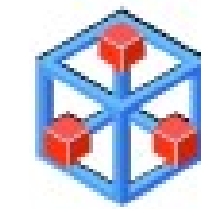


CALLISTO: A SEMANTIC-BASED PLATFORM FOR SHARING FAIR SCIENTIFIC DATA

<https://callisto.calmip.univ-toulouse.fr>

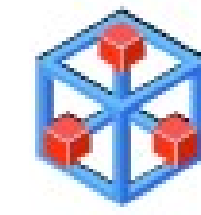
1ST WORKSHOP ON ONTOLOGIES FOR FAIR AND FAIR ONTOLOGIES (ONTO4FAIR)
TUESDAY, SEPTEMBER 13, 2022 VIENNA





Overview:

- 1- Foreword on the running example. Which data, which requirements?
- 2- CALLISTO architecture
- 3- Functionalities
- 4- Summary
- 5- Conclusion



Smart Morphing and Sensing (SMS) data

Data associated to the form of the wing and of the high-lift flap: example - Take-off from Toulouse-Blagnac airport

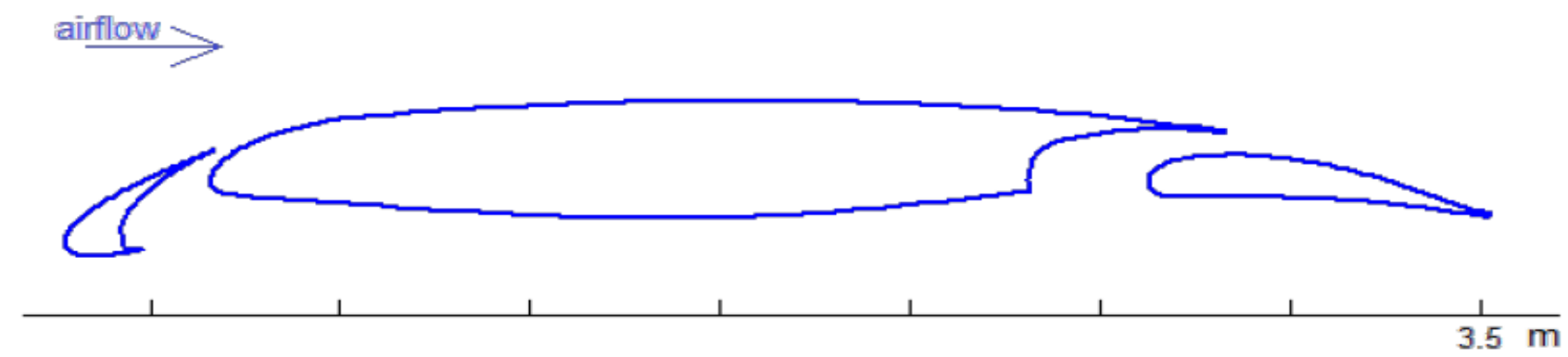
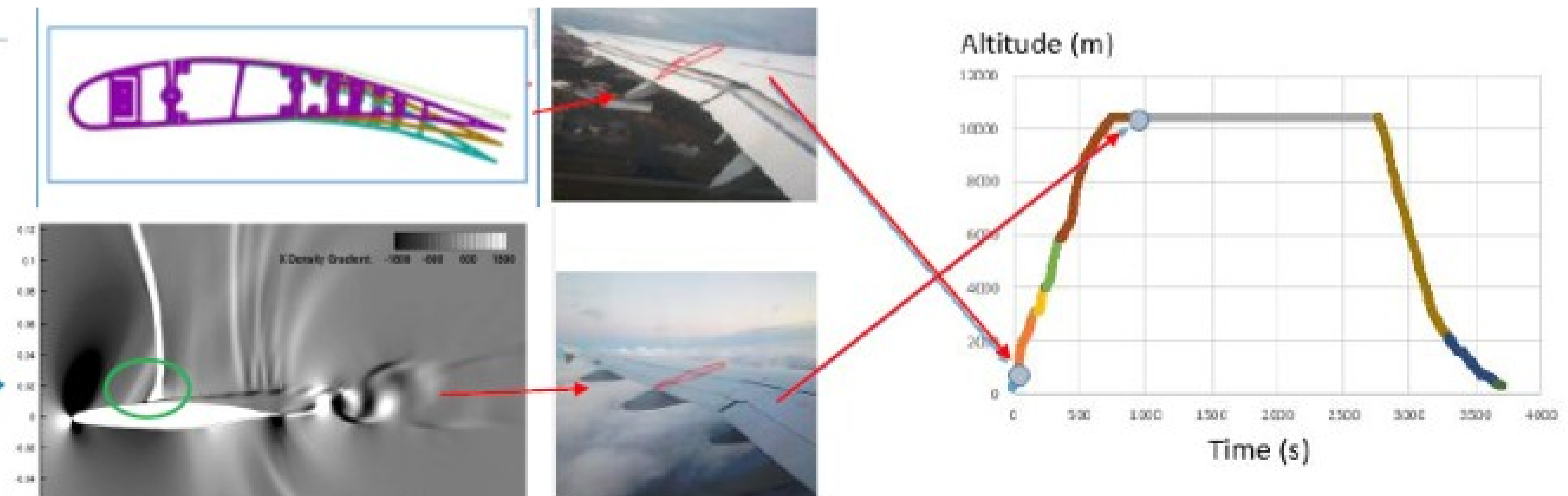
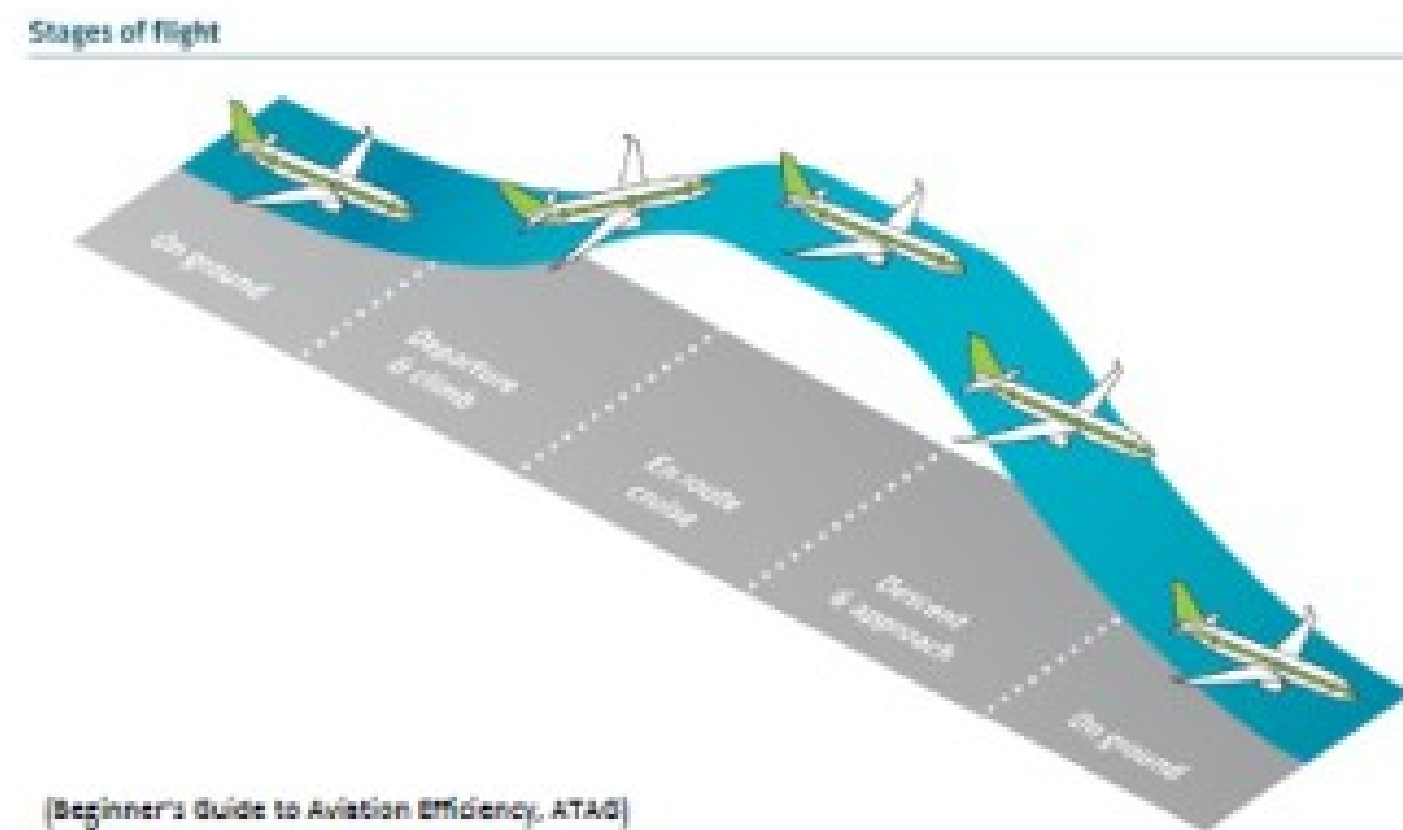
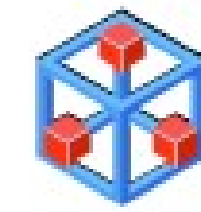


Figure 3: Airfoil cross section of the wing for Take-Of conditions

Take-off A320 Blagnac 2019 (photos of M. Braza)





Smart Morphing and Sensing (SMS) data

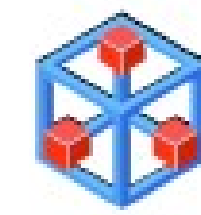
Measurement data (embedded sensors)

Simulation data (wind tunnels)

Calculation data (high performance computing)

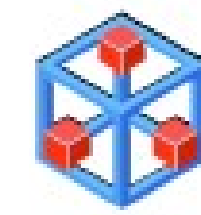
International consortium with different scientific backgrounds

- **Multiple degrees of heterogeneity**
 - . **format (csv, text, matlab...)**
 - . **scientific content**
 - . **methods of acquisition**



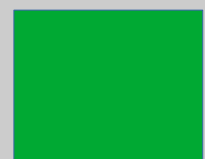




SMS data FAIRisation

Requirement	FAIR element
Provide a comprehensive metadata set understandable by all the stakeholders	I
Allow the extension of metadata through unambiguous references	I
Specify the analysis process the data went through	R
Link data to papers, claims and arguments	R
Access through user-friendly interfaces with no technical prerequisite	A



SMS data FAIRisation



Requirement	FAIR element	« Immediate » solution : Dataverse
Provide a comprehensive metadata set understandable by all the stakeholders	I	
Allow the extension of metadata through unambiguous references	I	
Specify the analysis process the data went through	R	
Link data to papers, claims and arguments	R	
Access through user-friendly interfaces with no technical prerequisite	A	

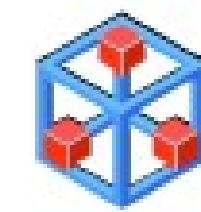
Dataverse **allows to** reference external vocabularies but **does not provide** the vocabularies by itself.

