
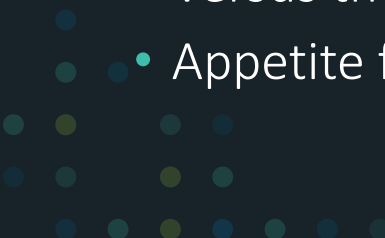




Repeated Measures Degradation In JMP 17 – Dev Tutorial

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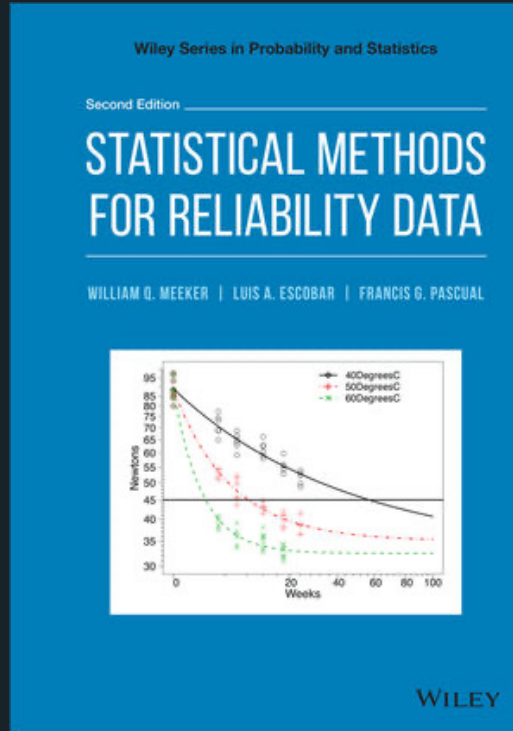
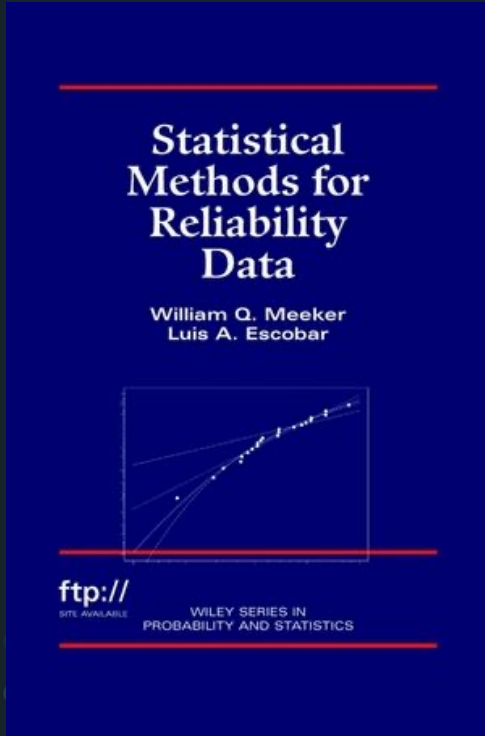
- 
- Where is the new platform in JMP?
 - Why should one use it?
 - Data.
 - Objective of analysis.
 - Demonstrations.
 - Tips from developer.
 - Versus the existing Degradation platform.
 - Appetite for a bit of theory?
- 

It is a new! Complement what's in Degradation.

The image shows a screenshot of the JMP software interface. The 'Analyze' menu is open, and the 'Reliability and Survival' sub-menu is selected. Within this sub-menu, the 'Degradation' option is highlighted with a red rectangular box. Below 'Degradation', the 'Repeated Measures Degradation' option is also highlighted with a blue rectangular box. To the right of the 'Repeated Measures Degradation' option, a tooltip box contains the text: 'Models repeated measures degradation data over time with random parameters.'

| Menu Item | Description |
|-------------------------------|---|
| Distribution | |
| Fit Y by X | |
| Tabulate | |
| Text Explorer | |
| Fit Model | |
| Predictive Modeling | |
| Specialized Modeling | |
| Screening | |
| Multivariate Methods | |
| Clustering | |
| Quality and Process | |
| Reliability and Survival | |
| Life Distribution | |
| Fit Life by X | |
| Cumulative Damage | |
| Recurrence Analysis | |
| Degradation | |
| Repeated Measures Degradation | Models repeated measures degradation data over time with random parameters. |
| Destructive Degradation | |
| Reliability Forecast | |
| Reliability Growth | |
| Reliability Block Diagram | |
| Repairable Systems Simulation | |
| Survival | |
| Fit Parametric Survival | |
| Fit Proportional Hazards | |

