

# Data Management at the FIBEr Lab

ManGO User Day 2024  
Heleen Fehervary & Ronny Moreas

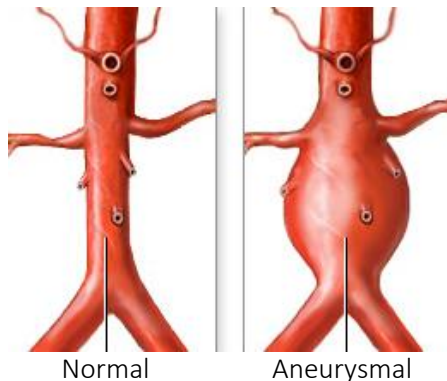
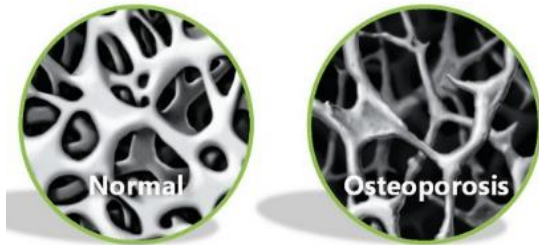


We test what's vital for you

WHY

# do we need biomechanical experiments?

Understanding  
mechanics-related  
pathologies



Development of treatments, medical  
products, diagnostic tools



# WHAT are biomechanical experiments?

## Material characterization



Aorta

## Medical device testing



Fracture plate

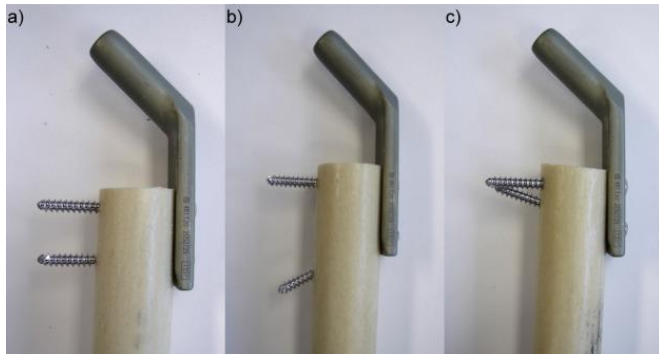
Non-exhaustive list of the **mechanical properties** we can measure:

- compliance or **stiffness** (e.g. Young's modulus),
- **strength** (tensile, compressive, flexural, peel, tear) and elongation,
- energy to **failure** and fracture toughness,
- Poisson's ratio,
- crack growth velocity,
- **fatigue** & fatigue life,
- visco-elastic properties (creep, stress relaxation)
- ...

# WHEN are biomechanical experiments useful?

at multiple stages of product development

## R&D stage



## Regulatory

INTERNATIONAL  
STANDARD

ISO  
7198

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Cardiovascular implants and  
extracorporeal systems — Vascular  
prostheses — Tubular vascular grafts  
and vascular patches



