User Guide for Software Engineering: Alkalytics

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Contents

1 Introduction

This comprehensive document provides complete instructions for installing, configuring, and using all features of the Alkalytics web application.

2 System Overview

This section describes the technical architecture, components, and requirements for running Alkalytics.

2.1 Detailed Requirements

Lists all hardware and software requirements for running the application.

Component	Minimum	Recommended
RAM	8GB	16GB
Storage	5GB	50GB SSD
Processor	2 cores	4 cores

Hardware Requirements

3 Installation Guide

This section provides complete step-by-step instructions for setting up the Alkalytics environment. We recommend using an Integrated Development Environment (IDE) such as VS Code for ease of handling the application.

3.1 Step-by-Step Installation

1. **Prerequisite Installation**

   (a) Install Node.js from https://nodejs.org

   (b) Install MongoDB from https://www.mongodb.com

   (c) Install Python 3.x from https://www.python.org

2. **Repository Setup**

```
git clone https://github.com/SumanyaG/Alkalytics.git
```

3. **Dependency Installation**

```
yarn install
pip install -r requirements.txt
```

4. **Database Configuration**

   These instructions outline the steps to configure a **local** MongoDB database.

   (a) Create a file named `.env` in the root directory of your project.

   (b) Add the following line to the `.env` file:

   ```
   CONNECTION_STRING="mongodb://localhost:27017/"
   ```

   (c) Save the file.

5. **Application Launch**

   Tip: To switch between directories use the command `cd <directory_name>` to naviagte to a specific directory or `cd ..` to go back one level.

   (a) With `src/backend` as your current directory, start backend:

   ```
   uvicorn api:app --reload --host 127.0.0.1 --port 8000
   ```

   (b) With `src/frontend` as your current directory, start server:

   ```
   yarn ts-node src/utils/server.ts
   ```

   (c) With `src/frontend` as your current directory, start frontend:

   ```
   yarn start
   ```

3.2 Verification

After installation, verify all components are running:

1. Frontend: `http://localhost:3000`
2. Server: `http://localhost:8000/graphql`
3. Backend: `http://localhost:8000/docs`
4. Database: Check MongoDB connection on port 27017

4 User Management

Section Overview

This application has different user roles. Each role has a different set of permissions and respective capabilities within the application.

4.1 Admin and Researcher Role

Administrators have full control over all system functionality including data management, user configuration, and system settings. Currently, both Admin and Researcher roles have the same permissions.

Available functionalities include:

- Editing tables, including modifying cells, adding/removing rows and columns.
- Setting data types for columns.
- Using the Excel function bar for calculations.
- Computing efficiency metrics.
- Managing bulk data uploads.
- Generating and exporting graphs.

4.2 Researcher Assistant Role

Researcher assistants can view data, run analyses, and generate reports. This role has limited system configuration capabilities.

Available functionalities include:

- Viewing and searching tables (Experiment, Efficiency, and Raw Data).
- Searching within a specific column or the entire table.
- Computing efficiency metrics.
- Generating graphs but with restricted data modification capabilities.

5 Web Application Pages

5.1 Sign In Process

When users first load the application, they will be greeted by a Sign In screen. If the user has registered credentials, sign in as normal.

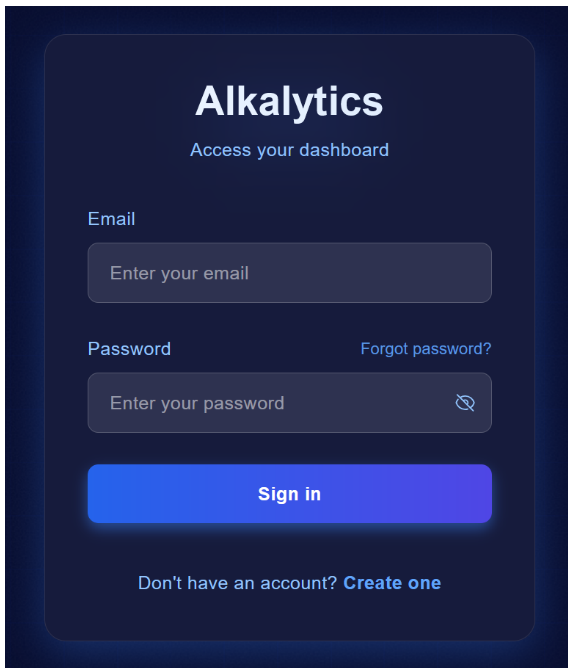


Figure 1: Sign-in Form

5.2 Sign Up Process

If users do not have an account, they will need to create one by clicking the **Create one** button at the bottom of the sign-in form. The user must then enter an email and desired password. There will be two roles to pick from, Researcher and Research Assistant. The admin role is not available for sign up and is only configured by the developer team for the head of the lab. After creating a user account, sign in as normal.

