MP21058-L Hands-on Training: Composite-Manufacturing “Hand Layup” Nesting + Laser Projection

Anthony D Muzzillo

SQA Manager

For cutting and composites

Class summary

This class is a follow up to "Intro to Composite Manufacturing Platform." This hands-on course will follow the entire manufacturing process for composites, carbon fiber, and parts. It will begin with determining manufacturing strategies with the help of TruPlan software. Then we will use TruNest Composites software to nest the 2D carbon fiber plies for material efficiency. Since the carbon fiber fabric is time-sensitive, temperature-controlled material, it must be followed through the manufacturing process with high precision. The complete lifecycle of each roll of material and each carbon fiber part will be tracked accurately using TruNest Composites software. Finally, when the 2D shapes are cut using part programs generated by TruNest software, they will be laid up on the 3D part mold by hand, using laser projectors to assist with layup. The laser projectors that assist with ply layup will be programmed using TruLaser software. This session features TruNest Composites, TruLaser, and TruPlan.

Key learning objectives

At the end of this class, you will be able to:

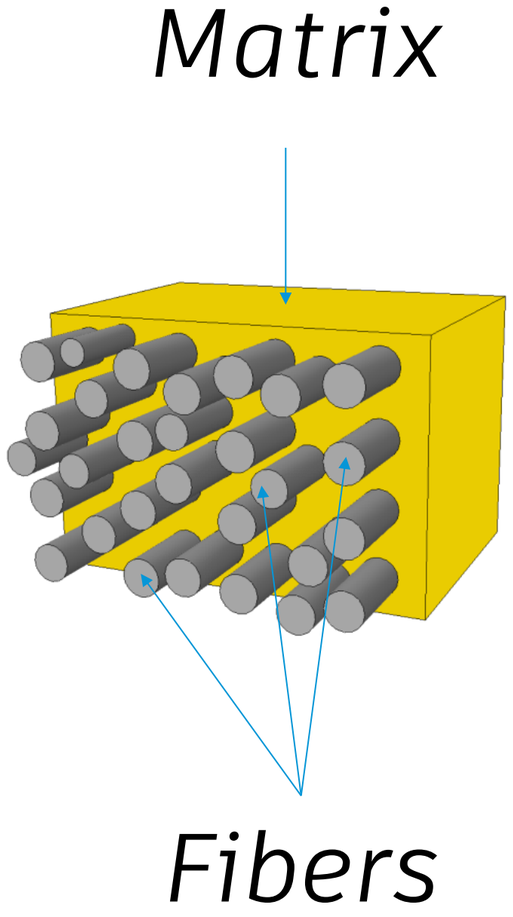
- *Use TruPlan to develop manufacturing strategy data*
- *Use TruNest Composites to nest 2D ply shapes*
- *Use TruLaser to simulate and prepare laser projection data*
- *Learn about material tracking with TruNest Composites*

About composite materials

What Are Composites?

Composite: Material with two or more constituents with *significantly different properties*.

In the scope of this discussion, our “constituents” are **Fibers** and a polymer **Matrix**



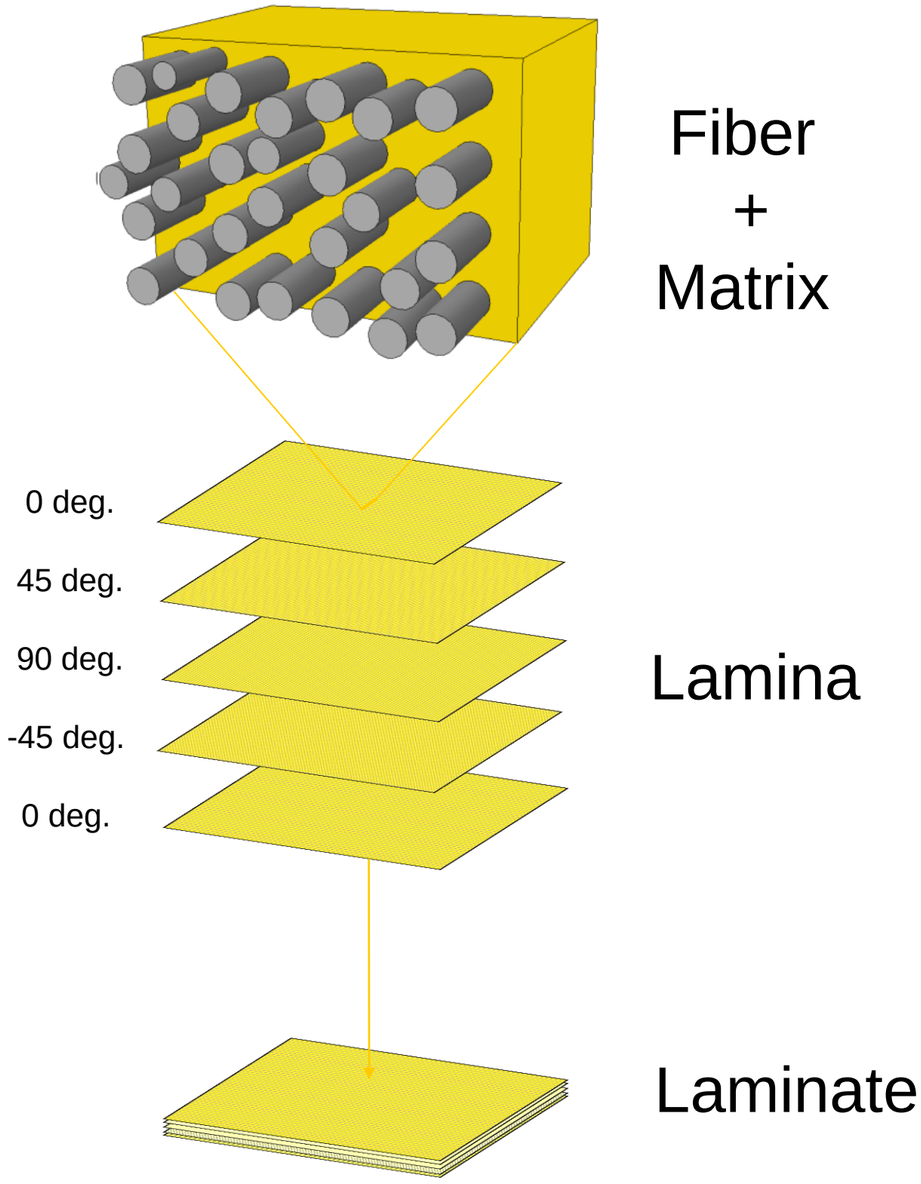
What Are Composites?

Composite: Material with two or more constituents with *significantly different properties*.

Homogenized material is called a **laminate**

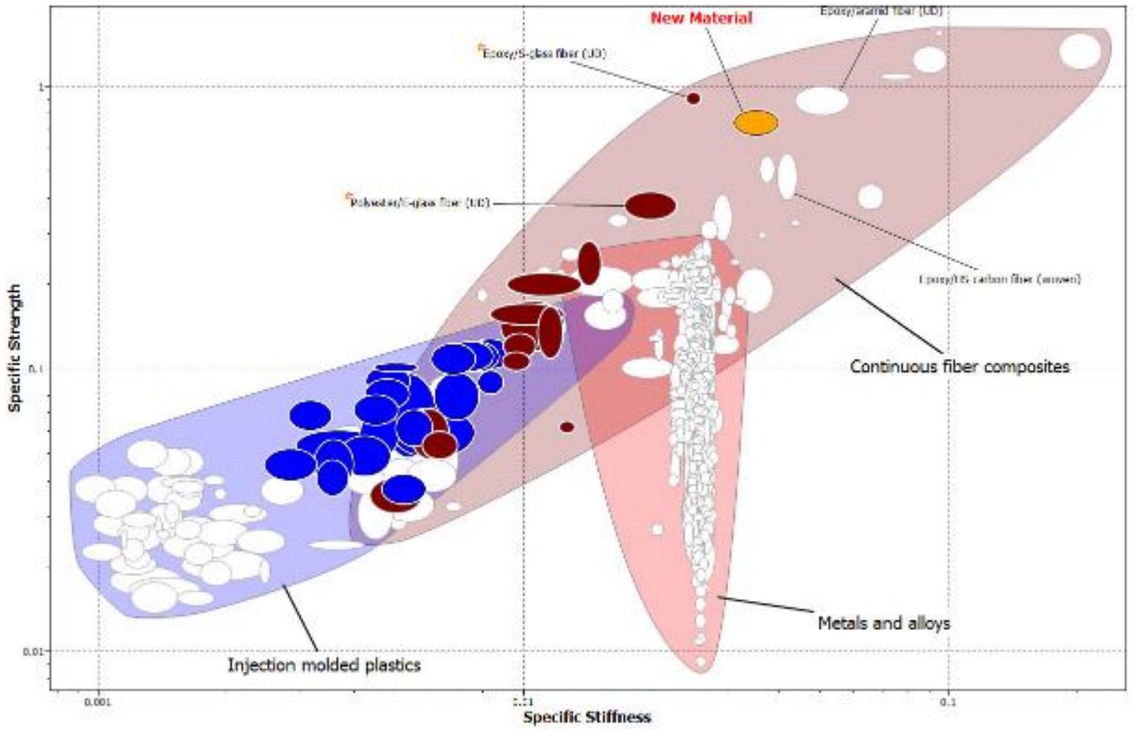
Composed of layers called **lamina**

Since we design lamina, we can **narrowly design** our material

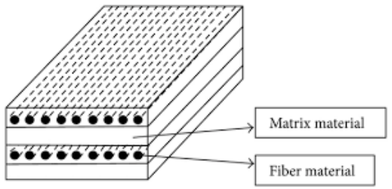


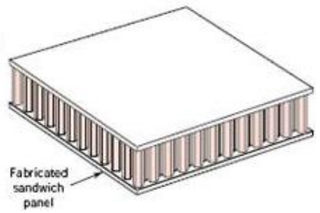
Why Composites?

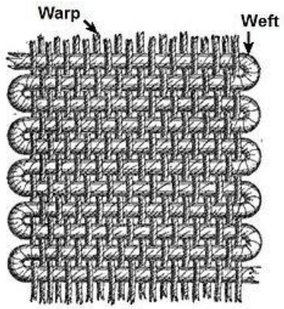
- *Favorable strength/weight ratio*
- *Tailor material properties to intended use*
  - *Customize compression, extension, torque characteristics*
  - *Warp/weft density*
  - *Direction of plies (0,-45,+45,90)*
  - *Mix materials*



