

# A-MATCH: FACILITATING DATA EXCHANGE BETWEEN DIFFERENT APPLICATIONS VIA API-MATCHING

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*German Aerospace Center (DLR), Institute of Data Science, Jena*

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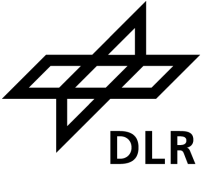
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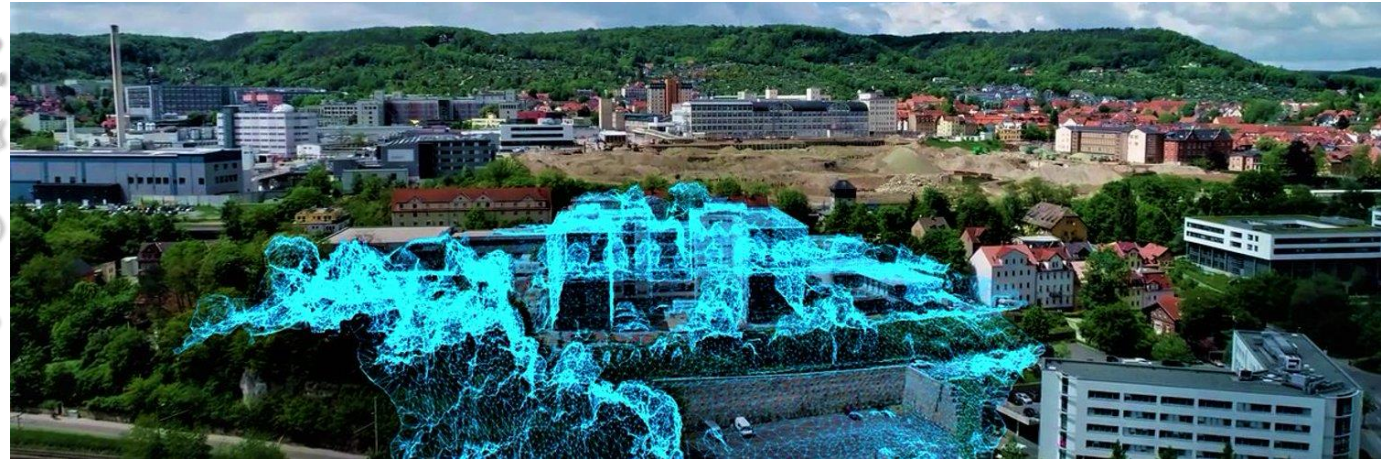
DLR