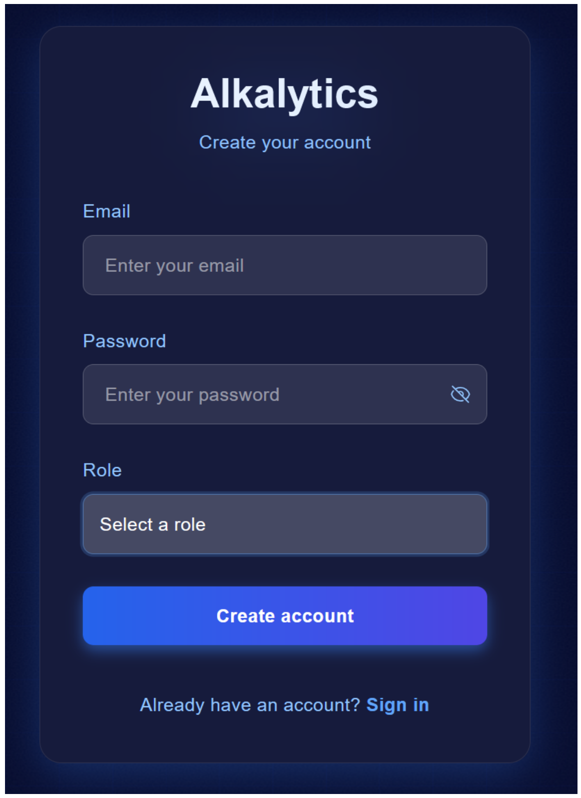


Figure 2: Sign Up Form

5.3 Dashboard

The Dashboard provides a quick, interactive, and structured overview of the most recent key data insights through visualizations and tables. It is designed to help users analyze trends, monitor performance, and interact with data efficiently.

Figure 3: Dashboard Interface

5.3.1 Key Features

- **Graphs**: Displays visual representations of data trends and relationships.
- **Data Tables**: Organizes numerical and analytical data in a structured format, allowing for sorting, filtering, and searching.
- **Navigation Panel**: A sidebar with quick access to different sections of the platform, including:
  - Dashboard
  - Data View
  - Upload
  - Graphs
  - Logout

5.4 Upload

The upload functionality allows users to efficiently import files in various formats for analysis. This section outlines the steps for uploading files, the types of files supported, and best practices to ensure a smooth upload experience.

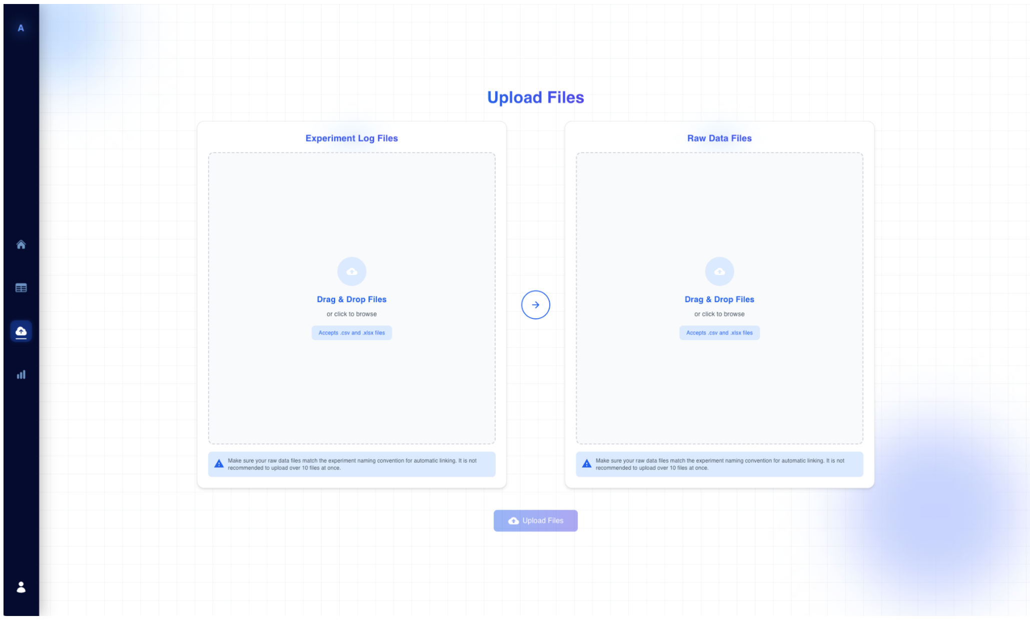


Figure 4: Upload Files Interface

5.4.1 Step-by-Step Upload

To upload files, follow these steps:

1. Navigate to the Upload Page.
2. Select the file type you wish to upload: either **Experiment Log** or **Raw Data**.
3. Choose your preferred upload method:
    - **Drag and Drop**: Drag files directly into the designated upload area.
    - **Browse and Select**: Click on the upload box to open a file browser and select files manually.
4. Click the **Upload** button to initiate the upload process.

5.4.2 Linking Raw Data Files to Experiments

In some cases, the migration algorithm may not be able to automatically link a raw data file to its corresponding experiment. When this occurs, users will be prompted to manually match the data file with the appropriate experiment ID.