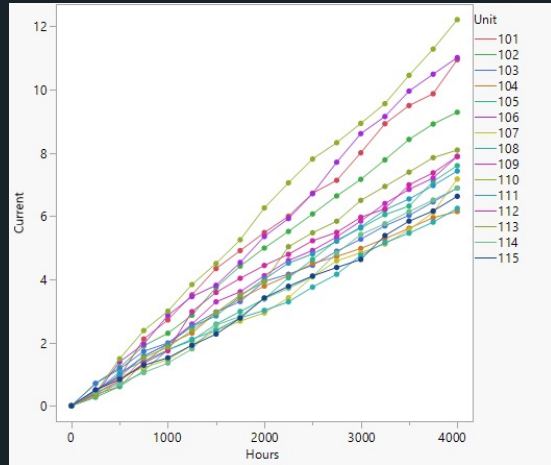
Methodological Basis



Chap 21: Repeated-Measures Degradation Modeling and Analysis

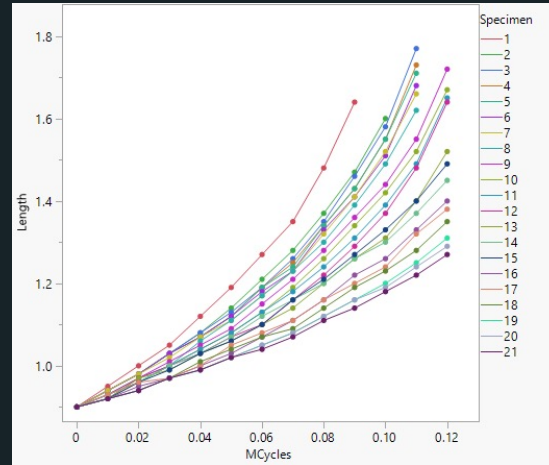
Repeated Measures Degradation Sample Data

