

Making Footage Work for You

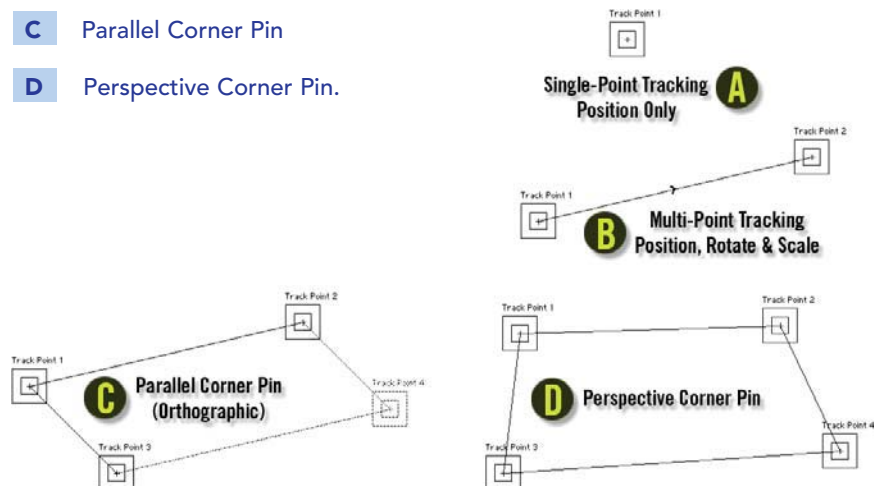
How often have you seen a commercial where the graphics appear glued to a specific moving visual feature or watched a movie where a floating translucent high-tech screen has amazing footage playing on what you know can't really exist. Perhaps you've seen really old footage that's been restored and is now steady. Effects such as these are achieved through the application of After Effects' Motion Tracking.

Motion Tracking and Stabilization

Of all the technologies programmed into After Effects, I find Motion Tracking and Stabilization one of the most remarkable. The idea that the computer can identify a visual feature and follow that feature as it progresses from one frame to the next is pretty blasé these days, but only a few years ago the technology was the sole domain of the rarified ultra-high-end visual effects compositing supercomputer. Then again, today's ordinary desktop computer clearly lays waste to yesterday's supercomputer – and the high-end motion tracking software has become an everyday feature of many graphics and editing programs.

Motion Tracking and Stabilization for After Effects operates in four modes:

- A** Single-Point Tracking
- B** Multi-Point Tracking
- C** Parallel Corner Pin
- D** Perspective Corner Pin.



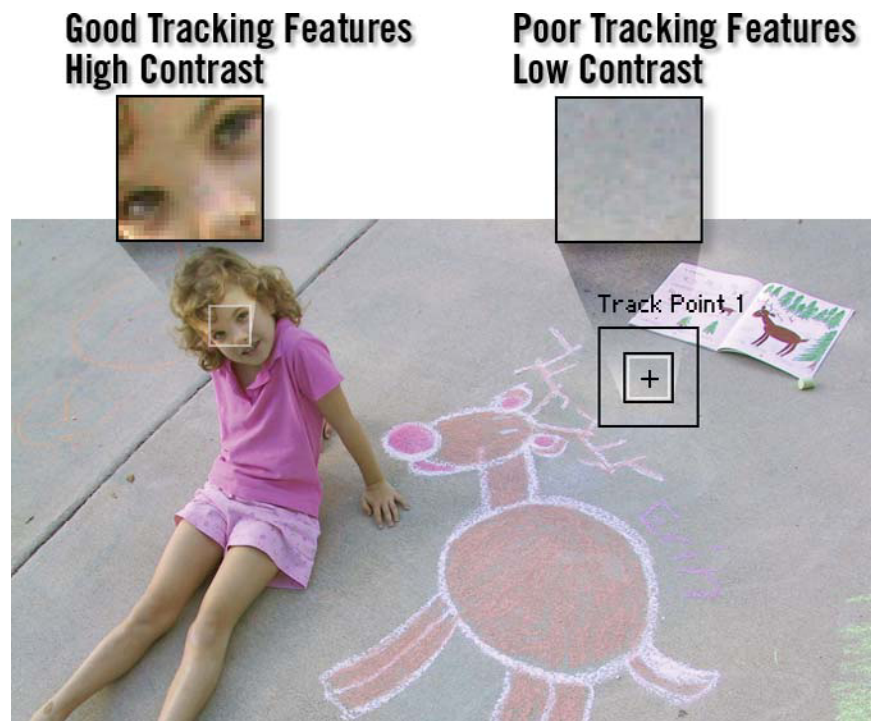
Single-Point Tracking

This is the most basic form of Motion Tracking where the system follows a single feature – a closely focused area of the image that changes location from frame to frame. The easiest features to track are highly contrasting clusters of pixels, where they maintain their contrast throughout their motion track path (i.e. eyes, corners of windows, computer screen edges, light bulbs).

The image below shows two examples of tracking features, both good and bad. The concrete has very low contrast and little for the tracking target to lock on to, whereas the cute little girl has many great features to track.

