

# Quick Tour

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# Weibull++

VERSION 2025

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***ReliaSoft***

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# Quick Tour of Weibull++

**Weibull++** offers the most comprehensive toolset available for **reliability life data analysis**, with support for all life data types and all commonly used product lifetime distributions.

**Accelerated Life Testing (ALTA)** and **Accelerated Life Testing PRO (ALTA PRO)** utilize powerful life-stress relationship models to design and analyze data from **accelerated life tests**.

**Reliability Growth (RGA)** supports all of the major **reliability growth models** and can analyze data from both developmental testing and fielded repairable systems. It also includes a comprehensive toolset for advanced reliability growth projections, planning and management.

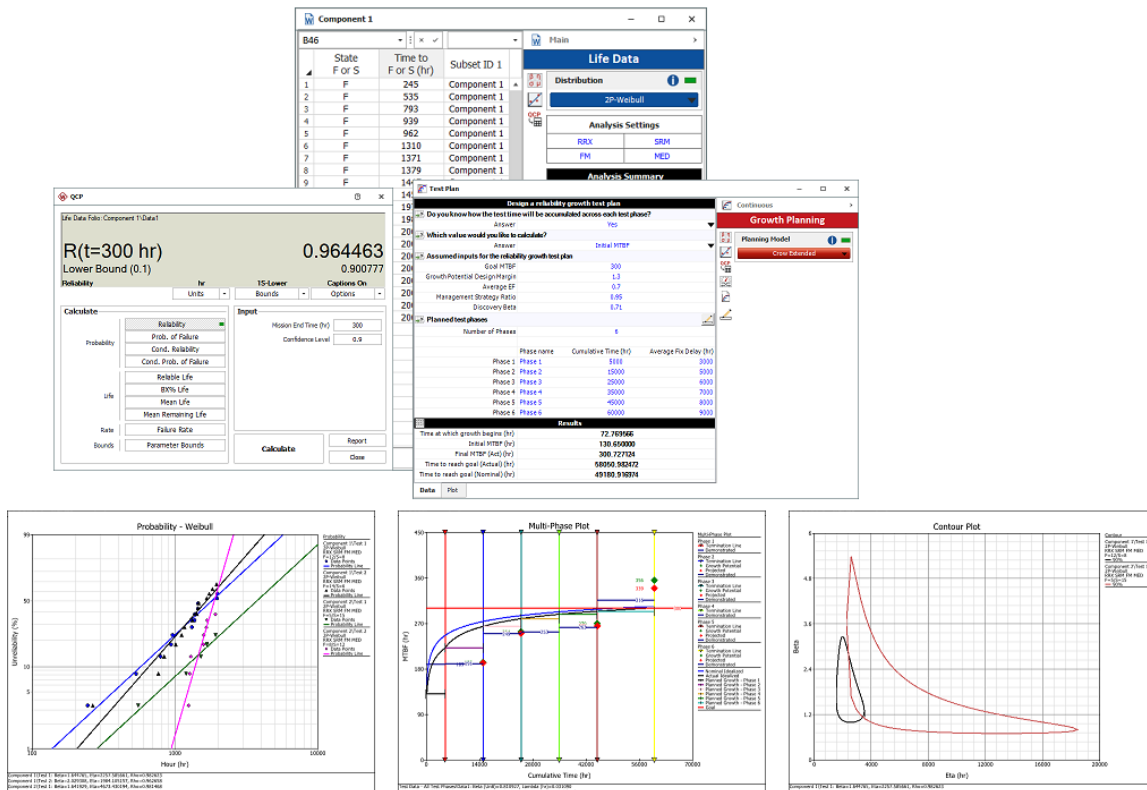
These applications are also packed with tools for related reliability analysis such as degradation data analysis, stress-strength comparison, reliability test design and design of experiments (DOE). In addition, Weibull++ also supports warranty data analysis, non-parametric data analysis and recurrent event data analysis.

For life data and life-stress data analysis, you can use this application to answer a wide variety of questions such as:

- How many units do you need to test? How much test time? At which stress levels?
- Will the product meet the reliability requirement?
- What is the influence of different failure modes? How does accelerated stress affect life?
- Which design (or supplier) will be more cost-effective over time?
- How many units are likely to be returned under warranty?
- Is there an emerging reliability problem in the field? With a particular supplier? In a particular region?
- When will a crack, wear, etc. degrade to the point of failure?
- What is the typical time to repair? How effective are the repairs?

For growth data analysis, you can use this application to answer a wide variety of questions, such as:

- Will the product meet the MTBF goal? How much test time is required?
- How does the product perform across different test phases? At which phase will the product meet the reliability requirement? What is the initial MTBF?
- How do the test data compare to the reliability growth test plan?
- What failure modes should be fixed and when?
- What is the optimum growth maintenance strategy? When is the best time to schedule maintenance/overhauls?



**Note:** For detailed examples for some common life data analysis features, refer to [https://help.reliasoft.com/weibull\\_quickstart/content/quickstart/quick\\_start\\_introduction.htm](https://help.reliasoft.com/weibull_quickstart/content/quickstart/quick_start_introduction.htm).

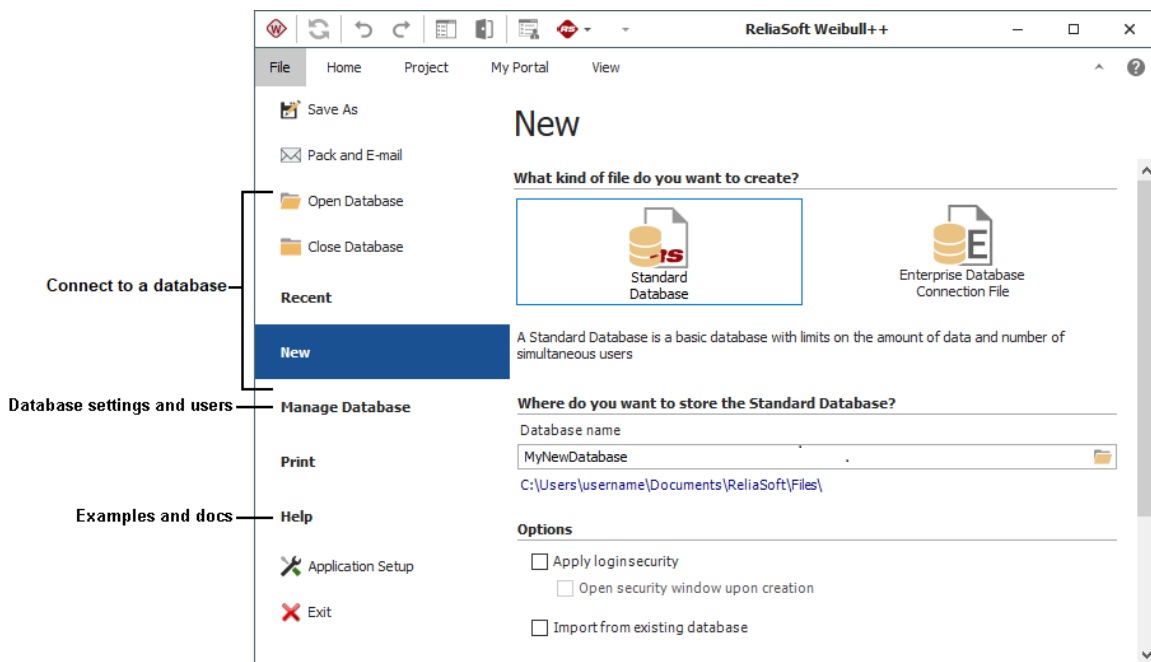
## Using Databases and Projects

### File Menu

Use commands on the **File** menu (**New**, **Recent** or **Open Database**) to create or open a database).

Each database supports simultaneous access by multiple users. If you have admin permissions, use **File > Manage Database** to control user access and manage configurable settings that apply throughout the database.

Use **File > Help** to access online help and shipped examples.

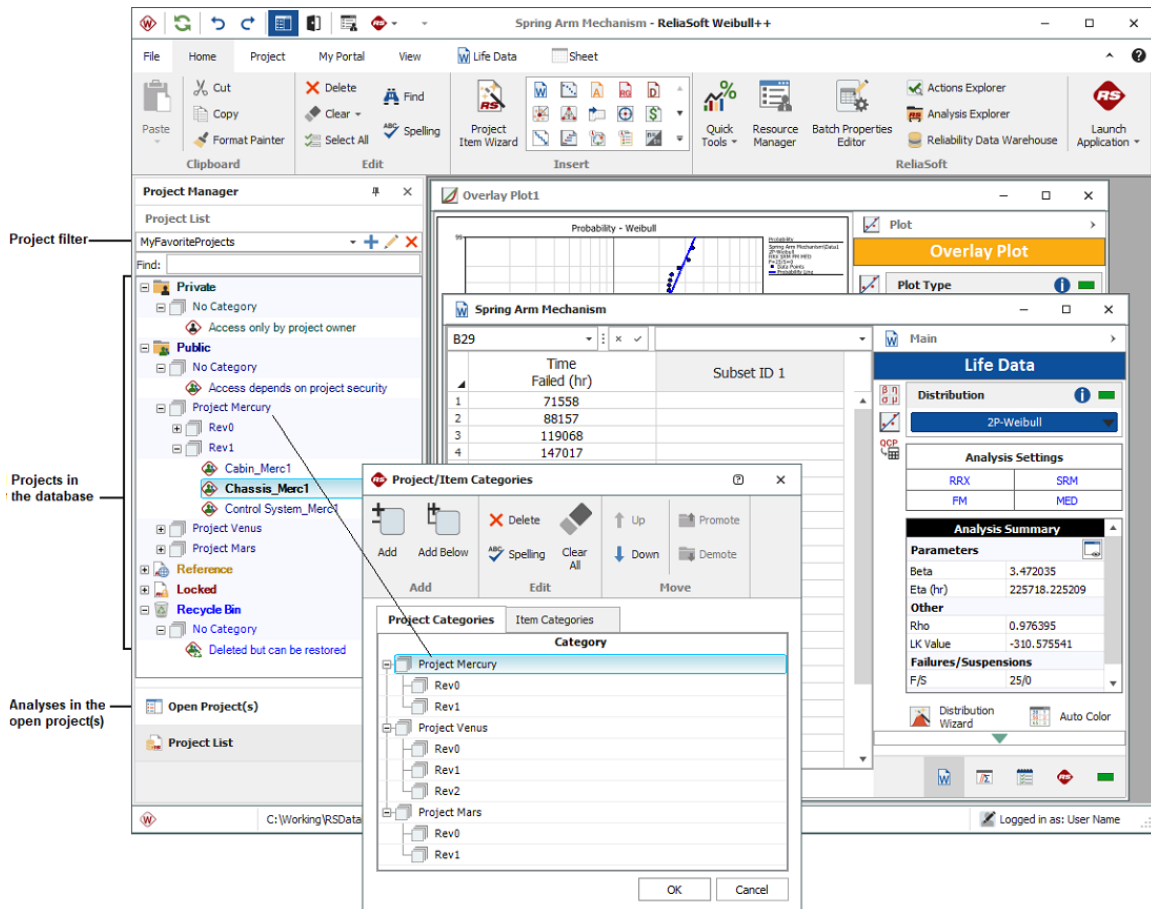


### Project List

Each database can contain multiple projects. Use the **project list** to create or open a project.

