

RDM in practice – Electronic lab notebooks

Dominik Brillhaus – [CEPLAS Data Science](#)

RPTU Summer School

July 20th, 2023

Content

- Intro to elabFTW as one example for electronic lab notebooks
- Pros & Cons of elabFTW
- Shaping your lab documentation towards FAIR

Check-in

elabFTW @ RPTU: <https://elab.rptu.de/>

⚠ this is the RPTU elabFTW instance → Changes cannot be deleted.

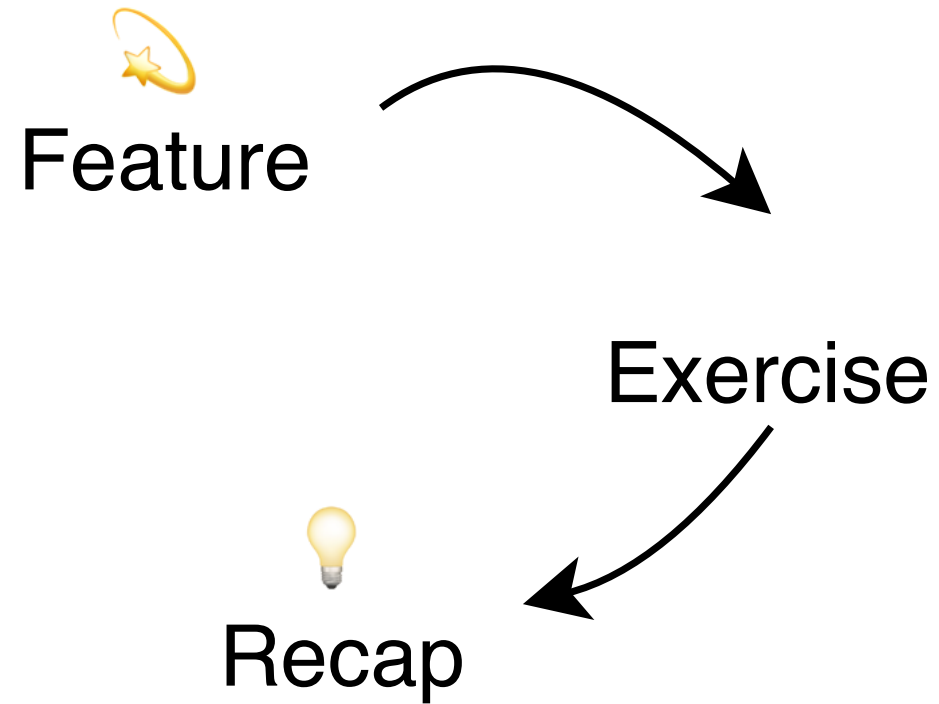
Demo elabFTW: <https://demo.elabftw.net/>

⚠ this is a public demo → All changes are public

🚀 **For today:** <https://clerk.cs.uni-kl.de/>

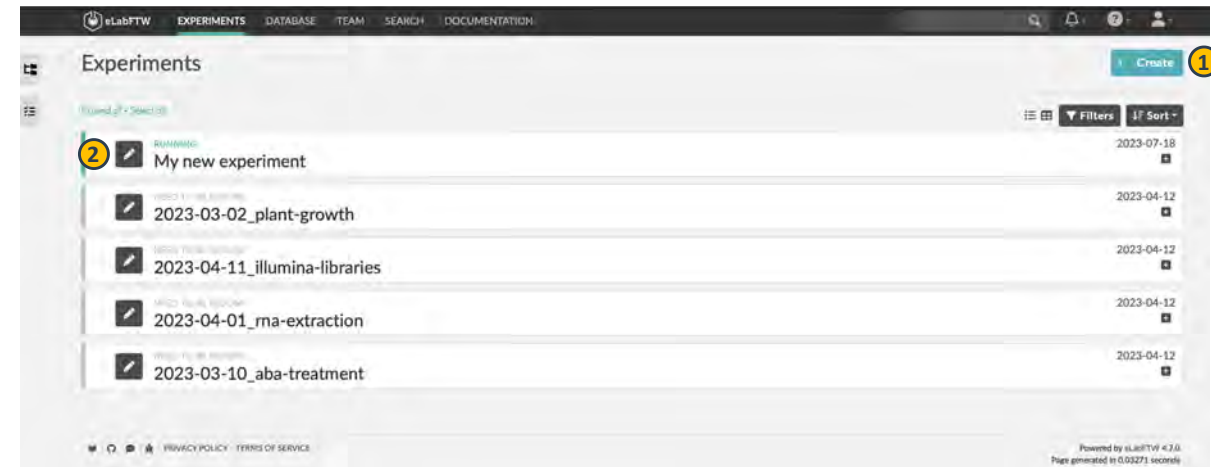
💡 this instance will be deleted after the summer school

Hands-on Circle



Experiments panel

- Create an experiment
- View / edit mode





Exercise

Create an experiment **Baking pancakes**

1. Ingredients
 - Flour
 - Eggs
 - Milk
2. Procedure
 - Mix ingredients
 - Fry in pan
 - Serve with maple syrup
3. ...



Recap

- keine Metadaten
- Freitext
- JSON hilfreich
- Daten nicht verlinkt






Categorize

- Tags
- Database
- Link items

Tags

eLabFTW EXPERIMENTS DATABASE TEAM SEARCH DOCUMENTATION

Experiments > Editing an entry Create

←     

Started on 🔒 ⭐⭐⭐⭐⭐

Title

Status

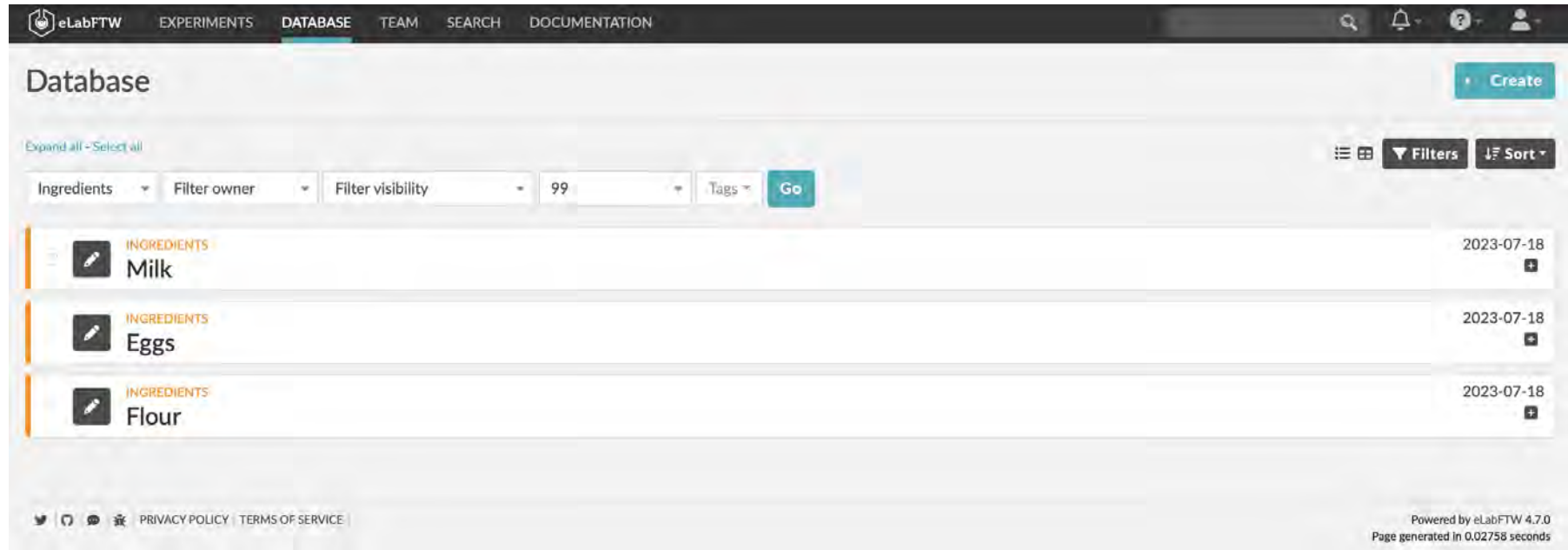
Tags **Extraction** **Plants** **sugar**

