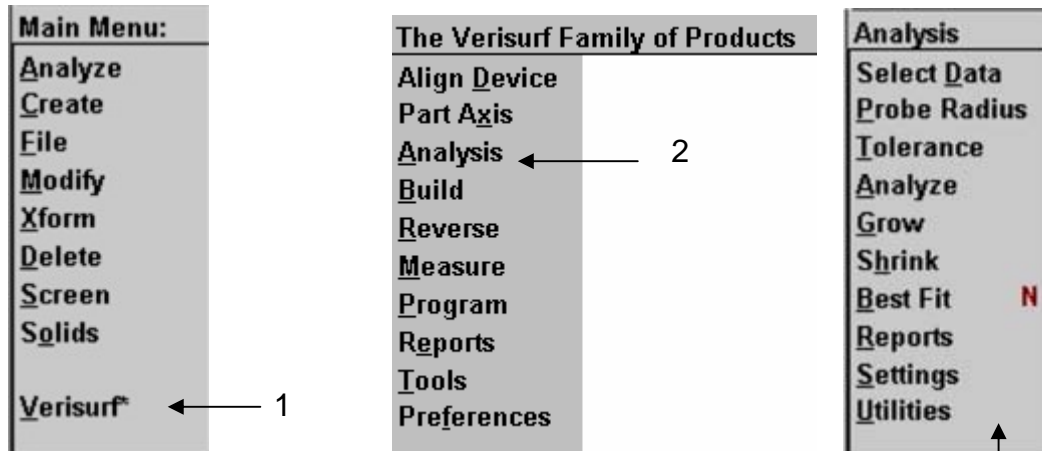




Verisurf Analysis™_{REV A1}

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Analysis menu



A complete description of the commands and settings on these menus is contained in this chapter.

Note: When you enter the Analysis menu, the graphics screen will display the results from the previous Analyze operation.

The Verisurf Analysis project file is created each time you select **Analyze** from the **Analysis** menu. It contains all of the information and settings from the analysis. The project file is used for the Shrink and the Grow vector display, error display, report generator and various other utilities that are an integral part of Verisurf Analysis.

The name of the project file is the geometry name with the .prj extension. This file contains all of the information and settings from the analysis that generated the file. The project file is a binary file that is saved in the Mcam9\data directory.

Quick Introduction Tutorial

The first tutorial is intended to serve as a limited introduction to working with the system. A later tutorial will guide you through some of the more advanced features and applications.

Step 1) Start the CAD System

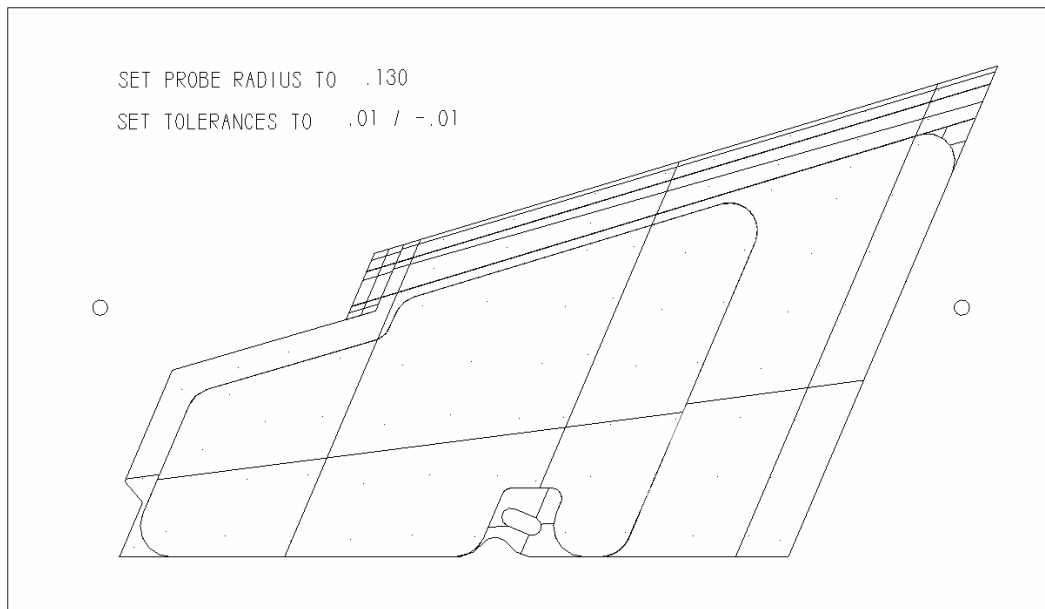
You can start Design by clicking the **Verisurf** icon from your desktop.



Step 2) Load the Sample Geometry

To begin using Analysis, you must have a CAD model on the Designs screen. It is very common to have data points on the screen as well. We have provided sample geometry files for your use in these tutorials.

Use the standard **File, Get** functions to retrieve the sample .mc9 file called Sample_1.mc9, located at C:\Mcam9\design\Mc9\Verisurf. This file contains 16 surfaces and eighty-one data points.



Step 3) Start Verisurf

After Design has started, there are four methods by which you can start Verisurf:

- Select **Verisurf** from the Design **Main Menu**. The Design **Main Menu** can always be accessed by clicking Matercam's **Main Menu** operation

button. You can also hit the Escape key continuously until you reach the **Main Menu**.

- Assign an Alt key to the Verisurf.dll C-HOOK.
- Press **Alt-C** and select Verisurf.dll from the list.
- Assign a Verisurf icon to the Design button bar.

This manual assumes that Verisurf has been installed on the Design **Main**



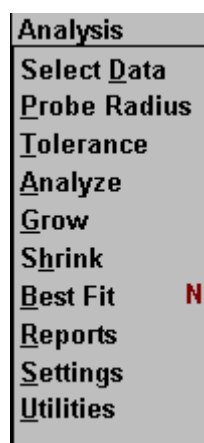
Menu. Start Verisurf by clicking its menu option at this location.

Step 4) Input the Analysis Settings

1. Select **Analysis** from the **Verisurf Family of Products** menu.

The VERISURF Analysis Menu

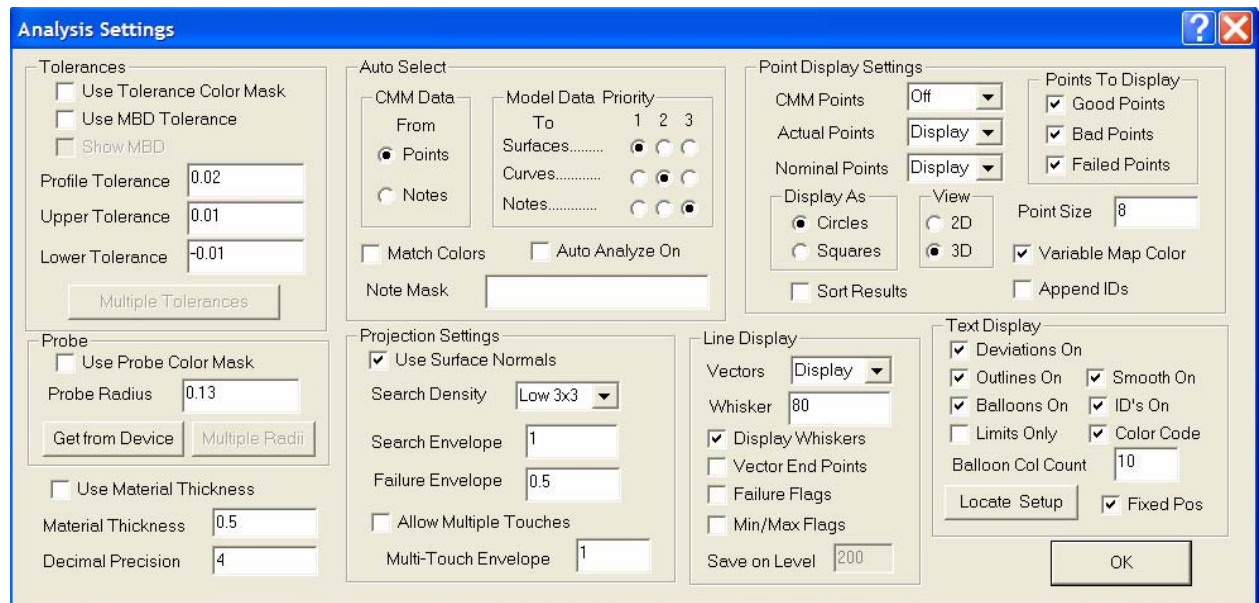
When activated, Verisurf Analysis will display a menu containing the following options:



All of these options are described individually in this manual. This tutorial will indicate which options to select in order to perform the sample analysis.

It is essential that the values for the **Radius** and **Tolerance** are properly set before beginning the Verisurf Analysis.

2. To View the Radius and Probe settings, as well as other operational options of Verisurf: click **Settings**, from the **Analysis** menu. The **Analysis Settings** dialogue box will be displayed.



3. Set the **Probe Radius** to .13
4. Set the **Profile Tolerance** to .02
5. Click **OK**.

Step 5) Processing the CMM Data

Once the necessary settings are entered, you are ready to begin the Verisurf analysis.

Select **Analyze**. Verisurf will perform the analysis and store the results in

Good points: 79 Bad points: 2 Failed points: 0 Total points: 81
 Minimum Deviation: -0.0160 Maximum Deviation: 0.0086 Range: 0.0246 Avg Dev: 0.0008 Std Dev: 0.0040 RMS: 0.0041

the project file. The results are also displayed in the Status line.

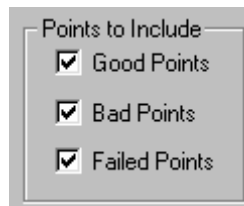
For this tutorial, two points have been set to “out of tolerance” locations and will be reported as bad points on the status line. Notice that the status bar provides you with an instant overview of many different factors

that influence the analysis. The minimum and maximum deviations and number of points processed are just a few examples.

Step 6) Generate a Report

1. Click on the button labeled **Reports** on the Verisurf **Analysis** menu. This will display the **Reports** menu. There are many options for the type of report to generate, as well as the choice of which CMM points to include on the report.

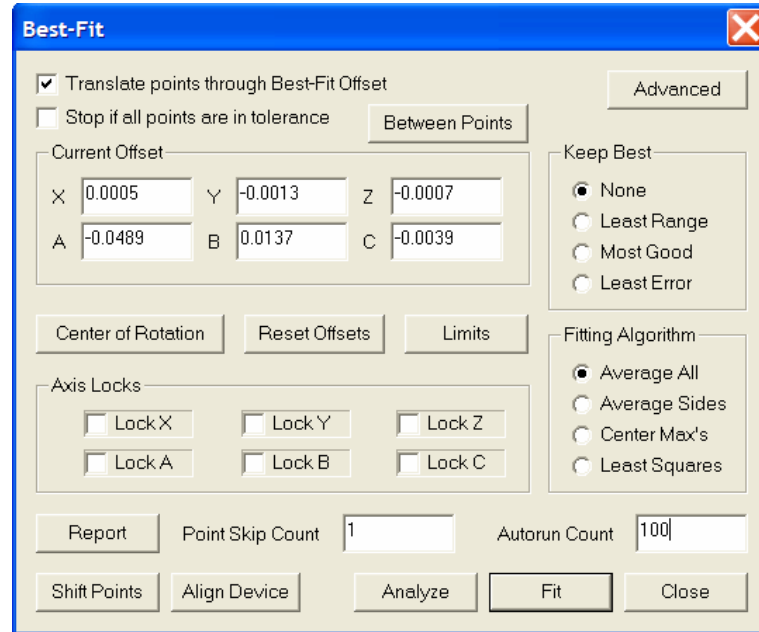
Check to be sure that Short is selected as the **Report Format** and that all of the **Points to Include** boxes are checked.



2. Select **Create Report**. This instructs Verisurf to generate the inspection report.
3. Click the **Save** button to save the report as Sample_1.prn. The report file is displayed on the screen. The options in the **File** and **Edit** menus will enable you to print or navigate the report.
4. Click the Windows Close Box to exit the **Reports** window.
5. Click the **Close** button to exit the **Reports** dialogue box.

Best-Fit Analysis

1. Click **Best-Fit** on the **Analysis** menu. The **Best-Fit** dialog box is displayed.



2. Make sure that **Translate points through Best-Fit Offset** is checked.
3. Select the **Fit** button at the bottom of the **Best-Fit** dialog box.

The six fields in the Current Offset section of the Best-Fit screen display the linear and rotational transformation applied to the CMM Data Points to achieve the current results.

Notice the changes that appear on the status bar, at the bottom of the screen, as the **offsets** are recalculated.

Good points: 81 Bad points: 0 Failed points: 0 Total points: 81
Minimum Deviation: -0.0098 Maximum Deviation: 0.0040 Range: 0.0137 BestFit Passes: 1

You have just performed a best-fit analysis of the model. Verisurf has accumulated the offsets required through reiteration of the analysis function. The reiteration is necessary because each time the offsets are changed the CMM data projects onto a different location on the model.

Print a Report of the Best-Fit Analysis.

1. Select **Close** to return to the **Analysis** menu.
2. Select **Reports**.
3. Select **Create Report**.

4. Click **Save**, to save the report as SAMPLE_1.prn. The Verisurf Inspection Report will appear.
5. To print the file, pull down the report's **File** menu and select the **Print** option.
6. Click the Windows close box to exit the report. This will return you to the **Reports** menu.

Display the Report on Your Browser

1. Click the down arrow of the **Report Format** list box to display additional report formats. Select the **HTML** report format.
2. Change the setting, in the **Open with:** list box to **Browser**.
3. Select **Create Report**.
4. The Analysis report is displayed in your default browser.

