USER GUIDE

MES DATA RETRIEVAL JMP ADD-IN

Version *2.0*

2023/11/17

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INTRODUCTION

This add-in automates data extraction tasks from Aspentech IP.21 and Osisoft PI (Aveva) historians.

This way, you can use JMP to diagnose manufacturing problems and monitor several tags daily and weekly.

SYSTEM CONFIGURATION REQUIREMENTS

The following configuration and modules are required to launch and run the add-in.

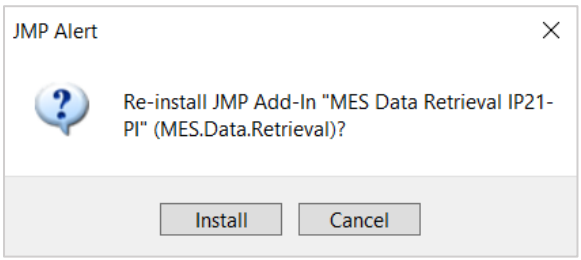
- JMP V17.1.0
- Aspen Manufacturing Suite (Aspen InfoPlus.21®) and its 64-bit SQLplus ODBC driver
- OSIsoft PI Client Tools (PI Process Book) and its PI OLEDB driver
- Hostname and access to the IP21/PI server of interest
- Be connected to enterprise network or VPN

Please contact IT support in case you are missing the packages or configuration above mentioned.

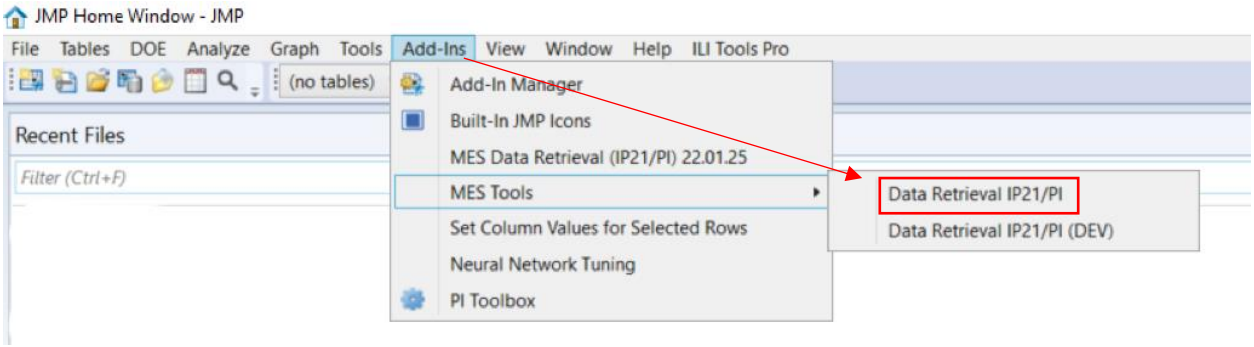
ADD-IN INSTALLATION

Download the JMP add-in "MES Data Retrieval IP21-PI.jmpaddin" file. If you don't have this file, please contact: uceccpe@pm.me.

Once downloaded, double-click on this file. You should have a JMP pop-up window namely "JMP Alert" asking you if you want to install or re-install (in the case you have already it installed) the JMP Add-In. Click on *Install*.

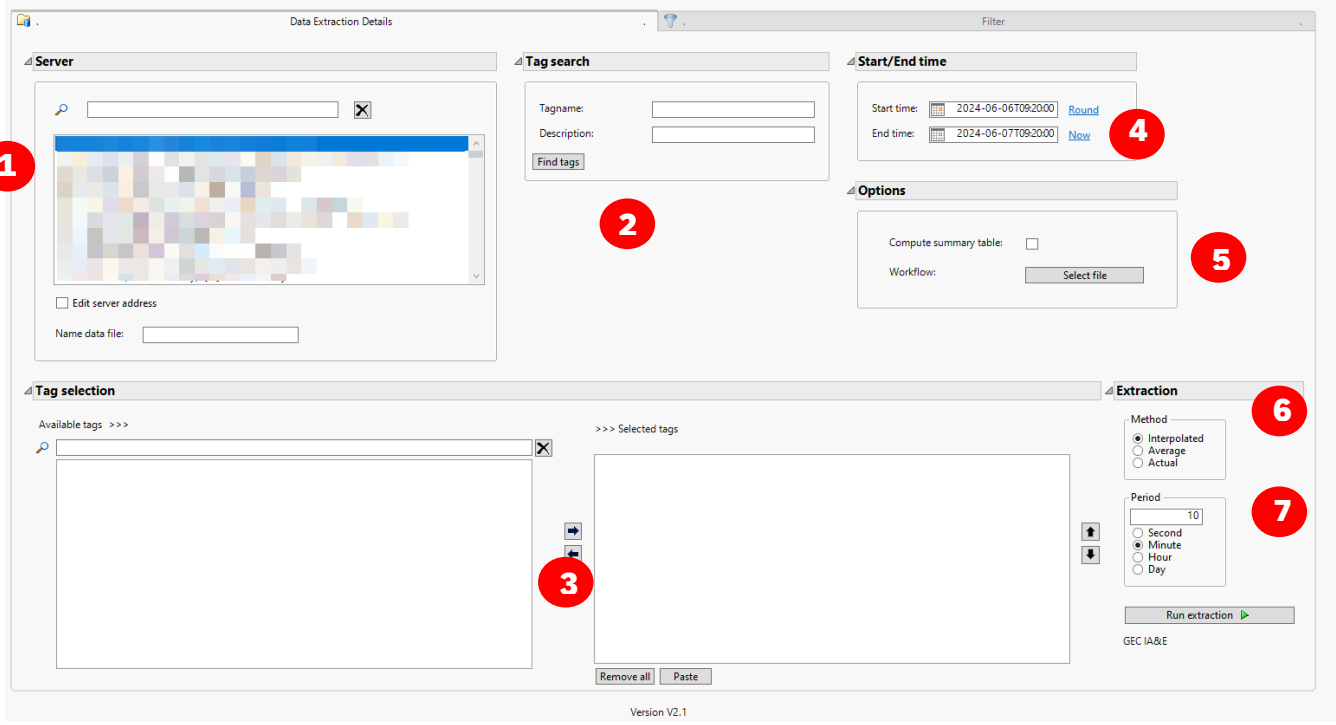


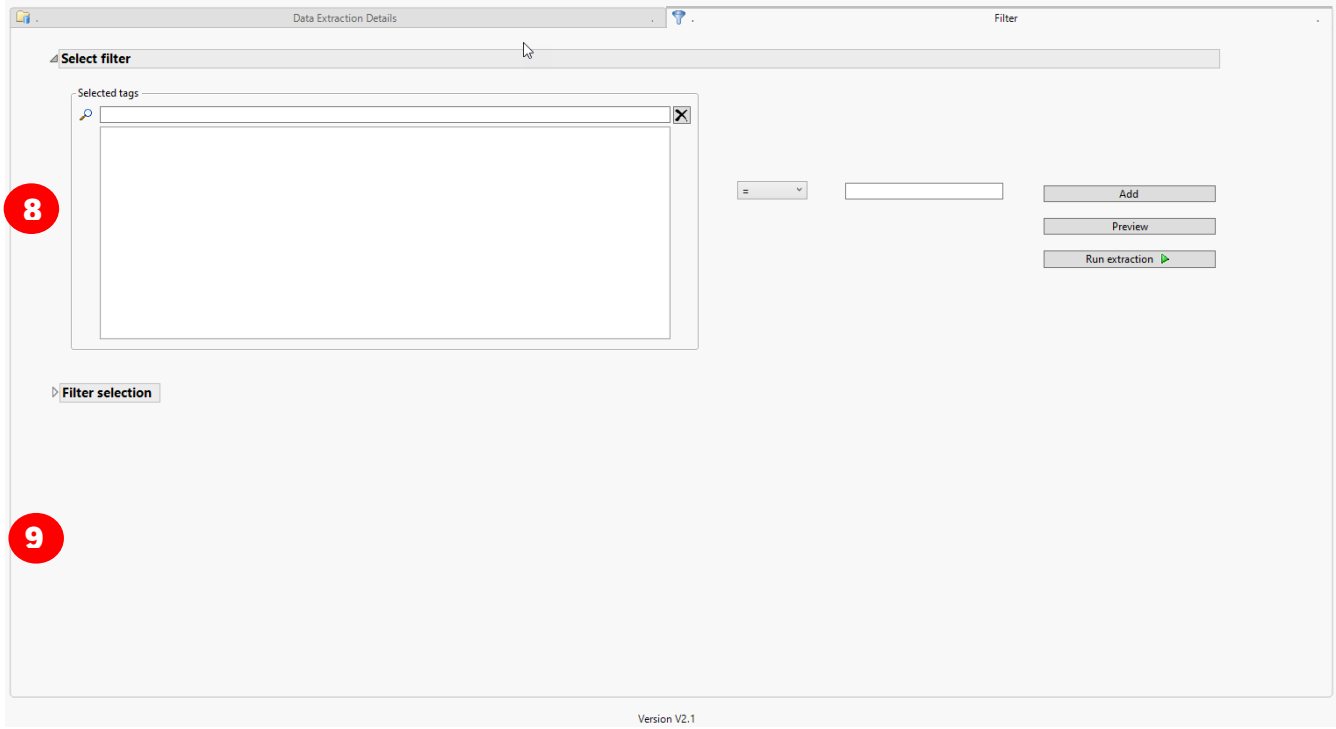
Afterwards, you will have a new sub-tab namely *MES Tools > Data Retrieval IP21/PI* installed in the JMP tab Add-Ins.



