

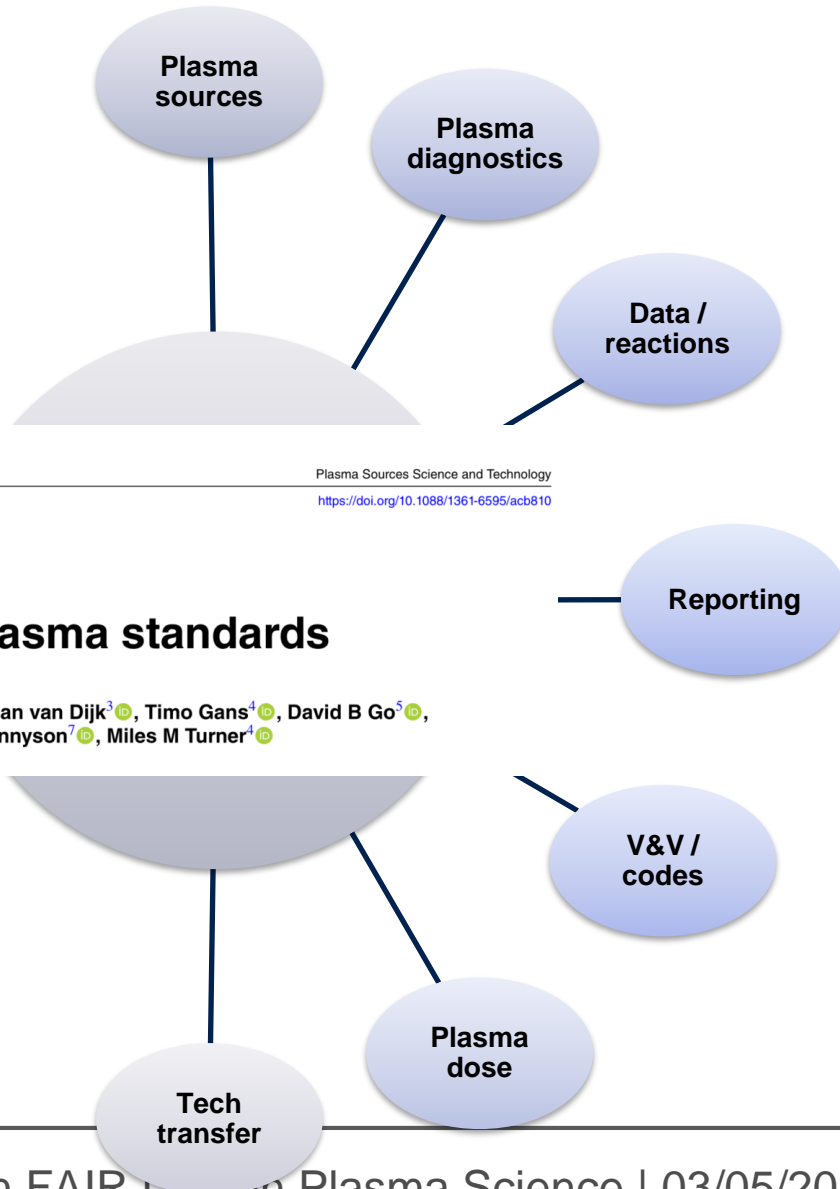


# RDM in the low-temperature plasma community

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*Bochum & online, 2023-05-03*



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Plasma Sources Science and Technology

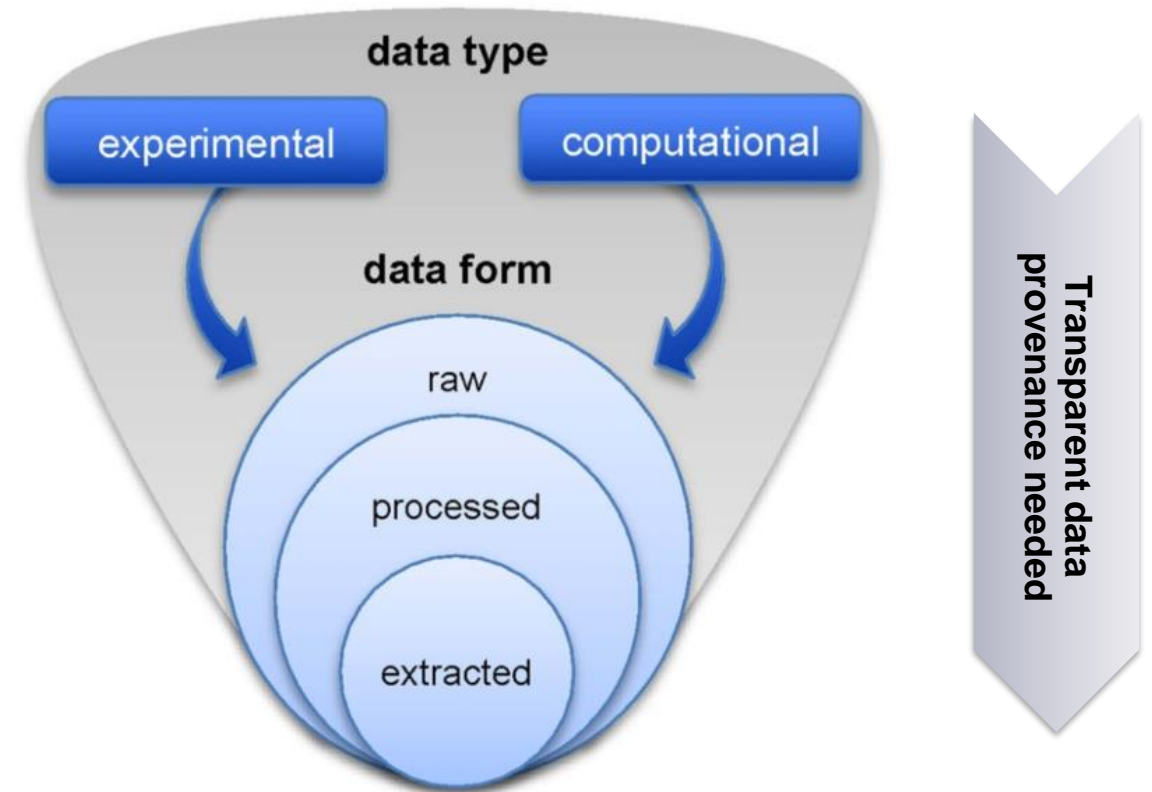
<https://doi.org/10.1088/1361-6595/acb810>