Quality  
control

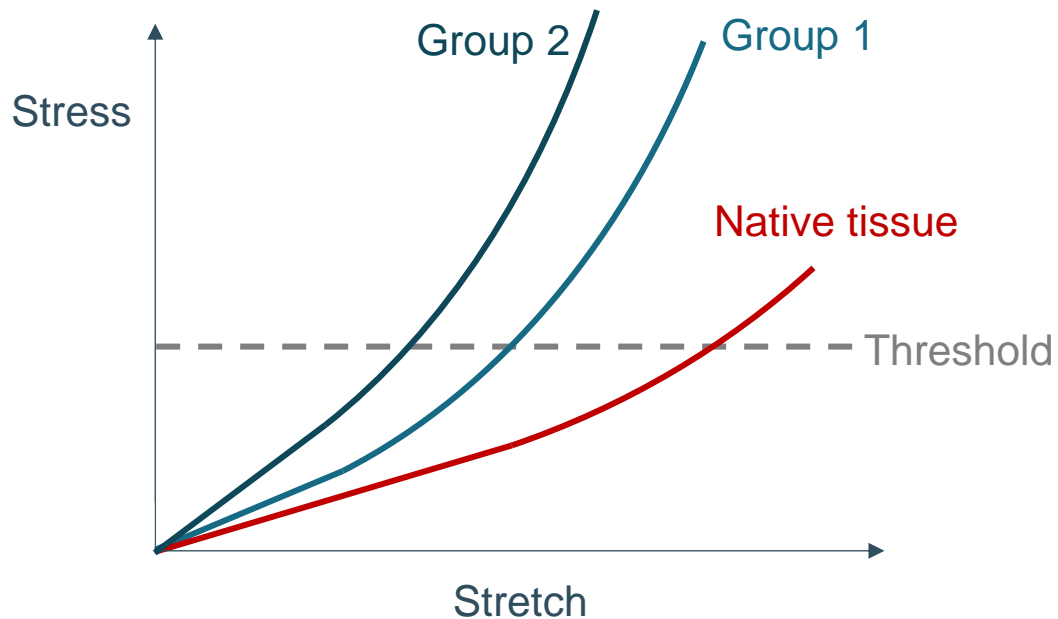


# HOW

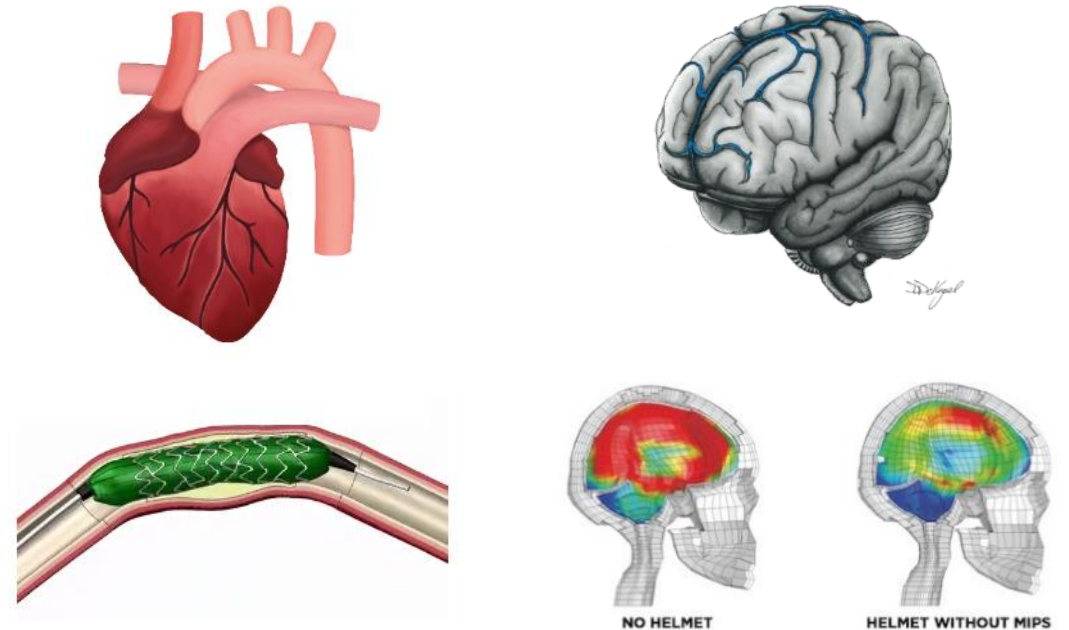
# can data from biomechanical experiments be used?

## Direct comparison

- Strength
- Stiffness/Elasticity
- Visco-elasticity
- Permeability
- Fracture behavior
- ...



## Input for in silico models

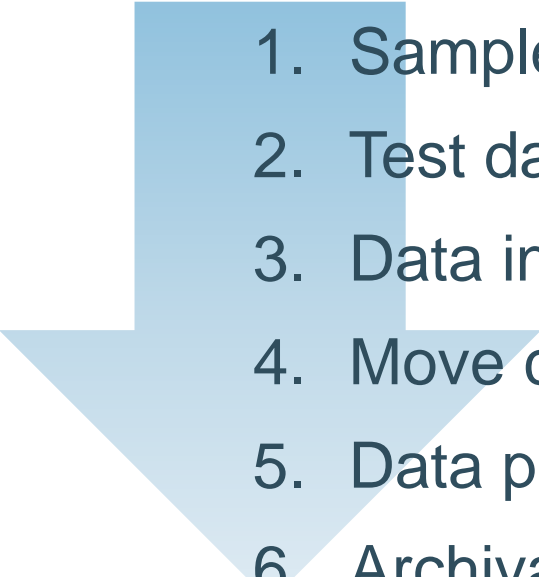


Grogan et al. 2015, Kleiven et al. 2006

# What is important for good data management at FIBEr?

- Different types of clients
  - Lab users (internal, external)
  - FIBEr team running service projects
- Samples (storage, traceability, linked data, ...)
- Large portfolio of testing equipment
  - Almost all measurements are digitalized
  - Some data is combined in post processing
  - Different data sizes (few KB to a few hundreds of GB)
- Sharing raw/processed data within/outside KU Leuven
- QMS: back-up, confidentiality, data integrity

# Overview Data Management at FIBEr

- 
1. Sample, project and experiment (meta)data
  2. Test data acquisition
  3. Data ingestion into ManGO
  4. Move completed data ingests to project collection
  5. Data processing
  6. Archival of completed projects



# Sample, project and experiment (meta)data

- **FIBEr Sample Manager:**  
Webapp for management of samples, projects and experiments



Welcome Ronny Moreas (u0012772). [Log out](#)

<a href="#">+ Store new sample</a>	<a href="#">📄 Copy data to new samples</a>	<a href="#">🔧 Add/modify sample data</a>
<a href="#">✂️ Divide sample</a>	<a href="#">🔥 Thaw in fridge E</a>	<a href="#">🏷️ Take over sample</a>
<a href="#">📊 Inspect sample</a>	<a href="#">👤 Show all my samples</a>	<a href="#">📋 Show all stored samples</a>
<a href="#">📦 Take out sample</a>	<a href="#">🏠 Bring back sample</a>	<a href="#">🗑️ Dispose of sample</a>
<a href="#">🔗 Link a new publication</a>	<a href="#">📁 Show my experiments</a>	<a href="#">📄 Show linked publications</a>
<a href="#">🗑️ Cleanup Management</a>		
<a href="#">+ New experiment</a>	<a href="#">📁 Experiment management</a>	<a href="#">👤 User management</a>
		<a href="#">📋 Project management</a>





