

STRABOEXPERIMENTAL

This manual describes the basic functionality and features of StraboExperimental. It is based on the prototype version as published and initially presented at AGU 2023. The manual will be continuously updated to accommodate future changes in the site repository.

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INTRODUCTION

StraboExperimental is a digital database for experimental geophysical data, particularly for rock deformation tests. In its envisioned, final form, StraboExperimental is going to be an essential part of the Strabo System. Projects entered via StraboExperimental can be linked to other data stored in the Strabo database, including data from the StraboMicro application for microstructure-related images and data as well as geologic field data imported through StraboMobile. Its aim is to provide experimentalists with a comprehensive and easy-to-use tool to manage, store and share experimental results.

Some of the major benefits of StraboExperimental are:

- Capability to add all relevant data to an experiment, including apparatus, operating procedures, sensor, sample information etc.
- Public Apparatus Repository
- User has complete access control over his datasets.
- Search and Presentation Features
- Import and Export all Metadata as JSON
- Use of reusable Templates for quick data entry
- Public Rest API
- Publicly funded.

THE STRABOEXPERIMENTAL PHILOSOPHIE

The goal of this project is to create a practical standard to describe experimental geophysical data, to implement the findings in an online digital repository and to provide tools for researchers to utilize these standards in the laboratory.

A Metadata Standard for Experimental Data

Experimental data are not per se self-evident and explanatory. As experiments and models are increasingly intricate and complex, contextual information, or metadata, gains proportionally in importance to describe the results in detail.

A comprehensive set of metadata is useful in many respects. It may be used to estimate the quality and reliability of experiments or its relevance to a theoretical model. It also may provide explanations for unexpected results and is essential to be able to find, reproduce and compile other researchers' discoveries. Direct public access to data and metadata allows to compare results between different laboratories improving data quality. It also creates accountability and facilitates further data processing and long-term storage.

Unfortunately, up to now, in experimental geophysics, no standards exist for the ways data and metadata are to be stored. Most laboratories have their own proprietary workflows and means of data gathering and storage. During publication, it is the researcher's responsibility to provide experimental data and metadata in arbitrary digital form in a publicly accessible repository. Without a structured approach, this is a frequently a tedious and difficult task.

During the last years The Strabo Team compiled the most important aspects of various experimental workflows and parameters and created a general schema to formalize data entry and storage. We particularly focused on aspects of 'ease of use' and compatibility with existing public repositories to draw on experiences and the needs of the experimental community.

The StraboExperimental Prototype

The underlying schema of the StraboExperimental database is based on a perceived workflow for a single experimental test. Following a strict protocol from choice of equipment, sample selection and preparation to experimental procedure, StraboExperimental will make sure that most relevant experimental parameters are recorded and stored in an organized way. While only a small fraction of metadata fields is mandatory, the user is presented with the option to add as much information as possible.

It might appear cumbersome and repetitive to use an extensive form to enter information for each experiment, but the underlying premise is that metadata and data needs to be stored and archived together to ensure the usefulness for future users as well as for machine learning applications. Adding all metadata information to a dataset does not add significant storage load (<1MB) compared to most other experimental data (e.g., images or data files).

Recognizing that within a project, a series of experiments often use similar or identical conditions and settings, the web application makes extensive use of templates as well as the possibility to import and export information from previous datasets. We hope that this approach saves significant time for data entry. By being able to import readable JSON files, lab managers can also incorporate the metadata structure into existing workflows. It is also possible to share these templates with different laboratories.

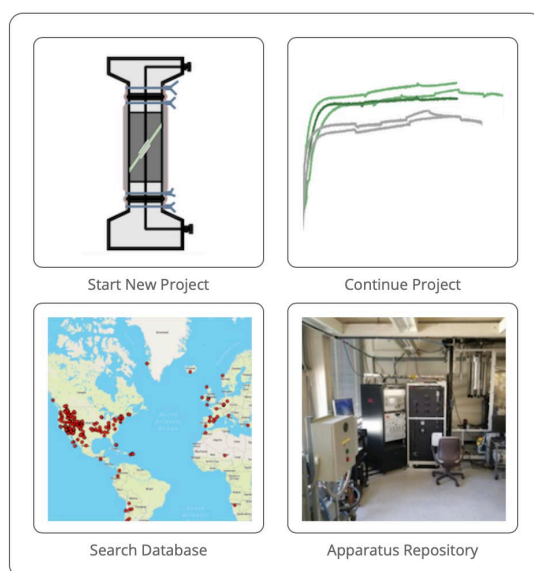
THE LANDING PAGE

StraboExperimental is accessible at <https://strabospot.org/experimental/>. Before being able to use StraboExperimental, you will have to sign up with your name, address and affiliation. Please contact the Strabo site administrator for more information. After login with your user credentials, you get to the main Projects landing page.

The Landing Page consists of four sections:

- *Start a New Project*
- *Continue Project*
- *Search database (in process)*
- *Apparatus Repository*

STRABOEXPERIMENTAL



APPARATUS REPOSITORY

The Apparatus repository contains a **publicly** accessible list of Equipment used in Experimental Rock Physics. It is maintained and updated by the community and **facilities** and laboratory managers can add to and edit their respective equipment at any time.