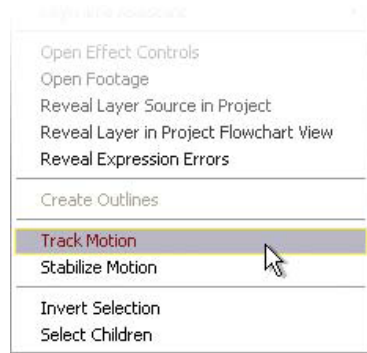
Single-Point Tracking will often be used for applying visual effects (lens flares, glows, and character thought bubbles).

Open *Motion Tracking.aep* and select *Pulp Mill – Stabilization*. We'll be using this shot for two purposes: Single-Point Tracking exercise and Multi-Point Tracking for Stabilization.



For the first exercise we'll be adding a brilliant flare to one of the lights in the scene.

- 1 Select the *Pulp Mill – Stabilization Comp.*
- 2 Right-click layer 1 to track the clip.
- 3 The menu at right opens – select **Track Motion**.



Track Point 1



The Composition Window changes into the Layer Window, where you can apply trackers, adjust Masks and the clip's Anchor Point (it's similar to the Footage Window, but without any clip editing capabilities). Immediately a Track Point is added to the window. The Track Point consists of three elements utilized for calculating tracker data: the outermost box (highlighted in magenta) designates the Search

Region. This is the furthest area the tracker will consider for the tracked feature's motion changes. The inside box (highlighted here in green) specifies the Feature Identifier Boundary: the shape, color, and/or luminosity to track. The cross-hairs identify the Attach Point that will define the tracking data's position to be applied to the object (Motion Target) you want to track in the scene.

Each box is adjustable – the larger the box, the greater amount of time it takes to track because it has so much more image to examine. This can make for a more precise track (unless there's too much clutter inside the search area), but usually it's a waste of time forming the Tracker too large. Also, a Track Point's inside box is limited to searching within the boundaries of the screen area. It cannot travel outside the Footage Window's image – the smaller the Feature Identifier Boundary, the closer





the Tracker approaches the screen's edges.

As you move *Track Point 1* (drag inside the boxes, but don't grab the cross-hairs), the Track Point boxes change into a magnification box of the area designated by the smaller Track Point box. This assists with the precise placement of the cross-hairs on the feature you're

trying to track. You can also zoom into the image for better placement precision either by changing the Magnification Pop Up selector or by rolling the center mouse wheel.

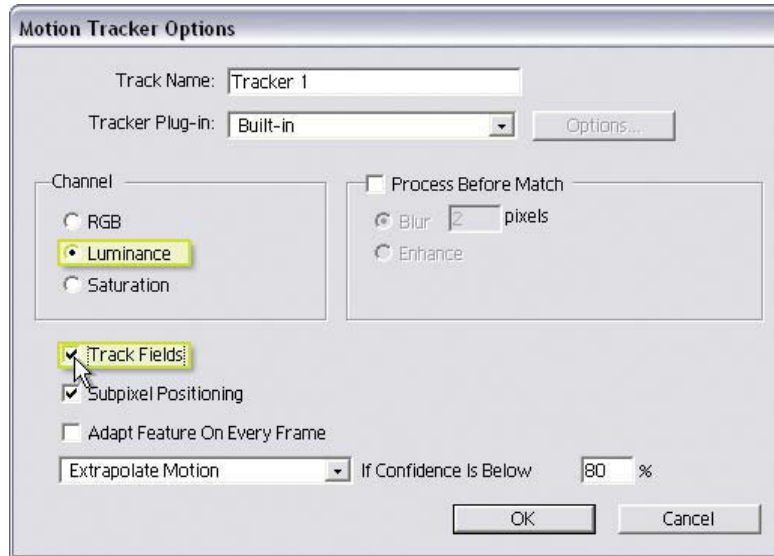
When you first opened the Footage Window and the Track Point appeared, another floating window menu opened as well: the Tracker Controls window. This menu contains the tools and controls used to adjust then run your track. Click on the Options button to access the Motion Tracker Options window, with its tools used to provide more accurate tracking and scene pre-processing.



The Tracker Controls window has several functions you can modify: the **Motion Source** defines from which clip it will calculate its track, **Current Track** identifies which Track Point is currently active for modification, **Track Type** designates the operational mode (as described earlier) and, below that, the property (Position, Rotation, and Scale) to be calculated.

By default, the Single-Point Tracking mode is first selected. Its Track Type, 'Transform', pre-selects the 'Position' property.

- 4 Ensure that the Layer Window's CTI is at its first frame.
- 5 Drag the Track Point and place it over any one of the lights in the room.



- 6 Adjust the Track Point to give it enough space (but not too much) to detect the consecutive positions the light follows.
- 7 Click on the 'Options' button to open the Motion Tracker Options window.

Before you begin any track, you should check the **Motion Tracker Options** are set to the appropriate adjustments for the feature you intend to track. The window consists of filtering techniques to best isolate the tracked feature. In the **Channel** section you can choose one of three methods for isolating your feature's details: use RGB where individual colors are tracked (i.e. blue objects over a red background); Luminance is best for high-contrast tracks where the feature is considerably darker or brighter than its surroundings (as in our example here); Saturation is where a color is tracked over a similar color background but of lesser or greater color intensity (i.e. a vivid green flower is tracked over a dull green pasture).

Process Before Match applies an adjustment to the image prior to the track's calculation. **Blur xx pixels** should be applied to images where the feature's surroundings are too detailed and might interfere with the Tracker accuracy. **Enhance** applies a sharpen filter to increase an image's contrast and exaggerate detail.

