GEM4D DOCUMENTATION

Moving, Rotating, Scaling and Transforming Meshes

User Manual

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1. What this covers

GEM4D has four tools that change where a mesh is, which way it faces and how large it is. They are four pages of the right-hand panel:

Page	What it does	You give it
Move	Shifts objects by an offset	A distance along X, Y and Z
Rotate	Turns objects about a point, around one axis	An angle, an axis and a rotation centre
Scale	Makes objects larger or smaller	A scale factor
Transform	Moves, turns and (if you want) scales one object in a single step, so that points on it land on points whose coordinates you know	Pairs of matching points

Move, Rotate and Scale are the single-action tools: each does one thing, by an amount you set. Chapter 3 gives the rules the three share, and Chapters 4 to 6 describe each page. Use them when you know the amount — "20 m up", "15° clockwise", "the model is in millimetres".

The Transform page (Chapter 7) is for when you do not know the amounts but do know where the object belongs: a photogrammetry or scanner model in its own local coordinates that must sit on surveyed control points, or a design drawn in another grid. You give matching points, GEM4D works out the best fit and tells you how well the points agree.

The same pages also place pictures. That is described in `Image_Objects_Manual.md` Chapter 8 and is only summarised here. How clicks in the scene work — snap modes, Ctrl, Shift, the right-click — is in `Scene_Navigation_and_Picking_Manual.md`.

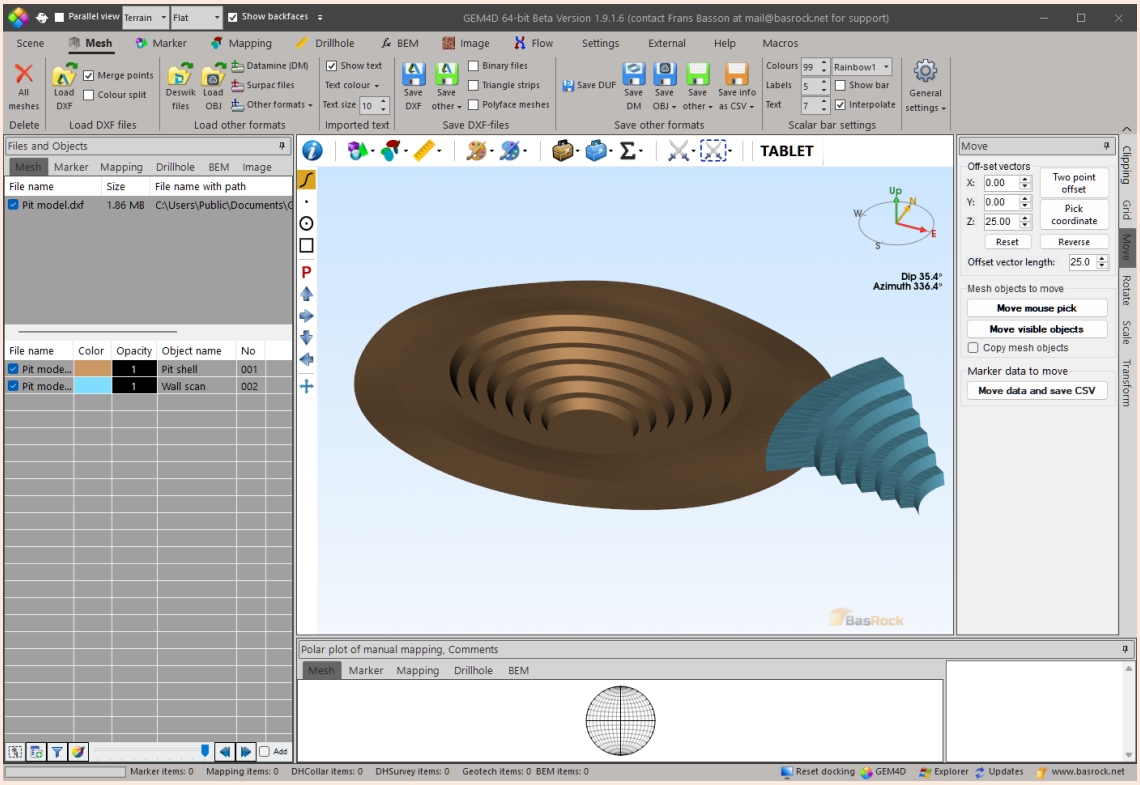


Figure 1 — The four pages. The right-hand panel open on the **Move** page; the tabs **Move**, **Rotate**, **Scale** and **Transform** run down its right edge. The scene holds the two objects used in the figures of this manual: a pit shell, and a scan of part of its wall that lies in the wrong place.

