Deep Dive: Data Analysis in Quiver

Course Introduction

About Quiver
Quiver is an analytical and dashboarding tool that enables you to search, visualize, and analyze object and time series data. It supports a wide range of no-code transformations and allows you to build interactive, parameterized dashboards that can be embedded into operational applications. Quiver also offers robust time series capabilities that include the ability to create, transform, visualize, and forecast time series data.

Key Features:

- Visualizing time series and object data.

- Exploring relationships between connected object types.

- Implementing no-code data transformations.

- Creating and sharing of interactive dashboards.

Quiver vs. Other Tools

- **Quiver**: Ideal for time series analysis, object data visualization, and embedding analyses into other applications. It supports no-code transformations and can write back to the Ontology. Note that Quiver only supports analysis for Ontology objects.

- **Contour**: Best for exploratory analysis and drilling down on specific issues with support for any dataset on the stack, not only Objects. It supports chart-to-chart filtering, inline parameter references, fullscreen presentation view, and PDF exports.

- **Pipeline Builder**: Recommended for building and maintaining production pipelines in a low- to no-code interface. It offers easy collaboration, secure and consistent schemas, a wide range of type-safe functions, and incremental transform mode.

- **Workshop**: Provides full customization and layout flexibility, supports multi-step workflows, embedding content from Quiver and other Foundry applications, and allows for writeback.

When to Use Other Tools

- **Complex Data Transformations:** Pipeline Builder or Code Repositories are better suited for tabular datasets that require highly complex data transformations beyond Quiver's support for no-code out-of-the-box transformations and simple formulas.

- **Advanced Statistical Analysis:** Create dataset models, configure automatic submission of models, leverage visualization libraries, and perform advanced statistical analyses in Code Workspaces or Code Repositories.

Quiver and AIP
Quiver is equipped with several key features from Foundry's Artificial Intelligence Platform (AIP). While this training doesn't focus on AIP, we'll highlight relevant features throughout the course for you to independently explore and enhance your analysis.

The Use Case

Scenario Overview

Welcome to your training as a Data Analyst for the notional TitaniumWorks Manufacturing company! As a Data Analyst, you're often tasked with reporting out analytic insights, and for this training, you'll be identifying and prioritizing which equipment should be next for inspection. You'll use Quiver to:

- **Perform no-code transformations:** Apply a wide range of transformations to equipment and parts objects without needing to write code.

- **Visualize object data**: Explore and analyze data trends over time and understand relationships between equipment and parts data.

- **Create and share interactive dashboards**: Build a parameterized dashboard that can be embedded into operational applications and shared with your team.

Your Role

As a Data Analyst, you'll identify the most critical equipment for inspection and maintenance based on parts quality and equipment performance.

Your Goal is to

- Prepare and join objects for analysis.

- Create derived columns to identify high-risk machinery given average part purity and equipment capacity.

- Create reusable visual functions.

- Visualize the data and create a dashboard for easy interpretation and decision-making.

- Learn where Quiver dashboard elements can be embedded for operational use.

Create a Course-Specific Folder

Step 1: Create a folder

1. In the top left, click on the star to favorite your project.

    o This will allow you to find it quickly later on.

2. Click on *New* in the center of the screen or in the top-right corner

3. Click on *Folder*
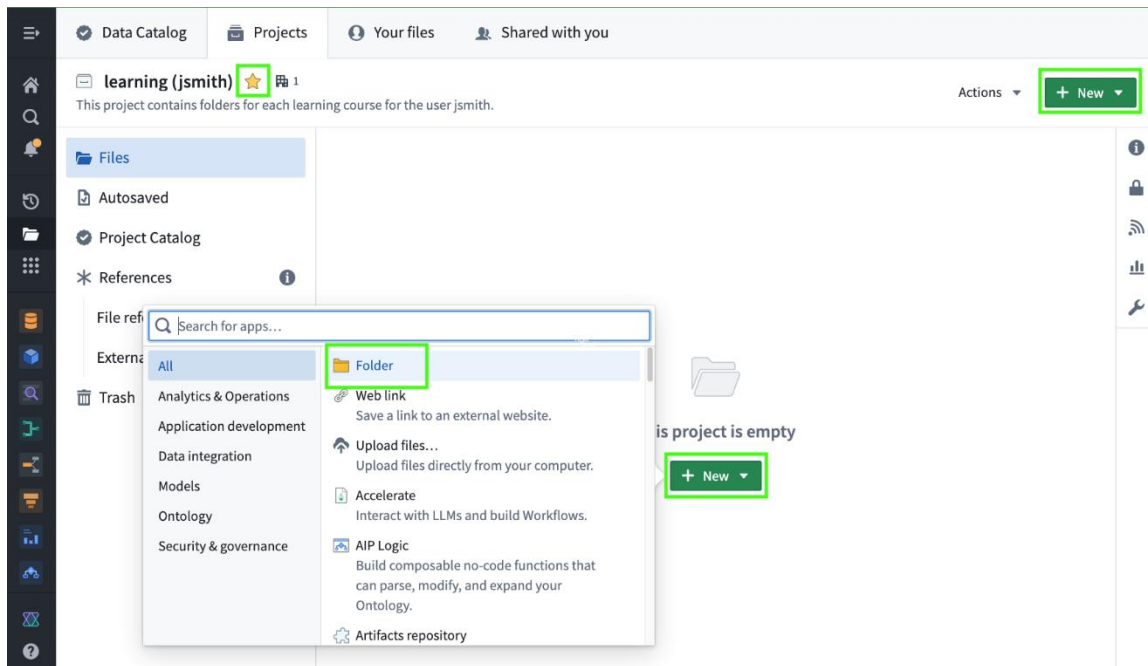
4. Name the new folder after the current learning course

   o For example: Deep Dive: Data Analysis in Quiver

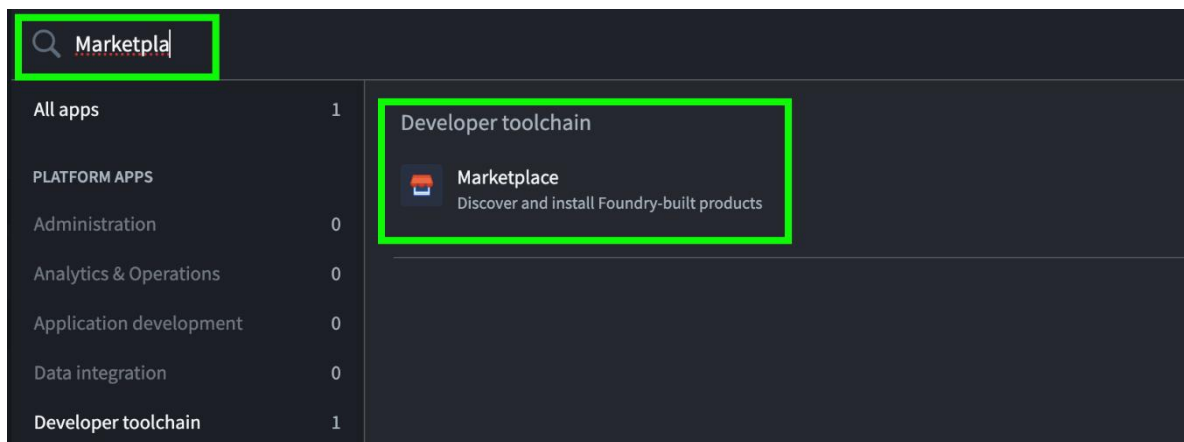## Install the Marketplace Product

With your working location created, you're now ready to install the resources required for this training through the Foundry Marketplace. Marketplace is a storefront application that allows you to discover and install various data products or "bundles." You'll be installing a bundle that contains all the resources you'll need for the training, including pipelines and notional datasets.

Step 1: Open Marketplace

1. Click on **Applications** on the left side of the screen
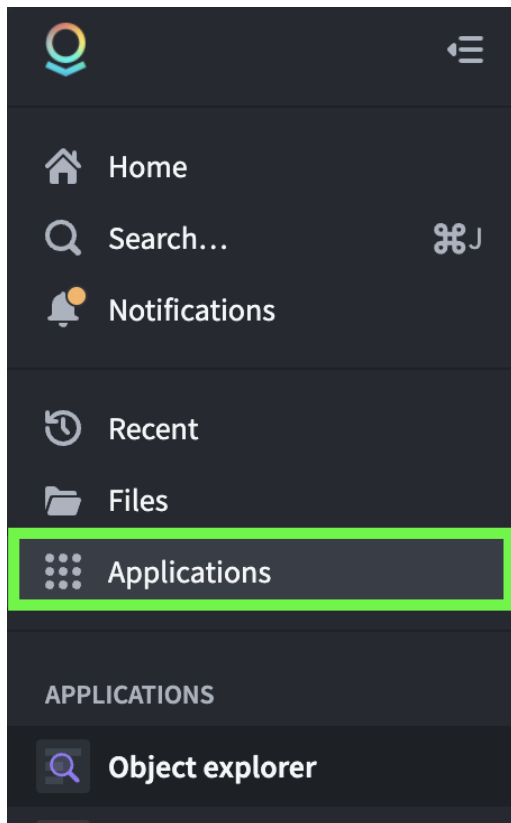
2. Search for Marketplace and open it.

Step 2: Open Deep Dive: Data Analysis in Quiver Marketplace product

1. Search the Deep Dive: Data Analysis in Quiver product in the top search bar labeled **Search products...** (not the lower search bar labeled **Search stores...**)

2. Click into the corresponding product
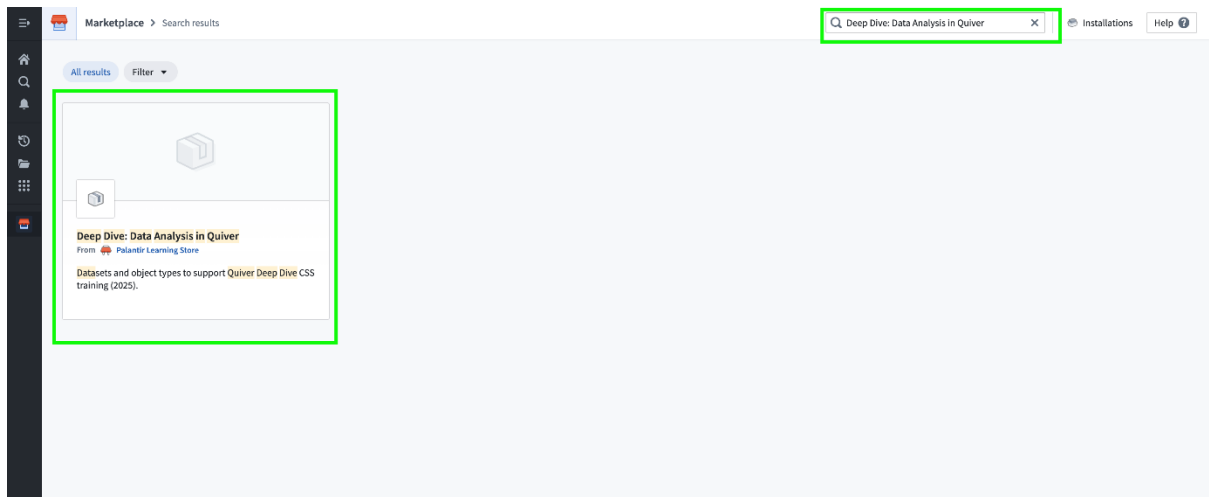
Step 3: Start the installation

1. Click **Install** or **Install again** in the top right corner
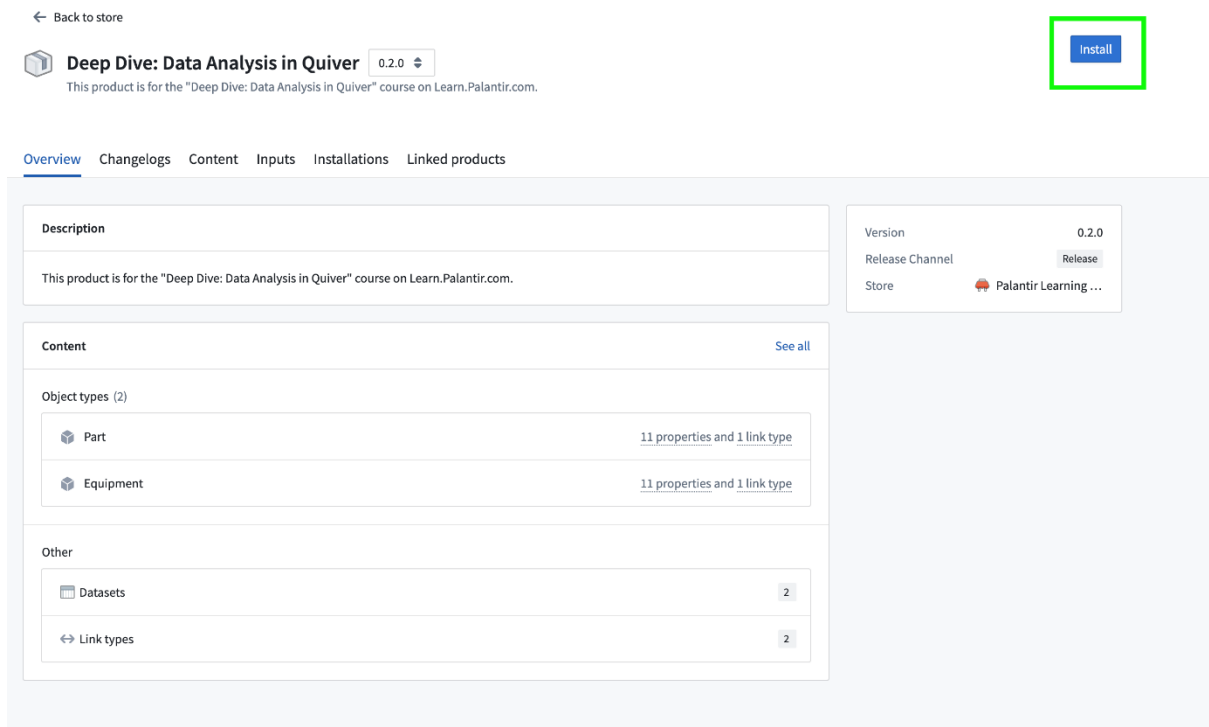
Step 4: Customize the installation

1. Set your username as the installation suffix

   1. Toggle on **Installation suffix**

   2. Enter your own <username>

2. Change the installation location to your course-specific training folder

1. Click **Use existing location**

2. Click **Browse**

3. Browse to your **Learning** *(<username>)* > **Deep Dive: Data Analysis in Quiver** folder

4. Click **Save**

3. Click **Next**

Step 5: Confirm the content

1. Ensure the content you are installing is similar to the one below

2. Click **Next**

Content

Object type (2)   ⌃

🎁 Part   11 properties and 1 link type

🎁 Equipment   11 properties and 1 link type

Dataset (2)   ⌃

▦ parts   11 columns

▦ equipment   11 columns

Step 6: Install

1. Ensure that all validations pass

2. Click **Install**

Review

✅ **All validations have passed**

Messages (1)   ︿

🗲 Automatic upgrades will be disabled for this installation

Compass resources

Dataset (2)	︿
▦ parts	11 columns
▦ equipment	11 columns

Ontology edits

Object type (2)	︿
🧊 Part	11 properties and 1 link type
🧊 Equipment	11 properties and 1 link type

Install

Step 7: Navigate to the installation

1. Wait for the installation and builds to finish

2. Click **View installation**

3. Click the **Installed in** hyperlink at the top of the screen to go to your course-specific folder

Your course folder should now contain something like this:

Navigate Quiver's Layout

Starting an Analysis

Quiver's interface is divided into several key sections, organized into Canvas mode and Graph mode layouts. We'll open a new analysis, which will start in Canvas mode by default.