Track Fields is an easily overlooked option that should be activated for all field-rendered or recorded footage (including 24 fps footage that has not been 3 : 2 Pulldown reduced). It's overlooked because if your field-rendered footage has been properly prepared via the **Interpret Footage's Remove Fields** dialog, then you won't see any of the tail-tail scan-lines in the Footage or Comp Windows. If you don't activate the **Track Fields** function, the item attached to the track data might appear stuttery or jagged as it moves, with the tracked footage ruining the whole tracking effect.

Subpixel Positioning should be left on – it's what makes the Tracker smoothly flow from frame to frame. If turned off, the Tracker data will round to the nearest pixel, making the motion rough.

Adapt Feature On Every Frame accounts for when the tracked feature becomes obscured by another image item (like a pole in the foreground moving across the scene in front of a person being tracked) or when the feature's surroundings change texture (i.e. color or brightness changes caused by shadows or blinking lights cast upon the feature). You can instruct what the Tracker should do if the Adapt Feature's Confidence (the accuracy of the Tracker's calculations) falls below the set percentage.

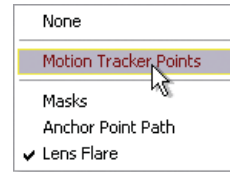
- 8** Set the Motion Tracker Options to the highlighted settings: Luminance and Track Fields.
- 9** Click 'OK' and return to the Footage Window to add our effect.
- 10** Right-click on the *Pulp Mill.mov* layer and select > **Effect** > **Render** > **Lens Flare**.
- 11** In the Effect Controls window, set 'Flare Brightness' to 75% and the 'Lens Type' to 105 Prime.

A Quick Word on the Disrespected Lens Flare: The bad reputation placed upon them is undeserved. They serve a great purpose – an appropriately designed and well-placed moving flare can provide a scene the sense of depth and life animation often lacks. The fact is that animation is often too clean and clear from computer-derived purity. For the best Lens Flare effects plug-in, consider the Knoll Light Factory 2 toolset (available from ToolFarm.com). This is a powerful set of pre-designed and customizable optical effects that will quite simply amaze your friends, astound your clients, and pay for itself in no time.



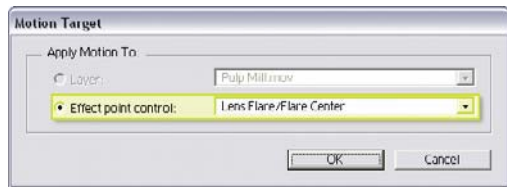
Now that you've assigned your Lens Flare to your clip you need to instruct the tracker to apply its data to the flare's center point. But since you

added the Lens Flare, the Tracker Controls menu has become inaccessible. To reacquire the Tracker Controls you need to change the Footage Window's **View:** selector (close to the bottom edge of the Footage Window) from Lens Flare to Motion Tracker Points. This hides the Lens Flare and returns to the Track Point screen, while reactivating the Tracker Controls menu.



12 Click on Edit Target in the Tracker Controls menu.

13 The Motion Target window opens and has selected the Lens Flare's Center as its point control – click 'OK'.

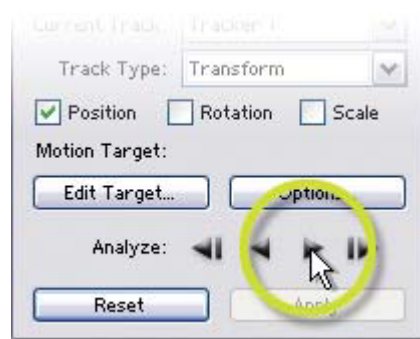


If your scene had many effects that can use Tracker or other layers to apply the Tracker's data, the Motion Target menu would offer many more selections in its drop-down menu.

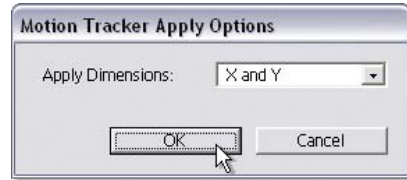
Now that you've placed the Track Point and set the Motion Target, your motion track is ready to proceed.

14 Click on the Track Forward arrow in the Tracker Controls menu (seen at right).

15 Once it has finished its track, click 'Apply'.



Another menu pops up – the Motion Tracker Apply Options allows you to select how the data will be applied to your target. This is convenient when you want to restrict your target's motions to one axis of motion.

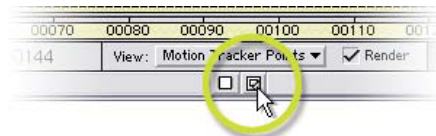


16 Click 'OK' in the Motion Tracker Apply Options menu.

17 Click on the Return to Comp Button at the bottom edge of the Layer Window to review the Tracker's results.

18 Run an RAM Preview.

19 Repeat the procedure to apply another Lens Flare on the other light near the first tracker.



For a challenge, try tracking the light on the left middle screen. It looks easy enough until the steam obscures the light. This is a great example of where to use the Adapt Feature On Every Frame in the Motion Tracker Options dialog.