Today, many laboratories are also service centers available to external users. Researchers without access to experimental facilities can use this repository to find and utilize appropriate equipment to conduct their experiments. This will benefit the laboratories as well as widen the scope for potential research. More detailed apparatus information might also serve as a valuable source of information when designing new equipment.

For convenience, the list of **apparatuses** is grouped by **facility** and shows name and type of the apparatus. Lab Managers may add, edit and delete apparatuses at any time. Users can only view and browse the directory for specific equipment. Search functionality based on apparatus specifics will be added at a later stage.

APPARATUS REPOSITORY

[Add New Facility](#)

Texas A&M University

John W. Handin Experimental Rock Deformation Lab [View](#) | [Edit](#) | [Delete](#) | [Add Apparatus](#)

	Apparatus Name	Apparatus Type	Last Modified
view edit delete	Griggs cube, Solid medium apparatus (modified by Gene Robertson)	Multi Arvii	Wed, Oct 18 2023 20:13:04 UTC
view edit delete	Griggs solid-medium piston-cylinder apparatus	Triaxial (conventional)	Wed, Oct 18 2023 20:10:33 UTC
view edit delete	Heard-type gas apparatus	Triaxial (conventional)	Wed, Oct 18 2023 20:07:52 UTC
view edit delete	Heard-type VSR 1	Triaxial (conventional)	Wed, Oct 18 2023 19:55:28 UTC
view edit delete	Heard-type VSR 2	Triaxial (conventional)	Wed, Oct 18 2023 19:55:37 UTC
view edit delete	High-speed biaxial rig	Biaxial	Wed, Oct 18 2023 20:02:26 UTC
view edit delete	Large MTS	Uniaxial	Wed, Oct 18 2023 20:04:32 UTC
view edit delete	Large Sample Rig 1	Triaxial (conventional)	Wed, Oct 18 2023 19:38:12 UTC
view edit delete	Large Sample Rig 3-1	Uniaxial	Wed, Oct 18 2023 19:48:00 UTC
view edit delete	Large Sample Rig 3-2	Triaxial (conventional)	Wed, Oct 18 2023 19:47:43 UTC

Massachusetts Institute of Technology

Rock Mechanics Laboratory - Civil Engineering [View](#) | [Edit](#) | [Delete](#) | [Add Apparatus](#)

	Apparatus Name	Apparatus Type	Last Modified
view edit delete	Test Rig	Uniaxial	Wed, Oct 18 2023 20:05:38 UTC

Facility

To get started, you need to add a **Facility Name**, i.e., the name of your lab or group. Also required entries are Facility **Type** and the name of your **Institution** (e.g., University). All other entries are voluntary, but we do recommend adding at least a contact name and email.

ADD NEW FACILITY

FACILITY INFO

Facility Name *	Facility Type *	Facility ID	Facility Website
<input type="text"/>	Select...	<input type="text"/>	<input type="text"/>
Institute Name *	Department		
<input type="text"/>	<input type="text"/>		
Description			
<input type="text"/>			

ADDRESS

Street + Number	Building/Apartment	Postal Code	City
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
State	Country	Latitude (decimal degrees)	Longitude (decimal degrees)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

CONTACT

First Name	Last Name	Affiliation
<input type="text"/>	<input type="text"/>	Select...
Email	Phone	Website
<input type="text"/>	<input type="text"/>	<input type="text"/>
ORCID ID		
<input type="text"/>		

Apparatus

Each Facility contains a list of **Apparatuses** the Lab manager or responsible party is willing to share with the community. Equipment details should be concise and not contain proprietary information. To add new equipment, click on '**Add Apparatus**' in the Facility section of the Repository.

Required information are **Name***, **Type*** of the Apparatus. Additional fields are shown to add specific details about the apparatus and its capabilities. Frequently, generic equipment is being modified over the years to add new **features** and capabilities. Such changes may be outlined to reflect the most recent upgrades.

The **Parameters** section lists machine limits with respect to Pressure, Temperature, Stress, Load, Dimensions, etc. capabilities. They are included to help users find equipment that covers a certain range of experimental conditions.

Supporting **documents** such as manuals, diagram, photos or schematics may be uploaded as desired. If in public domain, specific design drawings may be included.

EDIT APPARATUS

APPARATUS INFO

Apparatus Name *	Apparatus Type *	Location	Apparatus ID
Griggs cube, Solid medium apparatus (modified by Gene Robel)	Multi Anvil	Texas A&M Handin lab 358	Griggs Cube

Description

Griggs, solid-pressure-medium, multiple anvil "cubic" apparatus capable of applying high isostatic stresses or conventional and true triaxial stress states by way of six pistons that load a cubic solid-medium sample assembly, and capable of applying differential stresses on samples, ~1 mm diameter by 2 mm length (normally along a load column of WC, Al2O3 or other ceramic pistons). This apparatus is capable of confining pressures up to 7 GPa and temperatures up to 1200 °C, and measurement of ultrasonic P and S wave velocities in three principal stress directions using external piezoelectric transducers. Absent determinations of internal stresses by distortion of X-ray diffraction at a synchrotron beamline, stresses are only estimated from external load measurements, so this apparatus is used primarily for graduate teaching purposes.

