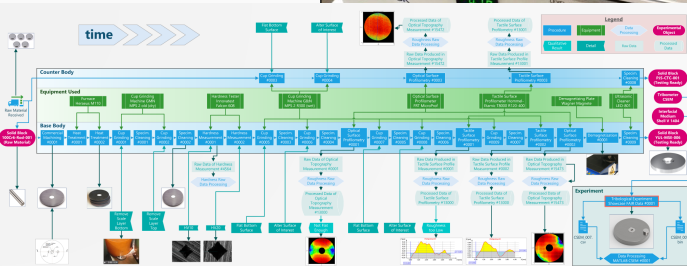
Proof of Concept (20 minutes)

Tribology:

Friction

Wear

Lubrication



Part 2

Current Framework (20 minutes)



Solutions for Smarter Data


FAIR Data

Findability

Accessibility

Interoperability

Reusability

- Communication with Others Researchers
- Avoiding Wasting Scientific Resources 
- Machine-actionable Information (e.g. Machine Learning)

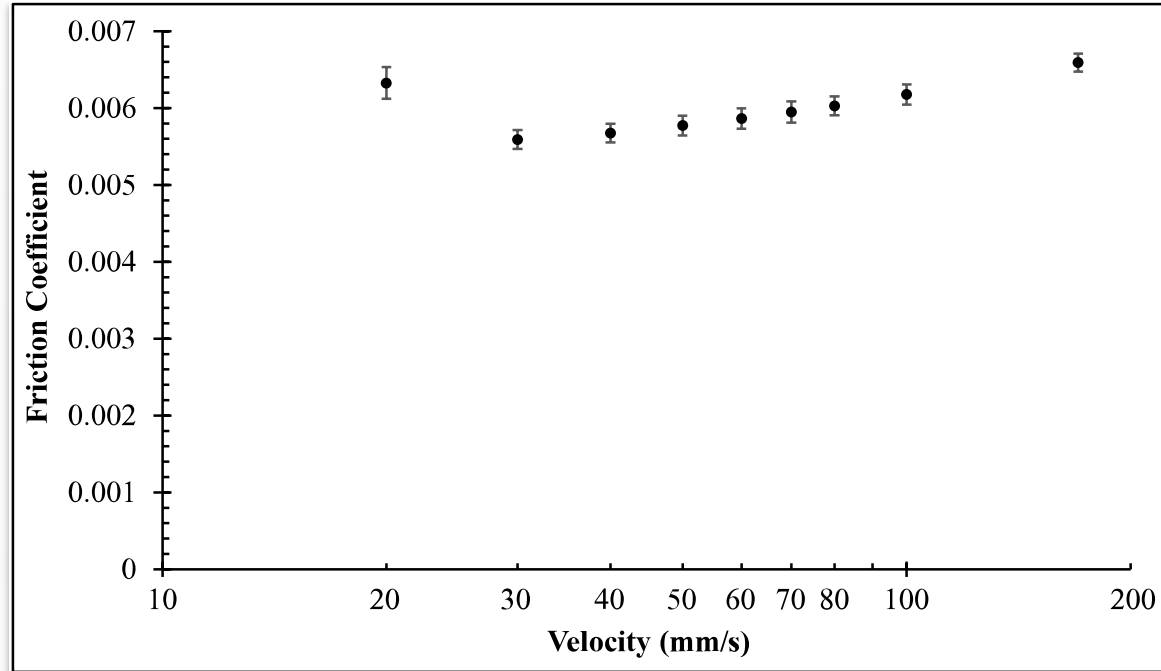
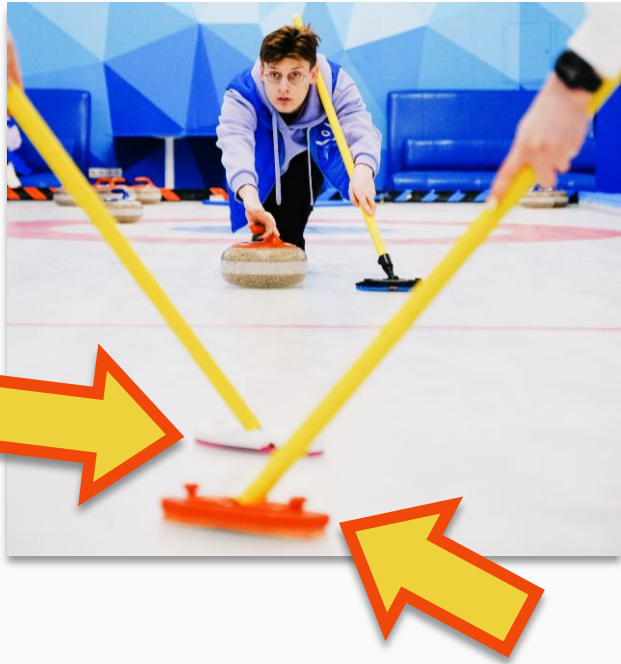
■ Limit Scope by **Implementing a “Standard” Showcase Experiment**

- Can Do it *FAIR*'ly?
- What is FAIR for *Tribology*?

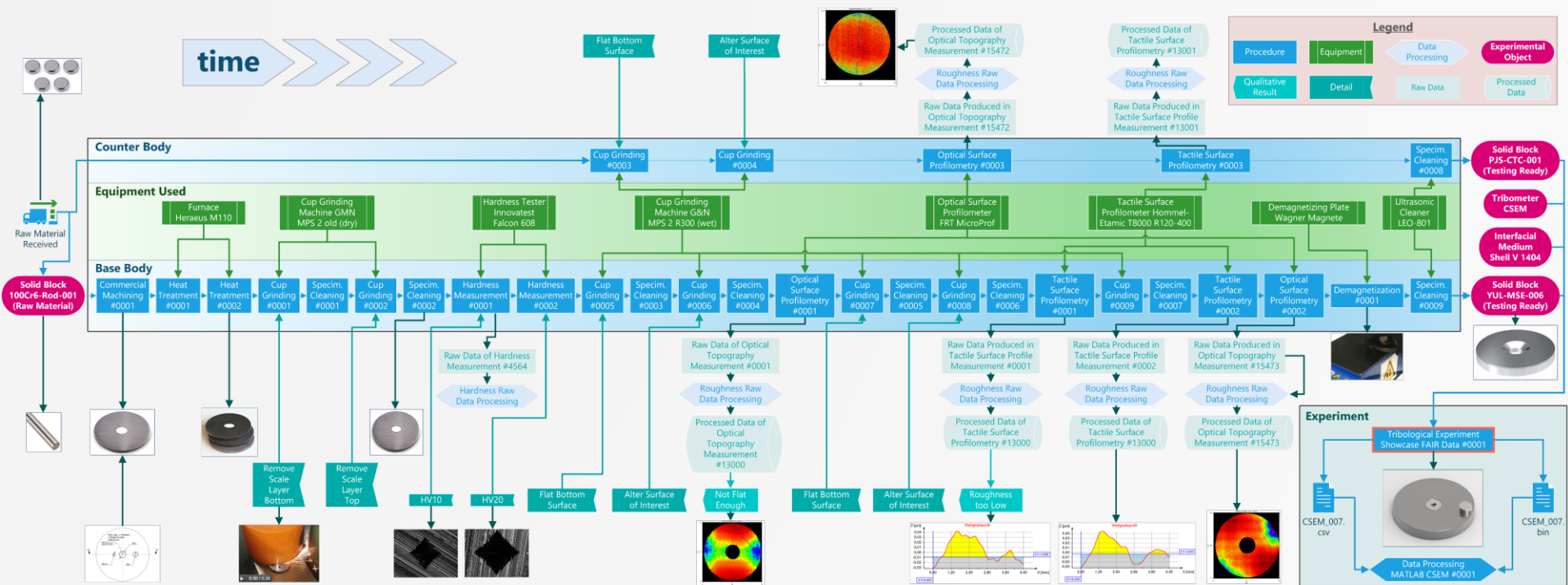
Generating FAIR research data in
experimental tribology
Nature Scientific Data, 2022

