

NI INSIGHT

Projecting Measured or Simulated Data onto 3D Models

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About This Manual

You can use this manual to familiarize yourself with NI INSIGHT features and how to use them.

The first chapter describes how to map measurement data onto a 3D model in a few easy steps. Each exercise contains diagrams that illustrate the steps involved.

The second chapter describes how to create 3D projections and how to work with models, measurement data, videos, and graphics. You will also learn how to save scenes, presentations, and layouts for reuse later.

The third chapter describes how to prepare data and models for use in NI INSIGHT and how to display data during measurements in other applications, such as LabVIEW and DIAdem, in NI INSIGHT.

Writing Conventions

The following conventions are used in this manual:

<>

Angles brackets indicate a key you press to perform a function, for example, <Ctrl> for the control key.

»

The » symbol leads you through nested menu items and dialog box options to a final action. If you read **File»Print»Printer**, you open the **File** menu, select the menu item **Print**, and select **Printer** in the dialog box that opens.



This icon denotes a tip, which alerts you to advisory information.



This icon denotes a note, which alerts you to important information.

bold

Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Parameters are also bolded.

italic

Italic text denotes variables, emphasis, cross-references, or an introduction to important concepts. Italic text also denotes text that is a placeholder for a word or value that you must supply.

monospace

Text in this font denotes text or characters that you should enter from the keyboard, such as sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, commands, variables, controls, events, methods, filenames, and extensions.

monospace bold

Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.

Related Documentation

For more detailed information on NI INSIGHT, refer to the following documentation:

- *NI INSIGHT Help*, which you open by clicking **Help»Contents**, or by pressing <F1>.

Getting Started with NI INSIGHT

NI INSIGHT is the National Instruments software for mapping measurement data and simulation data onto 3D models. With NI INSIGHT you display temperatures as color shading on a crash test dummy, for example, or you display strain on bridge elements as deformation. Using a three-dimensional model of the test object and the measured or simulated data, you link each signal to the associated model point. For model points at which no sensor was mounted, NI INSIGHT interpolates the values from the data of neighboring model points. To inspect the model from all sides, you can shift, rotate, and zoom the model in all directions.

You can run an evaluation automatically or inspect specific times or time segments more closely. You move the crosshair cursor along the measurement curves in the axis system for a more detailed view. For each point, NI INSIGHT displays the projection of the data onto the model. You also can define several model windows with the same model in one evaluation, to compare different perspectives or test results.

Parallel to the data projection, you can run a video recording of the test, to evaluate the measurement results and the test synchronously. This shows you at a glance, which test situation led to which result.

Creating Scenes with 3D Models

In the following exercise you link temperature signals to the model of a metal plate that has temperature sensors mounted at regular intervals. To assign data to the model, complete the following steps.

1. Start **NI INSIGHT**.

A prepared layout appears in the workspace with a model area, a data area, and a graphic area. In the data window on the right, you see the various NI INSIGHT file types that you use to create scenes with models, measurement data, and axis systems, in the workspace.



2. Click the **Model files** tab in the data window.
3. Drag and drop `plate.mod` into the model area of the layout.
4. Click the **DIAdem data files** tab in the data window.





5. Click + to open the plate data set.
6. Drag and drop the data channel Temp_1 to a model point on a grid line intersection. The model points are indicated by circles on the grid line intersections.



Note If you do not link the channel precisely to a model point, NI INSIGHT prompts you to assign the channel again. You can zoom the model to see the model points better, as described in the section on [Zooming and Rotating the Model](#).

7. Select **Color** in the **Display data as** dialog box.
8. Click **OK**.
9. Repeat steps 6–8 to link the channels Temp_2, Temp_3, and Temp_4 to any model points.

Complete the following steps to display data as curves in the axis system and to insert a diagram of the test in the layout.

1. <Ctrl>-click the channels Temp_1, Temp_2, Temp_3, and Temp_4.
2. Drag and drop the channels into the axis system area.
3. Click the **Graphic files** tab in the data window.
4. Drag and drop plate.jpg into the graphic area.