2. What can be transformed

Object	Move, Rotate, Scale	Transform
Mesh objects — surfaces, solids, lines and strings, and point objects such as point clouds; everything in the Mesh panel's Objects list	Yes, in place or as a copy	Yes, in place
Images — pictures, draped pictures, textured models	Yes, in place only (`Image_Objects_Manual.md` Chapter 8)	Yes, in place
Marker data	Move and Rotate only, through their own buttons (Chapter 8)	No
Mapping, drillholes, mark points, map discs, measure lines, BEM results	No	No

In this manual, *mesh* means any object of the Mesh panel.

3. Rules shared by Move, Rotate and Scale

3.1 Two ways to choose the objects

Each of the three pages has two buttons that apply the transform:

- **… mouse pick** (**Move mouse pick**, **Rotate mouse pick**, **Scale mouse pick**) — the button lights up and the cursor becomes a cross-hair. Click the object in the scene; that object alone is transformed. The button then switches itself off. To switch it off without picking, click the lit button again or right-click in the scene.
- **… visible objects** (**Move visible objects**, **Rotate visible objects**, **Scale visible objects**) — every visible mesh and every visible image is transformed at once. Hidden objects stay where they are: untick an object in the Objects list to keep it out of the transform.

The values on the page are read at the moment of each click, so set them first. A pick button refuses to arm while its value would change nothing (a zero offset, a zero angle, a scale factor of 1).

While a pick is armed you can still turn the view: hold **Ctrl** and drag (`Scene_Navigation_and_Picking_Manual.md` §4.1).

3.2 In place, or as a copy

Each page has a copy box: **Copy mesh objects** on the Move and Scale pages, **Make a copy of the rotation** on the Rotate page. It decides what the transform produces.

Copy box	Result
Unticked	The object itself is transformed. Nothing is saved and no dialog opens.
Ticked	The object stays where it is. A transformed **copy** is made as a new object, and a Save dialog opens for the DXF file that will hold it.

About copies:

- A copy is named after its source with `_MOVE`, `_ROTATE` or `_SCALE` added. It appears in the scene at once and is listed under the saved DXF in the Files list.
- The copy takes its source's colour. Colouring by values is switched off on a copy, because the values were worked out for the source's position.
- If you cancel the Save dialog the copies are deleted, and a message says so.

- Only meshes are copied. With the box ticked, images are left where they are, and a click on an image gives *"Only mesh objects can currently be copied"*.
- The box can be changed while a pick is armed; the next click follows it.

3.3 Shift — several picks in a row

Hold **Shift** while you click and the pick button stays armed, so you can go from object to object.

- **Copy box unticked:** each Shift-click transforms the object clicked. Clicking the same object again transforms it again.
- **Copy box ticked:** each Shift-click makes one more copy, and no Save dialog opens yet. You can click a copy made a moment ago to copy it again — a quick way to step a stope or a drive outline along at equal spacing. **Right-click** to finish: one Save dialog then saves all the copies into one DXF. A last click without Shift finishes the same way.

A Shift sequence left unfinished is not lost: the next time you click one of the three pick buttons, GEM4D first offers to save the copies still waiting.

3.4 What a transformed object keeps, and saving it

An object transformed in place keeps its name, colour, attributes and place in the Objects list. **The file it was loaded from is not changed.** To keep the new position, save the objects with the Mesh tab's save buttons (`Import_Export_Manual.md` §3.6), or save the whole scene as a project (`Project_File_Manual.md`).

3.5 In CLIPPING mode

While the scene is clipped you see slices of the meshes, not the meshes themselves. The copy box still decides:

- **Unticked** — the whole object behind the slice you click (or behind every visible slice, for the **… visible objects** buttons) is transformed, and the slices are cut again in the new position. Nothing is saved.
- **Ticked** — the transformed **slice** is saved as a new object. The mesh it was cut from does not move. This is the way to lift a section out of a model and set it down elsewhere. Shift collects several slices into one DXF, as in §3.3.

3.6 Undoing a transform

There is no undo button, but each page has a button that turns its values around: **Reverse** on the Move and Rotate pages, **Inverse** on the Scale page. Click it, then apply the transform to the same objects once more, and they are back where they were. **Reset** returns the page to values that change nothing.

For a copy, simply delete the copy.

4. Move

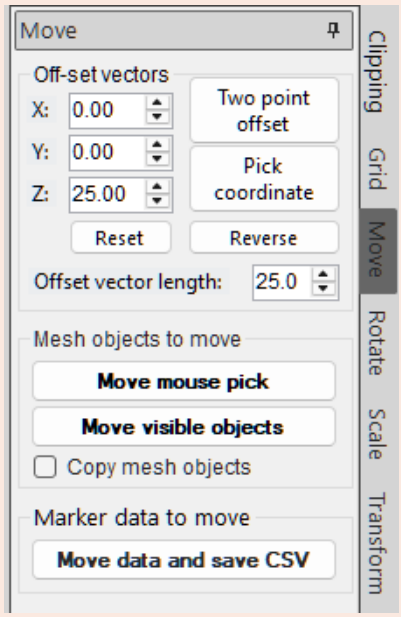


Figure 2 — The Move page. An offset of 25 m straight up.