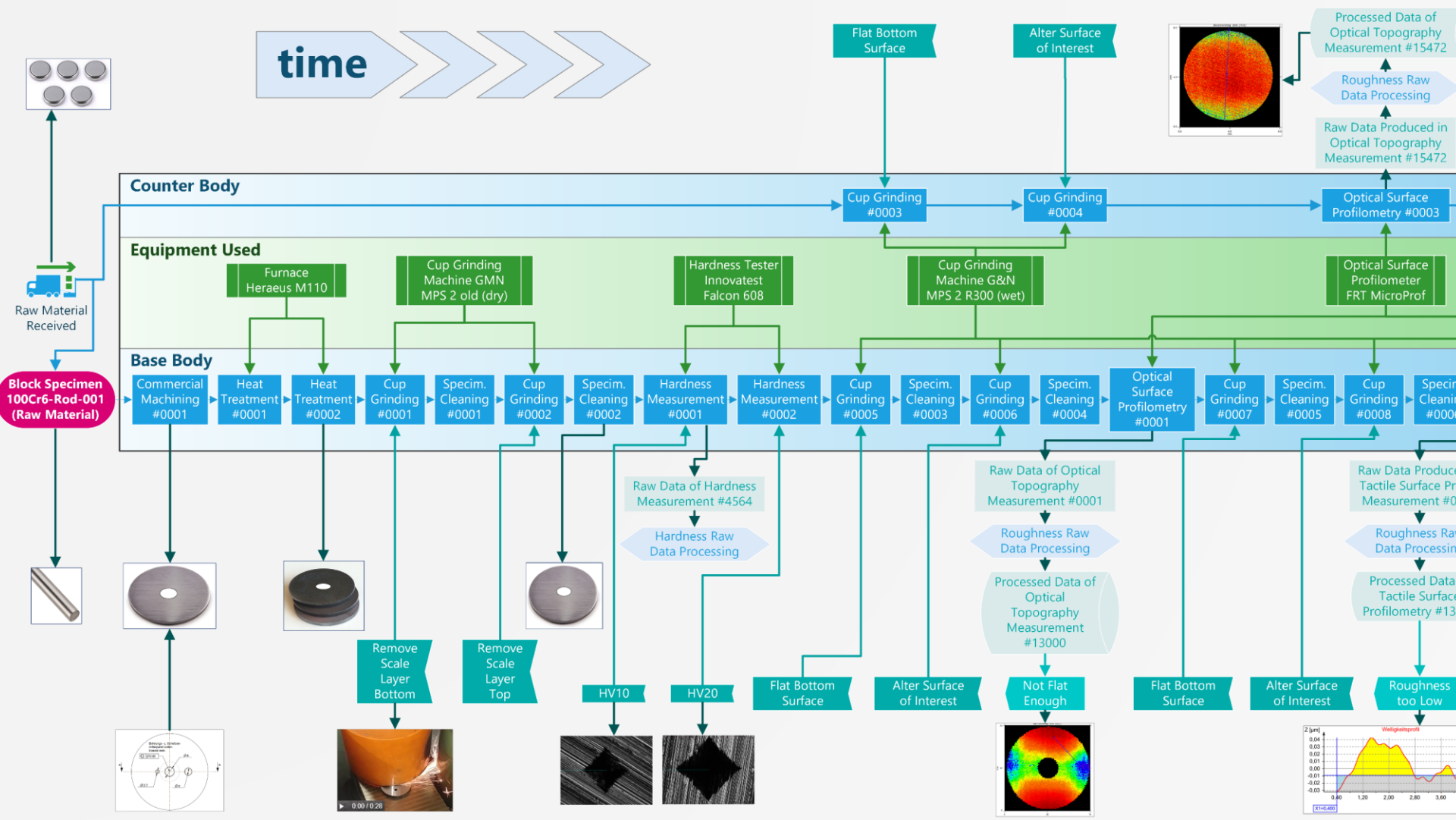


Tribologically FAIR Experiment



Tribologically FAIR Experiment





Kadi4Mat

Records Collections Groups Templates Users

Quick search

DOI: TBD

Created at March 9, 2021 4:26:59 PM (9 months ago)
Last modified at December 9, 2021 7:24:16 PM (13 minutes ago)

Created by Nikolay Garabedian

Tags

paper

publication

Records 45

Advanced search

Optical Surface Profilometry Showcase FAIR Data #0003

scientific procedure

@optical-surface-profilometry-showcase-0003

Scanning a WC-Ni pin's surface after grinding (2D topography raw data). Record based on TriboDataFAI...

Last modified 7 minutes ago

Tactile Surface Profilometry Showcase FAIR Data #0003

scientific procedure

@tactile-surface-profilometry-showcase-0003

Process to acquire 1D profilometric raw data of the WC-Ni pin after grinding. Record based on TriboD...

Last modified 8 minutes ago

Heat Treatment Showcase FAIR Data #0002

industrial procedure

@heat-treatment-showcase-fair-data-0002

Heat treatment of 100Cr6 discs to increase toughness. Heating: Furnace was pre-heated to 190 °C. Tem...

Last modified 3 days ago

Block Specimen YUL-MSE-006

experimental object

@block-specimen-yul-mse-006

A disc shaped sample made from 100Cr6 bearing steel. Record based on TriboDataFAIR-Ontology URL: htt...

Last modified 3 days ago

Specimen Cleaning Showcase FAIR Data #0004

industrial procedure

@specimen-cleaning-showcase-fair-data-0004

Cleaning procedure to remove residue after wet cup grinding. Record based on TriboDataFAIR-Ontology ...

Last modified 3 days ago

Heat Treatment Showcase FAIR Data #0001

industrial procedure

@heat-treatment-showcase-fair-data-0001

Heat treatment of 100Cr6 discs to increase hardness. Heating: Furnace was pre-heated to 860°C. Tempe...