Notice that you did not have to perform the analysis again to generate a different type of report. All of the pertinent data is stored in the project file and may be accessed at any time after the analysis has been performed.

1. Click **Cancel** to close the file list window.
2. Click **Save**, to save the report as SAMPLE_1.prn. The Verisurf Inspection Report will appear.

This concludes the Verisurf quick introduction tutorial.

Before You Start Analysis

Before attempting to run Verisurf, it must be installed as described in the chapter *Installing Verisurf*.

You will also need to have a geometry file open in the cad system. The file you open, with Design's **File** and **Get** commands, will be referred to as the "CAD model."

The next step is to read in the measured points. These will be referred to as the "CMM data." Assuming that the CAD model and the CMM data are aligned, you can start Verisurf from the Design **Main** menu. Select **Analysis** from the **Verisurf Family of Products** menu to display the **Analysis** menu.

Analyze

This is the main tool that runs the projections. All visible or selected points (CMM Data) are projected normal to all the visible or selected geometry. Then the results are recorded to the project file and displayed on the screen.

Verisurf will consider the closest geometry for the CMM point.

Grow

Grow lengthens the whisker display on the screen.

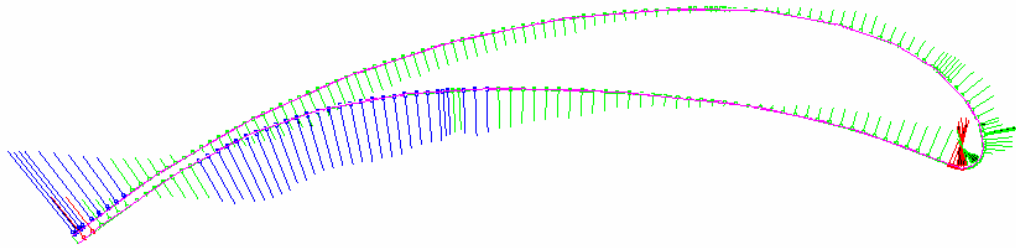
Shrink

Shrink shortens the whisker display on the screen.

The **Grow** and **Shrink** commands are for visual use only and have no affect on the results of the analysis. These commands can only be used to alter the appearance of an existing project file. Until an Analyze operation is completed and a project file is created, these commands will have no effect on the geometry displayed.



Whisker Display



This is the Sampleblade.mc9, located in the Verisurf directory.

Probe Radius is zero

Tolerance is .006

Settings for **Search Density** should be set to **Medium**.

Line Display settings should be set to **Display Whiskers**

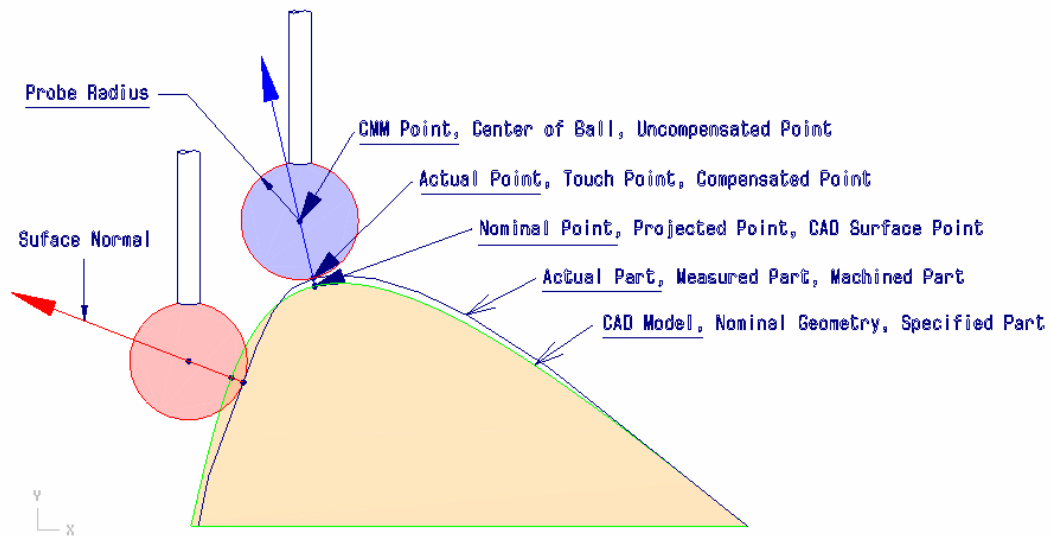
The data will be displayed on the screen in the following colors

Within tolerance: GREEN

Out of tolerance positive: BLUE

Out of tolerance negative: RED

Terminology



The CAD Model is sometimes referred to as the Master Model or Authority Dataset for inspection.

Analysis can be used to determine the accuracy of a measured part.

Geometric Dimensional Tolerances (GDT) that can be checked with Analysis are Form, Profile, Orientation, Location, Runout and True-Position of holes. Profile and True-Position of holes are the most commonly checked.

The **Color code** display is used to show the user which points are in tolerance (good points) or out of tolerance (bad points). Green is good. Red and blue are bad. Red means that the surface is undersize and blue means its oversize.

Best-Fit is another way to align the measured points to the CAD Model.

You can Best-Fit measured points to Datum features and then report the rest of the model's accuracy. You can also use Best-Fit when you have no specified Data or you are not locked to all three direction's (Datum's per the GD&T callout).

Analysis Settings

The **Analysis Settings** menu contains various settings and features you can use to change the way Verisurf performs certain tasks.

The settings have been organized into these categories:

- **Probe**
- **Tolerances**
- **Auto-Select**
- **Point Display Settings**
- **Line Display Settings**
- **Text Display Settings**
- **Create on Analyze**
- **Projection Settings**
- **General Settings**



The following pages contain descriptions of the options on this screen.

Analysis Settings

Tolerances

- ☐ Use Tolerance Color Mask
- ☐ Use MBD Tolerance
- ☐ Show MBD
- Profile Tolerance:
- Upper Tolerance:
- Lower Tolerance:
-

Auto Select

- CMM Data From: ☒ Points ☐ Notes
- Model Data Priority: To 1 2 3
- Surfaces..... ☐ ☐ ☐
- Curves..... ☐ ☒ ☐
- Notes..... ☐ ☐ ☒
- ☐ Match Colors ☐ Auto Analyze On
- Note Mask:

Point Display Settings

- CMM Points:
- Actual Points:
- Nominal Points:
- Display As: ☒ Circles ☐ Squares
- View: ☐ 2D ☒ 3D
- Sort Results: ☐
- Append IDs: ☐
- Points To Display: ☒ Good Points ☒ Bad Points ☒ Failed Points
- Point Size:
- Variable Map Color: ☒

Probe

- ☐ Use Probe Color Mask
- Probe Radius:
-
- ☐ Use Material Thickness
- Material Thickness:
- Decimal Precision:

Projection Settings

- ☒ Use Surface Normals
- Search Density:
- Search Envelope:
- Failure Envelope:
- ☐ Allow Multiple Touches
- Multi-Touch Envelope:

Line Display

- Vectors:
- Whisker:
- ☒ Display Whiskers
- ☐ Vector End Points
- ☐ Failure Flags
- ☐ Min/Max Flags
- Save on Level:

Text Display

- ☒ Deviations On
- ☒ Outlines On
- ☒ Balloons On
- ☐ Limits Only
- ☒ Smooth On
- ☒ ID's On
- ☒ Color Code
- Balloon Col Count:
-
- ☒ Fixed Pos

Point Display Settings Section

You have the option of saving, displaying or turning off the geometry of the **CMM Points**, **Actual Points**, and the **Nominal Points**. Simply select the appropriate setting on the pull-down selection.

There are three options for each of the data types:

Save

The data will be saved in the CAD system as regular geometry on the drawing level set in the **Save on Level** box located in the Line Display section.

Note: Once Verisurf has saved the geometry of your choice that particular setting will be reset to Off. This will help to prevent duplicate geometry in your database.

Display

The data will be displayed on the screen and does not become part of the database. When you exit Analysis and repaint the screen, the displayed data will be erased.

Off

The data is not displayed on the screen.

Boxes that are set to values of **Off** and **Display** will retain these settings the next time you use Verisurf. Boxes that are set to **Save** will be reset to a value of **Display**.

Points to Display subsection

This group box causes the display of points. Only the types of points (good, bad, failed) that are checked will be displayed on the graphics screen with the **Point Size** indicated here.

Points To Display

☒ Good Points

☒ Bad Points

☒ Failed Points

Point Size

☒ Variable Map Color

☒ Append IDs

Variable Color Map

By default Verisurf displays all points in one of four colors. There is one color for good points, one for points that exceed tolerance, one for points which fall below tolerance, and a fourth color for failed points. **The Variable Color Map** feature displays different shades of a color to indicate the extent to which a point is good or out of tolerance. If, for instance, red were selected as the color which signifies a below tolerance point, a lighter shade of red would be used to display a point, which is only slightly below tolerance. Severely below tolerance points would be a darker shade.

Colors are assigned to the different point types by using the Color Map option in the Analysis Utilities menu. For more information see: Color Map.

Append IDs

A checkmark in this option box will append, or add, the feature ID the points are analyzing to onto the balloons and the report.

Sort

A checkmark in this option box will sort the ID's and the report by the feature ID the points are analyzing to. It will also renumber the points by feature ID to begin at Point 1 for each new feature included.

Display As

Select the **Circles** or **Squares** buttons to specify the shape that will be used to display the points.

Display As

☒ Circles

☐ Squares

View

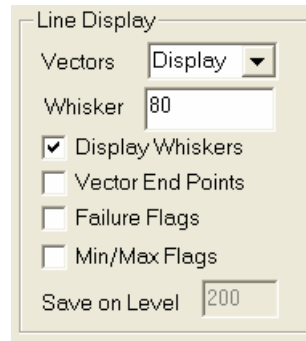
☒ 2D

☐ 3D

View

2D will draw a flat circle or square. **3D** displays these points as normal to the projected surface.

Line Display Section



Verisurf gives you the option of displaying the vector for each projected point with a length that is either fixed or is a function of the deviation for each projection. The display of these vectors has the appearance of “whiskers” on the part.

These whiskers are very useful in helping to visually determine where on the part the worst deviations occur.

The default field descriptor **Vector Length** will change to **Whisker Length** when the **Display Whiskers** box is checked. The value for **Vector Length** is a fixed amount and each vector has that specific length. The value for **Whisker Length** however, is multiplied by the deviation from tolerance for each individual CMM point that is projected. The length of each “whisker” displayed is proportional to the deviation of the referenced CMM point.

Vector Length

If you select **Save** or **Display** for **Vectors** and the **Display Whiskers** checkbox is not selected, you will see the surface normal vectors. Here you will have the option of setting the length of the vectors. Simply enter a non-zero value in the text box next to **Vector**.

Note: The **Grow** and **Shrink** commands, in the **Analysis** menu, may be used to change these values.

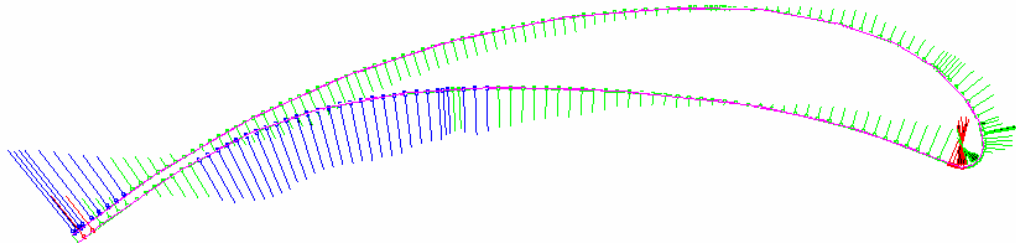
Whisker (Length)

If you select **Save** or **Display** for **Vector** and the **Display whiskers** checkbox is selected you will have the option of setting the length multiplier for the whiskers. Simply type a value greater than zero in the **Whisker** text box.

The default value for **Whisker Length** is 100. This is 100 times the error.

Note: This whisker length value will be multiplied by the deviation of each point to determine the length of the displayed whisker. The **Grow** and **Shrink** commands, in the **Analysis** menu, may be used to change these values

Whisker Display



The data will be displayed on the screen in the following colors:

CMM Data Points:

- Unsuccessfully projected: YELLOW

Actual, CMM, and Projected Points, and Surface Normal / Whisker Vectors:

- Within tolerance: GREEN
- Out of tolerance positive: BLUE
- Out of tolerance negative: RED

Create on Analyze Option boxes

Vector End Points

Verisurf gives you the option of saving the points at the end of the whisker or vector line for each projected point.

Failure Flags

If checked, Analyze will create a white vertical line at the failed points.

Min/Max Flags

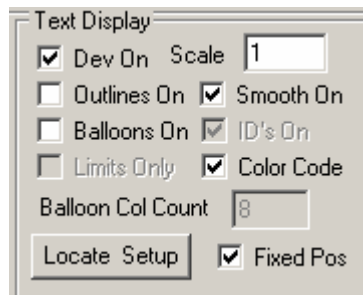
If checked, Analyze will create a vertical line at the worst two points in the Analysis. These include the point that has the minimum deviation and the point that has the maximum deviation.

Note: The **Vector Points** and **Min/Max Flags** features will be reset to an unchecked state after the Analyze operation has added the points and flags to the geometry.

Save on Level

If you select **save**, for any of the data types, you have the option of selecting which drawing level the data will be created on. Simply type a value between 1 and 255 (inclusive) in the edit box next to **Save on Level**. This edit box will only be activated when one of the **Create on Analyze** boxes is checked.

