PhotoMatch v3.5

New Features – a quick overview

- Streamlined mode switching
- Reloading of background images
- Changeable line width for calibration or modelling
- Editor filter switch for cleaned up editor views while working with PhotoMatch
- Optimized calibration mode for two and three point perspectives
- Real world angle between calibration lines can be changed individually (no need for 90° angles any more)
- New option to fix vertical lens shifting
- New offset and size parameters to ease modelling or more complex shapes
- Bookmark options to save different reference cube positions in your scene
- New lighting tool to set the main light source based on shadow direction
- New option to project point objects and splines onto the reference cube for more advanced image modelling
- New options to add basic shapes such as cubes and cylinders to your scene
- Several smaller bugfixes and performance enhancements

System specs

PhotoMatch v3.5 is optimized and compiled for CINEMA 4D 11.x on Windows and MacOS X, running with both 32 Bit and 64 Bit installations. If you still use CINEMA 4D 10.x, please continue to use PhotoMatch v3.4 instead.

Installation

Unzip the PhotoMatch archive into the CINEMA 4D plugins folder. If you already used older versions of PhotoMatch before, take care to remove them from the plugins folder before starting CINEMA 4D. The PhotoMatch object and the included export module to Maya .ma ASCII format can be found in the Plugins menue of CINEMA 4D. The PhotoMatch Lens effect is accessable through the **Effect** button in the Render Settings.

Theory of image analysis

Most photos taken and used for compositing show a two or three point perspective. This means that all horizontal lines are running towards one of at least two points in space. These are called vanishing points. Speaking of a two point perspective, these vanishing points are located somewhere on the virtual horizon line of the image. Knowing this horizon and the positions of the vanishing points, the rotation of the camera and even it's focal length can be calculated.

The latter can only be precise if you know the real world angle between those lines, that run towards the two vanishing points on the horizon. So the first thing to do before starting to calibrate the camera is to have a quick look at the image. With architectual photos you will often be able to find edges and corners that have a 90° angle. This can be at a window frame, carpet edges, table tops or just two walls coming together in a rectangular corner. (Note: when possible, choose structural elements to calibrate the horizon line direction as placed objects, furniture and area rugs, may not always be perfectly square to structual elements like walls.)

Outdoor scenes, with a lot of organic shapes, can be a bit more tricky, but often you can find roads, fences or street lamps there to help you out.

Starting to work with PhotoMatch

1. Open a new scene and get the PhotoMatch object from the Plugins menue
2. Be sure to work in Model tool mode and activate the Move tool
3. Switching to the front viewport (XY plane) you should now already see 4 lines with arrowheads and a horizontal green line. The arrow lines have handles at their ends, so you can move them around in the front viewport later to do your camera calibration
4. Within the Mode tab of the PhotoMatch dialog in the Attribute Manager switch to Calibrate Mode and enter a value for the maximum Number of Pixels that should be used to display your photo in the front viewport. This option works the same as the preview texture size parameter offered by CINEMA 4D in materials. Max. Pixel values between 640 and 1200 should be fine already to see enough details and not to slow down't editor redraws too much.
5. Use the **Load image** button to choose the photo that you want to use for calibration
6. The X and Y parameter fields will show the original bitmap resolution after loading the file. PhotoMatch also now creates a new material and a background object for you, so the loaded image can show up in the perspective viewport.
7. If you want to render the scene at another resolution than the original resolution of the loaded bitmap, uncheck the **Render this resolution** option
8. If you have any problems to see the loaded background image in the front viewport, use the **In Editor** option there. This disables the OpenGL display of the background image.
9. Use the **Filter on/off** button to remove all unneccessary lines and objects from the editor viewports. Using this button again, makes all hidden elements visible again. You can also use the Filter menue of each viewport to change the visability of the different elements manually at any time.
10. Use the **New** button next to the **Camera Object** field to create a new camera object in your scene. This camera will be used for the PhotoMatch calibration later.
11. Unfold the Preferences part of the dialog page to change the colors of the line elements if needed to get more color contrast. You can also change to thickness of the lines there.
12. If you want to sample some colors from your background image, switch on the **Active** option next to the **Color Sample** field and move your mouse over the background image in the front viewport. Holding down the CTRL key samples the color value of the bitmap under the mouse position and copies this value to the Color Sample field in the PhotoMatch dialog. A red circle will mark the position in the front viewport where you have taken the color sample. Unfolding the Color Sample allows you to view the numerical values of this color sample or to use the quick storage section of the color picker to store colors for later use. Unchecking the Active Option or choosing Calibrate from the Mode menue switches back to calibration mode again.

By following these simple steps you are ready for the camera calibration already. All of the following work is done in the front viewport only. Always take care to use the Move tool in Model mode to be able to work with the handles and line elements presented by PhotoMatch in the viewport.

Working in Calibrate Mode

After setting up the parameters on the Mode tab of the PhotoMatch dialog, switch to the Calibrate tab. The **Active** option there should be switched on already. If it isn't, activate this option to switch PhotoMatch to Calibrate mode.

<u>Choosing the right Perspective mode</u>
First parameter to be set is the **Perspective** menue. You can choose between **Three vanishing points** and **One vanishing point**. The three vanishing points mode supports full camera calibration, featuring orientation and focal length. This mode will work with most photos that show at least a slight angle of a building or structure.

When the photo shows a frontal view of a building or for example a view down a street or into a tunnel like environment, choose the one point perspective mode instead. This mode only supports limited support for the calibration, but you can compensate this by the use of reference shapes as described later. The one vanishing point mode should also be used if the photo was taken while using very short focal length, such as a fisheye perspective or some indoor photos of smaller rooms. Three vanishing points mode might fail with such photos because of too strong image distortions.

<u>Calibrating the camera in three vanishing points mode</u>
We are using an indoor scene for demonstration. Uncheck the **Set right vanishing point** option first, to concentrate on the lines that run to the left side.

The screenshot below shows an example of two possible directions that can be marked by the arrow lines.

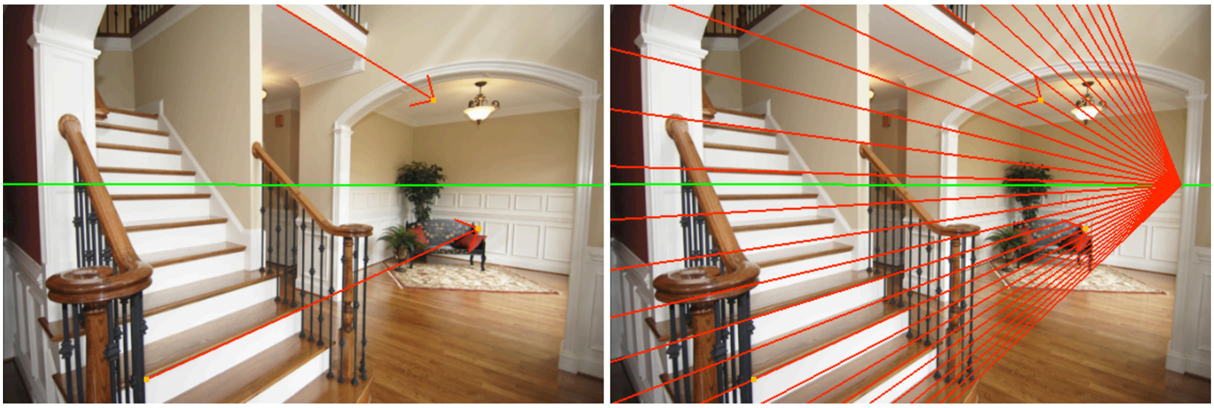
Use the handle points at the ends of the lines to move them. Holding down **CTRL** while moving one of the handles moves the complete arrow line at once. Holding down **Shift** together with left mouse button while clicking on one handle you can move the handle at the other end of the line. This can help to minimize mouse movement with larger photos.

Activating Left guides option shows additional lines matching the given perspective defined by the two arrow lines. Adjust the number value to increase or decrease the amount of lines.

Compare these additional lines to other structures you can find in the photo and adjust the arrow lines if needed.

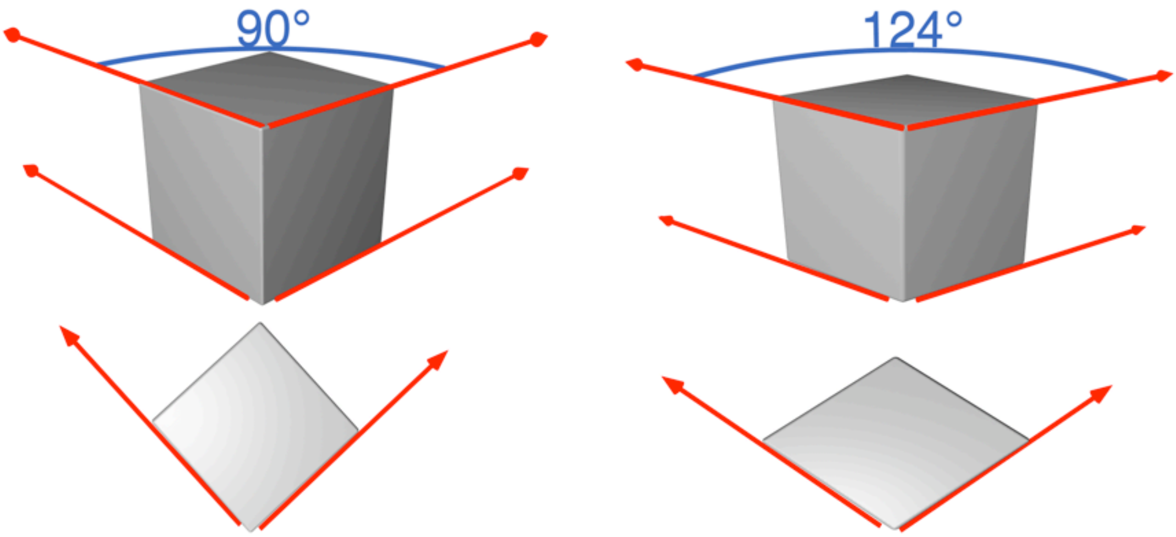
If this is done, switch off the Left guides option and the Set left vanishing point option and switch on the **Set right vanishing point** option.

Follow the same steps again, just this time with lines that run towards the right side of the photo. The image below gives an example for such line directions.



Remember that both choosen lines for each direction have to be parallel in reality, an that the arrow heads should always point away from the photographer, towards the distance, where the lines will meet on the horizon line. Longer lines are always more precise than shorter lines, so even if you mark short structures in the photo, you should use longer arrow lines to increase calculation precision.

After you are done with the right side, switch on Set left vanishing point option again. If the lines choosen for the left and the right vanishing points have a 90° angle between them in reality, you are done already with the calibartion and you should be able to find the calculated focal length value next to the **f:** string in the dialog. If the given structures are not rectangular, edit the **Inner Angle** value to correct the focal length calculation. The image below gives an idea about this parameter.



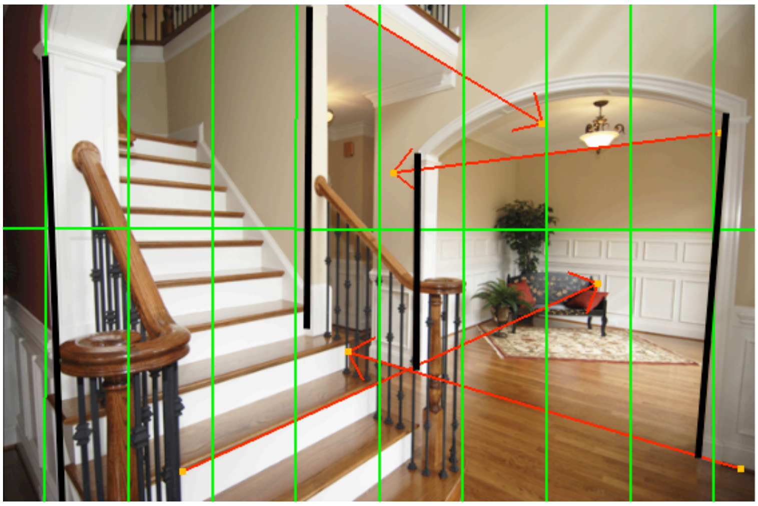
The image shows a typical structure. This could be a building, some walls of an indoor scene or any other structure that has horizontal, parallel lines. Normally when choosing the directions for the arrow lines, the angle between them will be 90° as shown on the left side of the image. The upper half on the left shows the structure as it might be presented on the photo. Below you can see an undistorted view of the structure as it might look from high above. The right side looks similar in the upper half, but in real world the walls or structures might have a different enclosed angle, in this case 124°. If you use these lines for the calibraton, you have to enter the matching enclosed angle of the real building or structure into the **Inner Angle** field.