- *Structural elements*
  - *Fibers*
  - *Bonding matrix*
  - *Core*







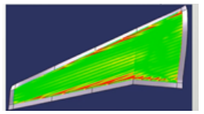
- *Cost vs. performance*

Composite workflow

Design

DFP

Manufacturing



Conceptual

Ply design

Structural simulation

Manufacturing design

Manufacturing simulation

Nesting

Cutting Kitting

Forming

Hand Layup

Material tracking

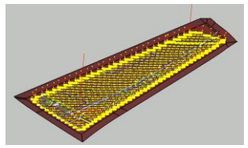
Inspection Repair

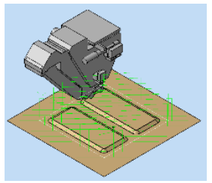
Trim

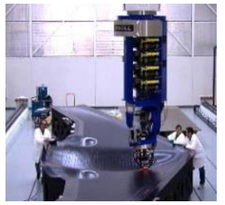
AFP/ATL Toolpath creation

Manufacturing simulation

AFP/ATL Machining







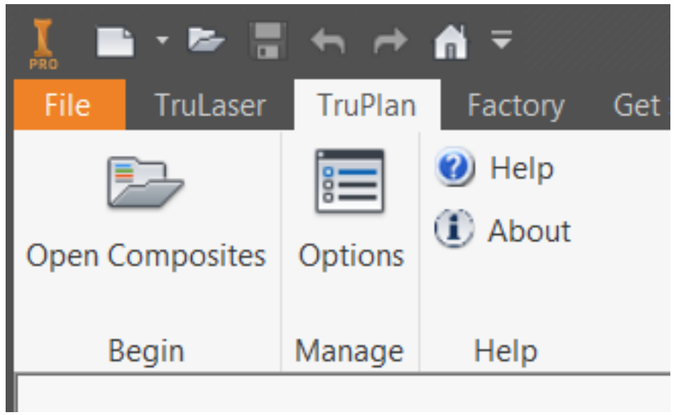
Adaptive

Setup Composite design in TruPlan

Setup Composite design in TruPlan

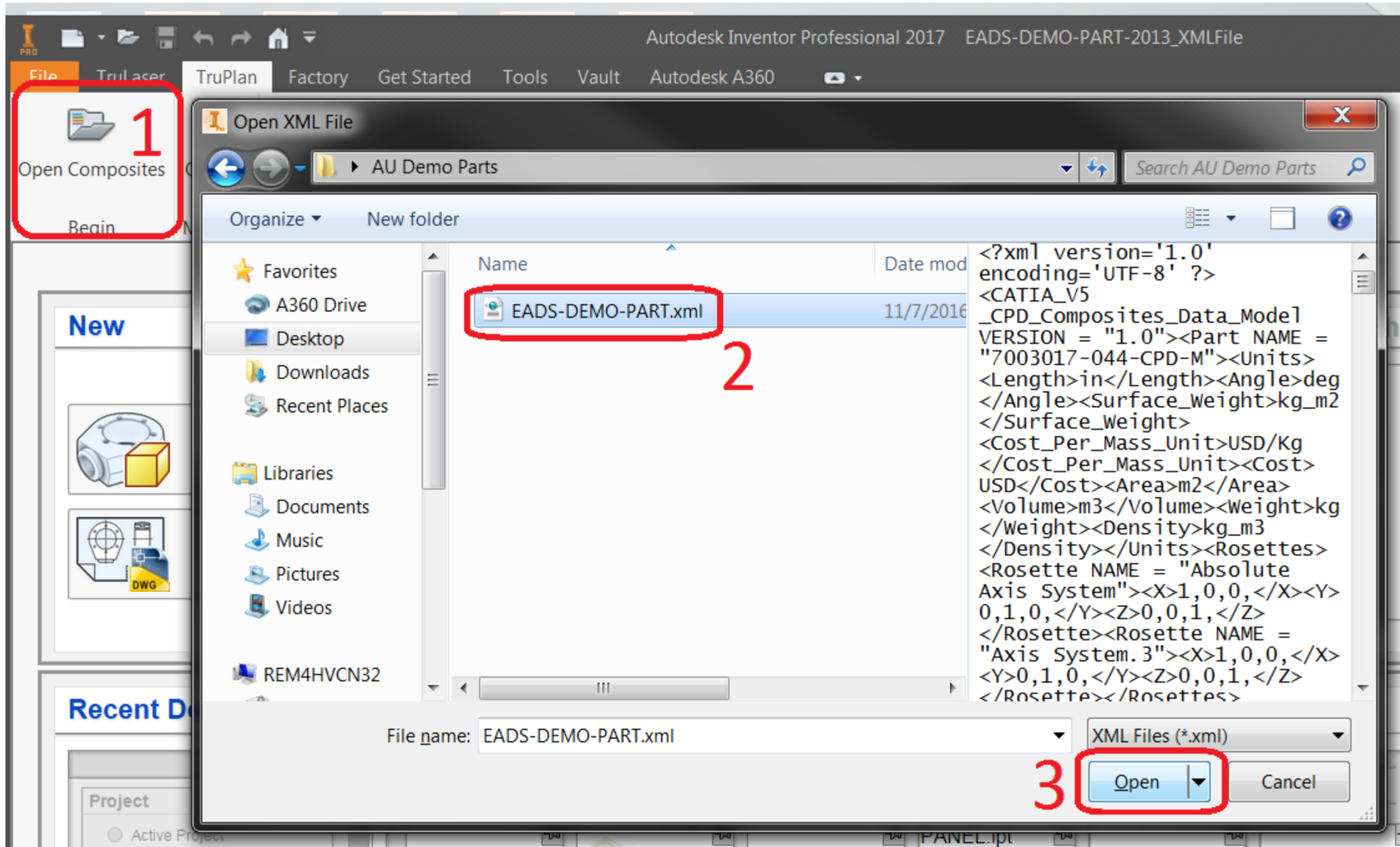
1. Open Inventor

2. Click the TruPlan tab



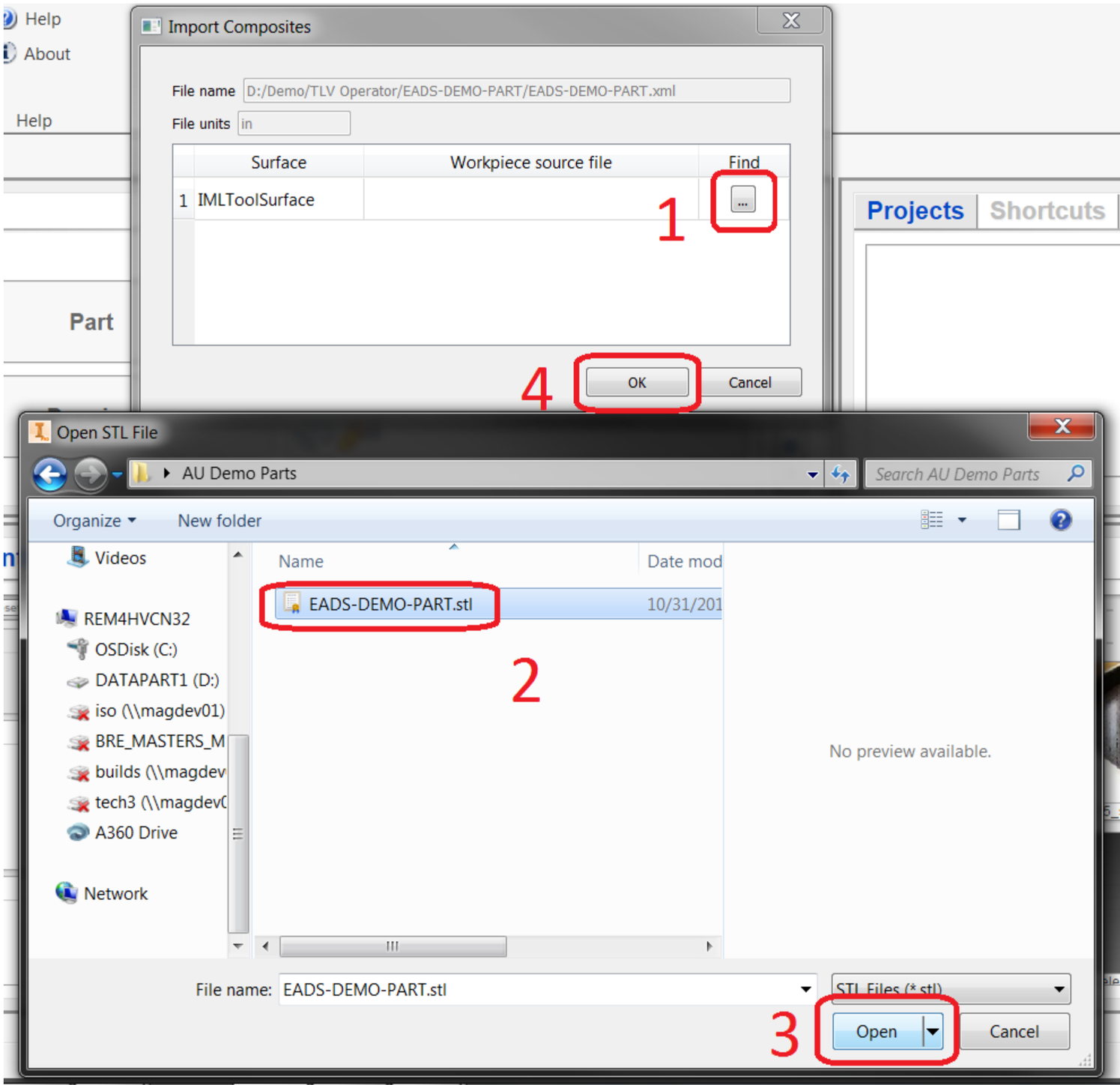
Setup Composite design in TruPlan

1. Click Open composites
2. Select **EADS-DEMO-PART.xml**
3. Click Open



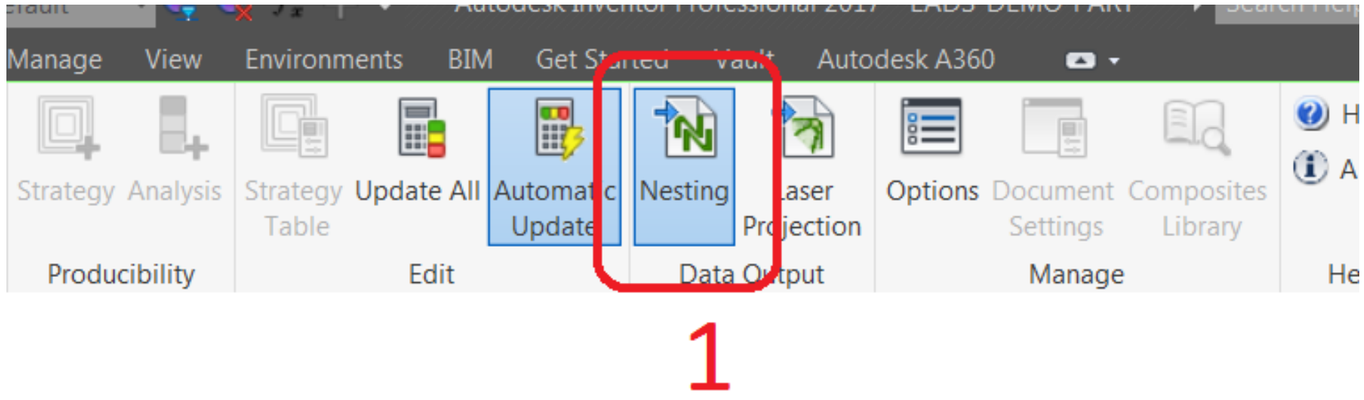
Setup Composite design in TruPlan

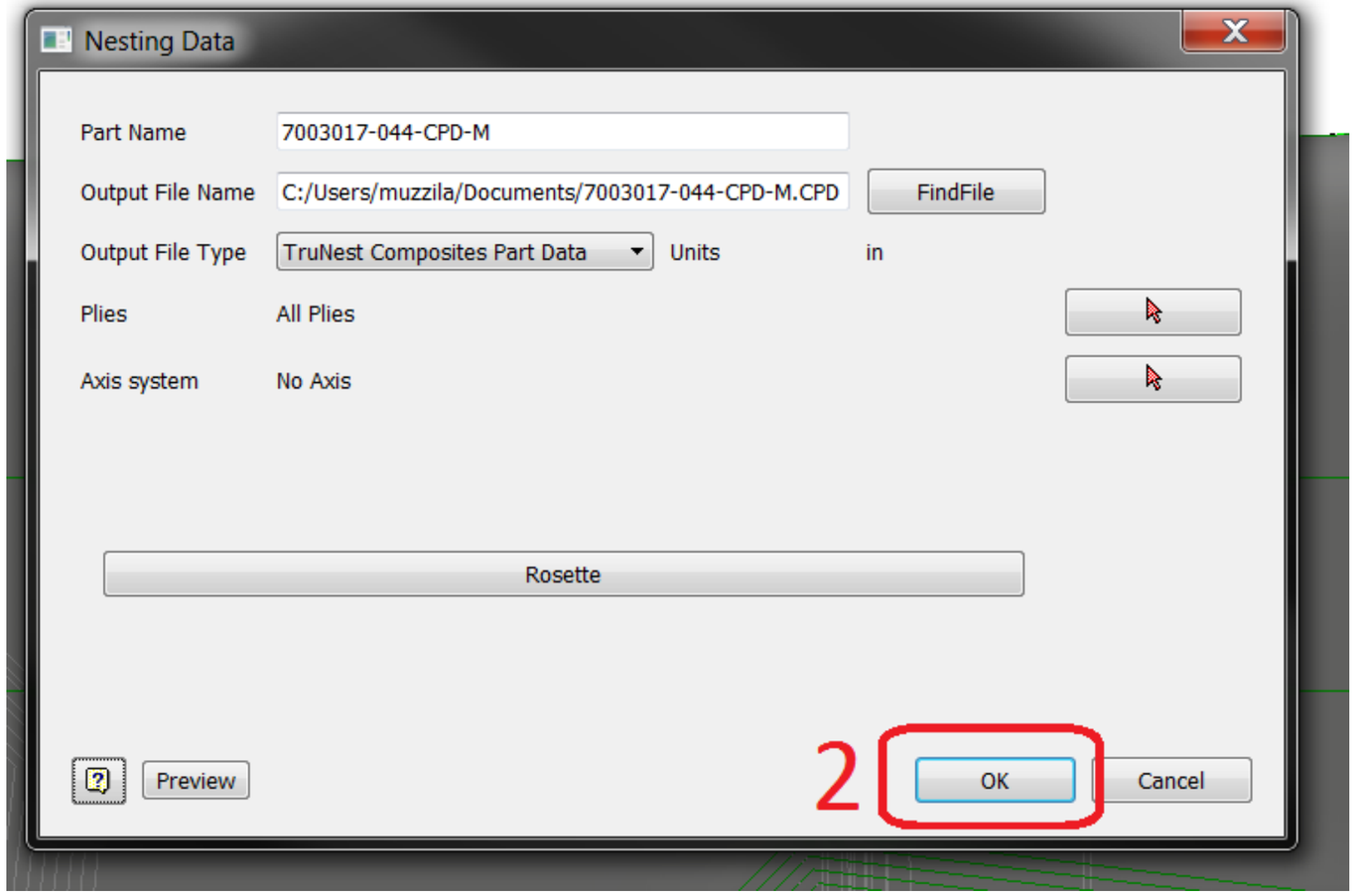
1. Click Find (…)
2. Select **EADS-DEMO-PART.stl**
3. Click Open
4. Click OK