DIAdem INSIGHT displays a scene similar to the following figure.

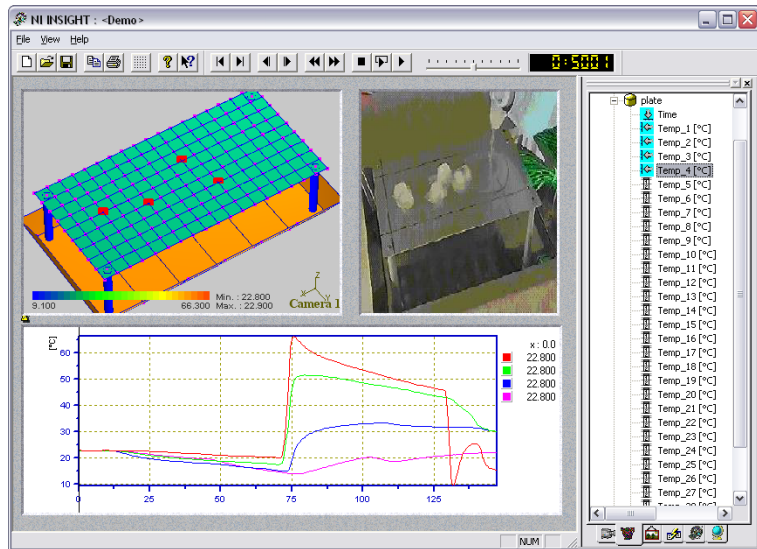


Figure 1-1. NI INSIGHT Links Temperature Signals to a 3D Model.

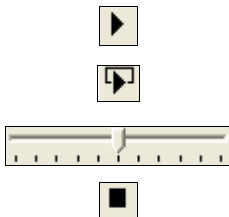
- Click **Save** to save the scene as `Test`.

A scene links the created layout to the model, to the data set, and to the graphic.

Analyzing Scenes with 3D Models

Once you have created the scene, you can compare the measurement data with the model simulation.

To run and then manually evaluate the curve display and the data projection, complete the following steps:



- Click **Play once** to run the whole evaluation.
- Click **Play continuously** to run the video repeatedly.
- Move the speed slider to change the playback speed.
- Click **Stop** to stop the repetitions.
- Click and drag the crosshair cursor in the axis system, for a more detailed examination.

NI INSIGHT synchronizes the model display and the video with the axis system and displays the evaluation with the crosshair cursor, as shown in the following figure.

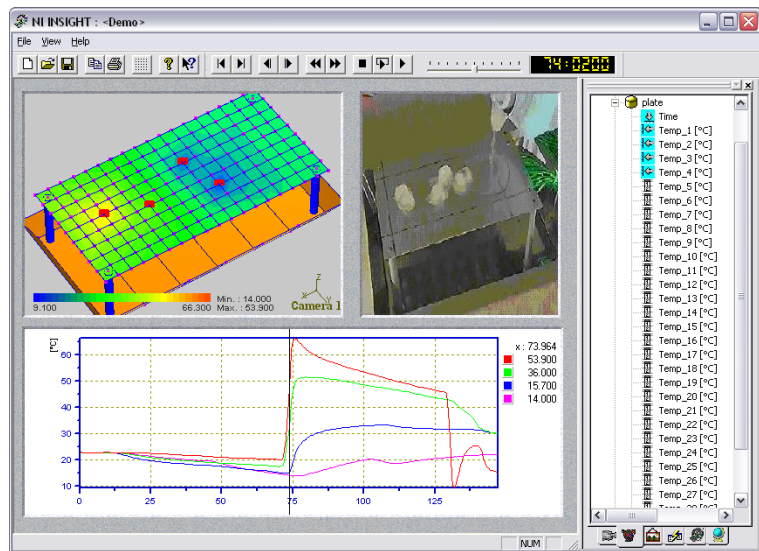


Figure 1-2. Projection of Temperature Data on 3D Model.

Zooming and Rotating the Model

At any stage, you can rotate and zoom the model in the model window.

