

Defining Sherlock Life Cycle Environments

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Agenda

- Background
- Life cycle properties
- Adding phases
- Adding events
- The events
 - Thermal
 - Mechanical
- Load Directions
- Life cycle management

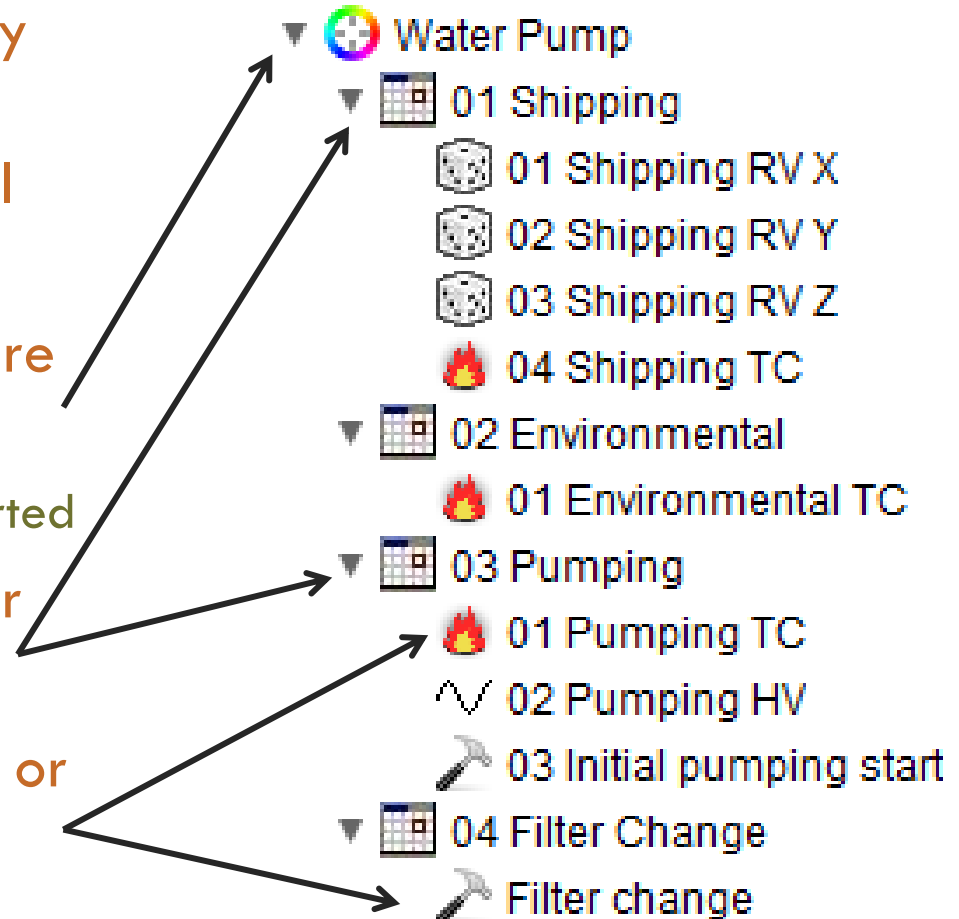
Speaker Bio

- **Research focus:**
 - Mechanical reliability of electronic systems and components
 - Multidisciplinary reliability of complex electro mechanical systems
 - Characterization and modeling of material behavior
 - Physics of failure of electromechanical and MEMS system
 - Mechanical performance of flip chip packages
- **Doctoral research**
 - Solder reliability
 - MEMS structures characterization
 - Embedded components failure analysis
 - Particle beam accelerator mechanical fatigue.
- **Experience at Amkor technology**
 - Advanced product development group as senior engineer
 - Analysis of chip-package interactions
- **Ph.D, Mechanical Engineering (University of Maryland)**



