Date: November 11, 2011
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For: VTube-LASER Operators
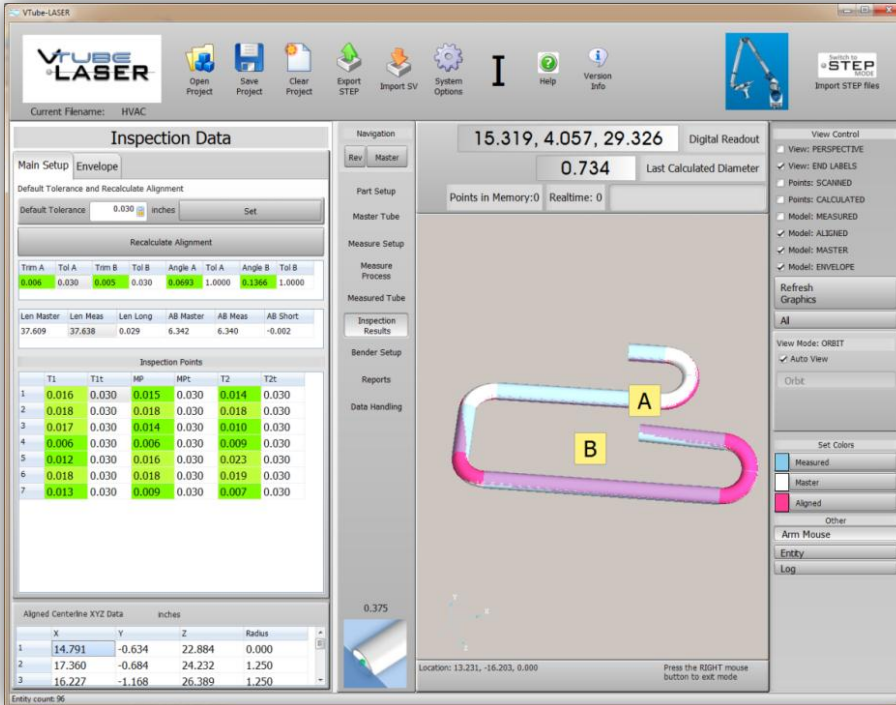
Technical Notes for Measuring COPPER TUBE

This document gives principles for effectively measuring copper tube using VTube-LASER. The system assumed is the FARO Edge with an LLP.

SCANNER SETUP FOR HIGH REFLECTIVE

For any copper part that is even slightly shiny, the high-reflectivity setting works best. Use this Edge LLP setting for even burnished copper (not smooth - but still reflective).
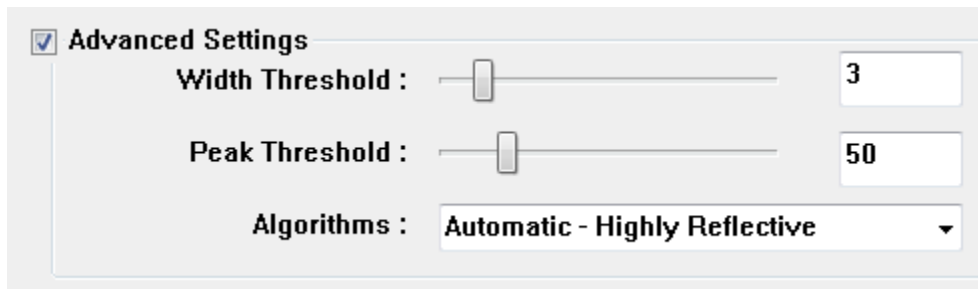
USE A SCAN RATE OF 1/2 FOR ACCURACY

As of v1.73 it is important to use the 1/2 setting in the scan control. This ensures higher accuracy of point data.

TIGHTEN CYLINDER FIT DATA TOLERANCES

Tighten the X and Y tolerances in the **cylinder fit data** window for every straight based on the OD ovality specification.

For example, a customer's copper tube OD has a spec of +/- 0.0015" in ovality. If the straight measured was not crushed and VTube showed an X or Y position value, for example, of 0.020", then conclude that outliers probably exist in the measurement - *and always remeasure* until the values were lower.

It may be possible to identify the issue by finding and avoiding areas of the surface that is different than the rest.

There are exceptions to this tighter tolerance rule:

1. If the straight is obviously oval – and/or it returns the same higher XY fit values after repeated measurements.
2. If the straight is very short. I urge caution with this – it is sometimes possible to get a very good fit numbers after a few remeasures.
3. If the straight seems to have deformations.

