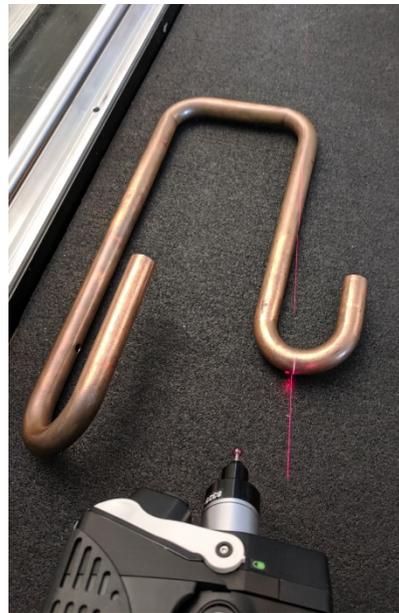
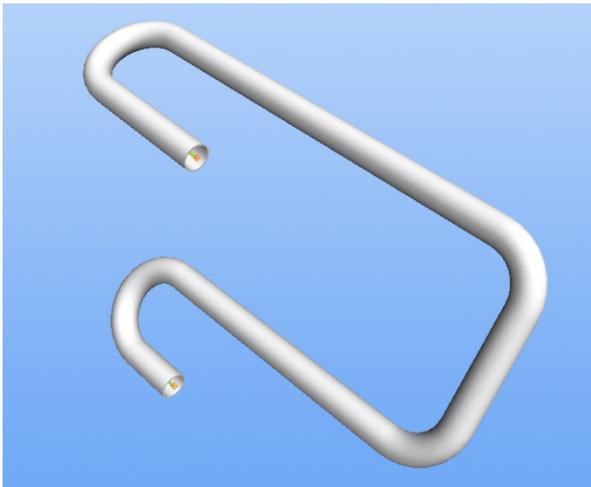


VTube-LASER Quick Start Guide for a HEXAGON 8-Series Arm – How to Import and Measure a 180-degree bend STEP model file with the SPLIT BEND feature



The steps in this workflow are from VTube-LASER version 2.9.20.

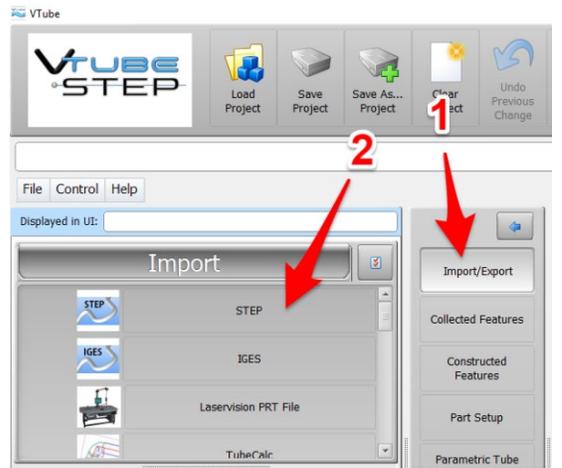
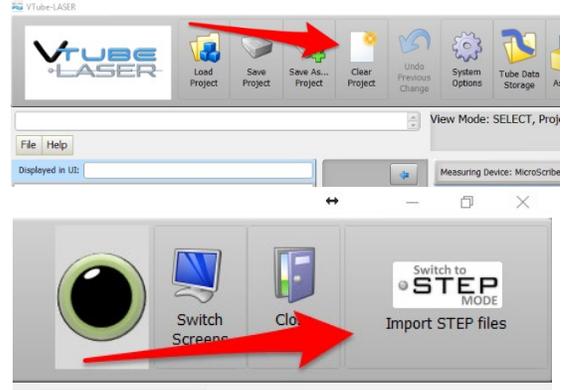
This guide uses file “HVAC Dual Split Bend.stp”



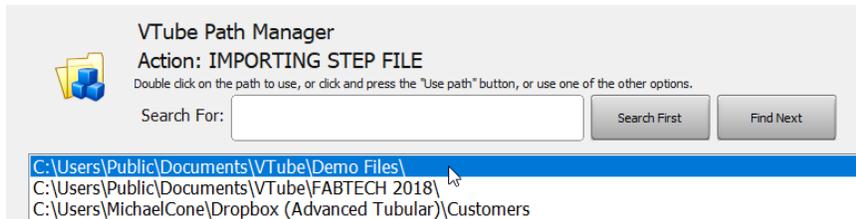
If this STEP file is not in your current installation, you can download it at
<https://www.advancedtubularsupport.com/vtube-demo-files.html>

VTube-LASER always starts in the LASER mode window.

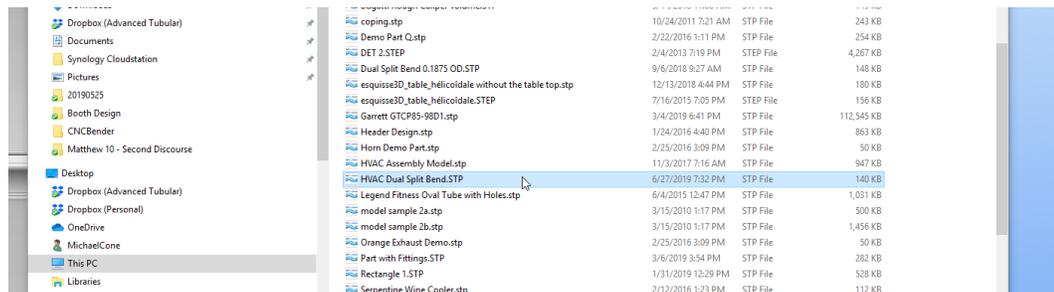
1. If VTube has a tube showing in the viewport, then press the **Clear Project** button in the tool bar on the top of the VTube-LASER window.
2. On the far-right side of the toolbar, press SWITCH TO STEP MODE button. This will allow switch you to the window that allows you to import solid models into VTube.
3. You are now in the VTube-STEP Window. Press the **Import/Export** button in the Navigation Pane, then press the **Import STEP** button in the Import menu.



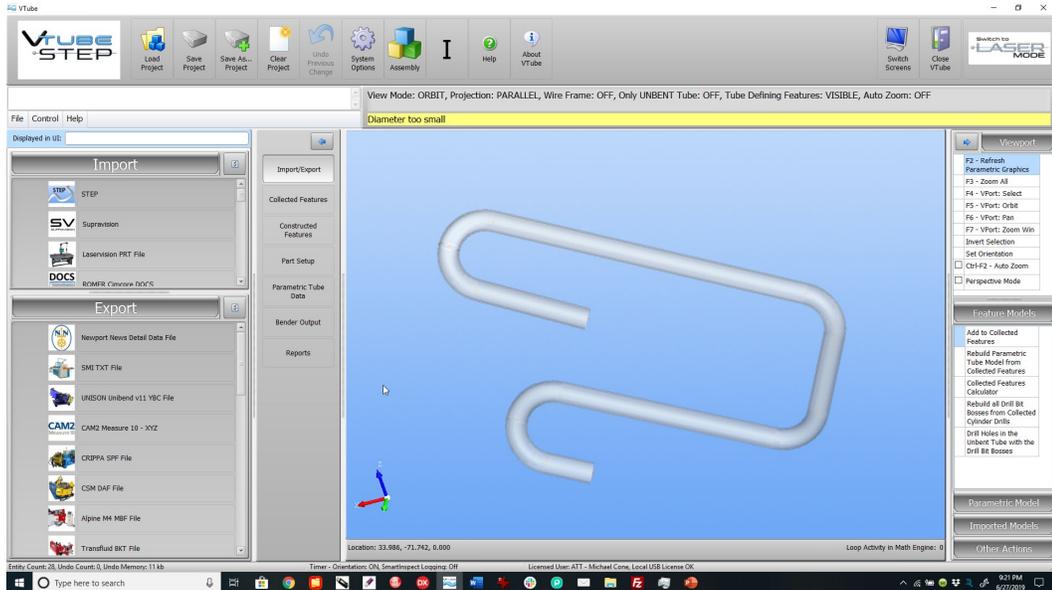
4. Double-click on the VTube path in the Path Manager.



Find **HVAC Dual Split Bend.stp** file and load it into VTube-STEP.



- You will see a model like this after the STEP or IGES import:

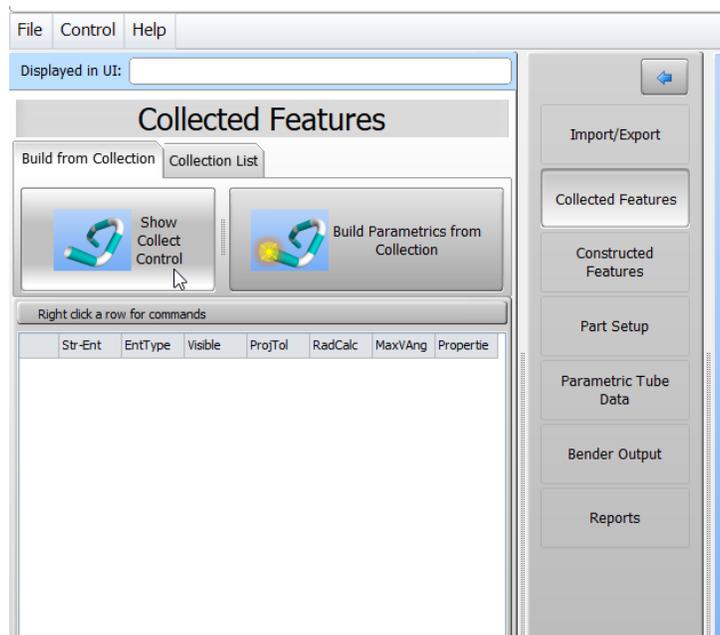


You can orbit viewport by pressing the mouse wheel down (like a button) until the viewport is in Orbit mode, then drag the image around until you can clearly see all five straights like we show above.

- Click on the Collected Features button in the navigation pane. Then press the **Show Collect Control** button.

The Collect Control floating window will display like shown to the right below.

