ME scope

Installation & Introduction

March 7, 2025

VIBRANT

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Computer Requirements

To enlarge this text, *Click* on it, hold down the **Ctrl key** and ***spin*** the mouse wheel.

MEscope will only run on x64 (64 bit) versions of Windows. To use MEscope, your computer must have at least the following capabilities.

- **Microsoft Windows 10**, **11**, or later, with the ***latest Service Pack installed***
- A hard disk with at least **50 Gigabytes (GB)** of available space
- Microsoft **DirectX 11** compatible graphics hardware

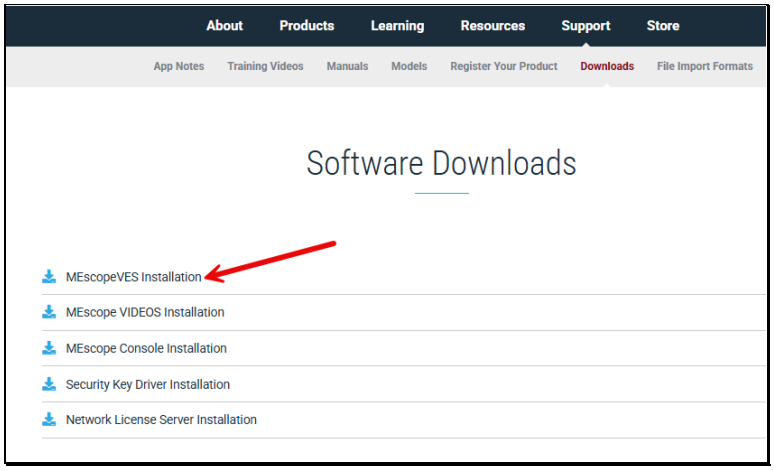
To use MEscope in a **Virtual Windows** system, on a **Linux** or on **Apple** computer, the system ***must support DirectX graphics hardware***.

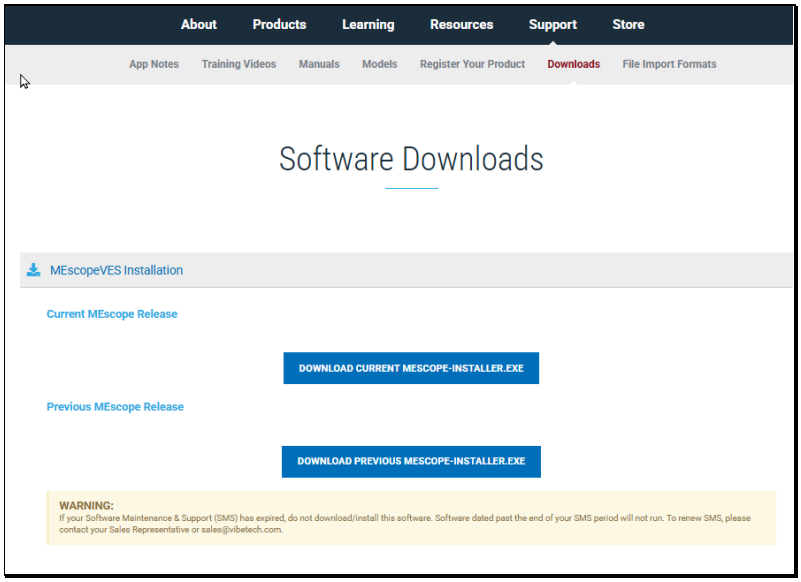
Installing MEscope

MEscope must be installed on a computer hard drive and will only run on the same computer as the hard drive.

Installing MEscope from the Vibrant Website

- On the Vibrant website www.vibetech.com, *Click* on MEscopeVES Installation on the Software Downloads page





You have the choice of downloading the **Current MEscope Release** or the **Previous MEscope Release.**

- *Double-Click* **DOWNLOAD CURRENT MESCOPE INSTALLER** or **DOWNLOAD PREVIOUS MESCOPE INSTALLER**

It might take a minute or two to download the **MEscope-Installer.exe.**

To reduce the installation time, *drag* **MEscope-Installer.exe** from the **Downloads** folder to your desktop.

- *Double-Click* on **MEscope-Installer.exe** on your desktop

MEscope Installation Dialog Box.

The following Installation window will open.

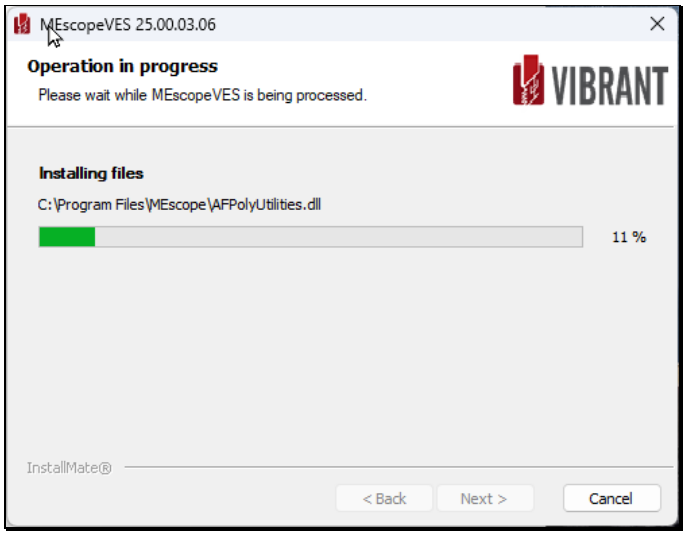
- *Click* on **Next**

The **License Agreement** dialog box will open next.

- *Check* **"I agree to these terms and conditions",** and *Click* **on Next**

The following dialog box will open next.

- Browse to a different **Installation folder** if necessary, and *Click* on the **Install** button



MEscope Installation Dialog.

Finish Installation dialog box.

When the MEscope installation has been completed, the dialog box shown above will open.

MEscope Security System

A complete MEscope installation consists of the following parts,

- The MEscope.exe successfully installed on your computer
- An MEscope license file named **VTxxxxxx.VTL,** where **xxxxxx** is your unique license number, copied to the **desktop** on your computer
- For example, if your license number is **15125**, your MEscope license file will be named **vt015125.vtl**

A **USB Security Key** must be attached to a **USB port** on your computer if your license requires one. A **Network License Server** license or a **Software** license does not require a **USB Security Key**.

If MEscope Won't Run

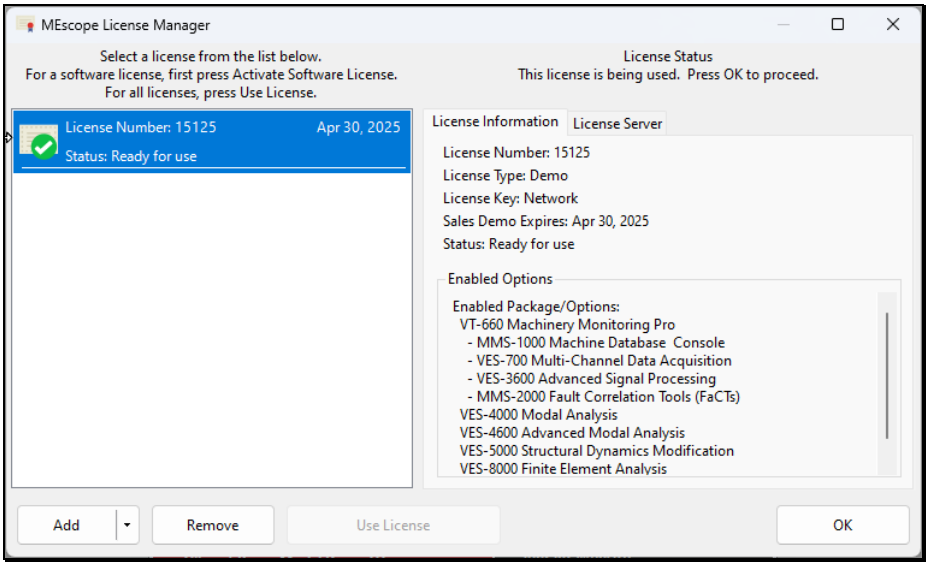
When you attempt to execute **MEscope.exe**, if you get an error message it could be for one of the following reasons.

- Either the **USB Security Key** or the **Network License Server** software is not properly installed and functional
- The **VTxxxxxx.VTL** license file is missing or corrupted
- The **VTxxxxxx.VTL** license file does not match your **USB Security Key** or is not recognized by the **Network License Server**
- The **MEscope.exe** software is corrupted

After checking the above items and reinstalling the software, if you still get an error message, contact Vibrant Technology at support@vibetech.com or call **(888) 815-5067** for assistance.

Help | License Manager

- Execute **Help | License Manager** in the MEscope window to open the **MEscope License Manager** as shown below



Help | License Manager.

The license file **VTxxxxxx.VTL** selected as **Ready for Use** on the left-hand side of the License Manager authorizes the operation of the MEscope **Package & Options** that were purchased for that license. The Package & Options authorized for the **Ready for Use** license file are listed on the right-hand side of the License Manager window.

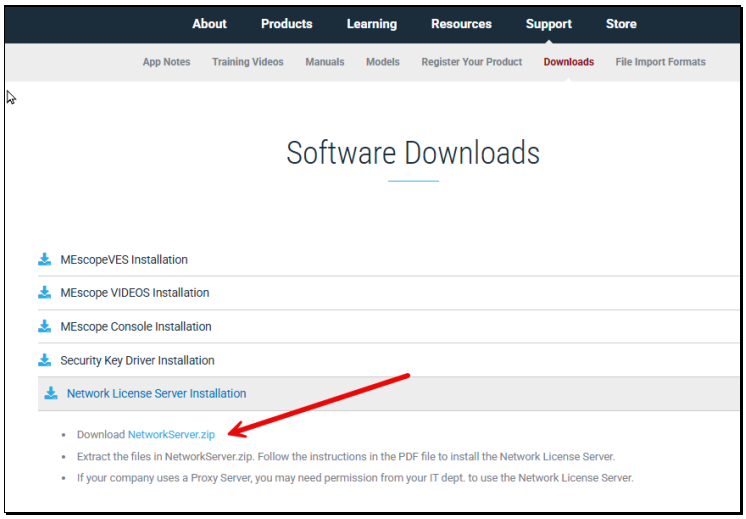
Installing the Network License Server (NLS)

The Network License Server (**NLS**) is a separate network-based software package that can authorize multiple copies of MEscope to run on a computer network.

The **NLS** must be installed on a computer that is accessible by any other computer on which authorization to run MEscope is required. Once the **NLS** is activated on a computer, it cannot be activated on a different computer.

To install the **NLS** software, execute the following steps,

- *Click* on **Downloads** on the **Support** page of Vibrant website; **www.vibetech.com**
- ***Double**-Click* on **Network License Server Installation** on the **Downloads** page
- ***Double**-Click* **Download NetworkServer.zip**



- In the **Downloads** area on your computer, right *Click* and execute **Extract All**
- Execute **Vibrant Network Server-Setup.exe**
- Follow the on-screen instructions to complete the program installation.

When the **NLS** has been installed, a window will display the Machine ID of the computer on which it was installed.

The Machine ID can also be obtained by executing **Program Files | Network License Server | Get Unique ID** from the Windows Start menu.

*** Email the Machine ID to **activate@vibetech.com** ***

A **VNS_######.Lic Network Server License** file will be emailed back to you.

The **VNS_######.Lic** file can be copied to anywhere on the computer on which the **NLS** is installed.

It is recommended that the **VNS_#####.Lic** file be copied to the **C:\ Program Files \ NETWORK LICENSE SERVER** folder on the **NLS** computer.

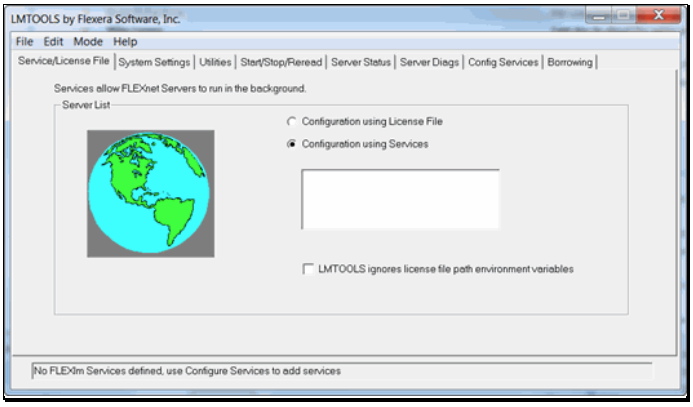
Configuring the NLS

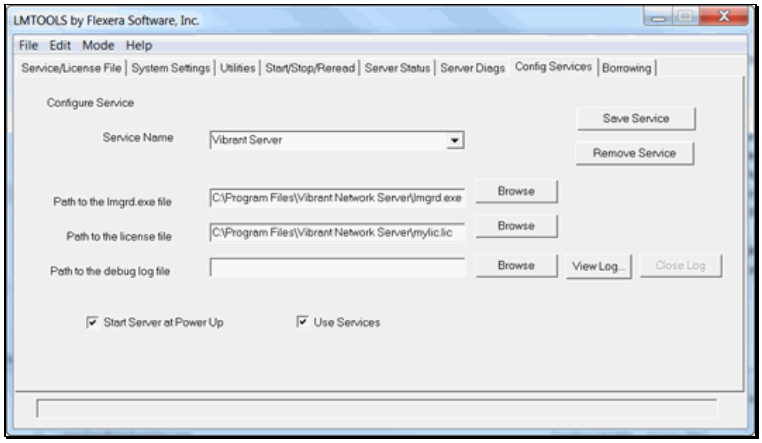
- Execute **Program Files | Network License Server | LMTOOLS** from the Windows Start menu.