# Test Data Acquisition

- **FIBEr DAQ Manager App**
  - Installed on instrument computers
  - Collect data and metadata to be added to dataset for upload
- After a test run the operator:
  - Selects files to be added to dataset
  - Adds metadata (from FIBEr Dashboard)
    - Instrument
    - Sample
    - Project
    - Experiment
    - Test Operator
- Dataset moved to drop location for upload to ManGO




1105210056-2410041417

Project

fiber\_oef

Search All

Project ID	Project	Sample ID	Storage Date	Name	Origin	Type	Remarks
b85cf558-f560-4d15...	FIBEr_oefenstaal	2510230001	2023-10-25	Balb/c mice femurs ...	Mouse	Bone	spare femurs from ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	1105210056	2023-01-19	Human brain 8/23 ...	Human	brain	Tryout brain without...
b85cf558-f560-4d15...	FIBEr_oefenstaal	1105210055	2023-01-19	Human brain 8/23 ...	Human	brain	Tryout brain sample ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	3011230001	2023-01-19	Human brain 8/23 ...	Human	brain	Tryout brain sample ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	3011230002	2023-01-19	Human brain 8/23 ...	Human	brain	Tryout brain sample ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	1105210064	2022-08-09	Crux-Project Minipig...	Human	Adipose tissue + skin	
b85cf558-f560-4d15...	FIBEr_oefenstaal	0402220083	2022-02-09	aorta practice material	Pig	Aorta	
b85cf558-f560-4d15...	FIBEr_oefenstaal	1612200001	2020-12-16	OEFEENSTAAL FIBEr - ...	Pig	Aorta	Meerdere stalen ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	0903200036	2020-03-09	OEFEENSTAAL FIBEr - ...	Pig	Aorta	Left over material ...
b85cf558-f560-4d15...	FIBEr_oefenstaal	0903200037	2020-03-09	OEFEENSTAAL FIBEr - ...	Pig	Aorta	Left over material ...



Ronny Moreas

Log Out

Select Device:

BIAX-01

Data Collected

Name	Size	Type	Date Modified
sample rat...		File Folder	04/10/2024 13:19
test20...		File Folder	04/10/2024 13:19
du...	794 bytes	CSV document	24/04/2024 16:15
du...	993,85 KiB	TIFF image	24/04/2024 16:15
du...	993,85 KiB	TIFF image	24/04/2024 16:15
du...	993,85 KiB	TIFF image	24/04/2024 16:15
input_...	327 bytes	plain text document	24/04/2024 16:15
input_...	683 bytes	plain text document	24/04/2024 16:15
chang...	43,94 KiB	PNG image	24/04/2024 16:15
PB_pro...	2,99 MiB	Gzip archive	24/04/2024 16:15
PB_pro...	213,00 KiB	Gzip archive	24/04/2024 16:15
Outpu...		File Folder	04/10/2024 13:18
PB_protoc...	213,00 KiB	Gzip archive	24/04/2024 16:15

Selected Data to Upload

Name	Size	Type	Date Modified
PB_protoc...	2,99 MiB	Gzip archive	24/04/2024 16:15

File Name

.txt

Text

Notes

Save Selected Data to Mango

Save Notes

# FIBEr DAQ Manager

Upload Wizzard

Select Experiment

Select an existing experiment or create a new one. Experiments shown/created are based on the device used.

Experiment:

Demo ManGo User Day 2024 | 2024-10-04 14:16

New Experiment

Title: \*

Demo ManGo User Day 2024

Description:

☒ Remember experiment?

+ Create

Next

Cancel

# Test Data Acquisition

- Metadata file (json) added to dataset for upload
- Dataset with metadata moved to drop location for upload to ManGO



1105210056-2410041417

```
{
  "acquisition_datetime": "2024-10-04T14:17:47",
  "device": {
    "model": "Biaxial Testing Machine, Messphysik - Zwick/Roell",
    "name": "BIAX-01"
  },
  "experiment": {
    "id": "5f7c7fdda75a8711261e4ea7",
    "name": "Demo ManGO User Day 2024"
  },
  "operator": {
    "name": "Ronny",
    "surname": "Moreas",
    "uid": "u0012772"
  },
  "project": {
    "id": "b85cf558-f560-4d15-a72d-36e1fbce1ed5",
    "name": "FIBEr_oefenstaal"
  },
  "sample": {
    "id": "1105210056",
    "name": "Human brain 8/23 Exp3.1"
  }
}
```

