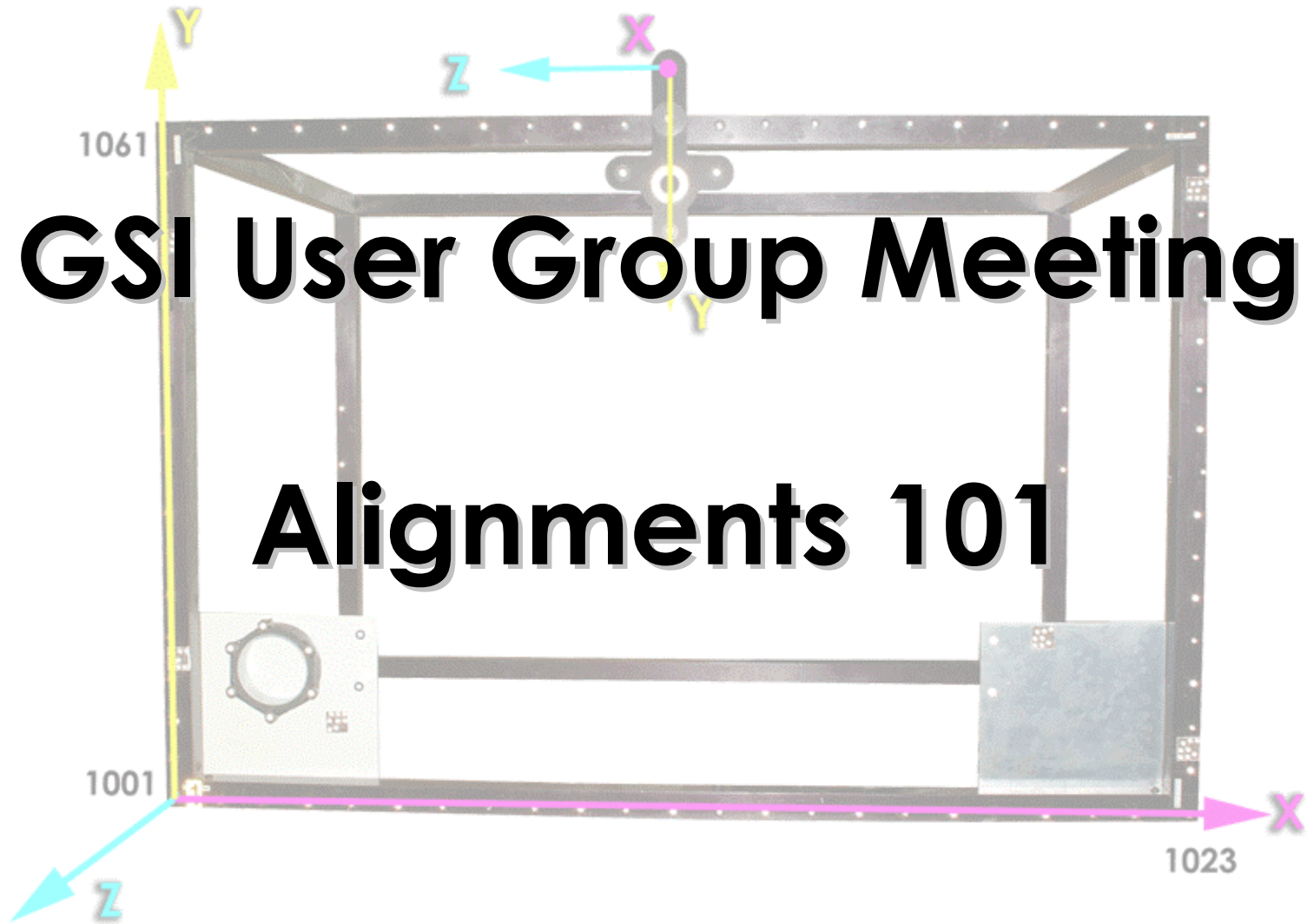


GSI User Group Meeting

Alignments 101



Basic Definitions

- Axis alignment
- Quick
- Standard
- File
- Manual

Axis Alignment

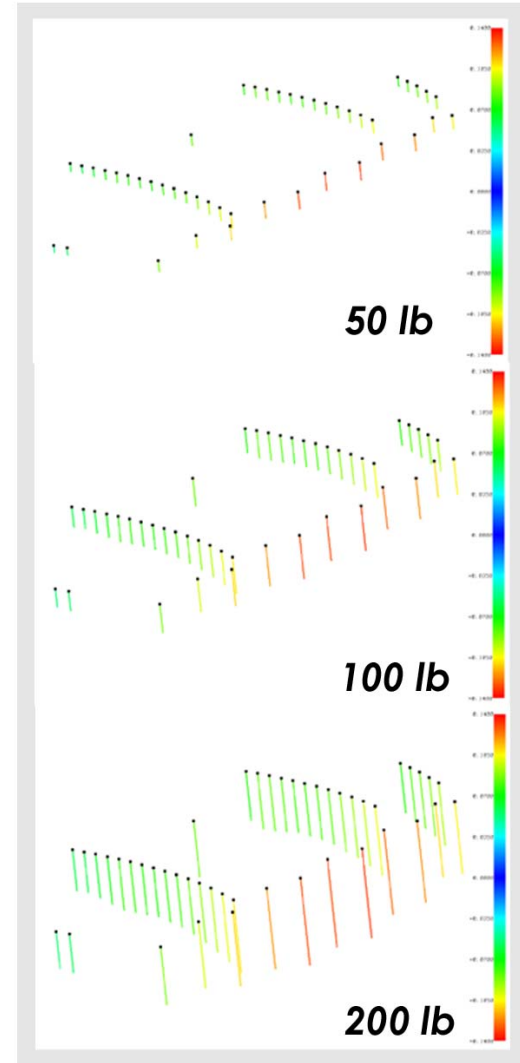
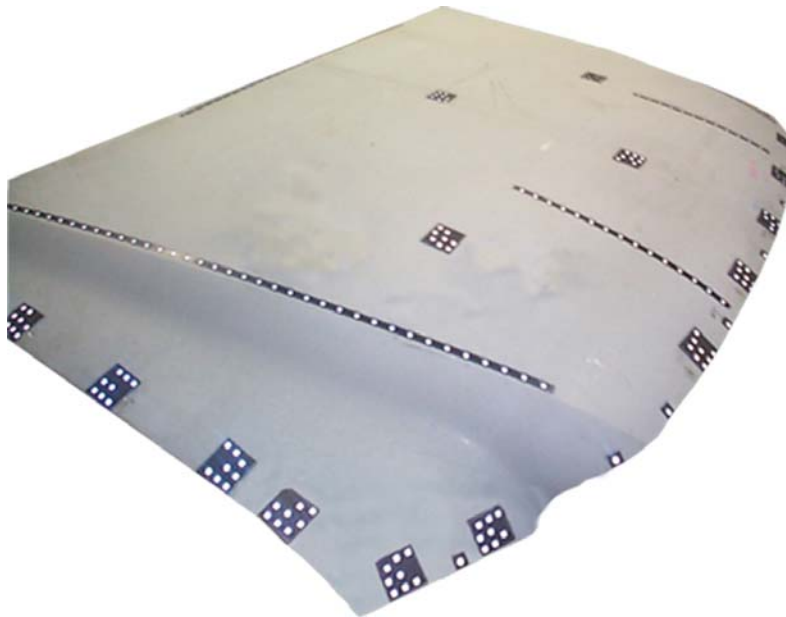
- Exactly aligns three specified points with the coordinate axes.
- Also called 321 alignment or Point-Line-Plane alignment.
- Coordinate system defined by Anchor point, Axis Point & Plane Point.

Quick Alignment

- Uses all common points “Design” & “Measured” folders.
- Commonly used when all control (i.e. “Design”) points are considered equally accurate.
- Example, previously established tooling points are used to define coordinate system.
- “Quick” gets its name because operator is required to do very little.

Quick Alignment

- Useful when best possible comparison between two sets of measurements is desired, for example deformation studies.



Standard Alignment

- The most powerful
 - provides greatest control, but
 - involves more work to setup.
- Use when control points are of unequal accuracy.
- Example: when alignment data exists that may only be accurate in one or two directions.