Text Display Section



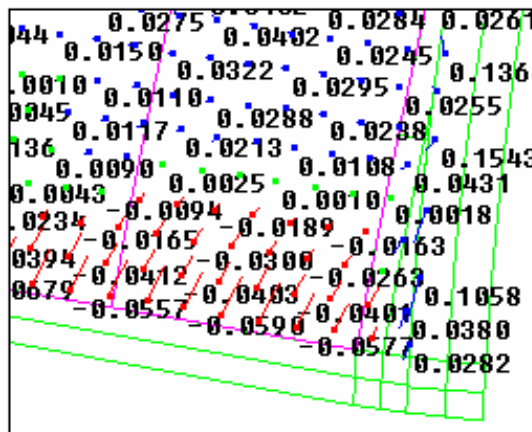
Text Display - Dev On

If checked, this will display the numeric value of the 3D error at each point.

Scale

This will alter the size of the deviation text. Text will always remain the same size on the screen. ???

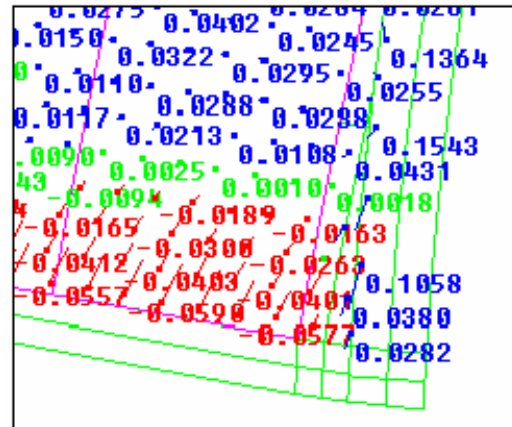
Color Code



Without Color Code

If the background is set to White, error fonts are

Black. Otherwise, they are **white**.

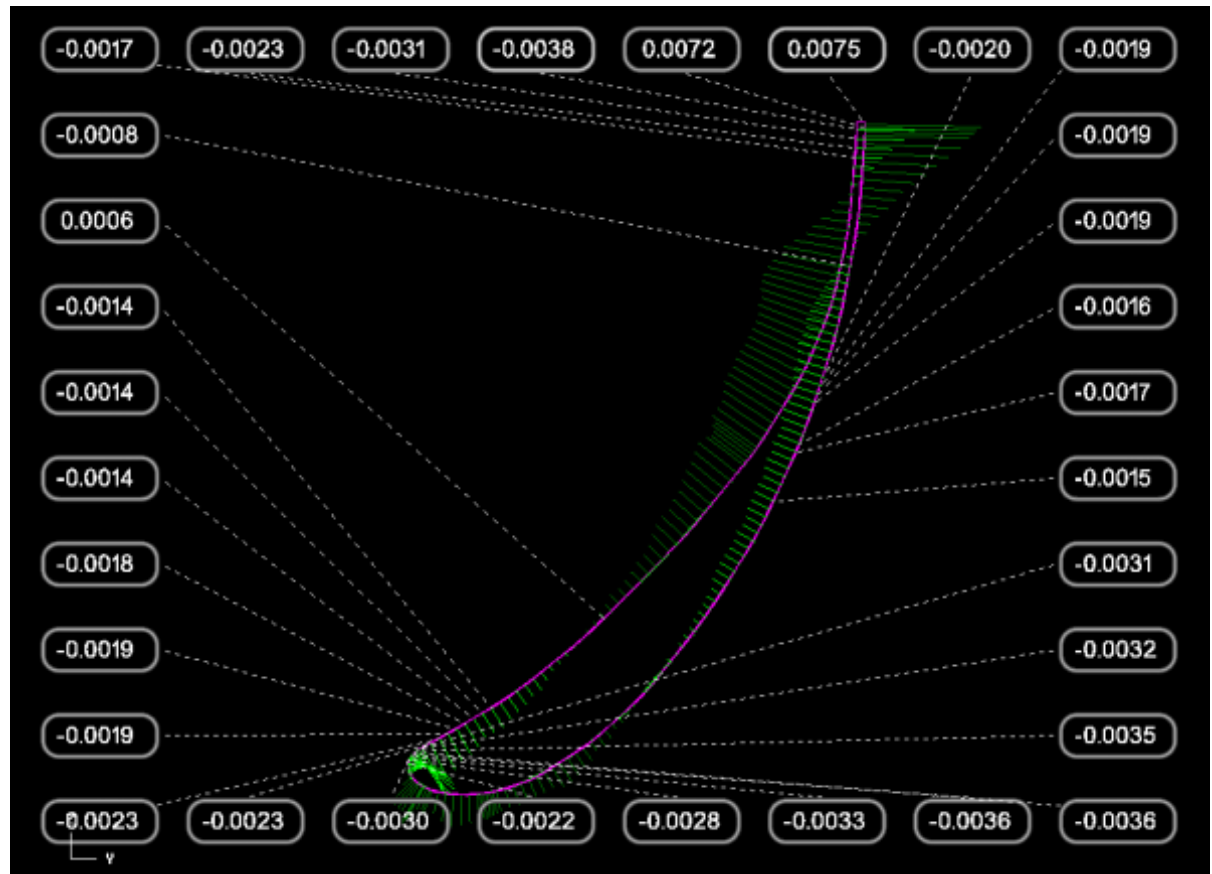


Color Code Display

- Green is in tolerance
- Red is bad, in the negative
- Blue is bad, in the positive

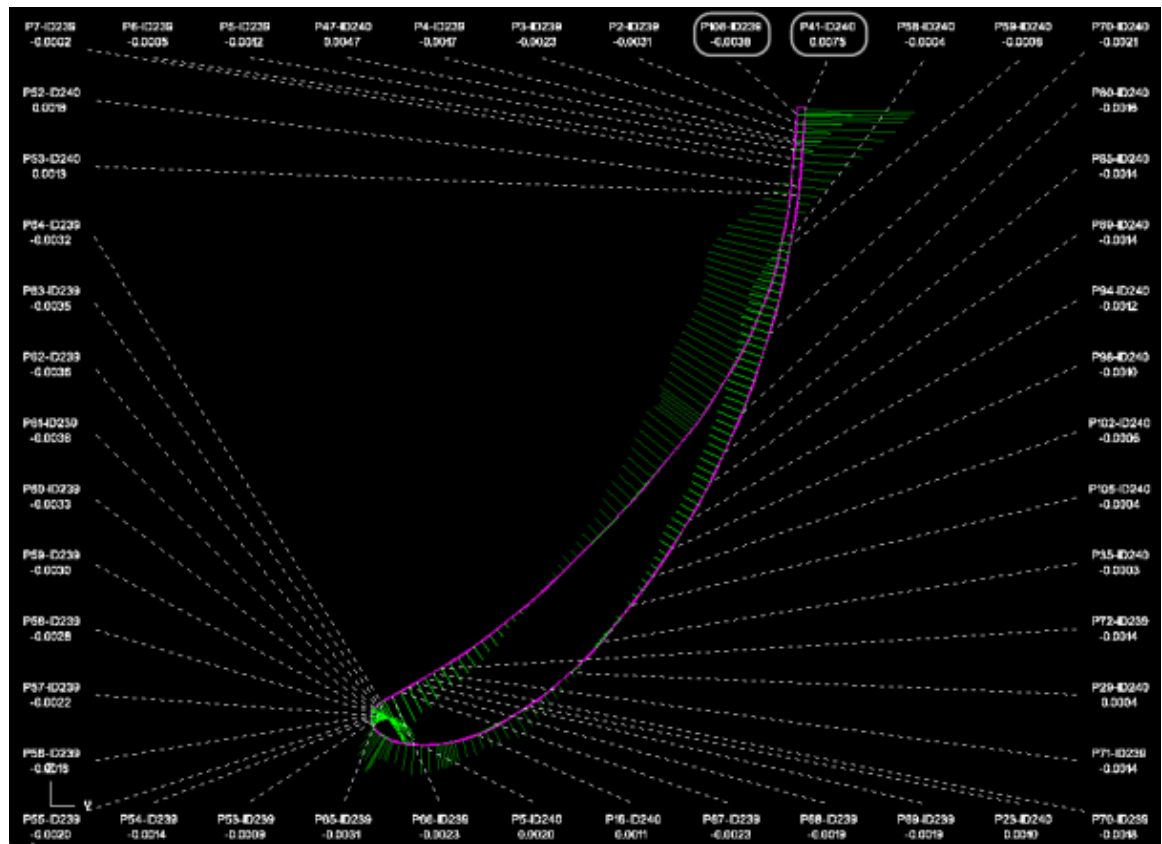
Balloons on - Outlines On – ID's Off – Col Count 8

This new Verisurf feature will create tags that are tethered to their respective points on the model. In this example we have Outlines On and Balloon Col (Column) Count set to 8 and ID's off. Balloon Col count of 8 means there are eight columns of balloons.



Balloons on - Outlines Off – ID's On – Col count 12

The next example is the same data with Outlines Off, ID's on and Col Count set to 12. You will also notice that two of the balloons still have outlines. Verisurf does this to indicate the max and min deviation of the measurements. You will also notice when zooming in and out of the model Verisurf will auto update the Min and Max points of what is shown on the screen.



Limits Only

This example shows Limits only checked with column count set to 4 and outlines on. There are no other balloons on the screen.



Locate Setup button – Fixed Position checkbox

??? to be completed?

Material Thickness

You may adjust this value to reflect an offset of the geometry. Analyze will automatically adjust the projections by this amount.

<input type="checkbox"/> Use Material Thickness	
Material Thickness	<input type="text" value="0.5"/>
Decimal Precision	<input type="text" value="4"/>

Decimal Precision

This value is for the display of the deviation results of the Analysis. It is also used for the Analysis Reports.

Projection Settings Section

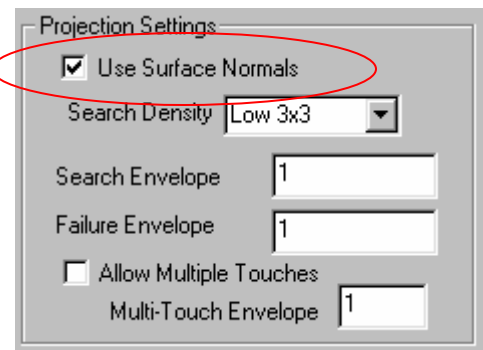
The various settings provide you with the flexibility to change the way Verisurf finds the projected geometry and the extent to which calculations are performed.

Use Surface Normals

When **Use Surface Normals** is checked, the plus or minus (+/-) direction of the error is determined by the surface normal.

Note: Make sure the surface normals are set correctly on the CAD Model.

Verisurf has the ability to use the geometrically defined surface normal of each surface in your CAD model. The benefit of this method is to ensure that Verisurf correctly understands which “side” of the surface the probe is on when the point was collected. If a point is on the “wrong” side of the surface then Verisurf will understand and calculate the correct deviations for that point. This is essential for best fitting the CMM data set.



When surfaces are developed from a solid modeling system, then the chances are good that all of the surface normals are pointing “outward” from the solid part of the model. You may have the habit of creating all of your CAD surfaces with the normals pointing “out”. There is always the option of manually setting the surface normal for each surface.

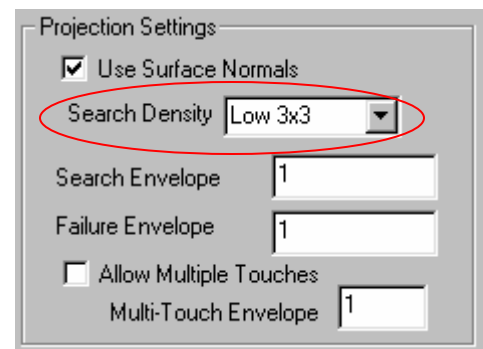
Regardless of the method used to ensure the surface normal integrity, a Projections Setting of “Use Surface Normal”, to ensure the proper calculation, is the preferred method.

Search Density

Due to the nature of the projection algorithms used by this program, it is sometimes necessary to attempt projection onto several areas of each surface until the projection is successful.

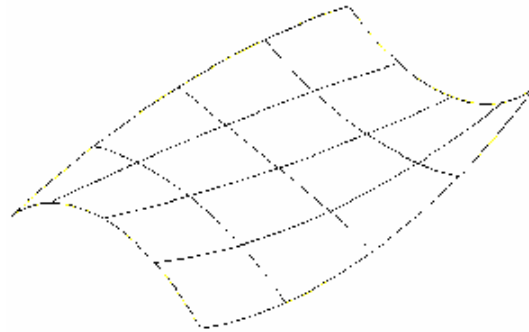
The success of the projection routine depends on the shape of the surface. Surfaces with smaller radii of curvature may require more attempts than do flatter surfaces.

To adjust the search density, select the appropriate density on the list box.

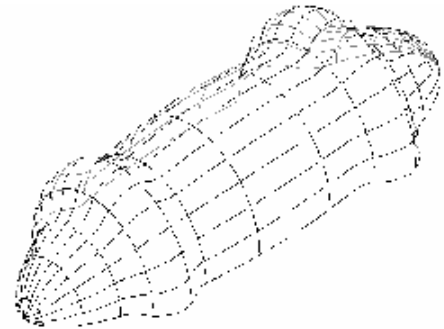


The low (**Low 3x3**) setting works most of the time. But if you are getting failed points that should project because the points are within the surface normal projection boundaries and within the Search and Failure Envelope, try running Analysis with a higher **Search Density**.

Note: The higher the density the longer the projection takes.