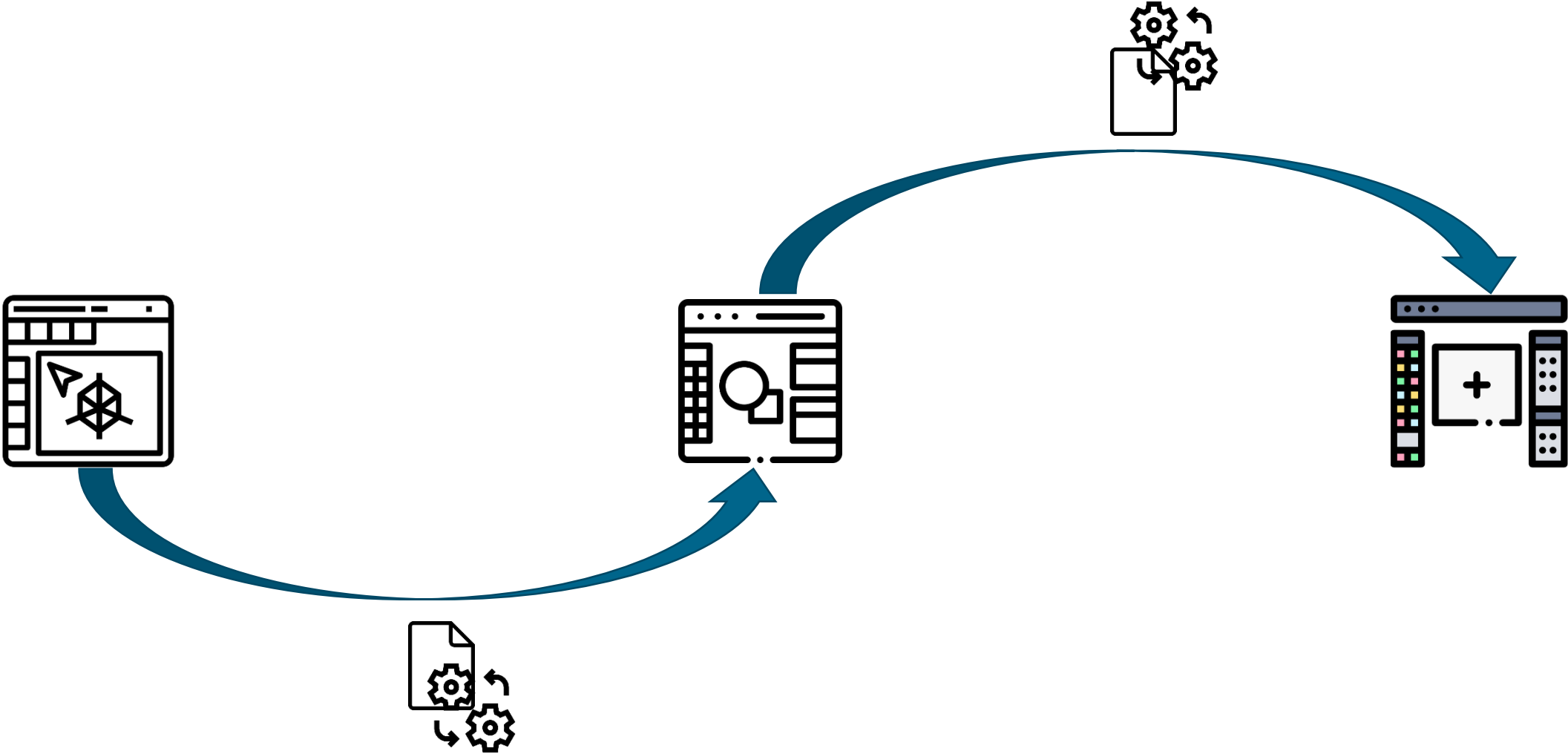
## DLR at a glance

- Research Institution
  - Space Administration
    - Project Management Agency

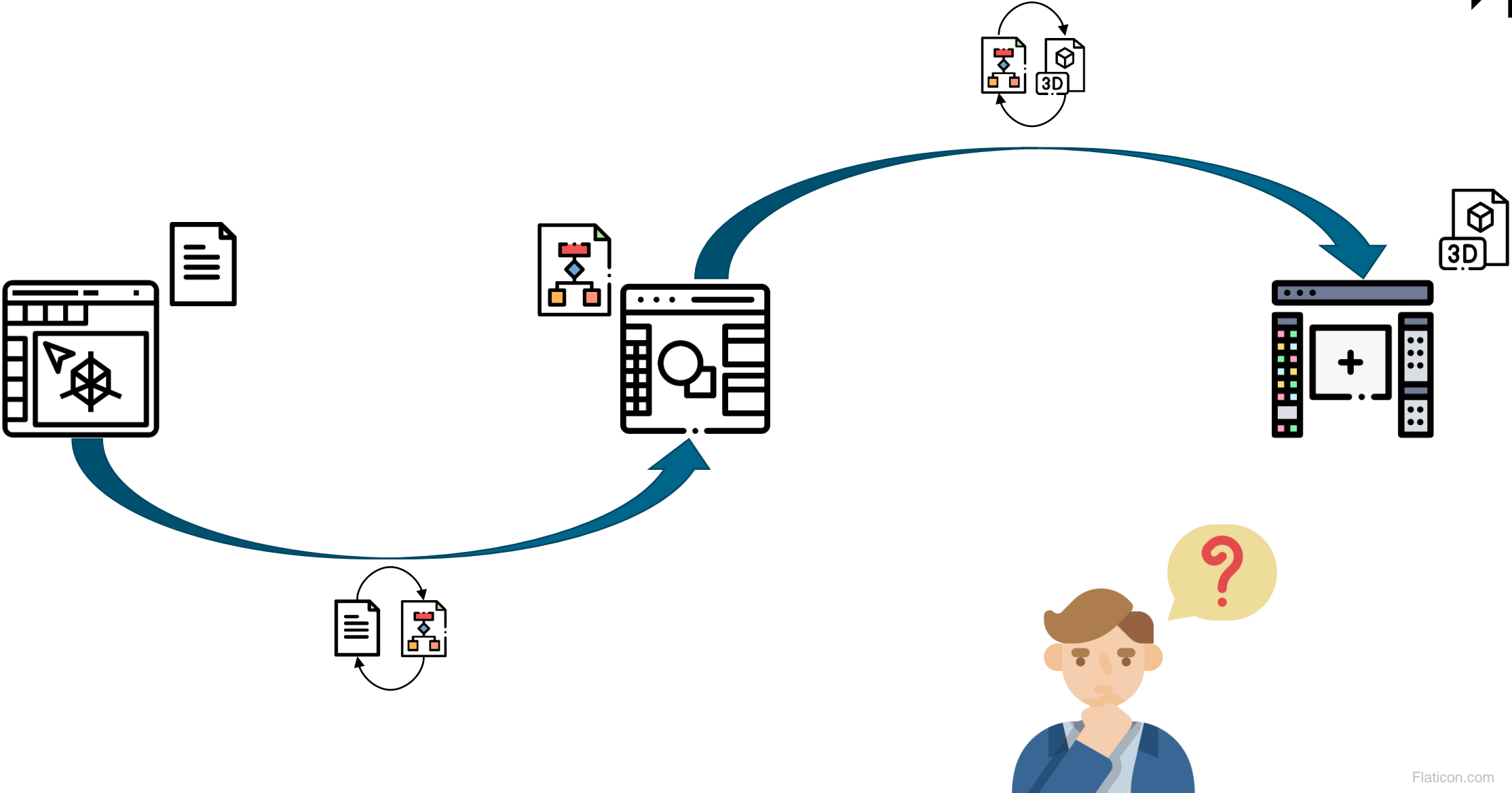
- Data Acquisition and Mobilization, **Data Management and Preparation**, Data Analysis and Intelligence
- Working group: Information Extraction and Interoperability