Topical Review

## Foundations of plasma standards

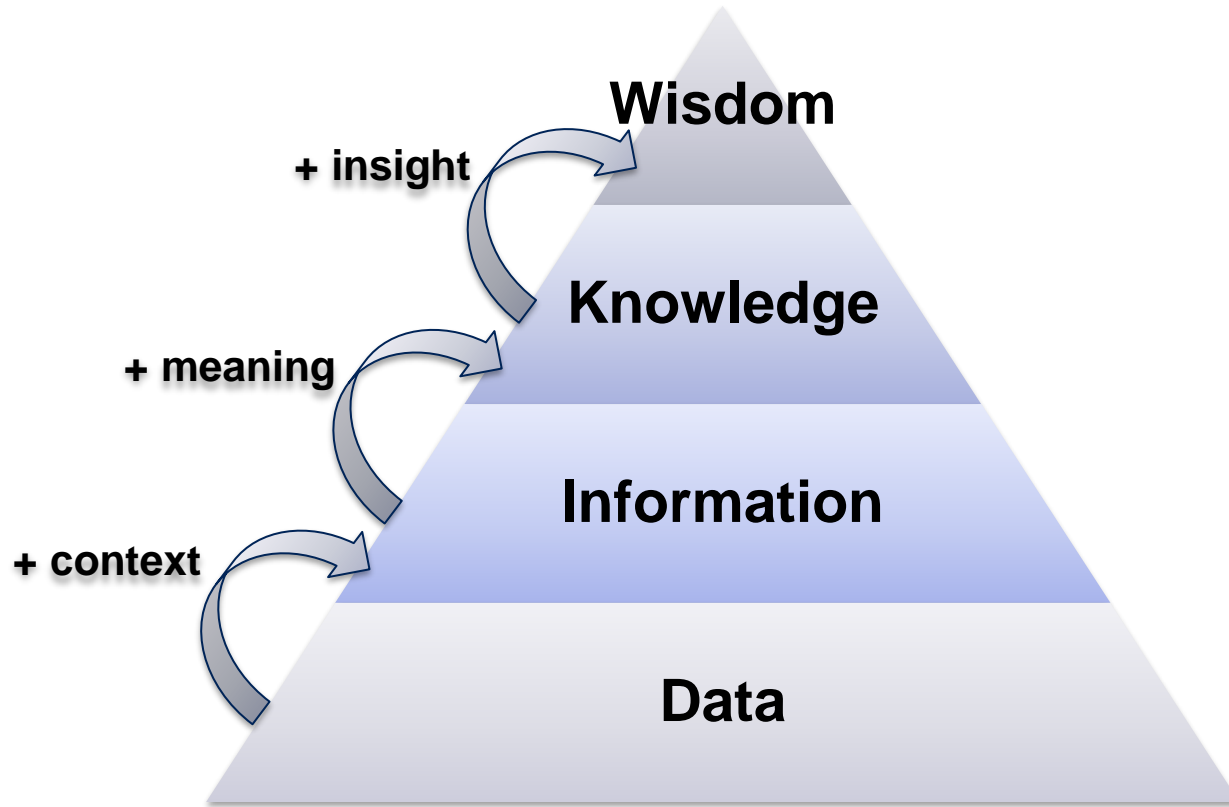
Luis L Alves<sup>1</sup>, Markus M Becker<sup>2</sup>, Jan van Dijk<sup>3</sup>, Timo Gans<sup>4</sup>, David B Go<sup>5</sup>, Katharina Stapelmann<sup>6</sup>, Jonathan Tennyson<sup>7</sup>, Miles M Turner<sup>1</sup> and Mark J Kushner<sup>8,\*</sup>

