



Data, Metadata, and FAIR

Max Novelli, data curation scientist

SIMS team (Scientific Information Management Systems)

ESS

About Me



Data Curation Scientist

SIMS team

Scientific Information Management Systems

Data Management and Software Center

European Spallation Source



Question #1 ...and #2



How do we manage
all this data?



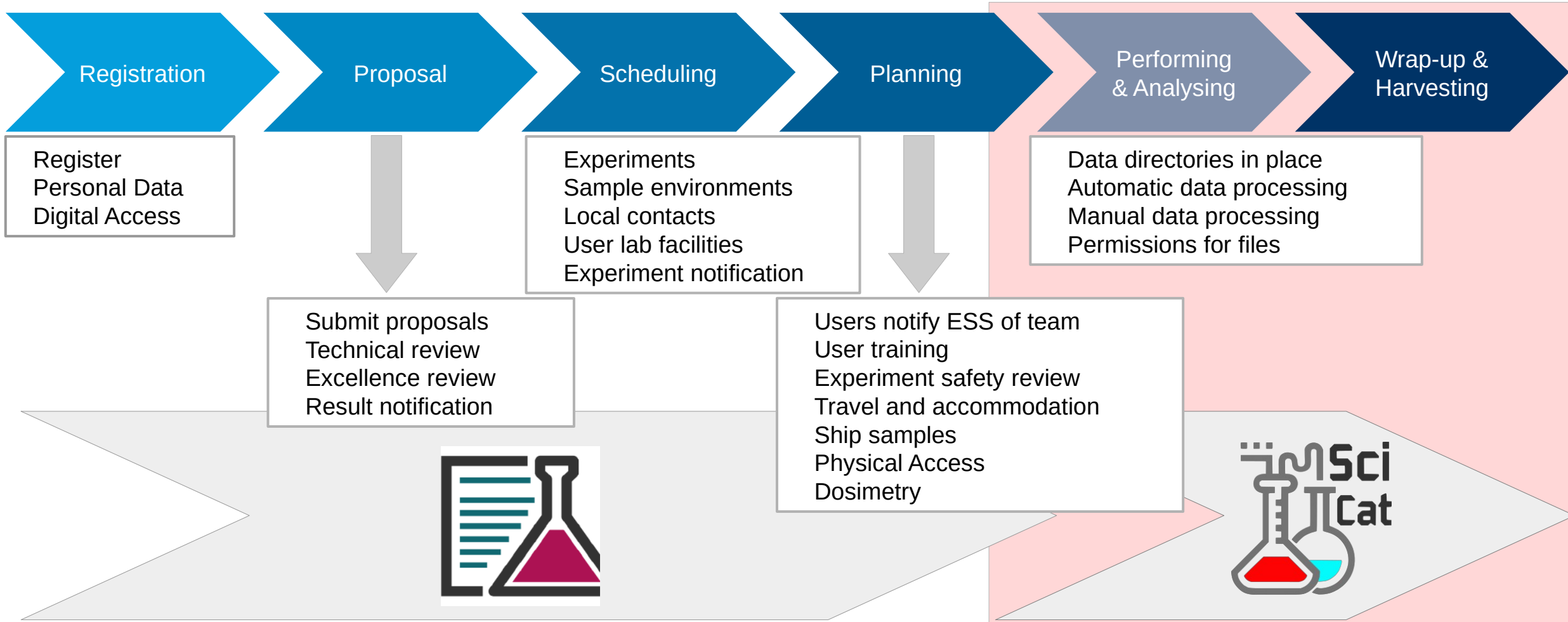
How do we deliver this
data to our users?

The journey

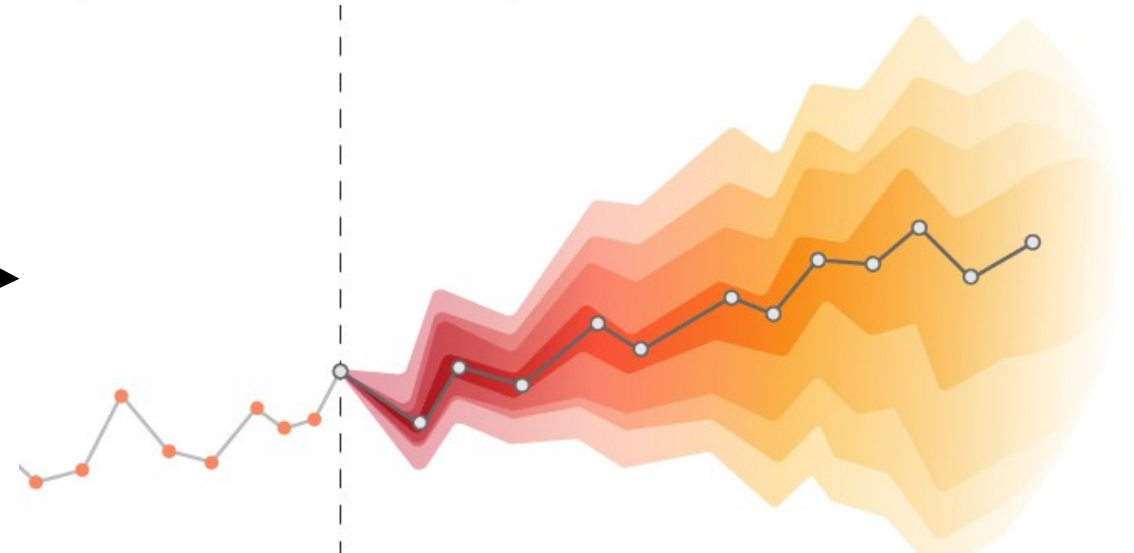
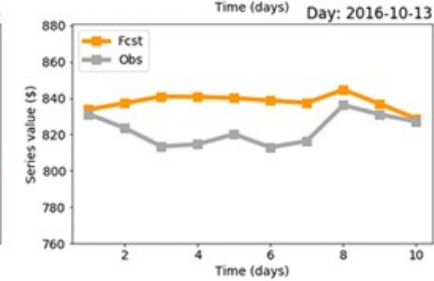
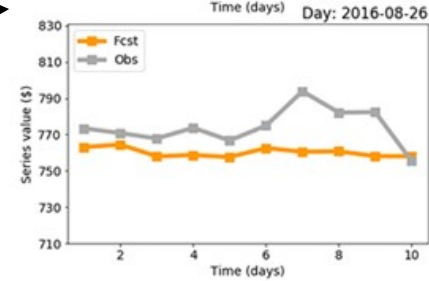
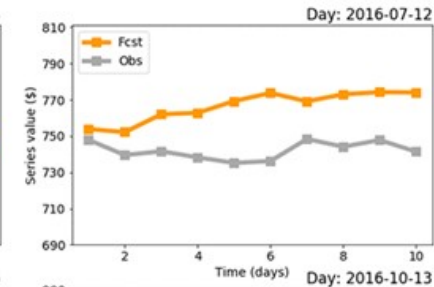
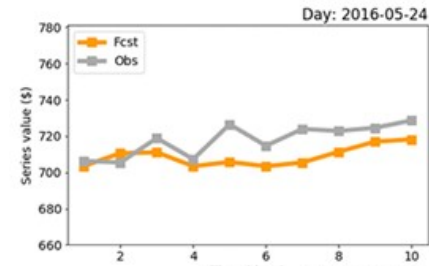