Experiments Create

Expand all - Select all ⌵ Filters ⌵ Sort

<input type="checkbox"/>	<div><div></div><div><div>RUNNING</div><div>Sugar extraction from plant leaves</div><div>Extraction Plants sugar</div></div></div>	2023-07-18 +
--------------------------	--	---------------------------

Database



The screenshot shows the 'Database' section of the eLabFTW application. The top navigation bar includes 'eLabFTW', 'EXPERIMENTS', 'DATABASE' (highlighted), 'TEAM', 'SEARCH', and 'DOCUMENTATION'. On the right, there are icons for search, notifications, help, and user profile. The main heading is 'Database' with a 'Create' button. Below it, there's a filter section with 'Expand all - Select all' and a table of filters: 'Ingredients' (selected), 'Filter owner', 'Filter visibility', and a value '99'. A 'Go' button is next to the filters. The table lists three items: 'Milk', 'Eggs', and 'Flour', all categorized as 'INGREDIENTS' and dated '2023-07-18'. Each item has a pencil icon for editing and a plus icon for adding. At the bottom, there are social media links, 'PRIVACY POLICY', 'TERMS OF SERVICE', and a footer note: 'Powered by eLabFTW 4.7.0 Page generated in 0.02758 seconds'.



The screenshot shows the 'Admin panel' of the eLabFTW application. The top navigation bar includes 'TEAM', 'GROUPS', 'USERS', 'STATUS', 'TYPES OF ITEMS' (highlighted), 'EXPORT', and 'TAG MANAGER'. The main heading is 'Admin panel'. Below it, there's a sub-heading 'Database Items Types'. A text box explains: 'This menu allows you to define categories for entries in the Database. A database item type is similar to an experiment template but for database entries.' There is a 'Create' button. Below the text, there's a table with one item: 'Ingredients', which has a pencil icon for editing.



Linking items

▼ LINKED ITEMS

 INGREDIENTS - Eggs	   
 INGREDIENTS - Flour	   
 INGREDIENTS - Milk	   

 Ingredients ▼ from the database Add


Database > Viewing an entry Create



←    

Started on 2023-07-18

Ingredients Eggs


Category **INGREDIENTS**


 Visibility  All the teams I am part of

 Can write  All the teams I am part of

Last modified on 2023-07-18 17:08:58
Unique eLabID: 20230718-71611bfef69a54bd08040bf1f0baa333db3d0f70

▼ RELATED EXPERIMENTS

 Baking pancakes 

 [Show linked experiments](#)

Exercise

Categorize your experiment items

- Use tags → "baking recipes"
- Create database entries → "ingredients"
- link items

Recap

- 2x selbes Item
- Capitalization
- using items in an experiment
- different approaches of linking / resuing items (from database)
- which metadata to add where
- "different ways to do it"
- CV / ontologies
- PIDs



Exercise

Start another experiment **Baking a chocolate cake**

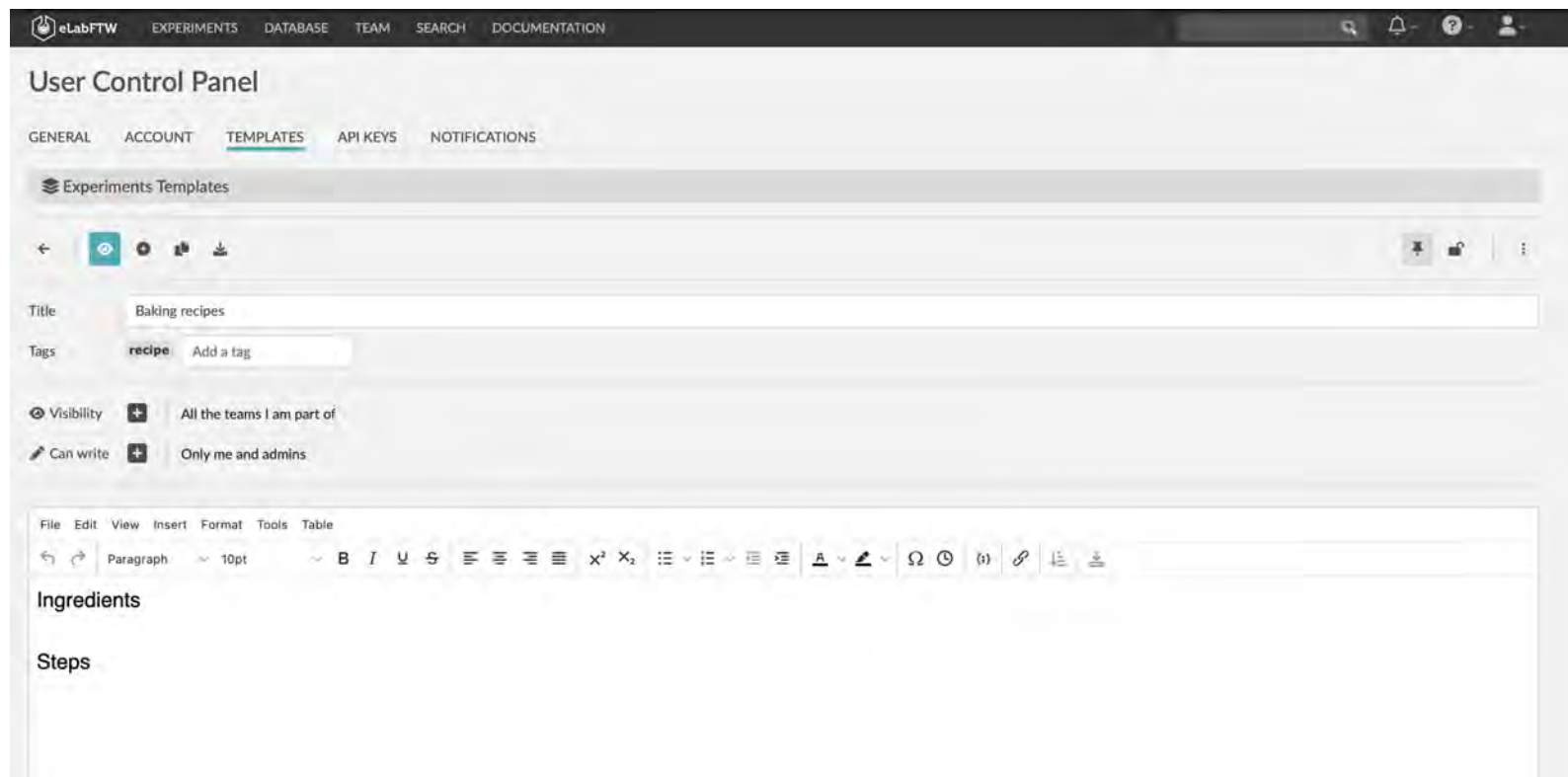
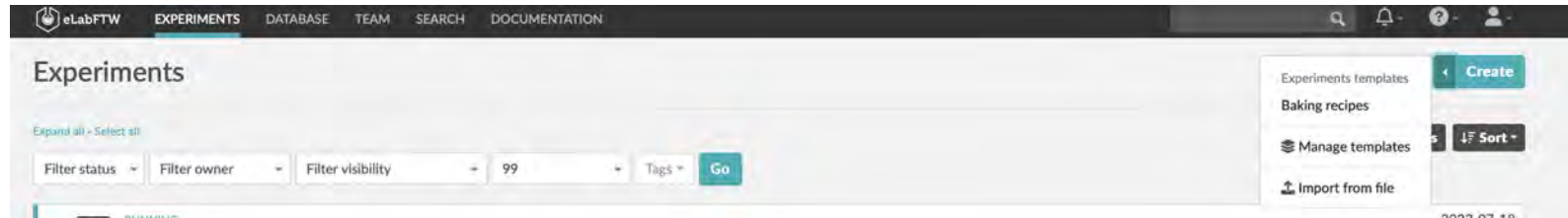
1. Grocery list
 - Flour, Sugar, Eggs, Butter, Milk, Chocolate
2. Steps
 1. Mix ingredients
 1. type of mixer
 2. speed
 3. type of beater
 2. Prepare cake pan
 1. type of cake pan
 2. butter cake pan
 3. Bake
 1. temperature
 2. top heat / circulating air
 3. Cooling phase