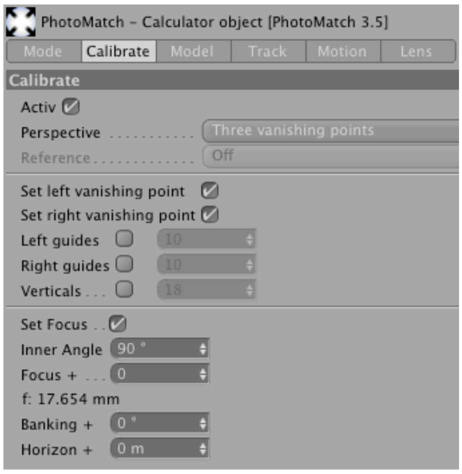
Manual editing
Sometimes the given structures in the photo are too short or the perspective is too distorted to get precise results. This is why you can adjust the calculation at any time with the parameters given at the lower part of the Calibrate tab.

By using **Horizon +** and **Banking +** you can adjust the height and orientation of the horizon line. This is needed especially in **One vanishing point** mode as the orientation of the camera cannot be extracted from such an image automatically.

Sometimes these parameters also make sense in the **Three vanishing points** mode as well. Activate the **Verticals** option, too, to get additional lines vertical to the given horizon line and compare them to vertical edges in your background photo. Adjust the **Banking +** value if needed to better match the vertical lines with the given structures.

Just take care that photos taken with smaller focal length show stronger distortions near the edges of the photo. Have a look at our indoor scene photo again. Some of the room verticals are marked by black lines there.



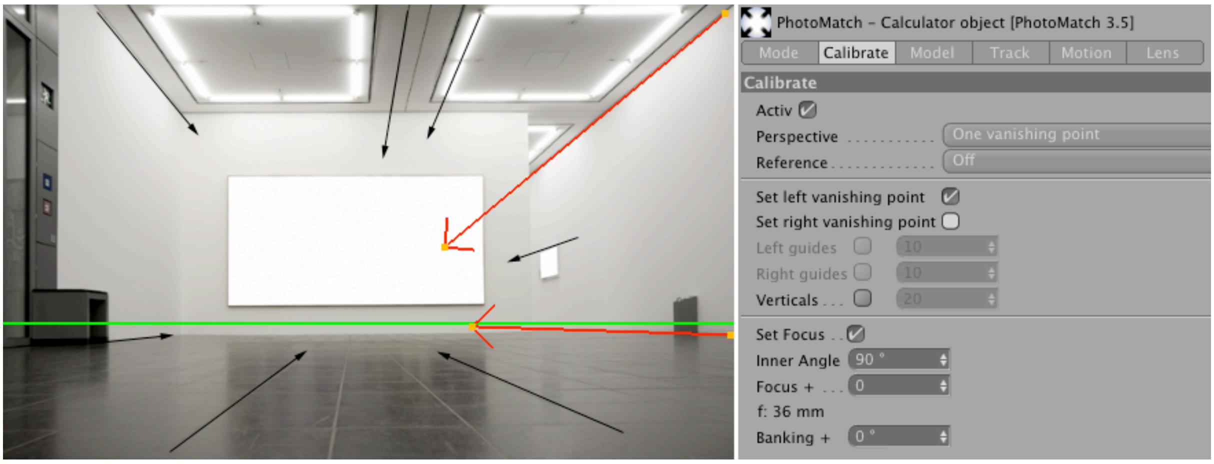


As you can see there, the verticals align well with vertical room edges near the center of the photo. Verticals near the border of the photo already show stronger distortions and don’t line up any more with the green vertical overlay lines. The verticals can even shape like arcs instead of straight lines then.

There is no need to adjust the banking with such photos as the offset in vertical alignement is a result of lens distortion or just perspective and not of camera banking.

In other cases you might find all verticals running toward another vanishing point. This can be fixed by using the vertical lens shift as described a little bit later within the section about the Model tab. Also changing the focal length in three vanishing points mode only makes sense in combination with the Model mode. You can find out more about this a little later.

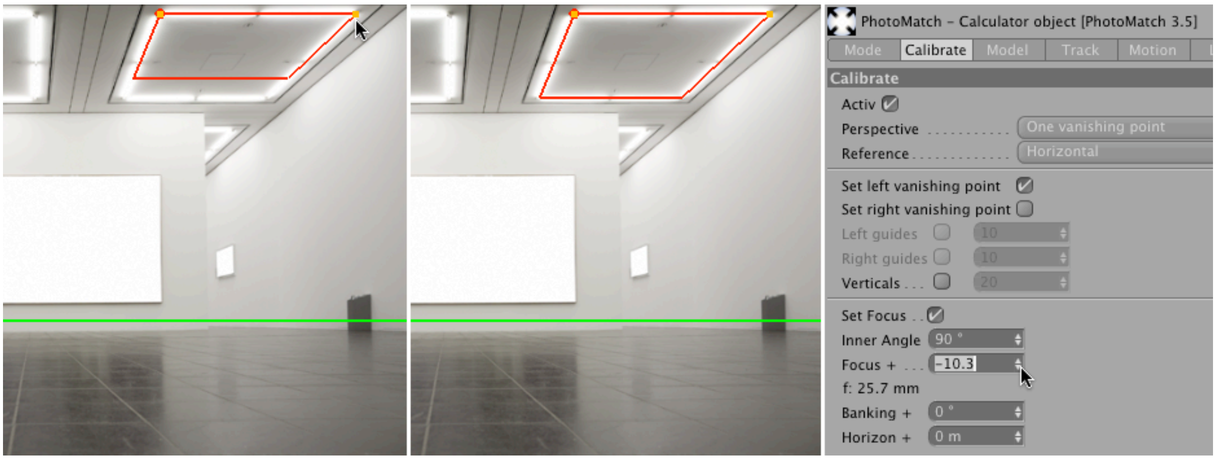
Calibrating the camera in one vanishing point mode
Having a look at the following photo, you can see a typical one point perspective. All horizontal lines will meet in just one point. Having such a perspective you should use the One vanishing point mode in the Calibrate tab. Using just one pair of lines is often enough in this mode, so just switch on Set left vanishing point or Set right vanishing point option.



In this example we picked two lines on the right side of the image as you can see above. Take care that the arrowheads point away from the photographer always, following the perspective of the edges. PhotoMatch can calculate the height of the horizon line by these lines already, but it cannot know about the camera rotation or it's focal length.

That's why you can access the **Reference** menue in this mode and chose between a vertical frame and a horizontal frame. This virtual frame has two new handles as you can see in the image below. The handle with the circle around it can be used to move the frame. The other handle scales the size.of the frame.

All edges of this rectangular frame have the same length. This allows us to match it to ground tiles or other square structures in the photo. As you can see in the next image, we used the horizontal alignment of this reference frame to place it above the lights on the ceiling.

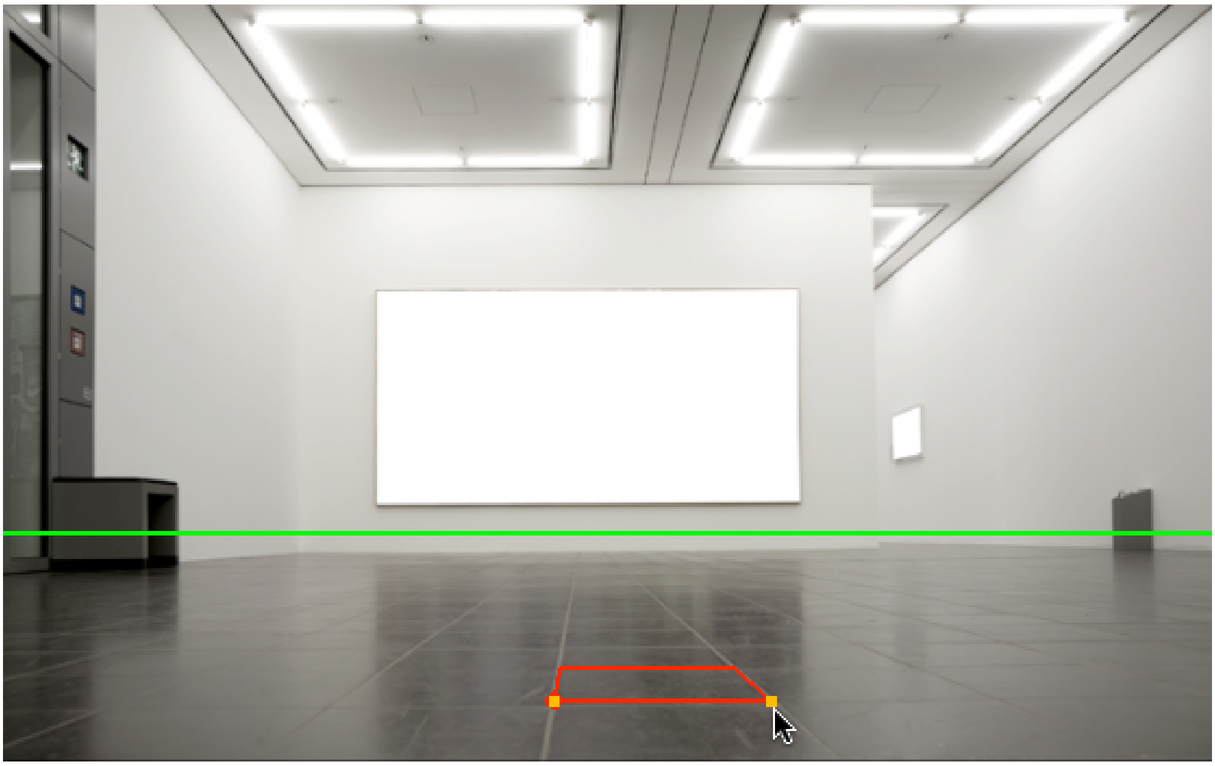


The left side of this image shows, that we cannot match the light shape exactly by scaling with the given handles. As we can asume, that the ceiling lights form a rectangular and square structure, we can use the manual focus parameter to adjust the focal length.

As you can see in the middle and on the right side of the image, lowering the **Focus +** value scales up the depth of the reference frame until it finally matches the photo.

To verify this value you can move the reference frame to another place now and check if it fits there, too.

As you can see in the next image we used the frame handles again to move it towards one of the floor tiles and to match the tile size. As we can asume that the ground tiles are perfect squares, too, it seems that we found a good estimation for the focal length.

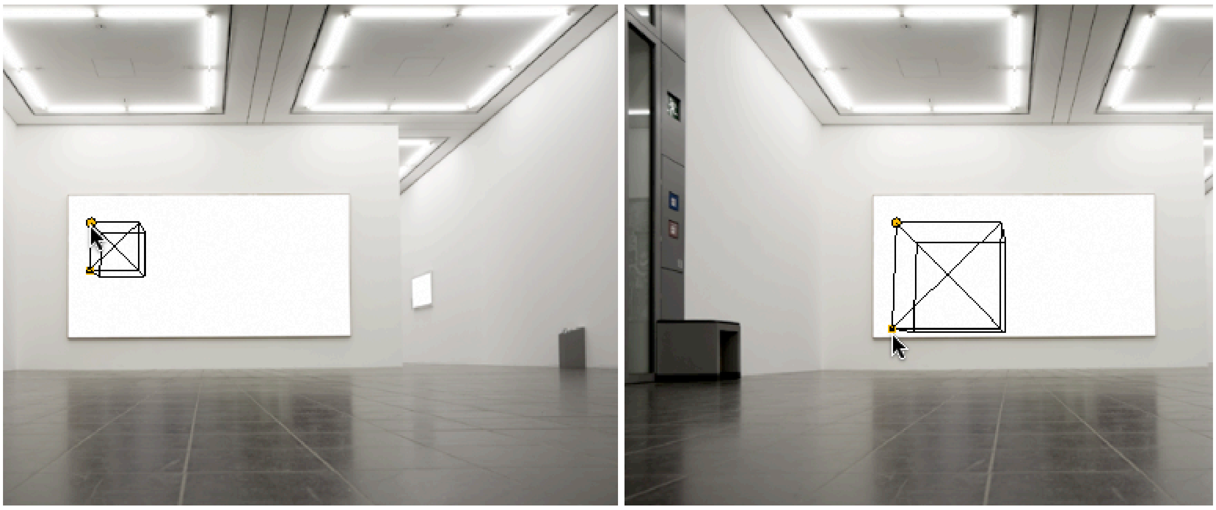


Working in Model mode

Using the reference cube for more precise calibration

After the calibration is done, you can already start to place your 3D objects in front of the camera. Their perspective will already align with the perspective of the background image. Just in some cases the calibration needs further enhancement, for example if vertical lines have to be corrected still.