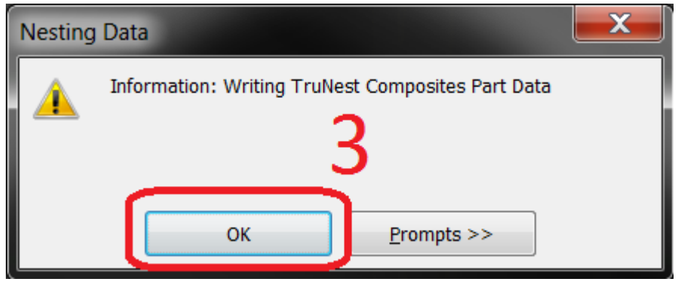


Setup Composite design in TruPlan

1. Click Nesting
2. Click OK
3. Click OK again

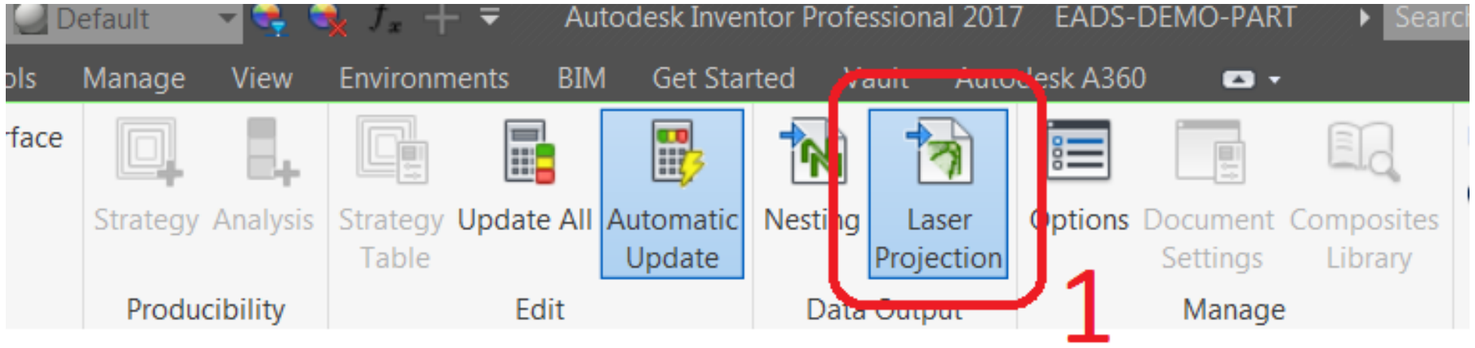


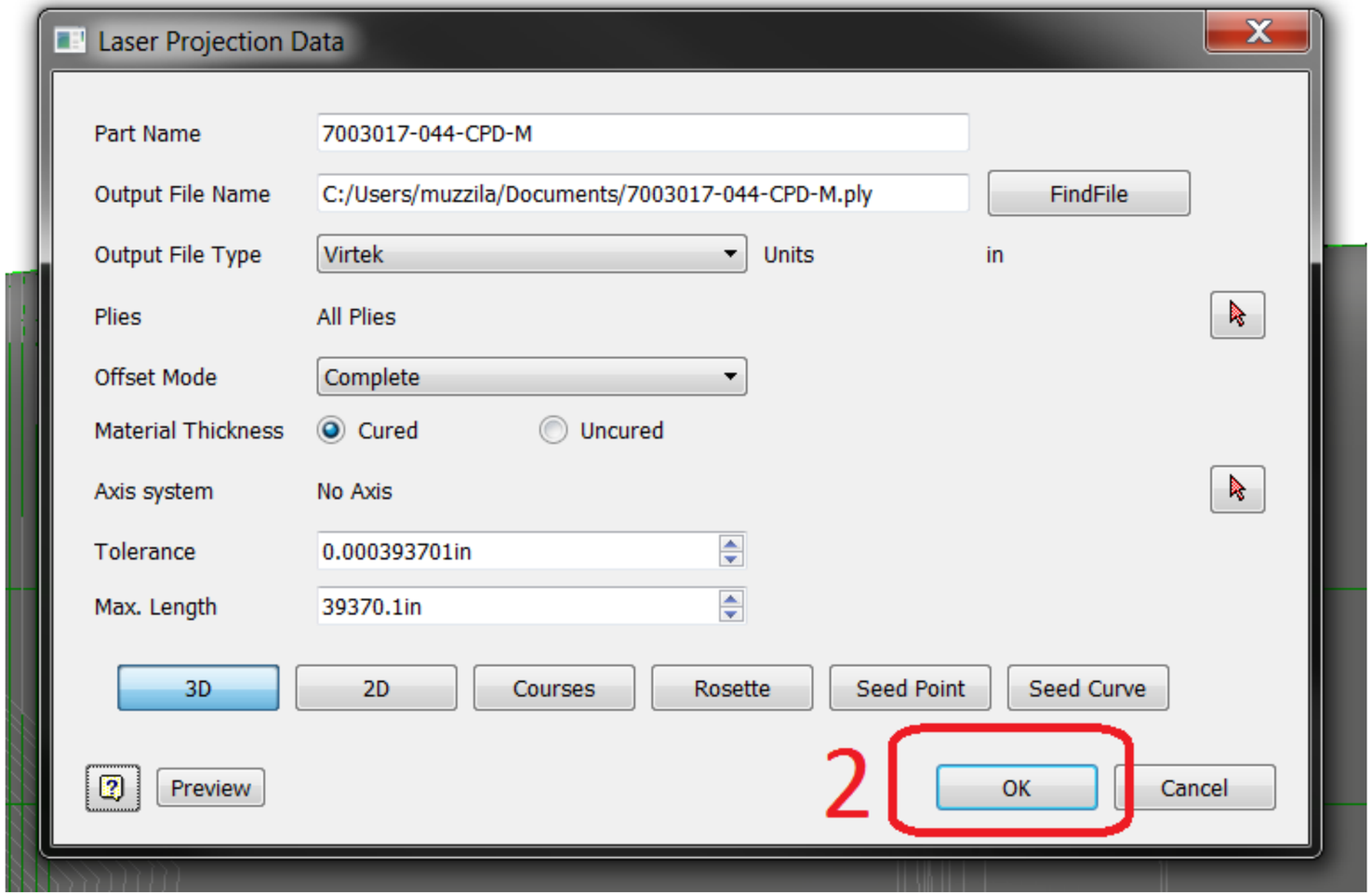


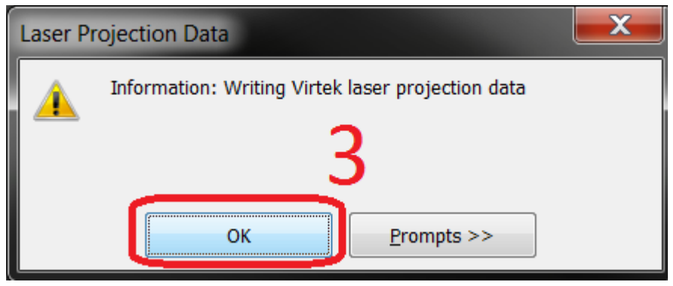


Setup Composite design in TruPlan

1. Click Laser Projection
2. Click OK
3. Click OK again





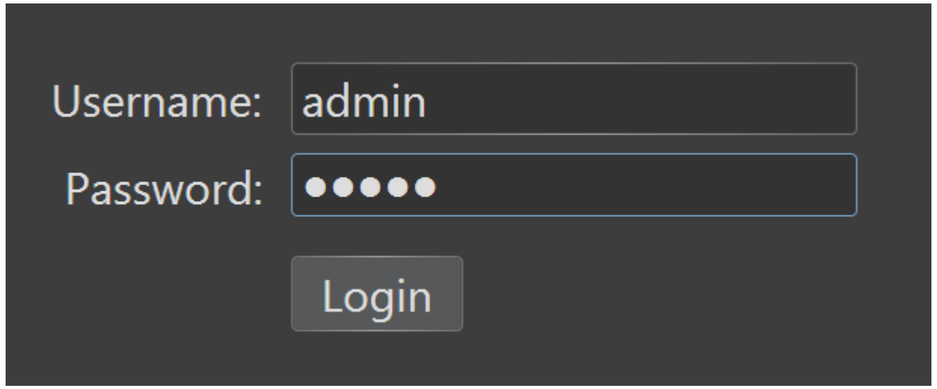


Nest 2D ply shapes in TruNest Composites

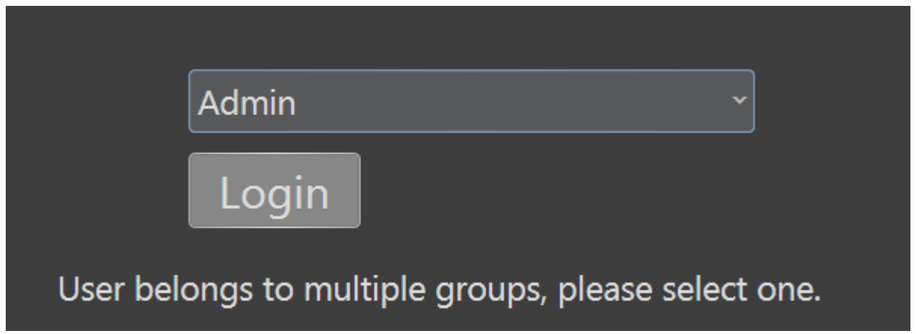
Nest 2D ply shapes in TruNest Composites

1. Open TruNest Composites

2. Login
    1. User: admin
    2. Pass: admin

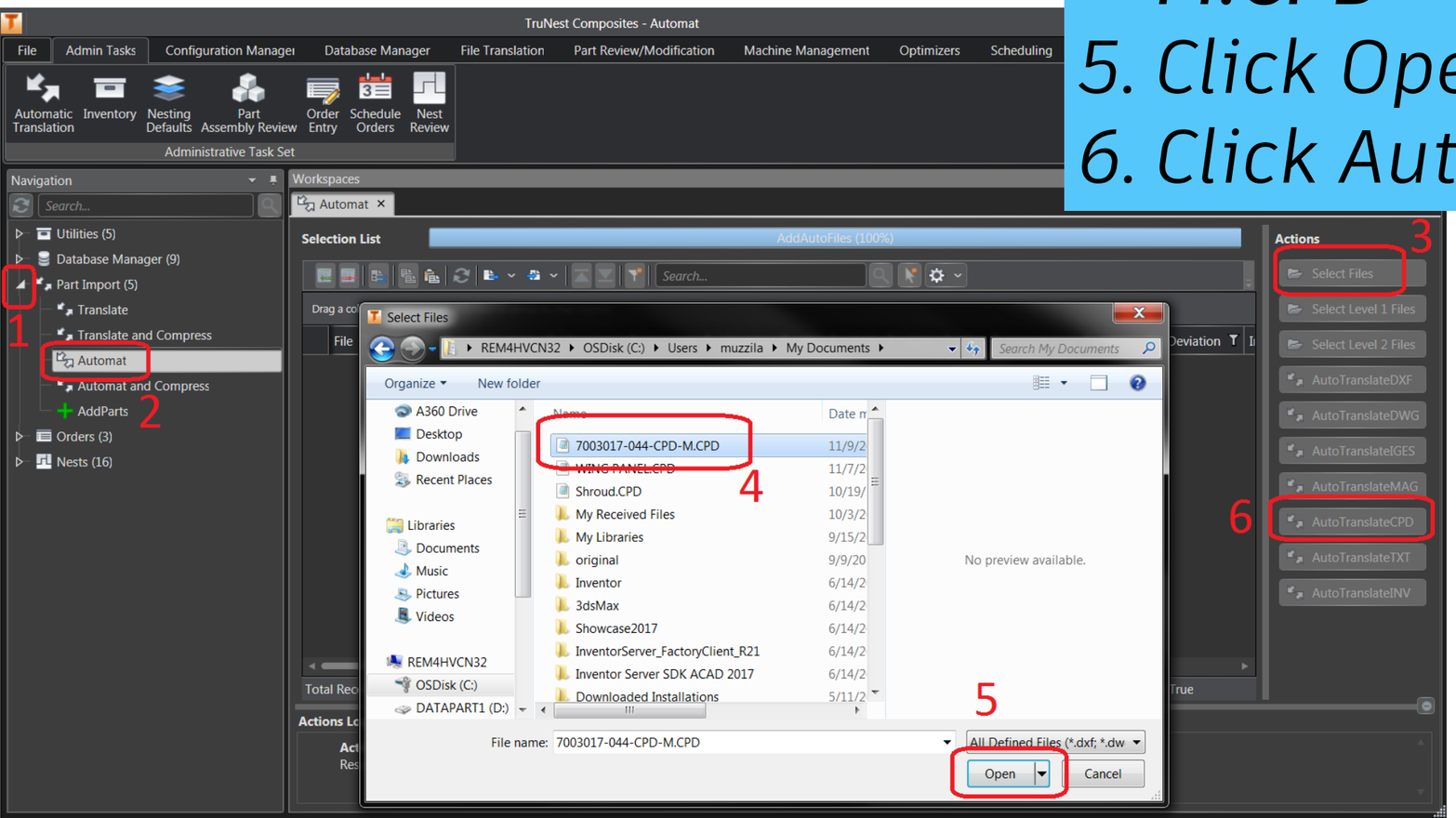


3. Click Login



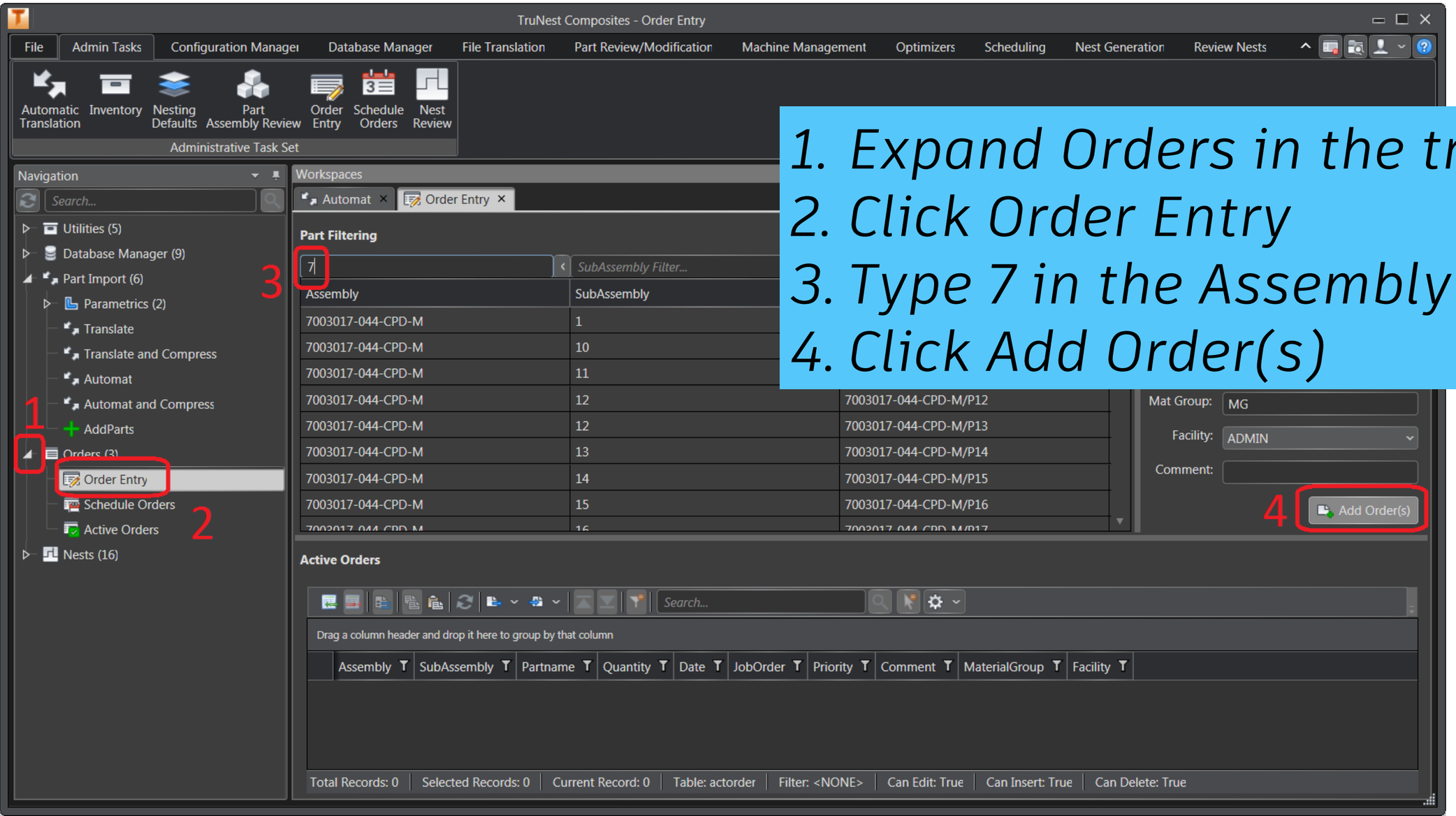
Nest 2D ply shapes in TruNest Composites

1. Expand Part Import in the tree
2. Click Automat
3. Click Select Files
4. Select C:\Users\public\My Documents**7003017-044-CPD-M.CPD**
5. Click Open
6. Click AutoTranslateCPD



AUTODESK.

Nest 2D ply shapes in TruNest Composites

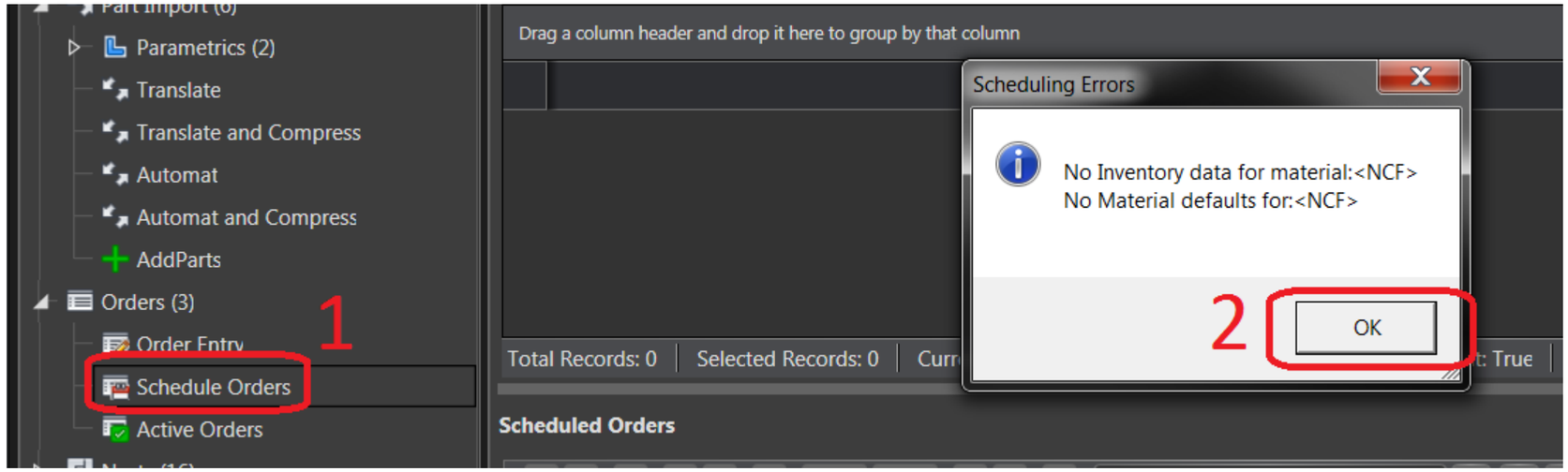


1. Expand Orders in the tree
2. Click Order Entry
3. Type 7 in the Assembly filter box
4. Click Add Order(s)

AUTODESK.