## Types of data from different sources

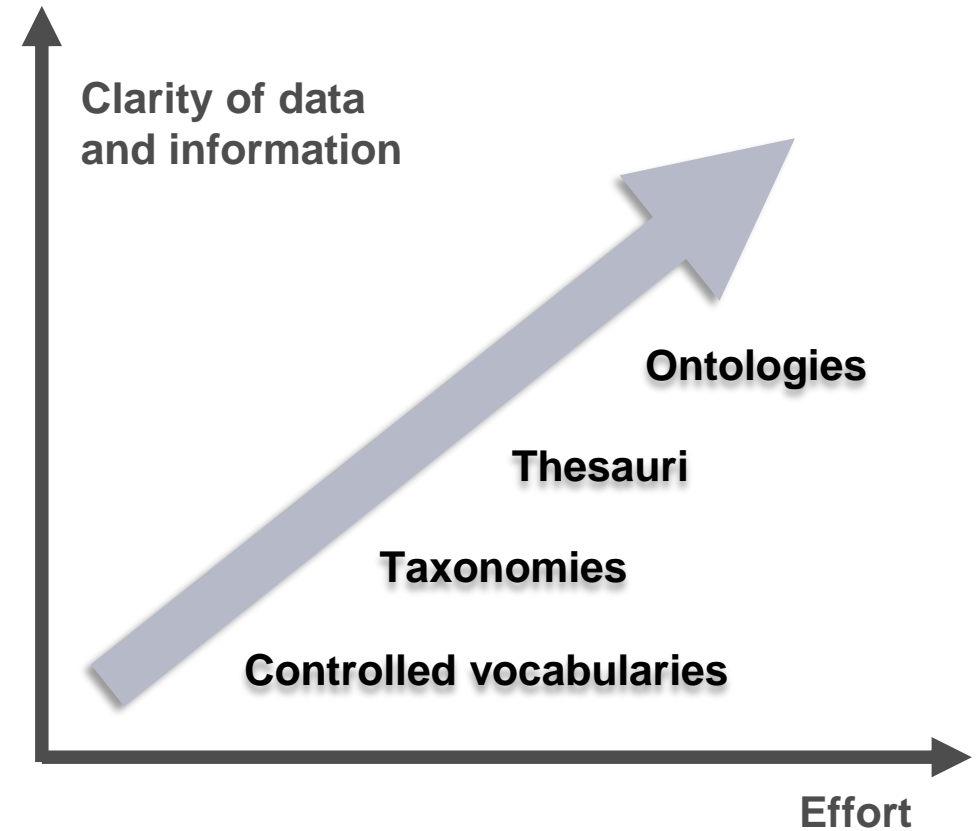


L.L. Alves *et al.*, *Plasma Sources Sci. Technol.* **32** (2023) 023001

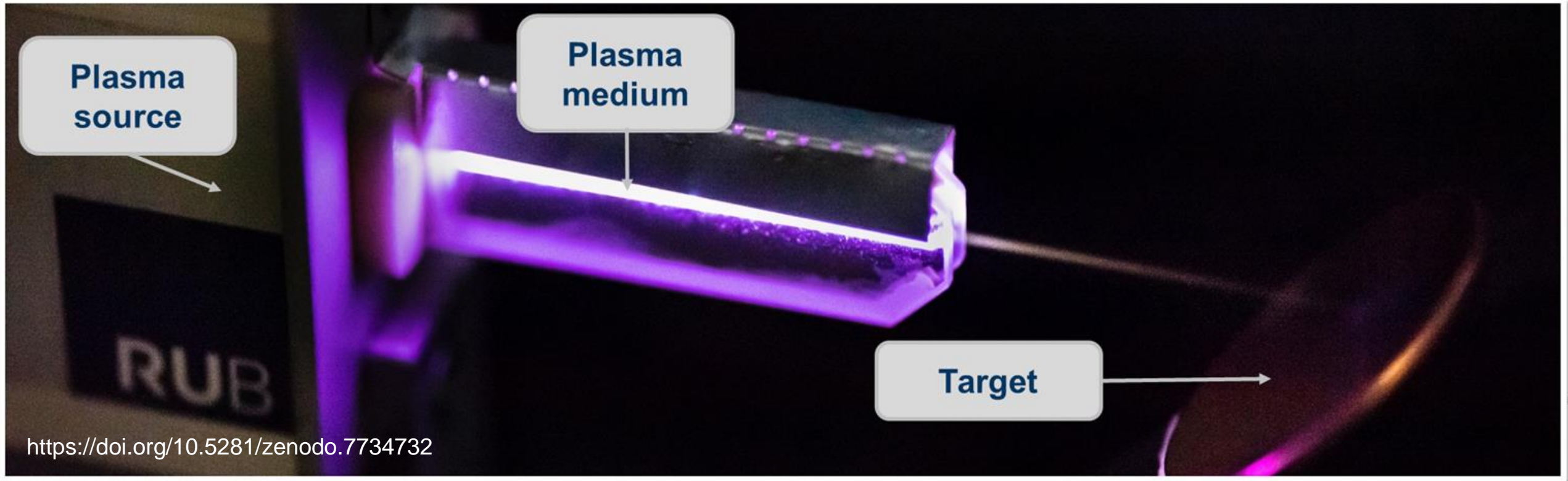
DIKW pyramid



Formality levels of metadata



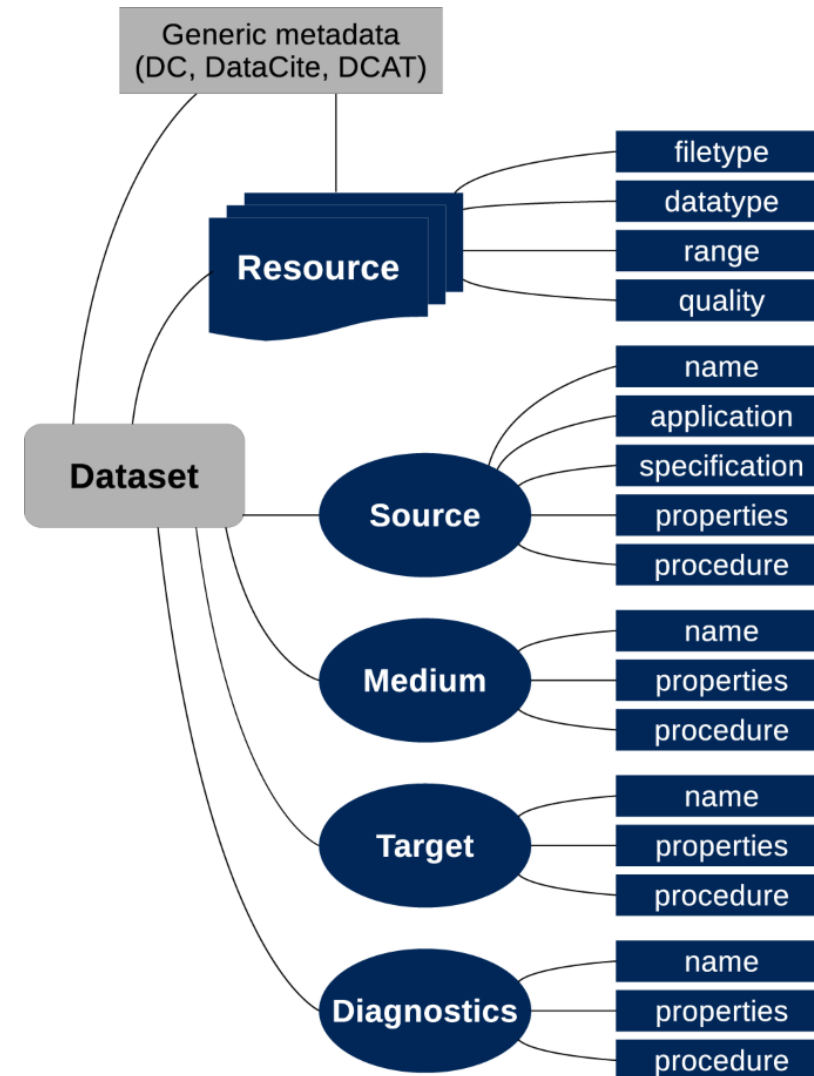
→ Data about data (**metadata**) are the key to efficient data (re-)use



- Data obtained by electrical / gas / plasma / surface **diagnostics** → experiments and simulations
- Description of **source, medium, target, diagnostics** and **resources** (data files) for reuse of datasets

# Plasma metadata schema

- Metadata schema for applied plasma science
- Standardised description of
  - plasma source
  - plasma medium
  - plasma target
  - diagnostics (experiment and modelling)
  - resources (data)