Brett Patzke on Unsplash

ESS User Journey



Experiment



Data: saving and transportation

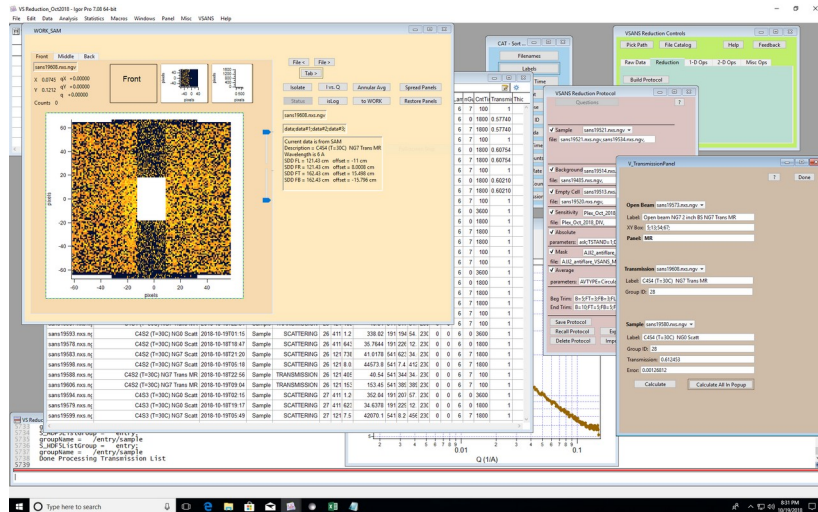


Experimental notes and log books



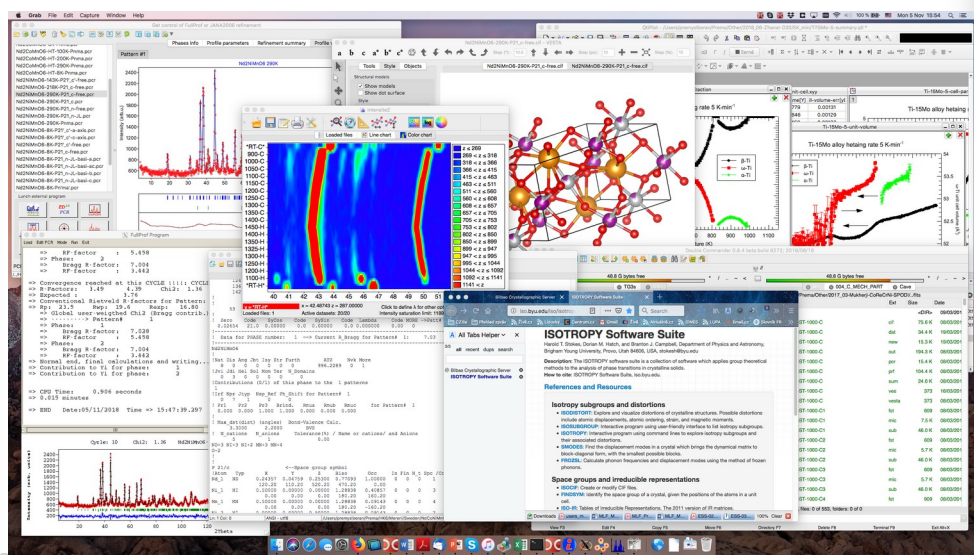
Date	Sample	Run number from	Run number to	Run time	Test (K)	Trag (K)	Team (K)	Mono	Doppler	Monitor	Comments
28/3/07	pure Mg O	22874		4						2.30	with 200E in 98mm capillary
28/3/07	pure Mg O	22875		4						2.20	
28/3/07	pure Mg O	22876		4						2.20	
28/3/07	pure Mg O	22877		4						2.20	
28/3/07	pure Mg O	22878		4						2.20	
28/3/07	pure Mg O	22879		4						2.20	
28/3/07	pure Mg O	22880		4						2.20	
28/3/07	pure Mg O	22881		4						2.20	
28/3/07	pure Mg O	22882		4						2.20	
28/3/07	pure Mg O	22883		4						2.20	
28/3/07	pure Mg O	22884		4						2.20	
28/3/07	pure Mg O	22885		4						2.20	
28/3/07	pure Mg O	22886		4						2.20	
28/3/07	pure Mg O	22887		4						2.20	
28/3/07	pure Mg O	22888		4						2.20	
28/3/07	pure Mg O	22889		4						2.20	
28/3/07	pure Mg O	22890		4						2.20	

reactor cycl: 2007-7
exper: 7-05-2807
page 1 of 2



$\text{C}_5\text{O}_{11} \cdot \text{CO}_2\text{H}_2$
mass of graphite = 12.24g
no of moles for 1 monolayer = $\text{Mg} \times \text{g} \times \text{at} \times \text{mole}$
area per molecule = $(n+4) \times 5.24 \text{ \AA}^2$
= $10 \times 5.24 = 52.4 \text{ \AA}^2$
mols for 1 mono = $12.24 \times 29.9 \times 10^{-20} \times 6.023 \times 10^{23}$
= 1.16×10^{-3} mols
RuM = 126
mass for 1 monol. = 0.14611 g
0.8 monolayers = 0.116888 g
mass added = 0.1189 g
Sealed under vacuum in glass vial
Annealed 170°C

Run number	Sample	head destination	head type	surface pressure	comments
41796	41799 D10			5.5	
41796	41797 D10			10.9	
41796	41798 D10			25	
41800	41801 D10			5.5	
41800	41802 D10			10.9	
41800	41803 D10			5.5	writing pressure
41800	41804 D10			25	
41800	41805 ACW			5.5	
41800	41806 ACW			10.9	
41800	41807 ACW			5.5	
41800	41808 ACW			10.9	
41800	41809 ACW			5.5	
41800	41810 ACW			10.9	
41800	41811 ACW			5.5	
41800	41812 ACW			10.9	
41800	41813 ACW			5.5	
41800	41814 ACW			10.9	
41800	41815 ACW			5.5	
41800	41816 ACW			10.9	
41800	41817 D10			5.5	C5O11
41800	41818 D10			10.9	C5O11
41800	41819 D10			5.5	C5O11
41800	41820 D10			10.9	C5O11
41800	41821 D10			5.5	C5O11
41800	41822 D10			10.9	C5O11
41800	41823 D10			5.5	C5O11
41800	41824 D10			10.9	C5O11
41800	41825 D10			5.5	C5O11
41800	41826 D10			10.9	C5O11
41800	41827 D10			5.5	C5O11
41800	41828 D10			10.9	C5O11
41800	41829 D10			5.5	C5O11
41800	41830 D10			10.9	C5O11
41800	41831 D10			5.5	C5O11
41800	41832 D10			10.9	C5O11
41800	41833 D10			5.5	C5O11
41800	41834 D10			10.9	C5O11
41800	41835 D10			5.5	C5O11
41800	41836 D10			10.9	C5O11
41800	41837 D10			5.5	C5O11
41800	41838 D10			10.9	C5O11
41800	41839 D10			5.5	C5O11
41800	41840 D10			10.9	C5O11
41800	41841 D10			5.5	C5O11
41800	41842 D10			10.9	C5O11
41800	41843 D10			5.5	C5O11
41800	41844 D10			10.9	C5O11
41800	41845 D10			5.5	C5O11
41800	41846 D10			10.9	C5O11
41800	41847 D10			5.5	C5O11
41800	41848 D10			10.9	C5O11
41800	41849 D10			5.5	C5O11
41800	41850 D10			10.9	C5O11
41800	41851 D10			5.5	C5O11
41800	41852 D10			10.9	C5O11
41800	41853 D10			5.5	C5O11
41800	41854 D10			10.9	C5O11
41800	41855 D10			5.5	C5O11
41800	41856 D10			10.9	C5O11
41800	41857 D10			5.5	C5O11
41800	41858 D10			10.9	C5O11
41800	41859 D10			5.5	C5O11
41800	41860 D10			10.9	C5O11
41800	41861 D10			5.5	C5O11
41800	41862 D10			10.9	C5O11
41800	41863 D10			5.5	C5O11
41800	41864 D10			10.9	C5O11
41800	41865 D10			5.5	C5O11
41800	41866 D10			10.9	C5O11
41800	41867 D10			5.5	C5O11
41800	41868 D10			10.9	C5O11
41800	41869 D10			5.5	C5O11
41800	41870 D10			10.9	C5O11
41800	41871 D10			5.5	C5O11
41800	41872 D10			10.9	C5O11
41800	41873 D10			5.5	C5O11
41800	41874 D10			10.9	C5O11
41800	41875 D10			5.5	C5O11
41800	41876 D10			10.9	C5O11
41800	41877 D10			5.5	C5O11
41800	41878 D10			10.9	C5O11
41800	41879 D10			5.5	C5O11
41800	41880 D10			10.9	C5O11
41800	41881 D10			5.5	C5O11
41800	41882 D10			10.9	C5O11
41800	41883 D10			5.5	C5O11
41800	41884 D10			10.9	C5O11
41800	41885 D10			5.5	C5O11
41800	41886 D10			10.9	C5O11
41800	41887 D10			5.5	C5O11
41800	41888 D10			10.9	C5O11
41800	41889 D10			5.5	C5O11
41800	41890 D10			10.9	C5O11
41800	41891 D10			5.5	C5O11
41800	41892 D10			10.9	C5O11
41800	41893 D10			5.5	C5O11
41800	41894 D10			10.9	C5O11
41800	41895 D10			5.5	C5O11
41800	41896 D10			10.9	C5O11
41800	41897 D10			5.5	C5O11
41800	41898 D10			10.9	C5O11
41800	41899 D10			5.5	C5O11
41800	41900 D10			10.9	C5O11