- If necessary, use the spinner to find the **Straight from Cylinder SURFACE**

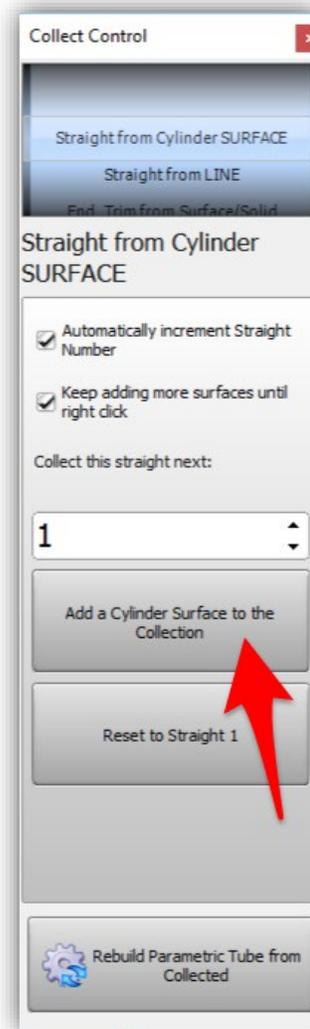


option.

To spin the wheel, click on the wheel, then spin the mouse wheel or press the up and down arrow keys.

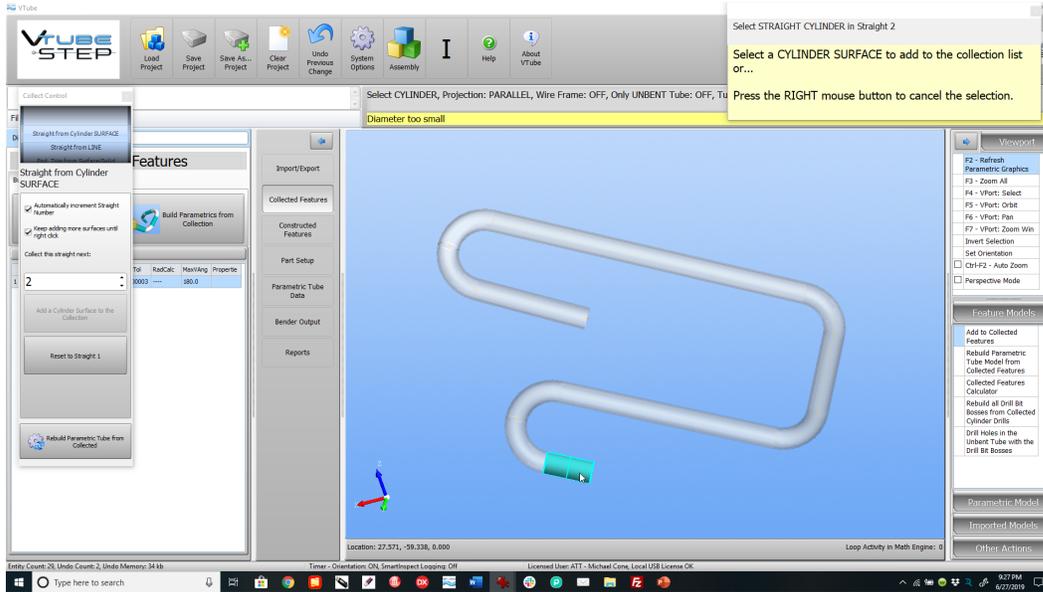
8. Press **Add a Cylinder Surface to the Collection** button.

Note that with the **Keep adding more surfaces** option enabled, VTube will continue to press the “Add Cylinder Surface to the Collection” button automatically after every straight surface selection.



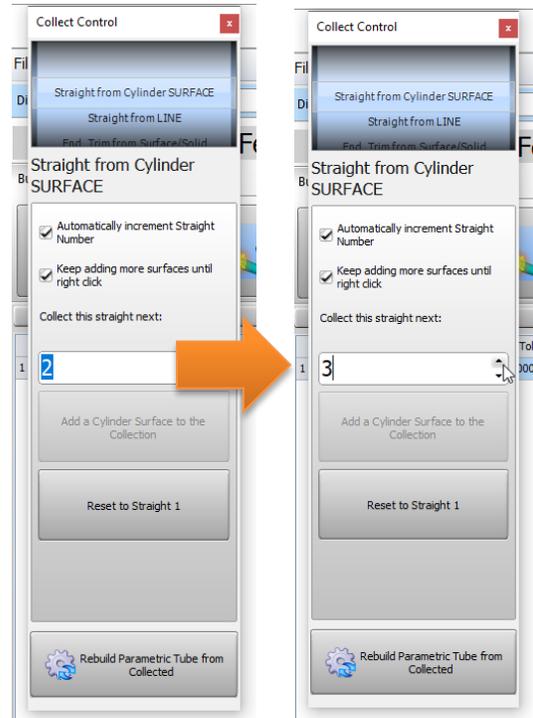
9. Select the first cylinder only. Don't select the second cylinder yet. You can choose either end as the first straight.

We're going to choose the short straight as the first one.



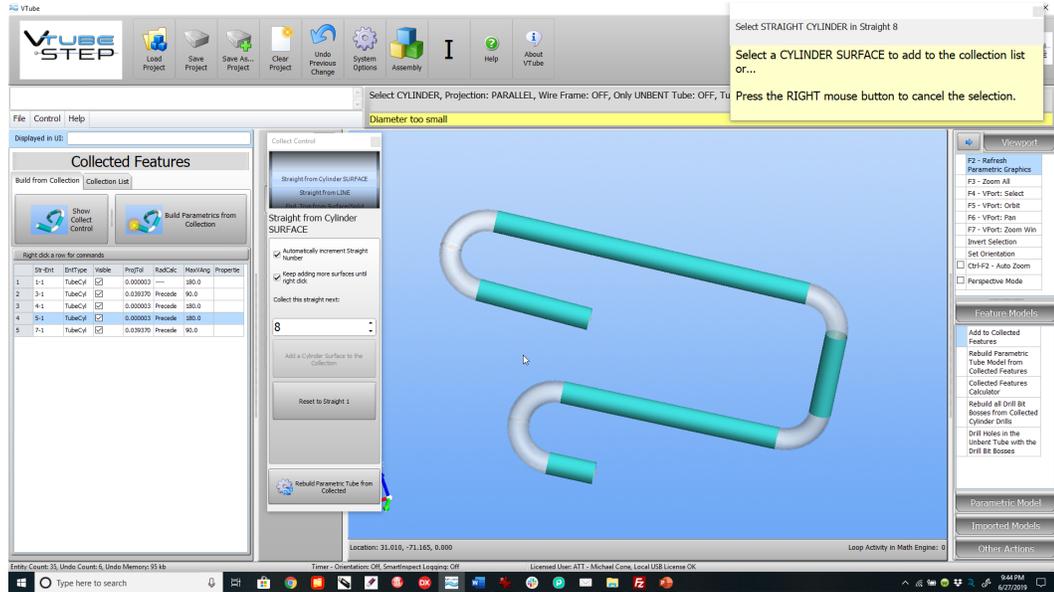
10. For the centerline XYZ coordinates VTube treats each 180-degree bends as if it has its own zero-length straight. So it is important to skip straight 2 in the Collect Control by changing the next straight to collect up one (in this case set it to 3).

If there are more 180-degree bends, then skip them as well. This part has two of them – so we will skip straights 2 and 6.

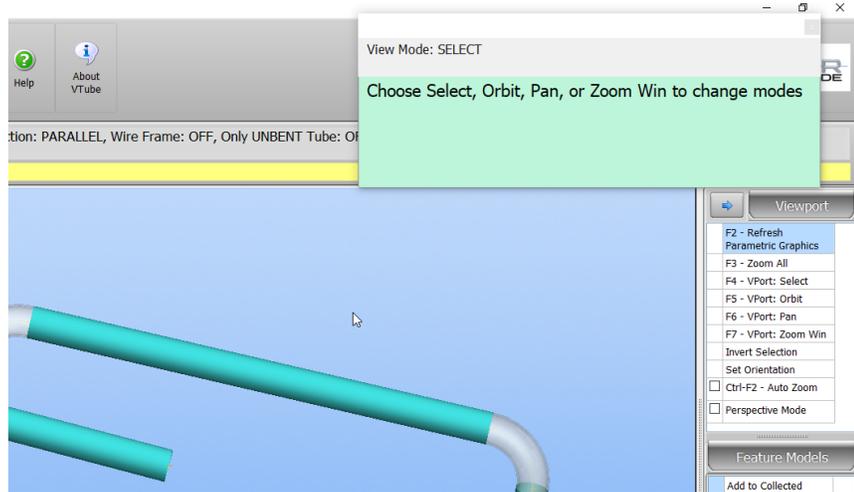


- It is acceptable to collect both outer diameter surfaces and inner wall surfaces in any straight. If you collect a variety of both, then VTube will calculate the wall thickness as well as the diameter.

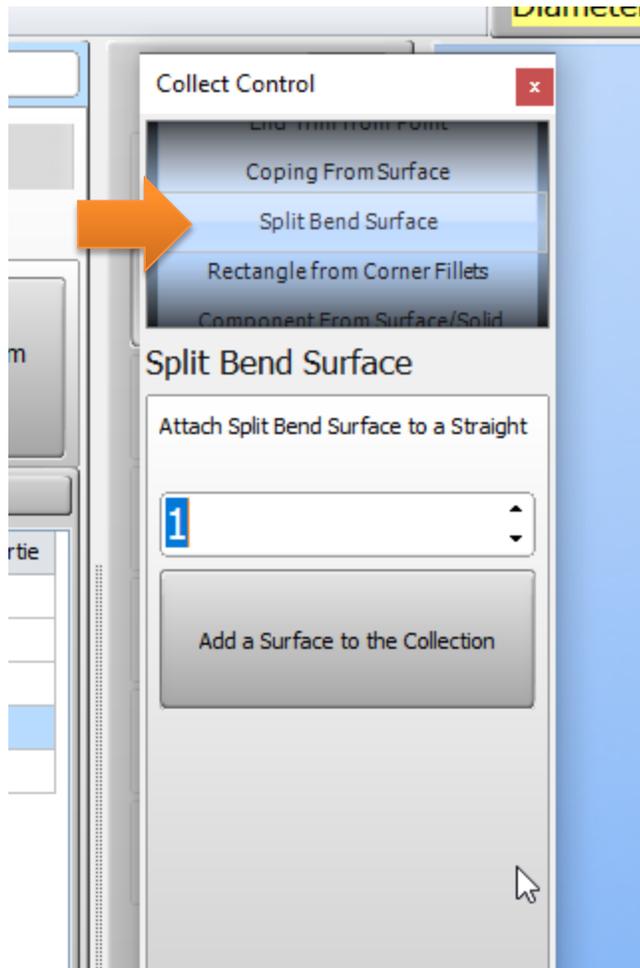
When you have selected all the straights, VTube will continue to ask for straight 8. There is no straight 8 in this part, so stop the collection process by RIGHT clicking the mouse on the viewport.