4.1 The offset

The group **Off-set vectors** holds the move: **X** (east), **Y** (north) and **Z** (up), in metres, and **Offset vector length**, the total distance. There are four ways to fill it:

How	Steps
Type it	Enter X, Y and Z. The length updates itself.
Two point offset	Click the button, then click two points in the scene: first where a feature is now, then where it should be. A ghost line follows the cursor between the clicks. The offset from the first point to the second is entered, and the information box shows the length, dip and direction of the line.
Pick coordinate	Click the button, then click a point on the object whose true coordinates you know. A dialog opens: enter the Easting, Northing and Elevation that the point should have. The offset from the clicked point to those coordinates is entered.
Set the length	With a direction already in X, Y and Z, type a new **Offset vector length**. The three components are rescaled to that distance, in the same direction. Useful after **Two point offset**: pick the direction, then set the exact distance.

Reverse changes the sign of X, Y and Z. **Reset** sets everything to zero.

Clicks land according to the snap mode (`Scene_Navigation_and_Picking_Manual.md` Chapter 6). For an exact corner-to-corner offset, use **Vertices & Points**.

4.2 Applying it

Under **Mesh objects to move**: tick or untick **Copy mesh objects**, then click **Move mouse pick** and click the object, or click **Move visible objects**.

When other kinds of objects are visible as well — markers, drillholes, mapping — **Move visible objects** first says *"Only meshes and images will be affected"*.

> **Note — very long moves.** For an offset of 1 000 000 m or more along an axis GEM4D warns *"The move distance is large and could result in rounding errors"*. Positions in the scene are held relative to where the first object was loaded, and lose precision far from there. After such a move, measure a known distance on the object to check it.

5. Rotate

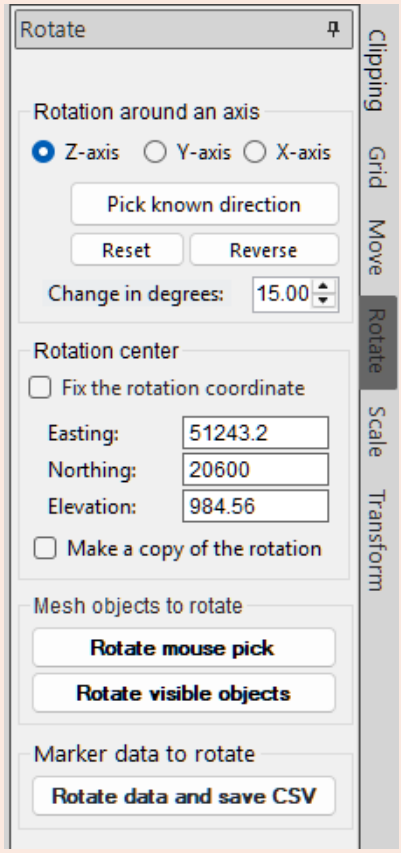


Figure 3 — The Rotate page. A turn of 15° clockwise about the Z-axis, around the rotation centre shown.

A rotation needs three things: an axis, an angle and a centre.

5.1 The axis and the angle

In the group **Rotation around an axis**, choose the axis and enter **Change in degrees**. Seen from the positive end of the axis, a positive angle turns the object clockwise.

Axis	Changes	A positive angle	Range
Z-axis (default)	The direction (azimuth) of the object	Turns it clockwise seen from above	−360° to +360°
X-axis	The dip, about the east–west axis	Lowers the north side	−90° to +90°
Y-axis	The dip, about the north–south axis	Raises the east side	−90° to +90°

One rotation is around one axis. For a rotation around two axes, apply them one after the other — or use the Transform page (Chapter 7), which finds any orientation in one step.

Reverse changes the sign of the angle. **Reset** sets it to zero.

5.2 Getting the angle from the scene

When a line on the object should point in a direction you know, GEM4D can work out the angle:

1. Choose the axis.
2. Click **Pick known direction** (with the X- or Y-axis chosen, the button reads **Pick known dip angle**).
3. Click two points along the feature — the two ends of a drive centre line, for example. The information box shows the length, dip and direction from the first click to the second.
4. A box opens showing what was measured: for the Z-axis *"Clockwise degrees from North"*, for the X- and Y-axis *"Clockwise degrees from horizontal"*. Replace the number with the true direction (0 to 360) or the true dip (0 to 90) and click OK.

The difference goes into **Change in degrees**. Apply the rotation, then check it: click the same two points again with **Pick known direction** and read the direction or dip in the information box (Cancel the box that opens). If a dip rotation turned the object the wrong way, click **Reverse** and apply the rotation **twice** — once to undo, once to turn it the right way.