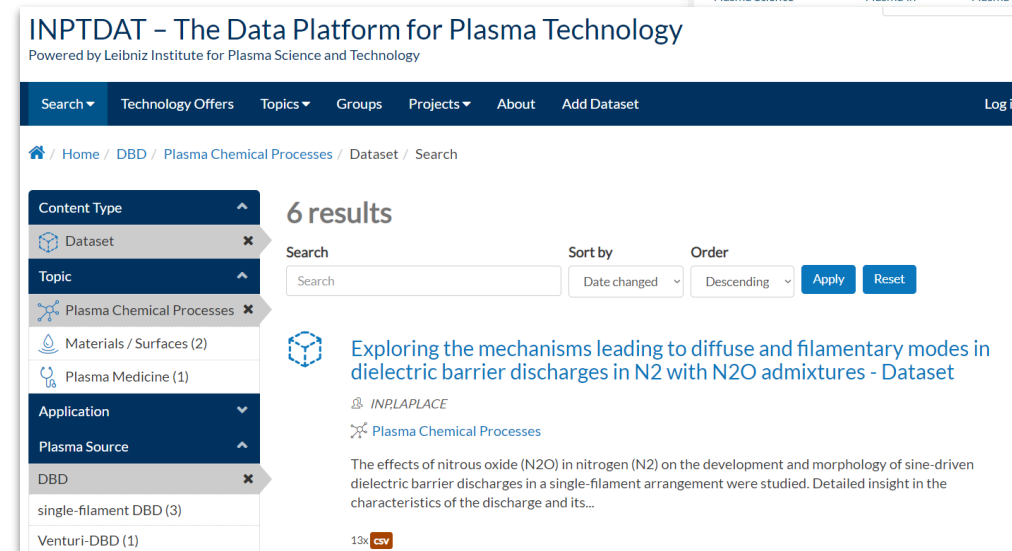


S. Franke *et al.*, *Sci. Data* 7 (2020) 439  
<https://github.com/plasma-mds/plasma-metadata-schema>

- Research data repositories implementing Plasma-MDS
  - INPTDAT (<https://www.inptdat.de>)
  - RDCPIDAT (<https://rdpcidat.rub.de>)
- Ongoing monthly workshops organised by INP, RUB and CAU
- Specific sub-schemas for various applications:  
<https://www.plasma-mds.org>



The screenshot shows the RUB Research Data Repository website. The header includes the RUB logo and the text 'Research Data Repository' and 'Research Department Plasmas with Complex Interactions'. A navigation menu contains 'Datasets', 'Data Stories', 'Plasmas', 'Topics', 'Groups', 'Projects', and 'Info'. A search bar is in the top right. The main content area features a large image of a plasma discharge with the text 'Research Data' and a description. Below this are several icons representing different research areas: Plasma Science, Plasma in, Plasma Modeling and Simulation, Plasma Chemical Processes, Plasma in Liquids, and Plasma Medicine.



The screenshot shows the INPTDAT website, titled 'INPTDAT - The Data Platform for Plasma Technology'. The header includes the text 'Powered by Leibniz Institute for Plasma Science and Technology' and a navigation menu with 'Search', 'Technology Offers', 'Topics', 'Groups', 'Projects', 'About', and 'Add Dataset'. The main content area shows search results for 'Plasma Chemical Processes'. The results list includes a dataset titled 'Exploring the mechanisms leading to diffuse and filamentary modes in dielectric barrier discharges in N2 with N2O admixtures - Dataset' by INPLAPLACE. The description of the dataset is: 'The effects of nitrous oxide (N2O) in nitrogen (N2) on the development and morphology of sine-driven dielectric barrier discharges in a single-filament arrangement were studied. Detailed insight in the characteristics of the discharge and its...'. A 'CSV' icon is visible at the bottom of the result.

# Regular Metadata Workshops

- Online workshops every third Friday of each month at 1 pm (duration of 60 up to 90 min)
- Join mailing list to stay tuned and benefit
- Re-use schemas for your own experiments
- Contribute to the further developments with your expertise and user experience
- Share your own schemas / templates
- Publish your digital data with metadata
- More information on [plasma-mds.org](https://plasma-mds.org)

2021	
26 Nov, 2021	Atmospheric pressure plasma jets (APPJ)
2022	
16 December, 2022	Wrap-up 2022
18 November, 2022	High-speed imaging
21 October, 2022	Optical emission spectroscopy (OES) - part 2
16 September, 2022	Mass spectrometry (MS)
19 August, 2022	X-ray photoelectron spectroscopy (XPS) - part 2
08 July, 2022	Optical emission spectroscopy (OES)
17 June, 2022	Plasma modeling and simulations
20 May, 2022	Fourier-transform infrared spectroscopy (FTIR)
29 Apr, 2022	X-ray photoelectron spectroscopy (XPS)
18 Mar, 2022	Passive high-voltage probes
18 Feb, 2022	Oscilloscope measurements
21 Jan, 2022	Low pressure plasmas (LPP)
2023	
3-4 May, 2023	<a href="#">2nd Workshop on FAIR Data in Plasma Science</a>
17 March, 2023	Ion chromatography (IC)
24 February, 2023	Laser-induced fluorescence (LIF) - part 2
20 January, 2023	Laser-induced fluorescence (LIF)



- Chairs from various disciplines are involved within the CRC 1316
  - Plasma physics
  - Plasma technology
  - Theoretical engineering
  - Biology
  - Chemistry
- Need on research data management differs as well
- Need is recognized, support in implementation





## ! Challenges

### Organizational

- Various research group work within the CRC 1316
- Research focus varies strongly
- Communication to all researchers required

### RDM related

- Knowledge of groups on RDM differs
- Demands on RDM are not homogenous btw. groups

## 🤖 Measures

- All dates available on <https://sfb1316.rub.de/index.php/en/support-projects/research-data-management>
- Mailing address `sfb1316+rdm@rub.de`



