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Elevating SAS Macros and Automation: Leveraging SAS Studio Custom Steps & Flows

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phuse.global



Agenda

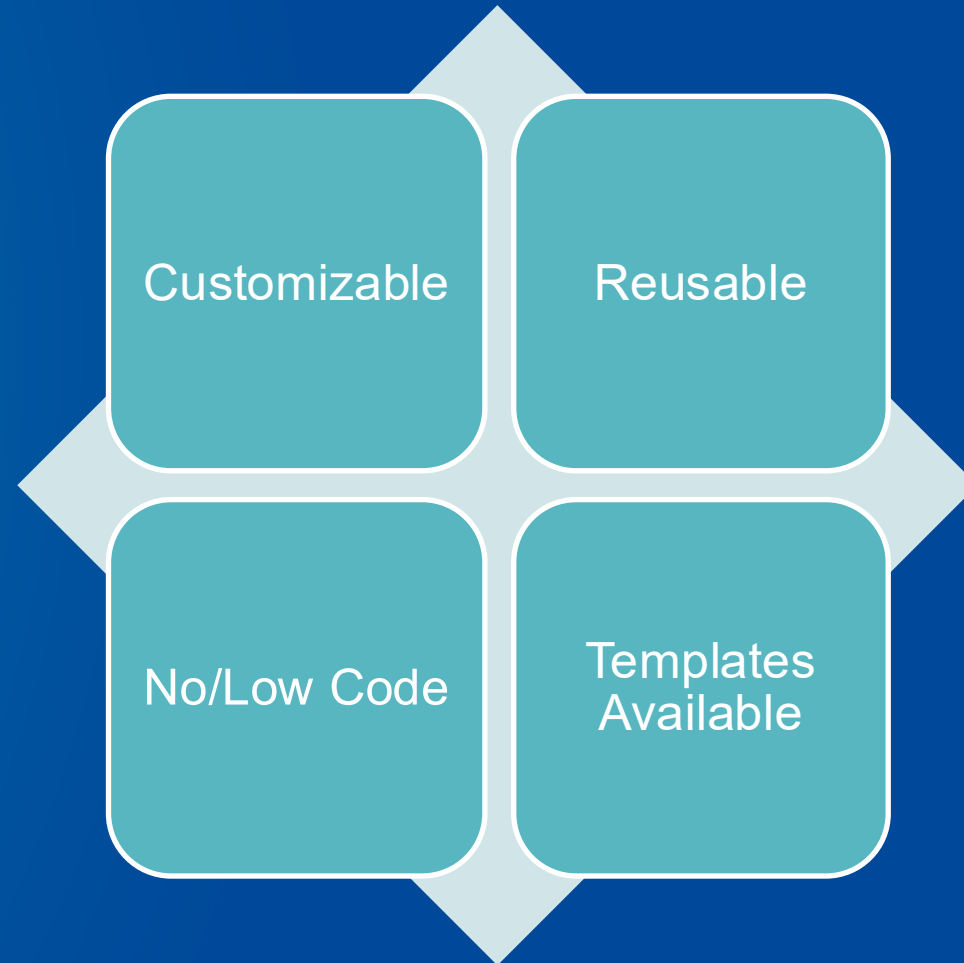
- SAS Steps – An Overview
- SAS Custom Steps
- SAS Flows
- SAS Custom Steps with Flows
- Key takeaways



SAS Steps – An Overview

GUI Driven Code Execution

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SAS Steps – An Overview

GUI Driven Code Execution

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- Data (Input and Output)
- Develop
- Transform Data
- Integrate
- Statistics
- Prepare Data
- Visualize Data
- Examine Data
- Statistical Process Control
- Optimization and Network Analysis
- Machine Learning
- Econometrics
- Manage Models
- Enrichment
- Data Quality
- Text Analytics

- Transform Data
 - Branch Rows
 - Calculate Columns
 - Filter Rows
 - Insert Rows
 - Manage Columns
 - Mask Data
 - Query
 - Rank Data
 - Recode Ranges
 - Recode Values
 - Remove Duplicates
 - Select Random Sample
 - Sort
 - Split Columns
 - Stack Columns
 - Transpose Data
 - Union Rows