GETTING STARTED WITH THE ADD-IN

1.1 OVERVIEW

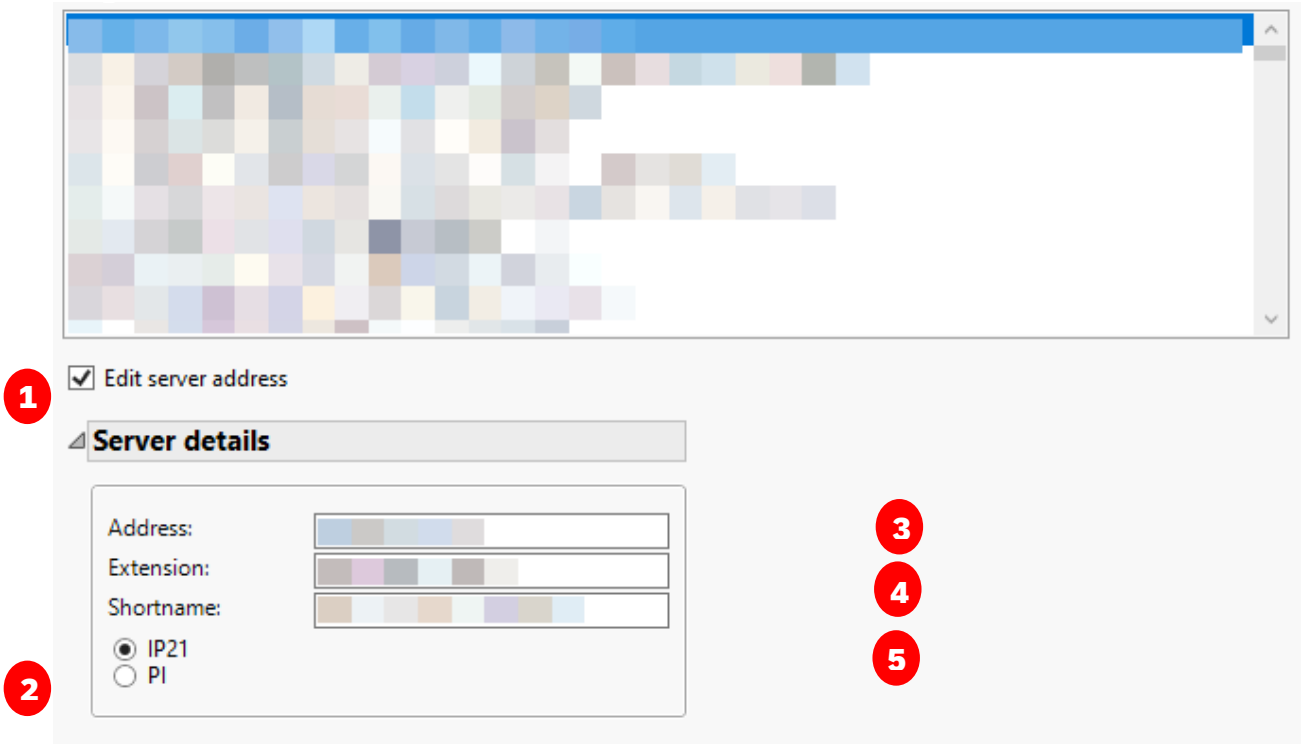




The **main interface** allows users to:

1. Select a server from a server list or manual input (edit server address) and edit the name of the extracted table
2. Find tags using either tag name or description
3. Add selected tag(s) or paste tag name(s) when copied from a spreadsheet. If you paste them, please remove any unit or description in the tag names.
4. Add options (workflow, summary table).
5. Filter by start and end date (now and 24 h earlier by default)
6. Select the extraction type (interpolated, average and actual values)
7. Select the extraction period (10 minutes by default)
8. Add filter(s) on tag(s)
9. Change filter(s) added (option to nest them)

To use the add-in, make sure to put your server details properly:

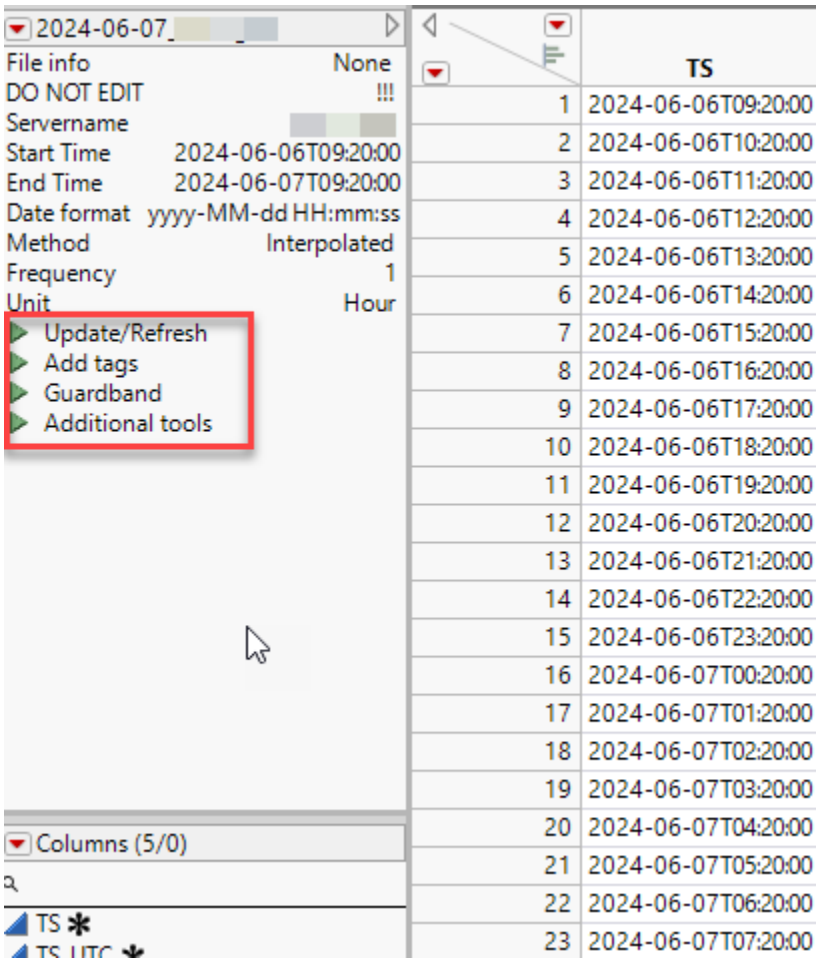


1. You can edit the server name from the list by using this checkbox
2. Make sure the proper server type is selected (IP.21 or PI)
3. Introduce your server name address (e.g., globcorp001)
4. Introduce the domain, usually this is optional
5. (Optional) Include a description

The extraction is done tag by tag with a high limit of rows (100,000) per tag to not saturate the server.

You will have a progress bar to track the progress of the data extraction. It should be fast enough for most cases unless limited by connectivity speed (e.g., VPN). Please notify in advance your OT/IT team if you are planning for massive data extractions.

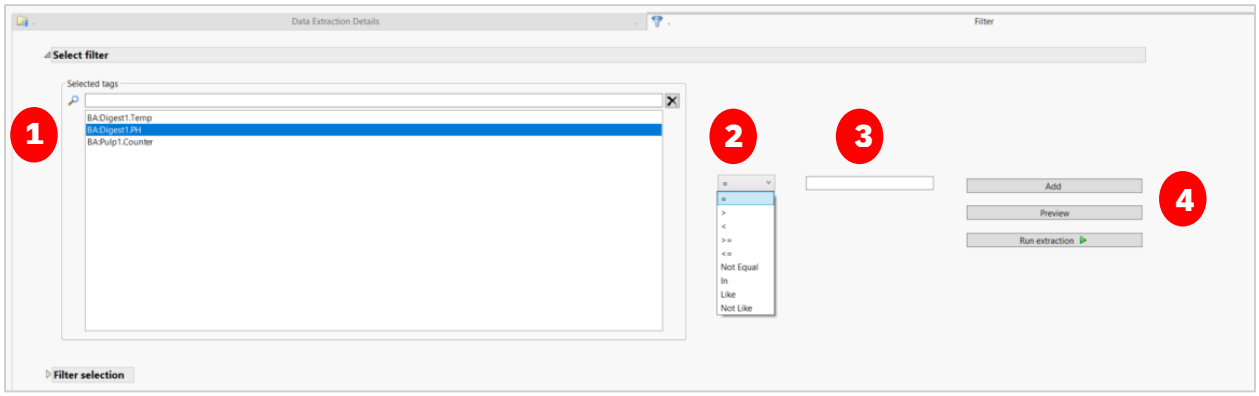
After you extract data for both IP21/PI servers, you can UPDATE/REFRESH, ADD new tags to the table with one click. You have also ADDITIONAL TOOLS if you want to do simple data manipulations on the table. Finally you have the GUARDBAND script, for guardband analysis.



1.2 FILTERS MANAGEMENT

1.2.1 ADD FILTERS

In the Filters tab, you'll find all the functions for adding and managing filters. These filters will be incorporated into the request sent to the server during data extraction.

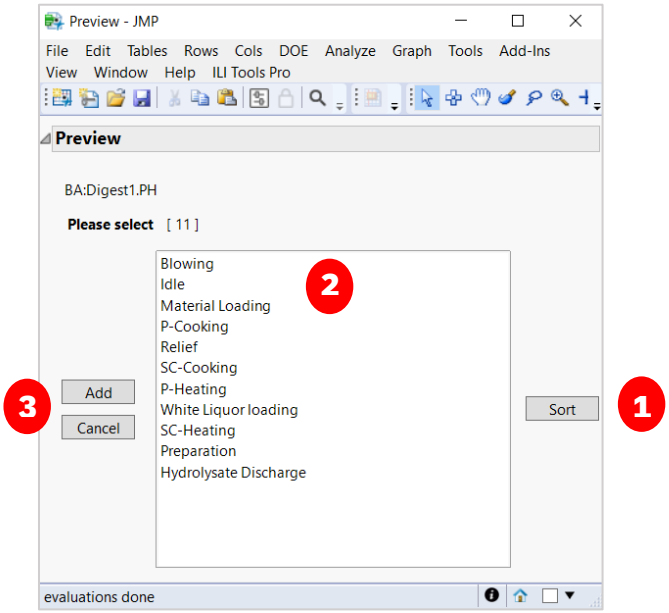


The **filters interface** allows users to:

1. Select the tag to which you wish to apply a filter
2. Select the comparator you wish to use in the filter. The >, <, >=, <= comparators are reserved for continuous numeric tags. The comparators In, Like, Not Like are reserved for discrete or text tags. The comparators = or Not Equal can be applied for both type of tags.
3. Specify filter value. If comparator In is selected, the user can list several possible values for the filter, separated by a value to be specified. For example: VALUE1 / VALUE2 / VALUE3 . The separator is /.
4. Add the filter by clicking on the Add button, or request a preview by clicking on the button Preview. Preview is only available for discrete or text tags. It allows you to view the possible distinct values of the selected tag over the given start/end time and over filters already saved by the user. This is useful when the user wants to apply a filter to a tag but doesn't know the possible values.

If the user clicks on preview, a new JMP window will open. This may take some time, but the list of possible values for the selected tag will be displayed. Don't forget that if you've already added filters, these will be taken into account when searching for tag values.

The **preview interface** allows users to:



1. Sort values alphabetically
2. Select one or more values to apply as a filter for this tag
3. Add the filter by clicking on the Add button or stop it by clicking on the Cancel button.

1.2.2 MODIFY FILTERS

Below the filter selection, you can modify or remove the filters you've added at any time.