Last modified 5 days ago

<<

<

Page

1

of 8

>

>>

Filter

Home

About

Help

Legals

Privacy policy

Language

© 2021 Karlsruhe Institute of Technology

Part 1

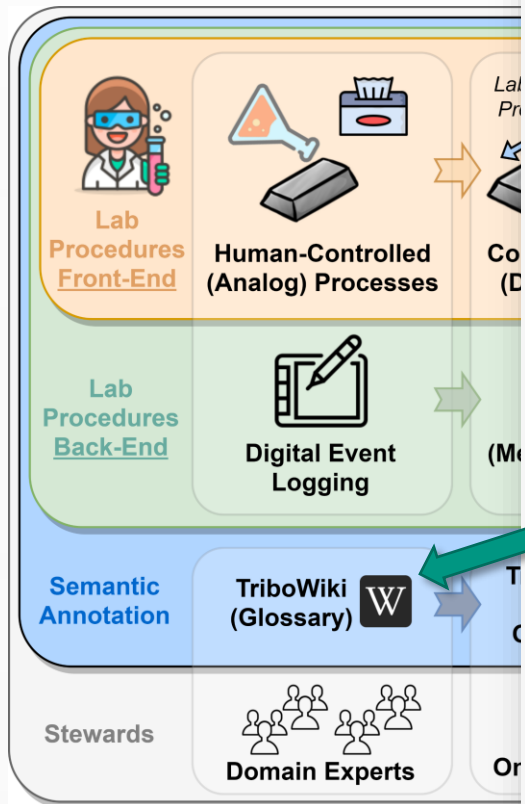
Part 2

The diagram illustrates the Kadi4Mat workflow for FAIR Data management, showing the flow from Publication to Data Export, Data Repository, ELN Key-Value Template, and finally to ELN Developers.

- Publication:** The top section, labeled "FAIR Data Package", shows a document icon and the word "Publication".
- Data Export, Data Repository:** The middle section shows a flow from "Data Export, Data Repository" (represented by a tree icon) to "Data Repository" (represented by a database icon).
- ELN Key-Value Template:** The bottom section shows a flow from "Data Repository" to "ELN Key-Value Template" (represented by a document icon).
- ELN Developers:** The bottom-most section shows a flow from "ELN Key-Value Template" to "ELN Developers" (represented by a group of people icon).

A large green arrow points from the "Data Repository" section to the "ELN Key-Value Template" section, indicating the primary data flow. The Kadi4Mat logo is prominently displayed on the right side of the diagram.

Record Experimental Tribological Data (*Findability, Accessibility, Interoperability*)



Main Page

This is an attempt to use a Wiki to work on and eventually define a (internal) meta

New users — to get started and learn how to contribute to the project, you can go to the

Experienced users — this link takes you to the **Work in Progress Hub**.

Overview [\[edit\]](#)

On the following wiki-pages we try to collect necessary terms (the vocabulary) to prop

Metadata [\[edit\]](#)

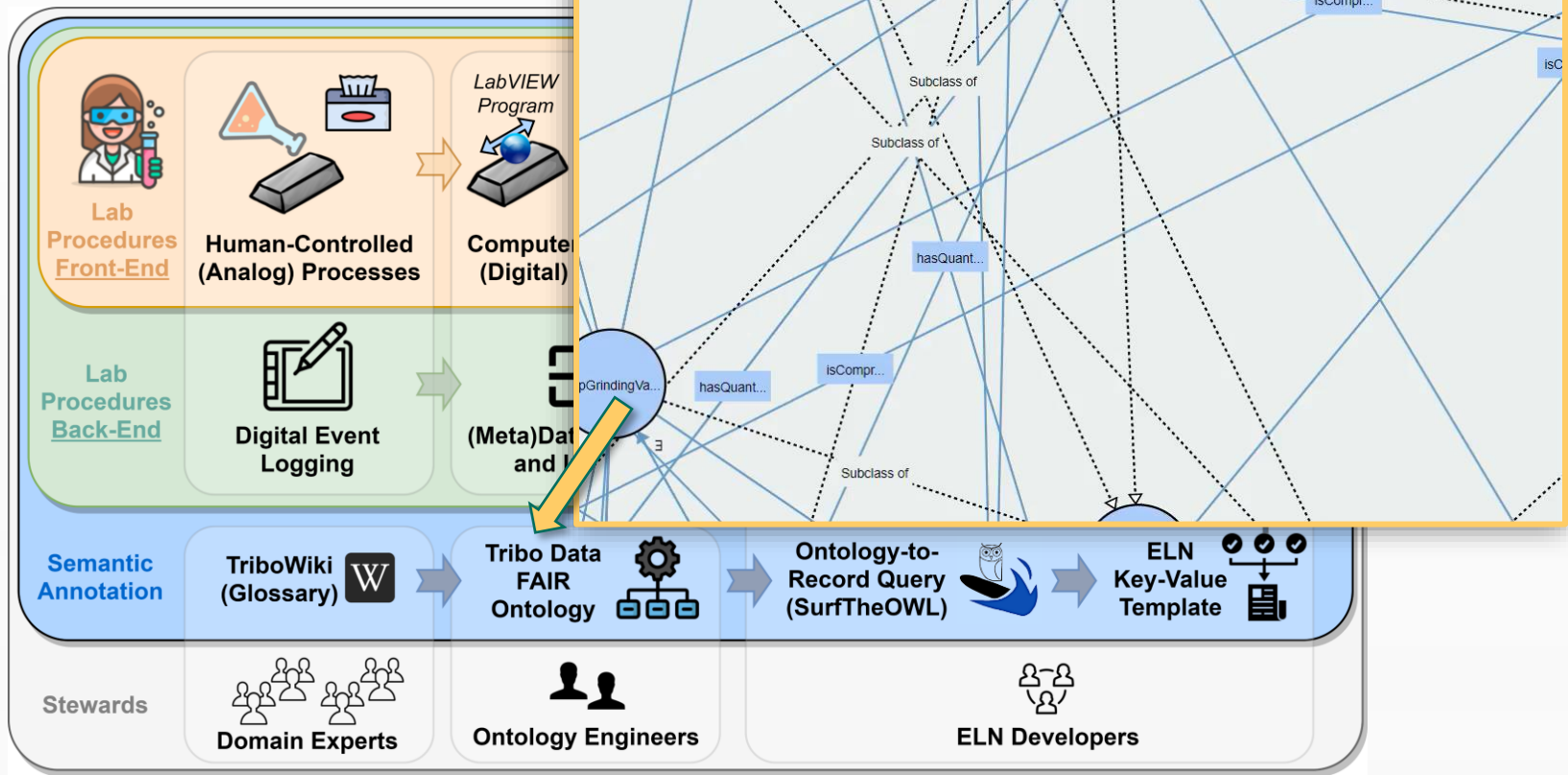
▼ Object

- General Vocabulary:Metadata/002 Tribometer*
- General Vocabulary:Metadata/004 Tribological sample*
- General Vocabulary:Metadata/005 Interfacial medium for tribological experiments*
- General Vocabulary:Metadata/007 Band saw*
- General Vocabulary:Metadata/008 Furnace*
- General Vocabulary:Metadata/009 Cup grinding machine*
- General Vocabulary:Metadata/010 Tactile surface profilometer*
- General Vocabulary:Metadata/011 Optical surface profilometer*
- General Vocabulary:Metadata/012 Demagnetizing plate*
- General Vocabulary:Metadata/013 Ultrasonic cleaner*
- General Vocabulary:Metadata/020 Hardness tester*

▼ Process

- General Vocabulary:Metadata/001 Tribological experiment*
- General Vocabulary:Metadata/006 Sample cleaning*
- General Vocabulary:Metadata/014 Sawing*

Record Experimental Tribological Data (*Findability, Accessibility, Interoperability*)



Ontology vs. Controlled Vocabulary

a. Free-Text Description

"The tests were performed on a CSEM tribometer at room temperature (20.7° C) and a low viscous automotive Shell V-Oil1404 was applied."