- Statistics
 - Analysis of Covariance
 - Canonical Correlation
 - Cluster Variables
 - Coin Toss Simulation
 - Combinations
 - Compute Similarities and Distances
 - Confidence Intervals Statistical Power
 - Correlation Analysis
 - Correspondence Analysis
 - Cox Regression Statistical Power
 - Custom Tests Statistical Power
 - Decision Tree
 - Dice Roll Simulation
 - Distribution Analysis
 - Equivalence Tests Statistical Power
 - Estimate Within-Cluster Covariances
 - Factor Analysis
 - Hierarchical Clustering
 - K-Means Clustering
 - Linear Regression

- Visualize Data
 - Bar Chart
 - Bar-Line Chart
 - Box Plot
 - Bubble Map
 - Bubble Plot
 - Choropleth Map
 - Heat Map
 - Histogram
 - Line Chart
 - Mosaic Plot
 - Pie Chart
 - Scatter Map
 - Scatter Plot
 - Series Map
 - Series Plot
 - Text Map



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SAS Custom Steps

Convert your Macros



SAS Custom Steps

GUI to Generate Code and Output

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Run Cancel

Data Table*

SASHELP.BMT

Time Variable*

T

Status Variable - Used for Censoring*

Status

Select the Censored Value

0

Stratification Group*

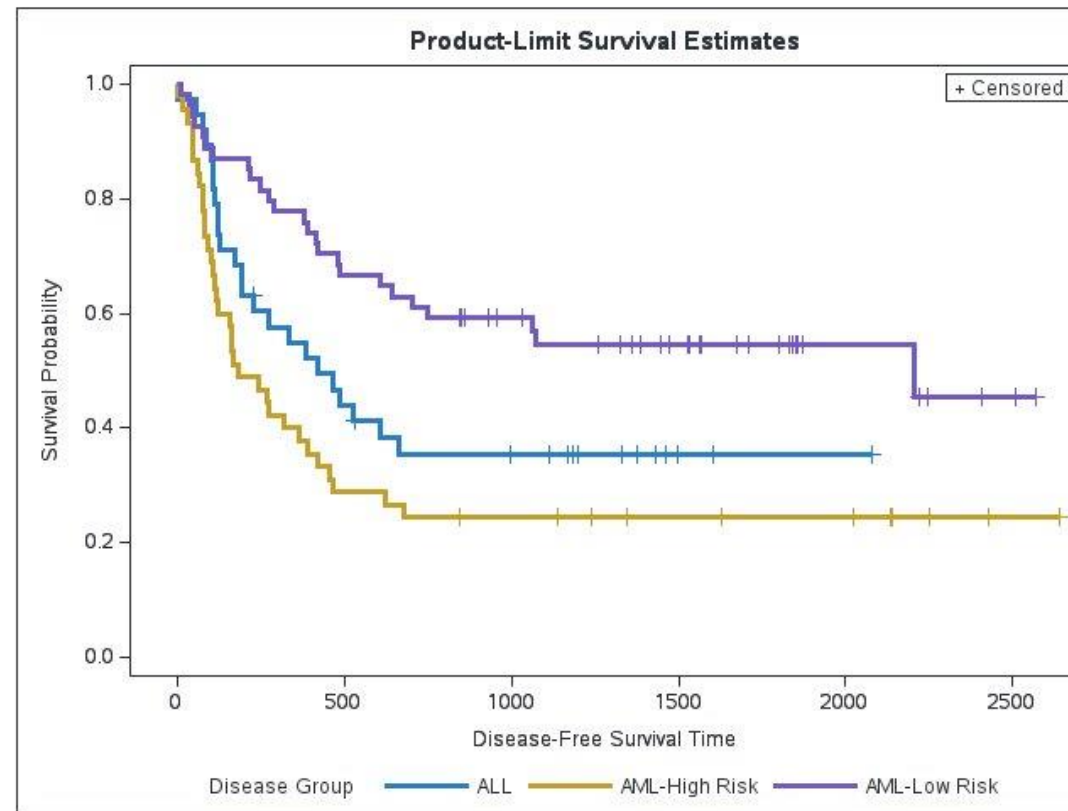
Group

User provides inputs via
GUI

Step produces output

Results

Edit Code



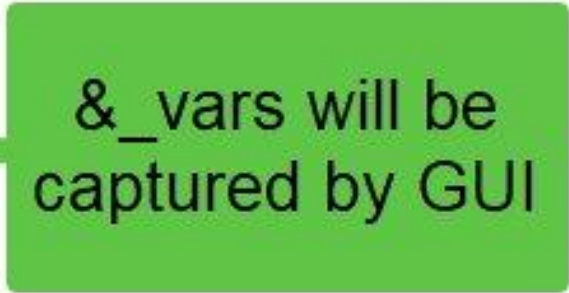


Building A Custom Step

Start with a Macro Program

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Designer	Prompt UI	Program
1		<code>/* SAS templated code goes here */</code>
2		
3		<code>ods noproctitle;</code>
4		<code>ods graphics / imagemap=on;</code>
5		
6		<code>%LET Dataset = &_Dataset;</code>
7		<code>%LET Time = &_TimeVar;</code>
8		<code>%LET Status = &_StatusVar;</code>
9		<code>%LET CenVal = &_CenVal;</code>
10		<code>%LET Strata = &GroupVar;</code>
11		
12		<code>/* Run the Lifetest to get the output */</code>
13		<code>ODS select SurvivalPlot;</code>
14	⊖	<code>proc lifetest data = &Dataset plots = (survival);</code>
15		<code>time &Time * &Status(&CenVal);</code>
16		<code>strata &strata;</code>
17		<code>run;</code>
18		





Building A Custom Step

Develop GUI: Input Table

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The screenshot displays the Phuse Designer interface, which is divided into three main sections: a top navigation bar, a left-hand Control Library, and a right-hand Properties panel.

Top Navigation Bar: Contains three tabs: "Designer" (selected), "Prompt UI", and "Program".

Control Library (Left Panel):

- At the top, there is a "+ Add Page" button, a trash icon, and a menu icon.
- Below this, the "Variable Assignments" control is highlighted with a green box.
- A search bar labeled "Filter controls" is present.
- A list of controls follows: "Radio Button Group", "Section", "Text", "Text Area", and "Text or Numeric Field".