# Data Ingestion into ManGO



# ManGO Ingestor



- Linux-based device designed to facilitate the **ingestion of instrument data and metadata from multiple devices** into the ManGO active data platform.
- Purpose
  - Streamline the process of ingesting and managing scientific data **across different platforms and environments with central control**.
  - Avoid installation of software on instrument computers by **pulling data directly from SMB/CIFS (or NFS) share(s) defined on the instrument computers**.
  - **Extendable** with custom handlers for metadata extraction



# ManGO Ingestor

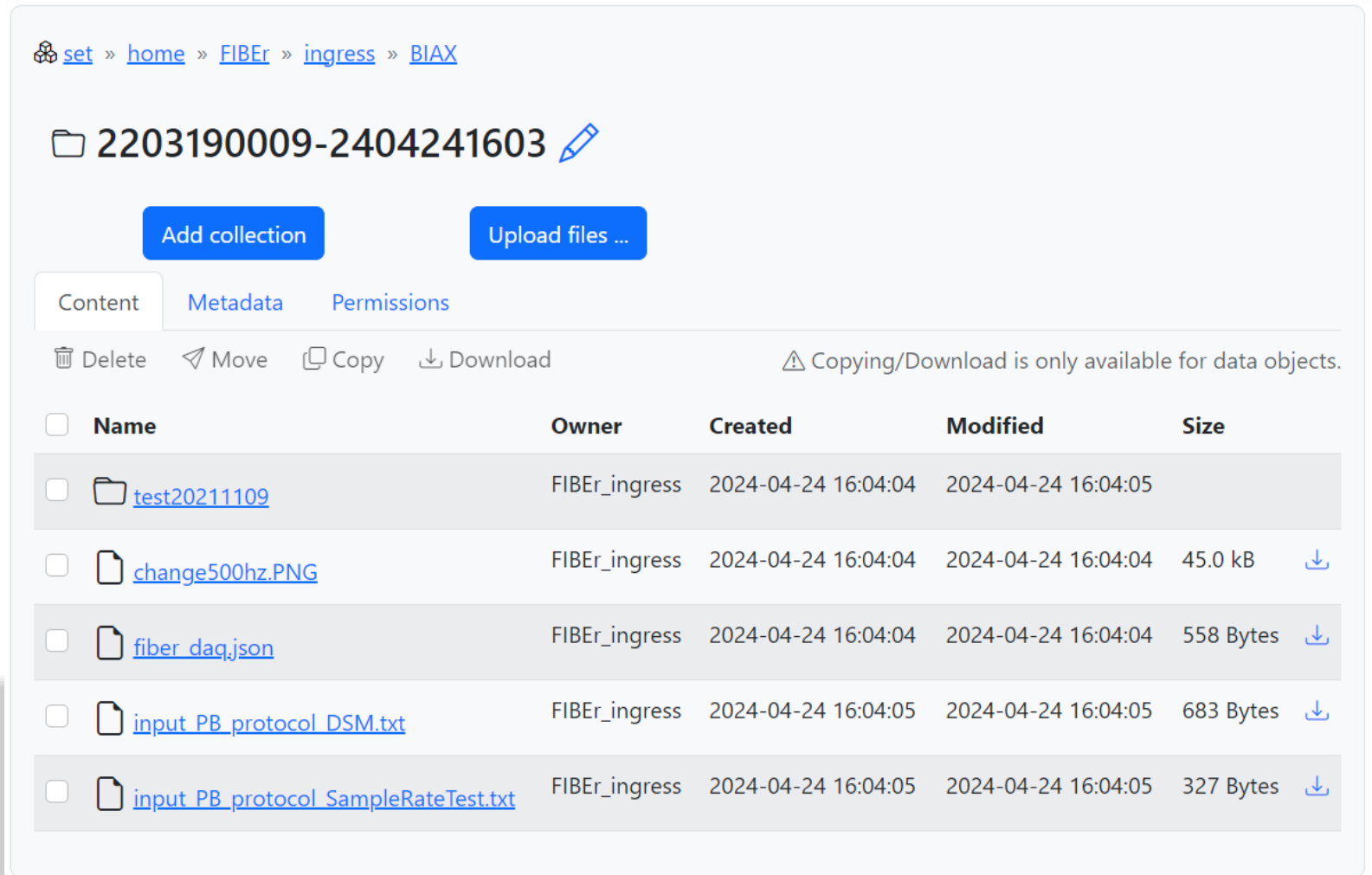


- Foundation
  - **Built upon the iRODS Capability Automated Ingest (iCAI)** to provide a library of common ingestion handlers with enhanced configuration features.
  - Includes base **handler classes** for different types of data ingestion, such as RunFolderIngestHandler, BCLIngestHandler, and FASTQIngestHandler.
    - Inspired by bihealth/rodeos-ingest: Code for ingesting omics data into omics storage based on iRODS capabilities (github.com)
- Cloud-based deployment of software components
  - K3s lightweight Kubernetes distro great for edge deployments in labs
  - ManGO Ingest Docker image
  - ManGO Ingest Helm chart to facilitate configuration, deployment and updating of all software components



# Data Ingestion into ManGO (ingress collections)

- The ManGO Ingestor syncs datasets from the DAQ device drop locations to an **ingress collection per source device**