GaAs Laser



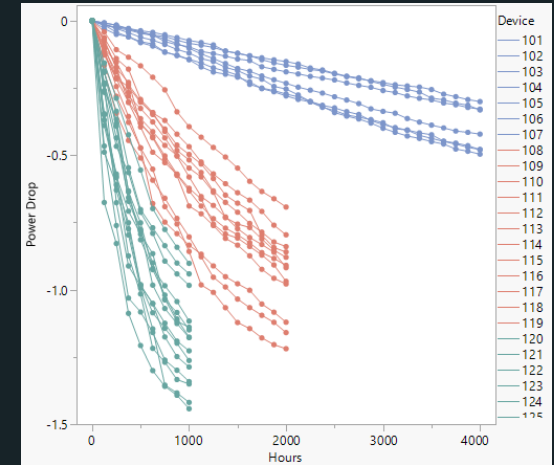
Operating current
increase over time

Alloy A



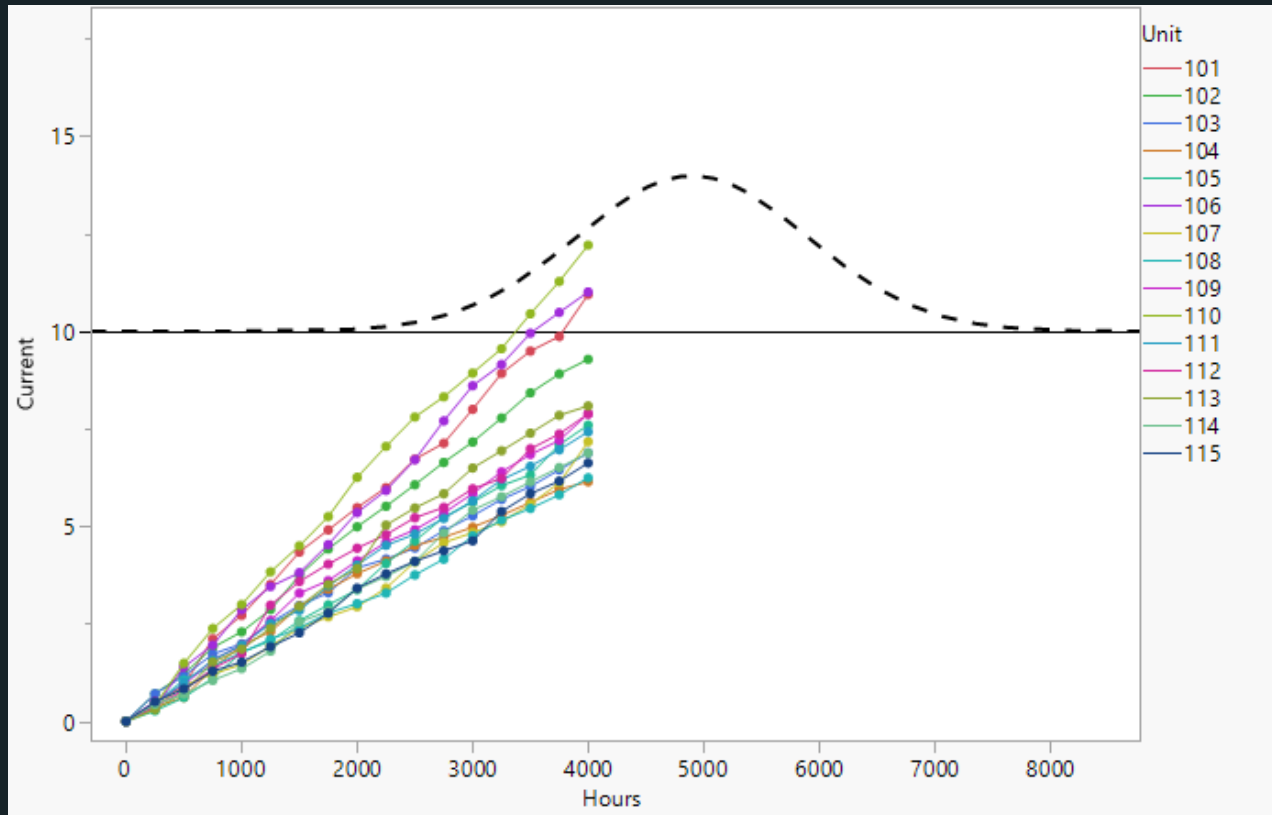
Crack length
over time

Device B