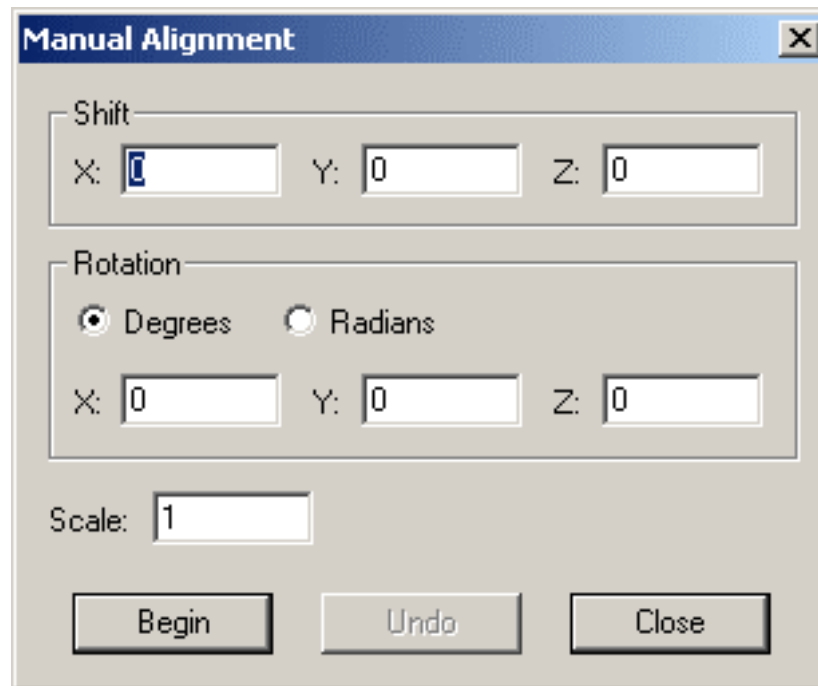
File Alignment

("Align to File")

- File - Transformations based on imported transformation parameters.
- Currently support CATS, HOLOS & GSI formats.

Manual Alignment

- Manual - Transformations based on manual shifting, rotation and scaling of the data.



The image shows a software dialog box titled "Manual Alignment". It contains three main sections: "Shift", "Rotation", and "Scale".

- Shift:** Three input fields for X, Y, and Z coordinates. The X field contains the letter 'C', while Y and Z contain '0'.
- Rotation:** Two radio buttons for "Degrees" (selected) and "Radians". Below them are three input fields for X, Y, and Z rotation angles, all containing '0'.
- Scale:** A single input field containing the value '1'.

At the bottom of the dialog are three buttons: "Begin", "Undo", and "Close".

Rigid Body Alignments

- Quick & Standard are so-called "rigid-body" transformations. (allow up to seven parameters to be adjusted).
- Three translations (X, Y & Z), three rotations (one about each axis) & scale
- Definition: does not allow shape of object to change.

General Definition

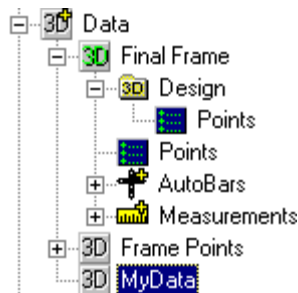
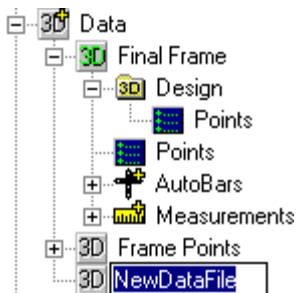
- “Measured” points are transformed into desired coordinate system using the “Design” data.

Design Data

- V-STARS 4.0 introduced design data concept.
- Design data sometimes represents engineering nominal values.
- Facilitates automation of alignment. The alignment is run automatically after the bundle.
- In addition, differences are automatically computed and viewed.

Creating Design Data

- Cannot edit directly (read-only).
- Methods of creation
- Create (and edit) (example)
- Importing Data from a File (example)
 - XYZ file format



Point Label	X	Y	Z	Sigma X	Sigma Y	Sigma Z	Offset
NEWPOINT	0.000	0.000	0.000	FIXED	FIXED	FIXED	0.000

Point Label	X	Y	Z	Sigma X	Sigma Y	Sigma Z	Offset
NEWPOINT	1.000	1.000	2.000	FIXED	FIXED	FIXED	0.000
NEWPOINT1	1.500	1.500	2.75	FIXED	FIXED	FIXED	0.000