If you have a lot of projects:

- Use the **project filter** to limit what's displayed.
- Use the **project category** to group projects within the list.



## Current Project Explorer

Use the **current project explorer** to create or open analyses and reports.

You can open the same project in any ReliaSoft desktop application. Analyses and reports are visible only in the application(s) that can edit them:

- Life data folios are visible only in Weibull++
- Fault trees are visible only in BlockSim
- FMEAs are visible only in XFMEA/RCM++
- Etc.

Common features such as **resources** and **project attachments** are visible in all ReliaSoft desktop applications.



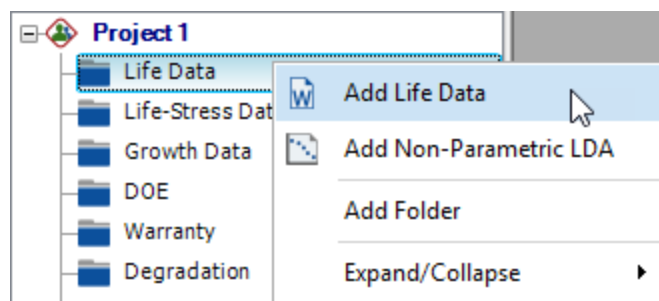
## Using Life Data Folios

Weibull++'s life data folio allows you to fit a statistical distribution to failure time data in order to understand the reliability performance of a product over time or to make projections about future behavior. From the analysis, you can obtain reliability information about a product such as probability of failure, reliability, mean life or failure rate.

The basic steps for using a life data folio are:

1. Add life data folio

Right-click the Life Data folder in the current project explorer and choose **Add Life Data**.



In the setup window, select the desired data type and the units for time/usage values (hours, cycles, etc.).

**Data Sheet Options**  
Specify the type of data that you will be entering into the folio for life data analysis.

**Data Type**

Times-to-failure data       Free-form (probit) data

**Units**  
Hour (hr)

**Options for the Times-to-Failure Data Type**

**My data contains units that did not fail (suspensions/right censored data)**  
Select this if your data set contains units that are being evaluated as having not failed.

**My data set contains units with an uncertain failure time (interval/left censored data)**  
Select this if your data set contains uncertainty as to exactly when a unit failed or was suspended within a specified interval. This allows you to specify the time frame in which each failure and/or suspension occurred.

**My data set contains rows that represent multiple units (Grouped data)**  
 Select this if your data set contains groups of units that contain the same time-to-failure and/or suspension times.

**Based on your selections, the data sheet will include these failure/suspension time columns:**

State F or S	Time to F or S
-----------------	-------------------

< Back    Next >    OK    Cancel

2. Enter data

Enter the data and use the control panel to specify the life distribution and analysis settings.

The screenshot displays the WEIBULL++ software interface. On the left, a data table is visible with the following columns: 'State F or S', 'Time to F or S (hr)', and 'Subset ID 1'. The data rows are as follows:


	State F or S	Time to F or S (hr)	Subset ID 1
1	F	16	prototype unit
2	F	34	prototype unit
3	F	53	prototype unit
4	F	75	prototype unit
5	F	93	prototype unit
6	F	120	prototype unit
7	S	120	prototype unit
8	S	120	prototype unit
9	S	120	prototype unit
10	S	120	prototype unit
11			
12			
13			
14			
15			

On the right, the 'Life Data' control panel is shown. It includes a 'Distribution' dropdown menu set to '2P-Weibull', an 'Analysis Settings' section with buttons for 'MLE', 'SRM', 'LRB', and 'MED', and a 'Not Analyzed' status bar. Below the control panel, there are tabs for 'Main' and 'Analysis', and a status bar at the bottom with various icons.

### 3. Analyze data

Click the **Calculate** icon on the control panel.



The Analysis Summary area displays the parameters of the distribution. Click the **Detailed Summary** icon  to view more information.

The screenshot shows the 'Life Data' analysis window in WEIBULL++ software. The window title is 'Main' and the main heading is 'Life Data'. The interface is divided into several sections:

- Distribution:** A dropdown menu is set to '2P-Weibull'.
- Analysis Settings:** A table with four options: MLE, SRM, LRB, and MED.
- Analysis Summary:** A table showing parameters and other statistics.
 

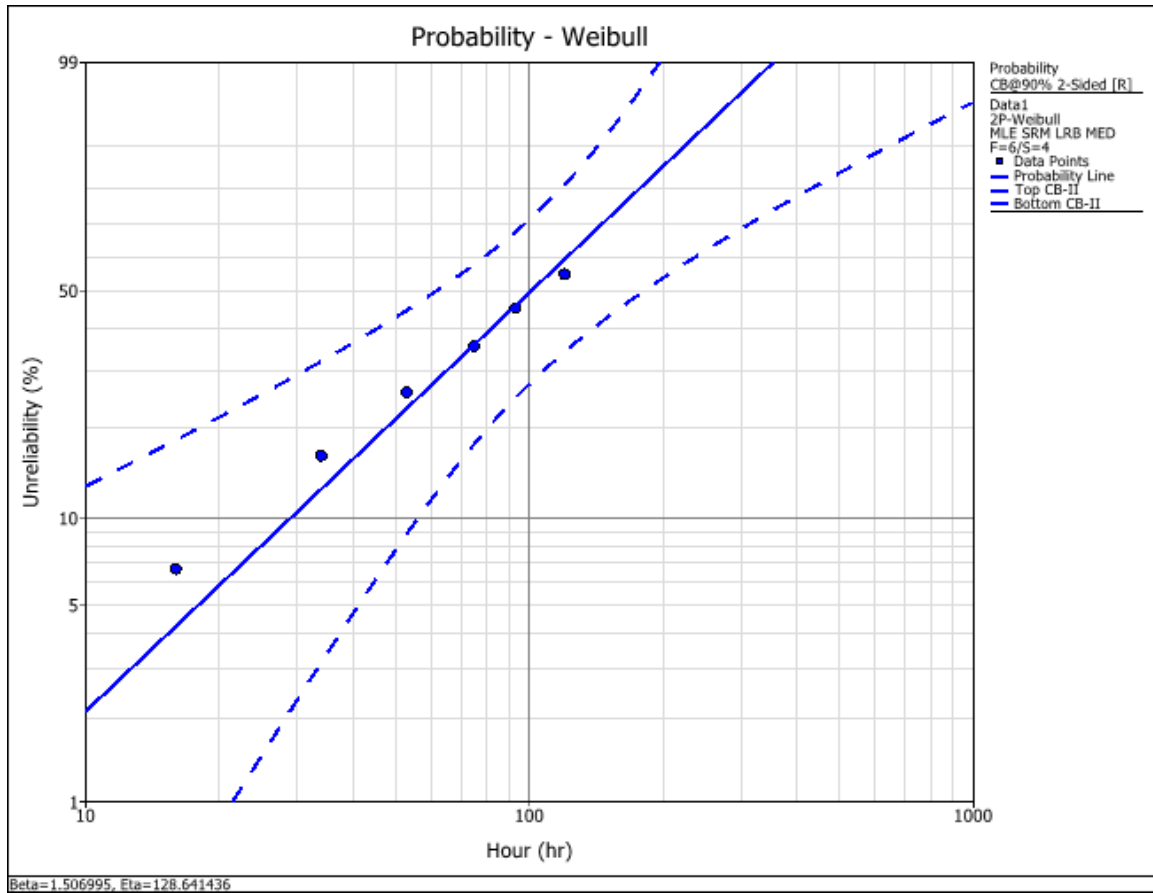
Parameters	
Beta	1.506995
Eta (hr)	128.641436
Other	
LK Value	-35.335766
Failures/Suspensions	
F/S	6/4
Comments	
- Control Panel:** A set of icons for 'Distribution Wizard', 'Alter Data Type', 'Change Units', 'Auto Color', and 'Batch Auto Run'.
- Bottom Bar:** A row of icons including a document icon, a plot icon, a list icon, a red 'F/S' icon, and a green status icon.

#### 4. View plots

Click the **Plot** icon on the control panel to open the plot sheet.



To show the confidence bounds, click the **Confidence Bounds** link on the plot's control panel, and then set the desired type of bounds and confidence level.



5. Calculate metrics

Click the **QCP** icon on the control panel to open the Quick Calculation Pad.



The following example shows the estimates for the reliability and the lower one-sided 90% confidence bound.

The screenshot shows the WEIBULL++ software interface. At the top, the window title is "QCP" and the file path is "Life Data Folio: Folio1\Data1". The main display area shows the reliability calculation results:  $R(t=60 \text{ hr}) = 0.728448$  and the Lower Bound (0.1) is 0.543195. Below the results, there are three dropdown menus: "Units" set to "hr", "1S-Lower Bounds" set to "1S-Lower", and "Captions On" set to "Options".

The interface is divided into two main sections: "Calculate" and "Input".