## 👤 Data experts

### INF ↔ Data experts

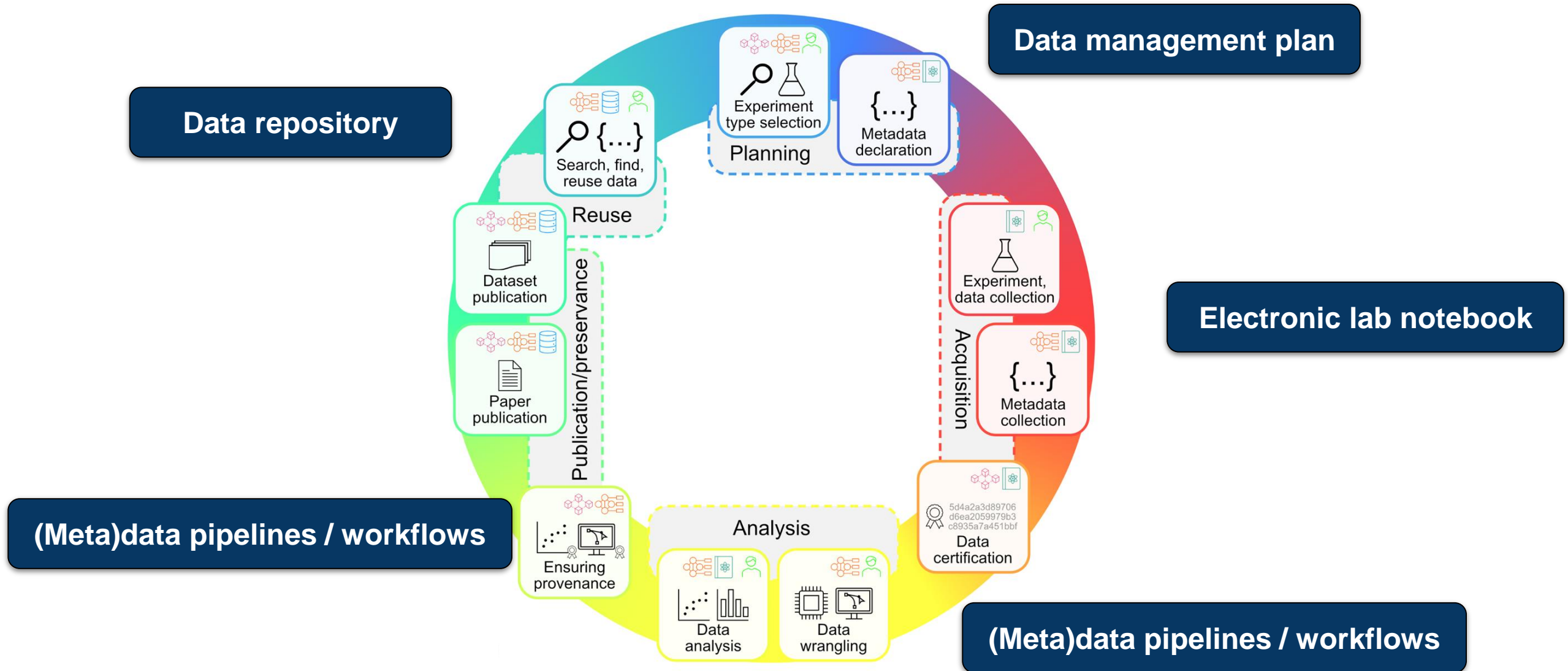
- Exchange on demands
- Exchange on new developments

### Organizational aspects

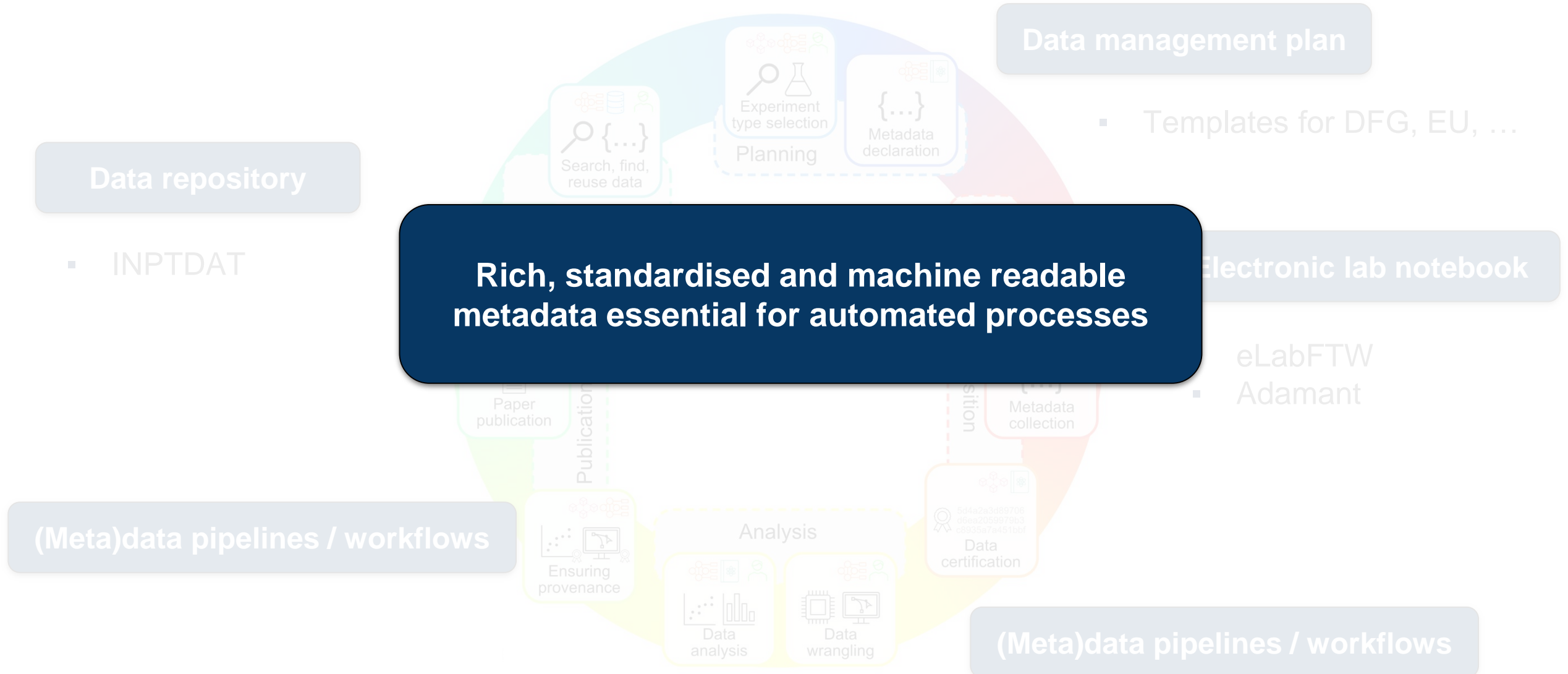
- All research fields represented
- Regular meetings
- Working as multipliers



# Tools for research data management along the data lifecycle



# Tools for research data management along the data lifecycle



- **eLabFTW** as electronic lab notebook
- **Adamant** for easy collection of structured metadata (based on JSON and JSON schema)
- Integration of **eLabFTW and Adamant**
- Digital **workflows** for collection, storage and re-use of machine readable metadata
- Different focus on eLabFTW, Adamant or **integrated solutions**, depending on lab demands
- **INPTDAT** for data publications
  
- Overarching metadata schemas, terminologies, plasma ontology

## Experiments

[Back to listing](#)

Create



Running ★★★★★ COST jet Surface treatment

Started on 2023-05-01

Visibility EDIT Only me Can write EDIT Only me

### Example experiment with COST jet

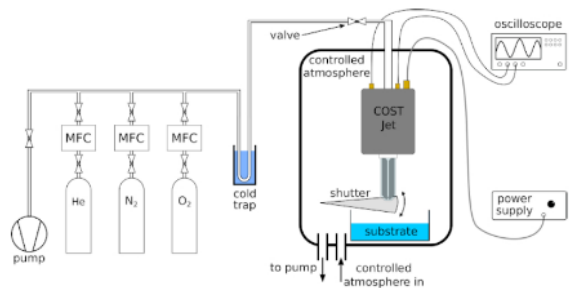
**Study/Experiment purpose (general information about the study/experiment)**  
Tell something

**Setup (description and sketch)**

Verbal description, sketches, ...