Recap

-

Provide structure: Create templates



Exercise


Create an experiment template for **baking recipes**

Recap


- user-friendly ++
- but a lot of free-text
- templating helps towards reusable structure

Add data to your experiment

▼ ATTACH A FILE



▼ ATTACHED FILE



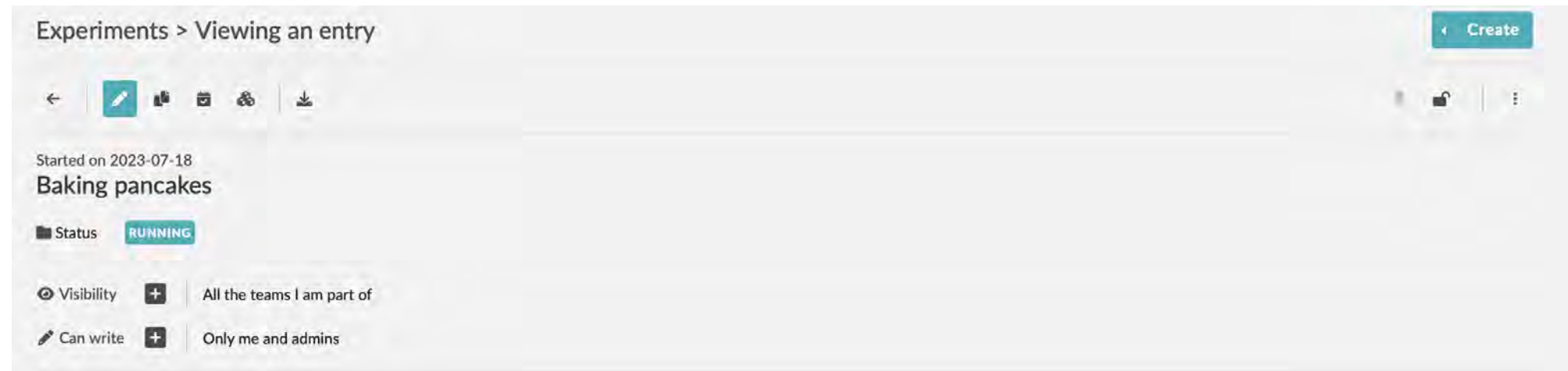
pancakes-cc0.jpg 298.64 KiB - 2023-07-19 11:51:54

Click to add a comment

Recap


Share & Collaborate

Visibility and write access



Version history

Experiments > Viewing an entry Create

←     

Started on 2023-07-18
Baking pancakes

Status RUNNING





1 revision available
[See changelog](#)

Experiments

[Go back](#)

Changelog

Date	User	Property changed	New value
2023-07-19 12:16:18	Dominik Brilhaus	body	Depending on your instance configuration, the change in the body is possibly recorded in the revisions. See revisions page.
2023-07-18 17:11:39	Dominik Brilhaus	title	Baking pancakes
2023-07-18 17:11:32	Dominik Brilhaus	title	Untitled

    [PRIVACY POLICY](#) [TERMS OF SERVICE](#)

Powered by eLabFTW 4.7.0
Page generated in 0.02185 seconds

Restore revision

Revisions

This server is configured to store 4 revisions per entry maximum.

[Go back](#)

44 seconds ago by Dominik Brilhaus [Restore](#)

1. Ingredients

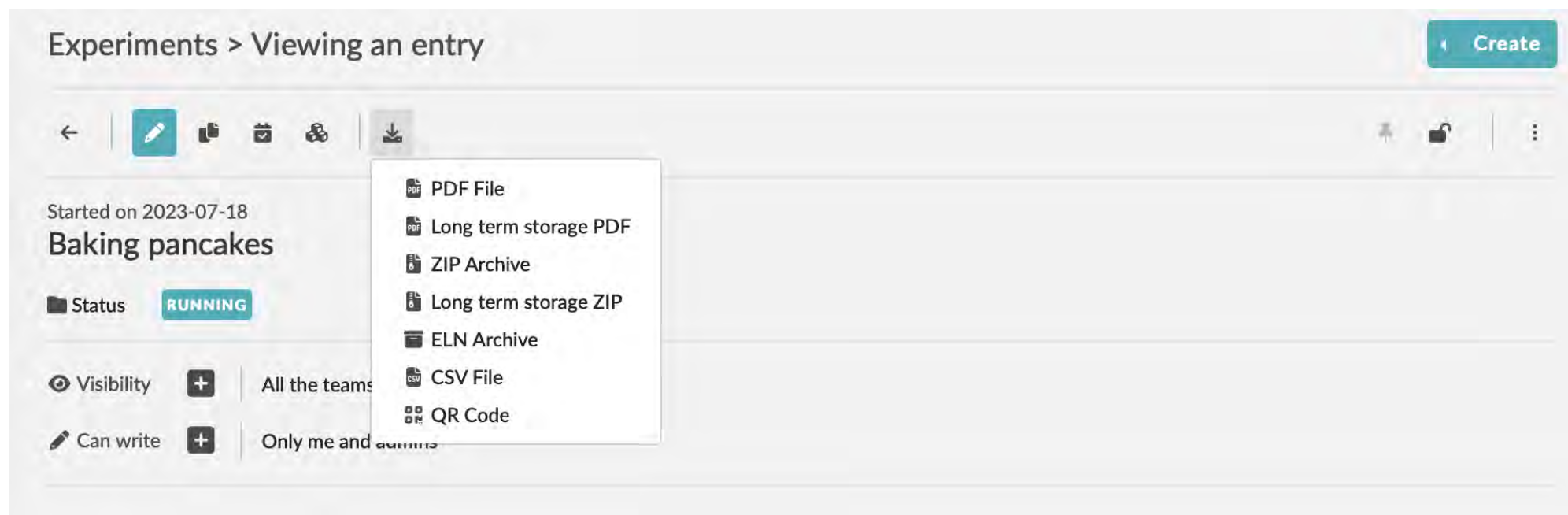
- Flour
- Eggs
- Milk

2. Procedure

- Mix ingredients
- Fry in pan
- Serve with maple syrup

3. ...