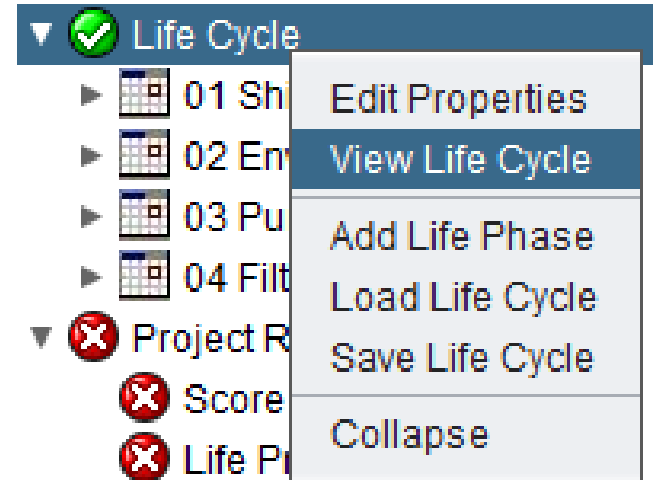
Background

- Sherlock predicts reliability based on the CCA design subjected to environmental conditions
- Environmental conditions are defined in a “Life Cycle”
 - Can be imported and exported
- Life cycles consist of one or more “Phases”
- Each Phase consists of one or more “Events”



Life Cycle Properties

- Right click on the “Life Cycle”
 - Select “View Life Cycle”
- Allows you to view the currently defined life cycle
 - Service life
 - Reliability desired
 - Phases
- Can also be viewed by events

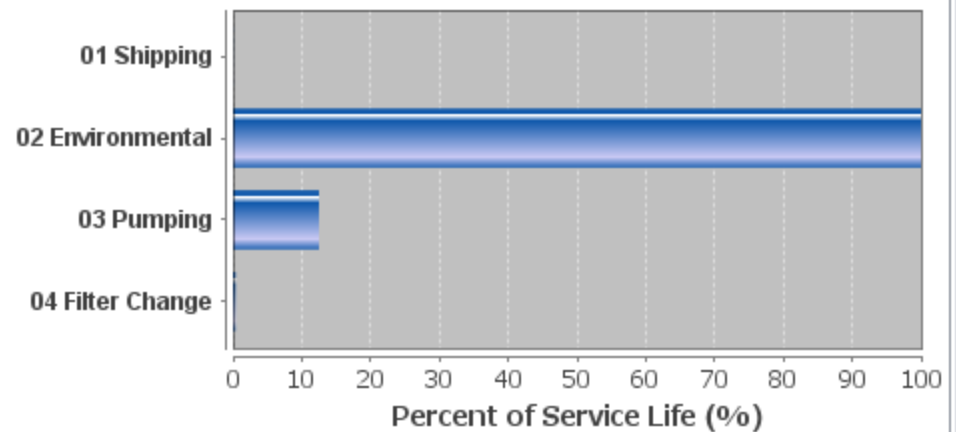


Reliability Goals

Service Life: 30 years

Prob. of Failure: 3 %

Life Cycle Phases



Set the Life Cycle Properties

- Double click the “life cycle”
- Name
- Description
- Reliability Metric
- Service Life

Life Cycle Editor

Modify any of the following properties and press the **Save** button to update the life cycle. You may also use the **Load Life Cycle** menu option to load a different life cycle from the file system or the **Save Life Cycle** menu option to save the current life cycle in a named file. Life cycle files can be used in across multiple projects and/or shared with other Sherlock users.

Identification

Name: Water Pump

Description:

Reliability Goals

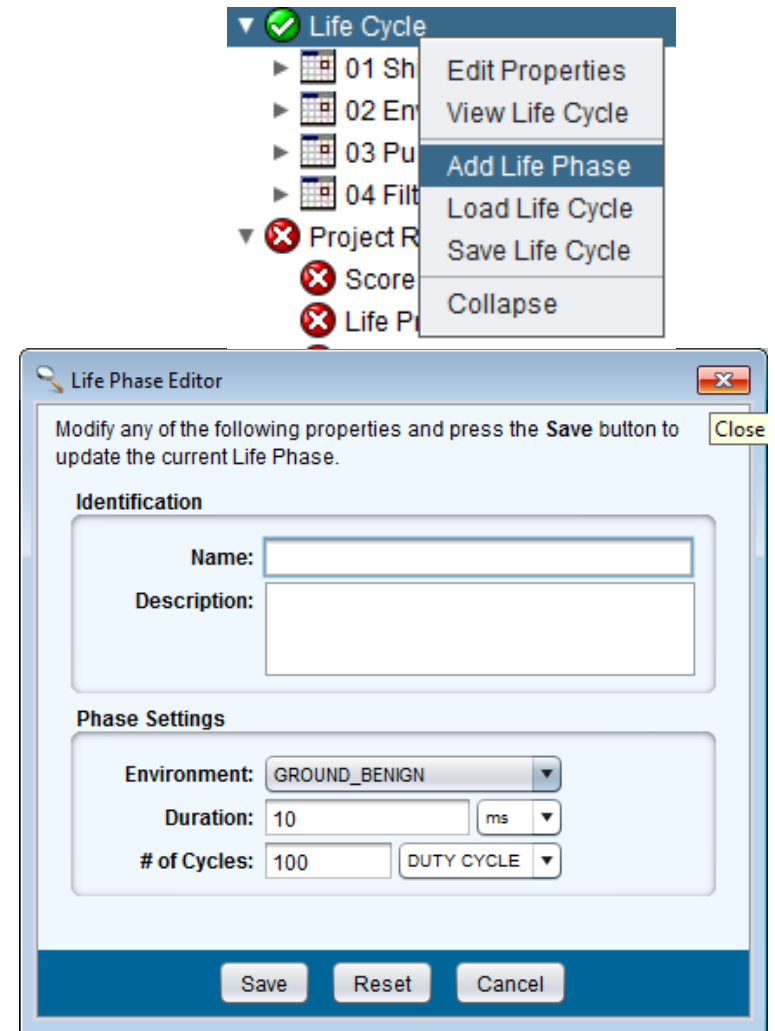
Reliability Metric: 3 Prob. of Failure (%)