Evident Results

Papers



Spectroscopic neutron imaging for resolving hydrogen dynamics changes in battery electrolytes

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Lithium-ion electrolyte materials

ABSTRACT

We present the use of spectroscopic neutron imaging (SNI), a bridge between imaging and scattering techniques, for analyzing battery electrolytes. The scattering information of CH_n-based organic solvents and electrolytes was mapped in a two-dimensional space through time-of-flight neutron imaging, which exploits the wavelength-dependent properties of hydrogen atoms. The results show partial solidification and concentration change of electrolyte as a function of temperature. Our investigation demonstrates a novel approach to tracking real-time physical and chemical changes in H-containing compounds, by which limitations of new electrolyte mixtures and additives can be evaluated. The sensitivity of SNI to hydrogen in CH_n functional groups extends the use of spectral methods to inspect electrolytes in Li-ion batteries and organic solvents for relevant applications beyond electrochemical systems.
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1. Introduction

Capabilities of neutron imaging (NI) have been significantly expanded with the advent of energy-resolved neutron imaging, which has become an essential tool for non-destructive material characterization [1–5], including studies of electrochemical energy storage and conversion devices [6,7]. The particular advantage of NI to investigate light elements of technological importance, i.e., hydrogen and lithium, even in *operando* processes has contributed to the improvements of green mobility technologies such as fuel cells [8,9] and lithium-ion batteries [10] (LIBs).

Electrodes in LIBs have been extensively studied by conventional (white-beam) NI [11–15], and energy-resolved NI has been effective in determining the state-of-charge via Bragg-edge analysis [16,17]. Physical or chemical changes in the electrolytes, on the other hand, are typically studied using spectroscopic techniques including Raman, nuclear magnetic resonance, and Fourier-transform infrared spectroscopies [18–22]. However, these techniques usually require specifically designed cells or involve complicated procedures to extract the electrolytes. Therefore, it is common to perform *post-mortem* mimicking *operando* conditions. Neutron instrumentation development (detection systems [2,23–26], methods [2,27,28]) narrowed the gap [29,30] between information accessible by imaging and scattering techniques [31–33], which lead to the design of new beamlines (e.g., ODIN, ESS [31]) to exploit new opportunities, especially in the NI field. In this work, we demonstrate that a study of battery electrolytes

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E-mail address: pierre.boillat@psi.ch (P. Boillat).

Less Evident Results



Data Loss



Missed Opportunity to Increase Value

So... then...

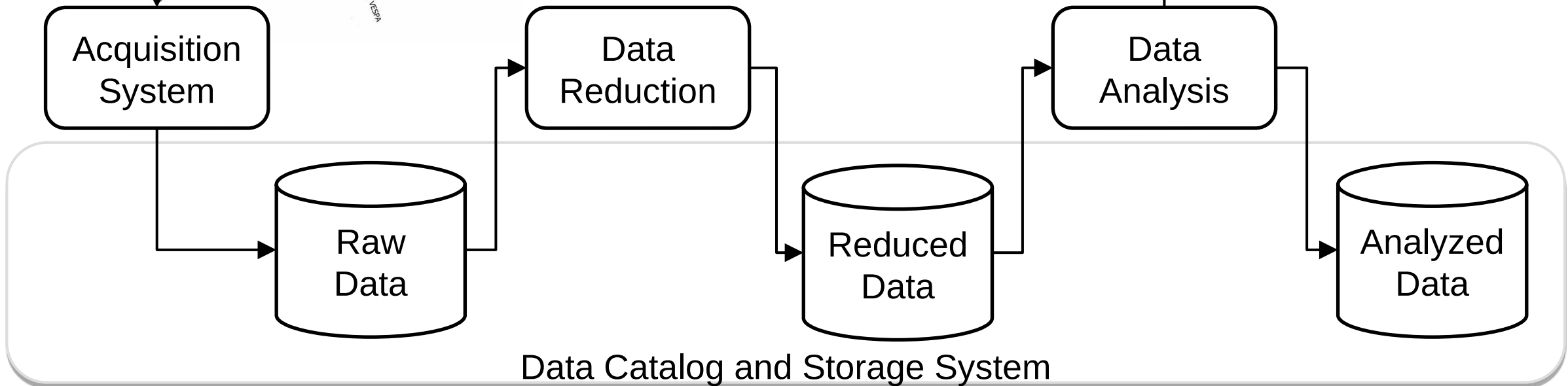
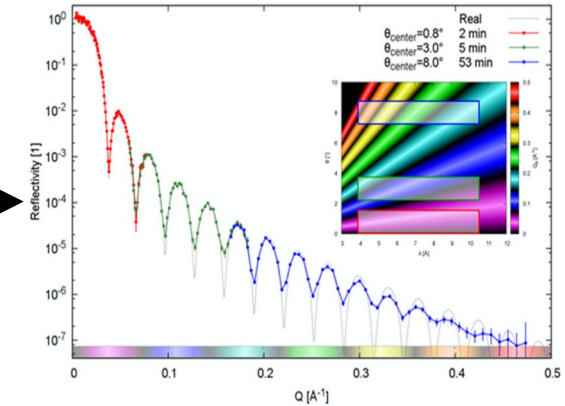
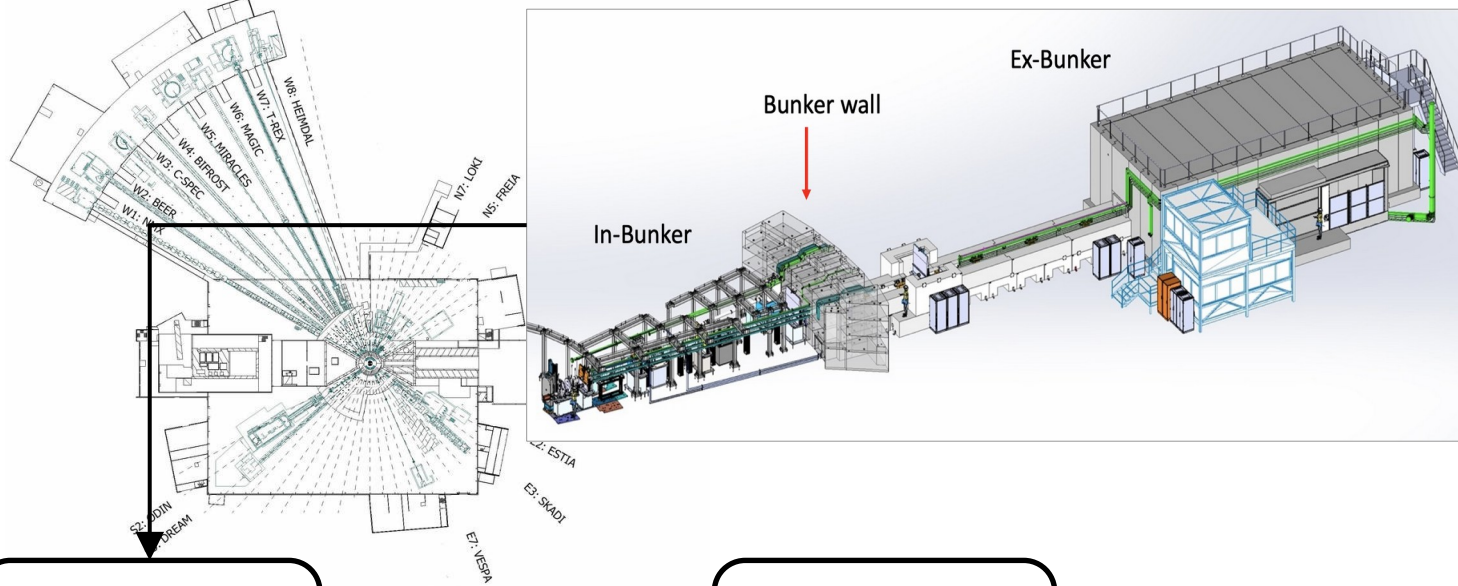