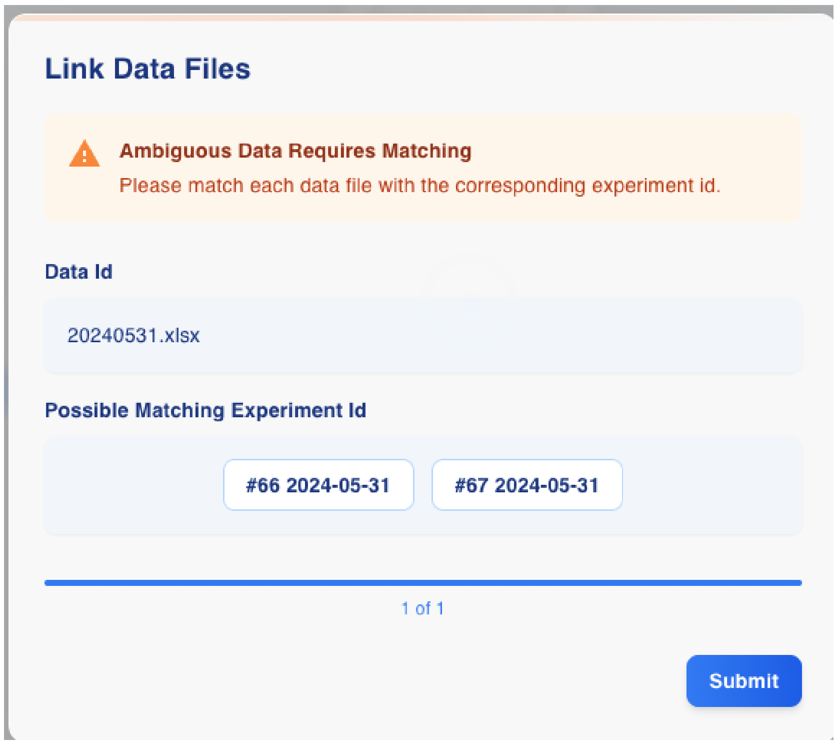


Figure 5: Link Data Files Prompt

When presented with this prompt, users should:

1. Review the displayed Data ID to ensure it corresponds to the correct file.
2. Select the appropriate Experiment ID from the provided options.
3. Click the **Submit** button to confirm the link.

This manual linking process ensures that all data files are accurately associated with their respective experiments, maintaining data integrity and facilitating effective analysis.

5.4.3 File Requirements

To ensure successful uploads, please adhere to the following file requirements:

Requirement	Specification
File Size	Maximum 10MB per file
Date Format	YYYY-MM-DD
Special Characters	Avoid at all costs

5.4.4 File Upload Types

The upload interface categorizes files into two primary types to facilitate structured data management:

- **Experiment Log Files**: Processed logs containing IDs, dates, and input parameters.
- **Raw Data Files**: Experimental data outputted by the machine, including IDs, dates, and results.

5.4.5 Supported File Formats

The following file formats are supported for upload:

- **CSV (.csv)**: A structured data format using comma-separated values.
- **Excel (.xlsx)**: A spreadsheet format that supports multiple sheets and structured data.

5.4.6 Upload Guidelines

To maintain system performance and ensure proper data processing, users should follow these best practices:

- Limit uploads to a maximum of 10 files at once.
- Ensure that data structures match the expected formats to prevent processing errors.
- If a file does not meet the required format, the system may issue a warning or reject the upload.

5.5 Data View

The Data View section provides users with a structured and interactive way to explore the data uploaded into the system.

5.5.1 Common Functionalities

Across all tables, users can utilize the following common functionalities to enhance their data exploration experience:

- **Search**: Locate specific data points quickly using the dynamic search bar. Users can search across the entire dataset or within a single column by selecting the desired field from the dropdown menu.
- **Sorting**: Organize data systematically by clicking on any column header to sort entries in ascending or descending order. Sorting indicators (arrows) will reflect the current order.
- **Highlighting Matches**: Relevant data points are automatically highlighted upon search, drawing immediate attention to key results.
- **Row Filtering**: Non-matching rows are temporarily removed from view, simplifying the focus on pertinent data.
- **Column Navigation**: Each column is labeled alphabetically (A, B, C, etc.) for easy reference, ensuring that users can quickly identify and focus on specific data fields.

5.5.2 Experiment Table

The Experiment Table provides comprehensive oversight of all experiment-related data. This table allows full control over data management, including editing and deleting entries, making it an essential tool for maintaining data accuracy and integrity.

