Alignments

There are several types of alignments.

Standard Alignment

3d Best Fit Alignment

RPS Alignment

P6 Alignment

Alignments

In order for an alignment to be valid it must restrain all 6 degrees of freedom.

Translational Freedom	Rotational Freedom
1. Along X Axis	4. Around X Axis
2. Along Y Axis	5. Around Y Axis
3. Along Z Axis	6. Around Z Axis

Alignments

The simplest example of restraining the 6 degrees of freedom is the 3-2-1 rule.

A 3 point feature (typically a plane) is used to restrain 2 degrees of rotational freedom and one degree of translational freedom.

A 2 point feature (typically a line) is used to restrain one degree of rotational freedom and one degree of translational freedom.

A 1 point feature (typically a hole) is used to restrain the last degree of rotational freedom and one degree of translational freedom.

Alignments are typically used for 2 reasons.

1. To tell Calypso where your part is located.
2. To set alignment of coordinates for evaluating a measurement.

Calypso will navigate relative to your base alignment.

There are 4 options for creating a Base Alignment.

1. Standard Method
2. RPS Method
3. 3D Best Fit Method
4. P6 Method

Alignments

Standard Method

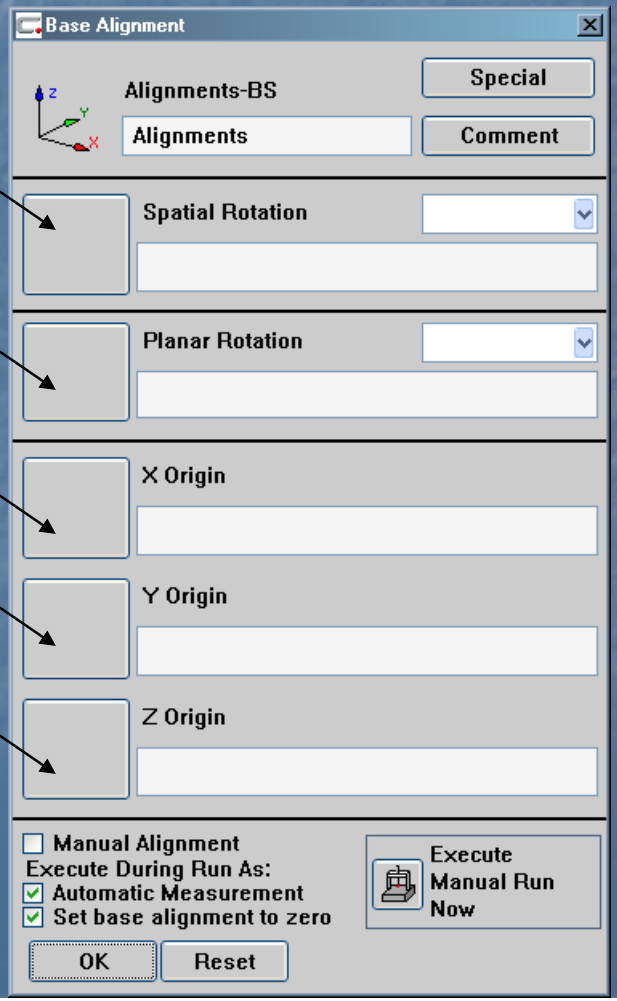
Constrains 2 degrees of rotational freedom

Constrains 1 degrees of rotational freedom

Constrains 1 degrees of Translational freedom

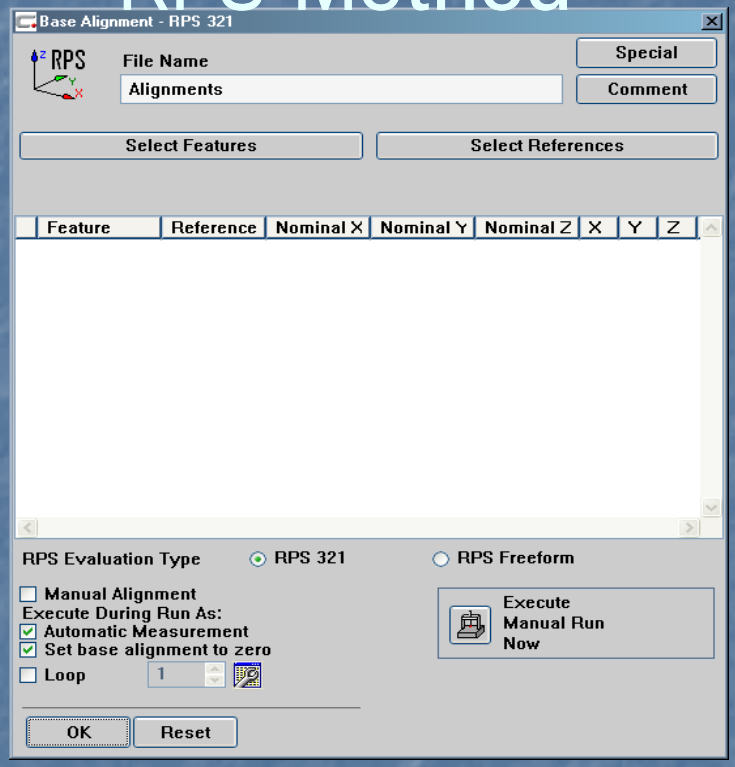
Constrains 1 degrees of Translational freedom

Constrains 1 degrees of Translational freedom



Alignments

RPS Method

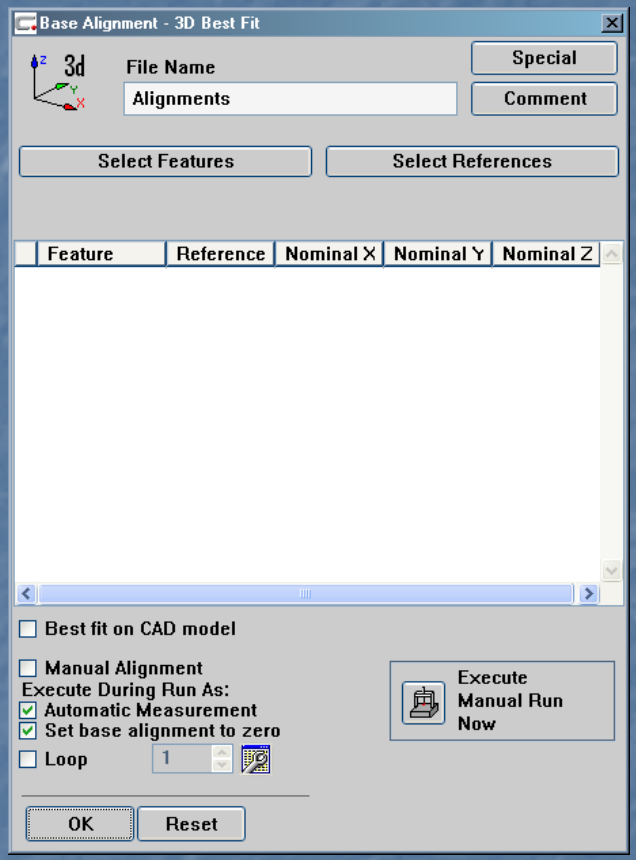


An RPS alignment will require 6 single point features. 3 features will restrain one direction, 2 will restrain another and 1 will restrain the last direction

In this way none of the alignment features will conflict with another they represent an exact nominal location/orientation on your work piece that other measurements will be taken from.