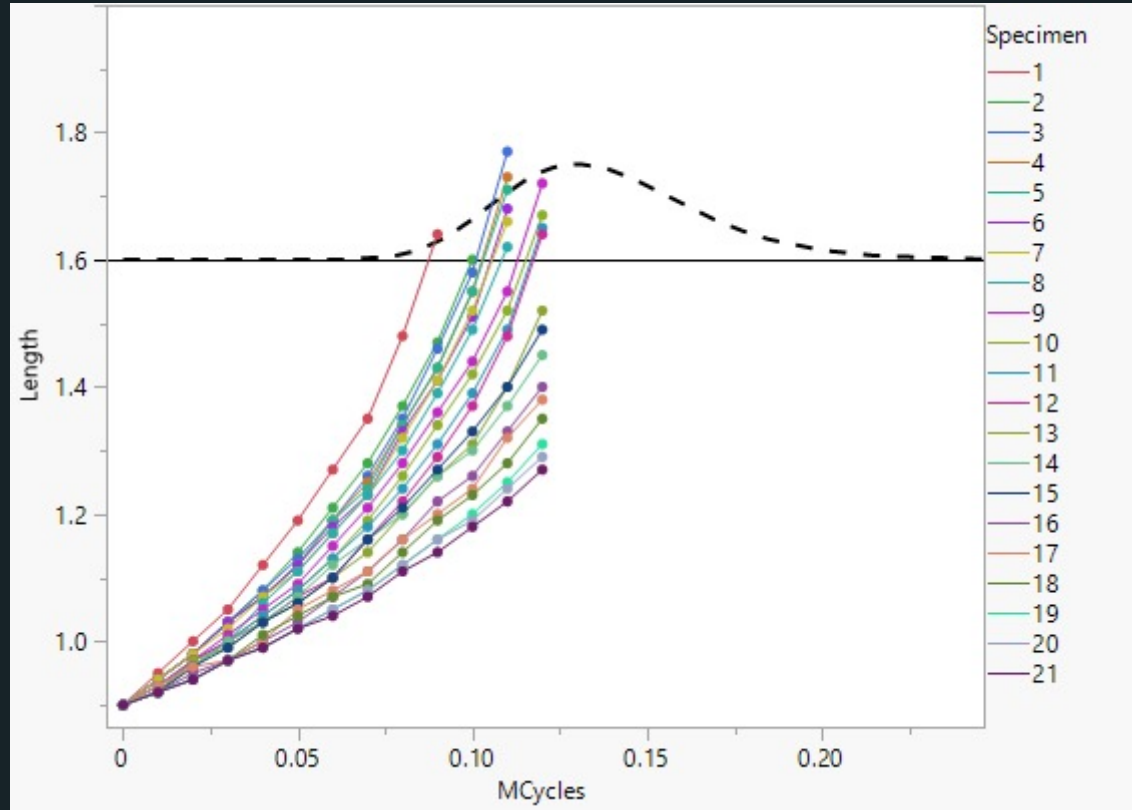


Power output drop
over time

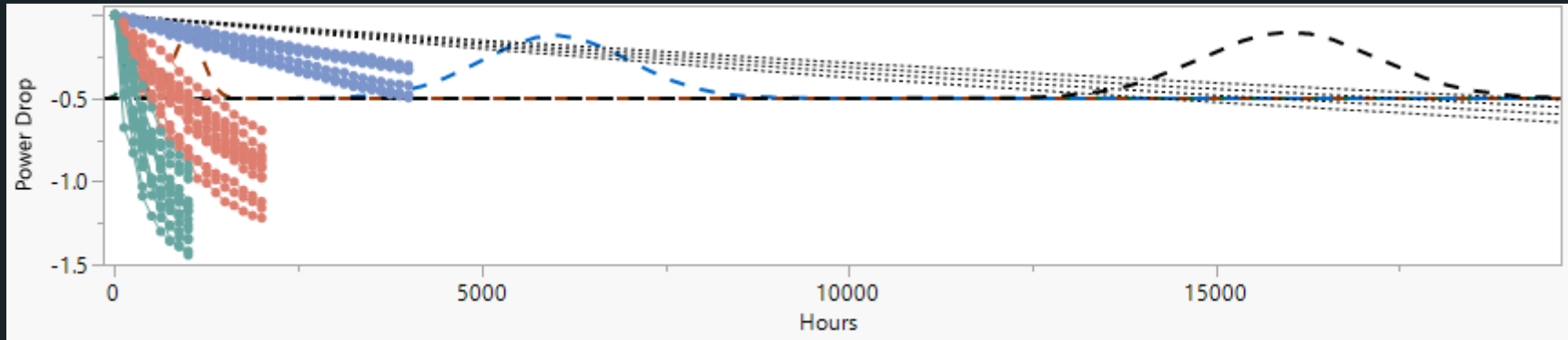
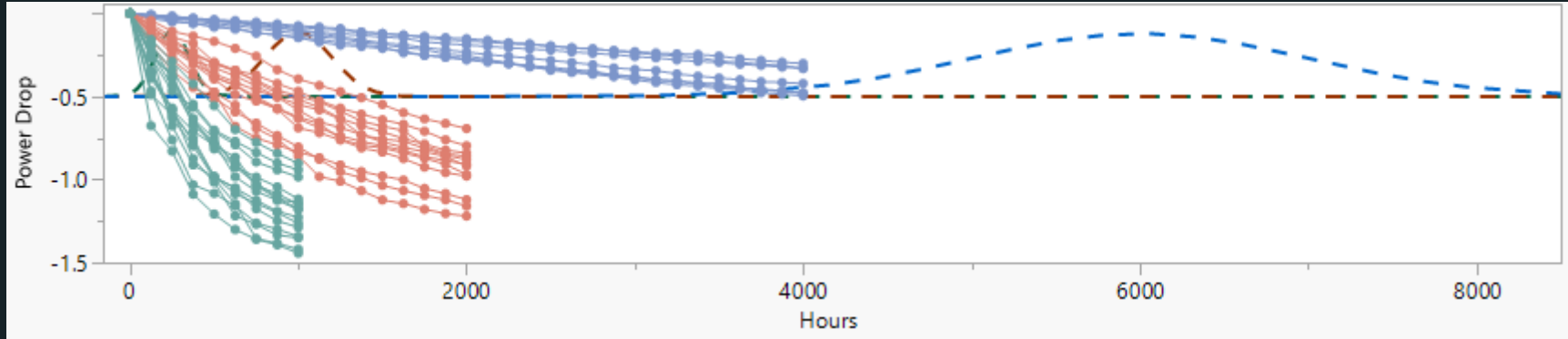
Objective: GaAs Laser