# Current State: Data Exchange between Software Tools



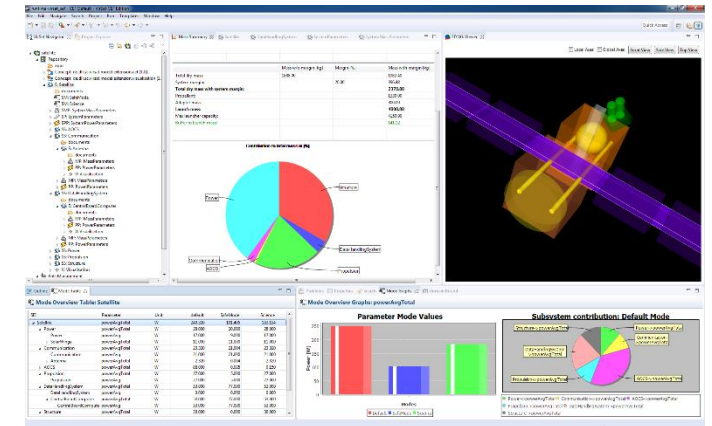
# Current State: Data Exchange between Software Tools



# Use Case at DLR



- Virtual Satellite
  - Software for modelling & planning of satellites
  - Only abstract components, parameters by hand
  - Has an API
- Part Database
  - Database with technical data from satellite components (star trackers, solar panels, batteries, etc.)
  - Extracted from data sheets from manufacturers
  - Has an API for queries



➔ Linking of APIs



Different terminology

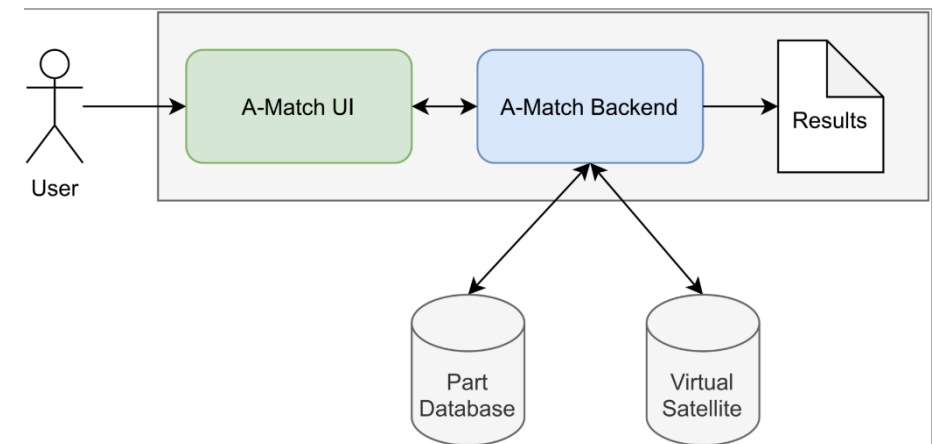


Semantic matching of parameters

A collage of technical data sheets and a database icon. The sheets include 'OVERVIEW', 'SPECIFICATIONS', 'HERITAGE', 'SYSTEM COMPONENTS', and 'µSTAR Tracker'. The 'µSTAR Tracker' sheet has a table with columns for 'Parameter', 'Unit', 'Value', 'Min', and 'Max'. The database icon is a black cylinder with white bands.