The reusability of data depends on (among many other things!):

- the understanding that we can have of the way they were collected or calculated
- the processing chains they went through

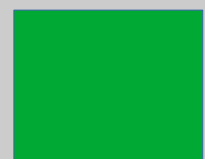


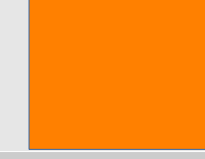

Dataverse **allows to** reference scientific papers with datasets.

But **does not offer** scientific claims modeling, scientific methods or any « inner » view of the paper contents.



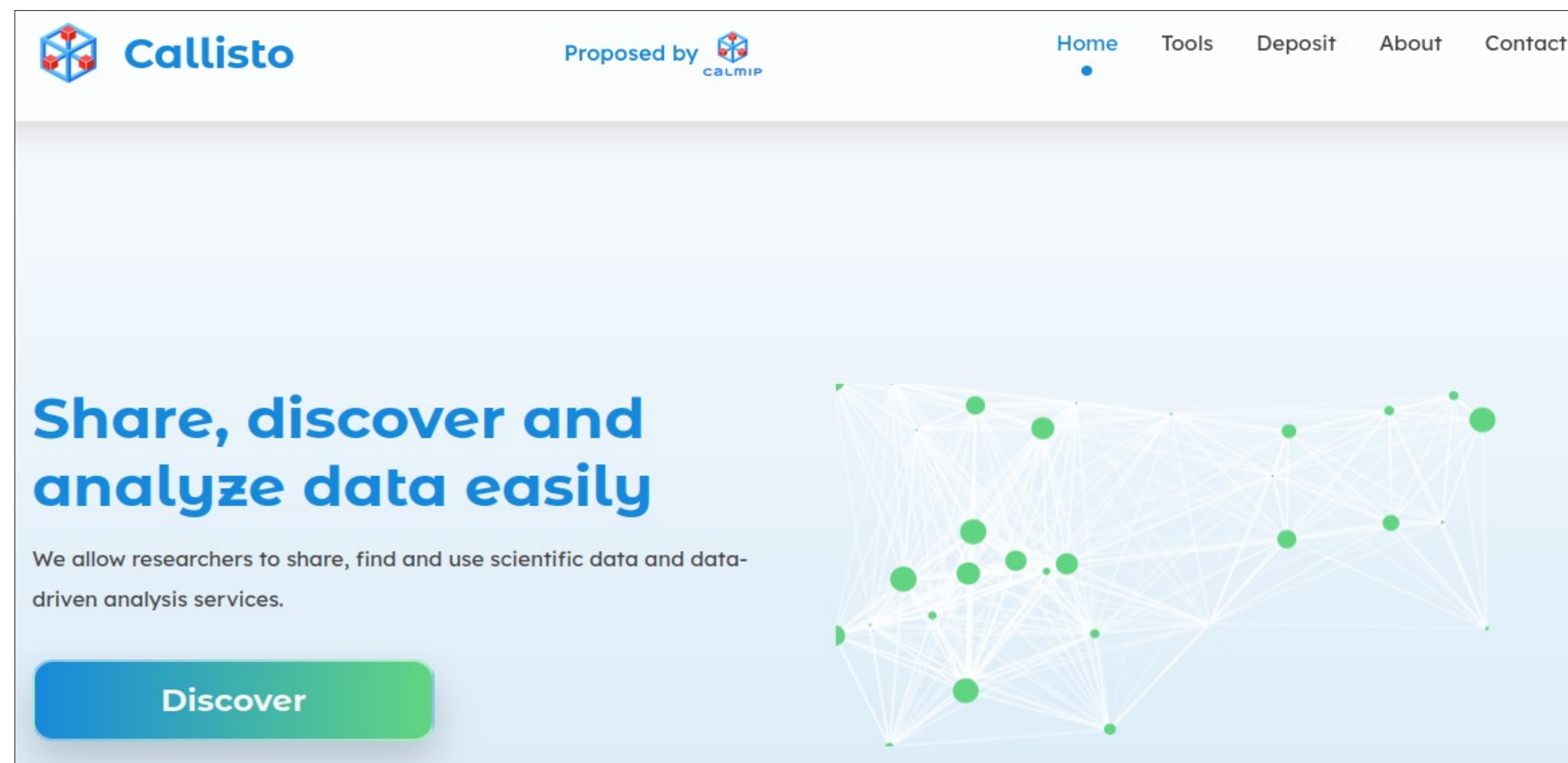
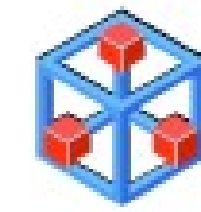
SMS data FAIRisation



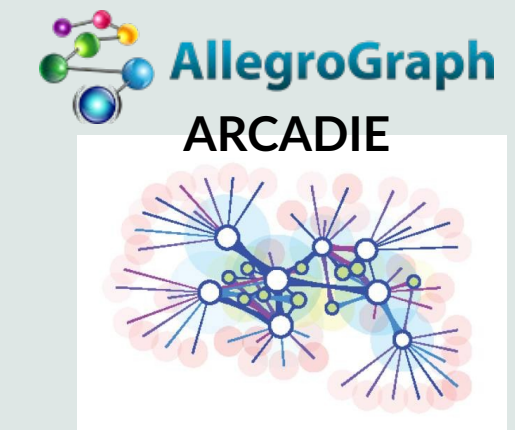
Requirement	FAIR element	« Immediate » solution : Dataverse
Provide a comprehensive metadata set understandable by all the stakeholders	I	
Allow the extension of metadata through unambiguous references	I	
Specify the analysis process the data went through	R	
Link data to papers, claims and arguments	R	
Access through user-friendly interfaces with no technical prerequisite	A	

CALLISTO **addresses these points** by the means of a three-layer architecture :