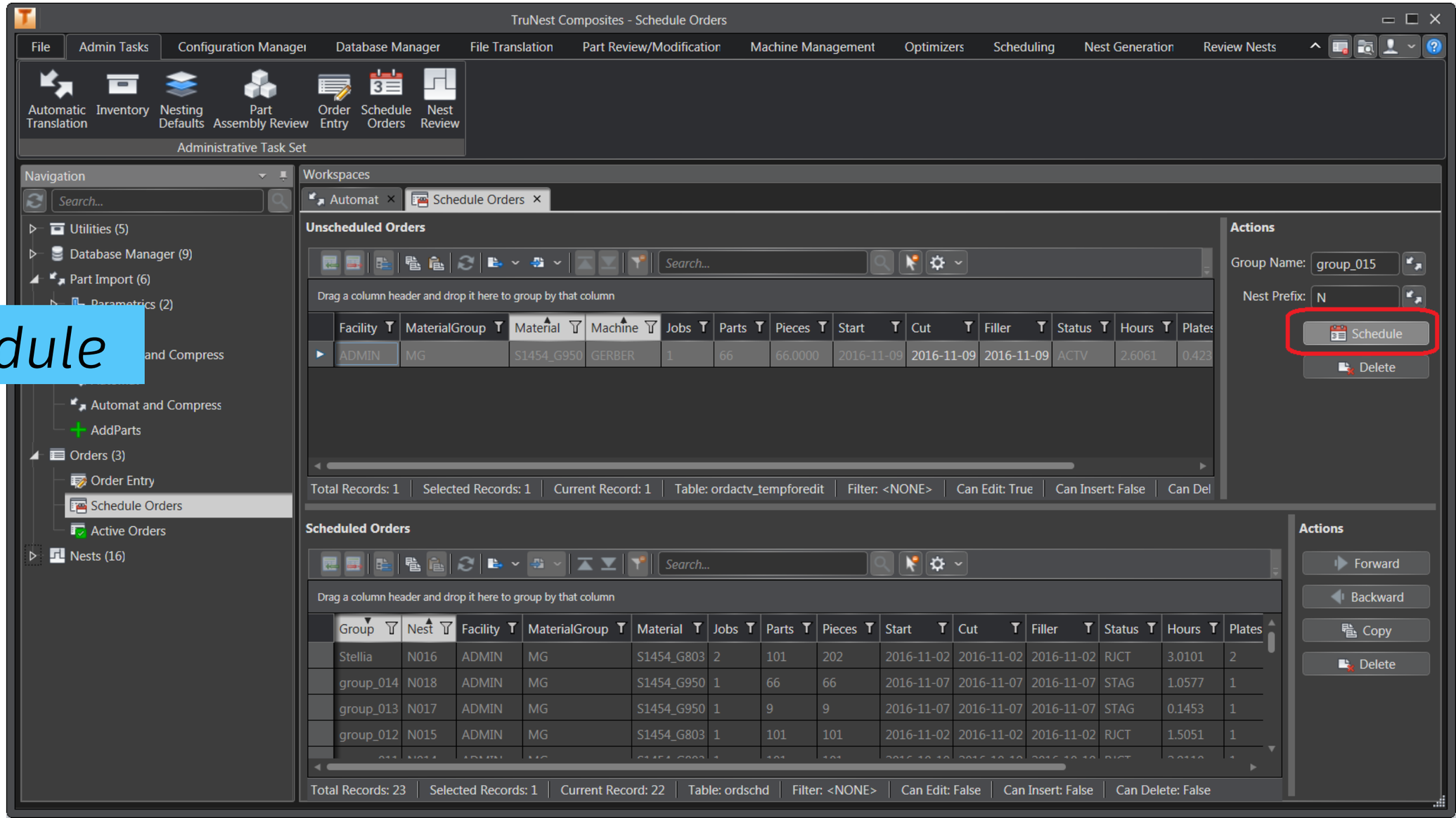
Nest 2D ply shapes in TruNest Composites

1. Click Schedule Orders in the tree
2. Click OK

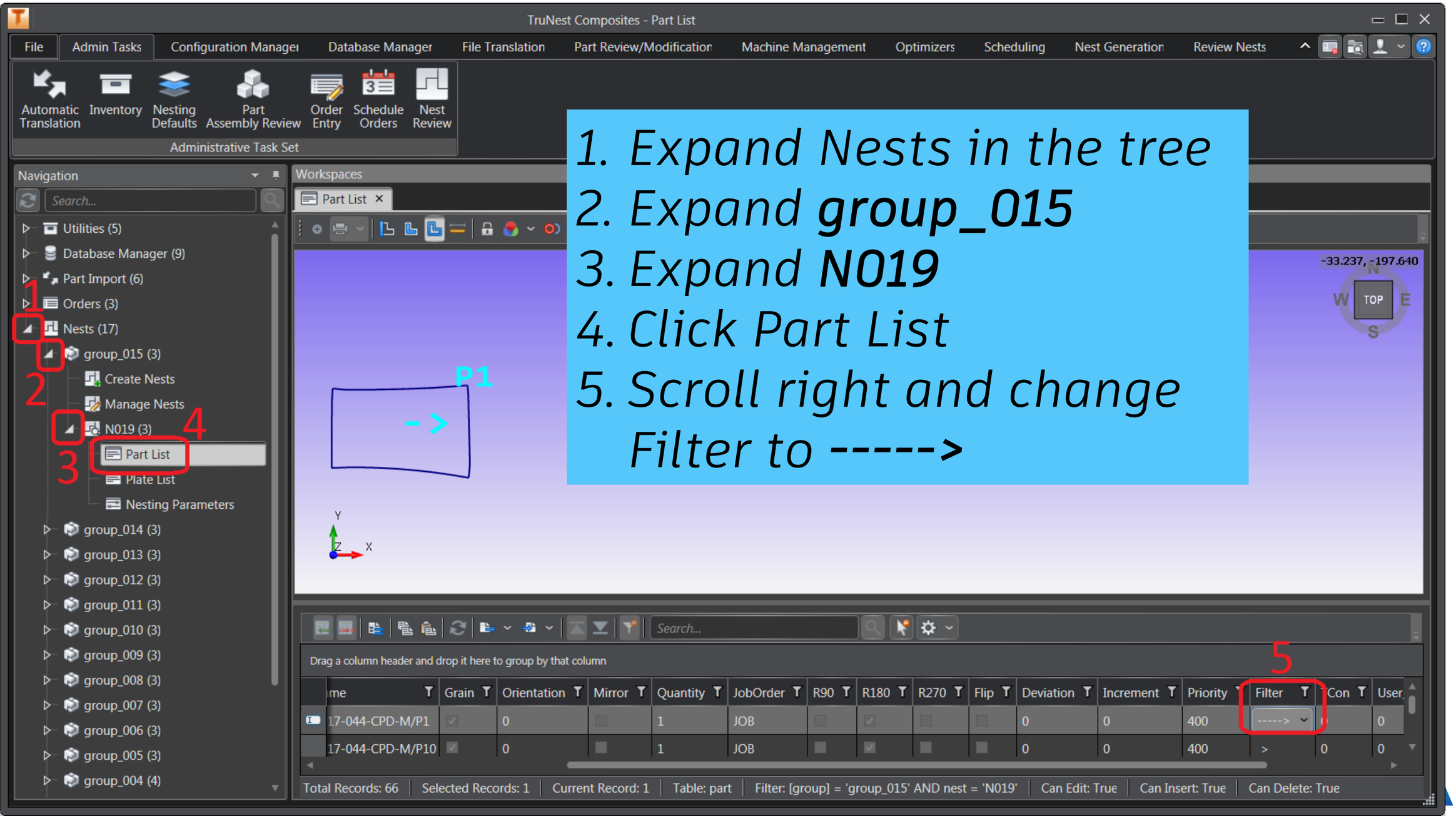


Nest 2D ply shapes in TruNest Composites

1. Click Schedule



Nest 2D ply shapes in TruNest Composites

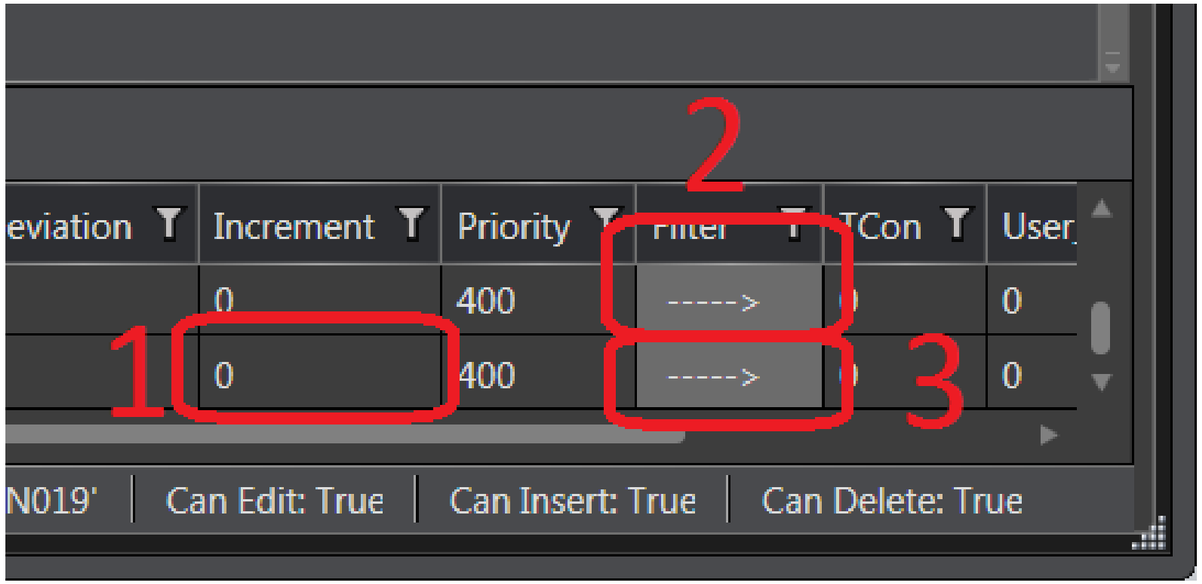


1. Expand Nests in the tree
2. Expand **group_015**
3. Expand **N019**
4. Click Part List
5. Scroll right and change Filter to ----->

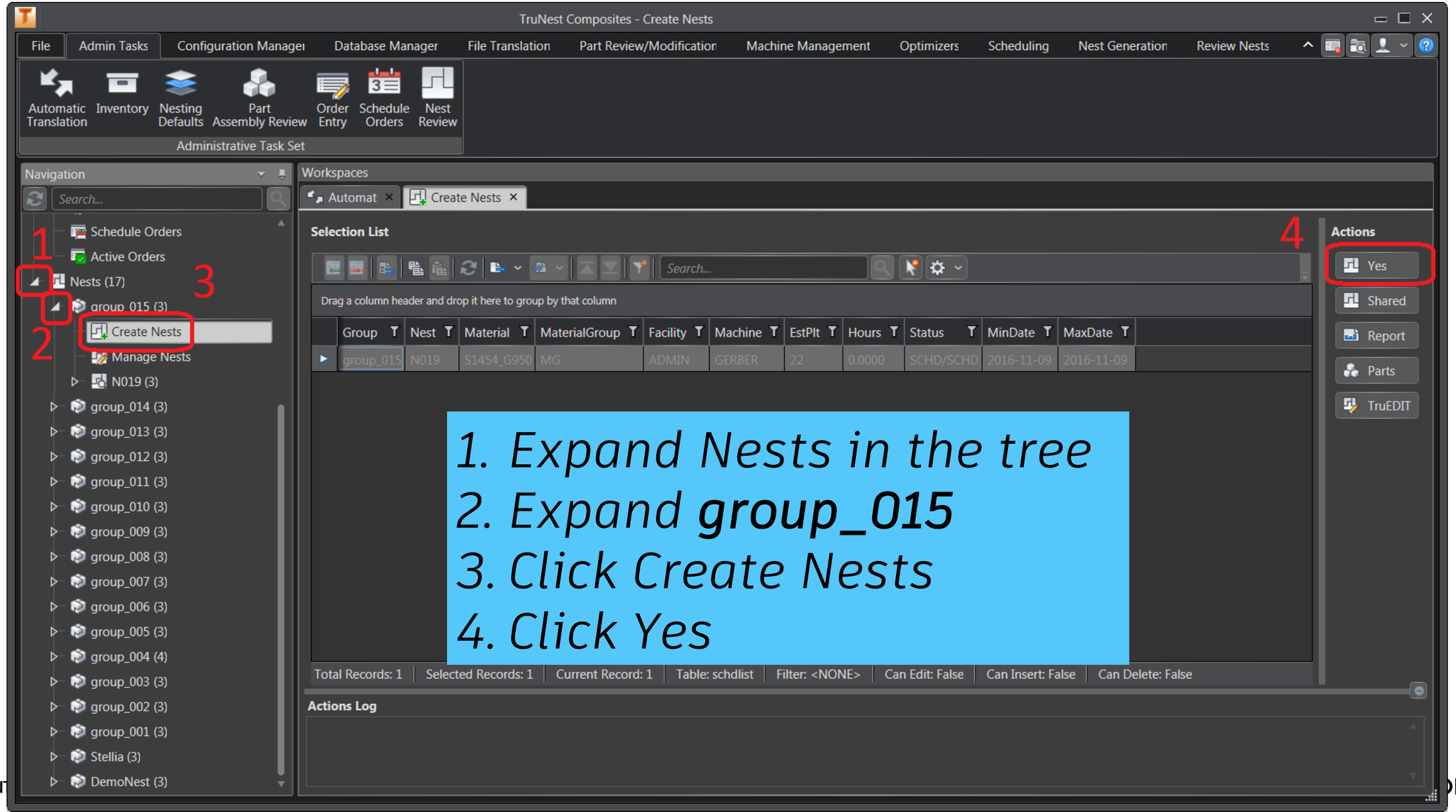
AUTODESK.

Nest 2D ply shapes in TruNest Composites

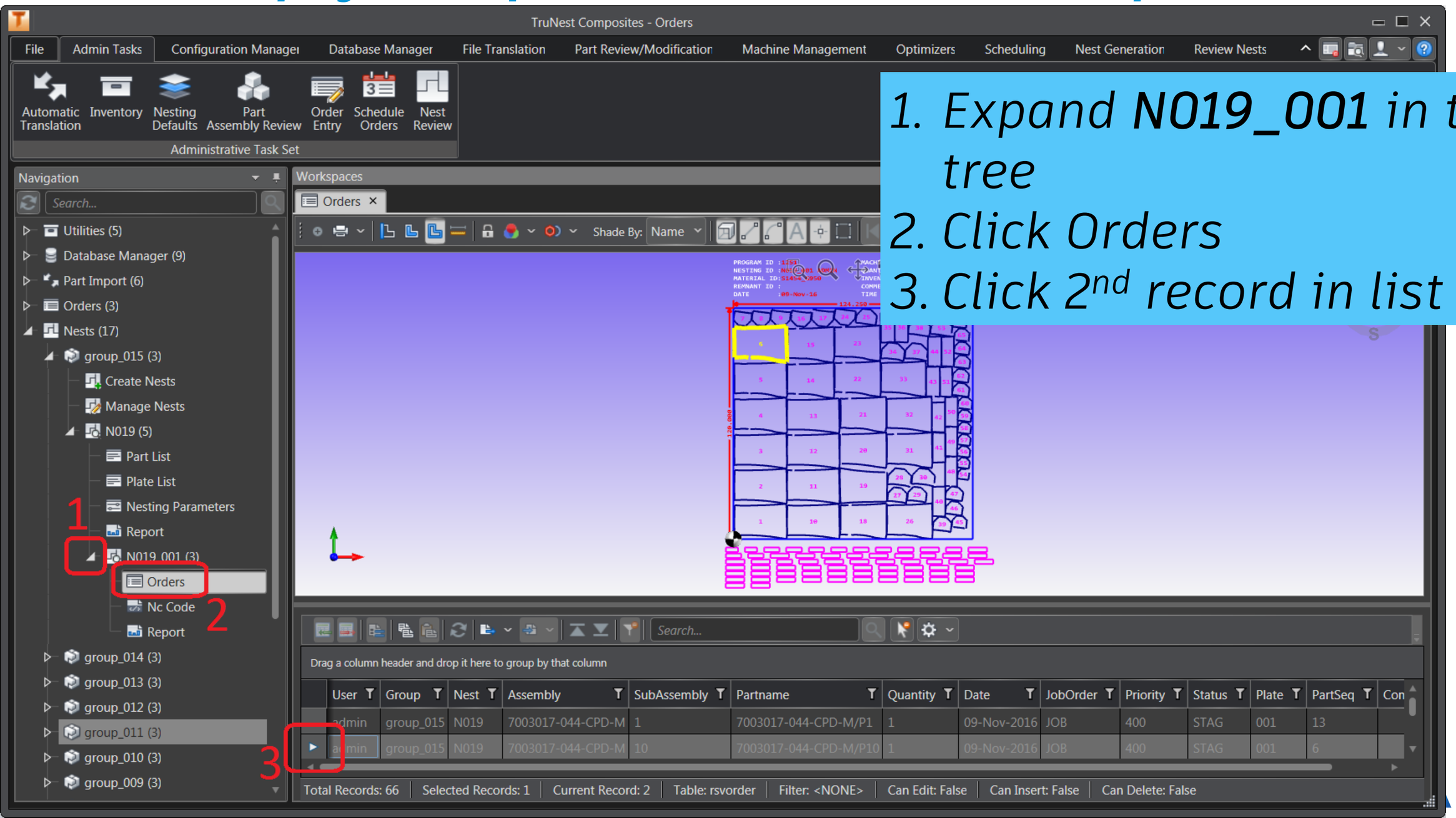
1. Click outside the current record
2. Select Filter on top record and type **Ctrl + c**
3. Click and drag down on Filter from 2nd record to the end of list
4. Type **Ctrl + v**