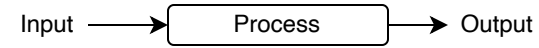
Export experiments



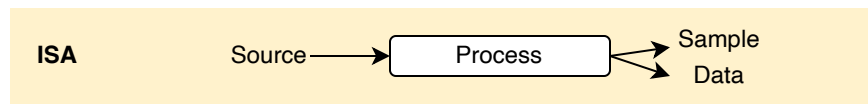
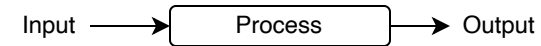
Recap

Towards **FAIR** elabFTW

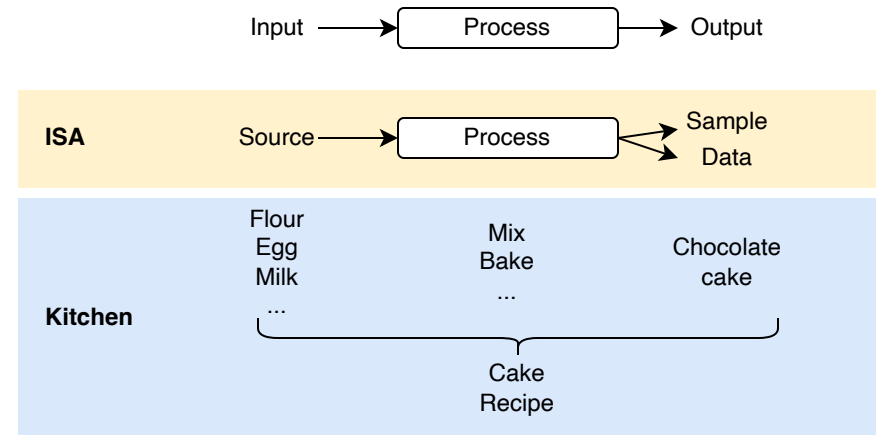
Cut protocols into pieces (processes)



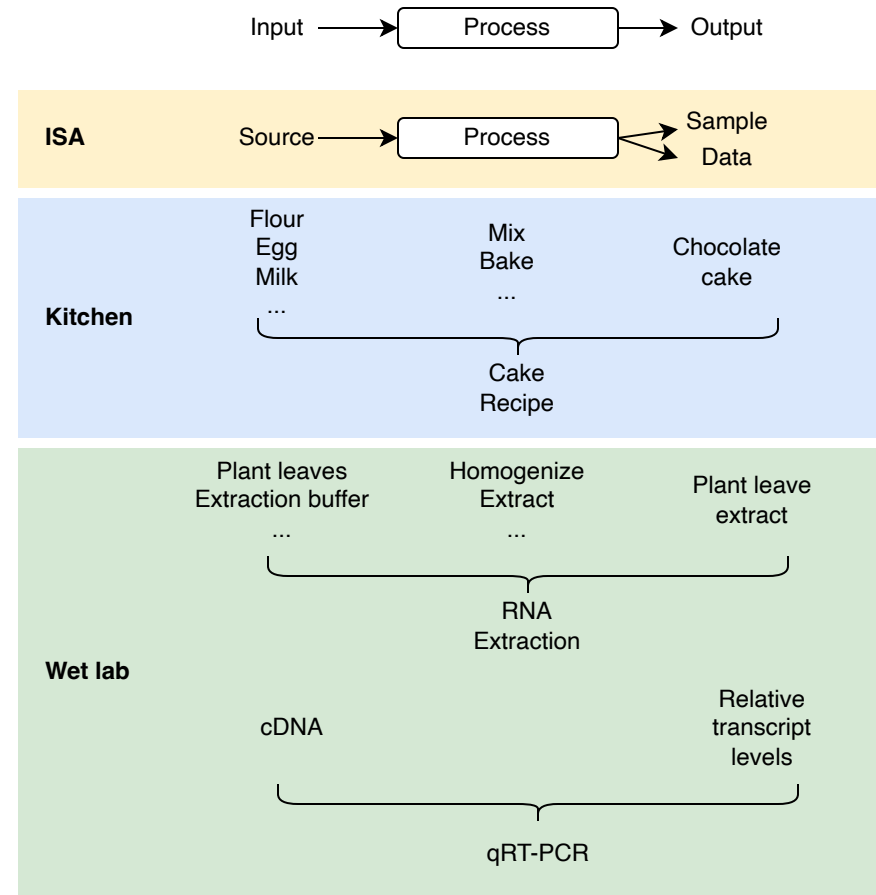
Define inputs and outputs



Cut protocols into pieces



Cut protocols into pieces



Bridging elabFTW and ARC



Example Scenario

1. You use **ARCs** to

- organize and store your (raw) data locally
- share and communicate data with collaboration partners
- annotate and prepare your data for publication

2. You use **elabFTW** to

- document your daily lab work "on the fly"
- organize lab routines with colleagues

Goals

1. Benefit from "both worlds" (ARC and elabFTW)
 - iteratively work on protocols
 - be able to associate metadata to the raw data
2. Align elabFTW structure and ARCs

Schematize: JSON templates

JSON EDITOR

Display main text ☒ ⓘ

You are currently editing the metadata attached to this entry.

```
1 {
2   "elabftw": {
3     "extra_fields_groups": [
4       {
5         "id": 1,
6         "name": "INVESTIGATION"
7       },
8       {
9         "id": 2,
10        "name": "INVESTIGATION PUBLICATIONS"
11      },
12      {
13        "id": 3,
14        "name": "INVESTIGATION CONTACTS"
15      }
16    ],
17  },
18  "extra_fields": {
19    "Investigation Title": {
20      "type": "text",
21      "value": "",
22      "group_id": "1",
23      "blank_value_on_duplicate": true
24    }
25  }
26 }
```