Service Life: 30 year

Save Reset Cancel

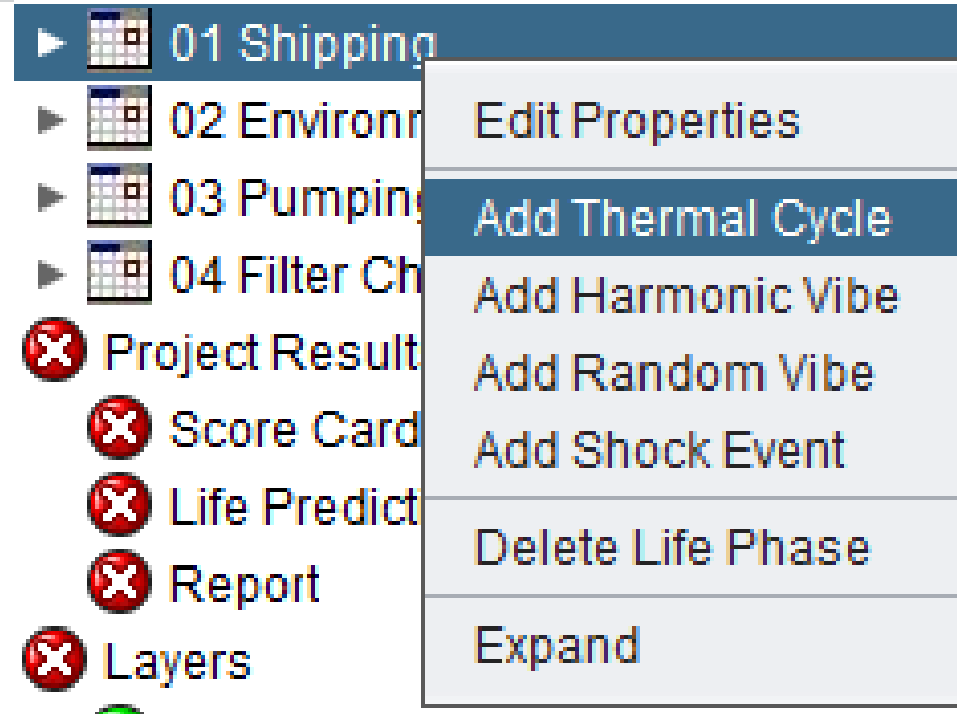
Add a Phase

- Right click the “Life Cycle”
 - Select “Add Life Phase”
- Name
- Description
- Environment
 - Ignore
- Duration
- Number of Cycles
 - For the phase



Add an Event

- Right click the Phase
 - Select the event to add
- Events:
 - Thermal Cycle
 - Harmonic Vibe
 - Random Vibe
 - Mechanical Shock



Thermal Event

- Name
- Description
- Number of cycles
- Life cycle State
 - Storage
 - Operating
- Thermal profile
 - Profile editor

Thermal Profile Editor

Profile Name:

Time Units:

Temp Units:

Step	Type	Time	Temp
Min Temp	HOLD	6.0	15.0
Ramp Up	RAMP	6.0	45.0
Max Temp	RAMP	6.0	35.0
Ramp Down	RAMP	6.0	15.0

Thermal Event Editor

Modify any of the following properties and press the **Save** button to update the current Thermal Event.