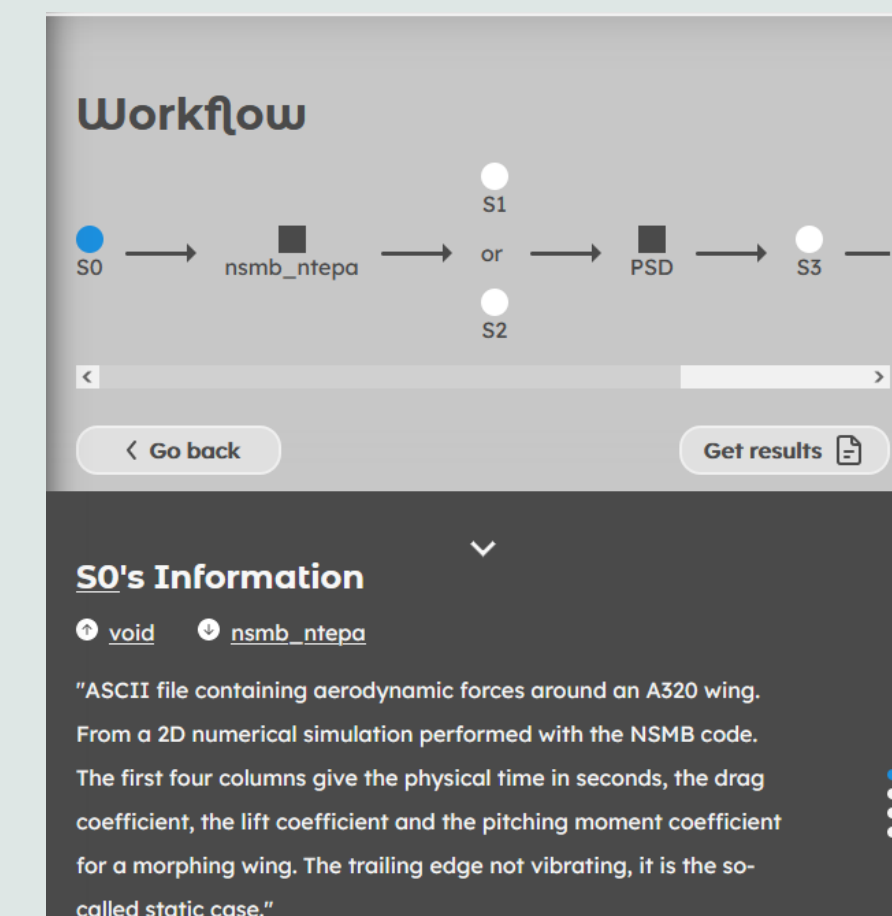
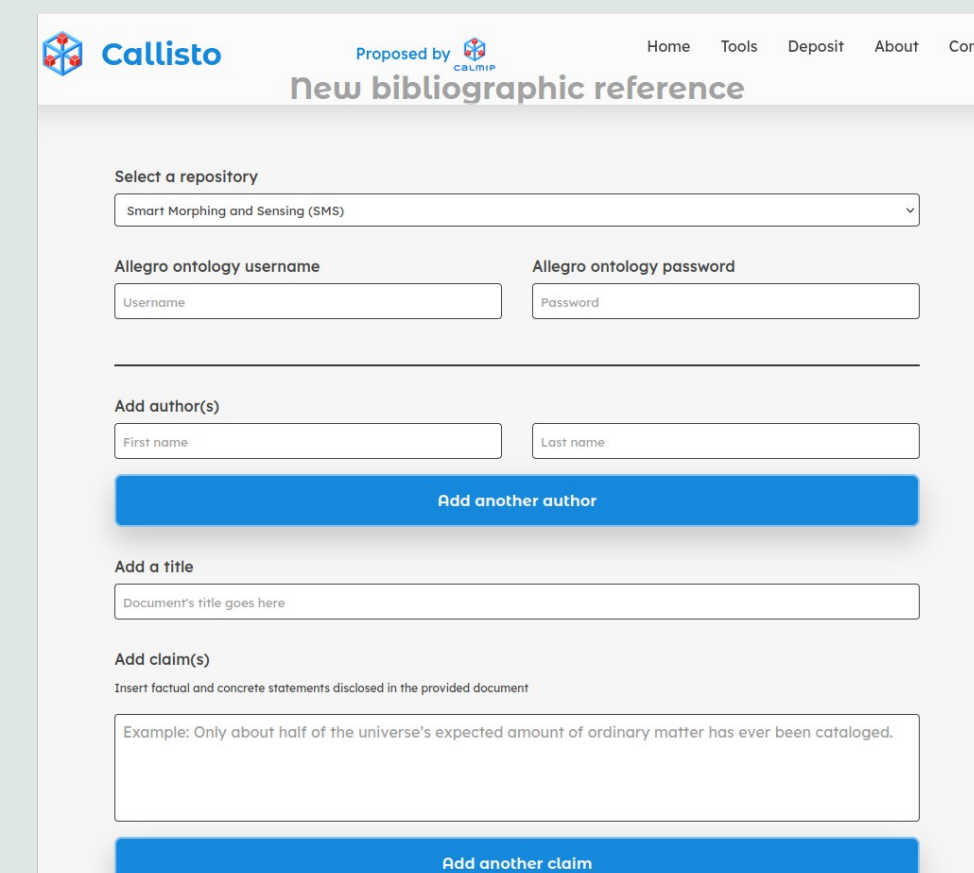
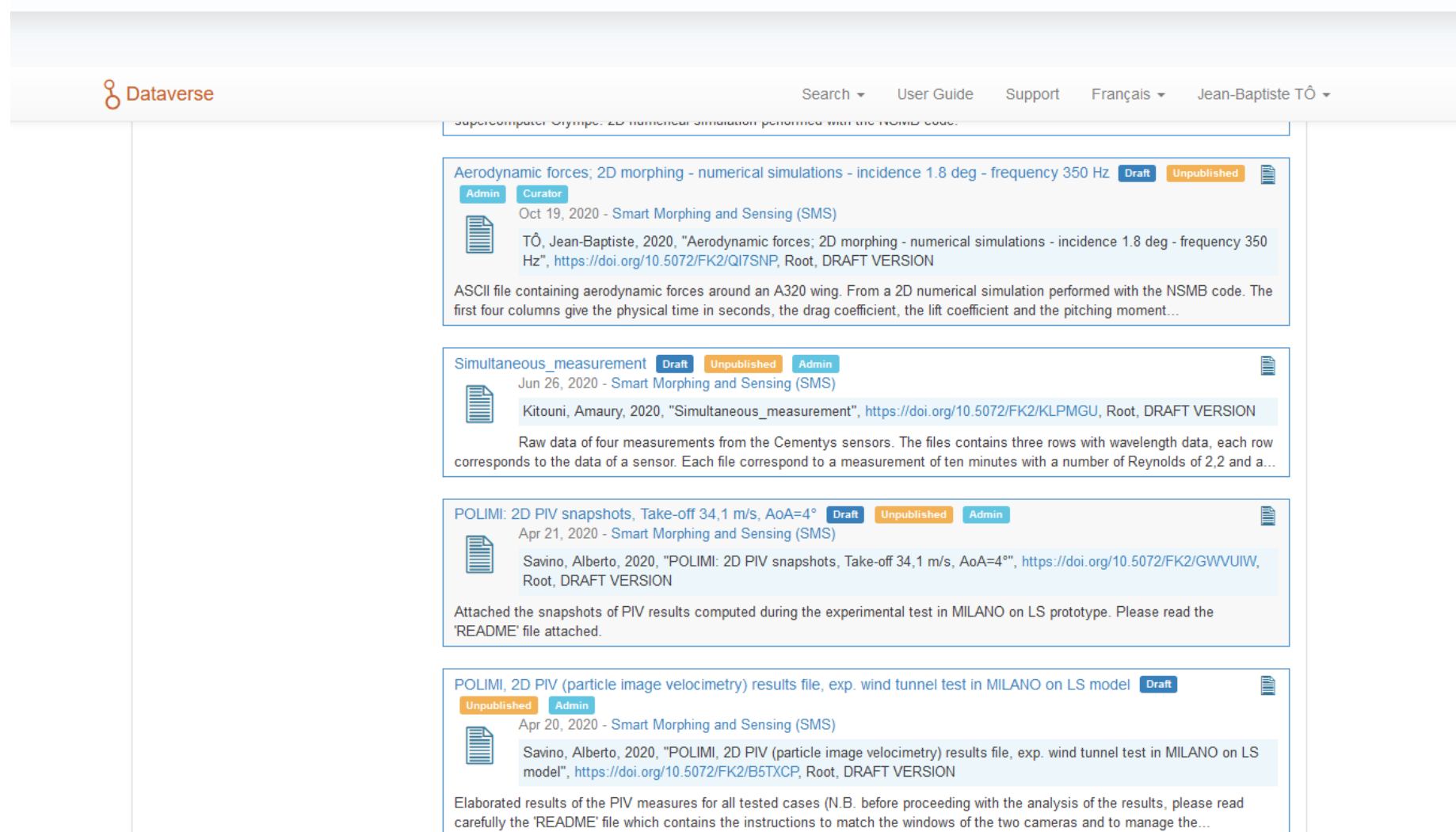
- . a dataverse instance
- . an ontological description of datasets
- . virtual research environment dedicated to semantic-based functionalities.