Low Density Search



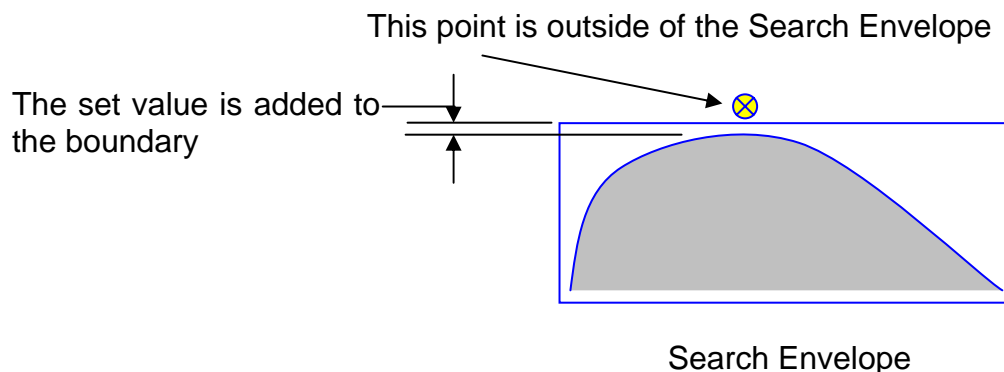
High Density Search

Projection Envelopes

Verisurf may successfully project CMM points onto surfaces and/or curves that are very far away from the point. You can control the distances that Verisurf uses to determine when a projection is successful.

Search Envelope

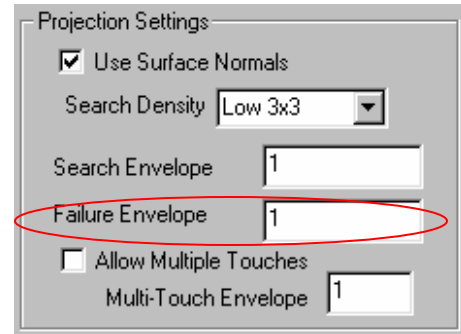
Each model entity has a 3D boundary that describes its extent in 3D space. Verisurf first considers whether each CMM point is within this boundary. Verisurf then considers a specified area outside of the model, referred to as the Search Envelope, before attempting projection onto that entity. CMM points within the envelope are projected. If the CMM point is outside of this envelope, Verisurf will not attempt to project onto the model entity. This point will show as a failed projection. This process is repeated until all CMM points within the search envelope have been projected.



Failure Envelope

When a point is successfully projected onto a CAD model entity, Verisurf checks to see if the calculated deviation is within this value. If the entity is too far away then it is considered to be a failed projection.

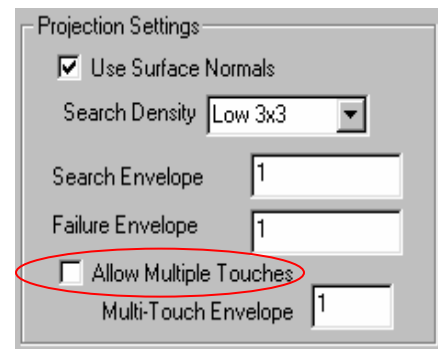
Note: When best fitting the CMM data to the CAD model it is important to set this to a large enough value so that Verisurf can find all of the necessary model entities.



Allow Multiple Touches

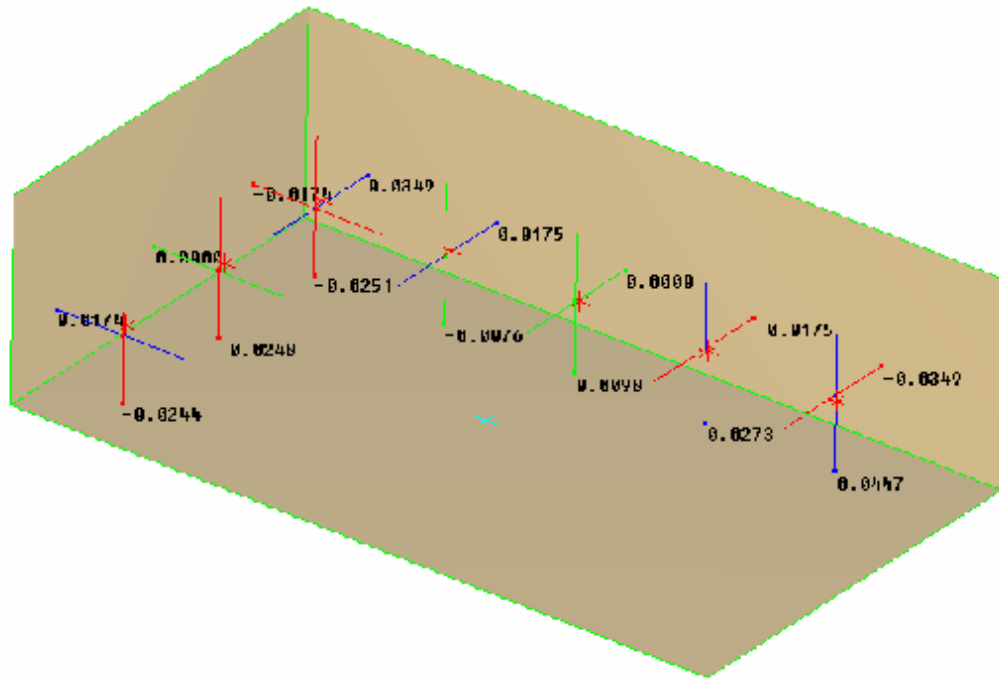
Many CMM users like to collect points at the intersections of multiple surfaces. For example, a tracker user may drag the tracker ball along a crease in the part, thereby collecting points that are valid for more than one surface. If you put the probe in the bottom corner of a pocket and collect a point, that point is valid for at least three surfaces (two sides and the floor).

Because of the accuracy of your part and your CMM, the collected point may be (and probably is) closer to one of the surfaces than the other(s). In this case, Verisurf will use only that closest surface for analysis.



Verisurf has the ability to retain knowledge about all of the surfaces that each CMM point can successfully project onto and include an analysis of each projection in the inspection report.

Successful projections must lie within the specified "Multi-Touch Envelope" to be considered valid projections. This setting is discussed later in this chapter. ???



????

Defining the Probe Radius

If using a probe when measuring data and the CMM data's XYZ location is at the center of the probe, then you need to set the probe radius before running Analyze. Verisurf Analysis will project each point onto a CAD model entity and calculate the distance between that point and its projected surface point. The probe radius is then subtracted from the calculated distance.



Note: Lines without a solid line style display attribute use a zero probe radius. This is helpful most of the time because lines are mainly used for a hole centerline and the CMM points are usually at the centerline. If you need to comp for lines, use a solid line type.

This setting will be remembered the next time that you use Verisurf Analysis for each project.

There are two ways to set the Probe Radius.

One way is to select **Probe Radius** from this menu.

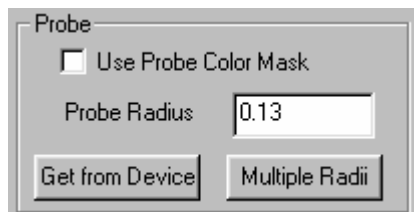
Type it in the prompt area and hit Enter to perform the analysis.

Enter the Probe Radius .125



The other way is in the **Settings** menu.

Here you can type in the Probe Radius or you can press the **Get from Device** button. This will retrieve the probe radius from the active device.



Values entered in the **Probe Radius** field will override the **Probe Radius** settings established using the **Probe Radius** command in the **Analysis** menu. Conversely, the value of this field is updated with the use of the **Probe Radius**

command.

Verisurf allows the definition of multiple probe radii for situations that require the use of multiple probes to perform the data collection.

To activate this feature select the **Use Probe Color Mask** switch until a checkmark appears to its left. Then press the **Multiple Radii** button and you will see this dialog box.

Colors	Probe Radius
00 - Black	0
01 - Dark Blue	1
02 - Dark Green	1
03 - Dark Cyan	0.5
04 - Dark Red	0.5
05 - Purple	0.5
06 - Brown	0.75
07 - Light Gray	0.75
08 - Gray	0.75
09 - Light Blue	0.75
10 - Light Green	0.25
11 - Light Cyan	0.25
12 - Light Red	0.25
13 - Magenta	0.25
14 - Yellow	0
15 - White	0

Apply To

Select the type of data that the colors represent, either **CMM Data** or **Model Data**.

Fill Down

Enter a new probe radius for any color and click this button.

This is a convenient way to automatically fill in the probe radius from the point that is highlighted to the bottom.

Reset All

This will set all fields to the probe radius typed using the **Probe Radius** command.

Type the probe radius for each color that your project uses.

Tip: When using Multiple Radii, the output on the Long report will show the Probe Radius that applies to that point.

Inspection Tolerances Section

These values are used to determine the acceptability of the deviation of each point. Deviations that violate these values will be reported as “bad” points.

There are two ways to set the tolerance.

One is to select Tolerance from this menu

Type it in, and then hit ENTER

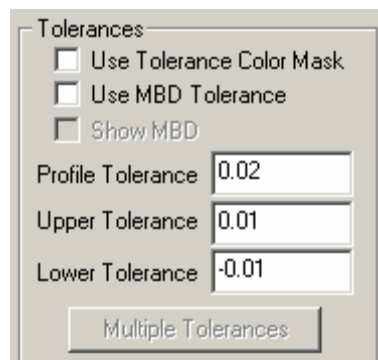
Enter the Tolerance 0.02



The other way is in the **Settings** menu.

The tolerance entered in the **Profile Tolerance** box will override the tolerance settings established using the **Tolerance** command in the **Analysis** menu. Conversely, the value of this box is updated with the use of the **Tolerance** command.

Verisurf allows the definition of multiple tolerances.



To activate this feature select the **Use Tolerance Color Mask** check box.

Profile Tolerance

You can do bilateral or unilateral Tolerances.

This tolerance is logically “linked” together with the Upper and Lower Tolerance. That is to say, the Profile Tolerance is always the difference between the *Upper Tolerance* and the *Lower Tolerance*. If you change the **Profile Tolerance** and then hit the TAB key, the **Upper** and **Lower Tolerance** are automatically adjusted to be half of the **Profile Tolerance**. If you change either the **Upper** or **Lower Tolerance**, the other is adjusted to be the **Profile Tolerance** minus the tolerance that you have changed.

Upper Tolerance

The **Upper Tolerance** is the maximum upper deviation allowed for any CMM data point before it is considered to be a “bad” or “blue” point.

Lower Tolerance

The **Lower Tolerance** is the maximum lower deviation allowed for any CMM data point before it is considered to be a “bad” or “red” point

Defining Multiple Tolerances

Selecting the **Multiple Tolerances** button will display this dialog box:

Colors	Profile Tol	Upper Tol	Lower Tol	Weight
00 - Black	0.5	0.25	-0.25	0.06
01 - Dark Blue	0.1	0.05	-0.05	0.3
02 - Dark Green	0.05	0.025	-0.025	0.6
03 - Dark Cyan	0.05	0.025	-0.025	0.6
04 - Dark Red	0.05	0.025	-0.025	0.6
05 - Purple	0.04	0.02	-0.02	0.75
06 - Brown	0.03	0.015	-0.015	1
07 - Light Gray	0.03	0.015	-0.015	1
08 - Gray	0.02	0.01	-0.01	1.5
09 - Light Blue	0.01	0.005	-0.005	3
10 - Light Green	0.005	0.0025	-0.0025	6
11 - Light Cyan	0.003	0.0015	-0.0015	10
12 - Light Red	0.002	0.001	-0.001	15
13 - Magenta	0.001	0.0005	-0.0005	30
14 - Yellow	0.0002	0.0001	-0.0001	150
15 - White	0.0001	0.0001	0	300

Apply To:
☐ CMM Data
☒ Model Data
 Fill Down
 Reset All
 OK

To Define Multiple Tolerances:

Type the profile tolerance for each color that your project uses. This tolerance is logically “linked” together with the **Upper** and **Lower Tolerance** and the **Weight**. **Weight** is used in the Best-Fit routine of Verisurf Analysis.

Apply to, Fill Down and Reset All

This works the same way that the Multiple Probe Radius Mask does.

Tip: When using multiple tolerances, the output on the Long report will show the tolerance that applies to that point.

Use MDB Tolerance

MDB or Model Based Definition is one of the newest Verisurf additions. It uses definitions that are attached in the model to surfaces, curves, lines, arcs, splines or points. With this switch enabled Verisurf will inspect any MBD tolerance to what it is defined to. Any undefined model areas will use the profile tolerance specified. **See Using MBD Tolerancing** for more information on MBD.

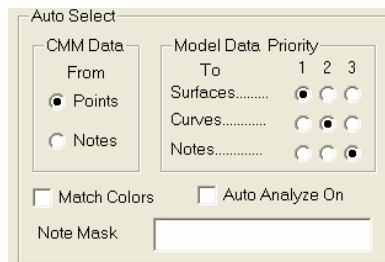
Auto-Select Data Section

By default, Verisurf selects all data on visible levels when you run Analyze. To analyze a subset of the data, begin by using the **Select Data** option to select the CMM Data and or the Model Data to use. Then run **Analyze**. Otherwise Analyze will automatically select all visible surfaces, curves, notes, and points in the CAD system according to the auto-select settings.

The **Auto-Select Settings** dialog box can be opened in the Analysis **Settings** menu or with **Auto-Select** option of the **Select Data** menu.

CMM Data are the points that are projected to the Model Data. If you select **Notes** then it uses the notes the same as it uses points. If there are no points on the screen, notes will be used.

The advantage of using notes is that the note's name will show up on the reports. This is good for labeled data that needs to be reported.



Model Data is the nominal geometry that the CMM Data will be projected to. The Priority 1 selection is looked for first. As configured in the illustration, the first priority model data will be **Surfaces**. If there are no visible surfaces, it will then look at Priority 2 Curves.” If there are no visible curves, it goes to Priority 3. You can set the priority to a variety of combinations.

Tip: Curves represent Lines, Arcs and Splines.

The **Note Mask** entry box is a way to pick certain groups of notes. Type in a prefix of a note's name or names separated by commas. Then Analyze will only select those notes that match these criteria. Be careful about how you type the note names. The Note Mask performs a case-sensitive search.