- A section titled "DATA" contains "Column Selector", "Input Table", "New Column", and "Output Table".

Properties Panel (Right Panel):

- The title is "Properties: Page".
- The "ID:" field is marked with a red asterisk and contains the value "page1".
- The "Label:" field is also marked with a red asterisk and contains the value "Variable Assignments", which is highlighted with a green box.

A dashed blue arrow originates from the "Input Table" control in the Data section of the Control Library and points towards the center of the main workspace.



Building A Custom Step

Develop GUI: Input Table

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The screenshot shows the Phuse GUI development interface for an **Input Table** control. The interface is divided into two main sections: a visual editor on the left and a properties panel on the right.

Visual Editor: Displays a control with the label "Input table label 1 *". Below the label is a text input field. A dashed green arrow points from the label to the input field.

Properties Panel: Titled "Properties: Input Table", it contains the following fields and options:

- ID:** A text field containing "inputtable1".
- Label:** A text field containing "Input table label 1".
- Required:** A checked checkbox.
- Make control read-only:** An unchecked checkbox.
- Hide control at runtime:** An unchecked checkbox.
- Default library:** A text field.
- Default table:** A text field.

Annotations:

- A blue box labeled "Name as passed to the program" has a blue arrow pointing to the **ID** field.
- A green box labeled "Label showing in GUI" has a green arrow pointing to the **Label** field.
- A yellow box labeled "You can provide default values" has two yellow arrows pointing to the **Default library** and **Default table** fields.



Building A Custom Step

Develop GUI: Column Selector

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The screenshot displays the Phuse Designer interface for building a custom step. The interface is divided into three main sections: a left sidebar, a central canvas, and a right-hand properties panel.

Left Sidebar:

- Control Library:** Contains a search bar labeled "Filter controls" and a list of controls: Radio Button Group, Section, Text, Text Area, Text or Numeric Field, and DATA.
- DATA:** A sub-section containing: Column Selector (highlighted with a blue dashed arrow), Input Table, New Column, and Output Table.

Central Canvas:

- At the top, there is a "Data Table*" dropdown menu.
- Below it is a control labeled "Column selector label 1".
- Inside this control is a box with the text "Add columns".
- A blue dashed arrow points from the "Column Selector" control in the left sidebar to the "Add columns" box in the central canvas.