Nest 2D ply shapes in TruNest Composites



Nest 2D ply shapes in TruNest Composites

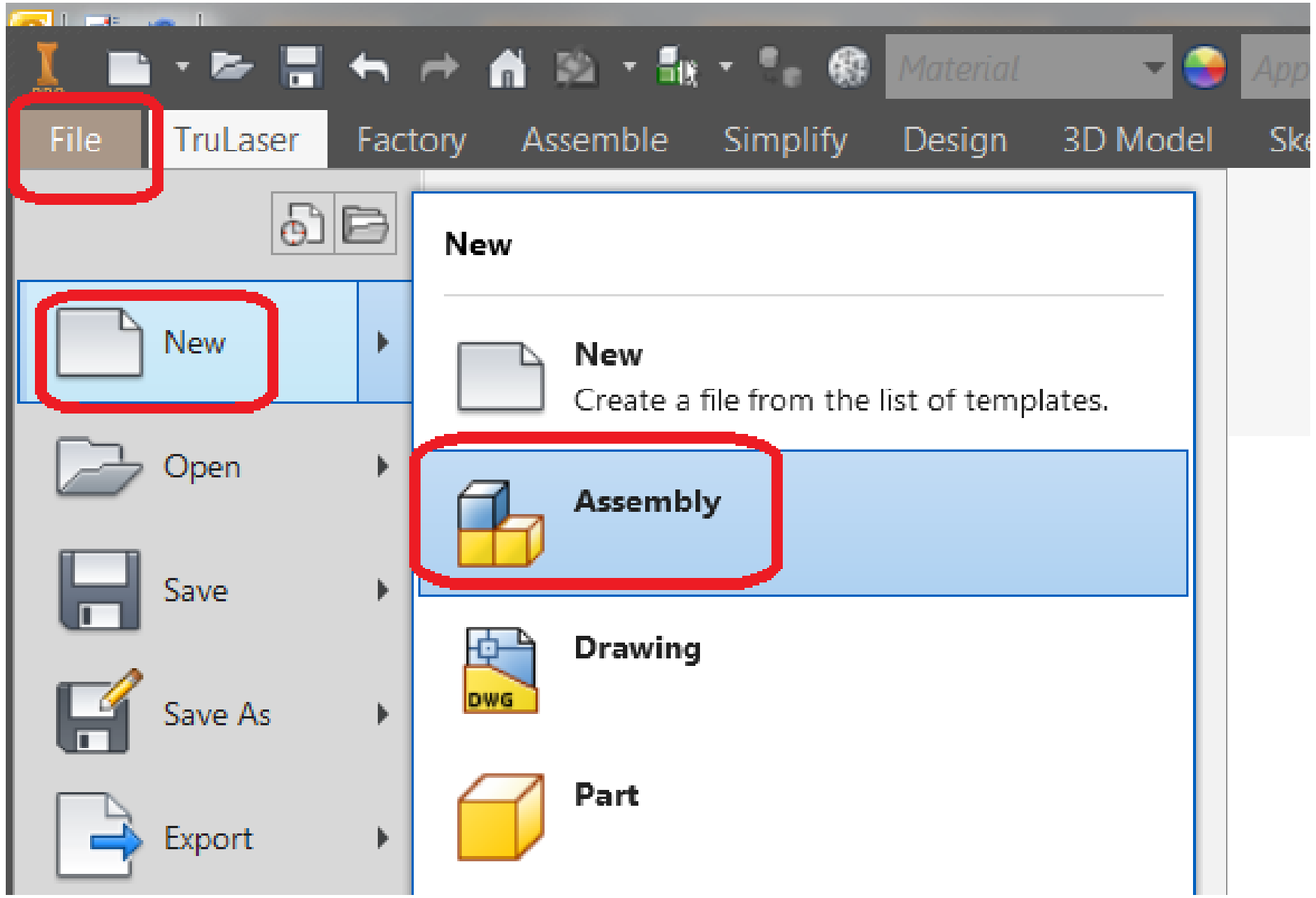


1. Expand **N019_001** in the tree
2. Click Orders
3. Click 2nd record in list

AUTODESK.

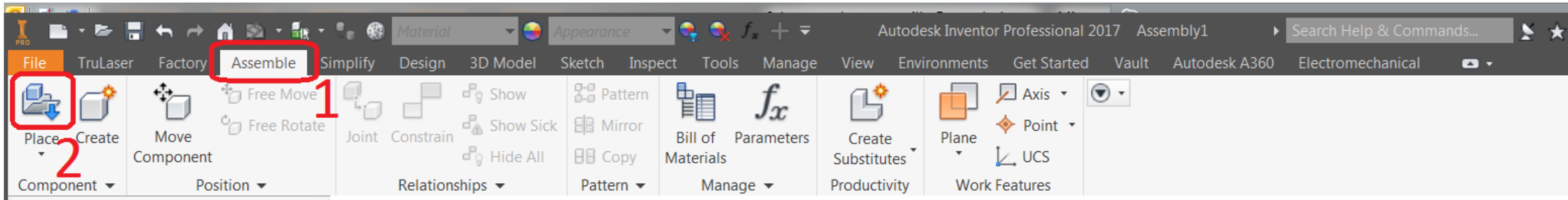
Optimize laser projection data with TruLaser

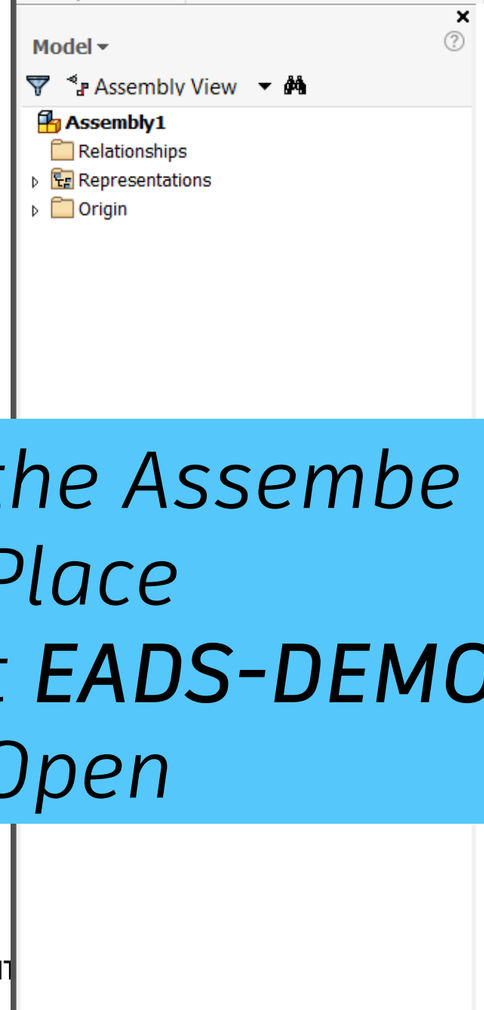
Optimize laser projection data with TruLaser

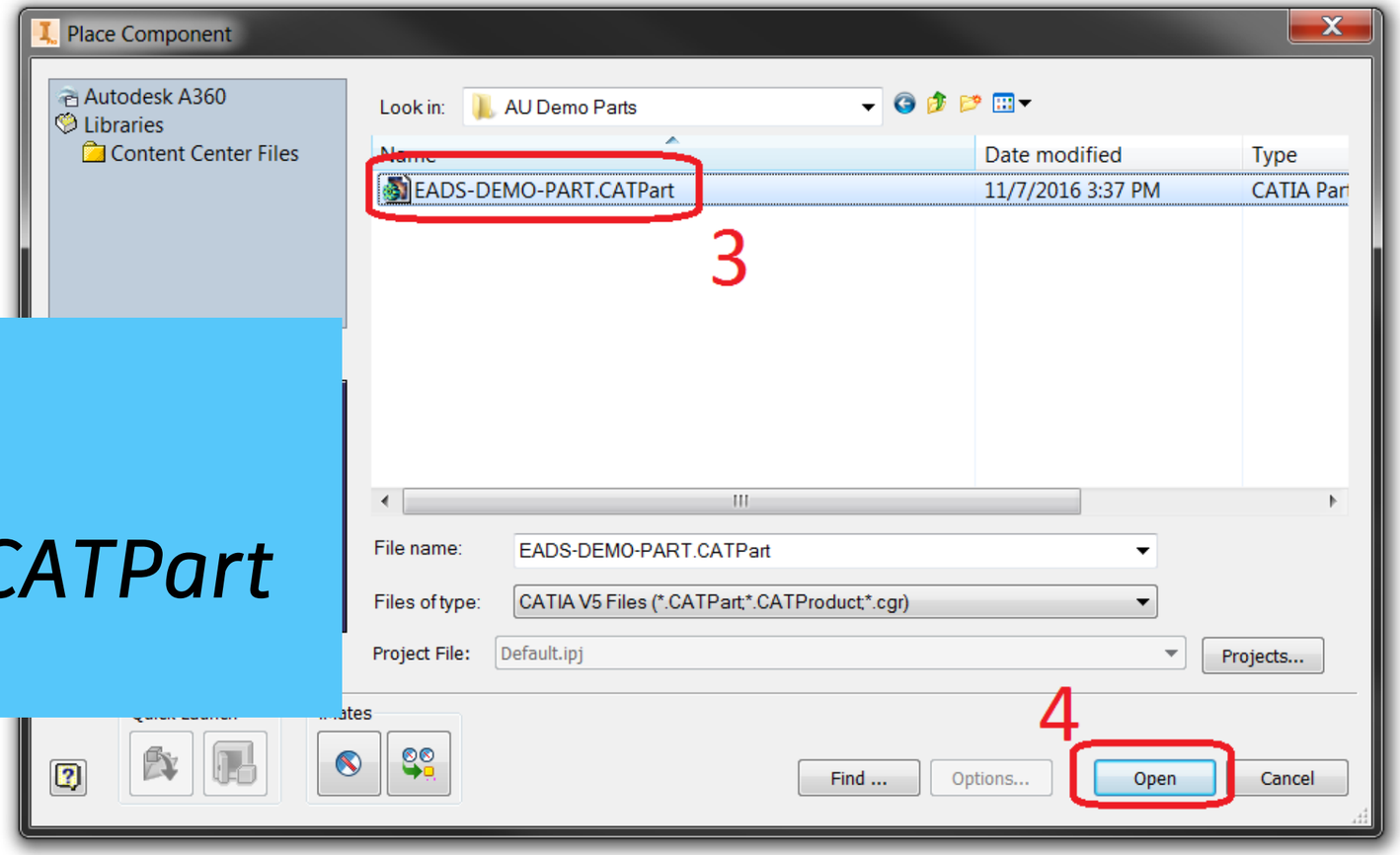


1. Click File
2. Hover over New
3. Click Assembly

Optimize laser projection data with TruLaser



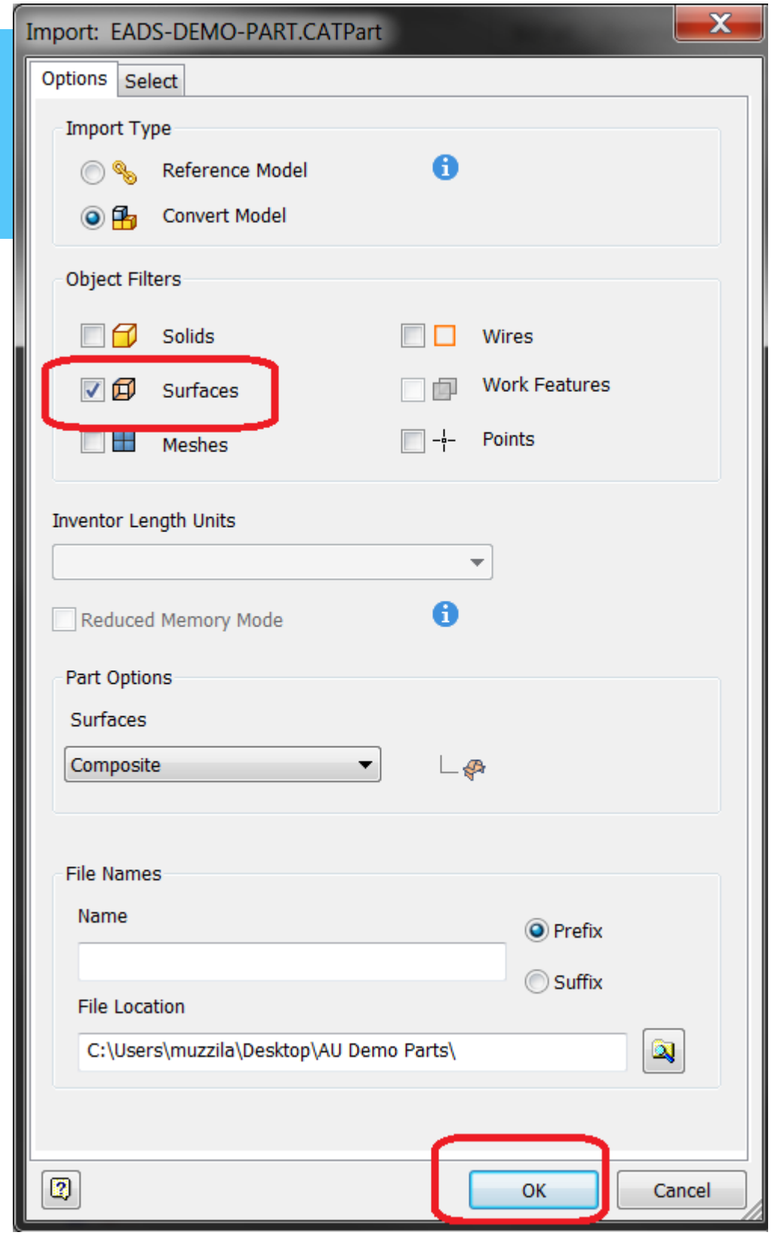




1. Click the Assembe tab
2. Click Place
3. Select **EADS-DEMO-PART.CATPart**
4. Click Open

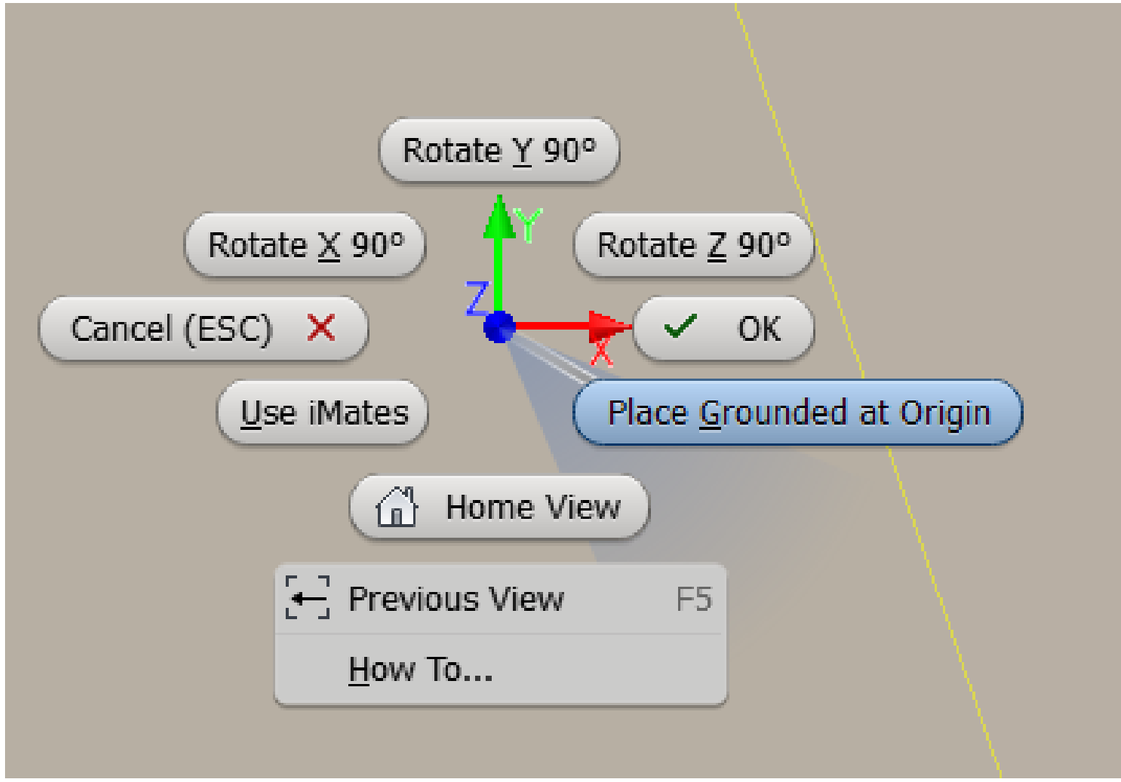
Optimize laser projection data with TruLaser