Our Vision

...and of the funding agencies



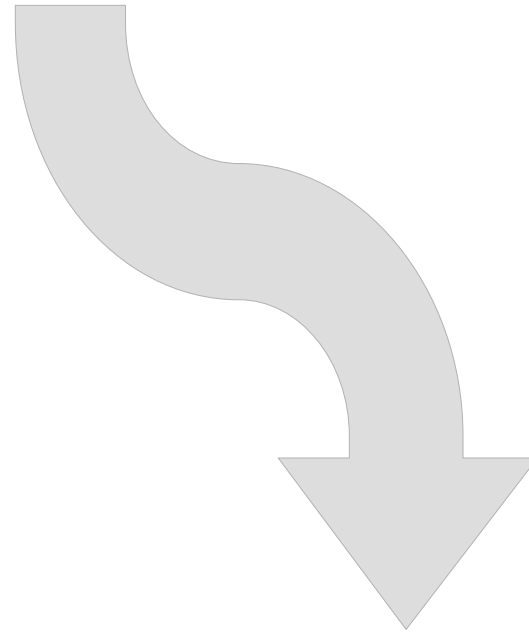
Data Journey



Paradigm Shift



MY DATA



**OUR COLLECTIVE DATA
(TAXPAYER FUNDED DATA)**



FAIR data

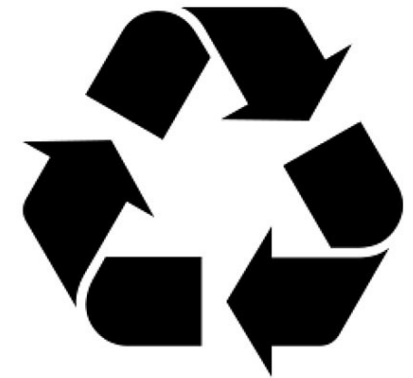
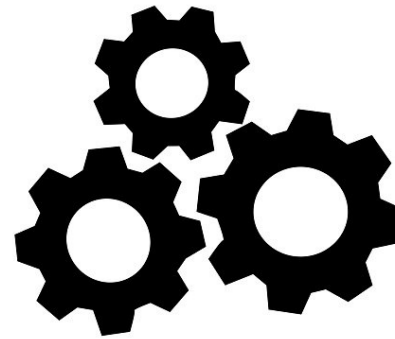


F
Findable

A
Accessible

I
Interoperable

R
Reusable



<https://www.go-fair.org/fair-principles/>

TRUSTed Repositories



<https://www.nature.com/articles/s41597-020-0486-7>

Open data



<https://data.europa.eu>

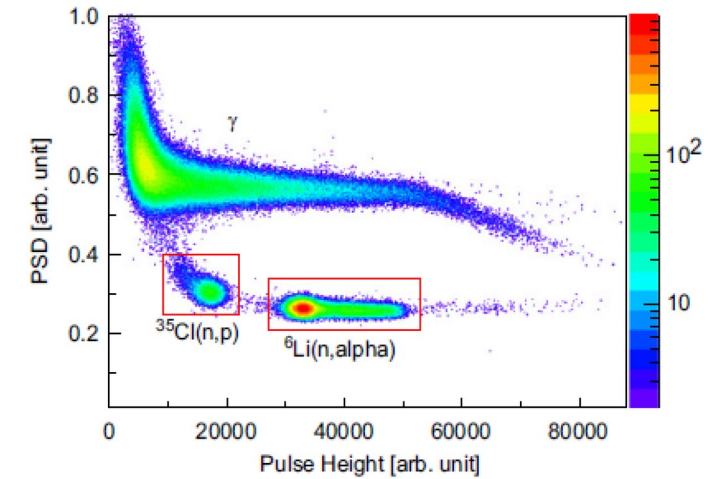
How do we get there?