USE THE WIDE-SCAN TECHNIQUE WHEN YOU CAN

The wide-scan technique can dramatically increase the accuracy of the points in tubes that may produce shorter perimeter stripes. The reason is because it gives points to the math engine that reach further around the cylinder.

The video shows an example of how you can measure around the tube with this technique. In the video, I show that 50 stripes are useful – however, I have found that this technique works great with lower stripe counts too – like 20 stripes that are each 0.039" apart.

Please see this video for a demonstration of a wide-scan:
http://youtu.be/2wVfE6wxnBg
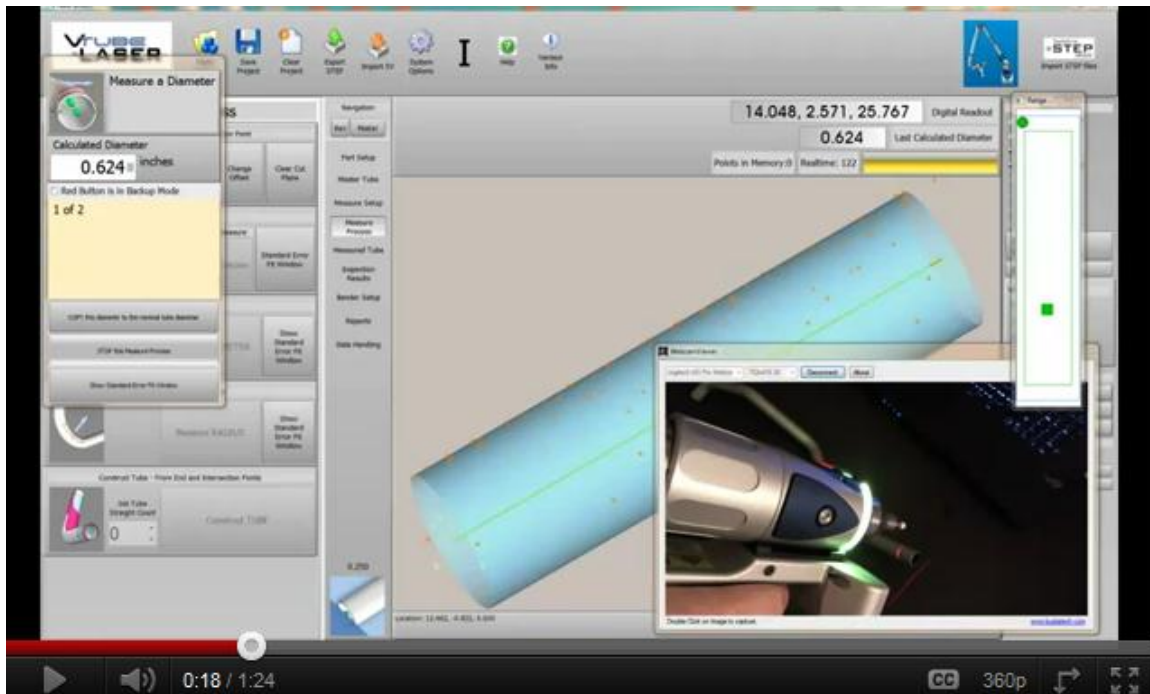
You don't have to follow the exact technique showed in the video to make this work. For quicker wide scans you could measure down one side on one end, then the other side from the other end.

MEASURE FROM THE TANGENTS TOWARD THE MIDDLE FOR BOTH MEASUREMENTS

- This is a technique change from earlier training that is designed to prevent scanning accidentally into the arc region.
- It also seems to decrease operator stress during measurement.
- It also slightly aids the math engine in VTube-LASER.

Here is how it works:

1. For the first end of a straight start near the first tangent.
2. Press the green button and scan *forward* toward the middle of the straight.
3. If stripes are still incoming when you reach the middle, then just reverse direction to use a back and forth spraying effect. Be very careful to stay out of the arcs.

1. For the second end of the straight start near that end's tangent.
2. Press the green button and scan *back* toward the middle of the straight.
3. If stripes are still incoming when you reach the middle, then just reverse direction to use a back and forth spraying effect. Be very careful to stay out of the arcs.

AVOID SKEWING FOR SHINY CYLINDER SURFACES

High reflectivity mode works very consistently when the probe skewing is kept to minimum. Watch the View Finder square at different skew angles. The probe orientation that shows the steadiest square is the best one to use.

BURNISHING HELPS MAKE THE SURFACE CONSISTENT

Burnishing the surface with steel wool can be very helpful in removing blemishes that may cause spikes in the scanning. It is faster and less messy than using a developer spray.

I show the GATOR Synthetic Steel Wool for Cleaning that I used to burnish this copper tube in a few seconds.