

KCS Motion

Video Motion Analysis Software

Overview

KCS Motion tracks moving objects in a video clip and analyzes their position, velocity and acceleration. Objects are tracked manually - requiring the user to identify the location of the object on a few key frames. The software fits a curve to the object's path based on the identified points. Once objects are tracked, the software can be used to plot a variety of curves and export the curve data to an Excel compatible CSV file for further analysis.

Capabilities

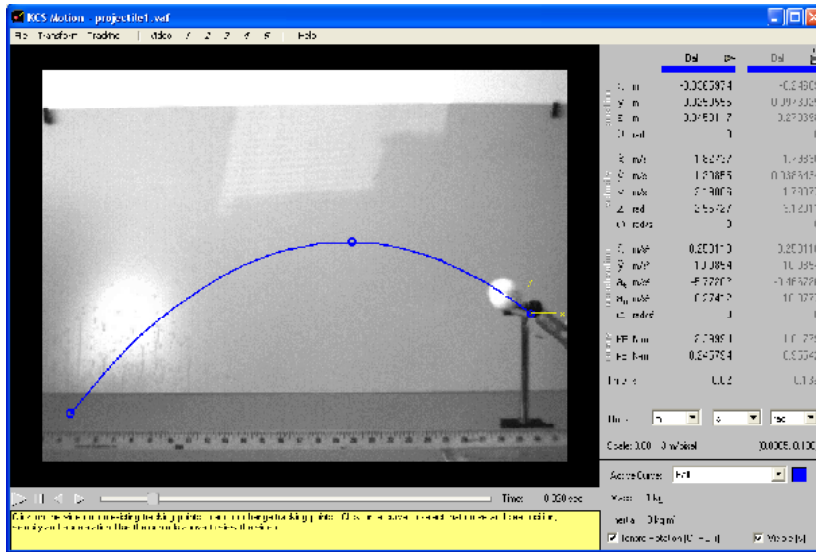
- Tracks up to 20 objects simultaneously
- Tracks the CG of multiple independent objects
- Calculates the following motion parameters for all tracked objects
 - Position: x, y, rotation and distance along the path
 - Velocity: x, y, rotation and tangential
 - Acceleration: x, y, rotation, normal and tangential
 - Energy: Kinetic and Potential
- Graphs any parameter vs time or vs another parameter
- Displays motion parameters in different units (changeable "on the fly")
 - Length: km, m, cm, mm, mile, yrd, ft, in
 - Time: hr, min, sec
 - Rotation: deg, rad
- Arbitrary location and orientation of coordinate axis, including translating/rotating coordinates
- Computes motions parameters with respect to a fix or moving coordinate systems
- Scales video using a measured object or using a free falling object
- Compensations for lens distortion
- Context sensitive help
- Captures video through any DirectShow® compatible device, including DV video camera and web cams
- Opens any video supported by DirectShow® such as avi, wmv, mpeg, mp4, ...
- Recompress video using DirectShow codec
- Available addin for FASTEC Imaging's high speed camera

Operations Overview

Motion tracking follows these basic steps

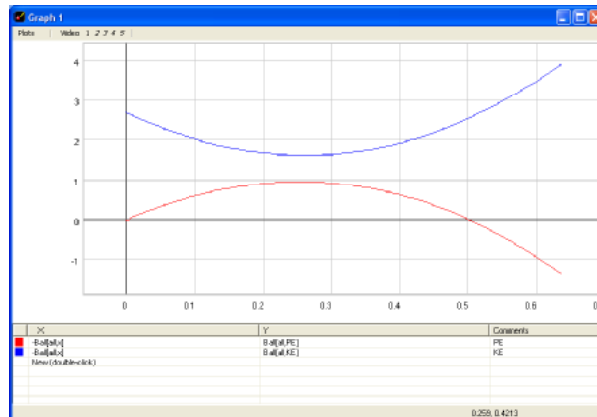
- 1) Capture a video of the moving objects
- 2) Open the video file in KCS Motion
- 3) Adjust the distortion parameters to compensate for the camera's lens distortion
- 4) Scale the video using an object of known size or a free falling object
- 5) Identify a few key point along the motion of an object to create a *tracking curve*. Repeat for each object of interest
- 6) Use the motion data calculated by the software to complete the analysis