**Calculate Section:**

Probability	Reliability <input checked="" type="checkbox"/>
	Prob. of Failure
	Cond. Reliability
	Cond. Prob. of Failure
Life	Reliable Life
	BX% Life
	Mean Life
	Mean Remaining Life
Rate	Failure Rate
Bounds	Parameter Bounds

**Input Section:**

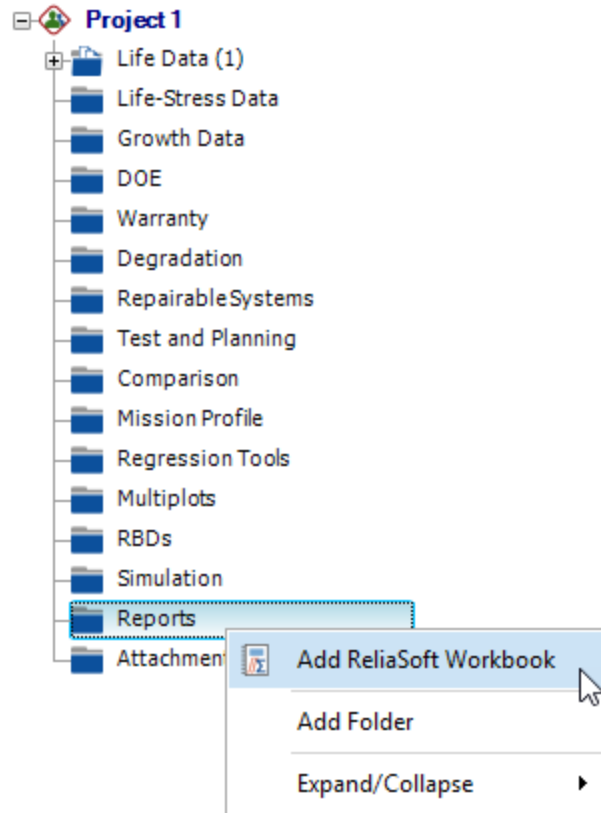
Mission End Time (hr)

Confidence Level

Buttons: **Calculate**, Report, Close

6. Create report

Right-click the Reports folder in the current project explorer and choose **Add ReliaSoft Workbook**.



In the ReliaSoft Workbook wizard, select the folio as the default data source. If desired, you can also select a standard or user-defined report template (e.g., the "Weibull Summary Style 1 Template" is shown below).

The screenshot displays the WEIBULL++ 2025 software interface. The main window shows a spreadsheet titled "Basic Report Sample" with the following data:

Analysis Settings				
<b>Distribution</b>	Weibull 2P			
<b>Method Used:</b>	MLE			
<b>Confidence Limits:</b>	Lower	5.00%	Upper	95.00%
<b>Method for CL:</b>	Likelihood Ratio		2-Sided	90.00%
Estimates and Confidence Bounds for Distribution Parameters				
	Parameter	Estimate	Lower Limit	Upper Limit
	Beta	1.506994639	0.758399828	2.607276213
	Eta	128.6414361	84.69230273	257.5742323
Selected Metrics				
	Parameter	Estimate	Lower Limit	Upper Limit
	Mean	116.0654733	74.6168519	220.866107
	Median	100.8688464	61.78887984	181.1700023
	B10	28.89727771	7.191877701	55.99633019



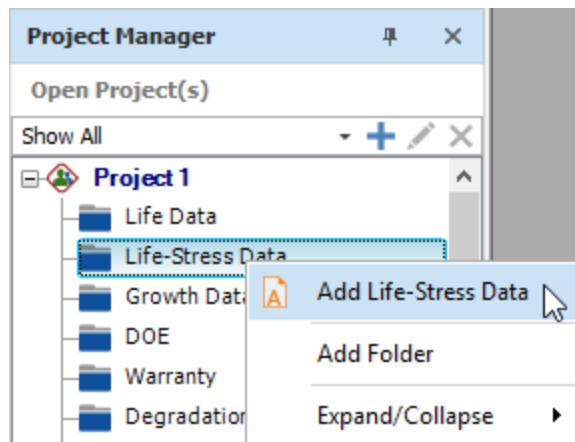
## Using Life-Stress Data Folios

Weibull++'s life-stress data folio allows you to perform quantitative accelerated life testing data analysis. In this analysis, you extrapolate a product's failure behavior at normal conditions from life data obtained at accelerated stress levels. Since products fail more quickly at accelerated stress levels, the analysis allows you to obtain reliability information about a product (e.g., mean life, probability of failure at a specific time, etc.) in a shorter time.

The basic steps for using a life-stress data folio are:

1. Add life-stress data folio

Right-click the Life-Stress Data folder in the current project explorer and choose **Add Life-Stress Data**.



In the setup window, select the desired censoring type and units for time/usage values (hours, cycles, etc.).

**ALTA Folio Data Sheet Setup**

**Data Sheet Options**  
Specify the type of data that you will be entering into the folio for life-stress analysis.

**Data Type**

Times-to-failure data       Free-form (probit) data

**Units**  
Hour (hr)

**Options for the Times-to-Failure Data Type**

**My data contains units that did not fail (suspensions/right censored data)**  
Select this if your data set contains units that are being evaluated as having not failed.

**My data set contains units with an uncertain failure time (interval/left censored data)**  
Select this if your data set contains uncertainty as to exactly when a unit failed or was suspended within a specified interval. This allows you to specify the time frame in which each failure and/or suspension occurred.

**My data set contains rows that represent multiple units (Grouped data)**  
**i** Select this if your data set contains groups of units that contain the same time-to-failure and/or suspension times.

**Based on your selections, the data sheet will include these failure/suspension time columns:**

State F or S	Time to F or S
-----------------	-------------------

< Back      Next >      OK      Cancel

On the next page, define the stress type(s) to use in the analysis and the use stress level.

ALTA Folio Data Sheet Setup
✕

**Select Stress Columns**

Define the stress columns that will appear in the data sheet, and specify the use stress level(s). The following table contains some commonly used stress types, but you can change any of the labels (e.g., if your vibration values use meters per second squared instead of hertz, you can change Hz to m/s<sup>2</sup>).

**Define Stress Columns and Use Stress Levels**

	Stress Name	Stress Units	Use Level
<input checked="" type="checkbox"/>	Temperature	K	298
<input type="checkbox"/>	Voltage	V	100
<input type="checkbox"/>	Humidity	RH	50
<input type="checkbox"/>	Vibration	Hz	25
<input type="checkbox"/>	Temperature	R	580
<input type="checkbox"/>	Mechanical	kips	25
<input type="checkbox"/>	<Stress name>	<Stress units>	10
<input type="checkbox"/>	<Stress name>	<Stress units>	10

**Based on your selections, the data sheet will also include these stress columns:**

Temperature  
K

< Back
Next >
OK
Cancel

2. Enter data

Enter the data and use the control panel to specify the life-stress model.

The screenshot displays the WEIBULL++ software interface. On the left, a data table is shown with columns for State (F or S), Time to F or S (hr), Temperature (K), and Subset ID 1. The data is as follows:


	State F or S	Time to F or S (hr)	Temperature K	Subset ID 1
1	F	105	313	
2	F	170	313	
3	F	224	313	
4	F	278	313	
5	S	350	313	
6	S	350	313	
7	S	350	313	
8	F	38	328	
9	F	62	328	
10	F	82	328	
11	F	103	328	
12	F	128	328	
13	F	165	328	
14				
15				

On the right, the 'Main' control panel is visible, titled 'Life-Stress Data'. It includes a 'Model' section with a dropdown menu set to 'Arrhenius-Weibull'. Below this are links for 'Select Stress Columns...', 'Stress Transformation...', and 'Set Use Stress...'. A 'Not Analyzed' status is displayed, along with a 'Comments' field. At the bottom of the control panel, there is a 'Calculate' icon (a square with a diagonal line) and other icons for data, analysis, and help.

### 3. Analyze data

Click the **Calculate** icon on the control panel.



The Analysis Summary area displays the parameters of the distribution. Click the **Detailed Summary** icon  to view more information.

**Life-Stress Data**

Model: Arrhenius-Weibull

[Select Stress Columns...](#)  
[Stress Transformation...](#)  
[Set Use Stress...](#)

Analysis Summary	
<b>Parameters</b>	
Beta	2.282545
B (K)	8245.573645
C (hr)	1.296656E-09
<b>Activation Energy</b>	
Ea (eV)	0.710548
<b>Scale Parameter (at Use Stress)</b>	
Eta (hr)	1347.806035
<b>Other</b>	
LK Value	-58.425859
<b>Use Stress</b>	
Temperature	298
<b>Failures/Suspensions</b>	
F/S	10/3
<b>Comments</b>	

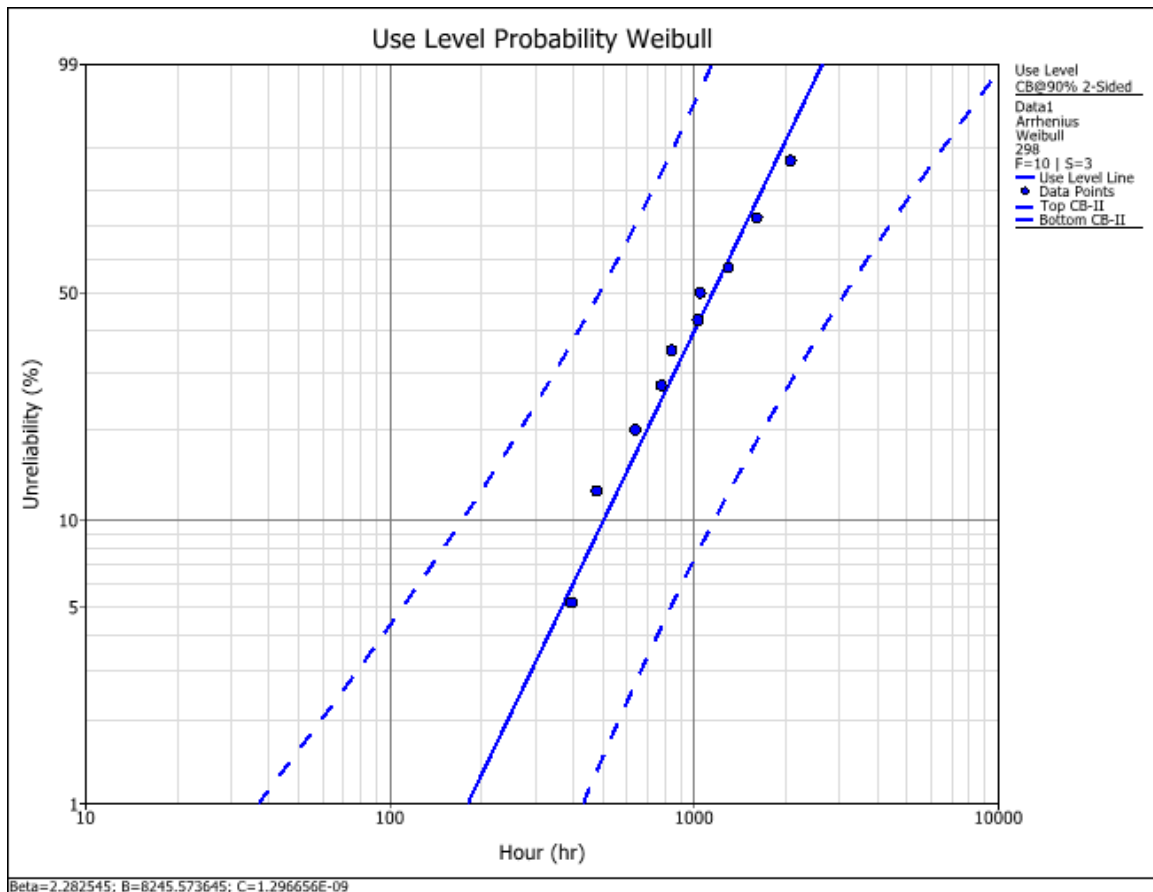
Distribution Wizard     Change Units  
 Alter Data Type     Likelihood Ratio Test  
 Add/Remove Columns     Transfer To Weibull

#### 4. View plots

Click the **Plot** icon on the control panel to open the plot sheet.