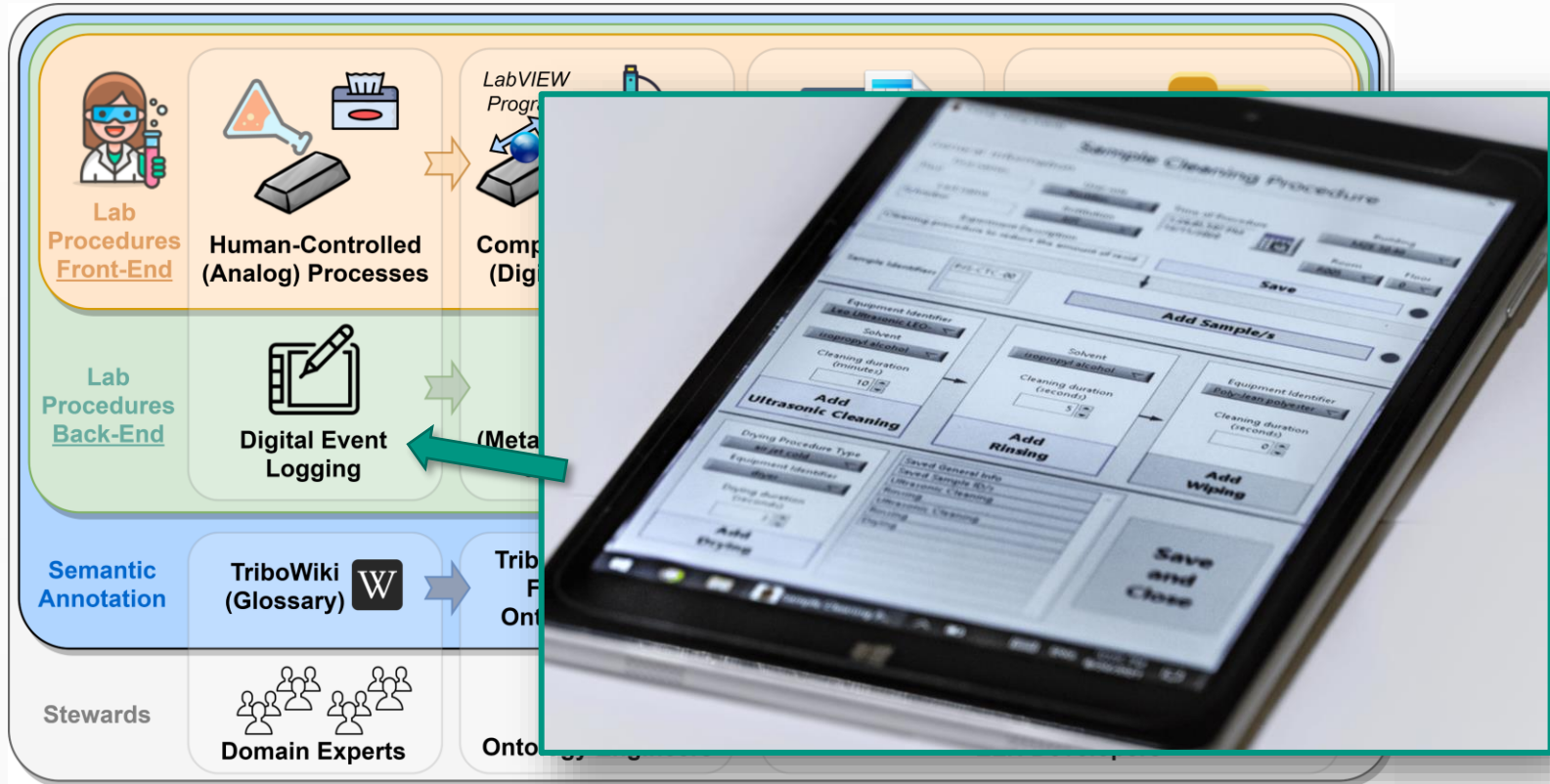
Ontology

Kadi4Mat

Controlled
Vocabulary

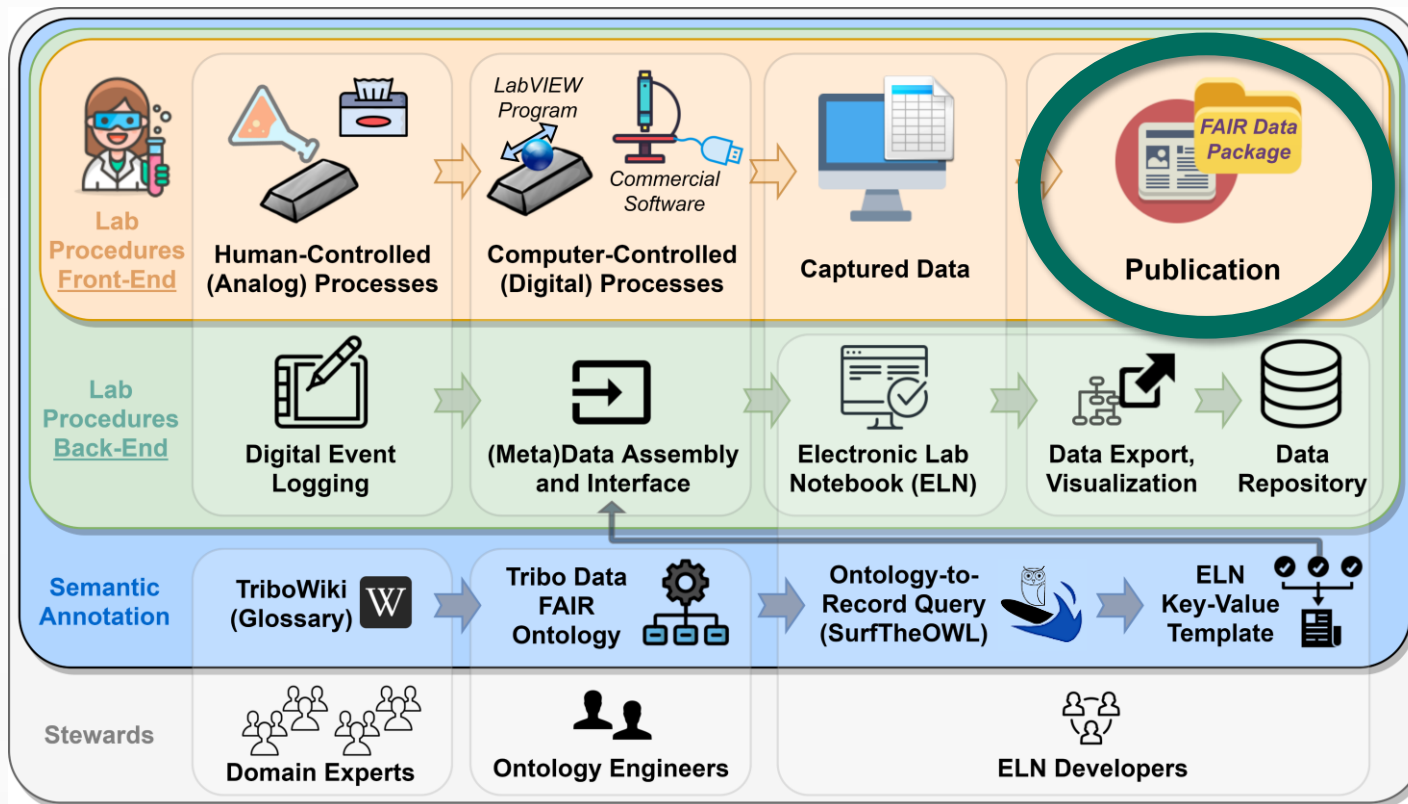
Record Experimental Tribological Data **FAIR**'ly