APPARATUS FEATURES

Loading
 Unloading
 Heating
 Cooling
 High Temperature
 Ultra-High Temperature
 Low Temperature
 Sub-Zero Temperature
 High Pressure

Ultra-High Pressure
 Hydrostatic Tests
 HIP
 Synthesis
 Deposition/Evaporation
 Mineral Reactions
 Hydrothermal Reactions
 Elasticity
 Local Axial Strain

Local Radial Strain
 Elastic Moduli
 Yield Strength
 Failure Strength
 Strength
 Extension
 Creep
 Friction
 Frictional Sliding
 Slide Hold Slide
 Stepping

Pure Shear
 Simple Shear
 Rotary Shear
 Torsion
 Viscosity
 Indentation
 Hardness
 Dynamic Tests
 Hydraulic Fracturing
 Hydrothermal Fracturing

Shockwave
 Reactive Flow
 Pore Fluid Control
 Pore Fluid Chemistry
 Pore Volume Compaction
 Storage Capacity
 Permeability
 Steady-State Permeability

Transient Permeability
 Hydraulic Conductivity
 Drained/Undrained Pore Fluid
 Uniaxial Stress/Strain
 Biaxial Stress/Strain
 Triaxial Stress/Strain
 Differential Stress

True Triaxial
 Resistivity
 Electrical Resistivity
 Electrical Capacitance
 Streaming Potential
 Acoustic Velocity
 Acoustic Events
 P-Wave Velocity
 S-Wave Velocity

Source Location
 Tomography
 In-Situ X-Ray
 Infrared
 Raman
 Visual
 Other

APPARATUS PARAMETERS

Name	Minimum	Maximum	Unit	Prefix	Detail/Note	
Confining Pressure	2	7	GPa	-		
Temperature	20	1200	degC	-		

APPARATUS DOCUMENTS

Document Type *	Document Format *	File Uploaded	Document ID
Picture	jpg	https://strabospot.org//3d30d92b-9325-4cf8-a5f2-41eedf4493cb/Griggs Cube.jpg (Delete File)	

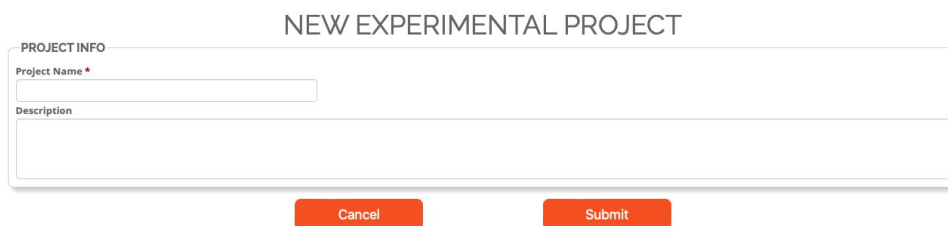
Description

Cancel

Save Changes

EXPERIMENTAL PROJECTS

The basic workflow for StraboExperimental users starts by creating an **experimental project**. This term is used to group individual experimental datasets. A new project may be started from the initial landing page or by adding a new project from within the **Project Management** page.



NEW EXPERIMENTAL PROJECT

PROJECT INFO

Project Name *

Description

Cancel Submit

The simple form requires only a project name. Once you save a project it will be added to the project list. You can add as many projects as needed.

PROJECT MANAGEMENT (CONTINUE PROJECT)

This page contains all experiments grouped by experimental projects. Differing from the Public Apparatus repository this information is only accessible by the registered user unless the Public option is selected. For ease of use a new project may be added directly from this page. The list of experiments contains the Experiment Id, Apparatus Type and Test Features. In addition, data entered, shows the sections of the workflow that are already completed.

Options for each Project are:

- **New Experiment** – creates a new experiment with experimental data and metadata
- **Delete** – deletes the current Project **including** all Experiments contained in it.
- **JSON** – View/Save JSON file of entire Project
- **Plot Data** – Filter and Plot Time Series Data
- **Public** – Toggle Switch for Private and Public view

Once a Project contains an experiment, the information can be Viewed, Edited, Deleted or Downloaded to your device. Please note that if you choose to download an experiment currently only the metadata will be saved to your computer. Any documents uploaded to the repository will be referenced by its server id. The functionality to download all information including data files will be added at a later stage.