To show the confidence bounds, click the **Confidence Bounds** link on the plot's control panel, and then set the desired type of bounds and confidence level.




5. Calculate metrics

Click the **QCP** icon on the control panel to open the Quick Calculation Pad.



The following example shows the estimates for reliability and the lower one-sided 90% confidence bound.

 QCP
?
×

Life-Stress Data Folio: Folio1\Data1

R(t=300 hr)
0.968113

Lower Bound (0.1)
0.842874

Reliability
hr
1S-Lower
Captions On

Units ▾

Bounds ▾

Options ▾

**Calculate**

	Reliability <span style="float: right;">■</span>
Probability	Prob. of Failure
	Cond. Reliability
	Cond. Prob. of Failure
	Reliable Life
Life	BX% Life
	Mean Life
	Mean Remaining Life
	Failure Rate
Rate	Acceleration Factor
Acceleration	Parameter Bounds
Bounds	

**Input**

Stress

Mission End Time (hr)

Confidence Level

298 ▾

300

0.9

Calculate

Report

Close

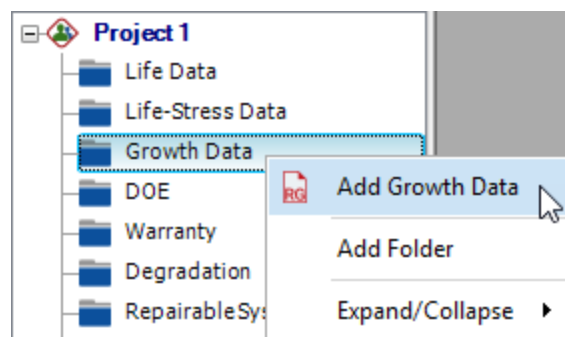
## Using Growth Data Folios

Weibull++'s growth data folio supports traditional reliability growth analysis, repairable systems analysis and reliability growth projections. The data type you select determines the type of analysis you can perform.

The basic steps for using a growth data folio are:

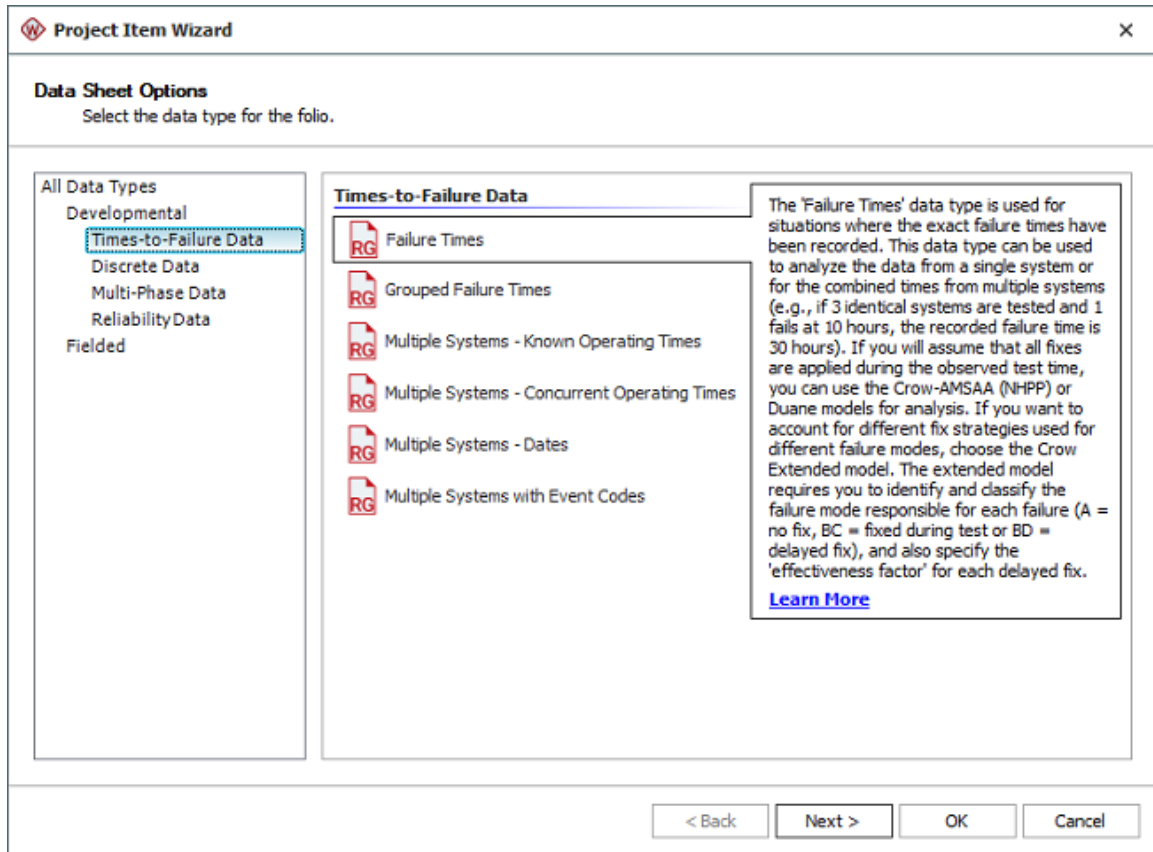
1. Add growth data folio

Right-click the Growth Data folder in the current project explorer and choose **Add Growth Data**.



In the setup window, select the desired data type. Then click **Next** to set the units for values (hours, cycles, etc.) and other preferences.





2. Enter data

Enter the data and use the control panel to specify the growth model and analysis settings.


The screenshot displays the WEIBULL++ software interface. On the left, a data table with 20 rows and 2 columns is shown. The first column is labeled 'Time to Event (hr)' and the second is 'Comments'. The data points are: (1, 0.7), (2, 3.7), (3, 13.2), (4, 17.6), (5, 54.5), (6, 99.2), (7, 112.2), (8, 120.9), (9, 151), (10, 163), (11, 174.5), (12, 191.6), (13, 282.8), (14, 355.2), (15, 486.3), (16, 490.5), (17, 513.3), (18, 558.4), (19, 678.1), and (20, 688). A red box highlights the last row with the text 'Note: Complete data set is not shown.' Below the table is a 'Data1' tab. On the right, a control panel titled 'Growth Data' is visible. It includes a 'Model' section with a dropdown menu set to 'Crow-AMSA (NHPP)'. Below that is a 'Calculation Options' section with radio buttons for 'Standard' (selected) and 'Change of Slope'. There are also buttons for 'MLE', 'Crow', 'No Gap', and 'Cumulative'. A 'Failure Terminated' button is at the bottom of the panel. The interface also shows a 'Main' window and an 'Analysis' window.


	Time to Event (hr)	Comments
1	0.7	
2	3.7	
3	13.2	
4	17.6	
5	54.5	
6	99.2	
7	112.2	
8	120.9	
9	151	
10	163	
11	174.5	
12	191.6	
13	282.8	
14	355.2	
15	486.3	
16	490.5	
17	513.3	
18	558.4	
19	678.1	
20	688	

### 3. Analyze data

Click the **Calculate** icon on the control panel.



The Analysis Summary area displays the parameters of the growth model. Click the **Detailed Summary** icon  to view more information.

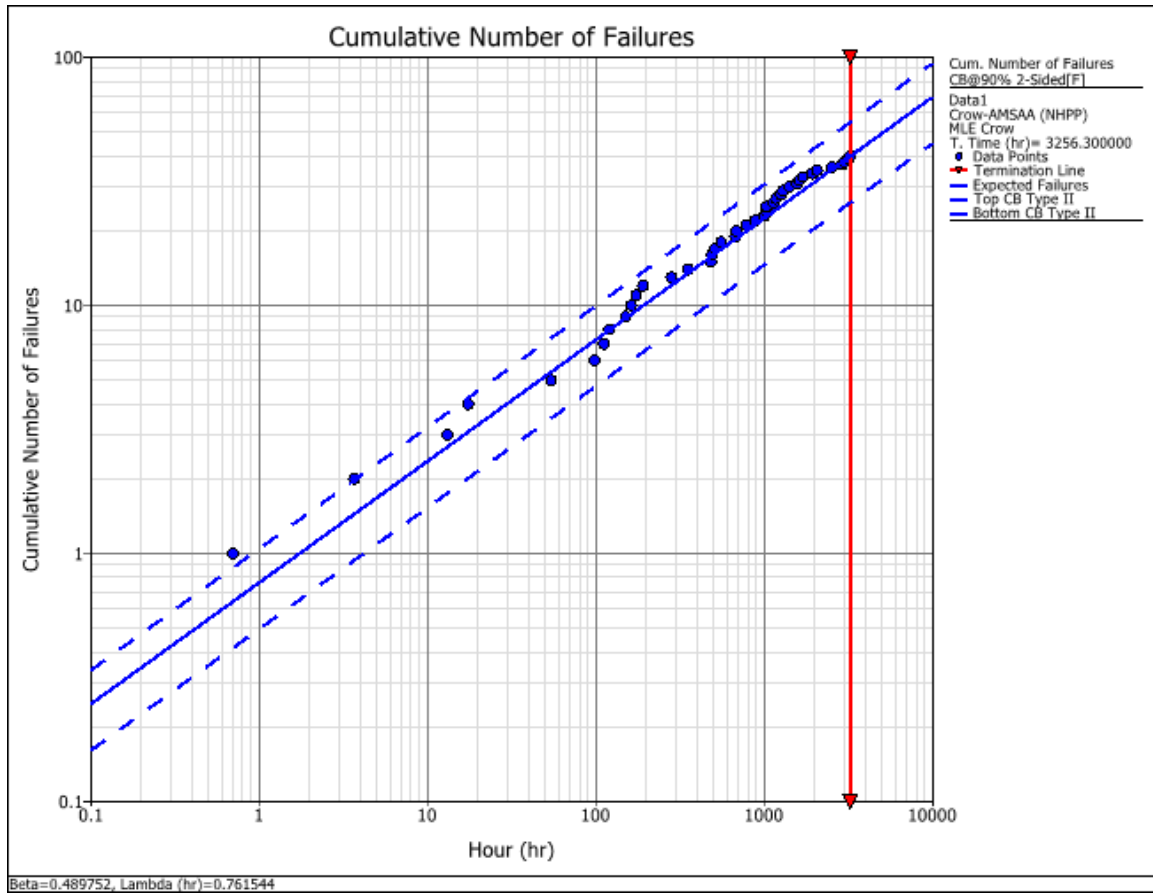
Results	
<b>Parameters</b> 	
Beta	0.489752
Lambda (hr)	0.761544
Growth Rate	0.510248
DMTBF (hr)	166.221749
DFI	0.006016
<b>Statistical Tests</b>	
Significance Level	0.1
CVM	Passed
<b>Other</b>	
Termination Time (hr): 3256.300000	

#### 4. View plots

Click the **Plot** icon on the control panel to open the plot sheet.