- Click and drag the left mouse button to rotate the model.
- Click and drag the right mouse button to zoom the model. You must move the mouse horizontally.

Creating and Evaluating Scenes

Project measured or simulated data as color shading or as deformation, onto a model of the test object, with NI INSIGHT. You load a grid model of the test object and you link the signals to the grid points on the 3D model. You can move and zoom the model to view it from all sides.

Parallel to the data projection, you can run a video recording of the test, to evaluate the measurement results and the test synchronously. You can integrate graphics into the scene for more clarity.

Creating 3D Projections

By default, the workspace in DIAdem INSIGHT displays a prepared layout with a model area, an axis system area, and a graphic area. The data window to the right of the workspace in NI INSIGHT organizes model files, measurement data files, graphics files, and video files.

The 3D model of the test object is the key element of the NI INSIGHT scenes. 3D models consist of numerous grid points. Connect the grid points, which represent sensor positions, to the measurement data from the individual sensors. NI INSIGHT displays the measured data on each grid point as shading or as deformation. To display the same measurement data as curves, drag and drop the data channels that are selected in the data window into the axis system.

To evaluate the effects of air conditioning on a car driver, for example, drag and drop each measured temperature channel onto the grid point of the dummy model, where the corresponding temperature sensor was mounted. Select **Color** as the display type.

Use the player functions on the NI INSIGHT toolbar for an overview of the climate test. NI INSIGHT processes the entire time channel and displays the temperatures on the dummy, in color. Red tones indicate warm areas and blue tones indicate cool areas. You use the slider control to regulate the speed of the evaluation display.

To inspect specific times or time segments more closely, use the crosshair cursor in the axis system. You can move the crosshair cursor from point to point in your graph to check critical or unclear ranges. For example, if an unexpected result occurs in the test, move the crosshair cursor to this time. NI INSIGHT displays the temperature distribution at this time, on the dummy model.

You can rotate and zoom the model while you create a scene and during an evaluation. To rotate a model, click and drag the mouse. To zoom a model in or out, right-click and drag horizontally. To move the model along a coordinate axis, right-click and simultaneously press <x>, <y>, or <z> for the relevant coordinate axis.

To resize or to move an area in the workspace, click the inside edge of the area. NI INSIGHT displays the selected area with a frame and square markers. Drag the black markers to resize the area. Drag the frame to reposition the area. Press to delete the selected area.

To add an area, drag and drop the model, the data set, the video, or the graphic, from the data window into the workspace. NI INSIGHT creates the associated area type and displays a model in a model area, displays data as a curve in an axis system, displays a video file in a video area, and displays a graphic in a graphic area. Each area can display only one file.

Saving Scenes, Presentations, and Layouts

When you save a scene, NI INSIGHT saves the evaluation layout and the links to the data files, model files, and graphic files used. The layout file has the filename extension `cis`. If you reload this scene, the data files, the model files, and the graphic files must be located in the folders that are shown in the file window.

If you save the scene as a presentation, you can demonstrate an evaluation on another computer. A presentation file combines all data files, video files, and picture files into a single CIP file. To save a presentation, select **File»Save as** and select **Presentation (cip)** as the file type. You also can password-protect a presentation to prevent alterations. Use the NI CLIP-INSIGHT Player to run presentations on computers on which NI INSIGHT is not installed.

You can load the layout as an empty template for evaluations of similar tests. A layout specifies only the type and the number of areas, including their size and position. To save the layout of the current scene in the layout library, select **File»Save layout**. To load a layout, select **File»Open layout** to open the layout library.

Working with Models, Test Data, Videos, and Graphics

The data window to the right of the workspace in NI INSIGHT lists folders with the available model files, measurement data files, video files, and graphics files, on various tabs. To add folders to the data window, select **New directory** from the shortcut menu of the tab. To delete a folder from the data window, right-click the folder and select **Delete** from the shortcut menu.