Step 1: Create an Analysis

1. In your Foundry folder, click the top right **+ New** dropdown, select **Analytics & Operations** then **Quiver Analysis.**
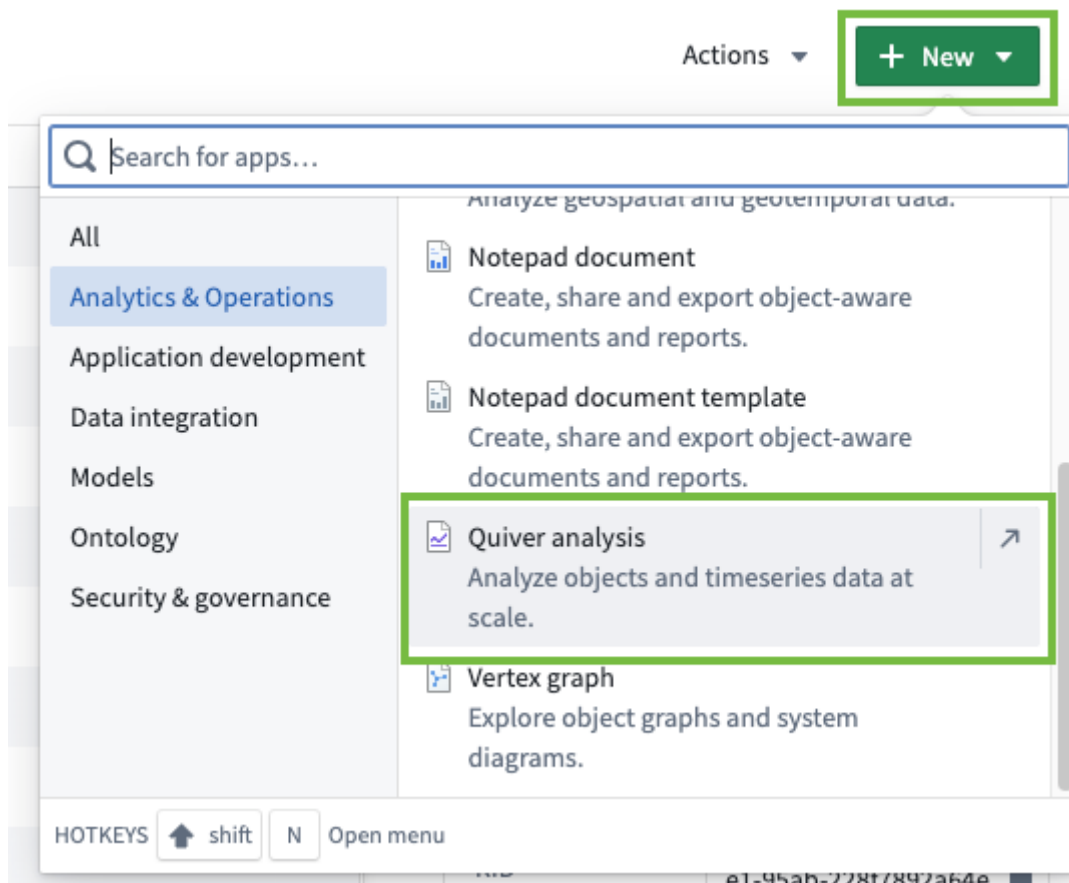
2. Name your analysis by clicking into **Quiver Analysis Created [Date]** in the top left corner and updating to **Equipment Analysis**. Hit the return/enter key.
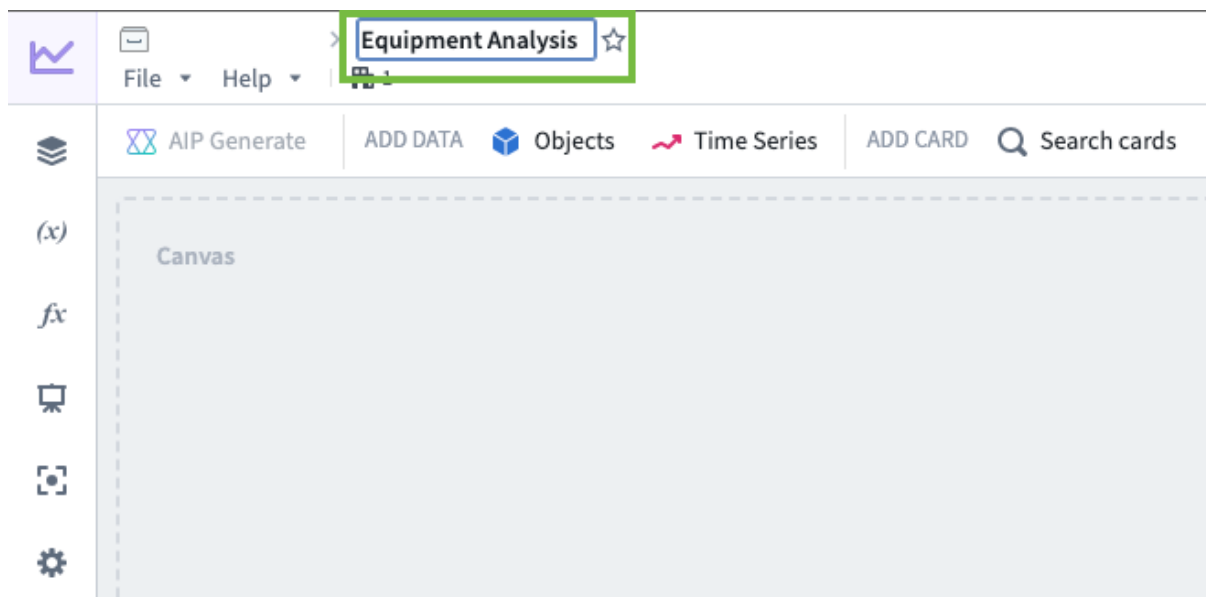
3. Click the **Save** button at the top. Save your analysis whenever you've made a change that you want to maintain.

Note: If your Foundry instance has a toggle here for 'New Quiver,' toggle it on at this step. This training will be based on the 'New Quiver' experience.
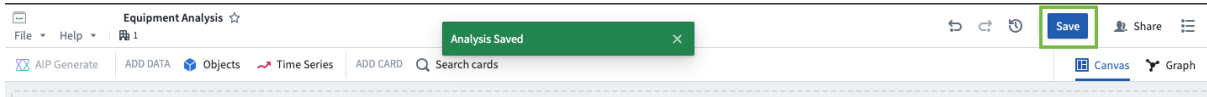
You'll see the option to add data to your analysis and perform various operations via the Toolbar in the middle of the screen. Each operation is performed within a card. Quiver offers a wide array of capabilities, making it a powerful and versatile tool for analysis. To identify equipment for inspection, we'll walk through some of these together.
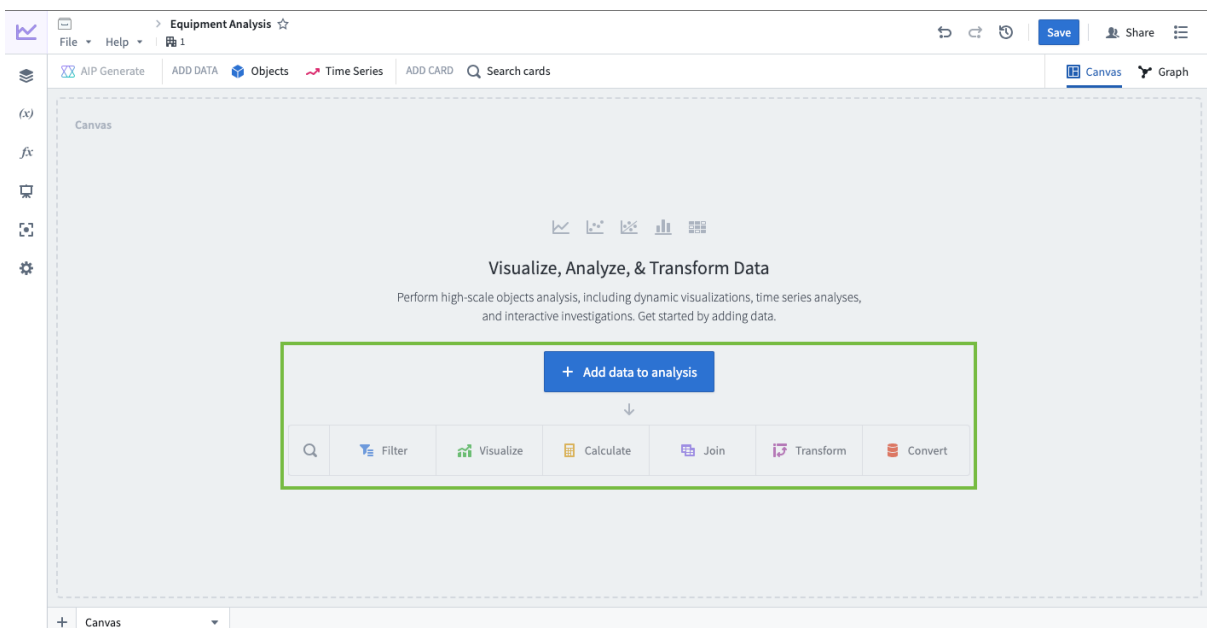
Canvas Mode vs. Graph Mode

Canvas Mode

Canvas mode is a flexible and visual way to build and organize your analysis into different logical paths, similar to tabs in other applications. It allows you to display, position, and resize cards on a page, providing a customized view of your analysis. You may add a new canvas by clicking the **+** icon in the lower-left corner of your screen.

Step 1: Name the Canvas

1. Double click on the canvas tab at the bottom of the page. Rename the canvas as Parts Purity Analysis and hit the return/enter key.
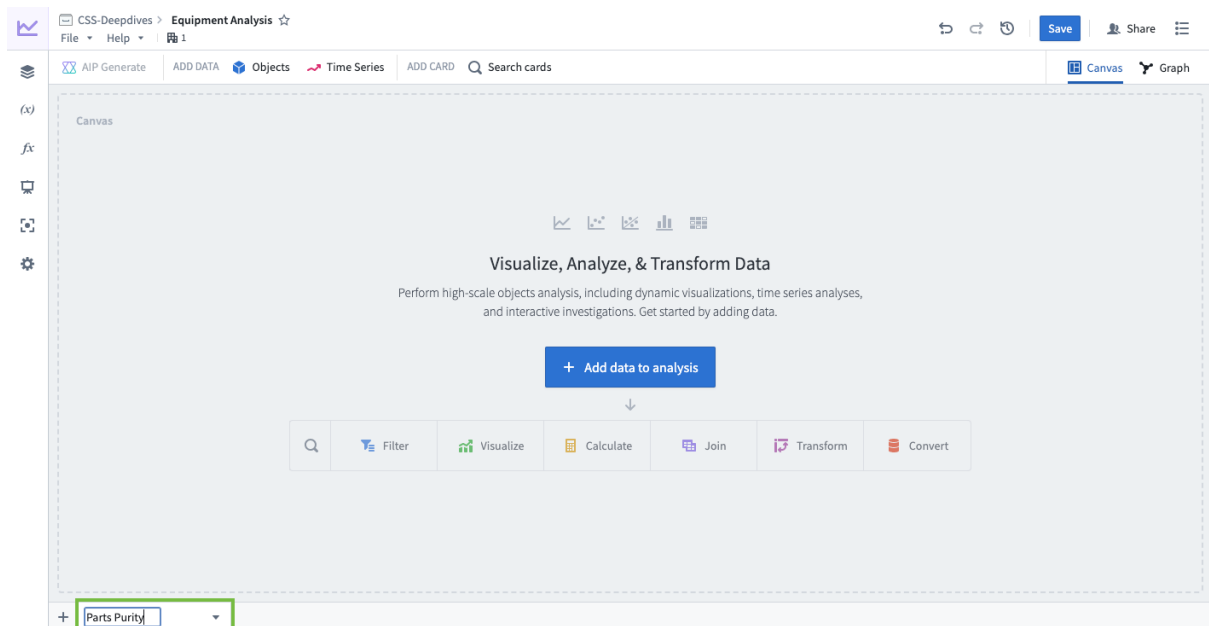
Graph Mode

Graph mode in Quiver provides a graphical view of your analysis, where each card is represented as a node on the graph, with inputs and outputs linked in its logical sequence. This differs from Canvas mode, which does not necessarily display cards in logical sequence. Graph mode is useful for understanding the lineage and dependencies within your analysis, and will be explored in subsequent steps.