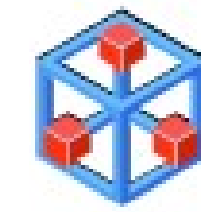
CALLISTO specific functionalities



Business-specific workflows
Datasets contextualization



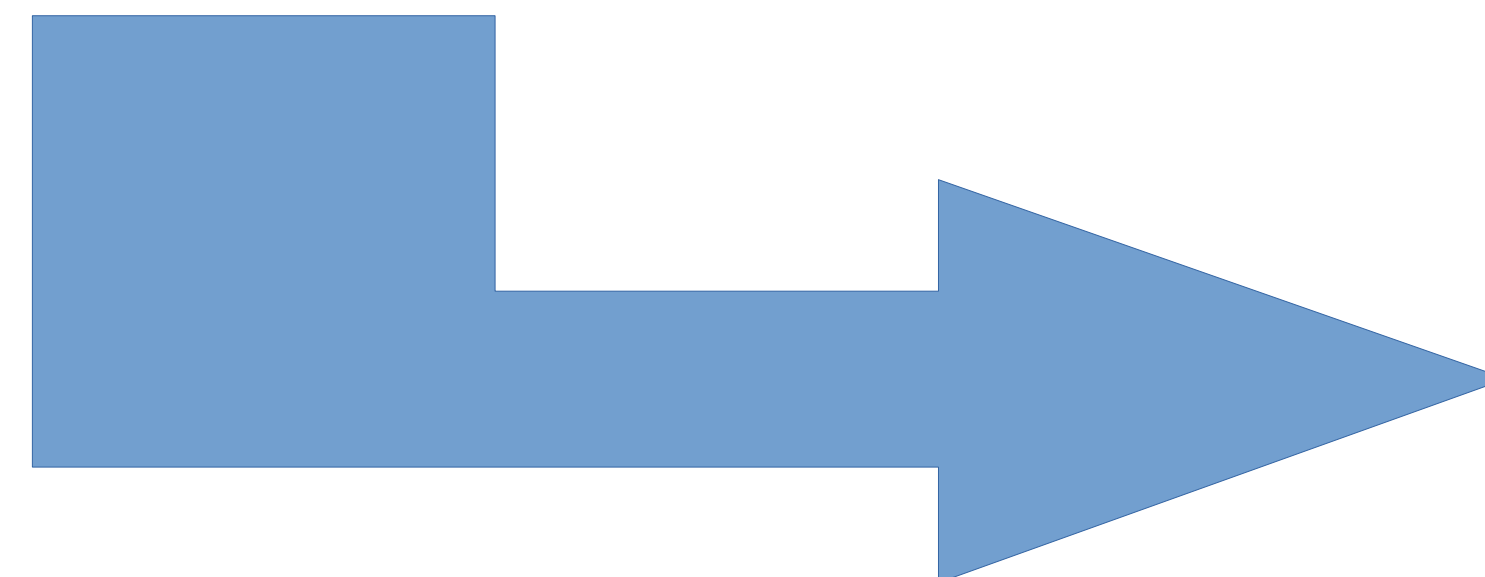
2- Callisto architecture: overview



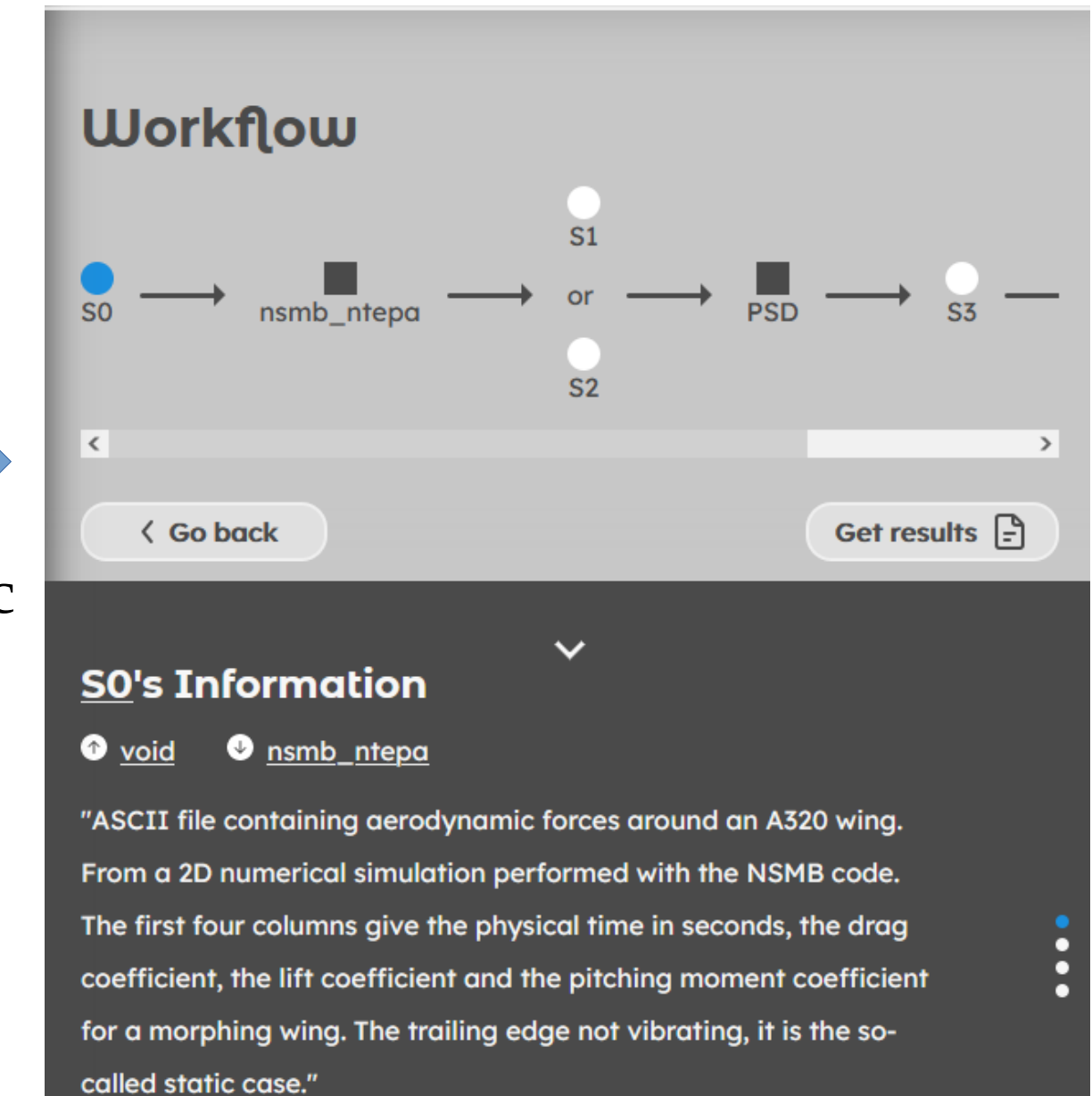
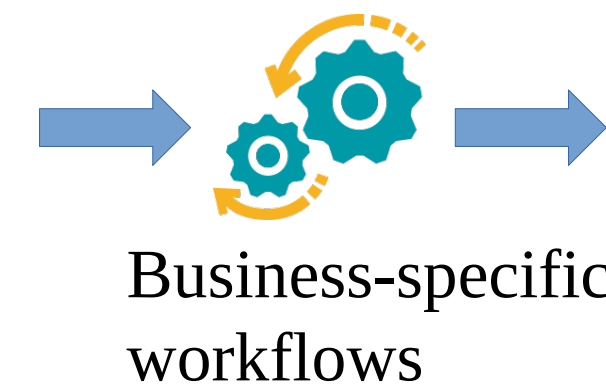
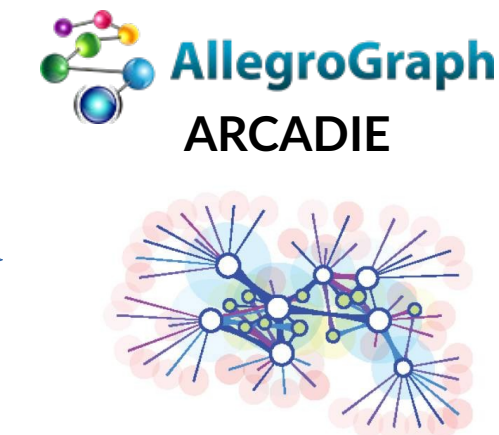
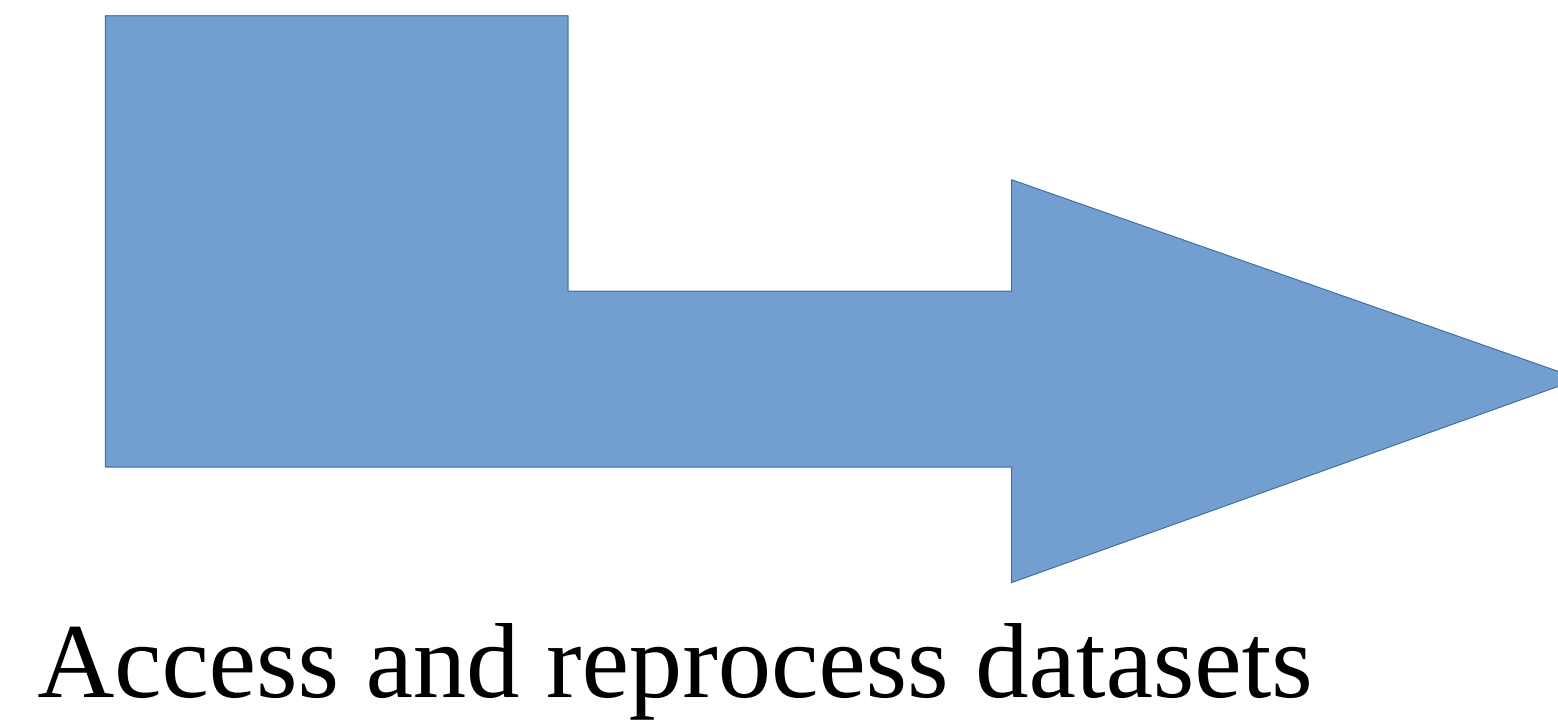
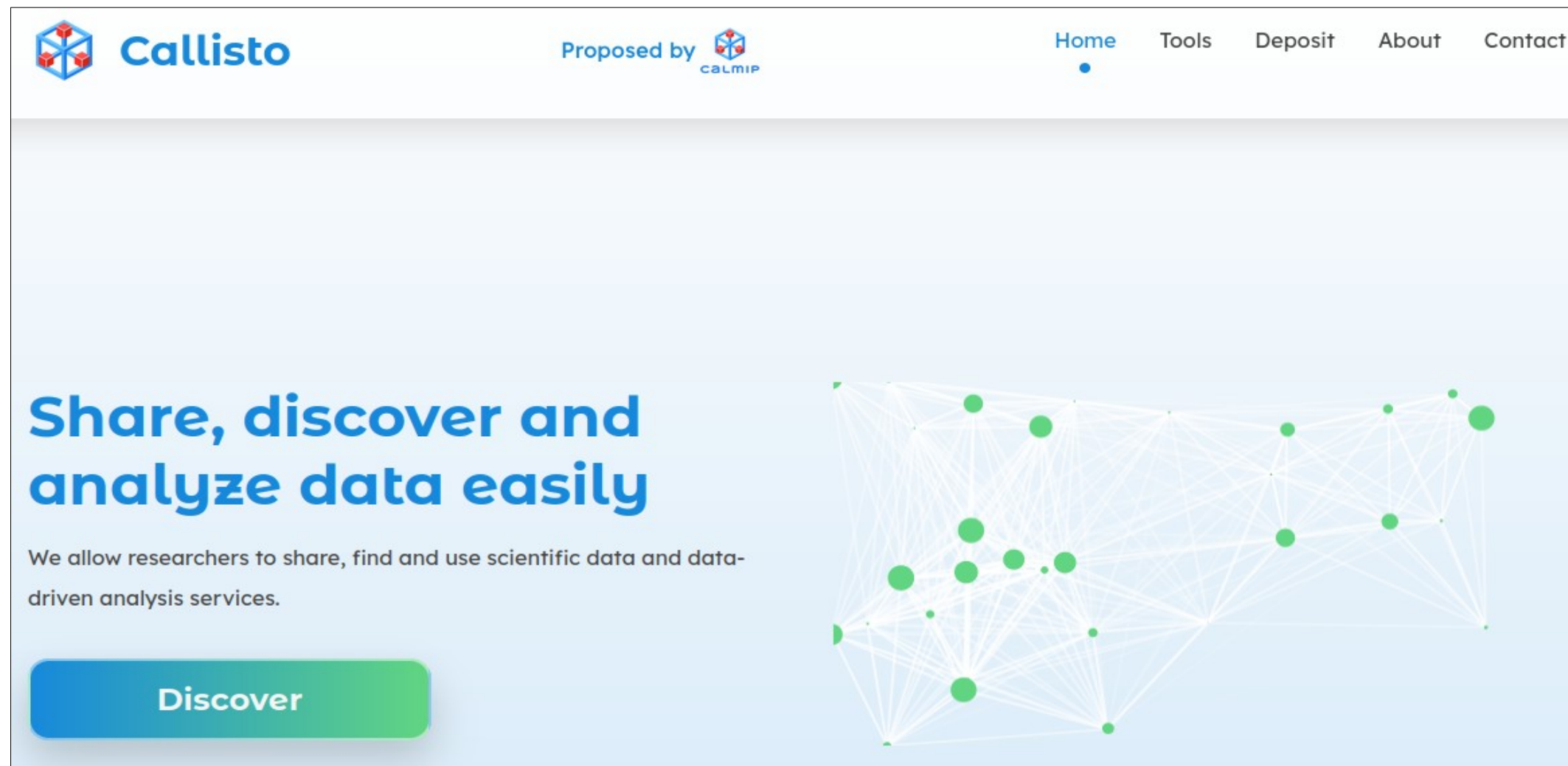
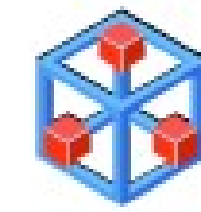
The screenshot shows the Callisto website homepage. At the top left is the Callisto logo. To its right, it says "Proposed by CALMIP" with a small CALMIP logo. A navigation menu includes "Home", "Tools", "Deposit", "About", and "Contact". The main content area features the headline "Share, discover and analyze data easily" in large blue text. Below this, a smaller line of text reads: "We allow researchers to share, find and use scientific data and data-driven analysis services." A prominent green button labeled "Discover" is positioned on the left. On the right side of the main area, there is a network diagram consisting of green nodes connected by thin white lines.