Models

NI INSIGHT projects data onto VRML models (*wrl*), which you can export with most CAD/CAE programs. You can use the VRML Optimizer to prepare the models for display in NI INSIGHT. Refer to the section on [Generating Suitable VRML Models](#) in the next chapter, for more information about creating and editing VRML models.

You can display data on a model as color shading, as deformation of the model surface, or as resizing of the model points. Use the **Color** display mode to display temperature changes as color shading on the model. Use the **Deformation** display mode to display movements of the model surface. If you assign a data channel to a point that already has data assigned to it, NI INSIGHT applies the new data channel.

You can combine display types on one model. For example, you can display temperature simultaneously as color shading and as deformation. To do this, assign the same data channel twice to one model point, with a different display mode each time. The ToolTip for a point shows which display type and which data channel you defined for a point.

To assign a data channel to several model points, press <Ctrl> and drag open a rectangle over the model points. Then drag and drop the data channel onto the selected model points. To delete the selection marking, select **Delete selection** from the shortcut menu of the model.

You can simplify the assignment of multiple data channels to multiple model points. Name the points in a model to match the channel names of the measurement data. Right-click the model point to rename it, and select **Point info** from the shortcut menu. Enter the name of the data channel. If you drag and drop the entire data file onto the model, NI INSIGHT automatically assigns the data channels to the matching model points.

If you have several different data files for the same model, you do not need to reassign the data channels to the model each time you load a new data set. As long as the data channels are in the same order in all the data sets, the channel assignment to the model points remains the same.

You can find a model point using its coordinates. To do this, right-click in the model area and select **Find point** from the shortcut menu. Enter the coordinates. NI INSIGHT displays the name of the model point that is at, or is closest to, these coordinates.



To delete the channel assignment of a model point, select the **Signal assignment deletion** button shown on the left, from the shortcut menu of the model point. To delete the assignment for several points, press <Ctrl> before you delete, and drag a rectangle around the model points.

Defining Display Modes

In the model area you can specify the display and the lighting of the model. Select **Display** from the shortcut menu to alter the settings for color shading, deformation, and size.

For the **Color** display mode, you use the settings **Surfaces** and **Color** on the **Structure** tab to specify the shading and you use the settings **Points** and **Edges** to specify the display of the model points. For the definition of a rigid body shift you can display the local coordinate systems.

You specify the **Deformation** display mode as shift or as rotation in the x-direction, the y-direction, or the z-direction, with a positive or a negative sign. To display even minor deformations, you can use the **Factor** to set the magnification of a shift. Use **Weighting** to specify the interpolation method for model points without measurement data. NI INSIGHT calculates the deformation behavior of these model points from the data of the neighboring measurement points.

The display mode **Size** displays measurement data as the extent of a circle point or as the height of a column in the x-direction, the y-direction, and the z-direction, on the model point. Use the size display, for example, to display local pressure changes as the extent of a circle surface.

To define the brightness of the display and additional light sources, select **Lighting** and **Light sources** from the shortcut menu of the model area.

Changing the Perspective



At the bottom right in the model area, you see a small coordinate system that shows the position of the model in space. You can use the shortcut menu of the coordinate system to rotate the model directly in a 2D view. Click **XY-plane** for a view from the top of the model, and click **XZ-plane** or **YZ-plane** for one of the side views of the model. Click **Perspective** to redisplay the last 3D view.



You can save different camera perspectives of the model and view them individually. You can run an evaluation in each camera position to view details from various perspectives. To change the camera position, select **Next camera** from the shortcut menu of the coordinate system. NI INSIGHT saves the last model position as **Camera1**. Rotate and zoom the model for a new setting. You can create up to ten different camera positions. The coordinate system shows you which camera view NI INSIGHT is displaying. Click **Next camera** and **Previous camera** to switch camera positions.

Creating Information Nodes



For each model point you can create a description and you can link the description to the model point. Save the description in HTML format in the `INSIGHT\INFO` folder. To link the HTML page to a model point, right-click the model point. Select **Point info** from the shortcut menu and enter the name of the HTML file, without the path or filename extension, instead of the point name.