You can toggle between Canvas mode and Graph mode using the view mode dropdown at the upper-right corner of the screen. Changes made in one mode are reflected in the other, allowing seamless switching between the two.
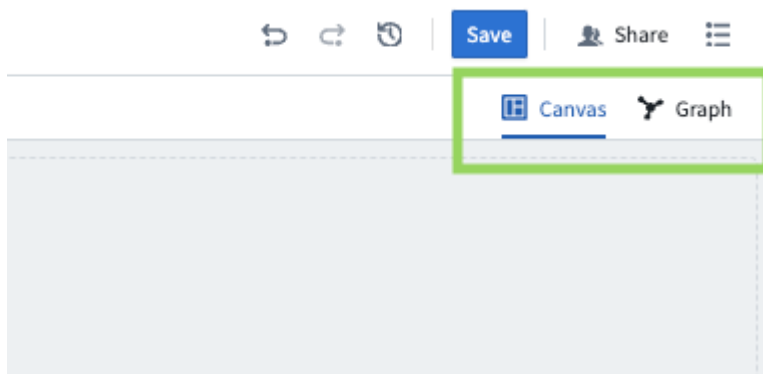
Adding Data to Your Analysis

Step 1: Add Equipment Object

1. Click the **Add Data to analysis** button in Toolbar and find the [yourUsername] equipment Object you deployed earlier.

Once selected, a green modal, **Object set added to analysis**, will appear at the top of the page. This will add all equipment data to your analysis. Note, you may alternatively add a single

equipment object to your analysis by clicking Add Data and searching by the name of the individual object.

2. Click the top-right **X** button to close the data modal and view the canvas.
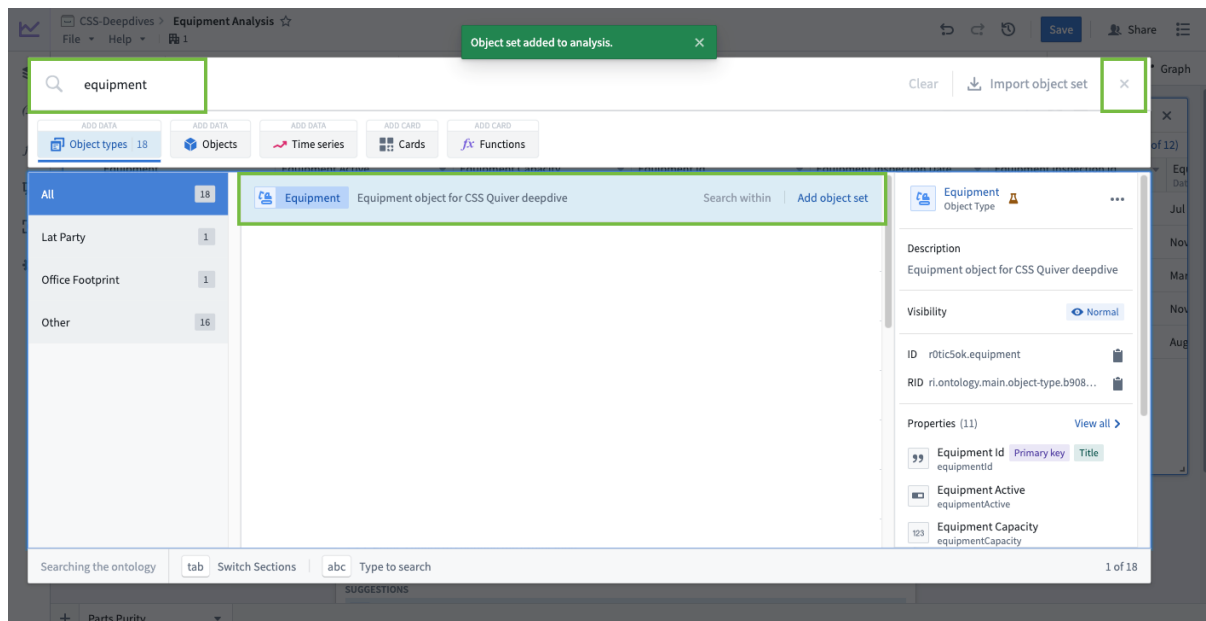
Configurations

Toolbars and Side Panels

In Quiver, there are several panels accessible in the left-hand sidebar that help you organize and manage your analysis. Here is an overview of the different panels:

- **Analysis contents**: Organizes your analysis by listing every card in the order it appears on the canvas.

- **Parameters**: Allows you to parameterize your analysis, making it more dynamic and flexible.

- **Visual functions**: Provides access to visual functions, reusable blocks of logic that allow you to load, combine, and transform data.

- **Dashboards**: Allows you to create and manage dashboards, providing a high-level view of your analysis.

- **Settings**: configure global settings, including the behavior for card apply button, display mode (light, dark), chart colors and other overrides, time zone formatting and tooltips.
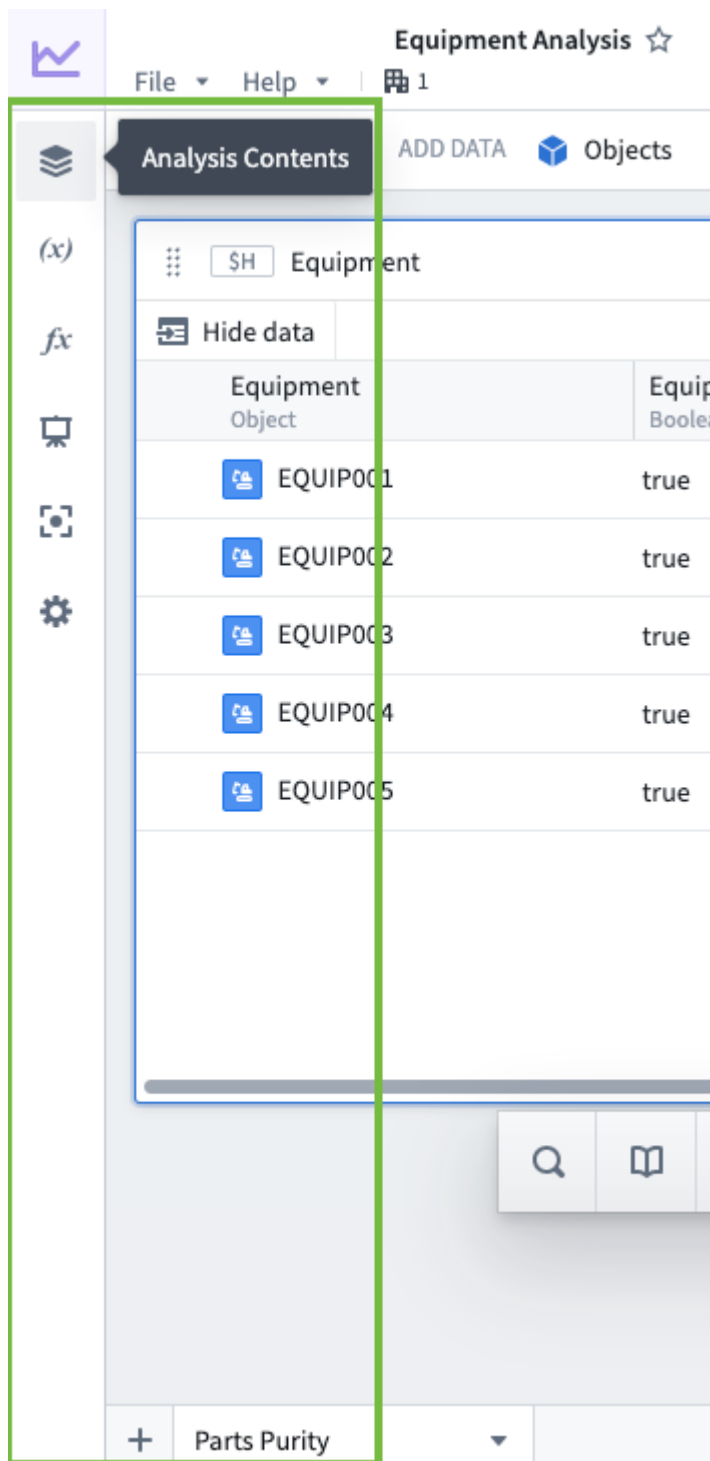
Each Quiver card is configurable in a right-hand panel. When a new card is added, the configuration panel displays automatically on the right side of your analysis. Should you need to update a configuration panel, you can click the cog icon of any card and its configuration panel will expand again.

Take a moment to view the Data, Display, Type, Objects, and Export tabs in the configuration panel.
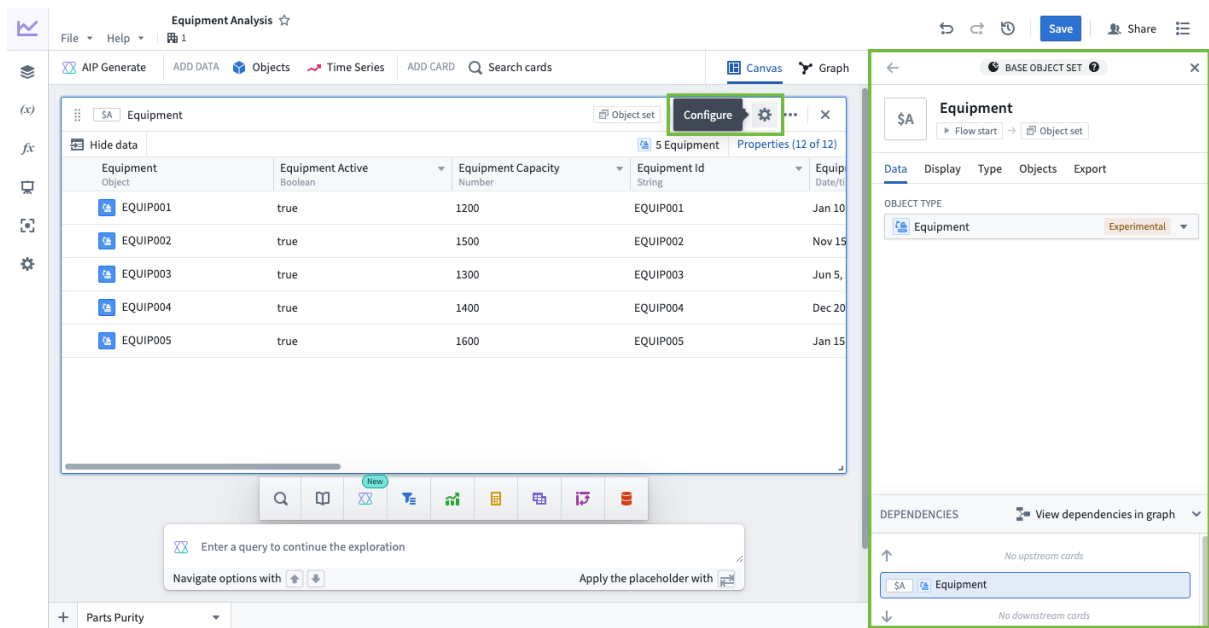
Inputs & Outputs

Note that every parameter, transformation, and visualization card in Quiver can take zero or more required inputs and produce zero or more outputs. Inputs and outputs have definitive data types. It's good practice to provide titles to your cards to understand their content as you build out your analysis.
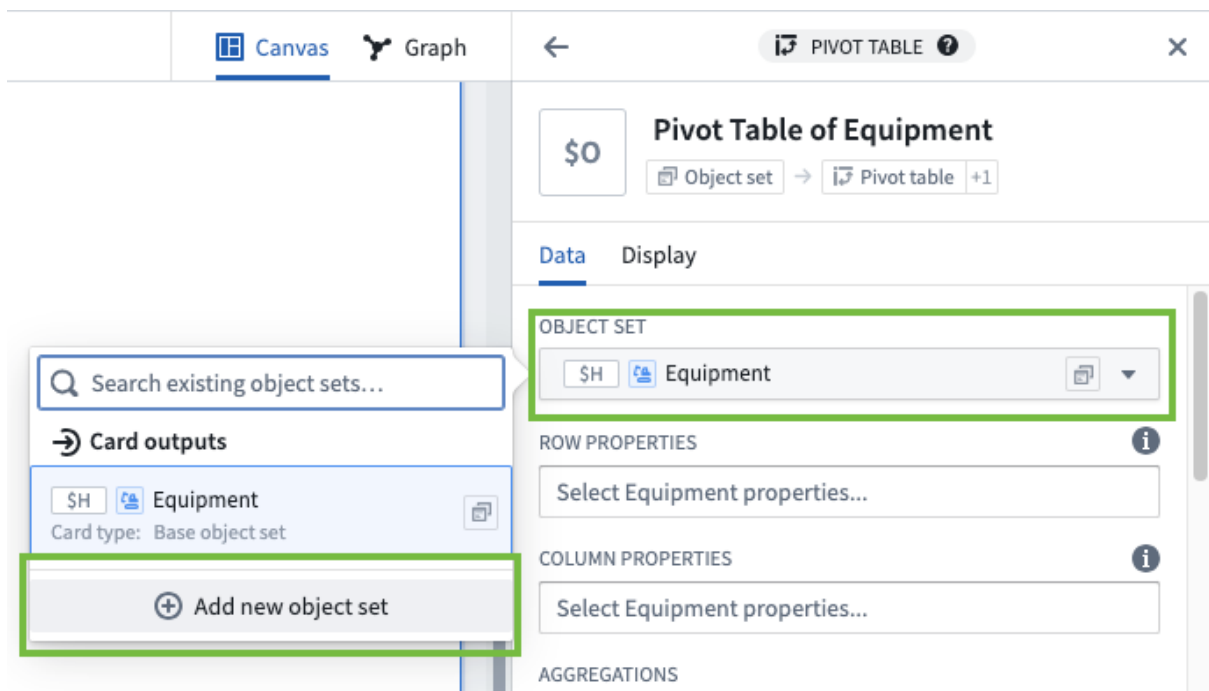
Unique Global IDs

Unique global IDs are automatically assigned to all Quiver data cards, data sources, and parameters. These IDs can be used in formulas and configurations to reference data sources, such as time series plots, transform tables, charts, arrays, or scalar values. Note that your global ID may differ from that depicted.
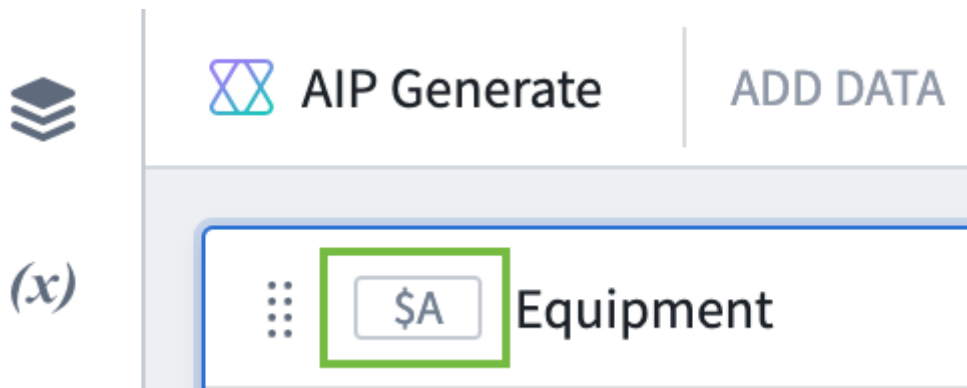
Data Preparation

Join Object Sets

You've now added an object table with all equipment data to your canvas. In the top navigation bar, you can add more data (objects, time series) or cards. As a reminder, cards in Quiver are discrete blocks of logic to help you operate on and visualize your data.