Match Colors

This check box is used to make sure the CMM data is projected to the right geometry. If it is checked, the CMM data only projects to the geometry with the same color as itself.

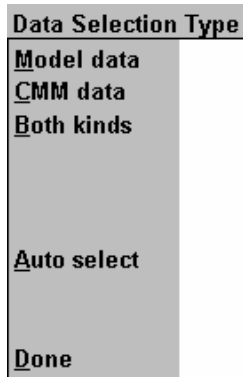
Auto Analyze On

This check box can be used to automatically run an analysis each time you leave the settings menu. This can facilitate the changing of various combinations of settings without having to hit the **Analyze** button again.

Select Data

You may choose to **Select Data** from the **Analysis** menu.

Choosing **Select Data** from the **Analysis** menu will present you with the **Data Selection Type** menu, as shown here.



The choices presented on this menu are very simple and straight-to-the-point. You may select **Model data**, **CMM data** or **Both Kinds** of data. You also have access to the **Auto-Select** settings from this menu.

Select **Done**, from the **Data Selection Type** menu, to return to the **Analysis** menu.



Selecting Model Data

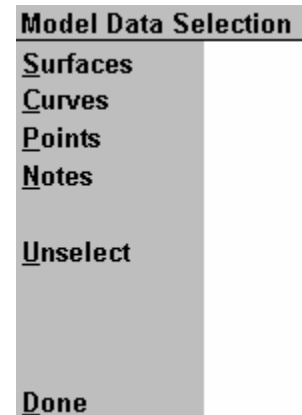
You must select one or more model entities for Analyze to project the CMM data onto. If you don't select any entities, the Analyze will automatically select all of the visible entities in the database according to the **Auto-Select Priority Settings**.

Model Data Selection Menu

Select **Model data** from the Verisurf **Data Selection Type** menu. You will be presented with another menu that allows you to select the type of model data. Your choices are **Surfaces**, **Curves**, **Points**, **Notes**, **Unselect**, and **Done**.

Manually Selecting Model Data

Use the features of the Verisurf **Data Selection Type** menu to select the surface(s), curve(s), note(s), and/or model point(s) that you wish to compare with the selected CMM data. You will be presented with the standard Design entity selection menu for each of these options. Select the desired entities with the mouse, with menu options or with a combination of the two. Select **Done** when you are finished selecting entities.



When selecting points as model data and CMM data, it is convenient for there to be some difference between the two types of points. They may be different colors or be on different drawing levels. For this reason it is important to become familiar with the Design's Levels Manager.

When importing CMM data, be sure to place the points on an unused drawing level and naming that level appropriately. This helps to keep your model organized.

Unselecting Model Data

Selecting **Unselect** from the **Model Data Selection** menu will cause Verisurf to unselect all previously selected model and/or CMM entities. After “unselecting” all data, you could begin a completely new selection.

If only the CMM points were “unselected”, you could start a new analysis with same CAD model and a new model data set. If you do not select any model data after unselecting, then Verisurf will automatically select model data based on the **Auto-Select Settings**.

Returning to Analysis after Model Data Selection

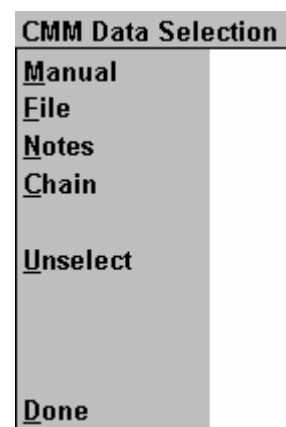
When you are finished with your model data selection, you can return to the main Analysis window by selecting **Done** from the **Model Data Selection** Menu. You can also press the ESC key to get the same result.

Selecting CMM Data

You must select one or more points or notes to project onto the selected model entities. You may do this by selecting individual CMM data from the screen, selecting data on the screen with a window, selecting all points or notes in the database, or by selecting a data file that contains point data in one of the supported formats. If you don't select any CMM data, Verisurf will automatically select all of the visible data in the database according to the **Auto-Select Priority Settings**. These settings are discussed later in this chapter.

To use the CMM Data Selection Menu:

Click the **Select Data** option in the **Analysis** Menu. Then select **CMM data** from the **Data Selection Type** menu. You will be presented with another menu that allows you to select the type of point data. Your choices are **Manual**, **File**, **Notes**, **Chain**, **Unselect**, and **Done**.



Manually Selecting Points

The **Manual** option will present you with the standard Design entity selection menu. Select the desired point(s) with the mouse, with menu options, or a combination of the two. You may select any existing point entities. Press the ESC key when you are finished selecting points.

Selecting Points from a Data File

Selecting **File** will present you with a menu of file types. Select the last item, **Next menu**, to view more types of files that Verisurf can use for analysis data input.

If you don't see your file type on the list, it may be possible for you to select a format that is compatible with your file. Verisurf is very flexible and can be modified by the author to include your file type on the list.

Select the type of file you want to use and you will then be prompted for the file name.

Manually Selecting Note Entities

Selecting **Notes** will present you with the standard Design entity selection menu. Select the desired note(s) with the mouse, with menu options or with a combination of the two. You may select any existing note entities. Press the ESC key when you are finished with selecting notes.

Selecting Points with a Chain of Entities

You may use a contiguous series of lines and/or arcs to define the points that you want to analyze. All of the endpoints encountered in the chain will be used as the data points for analysis. This is useful for creating a probe path for a DCC CMM.

Unselecting CMM Data

You may want to begin your selection over, or start a new analysis with the same CAD model, but a different CMM data set. Selecting **Unselect** from the **CMM Data Selection** menu will cause Verisurf to unselect ALL previously selected CMM points and notes. If you do not select any CMM data after unselecting, then Verisurf will automatically select CMM data based on the **Auto-Select Settings**.

Selecting Both Kinds

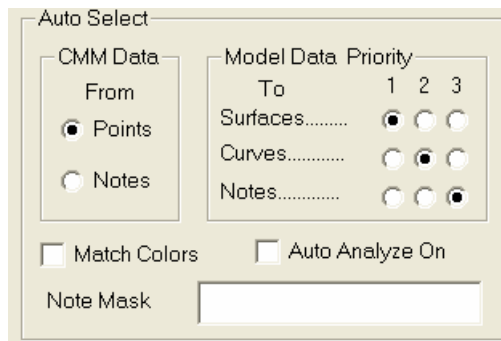
Often there will be CAD model entities on the screen that you want to view for reference while performing the analysis. Auto-Select will automatically select all entities of the required type for analysis. You might not want all of the entities, such as surfaces for example, to be selected.

If there are only a few entities for both the model and the CMM data then you may want to select them manually using the selection features already discussed. However, if there are many entities that you need to select for the analysis and there are entities that you don't want to select, you can use the **Both kinds** data selection method.

This function allows you to use the standard Design entity selection methods to select what you want. The most popular way to use this function is to select all of the CMM and model data with a window. You could also select a few entities individually.

When you are finished selecting entities and select **Done** from the **Data Selection Type** menu. Verisurf will use the Auto-Select settings to determine which entities that you have selected belong to the CMM data set and which entities belong to the model data set. This way you can

select the entities for analysis, but you don't have to separate them into their respective groups.



Auto-Select Settings

Verisurf allows the convenience of not selecting model data and CMM data for your analysis. This feature assumes that you wish to compare all of one type of CMM data with all of one or more types of model data. The data is selected for you automatically.

The default condition for this feature is for Verisurf to automatically select all of the points in the database, with all of the surfaces in the database. The settings, on the **Auto-Select Settings** dialog box, allow you to modify the way that Verisurf selects CAD data for your analyses.

The **CMM Data** section of this dialog box tells Verisurf whether to analyze selected points or notes as the CMM data. Verisurf will not automatically select both points and notes as CMM data. If you select **Points**, the **Model Data** section of the dialog box displays **Notes** as an option. If you select **Notes** as CMM data, the **Model Data** section displays **Points** as an option. This allows you to automatically project all points onto all notes or all notes onto all points, while avoiding all manual selection.

The **Priority** buttons are used to establish the order in which the CMM data will be projected to the different model types. If for instance, Surfaces has a **Priority** of "1", Verisurf will begin the analysis by projecting the CMM data to surfaces.

You may give any or all of the model data types the same **Priority** setting. For example, you may set the surfaces and curves priority both to the highest setting (1). This will cause Verisurf to select all of the surfaces and all of the curves as model data. If no surfaces or curves exist, the next lowest priority will be considered (notes or points, in this example).

You may project points and notes as CMM data onto any other entities as model data. You must manually select the CMM data in this case.

Best-Fit

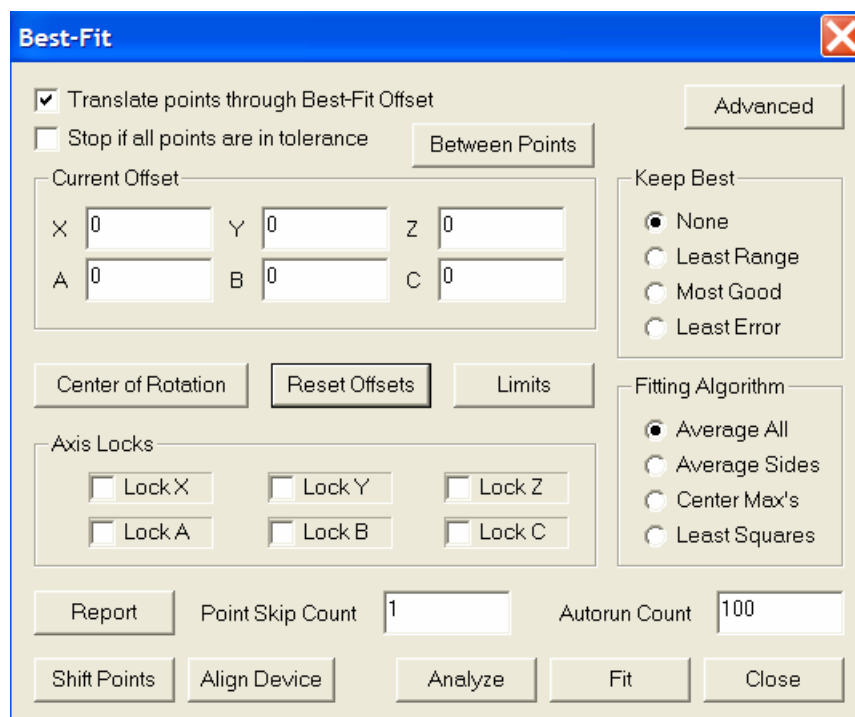
The **Best-Fit** Menu contains settings for the **Best-Fit Offsets**, **Axis Locks**, **Center of Rotation**, and other settings related to functions used to fit the CMM Data to the model.

The “**N**”, to the right of the Best-Fit option indicates that no Best-Fit shift happens when Analyze is run. If you see a “**Y**”, this means the points will be shifted though the Best Fit offsets when analyzed. The displayed error results are based on this shift.



Best-Fit Settings

The **Best-Fit** dialog box contains settings for the **Best-Fit Offset**, **Axis Locks**, **Center of Rotation**, and other settings related to Best-Fit Alignment of your CMM data.



Verisurf applies the Best-Fit offset to each CMM data point before that point is projected onto the CAD model. The CMM data points are not physically moved in the database, however, the utility Shift Points can be employed to shift the points once an acceptable offset is determined.

Current Offset

The **Current Offset** values on the **Best-Fit** dialog box are the settings that are used to translate CMM points before projection onto the CAD model. The values for **X**, **Y** and **Z** are applied as linear shifts while the **A**, **B** and **C** values are for rotational shifts. These values will change after a Best-Fit has been produced. You may also manually input a value and used in conjunction with the axis locks force the Best-Fit to a desired position.

The screenshot shows the 'Best-Fit' dialog box. At the top, there are two checked checkboxes: 'Translate points through Best-Fit Offset' and 'Stop if all points are in tolerance'. To the right of the second checkbox is a button labeled 'Between Points'. Below these is a section titled 'Current Offset' which contains six input fields arranged in two rows: X, Y, Z in the first row and A, B, C in the second row. All input fields contain the value '0'. At the bottom of the dialog are three buttons: 'Center of Rotation', 'Reset Offsets', and 'Limits'.

Translate Points Through Best Fit Offsets

The **Translate points through Best-Fit Offset** check box, in the upper-left corner of the **Best-Fit** dialog box, allows you to activate and deactivate the offsets that have been entered for Best Fit analysis.

Click on the switchbox until a checkmark appears in the box and Verisurf will begin to use the currently displayed offsets in calculating the deviation of each CMM data point. If this check box is empty, Verisurf will not use the displayed offsets.

Stop if all points are in Tolerance

This switch is used to automatically stop the Best-Fit passes after all the inspection points are in tolerance.

Note: Best Fit will automatically stop after all axis errors are less than system tolerance. The default setting for system tolerance is 0.00005.

Between Points

This is a selection tool that prompts the user to pick a “move from” point and a “move to” point. The XYZ distances are added to the offset values.

Reset Offsets

Selecting the **Reset Offsets** button will set the Best-Fit Offset values to zero.

Note: Locked axes will not be reset, nor will the Center of rotation.

Limits

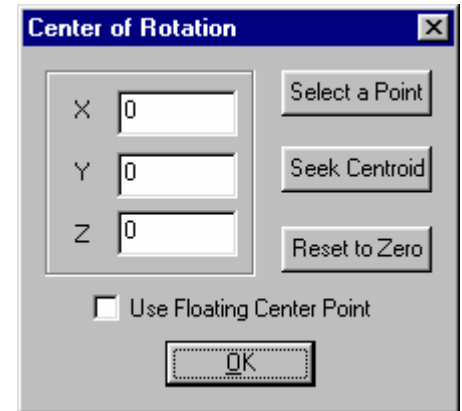
Here you can set the limits of movement for each axis.