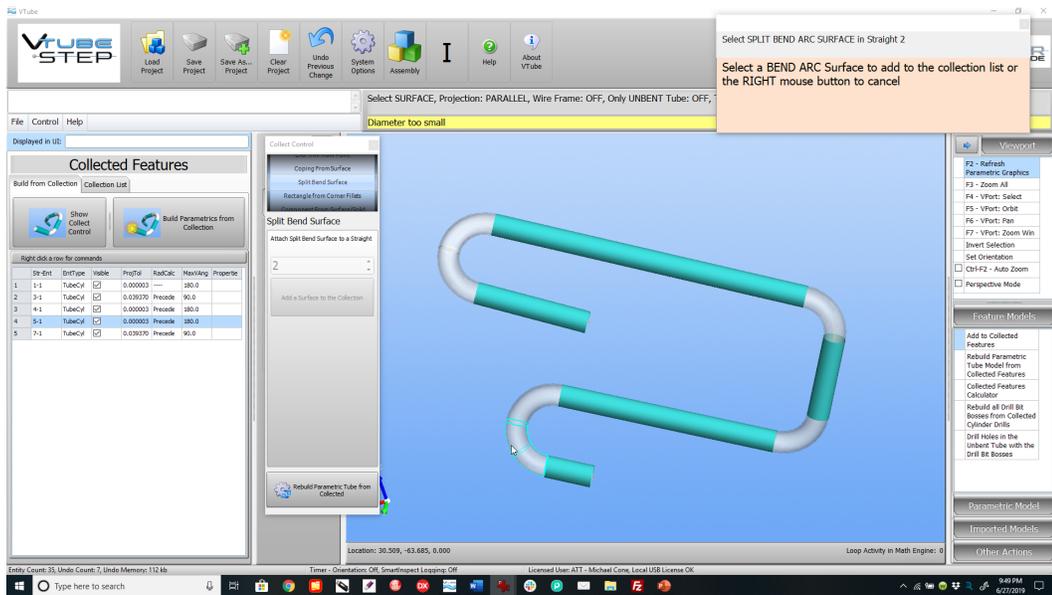
- The CAD mouse mode will change to SELECT mode, which means that the process of adding to the collection is stopped.



13. In the Collect Control, spin the blue wheel until you see **Split Bend Surface** as the selection in the wheel like this:

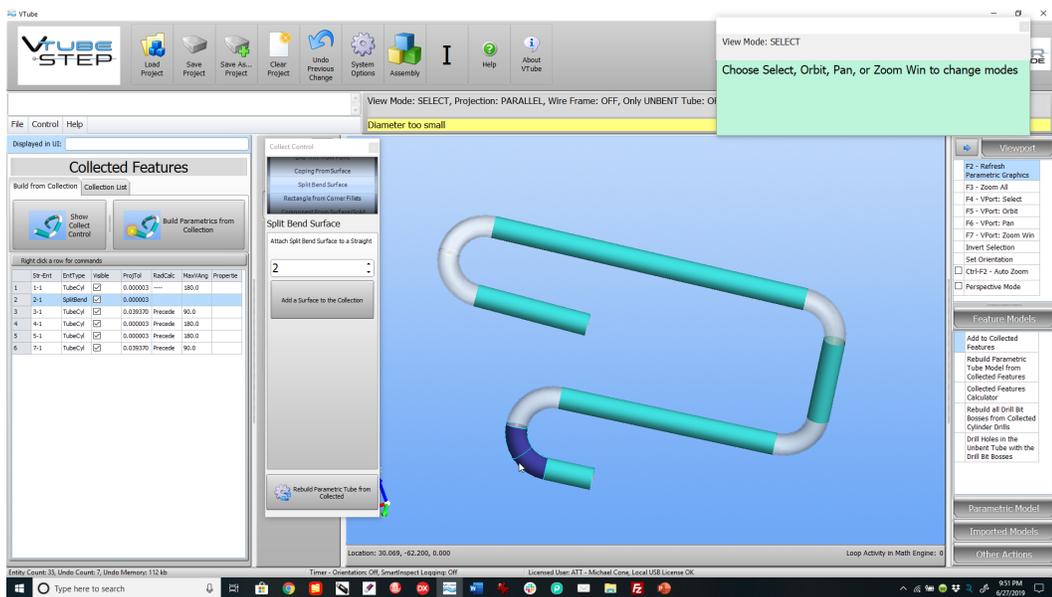


- Set the straight number to 2, then click in the button below the straight number.

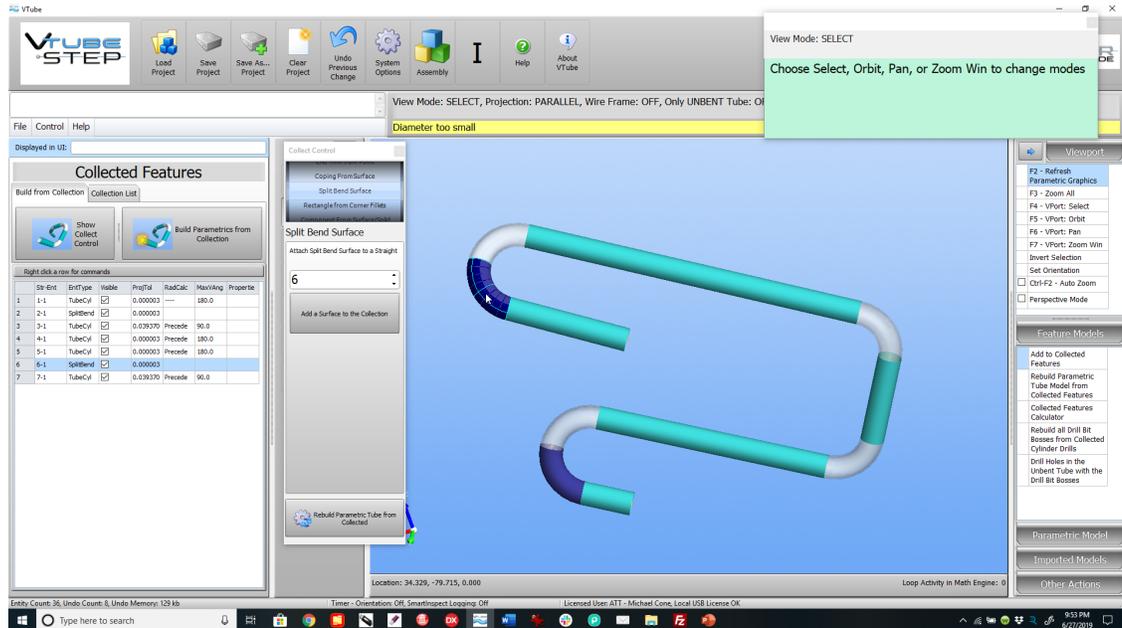


- Select any surface on the first 180-degree bend. The goal is to collect a surface that meets the extrados and the intrados. If a single selection only touches one of the two, then keep selecting surfaces by pressing the button again until you have surfaces touching the inside center and the outside center.

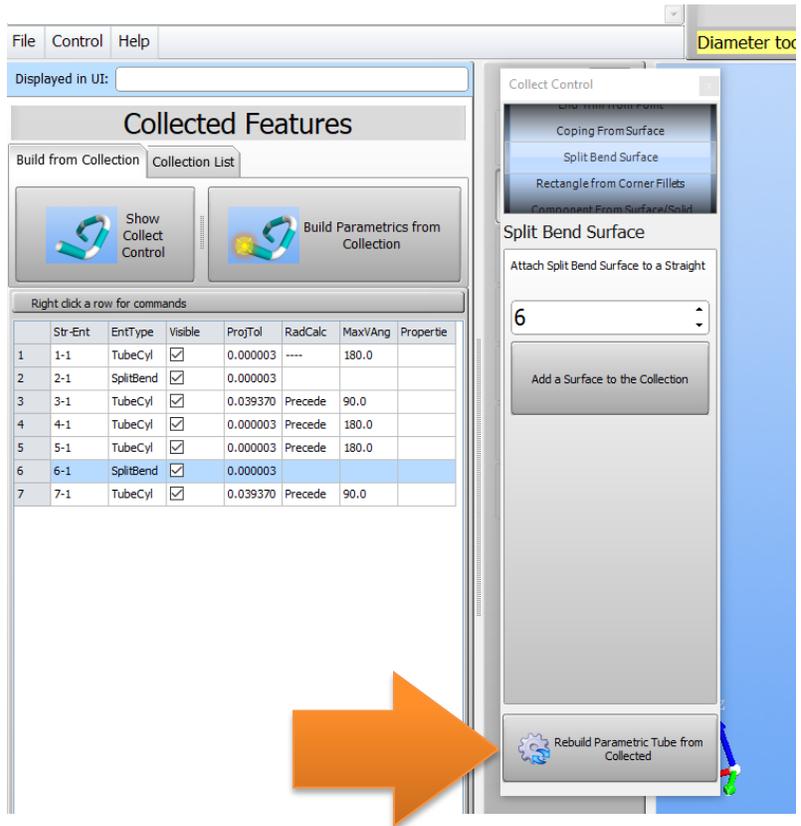
For this model, one selection is enough.