# A-Match: API Matching – The Idea

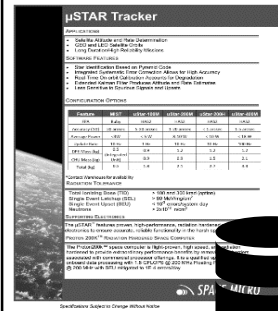
- Application for automatic data exchange between 2 APIs
- Matching of parameters/properties with values
- Support via ontologies
- Two parts: web-based UI & Matching server
  - UI: visualization for users; matching, correction, & export of results
  - Backend: calculation of similarities, handling of ontologies & API communication
- 1<sup>st</sup> use case & prototype: Matching objects for satellite planning



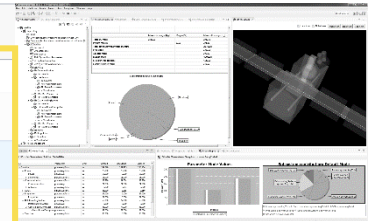
# A-Match – The Idea



```
{ "identifier":
"21_copia_di_a_str_autonomous_star_trac
ke",
"name": "A-STR and AA-STR",
"description":
"21_Copia_di_A_STR_Autonomous_Star_
Trackers_LQ_mm07786_.pdf",
"category": "star_tracker",
"properties": { "data_sheet": null,
"mass": 2.6,
"power": {
"power_standby": null,
"power_on": 12.6 },
"size": { "width": null,
"length": null,
"height": null,
"diameter": null },
"stl_file": null,
"temperature_no_ops": {
"temperature_no_ops_min": -35.0,
"temperature_no_ops_max": 65.0 },
"temperature_ops": {
"temperature_ops_min": -30.0,
"temperature_ops_max": 60.0 } } }
```