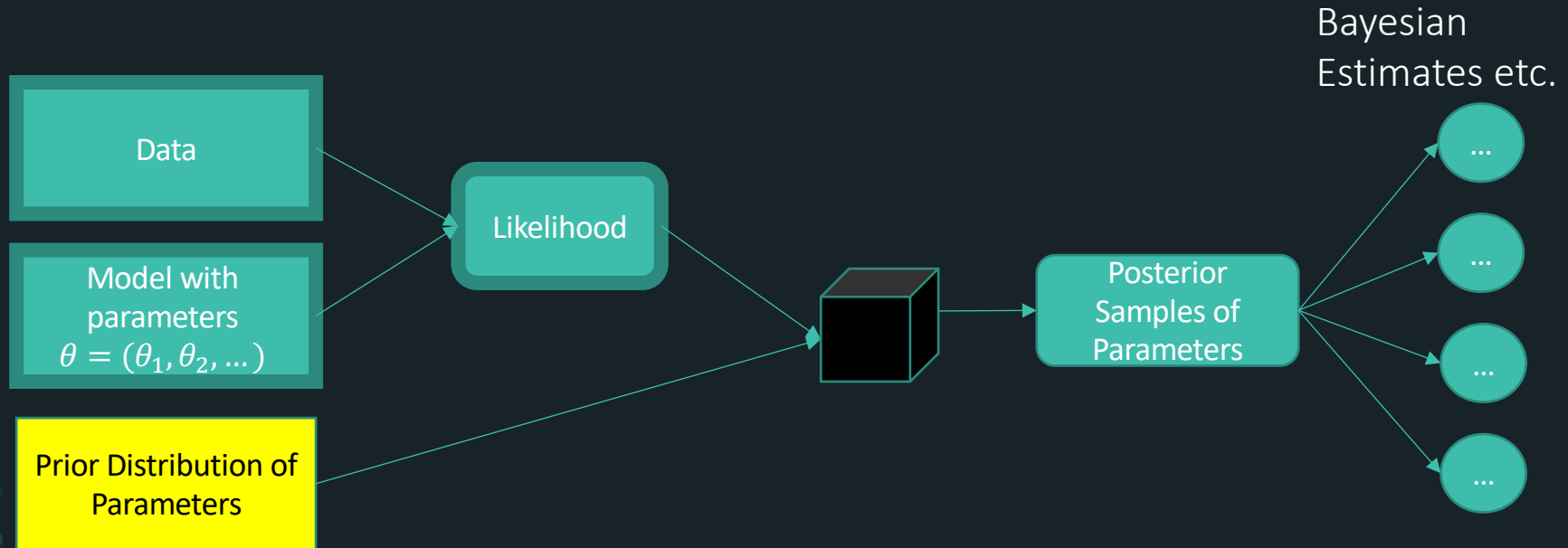
Objective: Alloy A



Objective: Device B



Mini-introduction of Bayesian Modeling



How to use the new platform to get there?

GaAs Laser

How to use the new platform to get there?