Key concepts



Data



Metadata

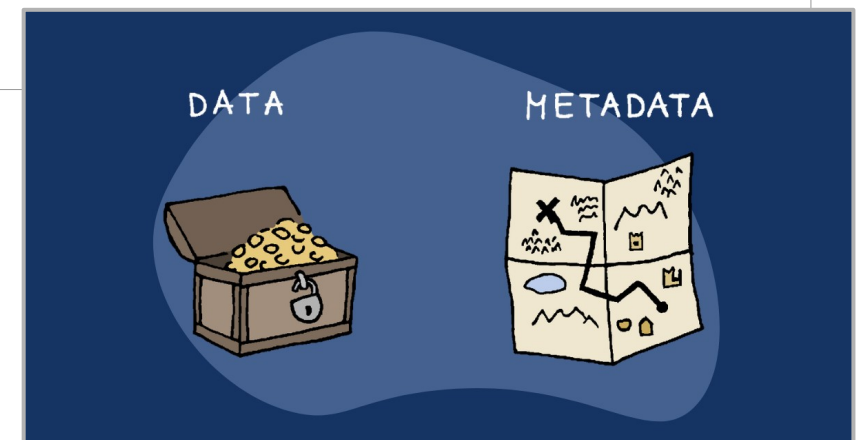
Data



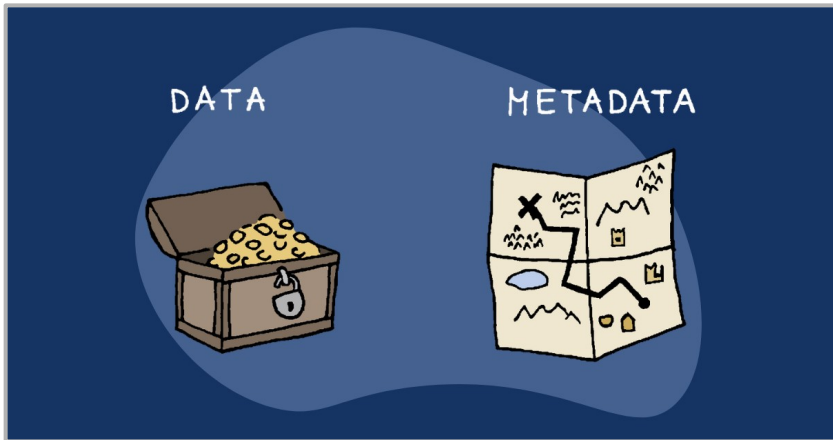
Data is a collection of discrete or continuous values that convey information, describing the quantity, quality, facts, statistics, other basic units of meaning, or simply sequences of symbols that may be further interpreted formally.

Such information is saved in one or multiple files which are generated during the experimental data acquisition or in relation to that time window.

<https://en.wikipedia.org/wiki/Data>



Metadata



Metadata is data that provides information about other data

<https://en.wikipedia.org/wiki/Metadata>

Metadata are any information saved in the data catalog and available to the user to search for and retrieve the specific information she is looking for

Dataset



- A **Dataset** is a collection of multi-modal items which:
- share a common purpose
 - were collected for a specific purpose,
 - describes an individual event or a series of events or an experiment,
 - pertains to the same experimental data collection.



Metadata



Metadata can be:

- a duplicate of any piece of data contained in the linked data files, as long it is of small size.
- any derived information that results from any type of data aggregation (like average, min, max or something more complex) performed on information contained in the linked data files
- any qualitative or quantitative information that has been collected or discovered at a later stage, which is relevant to describe and facilitate finding the dataset itself.

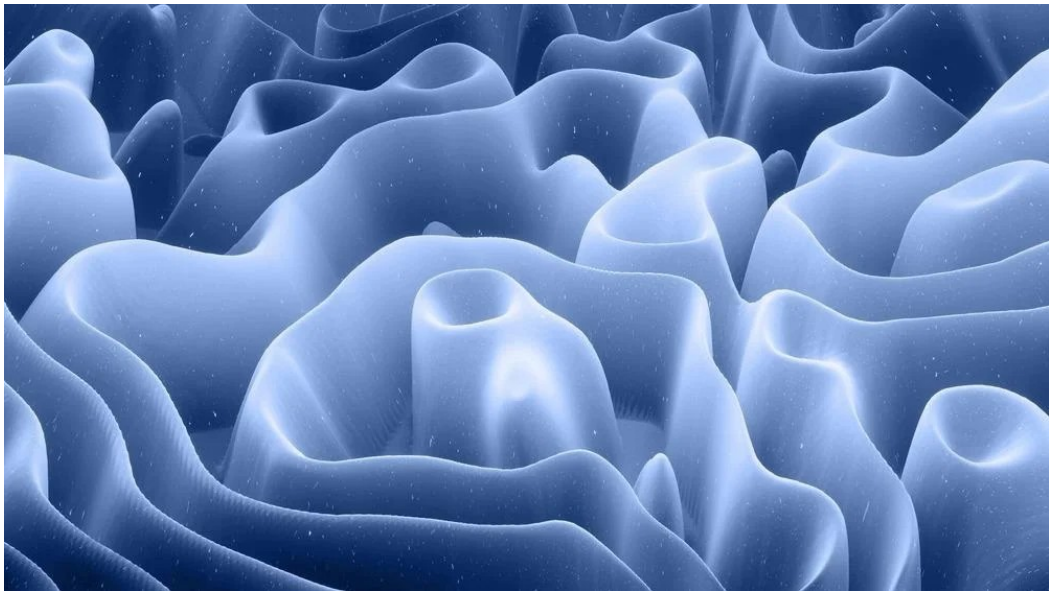


Metadata has to be relevant for the future utilization of the data.

Minimum Viable Metadata Set



The minimum set of key/values, descriptors that provides the best description of a dataset but is not overwhelming to use, search and maintain.



Metadata is an ever changing set of information.

They varies depending on:

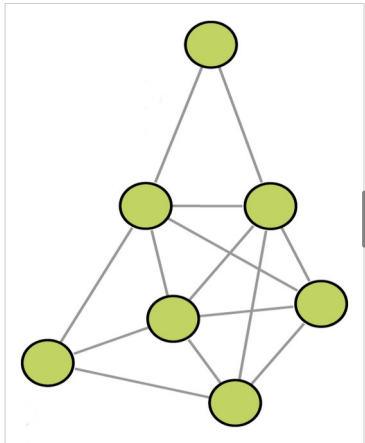
- Intended usage
- Stakeholder
- Domain knowledge

Data Curation



Data curation is the effort to organize and integrate data collected from various sources in a single entity, called dataset

https://en.wikipedia.org/wiki/Data_curation



Enrichment and Enhancement



Data Curation: example



Column 1
Connector 3
Channel B
Blue cable
Left light
Unknown
Resolution



Units
Which will be Metadata
Which aggregation
Other questions?

Sample Temperature
Temperature Controller 1
Sample position X axis
Light detector
Tomography light source
Slit position Y
Sample position resolution

Data Curation: understanding data

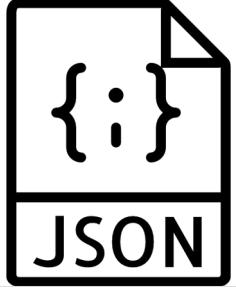


```
children:
  0:
    name: "entry"
    type: "group"
    attributes:
      0:
        name: "NX_class"
        dtype: "string"
        values: "NXentry"
    children:
      0:
        module: "dataset"
        config:
          name: "definition"
          values: "NXtomo"
          dtype: "string"
        1:
          module: "dataset"
          config:
            name: "experiment_identifier"
            values: "616254"
            dtype: "string"
        2:
          module: "dataset"
          config:
            name: "title"
            values: "odin"
            dtype: "string"
        3:
          config:
            name: "entry_identifier"
            values: "1967"
            dtype: "string"
            module: "dataset"
        4:
          config:
            name: "entry_identifier"
            values: "363d5bb4-e065-"
            dtype: "string"
            module: "dataset"
        5:
          name: "instrument"
          rroup: "group"
          NX_class: "string"
          Xinstrument: "string"
```

entry	["odin"]	NXentry			
daq_publication		NXcite			
~ bibtex	["@article..."]	string	1		
~ description	["Neutron..."]	string	1		
~ doi	["https://..."]	string	1		
~ endnote	["%0 Jour..."]	string	1		
data		NXdata			
~ rotation_angle		NXlog			
~ alarm_message	[""]	string	0		
~ alarm_severity	[""]	int16	0		
~ alarm_time	[""]	uint64	0		
~ average_value	["[]"]	float64	1		
~ connection_status	[""]	int16	0		
~ connection_status_time	[""]	uint64	0		
~ cue_index	[""]	int32	0		
~ cue_timestamp_zero	[""]	uint64	0		
~ maximum_value	["[]"]	float64	1		
~ minimum_value	["[]"]	float64	0		
~ time	[""]	uint64	1		
~ value	[""]	float64	0 x 1		
~ definition	["NXtomo"]	string	1		
~ entry_identifier	["1967"]	string	1		
~ entry_identifier_uid	["363d5b..."]	string	1		
~ experiment_identifier	["616254"]	string	1		
instrument	["ODIN"]	NXinstrument			
~ analyzer		NXPolarizer			
~ beam_monitor_1		NXmonitor			
~ beam_monitor_2		NXmonitor			
~ beam_monitor_3		NXmonitor			
~ beam_monitor_4		NXmonitor			
~ bpc1		NXdisk_chopper			
~ bpc2		NXdisk_chopper			
~ event_mode_detectors		NXdetector_group			
~ foc1		NXdisk_chopper			
~ alarm_message	[""]	string	0		

Can we leverage well defined metadata to:

- facilitate finding relevant information in the NeXus data files?
- expose some aggregated value to make the data more FAIR?