My StraboExperimental Projects: [\(Add Project\)](#)

test 3

Last Modified: September 20, 2023, 06:34:28 pm EDT | [New Experiment](#) | [Delete](#) | [JSON](#) | [Plot Data](#) | [Public?](#)

	Experiment ID	Apparatus Type	Test Features	Data Entered	Last Modified
View Edit Download Delete	test3 experiment	Paterson Apparatus	N/A	Facility, Apparatus, Sample, Data	September 20, 2023, 06:34:28 pm EDT

Yield Point Study Carrara Marble

Last Modified: October 18, 2023, 04:26:50 pm EDT | [New Experiment](#) | [Delete](#) | [JSON](#) | [Plot Data](#) | [Public?](#)

	Experiment ID	Apparatus Type	Test Features	Data Entered	Last Modified
View Edit Download Delete	MIT-Paterson+DAQ (Std)	Paterson Apparatus	N/A	Facility, Apparatus, DAQ	August 16, 2023, 01:28:07 pm EDT
View Edit Download Delete	MIT-Paterson-DAQ-Sample	Paterson Apparatus	N/A	Facility, Apparatus, DAQ, Sample	August 16, 2023, 01:37:10 pm EDT
View Edit Download Delete	Paterson+DAQ+Sample+Procedure	Paterson Apparatus	Loading, Unloading, Heating, Cooling, High Pressure, Elastic Moduli, Yield Strength, Strength, Permeability, Drained/Undrained Pore Fluid, Triaxial Stress/Strain, Differential Stress, Acoustic Velocity, Acoustic Events, P-Wave Velocity	Facility, Apparatus, DAQ, Sample, Experiment	August 16, 2023, 01:48:06 pm EDT
View Edit Download Delete	test	Paterson Apparatus	Loading, Unloading, Heating, Cooling, High Pressure, Elastic Moduli, Yield Strength, Strength, Permeability, Drained/Undrained Pore Fluid, Triaxial Stress/Strain, Differential Stress, Acoustic Velocity, Acoustic Events, P-Wave Velocity	Facility, Apparatus, DAQ, Sample, Experiment, Data	August 16, 2023, 04:28:16 pm EDT
View Edit Download Delete	test2	Paterson Apparatus	N/A	Facility, Apparatus, DAQ	October 18, 2023, 04:26:50 pm EDT

test

Last Modified: October 18, 2023, 04:07:30 pm EDT | [New Experiment](#) | [Delete](#) | [JSON](#) | [Plot Data](#) | [Public?](#)

No experiments found for test. Click [here](#) to add experiment.

The Klein Experiments

Last Modified: August 18, 2023, 04:57:29 pm EDT | [New Experiment](#) | [Delete](#) | [JSON](#) | [Plot Data](#) | [Public?](#)

	Experiment ID	Apparatus Type	Test Features	Data Entered	Last Modified
View Edit Download Delete	seven up	Paterson Apparatus	N/A	Facility, Apparatus	November 13, 169239, 12:00:00 am EST

My StraboSpot Projects: [+](#)

No Projects found. Click [here](#) to add project.

Experiment

The second step in the StraboExperimental Workflow is to Add an Experiment to a Project.

ADD EXPERIMENT

Experiment ID*

Load All Data from Previous Experiment Load All Data from JSON File

FACILITY AND APPARATUS INFO
Enter Data: Manually From Previous Experiment From JSON File From Apparatus Repository

DAQ INFO
Enter Data: Manually From Previous Experiment From JSON File

SAMPLE INFO
Enter Data: Manually From Previous Experiment From JSON File

EXPERIMENTAL SETUP INFO
Enter Data: Manually From Previous Experiment From JSON File

DATA
Enter Data: Manually From Previous Experiment From JSON File

Cancel Save

This page contains the main functionality and information for a specific experiment. The user has several options to enter the required data:

Load All Data from Previous Experiment: It is the fastest way to replicate a dataset for quick entry. Selecting this option opens a list of all projects and Experiments in the User database and will create a copy of the selected data and metadata under the current project. Please note that the data section contains a reference to the original data files. Make sure you update these accordingly.

Load All Data from JSON File: Recognizing that users would like more control over the type of metadata templates, you can choose to upload data from a JSON file on your computer. If you edit the JSON file to accommodate your needs, make sure you adhere to the original metadata structure outlined in the schema. If unsure, you can download an existing dataset as a template and modify it.

This feature will only upload the metadata and not the actual data files. Please note that if your template contains references to existing files on the server, these links will only work if you have

permission to view these. It is possible, and intended, to exchange templates between different laboratories, but existing data references in the JSON files will have to be updated.

The StraboExperimental metadata is organized into the following sections:

- Facility Information
- Apparatus Information
- DAQ (Digital Data Acquisition)
- Sample Information
- Experimental Setup and Procedure
- Data

Individual sections (e.g., Sample Info) may be populated **Manually**, from **Previous Experiment** or **From a JSON File**. The **Facility and Apparatus** section also allows the selection of equipment from the public **Apparatus Repository** as described previously. The added Apparatus will contain references to all files uploaded to the original repository. All registered users have permission to view these documents. If there are any changes to the Apparatus for a specific experiment (e.g., newly added capabilities), you can add them here. Any modifications made here will not update the information in the Apparatus Repository.

Please note that you can populate each section from its corresponding part from a **Previous Experiment** in your **Project Page**. For example, you can choose to load the **Sample Information** from one of the previous experiments and the **Apparatus** from another experiment. This gives you full flexibility in prepopulating StraboExperimental **within** the application. The **JSON Import/Export** capability will allow you to manipulate experimental metadata on your local computer as well.