1. DESELECT ALL checkboxes except Surfaces
2. Click OK



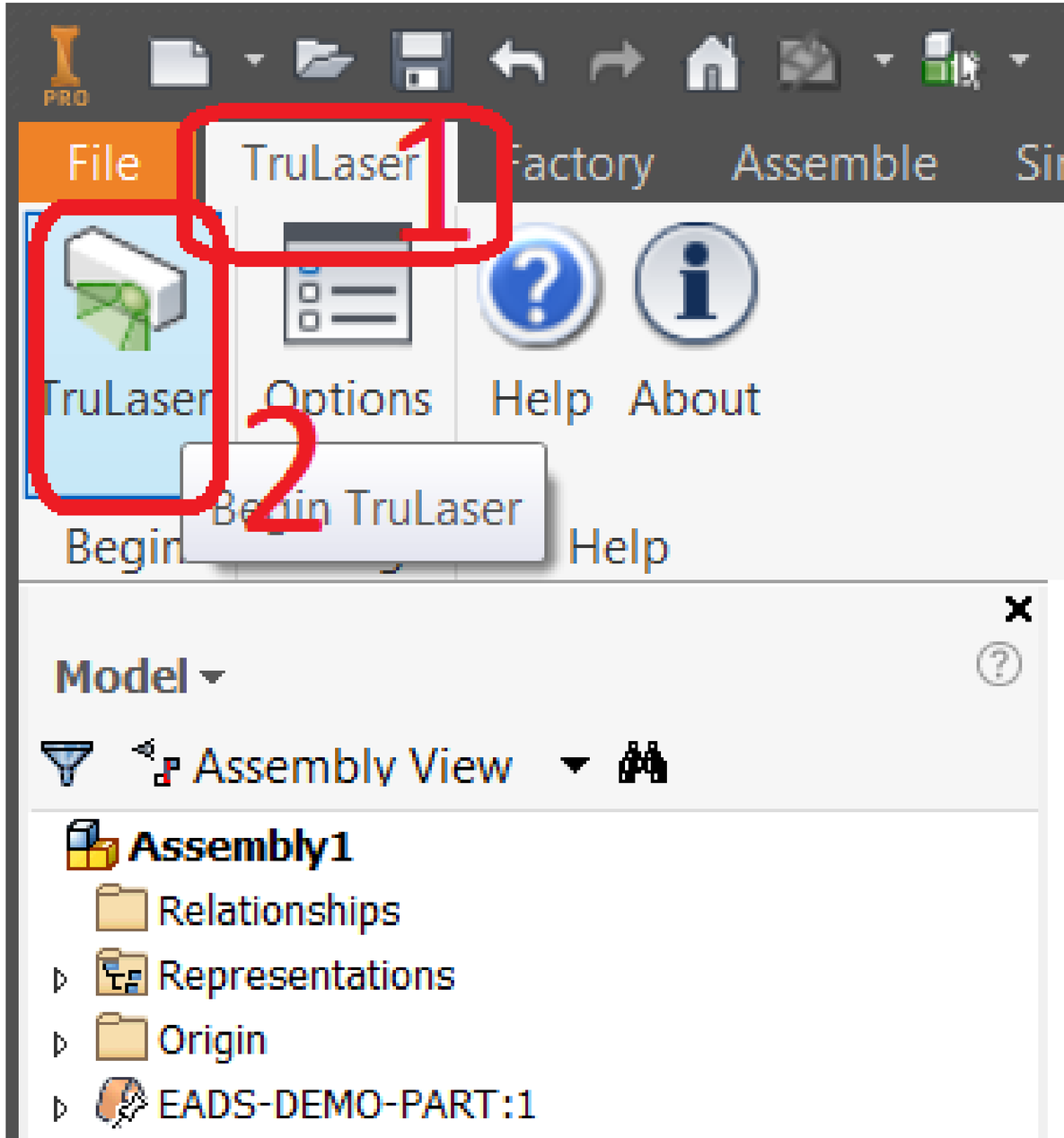
Optimize laser projection data with TruLaser

1. RIGHT-Click anywhere in the graphic window
2. Select Place Grounded at Origin
3. Type **Escape**



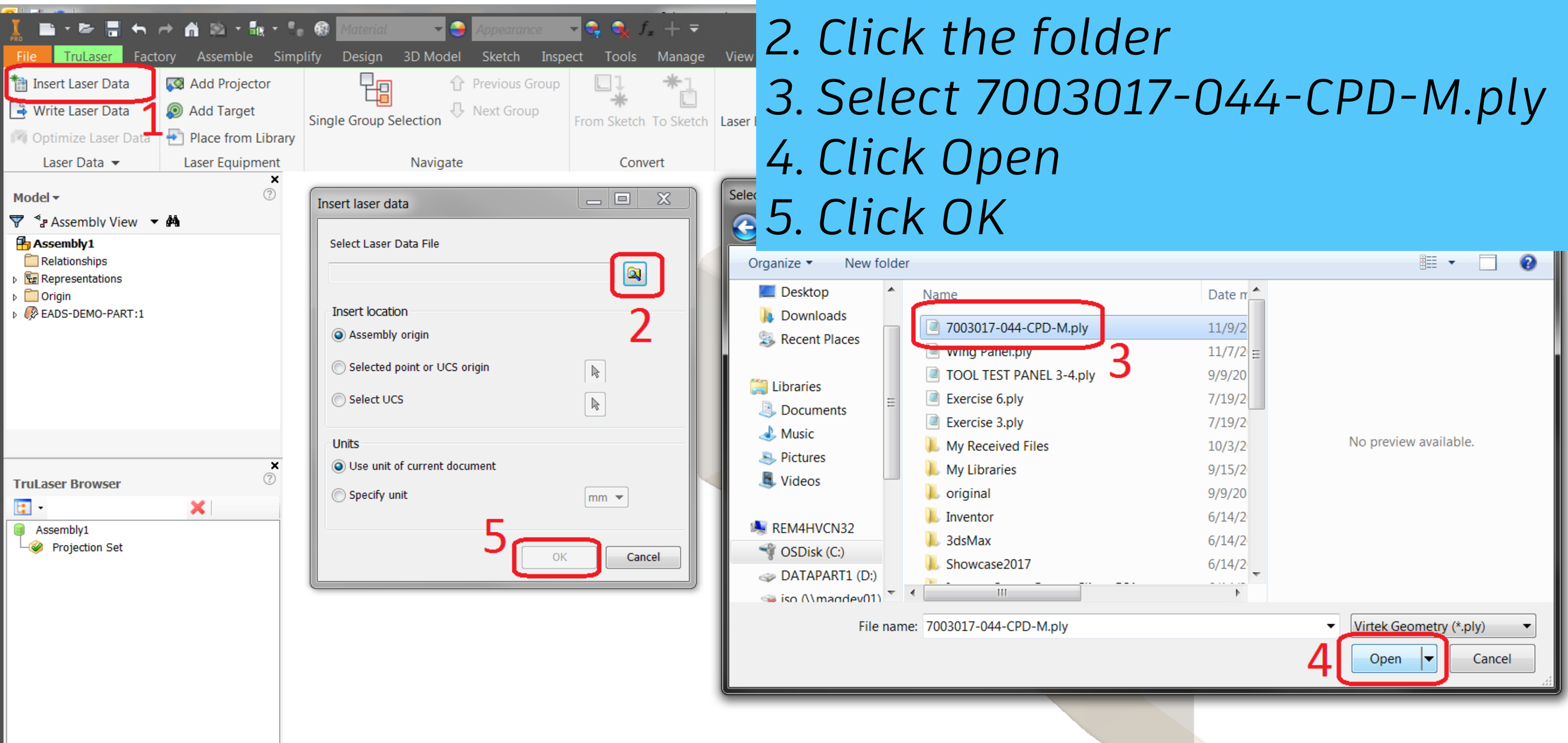
Optimize laser projection data with TruLaser

1. Click the TruLaser tab
2. Click TruLaser begin



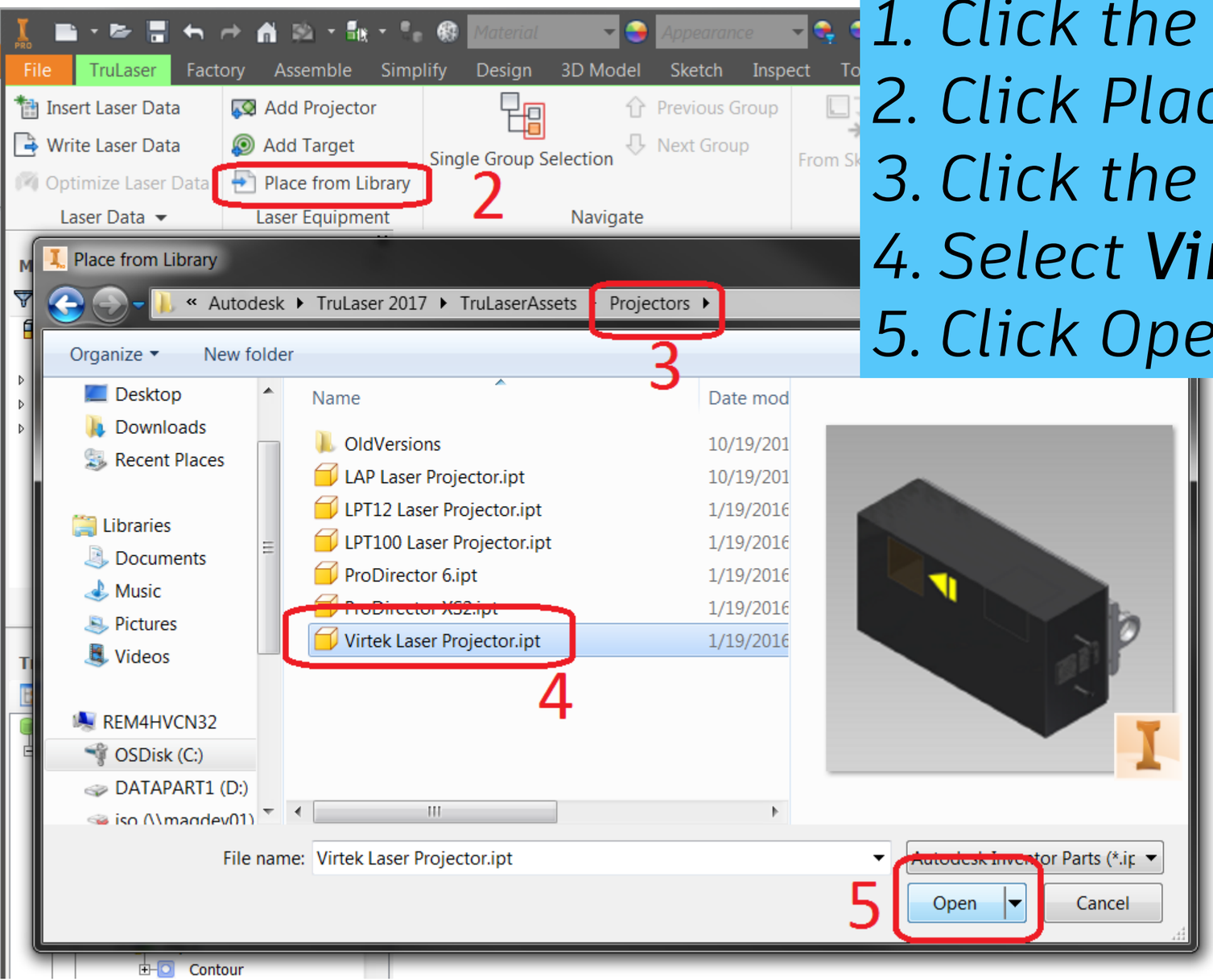
Optimize laser projection data with TruLaser

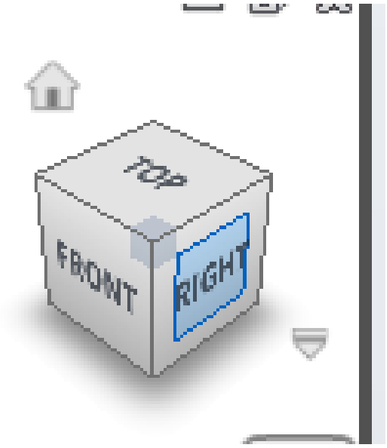
1. Click Insert laser data
2. Click the folder
3. Select 7003017-044-CPD-M.ply
4. Click Open
5. Click OK



Optimize laser projection data with TruLaser

1. Click the right face on the view cube
2. Click Place from Library
3. Click the projectors folder
4. Select **Virtek Laser Projector.ipt**
5. Click Open





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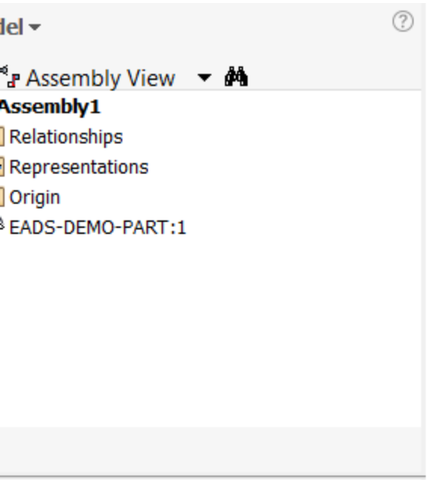
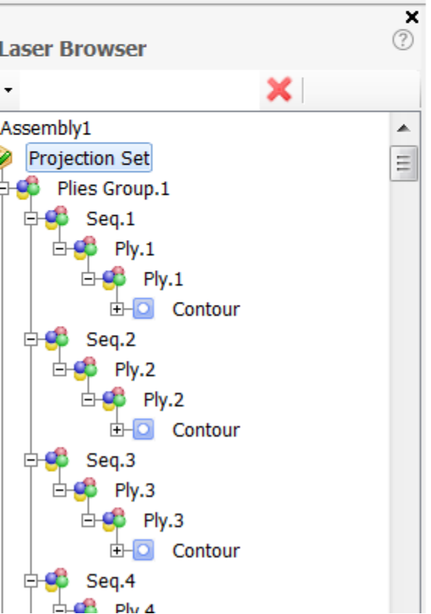
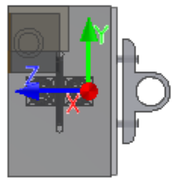
Optimize laser projection data with TruLaser

1. Scroll middle mouse wheel to zoom in and out
2. Move projector to the left of the tool
3. Click to place projector
4. Type **Escape**