5.3 The rotation centre

The group **Rotation center** holds the point the objects turn about: **Easting**, **Northing** and **Elevation**, in mine coordinates.

- The centre **follows the centre of the view**. Each time you double-click a point in the scene with no tool armed (`Scene_Navigation_and_Picking_Manual.md` §3.5), that point becomes the rotation centre. So the quick way to set it is to double-click the point the object should turn about.
- Tick **Fix the rotation coordinate** to stop that. The centre then stays as it is, or as you type it, whatever you double-click afterwards. Tick it whenever you type a centre — a survey station, a shaft centre — so that the next double-click does not replace it.

Rotate visible objects turns all the objects about the one centre, so they keep their positions relative to each other.

5.4 Applying it

Tick or untick **Make a copy of the rotation** — on this page the copy box sits in the **Rotation center** group. Then, under **Mesh objects to rotate**, click **Rotate mouse pick** and click the object, or click **Rotate visible objects**.

6. Scale

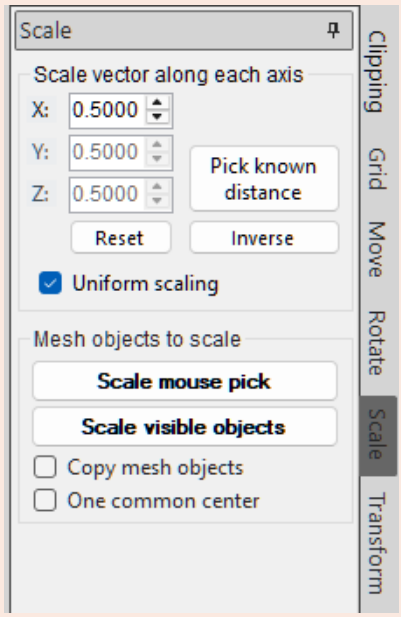


Figure 4 — The Scale page. A uniform factor of 0.5: Y and Z follow X. **One common center** chooses what **Scale visible objects** scales about (§6.2).

6.1 The scale factor

The group **Scale vector along each axis** holds a factor for **X**, **Y** and **Z**. A factor of 2 doubles the size, 0.5 halves it, 1 leaves it as it is. Factors from 0.0001 to 10 000 are accepted.

- **Uniform scaling** is ticked to start with: Y and Z are greyed and take the value of X, so the object keeps its shape. Untick it to stretch or squeeze the object along one axis — for example Z alone, to exaggerate the vertical.
- **Pick known distance** — click the button, then click two points on the object whose true distance apart you know. A box opens showing the measured distance (*"Actual distance between points"*); replace it with the true distance and click OK. The factor, true ÷ measured, goes into X — and into Y and Z while **Uniform scaling** is ticked. With it unticked, only X is set.
- **Inverse** replaces each factor by 1 ÷ factor (2 becomes 0.5). **Reset** sets all three to 1.

A common use is a change of units: 0.001 for a model drawn in millimetres, 0.3048 for one in feet.

6.2 What the objects are scaled about

A scale needs a point that stays where it is while everything else grows or shrinks around it. For **Scale visible objects** you choose it with the **One common center** box. Both ways are in everyday use:

One common center	Each object is scaled about	The result	Use it when
Unticked (as GEM4D starts)	The centre of its **own** bounding box	Every object stays where it is and changes size on the spot. The gaps between objects do not scale with them: two stopes that touched overlap after scaling up, or stand apart after scaling down.	Each object must keep its position — markers or symbols drawn as meshes that are too large or too small, a single object, objects that are to be resized one by one

One common center	Each object is scaled about	The result	Use it when
Ticked	**One** point: the centre of the box round all the objects being scaled	The group is scaled as one body. Objects keep their places relative to each other, and walls that touched still touch.	The objects belong together — a model drawn in other units, a set of stopes or levels, a design with its strings

"The objects being scaled" are the visible meshes, together with the visible images when the copy box is unticked (with it ticked, images are not scaled and do not count). A hidden object is neither scaled nor counted.

Scale mouse pick always scales the clicked object about the centre of its own bounding box, whatever the box says. A picture loaded as several tiles counts as one object: it is scaled about the centre of the whole picture.

Neither centre is a point you chose, so a scaled model usually still needs a **Move** to put a known point in its place (§4.1, **Pick coordinate**). When the true positions of several points are known, the Transform page in the **Full** mode (Chapter 7) scales and places the object in one step.

6.3 Applying it

Under **Mesh objects to scale**: tick or untick **Copy mesh objects** and — for the visible objects — **One common center** (§6.2), then click **Scale mouse pick** and click the object, or click **Scale visible objects**.

7. Transform — fitting an object to control points

7.1 When to use it

Use the Transform page when an object is in the wrong place, at the wrong orientation, or at the wrong size, and you can name points on it whose true coordinates you know:

- a photogrammetry or laser-scan model in the scanner's own coordinates, with surveyed targets or pegs visible in it;
- a design or survey in another grid — a local mine grid against MGA, or an old grid against a new one;
- a model that must be laid onto another model already in the scene, feature on feature.