(***F**indability, **A**ccessibility, **I**nteroperability, and **R**eusability*)




Record Experimental Tribological Data **FAIR**'ly

(***F**indability, **A**ccessibility, **I**nteroperability, and **R**eusability*)




Data Availability



November 23, 2021
Dataset
Open Access


FAIR Data Package of a Tribological Showcase Pin-on-Disk Experiment

 Garabedian, Nikolay; Schreiber, Paul; Li, Yulong; Blatter, Ines; Dollmann, Antje; Haug, Christian; Kümmel, Daniel; Meyer, Franziska; Morstein, Carina; Rau, Julia; Greiner, Christian

To assess the feasibility of producing FAIR data via the integration of a controlled vocabulary, an ontology, and an ELN, this dataset demonstrates the implementation of a tribological experiment while accounting for as many details as possible. The showcase experiment had a lubricated pin-on-disk arrangement, ran at 15 N normal load and a velocity range of 20 to 170 mm/s. With this dataset, we hope to provide a possible blueprint for FAIR data publication in experimental tribology.

This dataset is associated with a publication (soon to be linked here) detailing its purpose and explaining its contents.

Preview

 FAIR Tribological Data of Showcase Pin-on-Disk Experiment.zip

FAIR Tribological Data of Showcase Pin-on-Disk Experiment

- block-specimen-100cr6-rod-001

 - block-specimen-100cr6-rod-001.json

9.5 kB
 - block-specimen-100cr6-rod-001.pdf

76.8 kB
 - files

 - 2_1_8_100cr6_delivery_00087022.jpg

641.0 kB
 - 2_1_8_100cr6_delivery_00087022.txt

635 Bytes
 - 2_1_8_100cr6_delivery_00087023.jpg

524.4 kB
 - 2_1_8_100cr6_delivery_00087023.txt

637 Bytes
 - 2_1_8_100cr6_delivery_00087024.jpg

423.6 kB
 - 2_1_8_100cr6_delivery_00087024.txt

637 Bytes

106
views

20
downloads

[See more details...](#)


Indexed in

OpenAIRE

Publication date:
November 23, 2021

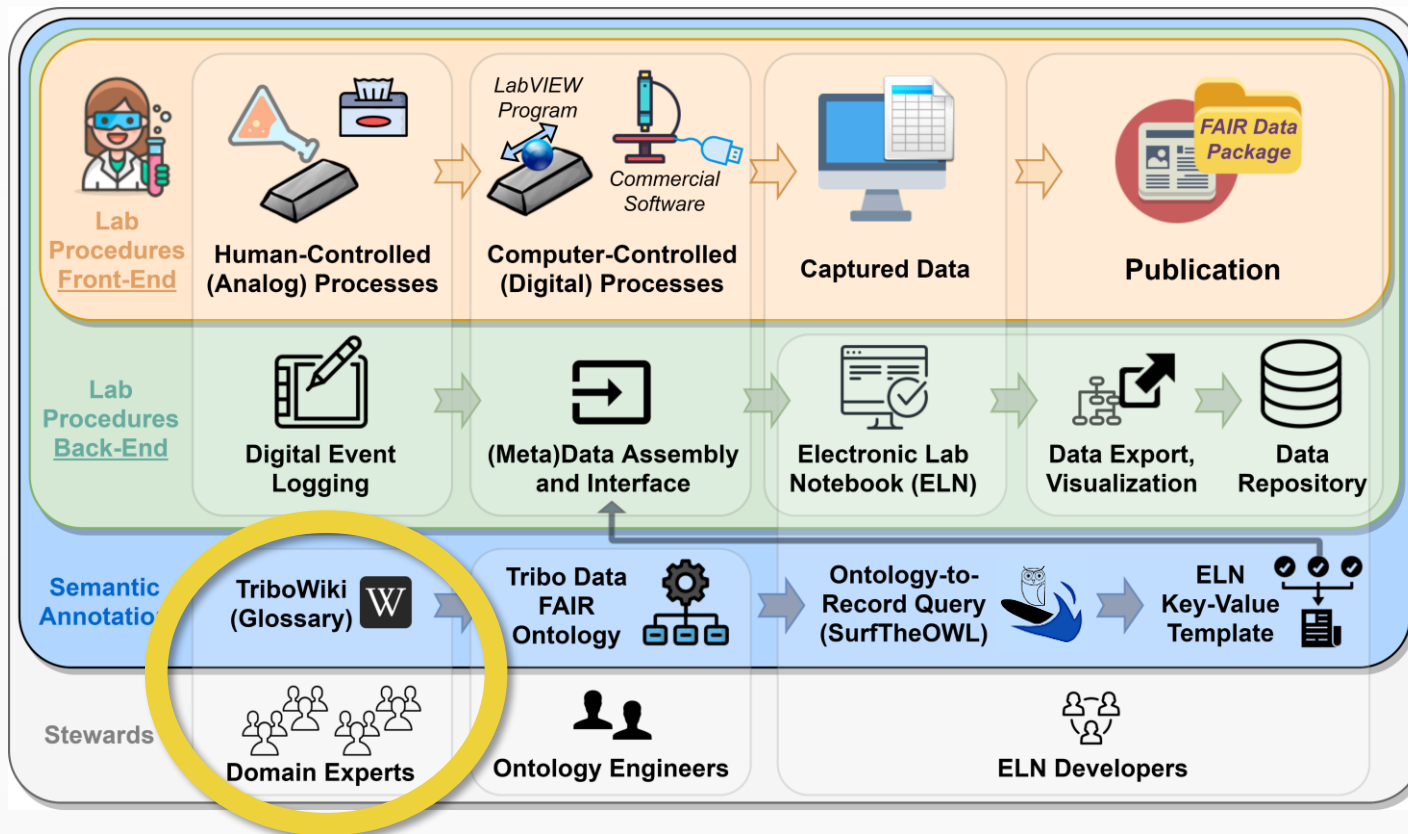
DOI:
DOI 10.5281/zenodo.5720626

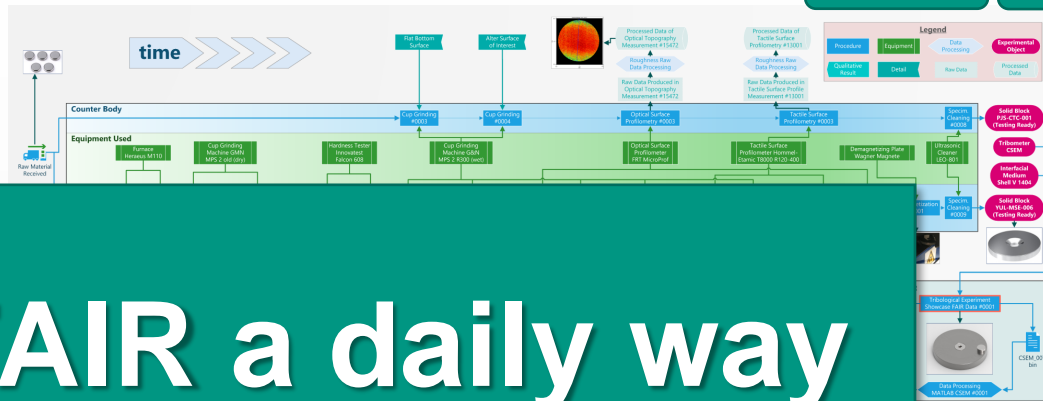
Related identifiers:
Cites
[10.5281/zenodo.5720198](#) (Other)