<https://www.nexusformat.org/>

Which tool can help us in our data journey?



Tools: Metadata Catalog



<https://scicatproject.github.io/>

<https://github.com/scicatproject>

<https://scicatproject.github.io/documentation>

International collaboration



SciCat Dataset Details



Datasets / [20.500.12269/2664269e-dfa7-4beb-b180-40dc766440e7](#) /

Details

Datafiles

Related Datasets

Logbook

Lifecycle

General Information

Name Uncalibrated nexus 60394 60395

Description Uncalibrated nexus from EFU processing with null calibration. Trans 60394. Sans 60395

PID 20.500.12269/2664269e-dfa7-4beb-b180-40dc766440e7

Type derived

Creation Time 2023-07-12 14:21

Keywords LOKI legacy small angle neutron scattering sans Uncalibrated nexus Data

Creator Information

Owner Judith Houston

Investigator Judith Houston

Orcid orcid.org/0000-0001-5205-3620

Contact Email max.novelli@ess.eu

Owner Group loki

Access Groups ecdc,swap,dram,ess

Scientific Metadata

Name	Value
Sample	ISIS polymer
Trans Id	60394
Sans Id	60395
Original Comment	60395 = negative tof
Trans Intensity	
Sans Intensity	
Run	THIRD
Trans Peak Intensity	
Sans Peak Intensity	
Trans Negative Tof	false
Sans Negative Tof	true
Trans Too High	false
Sans Too High	false
Data Type	Uncalibrated nexus

Publishing Data in SciCat



test

Help

About



6



Henrik Johansson

Published Datasets / [10.5072/2d629944-9792-449c-ab54-3feb9bd5ccaa](#) /

Publication Status

Status pending_registration

Register

About the published data

Title Demo
Creator List clement
Abstract Demo
DOI 10.5072/2d629944-9792-449c-ab54-3feb9bd5ccaa
URL doi2.psi.ch/detail/10.5072/2d629944-9792-449c-ab54-3feb9bd5ccaa

Administrative metadata

User ldap.Henrik Johansson
Creator clement
Data Description None
Dataset IDs 20.500.12269/BCMFEAcceptance_297_2020-07-14-17-04-37_3,20.500.12269/BCMFEAcceptance_297_2020-07-14-17-04-37_2,20.500.12269/BCMFEAcceptance_297_2020-07-14-17-04-37_1
Publisher ESS
Resource Type raw



Digital Object Identifier

How can we foster adoption and data usage?



Tools: language libraries



Scitacean is a high level Python package for downloading and uploading datasets from and to SciCat.

End user, data exploration, interactive

<https://github.com/SciCatProject/scitacean>

<https://scicatproject.github.io/scitacean/>

Scitacean in Jupyter Notebook



sfi_generator_v2.ipynb x SIMS_create_dataset_1.ipynb x +

Open in... Python 3 (ipykernel)

```
[11]: test_dataset_for_upload
```

[11]: RawDataset

Name	Type	Value	Description
* creation_time	datetime	2023-11-13 12:41:55+0000	Time when dataset became fully available on disk, i...
* source_folder	RemotePath	RemotePath('/ess/data/dmsc_summer_school/2023/872583d3-1537-4a3f-b...	Absolute file path on file server containing the files ...
description	str	Static webpages and php is out to hunt you!!! Wait now it seems that there is...	Free text explanation of contents of dataset.
name	str	The power of SWAP on this day and time 2023-11-13T12:41:55.135647	A name for the dataset, given by the creator to carry...
🔒 pid	PID	None	Persistent Identifier for datasets derived from UUID...
proposal_id	str	018727	The ID of the proposal to which the dataset belongs.
sample_id	str	None	ID of the sample used when collecting the data.

▶ Advanced fields

▼ Files: 1 (9.77 kiB)

Local	Remote	Size
test_10k.bin	None	9.77 kiB

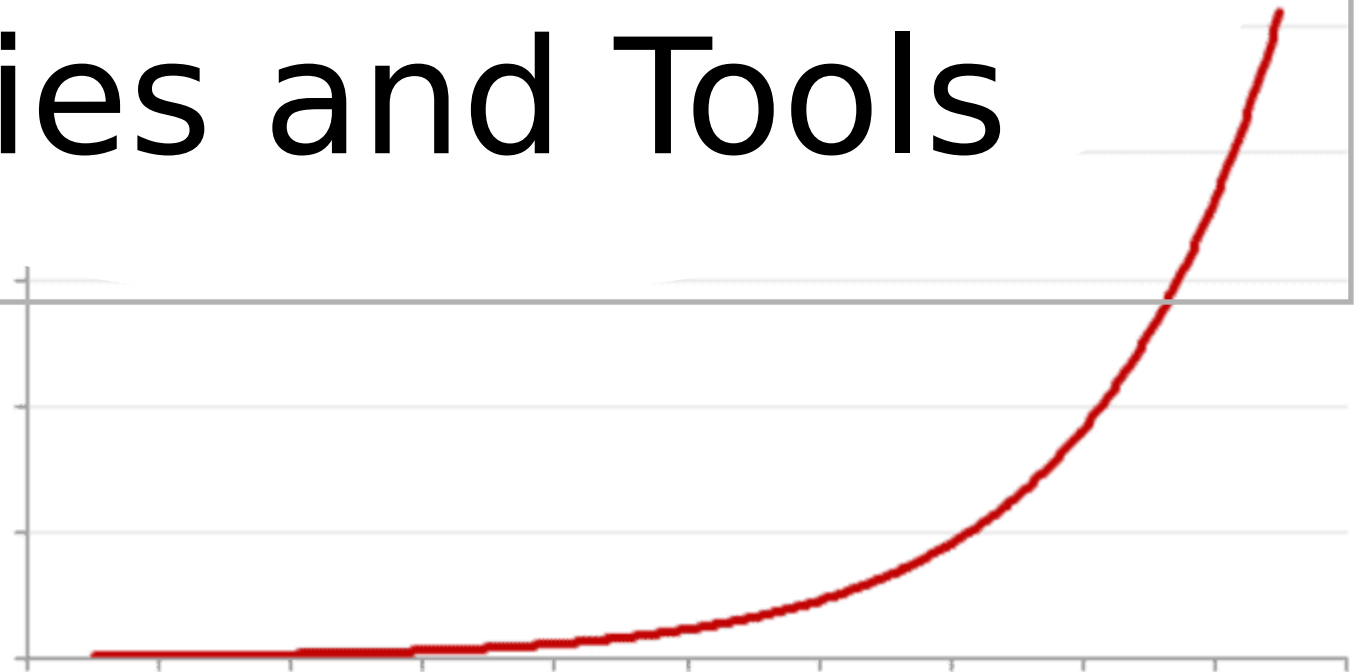
▼ Scientific Metadata

Name	Value
weather_of_today	beach day []
date	2023/11/13 []
time	12:41:58 []
coffee_break_duration	7860 [seconds]
distance_from_the_coffe_machine	34 [m]

Why?