If you now position the mouse on the information node, NI INSIGHT displays the description on the **Info** tab of the data window, as shown in the following figure.

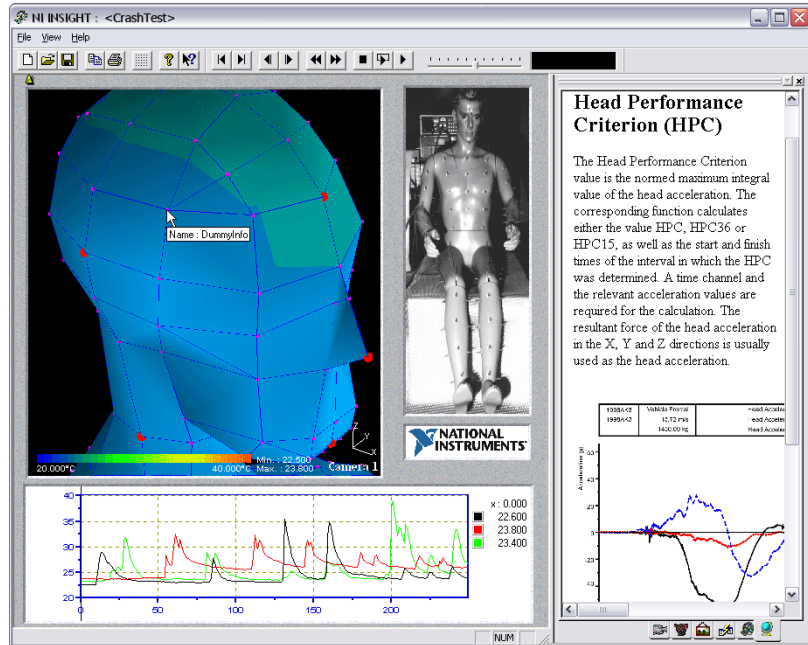


Figure 2-1. Description for a Model Point in the Data Window.

Measurement Data

NI INSIGHT works with measurement data and simulation data that are in the DIAdem DAT format. To use data in other formats in NI INSIGHT, you must save the data in DAT format in DIAdem NAVIGATOR, or use the DIAdem Connectivity VIs to save the data in DAT format in LabVIEW. Refer to the section on *Providing Measurement Data in DAT Format* in the next chapter for more information about converting data.

If you add a data file or a data channel to an axis system, NI INSIGHT uses the time channel of this data file as the x-channel. If this data file contains multiple time channels, select the x-channel you want to use. A downwards arrow appears in front of the x-channel. First select the x-channel and then the y-channel, which is indicated by an arrow to the left.



Each axis system has a legend, which you can display by selecting the **Legend on/off** button shown on the left, from the shortcut menu. The squares in the legend are the same color as the curves they represent. NI INSIGHT displays as many squares as the current height of the axis system allows. When you click a square, the associated curve appears dashed. The ToolTip indicates which data channel the curve represents.

To delete a curve from the axis system, select the curve symbol and press .

NI INSIGHT scales the y-axis to the value range of all data channels and the x-axis to the value ranges of the time channels. Use **Scale to extract/Curve** to zoom sections in the y-direction and use **Zoom on/off** to zoom time segments.

Videos

NI INSIGHT works with video files in AVI format and MPEG format, the same as DIAdem CLIP and DIAdem VIEW.

Each video area contains only one video. When you drag and drop a new video into the video area, NI INSIGHT replaces the old video with the new one. Create additional video areas to compare videos. You can zoom parts of a video to inspect details more closely.

NI INSIGHT synchronizes videos and curves using the time channel of the data set and the frame rate of the video. If the data acquisition rate is higher than the frame rate, NI INSIGHT displays the same video frame for several measured values. For example, if the data acquisition rate is 100 kHz and the video frame rate is 1,000 frames per second (1 kHz), the video frame changes at every 100th curve point.

If you have started and stopped the video recording and the measurement separately, you must specify the time segment during which the measured data overlaps with the videos. In NI INSIGHT, the time range you specify is called the *Active segment*. NI INSIGHT only displays changing video frames as shown in the following figure, when you move the crosshair cursor inside the active time section in the axis system.