Each of these steps is explained in detail on the following pages



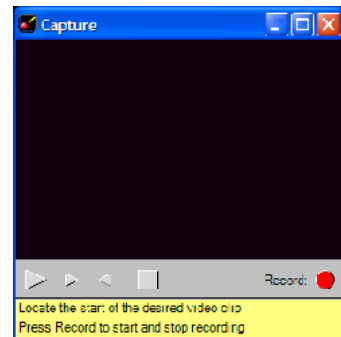
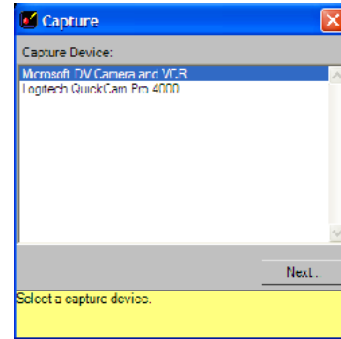
Projectile motion tracked by KCS Motion is shown to the left. Tracking point are marked as dots. The curve show the predicted object path.

Graph of kinetic energy and potential energy of the tracked object



Capturing Video from a Camera

- 1) Connect the camera to the computer
- 2) Select “*Capture Video*” from the “*File*” menu
- 3) Select the video source
- 4) If the desired footage is on a tape, use the controls to locate the footage and press RECORD while the desired footage is playing
If the camera is streaming live, press RECORD to capture the current video.
- 5) Press RECORD again to stop the video capture.
You will then be prompted to save the file.



Capturing Video Using 3rd Party Software

KCS Motion can utilize video captured or created using most software that support AVI or WMV. KCS Motion relies on the DirectShow® libraries installed on your computer to decompress and display the video. Some video compressors do not allow the user to easily step through each frame of a video. Uncompressed video or video compressed using Cinepak codec usually produces good results. You may need to experiment to find the best video format and compression for your system.

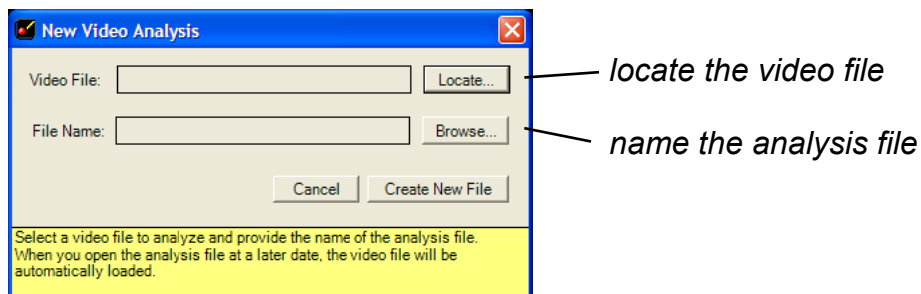
In addition, some capture devices, such as DV camera, interlace the video. You may need to install appropriate deinterlacing to handle these video sources. “ffdshow” is a free codec that support deinterlacing and is DirectShow® compatible.

Loading a Video for Analysis

A video analysis requires of two files: 1) the actual video file, and 2) the analysis file. The analysis file contains the distortion and tracking parameters. Video analysis files use the extension “.vaf” You can create multiple analysis files for a given video file.

To open a **new** video for analysis:

- 1) Select “*Open New Analysis...*” from the “*File*” menu
- 2) Click on “*Locate*” to locate the desired video file
- 3) An analysis file will be automatically created and stored in the same directory as the video file. If you want to change the name of the analysis file, click on “*Browse*” and entering the analysis file name.
- 4) Click “*Create New File...*”



To open an **existing** video analysis file and the corresponding video:

- 1) Select “*Open Video Analysis...*” from the “*File*” menu
- 2) Locate the video analysis file and click “*Open*”

The analysis file will automatically load the associated video file. If the video file has been moved, KCS Motion will prompt you to locate the video file.