Center of Rotation

Rotational offset calculations must have a point from which to calculate the angular deviations.

Initially, the center of rotation is the origin, but you may select another point. It is often desirable to select a point that is near the middle of your data set.

Note: When running the Best Fit, a Center of Rotation point is displayed with a cyan colored point.



X, Y, Z Values

With the **Center of Rotation** dialog box you may either enter the point coordinates manually or use one of the other features. You can define your own center of rotation by simply typing the desired value in the **X**, **Y**, or **Z** fields.

Select a Point

Use this button to access the standard Design **Point Entry** menu to define the desired center of rotation. Selecting a point somewhere near the center of the CMM data is usually helpful for Best Fitting.

Seek Centroid

Verisurf can calculate the exact centroid of the CMM data set and enter the values into the **Center of Rotation** dialog box. Simply click on the **Seek Centroid** button to activate this feature. When using the "Data Groups" entity selection method, the centroid is calculated as the centroid of the model data and the **Seek** button will only find these values.

Reset to Zero

Selecting **Reset to Zero** will set the values for the center of rotation back to zero, the origin. When using a Part Axis, the values will be set to its origin.

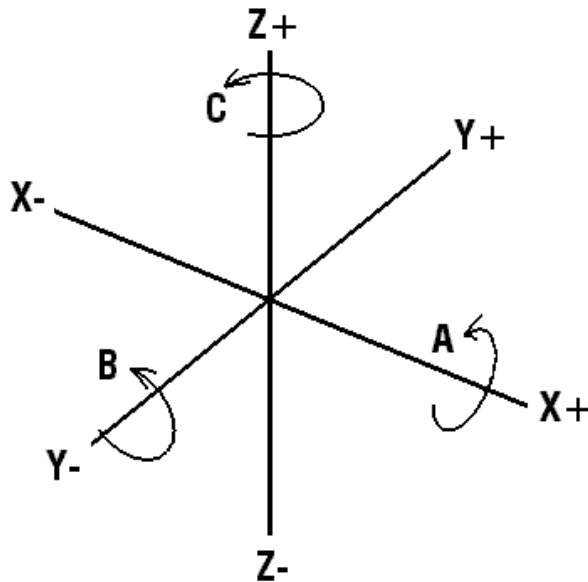
Use Floating Center Point

Verisurf will use whichever values are currently displayed in the **Center of Rotation** dialog box for the first Best-Fit iteration. On the second and all subsequent iterations of Best Fitting, Verisurf will calculate the centroid of the projected points of the previous iteration.

TIP: A floating center point is the preferred Best-Fit method.

Direction of Movement

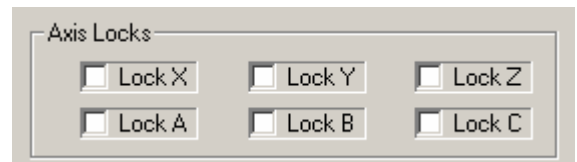
Translation and Rotational Best-Fit values are applied as illustrated below. The values for the Best-Fit offset may be adjusted manually by highlighting the current value and typing a new value. Automatic adjustment of the Best-Fit offset values can be performed in a variety of ways.



This is applied to the active Part Axis system

Locking an Axis

You may lock any or all six axes to prevent Verisurf from adding any additional offset value to those locked axes.



Existing offset for locked axes will not be modified by the system.

While the **Translate points through Best-Fit Offset** box is checked, the offset for any locked axis will be used for all functions of Verisurf.

Verisurf calculates all six of the errors for each point (XYZABC) and uses a ratio to determine how much of each error to use. The axis lock will have an effect on this ratio. For example, locking the C axis will increase the amount of X and Y adjustments to the calculated offsets. Locking the A-axis will have a similar effect on the Y and Z offsets.

Fitting Algorithm

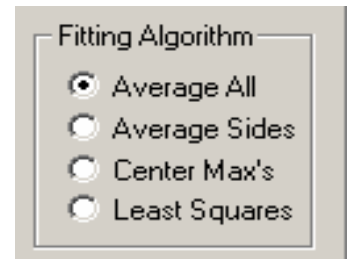
Verisurf provides several different methods for calculating the Best-Fit offset. These methods have similarities, but have subtle differences that allow the CMM data set to influence the calculations.

Best – Fit Routines

The Best-Fit offsets are calculated automatically each time you select **Fit** from the **Best-Fit** dialog box. This calculation may be adjusted in a variety of ways. These methods are described below.

Averaging All Errors

Select **Average All**, from the **Fitting Algorithm** group box, to cause Verisurf to calculate the average deviation of all of the points. This method allows the population of the CMM data set to influence the calculation. In other words, more points in one area of the model than another will cause the offset calculation to give more importance to the denser area.



Averaging Sides

Select **Average Sides** to calculate the average X, Y, and Z deviation of all of the points. This method does not allow the population of the CMM data set to influence the calculation. In other words, more points in one area of the model than another will not cause the offset calculation to give more importance to the denser area.

Centering Maximum Errors

Select **Center Max's**, to calculate an offset based on only the worst errors. That is, only the worst negative X, the worst positive X, the worst negative Y, the worst positive Y, etc. is used to calculate the offset.

This algorithm has the tendency to center the CMM data set about the CAD model rather quickly. However, after a few iterations, the data set will usually "bounce" between positive and negative conditions. Select one of the other algorithms to move the data set closer to the CAD model.

Least Squares

Select **Least Squares** to calculate using a least squares algorithm. This method is similar to **Averaging All errors** but uses each point separately from other points regardless of point population density.

Keep Best

Due to the nature of the fitting algorithms, used by Verisurf, it is often necessary to perform multiple iterations of the fitting process (see AutoRun Count). When the CMM data does not closely conform to the shape of the CAD model, the calculations tend to cause the data set to “drift” closer to and farther away from the CAD model. The **Keep Best** feature will track the progress of the fitting and will restore the offsets to the optimum fit determined during the analysis.



None

The **None** setting, of the **Keep Best** feature, will cause Verisurf to retain the calculations developed during the most recent analysis.

Least Range

The **Least Range** setting will cause Verisurf to remember the analysis iteration that generated the least range of deviation. The range is the difference between the minimum and maximum 3D deviations determined in the most recent analysis run.

Most Good

The **Most Good** setting will cause Verisurf to remember the analysis iteration that generated the largest number of good points. Points are considered good when the 3D deviation is within the Profile Tolerance.

Least Error

The **Least Error** setting will cause Verisurf to remember the analysis iteration that generated the least error of either the minimum or maximum 3D deviations determined in the analysis run. This is different from the **Least Range** setting in that the least range may not have the least error.

Point Skip Count	<input type="text" value="1"/>	Auturun Count	<input type="text" value="100"/>
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Point Skip Count

Best fitting a large amount of data can be very time consuming. To speed things up, Verisurf can skip CMM points using this value as a counter.

The default condition for this feature is a value of one (1), which causes Verisurf to use each point for the analysis. A value of two (2) would use every other point, three (3), every third point, etc.

You may use any positive number (greater than zero). Remember to set this back to one (1) for the final analysis.

AutoRun Count

The data points selected may require more than a single pass to achieve a best fit. Verisurf recalculates after each pass and adds to the current offset automatically.

The **AutoRun Count** tells Verisurf how many times to perform the inspection analysis. Each time AutoRun generates an analysis pass, the Best-Fit offset is automatically adjusted using the fitting algorithm that is currently selected.

Set this value to the number of desired passes. The next time you select **Fit**, from the **Best-Fit** dialog box, Verisurf will perform that many passes on your project. You can terminate it at any time by pressing the ESC Key or pressing a mouse button.

Best Fit will automatically stop passes after all axes average error is less than the system tolerance, which is set to 0.00005 by default.

Note: Best-Fit can't save every part but it can help bring it closer to print.

Advanced Settings

The **Best-Fit Advanced Settings** dialog box is accessed by clicking the **Advanced** button. These settings provide you with a variety of advanced adjustments that affect the Best-Fit performance.

Axis Weights

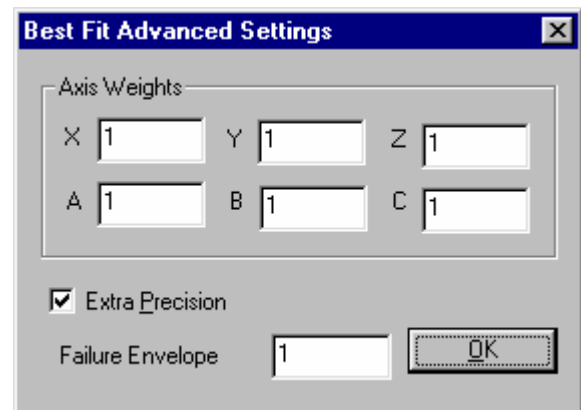
Use these to add or reduce the influence of each axes adjusted fit.

Extra Precision

If this check box is on, all of the X, Y and Z errors for each CMM point will be used for the fit. If unchecked, the X, Y or Z with the greatest error will be used for the fit. This can speed up the Best-Fit process.

Failure Envelope

This is a shortcut to the same parameter that is adjustable from the **Analysis Settings**. Using this feature can help the Best Fit by making points that are far away fail because they are outside the failure envelope. This way those bad points won't effect the fit.



Analyze

The **Analyze** button duplicates the function of the **Analyze** option, in the Analysis menu. This is a convenient way to analyze without closing the **Best-Fit** dialog box.



Shift Points (Shift Notes) translates all visible CMM points and/or notes using the best fit offset to a new location. This utility physically moves all of the visible points in the CAD system.

Whether this function shifts points or notes depends on the **Auto-Select Settings**. Whichever data type is selected for CMM data on the **Auto-Select Settings** menu is the default for this function.

Note: Be sure that you have turned on all drawing levels that contain points or notes that you want to shift. Conversely, be sure that you have turned off all drawing levels that contain points or notes that you don't want to shift.

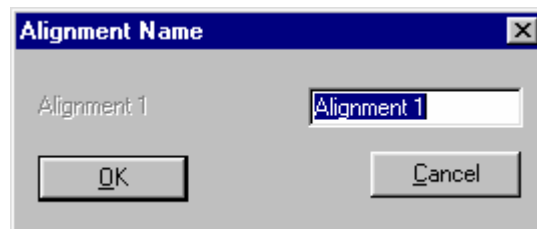
If a device alignment has been set, you will then be asked if you want to "Shift Device Alignment."

When you select this function, you will be prompted: "Shift all visible points and notes?" If you select **Yes**, in response to this question, all of the visible points or notes will be shifted. If however, you select **No** to the prompt, then you will have the opportunity to manually select points and notes from the screen. In this manner, you can shift both points and notes at the same time. Usually, you are working with either points or notes and the automatic selection is appropriate.

Align Device converts the Best-Fit Offsets into a transformation matrix saved as a device alignment.

This menu comes up so you can name the device alignment.

Note: It is important that the CMM points used for the fit are in the device's base coordinate system prior to using this feature.



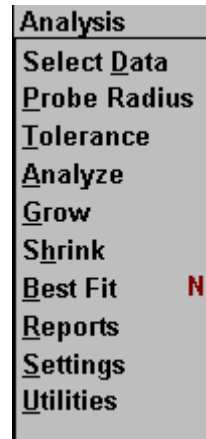
The device alignment created is not used within the scope of the Verisurf analysis function, but is used in conjunction with other modules available with Verisurf when using a CMM device. These other modules perform functions such as Build, Measure, and Reverse.

Analysis Reports

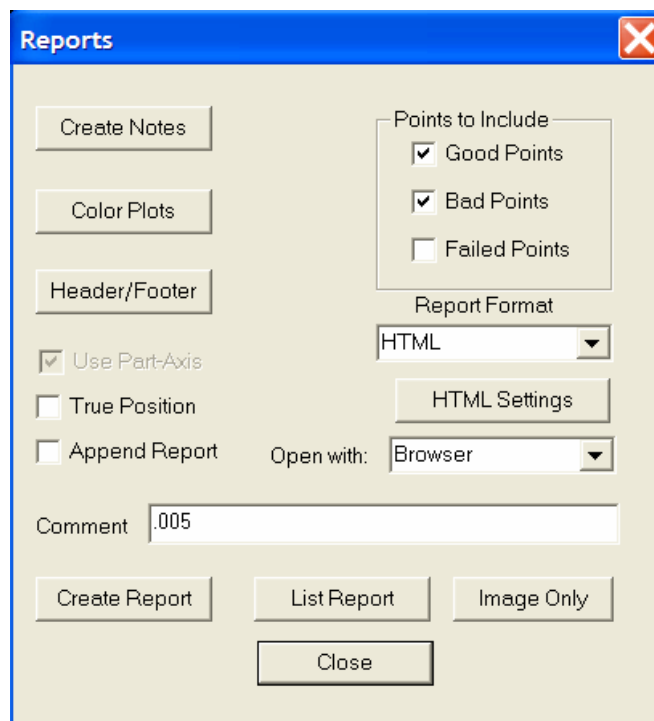
Once you have run Analysis, you can then create a report with the Verisurf report functions.

Many different types of reports can be generated with Verisurf. There are different report formats, as well as control over the included data, and SPC information.

In order to access Report functions, select **Reports** from the Verisurf **Analysis** menu.



Points to Include



Check which type of CMM points to include on the report.

A **good** point is one that has successfully projected onto your model and is within the specified tolerance.

A **bad** point is one that has successfully projected onto your model and is out of tolerance.

A **failed** point did not project successfully; there is no deviation to report for this point.

A report file is the all important objective of Verisurf. It lists each CMM point selected for comparison with your CAD model and shows the deviation from the CAD model for each point.