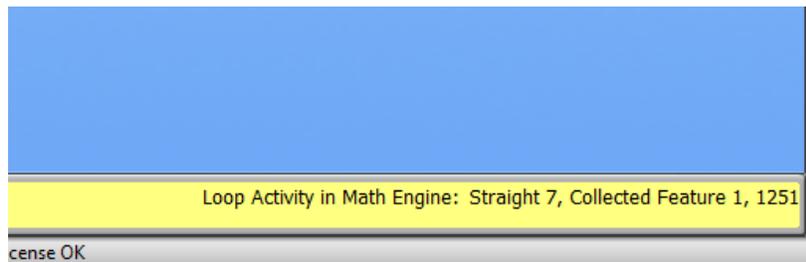
16. For this model, we will need to also select straight 6 as a Split Bend. Change the straight number to “6” and then press the “Add a Surface” button. Then select the other 180-degree bend the same way.



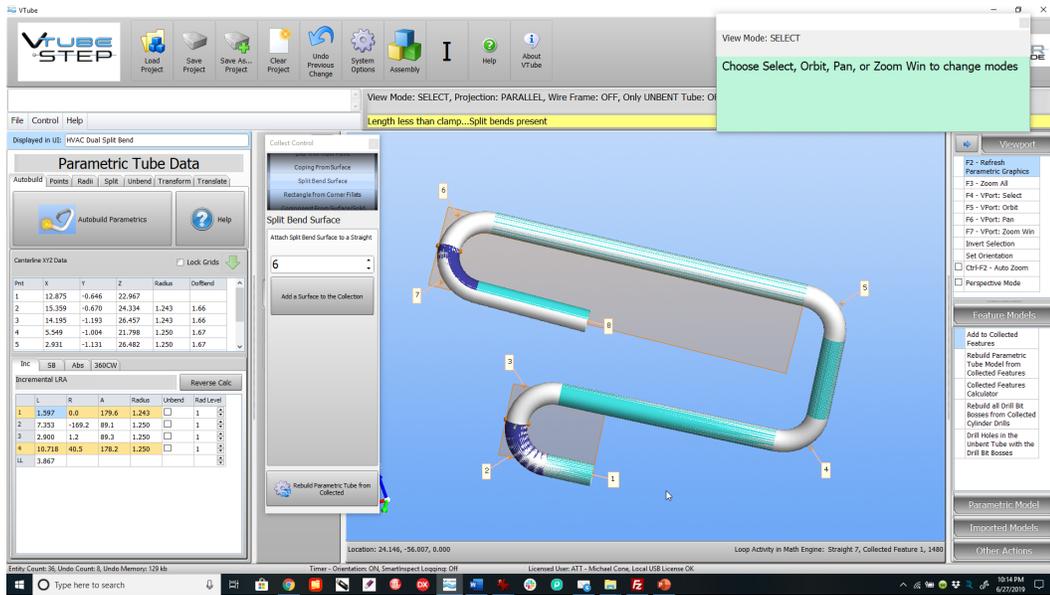
17. Click on **Rebuild Parametric Tube from Collected** at the bottom of the Collect control.



18. In the lower right corner of the viewport, you will see the math engine work its way through the straights to solve for the centerline end and intersection point positions.



- When the calculation is complete, you will see new XYZ data in the Tube Data menu. You will also see the white parametric tube model superimpose on the imported model.



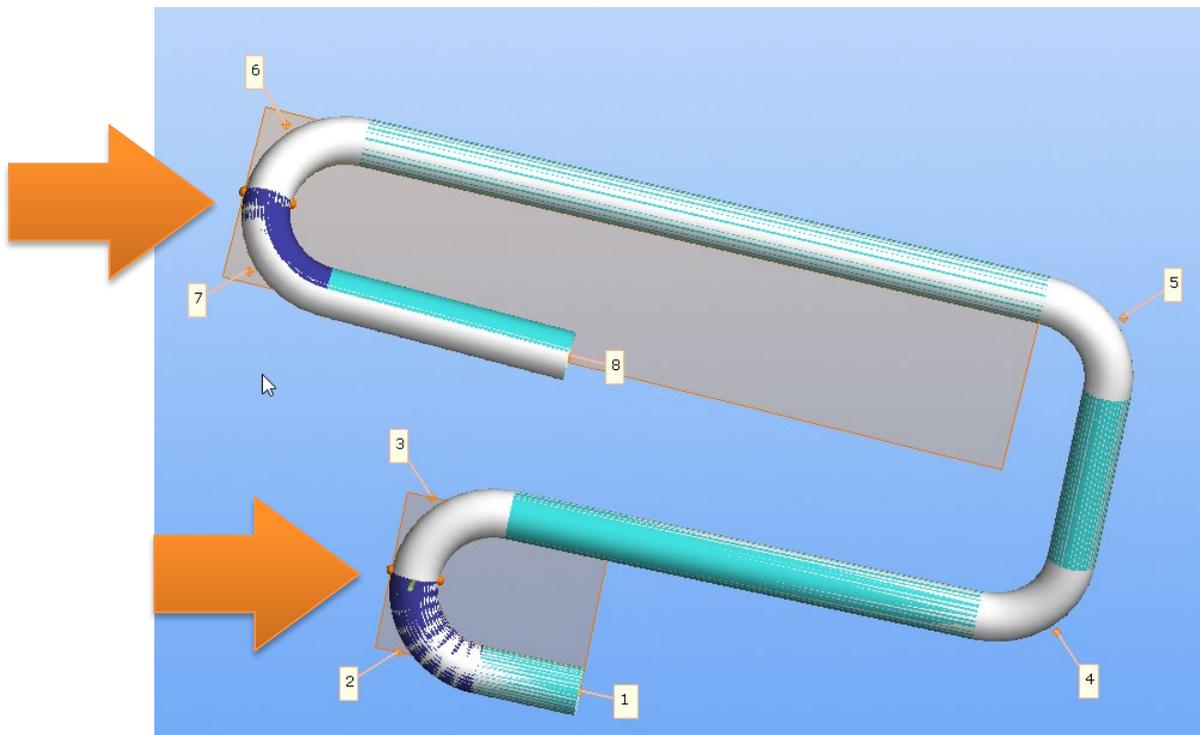
You will also see orange bars in the LRA bender data:

Incremental LRA							Reverse Calc
	L	R	A	Radius	Unbend	Rad Level	
1	1.597	0.0	179.6	1.243	<input type="checkbox"/>	1	▲▼
2	7.353	-169.2	89.1	1.250	<input type="checkbox"/>	1	▲▼
3	2.900	1.2	89.3	1.250	<input type="checkbox"/>	1	▲▼
4	10.718	40.5	178.2	1.250	<input type="checkbox"/>	1	▲▼
LL	3.867						▲▼

These orange bars indicate where VTube has combined two adjacent bends into a single 180-degree bend. This is important because benders do not work well with two adjacent bends that should really be considered a single bend together.

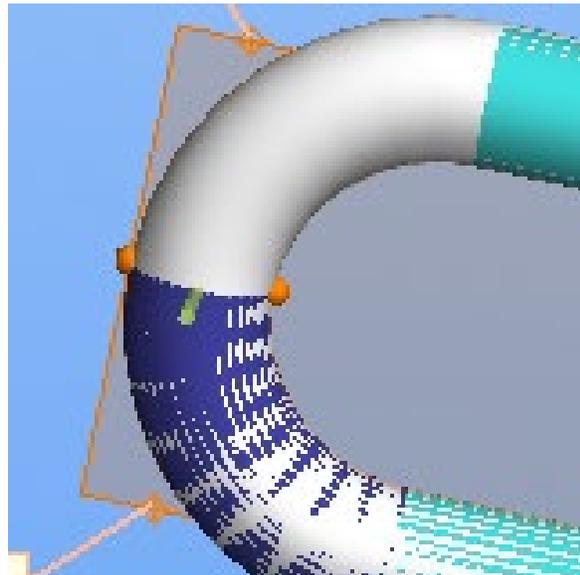
This is why you will see 8 points in the XYZ data, but only 4 bends in the bender data. VTube knows how to automatically compress these adjacent bends into one larger bend with the Split Bend feature.

21. Another feature to notice is that VTube will draw the construction geometry around the split bends like this:

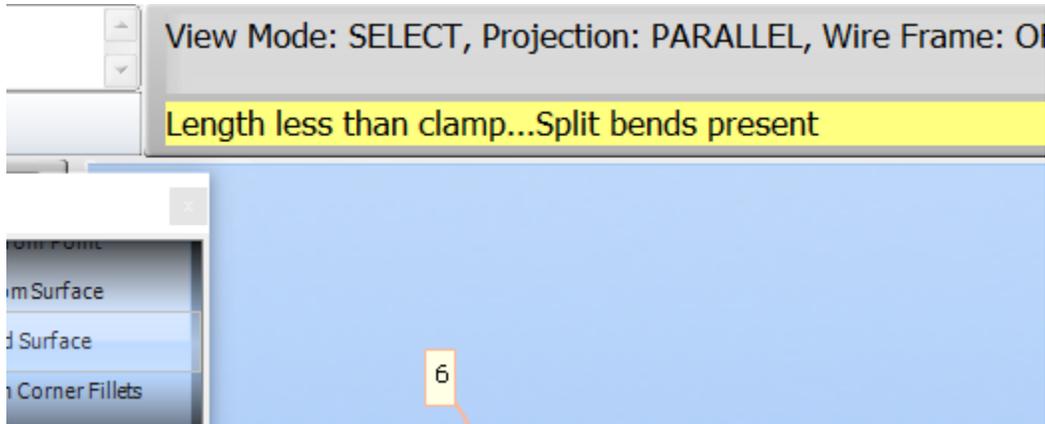


The benefit of this construction geometry is that it helps you to verify that the 180-degree split bends were handled correctly by VTube. See a closeup here.

Note that the two orange spheres should be at the exact center inside and outside of the bend. If they are, then you can know that the bend was handled properly.



22. Next, notice that the yellow notification bar at the top includes the words “Split bends present.” The goal is to give you all the visual cues necessary to help quickly identify that something is special about this tube.



23. Click on the **Part Setup** menu in the navigation pane to see how VTube automatically calculated what it could determine from the model.

During the calculation, VTube calculated...

- a. The **Part Number** (row 1)
- b. The **Diameters** (rows 16-18)
- c. The **Cut Length** (row 25)
- d. The default **Radius 1** (row 26)
- e. The default **D of Bend** value (row 29). (This is calculated as the RADIUS divided by the DIAMETER.)