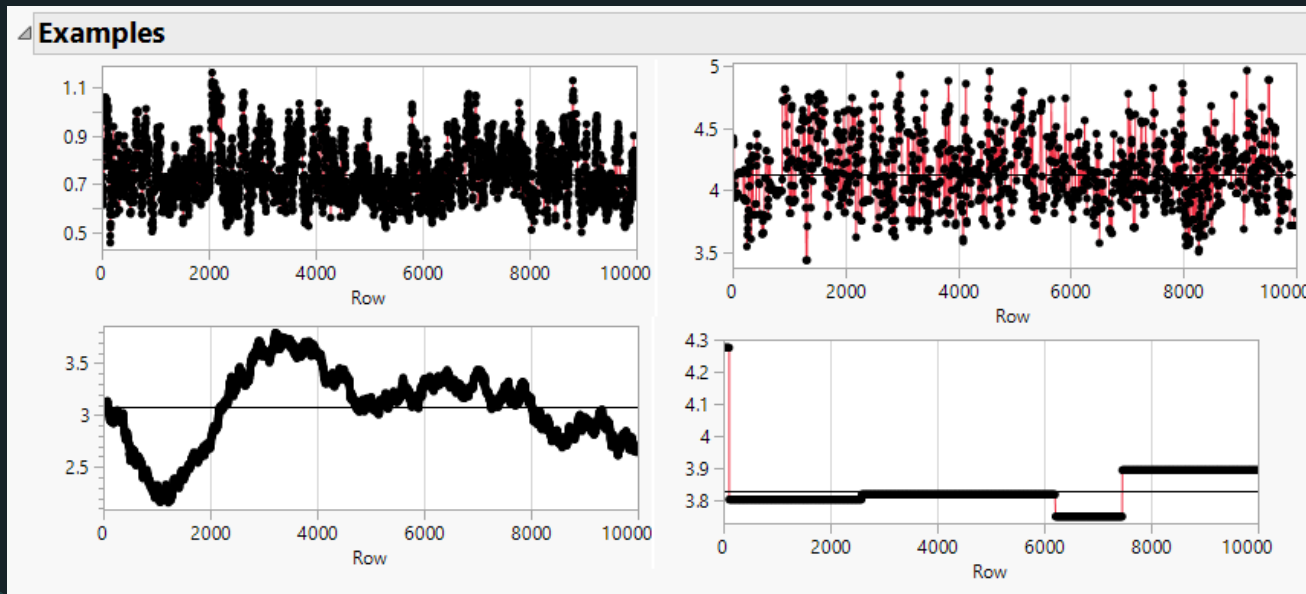
Alloy A

How to use the new platform to get there?

Device B

Tips for Working with JMP's Implementation

- Watch out for bad posteriors. Some can be easily addressed (next slide).
- Call Houston when you need help ...

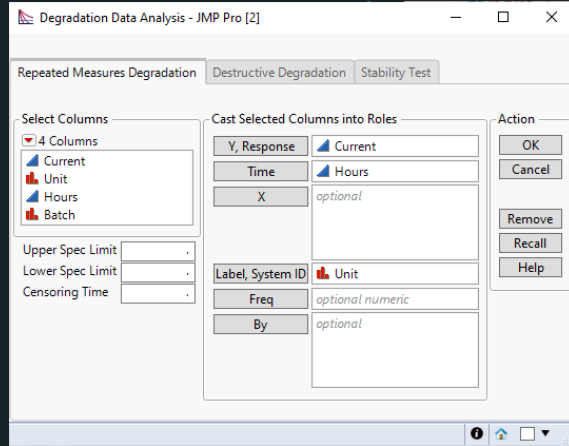


Tips for Working with JMP's Implementation

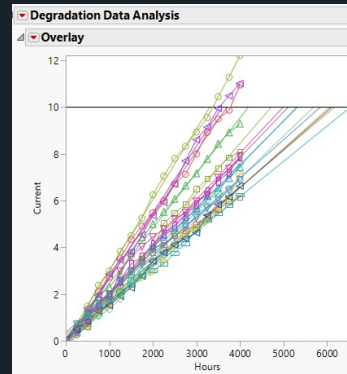
- Try increasing “Warmup Laps”, if it does not converge.
- Try using manual “Thinning”, if there is high auto-correlation.

| MCMC Controls | | | |
|---------------|---------|-------------------------------------|--|
| Name | Type | Value | Description |
| Warmup Laps | Integer | 10 | Set automatic tuning laps. |
| Auto Thinning | | <input checked="" type="checkbox"/> | Use suggested Thinning period. |
| Thinning | Integer | 1 | Thinning period if Auto Thinning is unchecked. |
| N Chains | Integer | 1 | Number of chains. |

vs. Degradation



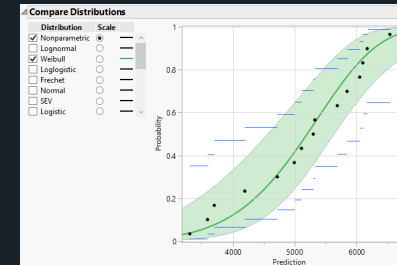
Degradation Model



Pseudo-Failure

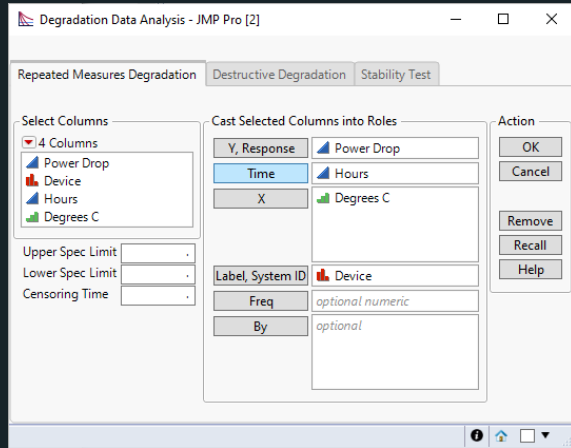
| Unit | Prediction |
|------|--------------|
| 101 | 3702.0352558 |
| 102 | 4194.424792 |
| 103 | 5846.7544355 |
| 104 | 6172.0705578 |
| 105 | 5300.9786714 |
| 106 | 3592.3385645 |
| 107 | 6050.786373 |
| 108 | 6538.47499 |
| 109 | 5110.0626145 |
| 110 | 3306.4840293 |