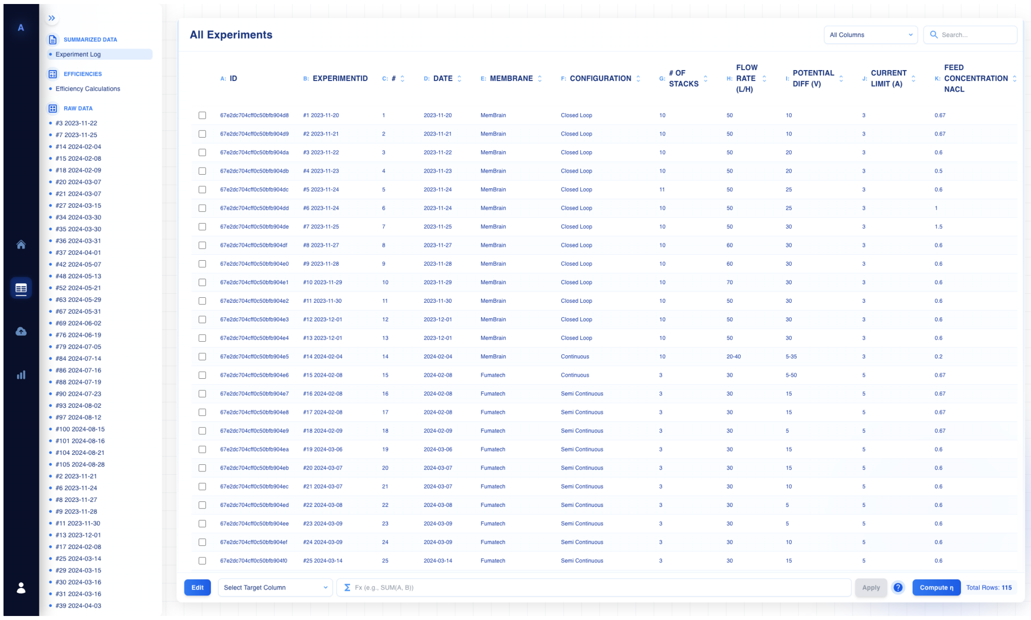


Figure 6: Experiment Table View

Row Selection The Row Selection feature allows users to select one or more rows for bulk actions such as editing or deleting.

1. Click the checkbox next to each row you wish to select.

2. Perform the desired bulk action (e.g., editing or deleting) on the selected rows.

Edit Dropdown Menu The Edit Dropdown Menu enables users to edit the table directly.

1. Click the "Edit" button to view available options.

2. Select the desired option from the dropdown menu.

Add Column The Add Column feature allows users to introduce a new column into the table for additional data entry.

1. Click the "Add Column" button.

2. Enter a name for the new column in the dialog box that appears.

3. The new column will be added to the right side of the table.

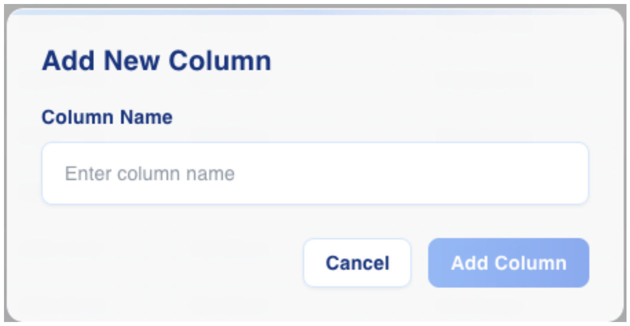


Figure 7: Add New Column Dialog

Add Row The Add Row feature enables users to insert a new row into the table for additional data entries.

1. Click the "Add Row" button.
2. A form will appear, prompting you to enter values for each column.
3. Fill in the required fields and click "Submit" to add the new row.

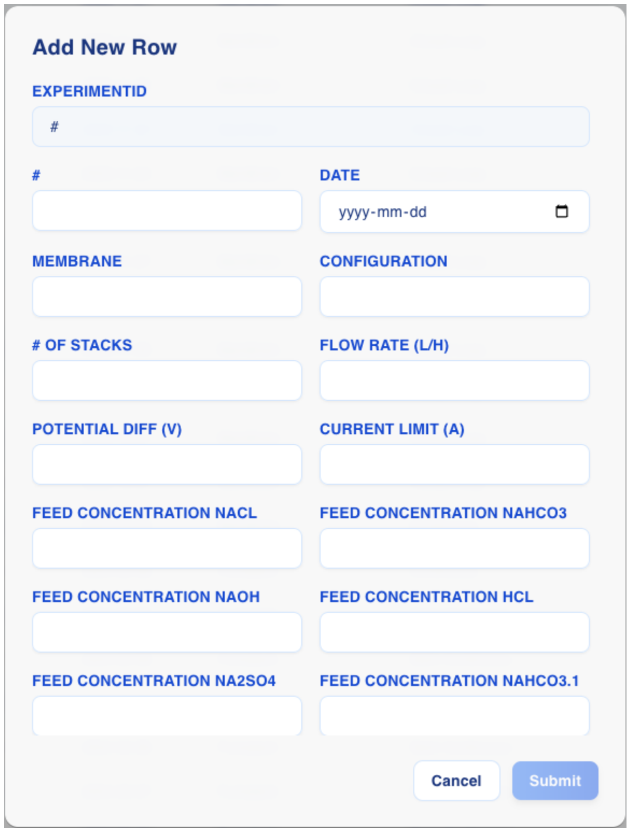


Figure 8: Add New Row Dialog

Remove Column The Remove Column feature allows users to delete an existing column from the table.

1. Click the "Remove Column" button.
2. Select the column you wish to remove from the dropdown menu.
3. Confirm your action by clicking "Remove Column."
4. Note that this operation cannot be undone.