Correcting Lens Distortion

KCS Motion can compensate for typical lens distortion and video aspect ratio (horizontal/vertical scaling).

To adjust the aspect ratio compensation

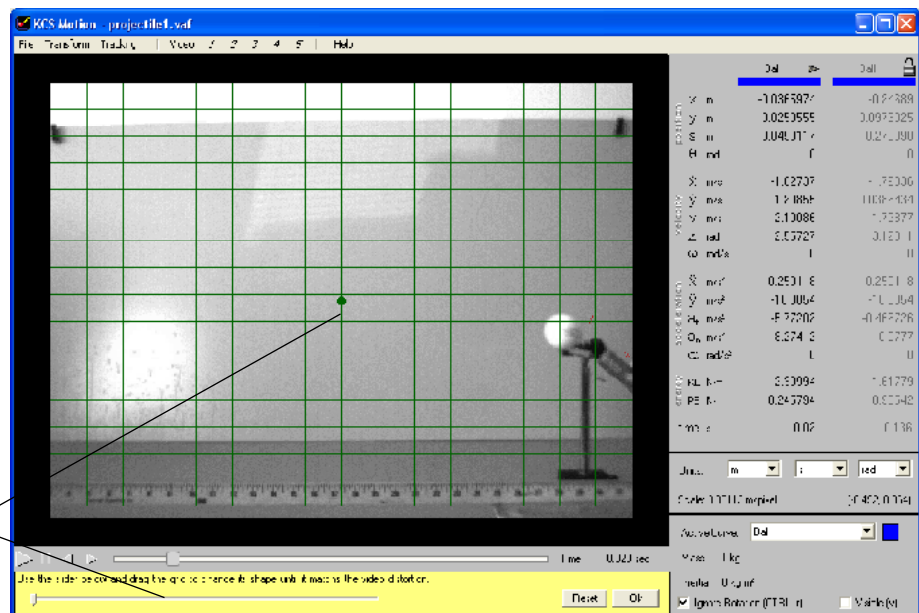
- 1) Open a video analysis file (previous step)
- 2) Select "Fix x-y aspect ratio" from the "Transform" menu
- 3) Click the mouse on the start and end of a horizontal item in the video
- 4) Click the mouse on the start and end of a vertical item in the video of the same length

To adjust the distortion compensation

- 1) Open a video analysis file (previous step)
- 2) Select "Fix Distortion..." from the "Transform" menu
- 3) Scan through the video and find a scene with horizontal and vertical lines.
- 4) Adjust the distortion slider to change the grid until it matches the straight lines in the scene. You can also drag the grid with the mouse to change the lens center point.
- 5) When the grid matches the scene, press OK.

It may not be possible to align the distortion grid exact with the scene. In that case focus on aligning the distortion grid with the area of the video where the motion occurs.

Move slider and center dot until the grid matches horizontal and vertical lines on the video