Verisurf stores the text of its printed report in a file that is a standard ASCII format. It can be printed or viewed with your choice of browser, word processor or Microsoft® Excel®.

The report can be edited with any application that reads these formats.

Header / Footer Settings

First Page

Use **Header/Footer Settings** to customize the information that will appear at the top and bottom of each report page.

Verisurf can merge a separate header file at the top of the report, and/or a footer file at the bottom of the report. This capability allows you to customize and standardize the way that your CMM programs begin and end.

To insert a Header file:

1. Click the **Header/Footer** Button
2. Check the box to the left of the **Header File** button.
3. Click the **Header File** button.
4. Select the file to be included as the header.
5. Click **Open**.

Header/Footer Settings

First Page

☒ Header File

☒ Report Title Verisurf Inspection Report

☒ Report Information (Job #, etc.)

☒ Tolerances ☒ Probe Radius

☒ Report Filename ☒ Geometry Filename

☒ Report Output Type

Subsequent Pages

☒ Report Title

☒ Report Information

☒ Report Filename

Page Length 58

Footer

☒ Footer File

☒ Report Summary

Report Header Settings (4 Lines Max)

Header Title	Header Text
JOB	
PO NUMBER	
PART NAME	
INSPECTOR	

Header Logo

Change Logo

Logo Filename C:\MCAM9\DATA\LOGO.JPG

OK

By default, Verisurf will produce a report with the title of “Verisurf Inspection Report.” You can change this title to reflect the contents of your report. Also by default, Verisurf will display all optional information at the top of the first page.

Check the **Tolerances** box to include the upper and lower tolerances used for the inspection. The **Report Information** option adds the text of the **Report Information Settings** to the heading of the first page. The **Report**

Output Type option is only applicable to reports generated with the Short Report format. See: Short Report Format

Subsequent Pages

To Display the Report Title, Report Information and File name on the second and all subsequent pages, check the appropriate boxes.

The **Page Length** setting controls the length of all pages of the report.

Check the **Report Summary** box to print a summary data on the last page.

```

----- REPORT SUMMARY -----
Sample Points:    216      DX      DY      DZ      3D
                  -----
Maximum Deviation :    0.00000    0.00802    0.00089    0.00800
Minimum Deviation :   -0.00000   -0.00436   -0.00759   -0.00750
Deviation Range   :    0.00000    0.01239    0.00848    0.01550

Average Deviation :    0.00000    0.00109   -0.00190    0.00112
RMS Deviation     :    0.00000    0.00251    0.00307    0.00396
Standard Deviation:    0.00000    0.00226    0.00242    0.00381

                  Neg      Nom      Pos      Total      Pct
                  ---      ---      ---      ---      ---
In Tolerance      :    46       2       78       126      58.3%
Out of Tolerance  :    32       -       58       90       41.7%
Failed points     :     -       -        -        0        0.0%
                  ---      ---      ---      ---      ---
Total points      :    78       2      136      216     100.0%

```

Report Header Settings

If the **Report Information (Job #, etc.)** box is checked, you can type up to four lines of descriptive information that will appear at the top of the report and optionally on all subsequent pages.

Report Information Settings (4 Lines Max)			
Info Line 1 Title	JOB NUMBER	Info Line 1 Text	A5677W2-3
Info Line 2 Title	PART NUMBER	Info Line 2 Text	NU98321
Info Line 3 Title	CUSTOMER NUMBER	Info Line 3 Text	0P9876
Info Line 4 Title	INSPECTOR	Info Line 4 Text	Herman Hollerith

Report Formats

Verisurf has the ability to present the analysis data in a variety of report formats. The different formats are explained below.

Long Report Format

This format contains the most information available about the inspection analysis. Information is provided for the CMM point, the actual point, the projected point, the deviation distances per axis, and the 3D-deviation distance.

	X	Y	Z	3D
	-----	-----	-----	-----
Point 1				
CMM DATA :	-12.9042	-7.6462	0.1659	
ACTUAL :	-12.9033	-7.6289	0.0371	
NOMINAL :	-12.9033	-7.6286	0.0345	
DEVIATION :	-0.0000	-0.0003	0.0026	0.0026
Point 2				
CMM DATA :	-12.6313	-5.4311	0.3589	
ACTUAL :	-12.6290	-5.4275	0.2290	
NOMINAL :	-12.6290	-5.4275	0.2286	
DEVIATION :	-0.0000	-0.0000	0.0003	0.0003
Point 3				
CMM DATA :	-11.3595	-2.5350	0.2923	
ACTUAL :	-11.3545	-2.5471	0.1630	
NOMINAL :	-11.3545	-2.5470	0.1637	
DEVIATION :	0.0000	-0.0001	-0.0007	-0.0007

Sample Long Report Format

The Long Report shown above is only one of two possible Long Reports that Verisurf can generate for you. When you select **Long** as the report format on the **Reports** menu, a button labeled **Long Settings** will appear. Selecting this button will enable you to choose between creating a **Full** or an **Actual** Long Report.

The full report is shown above. The actual report is the same as the full report except that the CMM points are not reported, only the actual points.

Note: When using multiple probe radii or tolerances, each point will output with that information.

Coordinate System

If you are using a Verisurf Part-Axis, the **Use Part-Axis** is turned on. As long as this is checked, the report output will be in the Part-Axis coordinate system. Otherwise, the report is output in the world XYZ coordinates.

World is the main Car or Aircraft coordinate system (CATIA *Axis1)

Short Report Format

The short report format contains the minimum information required for an inspection analysis. Information is provided for the CMM point and the 3D deviation.

ID	X	Y	Z	DEVIATION	% OUT
1	0.0000	0.0000	-1.4908	0.0026	
2	0.0000	0.0000	-1.4908	0.0003	
3	0.0000	0.0000	-1.4908	-0.0007	
4	0.0000	0.0000	-1.4908	-0.0013	
5	0.0000	0.0000	-1.4908	0.0007	
6	0.0000	0.0000	-1.4908	0.0000	

The short report shown above is only one of many different report formats that Verisurf can generate for you. When you select **Short** as the report format on the **Reports** Dialog box, a button labeled **Short Settings** will appear. Selecting this button will present your choices of Short Report output.

There are currently four choices for Short Report output: **CMM Points**, **Actual Points**, **Nominal Points** and **Delta Values**. The CMM points are the points recorded at the CMM and used as input to Verisurf. The ACTUAL points are the points calculated to be the 'touch' point (compensated for the probe radius). The Nominal points are the points projected onto the CAD model.

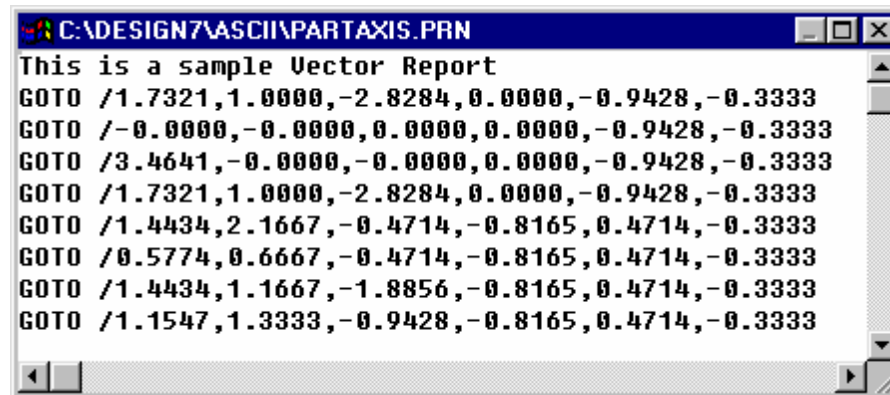
The output type that you select will be printed on the report if **Report Output Type** is checked in the **Header/Footer Settings**.

Vector Custom Report Format

The Vector Custom report format was developed to assist in programming or teaching your CMM to inspect the next part the same way as the first part. The report can contain the X, Y and Z values for each CMM point, as well as the U, V and W components developed from the analysis.

Vector reports can contain several other elements that your CMM software may require for proper interpretation of the data. These elements include a keyword for the data, such as **POINT** or **GOTO**, a separator for the data values, such as a space or a comma and end-of-block character(s).

Here is a sample vector report:



```

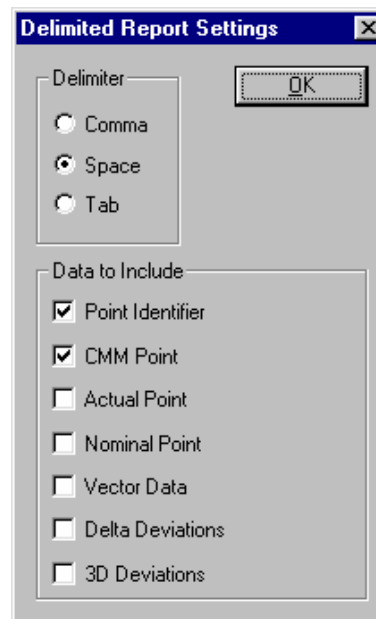
C:\DESIGN7\ASCII\PARTAXIS.PRN
This is a sample Vector Report
GOTO /1.7321,1.0000,-2.8284,0.0000,-0.9428,-0.3333
GOTO /-0.0000,-0.0000,0.0000,0.0000,-0.9428,-0.3333
GOTO /3.4641,-0.0000,-0.0000,0.0000,-0.9428,-0.3333
GOTO /1.7321,1.0000,-2.8284,0.0000,-0.9428,-0.3333
GOTO /1.4434,2.1667,-0.4714,-0.8165,0.4714,-0.3333
GOTO /0.5774,0.6667,-0.4714,-0.8165,0.4714,-0.3333
GOTO /1.4434,1.1667,-1.8856,-0.8165,0.4714,-0.3333
GOTO /1.1547,1.3333,-0.9428,-0.8165,0.4714,-0.3333
  
```

Delimited Report Format

This format is frequently used for creating reports that can be imported by database and spreadsheet programs.

Set the **Report Format** to **Delimited**. Then click **Delimited Settings**. The **Delimited Report Settings** dialog box is displayed.

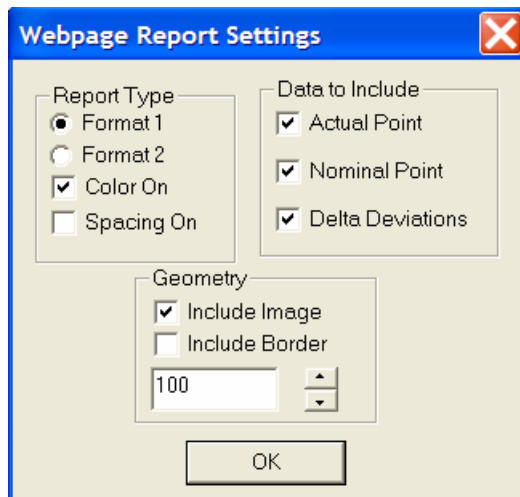
These **Delimiter** options enable you to specify whether commas, spaces or tabs will separate the columns in your report. Select the delimiter that is used by the program you will export to. Then select the data types to be reported and click **OK**.



HTML Format

Verisurf can also display reports in your default browser by selecting "HTML" as the **Report Format** and "Browser" as the **Open with:** program.

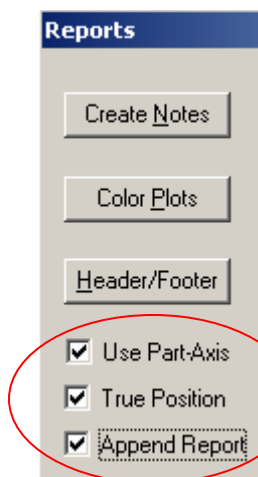
Click the **HTML Settings** button to display the **WebPages Report Settings**.



Select the data to include and the **Report Type**. **Format 1** displays the point axes as column headings and the point type and deviation as row headings. **Format 2** reverses this arrangement. **Color On** will create a report in color. **Spacing On** adds a white line between the report sections for each point.

Include Image

The **Include Image** button copies the geometry of the Analysis screen to the bottom of HTML formatted reports. HTML reports can be opened with your browser and Microsoft® Office 2000® or later, versions of Word® and Excel®.



Use Part Axis

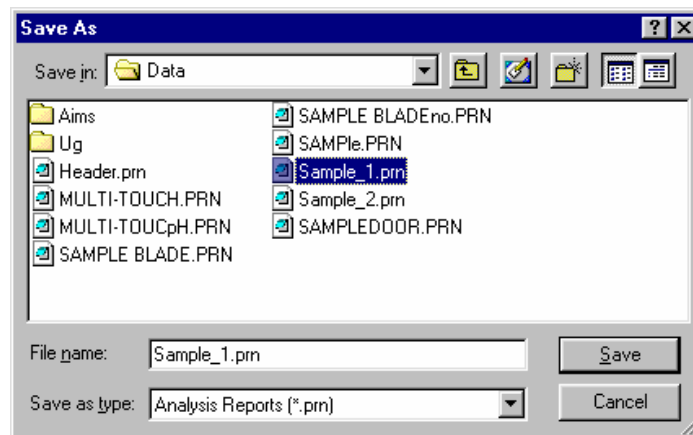
If you have created a part axis for your model's geometry and set this axis to be active, this box becomes available. The Verisurf report will use the active part axis rather than the default world part axis.

True Position

This is used for true position call-outs. This type of reporting is most commonly used in connection with inspecting holes. When this box is checked, the 3D deviation item, on the Analysis report, will display the diameter, rather than the radius of the error.