To show the confidence bounds, right-click the plot, choose **Show Confidence Bounds**, and then set the desired type of bounds and confidence level.



5. Calculate metrics

Click the **QCP** icon on the control panel to open the Quick Calculation Pad.



The following example shows the instantaneous MTBF with the lower one-sided 90% confidence bound.

QCP
?
×

Folio1\Data1

# IMTBF(t=32...

Lower Bound (0.1)

**Instantaneous MTBF**

# 166.221749 hr

131.212225 hr

Units ▼  
 hr

1S-Lower  
 Bounds ▼

Captions On  
 Options ▼

**Calculate**

Cumulative	<input type="button" value="MTBF"/>	<input type="button" value="Failure Intensity"/>
Instantaneous	<input checked="" type="checkbox"/> <input type="button" value="MTBF"/>	<input type="button" value="Failure Intensity"/>
Time (hr)	<input type="text" value="Time Given:"/>	
Failures	<input type="text" value="Number of Failures"/>	
Bounds	<input type="text" value="Parameter Bounds"/>	

**Input**

Time (hr)	<input type="text" value="3256.3"/>
Confidence Level	<input type="text" value="0.9"/>

**Calculate**

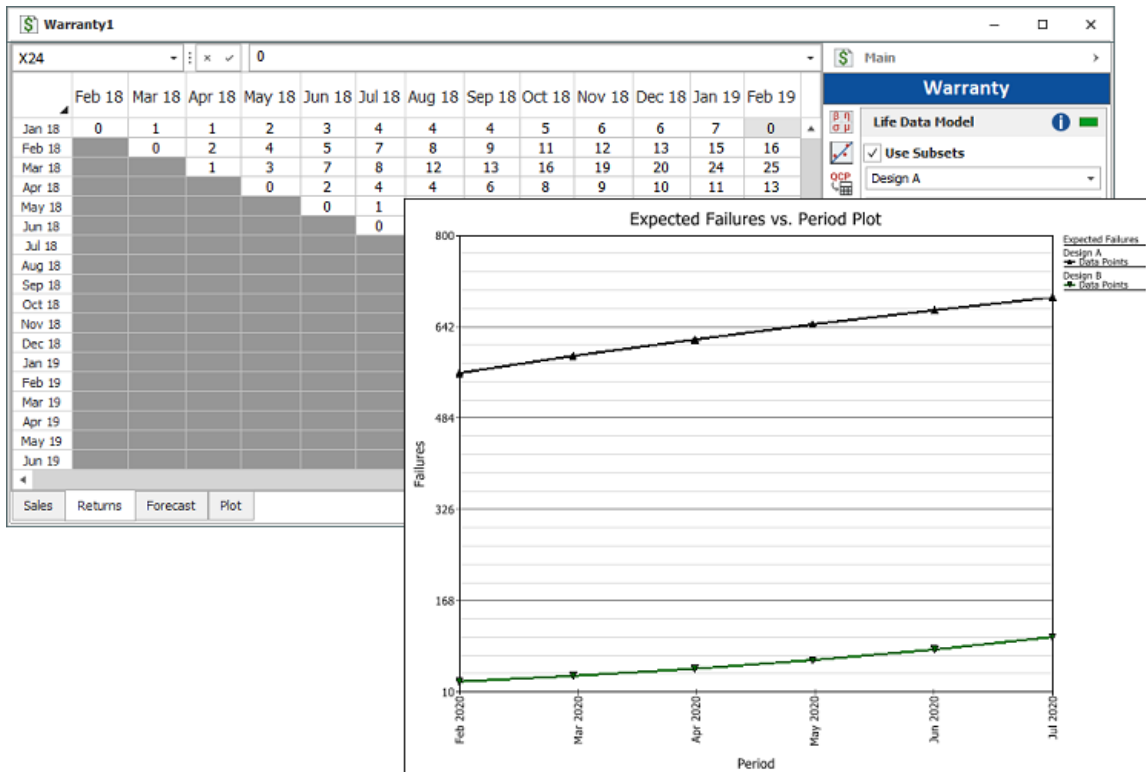
Report

Close

## More Analyses and Tools

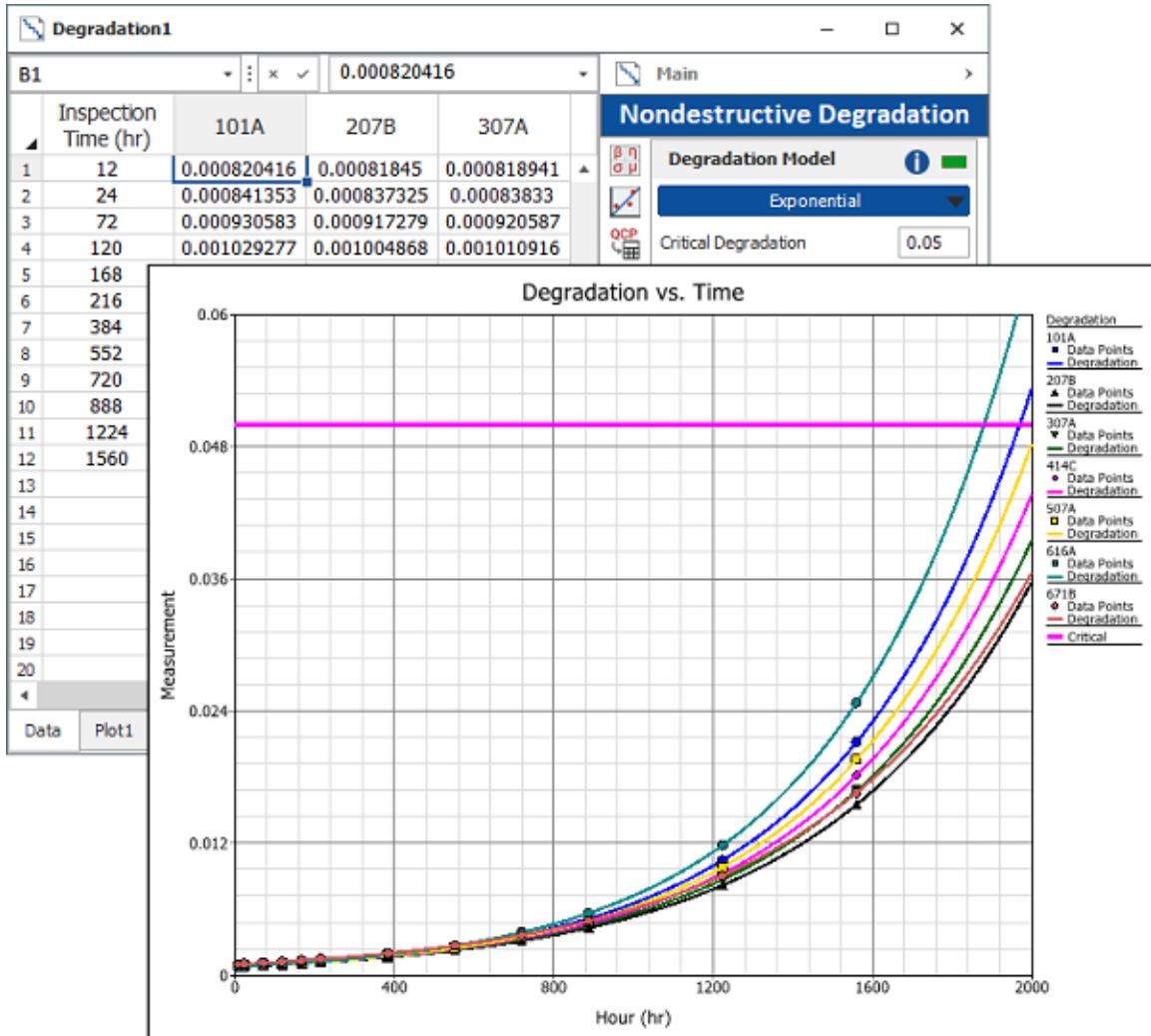
### Warranty Data Analysis

For life data analysis, the warranty folio offers a choice of 4 data entry formats that use sales and returns data to predict future returns under warranty: Nevada, Times-to-Failure, Dates of Failure and Usage.