Estimate Failure Distribution

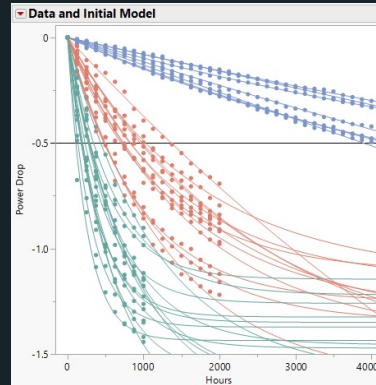


The method in Degradation is
A.K.A. Pseudo-Failure Approach.

vs. Degradation



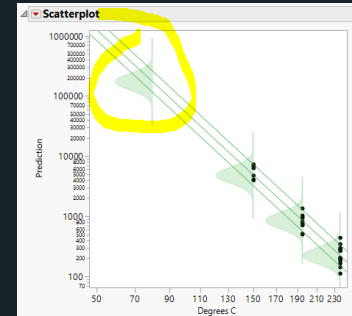
Degradation Model



Pseudo-Failure

| Device | Degrees C | Prediction |
|--------|-----------|------------|
| 1 | 101 | 150 |
| 2 | 102 | 150 |
| 3 | 103 | 150 |
| 4 | 104 | 150 |
| 5 | 105 | 150 |
| 6 | 106 | 150 |
| 7 | 107 | 150 |
| 8 | 108 | 150 |

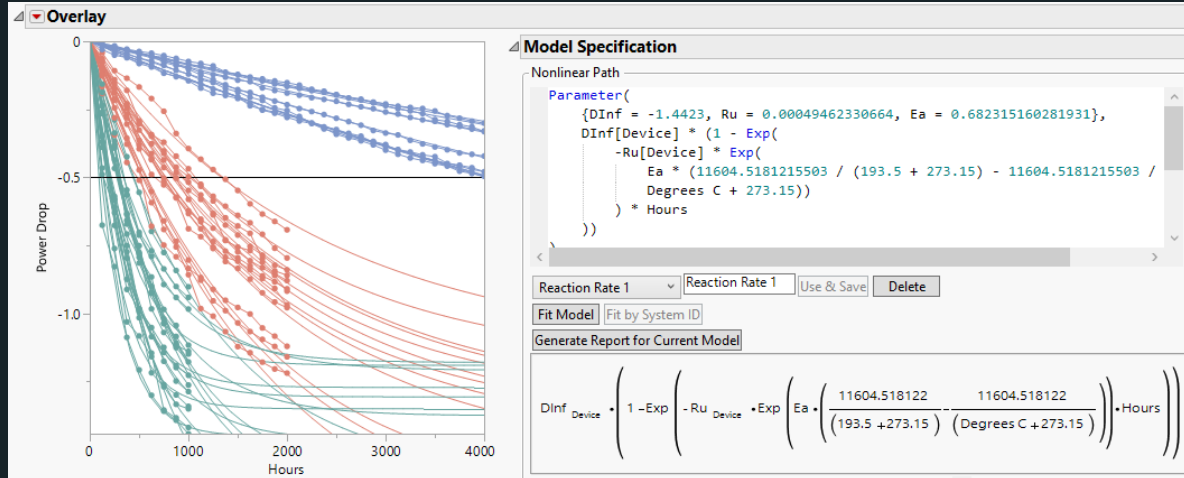
Estimate Failure Distribution



The method in Degradation is
A.K.A. Pseudo-Failure Approach.

vs. Degradation

- Two stages of approximation. At least two modeling uncertainties.
- Flexible and extensible for DIY models.
- Not to use, when a model in the new platform is appropriate.
- To use, when no models in the new platform are appropriate.



Appetite for a bit of theory?



Thank you!