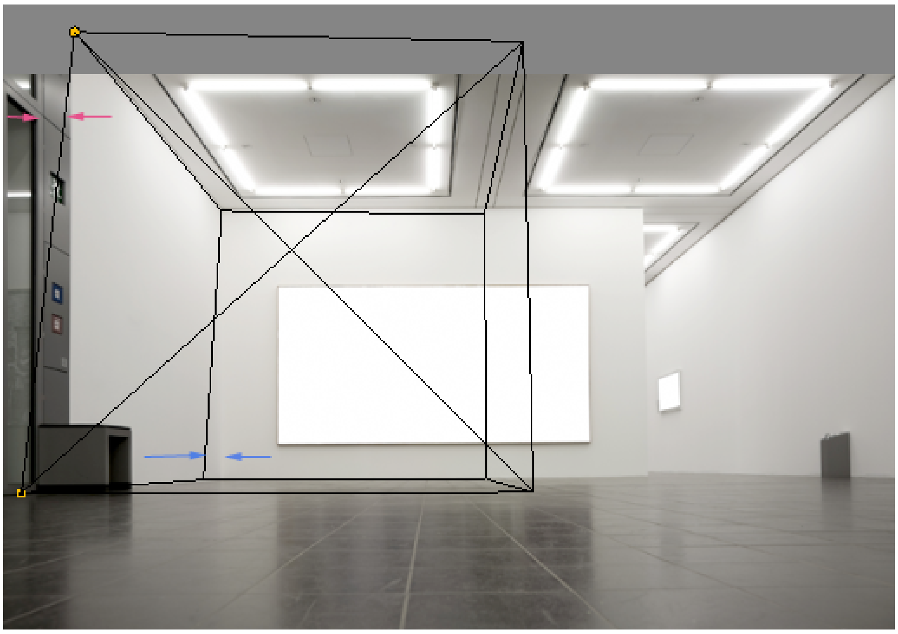
To verify this, navigate to the Model tab of the PhotoMatch dialog and switch on the **Active** option there. The front viewport will show a cube shape now with new handles. This cube can be used to verify the calibration and to place objects or polygons in your scene.



The above image shows this cube shape. You can move the cube with the handle that has a circle around it. The size of the cube is controled by the triangle shaped handle. Holding down the **CTRL** key while using the circular handle, you can rotate the cube.

Holding down the **Shift** key while using the left mouse button on the circular handle, you can change the width and depth of the cube.

To verify the calibration, place and scale the cube to match some of the structures you see on the background image. The image below shows how we tried to match the cube with the wall structures on the left side and the backside wall.



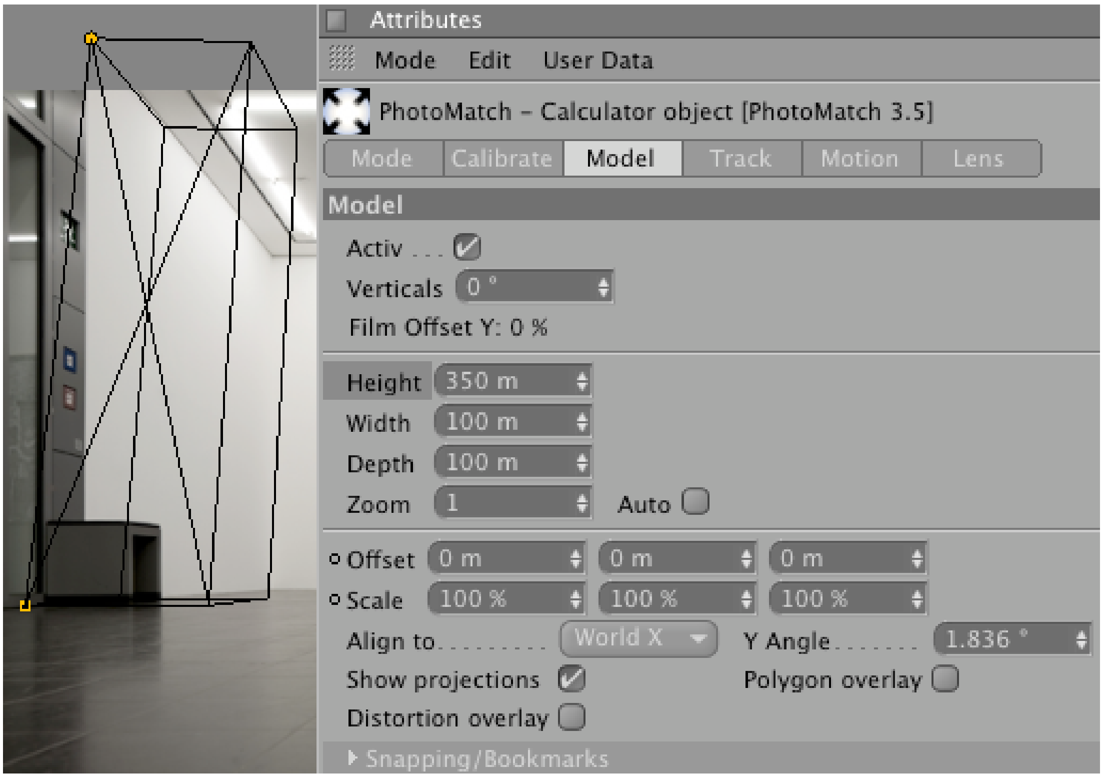
As indicated by the colored arrows, the vertical lines of the cube don't match the edges between the walls on the photo. We can fix this by using the film offset feature in a minute, but first lets try to work with real measurements.

As you can see in the Model tab of the PhotoMatch dialog, the cube shape offers **Height**, **Width** and **Depth** values to set its size. Using the handles in the viewport will not really change the cube size, but control the position of the cube in 3D space. Scaling the cube up there in the front viewport moves it closer to the camera so it appears larger. The real edge length is only set in the dialog or by using the **Shift** key with the circular handle.

The key value there is the **Height** of the cube shape. Set this value as precisely as you can to match the real world measurement of the structure below the cube on the photo.

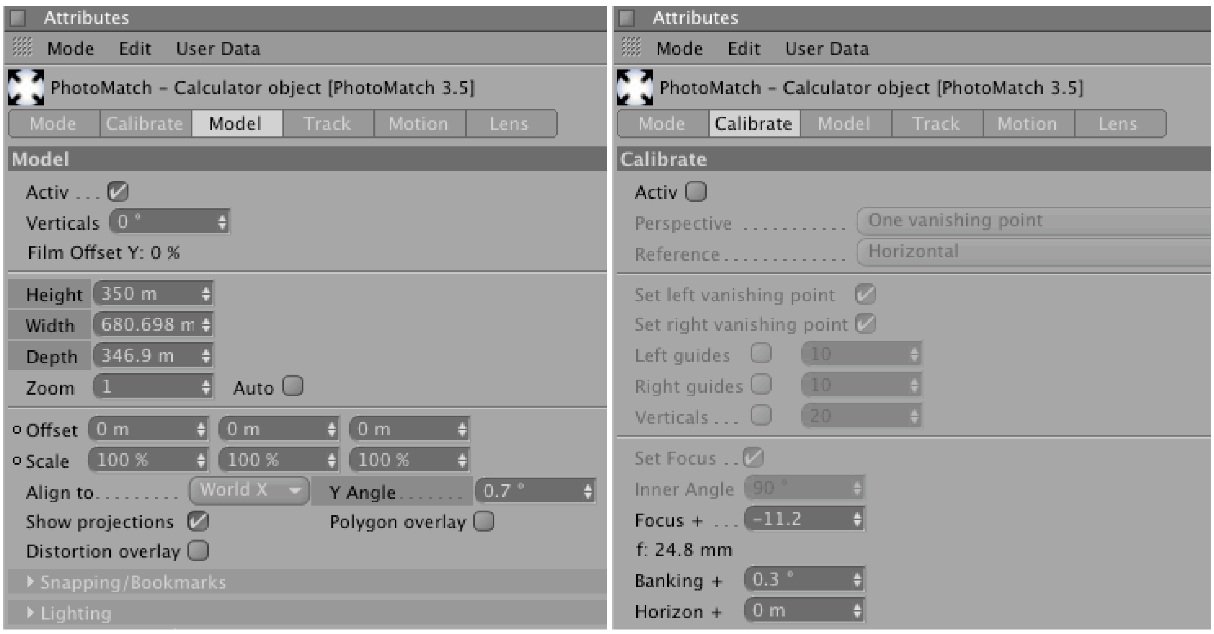
In our example we don't know the exact height of this exhibition room, but we can take a guess that it's maybe about 3.5 meters height. We enter 350 into the **Height** value field, so we don't have to deal with too small values.

As you can see in the next image below, this scales down the width and depth of the cube shape in the editor view, but the height stays fixed.



The cube now really has a height of 350 units and is placed in the right distance towards the camera to match the distance between the two handles. You can still move and scale the cube now by using the handles.

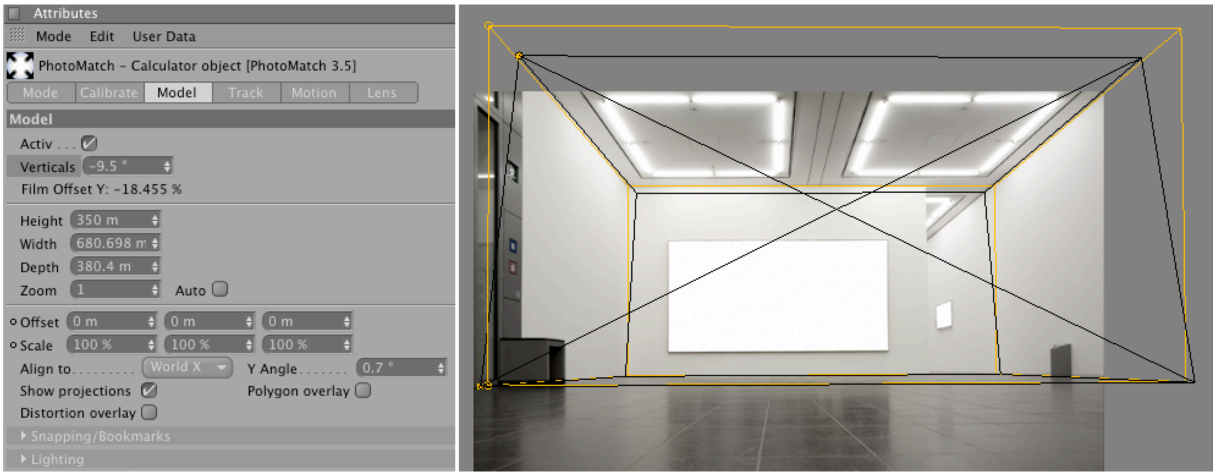
Now increase the **Width** and **Depth** values until the cube shape matches one of the structures you can see on the photo. This can be a building or just a sofa in an indoor scene. If you estimated the height precisely, you can get a perfect 3 dimensional measurement now by using the cube shape. You can also switch back to the Calibrate tab at any time and correct the manual focal length value **Focus +** or the other parameters there, to change the perspective of the cube. The cube shape is not only a modelling tool, but also nice to verify the calibration, especially in one point perspective mode.



As you can see in the image above, we changed all the size values and also the **Y Angle** value to match the cube shape with the room on the background image.

We also adjusted the **Banking +** value a little bit as you can see on the right side of the above image.

As the problem with the vertical edges on the cube still exists, we will now use the **Verticals** value on the Model tab part of the dialog to fix this. This will create another set of lines in the viewport, showing both the original and the distorted cube. You can still use the handles on the original cube to move and scale its shape, but you should only look at the new cube, which has orange color by default.



First correct the vertical lines by using the **Verticals** value, then reposition and resize the original cube shape to match the orange cube with the photo structures again if needed.

As you can see above we used the cube to match all visible walls, the floor and the ceiling.