To enter the beginning and the end of the active segment, select the **Synchronization parameters** button shown on the left, from the shortcut menu of the video area. With the **Apply cursor position** button, you can use the position of the crosshair cursor in this dialog box to specify the start time of the video or the beginning and the end of the active segment.

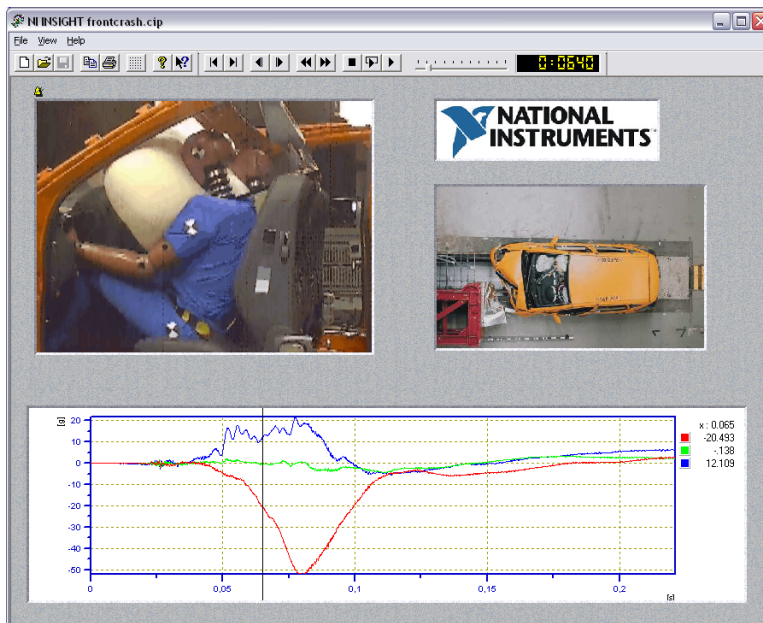


Figure 2-2. Evaluation of a Crash Test.



When you evaluate a scene using the player bar, use the metronome shown on the left to specify whether NI INSIGHT runs the entire video or the entire time axis of the axis system. If you drag and drop the metronome onto a video area, NI INSIGHT plays the entire video and the crosshair cursor follows inside the active segment of the axis system. If you drag and drop the metronome into the axis system, the crosshair cursor follows along the entire length of the axis system and the video plays only the active segment.

Graphics

Use graphics to include a diagram of a test stand or to insert a company logo into your presentation. You can load graphics in common formats. Each graphic area contains one graphic, which you also can zoom.

Preparing Models and Data and Displaying Measured Values Online

Before you can use NI INSIGHT to project data onto models, the data must be in the DIAdem DAT format and you must prepare suitable VRML models.

Other applications, such as LabVIEW and DIAdem, can communicate with NI INSIGHT to project data onto models during a measurement.

Providing Measurement Data in DAT Format

Your data must be available in DAT format if you want to project the data onto a model with NI INSIGHT. DIAdem and LabVIEW can both save data in DAT format.

By default, DIAdem saves data in TDM data format. DIAdem can load any data format for which a DataPlugin is registered. The **Save as** dialog box offers the DAT format and other data formats, as file types for exporting data.

Use the LabVIEW DIAdem Connectivity VIs to save data in DAT format with LabVIEW. These VIs can save data in DAT format or transfer the acquired data to the DIAdem Data Portal. The LabVIEW DIAdem Connectivity VIs are available at the National Instruments Web site.

The DAT format saves the data properties in a separate header file in the text format with the filename extension `dat` and saves the numeric data in the binary format that takes up the least amount of space for that particular data. One data set can include several binary files, for example, files with the filename extension `w16` or `r64`.

Generating Suitable VRML Models

Nearly all CAD/CAE packages allow for the export of 3D models to VRML 2.0 (`wrl`) format. Most of these programs also have some limited mesh generation capabilities, meaning that the package automatically creates a simple mesh for the VRML. The quality and density of this mesh determines how well this VRML file will work in NI INSIGHT.