The **filters interface** allows users to:

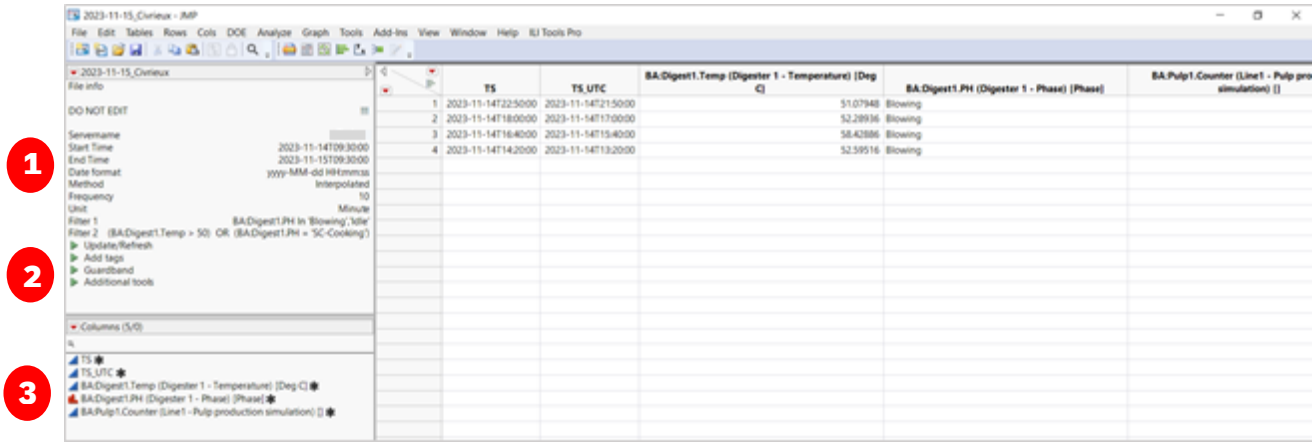
1. Define filter construction type. There are 2 choices: **(A) If ALL conditions are met (B) If ANY conditions are met**. By default it is choice (A). Imagine we've added 3 filters, if choice (A) is selected, we'll search for data corresponding to Filter 1 AND Filter 2 AND Filter 3. In case (B), this would result in Filter 1 OR Filter 2 OR Filter 3. If you change the filter construction type, it will automatically remove any nested registered filters.

2. Select the filter the user wants to modify.
3. Remove selected filter(s), or even remove all added filters. If the user selects 2 filters, he can nest them together. In our example, if I nest Filter 1 and Filter 2 , this would result in
    - **(A) If ALL conditions are met:** (Filter 1 OR Filter 2) AND Filter 3
    - **(B) If ANY conditions are met**: (Filter 1 AND Filter 2) OR Filter 3

    You cannot nest more than 2 filters.

1.3 TABLE OF EXTRACTED DATA

Following your data extraction, a JMP table will open on full screen with the extracted data. If you did not edited the name of this table in the main interface, then by default the table name will be the date of today in yyyy-mm-dd format plus the server name.



On this table, you will find:

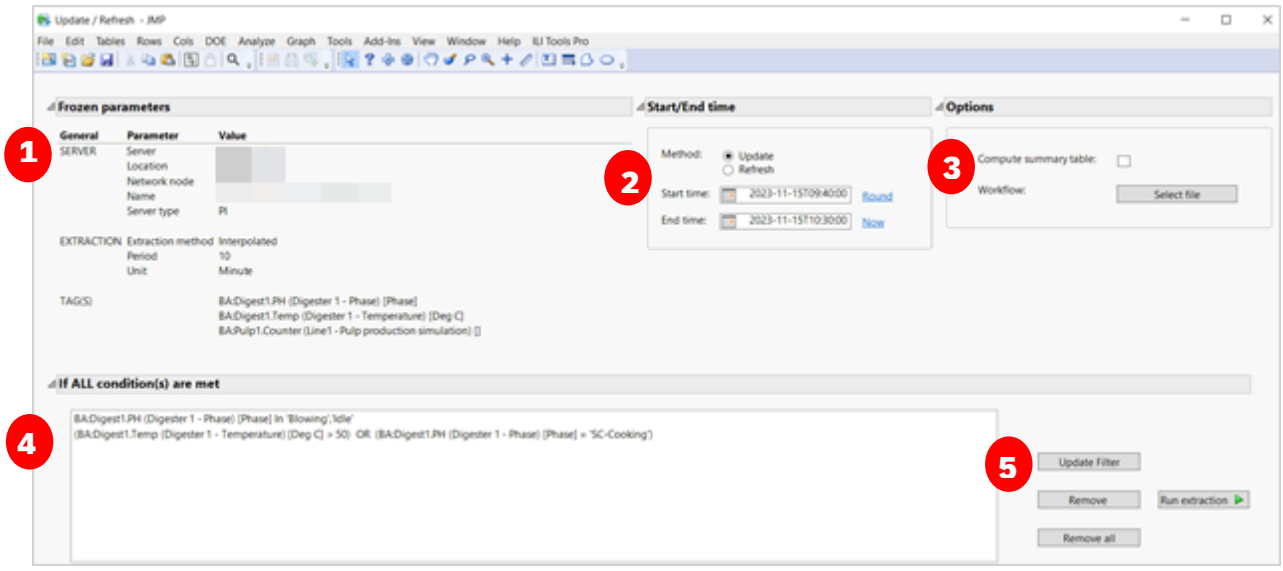
1. Several table variables that recall the modalities of your data extraction. Above all, you don't have to edit them manually, they are generated automatically and used in the additional scripts.
    - **Servername**: Server name
    - **Start Time**: Start time selected by the user in main interface
    - **End Time**: End time selected by the user in main interface
    - **Date format**: Date format of the Start and End time
    - **Method**: Method used for data retrieval
    - **Frequency**: Time interval used for data retrieval
    - **Unit**: Unit of the time interval used for data retrieval
    - **Filters**: List of filters added by the user in the main interface
2. Additional user scripts: UPDATE/REFRESH, ADD TAGS, GUARDBAND, ADDITIONAL TOOLS. The use of these scripts will be explained in greater detail below.

3. List of extracted tags. The first two columns will be the timestamp columns TS and TS_UTC in yyyy-mm-ddThh:mm:ss format. Do not delete the timestamp columns, as they are used in some additional scripts.

1.4 ADDITIONAL SCRIPTS

You have 4 scripts attached to the extracted data table. Their use is detailed below.

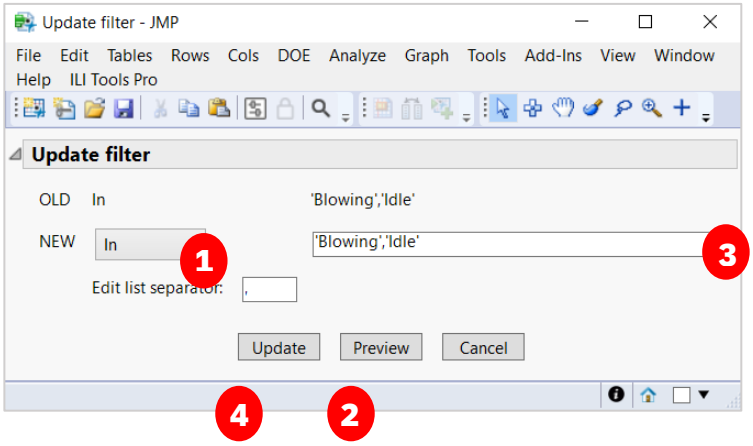
1.4.1 UPDATE/REFRESH



The **Update/Refresh interface** allows users to:

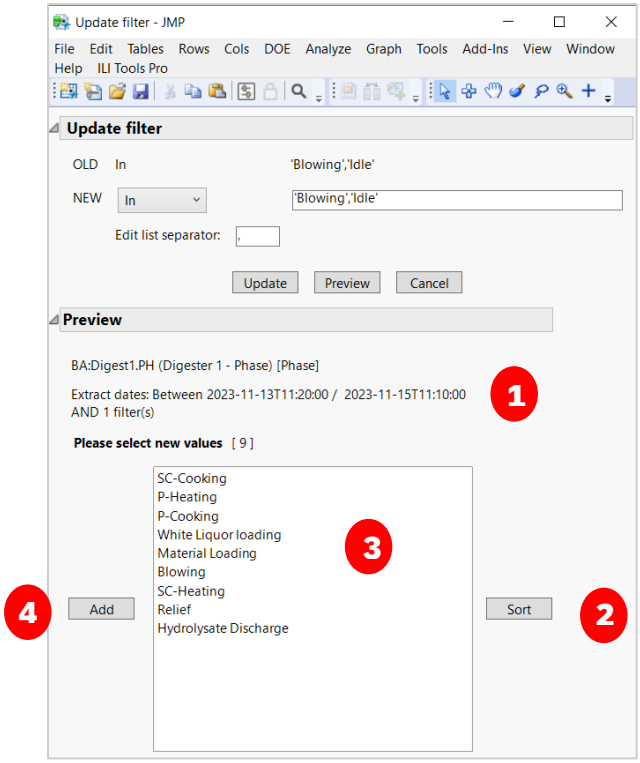
1. Remember which parameters are frozen and cannot be modified with Update/Refresh. In this script, you cannot modify basic extraction information such as server, extraction method and tags.
2. Select whether the user wants to UPDATE or REFRESH. UPDATE increments the table size by adding new data, never replacing existing data in the table whereas REFRESH keeps the same expected table size, replacing old data with new data.
    - If UPDATE: Select the start and end time of the data to be added. The default start time is the end time of the table plus the period, and the default start time is today. Please note that if your new data period overlaps with the current data period, you can have duplicates.
    - If REFRESH: Select the end time. The start time will be defined as the selected end time minus the number of points estimated as during the first data extraction.
3. Select options (summary table, workflow).

4. Select filter(s) you want to remove during UPDATE/REFRESH, or update. Whether you update or delete filters, this will only be valid during the UPATE/REFRESH run, this will not modify the variable tables. You cannot update a nested filter. Update filter is useful for example if in your initial extraction you had filter on batches and now there are new batches in the new data.