License (for files):
 Creative Commons Attribution 4.0 International

Tribological Data FAIR'ly

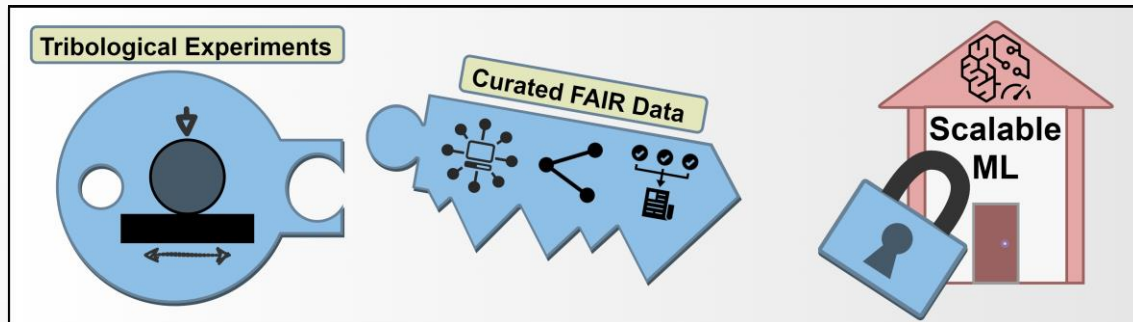
From Showcase to Business-as-Usual

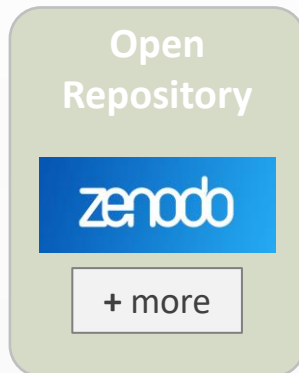
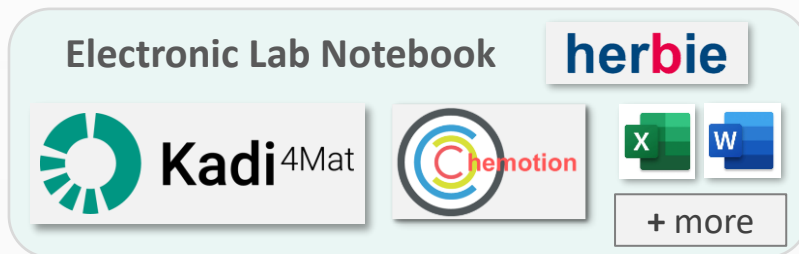
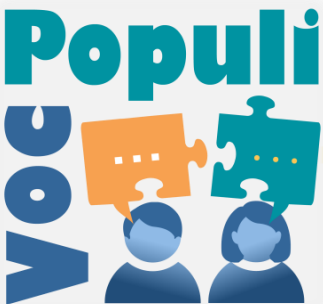


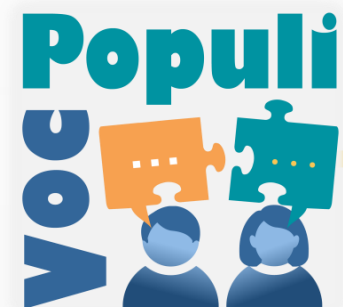


Make FAIR a daily way of conducting science

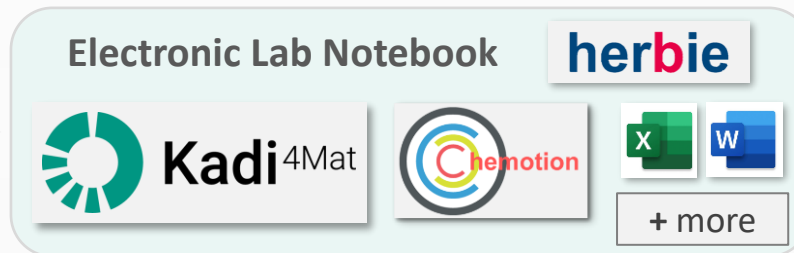
- Limit Set
 - Can Do it *FAIR*'ly?
 - What is FAIR for *Tribology*?







FAIR



Open

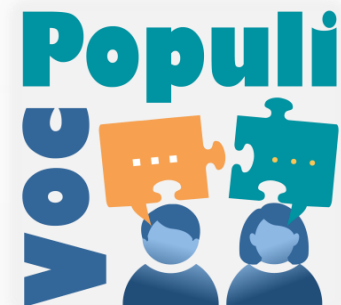


Open
Repository

Open

zenodo

+ more



[List terms](#)
[New term](#)

Available terms

Vocabulary Graph

[-]

Block Specimen

approved

[-]

General Info

approved

type: dictionary

[+]

Location

not approved

type: dictionary

[-]

Operator in Charge

not approved

type: dictionary

First Name

not approved

type: string

Last Name

not approved

type: string

Label: Block Specimen

Definition: Objects of this class contain a self-bound collection of mass bearing particles. Block spec

Synonyms (with language tags):

Data type:

Relatively broader terms:

Relatively narrower terms:

Related terms (non-hierarchical):

- Ultrasonic Cleaner

Upvote

2

Downvote

1

[Iliia Bagov @gg6915](#)
Updated on 2022-05-17 at 14:46

Looks good.