Alignments

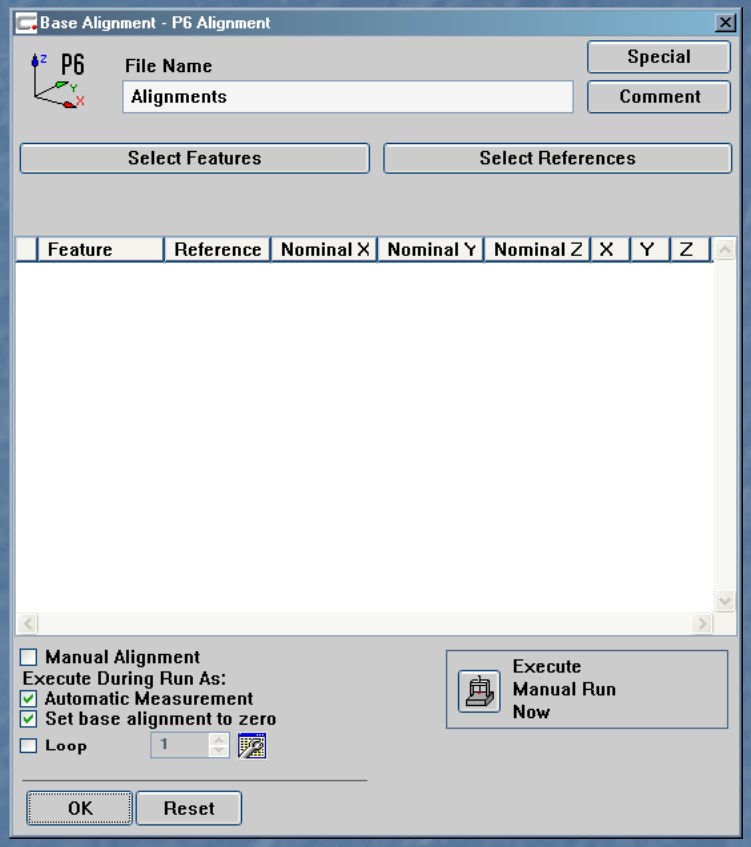
3D Best Fit Method



A 3d best fit requires a series of single point features which may conflict with each other in order to find a best fit averaging alignment

Alignments

P6 Method



A P6 alignment is an alignment that must have only 3 single point features. A common example of this alignment is tooling balls. Often a fixture will have a set of 3 tooling balls with offset coordinates so the fixture may be aligned from them.

Navigation

Calypso navigates around your part and to each feature relative to the base alignment.

This means that when choosing your alignment features you should consider how stable the location and orientation of your features will be.

You should also make your evaluation of these features as stable as possible so your measurement strategy will be more consistent.

Navigation

There are 2 ways to make an alignment more stable.

1. Select evaluation settings that provide the best repeatability.

2. Loop the Base alignment to control the Delta value of your Base Alignment.

Evaluation Settings

In most situations the feature evaluation settings should be LSQ.

Filter and outlier elimination should be normal to your process.

These settings will produce the most consistency in your base alignment.

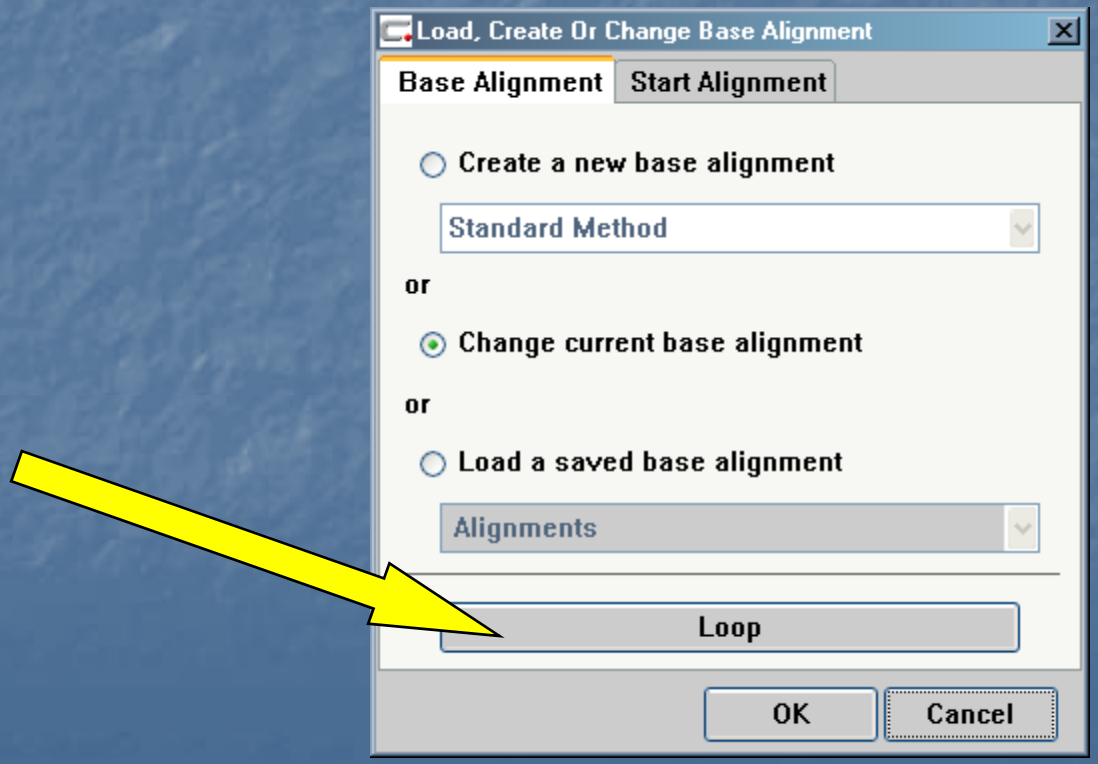
Delta Value

The Delta value is a measurement of how much your coordinate system has shifted from one measurement of the base alignment to the next.