Depending upon your computer security, you might need to *right Click* on the program **LMTOOLS** and execute Run as administrator.

- On the **Service/License File** tab, select **Configuration using Services**, as shown below

After the **NLS** has been activated on a computer, it cannot be activated on a different computer.





On the **Config Services** tab,

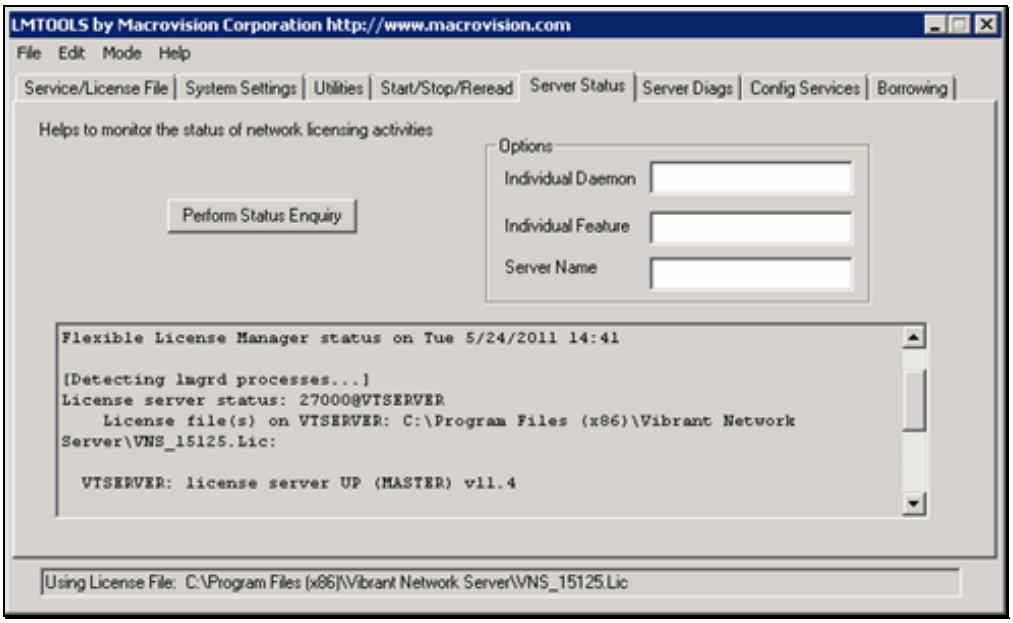
- Enter a Service Name, such as "**Vibrant Server**"
- Enter the Path to the **lmgrd.exe** file. (This will typically be found in the **C:\ Program Files \ NETWORK LICENSE SERVER folder**)
- Enter the Path to the **VNS_######.Lic** file
- *Check* **Use Services** and *check* **Start Server at Power Up**
- *Click* on the **Save Service** button
- On the **Start/Stop/Reread** tab, *Click* on the **Start Server** button
- On the **Server Status** tab, *Click* on the **Perform Status Enquiry** button

The status of the license server is listed, as shown below. The server port and server name are also listed.

The format **port@server name** is used to connect to the server.

In the example shown below, to connect to this **NLS**, enter **27000@vtserver** when prompted.

To connect to an NLS through port 27000@vtserver, the License server status 27000@vtserver should be entered in MEscope when prompted.



Configuring the Server Firewall

The Firewall on the computer hosting the **NLS** needs to have inbound TCP exceptions set up allowing all MEscope users access via the network.

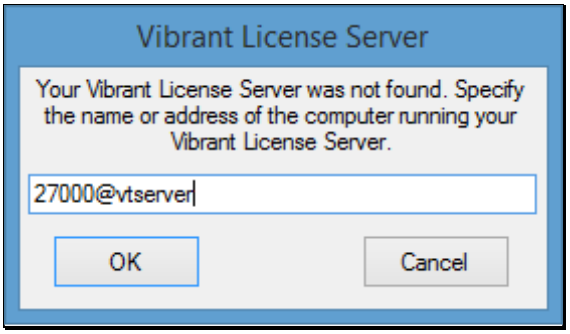
The configuration depends upon the Firewall being used. The following Firewall exceptions are required,

- The port used by the **NLS**, which is usually a number between **27000** and **27009.**
- The daemon, **VIBETECH.exe**, which is typically found in the **C:\Program Files\ Network License Server** folder.

Using the Network License Server

- Start MEscope

If the **NLS** is not found, the following dialog box will open.



The port and server name for the **NLS** should be entered using the format **port@server name**, as shown below.

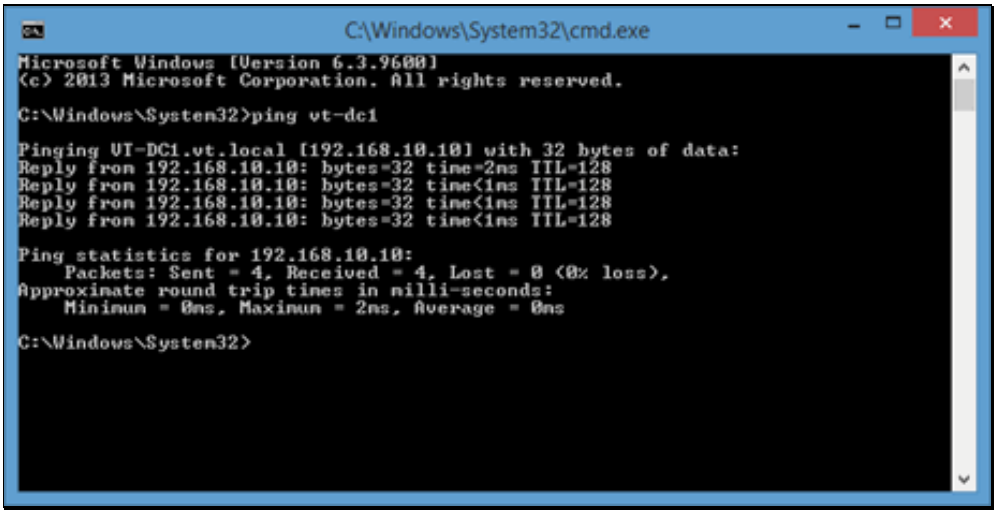
If Communication with the NLS is Slow

If you have difficulty connecting to the **NLS**, it may be that communication with the license server computer is slow and it has timed out. To address this issue,

- Open the Windows System Control Panel and enter **sysdm.cpl** in ***Search Programs and Files***
- Select the **Advanced** tab on the panel
- Execute **Environment Variables**
- Create a new environment variable named **FLEXLM_TIMEOUT** and a time out **in microseconds**.
- The default time out is **100,000 microseconds (0.1 seconds)**
- Reboot the computer to apply this change

Pinging the server computer can show how long communications take with the server computer. Ping will show the ***time to communicate*** in milliseconds (1 millisecond=1000 microseconds).

- Open the Windows Command line and enter **cmd** in ***Search Programs and Files***
- Enter **Ping** followed by the server's name, as shown below



Borrowing a License from the NLS

To run MEscope without being on the network with the **NLS**, a license must be ***borrowed*** from the **NLS**.

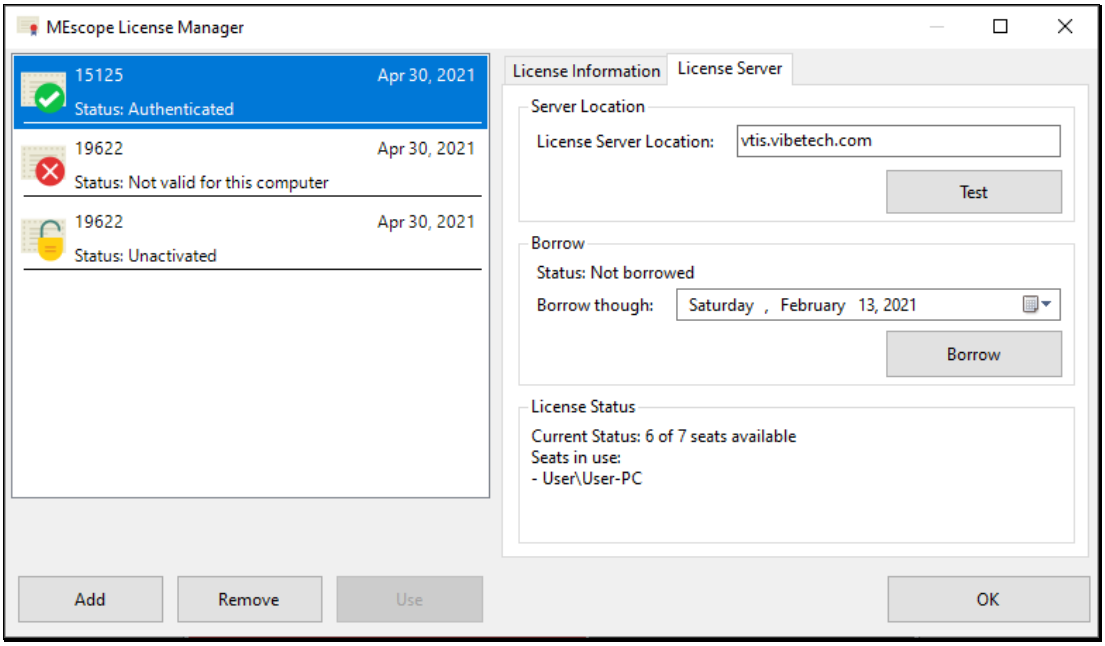
A borrowed license is node locked to the computer running MEscope, making that license unavailable to other users of the **NLS** until it is returned to the **NLS**, or ***30 days has expired***, whichever occurs first.

A borrowed license will be returned to the server when MEscope is closed down on your computer

To borrow a license from the **NLS**,

- Run MEscope while connected to the **NLS**
- From the MEscope Help menu, execute **Help | License Manager**

The **MEscope License Manager** dialog box will open, as shown below.



- *Click* on the **License Server** tab to display the License Server as shown above
- *Select* a **Borrow through** date

If the date and time settings are not changed, the license will be ***borrowed for the rest of the day***.

- *Click* on the **Borrow** button
- *Click* on the **OK** button to close the **License Manager**, and continue using MEscope with a **borrowed** license

Installing the MEscope Data Viewer

MEscope can be used as a **Data Viewer** on a computer without a valid MEscope license. If the Software Maintenance & Support (**SMS**) on your license is current, you can share your Project files with others who don't have a valid MEscope license on their computer.

Send your Project file and a copy of your **VTxxxxxx.VTL** MEscope License file to the person wanting to use MEscope as a Data Viewer, along with the following instructions,

- Download http://files.vibetech.com/MEscope-Installer.exe
- Copy the attached **VTxxxxxx.VTL** MEscope License file into the same folder as MEscope-Installer.exe
- Execute MEscope-Installer.exe to install MEscope and the license file
- Execute Start Menu | All Programs | Vibrant Technology, Inc. | MEscope Data Viewer

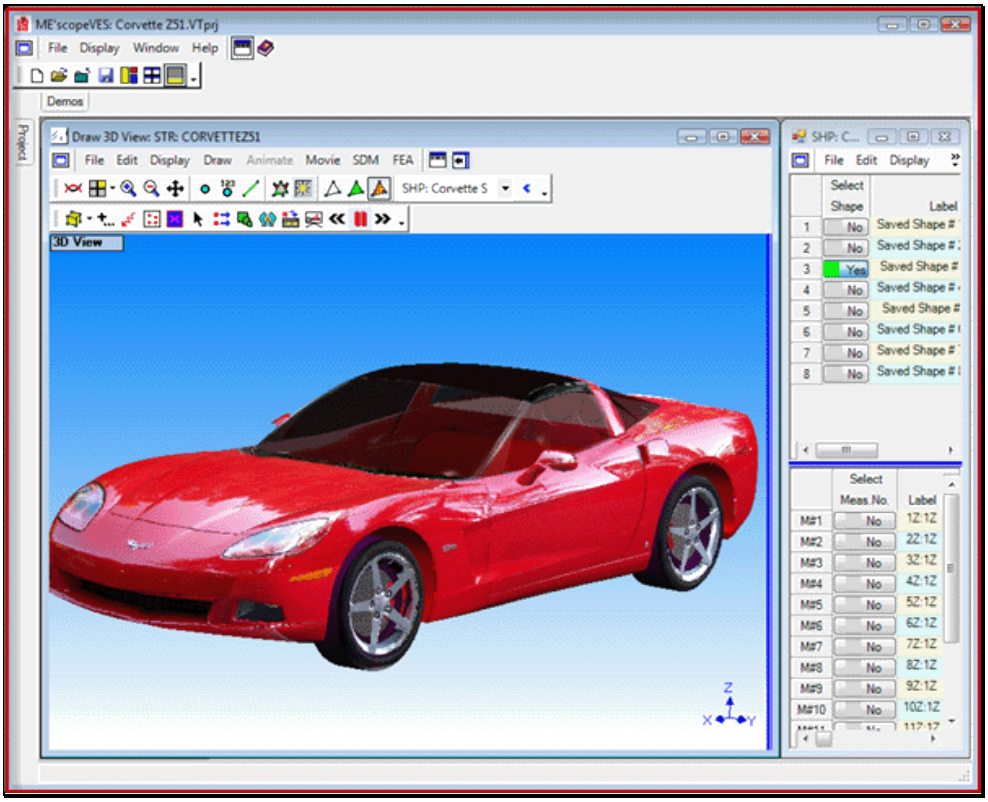
Introduction

MEscope is a series of software packages & options that makes it easier for you to acquire, analyze, observe and document noise & vibration in mechanical structures and operating machinery. You can use MEscope for a wide variety of engineering tasks.