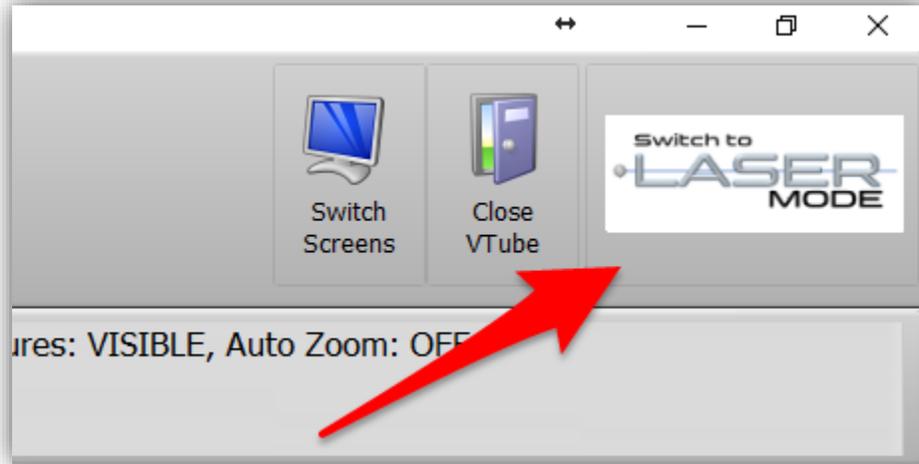
Variable Name	Value	
8	Material Spec	
9	Author	
10	Organization	
11	Bender Type	
12	Job Number	
13	Work Order	
14	Date/Time	6/27/2019 9:21:21 PM
15	Diameter Profile Setup	Cylinder
16	Diameter	0.750 inches
17	A-End Diameter	0.750 inches
18	B-End Diameter	0.750 inches
19	Wall	0.001 inches
20	Rec Width 1	1.000 inches
21	Rec Width 2	0.500 inches
22	Rec Wall	0.059 inches
23	Rec Fillet Radius	0.125 inches
24	Rec Angle	0.0 deg
25	Cut Length	38.089 inches
26	Radius 1	1.250 inches
27	Radius 2	0.000 inches

24. The import and calculation of the master data is complete.

The **Tube Data in VTube-STEP** will become the **Master Data in VTube-LASER** automatically – because they refer to the same data in memory. The Master data is used to help us know if we have a good part that is inside the deviation tolerance allowed after measurement.

Press the LASER button in the upper right corner to change to LASER mode. The LASER window is the only one that connects to the HEXAGON arm.

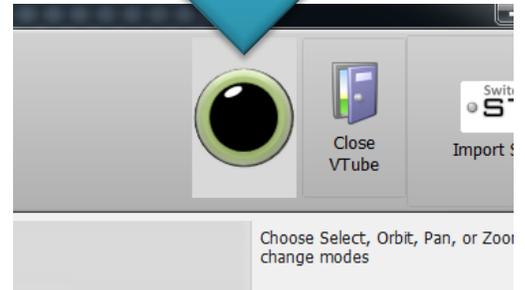
When you press this button, VTube-STEP will automatically close any control and guide windows.



Measuring and Qualifying the Tube Shape

Follow these steps to setup to measure the tube:

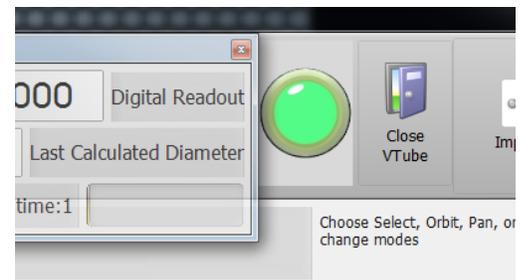
1. If the arm is not connected to VTube-LASER, then **click on the black LED** in the upper right corner.



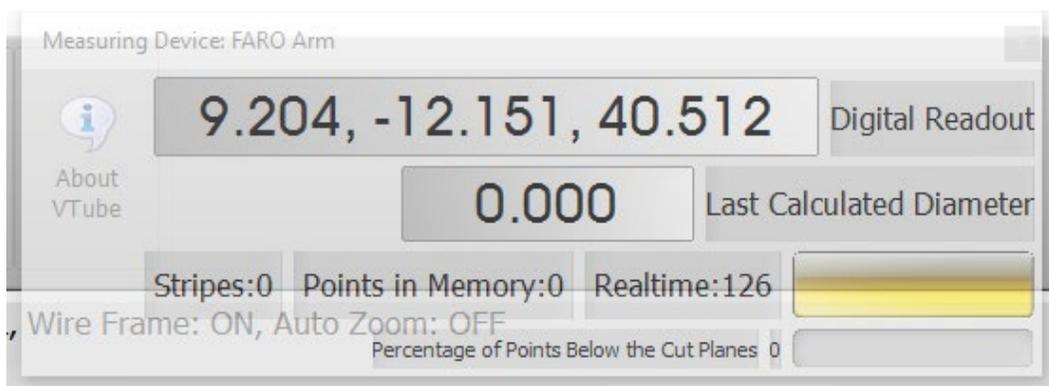
When the connection to the arm is active, the LED turns green, you will hear a connection sound, and the transparent DRO (Digital Readout) window will appear.

2. Pull the arm away from its resting position and watch the values in the DRO (Digital Readout) move.

If the laser scanner is on, then you can point the scanner about 6 to 8 inches from any object, and you will see XYZ data change in the DRO.



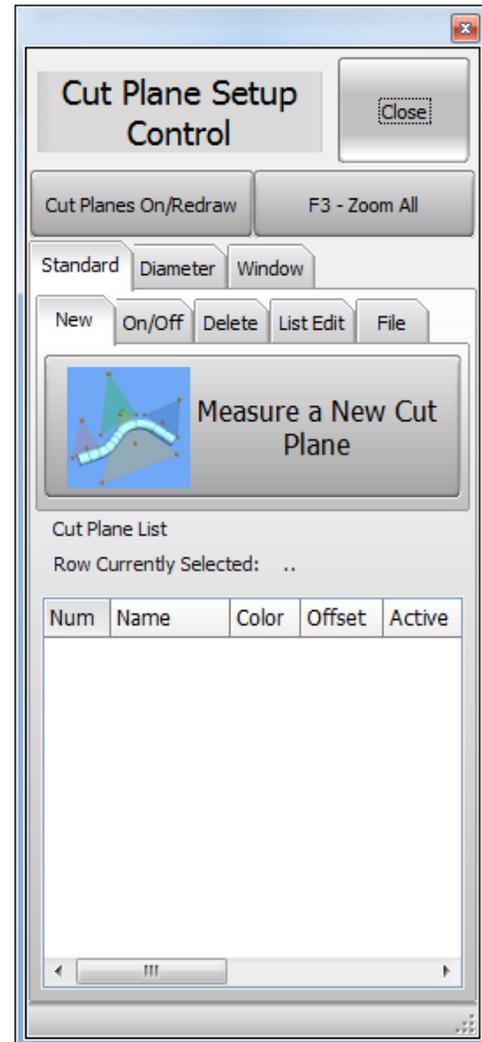
This is the **DRO (Digital Readout)**:



If the laser is not on, then you will see the XYZ data changing whenever you move the arm. In this mode, the data will represent the **center of the ball probe**.

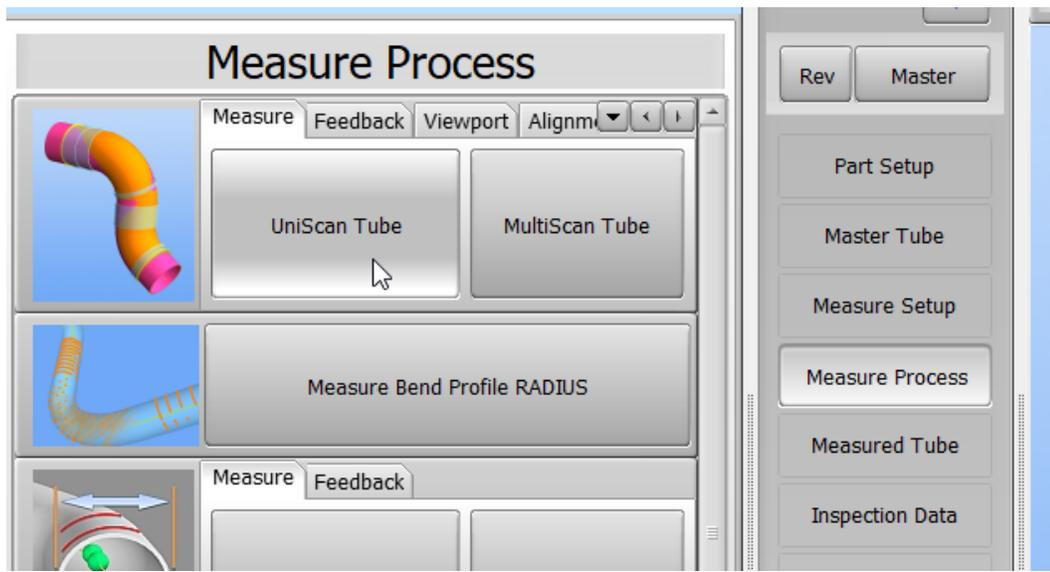
3. This guide assumes that you already have CUT PLANES setup if you are measuring the part on a table surface. Cut Planes will remove any laser points beyond the measured plane.

If you need to, setup the table as a cut plane using other training guides that include the cut plane creation steps.



4. Go to the Navigation Pane and press

MEASURE PROCESS menu and find the Tube - Cylinder panel at the top of the choices on the left side of the screen. Press the **UniScan**.



UNISCAN versus MULTISCAN Note: We are going to use the **UNISCAN** method to measure tubes. The UNISCAN motion feels like spray-painting the tube with laser stripes. When you press the green button, then VTube takes in the laser stripes. You can release the green button to pause scanning to move over obstacles. During scanning, when you release the green button, new scanned points will draw on the screen.