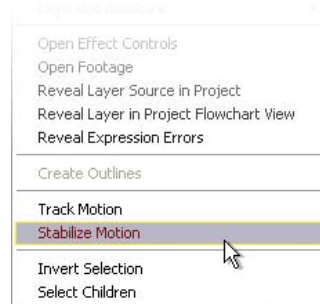
Multi-Point Tracking – Position and Rotate

Imagine you have some footage that was shot by a director of photography schooled in the MonkeyCam genre, or perhaps you are given a clip shot while the camera operator stood atop a platform with heavy machinery vibrating the platform viciously. Maybe you have an object in a scene where you need to attach a graphic sign but the object that you need to track both rotates and changes size at the same time.

These are examples where Multi-Point Tracking is appropriate. Both Stabilization of shaky footage and Motion Tracking of rotating and/or scaling features are types of Multi-Point Tracking. And fortunately for us, we have excellent case studies of both to practice upon.

Revert the *Motion Track.aep* project and again select the *Pulp Mill – Stabilization Comp*. You've already seen that this footage was difficult to shoot due to the heavy machinery environment, so let's fix it using Multi-Point Tracking.

1 Open the *Pulp Mill.mov* clip's Layer Window by right-clicking on the clip, but this time select > Stabilize Motion.



- 2 Make sure that the Layer Window's CTI is at first frame.

The Track Type should already be set to Stabilize, but the only property to be stabilized is the Position. Our footage has serious twists combined with its jitter, so the Rotation property needs to be selected. When a two-point track is used, a rubber-band line connects the two Track Points, with the first Tracker pointing to the second. The change in angle of this line determines the image's rotation factor.

- 3 Click the Rotation check-box to add this property to the track.
- 4 Drag 'Track Point 1', aligning it to the pulp conveyor's left far back corner.
- 5 Drag 'Track Point 2' horizontally across the conveyor, aligning it to the black dot near its right edge (seen below).
- 6 Open **Options . . .** in the Tracker Controls menu and activate **Fields** in the Motion Stabilizer Options (this is the same dialog as the Motion Tracker Options dialog), and click 'OK'.



- 7 Return to the Tracker Controls and run your track.
- 8 Click on 'Apply', then click on the Return to Comp Button.
- 9 Run an RAM Preview.

The Motion Target for the track was already pre-selected to the clip itself. So when you clicked 'Apply', the clip inherited the Keyframes generated by the Tracker for Position and Rotation.



0



12



24



72



143

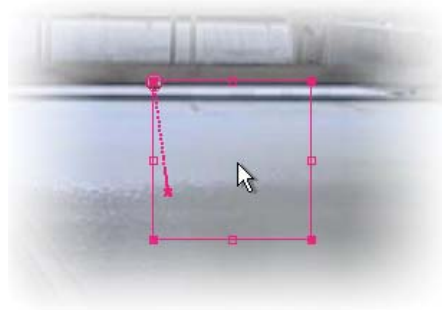
As you run the preview notice that the image becomes greatly offset from its initial position. Also note that the layer's Anchor Point (highlighted in magenta at left) is aligned with where the Tracker's first Track Point was set – this is the point where the image also pivots.

As it stands right now, the Stabilization is not very usable: the image is too far offscreen, with vast areas of black filling the view. You'll need to center the clip and simultaneously expand it to fill the screen, as much as possible. The most effective technique to accomplish this task is by Parenting the layer to a Null, then using the Null to both reposition and scale the whole clip.

- 10** Add a Null to the Timeline (Ctrl + Alt + Shift + Y).
- 11** Parent the *Pulp Mill.mov* layer to the Null (Shift + F4 opens the Parent column).
- 12** Adjust the Scale of the Null to approximately 110%.

- 13 Scrub the CTI through the Timeline to find a point where the image no longer moves abruptly.
- 14 Drag the Null through the Comp Window until the Parented layer appears roughly centered – you may have to scrub the CTI a few times to find a good compromise for the image’s center.

The only remaining issue with the clip is at its beginning: the camera move makes a tilt until it steadies upon the machinery. Again, the Null offers a solution – you’ll add two Keyframes to account for the camera’s initial downward angle, then move the Null to its current position for the remainder of the clip’s playback.



- 15 Add a Position Keyframe (Shift + Alt + P) to frame 34, where the clip has finished its tilt.
- 16 Return to the first frame (Home) and move the Null upwards to compensate for the tilt.
- 17 Add an Easy Ease (Shift + F9) to the second Keyframe to make the tilt transition smooth.
- 18 Increment and Save your work, then run another Preview.

The Stabilization is now complete. Even with the image’s slight scale increase, the overall effect improves greatly upon the original’s wobbly shot.

Multi-Point Tracking – Scale

There’s one additional Property that can be calculated by Multi-Point Tracking – Scale. By adding Scale, an object can be effectively tracked in 3D space, though it’s only acting on 2D data.

Revert the *Motion Tracking.aep* project, then open the *Chuck’s Chips – Tracker* Comp. Our task is to glue a sign to the back of the truck’s rear hatch, covering the oval logo above the red and white safety stripes. This is a difficult tracking



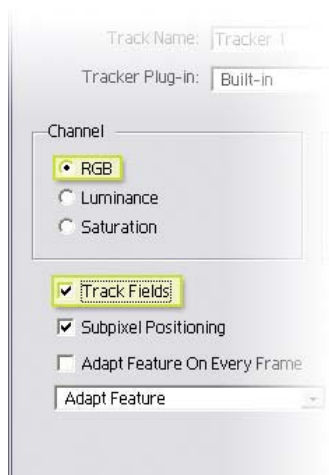
problem for several reasons: the chips dumping out of the truck add a lot of noise to the shot, the shot doesn't have any well-defined features in which to apply Trackers, and the feature to track moves into then out of the screen.

