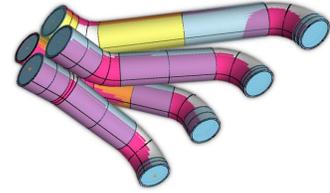


Document: On-site Training Information for FARO Systems

Description: This document gives information about what customers need to know about VTube-LASER training.



On-site Training Preparation Document

This document is intended to help you plan for setup before, during, and after our technician visits your facility.

WHAT TO EXPECT BEFORE WE ARRIVE

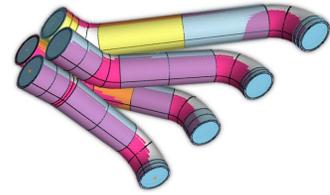
PROVIDE A CLEAN ENVIRONMENT

We ask that you set up the table and general area where the arm will be installed. We ask that area should be relatively clean of shop dust and debris. This is especially true of the table top where we will be measuring. A table is clean enough if we can sit a backpack or other items on the table without making them dirty or dusty. Our technicians are glad to serve you as trainers - however, it's not appropriate to ask our technician to clean and set up the area for you prior to training.

PROVIDE A PROPER TABLE

The table should meet our specification for measuring.

1. The table should not move when leaned on.
2. The table should be reasonably flat to use the VTube-LASER Cut Plane. Table flatness is less of a concern for larger diameter tubes and pipes (the floor is good enough). Smaller diameter parts benefit from tables that have better flatness. Measuring small diameter wires requires very flat surfaces like granite tops (or you can put the wire in a holder).
3. Unlike other metrology applications, super flat surfaces are not used by VTube-LASER as a reference plane. So, it is not necessary to have metrology-grade flatness for VTube-LASER.
4. The table surface should not be highly reflective. (See the next section about table surface recommendation.)
5. We prefer a table that is not filled with holes if possible. Sometimes the chamfers at the top of holes cause flyers with laser measurements.
6. The table depth should be about 3 feet (1 meter) deep from back to front. If the arm can reach well beyond the front of the table, then this is potentially wasted measuring



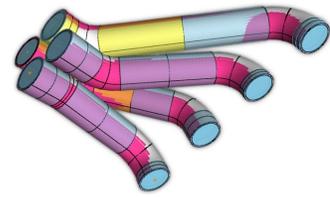
space. A table that is 4 feet wide is too wide for reaching the arm. (We discuss in the section about where to mount the arm.)

7. For average height operators, the table top should be no taller than 37 inches (94 cm) off the floor. Our test bench for development is 34.5 inches (87.6 cm) high – and it is slightly too high for large-diameter tubes. We have worked on 32-inch high (81 cm) tables that are very comfortable for large diameter tubes and pipes.

TABLE SURFACE RECOMMENDATION

We have experimented with several table surface types and have concluded that the best surface for scanners is a replaceable black rubber mat that does not reflect. Each of our VTUBE-iMC table systems include a ¼" thick rubber mat from Rubber-Cal (www.rubbercal.com). The benefits of using a black rubber mat are:

1. The rubber is non-reflective. The table surface under the tube will not compete for attention of the scanner exposure algorithm.
2. The rubber grips the part – keeping it in place.
3. The rubber protects the table.
4. The rubber mat is replaceable.
5. The cost is reasonable. (A 12-foot-long replacement strip can be purchased and shipped to your location for about \$180.)
6. It is easier to use than paint or contact paper.
7. You will no longer need to be concerned about table finish because it will be covered anyway.
8. It reduces out the planar waves in the table. It smooths out joint seams between two tables.