Right-hand Properties Panel:

- columnselector1:** The name of the control.
- Label:** A text field containing "Column selector label 1".
- Make control read-only:** An unchecked checkbox.
- Hide control at runtime:** An unchecked checkbox.
- Determine where values come from:** Two radio buttons: "Table" (selected) and "Column selector".
- Link to input table: *** A dropdown menu showing "Select an input table".
- Column type:** A dropdown menu showing "All types".
- Allow ordering of columns:** An unchecked checkbox.
- Minimum columns: ①** A dropdown menu.
- Maximum columns: ①** A dropdown menu.
- Add and organize items:** A section for managing the data table's contents.



Building A Custom Step

Develop GUI: Column Selector

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The screenshot displays the phuse Designer interface for configuring a 'Column Selector' control. The interface is divided into three main sections: a Control Library on the left, a central design canvas, and a Properties panel on the right.

Control Library: The 'DATA' section is expanded, showing various controls. A green dashed arrow points from the 'Column Selector' control in this list to the design canvas.

Design Canvas: The 'Time Variable' control is selected and highlighted with a red border. A green dashed arrow points from the 'Column Selector' control in the library to this control. A green callout box with the text 'Point to table selected above' has an arrow pointing to the 'Data Table' dropdown in the 'Time Variable' control. Below the 'Time Variable' control, there is a text input field with the placeholder 'Add a numeric column'.

Properties: Column Selector: The right-hand panel shows the configuration options for the 'Column Selector' control. The 'ID' is set to '_TimeVar'. The 'Label' is 'Time Variable'. The 'Make control read-only' and 'Hide control at runtime' checkboxes are unchecked. Under 'Determine where values come from:', the 'Table' radio button is selected. The 'Link to input table:' dropdown is set to 'Data Table (_Dataset)'. The 'Column type:' dropdown is set to 'Numeric'. The 'Allow ordering of columns' checkbox is unchecked. The 'Minimum columns:' and 'Maximum columns:' are both set to '1'.

Three callout boxes provide additional instructions:

- Point to table selected above:** A green box with an arrow pointing to the 'Data Table' dropdown in the 'Time Variable' control.
- Only show numeric columns:** A blue box with an arrow pointing to the 'Column type:' dropdown in the Properties panel.
- Set to only be able to select one variable:** A yellow box with two arrows pointing to the 'Minimum columns:' and 'Maximum columns:' dropdowns in the Properties panel.



Building A Custom Step

Develop GUI: Value Selector

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The screenshot displays the Phuse Designer interface with the 'Designer' tab selected. On the left, the 'Control Library' panel shows a search bar and a list of controls under the 'COMMON' category, including Check Box, Color Picker, Date and Time Picker, Drop-down List, File or Folder Selector, Link, List, Numeric Stepper, Option Table, and Radio Button Group. A green dashed arrow points from the 'Drop-down List' control in the library to the 'Drop-down List' control in the main workspace.

The main workspace contains several controls: 'Data Table *', 'Time Variable *', 'Status Variable - Used for Censoring *', and 'Select the Censored Value'. A blue box with the text 'Dynamic list will look at a specified column for inputs' has a blue arrow pointing to the 'Dynamic list' radio button in the 'Properties: Drop-down List' panel. A green box with the text 'Select the column of values' has a green arrow pointing to the 'Reference a column selector: *' dropdown menu in the same panel.

The 'Properties: Drop-down List' panel on the right includes the following fields and options:

- ID: * (Text field: _CenVal)
- Label: (Text field: Select the Censored Value)
- ☐ Required
- Determine where values come from:
 - ☐ Static list
 - ☒ Dynamic list
- Reference a column selector: * (Dropdown menu: Status Variable - Used for Censoring (_...))
- Default item: (Text field)
- Placeholder text: (Text field)
- Styles:
 - Indent level: * (Text field: 0)



SAS Custom Steps

GUI to Generate Code and Output

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▷ Run ■ Cancel ↺ ↻

Data Table*
SASHELP.BMT

Time Variable*
⊕ T

Status Variable - Used for Censoring*
⊕ Status

Select the Censored Value
0

Stratification Group*
⚠ Group

User provides inputs via GUI

Step produces output

Results

Edit Code

The plot, titled "Product-Limit Survival Estimates", displays survival probability on the y-axis (0.0 to 1.0) against disease-free survival time on the x-axis (0 to 2500). Three survival curves are shown: ALL (blue), AML-High Risk (yellow), and AML-Low Risk (purple). The AML-Low Risk group shows the highest survival, followed by ALL, and then AML-High Risk. Vertical tick marks on the curves indicate censored data points. A legend at the bottom identifies the groups, and a "+ Censored" label is present in the top right corner of the plot area.