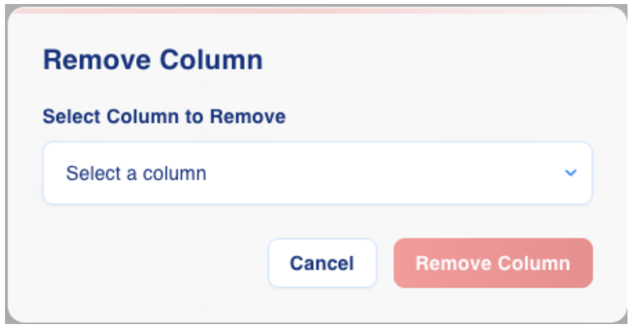


Figure 9: Remove Column Dialog

Remove Row The Remove Row feature enables users to delete one or more selected rows from the table.

1. Select one or more rows by checking the boxes next to them.
2. Click the "Remove Column" button.
3. Click the "Remove Row" button to open a confirmation dialog.
4. Review the warning message and click "Remove Row" again to delete the selected rows permanently.

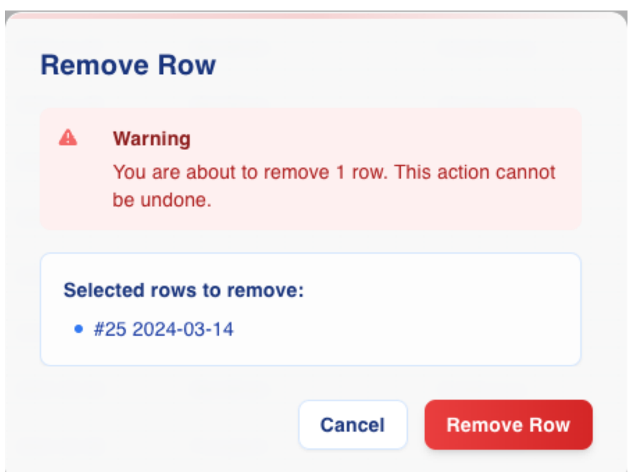


Figure 10: Remove Row Confirmation Dialog

Set Column Types The Set Column Types feature allows administrators to define the data type for each column in the table, ensuring consistency and accuracy.

1. Navigate to the "Set Column Types" section.
2. Select the desired data type (e.g., Number, Date, Text) for each column from the dropdown menu.
3. Click "Save Changes" to apply the updates.

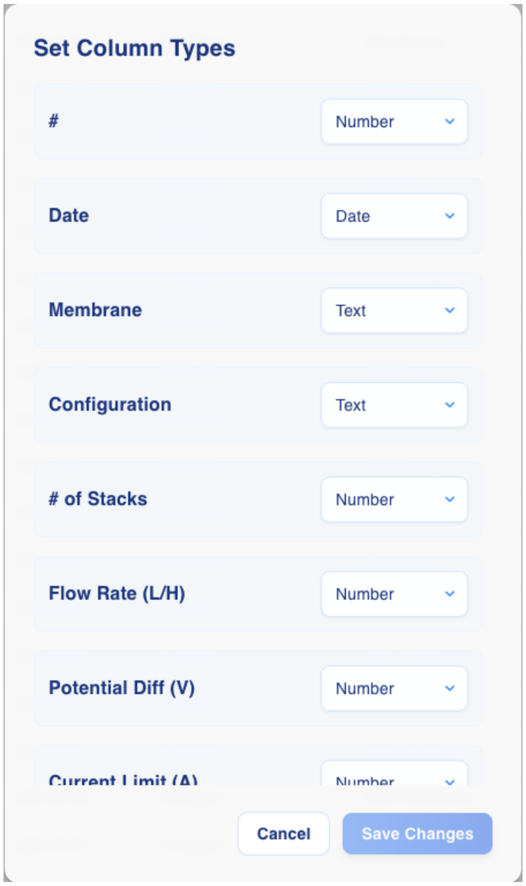


Figure 11: Set Column Types Dialog

Function Bar The Function Bar at the bottom of the table enables advanced data manipulation through calculations.

1. Select the rows you want to include in the calculation by checking the boxes next to them.

2. Choose the target column where the calculated result will be applied.

3. Enter a formula using column headers (e.g., SUM(G, I)).

4. Click the "Apply" button to calculate and update the target column with the results.

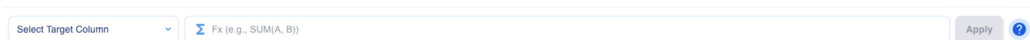


Figure 12: Function Bar

Compute Efficiency Factors The Compute Efficiency Factors tool enables administrators to calculate various efficiency metrics based on selected experiments and time intervals.