Miximizing Scientific Output Foster Innovation Methodologies and Tools

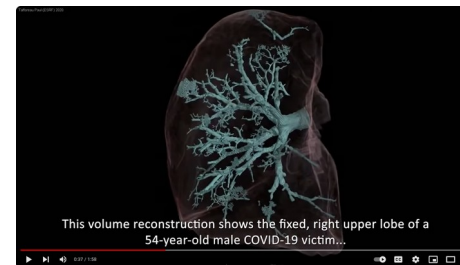


Use Cases



Greg Razoky on Unsplash

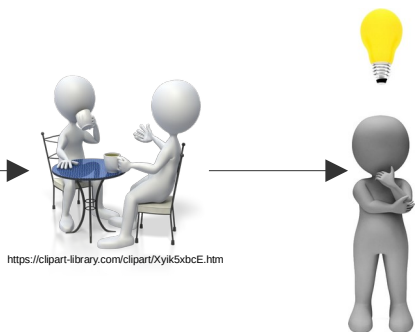
Use case: Story One



https://www.youtube.com/watch?v=wI_kfKrfDD8



<https://perchance.org/ai-text-to-image-generator>

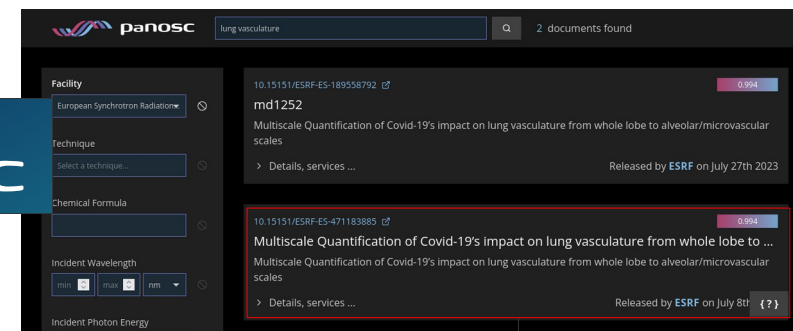


<https://clipart-library.com/clipart/Yyik5xbE.htm>

Covid-19 (whole) lung vasculature



<https://www.panosc.eu/>



<https://data.panosc.eu/search/?q=lung+vasculature&facility=ESRF>



The European Synchrotron
<https://www.esrf.fr>

Session **Restricted access**

Multiscale Quantification of Covid-19's impact on lung vasculature from whole lobe to alveolar/microvascular scales

Lee, Peter; Marussi, Sebastian; Tafforeau, Paul; Xian, Rui

Multiscale Quantification of Covid-19's impact on lung vasculature from whole lobe to alveolar/microvascular scales

Experimental Data	Experimental Report
The data are under embargo until 2024 but could be released earlier. Currently, they are only accessible to proposal team members. Access data for experimental team	One report has been found for this proposal. 94736_C.pdf

<https://data.esrf.fr/doi/10.15151/ESRF-ES-471183885>

Tafforeau, P., Walsh, C., Wagner, W. L., R. Patrick Xian, Verleden, S. E., Daniyal J. Jafree, Bellier, A., Werlein, C., Kühnel, M. P., Boller, E., Walker-Samuel, S., Robertus, J. L., Long, D. A., Jacob, J., Marussi, S., Emmeline Brown, Holroyd, N., Jonigk, D. D., Ackermann, M., & Lee, P. D. (2021). Complete left lung from the body donor LADAF-2020-27 (Version 1) [dataset]. European Synchrotron Radiation Facility. doi.org/10.15151/ESRF-DC-572196058

Data Collection **Open access**

Complete left lung from the body donor LADAF-2020-27

Paul Tafforeau; Claire Walsh; Willi L. Wagner; R. Patrick Xian; Stijn E. Verleden; Daniyal J. Jafree; Alexandre Bellier; Christopher Werlein; Mark P. Kühnel; Elodie Boller; Simon Walker-Samuel; Jan Lukas Robertus; David A. Long; Joseph Jacob; Sebastian Marussi; Emmeline Brown; Natalie Holroyd; Danny D. Jonigk; Maximilian Ackermann; Peter D. Lee

Complete scan at 25.08um performed by HIP-CT on the beamline BM05 of the left lung from the body donor LADAF-2020-27 using quarter-acquisition protocol.

Experimental Data	Experimental Report
The data can be accessed by clicking on the link below Access data	One report has been found for this proposal. 94736_C.pdf

<https://data.esrf.fr/doi/10.15151/ESRF-DC-572196058>

Use case: Story two



Human Organ Atlas EXPLORE SEARCH 3D RECONSTRUCTIONS HELP ← BACK

Complete left lung from the body donor LADAF-2020-27

Description
Complete scan at 25.08um performed by HIP-CT on the beamline BM05 of the left lung from the body donor LADAF-2020-27 using quarter-acquisition protocol.

DOI [10.15151/ESRF-DC-572196058](https://doi.org/10.15151/ESRF-DC-572196058)

Users
Paul Tafforeau, Claire Walsh, Willi L. Wagner, R. Patrick Xian, Stijn E. Verleden, Daniyal J. Jafree, Alexandre Bellier, Christopher Werleins, Mark P. Kühnel, Elodie Boller, Simon Walker-Samuel, Jan Lukas Robertus, David A. Long, Joseph Jacob, Sebastian Marussi, Emmeline Brown, Natalie Holroyd, Danny D. Jonigk, Maximilian Ackermann, Peter D. Lee

Technique
Hierarchical Phase-Contrast Tomography

Instrument
BM05, ESRF

Download files with Globus

- ZIP 25.08um_LADAF-2020-27_lung-left_pag-0.11_0.25_jp2_... 62.4 GB
- ZIP 50.16um_LADAF-2020-27_lung-left_pag-0.11_0.25_jp2_... 7.8 GB
- ZIP 100.32um_LADAF-2020-27_lung-left_pag-0.11_0.25_jp2_... 974.8 MB
- ZIP 200.64um_LADAF-2020-27_lung-left_pag-0.11_0.25_jp2_... 121.7 MB
- JPG pictures/IMG_4814 6.8 MB
- JPG pictures/IMG_4818 6.0 MB

<https://human-organ-atlas.esrf.eu/datasets/572195982>

panosc lung vasculature 2 documents found

Facility
European Synchrotron Radiator

Technique
Select a technique

Chemical Formula

Incident Wavelength

Incident Photon Energy

10.15151/ESRF-ES-189558792 [0.994](#)
md1252
Multiscale Quantification of Covid-19's impact on lung vasculature from whole lobe to alveolar/microvascular scales
> Details, services ... Released by ESRF on July 27th 2023

10.15151/ESRF-ES-471183885 [0.994](#)
Multiscale Quantification of Covid-19's impact on lung vasculature from whole lobe to ...
> Details, services ... Released by ESRF on July 8th (?)