DAQ

The Digital data Acquisition Part is specifically designed for Laboratory Managers and users who would like to know more about the system details and how the data was acquired. Adding information into this section is not required.

For most cases, DAQ is an integral part of the apparatus, but some tests use additional measurement devices or configurations. In addition, sensors and sensor calibrations might change from experiment to experiment. It is therefore important to have a means to add this information.

We chose the terminology of a **DAQ Group** that describes the complete set of physical measurements, sensors and actuators. If you choose to enter DAQ information, a **DAQ Group Name** and the **DAQ type** is mandatory.

A **DAQ Group** might consist of one or more **DAQ Devices** (required). Each device consists of an array of sensors and possibly actuators for measuring and controlling a range of physical properties and parameters (**Channels**).

You may select from a large selection of physical measurements (**Channel Header**) and a set of property dependent **Specifiers**. Please note that the list of options offered is a compromise for structuring the information. It therefore may not be exhaustive and is a work in progress. The **Header** section also contains fields for **Units** and additional information the user can add (**Other Specifiers**).



DAQ INFO

DAQ INFO

DAQ Group Name * DAQ Type * Location

Description

This is the standard DAQ configuration. It is built into the Paterson#5 Apparatus. Other Configuration may contain external AE sensors and digitizers.

DAQ DEVICES

Device Name *

DEVICE (DAQ) CHANNELS Add Channel

0 - Load
1 - Displacement
2 - Displacement
3 - Displacement
4 - Pressure
5 - Pressure
6 - Load
7 - Pressure
14 - Temperature
0 - Other
1 - Displacement
0 - Pressure
0 - Time

Channel Header

Load

Specifier A Specifier B Other Specifier Unit

Channel Information

Channel #	Type	Configuration	Note
0	Analog Input	Differential	Internal Axial Load

Res [bit]	Min	Max	Rate	Filter	Gain
16	0	10	1kHz		x1

Sensor/Actuator Information

IEEE Sensor Template

Type Manufacturer ID

Version Letter Version #

Sensor/Actuator

Model #

Serial #

Calibration Information

Data can be entered as Pairs: Calibration Table-Input/Unit; Linear Regression1 Input@0Input/Unit; Linear Regression2 u-(x^a0+a1^a2+a3; Polynomial-Base:Exponent); Frequency Response Table-Frequency/Amplitude

Template	Input	Unit	Excitation
Input@0:Input/Unit	Volt	kN	10V

Date Note

DATA Add Data

A: B:

DEVICE DOCUMENTS Add Document

Channel Information lists general parameters for the chosen property to measure, such as **index**, and details for the type of electrical connection, **range**, **frequency**, sample **resolution** and amplifier settings (**filter**, **gain**). Options not listed can be added in the Notes field.

For Sensor and Actuator Information, we follow a shortened IEEE template but also added commonly used Sensors for Geophysical laboratory tests, recognizing the fluidity of the field.

A Calibration Section allows users to store sensor calibrations in a variety of ways. After choosing a suitable calibration template and units, a table of input/output values may be used to the calibration data with the current calibration date.

Each DAQ device also allows the upload of documents describing its function and configuration in more details.

Sample

All sample related properties may be added in the Sample Form. Combination of **Sample Name***, **IGSN#**, **ID***, and **Description** should be unique for each dataset. We also provide the option to add **parent sample** ids to allow for experiments on successive samples.

SAMPLE INFO

Sample Name *	IGSN	Sample ID *	Description
Carr#1		Carr#1_1234	Another Carrara Marble sample
Parent Sample Name	Parent IGSN	Parent Sample ID	Parent Description
Block 1234		Carr1234	Core#1234

MATERIAL

Material Type *
Standards

Lab Standard *
Carrara Marble

State
Homogeneous

Note

MINERALOGY Add Phase

Mineral *
Calcite

Fraction
0.99

Grain Size (µm)
150

Unit
Vol%

PROVENANCE

Formation Name
Carrara (Italy)

Member Name

Sub Member Name

Source
Quarry

LOCATION

Street * Number

Building - Apt

Postal Code

City

State
Lombardia

Country
Italia

Latitude
0

Longitude
0

TEXTURE

Bedding

Lineation

Foliation

Fault

PARAMETERS Add Parameter

Weight

Density

Humidity

Fluid Saturation

Variable *
Weight

Value
23.7

Unit
g

Prefix
-

Note (Measurement and Treatment)

DOCUMENTS Add Document

Cancel Save

The Material Section entails all Sample material information, except for geometry and specific preparation for the test. This is covered in the Experimental form.

The material section is currently still the development stage. Common Material Types (e.g., Rock Types, Minerals or Commodities) are added for convenience but the list is not comprehensive. A menu lists different **material types** such as common minerals and rock types. In the prototype

version the selections are unique. In subsequent versions we plan to link the choices to standard mineral and rock databases as well as to the Strabo rock repository. Material **state** depicts the general condition of the sample (e.g., solid, powder, composite) together with a note field for more details. Description of more complex materials will have to be added as a separate document.