If you hover over your current card, the card's Toolbar at the bottom of your last board lets you take the next logical step in your analysis, using the currently selected card as input. We'll incorporate these cards sequentially to perform data preparation steps on the equipment and parts objects.

Note that cards don't necessarily have to be displayed in order of operation in Canvas mode. You may even remove (hide) cards completely from the Canvas while still using them in a chain of cards. In contrast, Graph mode will always show the logical dependencies of your different cards.

Step 1: Add the Part Object to the analysis

1. In the top navigation bar, select **Objects** next to **Add Data**
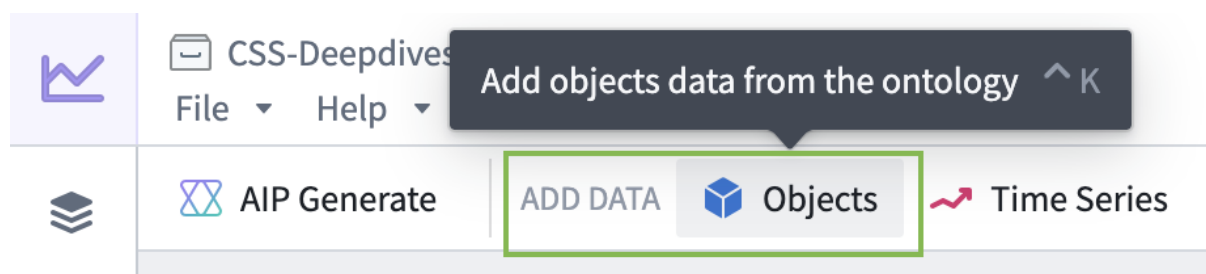
2. Search for the [yourUsername] part Object

3. Click **Add object set**.
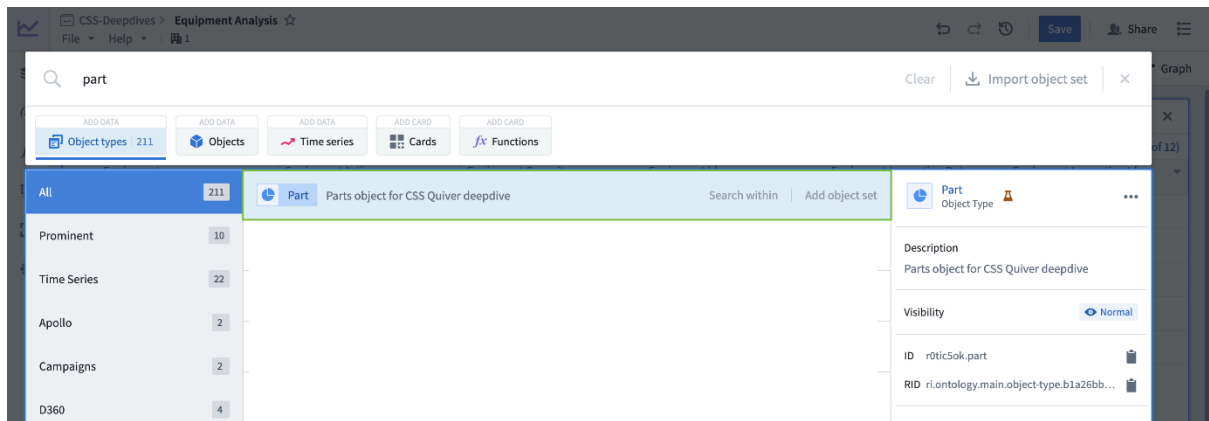
You should now see two object tables, one titled **Equipment** and one title **Parts**. In the next steps, we'll join join the equipment dataset with parts data.

Step 2: Join the Objects

1. Select the **Equipment** card so that it's highlighted in blue.

2. Choose **Join to transform table** to perform a left join.

A new Transform table card will display beneath the Parts card. For this join, the Equipment Object set is the left table and Parts Object set is the right table.
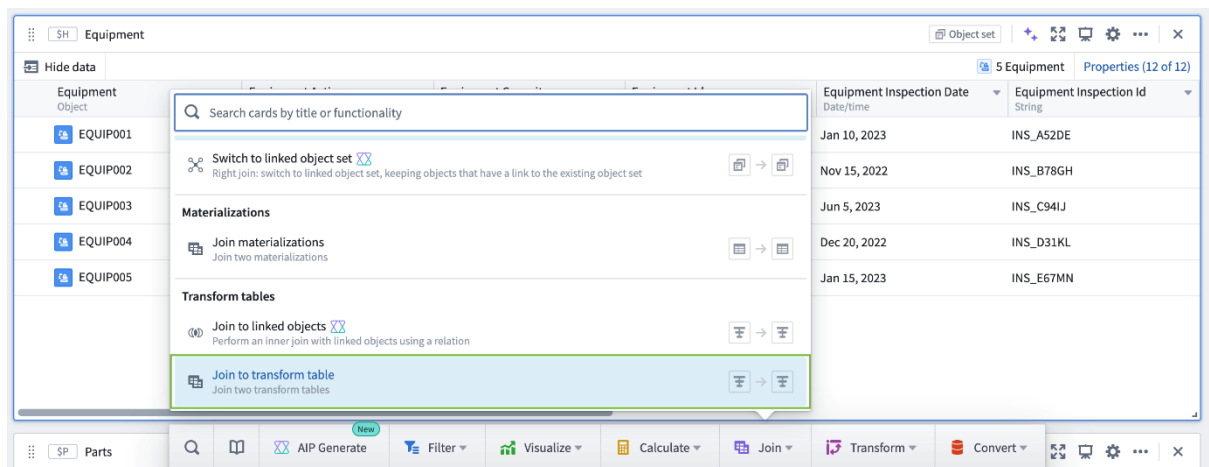
3. In the right configuration panel of the Transform Table, select LEFT join type.

4. Select **Parts** under the JOIN TABLE section to specify which table to join **Equipment** to

5. Leave all columns selected under **CURRENT COLUMNs** section.

6. Under **JOINED COLUMNS**, add **Part Id, Part Material, Part Production Date, Part Purity, Part Type**, to keep only the relevant columns and make your analysis easier to manage. You may always return to the configurations options by selecting the cog icon, then **Join to transform table** if you select too few or too many columns.

7. Under **Match Conditions**, leave **MATCH STYLE** toggled to **ALL**.

8. In **MATCHES**, select **Equipment Id** for the **INPUT** dropdown (left table) and **Eq Id** for the **JOINED** dropdown (right table).

9. Click **Save** at the top.

Note, in future analyses, you may add additional join conditions via the **Add match** button below.

Join to transform table

$AH

⊤ Transform table → ⊤ Transform table

Data   Display

JOINED COLUMNS

Part Id ✕   Part Material ✕   Part Production Date ✕

Part Purity ✕   Part Type ✕

⊕ Add all   ⊖ Remove all

PREFIX FOR JOINED COLUMNS   ⓘ

right

⌄ **Match Conditions**

MATCH STYLE

ALL	ANY

MATCHES

INPUT   💬 Equipment Id ▾   ✕

JOINED   💬 Eq Id ▾

Step 3: Name the transform table

1. Double click **Transform table** card title, and rename it to **Equipment - Parts Join**. It's good practice to name your cards to easily track different operations in your analysis.
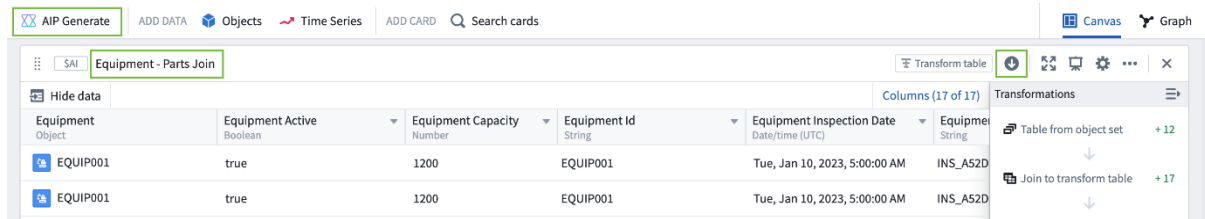
The cards Toolbar also offers AIP Generate, a feature that allows you to add and configure cards by generating the next steps in the analysis based on natural language prompts. It helps in creating meaningful graphs and analyses by interpreting your queries.

Filter Data and Implement a Parameter

Step 1: Filter the transform table

In our analyses, we often need to filter the data to only rows that meet specific criteria. For our analysis, we're going to exclude historical parts data to ensure we're using only recently manufactured parts as a basis for our decision-making.

1. Click on the **Filter** dropdown from the Cards Toolbar, then select the **Filter transform table** card.
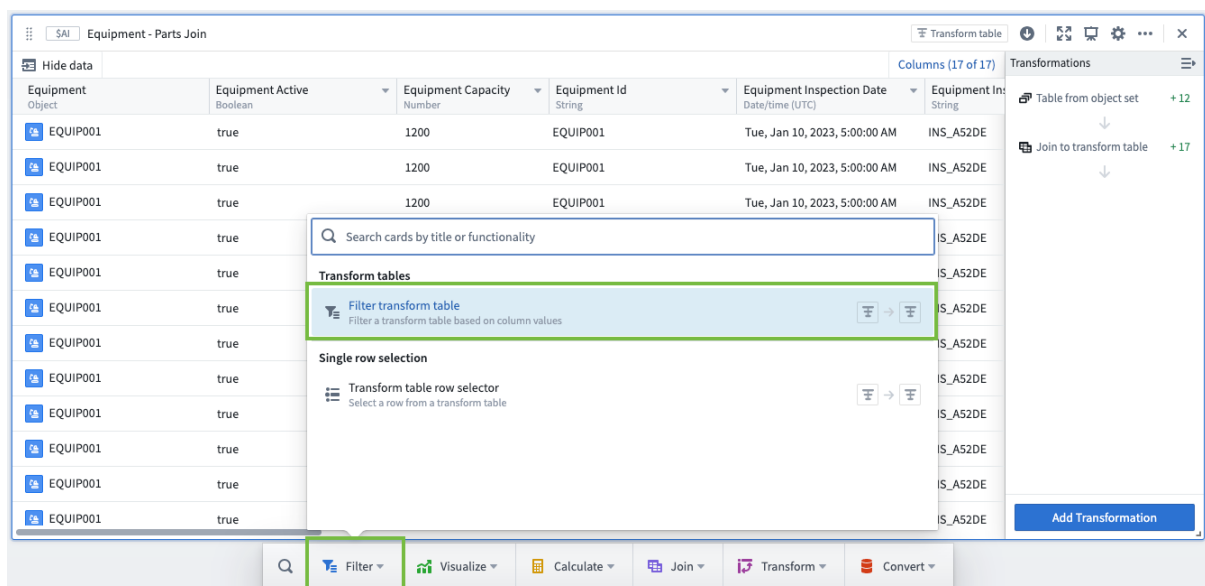
You have the option to keep or remove rows that meet a single filter or multiple filter criteria. In this case, we'll keep all rows that match all filters.

2. Under **CONDITIONS**, select **Part Production Date**

3. In the subsequent dropdown, select **On or after**

4. Choose **Jan 1, 2024** from the date selector

5. The objects that meet our filter condition are returned in the new Transform table. Rename this table as **Parts produced after Jan 1, 2024**.

Step 2: Implement a parameter

In future steps, we'll create a dashboard populated with outputs from our analysis to share with plant managers. Each plant manager will want to filter for the plant location relevant to them, and will want to interact with the dashboard at the same time. Unlike filtering for parts produced this year, we'll implement a parameter to filter dynamically and prevent users from overwriting others' selections.

1. In the left panel, select **Parameters**

2. Click **+ Create parameter** then hover over **Selection**.

3. Choose **Property value** to enable the user to select a value from a dropdown.

Note **Time**, **Numeric**, **String**, **Other**, and **Boolean** options require manual input or can be configured to evaluate against other column values for an object.