1. Click the "Compute η" button.

2. Select an experiment for which you want to compute efficiency factors.

3. Define the duration over which the calculations will be performed.

4. Select Efficiency Factor to compute.

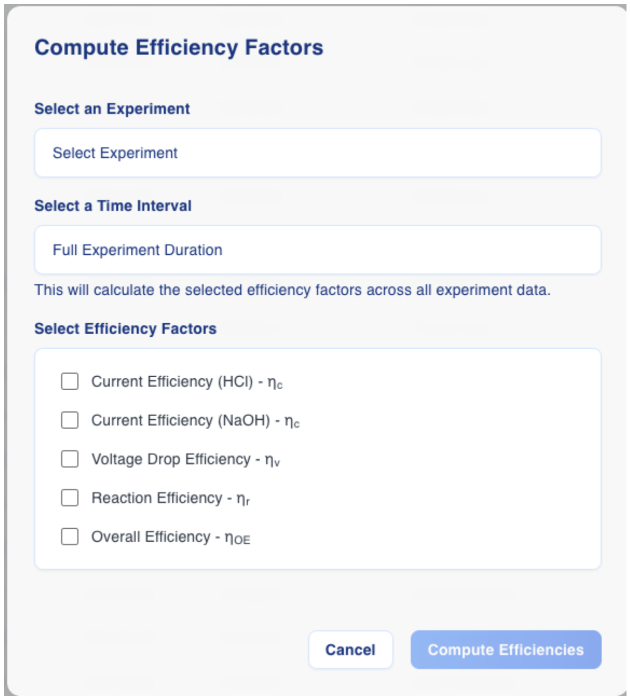


Figure 13: Compute Efficiency Factors Dialog

5.5.3 Efficiency Table (Read-Only)

The Efficiency Table offers a read-only view of efficiency metrics derived from the processed data. This table is designed to provide insights into performance trends and outcomes, enabling users to understand the effectiveness of their experiments without the ability to modify the underlying data.

5.5.4 Raw Data Table (Read-Only)

The Raw Data Table presents a read-only view of the raw experimental data, offering users the ability to explore detailed information captured during experiments. This table is crucial for users who need to examine individual data points and verify the integrity of the uploaded information without altering it.

5.6 Graph Generation

This section provides detailed instructions for creating, customizing, and exporting data visualizations.

5.6.1 Page Overview

The graph page is seperated in two sections.

Side Bar: On the left side of the page is the sidebar where it displays all the recently generated graphs and has the generate new graph button.

Main Content: On the right is the main content of the page. Here, the generated graph will be displayed along with a quick linear regression analysis with a short statement of its findings.

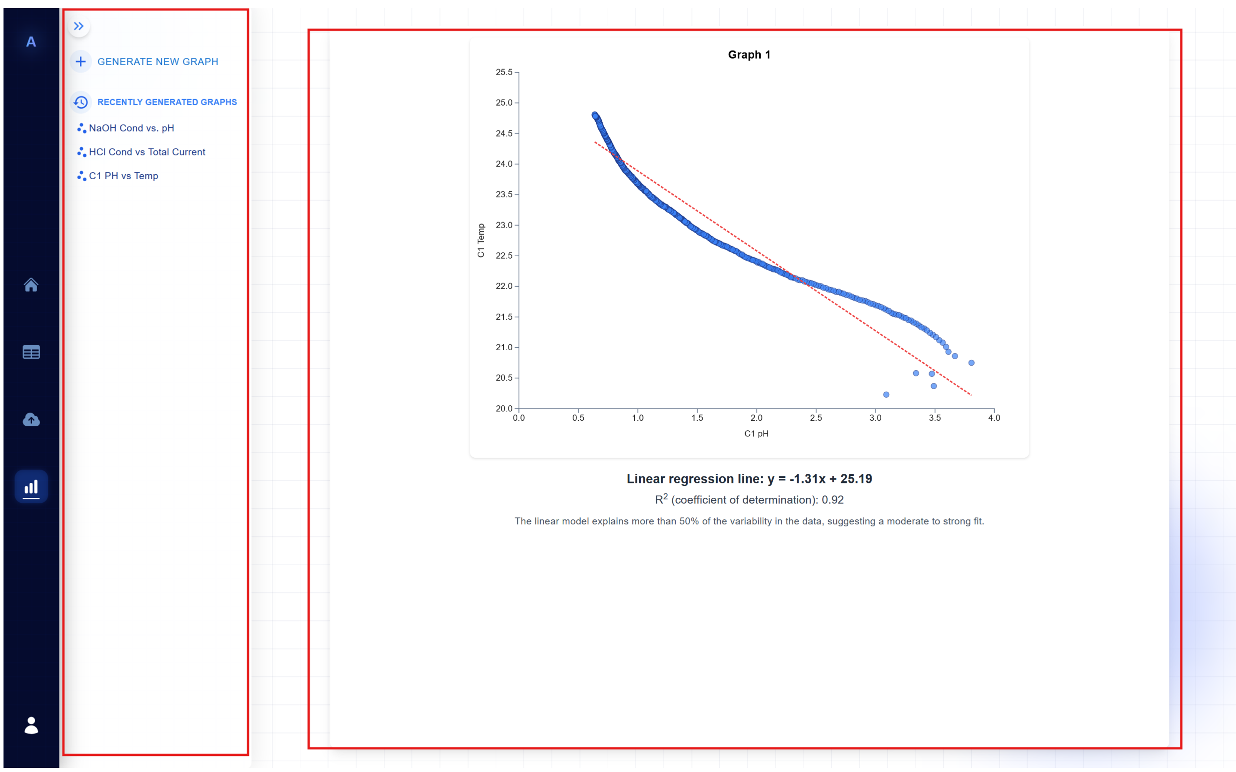


Figure 14: Graph Generation Interface, with Sidebar and Main Content sections highlighted in red

On the side bar, beside each generated graph item has an icon which signifies the type of graph it is.