The **Update filter interface** allows users to:

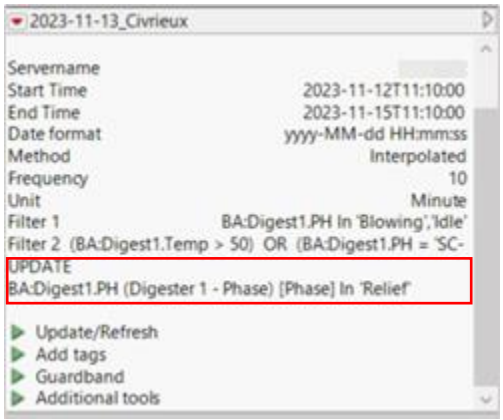
1. Select new comparator
2. Preview the possible values of the tag of the selected filter over the given new start and/or new end time and the given registered filters, except the one we are updating.
3. Edit new values manually
4. Update filter



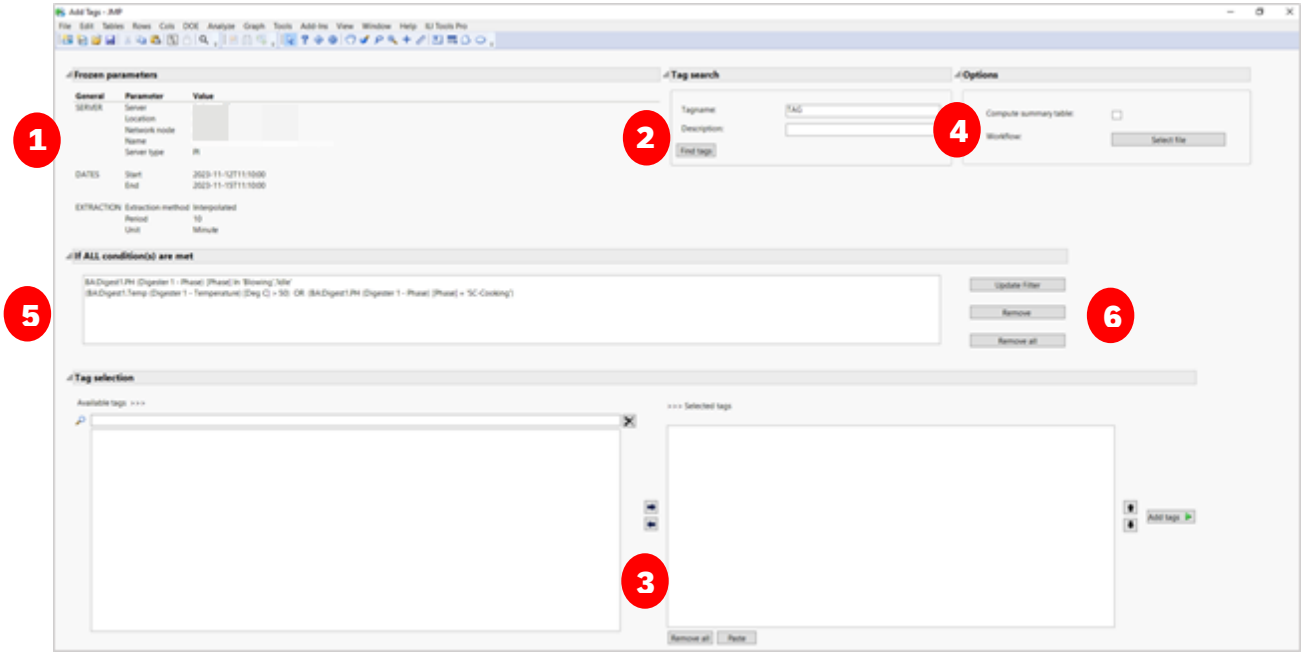
The **Preview in Update filter interface** allows users to:

1. Remember which tag and over what period and number of filters the preview is made
2. Sort the values obtained in the preview in alphabetical order
3. Select one or several values to add for the update of the filter
4. Update filter. After you click on update, you will return to the UPDATE/REFRESH interface and you will be able to see that in the added filters the update has been applied

If you run UPDATE/REFRESH after updating a filter, you will have a new variable table to notify you that there has been an update of a filter during an UPDATE/REFRESH.

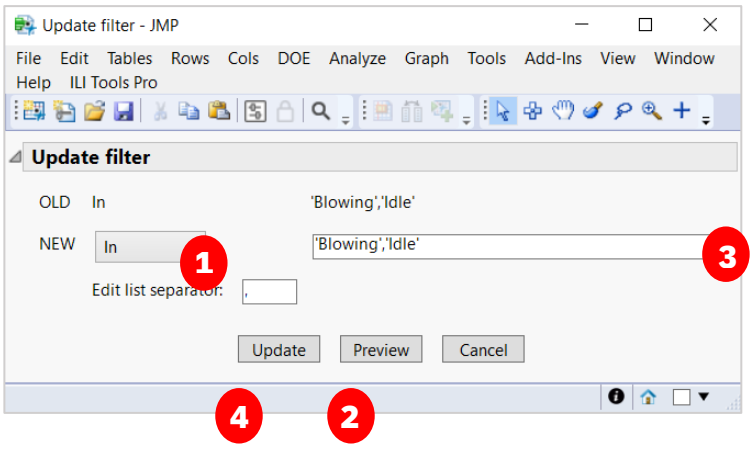


1.4.2 ADD TAGS



The **Add Tags interface** allows users to:

1. Remember which parameters are frozen and cannot be modified with ADD TAGS. In this script, you cannot modify basic extraction information such as server and extraction method.
2. Find tags using either tag name or description. The script will recall your last tag name/description search from initial data extraction.
3. Add selected tag(s) or paste tag name(s) when copied from a spreadsheet. If you paste them, please remove any unit or description in the tag names.
4. Add options (workflow, summary table).
5. Select filter(s) you want to remove during ADD TAGS, or update. Whether you update or delete filters, this will only be valid during the ADD TAGS run, this will not modify the variable tables. You cannot update a nested filter.



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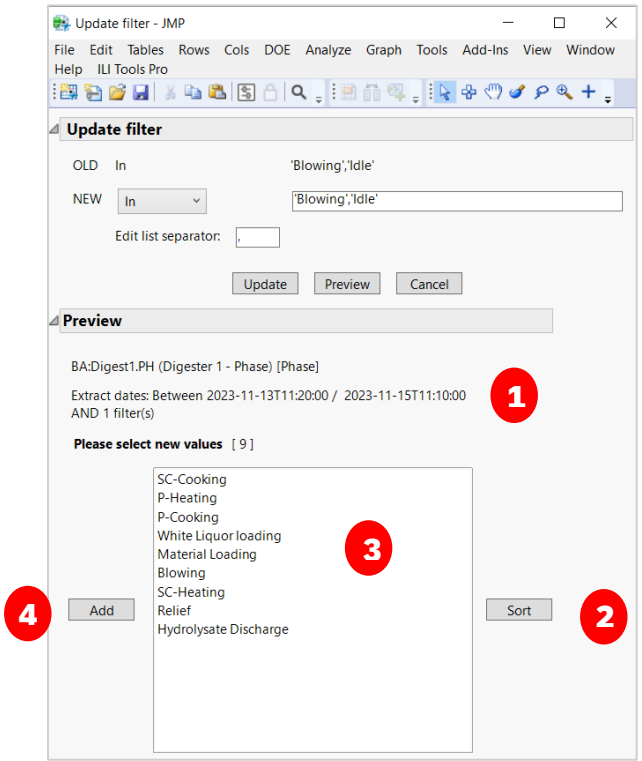
4. Update filter



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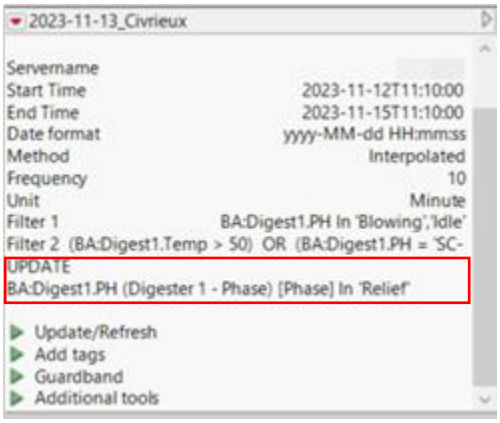
2. Sort the values obtained in the preview in alphabetical order
3. Select one or several values to add for the update of the filter
4. Update filter. After you click on update, you will return to the Update/Refresh interface and you will be able to see that in the added filters the update has been applied

If you run ADD TAGS after updating a filter, you will have a new variable table to notify you that there has been an update of a filter during an ADD TAGS.



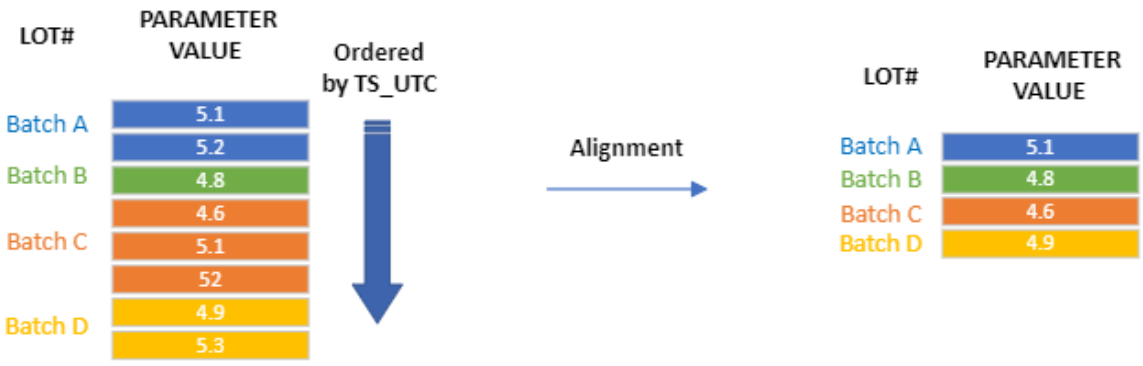
1.4.3 GUARDBAND

1.4.3.1 General principle

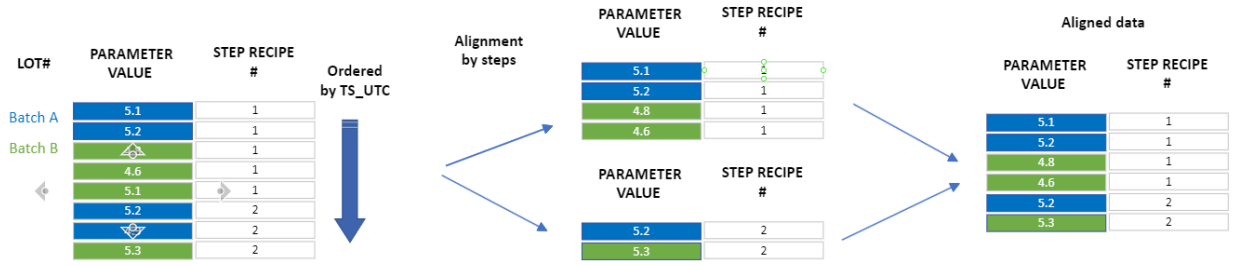
The Guardband script lets you analyze and compare several batches of a given parameter over time. The guardband analysis procedure is described in detail below:

1. Sort original table by TS_UTC column in ascending order
2. If a Lot# and Sublot# columns are given in the interface below, it will creates a new column namely “Lot&Sublot” that will be used to identify batches. Otherwise, batches witll be identify by the Lot# column if no Sublot# column specified.
3. Aligned data by batches meaning that we'll look at the number of lines per batch, see which batch has the fewest lines, and delete the oldest lines on the other batches so that they have as many lines as the minimum.