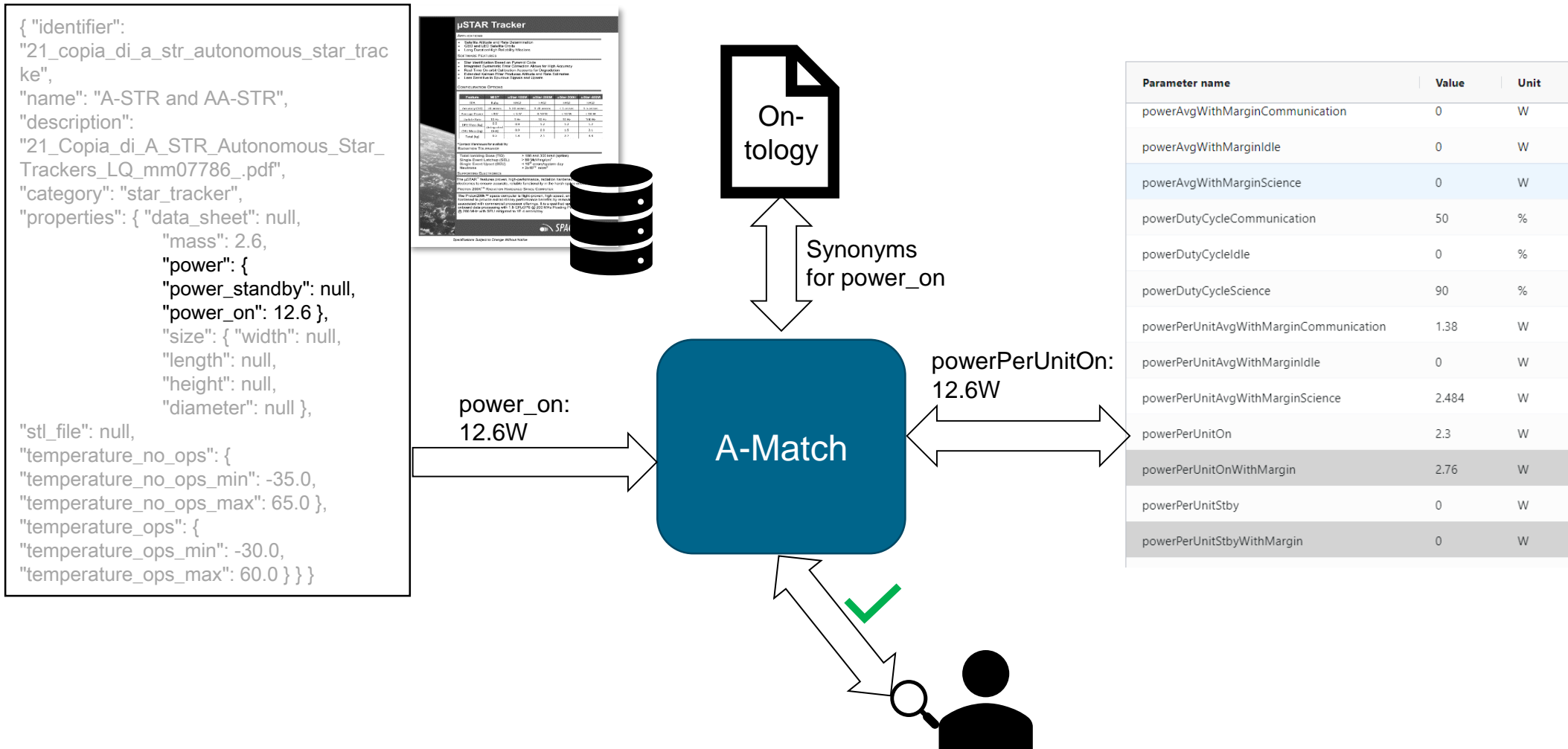


Parameter name	Value	Unit
powerAvgWithMarginCommunication	0	W
powerAvgWithMarginIdle	0	W
powerAvgWithMarginScience	0	W
powerDutyCycleCommunication	50	%
powerDutyCycleIdle	0	%
powerDutyCycleScience	90	%
powerPerUnitAvgWithMarginCommunication	1.38	W
powerPerUnitAvgWithMarginIdle	0	W
powerPerUnitAvgWithMarginScience	2.484	W
powerPerUnitOn	2.3	W
powerPerUnitOnWithMargin	2.76	W
powerPerUnitStby	0	W
powerPerUnitStbyWithMargin	0	W