- Operating Deflection Shape (**ODS**) Analysis
- Experimental Modal Analysis (**EMA**)
- Operational Modal Analysis (**OMA**)
- Vibration & Acoustic Signal Processing
- Multi-Input Multi-Output (**MIMO**) Modeling & Simulation
- Structural Dynamics Modification (**SDM**)
- Finite Element Analysis (**FEA**)

MEscope can also be used as the ***"heart"*** of an acquisition & post-processing system for remotely monitoring, analyzing, and diagnosing failures in operating machinery, or in structures such as bridges and wind turbines. When used together with its **archival database** and operator **Console graphics software**, MEscope can be used for,

- Machinery Health Monitoring (**MHM**)
- Structural Health Monitoring (**SHM**)
- Environmental Noise & Vibration Monitoring
- Machinery & Structural Qualification Testing



*Animated **ODS** Display Using a Photo Realistic Model.*

Animated ODS & Mode Shape Display

All MEscope packages contain a state-of-the-art interactive display for animating spatially defined shapes on a 3D model of a machine or test article. Shape data such as an operating deflection shape (ODS), mode shape, acoustic intensity shape, or sound power through a surface can be displayed in animation on a photo realistic model, like the one shown above. Displaying spatially defined shapes in animation makes it easier to visualize and analyze structural noise & vibration problems.

Observing Vibration in Slow Motion

By animating the ***spatial response*** of a structure in ***slow motion***, you can view ***overall motion*** of a structure, and the motion of ***one portion relative to another***. Locations of ***excessive vibration*** or ***high noise levels*** are easily identified.

- With interactive ***sweep animation***, you can sweep through a set of time wavforms and observe the ***recorded response*** of a machine or structure, whether its vibration is ***sinusoidal, random, transient, linear***, ***non-linear, stationary*** or ***non-stationary***
- With interactive ***sine dwell animation*** or ***stationary dwell***, you can dwell at a specific time in a set of response time waveforms, or at a frequency in a set of frequency spectra, and examine the deflected shape

Types of Data Imported

Every MEscope package can import multi-channel time-based or frequency-based data from a wide variety of third-party data files.

- File formats used by all popular multi-channel data acquisition systems, analyzers, recorders, and data collectors are supported

Most popular file formats are supported, including **ASCII text spreadsheet**, **MATLAB, DADiSP**, Microsoft **WAV**, and **Universal File Format (UFF**).

The following types of measurement functions are recognized by MEscope.

Time Domain Functions

- Time Waveform(**TWF**) ➔ vibration, sound pressure, strain gauge, temperature, etc.
- Auto Correlation (**A-COR**)
- Cross Correlation (**X-COR**)
- Impulse Response Function (**IRF**)

Frequency Domain Functions

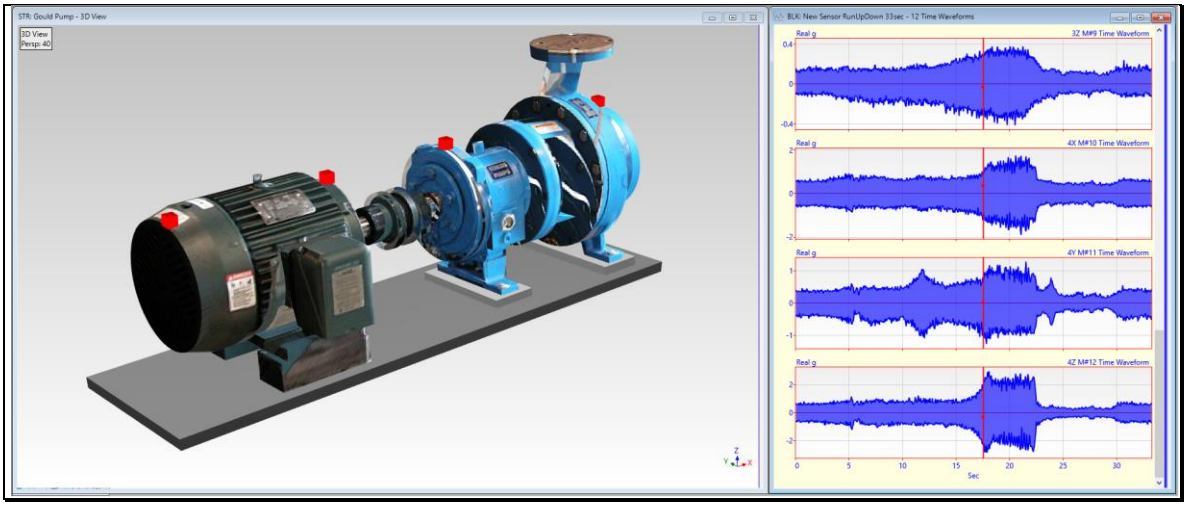
- Fourier Spectrum ➔ Digital Fourier Transform (**DFT)** of a uniformly sampled Time Waveform (**TWF**)
- Auto Power Spectrum (**APS**)
- Cross Power Spectrum (**XPS**)
- Power Spectral Density (**PSD**)
- Frequency Response Function (**FRF**) ➔ (Response **DFT** / Force **DFT**)
- Transfer Function (**TRFN**) ➔ (Output **DFT** / Input **DFT**)
- Transmissibility (**TRN**) ➔ (Roving response **DFT** / Reference response **DFT**)
- Coherence ➔ Ordinary Coherence (**COH**), Multiple Coherence (**M-COH**), Partial Coherence (**P-COH**)
- **ODS-FRF** (Roving response Auto Spectrum + phase relative to a Reference response)
- Acoustic Intensity (**INTEN**)
- Sound Pressure Level (**SPL**)

Time-Based ODS Animation

With MEscope, you can animate **time-based Operating Deflection Shapes (ODS's)** directly from multi-channel data that was acquired spatially from a machine or structure.

- Time-domain **Sweep Animation** is done by sweeping a cursor through a set of time waveforms

You can stop the animation, back it up, and play it forward to observe in slow motion vibration phenomena that may have taken place very quickly in real time. You can observe in slow motion the run up, coast down, or other transient behavior of a machine. During these transition periods, the machine may pass through a variety of vibrational states, due to resonances, unbalances, varying loads, fluid flow, etc.



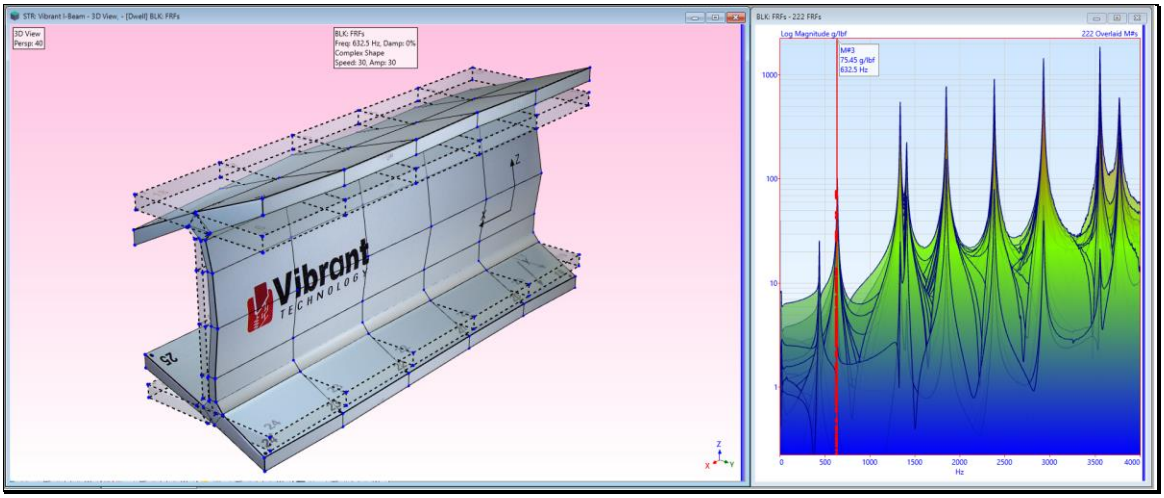
Sweep Animation from Multi-Channel Time Responses.

Frequency-Based ODS Animation

With MEscope, you can animate **frequency-based Operating Deflection Shapes (ODS's)** directly from data that was acquired from a machine or structure

- During Sine Dwell animation, the **ODS** at a specific frequency is displayed using sinusoidal modulation

A frequency-based **ODS** allows you to see how a structure behaves at a single frequency. While dwelling at a frequency, the **ODS** will show you ***where vibration levels are highest*** and will indicate loose parts and connections. You can display order-based **ODS**'s and determine how resonances are participating in the overall vibration.



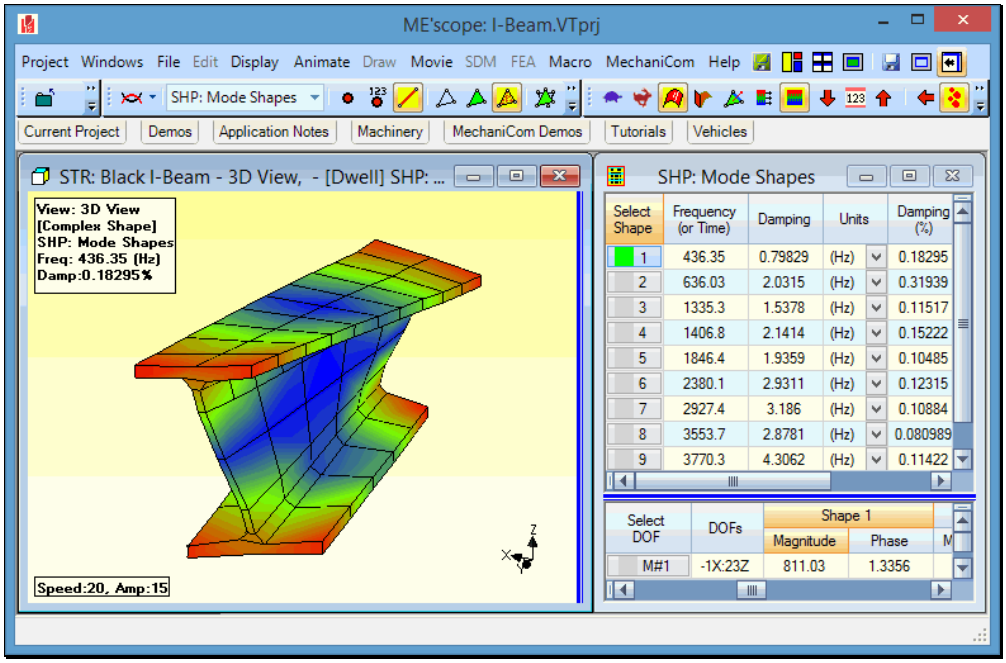
*Sine Dwell Animation of a Frequency-Based **ODS** at a Resonance.*

Mode Shape Animation

Modes of vibration are used to characterize resonant vibration in machinery and structures.

- All structures have specific ***natural frequencies*** at which they readily absorb energy
- When a resonance is excited, it can cause ***excessive noise and vibration***, resulting in premature structural failures
- Each resonance is defined by its natural frequency, damping, and mode shape
- At or near a modal frequency, the response of a structure is ***usually dominated by the resonance***
- A ***frequency-based ODS*** will often ***look like*** the mode shape of a nearby resonance, if the resonant response ***dominates the ODS***

However, mode shapes, along with their frequency and damping values, are more accurately obtained by curve fitting a set of **FRF** s, or Fourier spectra, Cross spectra or **ODS-FRF** s calculated from operating data.



Sine Dwell *Animation of a* Mode Shape.

Projects, Data Files, and Windows

All work in MEscope is done in the ***currently open Project file***.