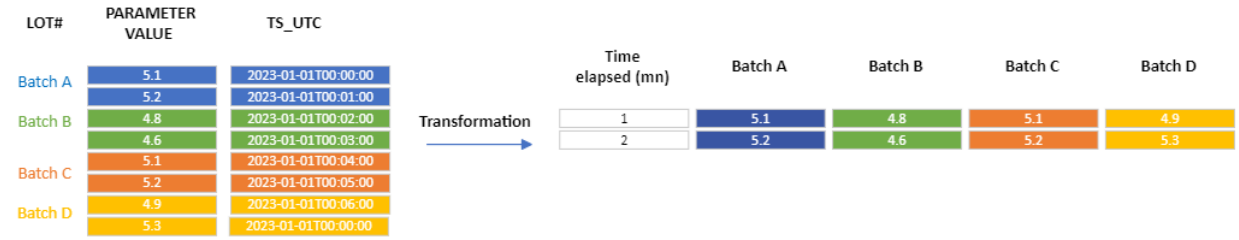
Below is an example of 4 batches: A, B, C and D, identified by the Lot# column. We can see that Batch A has 2 lines, B 1 line, C 3 lines, D 4 lines. The minimum is therefore 1 line, so when aligning we keep only 1 line per batch.



If a step column is specified, it's the same principle except that we first subset by step, and then in each step we align by batches. In our example below, we have a recipe step # column which takes 2 values: step 1 or step 2, and 2 batches: batch A and B.



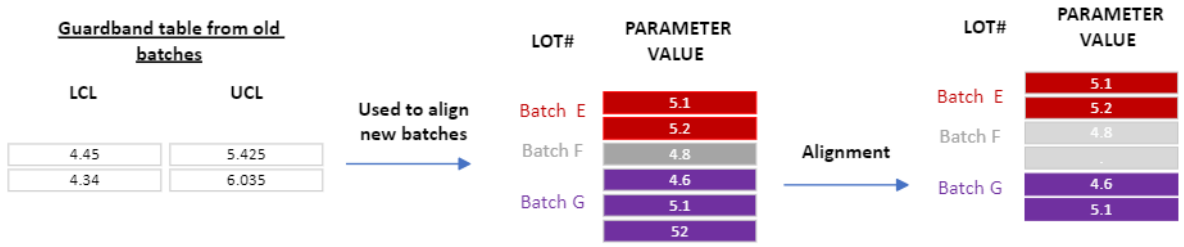
4. Transformation of the data aligned to have the points of time in rows and the batch values in columns at these points of time.



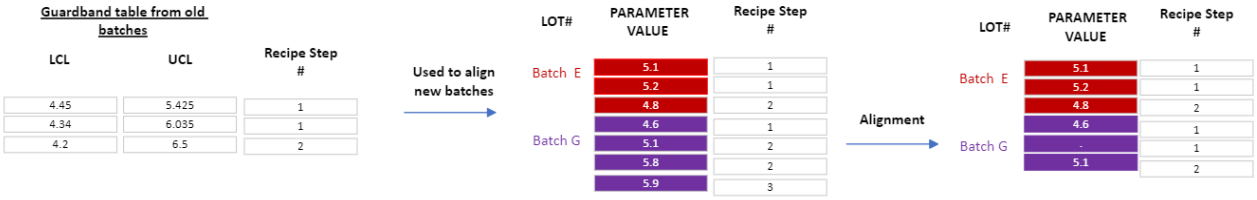
5. Calculate control limits UCL and LCL as Mean +/- 3 * Sigma per rows, and over the batches columns.

6. The table obtained will be called the “Guardband table” and the guardband chart will be built from this table. You can save this table to use it as a reference for future batches analysis. This means that these future batches will be aligned according to this guardband table and we will use the LCL/UCL of the guardband table. A guardband table has in general up to 3 columns: LCL and UCL mandatory, and eventually the step recipe column.

In the example below, we want to perform guardband analysis on new batches E,F,G. But we want to compare them with the guardbands (UCL/LCL) calculated with old batches A,B,C,D in the previous paragraph. So we'll take the guardband table calculated from old batches. We can see that there is 2 rows in the guardband table, which means that when we aligned the batches A,B,C,D, the smallest batch had just 2 rows, so the alignment was 2. We'll now perform the same alignment on the new batches. You'll notice that batch F has only one row, not 2. In this case, we'll add a missing value in the aligned data for this batch to match the guardband table used.

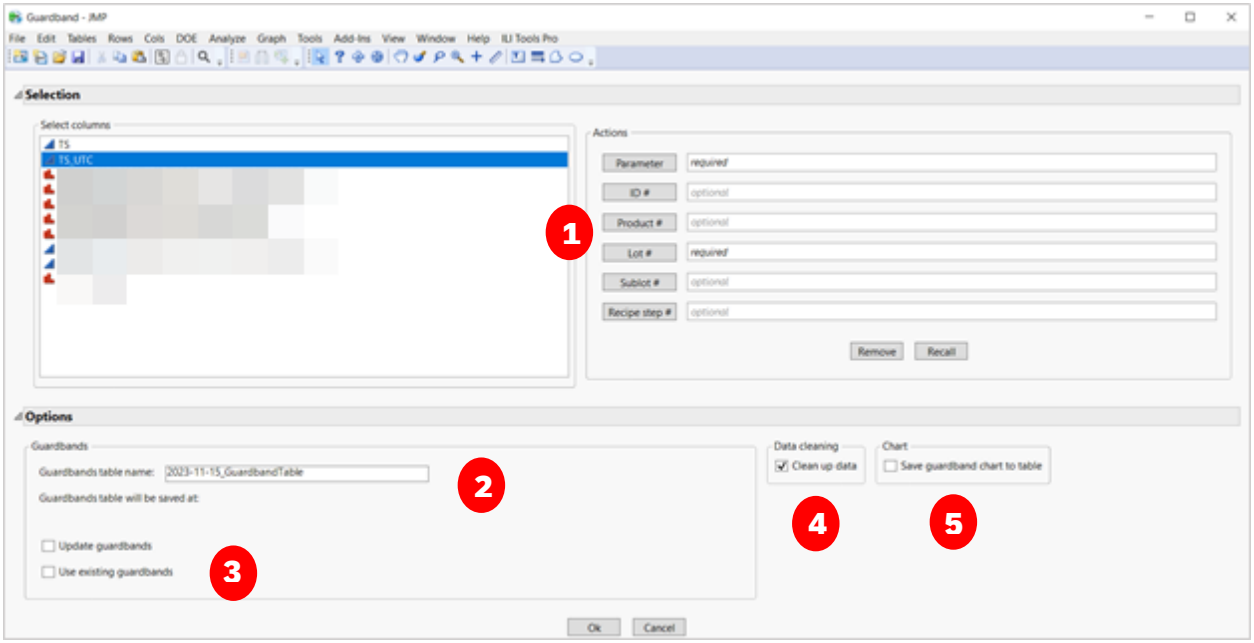


If there's a recipe step column in the guardband table, it's the same principle except that the step is subset first. In the guardband table, step 1 has only 2 rows, so for step 1 the alignment is 2, while for step 2 the alignment is row. If there some steps in the new batches (ex Step 3) unknown from guardband table of old batches, then they will be removed from analysis.



After this, we can perform the data transformation (see 4.) and add the LCL/UCL columns from the guardband table calculated on the old batches to the new aligned batches and plot the guardband chart.

1.4.3.2 Guardband chart



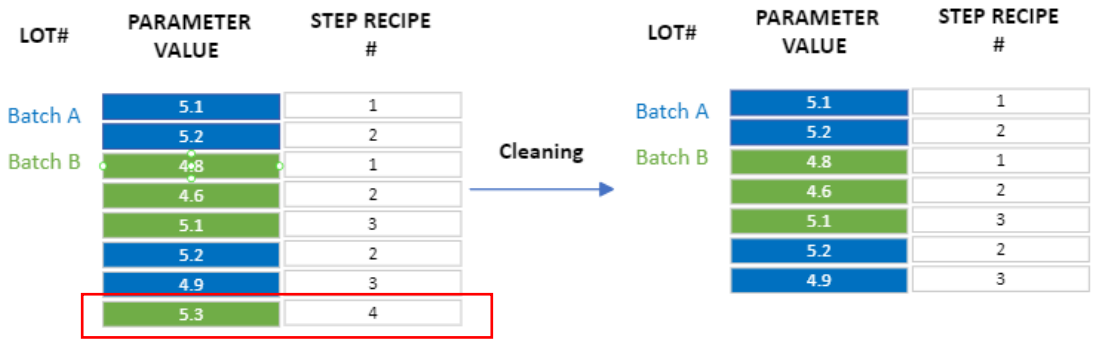
The **Guardband interface** allows users to:

1. Select columns and cast them in their various roles. Parameter and Lot# are mandatory. You have also the button “Recall” than can cast automatically the columns as in your last guardband analysis.
2. Specify the guardband table name. The guardband table will automatically be saved in the DOCUMENTS path of the user computer, at Guardband / Server name / ID# / Parameter / guardband table name.jmp. If no ID# was specified, then it would be Guardband / Server name / ID_UNKNOWN / Parameter / guardband table name.jmp.
3. Select backup options:
    - **Update guardbands**: If a guardband table already exists for this type of analysis and with the same name, then it will be replaced by the new guardband table. The user will still get a warning message to check that the user is OK.
    - **Use existing guardbands**: Instead of calculating the guardband table on the current dataset, the user can select an existing guardband table. In this case, it must contain the columns "LCL" and "UCL", as well as the corresponding Recipe step# column if the user specifies a column as Recipe step#.

4. Select data cleaning option. By default it is checked, meaning that, if a Recipe step# column is specified, we remove steps that are not available for all batches. We also remove rows whose step does not start at 1 per batches.