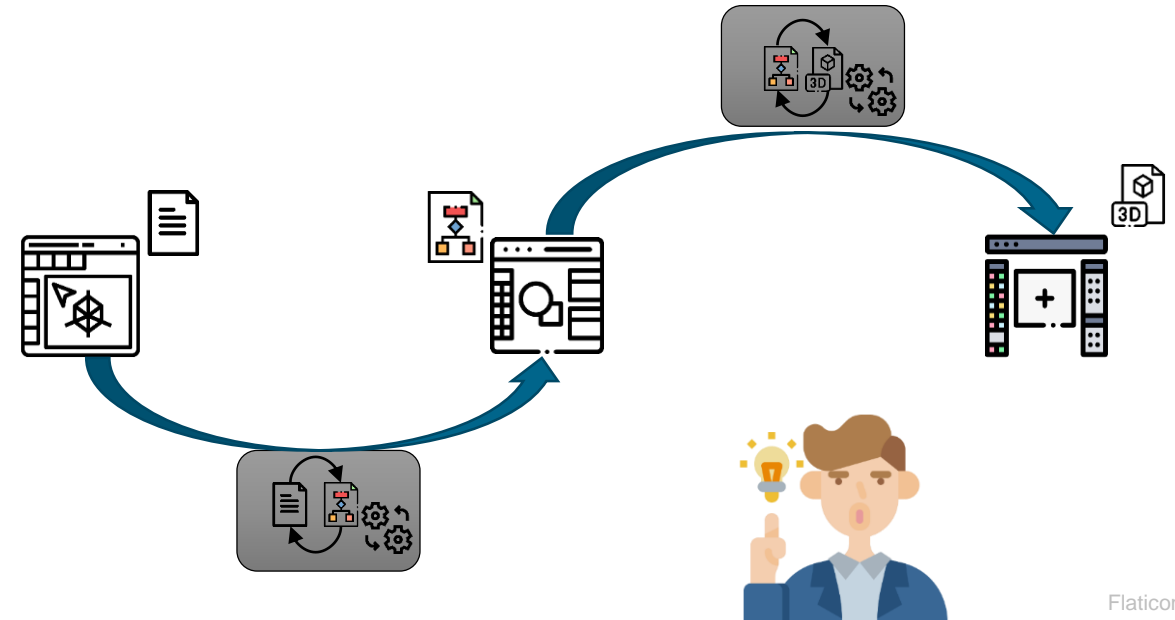


# A-Match – The Idea

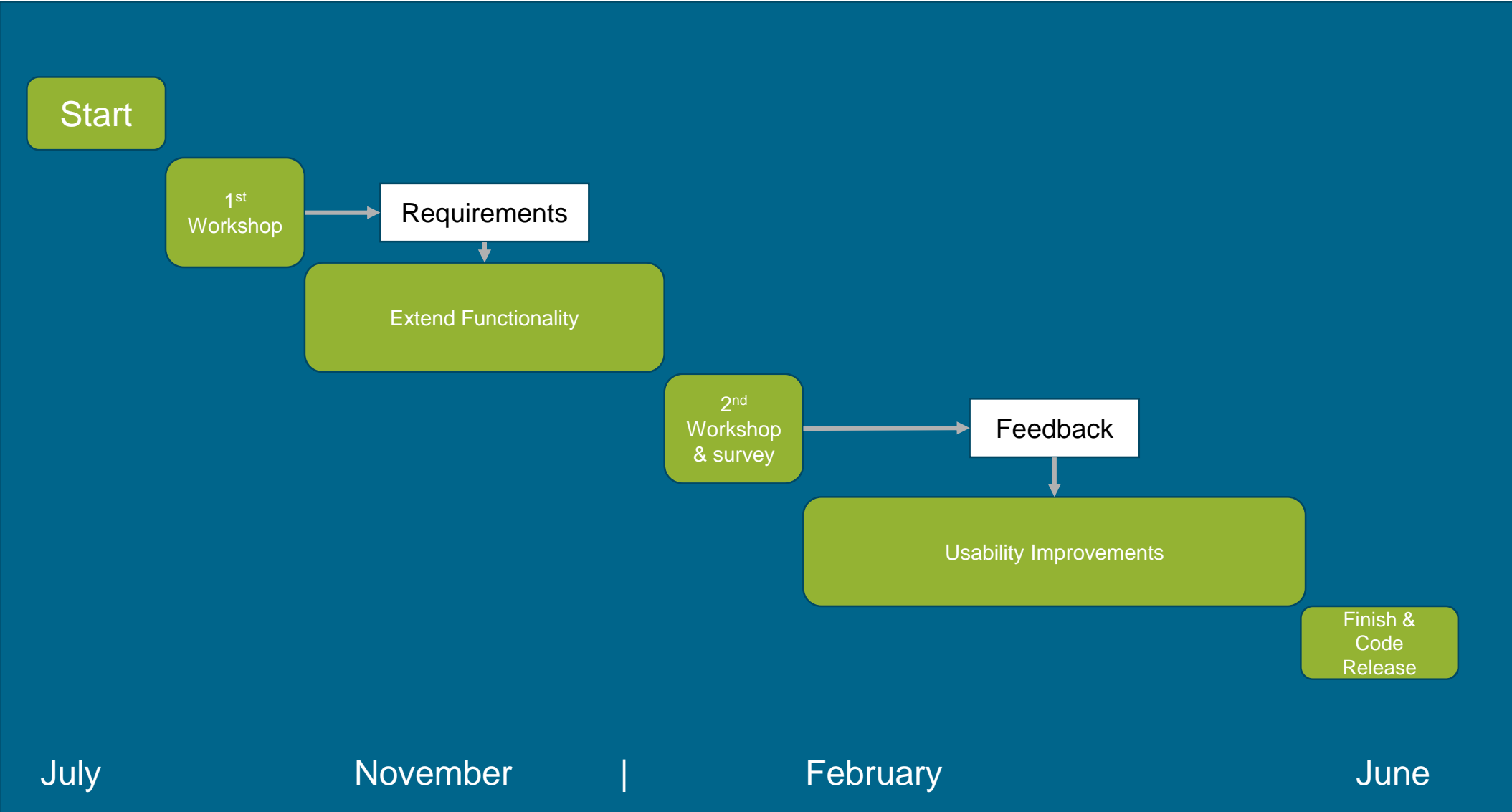


# A-Match as an NFDI4Ing Seed Fund

- Duration: July 2021 – June 2022
- Goals:
  - Development of prototype into functioning application
  - Support more software & data
  - Extend functionality
  - Improve prototype user interface
- Together with the NFDI4Ing community
  - 2 workshops for requirements & usability
- At the end: open-source publishing of code



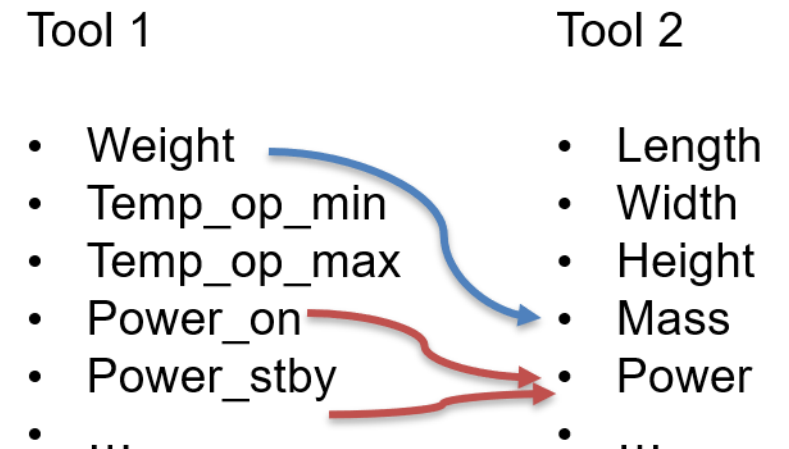
# The Project: From Prototype to Version 1.0