This shift is the result of data points being taken in slightly different locations each time your alignment is looped.

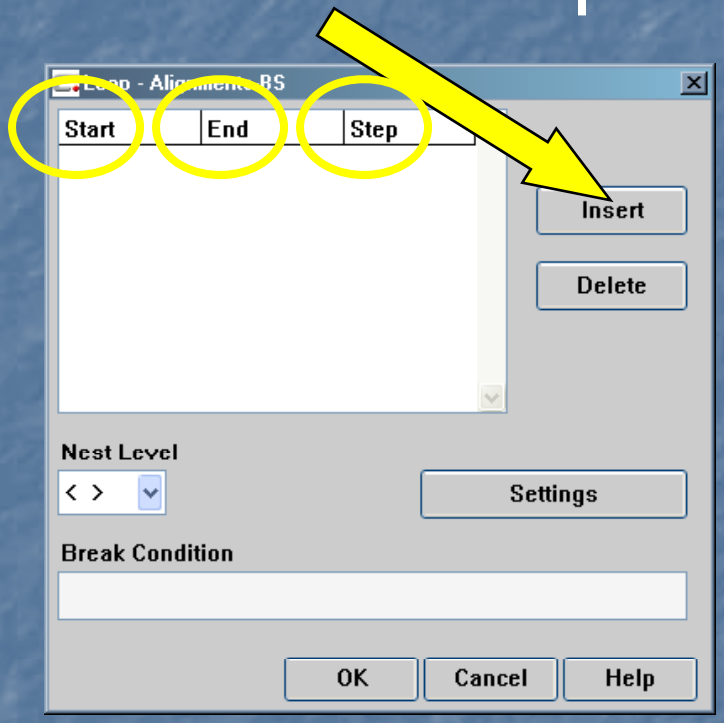
Delta Value

To loop your base alignment simply select the loop option from the appropriate window.



Delta Value

Insert a loop



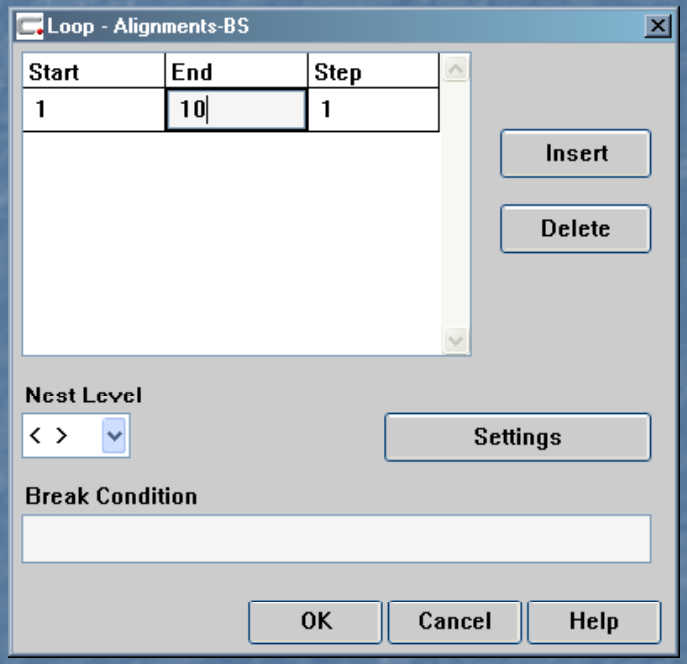
The start value is step where the loop will begin.

The end value is step where the loop will end and your program will continue.

The step value defines how many iterations each loop cycle will represent.

Delta Value

Define loop parameters



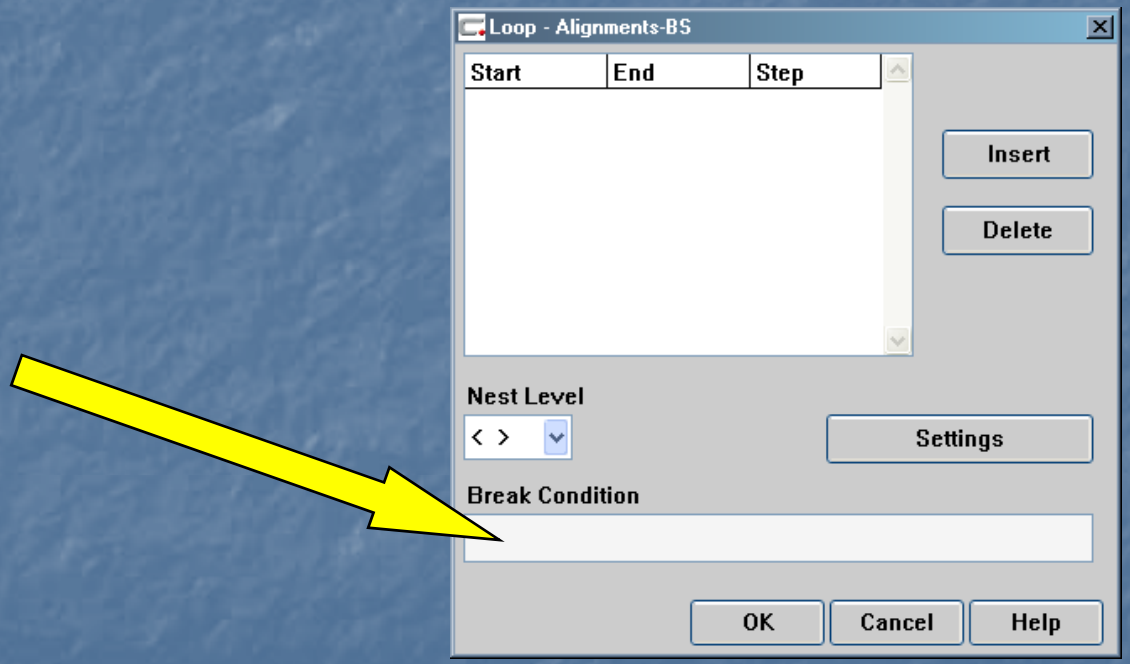
In this example the base alignment will loop 10 times. The loop will begin at 1 and end at 10 and each cycle of the loop will only represent one Iteration.

If the step where changed to 2 the base alignment would loop 5 times because each cycle of the loop would represent 2 iterations.