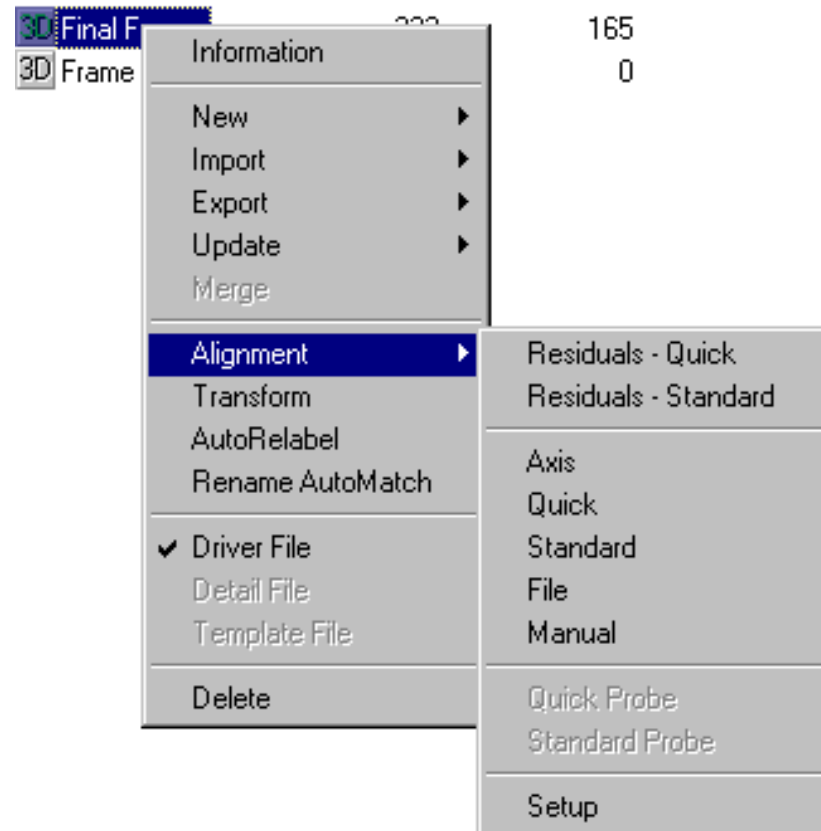
Driver File with Design Points

- Prevents loss of measured points.
- Copied to design folder of newly bundled file.
- Automatic coordinate transformation (standard) takes place after the Bundle is run.

Alignment Options

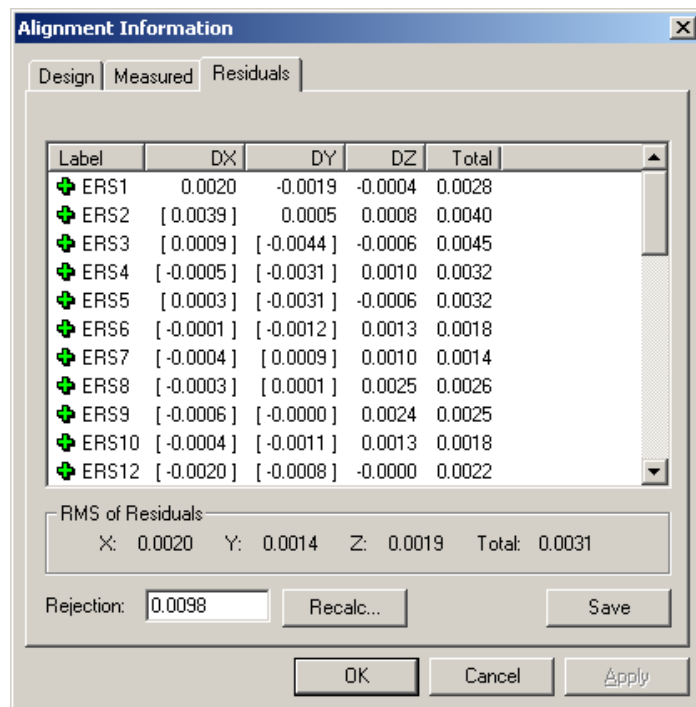
(right mouse click)

- Residuals Quick/Standard (new)
- Axis
- Quick
- Standard
- File (new)
- Manual (new)
- Setup



Residuals Quick/Standard

- Display usual residuals dialog.
- However, Residuals - Standard now recreates Standard Alignment condition.
- Re-evaluation is possible by typing new rejection value, but results ARE NOT changed.
- Save button added.