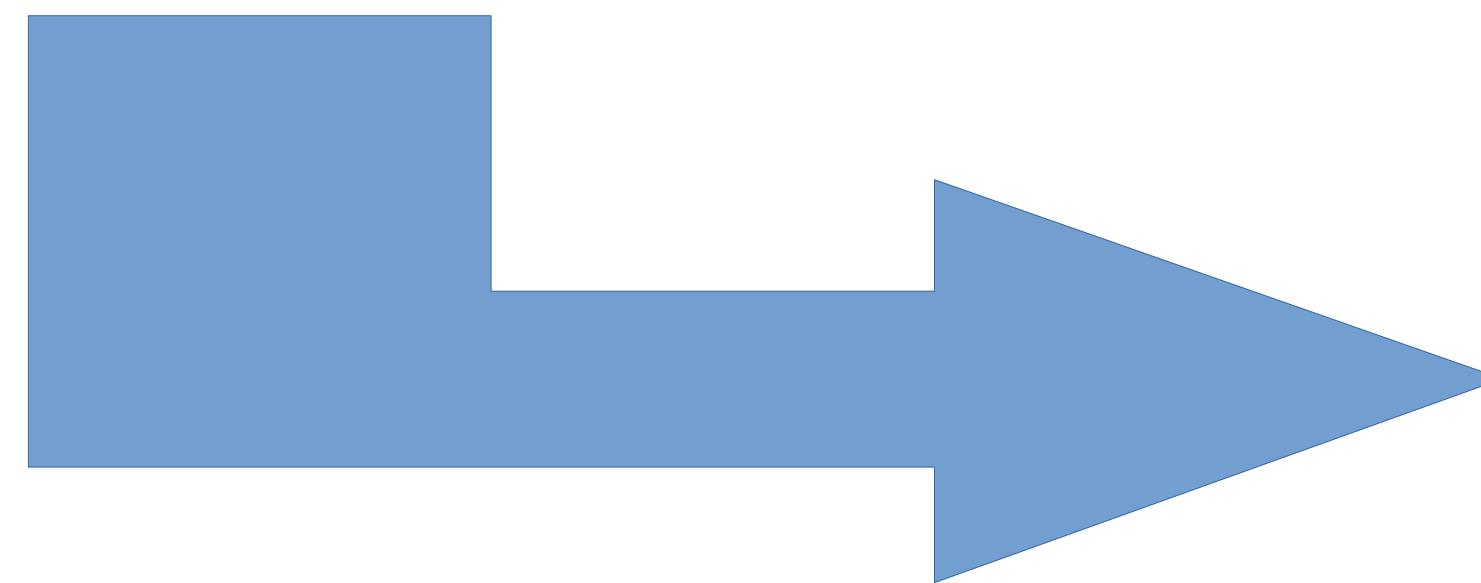
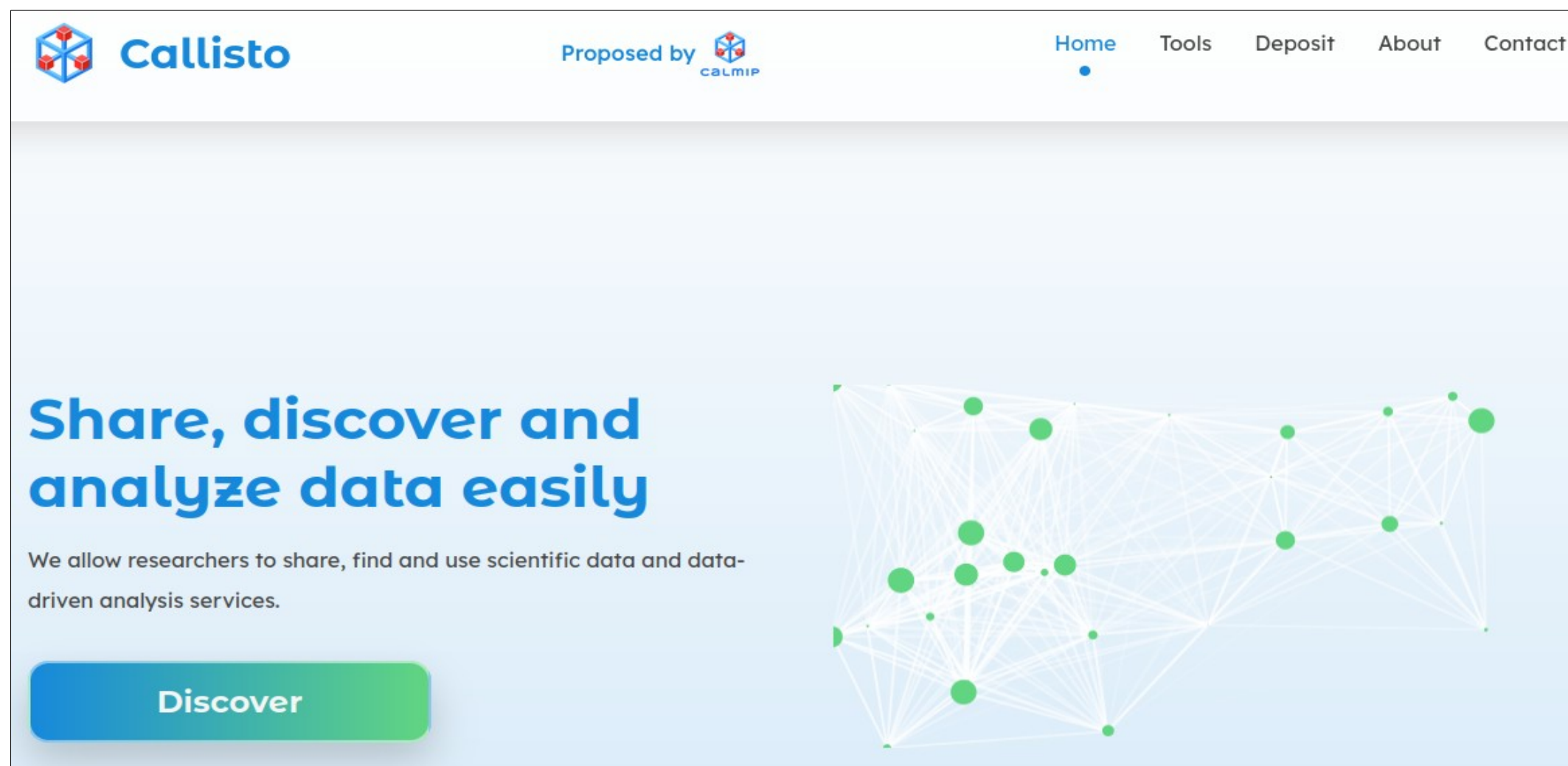
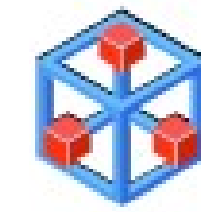


- Aerodynamic forces; 2D morphing - numerical simulations - incidence 1.8 deg - frequency 350 Hz** [Draft] [Unpublished] [Admin] [Curator]
Oct 19, 2020 - Smart Morphing and Sensing (SMS)
TÔ, Jean-Baptiste, 2020, "Aerodynamic forces; 2D morphing - numerical simulations - incidence 1.8 deg - frequency 350 Hz", <https://doi.org/10.5072/FK2/QI7SNP>, Root, DRAFT VERSION
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Attached the snapshots of PIV results computed during the experimental test in MILANO on LS prototype. Please read the 'README' file attached.
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Elaborated results of the PIV measures for all tested cases (N.B. before proceeding with the analysis of the results, please read carefully the 'README' file which contains the instructions to match the windows of the two cameras and to manage the...