Mineralogy lets you add the sample mineralogy or the composition of a powder, mixed sample or gauge layer. Adding **phases** to the mineralogy allows to add the **Mineral** name, the **Fractional Composition** and **Grain Size** if needed.

Provenance describes the general **source** and **location** of natural samples and rocks as well as their geological **formation** and **member** names.

Texture adds optional fields to describe macroscopic features, such as **bedding**, **lineation**, **foliation** and **faults**. For detailed descriptions and information, it is recommended to upload supporting documents (e.g., pictures and/or data).

Sample Parameters lists sample **weight** as well material specific properties, such as **density**, **permeability**, **porosity** and/or **prestress** conditions, as well as specific sample treatment (e.g., humidity, fluid saturation, etc.). This is not a comprehensive list, and it may be extended added in future. Sample and assembly geometry will be covered in the experimental section.

Experimental Setup/Protocol

Experimental **title**, **ID**, **start** and **end date** as well as a basic **description** are entered in the information section. The api also contains the **Project Name**.

EXPERIMENTAL SETUP INFO

EXPERIMENT INFO

Title *
Carrara Deformation Test

Experiment ID * Paterson+DAQ+Sample+Procedure IEDA ID

Start Date 31/10/2023 End Date 31/10/2023

Experiment Description
Just another Carrara Marble Test

TEST FEATURES

Loading Unloading Heating Cooling High Temperature Ultra-High Temperature Low Temperature Sub-Zero Temperature High Pressure
 Ultra-High Pressure Hydrostatic Tests HIP Synthesis Deposition/Evaporation Mineral Reactions Hydrothermal Reactions Elasticity Local Axial Strain
 Local Radial Strain Elastic Moduli Yield Strength Failure Strength Strength Extension Creep Friction Frictional Sliding Slide Hold Slide
 Stepping Pure Shear Simple Shear Rotary Shear Torsion Viscosity Indentation Hardness Dynamic Tests Hydraulic Fracturing
 Hydrothermal Fracturing Shockwave Reactive Flow Pore Fluid Control Pore Fluid Chemistry Pore Volume Compaction Storage Capacity Permeability
 Steady-State Permeability Transient Permeability Hydraulic Conductivity Drained/Undrained Pore Fluid Uniaxial Stress/Strain Biaxial Stress/Strain
 Triaxial Stress/Strain Differential Stress True Triaxial Resistivity Electrical Resistivity Electrical Capacitance Streaming Potential Acoustic Velocity
 Acoustic Events P-Wave Velocity S-Wave Velocity Source Location Tomography In-Situ X-Ray Infrared Raman Visual Other

AUTHOR

First Name Ulrich Last Name Mok Affiliation Lab Manager

Email u_mok@mit.edu Phone 6175154745 Website

ORCID user_id

Test Features allow to add commonly applied test procedures. They are distinct from Apparatus features because they will indicate the purpose of the test and the applied methods. Make sure that all procedures are checked.

Author is the experimentalist who is responsible for running the test. At least a **name** and **email** address is recommended to ensure the proper authorship of the experimental results.

GEOMETRY Add Geometry

Sample #1

Jacket #2

Geometry #	Material	Type	Geometry
1	Sample	Sample	Cylinder

☒ ↓

DIMENSIONS Add Dimension

Variable	Value	Unit	Prefix	Note
Length	20	mm	-	
Diameter	10	mm	-	

PROTOCOL Add Step

Loading

Heating

Yield Strength

Cooling

Unloading

Step	Objective
Loading	Initial pressurizing

Description

☒ ↓

PARAMETERS Add Parameter

Variable	Value	Unit	Note
Confining Pressure	10	MPa	
Temperature T	23	degC	

DOCUMENTS Add Document

Cancel Save

Geometry is for sample as well as assembly geometry. You can add as many assembly elements as you like, including **sample**, **jacket**, **spacer** and **forcing blocks**. It allows for most used geometries for rock physics and petrology (e.g., cylindrical, rectangular, dog bone). Even complex assemblies can be described using the indexed order of geometries.

Protocol lets the users add a step-by-step procedure for a test. Listed **steps** are all features checked under **Test Features** (e.g., Heating, Loading, Permeability, etc). Each step contains a field for Objective and description as well as Step Parameters. **Parameters** are **values** for specific test variables, such as Pressure, Temperature and Load.

The protocol order can be rearranged according to the test sequence.

Documents: supporting information to the test protocol and objective.

Experimental Data

This section is to upload pre- and post-experimental results and data, such as **Pictures, SEM, micrographs, Data files, software**, etc. We recommend organizing the data into **datasets**. Each dataset contains a specific type of data **type** (shown via pulldown menu are a list of common types for experimental results.)

Most **data** types are unstructured images, videos or experimental results and require a **Data Type, ID, File Format, Description** and an estimate of the **Data Quality**. A file **upload** option is available for each data type. Please refer to the API for the upload of a series of images or pictures.