Ln: 1 Col: 1

INVESTIGATION

Investigation Title

Investigation Identifier

Investigation Description

Investigation Submission Date

Investigation Public Release Date

INVESTIGATION PUBLICATIONS

Investigation Publication DOI

Investigation Publication Title

Investigation Publication PubMed ID

Investigation Publication Author List

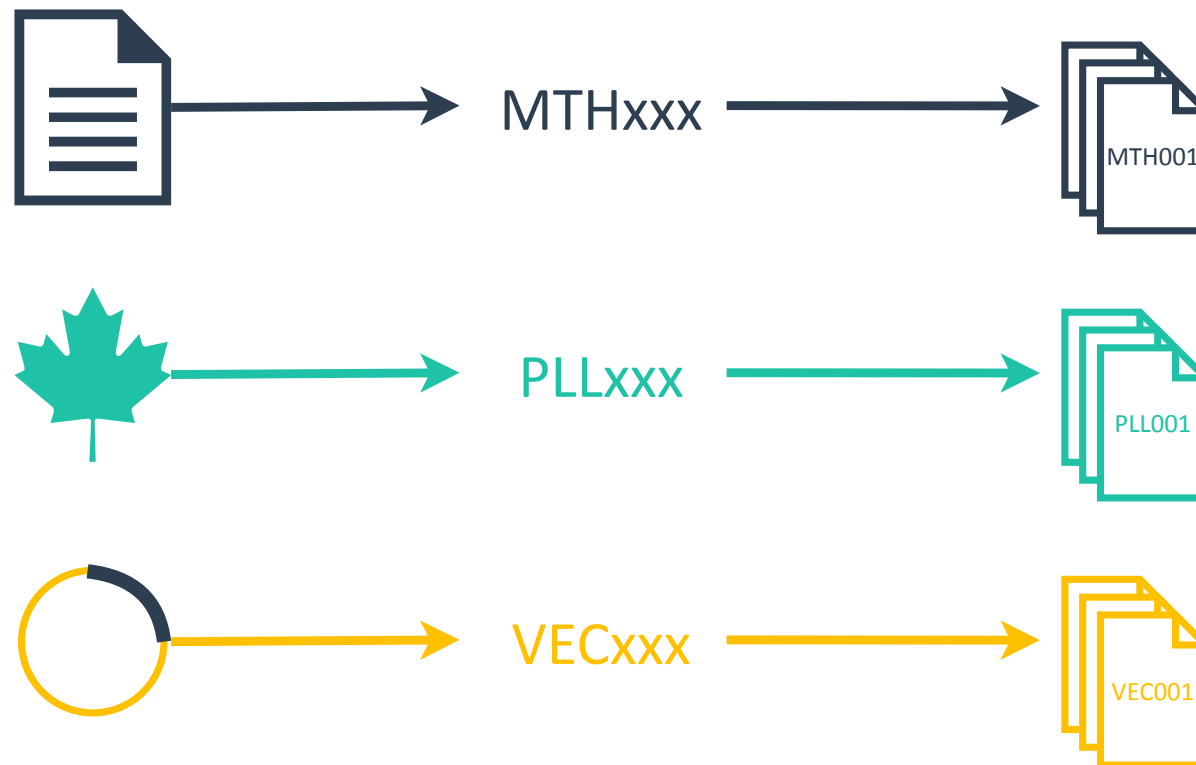
INVESTIGATION CONTACTS

Investigation Person Email


Investigation Person Phone

Catalog your lab

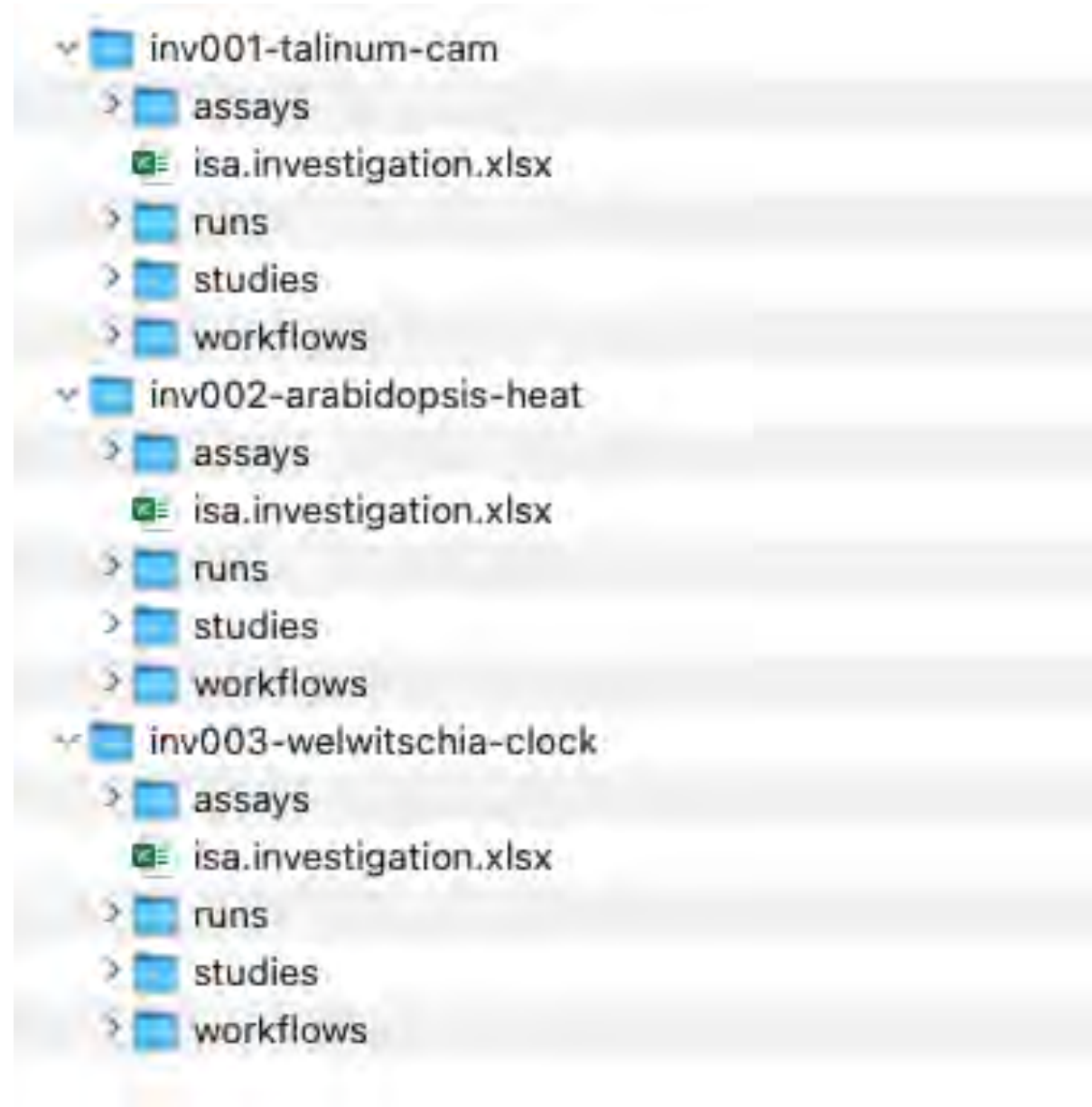
1. Which items want to be shared and cataloged?
2. catalog: Name / ID items
3. Create item database



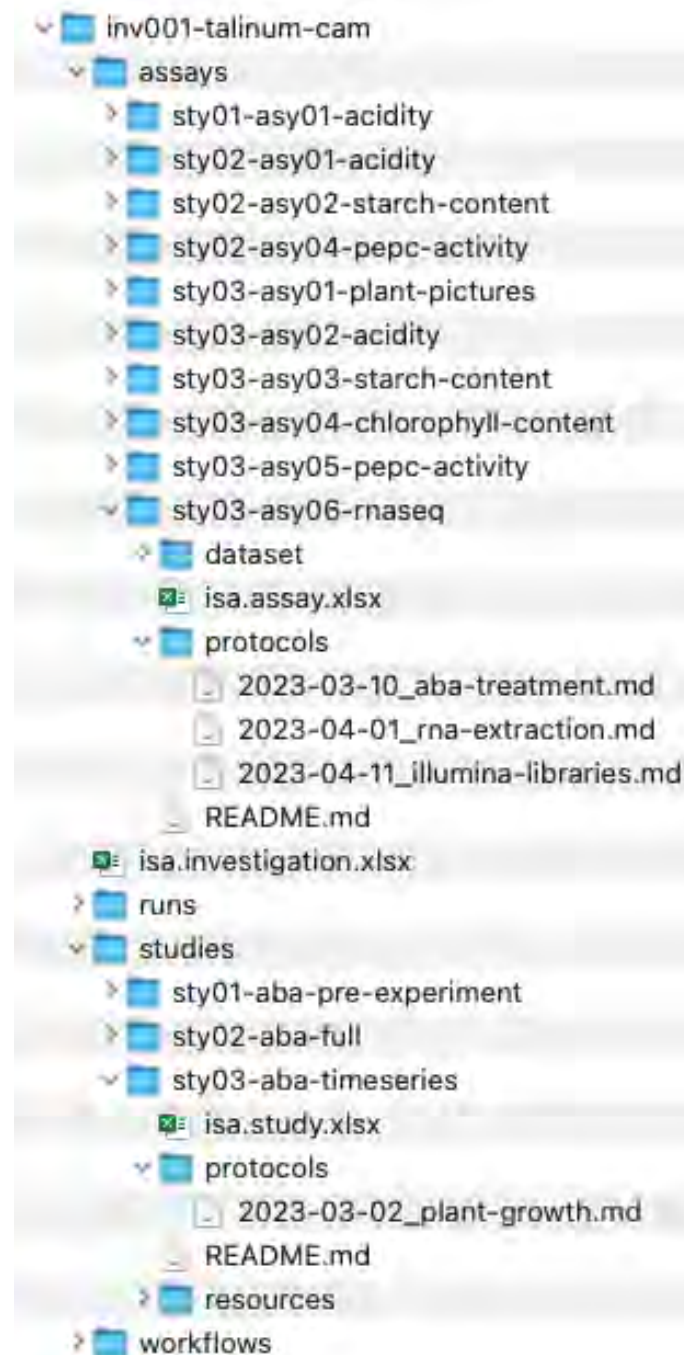
Local ARCs - Project overview

- >  inv001-talinum-cam
- >  inv002-arabidopsis-heat
- >  inv003-welwitschia-clock