# The Backend Server

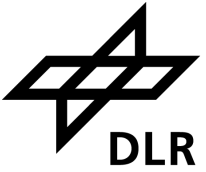


- Handles matching & communication with UI & 2 APIs
- Matching of parameters based on similarity metrics
  - can be combined
- Ontology support: Domain ontology & Units of Measurement ontology<sup>1</sup>
  - Define & update synonyms
  - Verify & convert measurement units

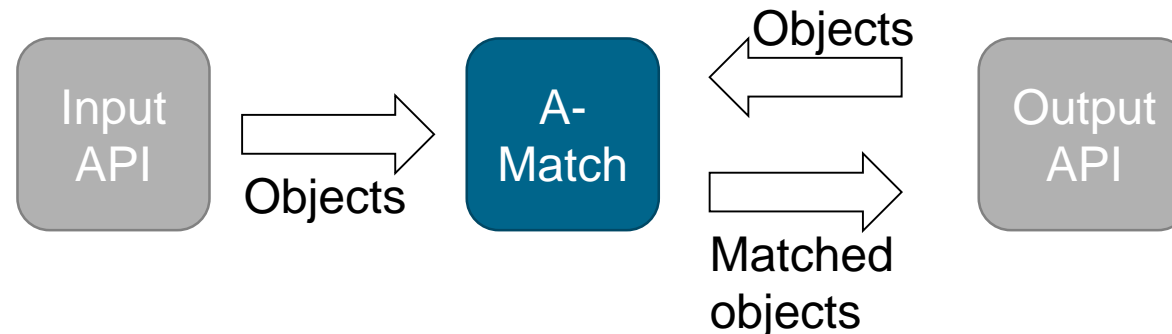


<sup>1</sup><https://github.com/HajoRijgersberg/OM>

# The APIs



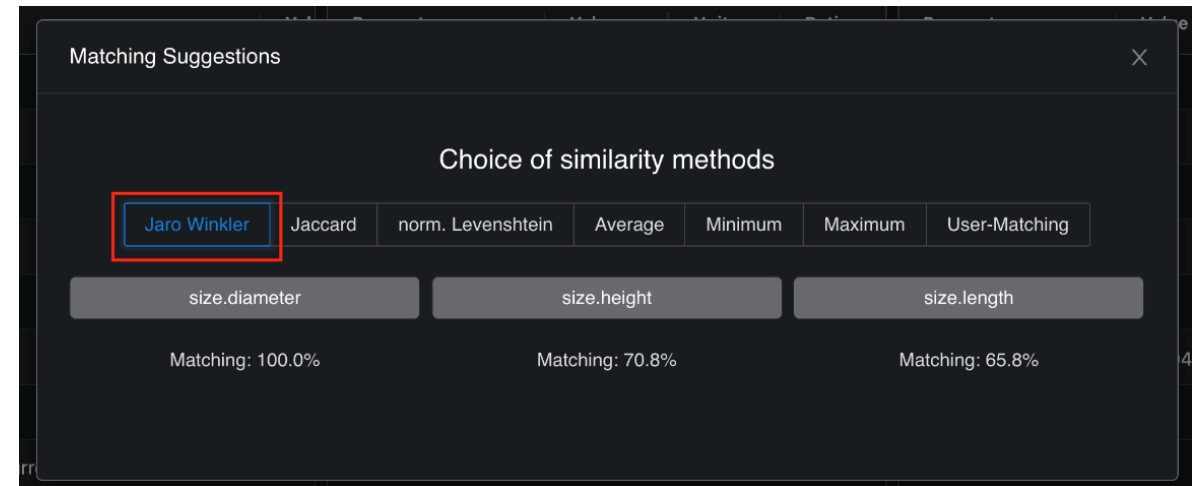
- Distinct input & output API needed
- Can support any API that provides products/objects with properties
- UI components need to be adapted to underlying data structure
  - Suitable for „beginners“
- Keep in mind: if the domain changes, the domain ontology needs to change