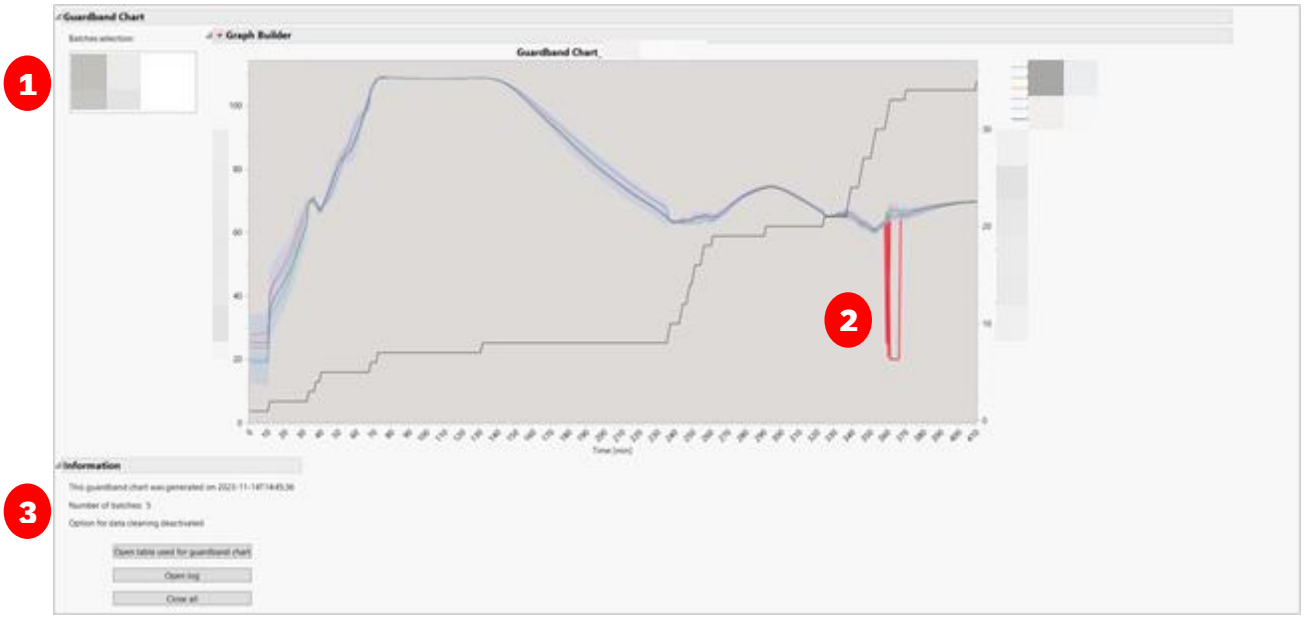
Example:

- Let's imagine we have 2 batches: A, B and that we have 4 steps. If steps 4 only have values for batches B but not A, then this step will be removed from the analysis.



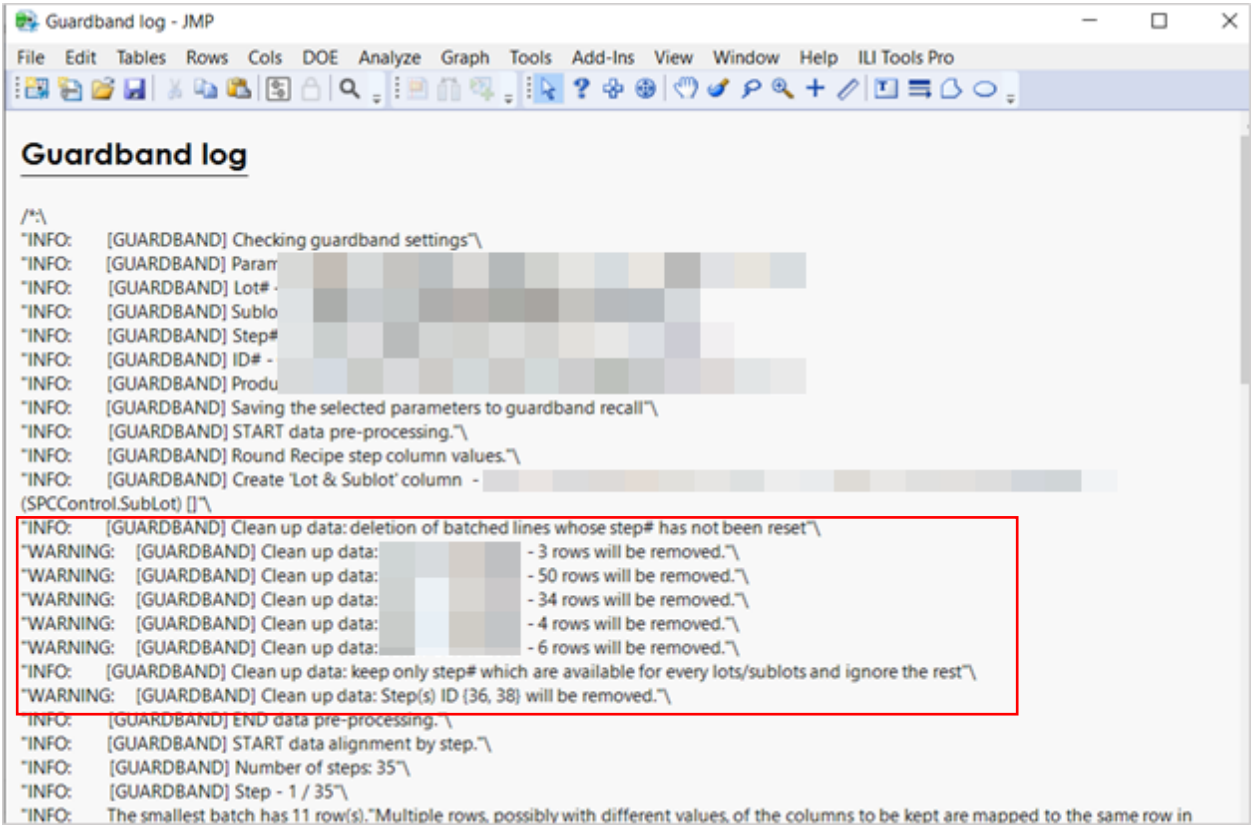
- In addition, after sorting by UTC, the first step must necessarily be 1 for each batches. If this is not the case, we delete the lines until they start with 1.

5. Select Chart option. If the user check this option, the chart generated will be saved to the original table. Warning: this means that it is a frozen image of the data in this guardband, it is not updated with the data in the table.

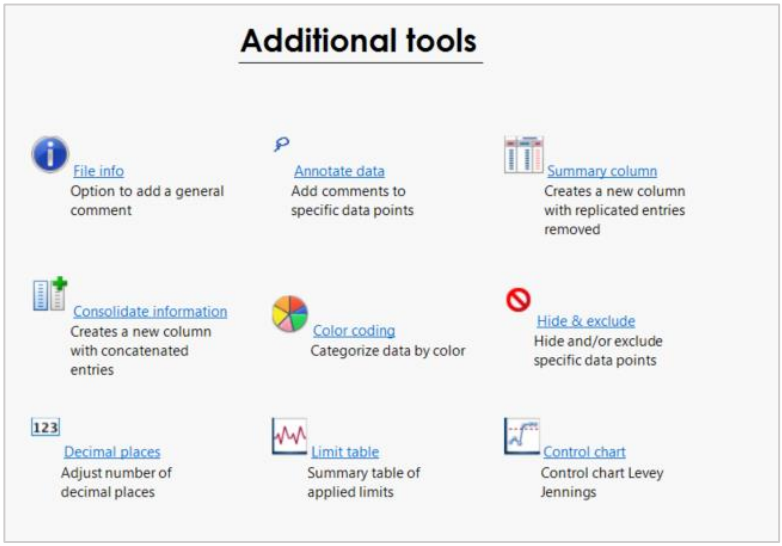


In the **Guardband chart**, you can find:

1. The user can interactively select the batches displayed
2. OOCs (Out Of Control), i.e. securities which exit outside UCL or LCL, are shown in red.
3. Some additional information on the generated guardband graph
    - The user can open the table which was used to generated the Guardband chart
    - The user can open the log associated with the Guardband chart generated where he can find some cleaning information.


Guardband log - JMP
File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help ILI Tools Pro
Guardband log
/*:\
"INFO: [GUARDBAND] Checking guardband settings"\
"INFO: [GUARDBAND] Param
"INFO: [GUARDBAND] Lot# -
"INFO: [GUARDBAND] Sublo
"INFO: [GUARDBAND] Step#
"INFO: [GUARDBAND] ID# -
"INFO: [GUARDBAND] Produ
"INFO: [GUARDBAND] Saving the selected parameters to guardband recall"\
"INFO: [GUARDBAND] START data pre-processing."\
"INFO: [GUARDBAND] Round Recipe step column values."\
"INFO: [GUARDBAND] Create 'Lot & Sublot' column -
(SPCControl.SubLot) []"\
"INFO: [GUARDBAND] Clean up data: deletion of batched lines whose step# has not been reset"\
"WARNING: [GUARDBAND] Clean up data: - 3 rows will be removed."\
"WARNING: [GUARDBAND] Clean up data: - 50 rows will be removed."\
"WARNING: [GUARDBAND] Clean up data: - 34 rows will be removed."\
"WARNING: [GUARDBAND] Clean up data: - 4 rows will be removed."\
"WARNING: [GUARDBAND] Clean up data: - 6 rows will be removed."\
"INFO: [GUARDBAND] Clean up data: keep only step# which are available for every lots/sublots and ignore the rest"\
"WARNING: [GUARDBAND] Clean up data: Step(s) ID {36, 38} will be removed."\
"INFO: [GUARDBAND] END data pre-processing."\
"INFO: [GUARDBAND] START data alignment by step."\
"INFO: [GUARDBAND] Number of steps: 35"\
"INFO: [GUARDBAND] Step - 1 / 35"\
"INFO: The smallest batch has 11 row(s)."Multiple rows, possibly with different values, of the columns to be kept are mapped to the same row in

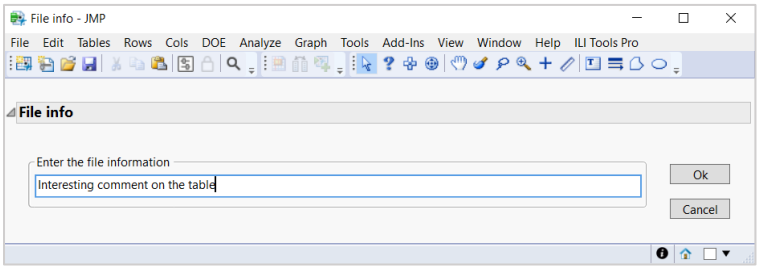
1.4.4 ADDITIONAL TOOLS

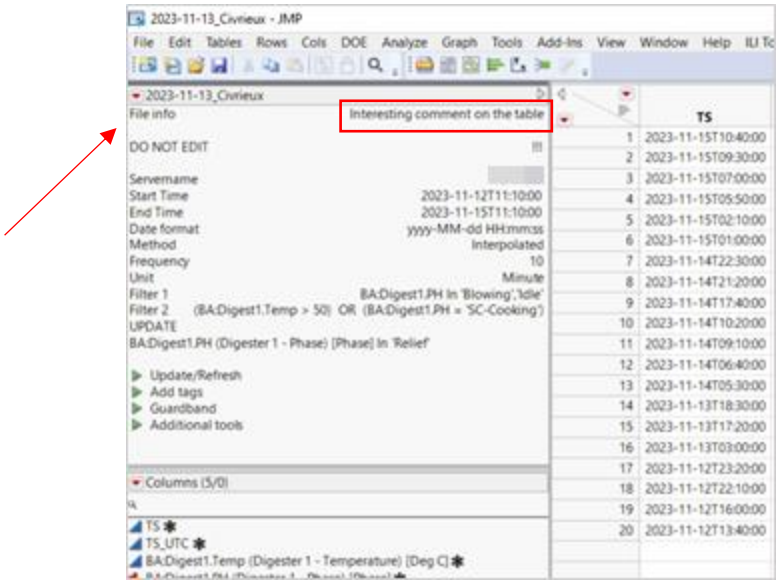


The **Additional Tools interface** allows users to do various data manipulation on your table.