Delta Value

Break Condition

A break condition is a way of telling calypso that once a certain condition is met the loop can be stopped and the program can continue.

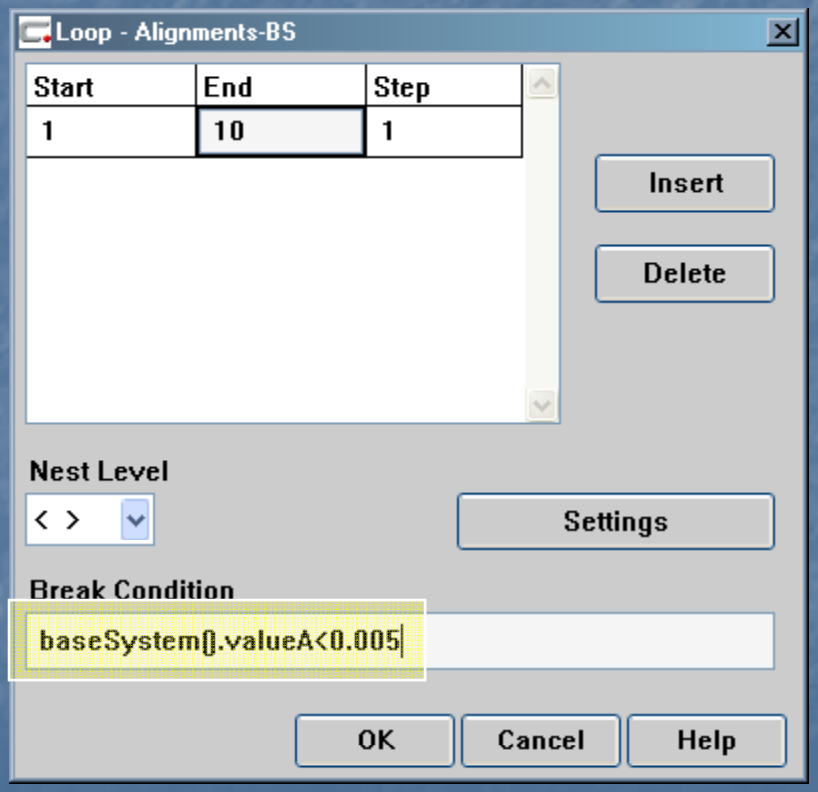


In order to set the break condition of a base alignment loop relative to the delta value a formula must be used.

Delta Value

Break Condition

baseSystem().valueA<0.005

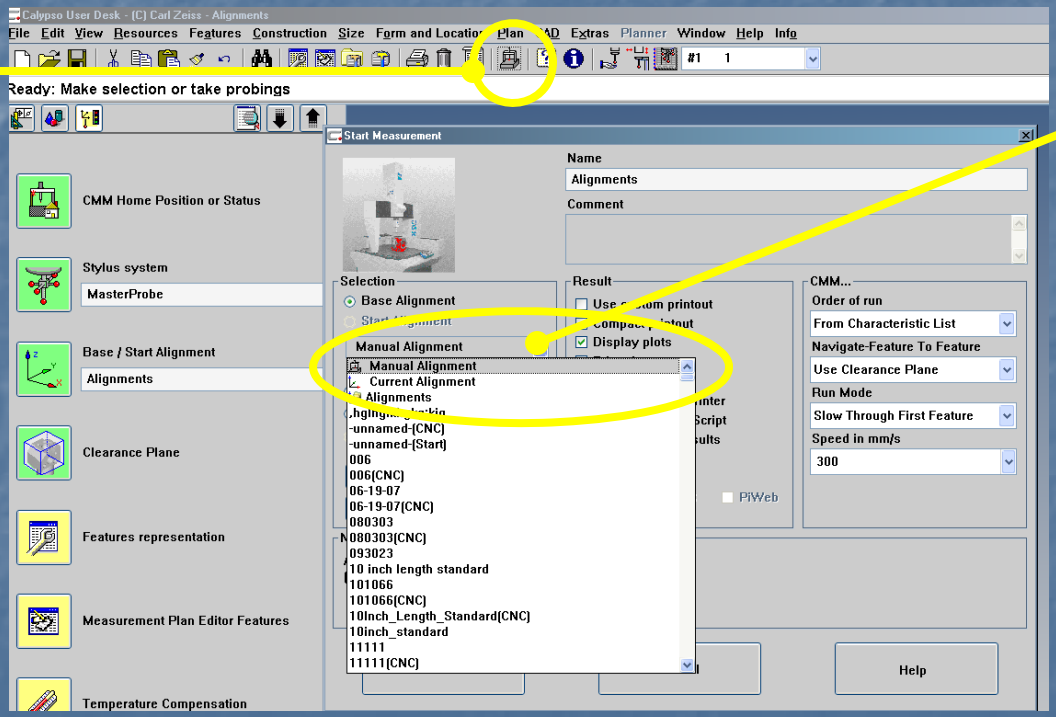


This formula tells Calypso that the loop may be stopped when the Base Alignment *"baseSystem()."* Delta Value *"valueA"* is less than 0.005

Locating the Work Piece

Now that you have defined a base alignment you still need to tell calypso where your part is located relative to your machine coordinates

Select “Start CNC Run”



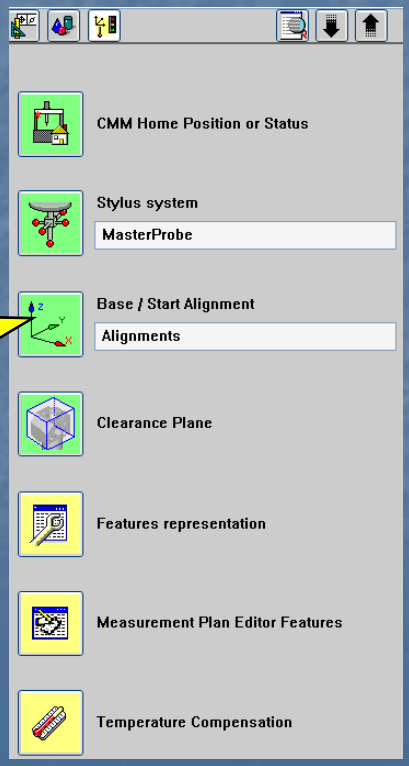
Select “Manual Alignment” from the drop down window.

You will now be prompted to take a series of points on your part to identify the location of your base alignment features.