Local ARCs - Project overview



Local ARCs - Protocols



DataHUB

<https://git.nfdi4plants.org>

Example ARC DataHUB - project overview

The screenshot shows the 'elab-demo-arcs' project overview in the ARC DataHUB. The left sidebar contains navigation links: 'elab-demo-arcs', 'Group information', 'Issues' (0), 'Merge requests' (0), 'CI/CD', 'Packages and registries', and 'Settings'. The main content area displays the project name 'elab-demo-arcs' with a lock icon and 'Group ID: 570'. It includes buttons for 'New subgroup' and 'New project'. Below this, there are tabs for 'Subgroups and projects' (selected), 'Shared projects', and 'Archived projects'. A search bar and a sort dropdown set to 'Updated' are also present. The list of subgroups and projects shows three items:

Project Name	Stars	Updated
inv001-talinum-cam	0	2 minutes ago
inv003-welwitschia-clock	0	32 minutes ago
inv002-arabidopsis-heat	0	32 minutes ago

Example ARC DataHUB - ARC overview

The screenshot displays the GitLab web interface for a project named 'inv001-talinum-cam'. The left sidebar contains navigation links for Project information, Repository, Issues, Merge requests, CI/CD, Security & Compliance, Deployments, Packages and registries, Infrastructure, Monitor, Analytics, Wiki, Snippets, and Settings. The main content area shows the project name, Project ID (374), and statistics (2 Commits, 1 Branch, 0 Tags, 379 KB Project Storage). A recent commit 'add protocols' by Dominik Brihtaus is shown. Below this, there are buttons for 'Find file', 'Web IDE', and 'Clone'. A table lists the project's files and their last commit details.

Name	Last commit	Last update
.arc	initialize ARC structure	19 hours ago
assays	add protocols	3 minutes ago
runs	initialize ARC structure	19 hours ago
studies	add protocols	3 minutes ago
workflows	initialize ARC structure	19 hours ago
.gitattributes	add protocols	3 minutes ago
isa.investigation.xlsx	initialize ARC structure	19 hours ago

Example ARC DataHUB - assay protocols

Search GitLab

inv001-talinum-cam

elab-demo-arc > inv001-talinum-cam

add protocols
Dominik Brithaus authored 3 minutes ago

b56d71c

main inv001-talinum-cam / assays / sty03-asy06-maseq / protocols History Find file Web IDE Clone

Name	Last commit	Last update
..		
.gitkeep	initialize ARC structure	19 hours ago
2023-03-10_aba-treatment.md	add protocols	3 minutes ago
2023-04-01_rna-extraction.md	add protocols	3 minutes ago
2023-04-11_illumina-libraries.md	add protocols	3 minutes ago

Example ARC DataHUB - protocol detail

The screenshot displays the GitLab web interface for a repository named 'inv001-talinum-cam'. The left sidebar contains a navigation menu with options: Project information, Repository, Issues, Merge requests, CI/CD, Security & Compliance, Deployments, Packages and registries, Infrastructure, Monitor, Analytics, Wiki, Snippets, and Settings. The main content area shows a commit titled 'add protocols' by Dominik Brilhaus, made 3 minutes ago. Below this, the file path is shown as 'main / inv001-talinum-cam / studies / sty03-aba-timeseries / protocols / 2023-03-02_plant-growth.md'. The file is 404 bytes and is currently open in the Web IDE. The file content is titled 'Plant Material and Growth Conditions' and lists the following details:

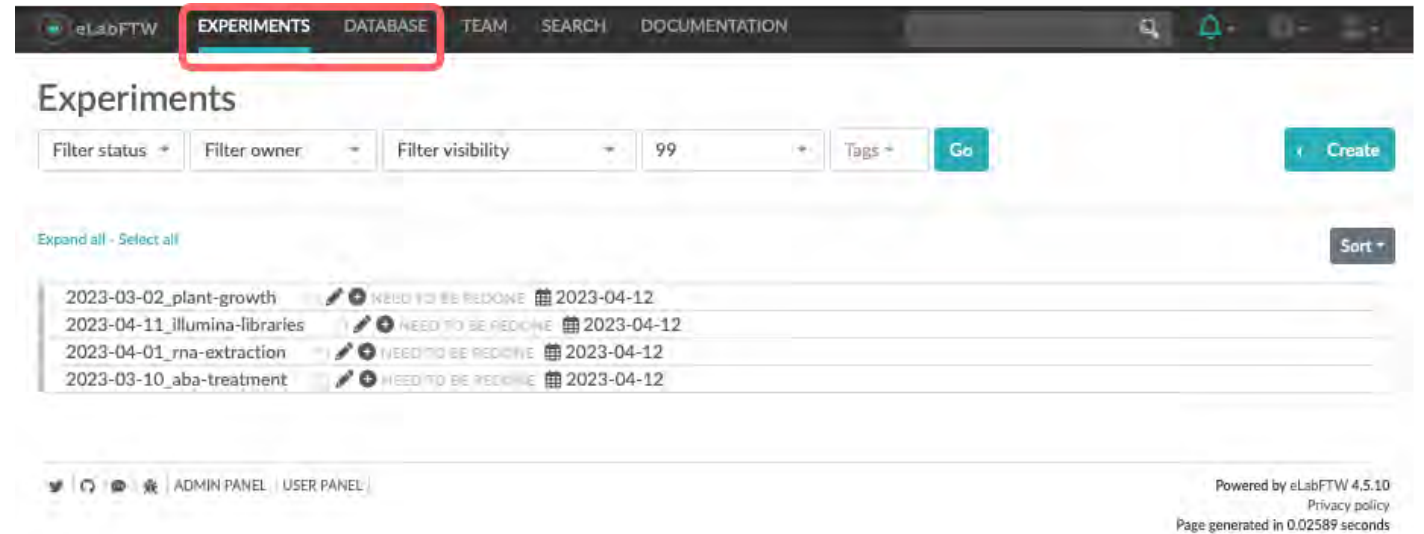
- Plant Material and Growth Conditions
 - Talinum triangulare, 28-d-old plants
 - Soil: Miracle-Gro Potting Mix (Miracle-Gro)
 - Pots: "Short-One" treepots, 1.6 l (Stuewe and Sons)
 - Chamber: Environmental Growth Chambers
 - Settings:
 - 12 h light (30°C, 37% relative humidity)/12 h dark (22°C) cycles
 - Photon flux density at leaf level was 425 mmol m⁻² s⁻¹