- ***Only one Project file*** can be open at a time in MEscope

A **Project** file (with file name extension **VTprj** or **VTmax**) can contain ***one (or more)*** of the following data files,

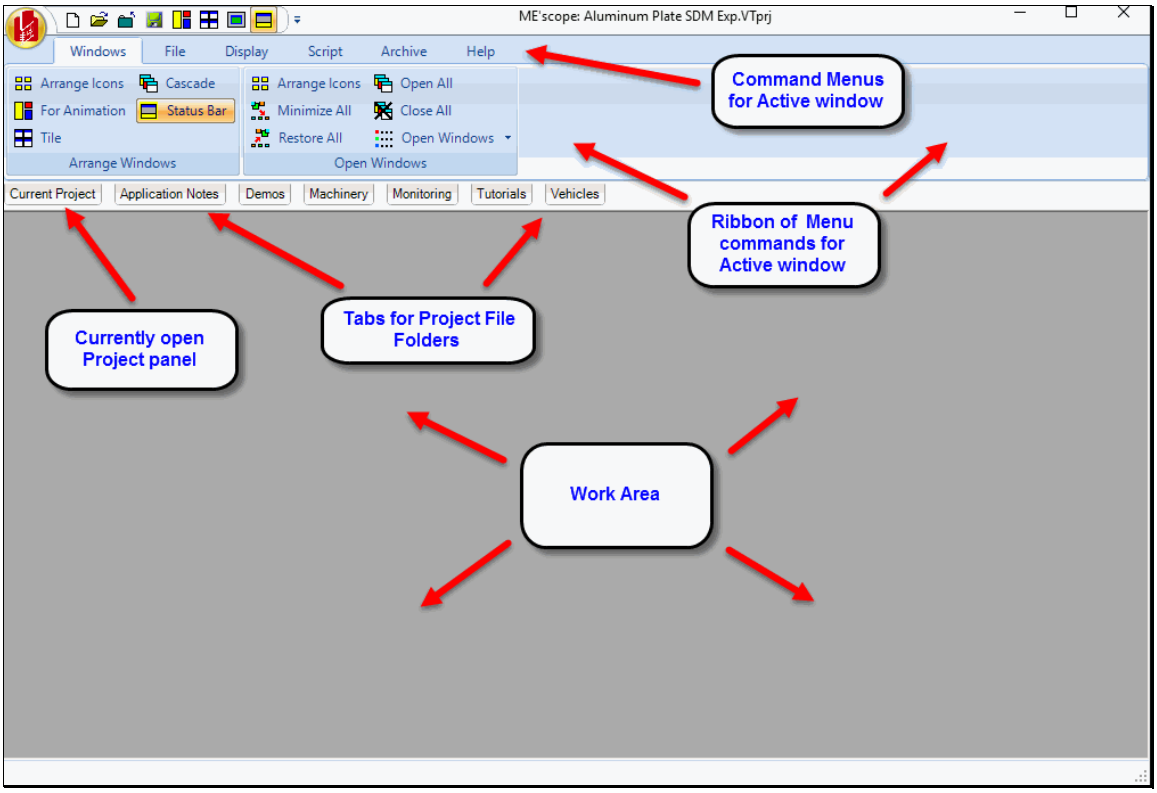
- Structure (**STR**) file
- Data Block (**BLK**) file
- Shape Table (**SHP**) file
- Acquisition (**ACQ**) file
- Report (**RTF**) file
- Script (**VSL**) file
- Added Files

All data in these files (except Added Files), is saved within the **Project** file on disk.

- Added Files are stored separately on disk and are opened from MEscope in a separate application program.

MEscope Window

- The MEscope window is ***always open*** when MEscope is running

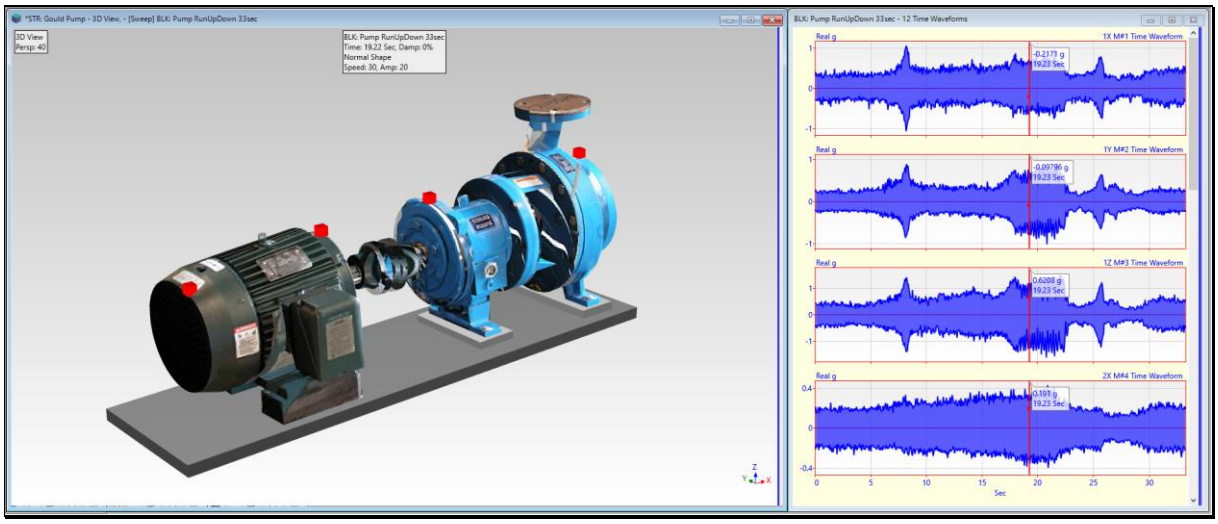


MEscope Window.

Data File Windows

A separate window is used to display and manipulate the contents of each data file within the ***currently open*** **Project**. When a data file is opened, a ***copy*** of its contents on disk is put into RAM memory and displayed in its own window. Each window name is preceded by its window type, followed by a colon

- A **Structure** file is displayed in an **STR** window
- A **Data Block** file is displayed in a **BLK** window
- A **Shape Table** file is displayed in an **SHP** window
- An **Acquisition** file is displayed in an **ACQ** window
- A **Report** file is displayed in an **RTF** window
- A **Script** file is displayed in a **VSL** window



*MEscope with a Structure (**STR**) and Data Block (**BLK**) Window Open.*

Saving Data Files

- When a file is saved in MEscope, its file contents in RAM memory ***replace the contents of the file*** in its **Project** file stored on disk
- If a Project ***is closed without saving changes*** to one of its data files, the file ***contents in memory will be lost***. The contents of that file on disk ***will not be changed***.

Mouse Operations

To enlarge this text, *Click* on it, hold down the Ctrl key and spin the mouse wheel.

Many operations in MEscope require the use of the Windows mouse. Commonly used mouse operations include;

- Selecting by ***pointing & clicking*** with the ***left mouse button***
- Displaying a context menu by ***clicking with the right mouse button***
- **Panning** a View by ***dragging with the left mouse button***
- **Rotating** the model in the 3D View or the **Waterfall** by **dragging with the right mouse button**
- **Zooming** the graphics or **scrolling** a spreadsheet by **spinning the mouse wheel**

Window Operations

More than one data file window is usually open for use in MEscope. Learning how to ***open***, ***close***, ***move, arrange*** & ***re-size*** windows is important for arranging them together in the Work Area.

Make a Window Active

- *Click* anywhere within a window to make it the ***active*** window
- The title bar of the ***active*** window is darkened or colored

Center the active Window in the Work Area

- To center a window in the Work Area, execute **Display | Center Window** either from the **right** *Click* **menu** or from the **menu bar**

Center the MEscope Window on the Desktop

- Execute **Display | Center MEscope Window** on the **upper tool bar** in the MEscope window

Move a Window

- Position the mouse pointer ***on the title bar*** (on the top of the window), and *Click* ***& drag*** the window to the desired position

Resize a Window

- ***Hover*** the mouse pointer over one of its edges so that the mouse pointer changes to a ***double arrow***
- Then *Click* ***& drag*** the edge

Close a Window

- *Click* on the close button  in the ***upper right corner*** of the window

Maximize a Window

- *Click* on the maximize  button in the ***upper right corner*** of the window

Minimize (Icon) a Window

- *Click* on the minimize  button in the ***upper right corner*** of the window

Restore a Minimized Window

1. ***Double****-Click* on its Icon on the bottom of the Work Area
2. Or ***Double****-Click* on its file name in the **Project Panel**
3. Or *Click* on its file name in the **Windows | Open Windows** list in the MEscope window

Tool Tips

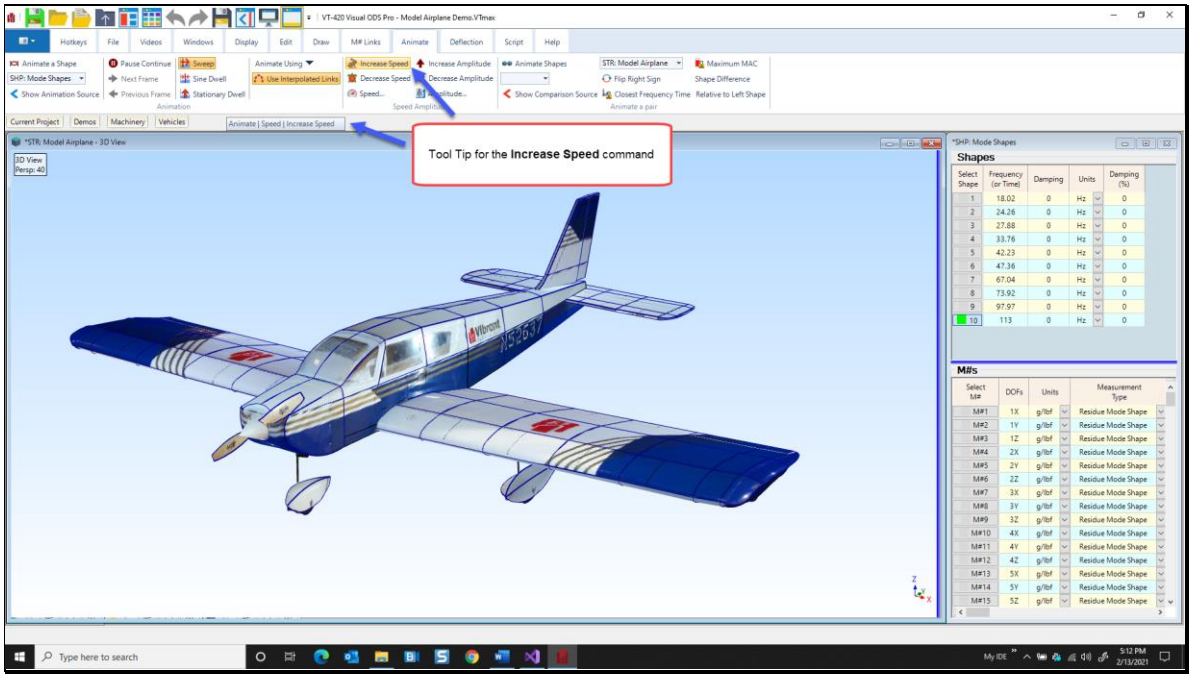
Each command in MEscope has a **Tool** associated with it.

- A Tool is a ***graphical button*** that accompanies the command in its menu
- A Tool Tip is a **brief description** of a command (typically its ***menu location*** and ***name***)

Help | Show Tool Tips

When this command is ***checked,*** the display of Tool Tips is enabled.

- *Click* on a window to make it ***active***
- ***Hover*** the mouse pointer over any Tool on a **Toolbar** or the **Ribbon** to display its Tool **T**ip



Structure Window Showing a Tool Tip.

Command Ribbon & Toolbars

Most of the MEscope commands are contained in menus. Commands for each window can be displayed differently by choosing one of three styles.

- A command menu style is chosen on the **Display** tab in the **Project | MEscope Options** box

Command Ribbon

A Ribbon of commands for the ***active window*** and the commands for the MEscope window are displayed on the top of the MEscope window.

Single Menu

A Toolbar of commands for the ***active window*** and the commands for the MEscope window are displayed on the top of the MEscope window.

Window Menu

This Toolbar of commands is displayed on the top of each window.

Adding Commands to a Toolbar

- Any command can be added to the command Toolbar for that window
- Any command can be added to an existing Toolbar, or a new Toolbar can be created

Moving a Toolbar

Toolbars can be ***floated*** or ***attached*** to one of the ***four sides*** of the MEscope window

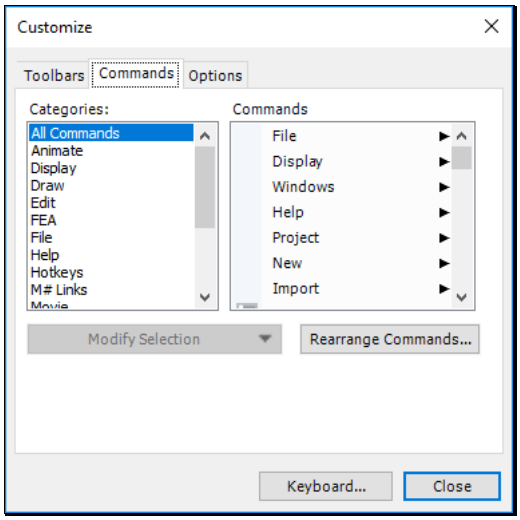
- Place the mouse pointer over the ***beginning area***  on the ***(left or top)*** of the Toolbar

The mouse pointer will change to ***crossed arrows***.

- ***Drag*** & ***drop*** the Toolbar to anywhere inside the MEscope window

Customizing a Toolbar

- ***Position*** the mouse pointer in the **menu** or in the **Toolbar** area, ***right*** *Click*, and execute **Customize** from the floating menu
- Or *Click* on the **More Tools** command  at the end of a Toolbar and execute **Add or Remove Tools | Customize**
- The Toolbar **Customize** dialog box will open, as shown below



Toolbar Customize Dialog Box.

Adding a Tool to a Toolbar

- Open the **Customize** dialog box
- *Click* on the **Commands** Tab in the Customize dialog box
  - The menus for the window will be displayed in the **Categories** list
- *Click* on the menu name in the **Categories** list to display the commands in that menu
- *Click* ***& drag*** a Tool from the **Commands** list onto the **Toolbar** (until an **I beam** is displayed), and ***drop*** it

Moving a Tool to Another Toolbar

- Open the **Customize** dialog box
- *Click* ***& drag*** a command Tool from the Toolbar and ***drop*** it onto another Toolbar

Repositioning a Tool on a Toolbar

- Open the **Customize** dialog box.
- *Click* ***& drag*** a command Tool from its position and ***drop*** it into its new position on the Toolbar

Removing a Tool from a Toolbar

- Open the **Customize** dialog box
- Position the mouse pointer on the Tool and *Click* ***& drag*** it ***off*** the Toolbar

Creating a New Toolbar

- Open the **Customize** dialog box
- *Click* on the **New** button in the Customize dialog box
- Enter the name of the new Toolbar in the dialog box that opens
- The new Toolbar is displayed in the Toolbar area at the top of the window

Locking the Toolbars

- ***Right** Click* in the menu or in the Toolbar area, and execute Lock the Toolbars
- If **Lock the Toolbars** is ***checked***, the Toolbars are locked in position.