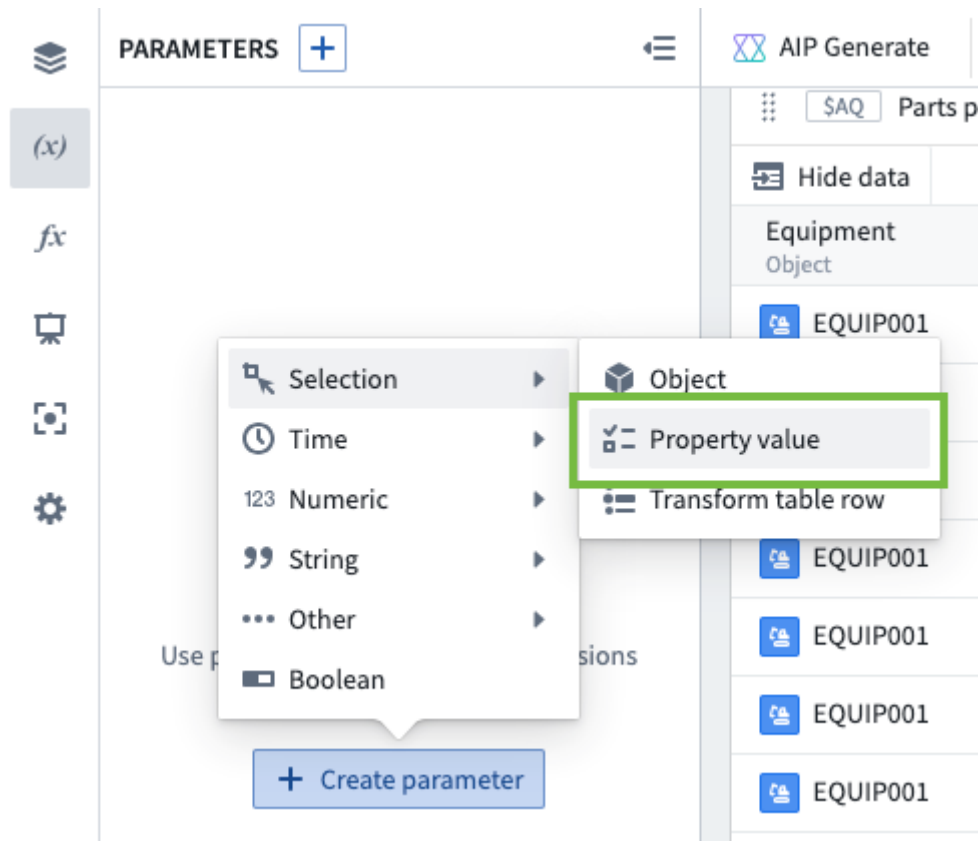4. In the right configuration panel, select **Equipment** as the **OBJECT SET** and **Equipment Plant** for **PROPERTY TYPE**
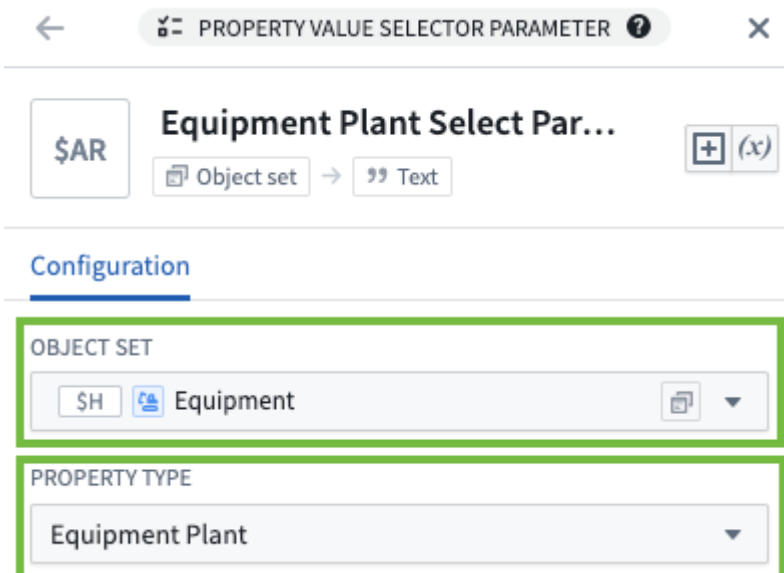
5. Scroll to the **Parts produced after Jan 2024** card and click the cog icon to open the configuration panel. You'll see the **New transform table** (object set) follow by **Filter transform table**.

6. Click **Filter transform table**.

7. Click **+ Add filter** and select **Equipment Plant.**

8. In the following dropdown, select **Is in array**. Note that if you select Is (string), no default value is passed through unless specified in the parameter configuration, and no objects will be returned in the card.

9. In the dropdown below **Is in array**, select **Equipment Plant Select Parameter**
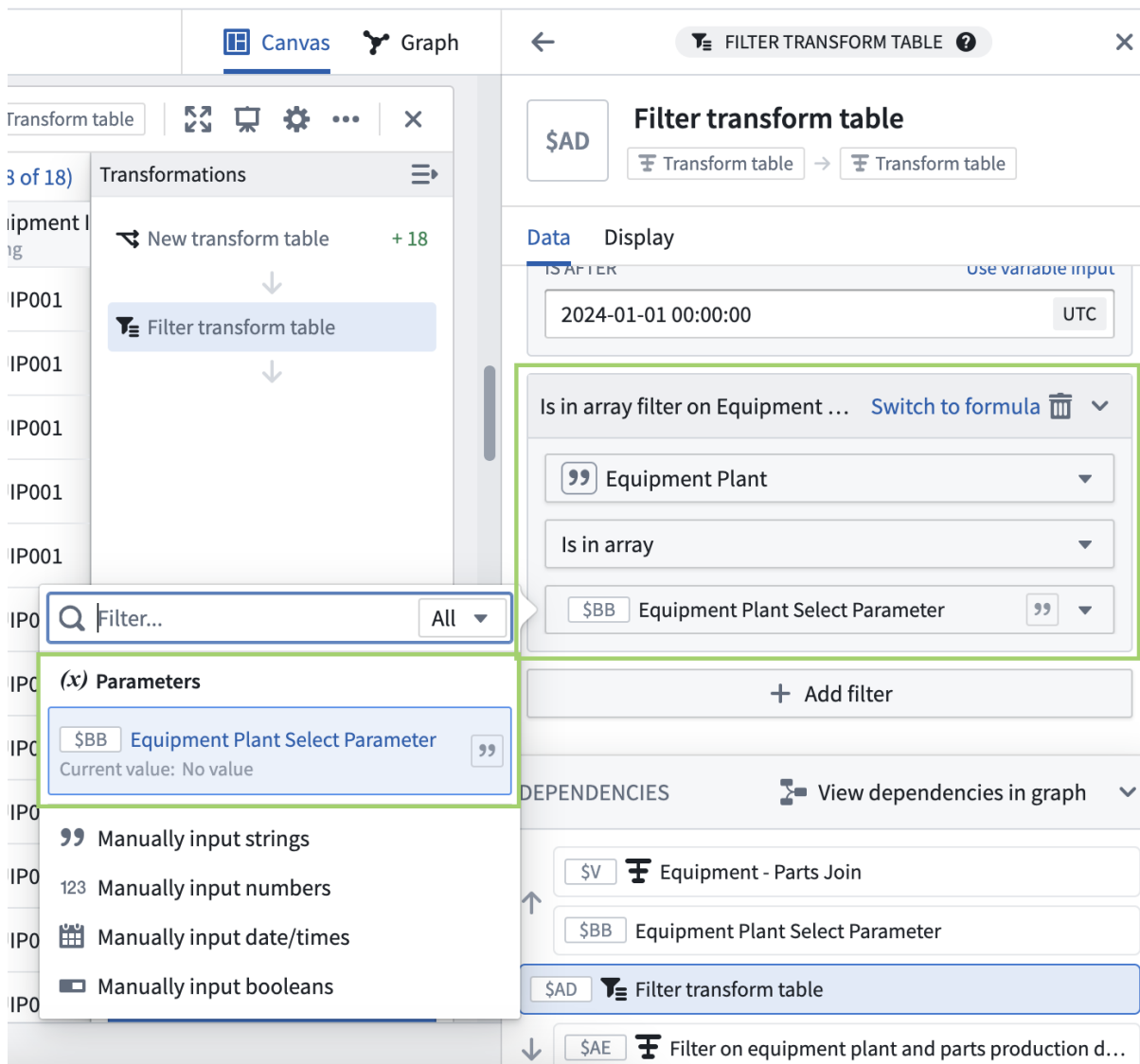
10. Lastly, update the table name to **Filter on equipment plant and parts production date**.

Update Column Values and Data Type

Step 1: Clean data with Find and Replace

It's often essential to transform column values and update data types to ensure operations can be performed efficiently and consistently across multiple datasets in our analyses. In this step, we'll remove a letter and a dash from the parts_purity column values then convert it from a string to a numerical data type, so that it's in a suitable format for numerical operations in future steps.

1. Select the **Filter on equipment plant and parts production date** table, then the **Transform** category from the cards Toolbar.

You'll notice many options to operate on your data including columns editing, comparisons, data type specific comparisons, and functions, which allows you to leverage published functions written in Code Repositories. For this analysis, we want to remove the 'p-' from the parts_purity values so we can display them in a numerical chart. **Edit values** allows users to manually update row values from any selected columns, which is not scalable for our case.

2. Scroll to **String operations**, and select **Find and replace**.

3. In the right hand configuration panel, input **Purity** as the new title to the output column

4. In **INPUT STRING** field, select **Use variable input** and choose **Part Purity** as the column to evaluate

5. In **FIND STRING** field, input p-. Leave **REPLACE STRING** as blank. Leave **CASE SENSITIVE** and **USE REGEX** as **False**

6. Scroll to the right in the table and find a new column, **Purity**, which has been derived from the existing one.

Find and replace

$AT	**Find and replace**
	⊤ Transform table → ⊤ Transform table

Data   Display

OUTPUT COLUMN NAMES

Purity

Enter the input string, along with find and replace string.

INPUT STRING   Use static input

⊟ Part Purity   〞 ▼ ✕

FIND STRING   Use variable input

p-

REPLACE STRING   Use variable input

Enter string...

CASE SENSITIVE   Use variable input

True	False

USE REGEX   Use variable input

True	False

Step 2: Use a transform operation

Quiver supports chaining multiple transformations in card to organize logic into single blocks.

1. In the Transformations panel within the current card, click the blue **Add Transformation** button

The **Transforms** modal offers a host of operations to perform in the same card.

2. Select the **Number operations** tab, then **String to number**.

3. In the **OUTPUT COLUMN NAMES** section, input **Part Purity**

4. Click **Use variable input** for the **INPUT** selection and select **Purity.**
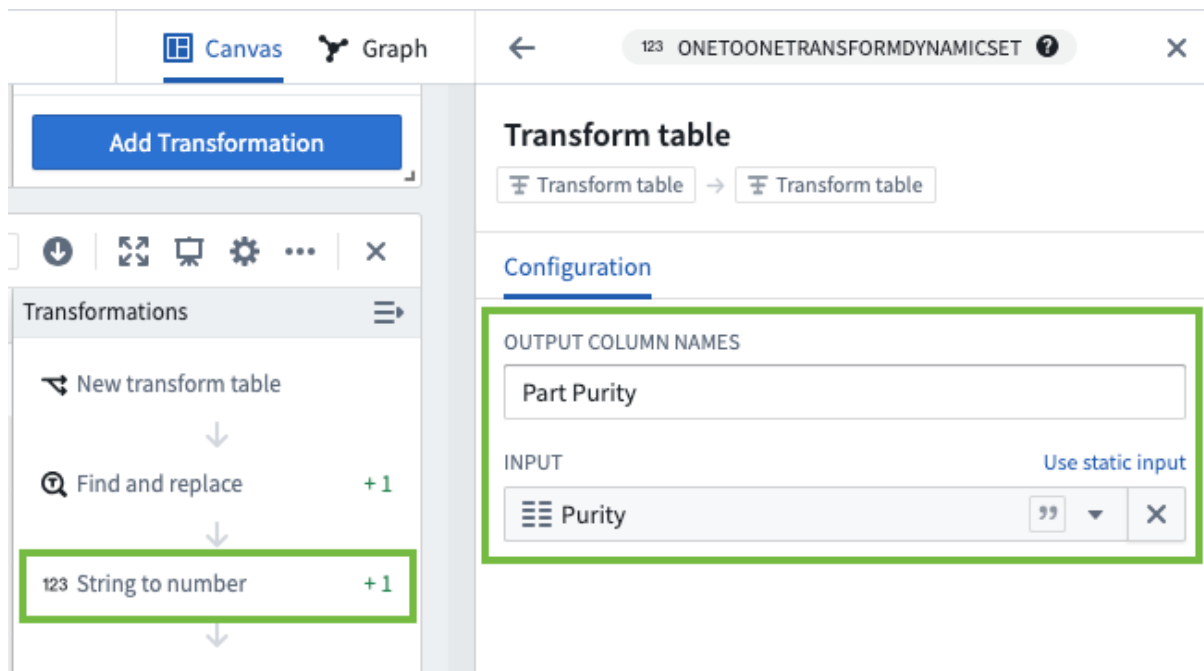
The original **Part Purity** (string) and the **Purity** columns are now no longer needed.

5. In the configuration panel, toggle to the **Display** tab.

6. Click the red eye icon next to both columns to remove them from the table, and make our analysis more manageable.
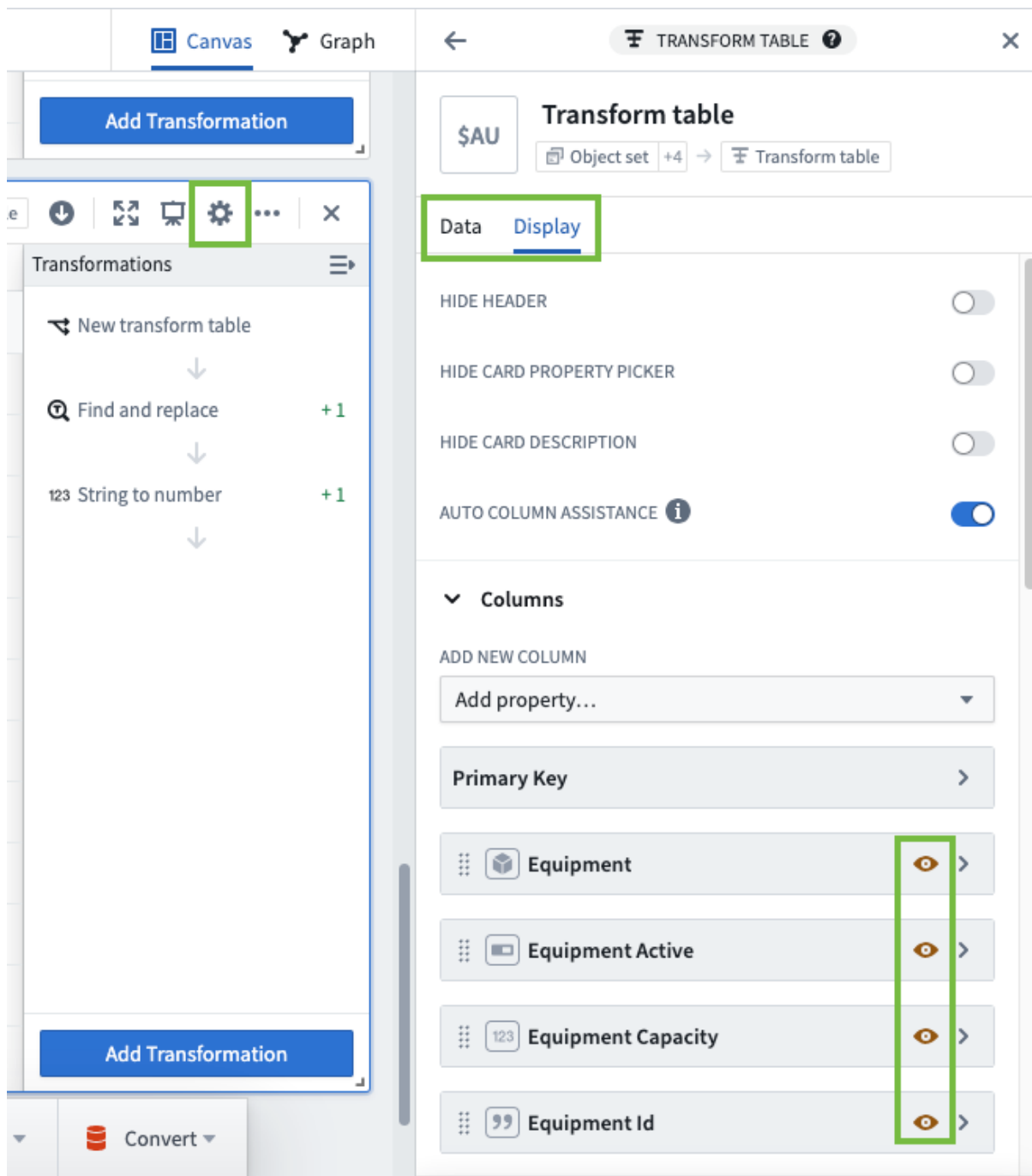
7. Title the table as **Update Part Purity Column**.