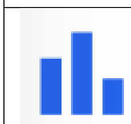
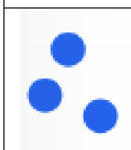
Icon	**Definition**
	Line Graph
	Bar Graph
	Scatter Plot

Table 1: Graph Types and Their Definitions

Generating a New Graph:
To create a new graph, click on the **Generate New Graph** button at the top of the side bar:

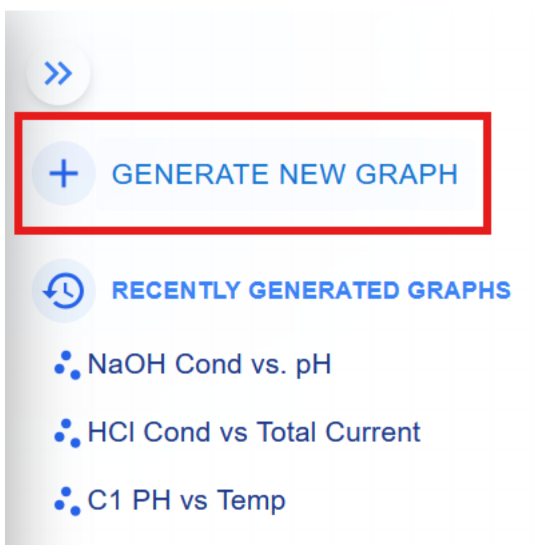


Figure 15: Highlights the Generate New Graph Button

5.6.2 Detailed Workflow

Description

There is a five-step process for generating custom graphs from experimental data.

1. **Select Graph Type:**
   The app currently only supports 3 types of graphs.

   - Line graph
   - Bar graph
   - Scatter plot

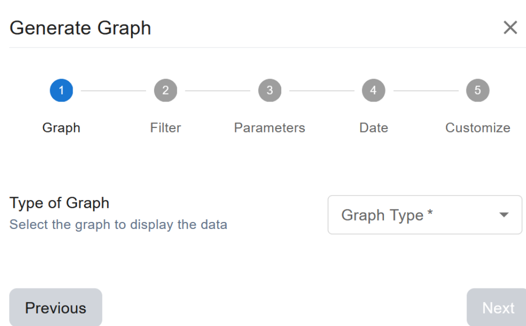


Figure 16: Highlights the Generate New Graph Button

2. **Optional: Apply Filters**:
   Use this part of the form to filter experiment dates based on a certain attribute. The attribute could be from the Experiment or Raw Data files.
   Note: Either all form field must be willed out or all must be empty in order to progress to the next stage of the form.

   (a) Choose which data file attribute to filter by
   (b) Choose filter attribute
   (c) Select filter value from dropdown

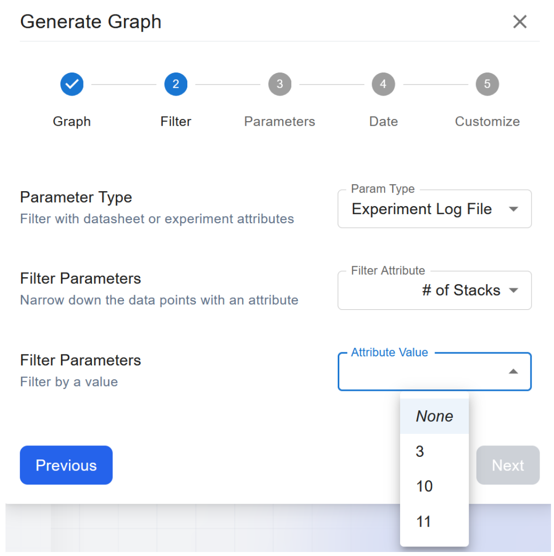


Figure 17: Sample Input of the Filter Step

3. **Set Parameters**:
   Select the attributes for the X and Y axis to plot. The two attributes must be from the same experiment sheet.

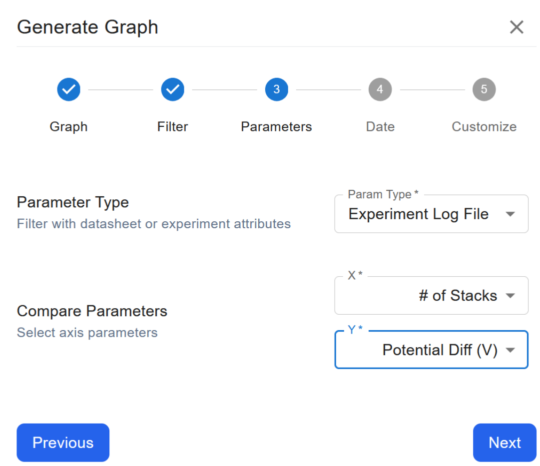


Figure 18: Sample Input of the Filter Step

4. **Selecting Dates**:

If no filter is applied, all experiemnt dates wil be listed.