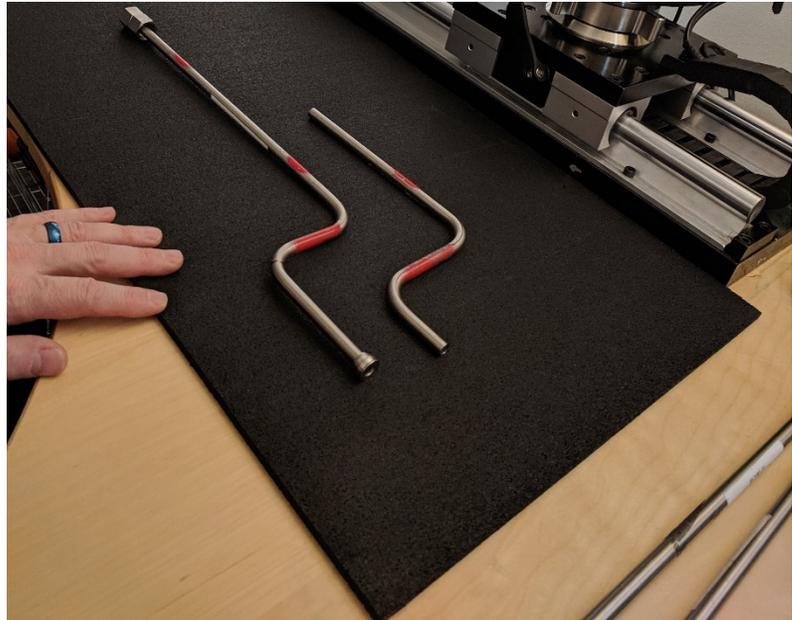
9. The rubber mat protects the arm probe if it is accidentally dropped. Of course, we recommend that you never drop the arm. But if you do, the ball probe will have a better chance of surviving the drop.

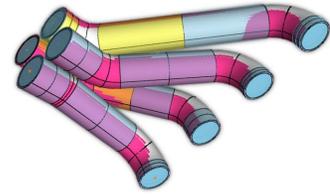
The type we use and recommend is **1/4" inch thick Rubber-Cal Recycled Rubber Flooring**.

Rubber-Cal stores this type of rubber in rolls of 50 feet long and 4 feet wide – so you can choose any length you need. For an extra \$15, Rubber-Cal will trim the mat width to your table width if it is less than four feet wide.

If you use other types of rubber, be careful to choose a non-reflective type. Some neoprene rubber mats are a bit shiny. Some recycled rubber mats, like “elephant bark”, have speckles and have rougher surfaces. We don’t recommend this kind because the mat we recommend has a smoother surface.

The mats are shipped in a roll – so plan on giving them a few days to flatten at the ends after you lay it on the table. Ends that curve up can interfere with a VTube-LASER Cut Plane filter.





WHERE ON THE TABLE TO INSTALL THE MEASURING ARM

Please have the arm mounted on the table before we arrive. Please feel free to ask questions for mounting location. If you have a mount that is not magnetic, then we recommend that you either C-clamp or bolt the mount to the center back of the table temporarily. We do not recommend that you mount the arm in a table corner.

The best systems put the base of the arm about 3 feet (91.4 cm) back from the front of the table. We have worked with 3-meter arms (which means that they are longer models) that were mounted at the back of a 4-foot (122 cm) table – and the arm is hard to reach for the average-height man. (A 5-foot [152 cm] tall operator would not be able to reach the arm at all without climbing on the table.)

Putting the arm less than 3 feet to the front means that some part of the tube may be placed too close to the base of the arm – which is not a good idea. Arms do not like to fold up on themselves.

SETUP AND TEST A COMPUTER THAT COMPLIES WITH OUR SPECIFICATION

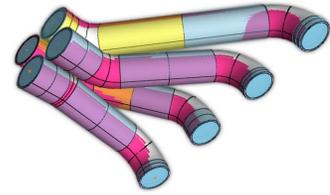
We ask that the computer be completely setup and ready for our technician. Read through this list to learn basics of the setup we need:

1. The arm driver should be installed to the computer. The appropriate driver can be downloaded from our Advanced Tubular Support webpage, here: <https://www.advancedtubularsupport.com/arm-drivers.html>
2. An initial copy of VTube-LASER software should be installed and registered.