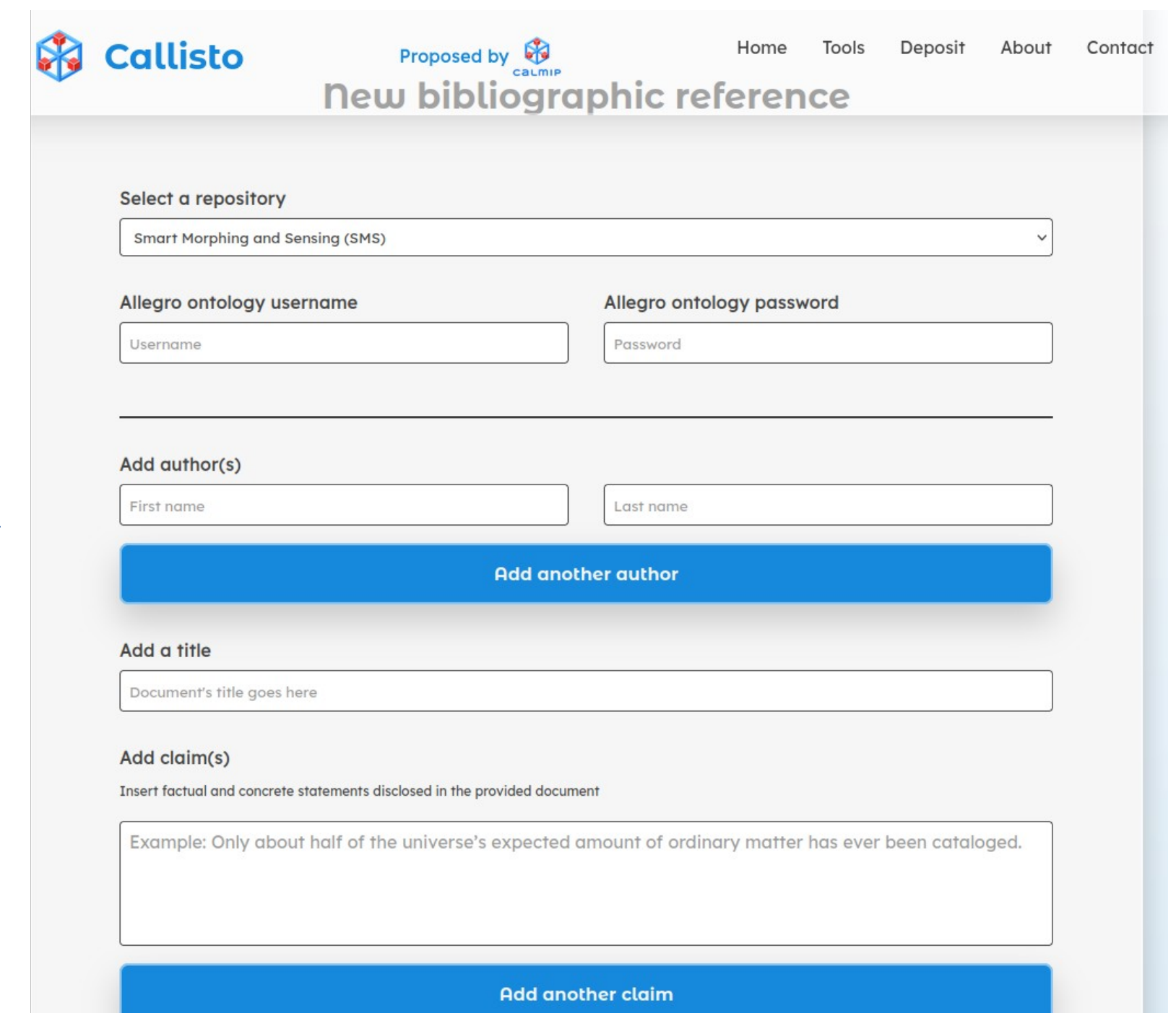
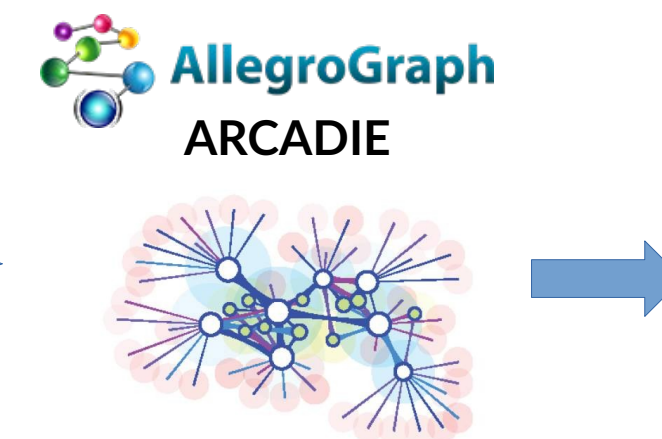


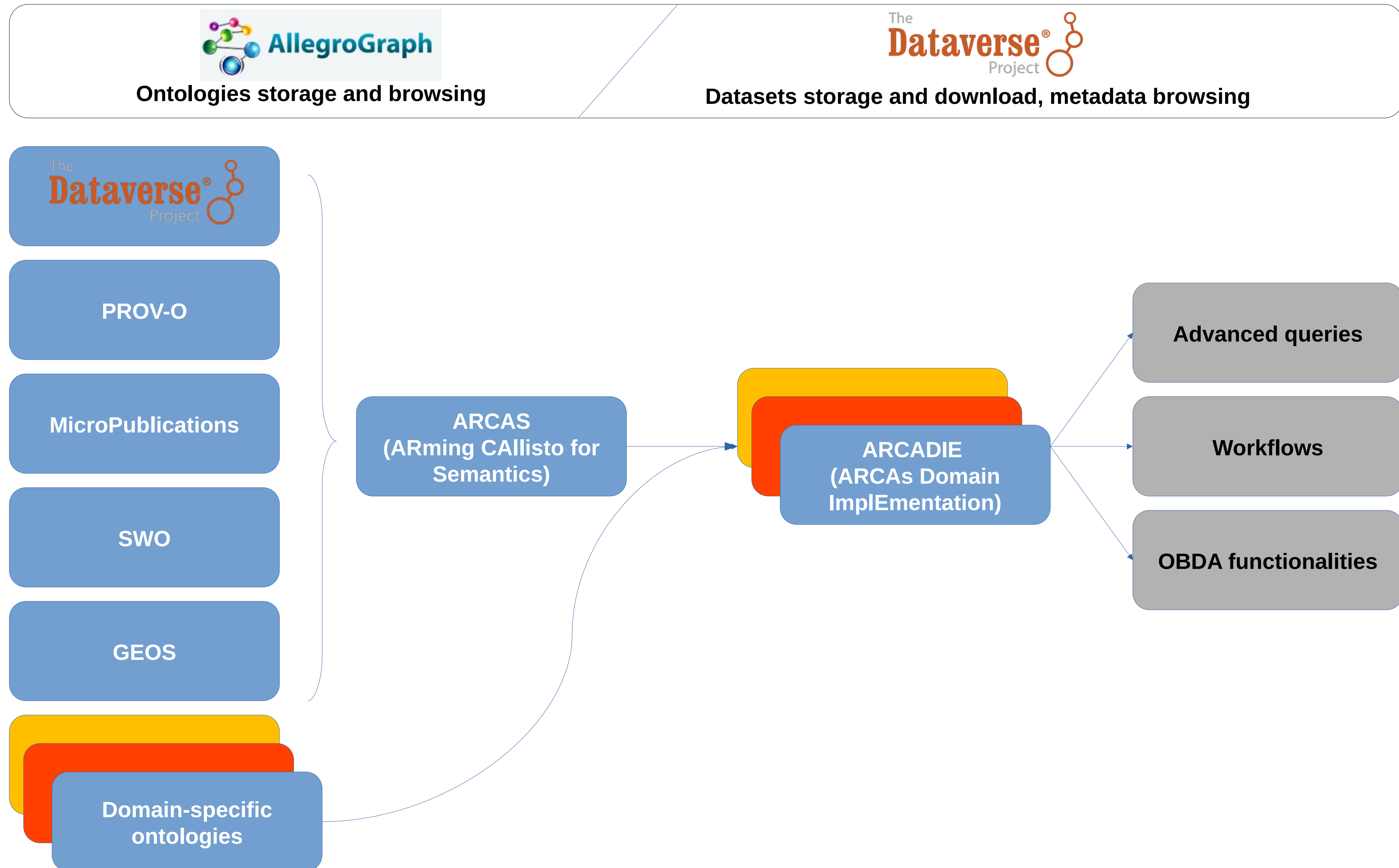
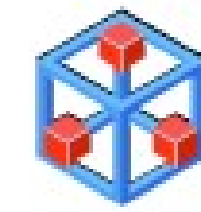
Deposit and access datasets

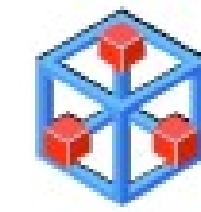




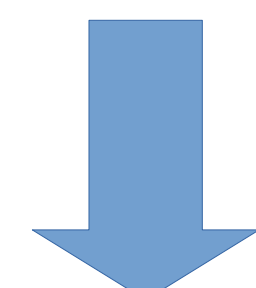
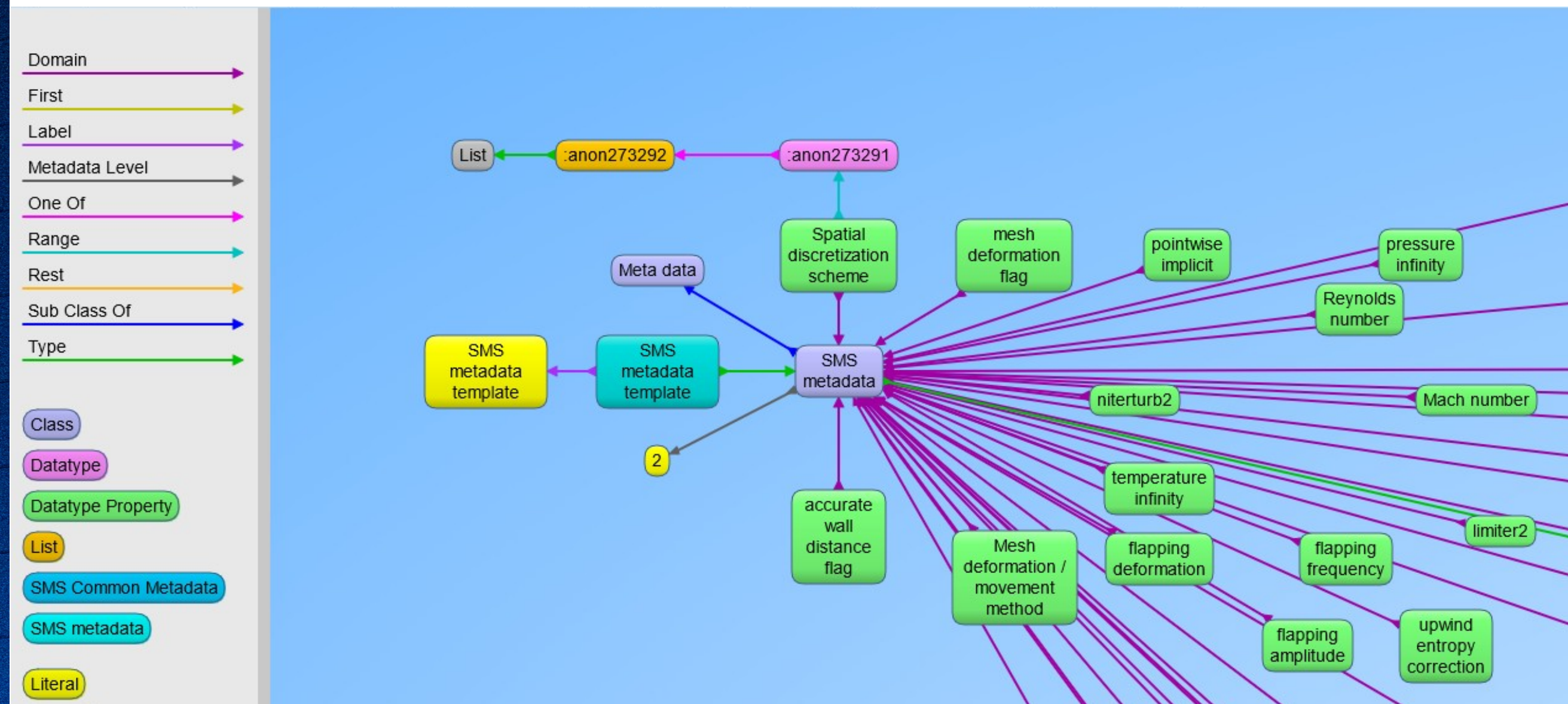
Contextualize datasets