You give **pairs** of points. In each pair the **current** point is where a feature is now, and the **target** point is where the same feature should be. GEM4D finds the single move, rotation and (if allowed) scale that brings all the current points as close to their targets as possible — a least-squares fit — and reports how far apart they remain. With more pairs than the minimum, small picking errors average out and a wrong pick shows up.

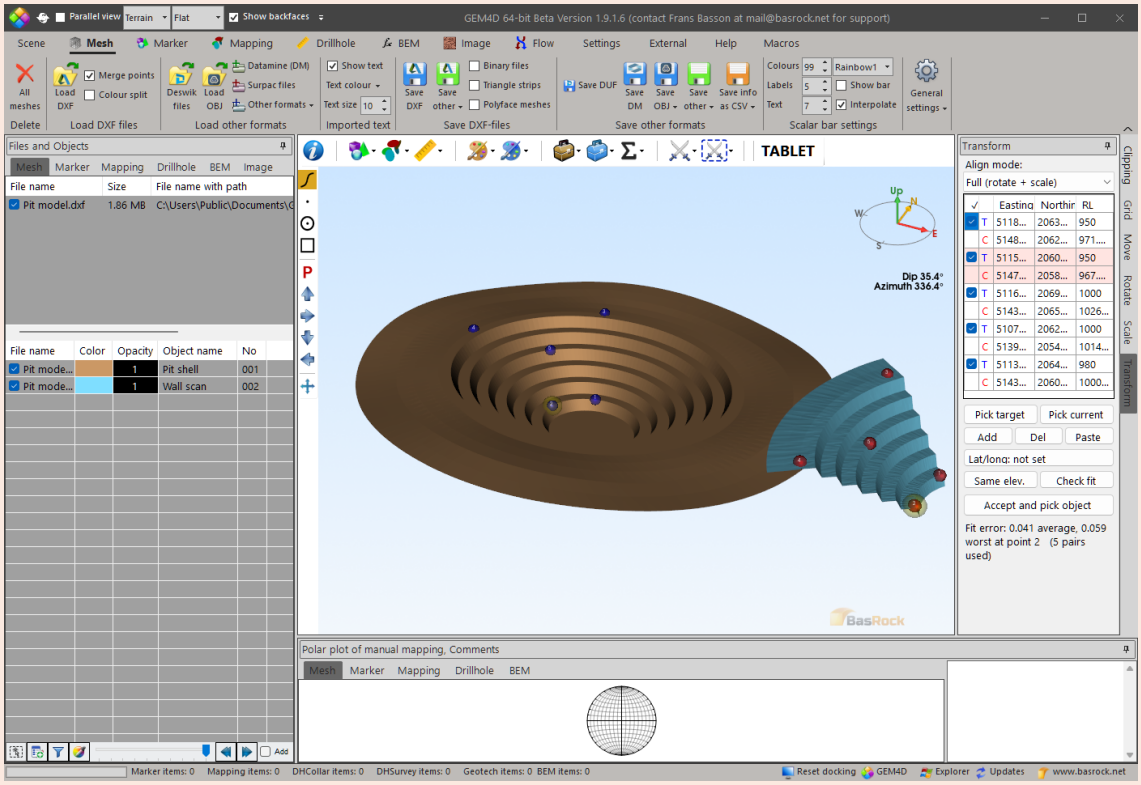


Figure 5 — Five point pairs, checked. Red dots mark the current points on the wall scan, blue dots the targets on the pit shell where the same features belong. **Check fit** has tinted pair 2 in the grid and ringed its dots in yellow: it is the pair that fits worst.

7.2 The page

Control	Purpose
Align mode:	What the fit may change (§7.4).
Pick target / **Pick current**	Pick points in the scene into the grid (§7.5).
The grid	The point pairs. Each pair is two rows: **T**, the target (blue), and **C**, the current point (red), with **Easting**, **Northing** and **RL** in mine coordinates. The ✓ box on the target row says whether the pair is used.
Add / **Del**	Add an empty pair; remove the selected pairs.
Paste	Paste pairs, or latitude / longitude targets, from the clipboard (§7.5).
Lat/long	How a pasted latitude, longitude becomes a mine coordinate (§7.5).
Same elev.	Sets every RL in the grid to the first target's RL.
Check fit	Works out the fit and shows its error, without moving anything (§7.6).
Accept and pick object	Applies the fit to the object you click next.
Fit error:	The result of the last check or fit; red when the fit should not be trusted.

Every complete row shows as a numbered dot in the scene — blue for targets, red for current points, with the pair number — so a point in the wrong place is easy to see. The dots of an unticked pair are dimmed. The dots are cleared when another tool is used; the next pick, an edit of a cell or **Check fit** draws them again from the grid.