Hidden Floating Toolbars

Floating Toolbars will become hidden behind other windows whenever their window is not the ***active window***.

- To make floating Toolbars visible, *Click* anywhere on a window to make it the ***active window***

Resetting the Toolbars

- Execute **File | MEscope Options** in the MEscope window to open the Options dialog box
- On the Display tab, *press* Toolbars in the Clear User Settings section

The MEscope Window

The **MEscope** window is ***always open*** when MEscope is running.

- *Click* on its **close** button to terminate the operation of MEscope

The MEscope window contains a **Command Menu**, a **Ribbon or Toolbar**, a **Project** tab, and File Folders tabs, all normally located at the top of the window, as shown below.

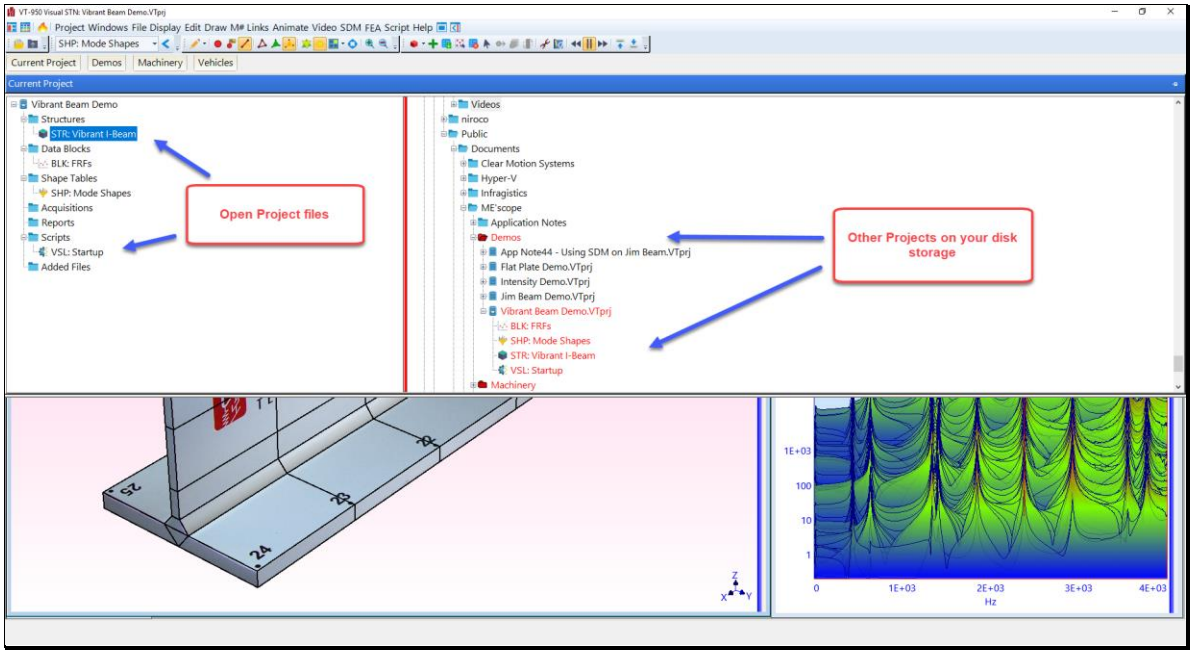
The **Work Area** is in the center, and the **Status Bar** is located on the ***bottom left*** of the window.

Current Project Fly-out Panel

The Current Project Fly-out Panel contains two panes, separated by a moveable **red splitter bar**.

One pane lists the data files in the ***currently open*** **Project** file**,** and the other pane lists the Project files in the current disk folder.

- *Click* on the **Current Project** tab to display the Current Project Fly-out Panel



Current Project Fly-out Panel.

Work Area

The center of the MEscope window is called the **Work Area**.

All data file windows in the ***currently open*** Project are opened into the Work Area.

- Execute one of the commands in the **Window | Arrange Windows** menu to arrange the open windows in the Work Area
- ***Right*** *Click* in any window and execute **Display | Center Window** to center it in the Work Area

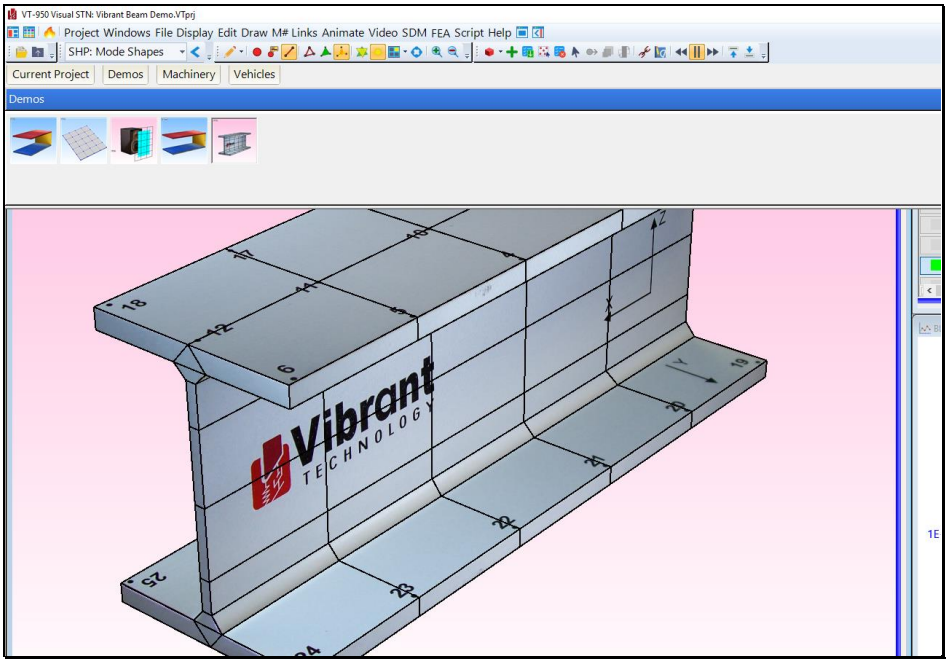
Projects Tabs

In addition to the **Current Project** tab, ***several*** **Projects** tabs are added to the MEscope window when it is installed.

- *Click* ***on*** a **Projects** Tab to open its ***fly-out panel*** containing the MEscope Projects in that folder

Opening a Project From a Projects Tab

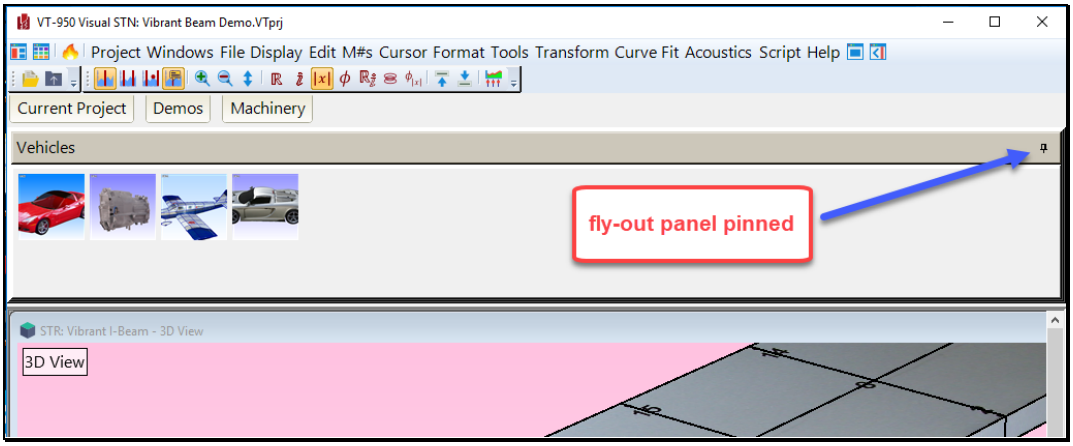
- ***Hover*** the mouse pointer over each Project ***thumbnail*** (picture) on the panel to display its name
- ***Double****-Click* on any Project in a fly-out panel to open the Project
- ***Move*** the mouse pointer ***off a fly-out panel*** to close it



Demos Tab Fly-out Panel.

Moving a Fly-out Panel

- *Click* on a Projects Tab to open its fly-out panel
- *Click* on the **pin icon** in the ***upper right corner*** to **pin the fly-out panel open**, as shown below



Pinned Fly-out Panel.

- ***Drag*** the ***pinned*** fly-out panel into the ***middle*** of the Work Area

Notice that ***four arrow icons*** appear near the ***top, bottom & sides*** of the Work Area.

- ***Drag*** the ***pinned*** fly-out panel onto an ***arrow icon*** to attach it to the ***top, bottom*** *or a* ***side*** of the Work Area
- *Click* ***again*** on the **pin icon** in the ***upper right corner*** to **un-pin the fly-out panel**

Opening a Previously Saved Project File

There are several ways to open a previously saved Project

- Execute **Project | Open** in the MEscope window
- Select the Project from the list of **Recent Projects** in the **Start Page** window
- ***Double****-Click* on the Project file name in the ***(right or lower)*** pane of the Current Project Fly-out Panel
- ***Right*** *Click* on the file in the ***(right or lower)*** pane of the **Current Project Fly-out Panel**, and select **Open** from the context menu

Creating a New Project

- Execute **Project | New** in the MEscope window

If another Project is already open, you will be asked to save the current Project file before creating a new Project.

Creating a New Data File

- Execute one of the commands in the **File | New** menu in the MEscope window

Adding a File from Another Project

- ***Double****-Click* on the file from another Project in the ***(right or lower)*** pane of the **Current Project Fly-out Panel**
- Or ***right*** *Click* on the file in the ***(right or lower)*** pane of the **Current Project Fly-out Panel**, and select **Add** from the context menu

Importing a Data File

- Execute one of the commands in the **File | Import** menu in the MEscope window

Structure (STR) Window

A Structure **(STR)** file contains a 3D geometric model of a test article or acoustic surface on which shape data will be displayed in animation. Each structure model is defined using Points, Lines, and Surfaces (***Surface Triangles or Surface Quads***).

A Structure window is used for several purposes,

- ***Drawing*** a 3D model of a test machine or structure
- ***Animating*** deflection shapes (**ODS's,** mode shapes, or acoustic shapes), or displaying scalar engineering data using color contours
- Creating an **FEA model** by attaching **FEA Objects (FEA elements)** to the geometric model

SDM & FEA commands use FEA Objects. FEA Objects are provided when the **VES-6000 & VES-8000** options are licensed in your software.

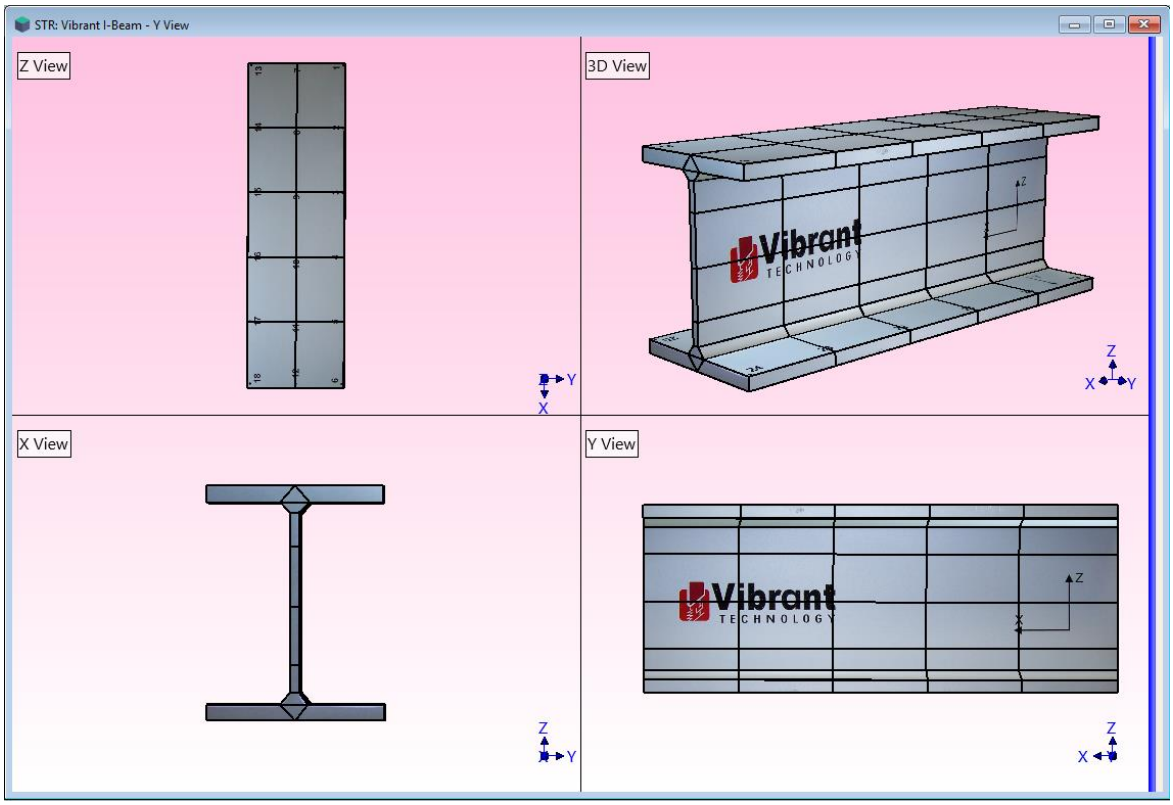
Adding a Structure Model to a Project

There are several ways to add a structure model to a Project;

- Execute **File | Import | Structure**, and ***import*** the model from an external source such as a CAD program or spreadsheet file
- ***Double****-Click* on a Structure (**STR**) file in the ***(right or lower)*** pane of the Current Project Fly-out Panel
- ***Right*** *Click* on a Structure (**STR**) file in the ***(right or lower)*** pane of the Current Project Fly-out Panel and select **Open** from the menu

Creating a New Model

- Execute **File | New | Structure** in the MEscope window, and create the model using the drawing tools in the new Structure window.