Disease-Free Survival Time	ALL (Survival Prob)	AML-High Risk (Survival Prob)	AML-Low Risk (Survival Prob)
0	1.00	1.00	1.00
500	0.45	0.30	0.70
1000	0.35	0.25	0.60
1500	0.35	0.25	0.55
2000	0.35	0.25	0.55
2500	0.35	0.25	0.45



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SAS Flows

Connect Data and Steps for Automation



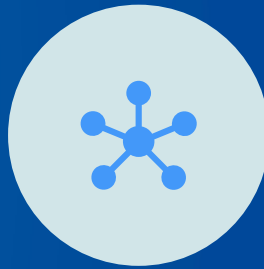
SAS Studio Flows

Design & Build Analytics Workflows

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VISUAL WORKFLOW
DESIGN



INTEGRATION



REUSABILITY



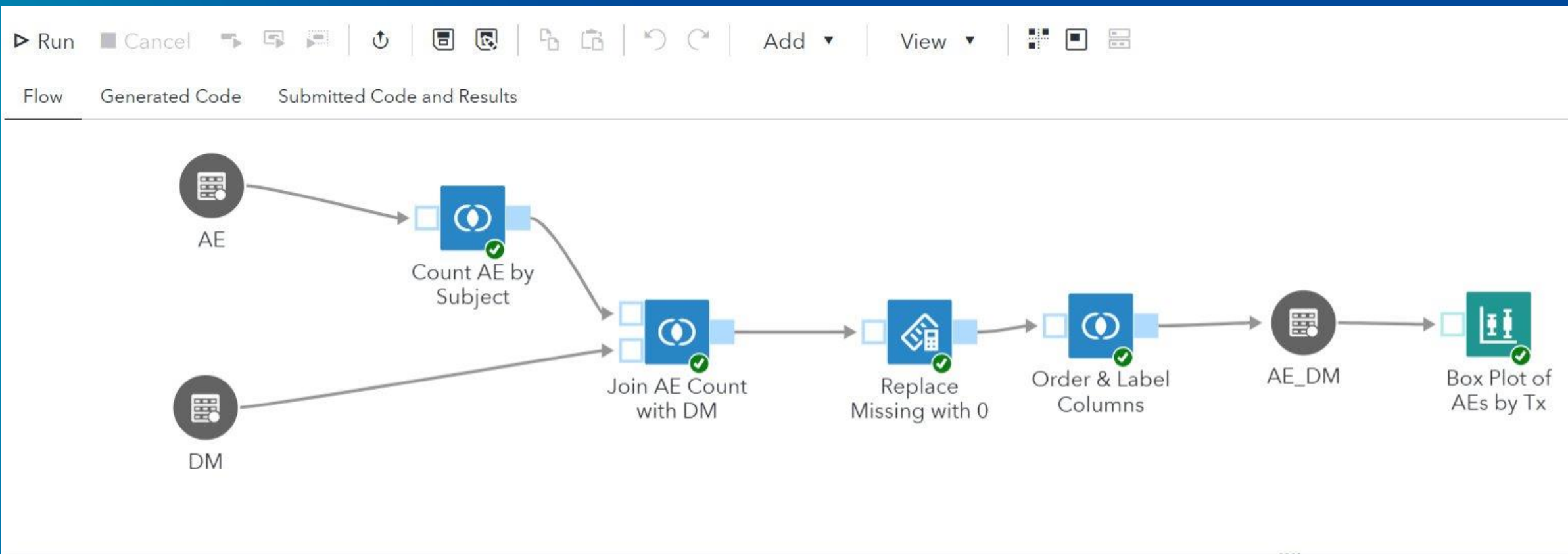
COLLABORATION



SAS Studio Flows

Example Flow

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SAS Studio Flows

Flow Construction

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The screenshot displays the SAS Studio Flows interface. On the left, the 'SAS Steps' pane is open, showing a list of steps under the 'Data (Input and Output)' category. A dashed green arrow indicates the 'Table' step is being dragged into the flow area. The flow area shows a single step labeled 'AE' with a table icon. Below the flow area, the 'Table Properties' panel is visible, showing the 'Library' set to 'SDTM' and the 'Table name' set to 'AE'.