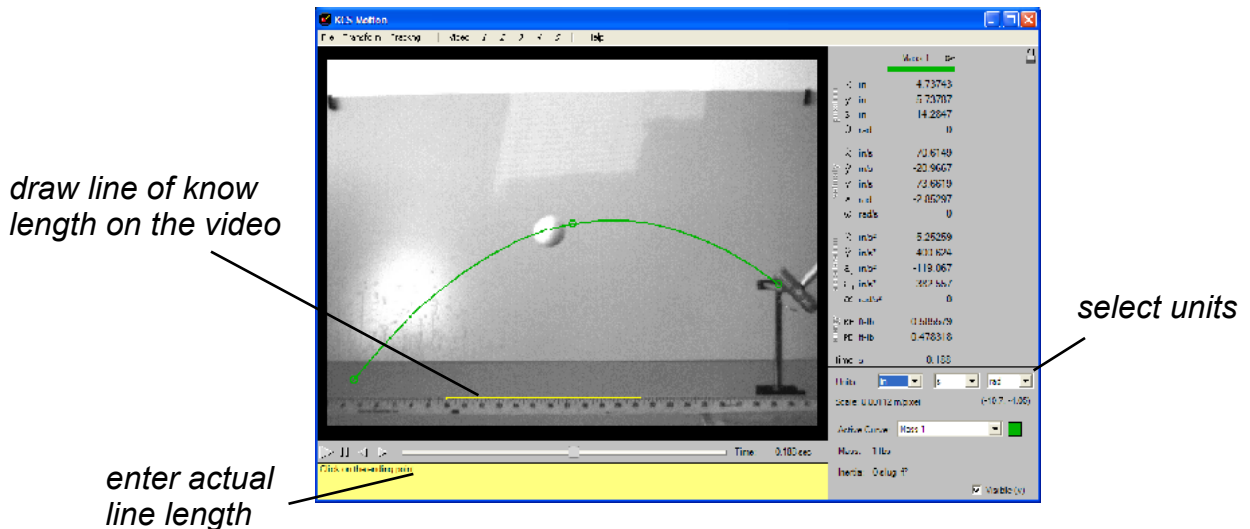


Scaling the Image

Before performing analysis, you should set the scaling for the scene. You can do this at any time after adjusting the distortion correction.

Scaling from Points

- 1) Select the desired length units from the units dropdown menu
- 2) Select “*Scale from Points...*” from the “*Transform*” menu
- 3) Click the mouse on the first point
- 4) Click the mouse on the second point
- 5) Enter the distance between the two mouse clicks and press OK



Scaling from a Free Fall Drop

If you have a free falling object in your scene, you can set the scale using data points from the dropping object. This method is not as accurate as scaling from points because air resistance affects the acceleration of the object.

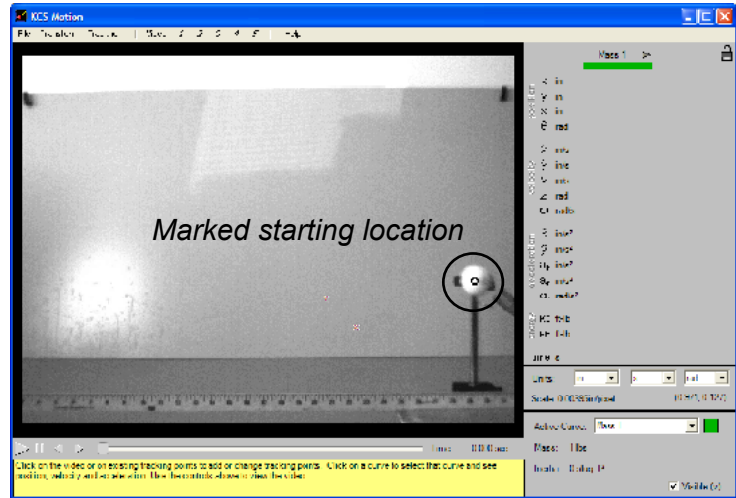
- 1) Select “*Scale from Drop...*” from the “*Transform*” menu
- 2) Scan through the video and find a frame near the start of a free falling object
- 3) Click on the object’s center
- 4) Advance the video to near the center of the object’s free fall
- 5) Click on the object’s center
- 6) Advance the video to near the end of the object’s free fall
- 7) Click on the object’s center

Creating a Tracking Curve

To track the motion of an object, the user must identify several points along the path of the object. These points are placed in both space (the location on the video) and time (the time in the video at which they were placed).