For cases where the feature comes from or moves offscreen, you have to manually adjust the tracked

overlay to account for the offscreen motion.

But other than these offscreen issues, preparing for a Scale Track is the same as any other Multi-Point Tracking:

- 1 To ease the Tracker's setup, choose a frame toward the center of the clip (frame 40).
- 2 Right-click on the clip layer and select > Track Motion.
- 3 Check 'Rotation' and 'Scale', in addition to 'Position'.



- 4 Click on **Options . . .**
- 5 Select both 'RGB' and 'Track Fields', then 'OK'.

We're using RGB to track the features because they have strong color and luminance differences.

The **Motion Target** is blank because there's nothing yet in the Comp to apply the Tracker's data. A good habit to follow is to use Nulls for applying your data. This allows you to make further adjustments to your tracked object after the Track is complete.

6 Press 'Ctrl + Alt + Shift + Y' to add a Null Object.



7 Click on **Edit Target . . .**, then press 'OK' – the Null is the only thing in the scene for the Tracker to use.



8 Align the Track Points to the lower corners of the door nearest to the oval logo – place Track Point 1 to the right and Track Point 2 at left.

The Tracker Controls menu has four buttons to activate your track: Single Frame Track Back, Reverse Track, and Single Frame Track Forward. Previously, we've been using Track Forward, but since we set up the Track Points within the middle of our clip, this requires reverse tracking.



- ◀ Single Frame Track Back
- ◀ Reverse Track
- ▶ Track Forward
- ▶ Single Frame Track Forward
- Stop Track

9 Click on Reverse Track to run your Track, but as the Track points approach the screen's edge, click on the Stop Track button (the Play becomes the Stop button).

10 Manually step the Tracker backward with Single Frame Track Back to bring the Track Points center box as close to the screen edge as possible.

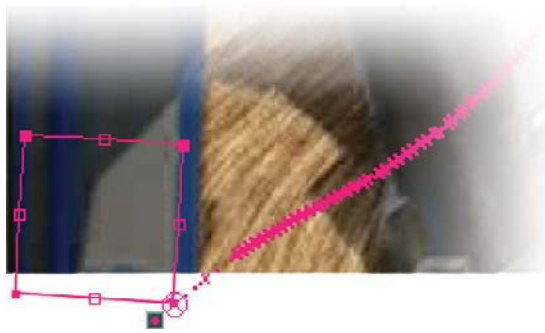
11 Jump back to frame 40 (Ctrl + G) and resume your Track Forward, but again stop the Track as it approaches the screen edge.

12 Manually step the Tracker forward with Single Frame Track Forward to bring the Track Points center box as close to the screen edge as possible.

- 13 Click on 'Apply', then in the Motion Tracker Apply Options dialog click 'OK' to transfer the data to the Null.
- 14 Click on the Return to Comp Button and then scrub the CTI to review the Tracker's results.

Select the Null 1 layer, then press 'U' to examine its Keyframes for all three properties: Position, Rotate, and Scale. Because the Trackers are limited to staying inside the image area, you have to manually extrapolate the offscreen track data.

- 15 In the Timeline Window return to frame 0.
- 16 Drag the Null up to align it to the same feature point just inside the screen.
- 17 Go to the last frame (End); you'll need to scrub the CTI and tweak the Null, guessing where the feature would be offscreen.



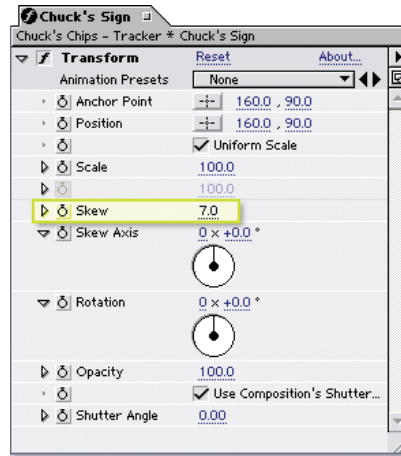
A good trick in offscreen feature situations such as this is to use the Null's edges to line up with some other item in the scene that is common to the offscreen feature – in this case, we'll use the door's blue frame.

The only activity left is to add an item to attach to the Null.



- 18 Go to frame 40 to prepare the new layer for attaching to the Null.
- 19 Drag *Chuck's Sign Comp* from the Project Window into the *Chuck's Chips – Tracker Comp* as layer 1.
- 20 Scale the new layer to 15% then move it, placing the sign near the edge of the truck's door frame.

- 21 Right-click on *Chuck's Sign* layer and add > **Effect > Distort > Transform** to the layer.
- 22 Adjust the Skew (not Skew Axis) to 7.0.
- 23 Parent *Chuck's Sign* layer to the *Null 1* layer.
- 24 Activate the Motion Blur switch on *Chuck's Sign* layer and the Timeline's Enable Motion Blur.
- 25 Run a Preview.