Start Alignment

Some times a Base Alignment will contain many feature that are time consuming to measure manually. In order to save time during a manual alignment you may find it useful to create a “Start Alignment”. This is especially useful if you will be measuring your part in different locations on your CMM since each time the part is moved a manual alignment must be completed.

To create a Start Alignment click on the “Define Base or Start Alignment” button located on the Resources screen

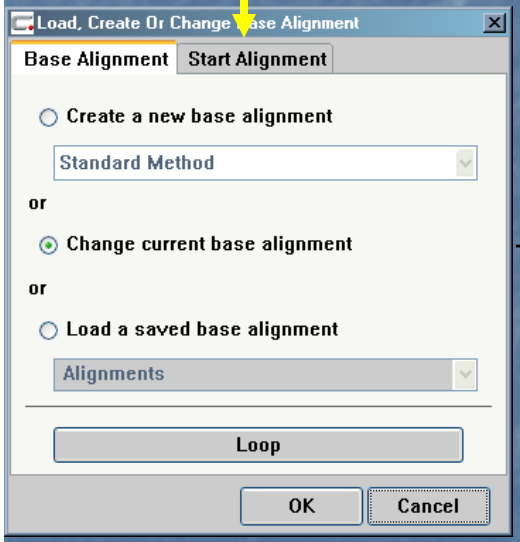


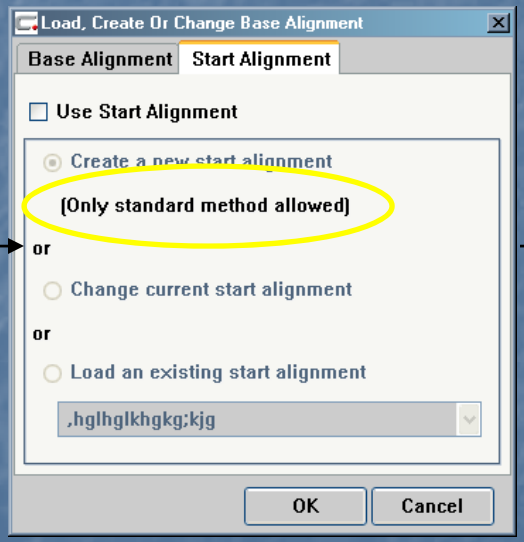
Start Alignment

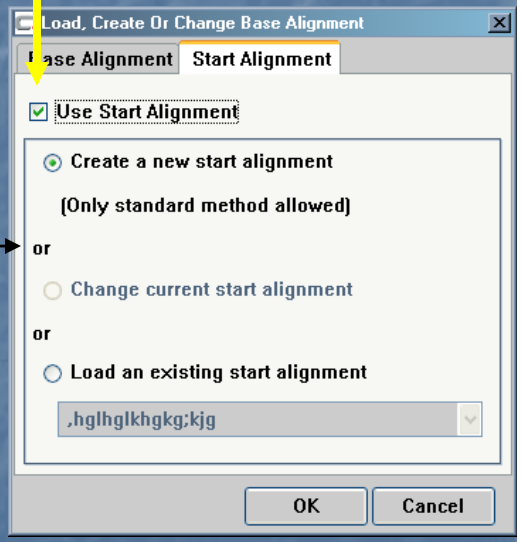
Click on the Start Alignment tab on the Load, Create or Change Base Alignment Window

Notice that only the Standard Method is available as an option for the Start Alignment

Check the box for Use Start Alignment and click ok







Start Alignment

Fill in the features for the Start Alignment making sure that all six degrees of freedom are accounted for. You should use any features you want but it should simplify the manual alignment process.

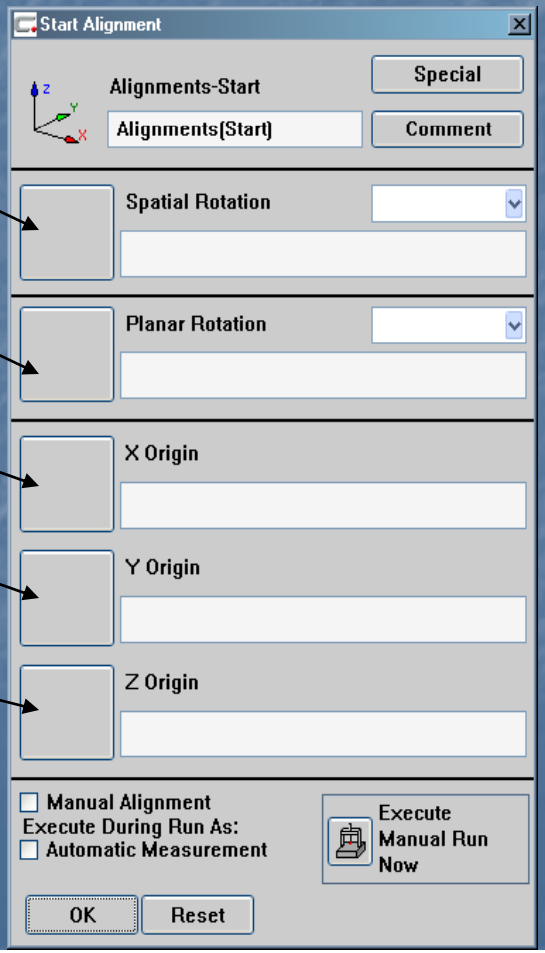
Constrains 2 degrees of rotational freedom