elabFTW - Overview

elabFTW data is mainly divided in two main panels

Experiments

Database

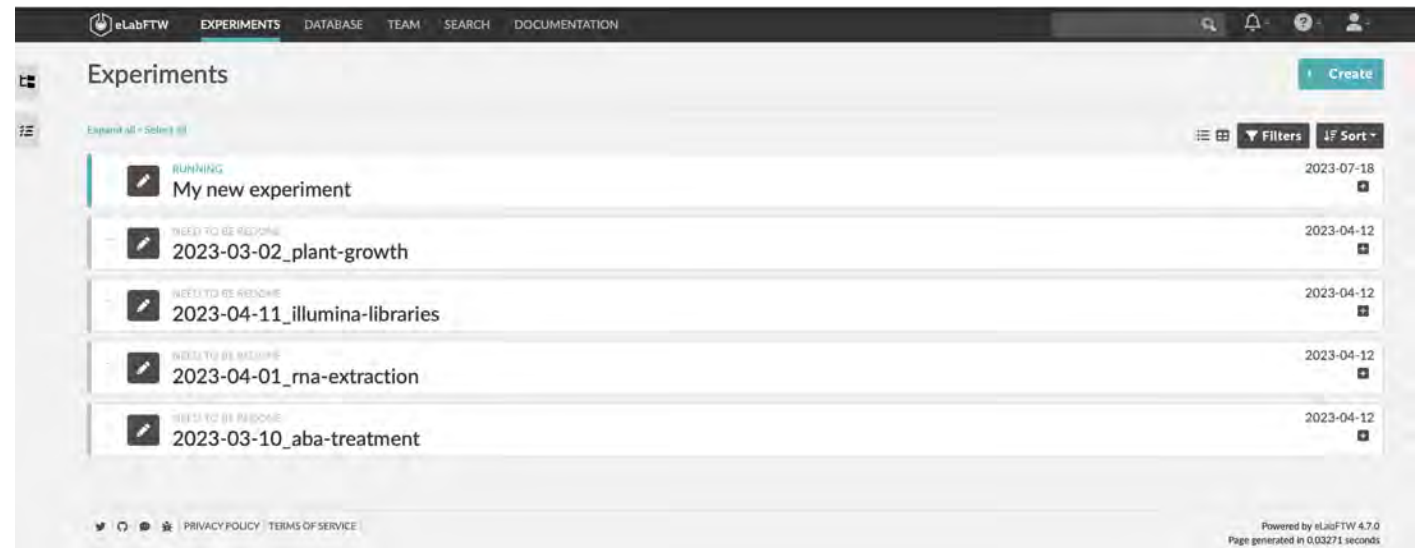


The screenshot displays the elabFTW web application interface. The top navigation bar includes links for EXPERIMENTS (highlighted with a red box), DATABASE, TEAM, SEARCH, and DOCUMENTATION. Below the navigation bar, the 'Experiments' section is visible, featuring filter controls for status, owner, visibility, and a count of 99. A 'Create' button is located on the right. The main content area shows a list of experiments with details such as dates, names, and status indicators. At the bottom, there are links for ADMIN PANEL and USER PANEL, and a footer indicating the software version (4.5.10) and generation time.

Experiment Name	Status	Date
2023-03-02_plant-growth	NEED TO BE REDONE	2023-04-12
2023-04-11_illumina-libraries	NEED TO BE REDONE	2023-04-12
2023-04-01_rna-extraction	NEED TO BE REDONE	2023-04-12
2023-03-10_aba-treatment	NEED TO BE REDONE	2023-04-12

Experiment Panel

The Experiment panel is the default "working area" for protocols of daily lab work



Database Panel

The Database panel is elabFTW's place to categorize contents

The screenshot displays the 'Database' panel in the elabFTW interface. At the top, a navigation bar includes links for 'eLabFTW', 'EXPERIMENTS', 'DATABASE' (which is highlighted), 'TEAM', 'SEARCH', and 'DOCUMENTATION'. Below the navigation bar, a status message in a light blue box states '10 items imported successfully'. Underneath this, there are filter controls: 'Filter by type', 'Filter owner', 'Filter visibility', a count of '99', a 'Tags' dropdown, and a 'Go' button. To the right of these filters is a 'Create' button. Below the filters, there is a link to 'Expand all - Select all' and a 'Sort' dropdown. The main area of the panel is a table listing 10 items. Each row contains a name, a status icon (a circle with a dot), a category icon (a document with a plus sign), and a date. The items are: 'sty03-asy06-rnaseq' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-asy05-pepc-activity' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-asy04-chlorophyll-content' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-asy03-starch-content' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-asy02-acidity' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-asy01-plant-pictures' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty02-asy04-pepc-activity' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty02-asy02-starch-content' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty02-asy01-acidity' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty01-asy01-acidity' (ASSAY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty03-aba-timeseries' (STUDY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty02-aba-full' (STUDY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'sty01-aba-pre-experiment' (STUDY, 2023-04-12), 'inv001-talinum-cam' (2023-04-12), 'inv003-welwitschia-clock' (INVESTIGATION, 2023-04-12), 'inv003-welwitschia-clock' (2023-04-12), 'inv002-arabidopsis-heat' (INVESTIGATION, 2023-04-12), 'inv002-arabidopsis-heat' (2023-04-12), 'inv001-talinum-cam' (INVESTIGATION, 2023-04-12), and 'inv001-talinum-cam' (2023-04-12).

💡 Item types can be defined in the Admin Panel




48

Preparing database lists for elabFTW import

💡 elabFTW offers batch-import from csv.

- elabFTW offers to import data from a csv file as described here:
<https://doc.elabftw.net/user-guide.html#importing-from-a-csv-file>
- These can be imported as any type of database item or experiment
- elabFTW-specific columns
 - `title` : will be the displayed name of the individual item
 - `tags` : (separated by `|`) will be used as tags

Database import

 eLabFTW


EXPERIMENTS


DATABASE


TEAM


SEARCH

DOCUMENTATION









Database

Filter by type ▾

Filter owner ▾

Filter visibility ▾

99 ▾

Tags ▾

Go

Expand all - Select all - Clear selection - Invert selection

With selected:

Change item type ▾

Change visibility ▾

Export ▾

Add a tag

Add a link

Any category ▾

Link to an experiment

Any author ▾

LOCK

DELETE

Edit me

Investigation





Study

Assay

Import from file

Create

Sort ▾

    ADMIN PANEL | USER PANEL

Powered by eLabFTW 4.5.10
Privacy policy
Page generated in 0.03621 seconds

Database import example - Investigations

db_investigations.csv

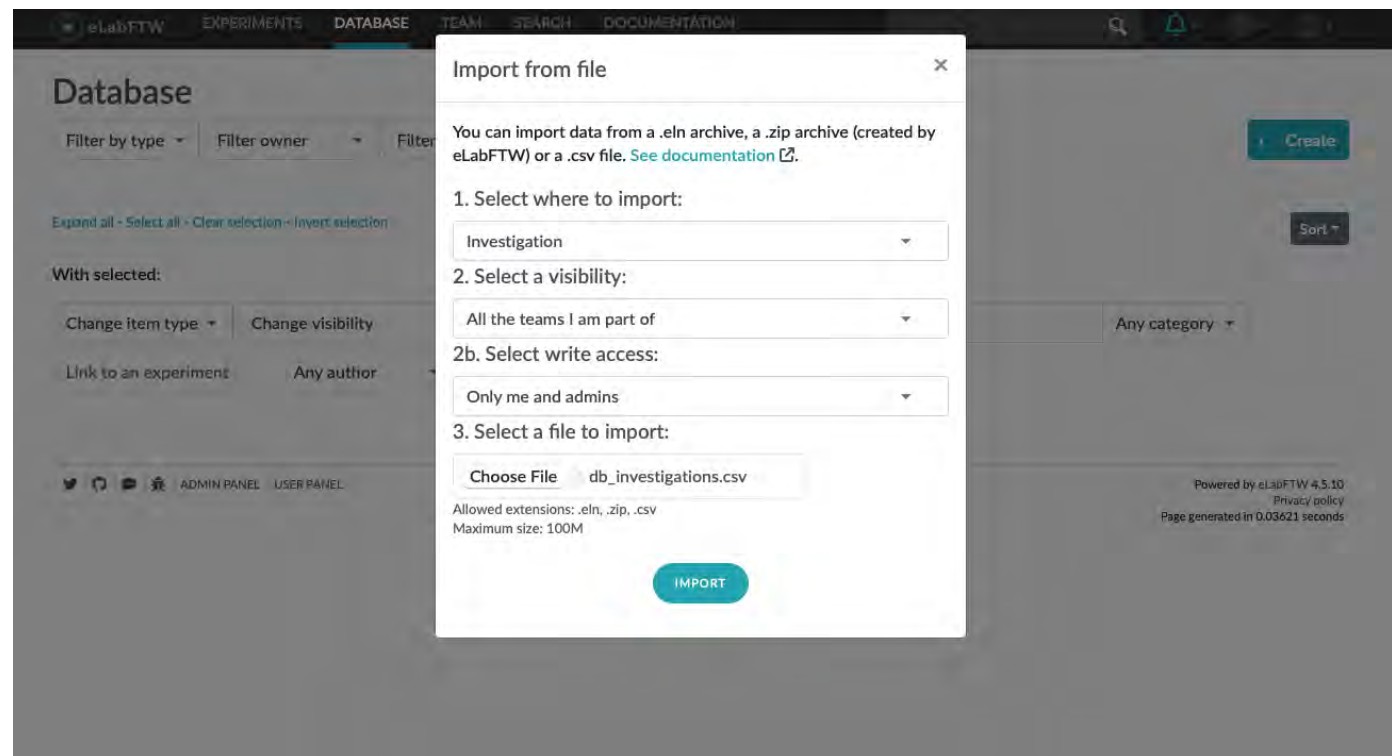
title	tags	Investigation Identifier	Investigation Person Last Name	Investigation Person First Name	Investigation F Email
inv001-talinum-cam	inv001-talinum-cam	inv001-talinum-cam	Beetroot	Jasmine	jasmine.beetroc@uni.org
inv002-arabidopsis-	inv002-arabidopsis-	inv002-arabidopsis-	Sage	Oliver	oliver.sage@arc.uni.org