- 1) Advance the video to the first frame in the video where you would like to begin tracking
- 2) Click on the centroid of the object and select "Add Point"

click on the object's centroid to mark the starting location



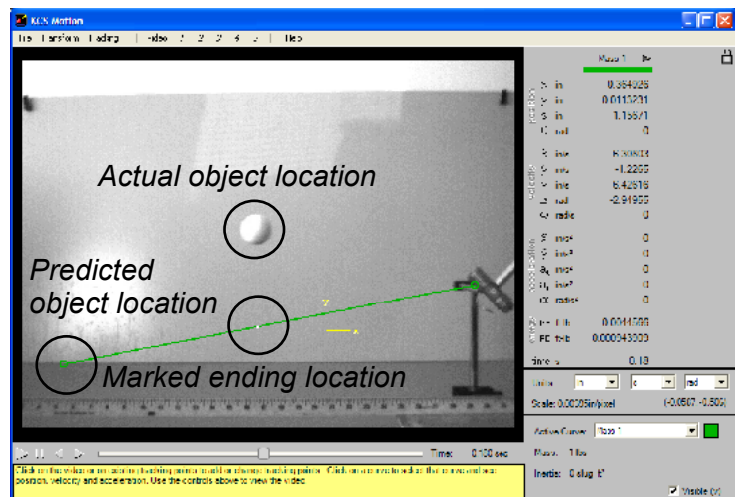
- 3) Nominally KCS Motion only tracks position. To track the position and orientation disable "Ignore Rotation" under the "Curves" menu.
- 4) Advance the video to the frame in the video where you would like to end tracking
- 5) Click on the centroid of the object and select "Add Point"

The software will draw a straight line between the two points. This is the estimated object path based on the current data. As you advance the video, a small white dot will move along the estimated object path. This dot should match the path of the physical object. If it does not you will need to refine the path by adding more data points.

Click on the object to mark the ending location of an objects

KCS Motion shows the computed path of the object based on tracking points

The computed location of the object based on marked points is shown along the path as a white dot



Creating a Tracking Curve (continued)

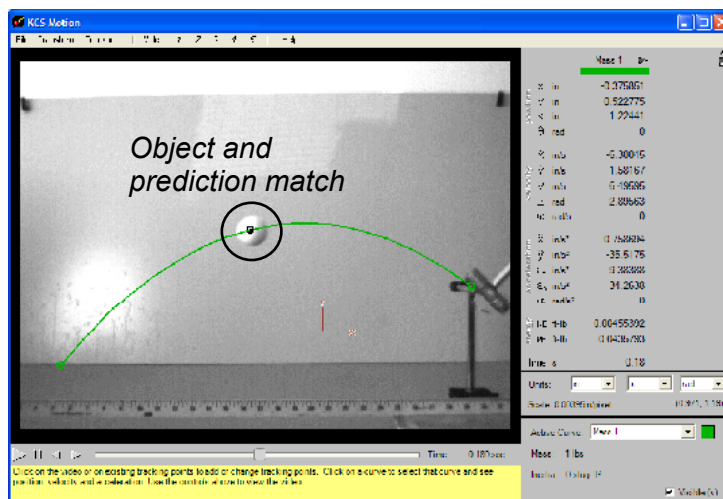
To refine the object's tracking curve,

- 6) Advance the video to a frame near the center of the object's motion, click on the centroid as before and add a new tracking point. The software will adjust the tracking curve based on the new tracking point.
- 7) Check the object's motion and continue adding tracking points as required

Refine the tracking curve by marking additional points

The tracking curve is updated as new points are added.

HINT: Click on a marked point and select "Jump to Time" to advance the video to that time in the object's motions



Tracking Multiple Objects

KCS Motion can track up to 20 objects at once. To track a new object

- 1) Select "New Curve..." from the "Curve" menu
- 2) Enter a unique name and color for the curve, and supply the mass and moment of inertia about the center of mass if applicable
- 3) Once a new curve is created, track the second object as discussed in the previous section.

HINT: You can switch between curves by clicking on the curve or selecting the curve from the curve menu. The currently active curve will be draw with a thicker line.

To refine the object's tracking curve,

- 6) Advance the video to a frame near the center of the objects motions and click on the centroid and add a new point. The software will adjust the motion path based on the new data point.
- 7) Check the objects motion and continue adding data points as required

The screenshot shows the KCS Motion software interface. The main window displays a video frame with two wheels and their tracking paths. The interface includes a menu bar (File, Transform, Tracking, Video, Help) and a data table for Mass 2 and Mass 1. The data table shows position, velocity, acceleration, energy, and time for both masses. The video control bar at the bottom shows a play button, a progress bar, and a time display of -0.535 sec. A yellow tooltip at the bottom of the video frame provides instructions on how to use the software.