If you generate a VRML model, the mesh model should meet the following criteria:

- A uniform mesh with no severely elongated polygons.
- A mesh without multiple surfaces.
- A mesh with nodes that are dense enough to display the details that you want to show. This depends on how detailed your model is and how many measurement points you want to display.

The surface of the VRML file is composed of triangles or squares. Elongated polygons are a common problem for most CAD/CAE applications. If these triangles or squares are elongated, thus not mostly uniform, any interpolation scheme will be distorted by the mesh. The interpolation schemes normally use the distance between points or nodes along the connecting lines for distance calculations. Many of the CAD/CAE packages support functions to add “split lines” or additional points that can be used in the creation of the mesh. Many programs also have support for controlling the density of the mesh. Using these tools can eliminate most elongated polygons.

Some CAD/CAE packages generate double surfaces for a single area when they generate the model, especially for thin-walled bodies. When you convert the model into a VRML file, these double surfaces distort the display and make it difficult to select the correct grid point. Some CAD/CAE packages have controls for what surfaces are used when you create your VRML model. NI INSIGHT also comes with an Optimizer tool for VRML files which eliminates most multiple surfaces.

Occasionally a CAD/CAE package will not create VRML 2.0 files but VRML 1.0. Others are supposed to create VRML 2.0 files but do not create them correctly or use some sort of non standard format for the VRML file. These files will often not display or will display incorrectly in NI INSIGHT. There are third party tools that can be used to convert from VRML 1.0 and sometimes from non standard VRML to VRML 2.0.

Some CAD/CAE programs cannot create VRML models with suitable mesh. In these cases there are often add-on tools to the CAD/CAE package or third party tools that can be used to generate a better mesh. Another option is to save the model in another format, such as Stereo Lithography (STL), and convert to VRML using a third party model conversion utility. This will often result in a cleaner model in some CAD/CAE packages.



Note The National Instruments Web sites have step-by-step instructions on how to use the common CAD/CAE software packages to create VRML models that are suitable for NI INSIGHT.

Creating Online Projections

You can open NI INSIGHT from another application, such as LabVIEW or DIAdem, to project data onto a model of the test object during the measurement.

LabVIEW INSIGHT Connectivity VIs

With the LabVIEW INSIGHT Connectivity VIs you can launch NI INSIGHT from LabVIEW, to project measurement data on 3D models online. The wizard helps you to link model points to the measurement data. You select a scene from NI INSIGHT, specify the data sources from LabVIEW, and link model points to the channels of the data source. You specify the display mode for each channel, as shown in the following figure. You must then define a measurement that writes the measurement data to the data channels.

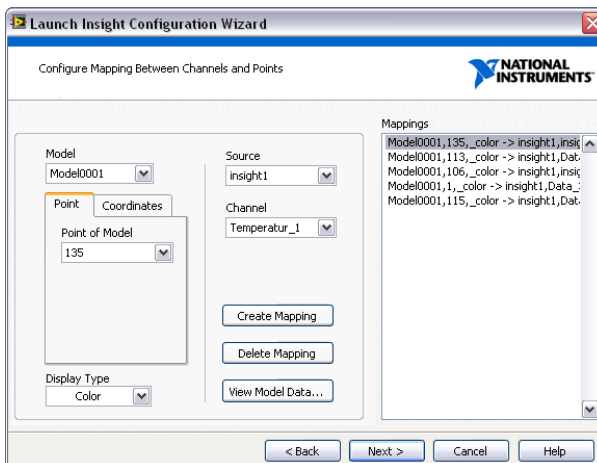


Figure 3-1. The Wizard Links Measurement Data to Model Points.

During a measurement, you can change the settings for the display modes **Color** and **Deformation**, for single model points. To do this, you use the point number or the coordinates of the model point.

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Online technical support resources at ni.com/support include the following:
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If you searched ni.com and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of ni.com/niglobal to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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