Database import example - Studies

exp_inv001-talinum-cam_studies.csv

title	tags	Study Identifier	Study Title	Study Description
sty01-aba-pre-experiment	inv001-talinum-cam	sty01-aba-pre-experiment	Pre-experiment to test ABA treatment	ABA treatment
sty02-aba-full	inv001-talinum-cam	sty02-aba-full	Large scale experiment with ABA	ABA treatment

Database import



Database import

The screenshot displays the eLabFTW Database management interface. At the top, a navigation bar includes links for EXPERIMENTS, DATABASE (which is highlighted), TEAM, SEARCH, and DOCUMENTATION. Below the navigation bar, a light blue banner indicates that 3 items were imported successfully. Underneath this banner, there are several filter controls: 'Filter by type', 'Filter owner', 'Filter visibility', a count of '99', a 'Tags' dropdown, and a 'Go' button. To the right of these filters is a '+ Create' button. Below the filters, there is a link to 'Expand all - Select all' and a 'Sort' dropdown menu. The main content area shows a list of three imported items, each with a toggle switch, an edit icon, a status label, and a date. The items are: 'inv003-welwitschia-clock' (INVESTIGATION, 2023-04-12), 'inv002-arabidopsis-heat' (INVESTIGATION, 2023-04-12), and 'inv001-talinum-cam' (INVESTIGATION, 2023-04-12). At the bottom of the interface, there are social media icons, links to 'ADMIN PANEL' and 'USER PANEL', and footer text stating 'Powered by eLabFTW 4.5.10', 'Privacy policy', and 'Page generated in 0.02692 seconds'.

eLabFTW EXPERIMENTS DATABASE TEAM SEARCH DOCUMENTATION

Database

3 items imported successfully.

Filter by type Filter owner Filter visibility 99 Tags Go + Create

Expand all - Select all Sort

inv003-welwitschia-clock	<input type="checkbox"/>		INVESTIGATION	2023-04-12
inv002-arabidopsis-heat	<input type="checkbox"/>		INVESTIGATION	2023-04-12
inv001-talinum-cam	<input type="checkbox"/>		INVESTIGATION	2023-04-12

Twitter GitHub YouTube Instagram ADMIN PANEL USER PANEL

Powered by eLabFTW 4.5.10
Privacy policy
Page generated in 0.02692 seconds

Database Panel

eLabFTW

EXPERIMENTS

DATABASE

TEAM

SEARCH

DOCUMENTATION

Database

10 items imported successfully

Filter by type

Filter owner

Filter visibility

99

Tags

Go

Create

Expand all

Select all

Sort

sty03-asy06-rnaseq	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-asy05-pepc-activity	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-asy04-chlorophyll-content	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-asy03-starch-content	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-asy02-acidity	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-asy01-plant-pictures	ASSAY	2023-04-12
inv001-talinum-cam		
sty02-asy04-pepc-activity	ASSAY	2023-04-12
inv001-talinum-cam		
sty02-asy02-starch-content	ASSAY	2023-04-12
inv001-talinum-cam		
sty02-asy01-acidity	ASSAY	2023-04-12
inv001-talinum-cam		
sty01-asy01-acidity	ASSAY	2023-04-12
inv001-talinum-cam		
sty03-aba-timeseries	STUDY	2023-04-12
inv001-talinum-cam		
sty02-aba-full	STUDY	2023-04-12
inv001-talinum-cam		
sty01-aba-pre-experiment	STUDY	2023-04-12
inv001-talinum-cam		
inv003-welwitschia-clock	INVESTIGATION	2023-04-12
inv003-welwitschia-clock		
inv002-arabidopsis-heat	INVESTIGATION	2023-04-12
inv002-arabidopsis-heat		
inv001-talinum-cam	INVESTIGATION	2023-04-12
inv001-talinum-cam		

Linking / grouping items

 Two mechanisms

1. Tags

- i. user-friendly, easy way to group items

2. Linking

- i. Database items

- ii. Experiment items

Linking items

In edit mode

Title

2023-03-02_plant-growth

Tags

Add a tag

File Edit View Insert Format Tools Table

Paragraph 14pt

B *I* U ~~S~~

≡ ≡ ≡ ≡

x^2 x_2

⋮ ⋮ ⋮ ⋮

⋮ ⋮ ⋮ ⋮

A

Ω

⌚

(i)

Plant Material and Growth Conditions

- Talinum triangulare, 28-d-old plants
- Soil: Miracle-Gro Potting Mix (Miracle-Gro)
- Pots: "Short-One" treepots, 1.6 l (Stuewe and Sons)
- Chamber: Environmental Growth Chambers
- Settings:
 - 12 h light (30°C, 37% relative humidity)/12 h dark (22°C) cycles
 - Photon flux density at leaf level: 425 mmol m⁻² s⁻¹

SPAN

POWERED BY TINY

SAVE

SAVE AND GO BACK

Steps

Add a step

Linked experiments

Add a link to an experiment Any author

Linked items

Add a link from the database Assay

Assay - sty03-asy06-maseq

INVESTIGATION - inv001-talinum-cam

Data
PLANT

CEPLAS

CC BY

57

Linked items

eLabFTW

EXPERIMENTS

DATABASE

TEAM

SEARCH

DOCUMENTATION

Back to listing

Create

Need to be redone

Started on 2023-04-12

2023-03-02_plant-growth

Plant Material and Growth Conditions

- Talinum triangulare, 28-d-old plants
- Soil: Miracle-Gro Potting Mix (Miracle-Gro)
- Pots: "Short-One" treepots, 1.6 l (Stuewe and Sons)
- Chamber: Environmental Growth Chambers
- Settings:
 - 12 h light (30°C, 37% relative humidity)/12 h dark (22°C) cycles
 - Photon flux density at leaf level: 425 mmol m⁻² s⁻¹

Visibility

Can write

All the teams I am part of

Only me and admins

Linked items

ASSAY - sty03-asy06-maseq

INVESTIGATION - inv001-talinum-cam

elabFTW – Conclusion

Good

- Documenting daily lab routine
- Lab methods & protocols
- Lab inventory (biologicals, chemicals, instruments)
- Local sharing & collaboration
- Backup (locally)

Intermediate

- Version control
- Track changes / contributions
- Use of IDs
- External sharing

Limited

- Data storage
- Analyses
- Structured metadata
- PIDs