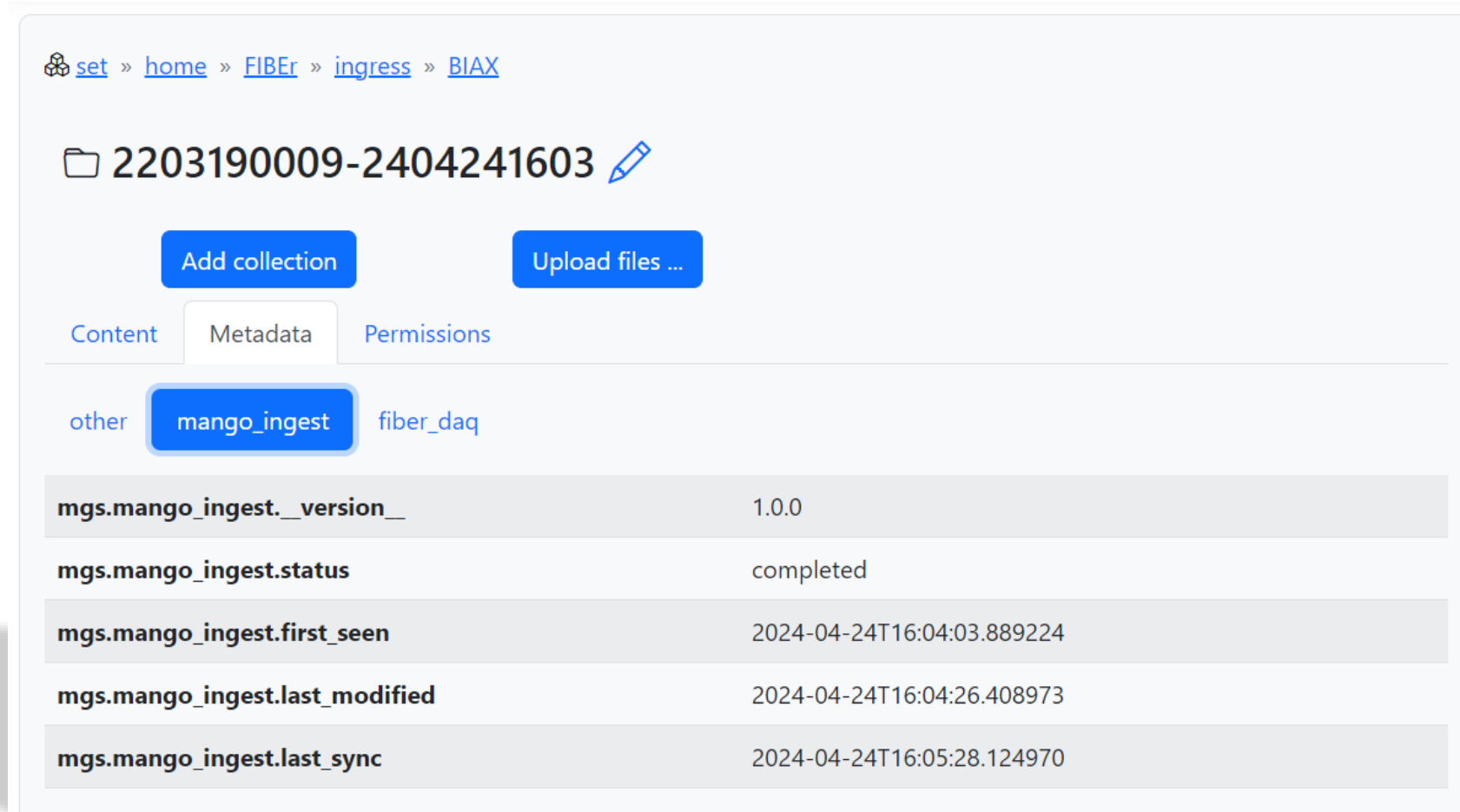


The screenshot displays the ManGO web interface for an ingress collection. The breadcrumb navigation shows the path: [set](#) » [home](#) » [FIBEr](#) » [ingress](#) » [BIAX](#). The collection ID is 2203190009-2404241603. There are two buttons: "Add collection" and "Upload files ...". Below these are tabs for "Content", "Metadata", and "Permissions". Action buttons include "Delete", "Move", "Copy", and "Download". A warning message states: "Copying/Download is only available for data objects." A table lists the contents of the collection:

<input type="checkbox"/>	Name	Owner	Created	Modified	Size	
<input type="checkbox"/>	<a href="#">test20211109</a>	FIBEr_ingress	2024-04-24 16:04:04	2024-04-24 16:04:05		
<input type="checkbox"/>	<a href="#">change500hz.PNG</a>	FIBEr_ingress	2024-04-24 16:04:04	2024-04-24 16:04:04	45.0 kB	<a href="#">↓</a>
<input type="checkbox"/>	<a href="#">fiber_daq.json</a>	FIBEr_ingress	2024-04-24 16:04:04	2024-04-24 16:04:04	558 Bytes	<a href="#">↓</a>
<input type="checkbox"/>	<a href="#">input_PB_protocol_DSM.txt</a>	FIBEr_ingress	2024-04-24 16:04:05	2024-04-24 16:04:05	683 Bytes	<a href="#">↓</a>
<input type="checkbox"/>	<a href="#">input_PB_protocol_SampleRateTest.txt</a>	FIBEr_ingress	2024-04-24 16:04:05	2024-04-24 16:04:05	327 Bytes	<a href="#">↓</a>