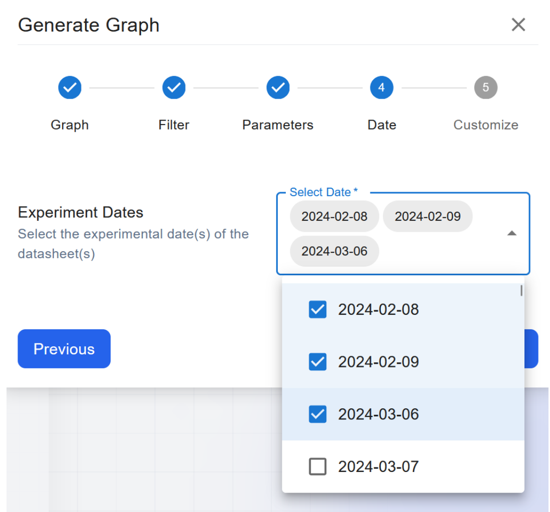


Figure 19: Sample Input of the Date Step

5. **Customize Display**:
   Users are able to customize the graphs. All fields on this step are optional.If no axis labels are inputted, the axis would be nammed the attribute name selected by default.
   There are the following options for customization

   - Graph title
   - Axis Ranges
   - Axis Labels

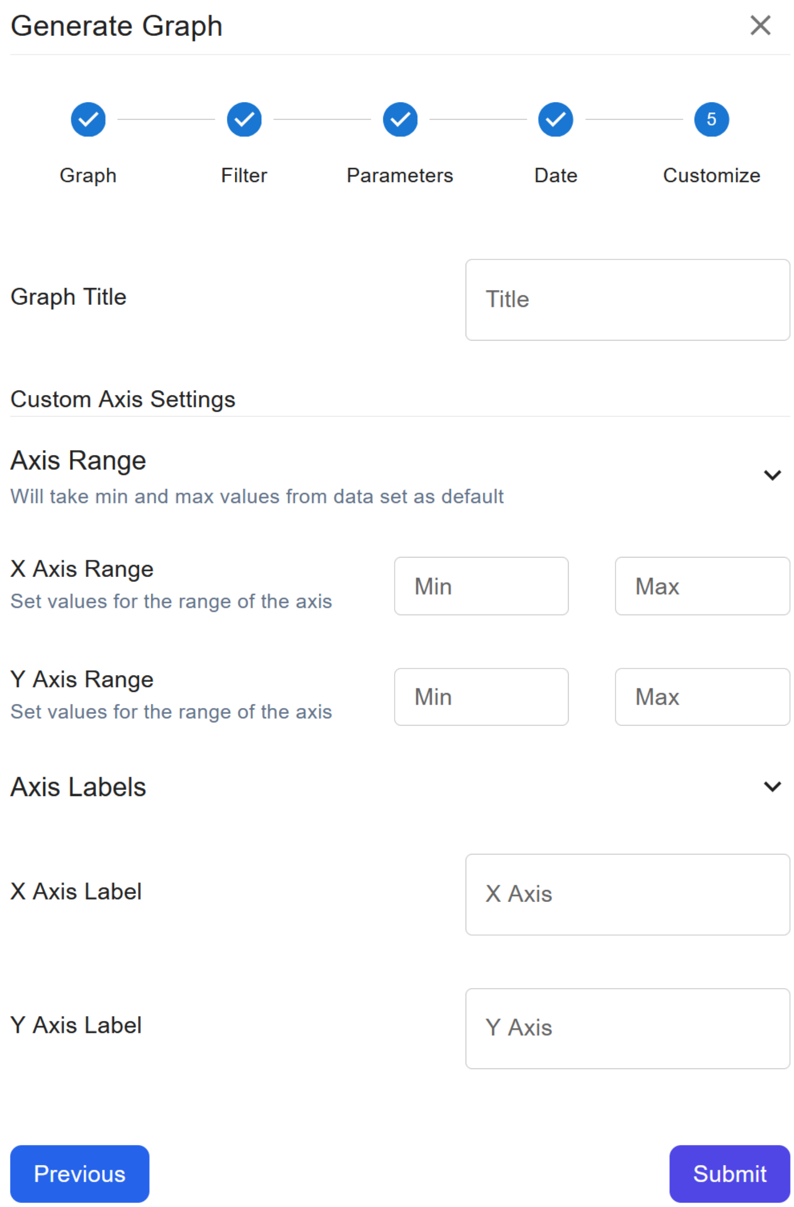


Figure 20: Sample Input of the Filter Step

6 Troubleshooting

This section lists common issues, error messages, and their solutions, along with advanced diagnostic procedures.

6.1 Common Graphing Issues

Issue	**Solution**
Dropdown options not appearing	There may be no value for the selected combination of attributes or filters. Check to verify inputted options
Frozen form	There may be a large number of options to select from. Please give the page a few minutes to finishing loading up and displaying all the data
Rendering failed	Validate data selection