However, there are some exceptions where data may be entered in a more structured way. Please note that this is an attempt make the data more useful for external users and the public.

EXPERIMENTAL DATA

DATASETS Add Dataset

Parameters (selected) | Sample Description

Data* Parameters | Data Type* Data | Choose File* Choose File no file selected

Data ID | File Format Select... | Data Quality Select...

Description

PARAMETER LIST Add Parameter

Data	Value	Error	Unit	Prefix	Note
Weight	20		mg	-	

Cancel Save

Specific structured Data Types:

Parameters: Here the user can manually add a list of pre- and post-experimental measurements. They can include sample **length** or **diameter** or any other single measurement (e.g., **permeability**) that applies to the test.

Pore Fluid: Users can add multiple pore fluid **phases** with their respective **fraction/fugacity** or **activity** values. For each **phase** the pore fluid **chemistry** can be added with the most common **anion/cation** composition.

Time Series: Most commonly, a deformation experiment will contain some form of time dependent measurement (**time series**). These are mostly used to analyze elastic and inelastic rock properties and may contain **time, stress, strain, pressure, load, temperature** or any other low frequency measurements. High frequency data such as **acoustic emissions** will be treated separately.

The **time series dataset** should contain details about **file** content and **format**. The data **header** section is an attempt to allow digestion of the data files in a more structured way. Like the Headers in the **DAQ** section, they contain additional descriptors to make each header unique.

It is assumed that the data is contained in a text file and a tabular format with individual measurements listed as columns. Only the number and standardized names of data **headers** entered with their respective format are considered. Additional headers or columns contained in the data file will be ignored.

Nomenclature of Data Headers

The main **Header** categorizes the type of measurement taken. These include common basic and derived Variables such as: **Time, Temperature, Pressure, Load, Stress, Displacement, etc.**

Secondary Header Information (**Specifier A**) depend on the initial header choice. For example, if **Temperature** is chosen as main header, there are the following options available: **Room, Sample, Furnace, Vessel, Pore, Fluid.**

Lastly, **Specifier B** depicts more detailed information about measurement location (**e.g., Sample Top, Average, Bottom, Internal, External, etc**). An additional descriptor field is added for more measurement details but is not mandatory.

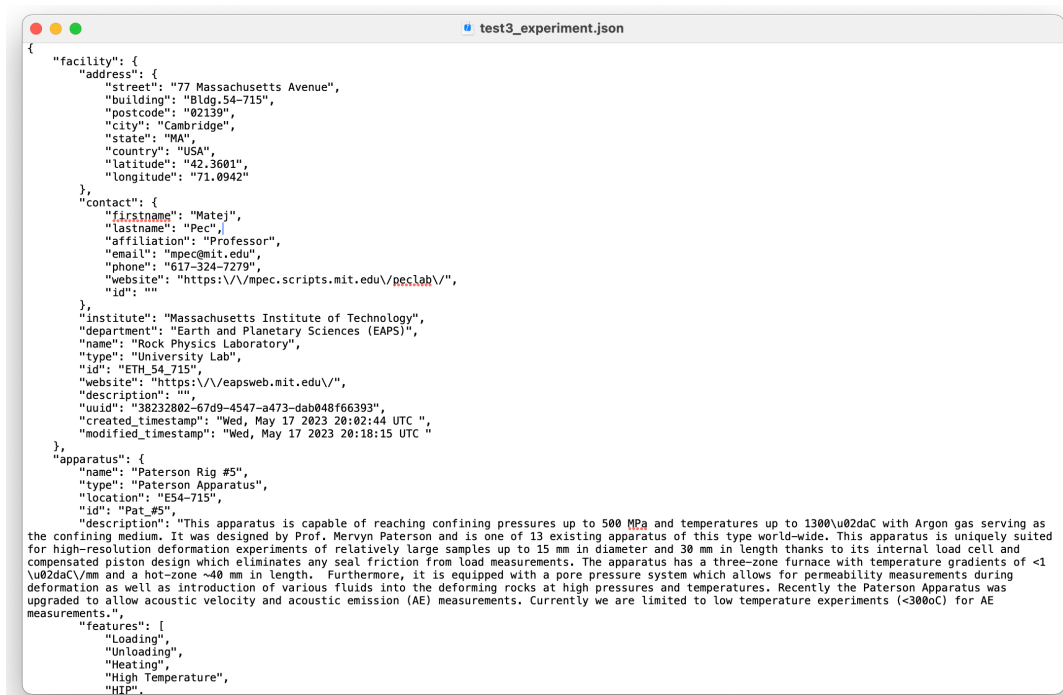
For non-conventional data headers, a list of SI and derived units is available as well.

JSON IMPORT/EXPORT

This section describes the (optional) capabilities for using readable JSON files as experimental templates. They are using the same schema as the API but are more easily accessible for the end users. We briefly summarize the various options to make use of the Import/Export capabilities of StraboExperimental.