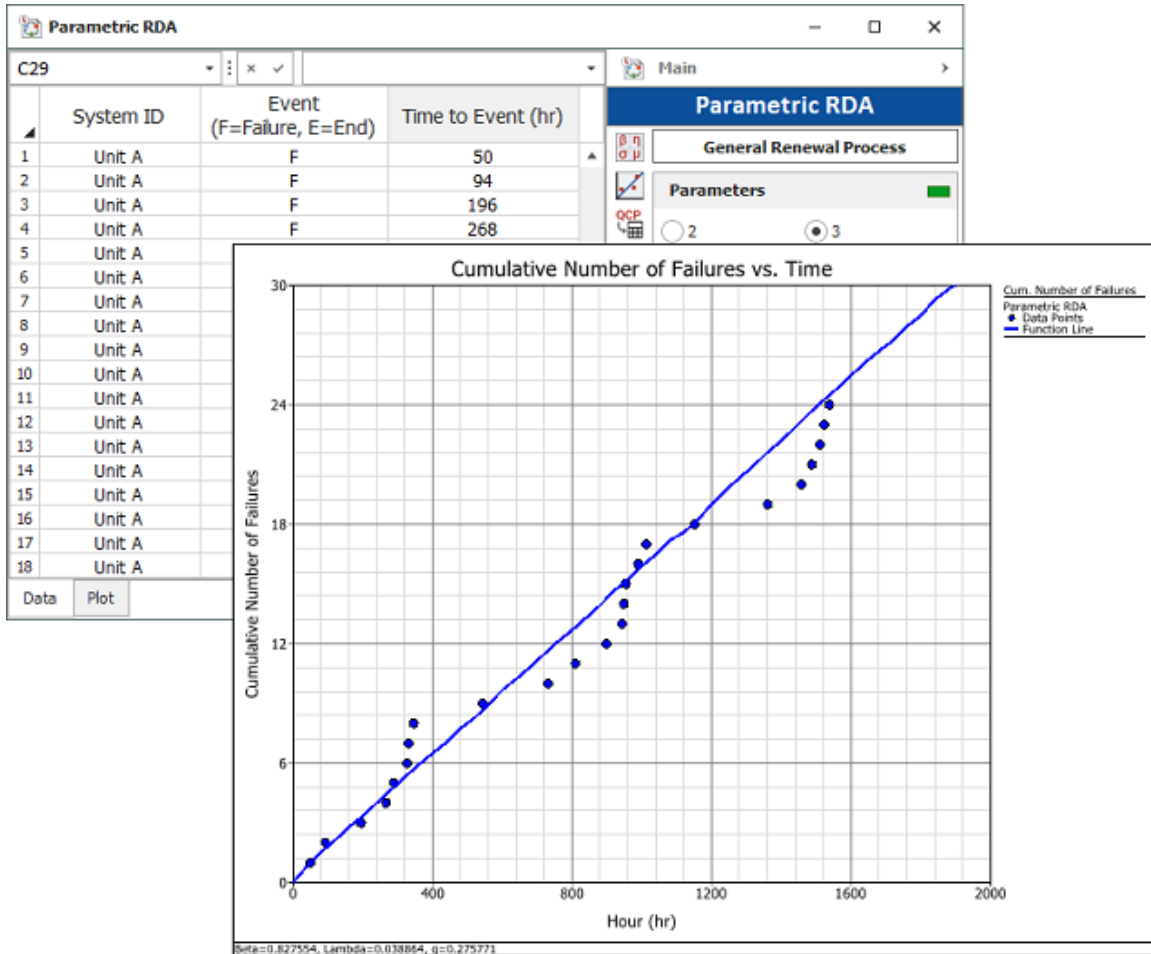
## Degradation

For life data and life-stress analyses, the degradation folio extrapolates expected failure times based on how a performance measure (e.g., crack propagation, tread depth, vibration) has degraded over time.



## Recurrent Event Data Analysis

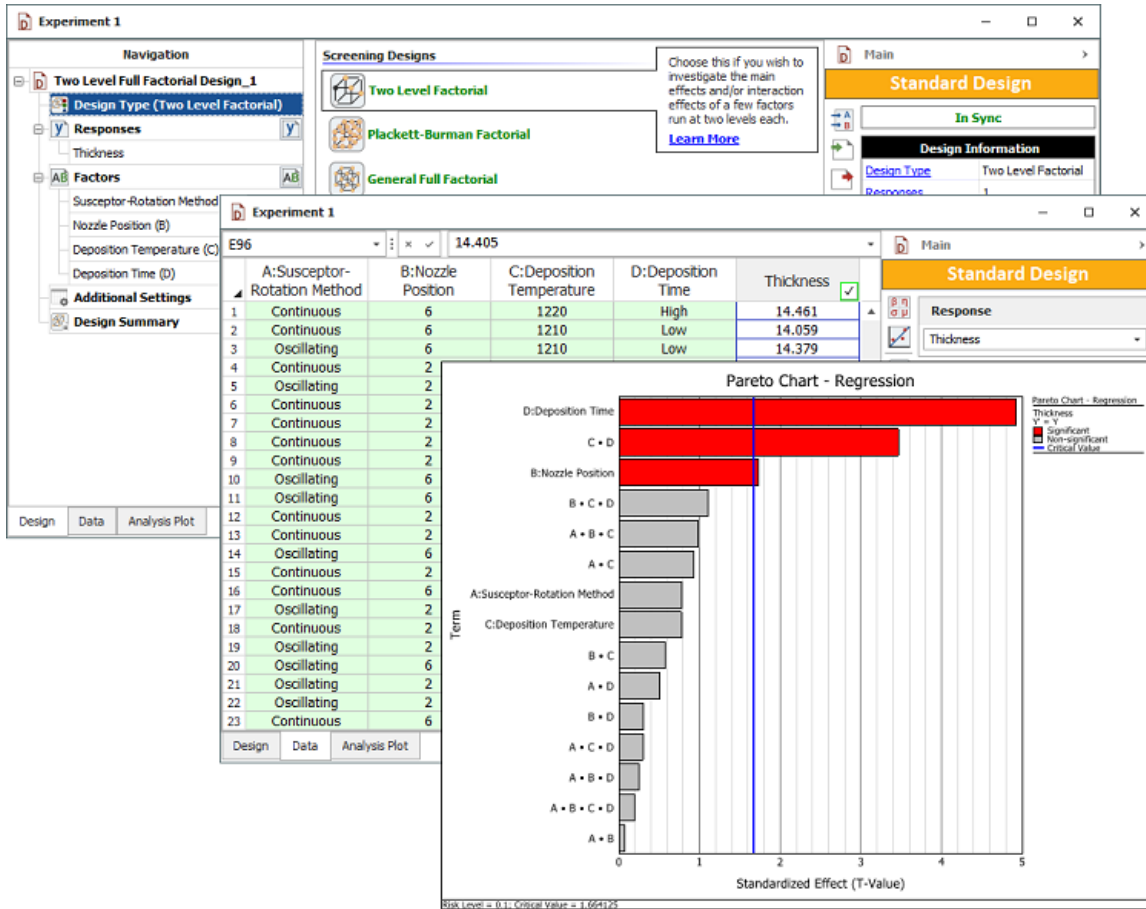
For life data analysis, the non-parametric RDA folio uses the Mean Cumulative Function to plot the average number of recurring failures over a given period of time. The parametric RDA folio uses the General Renewal Process (GRP) model, which considers the effectiveness of repairs, to model the cumulative number of failures over time.





## Design of Experiments

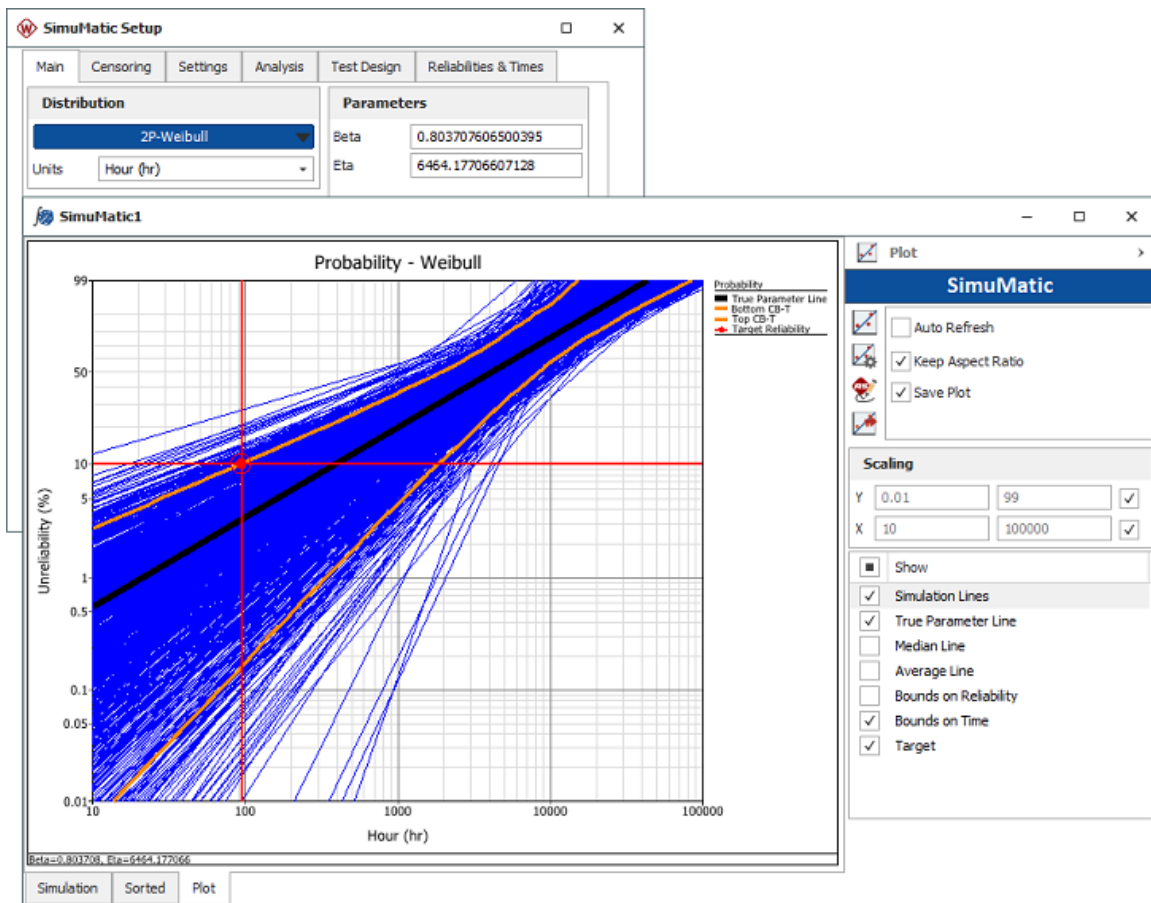
A set of design folios provide techniques for DOE analyses such as identifying key factors that affect performance (standard design), minimizing a system's sensitivity to noise (robust design) and determining the best proportion of components in a mixture (mixture design).