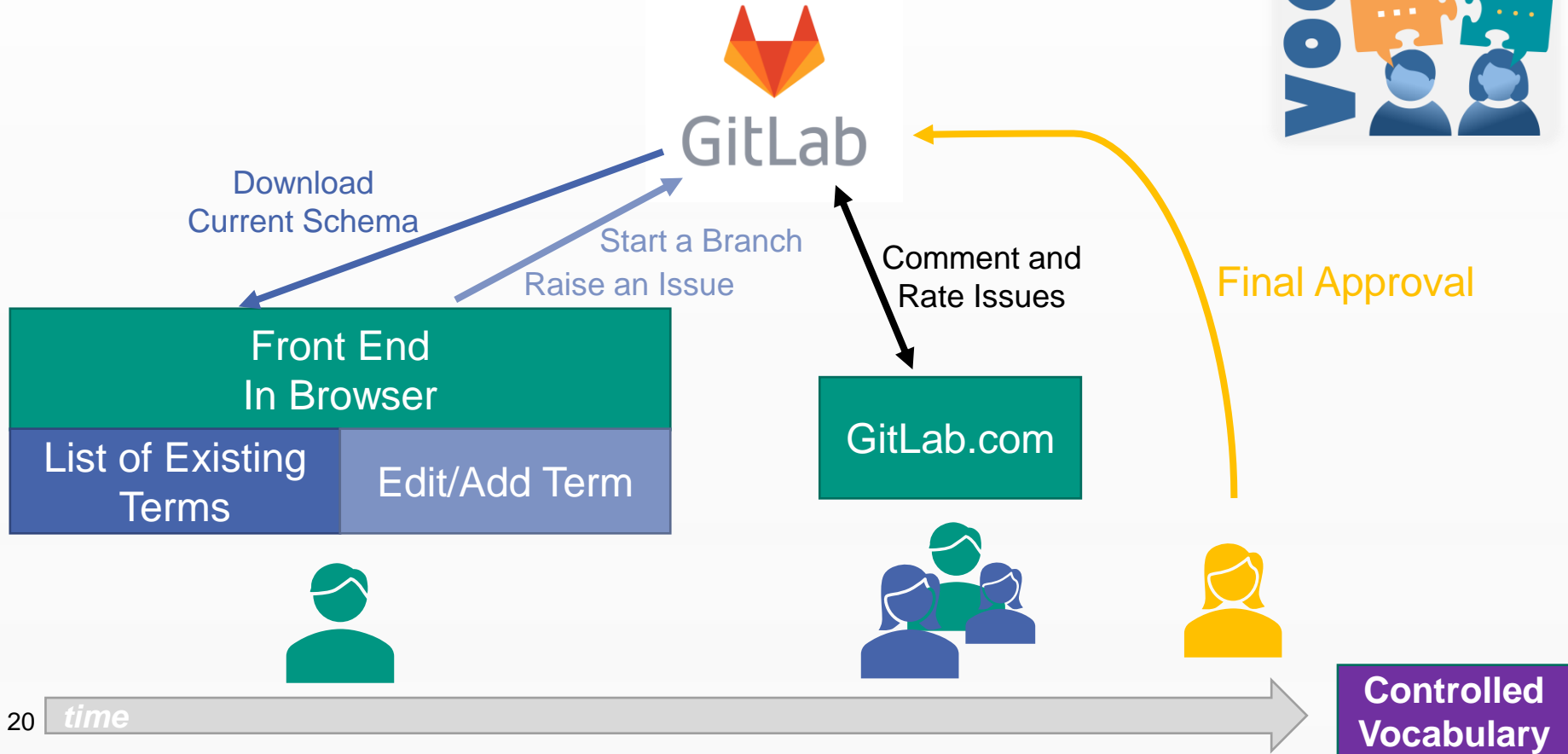
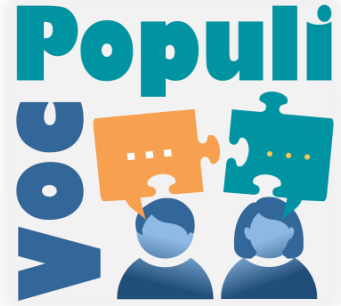
[nick-garabedian @nick-garabedian](#)
Updated on 2022-05-18 at 18:48

I like it.

Add a new comment:

Submit comment

System for Controlled Vocabularies



VocPopuli Features

Part 1

Part 2

List terms

New term

Import vocabulary

Choose a vocabulary project: ▾

Select

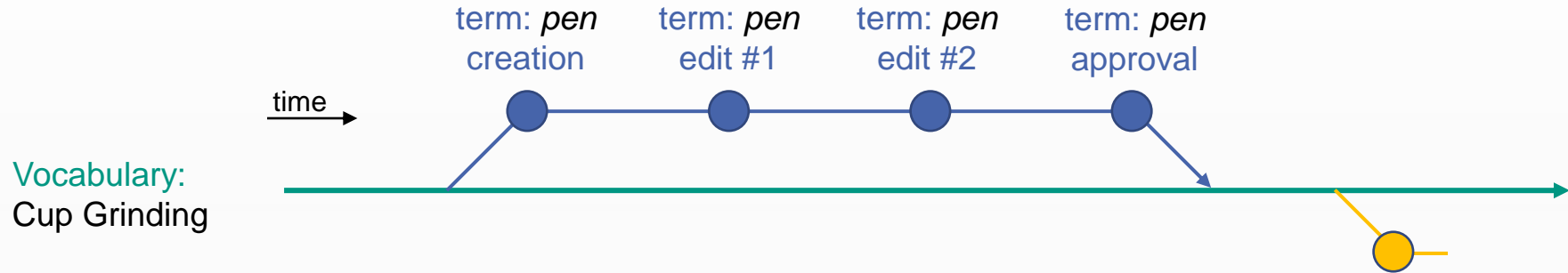
[Login with GitLab](#)

VocPopuli Under the Hood: Term Creation

time →

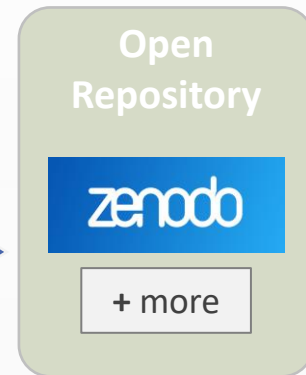
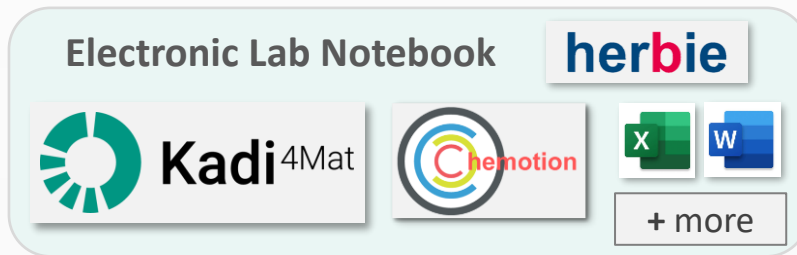
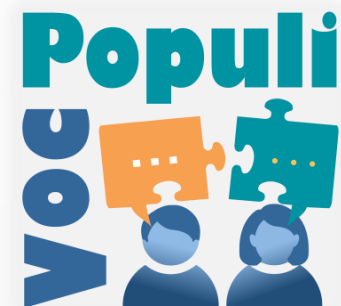
Vocabulary:
Cup Grinding

VocPopuli Under the Hood: Term Creation



VocPopuli Under the Hood Features:

- Git-based tracking
 - Who?
 - When?
- PROV-DM data model
- SKOS ontology



Vocabulary Management Tool

Controlled Vocabulary (in VocPopuli)

VocPopuli List terms New term Import vocabulary

Available terms

Populi

semi-supervised

- > Ultrasc
- ✓ Specin
- > Spec
- ✓ Gene
- > Op
- ✓ Location Information **approved** **unread**
 - > Room Number **approved** **unread**
 - > Institution (Location) **approved** **unread**
 - 123 Floor **approved** **unread**
 - > Building **approved** **unread**