SOFTWARE: The silver flash drive included with your software package includes the VTube version that was current at the time the license was purchased.

INSTALLATION PASSWORD: The installation is provided upon request.

REGISTRATION: The registration process is described here: http://www.advancedtubular.wiki/index.php/How_To_Register_VTube-LASER_Licenses. This is completed in an email exchange. Please contact our office for assistance.

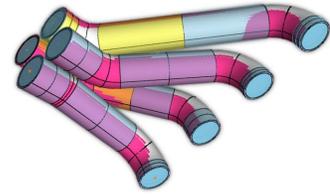


3. The VTube-LASER license dongle should be activated. The activation program is provided by email.
4. The computer should comply with our specification for operating system, CPU power, and minimum RAM. Specifications can be found listed here:
http://www.advancedtubular.wiki/index.php/VTube_Computer_Specification.
5. The video system used to display VTube-LASER should have a screen resolution of at least 1920 x 1080. Any lower resolution will not work well with VTube-LASER.
6. For effective use of VTube-LASER, we strongly recommend that you purchase and install a stand-alone monitor starting at 32" diagonal that can handle the resolution required. **Using an external monitor is very important for effective use of VTube-LASER.** You can also purchase monitors larger than 32" - not only for excellent training, but also for best use of the system later.
7. Plug the monitor into the HDMI port on the laptop. The HDMI port on the laptop is usually connected to a high-powered NVIDIA card – and is designed for fast graphics.
8. If you are using a laptop with VTube-LASER, then we strongly recommend that you use a separate keyboard and mouse and that you close the lid on the laptop to keep the computer clean and safe. This will require that Windows is setup so that closing the lid does not cause the computer to enter sleep mode.
9. VTube-LASER requires amplified speakers. For noisy shop environments, be sure to get very powerful speakers. If an operator cannot hear the sound, then he will not be able to measure effectively.

PERFORM AN INTEGRATED SYSTEM TEST

Please test the connection of the arm to VTube-LASER computer and VTube-LASER before we arrive. If there is a problem with the overall system, then it should be addressed before we make the trip to your factory.

If necessary, you can ask the arm representative to help you. The arm hardware companies make a significant margin of profit on the sale. They also pay their account managers commission – even when we sell you the VTube-iMC systems.



For new arm users, it is appropriate and important for an account manager or application engineer from the arm company to help you connect and test the arm with the laptop computer with the appropriate arm driver and VTube-LASER installed before we arrive.

If necessary, our technician can perform the initial test. However, please note that if something is not correct in the system, **the training may be delayed, and another training trip will need to be purchased.**

When physically connecting the arm, we are only able to guarantee the connection using a USB cable and not any other method of connection. (Please don't expect WiFi or Bluetooth to fast enough without extensive testing.)

BENDERLINK SETUP

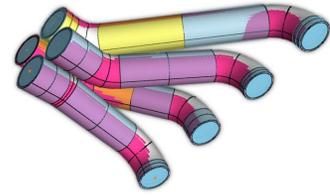
If we are setting up bender communications, then please follow the setup that we recommend in advanced of our visit. Installing the network infrastructure before we arrive will save us from spending a few hours on networking that can be performed by most IT departments.

NOMINAL DATA PREPARATION

We need you to prepare nominal (master) data against which we will compare all measurements.

1. Most customers prefer to use STEP files of the master data which VTube can import and convert to parametric data that can be used as master data. Importing solid models is safer and faster than manual data entry. This method of bringing master data into the system is called MBD, or model-based definition.
2. Some customers prefer the traditional approach of manually entering XYZ centerline data from prints.
3. Some customers only have access to bender data. You can enter the bender LRA data and reverse-calc back to centerline XYZ data.
4. Some customers have other methods of transferring data into VTube-LASER – like importing older databases or reverse-engineering.

In any case, we ask that you **explain to us in advance** which methods you will use – and then prepare data for us to use during training.