You can confirm that the new column has been created by scrolling to the right-most column in the card, and that it is of Number data type. This could also be confirmed in in the configuration panel by the '123' icon.

Review Your Logic

Step 1: Save and review analysis

1. Click **Save** to ensure all data preparation steps are saved.

2. Click **Graph** to review all implemented logic in visual form to track operations in sequence and validate the steps are correctly linked.
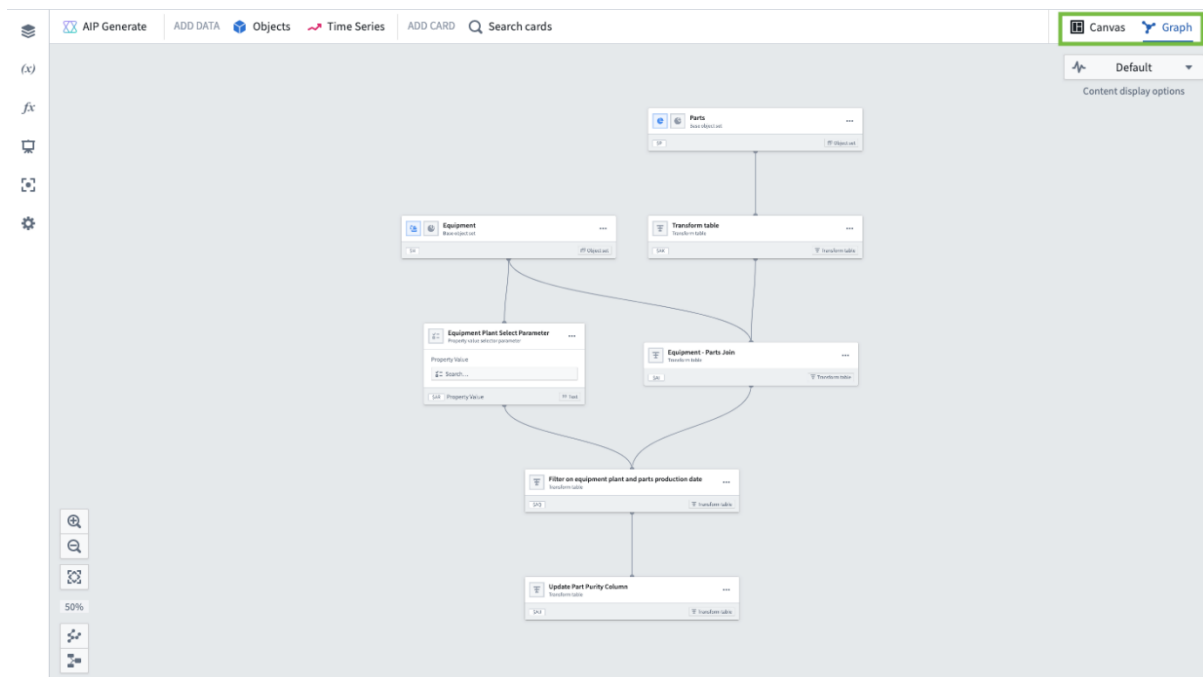
3. After you've reviewed, toggle back to the **Canvas** mode.

Takeaway

We've only covered a small subset of the point-and-click transformations Quiver supports.

Chaining multiple transformations in a single card can help keep the logic grouped and the analysis more manageable. However, consider separating transformations into different cards, especially for aggregations, which we'll cover in the next step. This allows you to use the outputs of these separate cards as different inputs for further analysis.

To confirm your logic clearly, use Graph Mode to visualize the analysis sequence and ensure you've selected the correct cards as inputs for subsequent operations.

In addition to AIP Generate, Quiver offers **AIP Configure** which enables users to create new cards or change pre-existing card configurations by describing how data or a card should be manipulated. This includes configuring output visualizations such as layouts, colors, orientation, and titles. AIP Configure provides suggestions that you can accept or reject.

Create Derived Columns

Create a Derived Column via Formulas

In this section, we'll find the average part purity for equipment and create alerts for inspection using "Group by" and numeric formulas.

Step 1: Make a Group By Statement

1. From the **Update Part Purity Column** table, select **Transform** in the card Toolbar

2. Next select **Group** then **Group by**

3. In the configuration panel, select **Equipment Id** and **Equipment Name**.

The output will organize all the objects belonging to the same equipment into a unique row, where all values for each property are grouped into an array. We will perform further operations on these arrays to extract single values to further transform.

Step 2: Add a transformation

1. Click **Add Transformation**, select **Array operations**, and **Number array aggregation**.

2. Title the **OUTPUT COLUMN NAMES** as avg_purity

3. Under **INPUT ARRAY**, select **Part Purity_group**

4. Leave **AGGREGATE TYPE** as **Average**

Step 3: Select an array

We've successfully transformed the array containing all purity values to derive the average purity across all parts per equipment. Next, we'll prepare one additional column to compare capacity and actual output.

1. Click **Add Transformation**, select **Array operations**, and **Array start**.

2. In the configuration panel, set the **OUTPUT COLUMN NAMES** as capacity and select **equipment_capacity_array** as the **INPUT ARRAY**.

Note that all values in the array across each Object are the same, so this operation gives us the capacity of each piece of equipment.

Step 4: Add a formula

1. Click **Add Transformation**, search for formula and select **Numeric formula**

2. Title the column actual_percent_output, and copy and paste @count / @capacity into the below text field.

Note that when performing a group by (Step 1 of this section), Quiver automatically adds a count column that specifies the number of objects per grouped row.

3. Click the **Update** button to generate the new field

4. Update the table name to **Aggregated Parts Summary**
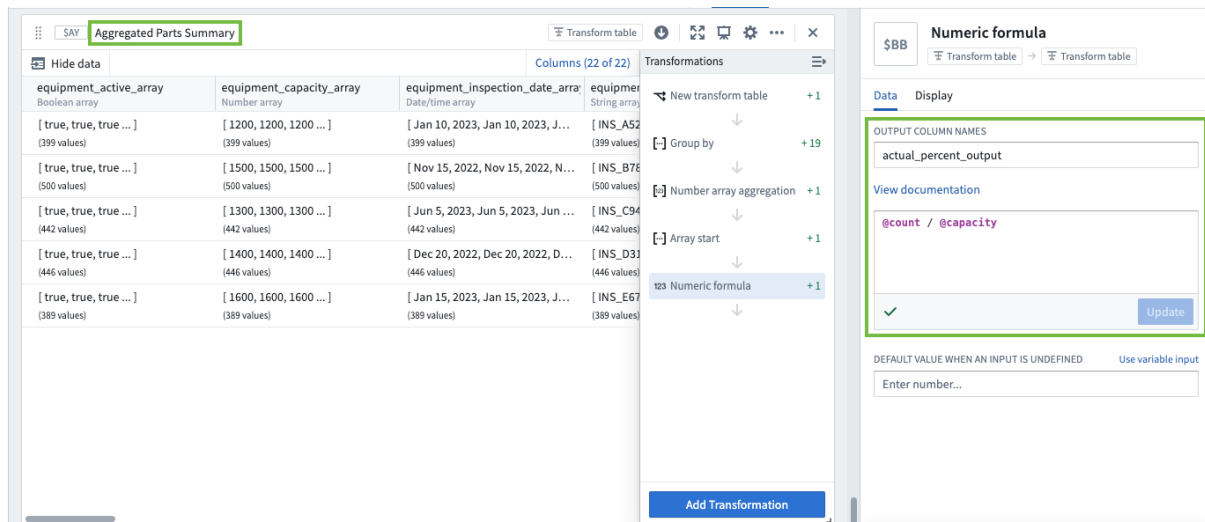
Takeaway

Quiver offers several ways to create more informative derived columns from raw data. You can use point-and-click operations on grouped data, write simple arithmetic or comparisons with formulas, or apply existing TypeScript functions from Code Repositories. Though not covered in this training, functions in Quiver can be reused across multiple analyses, reducing duplicative work and ensuring consistent logic across applications.

Create a Visual Function

Add a Visual Function

Visual functions in Quiver are reusable blocks of logic built using Quiver's point-and-click interface. They consist of one or more Quiver cards that load, combine logical steps to data inputs, and transform data within a Quiver analysis. These functions can be used multiple times within the same or other Quiver analyses and can be shared with other users. Visual functions allow you to build reusable logic without code, collaborate with colleagues, and simplify large analyses.

Step 1: Calculate the average part purity

We'll derive the average part purity, which can be dynamically filtered in our dashboard by Plant Managers.

1. Select the **Update Part Purity Column** card

2. **Select Calculate** from the card Toolbar, then select **Transform table aggregation**

Note that the card is automatically added to the bottom of the analysis and you may update the **INPUT TABLE** as needed.

3. Change the **AGGREGATION** selection to **Average**

4. Select **Part_purity** in the **COLUMN** dropdown

5. Update the table name to Average Part Purity.

Average Part Purity

$BC | Transform table | → | 1.0 Number

Data   Display

INPUT TABLE

$AU Update Part Purity Column

AGGREGATION

x̄ Average ▼

COLUMN

123 Part Purity ▼

DEFAULT VALUE WHEN UNDEFINED

Enter number…

Step 2: Create a new function

1. In the left panel, select **Visual Functions**, then **Create new functions**.

2. You'll automatically be presented with a graph view where you can configure your visual function.
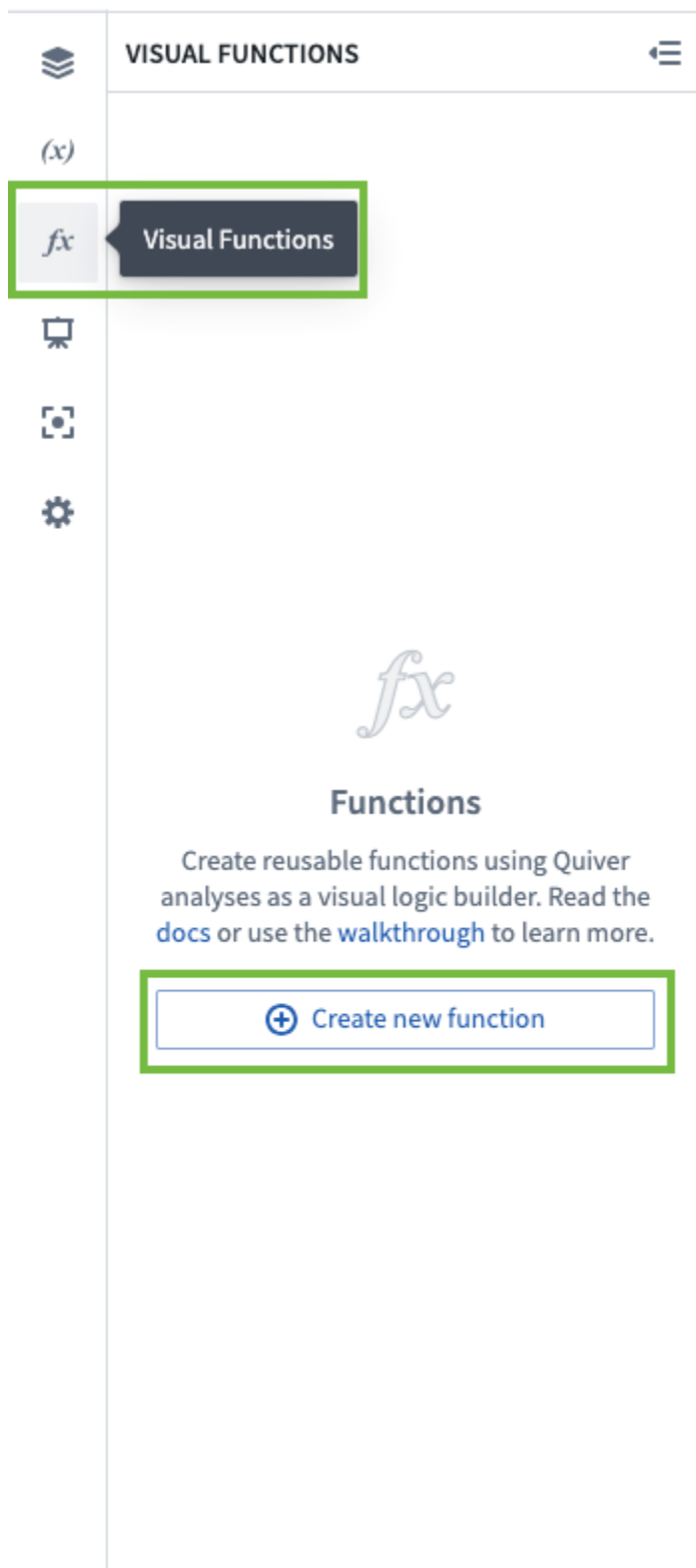
3. Select the **Average Part Purity** on the graph; this will be output of your function.