## Monte Carlo Data Generation and SimuMatic

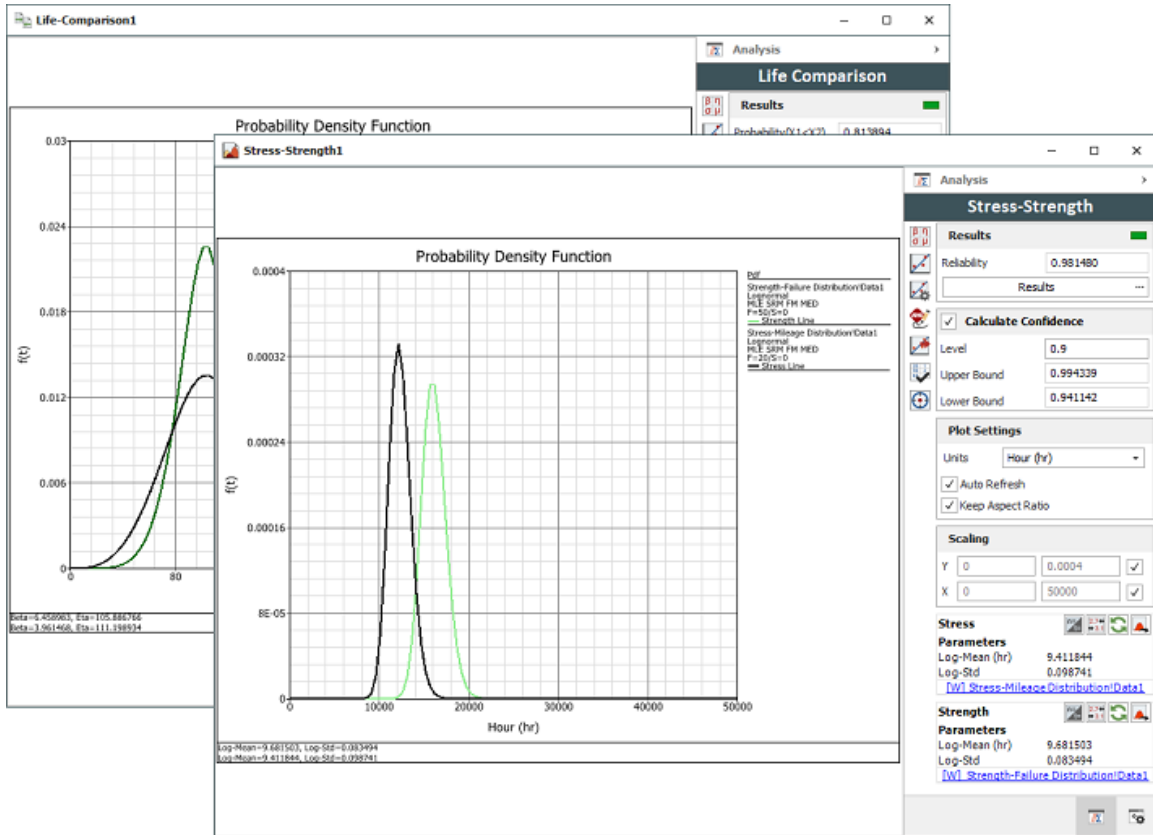
For life data and life-stress data analyses, the Monte Carlo utility generates a data set based on a specified probability distribution. SimuMatic performs analyses on a large number of simulated data sets, based on a specified probability distribution. For growth data analysis, the Monte Carlo utility generates a data set based on the Crow-AMSAA model, with specified beta and lambda parameters while SimuMatic performs analyses on a large number of simulated data sets, based on the Crow-AMSAA model.

The life data versions look like this:



## Comparison Folios

The life comparison folio determines the probability that the life of one population will be greater or less than that of the second. The stress-strength analysis folio determines the probability of failure based on the probability of stress exceeding strength.



## Test Design

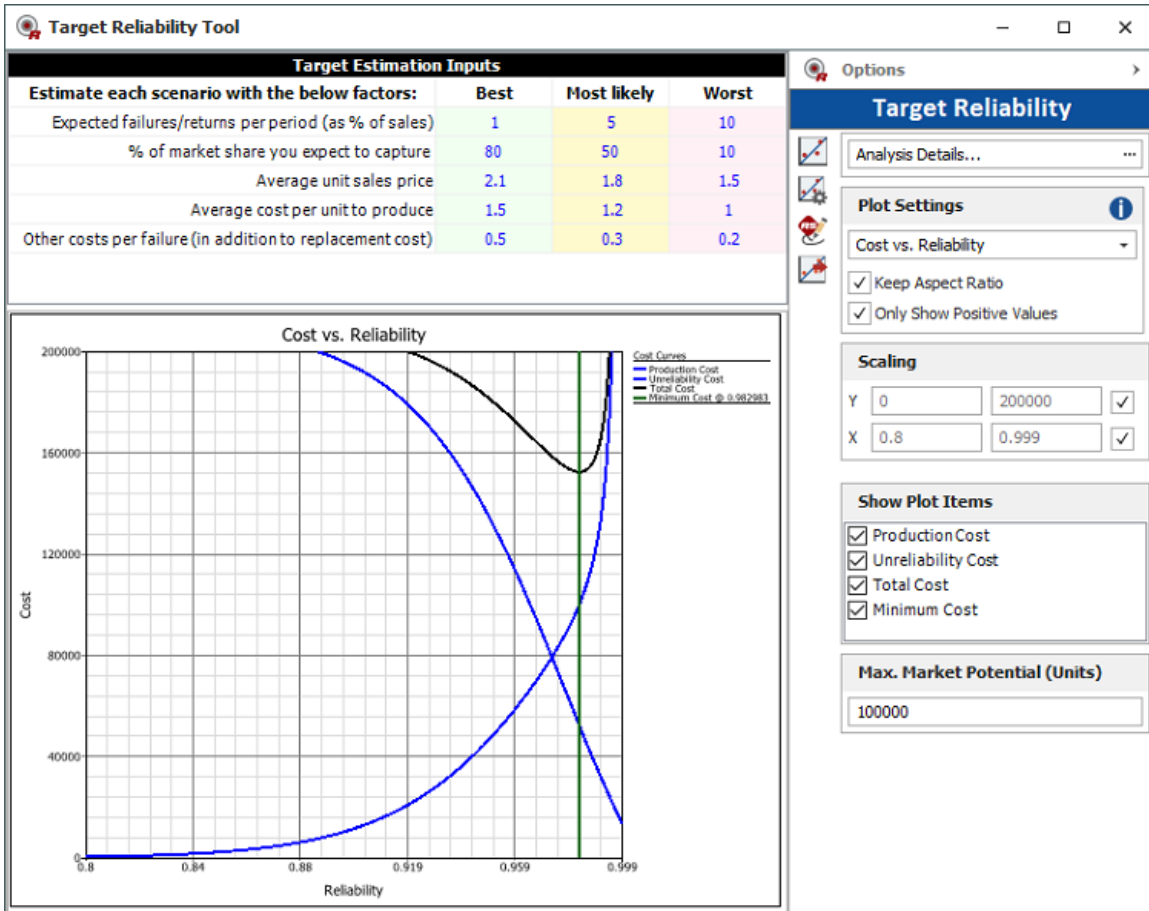
For life data analysis, Weibull++ offers a choice of tools to assist with reliability test design: Reliability Demonstration Test (Parametric Binomial, Non-Parametric Binomial, Exponential Chi-Squared or Non-Parametric Bayesian), Expected Failure Times Plot and Difference Detection Matrix. For growth data analysis, the Test Design folio uses the non-homogeneous Poisson process (NHPP) to design a demonstration test for repairable systems by solving for either the test time required per system or the number of systems that must be tested.

The screenshot displays the 'Test Design Folio1' window, which is a central hub for reliability test design. It features several key components:

- Design 1 Mean Life Table:** A table with 'Design 2 Mean Life' on the y-axis (300 to 2400) and 'Design 1 Mean Life' on the x-axis (300 to 3000). The cells are colored red and black, representing different test outcomes.
- Expected Failure Times Plot:** A graph titled 'Units vs. Time' showing a curve representing the expected failure times.
- Parametric Binomial Test Design Panel:**
  - What metric would you like to demonstrate?** Metric: Reliability value at a specific time. Demonstrate this reliability (%): 90. With this confidence level (%): 90. At this time (hr): 100.
  - Assume the failure rate behavior is governed by this distribution:** Distribution: 2P-Weibull. With this Beta: 2.
  - Solve for this value:** Value: (blank). With this test time (hr): (blank). With a maximum of this many failures: (blank).
  - Results:** Sample size: (blank).
  - Notes:** This is based on both the assumed failure specified distribution and the specified ac...
  - Buttons:** RDT 1, Table of RDT 1, Plot of RDT 1.
- Test Design Assistant:** A dialog box titled 'Select Test Design' with the instruction 'Specify the type of test you would like to perform.' It offers three options:
  - Reliability Demonstration Test Design:** Explore different reliability demonstration test design options. Use the tool to determine the number of units and/or test time required to demonstrate a specified target reliability.
  - Expected Failure Times Plot**
  - Difference Detection Matrix**
- Test Design Method Panel:**
  - Test Design Method:** Parametric Binomial.
  - Input:** Units: Hour (hr). Acceleration Factor: 1.
- Expected Failure Time Panel:**
  - Expected Failure Time:** Results... (dropdown)
  - Plot Setup:** Sample Size: 5. Two-Sided Confidence (%): 90. Acceleration Factor: 1. Actual Failures: (dropdown).
  - Expected Failure Model:** WB2 (2, 500).
  - Plot Options:**  Keep Aspect Ratio,  Auto Refresh.
  - X-Axis Scaling:**  Linear,  Logarithmic.
  - Scaling:** Y: 0, 6 (checked). X: 0, 1200.

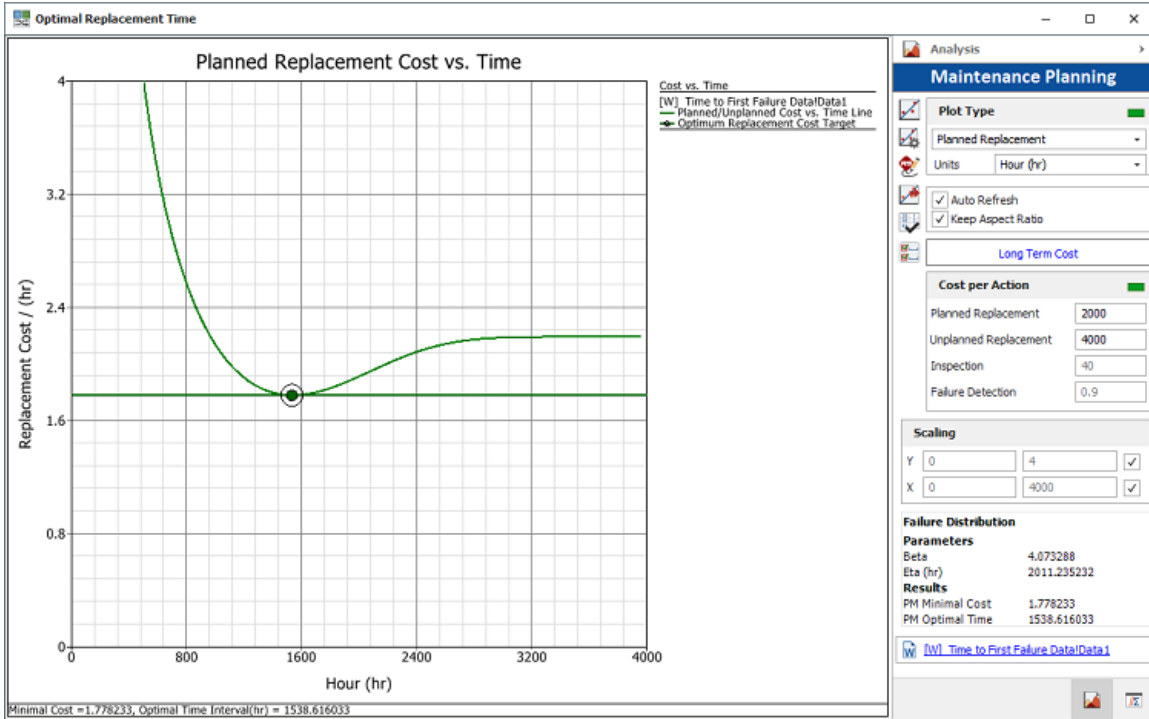
## Target Reliability Planner

For life data analysis, the Target Reliability folio finds the optimum cost and reliability of a product, given estimates for various factors involved in the product’s production and sale.