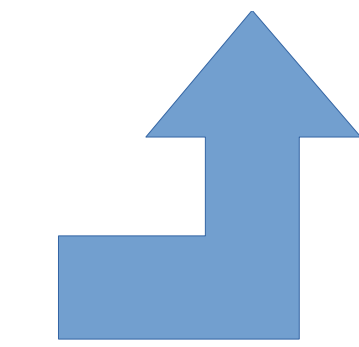


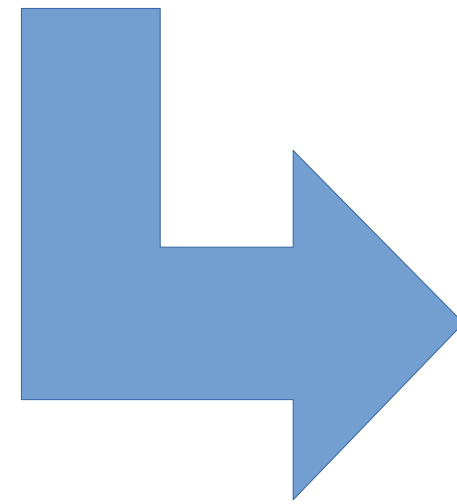
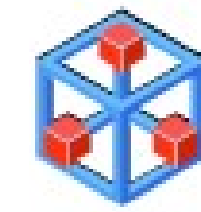
Content in ARCADIE



- Automatic processing (After any change in ARCADIE) :
- 1- Extract metadata elements from the ontology
 - 2- Generate a .tsv file from those elements
 - 3- Ingest .tsv file in Dataverse
 - 4- Make the metadata elements available in Dataverse for future dataset integration

Dataverse dataset registration screen



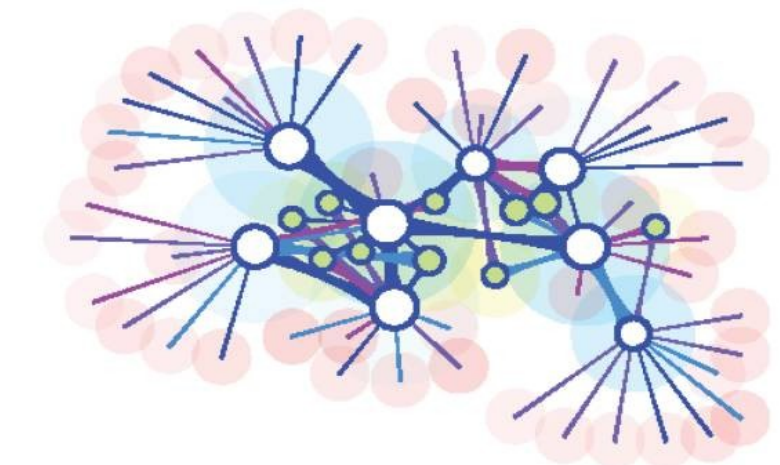


When dataset is uploaded :

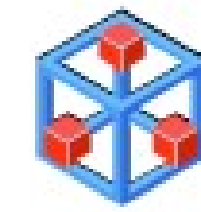
- 1- Read the metadata for newly-integrated datasets
- 2- Express the metadata in owl
- 3- Populate ARCADIE with the new content



ARCADIE



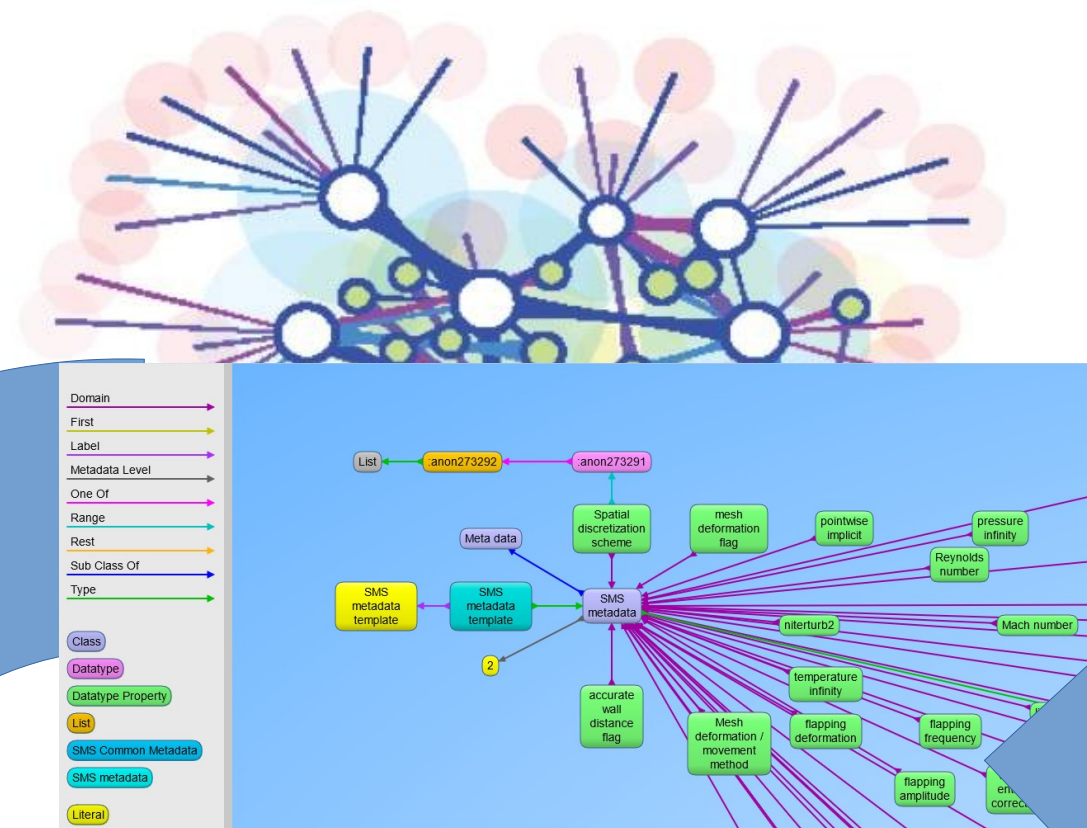
3- Functionalities: keeping ontological representation and dataverse repository content consistent with each other (summary)



Automatic processing

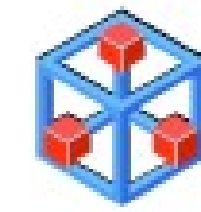
On ontology structural change :
Derive dataverse metadata
from ontology elements

ARCADIE




On dataset integration :
Populate ARCADIE with
new datasets description.

Register datasets in dataverse




supercomputer Olympus. 2D numerical simulation performed with the NSMB code.


Aerodynamic forces; 2D morphing - numerical simulations - incidence 1.8 deg - frequency 350 Hz Draft Unpublished 

Admin Curator


Oct 19, 2020 - Smart Morphing and Sensing (SMS)

 Tô, Jean-Baptiste, 2020, "Aerodynamic forces; 2D morphing - numerical simulations - incidence 1.8 deg - frequency 350 Hz", <https://doi.org/10.5072/FK2/QI7SNP>, Root, DRAFT VERSION


ASCII file containing aerodynamic forces around an A320 wing. From a 2D numerical simulation performed with the NSMB code. The first four columns give the physical time in seconds, the drag coefficient, the lift coefficient and the pitching moment...

Simultaneous_measurement Draft Unpublished Admin 


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POLIMI: 2D PIV snapshots, Take-off 34,1 m/s, AoA=4° Draft Unpublished Admin 

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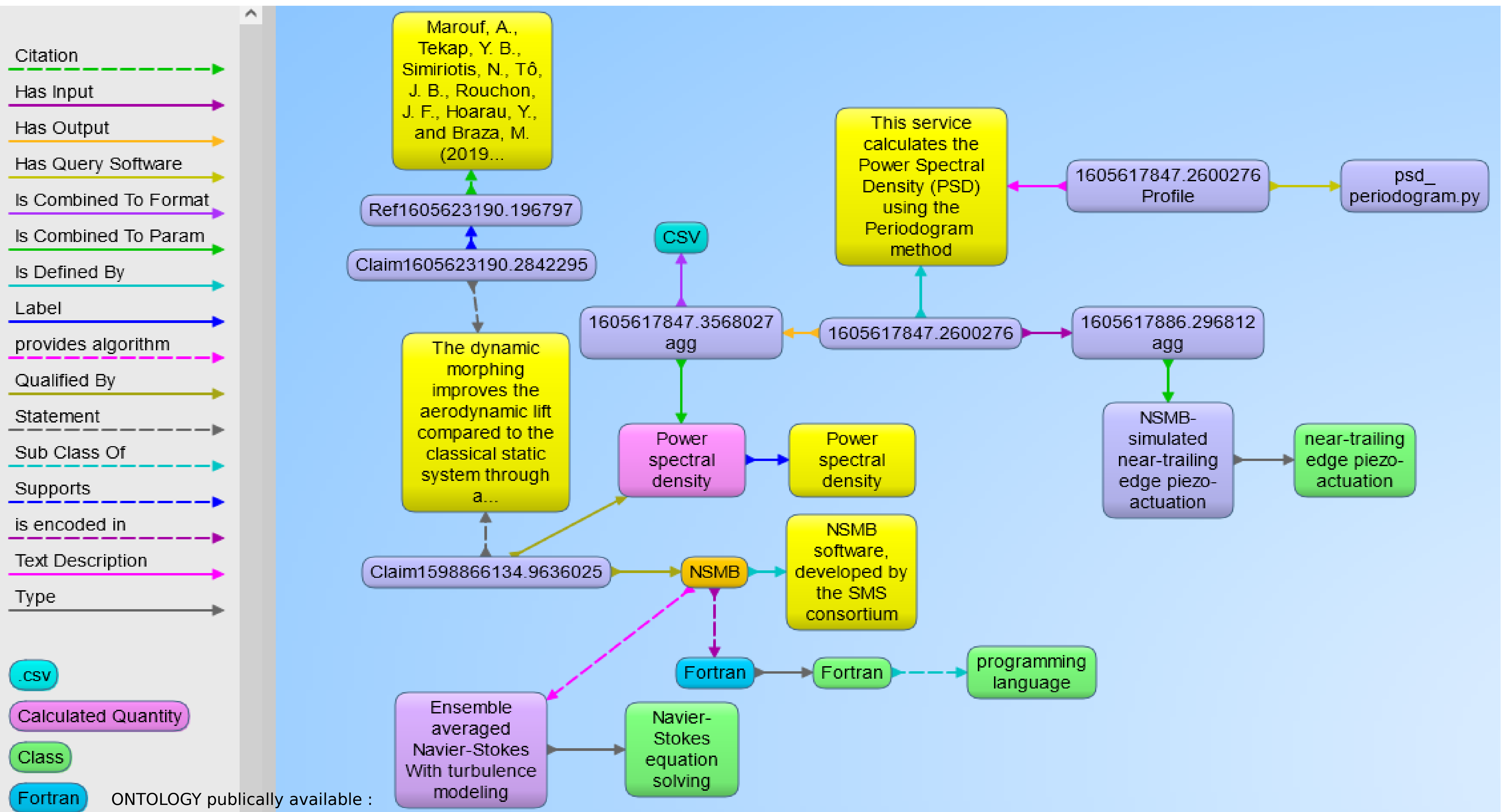
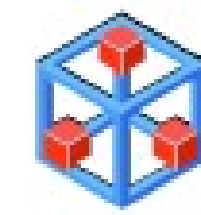
POLIMI, 2D PIV (particle image velocimetry) results file, exp. wind tunnel test in MILANO on LS model Draft 