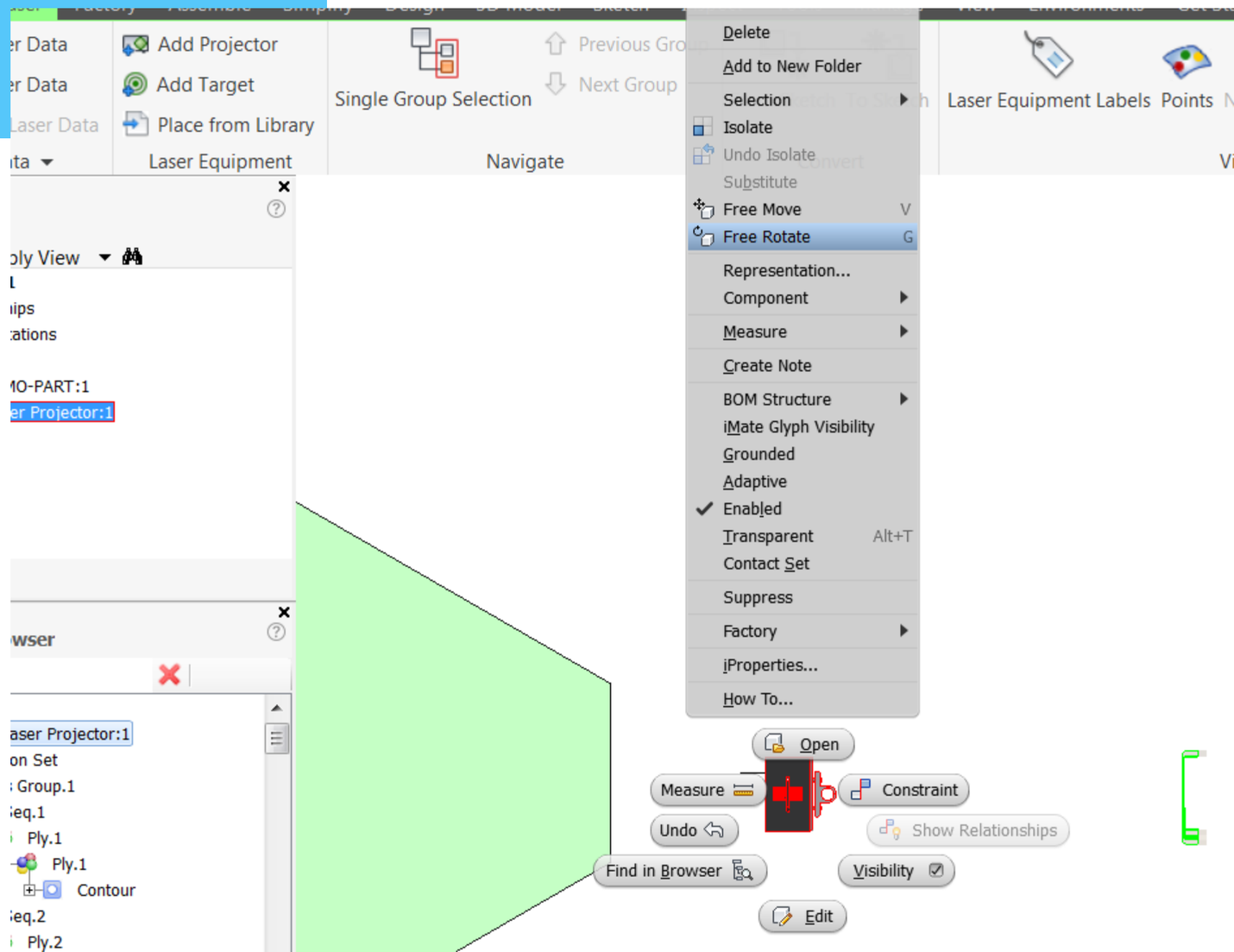




AUTODESK.

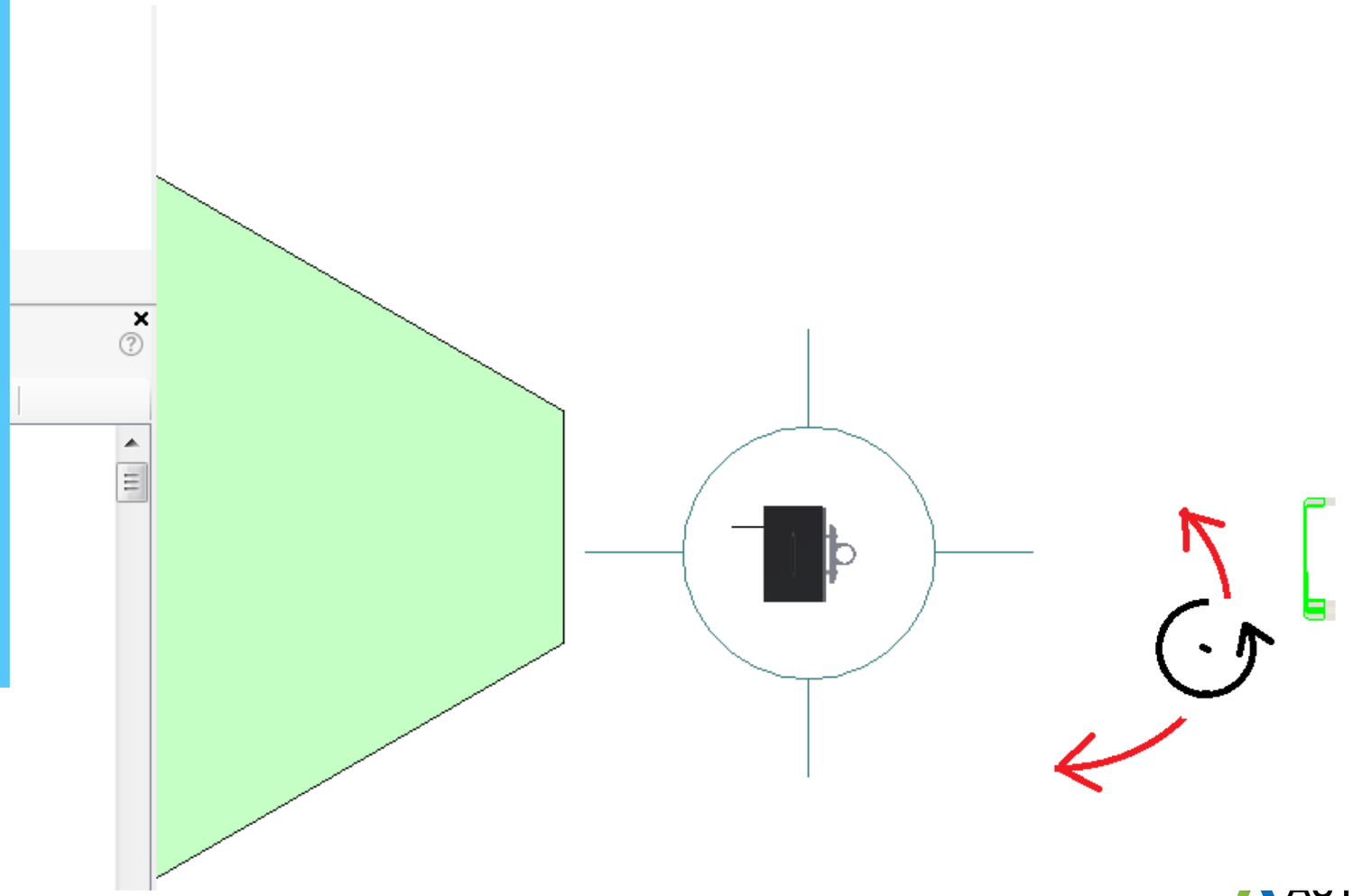
Optimize laser projection data with TruLaser

1. Click the projector to select
2. Right click the projector
3. Select Free Rotate



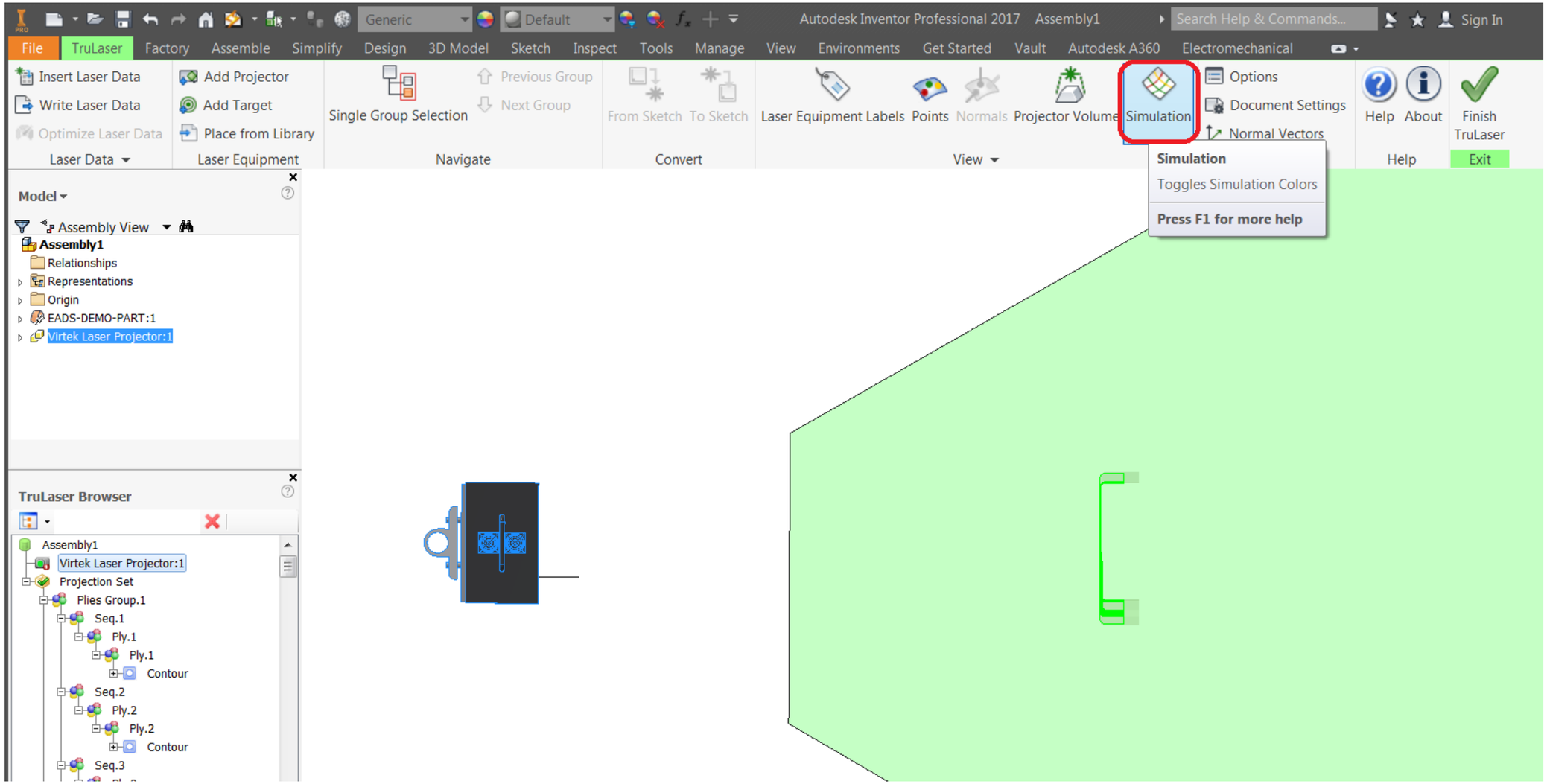
Optimize laser projection data with TruLaser

1. Move the pointer outside the rotation circle
2. Click and drag until the projector is pointed towards the tool
3. Single click over open space to accept changes



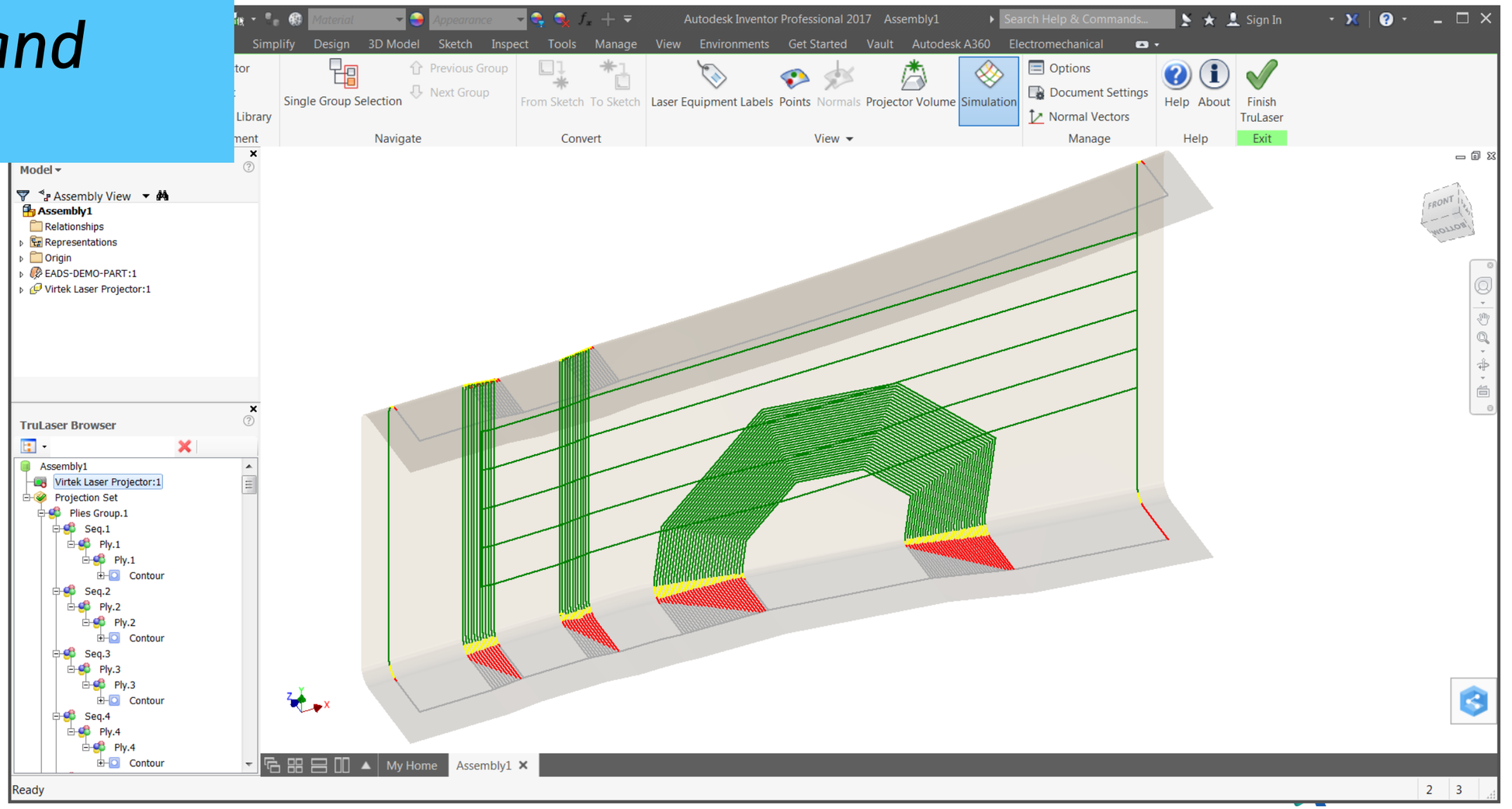
Optimize laser projection data with TruLaser

1. Click Simulation



Optimize laser projection data with TruLaser

1. Rotate model with **Shift + middle mouse click and drag**



TruNest composites for Material tracking

Material Tracking

AUTODESK® TRUNEST

Freezer

Cutting

- *Expiration dates for all plies*
- *In/Out time for all plies*
- *Remaining shelf life for plies*
- *Which Roll Each Ply Came From*