4. Click **Set as output** at the bottom of the screen.

5. Now, we'll set the function input. Eligible inputs in the analysis graph will be highlighted in purple.

6. Select the **Parts** Object Set at the top of the screen

7. Click the black **Set as input button**

8. Click the **Publish** button

9. Title the function [yourUsername]_avg_parts_purity_function and save

Your function is now published and available for others to use on the platform.

Validate Your Visual Function

Step 1: Test your function

In this section, you will double check that your function is working as expected.

1. Click **Exit Function** on the top left

2. Click the **+** at the bottom of your page to add a new canvas

3. Add **Part** Object Type via the blue **+ Add data to analysis**

4. Expand the Visual Functions in the left navigation panel

5. Click the **+** to add **[yourUsername]_avg_parts_purity_function**

6. In the configuration panel, select the **Parts** Object Set under **PARTS.** Make sure the variable name (e.g., $Z at the top of the card) corresponds with the new Parts object set that you just added.

7. Toggle on **Auto-update** to ensure that whenever a new function version is published, it's automatically applied to the analysis.

The value in the screenshot below is what is expected for the average.
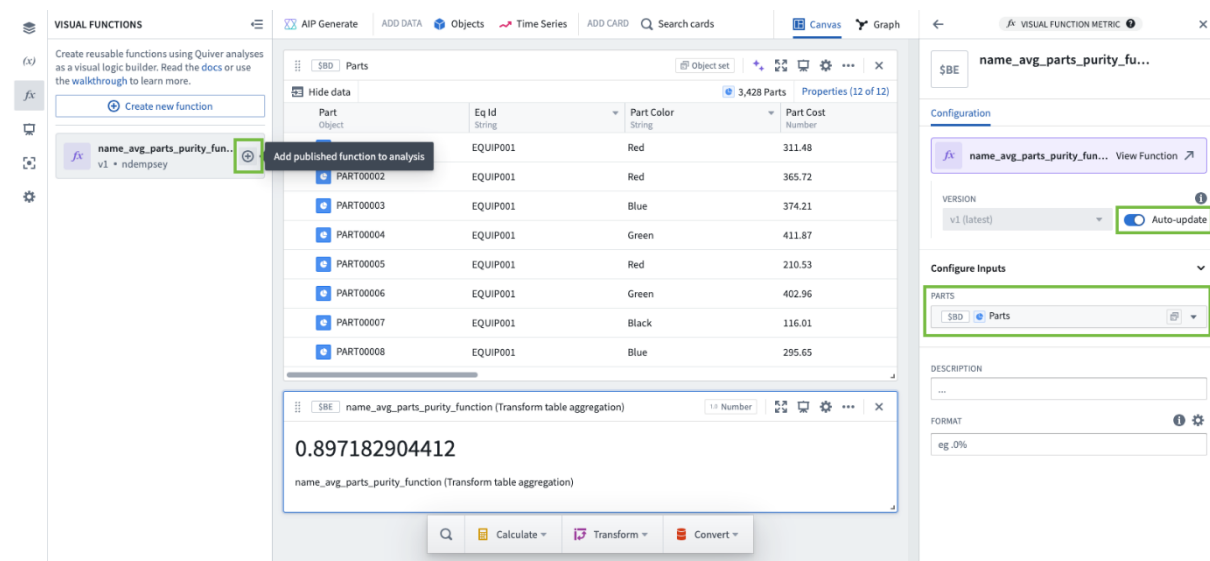
Create Visualizations

Create a Bar Chart

Quiver supports a variety of visualizations to help you analyze and present data effectively. Some visualizations include categorical charts, time series visualizations, Vega plots (box plots, sunbursts, radar charts, etc.), heat grids, and overlay charts (combines line charts, bar charts, and categorical scatter plots on the same set of axes).

Step 1: Create a bar chart comparing capacity and actual output

1. On your first canvas, select the **Aggregated Parts Summary** card, and click **Visualize** category in the cards Toolbar

2. Select **Categorical plot from transform table**

3. In the **GROUP BY** dropdown, choose **equipment_name_group_name**

4. In the **SERIES** section, select **Max** as the **METRIC**

5. Select **coun**t under **PROPERTY**

6. Click **+ Add Series**, and again, select **Max**

7. Select **capacity** under **PROPERTY**

8. Click the **Display** tab and change the **SEGMENT OPTIONS** to **Grouped**

9. Update **CATEGORICAL AXIS TITLE** to **Equipment** and **VALUE AXIS TITLE** to **Output**

10. Beside **VALUE AXIS FORMAT**, click the cog icon and select **Visual Format**

11. Under **Use Grouping**, toggle **Use grouping** on. This setting formats long numbers in a more readable way.

$BF	**Categorical plot from trans…**
	⊤ Transform table → |≡ Categorical chart

Data   **Display**

SEGMENT SORT BY   [↓1/9] [↓9/1]

SERIES

⠿ 🟥 max of capacity

⠿ 🟦 max of count

VISUALIZATION TYPE

|≡	∿	|∴

ORIENTATION   [|≡] [ɪɪɪ]

SEGMENT OPTIONS

ılı Stacked	⠿ Percentage	ılıl Grouped

CATEGORICAL AXIS TITLE   Use variable input

| Equipment | 🔵 Show Title

CATEGORICAL AXIS FORMAT   ❶ ⚙

| eg .0% |

VALUE AXIS TITLE   Use variable input

| Output | 🔵 Show Title

VALUE AXIS FORMAT   ❶ ⚙

| eg .0% |

Y AXIS POSITION

🔵 Left   ◯ Right

LABELS

🔵 Draw Labels

VALUE AXIS FORMAT ⚙

Base type

Standard ▼

˅ Additional options

Use grouping ⓘ ✕

🔵 Use grouping

12. Enter **Output by Equipment** as the name of the board

13. Click the dashboard icon, then **Add to new dashboard**. Quiver dashboards are most commonly used for embedding Quiver charts into Workshop applications, Foundry's low, no-code application builder.
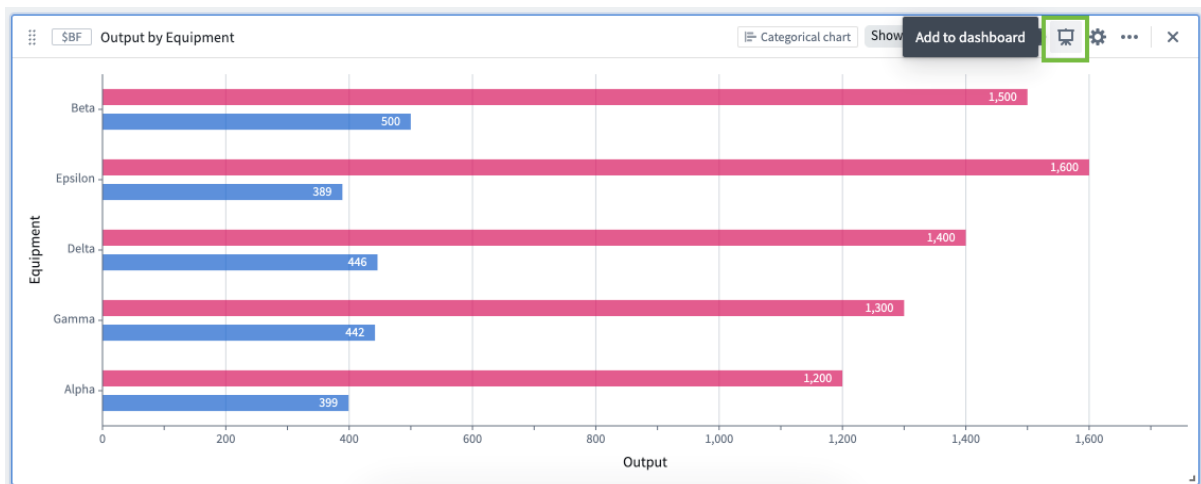
Create a Scatter Chart

Step 1: Create a scatter chart for displaying Part Purity

1. Select the **Update Part Purity Column** card, and click **Visualize** category in the cards Toolbar

2. Select **Categorical plot from transform table**

3. For the **GROUP BY**, select **Part Production Date** with **BUCKETING** by **Month**

4. In the **SERIES** section, select **Average** as **METRIC**

5. Set **PROPERTY** as **Part Purity** and **SEGMENT BY** the **Equipment Name**. You'll note that the production date has to be configured as the horizontal axis.

6. Select **Display,** and update **VISUALIZATION TYPE** to **Scatter Chart**

7. Change **CATEGORICAL AXIS TITLE** to **Part Production Date**

8. Update the **VALUE AXIS TITLE** to **Part Purity**

9. Click the dashboard icon, then **Dashboard 1**
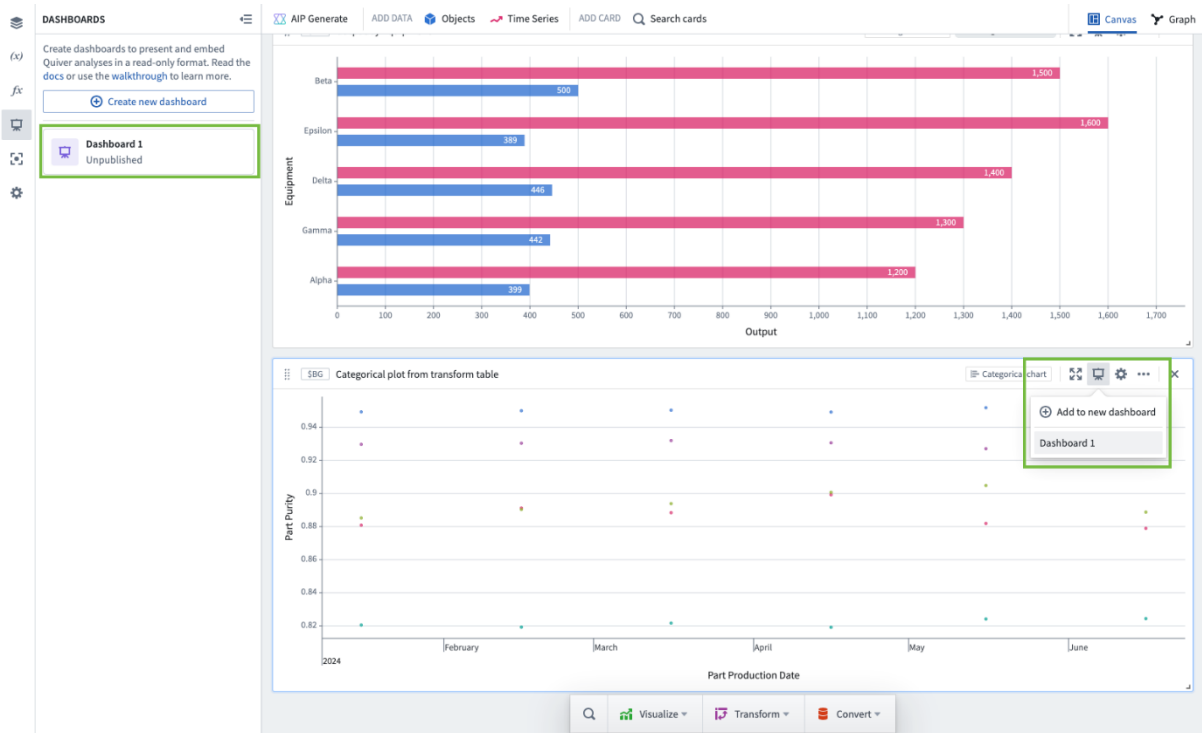
Create a Vega Chart

Step 1: Create a Vega Chart for visualizing cost

1. Select the **Parts** Object Set card towards the top of the page
2. Click **Visualize** category in the cards Toolbar and select **Vega Plot**
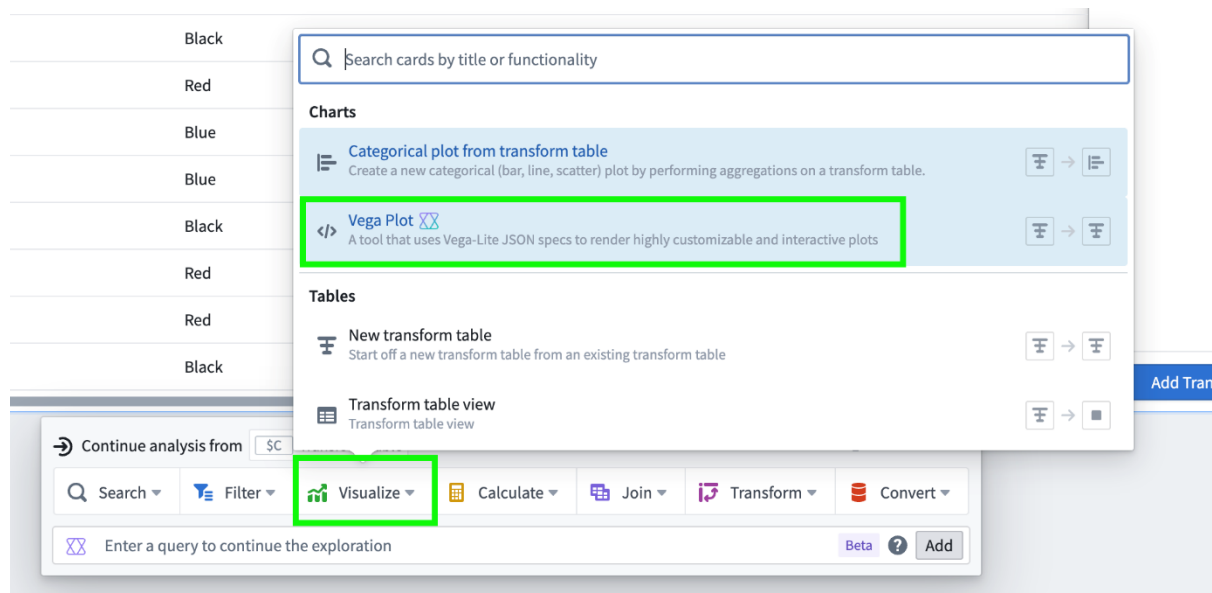
Step 2: Configure your Vega Chart

The Vega Plot widget will automatically show a boxplot - we'll update these default configurations. In the **Editor** text box in the right-side panel, you'll note **values** is set to the ID of the Parts card you selected as the input. You'll need this ID to set the X and Y values.