Plasma treatment was performed with [Device - COST Jet Id4425](#)

Treated sample: [Sample - Example sample id4456](#)



(Image from J. Golda et al. J. Vis. Exp. 165 (2020) e61801, <https://dx.doi.org/10.3791/61801>)

**Measurements (description of the procedure and list of parameters)**

Measurements were done according to protocol [Protocol - Treating Surfaces with a Cold Atmospheric Pressure Plasma using the COST-Jet](#)

**Evaluation/Results (evaluation steps and summary)**

Evaluation steps, conclusions, ...

**Path to data // Datenverzeichnis**

Paste it here ...

### Linked items

- [DEVICE - COST Jet Id4425](#)
- [LAB UNIT \(MESSPLATZ\) - E.17-QPTDat](#)
- [PROJECT - XS9324-QPTDat](#)
- [PROTOCOL - Treating Surfaces with a Cold Atmospheric Pressure Plasma using the COST-Jet](#)
- [SAMPLE - Example sample id4456](#)

### Attached files

- [json\\_schema.json](#) Click to add a comment
- [json\\_data.json](#) Click to add a comment
- [CostJetExperiment.jpg](#) Click to add a comment
- [image.png](#) Click to add a comment

### JSON Editor

- Open Adamant
- Load metadata
- Add field
- Import from file
- Clear ?

Editing metadata

### Comments

Add a comment

SAVE

[See changelog](#)

3 revisions available

Last modified on 2023-05-02 09:26:52

Unique eLabID: 20230501-d3dab80efe02e177fe5426bde613ce1330a2ba8d

# eLabFTW → integration with Adamant

EXPERIMENTS DATABASE TEAM SEARCH DOCUMENTATION

Experiments

< Back to listing Create

```
1 {
2   "name": "#COST Jet Id4425",
3   "dissipatedPower": 0.75,
4   "ppVoltage": 600,
5   "voltFrequency": 13560000,
6   "burstMode": false,
7   "gasMix": "He + O2",
8   "feedGasFlowRate": 1,
9   "addGasFlowRate": 1,
10  "ambGas": "Air",
11  "ambTemperature": 20,
12  "ambHumidityRel": 65,
13  "ambPressure": 100000
14 }
```

... using the COST-Jet

Evaluation/Results (evaluation steps and summary)  
Evaluation steps, conclusions, ...

Path to data // Datenverzeichnis  
Paste it here ...



Linked items

## Adamant

A JSON schema form renderer and editor

### APPJ

Documentation of experiments using atmospheric pressure plasma jet (APPJ), e.g. COST jet, KINPen

Name \*  
#COST Jet Id4425  
Name of the plasma source device

Power [W]  
0.75 W  
Power dissipated in the plasma

Reflected power [%]  
%  
Part of the input power which is reflected and not coupled to the electrode

Voltage (p-p) [V] \*  
600 V  
Peak-to-peak voltage

Frequency [Hz] \*  
13560000 Hz  
Frequency of the voltage signal

Current (p-p) [A]  
A  
Peak-to-peak current

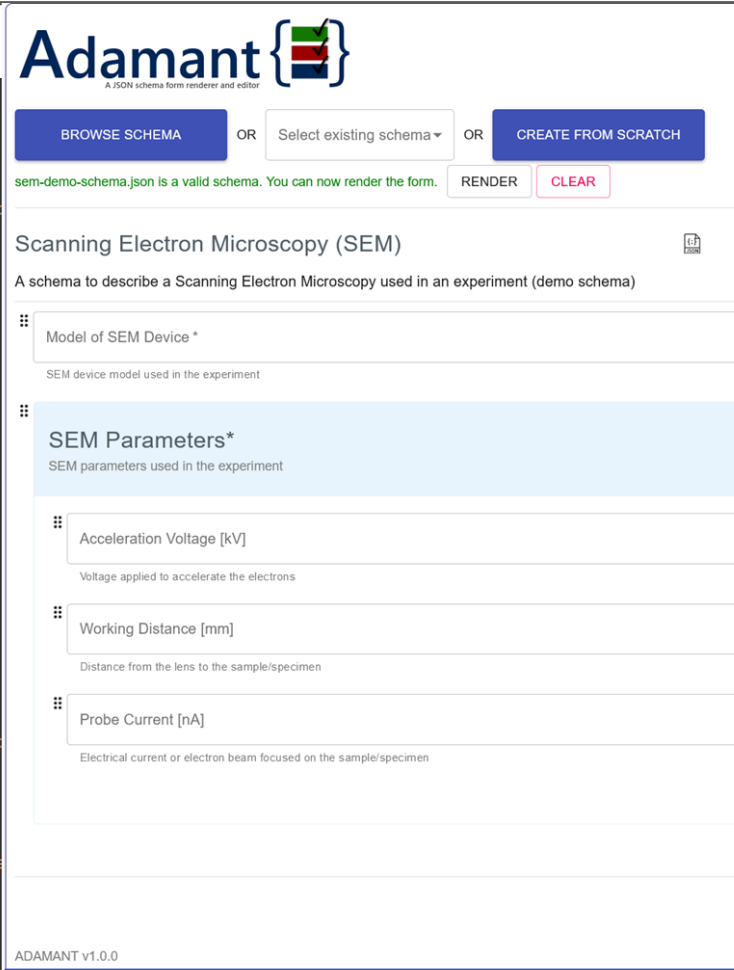
# Basic functionality of Adamant

```

{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "id": "http://scanning-electron-microscopy",
  "title": "Scanning Electron Microscopy (SEM)",
  "description": "A schema to describe a Scanning Electron Microscopy experiment (demo schema)",
  "type": "object",
  "required": ["DeviceModel", "SEMParameters"],
  "properties": {
    "DeviceModel": {
      "title": "Model of SEM Device",
      "description": "SEM device model used in the experiment",
      "type": "string"
    },
    "SEMParameters": {
      "title": "SEM Parameters",
      "description": "SEM parameters used in the experiment",
      "type": "object",
      "properties": {
        "AccelerationVoltage": {
          "title": "Acceleration Voltage [kV]",
          "description": "Voltage applied to accelerate the electrons",
          "type": "number"
        },
        "WorkingDistance": {
          "title": "Working Distance [mm]",
          "description": "Distance from the lens to the sample/specimen",
          "type": "number"
        },
        "ProbeCurrent": {
          "title": "Probe Current [nA]",
          "description": "Electrical current or electron beam focused on the sample/specimen",
          "type": "number"
        }
      }
    }
  }
}