Constrains 1 degrees of rotational freedom

Constrains 1 degrees of Translational freedom

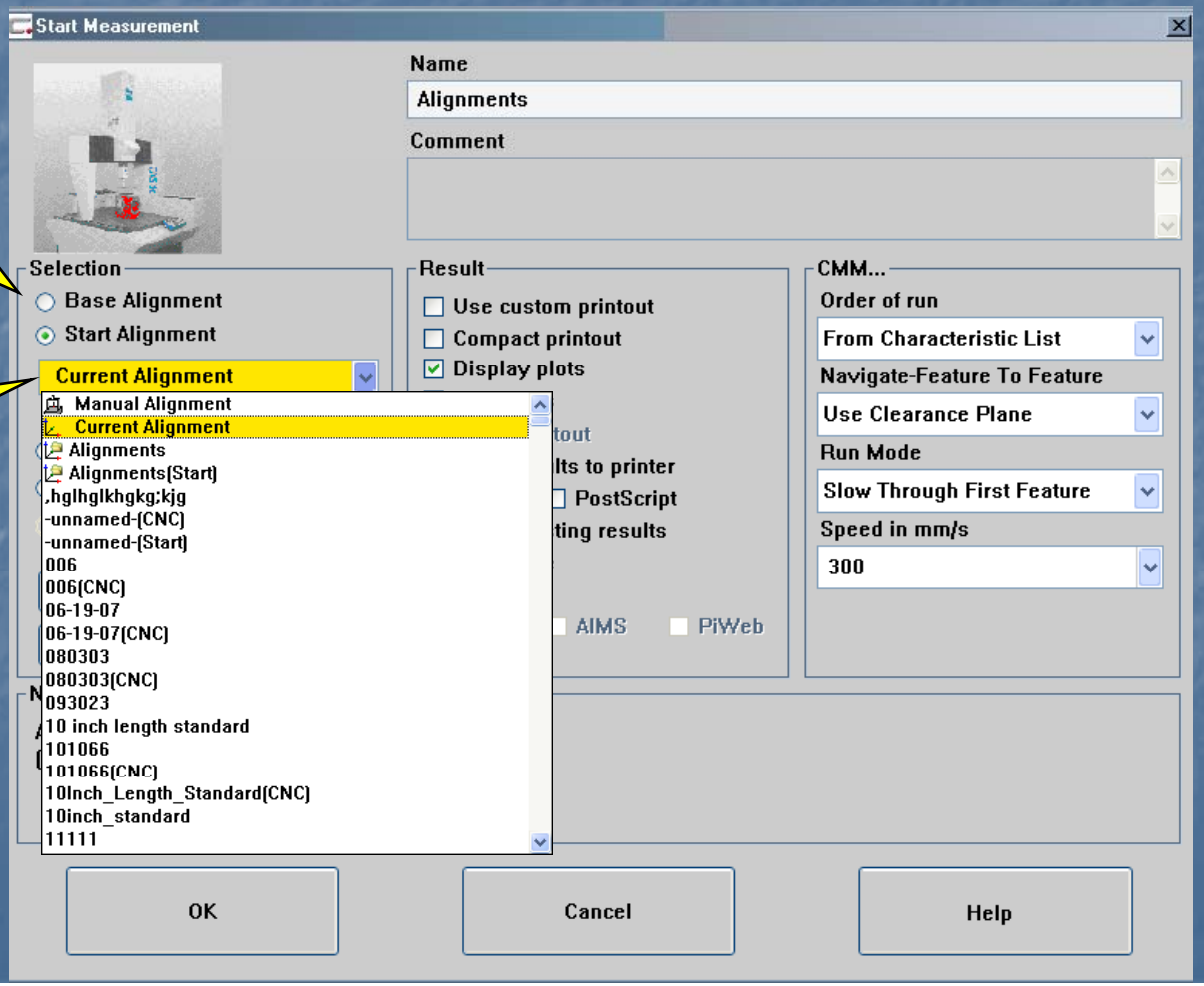
Constrains 1 degrees of Translational freedom

Constrains 1 degrees of Translational freedom



Start Alignment

Now that you have a start alignment created when you run your program select “Start Alignment” under the Selection option.



Now when you select Manual Alignment it will prompt you to probe the start alignment features not the base alignment features

Type of Alignment Runs

A note on running different types of alignments:

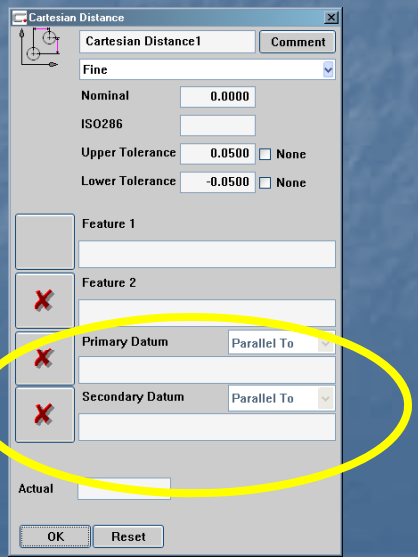
Typically there are 5 alignment choices to choose from: "Manual Alignment"," Current Alignment“ , "Program Name“ ,"Program Name (CNC) ","Program Name (Start)". If you choose the manual alignment you must manually probe the alignment features on the part before the program will align the part. If you choose the Current Alignment the program does not align the part assuming the last alignment that was completed. If you choose the Program Name the part is aligned based on the last time a manual alignment was completed. If you choose the Program name with (CNC) the program will begin the alignment based on the last CNC alignment. If you choose the Program Name with (Start) the program will begin the alignment from the last time a Start Manual alignment was completed.

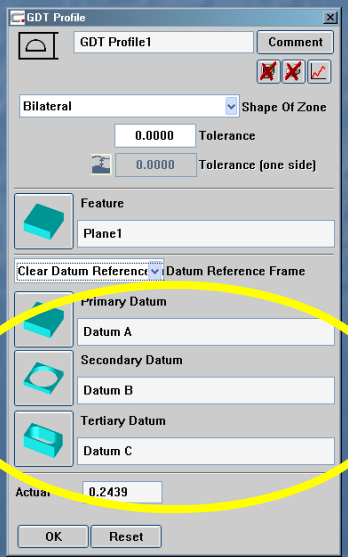
Alternate Alignment

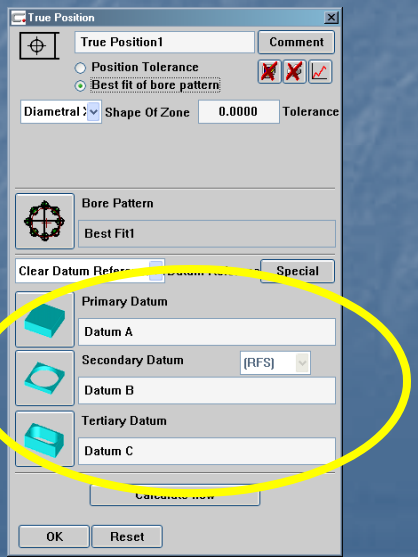
The other main reason for using alignments is evaluation.

Since the base alignment is best defined using non functional evaluation methods (LSQ), If an Alignment is needed for evaluation it is best to use an alternate alignment that will represent the functional evaluation of features.