Identification

Name:

Description:

Thermal Event Settings

of Cycles:

Life Cycle State:

Thermal Profile

Shipping TC

Temperature (C)

Time (hr)

Buttons: Load Profile ... Edit Profile ... Save Profile ... Save Reset Cancel

Mechanical Events: Shock

- Name
- Description
- Duration
- Number of Cycles
- Peak Load
- PCB Orientation
- XY Angle
- YZ Angle
- Load Direction
- X,Y and Z vector

Shock Profile Editor

Profile Name:

Pulse Duration: ms

Sample Rate: ms

Load Units:

Freq Units:

Options: X-Axis Log Scale
 Y-Axis Log Scale

Shape	Load	Freq	Decay
HalfSine	10.0	100.0	0.0

Shock Event Editor

Modify any of the following properties and press the Save button to update the current Shock Event.

Identification

Name:

Description:

Shock Event Settings

Duration: ms

of Cycles: PER HOUR

Shock Load Settings

Peak Load: G

PCB Orientation: XY Angle YZ Angle

Load Direction: X Y Z

Shock Pulse Profile

Pump Start

Load (G)

Time (ms)

Load Profile ... Edit Profile ... Save Profile ...

Apply Save Reset Cancel

Mechanical Events: Harmonic Vibe

- Name
- Description
- Duration
- Number of Cycles
- Sweep Rate
- PCB Orientation
- Profile type
 - Uniaxial
 - Load Direction (X,Y,Z)
 - Triaxial
 - Different profile for every direction

Harmonic Profile Editor

Profile Name:

Freq Units:

Load Units:

Options: X-Axis Log Scale
 Y-Axis Log Scale

Freq (HZ)	Load (G)
10.0	0.2000
100.0	0.4000
500.0	1.0
750.0	0.3000
1,000.0	0.3000
2,000.0	0.0500

Harmonic Vibe Editor

Modify any of the following properties and press the Save button to update the current Harmonic Vibe.

Identification

Name:

Description:

Harmonic Vibration Settings

Duration:

of Cycles:

Sweep Rate: octave/min

Harmonic Load Settings

PCB Orientation: XY Angle YZ Angle

Profile Type:

Harmonic Profile

Load Direction: X Y Z

Pumping HV

Load (G)

Frequency (HZ)

Load Profile ... Edit Profile ... Save Profile ...

Save Reset Cancel

Mechanical Events: Random Vibe

- Name
- Description
- Duration
- Number of Cycles
- PCB Orientation
- Profile type
 - Uniaxial
 - Triaxial

Random Vibe Profile Editor

Profile Name:

Freq Units:

Ampl Units:

Options: X-Axis Log Scale
 Y-Axis Log Scale

Freq (HZ)	Ampl (G2/Hz)
10.0	0.0010
100.0	0.0100
500.0	0.0100
2,000.0	0.0010

Random Vibe Editor

Modify any of the following properties and press the Save button to update the current Random Vibe.

Identification

Name:

Description:

Random Vibration Settings

Duration: hr

of Cycles: PER DAY

Random Load Settings

PCB Orientation: XY Angle YZ Angle

Profile Type:

Random Profile

Load Direction: X Y Z

Shipping RV

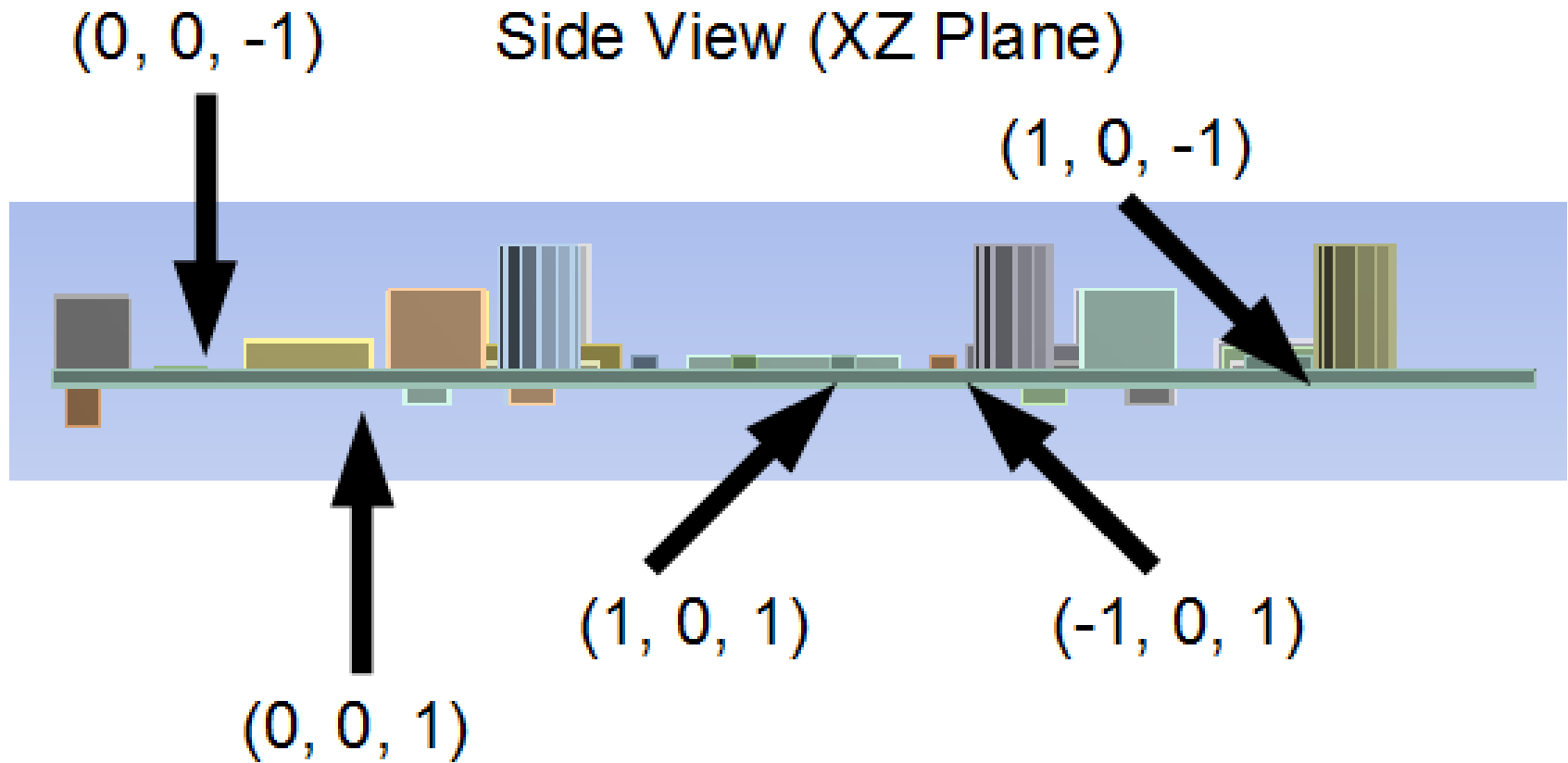
Amplitude (G2/Hz)

Frequency (HZ)

Load Profile ... Edit Profile ... Save Profile ...