WHAT TO EXPECT AFTER WE ARRIVE FOR TRAINING

ADMINISTRATIVE ACCESS TO LAPTOP

There is a strong possibility that our technician will install the latest VTube-LASER software on your laptop before training occurs. The technician will need administrative access.

If this requires your IT department, then please plan on scheduling your IT department to be present either on-site or remotely for the start of the training session.

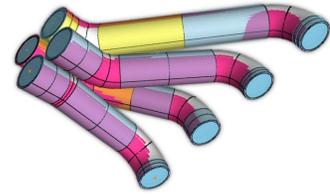
BENDER COMMUNICATIONS SETUP

If you want us to help you link to benders, then we will finalize the setup with your IT department if necessary.

VTUBE-LASER TRAINING

We will train your team using the data that you prepared for us. These are the basics of training requirements:

1. If we are correcting bending machines, then they should be setup with tooling and ready to bend parts. It's not the best if bender setup requires a significant part of bender corrections training. Please try to avoid that so that we can measure, qualify, correct, and bend several times in one day.
2. Please provide enough tubing stock available for corrections and bending of each part several times. You can work on actual projects or allocate less expensive test material.
3. At least one bending machine should be available for our use during our training.
4. Unless there is an emergency, the trainees should be required to be available for training exclusively. It is important that the primary operators are not called away during training. If they are, and training is delayed, then you may need to be ready to purchase more training from us in the future.

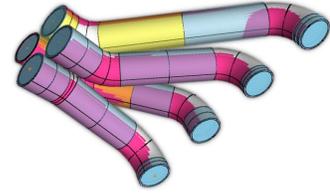


5. If a trainee signs the training sheet but is not present for a portion of the class, then we may not be able to certify that trainee for VTube-LASER.
6. We provide a Quick Start guide that we reference for training. We will give each trainee one of these guides before training starts. These can also be downloaded and printed in advance if you prefer.
7. We go out of our way to make training extremely hands-on. This slows the pace of training considerably – but allows the trainees to learn and remember by doing the process themselves repeatedly. By the middle of the training day, the Advanced Tubular technician will not be touching the arm or entering data in VTube-LASER. The trainees should be prepared to do a lot of interactive hands-on training.
8. Because training is hands-on, it is helpful to limit the number of trainees that handle the system to three. If you have 3 trainees, then eventually all three trainees will need to learn to handle the arm and use VTube-LASER. The other trainees should be observers, please.
9. At some point during the class, the trainer will start to ask the trainees to *help each other* through a measuring project. This will enable them to work as a team without reference to the trainer. This will simulate using the VTube-LASER system for when the trainer is no longer standing next to them giving active input.

PROBE and SCANNER ALIGNMENT TRAINING

We can train students on how to align and/or certify the probes and scanners. However, if you have this completed with the help of your arm account manager before we arrive, then we will not have to spend the hour on that portion of training.

In the case of FARO probes and scanners, this setup must be performed before we train. So, it can be done by an account manager in advance or by our technician during training. If it is not performed by the FARO account manager or application engineer, then we can provide this training – but please expect that it will take an hour of our training.



TRAINING AGENDA DOCUMENT

We can often provide an approximate agenda if you want it. However, each training session is customized for the application in your environment. This means that the agendas are usually unique based on the application and needs of your staff. A general agenda is available here: http://www.advancedtubular.wiki/index.php/VTube-LASER_Training_Agenda

ADAPTING TO YOUR TUBE BENDING APPLICATION

The VTube-LASER technician often adapts VTube-LASER configurations and measuring methods based on what we encounter in each customer training session. For example, we might actively adjust the default tolerances required by our 5-level Cylinder Fit math engine. This is especially true if you have highly deformed tube cylinders in the straights. VTube-LASER is highly adaptable in these situations by setting up the configuration to best fit your application. Our technician will be learning and applying his knowledge based on is encountered in training.