# Data Ingestion into ManGO (ingest metadata)

- ManGO Ingestor adds metadata to datasets about the sync status
- Ingestor uses customizable hook method to detect completion of a test/measurement sequence



The screenshot displays the ManGO web interface for a dataset. The breadcrumb navigation at the top reads: [set](#) » [home](#) » [FIBEr](#) » [ingress](#) » [BIAX](#). Below this, the dataset identifier **2203190009-2404241603** is shown with a folder icon and an edit icon. Two blue buttons, **Add collection** and **Upload files ...**, are positioned below the identifier. A tabbed interface shows **Content**, **Metadata** (selected), and **Permissions**. Under the **Metadata** tab, there are three buttons: **other**, **mango\_ingest** (highlighted with a blue border), and **fiber\_daq**. Below these buttons is a table of metadata for the **mango\_ingest** collection.

<b>mgs.mango_ingest.__version__</b>	1.0.0
<b>mgs.mango_ingest.status</b>	completed
<b>mgs.mango_ingest.first_seen</b>	2024-04-24T16:04:03.889224
<b>mgs.mango_ingest.last_modified</b>	2024-04-24T16:04:26.408973
<b>mgs.mango_ingest.last_sync</b>	2024-04-24T16:05:28.124970

# Data Ingestion into ManGO (other metadata)

- Acquisition metadata is added to the dataset collection
- ManGO Ingestor can be extended with custom handlers to extract and add metadata for specific instruments

The screenshot displays the ManGO web interface for a specific dataset collection. The breadcrumb navigation at the top reads: [set](#) » [home](#) » [FIBEr](#) » [ingress](#) » [BIAX](#). Below this, the collection identifier **2203190009-2404241603** is shown with a folder icon and an edit icon. Two blue buttons, **Add collection** and **Upload files ...**, are positioned above a tabbed interface. The tabs are **Content**, **Metadata** (which is selected), and **Permissions**. Under the **Metadata** tab, there are three sub-tabs: **other**, **mango\_ingest**, and **fiber\_daq** (which is selected). The main area displays a table of metadata for the **fiber\_daq** collection.

<b>mgs.fiber_daq.__version__</b>	1.0.0	
<b>mgs.fiber_daq.sample.id</b>	2203190009	1
<b>mgs.fiber_daq.sample.name</b>	cerebellum	1
<b>mgs.fiber_daq.project.id</b>	a4943114-de7f-4690-b946-e4aba55bdb67	1
<b>mgs.fiber_daq.project.name</b>	Oefenstaal STB	1
<b>mgs.fiber_daq.acquisition_datetime</b>	2024-04-24T16:03:27	
<b>mgs.fiber_daq.experiment.id</b>	5dea7e7c37f5b86413b15267	1
<b>mgs.fiber_daq.experiment.name</b>	Pia Mater	1
<b>mgs.fiber_daq.device.model</b>	Biaxial Tester	1
<b>mgs.fiber_daq.device.name</b>	Biax	1
<b>mgs.fiber_daq.operator.name</b>	Paulien Vandemaele	1
<b>mgs.fiber_daq.operator.uid</b>	u0131530	1

# Move Datasets to Project Collections

Work in Progress

- **ManGO Flow** moves completed data ingests from ingress collection to raw collection of the associated project