RFID
Bar Code

Bar Code

Autoclave

Layup

RFID
Bar Code

Bar Code

AUTODESK®

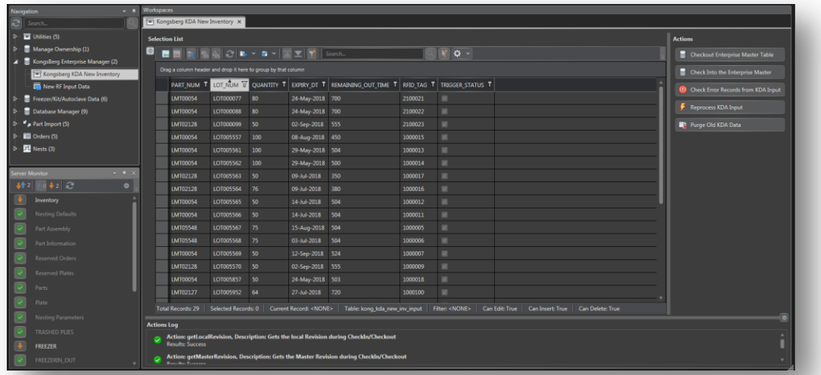
TruNest composites for Material tracking

*TruNest connects to **multiple** systems*

1. *Automated freezer tracking system / **RFID** material tracking point on cutting table*

2. ***ERP** connection for order input and inventory feedback*

3. ***Bar code** readers*
    1. *Unload from cutting table*
    2. *Layup station*
    3. *Autoclave*



TruNest composites for Material tracking

*TruNest connects to **multiple** systems*

4. ***NC code** generated for cutting table / labeler*

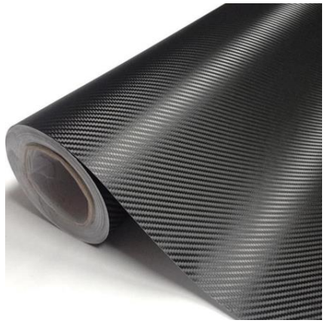
5. ***Laser projection** files generated for layup assist*

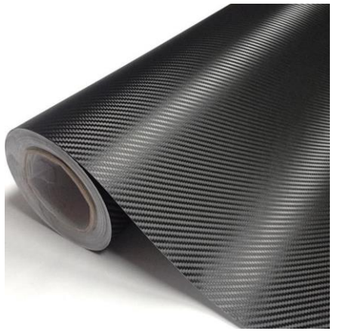
VIRTEK
A Gerber Technology Company

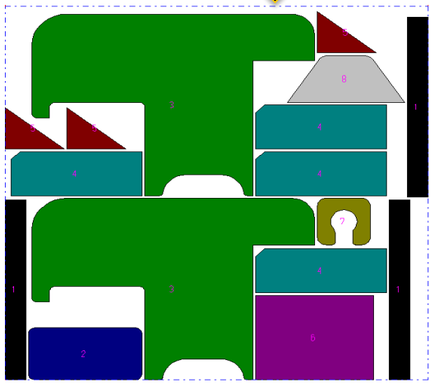
6. *XML **print** template for ply bag labels*

Adobe®

Workflow for Material tracking





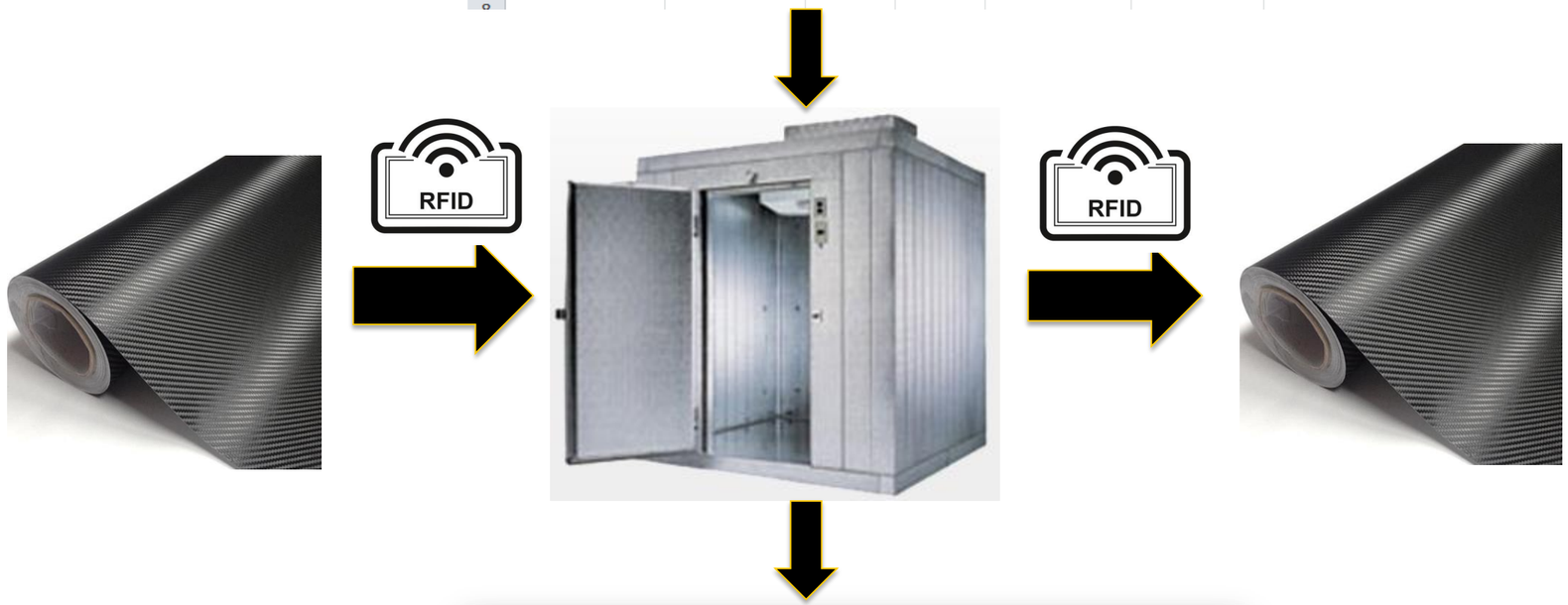


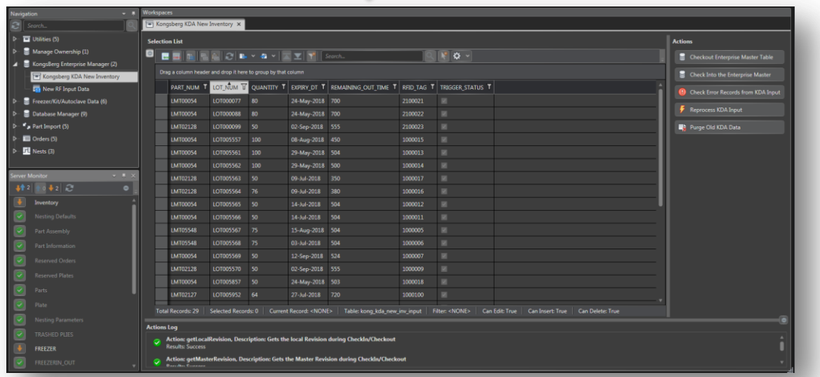
Timer for Material tracking

Workflow for Material tracking

	A	B	C	D	E	F
1	**Roll name**	**Material**	**Quantity**	**Width**	**Time remaining**	**Expiration date**
2	ATP000001	2ZZZ8v96de	100	1270	222	12/31/2016
3	ATP000002	2ZZZ8v96de	60	1270	162	12/31/2016
4	ATP000003	2ZZZ8v96de	90	1080	992	12/31/2016
5	ATP000004	2ZZZ8v96d48	80	1270	264	4/30/2017
6	ATP000005	2ZZZ8v96d48	22	1270	926	4/30/2017
7	ATP000006	2ZZZ8v96d48	109	1080	453	4/30/2017

Microsoft® SQL Server®





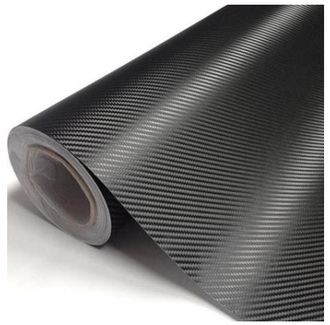
Freezer station

1. *Automated freezer*
2. *Software driven*
3. *Feeds data to TruNest*

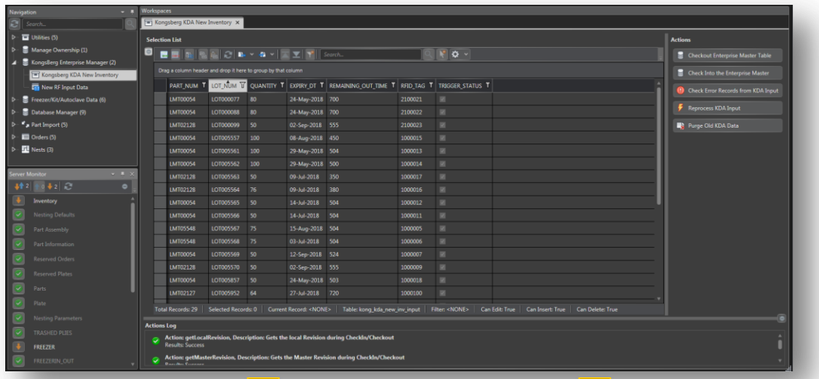
Workflow for Material tracking

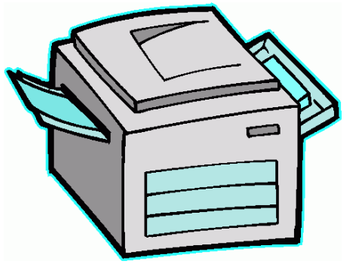
	A	B	C	D	E	F
1	Roll name	Material	Quantity	Width	Time remaining	Expiration date
2	ATP000001	2ZZZ8v96de	100	1270	222	12/31/2016
3	ATP000002	2ZZZ8v96de	60	1270	162	12/31/2016
4	ATP000003	2ZZZ8v96de	90	1080	992	12/31/2016
5	ATP000004	2ZZZ8v96d48	80	1270	264	4/30/2017
6	ATP000005	2ZZZ8v96d48	22	1270	926	4/30/2017
7	ATP000006	2ZZZ8v96d48	109	1080	453	4/30/2017

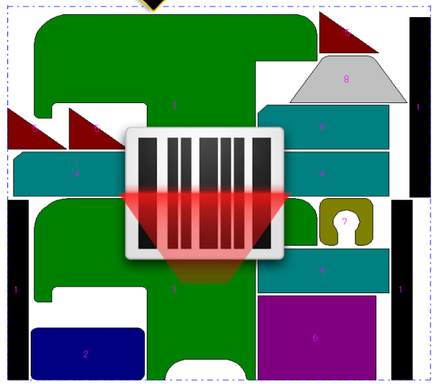
SAP®



RFID



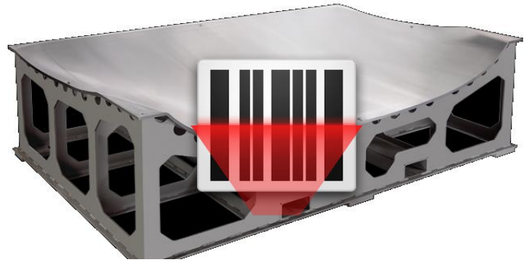


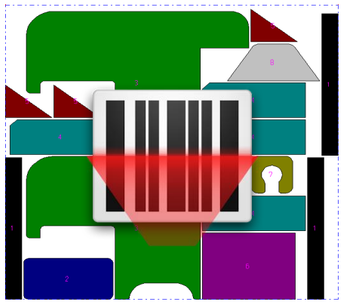


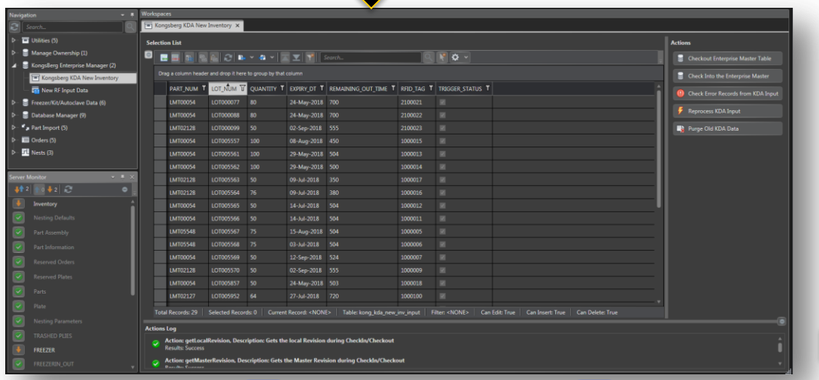
Cutter station

1. Orders from ERP
2. RFID shows roll
3. Post for cutter
4. Bar code label
5. Bag label to printer

Workflow for Material tracking



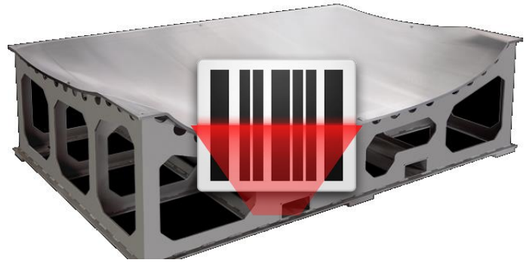


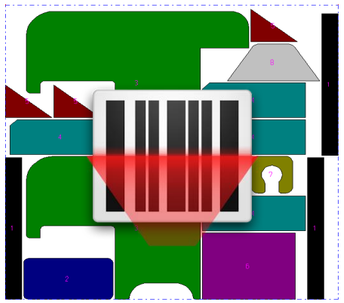


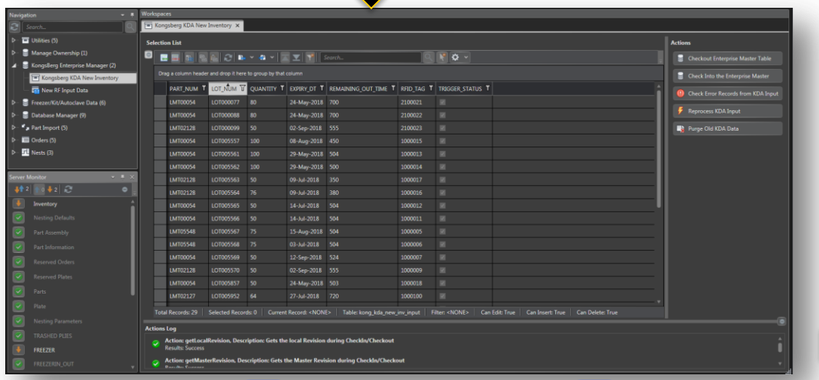
Layup station

1. *Come from cutter or freezer*
2. *Bar code kit bag*
3. *Bar code tool*
4. *Trash / Transfer plies*

Workflow for Material tracking



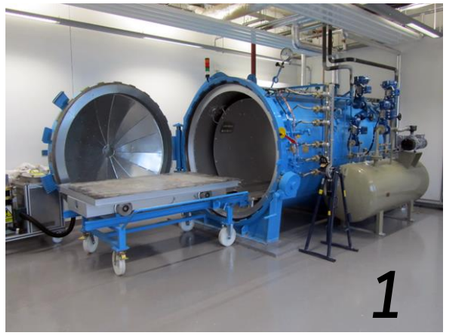




Autoclave station

1. Bar code from tool
2. 4 autoclave
3. Prep station
4. IN status
5. Stops timer after 3 hours

	A	B	C	D	E	F
1	Roll name	Material	Quantity	Width	Time remaining	Expiration date
2	ATP000001	2ZZZ8v96de	100	1270	222	12/31/2016
3	ATP000002	2ZZZ8v96de	60	1270	162	12/31/2016
4	ATP000003	2ZZZ8v96de	90	1080	992	12/31/2016
5	ATP000004	2ZZZ8v96d48	80	1270	264	4/30/2017
6	ATP000005	2ZZZ8v96d48	22	1270	926	4/30/2017
7	ATP000006	2ZZZ8v96d48	109	1080	453	4/30/2017



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