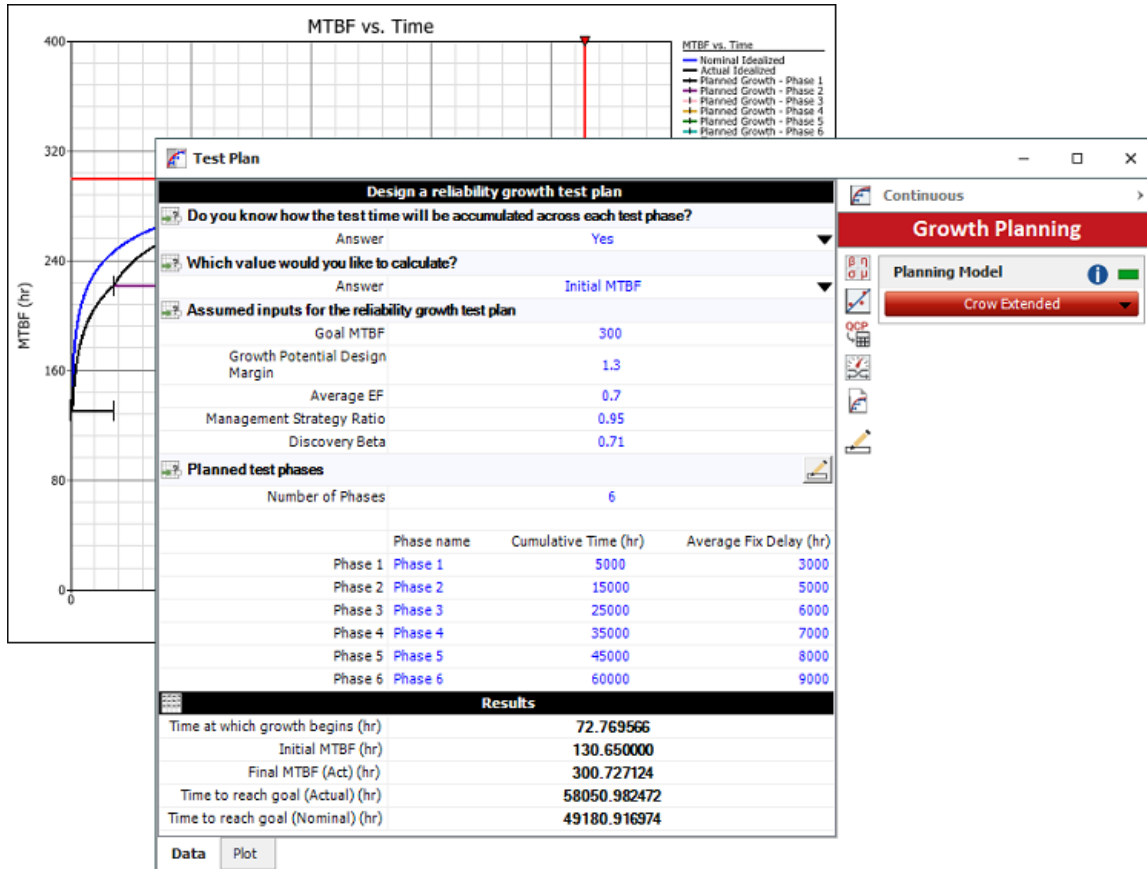
## Maintenance Planning

For life data analysis, the Maintenance Planning folio uses the optimum replacement age model to determine the most cost-effective time to replace aged components.



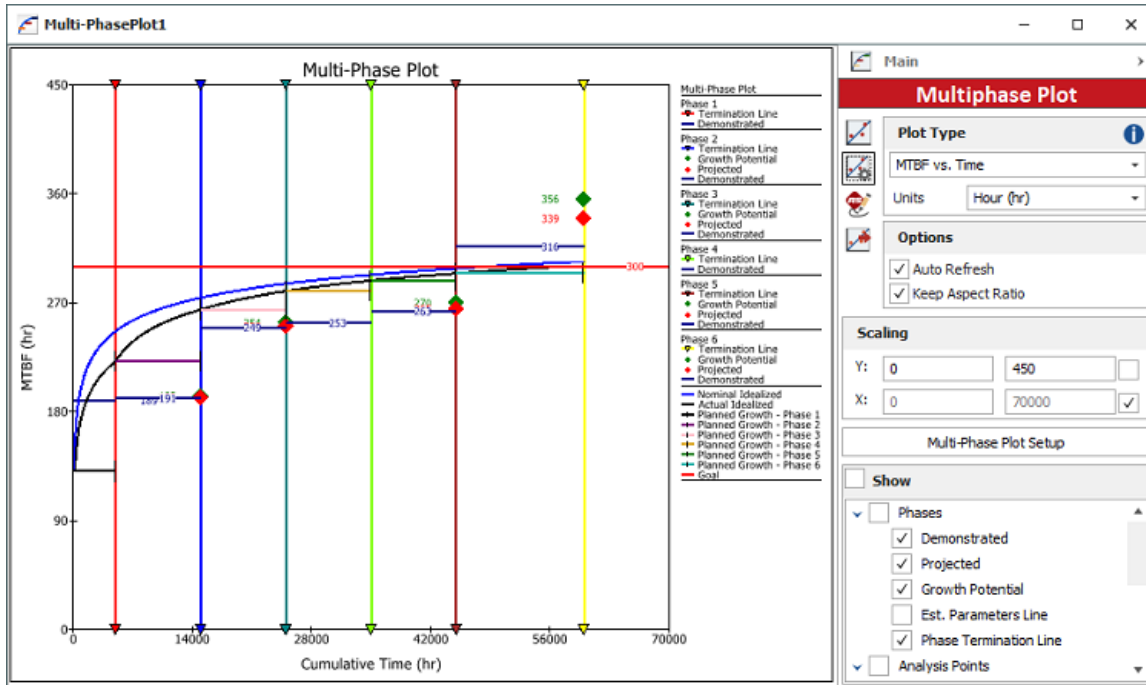
## Growth Planning

For growth data analysis, the growth planning folio helps you to create a multi-phase reliability growth testing program that is designed to achieve a specific MTBF or reliability goal.



## Multi-Phase Plot

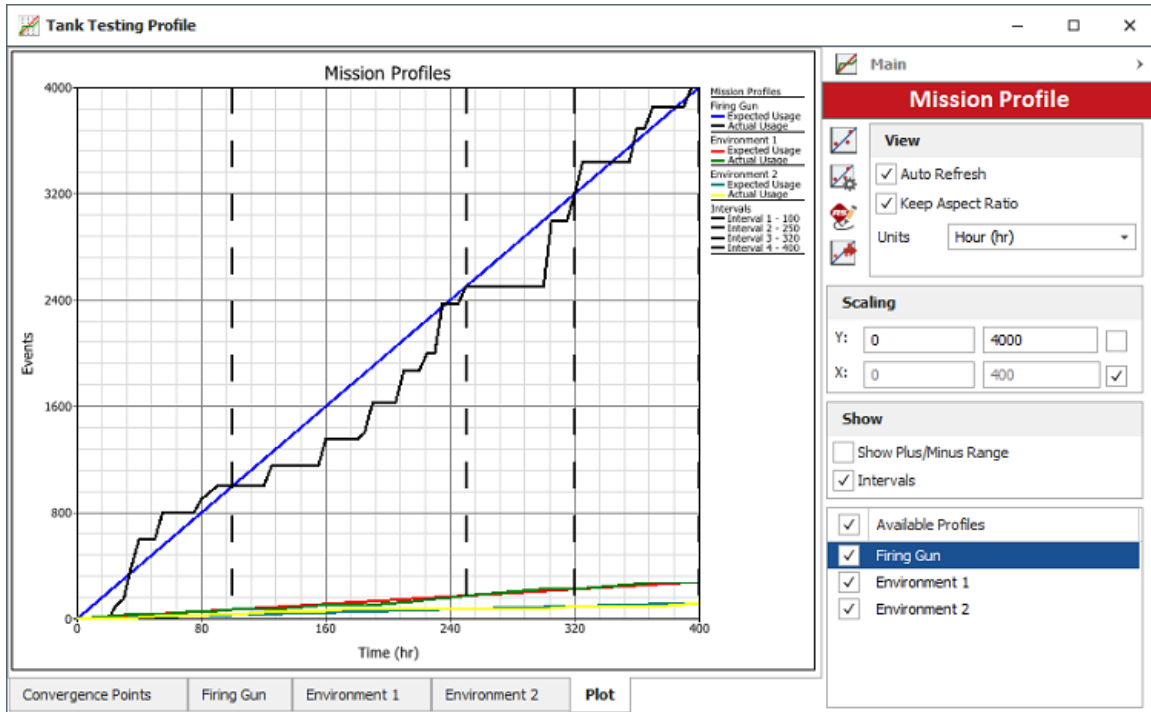
For growth data analysis, the multi-phase plot displays actual test results (e.g., demonstrated, projected and growth potential MTBF or failure intensity) across multiple analysis points and/or test phases. It can be linked to a growth planning folio to compare actual test results against the test plan.





## Mission Profiles

For growth data analysis, mission profiles help to create a balanced operational test plan and track the actual testing against the plan to make sure the data will be suitable for reliability growth analysis.



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