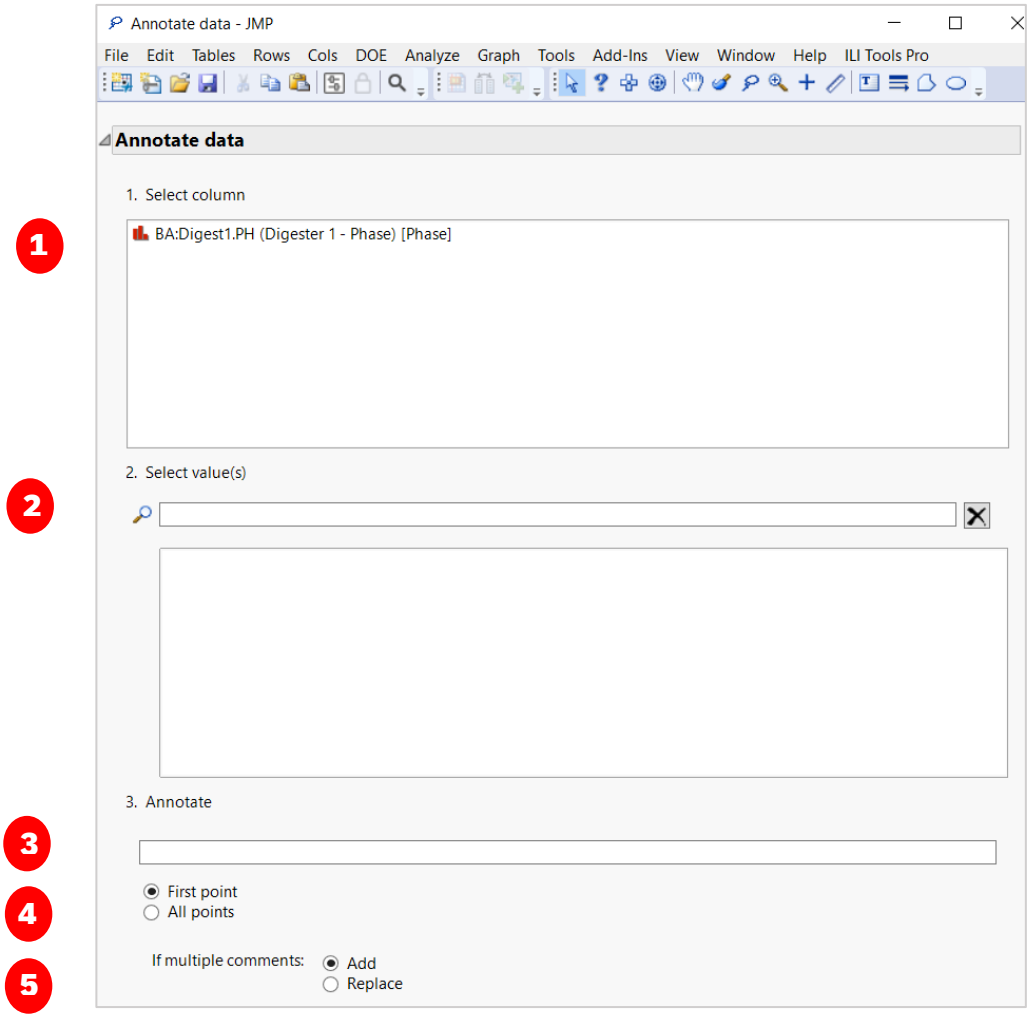
1.4.4.1 File info

With this option, the user can add a general comment on the table. This comment will be saved as a table variable at the top.




2023-11-13_Civrieux - JMP
File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help
2023-11-13_Civrieux
File info
Interesting comment on the table
DO NOT EDIT
Servername
Start Time 2023-11-12T11:10:00
End Time 2023-11-15T11:10:00
Date format yyyy-MM-dd HH:mm:ss
Method Interpolated
Frequency 10
Unit Minute
Filter 1 BA:Digest1.PH In 'Blowing','Idle'
Filter 2 (BA:Digest1.Temp > 50) OR (BA:Digest1.PH = 'SC-Cooking')
UPDATE
BA:Digest1.PH (Digester 1 - Phase) [Phase] In 'Relief'
Update/Refresh
Add tags
Guardband
Additional tools
Columns (5/0)
TS
TS_UTC
BA:Digest1.Temp (Digester 1 - Temperature) [Deg C]
TS
1 2023-11-15T10:40:00
2 2023-11-15T09:30:00
3 2023-11-15T07:00:00
4 2023-11-15T05:50:00
5 2023-11-15T02:10:00
6 2023-11-15T01:00:00
7 2023-11-14T22:30:00
8 2023-11-14T21:20:00
9 2023-11-14T17:40:00
10 2023-11-14T10:20:00
11 2023-11-14T09:10:00
12 2023-11-14T06:40:00
13 2023-11-14T05:30:00
14 2023-11-13T18:30:00
15 2023-11-13T17:20:00
16 2023-11-13T03:00:00
17 2023-11-12T23:20:00
18 2023-11-12T22:10:00
19 2023-11-12T16:00:00
20 2023-11-12T13:40:00

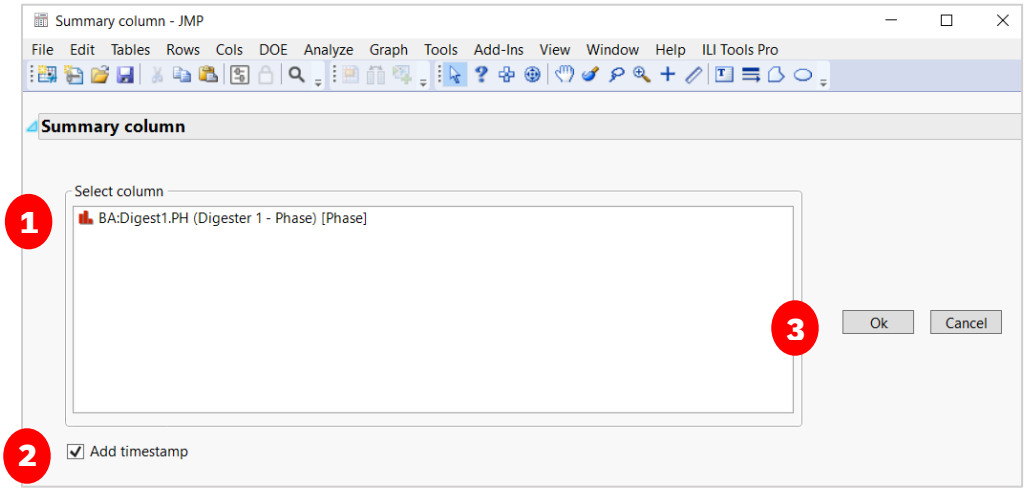
1.4.4.2 Annotate data



The **Annotate data interface** allows users to:

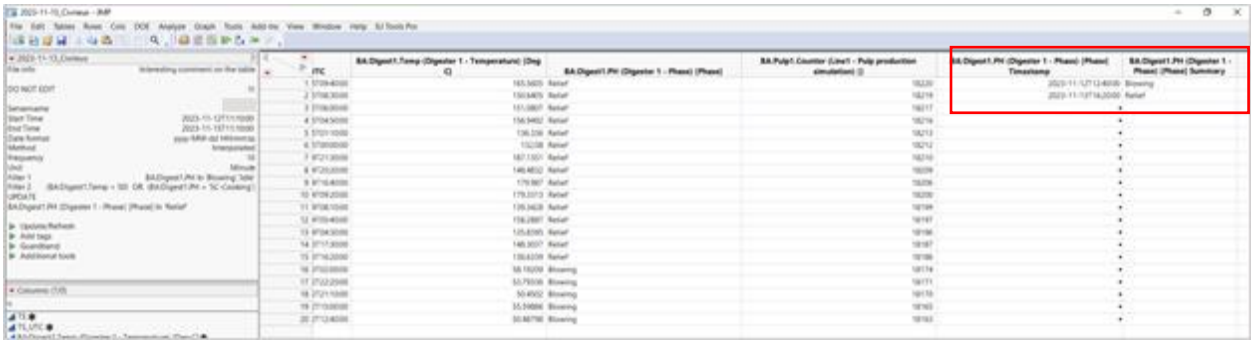
1. Select a discrete or text tag to annotate
2. Select the value(s) to be annotated on this tag
3. Select the comment you want to add for this values on this tag. The comments will be added in a new column Comment at the end of your table
4. Select option for annotation. By default, it will annotate the first point for each selected value. But you can select “All points” if you want to annotate every matching points.
5. Select option for multiple comments. By default, if there is already an existing Comment column, your new comment will be added next to the old comment in the column (“Add”). If you check “Replace”, you will replace the old comment with your new comment instead.