SAS Steps : Shared

- Data (Input and Output)
 - Export
 - File
 - Import File
 - Table
- Develop
 - Python Program
 - SAS Program
- Transform Data
 - Branch Rows
 - Calculate Columns
 - Filter Rows
 - Insert Rows
 - Manage Columns
 - Mask Data
 - Query
 - Rank Data
 - Recode Ranges
 - Recode Values
 - Remove Duplicates

AE

Table Properties Published Columns Preview Data

Library: *
SDTM

Table name: *
AE





SAS Studio Flows

Flow Construction

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Query

Options Node Notes

Columns

+ Calculated Column

Filter

t1 (AE)

- STUDYID
- DOMAIN
- USUBJID
- AESEQ
- AESPID

Select Join Filter Sort Output Options

Columns Groups Filter Groups

Remove Row Convert to Aggregate

	Table	Source	Name
☐	t1	USUBJID	USUBJID
☐	Calculated	AE_Count	AE_Count

+ - * ÷ ** || | | " ' : , %n | t)

CASE WHEN THEN ELSE END | AND OR NOT | = < > <= >=

```
1 count(*)
```

Properties Values Log

Column name: AE_Count

Column label: Number of AEs

Type: Numeric





SAS Studio Flows

Flow Construction

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Select Join Filter Sort Output Options

Expression Builder Reset Join

Join 1

t1(Count AEs by Subject) t2(DM)

t1.USUBJID

- Inner join
- Left join
- Right join
- Full join





SAS Studio Flows

Flow Construction

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Replace Missing with 0

Options Node Notes

Available Columns

Define New

Filter

Join AE Count with DM

- STUDYID
- USUBJID
- AGE
- SEX
- RACE
- ETHNIC
- ARM
- AE_COUNT

Replace "AE_Count"

Expression

Output column:

AE_Count

Expression Builder Save Cancel

Data Functions

Filter

Join AE Count with DM

- STUDYID
- USUBJID
- AGE
- SEX
- RACE
- ETHNIC
- ARM
- AE_COUNT

1 max(AE_COUNT, 0)

Properties Log

Column name: * AE_COUNT Length (in bytes): 8

Column label: Number of AEs Format: Informat:





SAS Studio Flows

Flow Construction

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SelectJoinFilterSortOutput Options

ColumnsGroupsFilter Groups

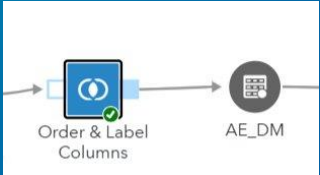
Remove RowConvert to Aggregate

☐	Table	Source	Name	Label	Type
☐	t1	STUDYID	STUDYID	Study Identifier	Character
☐	t1	USUBJID	USUBJID	Unique Subject Identifier	Character
☐	t1	AE_Count	AE_Count	Number of AEs	Numeric
☐	t1	AGE	AGE	Age	Numeric
☐	t1	SEX	SEX	Sex	Character

AE_DM

Enter expression

	Study Identifier	Unique Subject Identifier	Number of AEs	Age	Sex	Race
1	CDISCPILLOT01	01-701-1015	3	63	F	WHITE
2	CDISCPILLOT01	01-701-1023	4	64	M	WHITE
3	CDISCPILLOT01	01-701-1028	2	71	M	WHITE
4	CDISCPILLOT01	01-701-1033	0	74	M	WHITE





SAS Studio Flows

Flow Construction

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Box Plot of AEs by Tx

Data Options Node Notes

Filter input data:

Plot orientation:

☐ Vertical

☒ Horizontal

Analysis variable: *

⊕ AE_Count

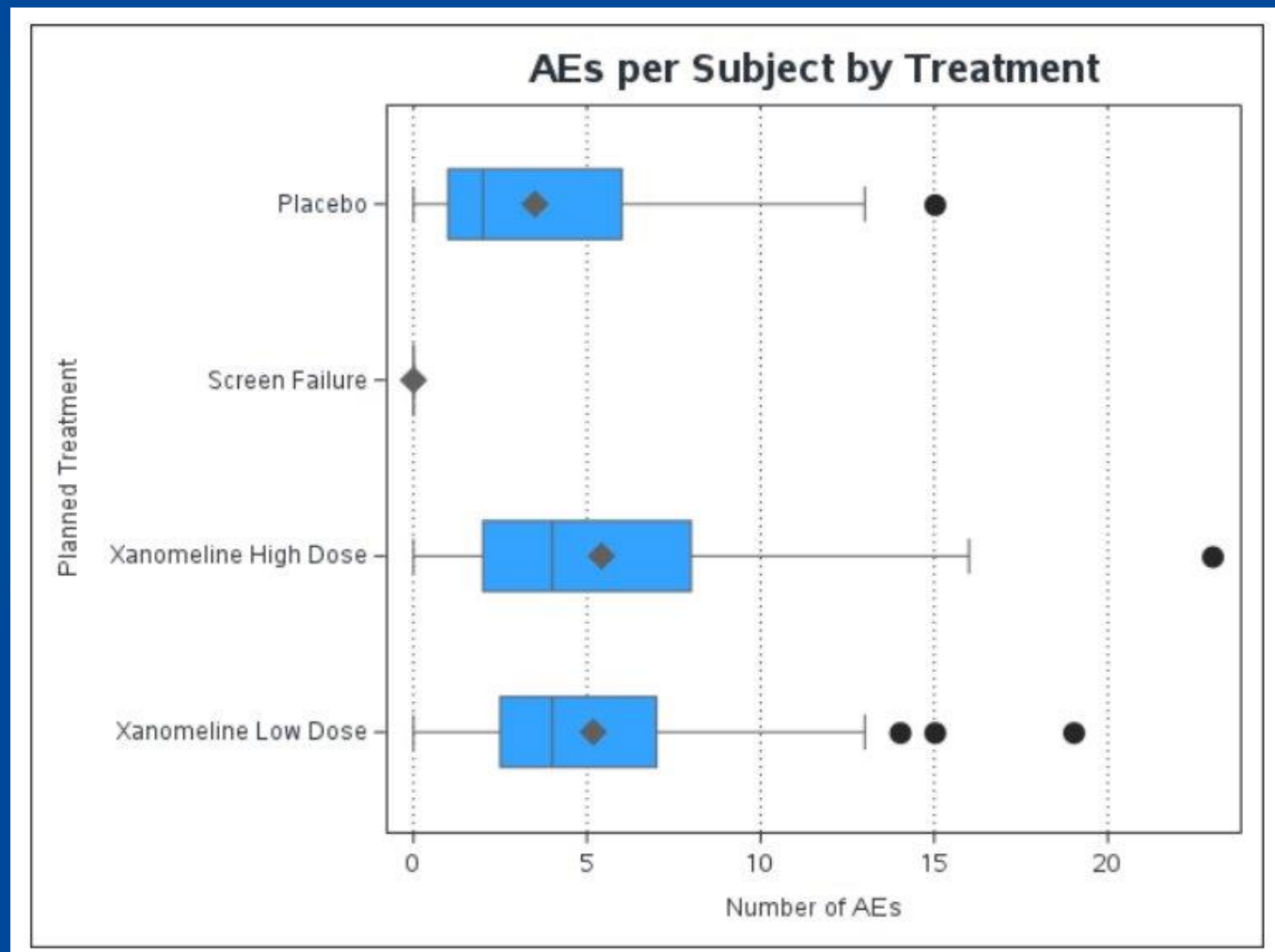
Category:

⚠ ARM

Subcategory:

🔍 Add a column

> Additional Roles





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SAS Custom Steps & Flows

Final Thoughts



SAS Custom Steps & Flows

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Custom steps and flows are excellent ways to leverage existing and new assets



Easily understand and manage workflows



Publish as scheduled or ad-hoc jobs



Create a flow from an existing program to understand how it works



Enable non-programmers to utilize your programs



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Thank You!



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