set » home » FIBEr

projects

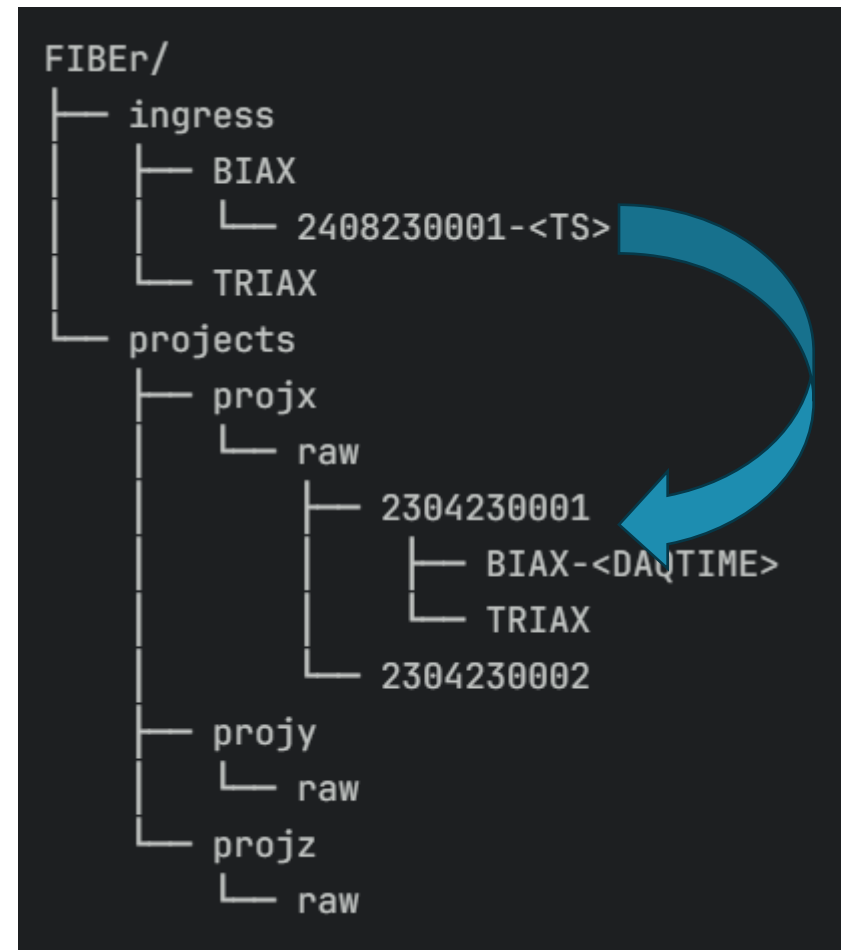
Add collection Upload files ...

Content Metadata Permissions

Delete Move Copy Download

Copying/Download is only available for data objects.

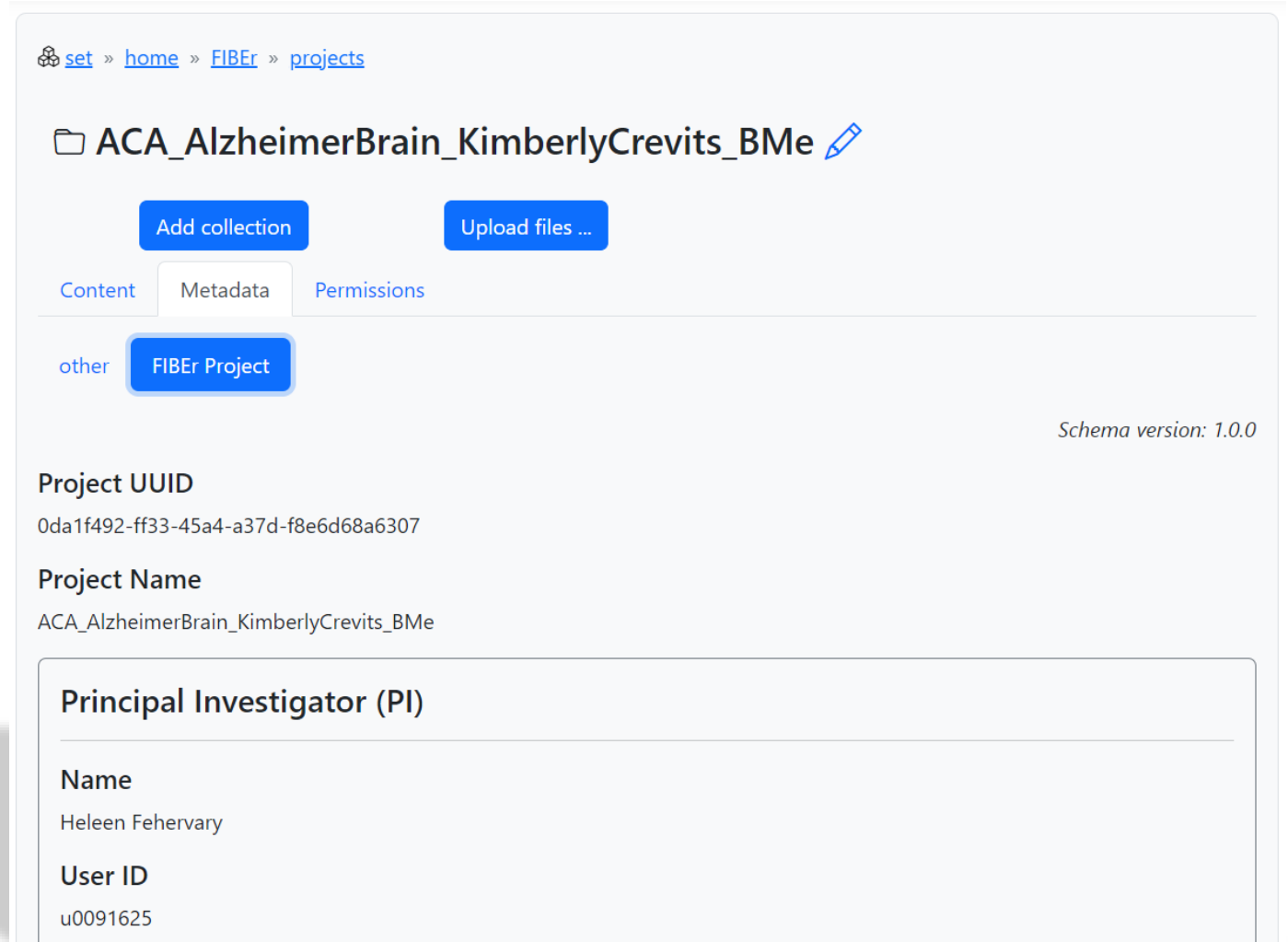
<input type="checkbox"/>	Name	Owner	Created	Modified	Size
<input type="checkbox"/>	ACA AlzheimerBrain_KimberlyCrevits_BMe	u0109593	2024-09-12 11:19:52	2024-09-12 11:19:52	
<input type="checkbox"/>	ACA CompressionOfSferoidsInMicroCT_JahrHolger_ACA	u0109593	2024-09-12 12:05:08	2024-09-12 12:05:08	