Label	DX	DY	DZ	Total
ERS1	0.0020	-0.0019	-0.0004	0.0028
ERS2	[0.0039]	0.0005	0.0008	0.0040
ERS3	[0.0009]	[-0.0044]	-0.0006	0.0045
ERS4	[-0.0005]	[-0.0031]	0.0010	0.0032
ERS5	[0.0003]	[-0.0031]	-0.0006	0.0032
ERS6	[-0.0001]	[-0.0012]	0.0013	0.0018
ERS7	[-0.0004]	[0.0009]	0.0010	0.0014
ERS8	[-0.0003]	[0.0001]	0.0025	0.0026
ERS9	[-0.0006]	[-0.0000]	0.0024	0.0025
ERS10	[-0.0004]	[-0.0011]	0.0013	0.0018
ERS12	[-0.0020]	[-0.0008]	-0.0000	0.0022

RMS of Residuals:
X: 0.0020 Y: 0.0014 Z: 0.0019 Total: 0.0031

Rejection: Recalc... Save

OK Cancel Apply

Axis

- Available only from 3D viewer
- User selects Anchor, Axis and Plane points in that order, or,
- Choose points from Axis Alignment dialog.
- Select Axis directions radio buttons.

Axis Alignment

Data Set: Final Frame - inches

Anchor Point
TARGET83 X: 1000 Y: 200 Z: 0.0000

Axis Point
TARGET320 +X +Y +Z
 -X -Y -Z

Plane Point
TARGET212 +X +Y +Z
 -X -Y -Z

Begin Undo More... Close

Quick

- All points are treated equally.
- Automatic Rejection – yes/no.
- Hold Scale – yes/no.
- Undo - only the last transformation can be undone.

Alignment - Quick

Data Set: Final Frame - millimeters

Options

Rejection: 0.073

Automatic Rejection

Hold Scale

Points

Design: 102 Matching: 102

Measured: 113 Accepted: 98

RMS of Residuals

X: 0.013 Y: 0.012 Z: 0.010 Total: 0.020

Iterations

1/1: 1.333
1/2: 0.024
1/3: 0.020
Solution Done

Begin Undo More... Close

Quick

Alignment - Quick

Data Set: Bundle10 - inches

Options

Rejection Limit: 0.6117

Automatic Rejection

Hold Scale

Points

Design:	70	Matching:	46
Measured:	330	Accepted:	46

Iterations

1/1: 0.2037
Solution Done

RMS of Residuals

X:	Y:	Z:	Total:
0.0494	0.0833	0.1792	0.2037

Buttons: Begin, Undo, More..., Close

Annotations:

- Bundle being transformed. (points to Data Set)
- Point rejection limit. (points to Rejection Limit)
- Set rejection limit automatically. (points to Automatic Rejection)
- Hold the scale fixed. (points to Hold Scale)
- Number of Design and Measured points. (points to Design/Measured)
- Number of matching points in two data sets. (points to Matching)
- Number of accepted points in two data sets. (points to Accepted)
- Iterations summary (points to Iterations)
- Transformation residuals. (points to RMS of Residuals)
- Start the transformation. (points to Begin)
- Undo the transformation. (points to Undo)
- More Information (points to More...)
- Close the transformation (points to Close)

Standard

- Similar to Quick alignment.
- Difference in Design info.
- Standard Deviations of each coordinate are considered. This means that points can be un-weighted.