Append Report

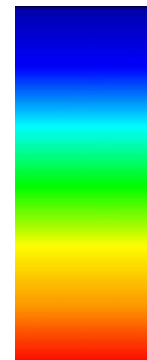
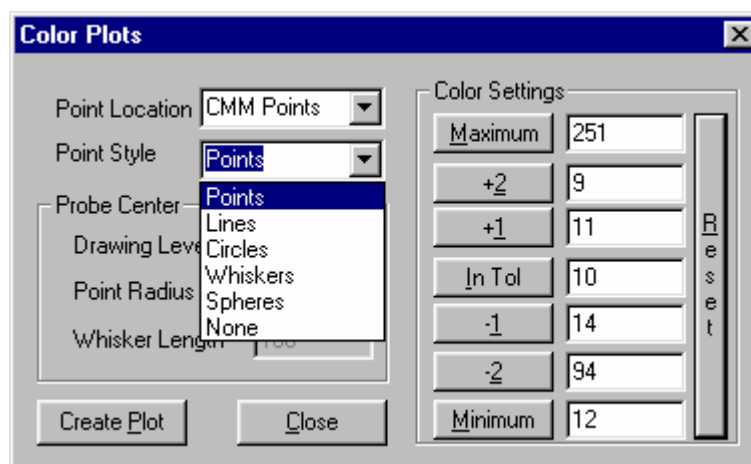
When you click the **Create Report** button, the **Save As** dialog box is displayed.



If **Append Report** is checked, you can add the new report to the end of an existing report by clicking a file with the PRN extension and clicking **Save**.

Color Plots Button

Selecting this button will cause Verisurf to display the **Color Plot** dialog seen below. Color Plots provide an accurate detailed map of where your data deviates from the CAD model. Verisurf uses a graduated color scale



to represent the magnitude of deviation.

Displaying a Color Plot

You may display a color plot at any time after you have completed an analysis. Verisurf will create points in your CAD system that represent the projected points in the project file. These points will be color-coded to represent their degree of deviation from nominal, as measured by Verisurf.

Color Plot Legend

After creating the color plot you will be prompted to create a legend. This legend indicates which deviations the different colors represent.

You can place the legend manually in your drawing by sketching a rectangle. This allows you to visually control the size and placement of the legend to obtain the best effect.

Changing the Point Markers

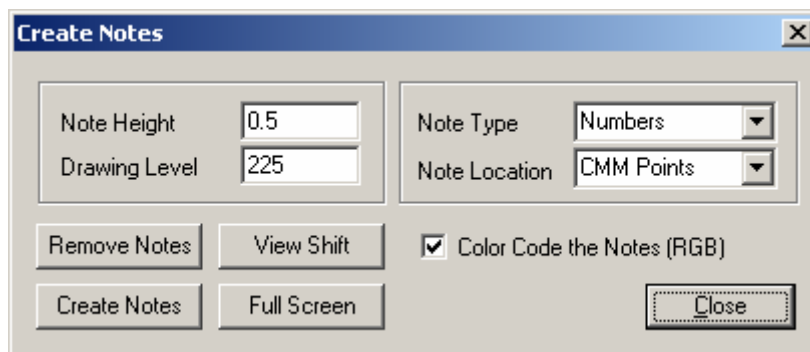
Verisurf normally displays color plot data with Design point entities. The **Point Style** list box also allows the specification of **Lines**, **Circles**, **Whiskers**, **Spheres** and **None**.

These point entities remain the same size on the screen regardless of the screen scale. This can cause some Color Plots to become crowded and unintelligible if you zoom out too far.

Tip: You may wish to erase all of the existing points or put them on an inactive drawing level, before printing a Color Plot.

Create Notes Button

Selecting this button will cause Verisurf to display the **Create Notes** dialog box as seen below. This feature creates notes that identify the CMM data with either the number of the CMM point (or note) or the deviation of the point. There are several options for this feature.



Note Height

You may specify the height of the notes to create. Place a value in the **Note Height** box and the notes will be created with this height.

Drawing Level

You may specify the Design drawing level on which to create the notes. This allows you to separate the notes from the rest of the CAD drawing.

Note Type

You may specify the type of notes to create. Select **Numbers**, **Errors** or **Both**, to display Numbers and Errors.

Note Location

You may also specify where to position the notes. Select this button to position the notes at the **CMM**, **Actual** or the **Projected** (nominal) points.

Color Code

Selecting this option will cause Verisurf to “color code” the notes that this feature creates. The color scheme is the standard for Verisurf. Good points are GREEN, Bad points are BLUE for too high and RED for too low.

If this option is not selected the Verisurf will create the all notes using the active main drawing color.

Create Notes Button

Selecting this button will cause Verisurf to generate the notes according to the latest analysis and other settings described above.

Remove Notes Button

This feature will delete all of the created notes in the database.

View Shift Button

Notes are normally created in the current graphics view, or gview. Often, it is desirable to change the graphics view to get an unobstructed view of the geometry and CMM data. **View Shift** will convert the view of all note entities in the database to place them into the current graphics view.

View Shift will resize all notes to the current value of the **Note Height** setting.

Full-Screen Button

When placing notes on your drawing using the **Create Notes** function, you may wish to change the graphics view, the note height, or the colors of the created note entities.

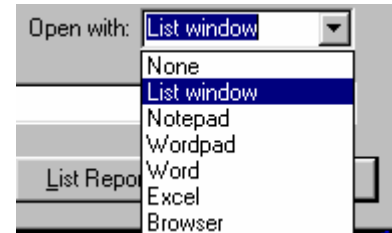
This feature will hide the dialog menu and give you an unobstructed view of the screen so that you can judge the placement and orientation of the created notes.

Open with:

Verisurf reports can be opened with a variety of Windows applications. Click the **Open with** arrow to display a list of programs.

Opening Existing Reports

Select a program and then click the **List Report** button. Navigate your directory structure to find a report. The report you select will be opened with the specified application.



Reports that have been created with the HTML format can be opened with a browser, Microsoft® Word® or Excel®. The Office 2000, or later, versions of these programs are required to open HTML reports.

Using Open With to Create a New Report

Select the program that will open your report before you click the **Create Report** button. The report will then be displayed by the selected application. Use only Microsoft® Office 2000®, or later, versions of Word® and Excel® to open HTML reports.

Analysis Utilities

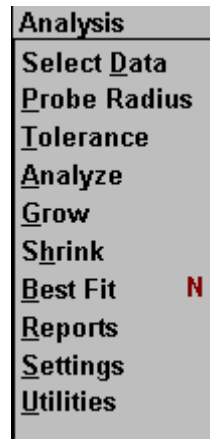
The **Analysis Utilities** menu contains various features that were developed to perform individual functions. These functions are not necessarily related to the actual analysis functions of Verisurf. These are however quite useful in setting up and adjusting your CAD model and CMM data set.

Shift Points

Shift Points (Shift Notes) translates all visible CMM points and/or notes using the Best Fit offset to a new location. This utility physically moves all of the visible points in the CAD system.

Whether this function shifts points or notes depend on the **Auto-Select Settings**. Whichever data type is selected for CMM data on the **Auto-Select Settings** dialog box is the default for this function.

Be sure that you have turned on all drawing levels that contain points or notes that you want to shift. Conversely, be sure that



you have turned off all drawing levels that contain points or notes that you don't want to shift.

When you select this function, you will be prompted: "Shift all visible points?" or "Shift all visible notes?" If you select **Yes**, all of the visible points or notes will be shifted. If you select **No**, you will have the opportunity to manually select points and notes from the screen. In this manner, you can shift both points and notes at the same time. Usually, you are working with either points or notes and the automatic selection is appropriate.

Shift Device

Shift Device converts the Best-Fit Offsets into a transformation matrix and stores a drafting note in the database with the appropriate information.

This note is created in a "blanked" state. That is to say that it will not appear on the graphics screen, but is stored with the geometry the next time you save it.

New Position

New Position prompts you to pick a point on the screen and then reports the XYZ values plus what the XYZ values are after translating the point using the current Best Fit offset. You may continue this function by picking another point. When you are done, hit the ESC key. The file tball.doc will appear on your screen. Click the Windows close box to exit the file.

Tip: All of the values that were displayed during this function have been stored in a file called Tball.doc along with the current Best-Fit offset. You may view or edit this file to suit your needs. This file is overwritten the next time you select **New Position**.

Verify Point

This function provides a method of measuring the 3D distance from a point to a surface or curve, one point at a time. The current probe-radius and Best-Fit offsets will be applied to each calculation performed by this function.

How it works:

- Select the **Verify Point** option, in the **Utilities** menu.
- Pick a point or note.
- Pick a surface or a curve.
- View the results on the status bar.
- Continue picking or press ESC to end.
- After pressing ESC, the file Veripnt.doc will be displayed. Click the Windows close box to exit this file.

All of the values that were displayed during this function and the current Best Fit offset have been stored in a file called Veripnt.doc. You may view or edit this file to suit your needs. This file is overwritten the next time you select **Verify Point**.

Sys Reset

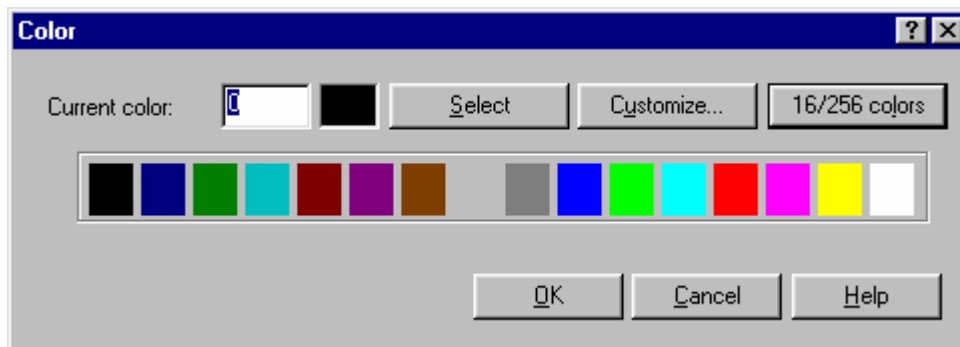
This function resets all Verisurf system variables to the system default condition. Verisurf uses this function internally whenever you load a new project file.

Flags

Verisurf can show you where the worst two points in the data set are located. These include the point that has the minimum deviation and the point that has the maximum deviation. When you select this feature Verisurf reads the current project file, finds the two worst points, and draws “flags” at the point locations. The point with the minimum deviation has a flag that is red. The point with the maximum deviation has a flag that is blue. These flags are line entities in the database and may be deleted, moved to another layer, or have any standard Design function performed on them.

Background

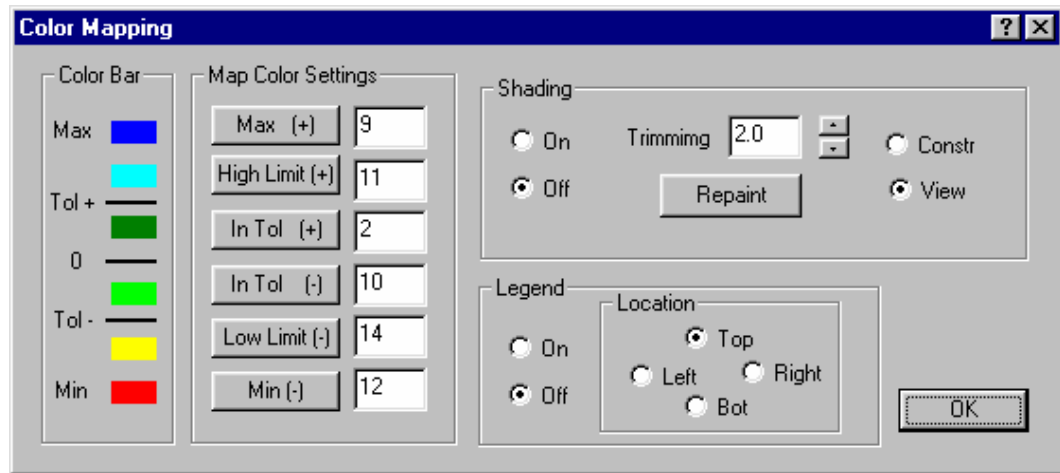
By default, geometry and Analysis information is displayed on a black background. After selecting the **Background** command, the **Color**



Dialog box is displayed. The simplest way to change the background color is to click one of the sixteen colors that are displayed and then click **OK**. To display a larger selection of colors, click the **Customize** or **16/256 colors** buttons. Use the **Select** button.

The **Select** button is used to select the color of an item on the graphics screen as the new background color. Click **Select**, click an entity with the new desired background color and click **OK**. This will cause the selected item to become invisible.

Color Map



Color Map Settings

The colors used to indicate which points are above, below or within tolerance can be customized by clicking on one of the buttons in the **Color Map Settings** group. You could then select one of the sixteen colors provided and click **OK**. To select from up to 256 colors, click the **16/256** button. The Customize button lets you create your own colors by varying the relative proportions of red, blue and green.

Note: To view any changes made to the Color Mapping, click the **Repaint** button.

Legend

Verisurf can display a legend, on the Analysis screen and in reports, that assists the viewer in interpreting the meaning of the colors used to display points and lines.

Click the **On** button, in the **Legend** group, to display a legend on the graphics screen. Position the legend with one of the buttons in the **Location** group.

Shading

Shading colors the space between the points with a blend of the colors that best describe its location above or below. Space between points that are too close to tolerance to be red and too far away from tolerance to be yellow, will be represented by orange, a blend of yellow and red.

Trimming

Trimming controls the amount of shaded color that is displayed between the points. When the points are farther apart, a higher trimming setting will be required to fully shade the space between the points.

Constr and View

This control refers how the geometry will be oriented at the time when the shading is applied. Select **Constru** to triangulate the CMM from the perspective of Design's current construction view. The **View** option shades the geometry according to its orientation on your screen.

Repaint

After you make any changes in the **Color Mapping** setting, you must click **Repaint** to view the result.