1.4.4.3 Summary column

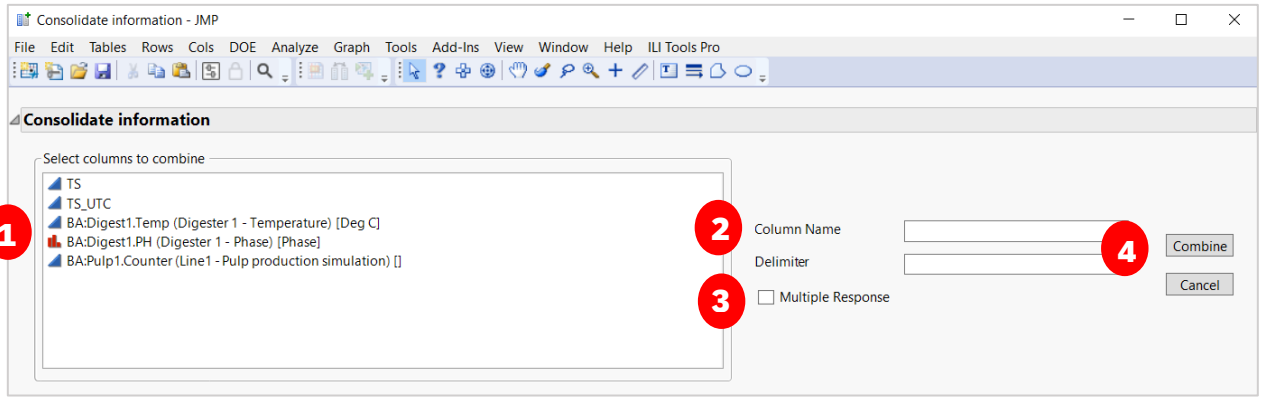


The **Summary column interface** allows users to:

1. Select a discrete or text type tag
2. Check option “Add timestamp” if you want to display in the summary the first date of appearance of each values of the selected tag in the table
3. Run the summary column. It will generate 2 new columns at the end of the table if you checked “Add timestamp” option, 1 new column otherwise. One will be named as the Tagname + “Timestamp” and the other one the Tagname + “Summary”



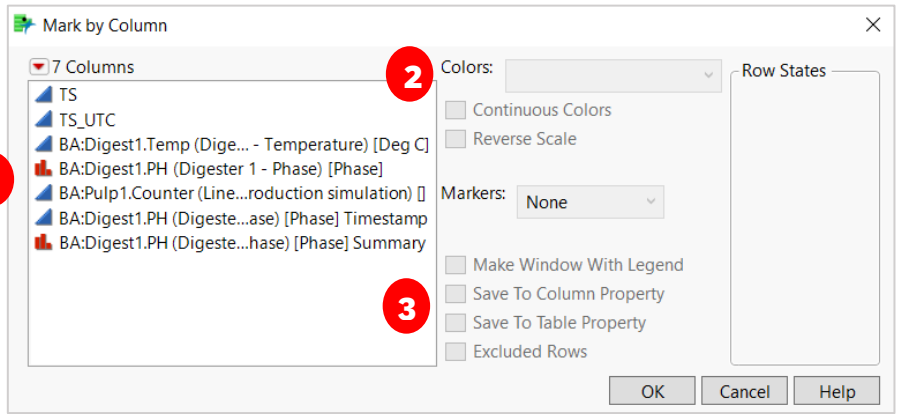
1.4.4.4 Consolidate information



The **Consolidate information interface** allows users to:

1. Select several tags to combine
2. Select the new column name and delimiter to be used for this new column
3. Check option “Multiple Response” if you want this new column to be treated as a multiple response in JMP. Otherwise it will be considered as a categorical column.
4. Combine these columns and create the new one. The new column will be placed at the end.

1.4.4.5 Color coding

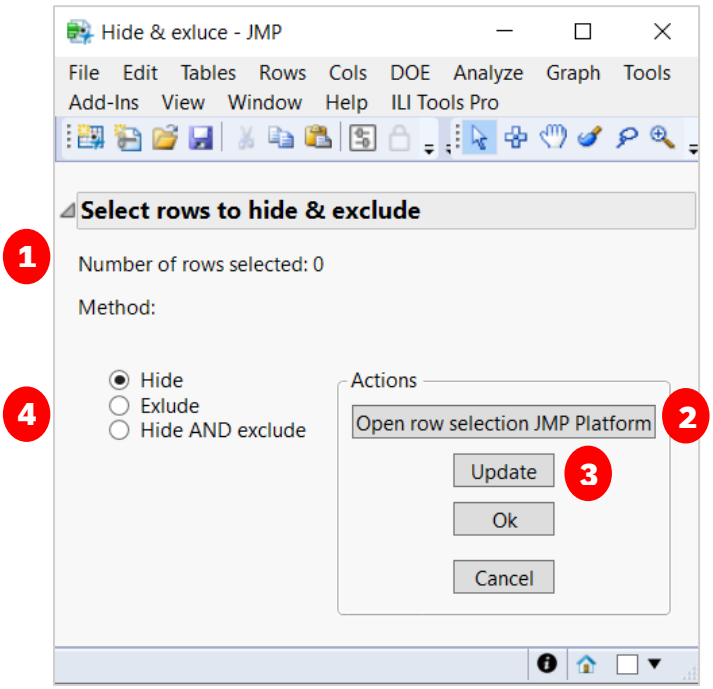


The **Color coding interface** allows users to:

1. Select the tag to color
2. Select the color code or color gradient you want
3. Select the different options you want. For more information about the available options, see:

https://www.jmp.com/support/help/en/17.2/index.shtml#page/jmp/assign-colors-or-markers-to-rows.shtml#ww510952

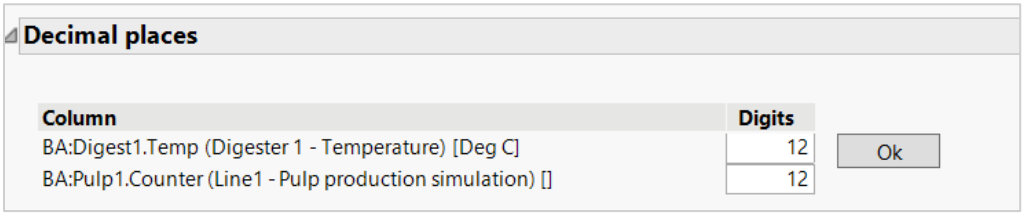
1.4.4.6 Hide & exclude



The **Hide & exclude interface** allows users to:

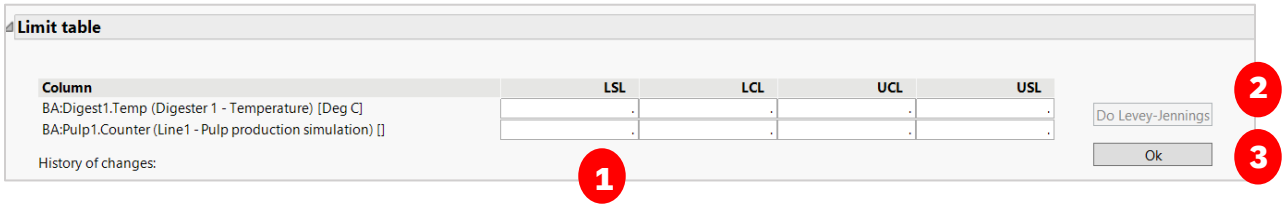
1. See how many rows were selected at the launch of "Additional tools"
2. Select rows based on various criterion with JMP dedicated platform
3. Update the number of rows selected
4. Select the method: either hide the selected rows, exclude them, or both.

1.4.4.7 Decimal places



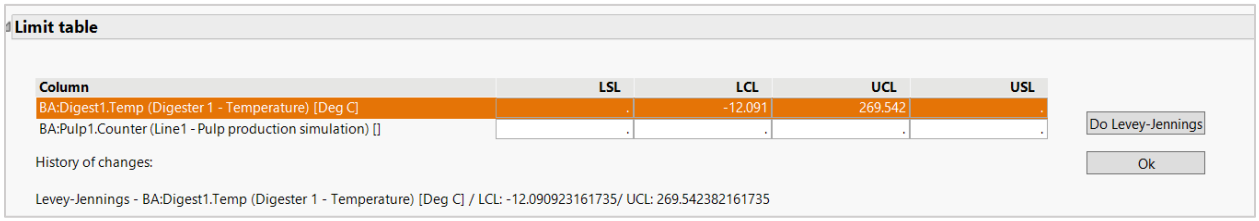
The **Decimal places interface** allows users to define the number of digits to be displayed per tags. Press "Ok" to apply the changes.

1.4.4.8 Limit table

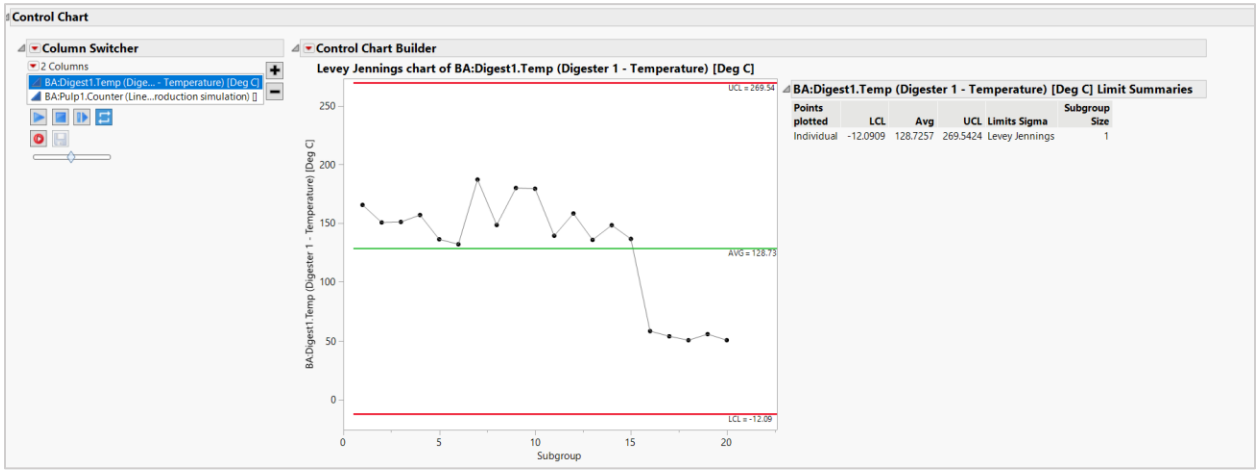


The **Limit table interface** allows users to:

1. Manually enter values for LSL, LCL, UCL or USL. Each time you modify the values, these changes will appear in the log under "History of changes".
2. Select rows in the table (corresponding to tags) and apply Levey-Jennings for LCL and UCL. The lines will be highlighted in orange and the changes will appear in the log under "History of changes". The excluded rows are excluded from the calculus of Levey-Jennings for LCL and UCL.



3. Press “Ok” to apply the changes. These values will be added to the "Spec Limits" and "Control Limits" column properties of the corresponding tags. If there were already existing values for these properties, you will get a warning message asking you to confirm.

1.4.4.9 Control chart

You can view the control chart and switch between the various continuous digital tags.