1. In the **encoding** block, update the **x** field to be $yourCardID."part_type".

2. Update the **title** to be Part Type.

3. Likewise, for **y**, update the field to $yourCardID."part_cost" and **title** to be Part Cost.

4. Leave the **type** as boxplot.

5. Click **Update.**

Editor   Preview

```
{
  "data": {
    "values": $C
  },
  "mark": {
    "type": "boxplot",
    "extent": "min-max"
  },
  "encoding": {
    "x": {
      "field": $C."part_type",
      "type": "nominal",
      "title": "Part Type"
    },
    "y": {
      "field": $C."part_cost",
      "type": "quantitative",
      "title": "Part Cost"
    }
  }
}
```

✓   Update

Your Vega chart should now resemble the below. The box plot layout clearly displays datapoints on the Part Cost for each Part Type, including minimum, median, and maximum cost numbers.
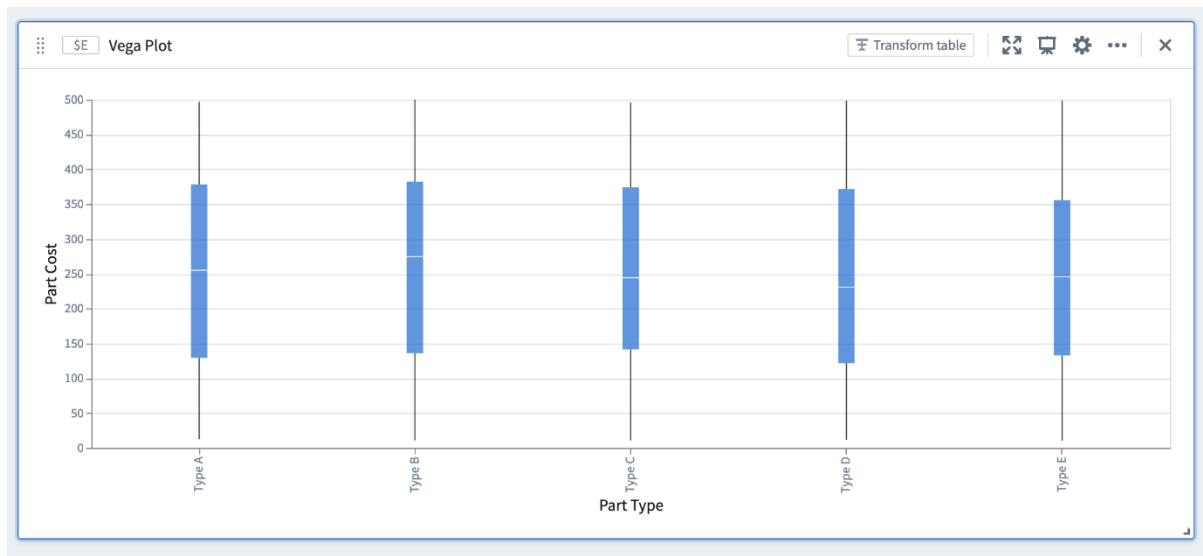
Takeaway

Quiver charts enable you to visualize data in versatile formats, facilitating better data analysis and decision-making. They're also interactive, allowing you to drill down into data points, filter data, and explore different aspects of their data dynamically. You may also In the next steps, we'll update our dashboard and review how Quiver charts can be integrated with other data analysis tools and workflows within Foundry, providing a seamless experience for users to analyze and visualize data in one platform.

Additionally, AIP Configure is particularly useful for Vega Plot configuration. You can describe the desired Vega plot, and AIP will generate the corresponding json configuration.

Build an Interactive Quiver Dashboard

Set-up Your Dashboard

Step 1: Configure your dashboard

1. Click the dashboard icon in the left panel and select **Dashboard 1**. The display will update with the current state of the dashboard

2. Note we've forgotten to add the Vega plot. In the **Add to Dashboard** section, find **Vega Plot**, click the three dots icon and then **+ Add to dashboard**

3. Provide your Vega chart with a clear name like Vega chart for cost

You'll note here that it's always helpful to maintain clear card titles! Note, in addition to visualizations, you can also add tables and table aggregation cards, like our average part purity.

Step 2: Name and style your dashboard

1. Hover your mouse above the first chart on your dashboard and click the **+** icon. This will add a text box.

2. Update the left dropdown from **Paragraph** to **Large Heading**, and name your dashboard **Equipment Analysis**.

Note, you may apply text formatting and add additional text blocks throughout the dashboard to guide your audience and provide analysis. You may also add another tab, for instance if you

wanted to separate your analysis into equipment and parts drill downs, and add sections to denote clear logical distinctions.
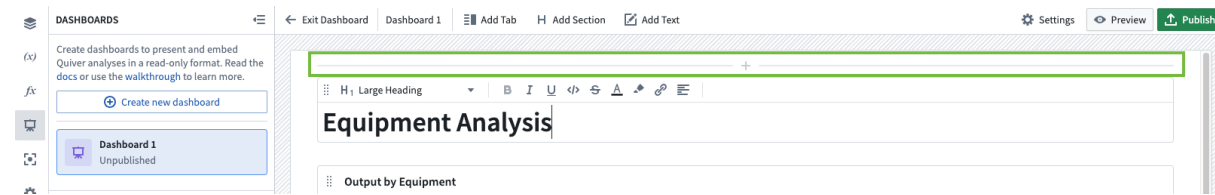
Interact with Your Dashboard

Step 1: Add a parameter

1. Expand the left Dashboard panel again and in the **Add to Dashboard** section, find the parameter for **Equipment Plant**

2. Click the three dots and select **+ Add to Dashboard**

3. Collapse the left panel
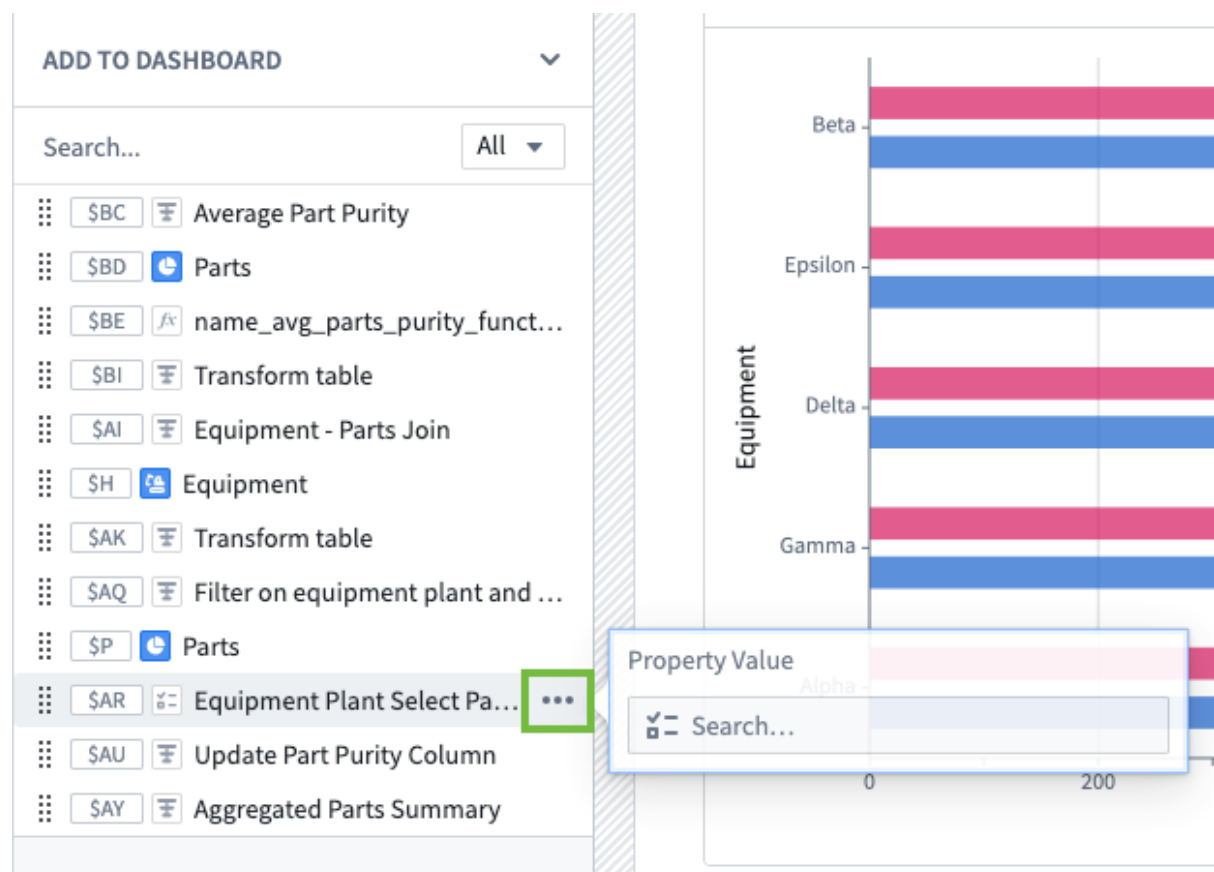
The parameter is now populated at the bottom of the dashboard and is available for any end user to select from.

1. Click and hold your mouse to grab the top left button and drag the parameter block under the dashboard title. Note, you can rearrange any of the dashboard blocks this way.
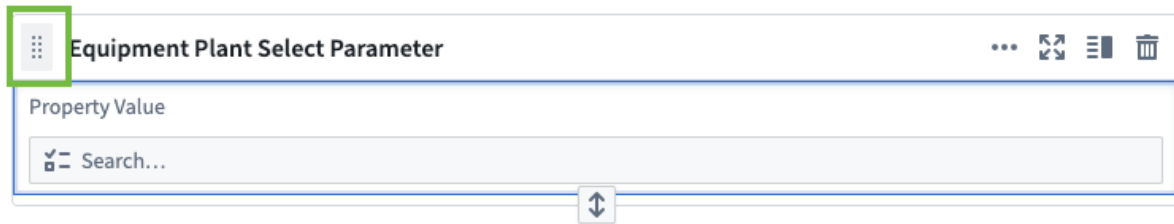
Step 2: Publish your dashboard

1. Click the **Publish** icon and save your dashboard as **Equipment Analysis Dashboard** to your folder. Note that publishing a Dashboard automatically saves your analysis.

2. Click the **Preview** button to see how the dashboard looks to end users.

Note, if you select the lefthand **Equipment Analysis Dashboard** button, you can access the production version and send this link to colleagues with appropriate permissions to view.


Embedding Quiver Dashboards in Other Foundry Applications

Integrate Quiver Dashboards with Notepad and Workshop

Foundry provides the option to integrate Quiver into Workshop applications, Object Views, Carbon Workspaces, and Notepad to enhance data analysis, visualization, and sharing. We'll preview how to embed cards and dashboards into Notepad for automatic report sharing, and how to embed dashboards in Workshop applications.

Step 1: Integrate Quiver insights into Notepad Report

1. Return to your analysis by clicking **Exit Dashboard** and scroll to the **Output by Equipment** chart

2. Click More Actions, represented by the three dots button, and select **Copy embeddable chart**

3. The chart is now ready to paste in a Notepad document
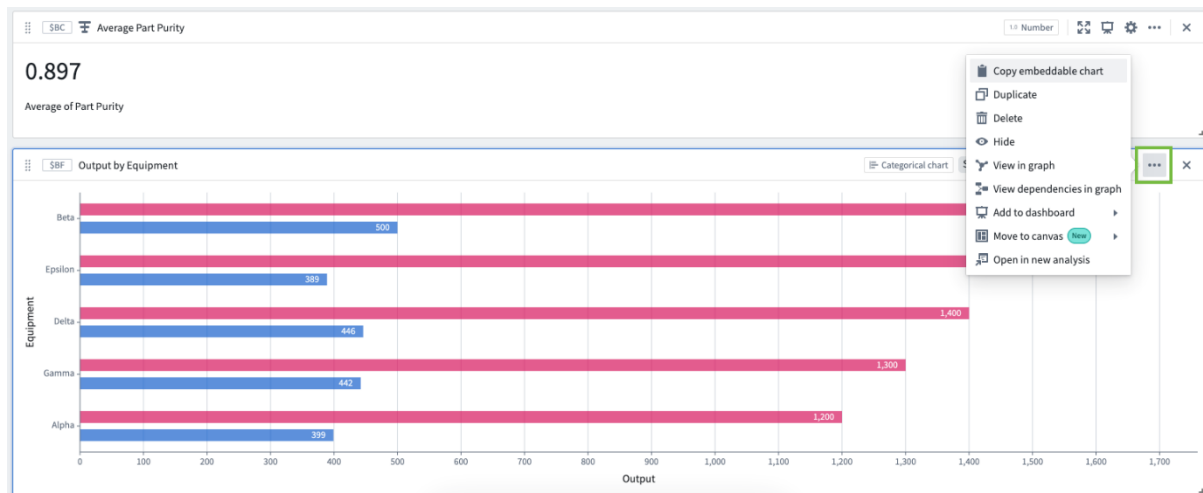
Within the Notepad application, you may also embed an entire Quiver dashboard via the **Widget** button, and automate the report distribution by the **Action** dropdown and configuring an **Automation** to send regular emails to specified Foundry users. This functionality allows for seamless integration of advanced analytics into comprehensive reports and ensures that insights are easily accessible and shared efficiently.

Step 2: Embed Quiver Dashboard into a Workshop Application

While we won't walk through the implementation steps together, it's useful to embed Quiver dashboards into Workshop module to create a more interactive and integrated data analysis environment and to preserve maintainability across resources. To do so, you simply need to add the Quiver dashboard widget to the desired Workshop module, and configure the input object sets (and optional output object sets for interactive Quiver dashboards).

Deploy **this Example** to your Foundry instance to view a reference use case of a Quiver graph embedded in a Workshop application.