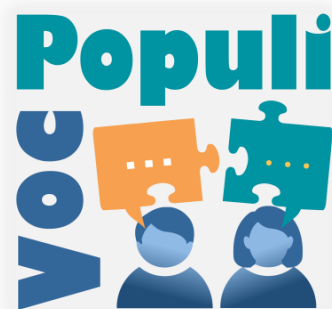
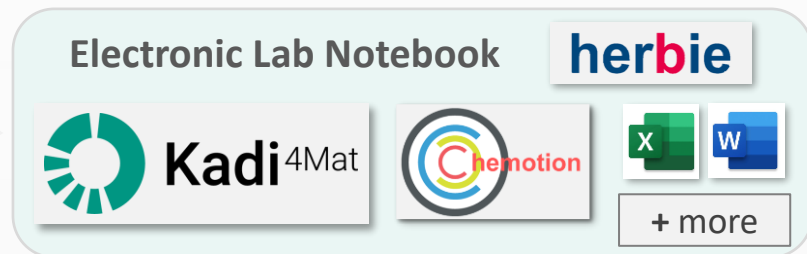
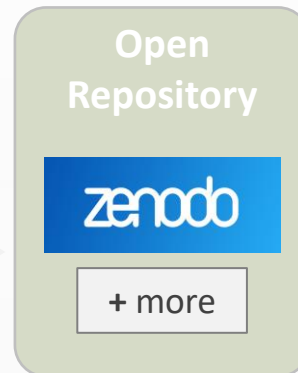
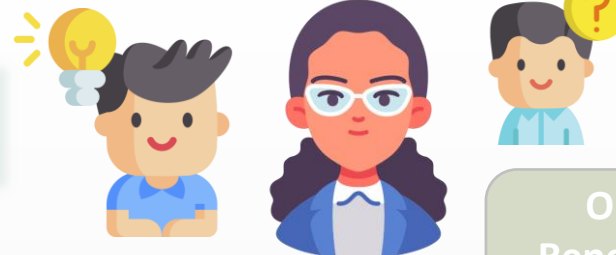
Ontology (TriboDataFAIR)



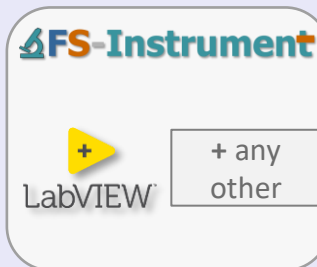
Karlsruhe Lab Framework

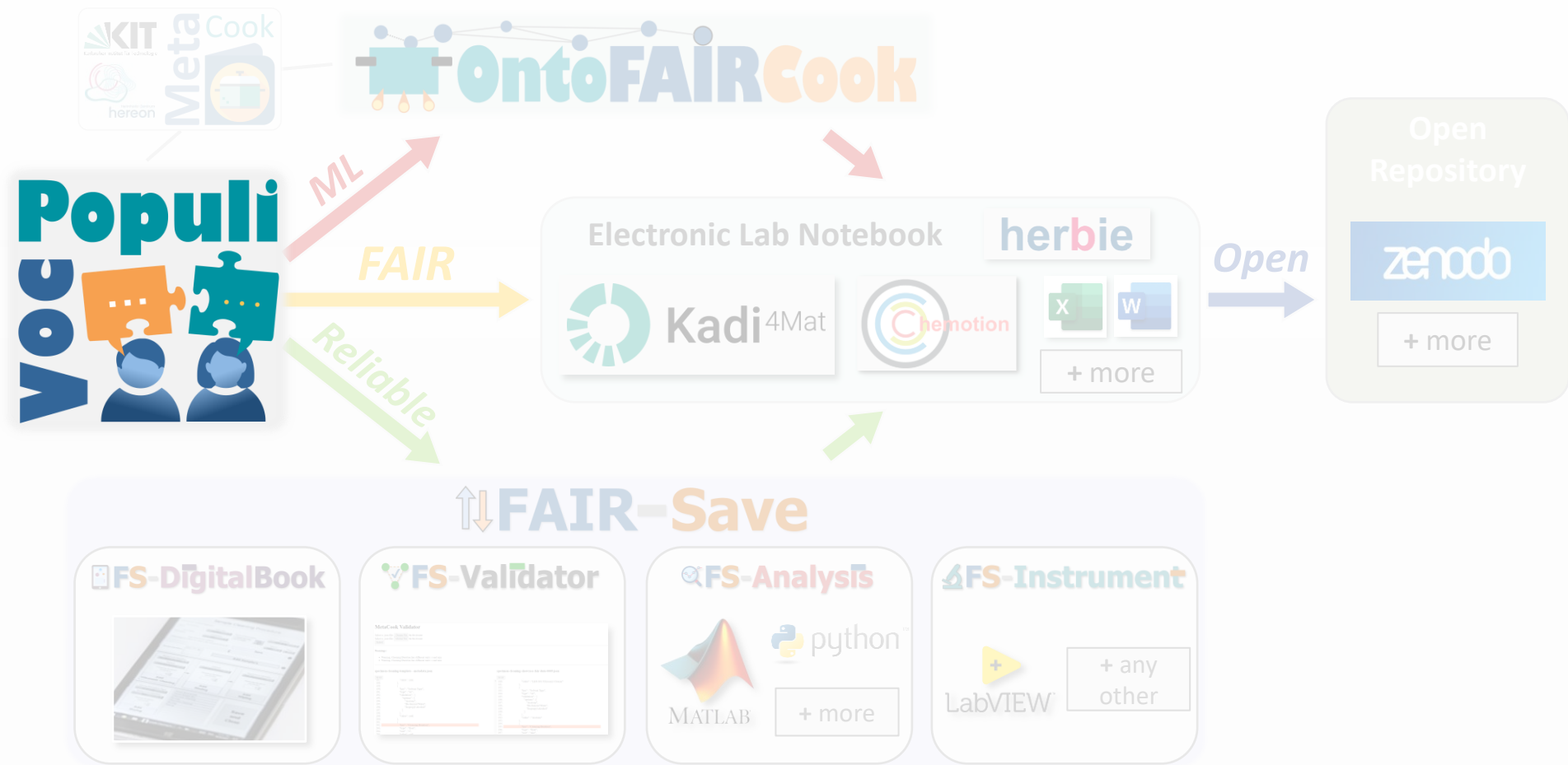
Part 1

Part 2



FAIR-Save





VocPopuli Summary

- **Collaborative FAIR** vocabulary management
- Entry point to digitalization (on individual level)
- A step towards scalable machine learning



Current Affairs (Results)

- How long to see the tribological results after an experiment?

- ~ 2 minutes

- Immediate Returns:

- A Recent Accident and Calibration Check*

- How long do it take **us** to set up?

- > 2 years

- How long will it take **others** to set up?

- Highly variable:

- From HOURS to WEEKS to MONTHS (goal dependent)*

Is it worth it?
Absolutely!

Acknowledgements

■ Domain Expert Team:

- Dr. Paul Schreiber (1)
- Ines Blatter (1,2)
- Antje Dollmann (1,2)
- Christian Haug (1,2)
- Dr. Daniel Kümmel (1)
- Yulong Li (1,2)
- Franziska Meyer (1)
- Carina Morstein (1,2)
- Dr. Julia Rau (1,2)
- Malte Flachmann (2)
- Karlheinz Weber (2)
- Jakob Biesinger (2)



■ Developers:

- Manfred Weber (1)
- Ilia Bagov (2)
- Juergen Schaefer (2)
- Nuoyao Ye (2)
- Floriane Bresser (2)
- Benedikt Stoll (2)

(1) *Showcase Implementation*
(2) *Production-Ready Implementation*

■ Advisors:

- Prof. Christian Greiner (1,2)
- Dr. Johannes Schneider (1,2)
- Prof. Peter Gumbsch (1,2)

■ Kadi4Mat Team:

- Nico Brandt (1,2)
- Philipp Zschumme (1)
- Dr. Michael Selzer (1,2)