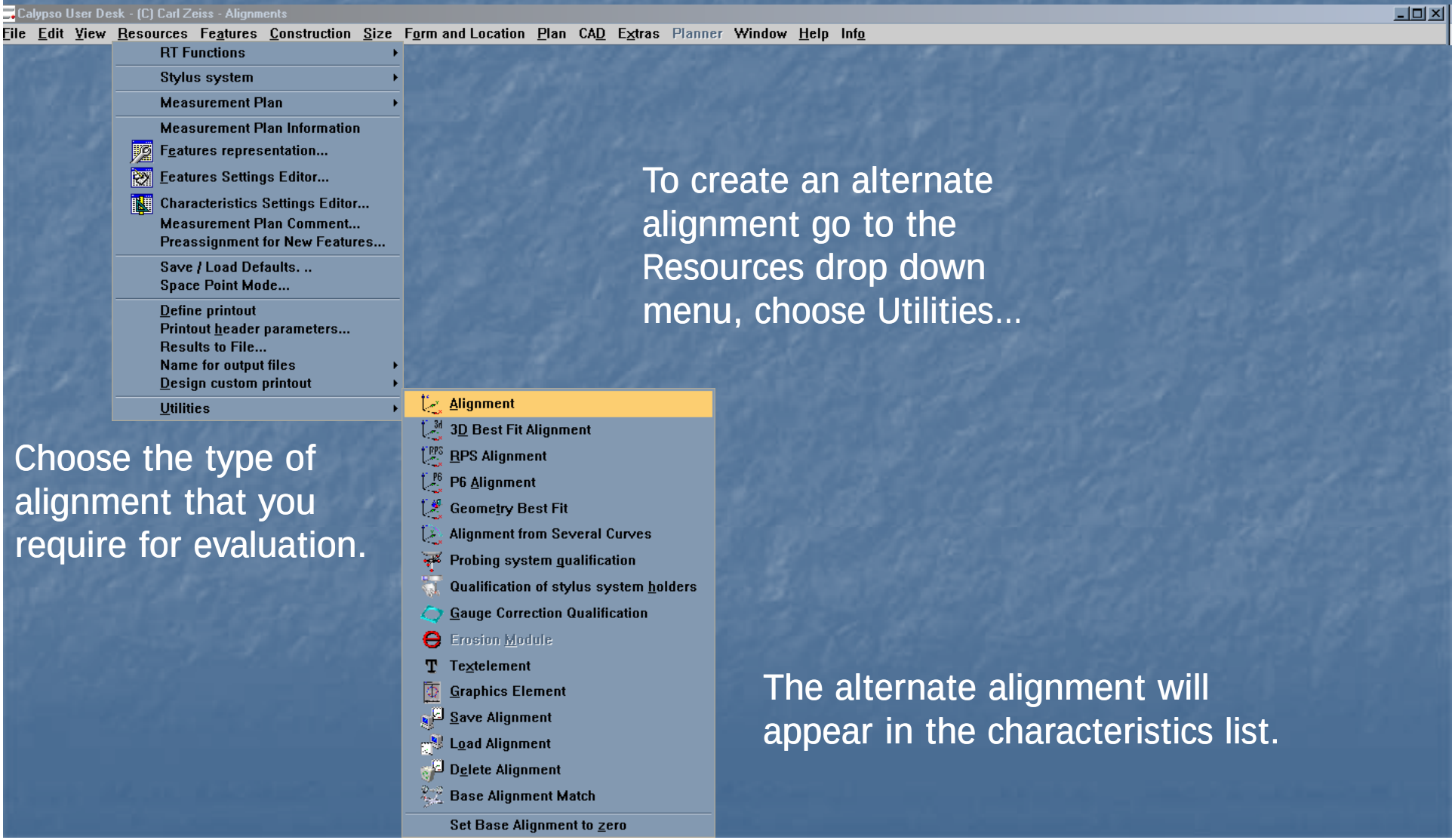
It should be noted that most of the time it is not necessary to use an alternate alignment for evaluation as control frames can be established in many of the characteristics themselves.







Alternate Alignment



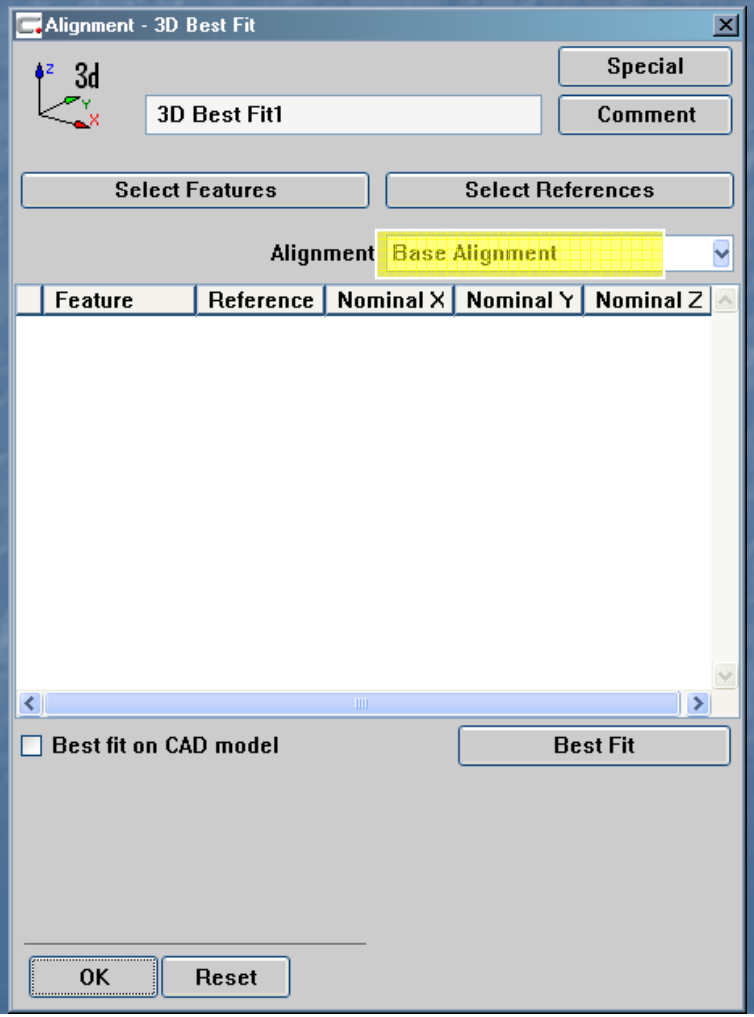
To create an alternate alignment go to the Resources drop down menu, choose Utilities...

Choose the type of alignment that you require for evaluation.

The alternate alignment will appear in the characteristics list.