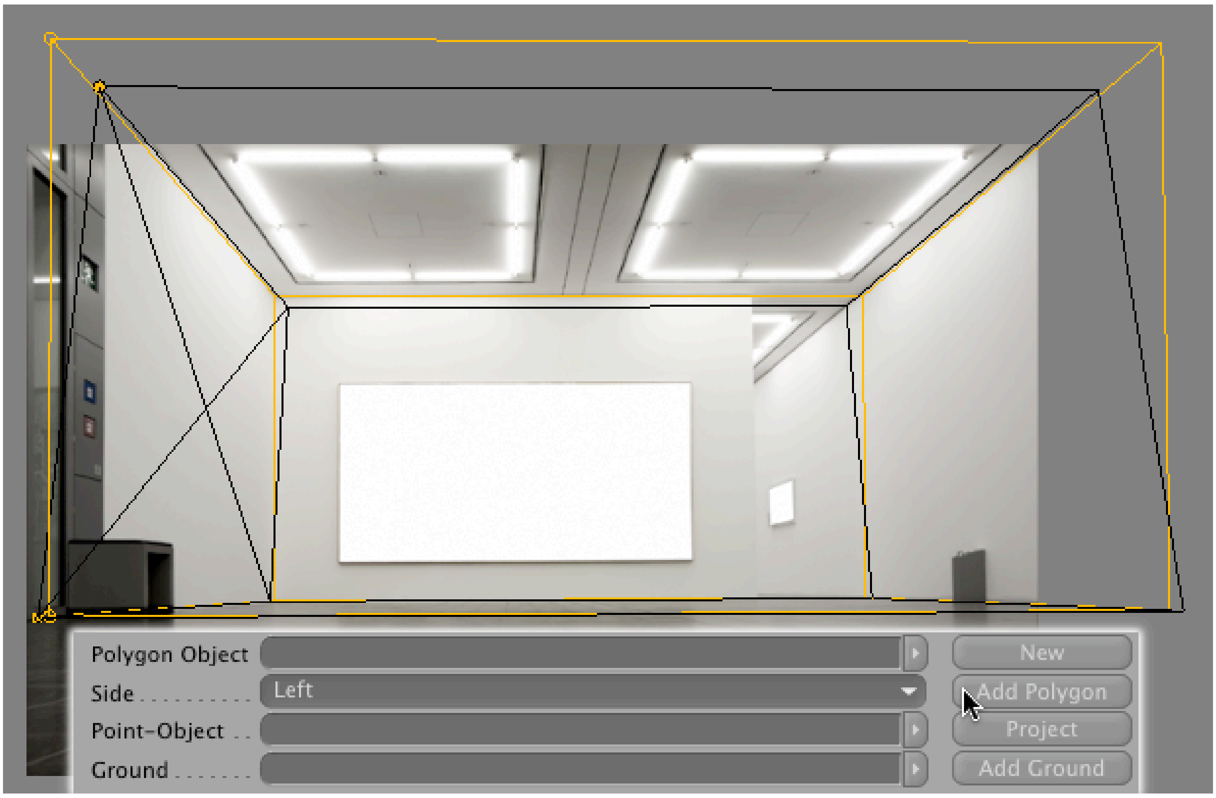
Using the modelling features

As the cube now already alignes perfectly with the photo features, why not use it directly for modelling as well? To create geometry you can use different PhotoMatch features. If you want to create a parametric object within the reference cube shape, just use the buttons in the lower part of the Model tab.

You can use these buttons to create a **cube**, a **pyramid**, a **cylinder** or a **sphere** with just one click. As those objects are just simple CINEMA 4D parametric objects, you can edit them just the way you are used to already, for instance to add a bevel on a parametric cube.

If you don't need complete objects you can also add single polygons. Just choose the polygon you want to create by the **Side** menue on the Model tab. This will create an X shape on the choosen modelling cube side in the front viewport for better reference.

If you want to rebuild the left wall in this scene, just chose **Left** from the **Side** menue as you can see in the following image.

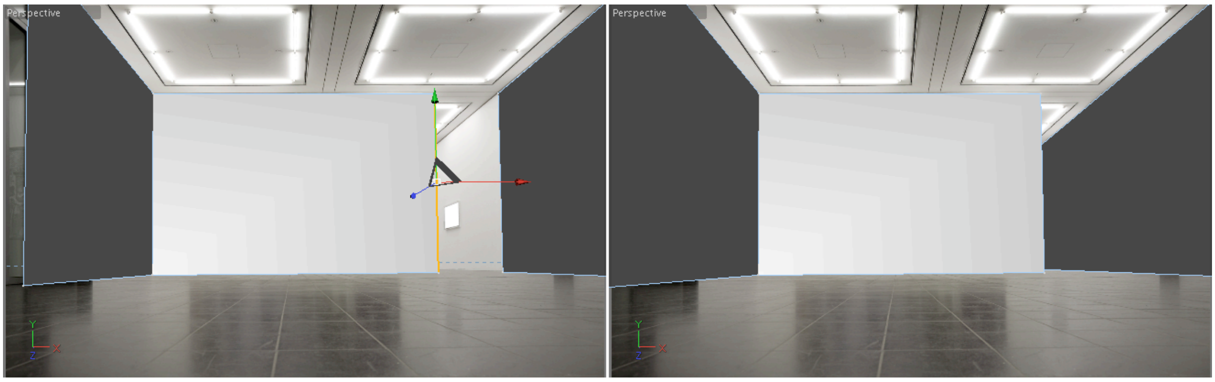


Of course this could differ from your scene in case you used other cube orientations. Just have a look for the X shape always to be sure about your side selection.

After this just use the **Add Polygon** button to add this polygon to your scene.

PhotoMatch automatically creates a new polygon object for you, but you can also drag and drop an existing polygon object into the **Polygon Object** field before adding new polygons with PhotoMatch.

After this choose the **Right** and the **Back** side to add polygons for them als well. Floor and Ceiling can be added later. They would block too much of the background image now in the perspective view.



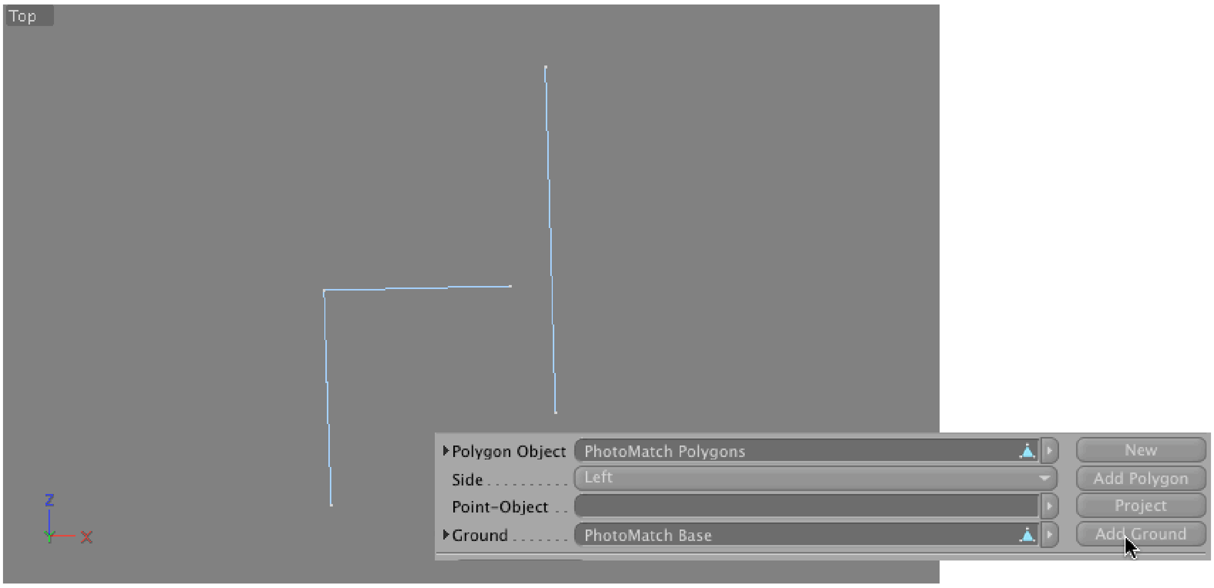
As all created polygons are not optimized and merged by default, you can still select individual edes and move them as you can see in the above image.

As you can see, we work in the perspective view there, to move to selected edges to match the background image.

First move the right vertical edge of the back polygon more to the left, so it aligns with the frontal exhibition wall. This is shown on the left side of the above image.

After this move the edges of the side walls to fill the camera view as you can see on the right side.

Be sure to always use the Modelling Axis tool first to align the axis to the Normal vector of the selected edge. By this you can be sure not to change the angles between the polygons by moving their edges.



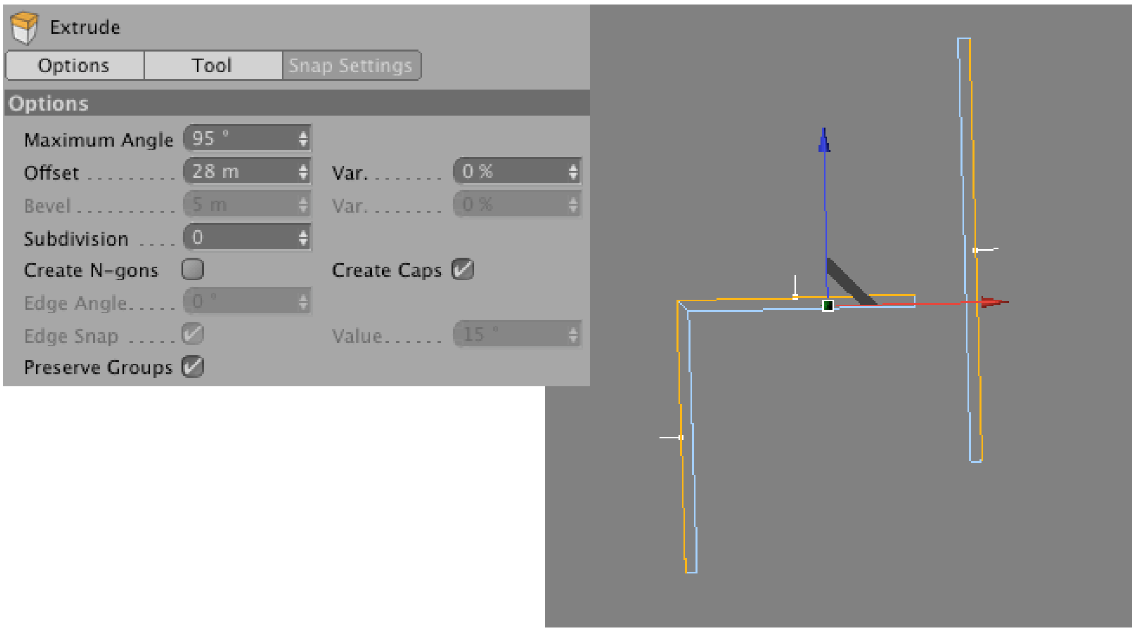
This is proven by the top down view on the scene shown in the image above.

If you are happy with the rebuild of the walls, use the **Add Ground** button to add a huge groundplane.

This is a 1 polygon object, so it will not waste much memory and can still be easily modified if needed. PhotoMatch automatically places this object on the same level as the lowest point that was created by PhotoMatch modelling tools.

To finish the wall geometries, select all 3 polygons and get the **Extrude** command from CINEMA 4D Structure menue.

Activate the **Create Caps** option there and enter a **Maximum Angle** value well above 90° before using it. This will give some real thickness to the walls as you can see in the following image.



<u>Modelling with Offset features</u>

If you need PhotoMatch to model more complex structures and many different shapes at different locations, the new **Offset** and **Scale** features will be your best friends.

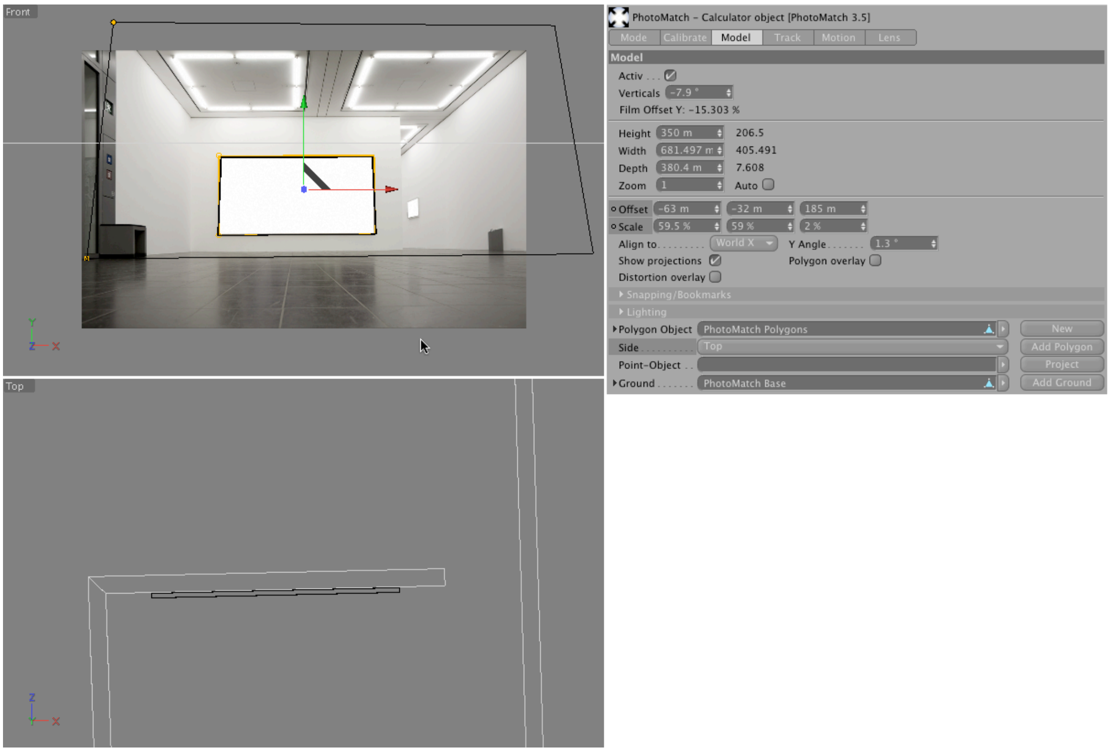
By using them you don't have to move the original reference cube. Just use it as a basis for further modelling.