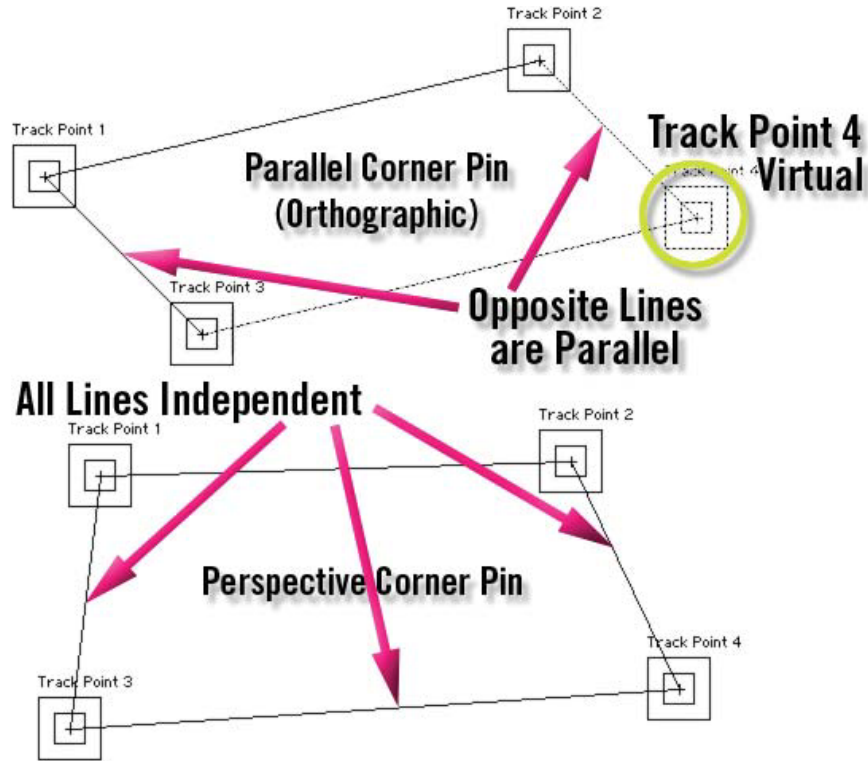
The sign is effectively attached to the truck's doorframe. The Motion Blur adds even more realism by blending the sign into the frame. To really make the effect even more convincing, you could add some noise and color correction to match the image's texture.

Corner Pin Tracking – Parallel and Perspective

We've all seen them – the replacement image tracked inside a TV monitor, the moving-footage photo album, or the animated sign high on a billboard. These are examples of Corner Pin Tracking: the application of a rectangular image distorted to fit within another rectangular moving space. Corner Pin Tracking works in conjunction with the > Effect > Distort > Corner Pin.

There are two modes of Corner Pinning:

- **Parallel** – this mode (top example, next page) is best described as skewing an image where each opposing side remains parallel to each other. Architects would call this orthographic projection. With this mode you only assign three of your four Tracker Points – the fourth is a 'virtual' point that is extrapolated to ensure the shape remains a parallelogram.
- **Perspective** – this mode (bottom example, next page) allows for complete freedom of all four Tracker Points, resulting in an image that matches real-world camera angles more accurately.



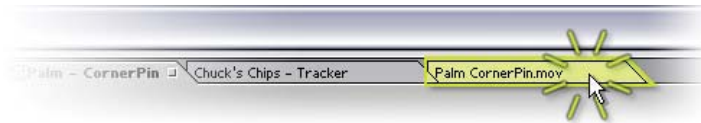
Returning to the *Motion Tracking.aep* project, select the *Palm – CornerPin* Comp. This project offers a common application of Perspective Corner Pinning (but you can try Parallel as well).

Double-click to open the shot in the Layer Window. Scrub the CTI to review the footage and how it moves. Notice that the track points adhered to the PDA's screen have great contrast, but as they move away they change size so severely that the Trackers might become confused to their original placement. This example will work best as a Reverse Track.

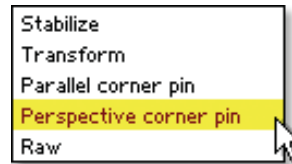


For our inserted image Motion Target, we'll be using the previously stabilized *Pulp Mill – Stabilization* footage Comp.

- 1 From the Project Window, drag your Stabilization test Comp (or dig into the Solutions folder and grab the *Pulp Mill – Stabilize Solution*) into the *Palm – CornerPin* Comp’s Timeline.
- 2 Snap the Pulp Mill’s end frame to the last frame of the Palm Comp.

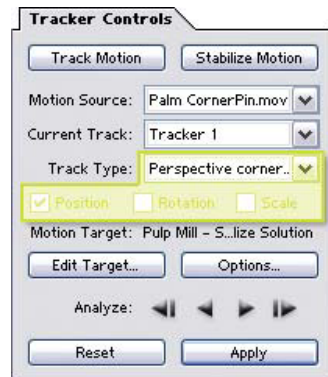


- 3 Return to the *Palm CornerPin.mov* Layer Window by clicking on the Tab at the top of the Comp Window (or double-click the layer again).
- 4 Activate the Tracker by clicking on the ‘Track Motion’ button in the Tracker Controls floater window.
- 5 Click the Track Type drop-down and select ‘Perspective corner pin’.