# Move Datasets to Project Collections (project metadata)

- Target project collection is determined by project metadata set on project collections and the acquisition metadata set on the ingested dataset



The screenshot shows the FIBEr project metadata interface. At the top, there is a breadcrumb navigation: [set](#) » [home](#) » [FIBEr](#) » [projects](#). Below this, the project name is displayed as **ACA\_AlzheimerBrain\_KimberlyCrevits\_BMe** with an edit icon. There are two main buttons: **Add collection** and **Upload files ...**. Below these are three tabs: **Content**, **Metadata** (which is active), and **Permissions**. Under the **Metadata** tab, there is a section for **other** with a button for **FIBEr Project**. On the right side, it says *Schema version: 1.0.0*. The main content area shows the following fields:

- Project UUID**: 0da1f492-ff33-45a4-a37d-f8e6d68a6307
- Project Name**: ACA\_AlzheimerBrain\_KimberlyCrevits\_BMe
- Principal Investigator (PI)**:
  - Name**: Heleen Fehervary
  - User ID**: u0091625

# Data Processing



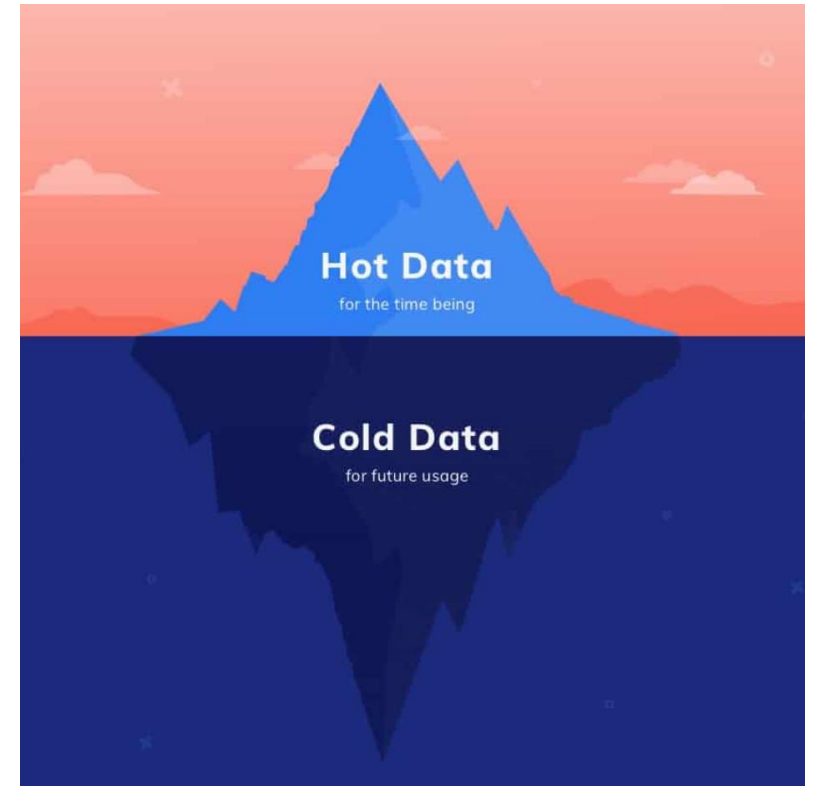
- Workflow depends on project and data types
- Generic workflow using Globus for data transfers
  - Transfer raw data to workstation or HPC for processing
  - Upload of results
  - Still early-stage ideas to be worked out



# Archival of completed projects (in the future)



- Move data of completed projects to **cold storage**
  - Long-term storage
  - *Qualified* and well described *immutable datasets*
  - May be re-used or re-examined in the future
    - Enough *metadata* provided, to allow the datasets to be re-used
    - *Searchable* in the long-term





Any Questions?

# References

- <https://fiber.biomech.be>
- <https://gitlab.kuleuven.be/setit/rdm/mango-ingest>
- <https://gitlab.kuleuven.be/setit/rdm/mango-ingest-helm-chart>
- [https://github.com/irods/irods\\_capability\\_automated\\_ingest](https://github.com/irods/irods_capability_automated_ingest)
- <https://github.com/kuleuven/mango-mdschema>
- <https://rdm-docs.icts.kuleuven.be/mango/>
- <https://rdm-docs.icts.kuleuven.be/globus/>