Structure Window in Quad View.

Data Block (BLK) Window

A Data Block **(BLK)** file contains one or more ***time*** or ***frequency*** domain measurements (**M#**s). An **M#** is a trace of uniformly sampled time or frequency data.

- All **M#**s in a Data Block have the ***same time or frequency axis*** values
- Each **M#** has a ***unique measurement number*** **(M#)**, based in its ***row*** in the **M#s** spreadsheet

Time-based or ***frequency-based*** **ODS**'s, mode shapes, acoustic shapes, or engineering data shapes are interactively displayed on the structure model in a ***connected*** Structure window, using measurement values at the ***cursor position*** in a Data Block window

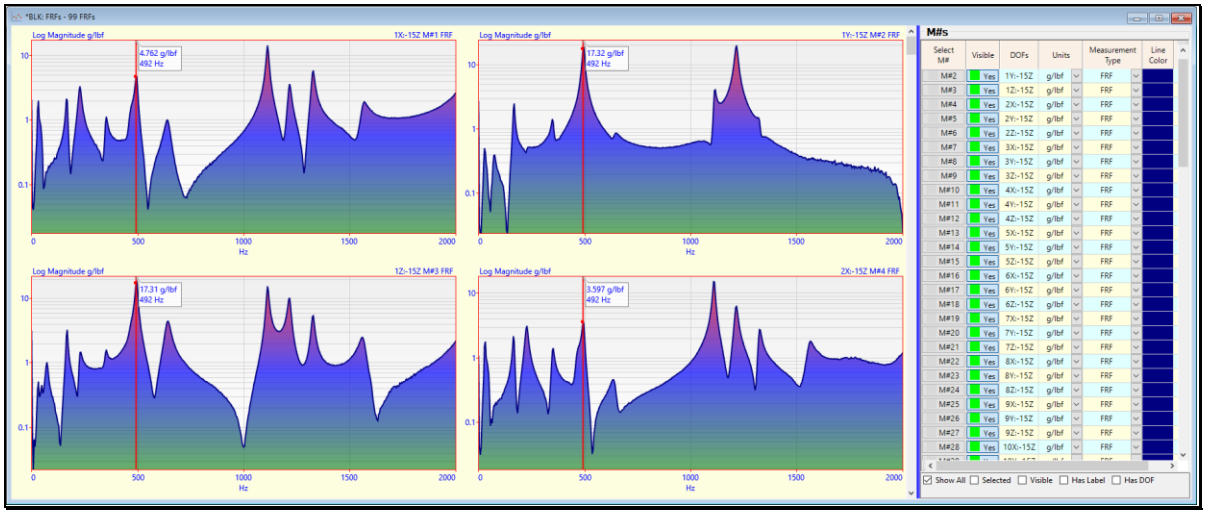
Adding a Data Block to a Project

There are several ways to add a Data Block to a Project.

- Execute **File | Import | Data Block** and import measurements from a third-party data file
- ***Double****-Click* on a Data Block **(BLK)** file in another Project, listed in the ***(right or lower)*** pane of the Current Project Fly-out Panel
- ***Right*** *Click* on a Data Block **(BLK)** file in another Project, listed in the ***(right or lower)*** pane of the Project Fly-out Pane, and select **Open** from the menu

There are several ways to create a new Data Block in a Project.

- Execute **File | New | Data Block** in the MEscope window and create a Data Block with synthesized time waveforms in it
- Use an **Acquisition** window to ***acquire*** measurements from a ***third-party*** acquisition front end, and save them into a Data Block



*Data Block Window Showing Four **M#**s in Row Column Format.*

Shape Table (SHP) Window

A Shape Table (**SHP**) file contains multiple ***time-based*** or ***frequency-based*** **ODS**'s, mode shapes, acoustic shapes, or engineering data shapes

- A ***"shape"*** is defined as any data from ***two or more*** measurements made at different points & directions on a test article.
- Each shape can be displayed in animation directly from a Shape Table, on the structure model in a ***connected*** Structure window.
- Each shape has ***one or more*** shape components, defined in the **M#s** spreadsheet

- Each shape component has a ***unique measurement number*** **(M#)**, defined by its ***row*** in the **M#s** spreadsheet

Creating a Shape Table

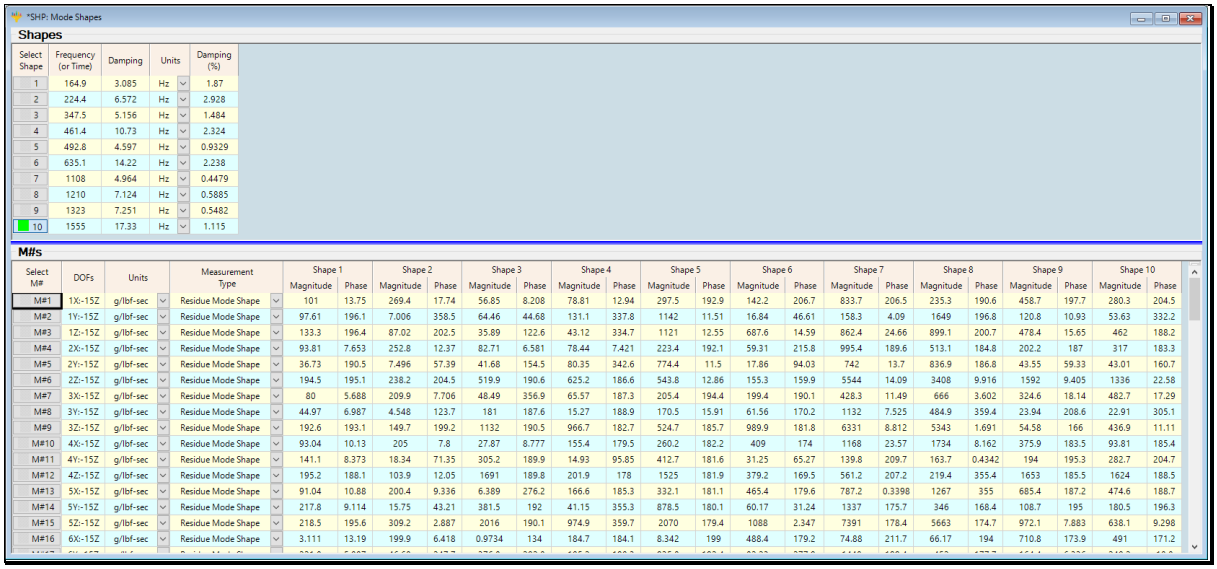
A Shape Table (**SHP**) file can be created in several different ways,

- By **saving shapes** from a Data Block window during **animation** or **curve fitting**
- By **saving shapes** from an **SDM or FEA** calculation
- By **saving shapes** from a **Sinusoidal ODS** calculation in a Data Block or Shape Table
- By executing **File | New | Shape Table** and ***manually entering*** data into the empty Shape Table

Adding a Shape Table to a Project

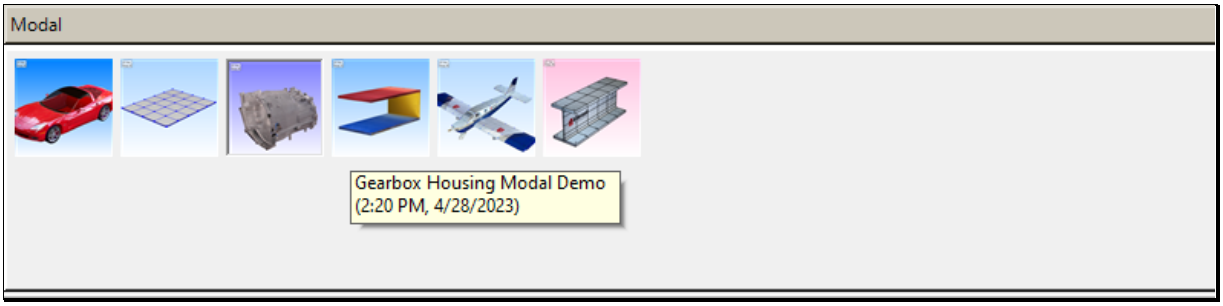
There are several ways to add an existing Shape Table (SHP) file to a Project

- Execute File | Import | Shape Table and import shapes from a *third-party data file*
- ***Double****-Click* on a Shape Table (**SHP**) file in another Project, listed in the ***(right or lower)*** pane of the **Current Project Fly-out Panel**
- ***Right*** *Click* on a Shape Table (**SHP**) file in another Project, listed in the ***(right or lower)*** pane of the **Current Project Fly-out Panel**, and select **Open** from the menu


Shape Table Containing Mode Shapes.

Modal Demos

- *Click* on the **Modal** tab to display the **Modal** demo projects fly-out panel as shown below
- Move the mouse pointer over one of the **Modal Analysis** demos, and ***Double-****Click* to open its Project



Modal Demos Tab with Mouse Over Gould Pump Demo

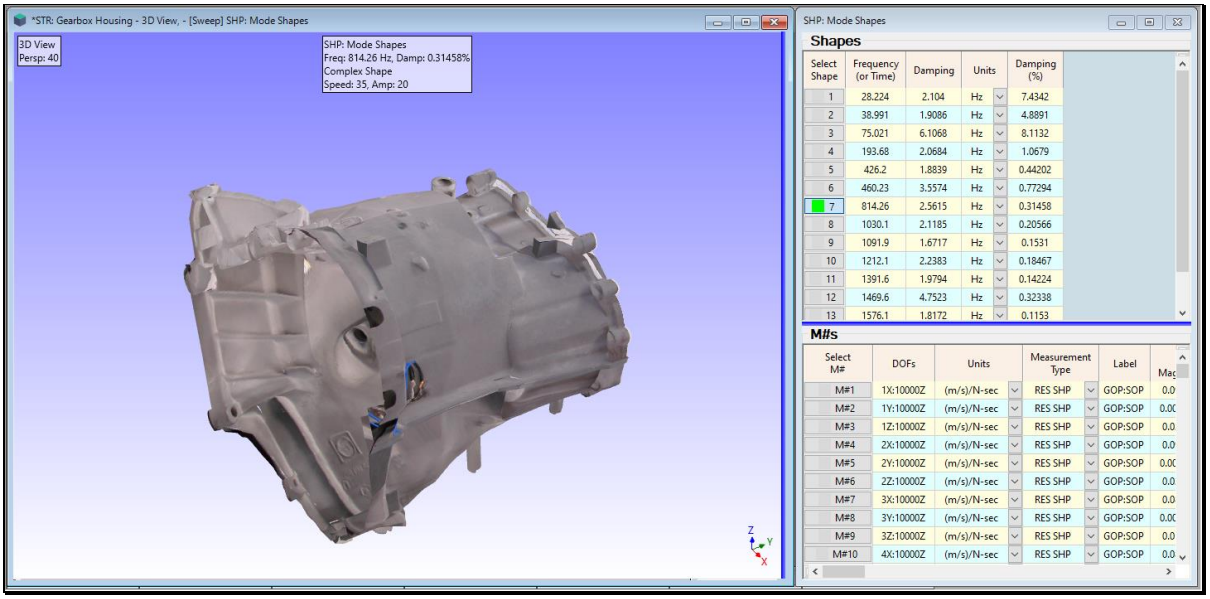
- **Double-***Click* on the **Gearbox Housing Modal Demo** to open its project file
- Press **Hotkey 1**

Sweep animation will begin displaying mode shapes from the Shape Table on the right. The Shape Table has 14 mode shapes in it. Each mode shape has **2067 DOFs**.

Changing the Animation Speed

The animation may be too fast or too slow, depending on the speed of your computer.

- *Click* in the Structure **STR** window to make it ***active***
- Locate the **Animate | Speed | Increase Speed** (***rabbit***) and **Animate | Speed | Decrease Speed** (***turtle***) Tools 
- *Click* on the **Turtle** Tool to ***decrease*** the animation speed
- *Click* on the **Rabbit** Tool to ***increase*** the speed



Gearbox Housing Modal Demo Showing Sweep Animation.

Quad View versus Single View

The Structure window can display a single View of the structure model, or four Views together in a Quad View format.

- 3D View (***upper right quadrant***)
- Z Axis View (***upper left quadrant***)
- X Axis View (***lower left quadrant***)
- Y Axis View (***lower right quadrant***)

To change between the Quad View and one of the four Views,

- ***Double****-Click* on a single View in the **Quad View** to display that View
- ***Double****-Click* on the single View to display the **Quad View**

When the **Vertical Axis** is changed on the **Display** tab in the **File | Structure Options** box, the labeling of the three 2D Views will also change.

Active View

When the Structure window is in Quad View, the ***active View*** is indicated by the **yellow box** in the **Display | View** button.