Using the 3 **Offset** values you can move the preview cube relativ to its original position in space. By entering 10, 20 and 30 into the 3 input fields, the cube will move 10 units along its X axis, 20 unitis up on its Y axis and 30 units along its Z axis. So setting all values back to 0 brings back the original cube position again.

Using the **Scale** vector works the same way, just this time you can change the size of the original cube shape. A value of 100% in all 3 input fields brings back the original size at any time.

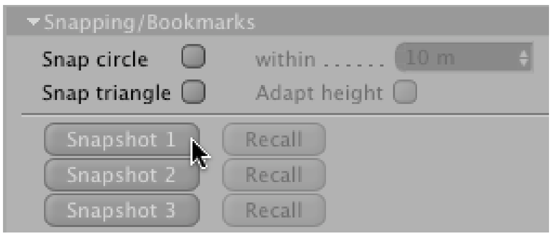
Changing the **Scale** values above or below 100% changes the size of the cube, so you can see new **Height**, **Width** and **Depth** values next to their input fields.

In the following image we used these features to scale and move the preview cube to match the image frame on the exhibition wall. If you use **Top** in the **Side** menue and activate **Show projections**, you can have a look at the top down viewport for a more precise placement of the new cube.



As you can see in the above image, it’s easy now to place the cube directly on the wall and to match the given frame representation of the photo.

<u>Bookmarks</u>
While modelling more complex scenes you might want to move around the reference cube a lot to add geometry at different places in space. If you want to get back to a specific place at any time you can use the Bookmark feature by using one of the 3 available **Snapshot** buttons.

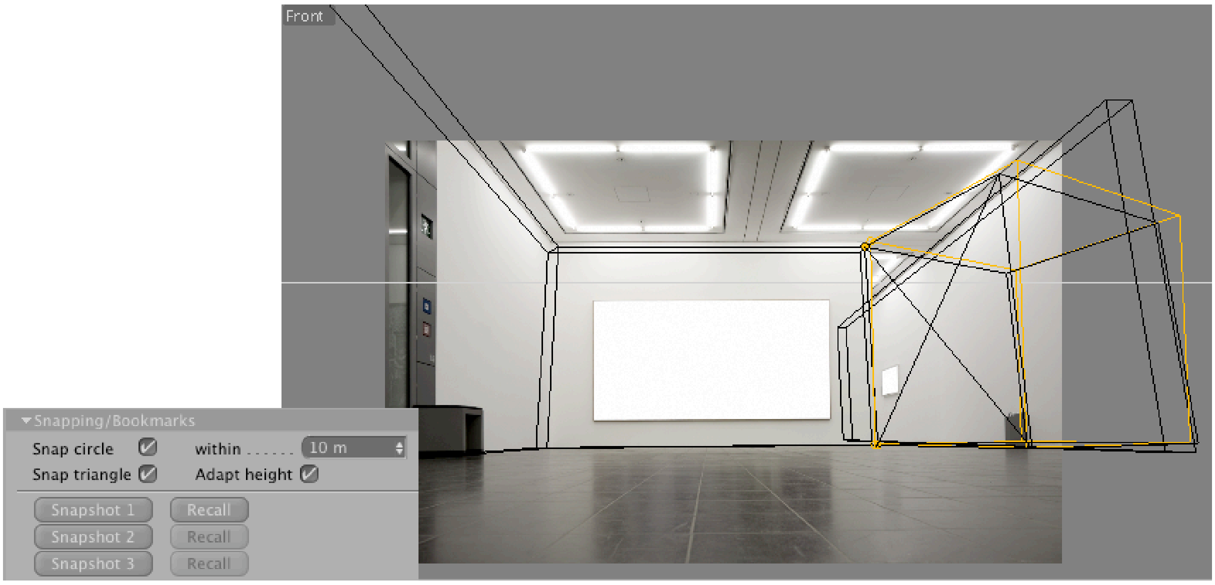


Using a **Snapshot** button will save the current position, size, rotation, offset and scale of the reference cube. You will be able to get back the stored data by using the **Recall** buttons next to the **Snapshot** buttons.

<u>Snapping</u>
Another nice feature allows you to snap the handles of the preview cube to already existing points. To use this feature you have to select one or both of the **Snap circle** and **Snap triangle** options. „Circle“ and „triangle“ are refering to the 2 reference cube handles that have a circular or triangular shape around them.

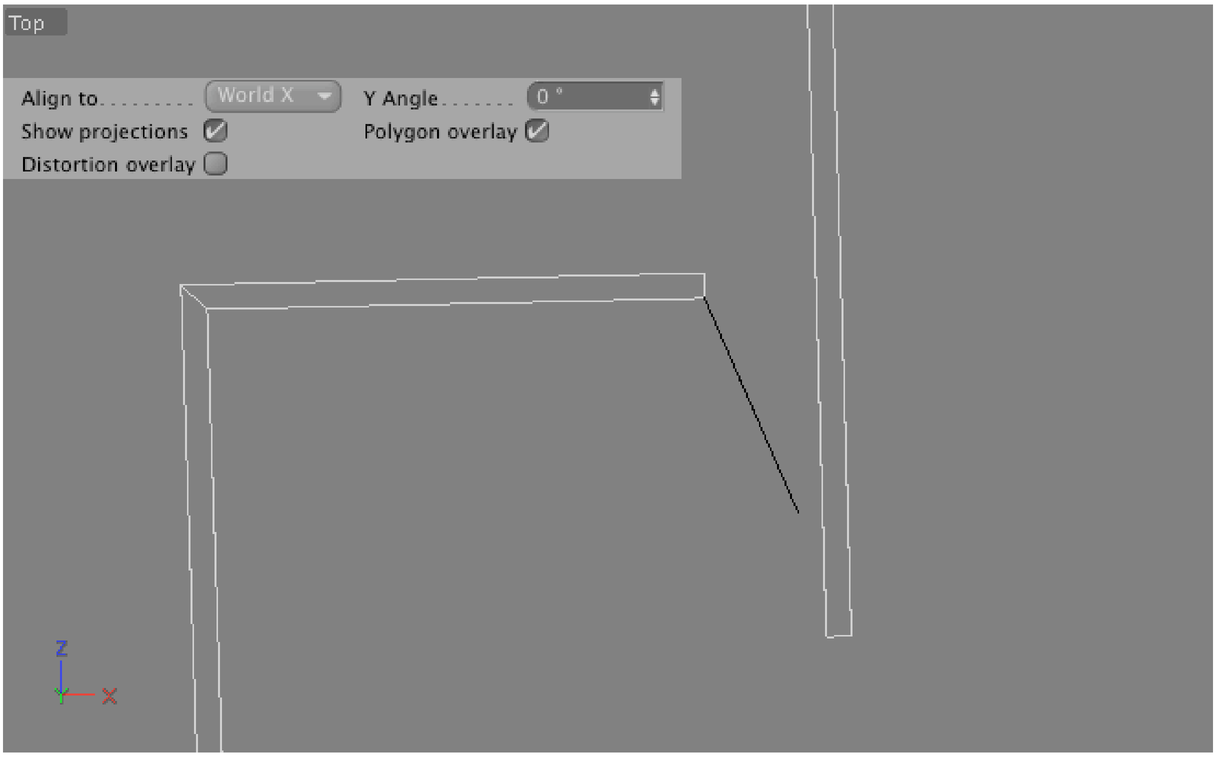
To make this feature useable, you should also activate the **Polygon overlay** option, to see already existing polygons in the front viewport.

This only works for polygons that belong to the object set in the **Polygon Object** field.



The **within** value, defines the snapping radius. Snaping with PhotoMatch is only a 2D snapping by default. The handles will snap to the frontal projection of geometry points only. If you need real 3D snapping, use the **Adapt height** option before snapping the handles to existing geometry. Only this will allow you to add geometry at the 3D position of the snapped points.

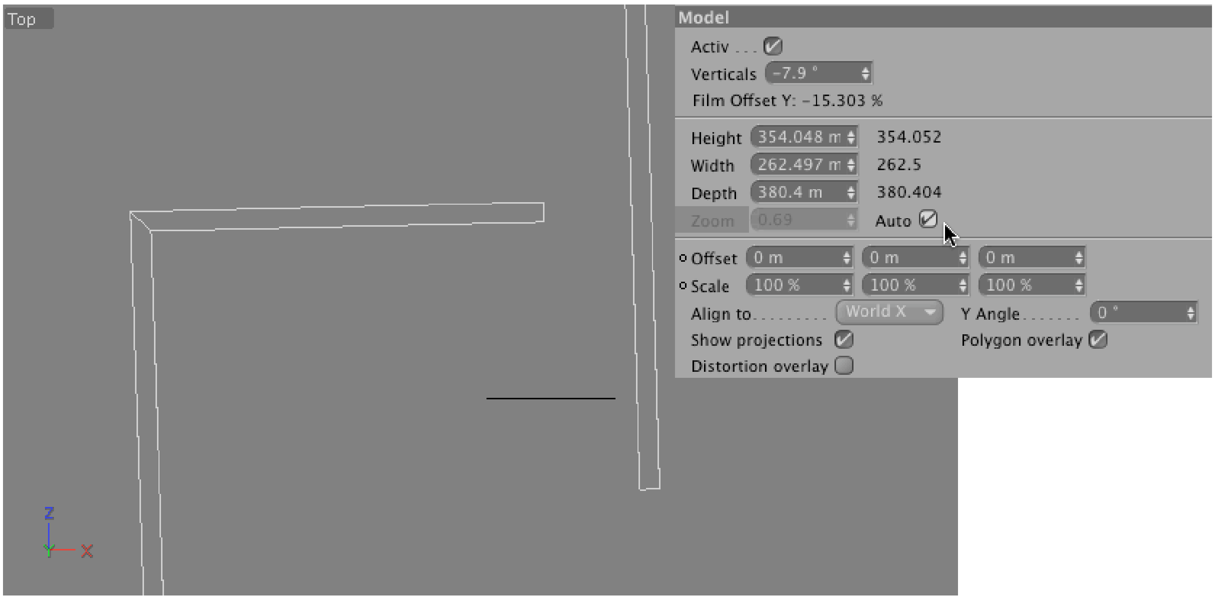
After such snapping is done, PhotoMatch also gives you 2 different rotation systems to choose from. The default setting is **Align to World X**. This means that a reference cube with a **Y Angle** value of 0° is parallel with the world X axis. Choosing **Align to Normal** calculates the surface normal at the snapped polygon edge, so a **Y Angle** of 0° will align the reference cube with the snapped edge normal.



Ground snapping

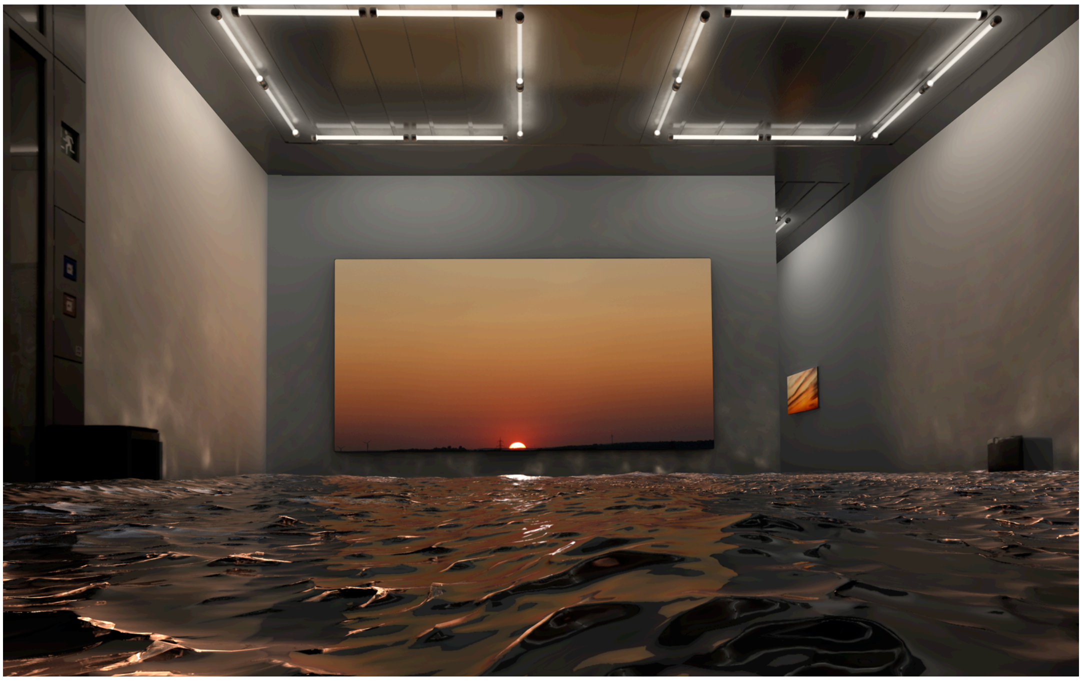
As all PhotoMatch modelling is done in the frontal view, the workspace is missing the depth information to place our geometry. This is no big problem as we can work with real world measurements and PhotoMatch will automatically place the cube at the correct distance.