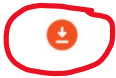
The exported JSON file lists all data entered in the web form (values) as well as their corresponding properties in a hierarchical structure that follow a predefined schema. Only files that adhere to this schema and are valid JSON may be used as templates and can be later uploaded to StrabExperimental. If you follow the schema guidelines, you are free to modify the files in a text editor. We will also offer offline editing tools with LAPS later.

Option 1: In your Project Page, choose an Experiment and select Download. This will download your entire experiment. You can download a JSON file at various stages in your workflow and save them as backup or template containing a combination of Apparatus, DAQ, Sample and Testing Information. For a series of experiments using similar settings, you may simply upload the template and modify experiment specifics (i.e., Sample Name or Specific Sensor Calibrations). This will speed up your data entry significantly.



```
{
  "facility": {
    "address": {
      "street": "77 Massachusetts Avenue",
      "building": "Bldg.54-715",
      "postcode": "02139",
      "city": "Cambridge",
      "state": "MA",
      "country": "USA",
      "latitude": "42.3601",
      "longitude": "71.0942"
    },
    "contact": {
      "firstname": "Matej",
      "lastname": "Pec",
      "affiliation": "Professor",
      "email": "mpec@mit.edu",
      "phone": "617-324-7279",
      "website": "https://mpec.scripts.mit.edu/pec/lab/",
      "id": ""
    },
    "institute": "Massachusetts Institute of Technology",
    "department": "Earth and Planetary Sciences (EAPS)",
    "name": "Rock Physics Laboratory",
    "type": "University Lab",
    "id": "ETH_54_715",
    "website": "https://eapsweb.mit.edu/",
    "description": "",
    "uuid": "38232802-67d9-4547-a473-dab048f66393",
    "created_timestamp": "Wed, May 17 2023 20:02:44 UTC ",
    "modified_timestamp": "Wed, May 17 2023 20:18:15 UTC "
  },
  "apparatus": {
    "name": "Paterson Rig #5",
    "type": "Paterson Apparatus",
    "location": "ES4-715",
    "id": "Pat_#5",
    "description": "This apparatus is capable of reaching confining pressures up to 500 MPa and temperatures up to 1300\u002daC with Argon gas serving as the confining medium. It was designed by Prof. Mervyn Paterson and is one of 13 existing apparatus of this type world-wide. This apparatus is uniquely suited for high-resolution deformation experiments of relatively large samples up to 15 mm in diameter and 30 mm in length thanks to its internal load cell and compensated piston design which eliminates any seal friction from load measurements. The apparatus has a three-zone furnace with temperature gradients of <1\u002daC/mm and a hot-zone ~40 mm in length. Furthermore, it is equipped with a pore pressure system which allows for permeability measurements during deformation as well as introduction of various fluids into the deforming rocks at high pressures and temperatures. Recently the Paterson Apparatus was upgraded to allow acoustic velocity and acoustic emission (AE) measurements. Currently we are limited to low temperature experiments (<300\u002daC) for AE measurements.",
    "features": [
      "Loading",
      "Unloading",
      "Heating",
      "High Temperature",
      "HIP"
    ]
  }
}
```

Option 2: In the Project Page, choose an experiment and click View. The download button for *Download Project JSON* on the top right corner of the page will let you download or copy the JSON data for the experiment.



EXPERIMENT: TEST3 EXPERIMENT

APPARATUS INFO

Apparatus Name Paterson Rig #5 Institute Massachusetts Institute of Technology	Apparatus Type Paterson Apparatus Department Earth and Planetary Sciences (EAPS)
---	---

DAQ INFO

No DAQ Data.

SAMPLE INFO

Sample Name test sample	IGSN Not provided.	Sample ID testsample1
-----------------------------------	------------------------------	---------------------------------

EXPERIMENTAL SETUP INFO

No Experiment Setup Data.

DATA

Dataset Id ssss	Data Source Parameters	Data Type Data
---------------------------	----------------------------------	--------------------------

[Back](#)

DOWNLOAD PROJECT

PROJECT JSON

```
{
  "facility": {
    "address": {
      "street": "77 Massachusetts Avenue",
      "building": "Bldg.54-715",
      "postcode": "02139",
      "city": "Cambridge",
      "state": "MA",
      "country": "USA",
      "latitude": "42.3601",
      "longitude": "71.0942"
    },
    "contact": {
      "firstname": "Matej",
      "lastname": "Pec",
      "affiliation": "Professor",
      "email": "mpec@mit.edu",
      "phone": "617-324-7279",
      "website": "https://mpec.scripts.mit.edu/peclab/",
      "id": ""
    },
    "institution": "Massachusetts Institute of Technology",
    "department": "Earth and Planetary Sciences (EAPS)",
    "name": "Rock Physics Laboratory",
    "type": "University Lab",
    "id": "ETH_54_715",
    "website": "https://eapsweb.mit.edu/",
    "description": "",
    "uuid": "38232802-67d9-4547-a473-dab048f66393",
    "created_timestamp": "Wed, May 17 2023 20:02:44 UTC ",
    "modified_timestamp": "Wed, May 17 2023 20:18:15 UTC "
  }
}
```

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