- ***Double****-Click* on a View to make it ***active***

When the 3D View is ***active*** the **upper right quadrant** of the **Display | View** button is yellow  .

- In **Quad View**, ***Double****-Click* on each View to make it the ***active View*** and turn it **yellow** on the **Display | View** Tool

Zoom

- *Click* in a View to make it ***active*** and ***spin the mouse wheel*** to Zoom the structure in that View

Pan

- ***Hold down*** the **Ctrl key** on the computer keyboard and ***drag*** the mouse pointer to Pan the structure model in the ***active*** View

Rotate the Model in the 3D View

- ***Hold down*** the **Right mouse button** and ***drag*** the mouse pointer in the **3D View** to rotate the 3D model

Geometric Interpolation

The **Animate | Use Interpolated Links** command in the **STR** window is used to ***enable*** and ***disable*** animation of the ***un-measured*** **DOFs** on the test article using ***Geometrically Interpolated*** **M# Links**.

- The mode shapes contain **2067** ***measured*** **DOFs** of the Gearbox Housing which are deflected during animation using the ***Measured Links*** of the model in the STR window
- The remaining ***un-measured*** **DOFs** of the Gearbox Housing are deflected during animation using the ***Interpolated Links*** of the model

When **Animate | Use Interpolated Links** is ***un-checked***, only the **Measured Links** are used to create the **3D deflection** of **689 measurement Points** on the model, using the **2068 DOFs** of mode shape data in Shape Table on the right.

When **Animate | Use Interpolated Links** is ***checked***, the **Interpolates Links** are used to create the **3D deflection** of all the other ***un-measured*** **DOFs** on the model using the **2068 DOFs** of mode shape in Shape Table on the right.

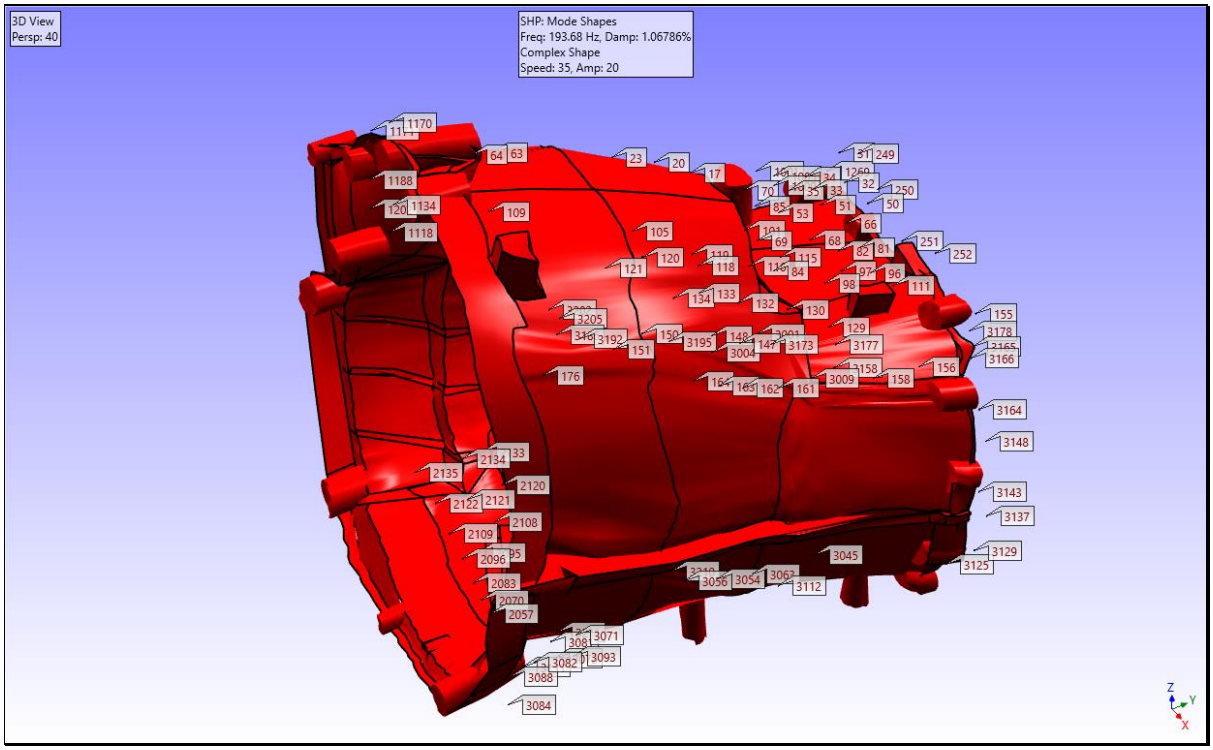
Rotating the Model in the 3D View

- Return the Structure window to the **3D View**
- Press **Hotkey 2**

Removing Photographs from the Surfaces

To alternately display of the model between a photorealistic model and the surface beneath it,

- Toggle **Hotkey 3**



Surface Model Showing Labeled Test Points

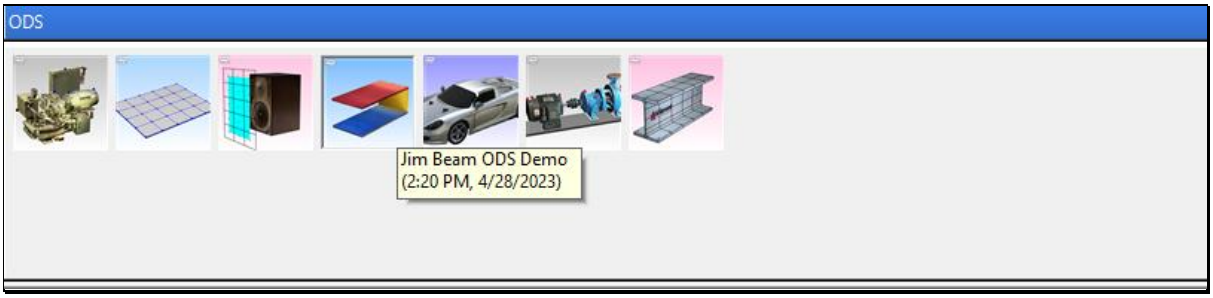
Displaying Test Point Labels

To display the test point labels on the model,

- Toggle **Hotkey 4**

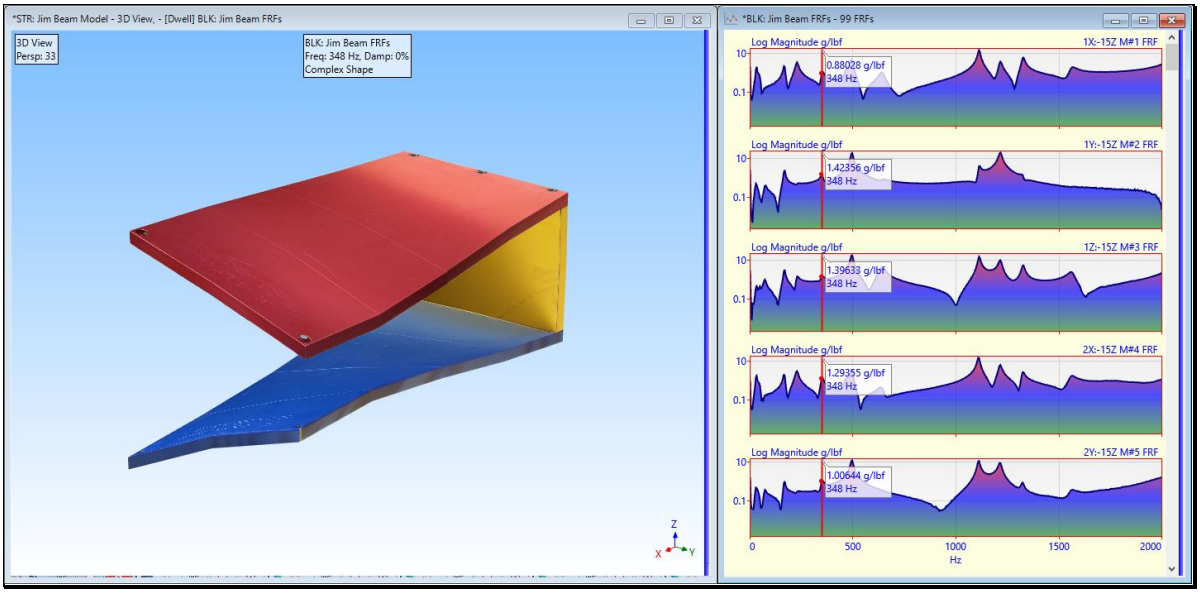
ODS Demos

- *Click* on the **ODS** tab to display the **ODS** demo projects fly-out pane, a shown below
- Move the mouse pointer over one of the **ODS** demos, and ***Double-****Click* to open its Project



ODS *Demos Tab with Mouse Over Jim Beam* ***ODS*** *Demo*

- **Double-***Click* on the **Jim Beam Demo** to open its project file
- Press **Hotkey 1**



Dwell Animation at a Resonance Peak.

Animating the ODS at a Resonant Frequency

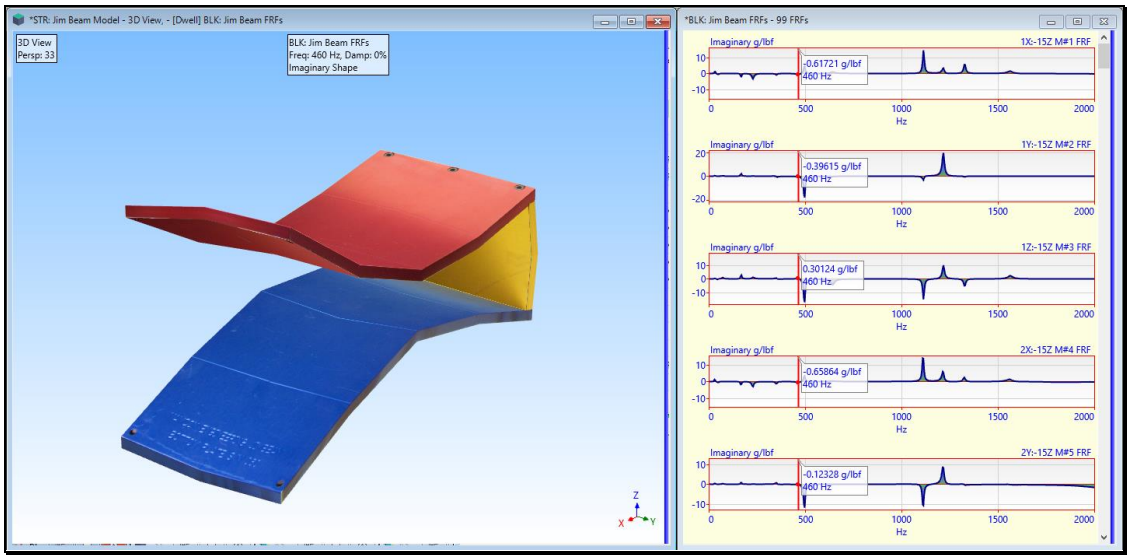
Peaks in an **FRF** measurement are evidence of structural resonances, or modes of vibration. At or near a resonance peak, the **ODS** (***values of the FRFs***) ***is dominated by the mode shape*** associated with that resonance. For lightly damped structures, the **ODS** at or near a resonant frequency will ***closely approximate a mode shape***.

Display Formats

Notice the **ODS** at **460 Hz** has a lot of ***"complexity"*** in it, which causes the **ODS** to ***"roll around"*** as it is being deflected. This is because the data from the resonance at **492 Hz** is heavily influencing the data at **460 Hz**.

One way to remove the complexity of the **ODS** is to display the **FRF** data in **Imaginary** format. In **Imaginary** format, the resonance peaks are sharp and have influence on neighboring resonance peaks.

- **Right-***Click* on the **FRF** s and execute **Format | Imaginary** in the Data Block window



ODS *from the Imaginary Peaks in the* ***FRF*** *s.*

Normalize Shapes

Another way to remove the **"complexity"** from the **ODS's** is to ***normalize*** them. **Shape normalization** changes the phases of an **ODS** so that all its components are **either 0 or 180 degrees** from each other. When it is normalized, it will display as a ***"standing wave"*** during animation.