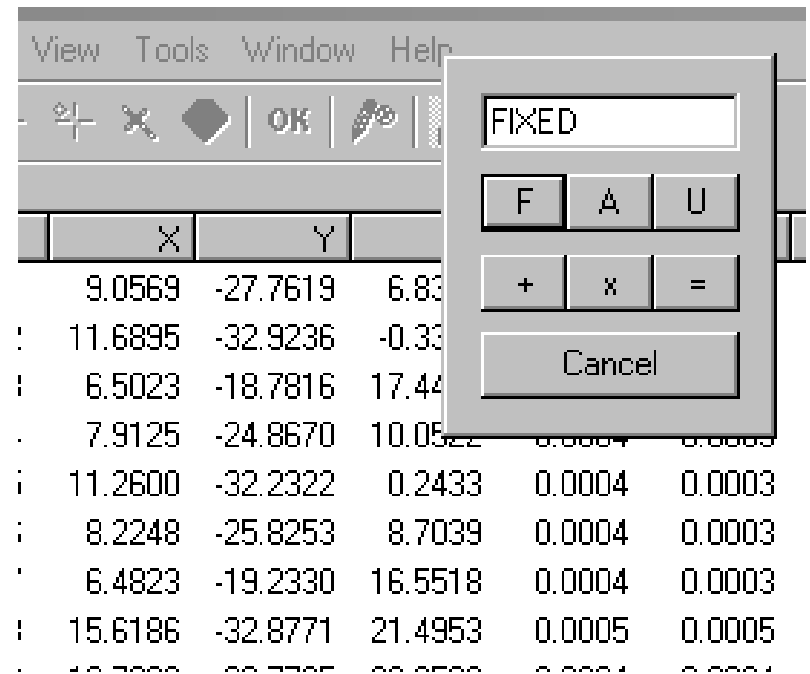
Point Label	X	Y	Z	Sigma X	Sigma Y	Sigma Z
✚ ER51	298.4934	21.9827	146.2924	FIXED	FIXED	FIXED
✚ ER52	298.4948	-0.2246	151.4334	APPROX	FIXED	FIXED
✚ ER53	298.4712	-21.4437	146.4561	APPROX	APPROX	FIXED
✚ ER54	298.4606	-41.6743	154.9358	UNKNOWN	UNKNOWN	FIXED
✚ ER55	298.4563	-41.5792	176.3950	UNKNOWN	UNKNOWN	FIXED
✚ ER56	298.5018	-0.4182	176.8844	UNKNOWN	UNKNOWN	FIXED
✚ ER57	298.5383	41.5906	154.6425	UNKNOWN	UNKNOWN	FIXED
✚ ER58	298.5186	41.5327	176.9134	UNKNOWN	UNKNOWN	FIXED
✚ ER59	298.5411	41.3769	206.1472	UNKNOWN	UNKNOWN	FIXED

Standard Deviation Options

- FIXED - Coordinate is used.
- APPROX - Coordinate used to initiate only.
- UNKNOWN - Coordinate not used.
- Value – Less effective/meaningful, open to interpretation

Changing Standard Deviation Fields

- Change entire column.
- Change selected entries.
- Change single entries.



Design Data Remarks

- Protected/Read Only. Changes must be made in another 3D file and re-imported.

File

- Allows transformation using transformation file. Currently support CATS, HOLOS, and GSI formats.

Alignment File

Filename:

Type:

Rotation Matrix

1.0000	0.0000	0.0000
0.0000	1.0000	0.0000
0.0000	0.0000	1.0000

Rotation Angles

0.0000	0.0000	0.0000
--------	--------	--------

Shift

0.0000	0.0000	0.0000
--------	--------	--------

Scale

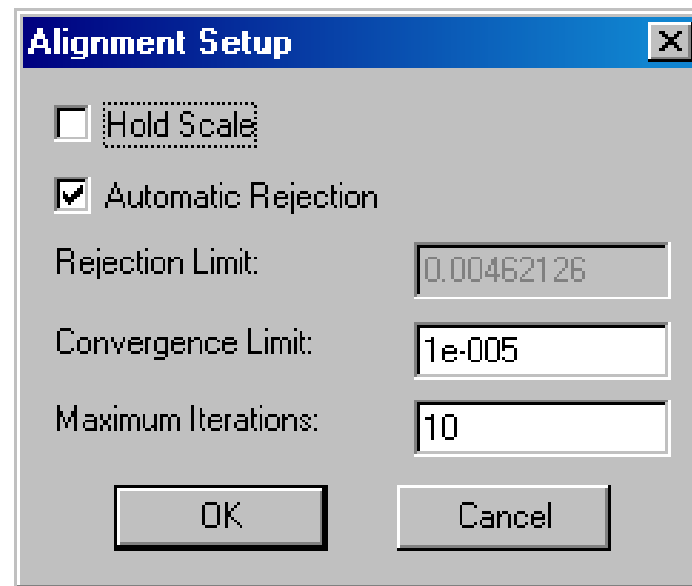
1.0000

Manual

- Provides new feature to manually shift, rotate or scale 3D files.
- Constructed objects are moved too!
- One rotation at a time please (counter-clockwise is positive).
- Undo – Only most recent.

Alignment Setup

- Modify default alignment settings.
- Applies to Quick & Standard only.



Questions?