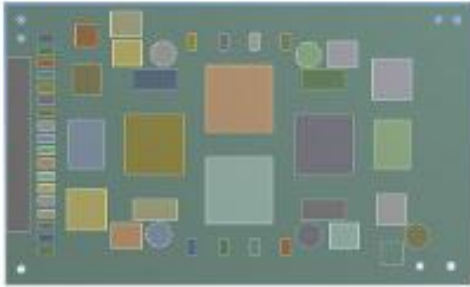
Save Reset Cancel

Load Direction

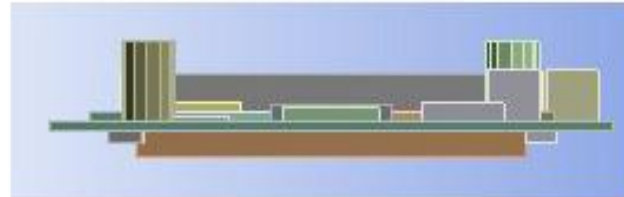


PCB Orientation

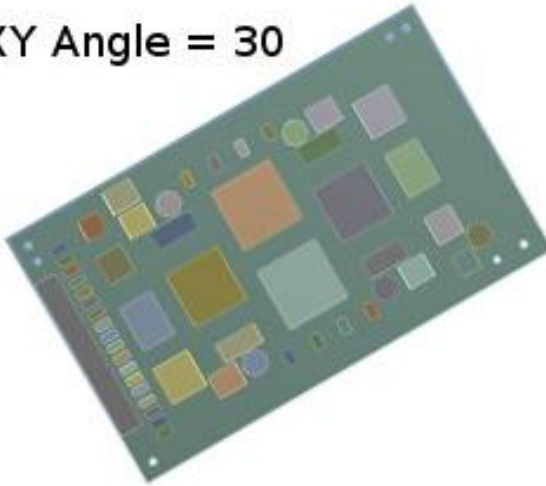
XY Angle = 0



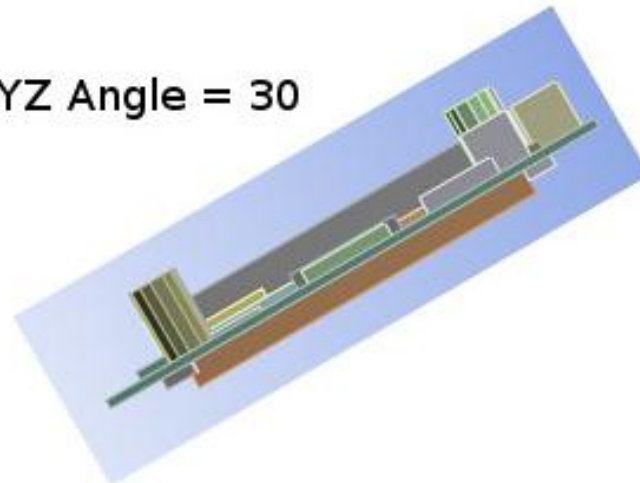
YZ Angle = 0



XY Angle = 30

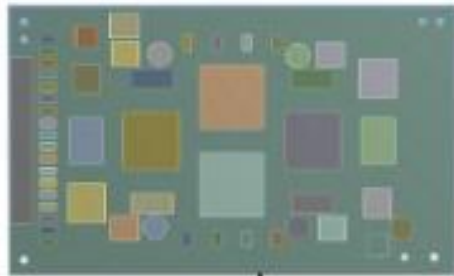


YZ Angle = 30



Combined Load and PCB Orientation

XY Angle = 0



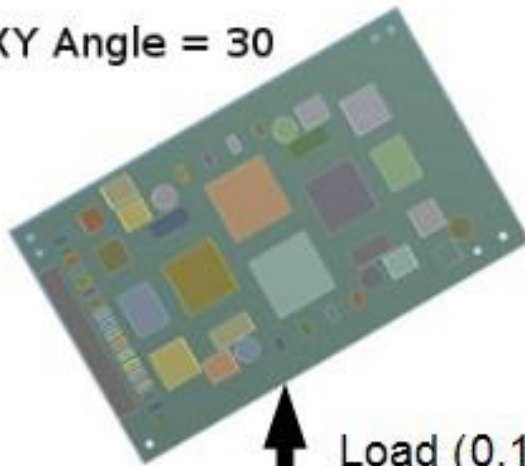
↑ Load (0,1,0)

YZ Angle = 0



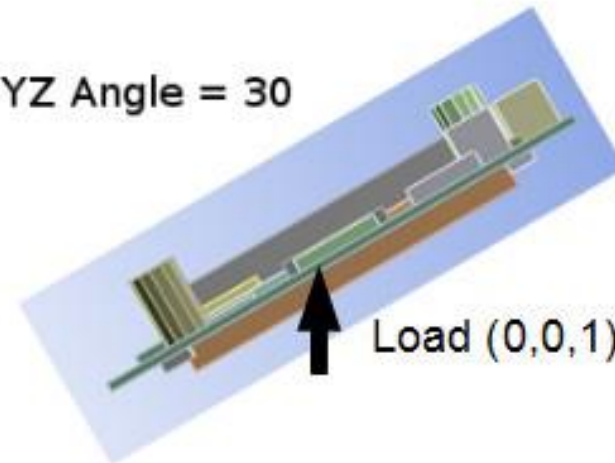
↑ Load (0,0,1)

XY Angle = 30



↑ Load (0,1,0)

YZ Angle = 30



↑ Load (0,0,1)

Life Cycle Management

- Importing and exporting
- Life cycle manager
 - Generate report

Q & A

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