Sometimes, if we don't know the real height of the structure below the reference cube, we can use the **Zoom** value to move the preview cube away from the camera or to reduce the distance. You can see how the choosen cube face moves in space by activating the **Show projections** option and watching the top down or side viewports.



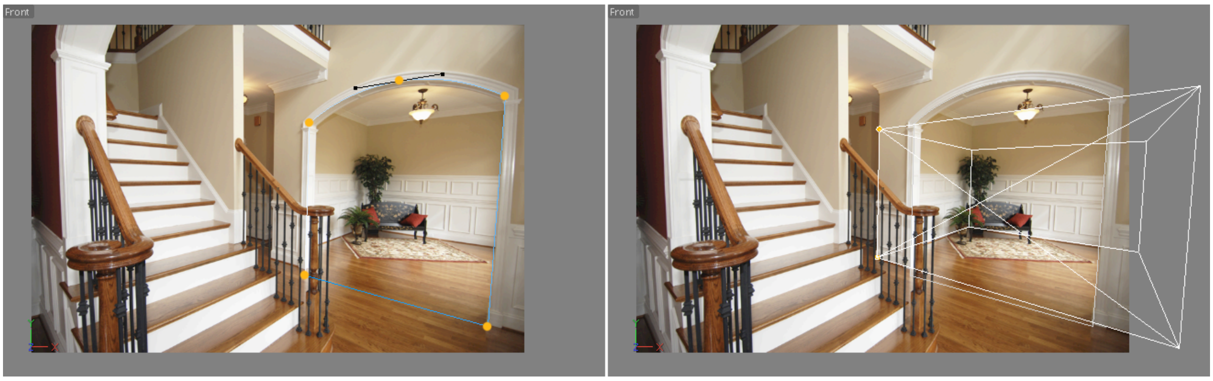
If there is already a Ground object in the scene and asigned to the **Ground** field in the PhotoMatch dialog, switching on the **Auto** option will automatically calculate the right distance for the reference cube at any time, so its lowest edges always stay firmly on this groundplane. Using the **Zoom** or the **Auto** options will change the given cube size parameters. The new values can be found to the right of the original **Height**, **Width** and **Depth** input fields.

To move the cube in 3D space while **Auto** is switched on, you can still use the reference cube handles. Just take care that the lower handle can still be projected to the ground plane and is not placed above the horizon line. The cube can not be snapped to the ground if positioned too high.



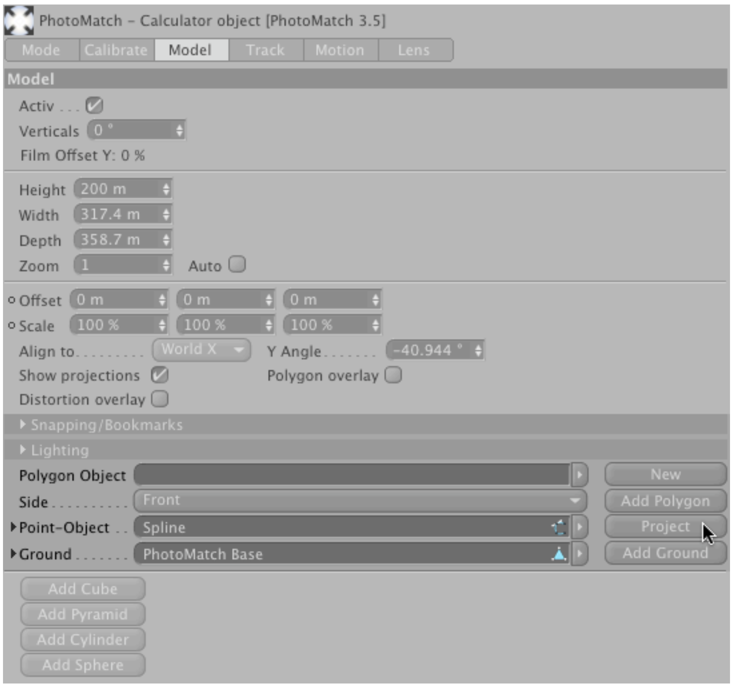
Using Spline objects for modelling

Of course not all structures can be modelled by using simple planes, cubes or cylinders. For more complex shapes using a spline object with a CINEMA 4D NURBS object gives better results. PhotoMatch allows this mode also. Just draw a spline object in the frontal viewport above the structure on the background image that should be rebuild. After this adjust the PhotoMatch reference cube so that one of its faces has the same position and orientation as the structure that is below the spline shape. The following image shows such a spline drawn in the front view on the left side. The right side is showing the position and orientation of the reference cube. Take care to switch from Point mode to Model mode within CINEMA 4D to be able to see the reference cube in the front viewport.



Select the right reference cube face using the PhotoMatch **Side** menue and drag the spline object from the Object Manager to the **Point Object** field on the Model tab. Use the **Project** button to project this spline object to the choosen face of the reference cube.

The next image is highlighting the important part of the PhotoMatch dialog for this step.



The size of the reference cube doesn’t have to match the size of the created spline.

Only the position and orientation of the reference cube is important for this projection calculation.

After projecting the spline, you should be able to see the spline curve in the PhotoMatch camera viewport. You can now combine this spline object with any NURBS objects to create 3D geometry. The next image shows the projected spline on the left and an example of a possible combination of modelling objects on the right side. Here the spline was used with an ExtrudeNURBS objects and then subtracted from a cube that was created by PhotoMatch.

Please also watch our workshop movies for a more in depth understanding of such modelling and texturing techniques for compositing.

Finding the matching key light position

PhotoMatch not only helps you to calibrate your camera and rebuild geometry, it is also very helpful while trying to match the lighting of your scene.

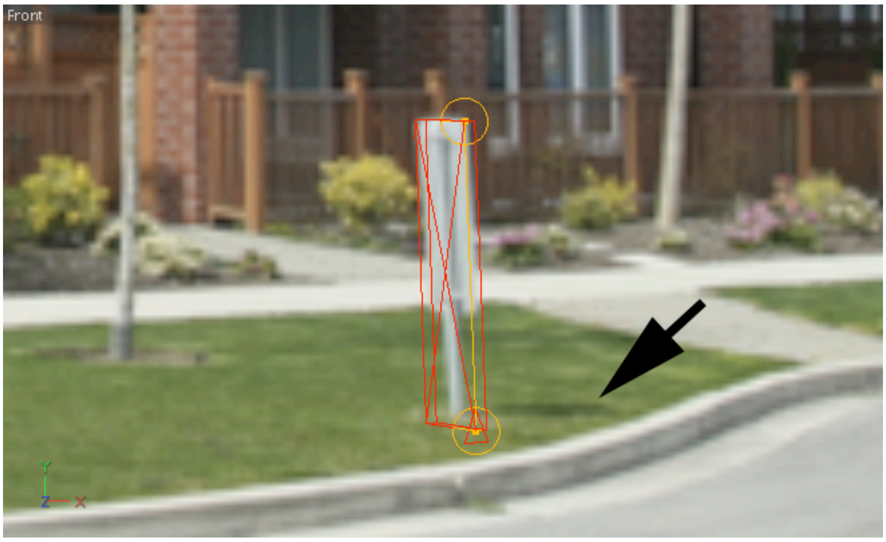
As we can rebuild parts of the shown image, we can also simulate shadow directions using the Lighting features within the Model Tab of the PhotoMatch object. Have a look at the following example to understand the basic workflow of this feature.

As you can see here, we loaded an image with an outdoor scene, already did the calibration and placed the reference cube over some part of the building to verify the calibration and to place a cube object there.

Doing this we are able to add a ground plane object using PhotoMatch. This new polygon object is placed right below the building cube. You should add this object before using the lighting tools of PhotoMatch, as most shadows are seen on the ground of your scene.

As we want to match the keylight of this scene for compositing, we should have a closer look at the background image for shadows then. Most of the stronger shadows are caused by the keylight, for example the sun. Having a look at the trees and the street signs in front of the buildings we can spot some nice shadows, so we should place the reference cube at the position of one of these objects.

We can estimate the height of the street sign with about 1 m. That's all we need to know. Activating the **Auto** option for the **Zoom**, PhotoMatch will take care, that the lower part of the reference cube stays firmly on our ground plane. Adjust **Width** and **Depth** of the cube to match the street sign shape.



The image above shows the already aligned reference cube and marks the shadow with an arrow.

Now it is time to switch on PhotoMatch lighting by the **Active** option within the Lighting part of the Model tab. As lighting needs a light source, use the **New** button next to the Lightsource link field in the dialog or drag and drop an existing light object from the Object Manager to this field.

As you can see in the image above, the Lighting section of the dialog offers a **Center** vector to position the center of the sky hemisphere.

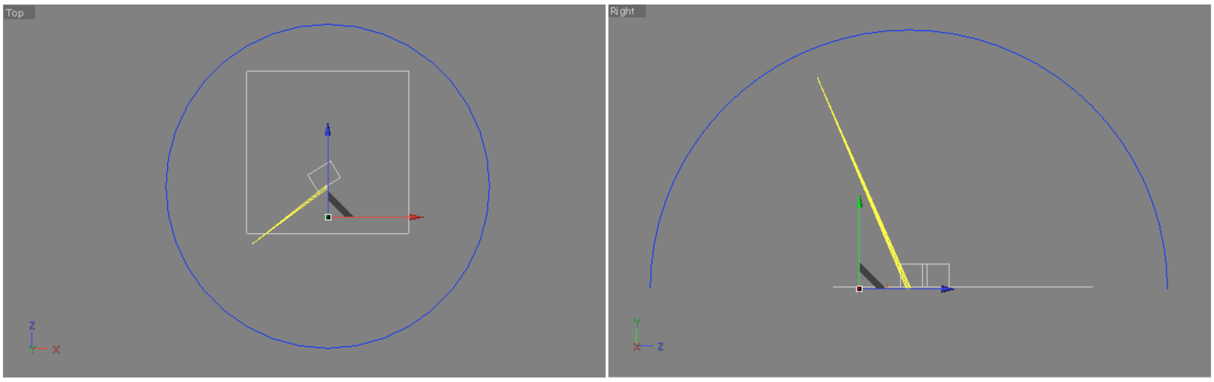
This values are used in world coordinates, so the vector 0,0,0 will place the center of the sky dome within the world origin. Changing the values you can move the hemisphere around and place it closer to your main geometry if needed.

Using the **Radius** value you can define the size of the hemisphere and adapt it to the scale of your scene. The key light will always be placed on the hull of this hemisphere.

The **Direction** value moves the light source around the hemisphere. A value of 0° places the key light along the positive world X axis, 90° would place it above the positive World Z axis.

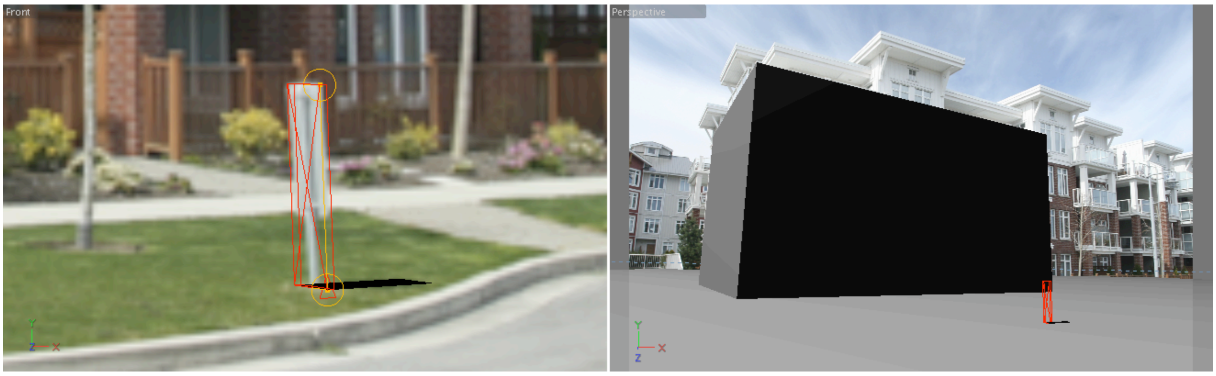
The **Height** value sets the height of the key light above the Center of the hemisphere. A value of 0° will place the light on the horizon line of the hemisphere, a value of 90° will result in a placement right above the hemisphere center.