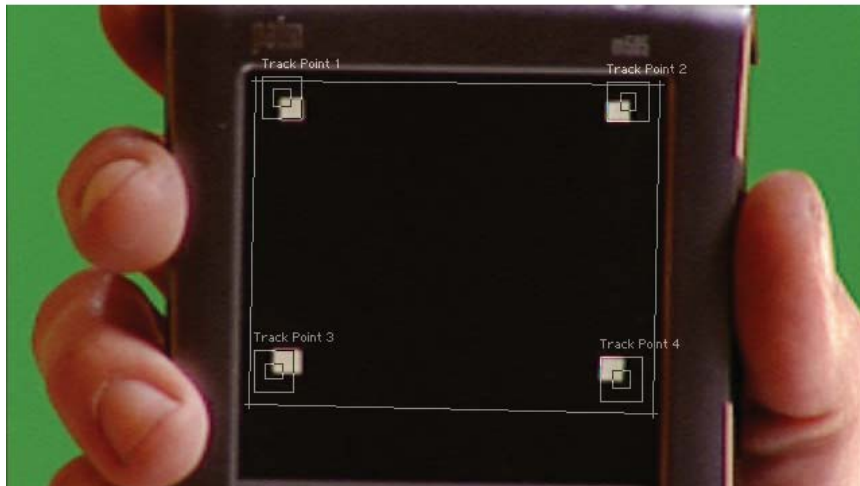
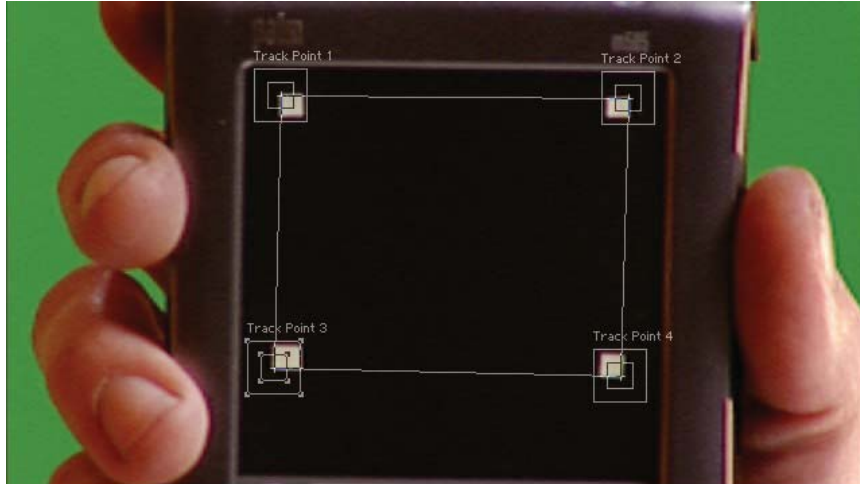


The three Properties have all been subdued because this special instance of tracking only works with the Corner Pin distortion effect.

- 6 Open the **Options . . .** and set the **Channel** to **Luminance**, **Track Fields**, and activate the **Process Before Match – Enhance**, then click ‘OK’.
- 7 Jump to the last frame (End) to set your Tracker Points, placing each Track Point’s center upon the outermost corner of the tracker marks.
- 8 Drag the cross-hair Attach Point from each Tracker Point’s center to expand the Corner Pin frame coverage, fully obscuring the PDAS’s tracker marks.
- 9 Reduce the size of each Track Point to restrict the search areas – this will help when the track markers become so small.



The advantage of repositioning Tracker Attach points is most clear when you have an object with features that must be covered by the tracked overlay. Sometimes the best Track Point will be different from where you need the tracked image to align.



Compare the two images above and you can see how the expanded Attach Points form a more encompassing image area that obstructs the adhered track marks.

- 10** Run the Track in reverse, then stop it prior to where the Tracker Points run into the screen's edge.

- 11 Apply the Tracking Data to the *Pulp Mill* layer.
- 12 Return to the Composition Window and run a Preview.

The Perspective Corner Pin should have worked well enough for this exercise, but if this were a client’s project you might have to extend fully the overlay’s track, forcing you to manually extend the Track Points offscreen.

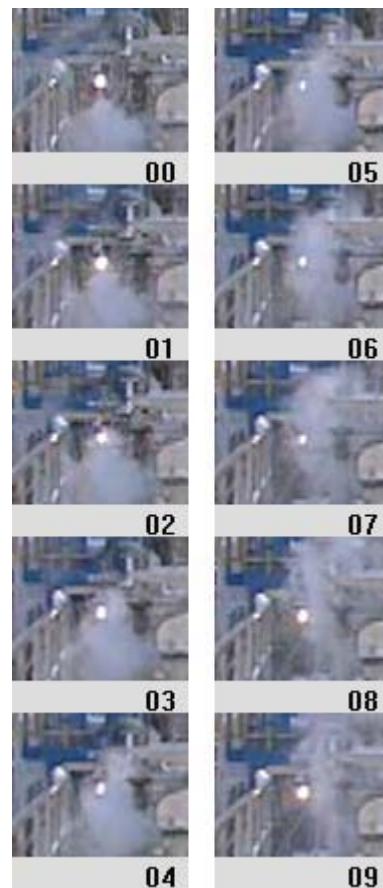
This brings up one last important issue with Motion Tracking – fixing aberrant Tracker errors.