```

Metadata schema described in JSON



**Adamant**  
A JSON schema form renderer and editor

BROWSE SCHEMA OR Select existing schema OR CREATE FROM SCRATCH

sem-demo-schema.json is a valid schema. You can now render the form. RENDER CLEAR

**Scanning Electron Microscopy (SEM)**  
A schema to describe a Scanning Electron Microscopy used in an experiment (demo schema)

Model of SEM Device\*  
SEM device model used in the experiment

SEM Parameters\*  
SEM parameters used in the experiment

Acceleration Voltage [kV]  
Voltage applied to accelerate the electrons

Working Distance [mm]  
Distance from the lens to the sample/specimen

Probe Current [nA]  
Electrical current or electron beam focused on the sample/specimen

ADAMANT v1.0.0

Dynamically rendered (editable) web form

```

{
  "DeviceModel": "Jeol JSM-7500F",
  "SEMParameters": {
    "AccelerationVoltage": 15,
    "WorkingDistance": 10,
    "ProbeCurrent": 10
  }
}

```



## Scanning Electron Microscopy (SEM)

Model of SEM Device	Jeol JSM-7500F
---------------------	----------------

## SEM Parameters

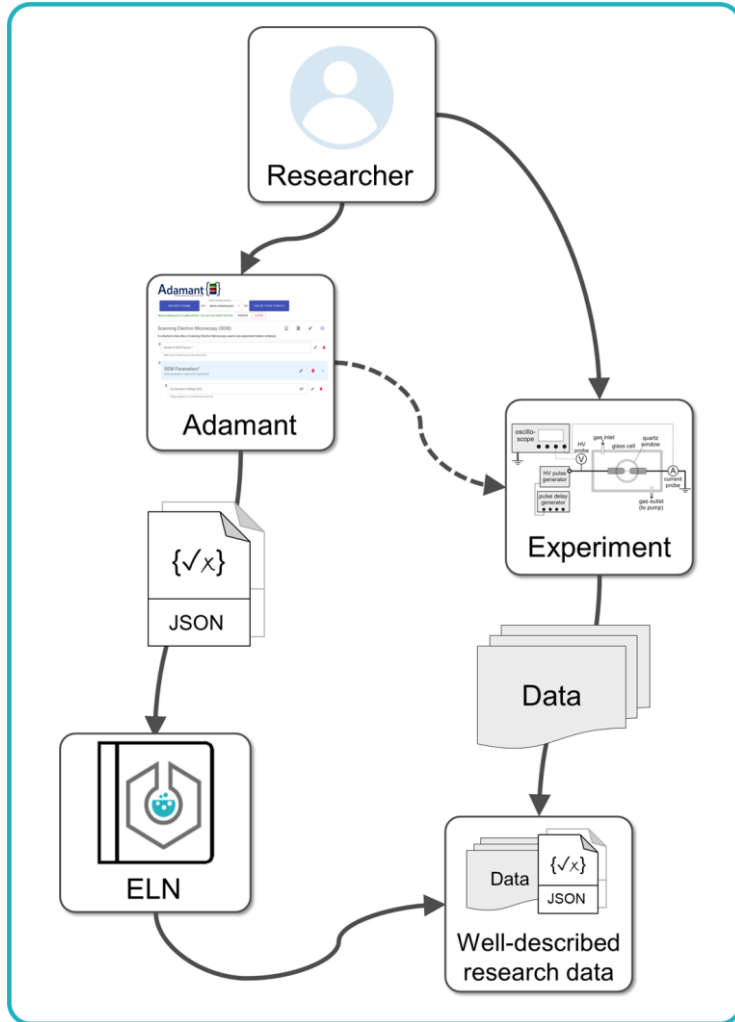
Acceleration Voltage [kV]	15
Working Distance [mm]	10
Probe Current [nA]	10