- Toggle **Hotkey 4**
- *Click* near the **460 Hz resonance peak** in the **FRFs** to display the **460 Hz ODS**

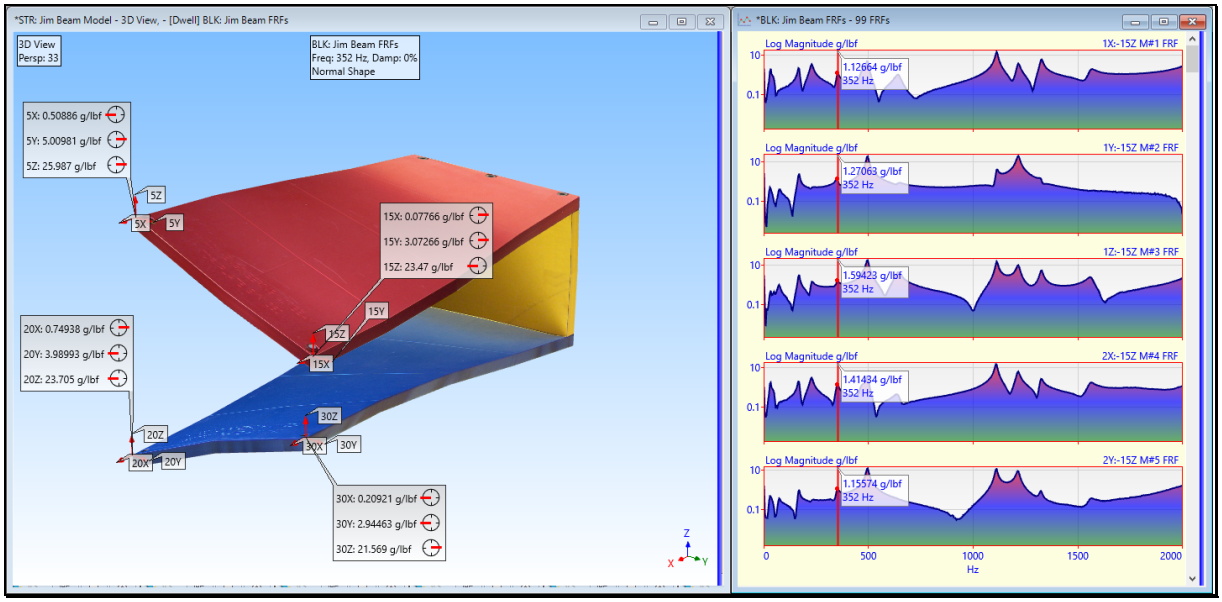
Now when the **ODS** at **460 Hz** will display as a ***"standing wave"*** and will look like the mode shape at 460 Hz.

Magnitudes & Phases of the ODS

Each **ODS** is **complex valued**, meaning that each shape component has both ***magnitude and phase***. To display the magnitude and phase of the **ODS** at several points on the Jim Beam

- Press **Hotkey 5**
- ***Drag*** the mouse pointer to each of the resonance peaks in the **FRFs**

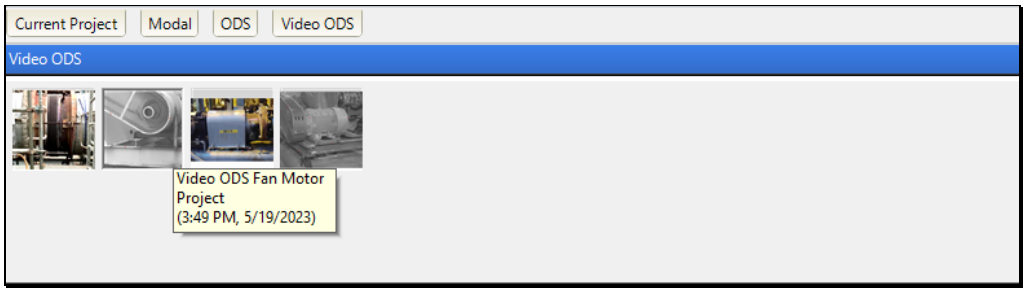
Notice that when **shape normalization** is ***enabled***, all the **ODS** phases are 0 or 180 degrees from each other. When ***shape normalization*** is ***disabled***, the **ODS** phases exhibit the ***"complexity***" of the **ODS**.



ODS with Shape Normalization Enabled

Video ODS Demos

- *Click* on the **Video ODS** tab to display the **Video ODS** demos fly-out panel as shown below
- Move the mouse pointer over one of the **Video ODS** demos, and ***Double****-Click* to open its Project

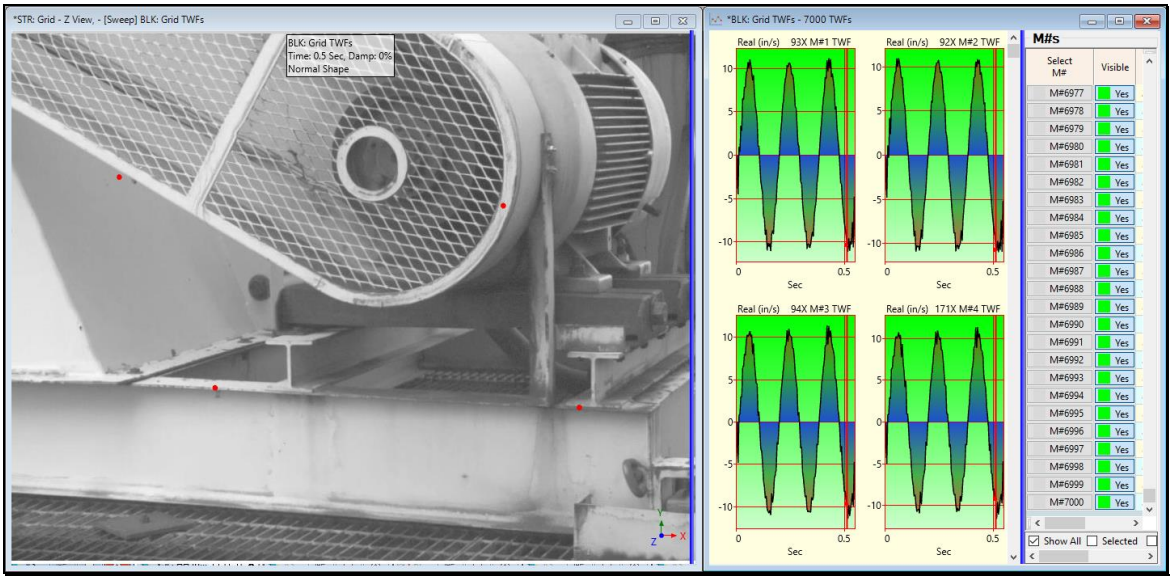


Video ODS *Tab with Mouse Over Video* ***ODS*** *Fan Motor*

- **Double-***Click* on **Video ODS Fan Motor** to open its project file
- Press **Hotkey 1**

Sweep Animation from TWFs

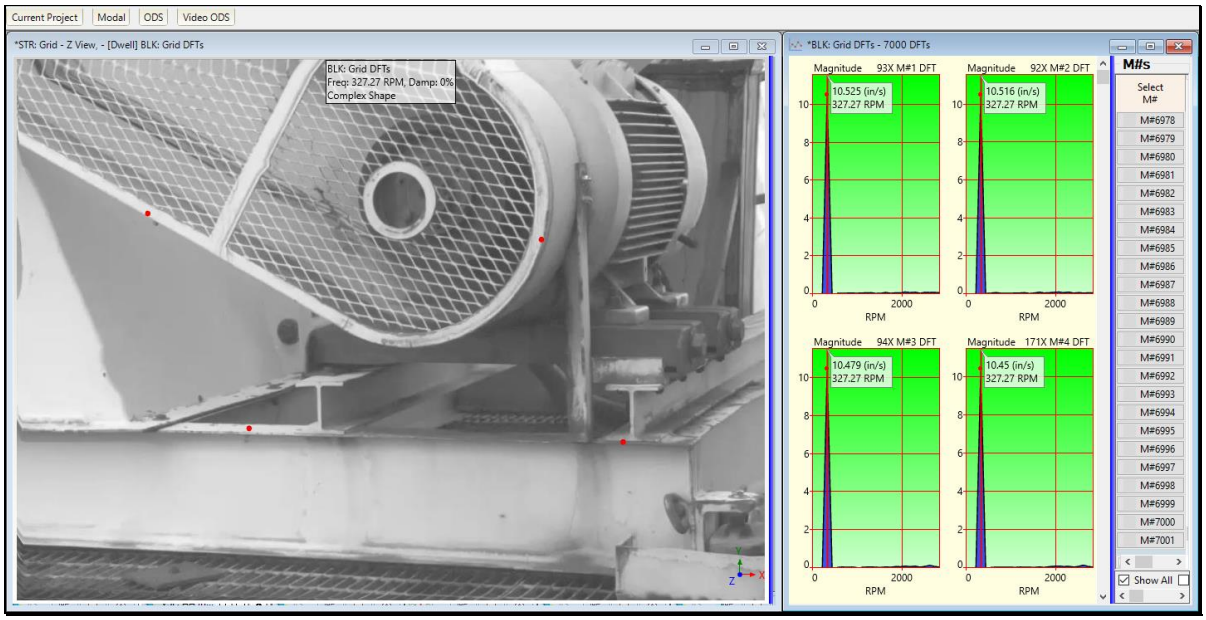
Sweep animation from a Data Block of **TWFs** will begin. The **time-based ODS** at the **line cursor position** at each sample in the **TWFs** is displayed on a frame of the video corresponding to each sample of the **TWF** data. **7000 TWFs** were extracted from the video recording of a motor and fan during operation.



*Sweep Animation of the **ODS** from **TWFs** of the Motor and Fan.*

Dwell Animation from DFTs

Sinusoidal dwell animation will begin. The **frequency-based ODS** at the **line cursor position** in the **DFTs** is displayed on a frame of the video. The **DFTs** were calculated from the **TWFs** that were extracted from a video that was recording of a motor and fan during operation.



*Dwell Animation of the **ODS** from **DFTs** of the Motor and Fan.*

Point Labels

- Toggle **Hotkey 4**

To deflect the ODS data in animation, each video frame is attached to a rectangular grid of Points. Each Point is deformed with **ODS** data in in the **X & Y** directions.

ODS Magnitude & Phase

- Toggle **Hotkey 5**

The magnitude & phase of the complex valued **ODS** data is displayed at several Points on the Point grid.

ODS Orbits

- Toggle **Hotkey 6**

The complex **ODS** data is displayed as **orbits** at several Points on the Point grid.

ODS Vectors

- Toggle **Hotkey 7**

The complex **ODS** data is displayed as **vectors** at several Points on the Point grid.

Documentation with Videos

MEscope allows you to interactively record a video of the contents of a Structure (**STR**) window or the MEscope window.

A video is a sequence of animation frames saved into a video **mp4** file. A Video can be played back on any computer that can play an **mp4** file

You can send videos to your clients, and they can view the animation just as it appears in MEscope. Videos can also be embedded in Microsoft ***Power Point*** presentations or ***Word*** documents. Individual frames can be cut from a video and pasted into documents, or annotations added to frames with a graphics or text processor.

Videos Menu

The commands in the **Videos** menu are used to record two different types of videos, Animation Frames or the entire MEscope window.

Each video is saved as a **MP4** file.

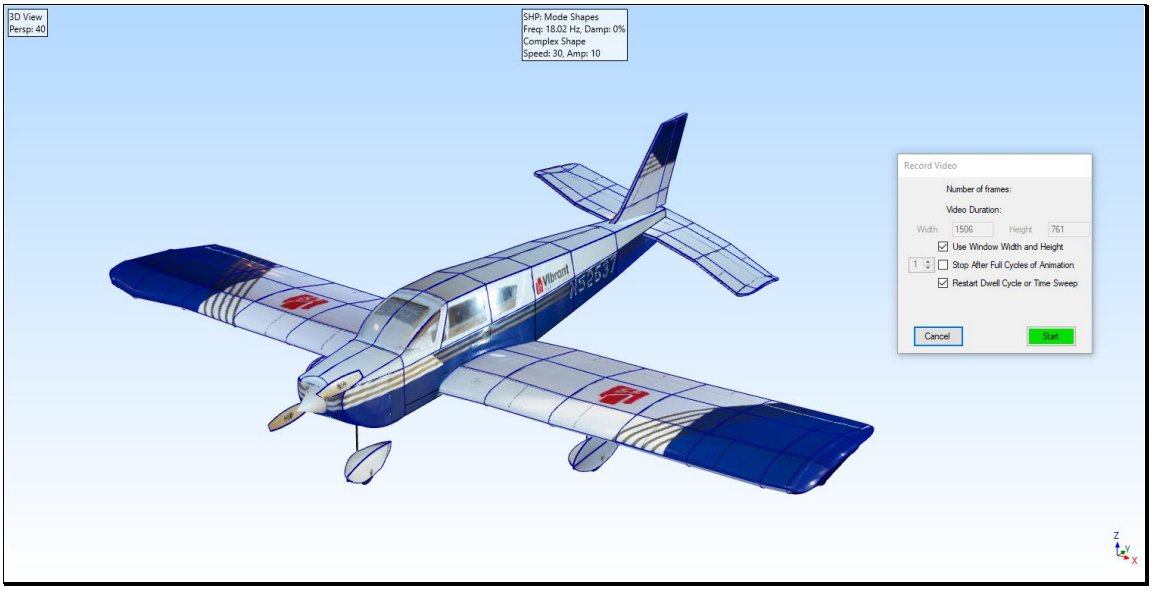
Videos | Animation Frames

Records the animation frames in the active Structure (**STR**) window. When this command is executed, the **Record Video** dialog box will open, as shown below.

- ***Press*** the **Start** button to start recording a video
- ***Press*** the **Stop** button to finish recording the video, and open it in your attached **Windows MP4 player**

While a video is being recorded, you can change the 3D View Rotation, Zoom, Pan, display Points, Lines, Surfaces, etc.

The **Videos** tab in the **File | Structure Options** box contains controls for video **Quality** and **Frames per Second.**



Record Video Dialog Box.

Record Video Commands

Use Window Width and Height

If ***checked***, the video will be the size of the graphics area, either the Structure (**STR**) window or the **Work Area**.

- If ***un-checked*** the **Width** and **Height** can be entered their respective boxes

Stop After Full Cycles of Animation

If ***checked***, video recording will stop after (**N**) animation cycles are completed.

Restart Dwell Cycle or Time Sweep

If ***checked***, video recording will start at the beginning of an animation dwell cycle.

Videos | Record

Records a screen capture of the MEscope window.

- ***Press*** **Record** to start a screen capture of the MEscope window
- ***Press*** **Record** ***again*** to stop recording a video