Unpublished Admin

Apr 20, 2020 - Smart Morphing and Sensing (SMS)

 Savino, Alberto, 2020, "POLIMI, 2D PIV (particle image velocimetry) results file, exp. wind tunnel test in MILANO on LS model", <https://doi.org/10.5072/FK2/B5TXCP>, Root, DRAFT VERSION

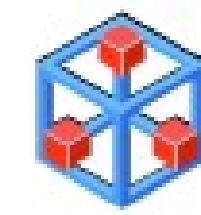
Elaborated results of the PIV measures for all tested cases (N.B. before proceeding with the analysis of the results, please read carefully the 'README' file which contains the instructions to match the windows of the two cameras and to manage the...



- Citation
- Has Input
- Has Output
- Has Query Software
- Is Combined To Format
- Is Combined To Param
- Is Defined By
- Label
- provides algorithm
- Qualified By
- Statement
- Sub Class Of
- Supports
- is encoded in
- Text Description
- Type

- csv
- Calculated Quantity
- Class
- Fortran

ONTOLOGY publically available : <https://allegro.callisto.calmip.univ-toulouse.fr/#/repositories/sms/overview>
 and browsing with graphical interface : <https://allegro.callisto.calmip.univ-toulouse.fr/#/repositories/sms/gruff>



Callisto

Home Tools Deposit About Contact

SADA (Semi-automatic data analysis)

This semi-automatic data analysis interface allows you to identify datasets in a specified repository that match the text entered in the search field. For each of these datasets, you can then examine what operations are possible and what potential results you can obtain (automatic processing flows).

Step 1: Select a repository
Smart Morphing and Sensing (SM)

Step 2: Search by keywords
NSMB-simulated near-trailing edge

Search

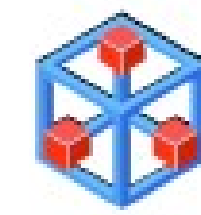
Step 1,2 :
specify the repository for the query
specify the information to retrieve

Step3 :
select a dataset

5 Result(s)

FDV_611
ASCII file containing aerodynamic forces around an A320 wing. From a 2D numerical simulation performed with the NSMB code. The first four columns give the physical time in seconds, the drag coefficient, the lift coefficient and the pitching moment coefficient for a morphing wing. The trailing edge is vibrating around its clean configuration at a frequency of 750 Hz"

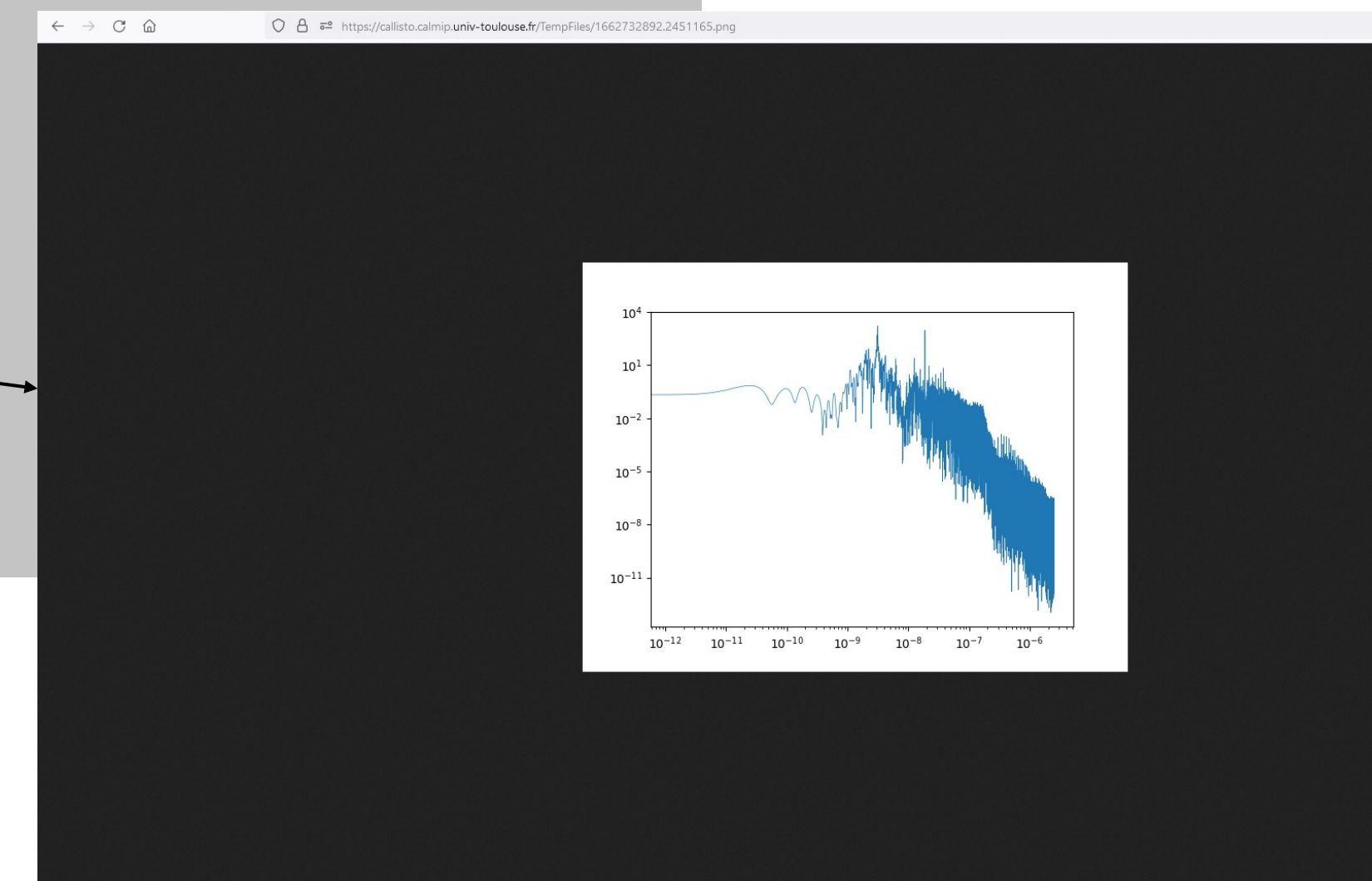
FDV_609
ASCII file containing aerodynamic forces around an A320 wing. From a 2D numerical simulation performed with the NSMB code. The first four columns give the physical time in seconds, the drag coefficient, the lift coefficient and the pitching moment coefficient for a morphing wing. The trailing edge is vibrating around its clean configuration at a frequency of 710 Hz"

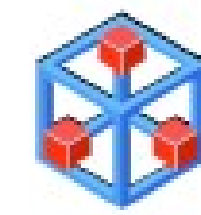






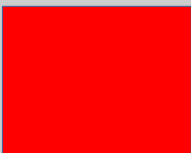
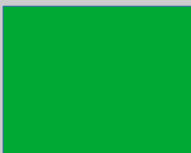
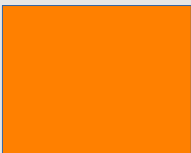



The screenshot shows the Callisto SADA interface. On the left, the 'SADA (Semi-automatic data analysis)' section includes a description and two steps: 'Step 1: Select a repository' with a dropdown menu showing 'Smart Morphing and Sensing (SMS)', and 'Step 2: Search by keywords' with a text input field containing 'NSMB-simulated near-trailing edge piezo-actuation'. On the right, the 'Workflow' section displays a graph with nodes: 'void', 'S0', 'nsmb_nlepa', 'S1', 'S2', 'PSD', 'S3', and 'PSD_DISPLAY'. A blue arrow points from the 'nsmb_nlepa' node in the workflow to the search input field in Step 2. Below the workflow, there is a description of the PSD service and a 'Get results' button.

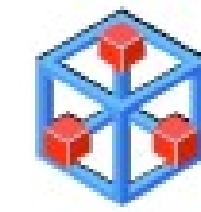
Step 4 :
Choose which service to put in the workflow, when multiple choices appear.

Step 5 :
Click on « get results » to run the workflow and get access to the results of the processing.





Requirement	FAIR element	Dataverse	• CALLISTO solution
Provide a comprehensive metadata set understandable by all the stakeholders	I		 Custom metadata sets subset of project-scale ontologies
Allow the extension of metadata through unambiguous references	I		 Extension of metadata by referencing elements in the ontology
Specify the analysis process the data went through	R		 Using SWO and GEOS to specify software and automation
Link data to papers, claims and arguments	R		 Using Micropublications and referencing Dataverse datasets as data supporting claims
Access through user-friendly interfaces with no technical prerequisite	A		 Using Dataverse and AllegroGraph for user-friendly frontends



Future works :

Investigate the use of software description ontology (SD) for linking data and software.

Investigate the use of ro-crate for linking data, metadata and overall context (researchers, institutes...)

And many other possibilities for expanding the functionalities ! rdf data cube, DCAT...

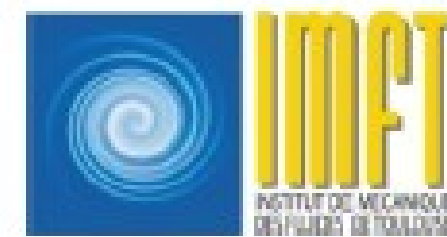
Final words :

This work could not have been conducted without the implication of scientific projects using the platform for managing their data.

Many thanks to SMS and HiperBorea (OMP/GET) stakeholders for their support.



Thanks for your attention !



<https://callisto.calmip.univ-toulouse.fr>