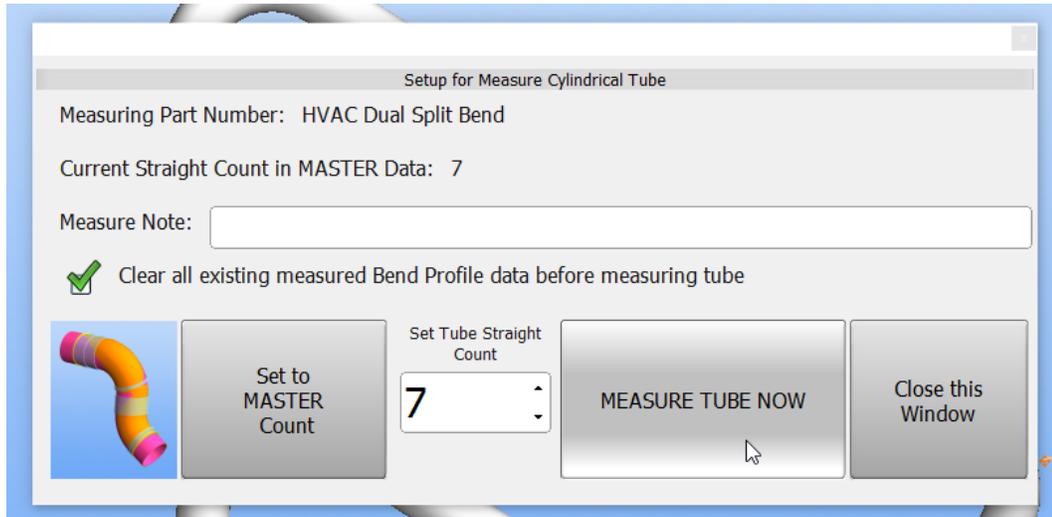
There is another method called **MULTISCAN** that is ideal for situations where the straights are bowed or curved. In MULTISCAN, you aim near the first tangent, then hold the arm still, then press and hold the green button until you hear the scan complete sound. Then you do the same at the other end of the straight.

For most measurements, we recommend UNISCAN, because this mode takes in much more data and is able to give operators better assurance that the scan is good. For example, using DCF – Dual Cylinder Fit, UNISCAN can reduce uncertainty significantly because it takes many more surface points than

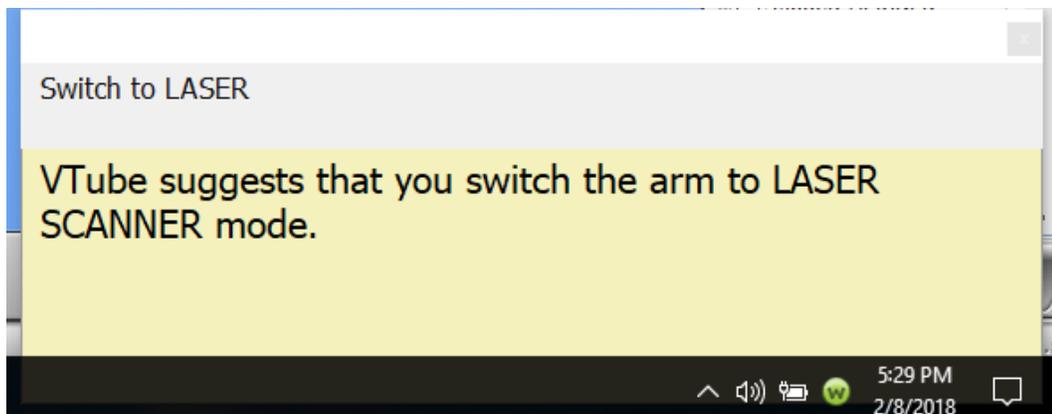
MULTISCAN, then uses this to your advantage.

5. Press

MEASURE TUBE NOW.

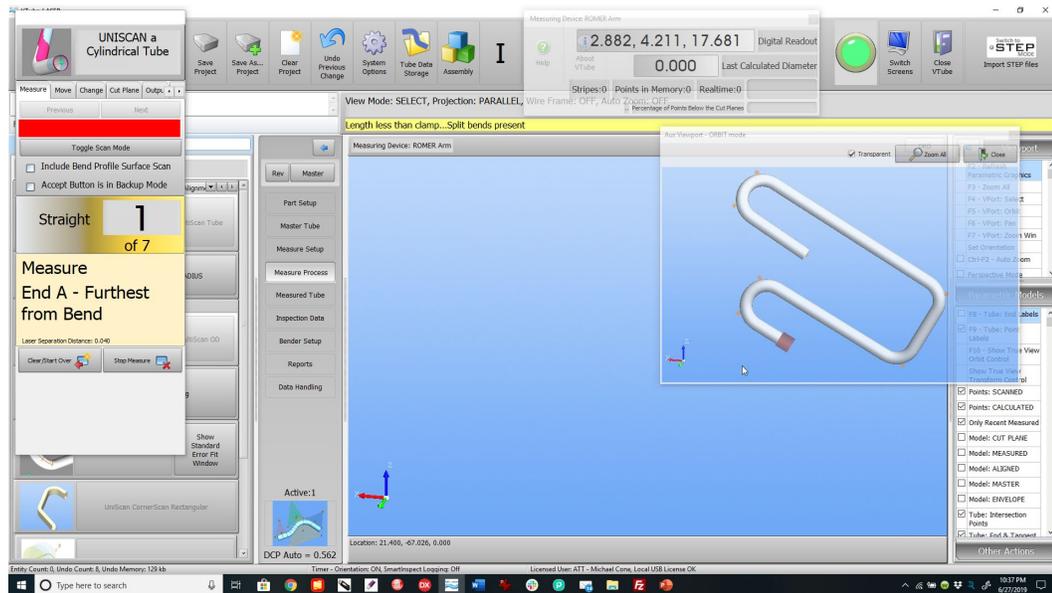


If the scanner switch is still in ball probe mode, then VTube-LASER will suggest that you switch it to LASER SCANNER mode (if you are using the default setup).



6. Measure the part following the instructions in the guide box like the one shown here. The yellow box tells you the current step.

If VTube is setup to measure the ends with the ball probe, the red laser box will turn black. If you want to measure the end with the laser, then just press the **Toggle LASER** button.

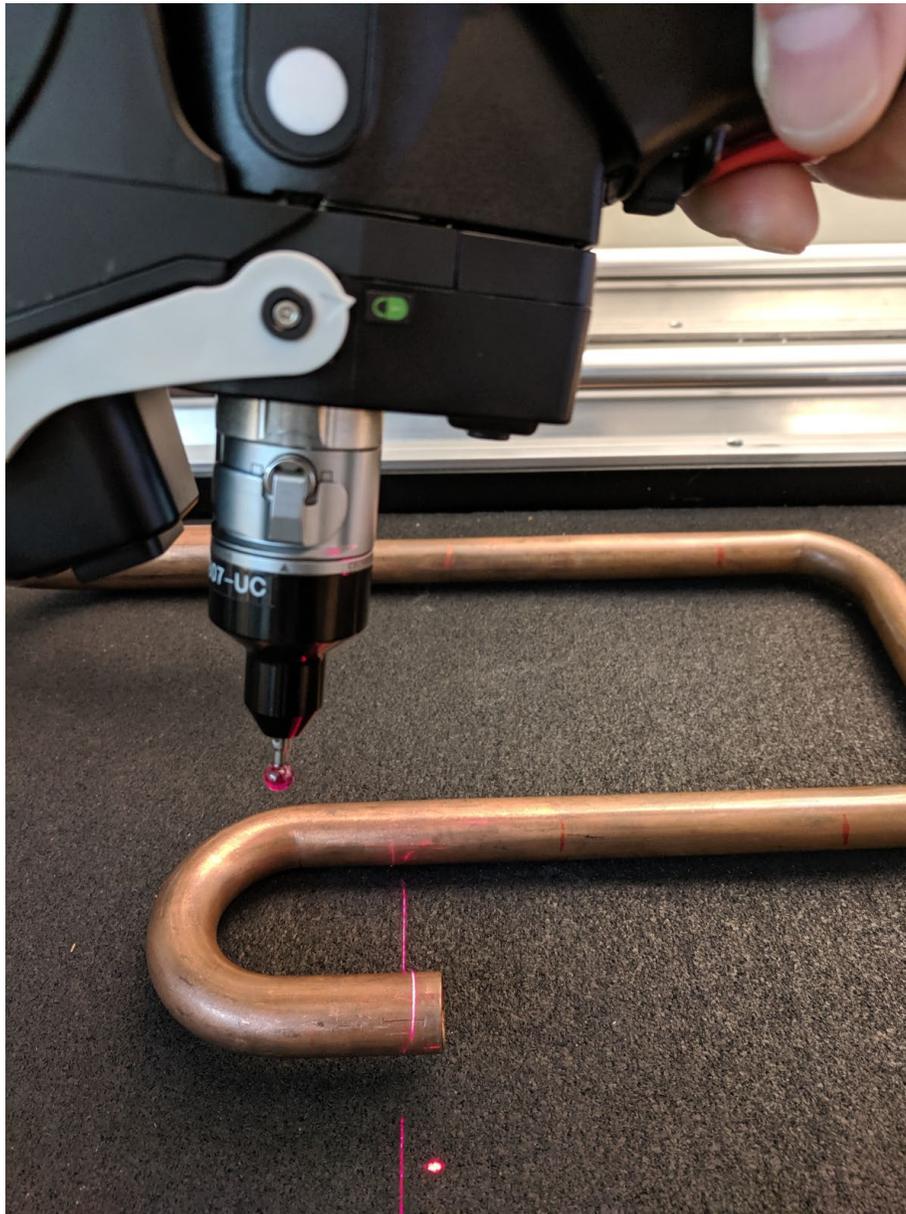


The small guide box should appear in the upper right corner (that is its default location). If the guide box does not display, then the option can be turned on with the Measure Setup, Other, **Automatic Display of Master** option.