As the front viewport, the top down view and the camera viewport will show you a preview of the shadow caused by the lightsource and the reference cube, The **X-Ray** option can give this shadow a more transparent look, so it is sometimes easier to see the original shadow of the background image.



In the top down viewport and in the side viewport you will get some reference about the size and position of the hemisphere and the position and the direction of the lightsource. The image above gives some idea about this.

The lightsource is always pointing at the center position of the hemisphere. Yellow lines indicate the position of the lightsource and the direction of the lightbeams. The Z axis of the lightsource is auto aligned to this direction so you can also use area lights, directional lights and shadow cones without further preparations.



The image above shows two different viewports and how the PhotoMatch shadow visualisation is calculated there. The shadow visualisation always represents a hard shadow, so the size and strength of the rendered shadow can differ from the final rendering based on your shadow type choice.

The above image shows a test rendering of this scene after activating Global Illumination and adding a large sphere around the scene to add a diffuse bounce light.

Use the given parameters to control the length and orientation of the shadow below the modelling cube. When you are happy with the result, just switch off the **Active** option in the Ligthing section of the PhotoMatch dialog again.

As PhotoMatch creates a simple CINEMA 4D lightsource using the Lighting features, you can change the color, intensity and shadow parameters of this light at any time by selecting the PhotoMatch Light object in the Object Manager.

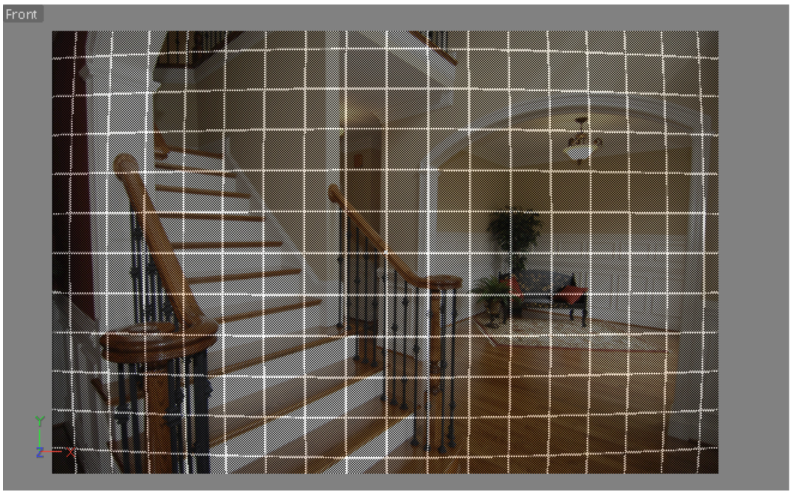
As a lightsource created with PhotoMatch has no shadow by default, you should choose one of the shadow types first after creating this light.

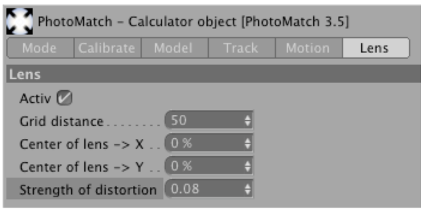
You can do this from within the PhotoMatch dialog by unfolding the triangle icon in front of the Lightsource input field.

Working in Lens mode

<u>Setting the Lens distortion</u>
Especially when using lenses with small focal length values, you will get photos with noticeable lens distortions. The amount of distortion is always stronger near the borders of the photo. If you have to compose 3D objects near the borders of the background image you should undistort the photo before loading to PhotoMatch. Software packages specialized in image manipulations such as Adobe Photoshop can do this for you. An image is undistorted if all straight structures also appear straight in the photo as well.

Sometimes you might want to keep the lens distortion for artistic reasons or to add more photo realism to your renderings. For such situations PhotoMatch includes a Lens mode to estimate the amount of lens distortion of your loaded background image.

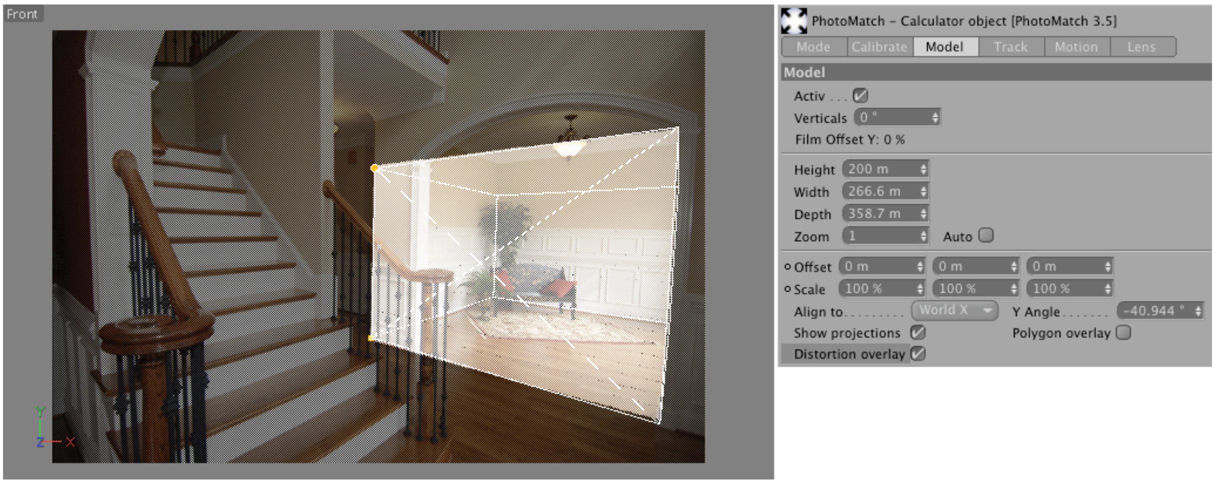




By activating this mode, the front view will show some grid lines. Increasing or decreasing the **Strength of distortion** in the PhotoMatch dialog will bend those lines, as you can see in the image above. If you need to see more or less grid lines, decrease or increase the **Grid distance** value.

Normally a perfect lens has its center exactly in the middle of the photo, so both **Center of lens** values can be kept at 0%. If you are using cropped photos, the original image center might be offset a little, so you can use those values to shift the virtual lens center.

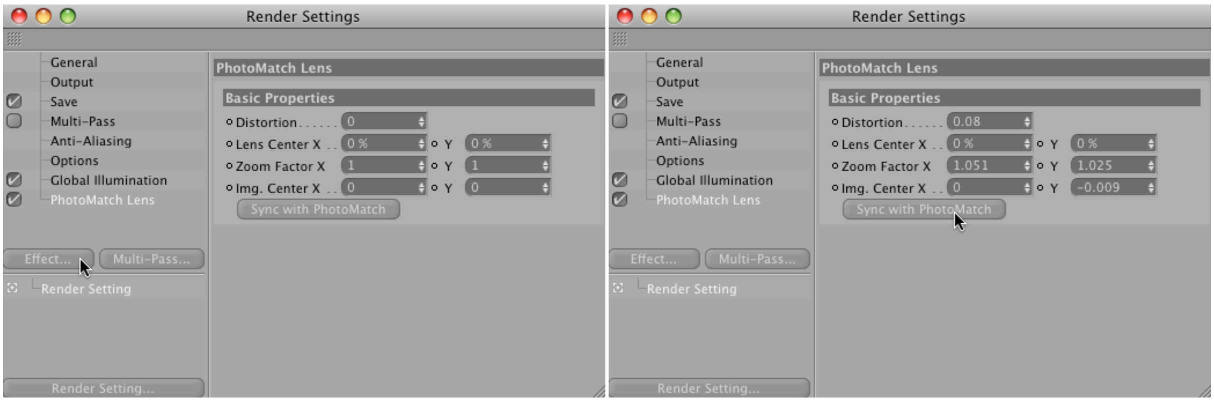
The grid lines only can give you a rough representation of the distortion, because the distortion calculation is quite complex. That's why you will find **Distortion overlay** options in Model mode and in Track mode. Activating these options, the set lens distortion is calculated for the choosen reference cube face in the front viewport. The next image shows such an overlay in white color.



Larger cube faces might take some time to compute and will slow down the editor, but can give you a good reference for the amount of distortion in your background image. In the scene above, we matched the right side of the cube front to the wall opening. Switch back to Lens mode at any time to adjust the strength of distortion if needed.

If you are happy with the results, don't forget to switch off the **Distortion overlay** to speed up the editor again.

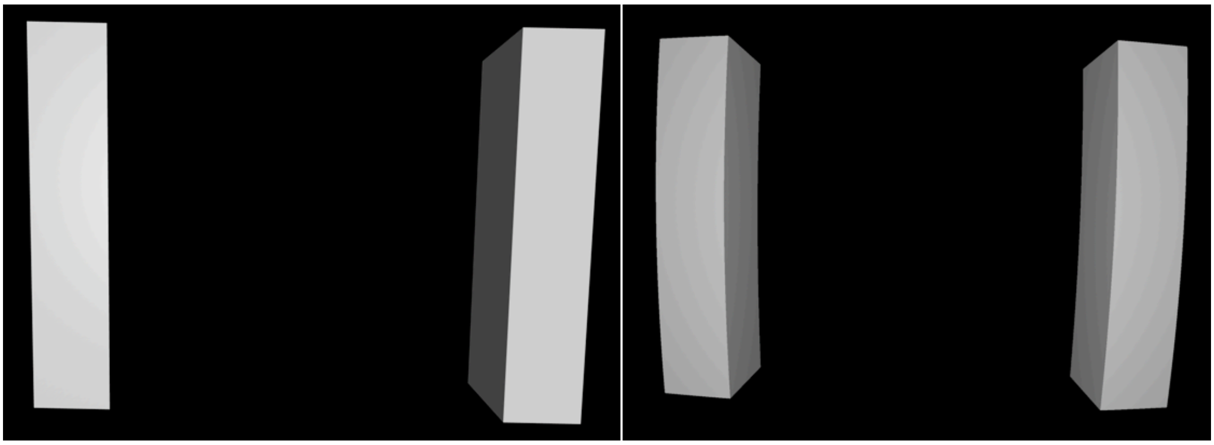
<u>Calculating lens distortions for your rendering</u>
To be able to render lens distortions, PhotoMatch comes with a separate PhotoMatch Lens plugin. You can activate this functionality within the **Render Settings** of your scene, using the **Effect** button as you can see below.



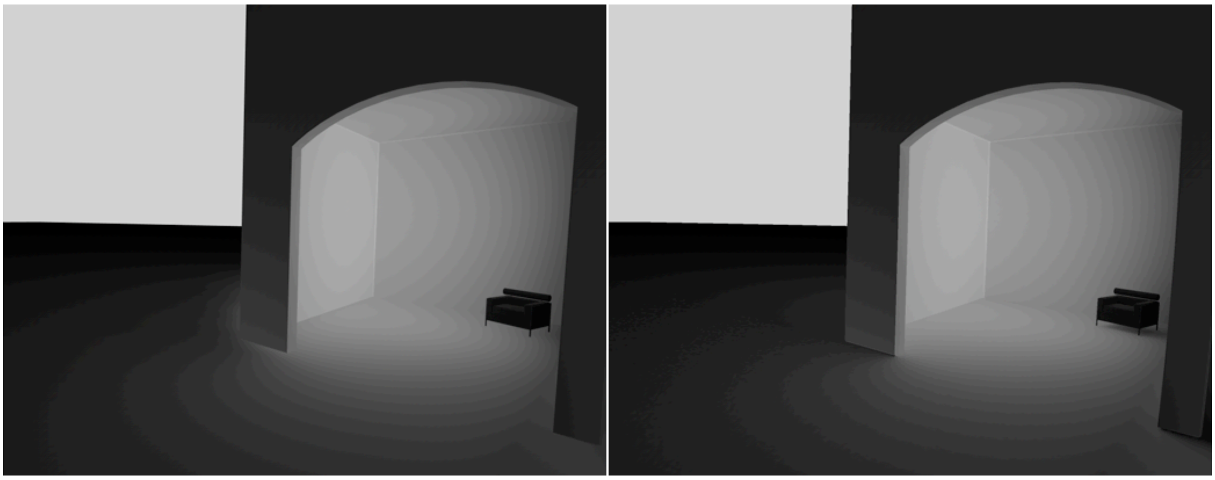
Choose the PhotoMatch Lens effect from the list and then use the **Sync with PhotoMatch** button to transfer the lens distortion settings from PhotoMatch to this rendering effect plugin.