	Mass 2	Mass 1
position		
X in	8.65888	3.82728
Y in	-2.37973	2.85925
S in	3.47494	2.99912
θ rad	-0.583003	-0.588003
velocity		
\dot{X} in/s	-10.2267	7.82926
\dot{Y} in/s	4.76490	-5.78963
\dot{S} in/s	11.2823	0.73741
$\dot{\alpha}$ rad	2.70557	-0.636738
ω rad/s	0	0
acceleration		
\ddot{X} in/s ²	0	0
\ddot{Y} in/s ²	0	0
\ddot{S} in/s ²	0	0
$\ddot{\alpha}$ rad/s ²	0	0
$\ddot{\omega}$ rad/s ²	0	0
energy		
KE ft-lb	0.00115368	0.00110539
PE ft-lb	-0.0209928	0.0257483
time s	-0.536	-0.536

Units: in s rad
Scale: 0.000928 m/pixel (10.0, 1.05)
Active Curve: Mass 2
Mass: 0.002004474922704 slugs
Inertia: 0 slug-ft²
 Visible (v)

Click on the video or on existing tracking points to add or change tracking points. Click on a curve to select that curve and see position, velocity and acceleration. Use the controls above to view the video.

Analyzing Motion

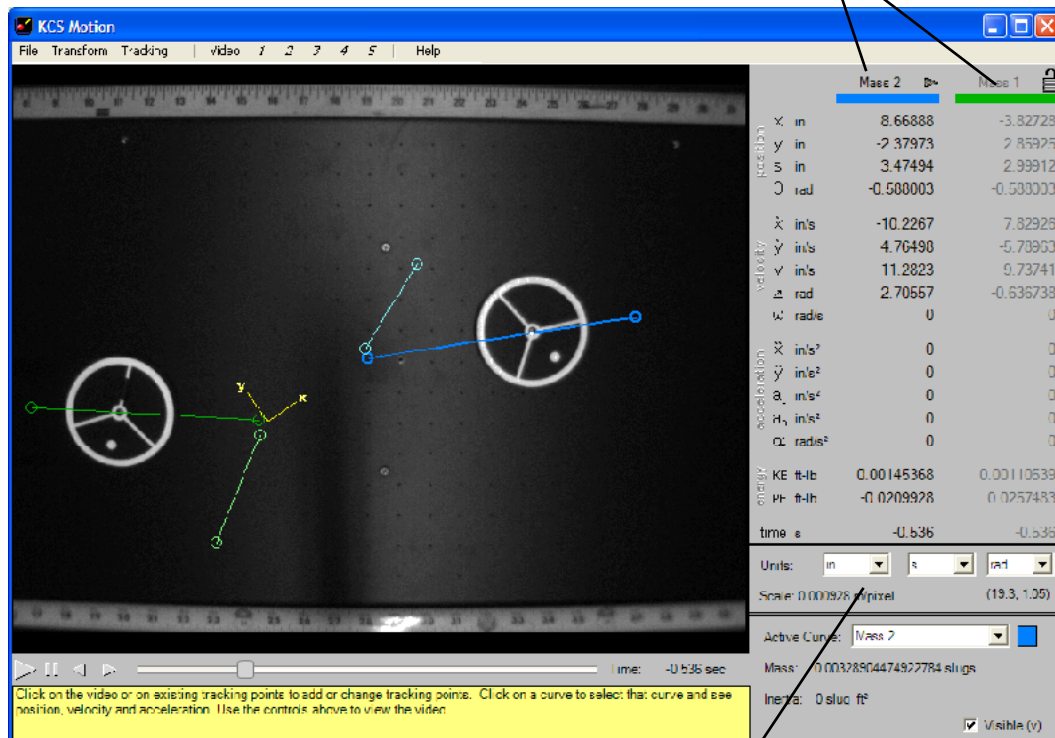
Once an object tracking curve is established, KCS Motion can report the motion parameters for the object at any location along the curve. The motion parameters are reported in the first column to the right of the video. Values are reported with respect to the current coordinate system and units.