7. Scan the end. You will hear the end scan completion sound when you have enough data. **(If you have a trainer from Advanced Tubular, then the trainer will show you the exact technique to use for scanning the ends and the straights.)**

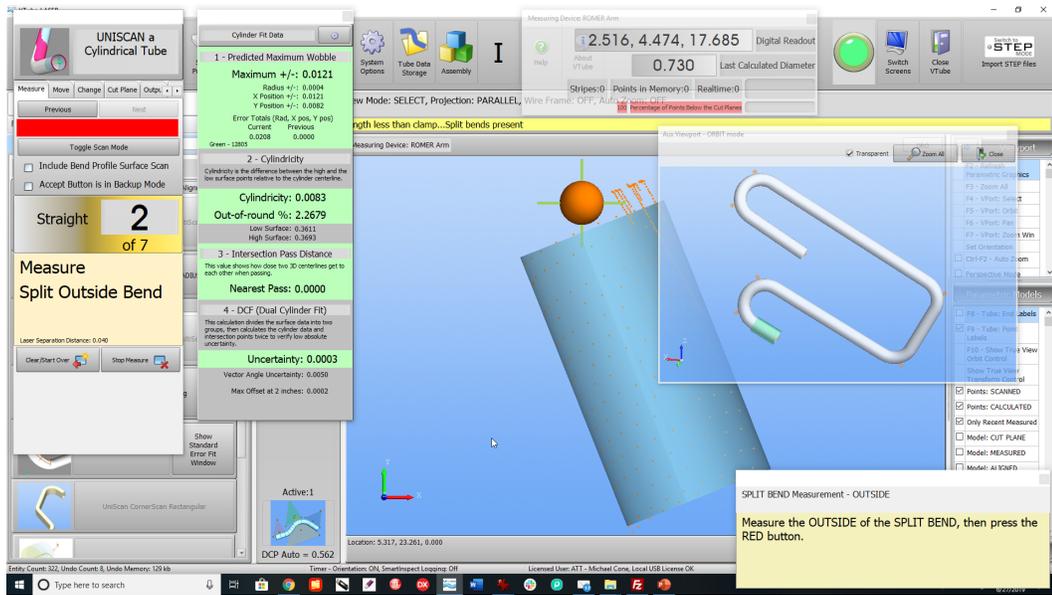


8. Scan the first straight. If VTube-LASER is set to LASER TIMER ACCEPT mode, then it will automatically calculate the cylinder when you let go of the trigger.



Be sure to start at the end of the cylinder nearest the end of the part, and finish the scan closer to the bend. (Avoid scanning into the bend, or VTube-LASER will ask you to rescan.)

- When the first straight is scanned and the cylinder is calculated, VTube-LASER will make a new sound that indicates that it is entering SPLIT BEND mode. The screen will look like this:



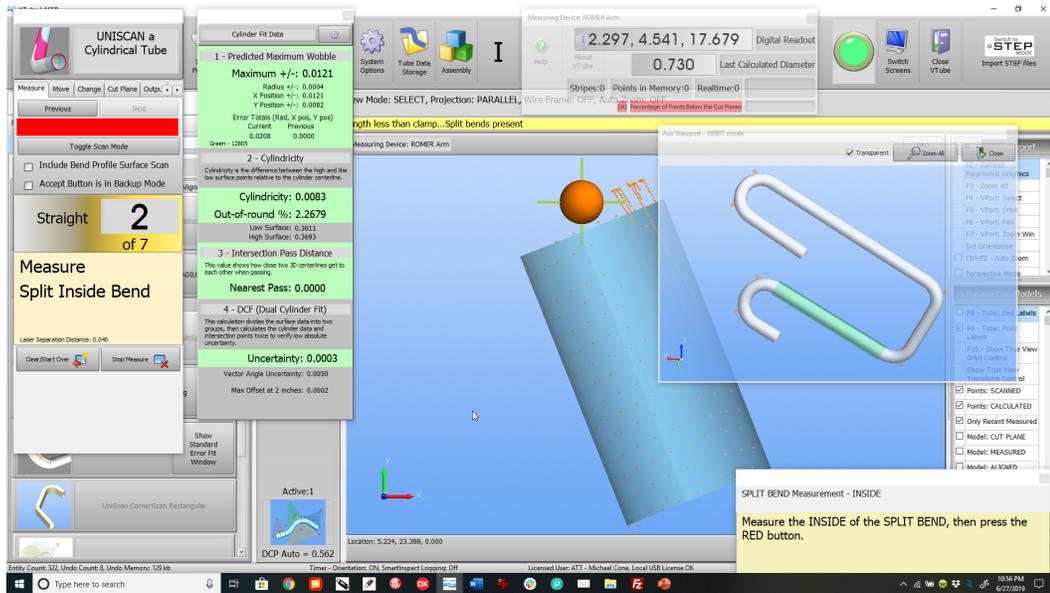
- Scan the outside like this photo shows. It is good to sweep back and forth like you're spray painting. The goal is that at least one point in the scan data passes the apex of the outside.

When scanning, be careful to only let the laser touch the outside of the tube. Son't it scan any object that is closer to the scanner than the apex of the part.

(We're using Cut Plane, so you can safely ignore the table surface - even though you see the laser line on the table is nearer to the scanner).



- Next, VTube-LASER will make another unique sound and ask you to scan the **inside** of the bend with this screen:



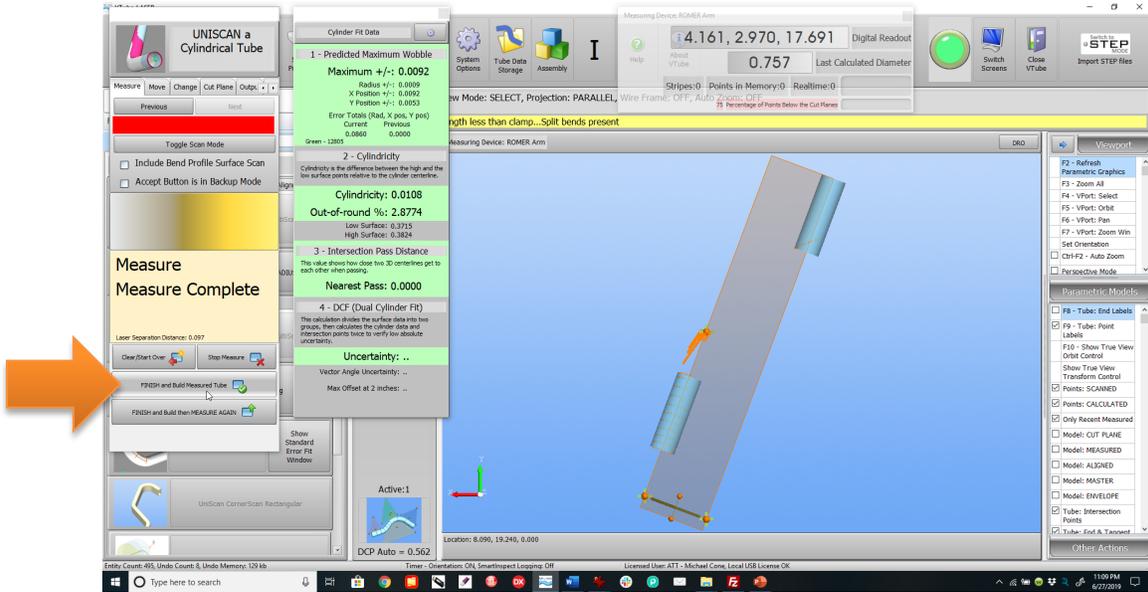
- Scan the inside of the bend like this. Scan back and forth like spray painting.

Scan any part of the tube on the inside of the bend.

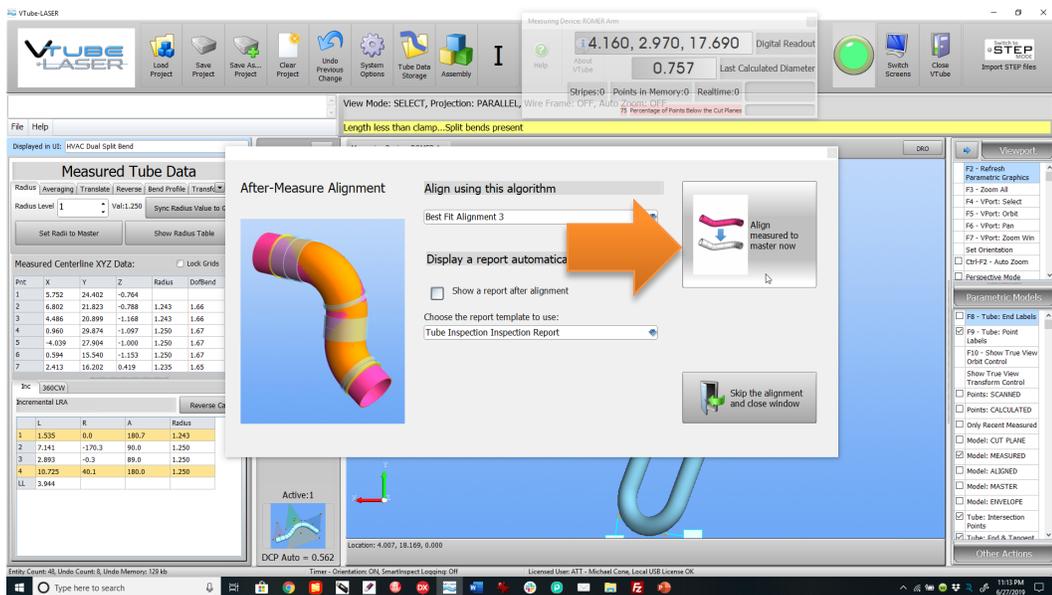
VTube will find the point in the cloud of data that comes closest to the projected center of the two straights adjacent to the 180-degree bend.