<https://data.panosc.eu/search/?q=lung+vasculature&facility=ESRF>

Article | [Open Access](#) | [Published: 04 November 2021](#)

Imaging intact human organs with local resolution of cellular structures using hierarchical phase-contrast tomography

[C. L. Walsh](#) [P. Tafforeau](#), [Walker-Samuel](#), [J. L. Robertus](#), [Ackermann](#) & [P. D. Lee](#)

Nature Methods **18**, 1532-1541 (2021) | [View Article](#) | [View Abstract](#)

97k Accesses | 61 Citations

<https://doi.org/10.1038/s41592-021-01317-x>

Resolution	Sample	DOI	Energy	Size	Time
25.08 μm	Complete organ	10.15151/ESRF-DC-572196058	~93 keV	145	24
35.35 μm	FSC A&B	10.15151/ESRF-DC-572221247	~88 keV	145	1.8

Data Collection [Open access](#)

Complete left lung from the body donor LADAF-2020-27

Paul Tafforeau; Claire Walsh; Willi L. Wagner; R. Patrick Xian; Stijn E. Verleden; Daniyal J. Jafree; Alexandre Bellier; Christopher Werleins; Mark P. Kühnel; Elodie Boller; Simon Walker-Samuel; Jan Lukas Robertus; David A. Long; Joseph Jacob; Sebastian Marussi; Emmeline Brown; Natalie Holroyd; Danny D. Jonigk; Maximilian Ackermann; Peter D. Lee

Complete scan at 25.08um performed by HIP-CT on the beamline BM05 of the left lung from the body donor LADAF-2020-27 using quarter-acquisition protocol.

Experimental Data
The data can be accessed by clicking on the link below
[Access data](#)

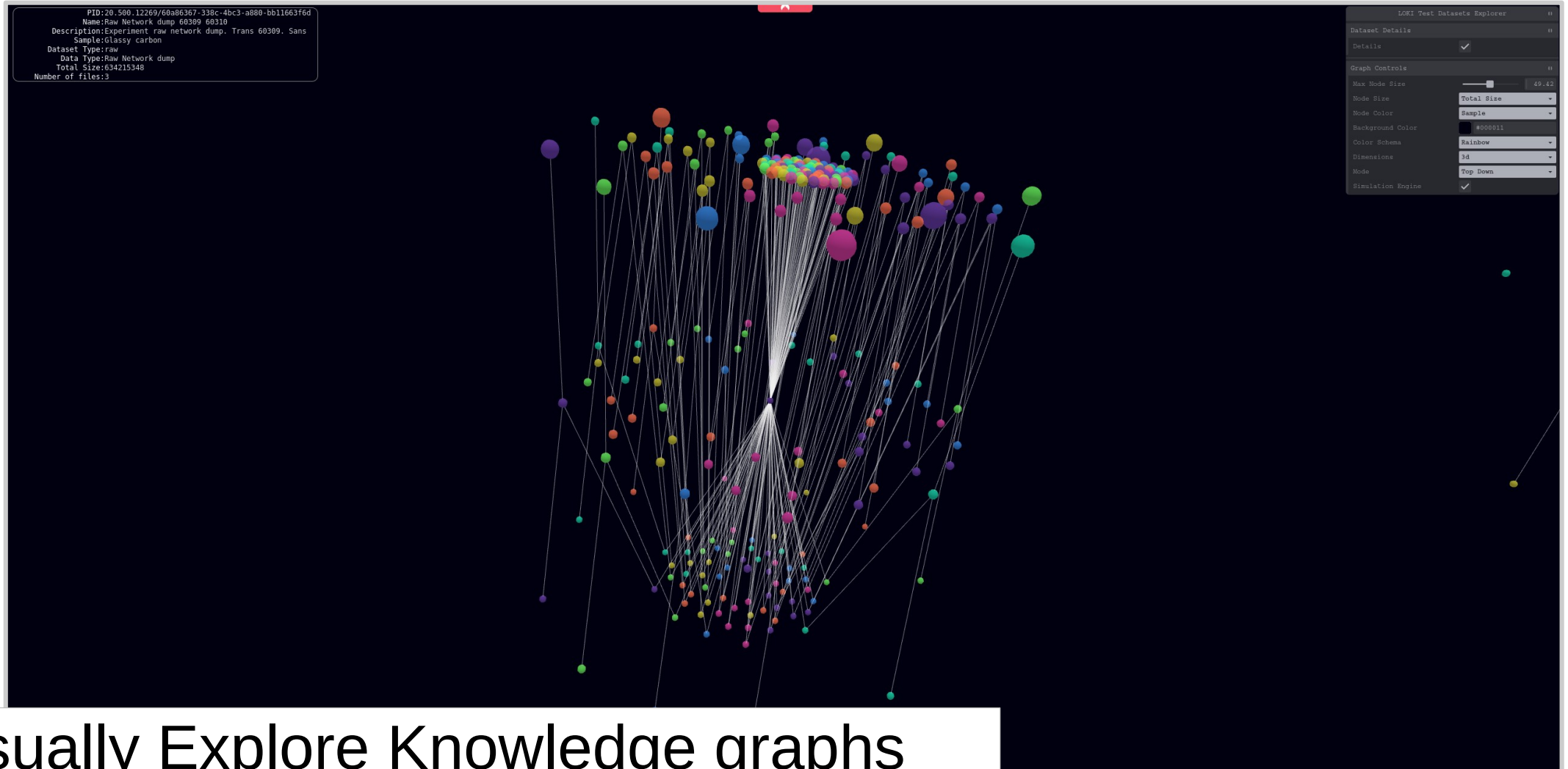
Experimental Report
One report has been found for this proposal.
[94736_C.pdf](#)

<https://data.esrf.fr/doi/10.15151/ESRF-DC-572196058>

- <https://www.nature.com/articles/s41596-023-00804-z>
UK, DE - 2023
- <https://doi.org/10.1016/j.ebiom.2022.104296>
DE, UK, BE, CH, US - 2022
- <https://doi.org/10.1016/j.lanep.2022.100330>
DE - 2022
- <https://doi.org/10.1164/rccm.202206-1041ST>
US, EU, JP, CL, ... - 2022
- <https://doi.org/10.48550/arXiv.2211.06689>
CN - 2022
- <https://doi.org/10.48550/arXiv.2209.15180>
CN - 2022
- <https://doi.org/10.1101/2022.12.03.518948>
CN - 2022

- Data Preparation
- Disease Analysis
- Data Compression Techniques

New exploratory tools



Visually Explore Knowledge graphs

New methodologies



We are constrained by the boundaries of our domain knowledge and experience.

Only by opening our data to actors from different fields and domains, we can further push innovation beyond the borders of our knowledge and comfort zone.

Think about Machine Learning, AI and visualization.

Example : **kaggle** <https://www.kaggle.com/>

FAIR Open Data Benefits and Challenges



Benefits

- Easy discovery of other resources
- Hidden connections
- Increase scientific output and better science quality
- Driving innovation and best practices
- Longer data life and better data quality

Challenges

- Data access and sharing
- Proper data curation
- Cross institution and cross national collaboration
- Right tools for the job



Call to Action

Talk to your data curation expert.
Include all your stakeholders in the discourse.
Prioritize FAIRness of your data.
Increase the value of your data.



Exercise 1



In small groups, discuss and list few properties of the objects shown below



Mister Babache



<http://www.pegani.dk>

Exercise 2



How could you find all the balls that are intact and of the same color?

Which minimum viable metadata set would you use?

<https://stock.adobe.com>

Exercise 3



Which questions would you ask to capture the minimum viable metadata set for the objects shown below?



<https://www.santafixie.dk>



Thank you

Questions?

Max Novelli
max.novelli@ess.eu