# The User Interface



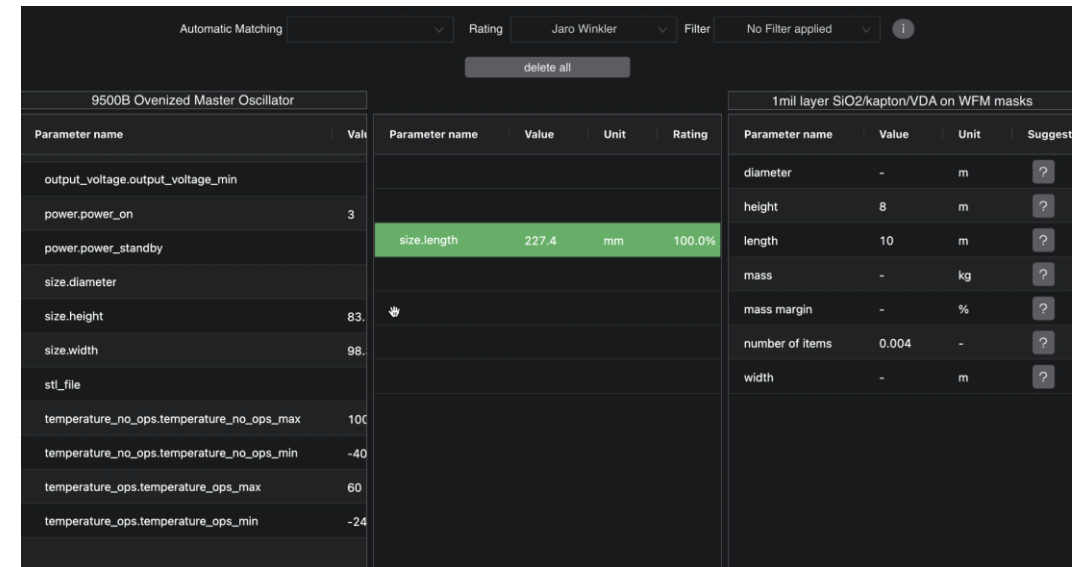
- User-supported matching
- Upload own domain ontology
- Select objects to match
- Match their parameters
- Automatically or by hand
- User can correct suggestions
- User can select different similarity metrics
- User can save matches offline



# Conclusion

- Finished implementation to standalone application
- Workshops provided vital feedback & guided development
- Survey showed good usability
- Possibility to connect own APIs
- A-Match 1.0 is now Open-Source:  
[10.5281/zenodo.6641652](https://zenodo.org/record/6641652)

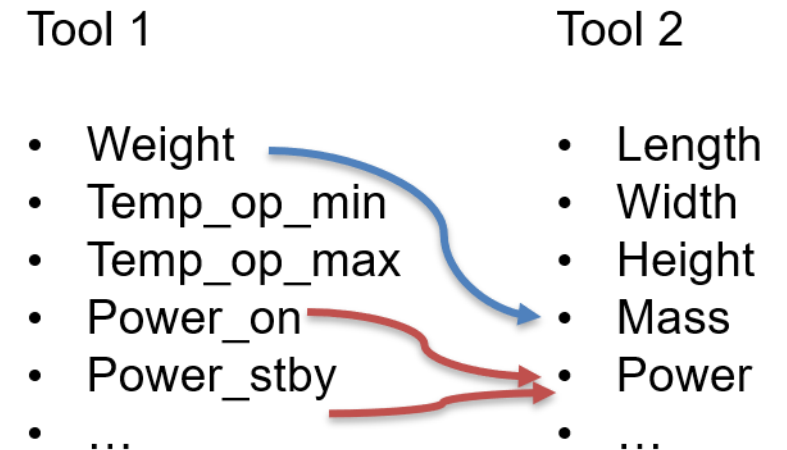
Check it out on Zenodo



The screenshot shows the A-Match 1.0 interface with two tables comparing parameters for a '9500B Ovenized Master Oscillator' and a '1mil layer SiO2/kapton/VDA on WFM masks'.

9500B Ovenized Master Oscillator		Automatic Matching				1mil layer SiO2/kapton/VDA on WFM masks			
Parameter name	Value	Parameter name	Value	Unit	Rating	Parameter name	Value	Unit	Suggest
output_voltage.output_voltage_min						diameter	-	m	?
power.power_on	3	size.length	227.4	mm	100.0%	height	8	m	?
power.power_standby						length	10	m	?
size.diameter						mass	-	kg	?
size.height	83.					mass margin	-	%	?
size.width	98.					number of items	0.004	-	?
stl_file						width	-	m	?
temperature_no_ops.temperature_no_ops_max	100								
temperature_no_ops.temperature_no_ops_min	-40								
temperature_ops.temperature_ops_max	60								
temperature_ops.temperature_ops_min	-24								

- More ideas for future updates:
  - Formula support for complex unit conversions
  - Add notes to matches for cooperation
  - Ideas from workshops & survey
- Support more matching techniques (N-to-1, ...)





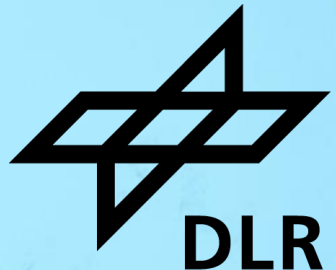
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Topic: **A-Match: Facilitating Data Exchange Between different Applications via API-Matching**

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Institute: Institute of Data Science, Jena

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