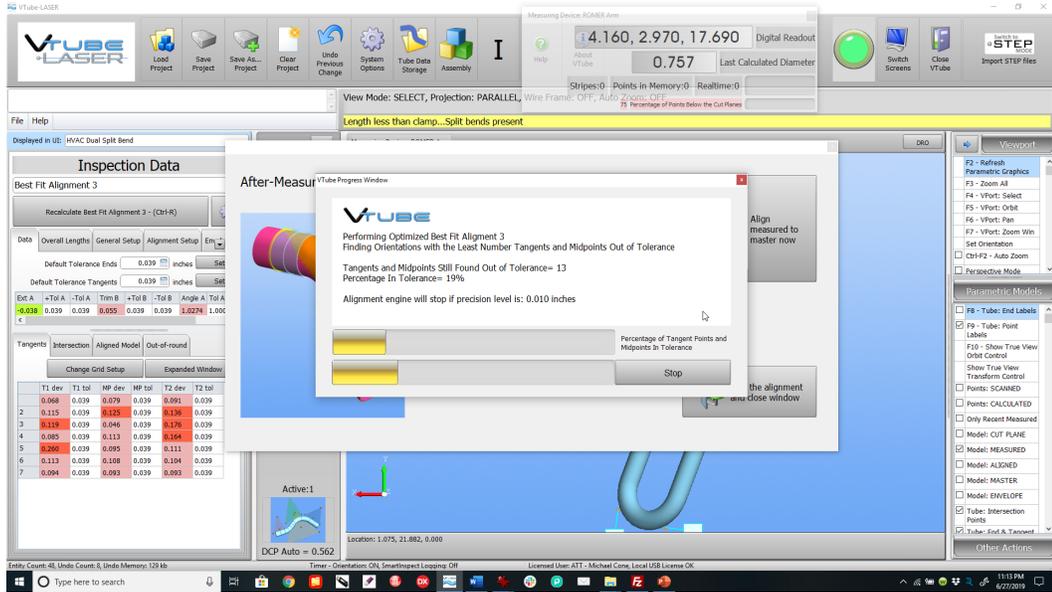
- Scan the rest of the straights (and the other Split Bend). After measuring End B, press the **Finish and Apply** button.



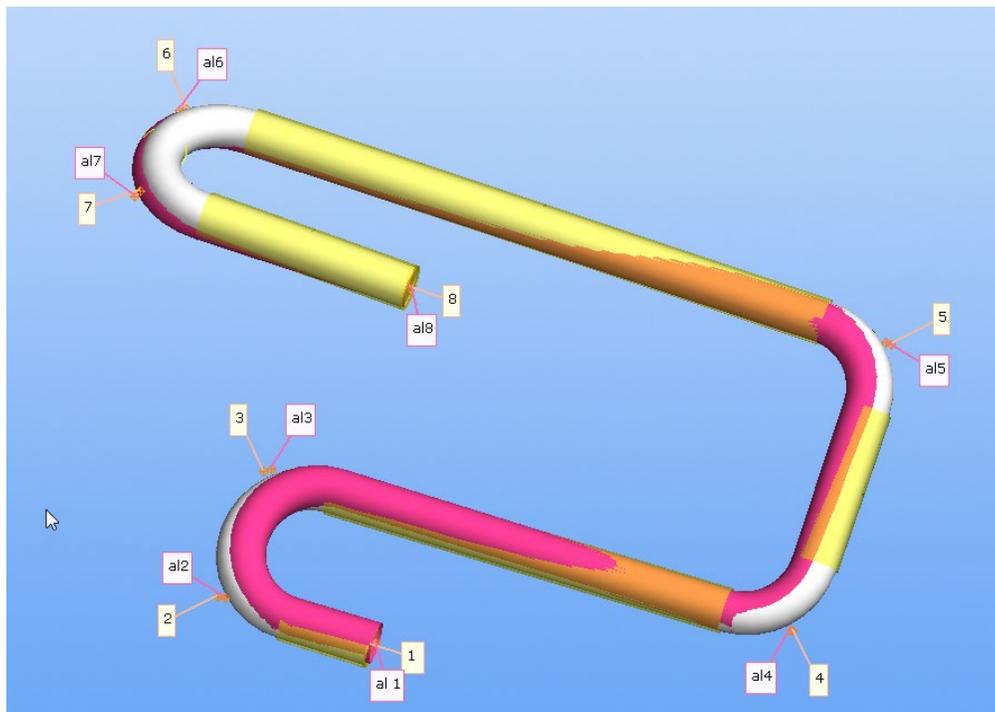
- Press the **Alignment** button with the image of the two tubes.



- VTube will align the measured part to the master part. It will show a progress bar as it is doing the alignment.



16. The pink tube on the screen is the **measured-aligned** tube.
 The white tube is the **master** tube.
 The transparent cylinders are the **tolerance envelopes**.



17. You will also see the **Inspection**

Data menu display on the left with color-coded deviations. End length and tangent point deviations are always shown here.

The **default tolerances** can be set at the very top. If you set these tolerances, then press the Set button after you make the change. The values will be propagated to the cells in the appropriate grid below.

The **end lengths** are qualified at the top grid of the menu. There is always a plus and minus tolerance – which can be set independently of each other.

The **Tangents** deviation grid

qualifies the profile of the straights as a virtual gauge for the tube shape.

Tangents are where the straights meet the bends. For example, the **T2 dev, row 1** cell shows the deviation where the first straight meets the first bend on the centerline. In this case, the deviation is 0.001 inches (25 microns).

The first tangent deviation and the last tangent deviations are not really tangents because they represent the end of the tubes. For example, **T1-1** and **T2-6** cells in this grid are trimmed end points (not tangent points). So, be careful to not confuse these deviations with the end length deviations – which are untrimmed.

18. This part is clearly outside the 0.039” tolerance we’re using in this example. It would need to be adjusted at the bender in order to bring it into tolerance. You can either print out a bender corrections report, or you can use Bender Setup to automatically correct the bender (if you have a network connection to the bender).

Displayed in UI: HVAC Dual Split Bend

Inspection Data

Best Fit Alignment 3

Recalculate Best Fit Alignment 3 - (Ctrl-R)

Data Overall Lengths General Setup Alignment Setup Env

Default Tolerance Ends 0.039 inches Set

Default Tolerance Tangents 0.039 inches Set

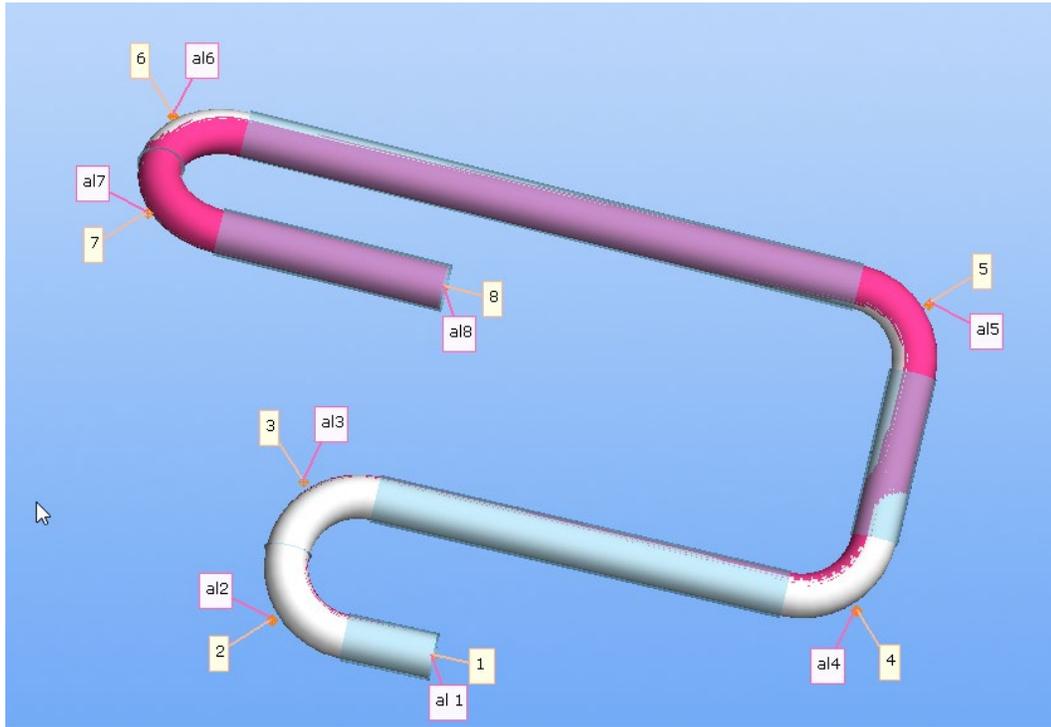
Trim A	+Tol A	-Tol A	Trim B	+Tol B	-Tol B	Angle A	Tol A	Ar
0.089	0.039	0.039	0.010	0.039	0.039	0.7453	1.0000	1.

Tangents Intersection Aligned Model Out-of-round

Change Grid Setup Expanded Window

	T1 dev	T1 tol	MP dev	MP tol	T2 dev	T2 tol
1	0.071	0.039	0.067	0.039	0.064	0.039
2	0.170	0.039	0.171	0.039	0.173	0.039
3	0.129	0.039	0.067	0.039	0.006	0.039
4	0.059	0.039	0.073	0.039	0.089	0.039
5	0.041	0.039	0.030	0.039	0.087	0.039
6	0.155	0.039	0.155	0.039	0.155	0.039
7	0.128	0.039	0.121	0.039	0.138	0.039

This is what the same part looks like in-tolerance:



You can see that the tolerance envelopes turn blue when the pink measured-aligned part is inside the tolerance.

19. This is what the Inspection Data would look like for the part above.

Inspection Data									
Best Fit Alignment 3									
Recalculate Best Fit Alignment 3 - (Ctrl-R)									
Data		Overall Lengths		General Setup		Alignment Setup		Env	
Default Tolerance Ends		0.039 inches		Set		Default Tolerance Tangents		0.039 inches	
Set		Set							
Ext A	+Tol A	-Tol A	Ext B	+Tol B	-Tol B	Angle A	Tol A	Ar	
-0.006	0.039	0.039	-0.001	0.039	0.039	0.3692	1.0000	0.	
Tangents: Intersection Aligned Model Out-of-round									
Change Grid Setup					Expanded Window				
	T1 dev	T1 tol	MP dev	MP tol	T2 dev	T2 tol			
1	0.026	0.039	0.024	0.039	0.024	0.039			
2	0.017	0.039	0.017	0.039	0.017	0.039			
3	0.021	0.039	0.017	0.039	0.013	0.039			
4	0.008	0.039	0.005	0.039	0.017	0.039			
5	0.017	0.039	0.019	0.039	0.031	0.039			
6	0.007	0.039	0.007	0.039	0.007	0.039			
7	0.019	0.039	0.017	0.039	0.014	0.039			

This is the end of the Quick Start Guide.