Human- and machine-readable metadata

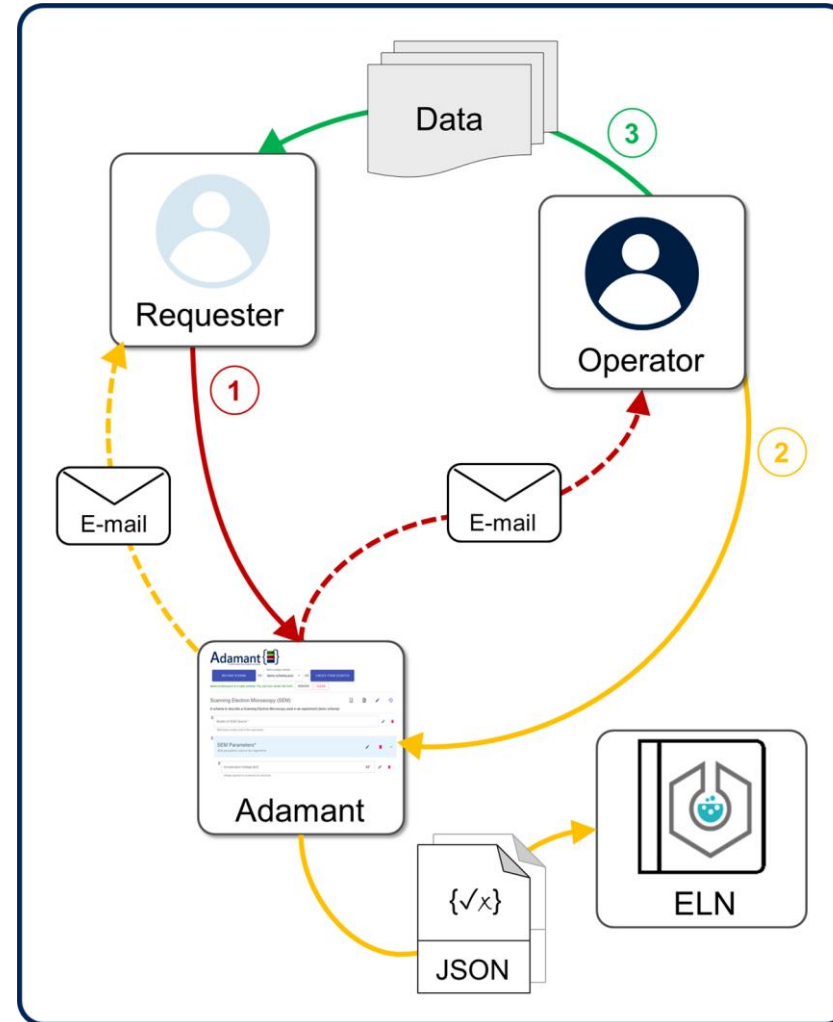
<https://plasma-mds.github.io/adamant/>

# Workflow implementations with Adamant

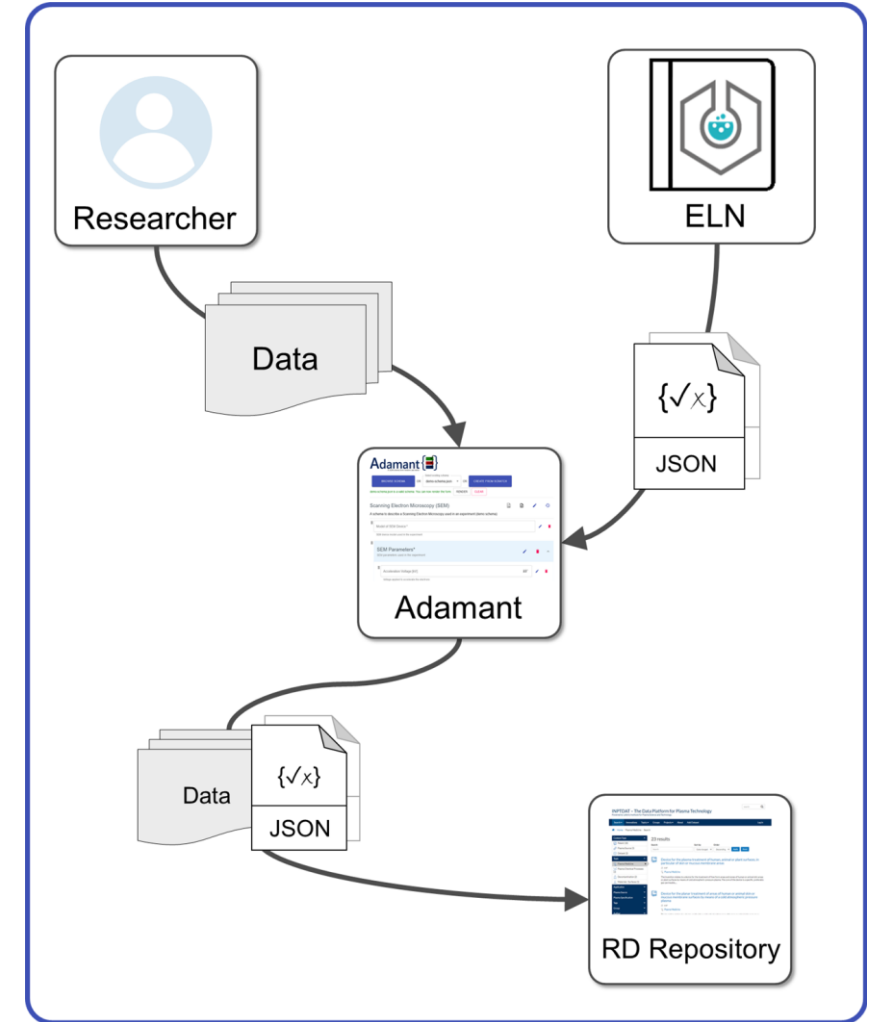
## Metadata collection



## Job request



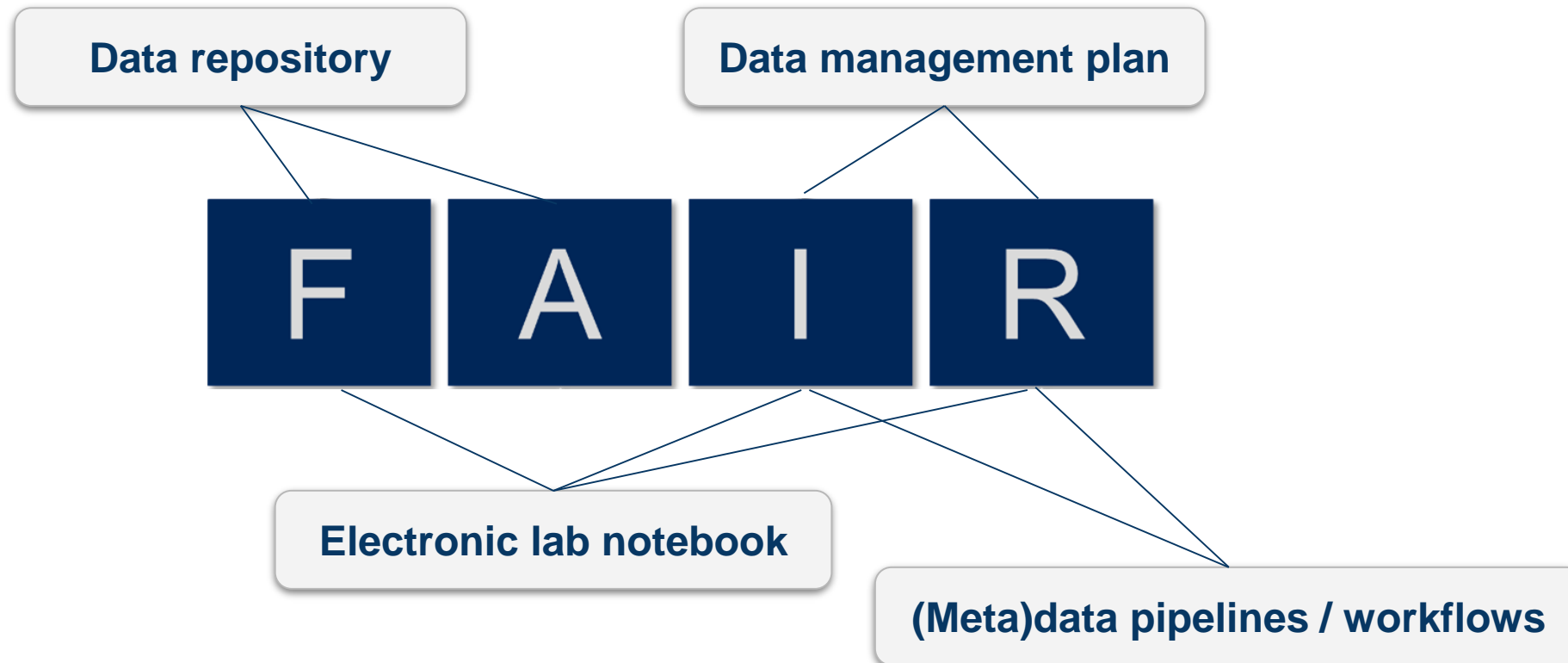
## Data publication





## Summary

- Many different aspects concerning FAIR principles already mentioned
- Different tools address different aspects of FAIR



- What can you pull out for yourself?
- More in the course of the workshop