7.3 Step by step

1. Load the object to be transformed and, if the targets are to be picked, the data that shows where it belongs.
2. Set **Align mode:** (§7.4).
3. Click **Pick current** and click the features on the object, one after the other. Each click fills the next empty current row and drops a red dot. Click **Pick current** again, or right-click in the scene, to stop.
4. Give the targets **in the same order**: click **Pick target** and click the same features where they belong (blue dots), or type or paste their coordinates into the target rows.
5. Click **Check fit** and read **Fit error:** (§7.6). Correct or untick a bad pair and check again.
6. Click **Accept and pick object**, then click the object. It is moved onto the targets, the dots are removed, and **Fit error:** shows the result.

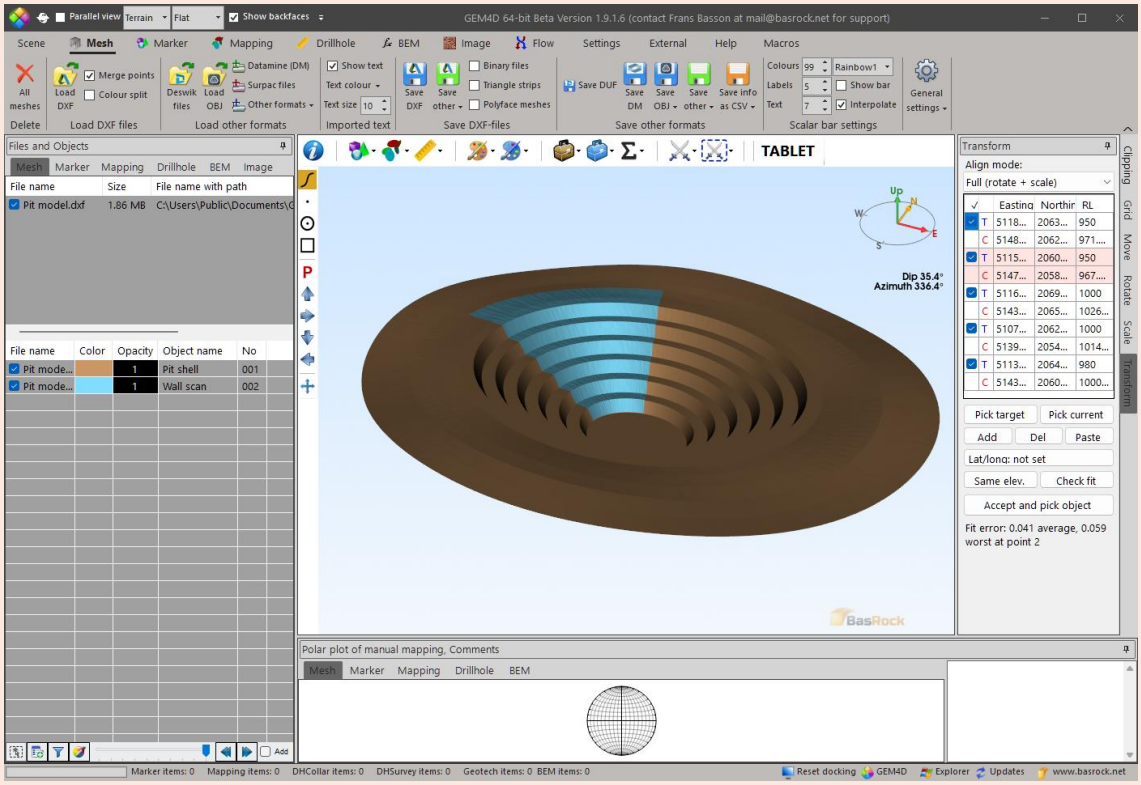


Figure 6 — After the fit. The wall scan of Figure 5 has been turned, levelled, scaled and moved onto the pit wall in one step. The pairs stay in the grid.

The object is always transformed in place — the Transform page has no copy box. The file it came from is not changed (§3.4), so the original can be loaded again if it is needed as well. Clicking any of the three pick buttons leaves CLIPPING mode first.

> **Note — spread the points.** Choose points that are far apart and not in one line: the corners of the object rather than a cluster on one side. Points that are close together fix the position there but leave the far end of the object free to swing. GEM4D warns when the points span less than a tenth of the object, and when they lie nearly in a line.

7.4 Align modes

Align mode	The fit may	Pairs needed	Use it when
Full (rotate + scale) — the default	Move, rotate in any direction, and scale by one factor in all directions	3 or more	The size is not known or not trusted: a photogrammetry model without scale, a drawing in other units, a grid with a scale factor
Rigid (rotate only)	Move and rotate in any direction. The size is kept.	3 or more	The object is at its true size but tilted and turned: a scanner model that was not levelled
Horizontal (azimuth + shift)	Move in all three directions and turn about the vertical axis only. The size is kept and the object is not tilted.	2 or more	The object is level and at its true size: one grid against another, a plan that only needs turning and shifting

Choose the mode that allows the least. Every freedom the fit is given is one more thing a picking error can push the wrong way; a fit that may not scale or tilt cannot be made to scale or tilt by a poor pick. With three pairs, **Horizontal** has the most checks left over and **Full** the fewest.