Beside the parameters given in the PhotoMatch dialog, the PhotoMatch Lens plugin will also calculate additional zoom and offset values for you. This is necessary, as applying lens distortions to an image will change the size of the objects.

The next image gives an example for such a calculation without additional zooming. On the left side you can see a rendering of two cubes without applied distortions. The right side of the image shows the same rendering just with additional lens distortions. The cubes appear shorter. This could be a problem while doing precise compositing later as rendered background objects and their textures are not affected by the lens distortion calculation.



Of course you can also use PhotoMatch Lens just by itself, without using PhotoMatch in your scene. Just enter the amount of distortion you would like to add to your rendering. Syncing with PhotoMatch of course only makes sense if the PhotoMatch object is used in your scene and the **Strength of distortion** there is set to something different than 0. Real world lens distortions range between 0 and 0.2, so there is no need for too high numbers to get realistic renderings.



Finally you can see the distortion result for our simple room geometry from the indoor scene. The left side was rendered without the PhotoMatch Lens effect, the right side shows the small, but noticeable distortion especially on the right side of the frame.

As the distortion calculation includes some complex mathematics, it will slow down the rendering. Using normal raytracing this is no problem, but using Global Illumination this can slow down rendering quite a bit, because many calculation rays are send out to the scene and have to be distorted. Having to render at higher resolutions with Global Illumination you should think about adding lens distortions in post to save on rendering time.

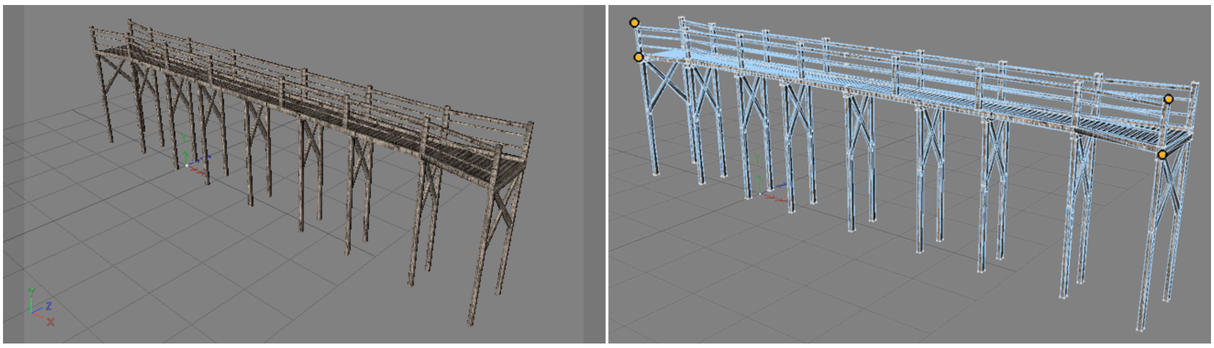
Working in Track mode

Placing 3D objects within the calibrated scene
You already know how to add polygons and primitive objects to your scene with PhotoMatch. How about adding already existing, more complex objects?

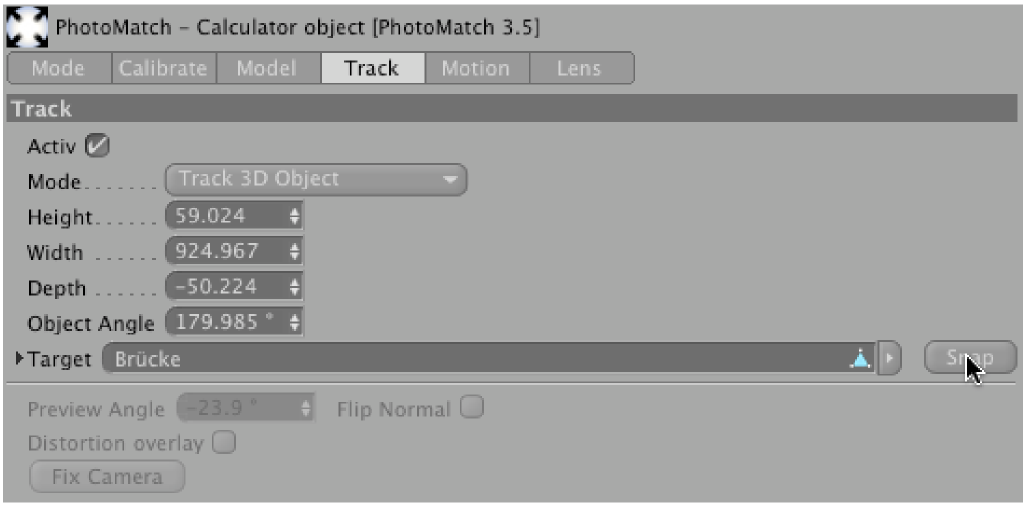
PhotoMatch is also prepared for this. Think about an outdoor scene and about a situation, when you have to replace one of the shown buildings by a new one. Maybe you already have this new 3D building and just have to compose it with the given background image.

As you can see in the upper image, we are using a photo of an old town and already placed the calibration lines to match the perspective and the focal length for the PhotoMatch camera.

At the lower left side, there is a door opening in the wall leading nowhere. Maybe it would be a good idea to add a bridge there to be able to cross the river.



Lets say we found a nice matching bridge object somewhere on the net or built one by ourselves. The left side of the above image shows an example of such a bridge. As the size and orientation of this bridge has to be matched to the background image, activate the CINEMA 4D Point mode and select four points on the front part of the 3D object that should be visible in the compositing later. This is seen on the right side of the above image.



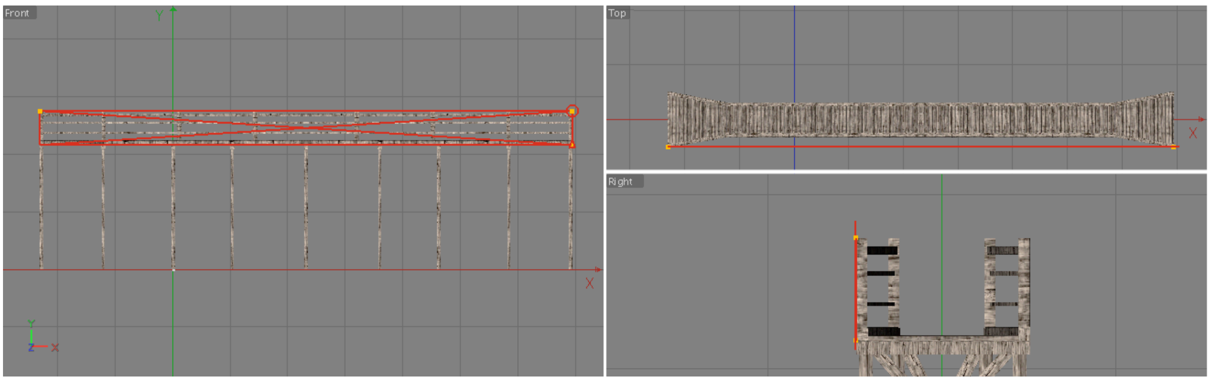
Activate the Track mode within the PhotoMatch dialog and take care that the Mode menue is switched to **Track 3D Object** there. Drag and drop the polygon object with the selected points to the **Target** input field and use the **Snap** button.

PhotoMatch will then calculate the size and orientation of the area between the point selection for you. If you switch back to CINEMA 4D Model mode, you should be able to see a reference frame between the selected points now. The next image shows this reference frame in the different viewports.

If you have to adjust this reference frame or if you want to place it by yourself, you can use the given handles in the top down viewport, the side viewport or the front viewport at any time to move and scale the frame.

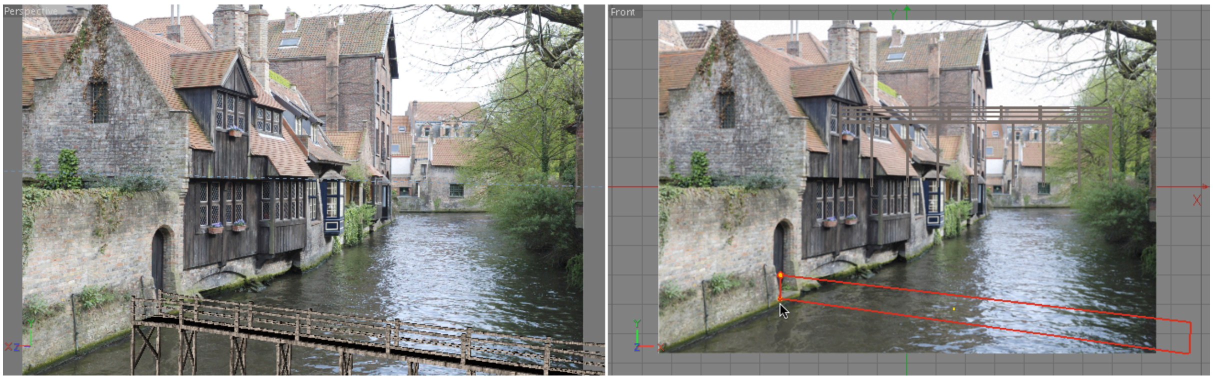
The **Depth** value is controling the World Z position of the Circle handle on this reference frame. **Height**, **Width** and **Object Angle** values can be used to scale and rotate the frame if needed.

This step is necessary to give PhotoMatch enough informations about the size and orientation of the 3D object and its front face.



After you have marked the 3D object with this reference frame, switch the Mode to **Match to Image**. Instead of the 3D reference frame you will now see a different rectangle in the front viewport. This rectangle has two handles again.

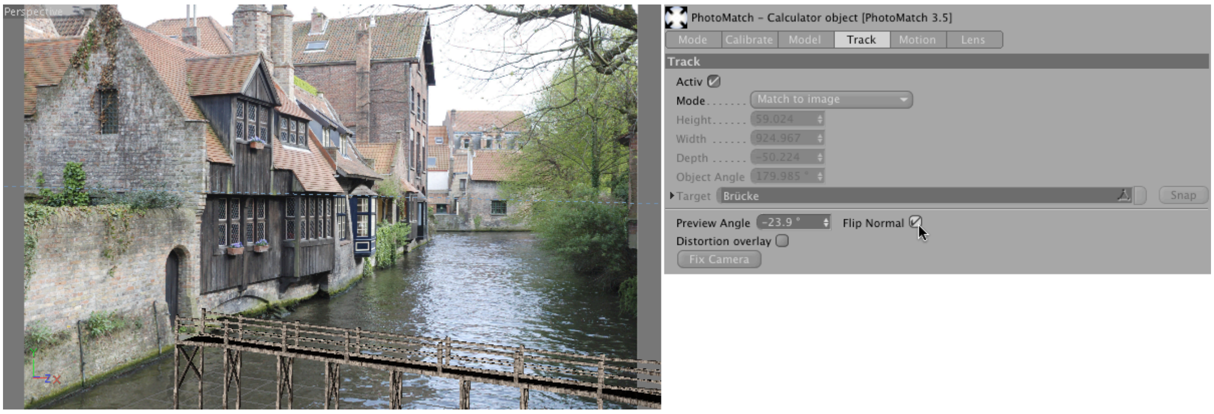
The top handle has a circle around it and can be used to move the frame. The lower handle is used for scaling. Within the PhotoMatch dialog you will also find a **Preview Angle** value to rotate the rectangle.



You should now rotate and place the rectangle above that part of the background image in the front viewport where you would like to see your 3D object. This is shown on the right side of the image above. The left side is showing the perspective view of your PhotoMatch camera.

You can see the bridge object there at the same position and size already compared to the rectangle shape in the front view.

If you have to switch the orientation of the 3D object, use the **Flip Normal** option within the Track tab. The next image is showing the result.



The nice part about this kind of object compositing is, that the size, orientation and position of your 3D object doesn't change at all. Just the PhotoMatch camera is moving around in 3D space. This allows you to exchange, reload or edit the 3D geometry at any time later without changing the 3D composition.

If you are happy with the result, use the **Fix Camera** button to save the camera position and orientation. This allows you to switch to PhotoMatch Model mode and to start adding new geometry with PhotoMatch if needed.

Without fixing the camera, switching the PhotoMatch mode will reset the camera again to match the original image calibration.

Finally the image above shows a possible result after adding some compositing layer below the bridge and one area light above. There is also a tutorial movie available at our website about this project for more in depth informations.