Alternate Alignment

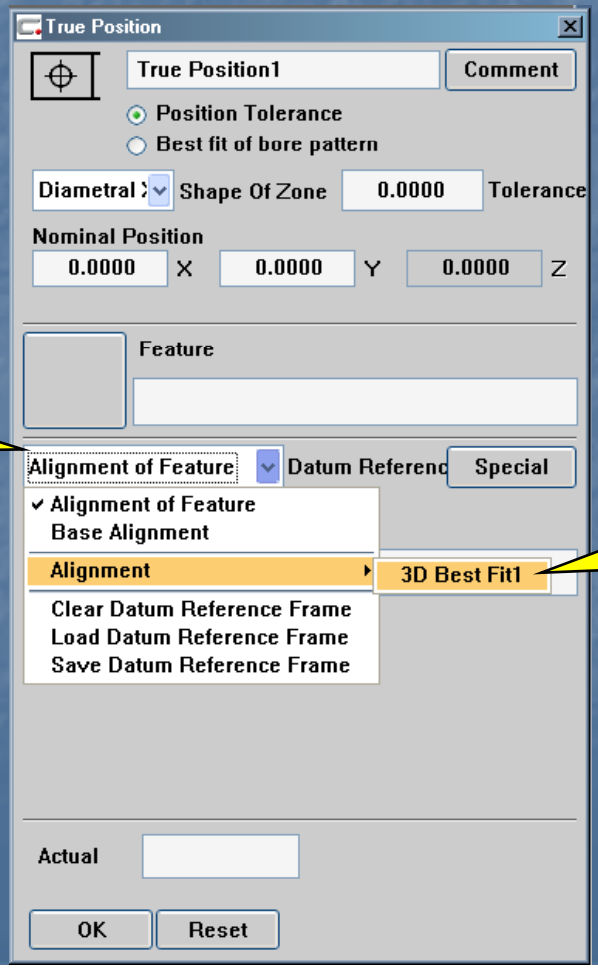
Alternate alignments will reference the base alignment so it is not necessary to restrain all 6 degrees of freedom



Alternate Alignment

After your alignment is set up you can use it as the alignment in your characteristics

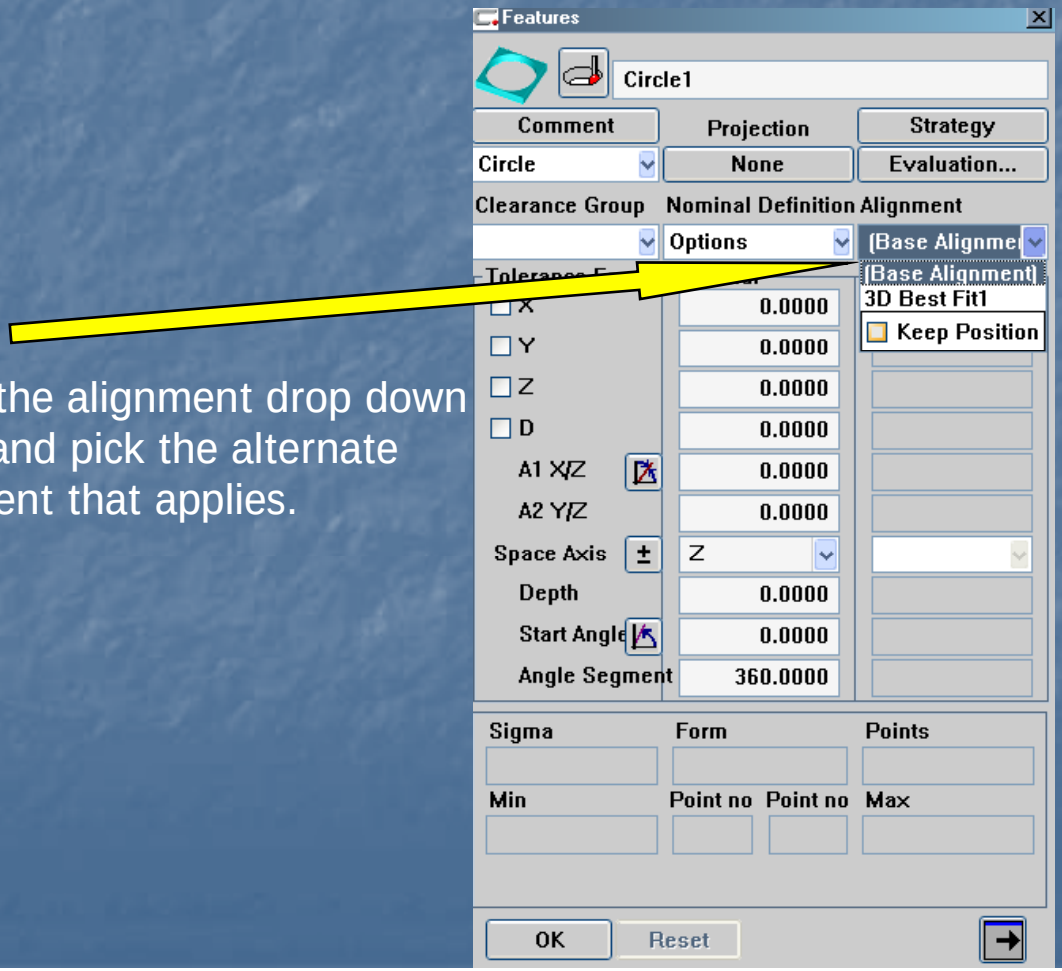
Select the alignment drop down menu



Choose your alignment from the alignments available.

Alternate Alignment

Additionally for call outs such as X/Y/Z value or projection angle you can select the alternate alignment within the feature



Select the alignment drop down menu and pick the alternate alignment that applies.

Note: changing a features alignment will cause the navigation and measurement strategy of that feature to now be relative to your alternate alignment instead of your base alignment.

Navigation with Alternate Alignments

Sometimes it is not practical to measure all features of your part relative to the Base Alignment.

This is especially true when there is limited probing area, limited probing clearance or when a part is produced in multiple stages with multiple setups.

To help with this situation alternate alignments can be setup to “Re-Center” your measurement strategy so programs will run more smoothly and be less prone to crash when there is little probe clearance

Patterns with Alternate Alignments

Simple Alternate Alignments can also be created to copy patterns of features and make programming easier and more efficient.

Step 1: Create the original pattern of features. Be sure to complete measurement strategy, clearance data, stylus data and all other aspects of the feature that can be copied to the patterns of features.

Step 2: Create an alternate alignment using one of the features from the pattern.

Step 3: Copy/paste the features in the pattern and set the alignment to the new alternate alignment.

Step 4: Copy/paste the features in the pattern and set the alignment to the new alternate alignment.

Step 5: Move the alignment feature to the correct location and notice that all of the other features will move with it. Once the pattern is in the correct location change the alignment of the features back to the base alignment.