The fit never mirrors an object. Pairs given in an order that would need a mirror image show up as a large fit error instead.

7.5 Entering the points

Picking. Pick target and **Pick current** stay armed until you click the button again or right-click, so several points can be picked in a row. Each click fills the next empty row of its kind, and starts a new pair when none is empty. Clicks follow the snap mode (`Scene_Navigation_and_Picking_Manual.md` Chapter 6); hold Ctrl and drag to turn the view between picks.

Typing. Click **Add** for an empty pair and type into the cells. The dots update as you type. Hover over a cell to see its full value when the column is too narrow.

Pasting pairs. Paste takes lines of six numbers — target E, N, RL, then current E, N, RL — separated by tabs, commas, semicolons or spaces. Six columns copied from a spreadsheet paste directly. Lines that do not hold six numbers are skipped, and the status line says how many.

Pasting latitude, longitude. A line copied from Google Maps (`-22.71234, 118.12345`) is taken as a **target**: it is converted to mine coordinates and put in the next empty target row, at the RL of its pair's current point. The **Lat/long** button sets the conversion — a LaLoCon conversion file (`.cnv`) for a mine grid, or MGA / UTM — and GEM4D asks the first time. The full description, with the accuracy to expect, is in `Image_Objects_Manual.md` §8.1.

Same elev. sets every RL to the first target's. Use it when the object only has to be placed in plan and the elevations picked are not reliable — a flat picture, or targets pasted from a map.

7.6 Reading the fit error

Check fit shows, for example:

```
Fit error: 0.041 average, 0.059 worst at point 2   (5 pairs used)
```

- **average** — the typical distance, in metres, between each target and where the fit puts its current point. Zero would be a perfect fit.
- **worst at point N** — the largest distance, and the pair it belongs to. The two rows of that pair are tinted in the grid and its dots get a yellow halo in the scene.

How large an error is acceptable depends on how well the points could be picked: a few centimetres for surveyed targets in a sharp scan, more for features clicked on a coarse mesh. What to look for is a worst point that stands well above the rest — usually a click on the wrong feature, or two targets in the wrong order. Correct it, or untick its ✓ box to leave the pair out, and check again.

With only the minimum number of pairs the fit has little or nothing left over to check itself with, and the error can read close to zero however poor the picks are. One or two pairs more than the minimum make the figure mean something.

The text turns red, with a reason, when the fit should not be trusted:

Text	Meaning
picked points nearly in a line, so the rotation is unreliable	The points fix a line but not the turn about it. Add a point well off the line.
control points cover only a small part of the mesh, so the orientation may be imprecise - spread them wider	Shown after the fit is applied: the points span less than a tenth of the object.

7.7 One fit for several objects

The grid keeps its pairs after a fit, so the same fit can be applied to the next object: click **Accept and pick object** again and click it. This is how to carry a set of objects that belong together — the scan and the strings digitised on it — to the same place. Apply it **once** to each object: a second click on an object already moved would move it again.

When a job is finished, select the rows and click **Del** before starting the next.

8. Marker data

Marker points are not picked or copied like meshes. The Move and Rotate pages each have one button for them, which uses the same values as the mesh buttons:

- **Move data and save CSV** (Move page, group **Marker data to move**) adds the offset to the coordinates of the Marker data.
- **Rotate data and save CSV** (Rotate page, group **Marker data to rotate**) turns the Marker data by the angle, about the axis and rotation centre set on the page.

The Marker grid and the scene show the new positions at once; all other columns are kept. A Save dialog then opens for the CSV file that takes the result. Cancel it to keep the new positions in the grid without saving a file. The copy boxes of the two pages belong to the mesh buttons and play no part here.

Only the rows shown in the Marker grid are transformed, and the grid is rebuilt from them. Reset any filter first, so that all the data moves together. There is no Scale button for Marker data.

9. Worked examples

9.1 Copy a stope outline to the levels above

1. On the **Move** page set X = 0, Y = 0 and Z = 25 (the level spacing).
2. Tick **Copy mesh objects** and click **Move mouse pick**.
3. Hold **Shift** and click the outline: a copy appears 25 m up. Still holding Shift, click the new copy: another appears 25 m above it. Repeat for each level.
4. Right-click, and save the copies in the dialog that opens.