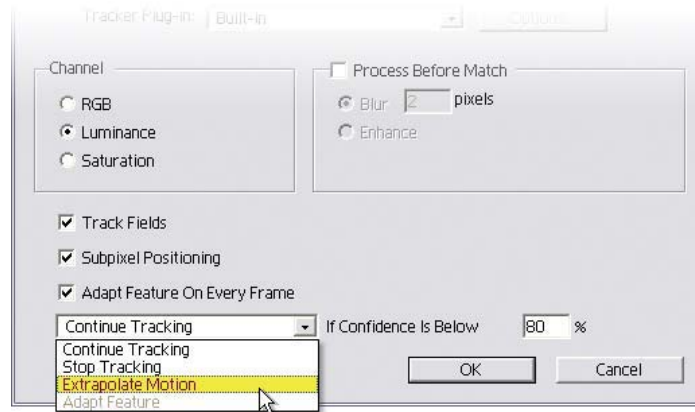
When Tracking Goes Awry

The *Palm – CornerPin* footage is a good example of a difficult track due to the PDA track marker’s size change. But there are many other far worse problems you can encounter: obscuration by foreground interference, excessive motion blur, extraneous intermittent environmental artifacts (flashing lights), to name just a few.

Revert to the *Motion Tracking.aep* project one more time, then return to the *Pulp Mill – Stabilization Comp.* As we’ve previously seen, there are many excellent features to track in this shot – and one troublemaker that’s hard to track.

In the *Pulp* footage there’s a light to the left of the conveyor that becomes obscured by steam billowing out from the machinery. Try to perform a Track Motion on this feature and you’ll quickly discover that it’s not so simple a task.





- 1 Add a Null to the Comp.
- 2 Open *Pulp Mill.mov* in the Layer Window and set up a **Track Motion > Transform > Position**.
- 3 Set the **Edit Target . . .** to the Null.
- 4 Place the Track Point over the steam-blocked light and make the Feature and Search boxes relatively small to limit interference as you run the track.
- 5 In the **Options . . .** dialog, activate **Luminance**, **Track Fields**, and set **Adapt Feature On Every Frame** to **Extrapolate Motion**, then 'OK'.
- 6 Run the 'Track Forward' and watch the disorder ensue.

The Track holds for about 40 frames then loses lock, even with the Adapt Feature option on. Times like this call for manual adjustment and Single-Frame Tracking.

- 7 Reset the Track Controls, jump to frame 25, and again place the Track Point over the light.
- 8 Zoom into the image 400% (press the Period key twice) and adjust the Track Point's boxes tightly around the feature.
- 9 At frame 25, click on the Single Frame Forward to set your first Tracker Keyframe.

- 10 Use the keyboard's Page Up and Down (PgUp, PgDn) buttons to advance the Layer Window's CTI three to five frames.
- 11 Reposition the Tracker Point manually using the mouse to re-center over the feature; be ready to use 'Ctrl + Z' to Undo any errors you make when moving the Track Point.
- 12 Repeat steps 8 and 9 using your good judgement to what constitutes an acceptable loss of lock – try using the Single Frame Forward button now and then to see if the feature is clear enough for an automatic track.
- 13 At approximately frame 85, deactivate the **Option > Adapt Feature . . .**, then resume the continuous Track Forward until it loses lock again.

After a while the Tracker is all in turmoil – to resume manual Tracking you'll need to remove some of the previously gathered data. The Tracker stores its track info in the *Pulp Mill.mov* layer's Timeline. Open the layer (press 'U' to reveal all Keyframes) to examine all the Tracker data Keyframes created so far (seen below). The first half shows the intermittent manual tracks, while from 85 onward are the sequential automatic tracks. To correct the bad data, delete the offending Keyframes, then repeat your track beginning from the point of the first deleted frame.

Occasionally the Track might throw a sporadic wig-out and then return to normal. For those spikes, manually place the Tracker Point back centered on the feature. However, keep alert to the Tracker's Attach Point cross-hairs – this



needs to be kept in line with the track path as a whole. When the Tracker goes off half-cocked, the Attach Point goes with it.

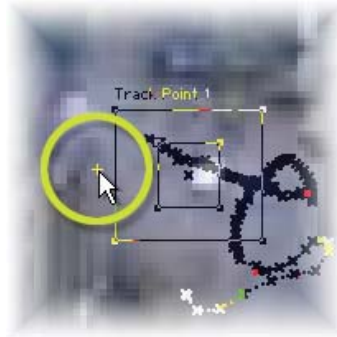
14 Use the cursor to select all the Keyframes from about 120 onwards, then press 'Delete'.

15 Return to the Layer Window and resume the track process, using the Track Forward button this time.

16 Once complete, scrub the CTI to find any aberrant Tracker Keyframes, then re-center them atop the feature – be sure to place the Attach Point back in the center of the Tracker where needed.

17 Once all the latter Tracks are complete, jump back to frame 25, then run a Reverse Track to finish the process.

18 Apply the Tracker's data to the Null, then return to the Comp Window to review the track by scrubbing the CTI – look for any additional bad tracks that need to be manually adjusted.



From now on, you can simply adjust the Null's position to correct for any Tracking errors. But once you select the Null layer, the footage becomes obliterated by countless Tracker Keyframes and its path. Open the **> Edit > Preferences > Display** dialog to disable the 'Motion Path'. You can then resume your manual repair of the bad track and use the Null as a Parent for whatever element you need to add to the scene.