9.2 A model drawn in millimetres

1. Show only the model's objects.
2. On the **Scale** page, with **Uniform scaling** ticked, set X = 0.001. Tick **One common center**, so that the objects keep their places in the model (§6.2), and click **Scale visible objects**.
3. On the **Move** page click **Pick coordinate**, click a point on the model whose coordinates you know, and enter them. Click **Move visible objects**.

9.3 Turn a design from mine grid north to true north

1. On the **Rotate** page choose **Z-axis** and enter the angle between the two norths in **Change in degrees** (a positive angle turns the design clockwise seen from above).
2. Type the grid's origin point into **Rotation center** and tick **Fix the rotation coordinate**.
3. Click **Rotate visible objects**.

9.4 A photogrammetry model onto survey control

1. Load the model, and the survey pegs as a DXF or as Marker points.
2. On the **Transform** page choose **Full (rotate + scale)** — or **Rigid (rotate only)** when the model was scaled in the photogrammetry software.
3. Click **Pick current** and click four or more targets in the model. Right-click.
4. Click **Pick target** and click the matching pegs in the same order — or paste their surveyed coordinates. Right-click.
5. Click **Check fit**. If one point stands out, correct or untick it.
6. Click **Accept and pick object** and click the model.
7. Save the model (§3.4).

10. Messages and troubleshooting

Message or symptom	Cause and remedy
"The move distance is zero, please select an offset vector"	X, Y and Z are all zero. Enter or pick an offset (§4.1).
"The rotation is zero, please select a rotation angle"	**Change in degrees** is zero (§5.1).
"The scale factor is one, please select a scale factor other than 1.0"	All three factors are 1 (§6.1).
"First load mesh and image data"	No mesh or image is visible. Load one, or tick it in the Objects list.
"Pick on a mesh or image"	The click landed on a marker, a drillhole or another object that these tools do not transform (Chapter 2).
"Only mesh objects can currently be copied"	The copy box is ticked and the click was on an image. Untick it to move the image itself (§3.2).
"Only meshes and images will be affected"	Other kinds of objects are visible as well. They stay where they are; for Marker data see Chapter 8.
"The move distance is large and could result in rounding errors"	An offset of 1 000 000 m or more along an axis (§4.2).
"Saving was cancelled and the created objects deleted"	The Save dialog for the copies was cancelled. Make the copies again and save them.
"Range should be between … and …"	The angle from **Pick known dip angle** is outside ±90°. Check which axis is chosen and which two points were clicked (§5.2).

Message or symptom	Cause and remedy
A Save dialog opens when a pick button is clicked	Copies from an unfinished Shift sequence were still waiting (§3.3). Save them, or cancel to delete them.
The object moved, but is back at its old place after reloading	A transform changes the object in the scene, not its file. Save it (§3.4).
The object turned about the wrong point	The rotation centre followed a double-click. Set it again and tick **Fix the rotation coordinate** (§5.3).
The object turned the wrong way	Click **Reverse** and apply the rotation twice (§5.2).
Objects overlap or stand apart after **Scale visible objects**	**One common center** was unticked, so each object was scaled about its own centre. Click **Inverse**, apply it again, then tick the box and scale once more (§6.2).
Objects moved away from where they were after **Scale visible objects**	**One common center** was ticked, so the objects were scaled about the centre of the group. Click **Inverse**, apply it again, then untick the box (§6.2).
After **Pick known distance** only one direction was scaled	**Uniform scaling** was unticked, so only X took the factor (§6.1).
The images did not move with the meshes	The copy box was ticked — a copy is made of meshes only — or the images were hidden.
"Tick at least 3 complete pairs (target + current) to check the fit." (2 in **Horizontal** mode)	Too few pairs have both rows filled and their ✓ box ticked (§7.4).
"Tick at least 3 complete control-point pairs (target + current) in the Transform grid before picking the mesh."	The same, at **Accept and pick object**.
"Source points coincide in plan — a horizontal rotation is undefined."	In **Horizontal** mode all the current points have the same Easting and Northing. Pick points that are apart in plan.
"Enter the first target's RL before using “Same elev.”."	The first target row has no RL.
"… line(s) skipped — expected 6 numbers (target E N RL, current E N RL) or a latitude, longitude."	Pasted lines that could not be read (§7.5).
A large fit error on every point	The targets are in a different order from the current points, the wrong **Align mode** is chosen (a model that needs scaling fitted with **Rigid**), or the pairs describe a mirror image (§7.4).
The object landed in the right place but tilted or the wrong size	Small errors in closely spaced points. Spread the points (§7.3) or choose a mode that allows less (§7.4).
The red and blue dots have gone	They are removed when the fit is applied, and whenever a tool is cancelled or another button is clicked. The grid still holds the pairs: the next pick, an edit of a cell or **Check fit** shows the dots again.

Revision history

One row per edition. `Mesh_Transform_Changelog.md` holds the full record of changes.

Date	GEM4D	Main changes
2026-11-12	1.9.1.6	First issue.