You can change the units for the motion parameters by selecting the units from the drop down below the parameters. To change the coordinate system, select "Set Axis Orientation..." or "Move Axis..." from the "Transform" menu.

When you tap on a curve, KCS Motion takes a snap-shot of the current motion and places those values in the second column of report area. Those values will remain there until you select a curve again. This lets you easily compare the parameters for two objects, or for one object at two distinct times.

If you click the mouse on any parameter value, that value will be copied into the clipboard.

motion parameter values

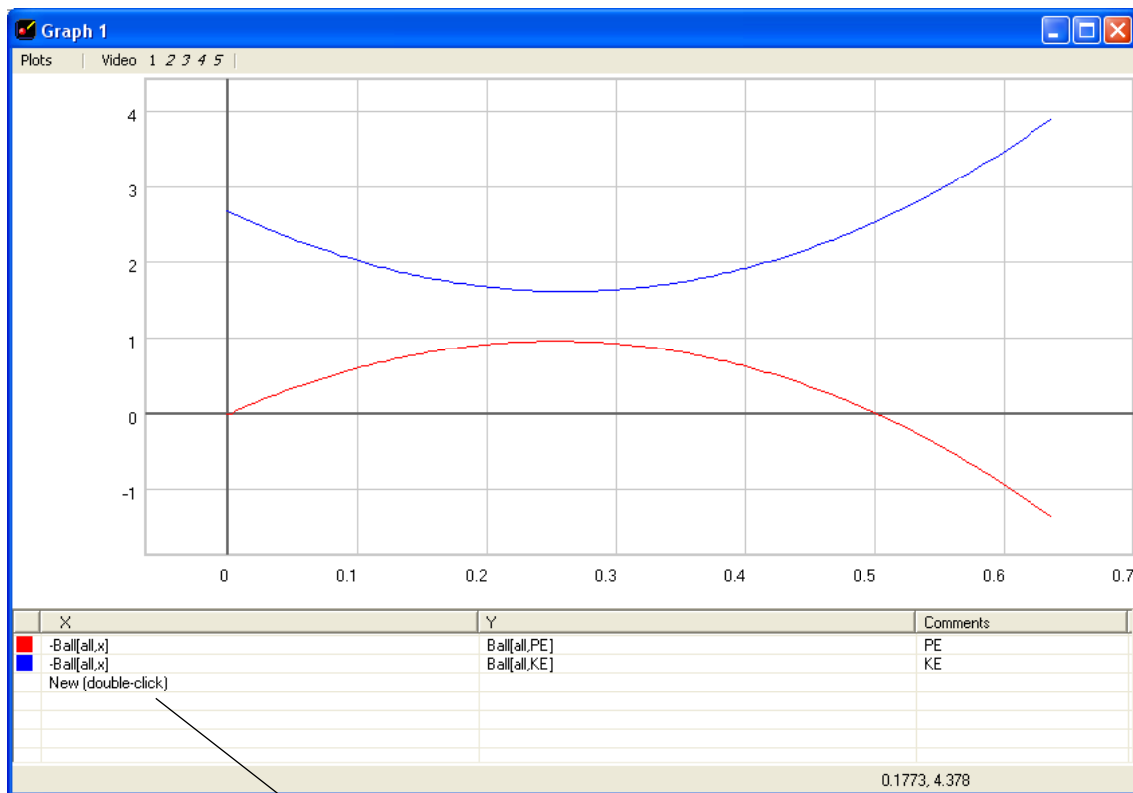


units

Graphing Motion

Motion parameters can also be displayed on a graph. To graph motion parameters

- 1) Select "Graph Curves..." from the "Curves" menu
- 2) In the grid at the bottom of the window, select a curve, x axis value, y axis value and color.
- 3) Click Refresh.
- 4) To see a curve value, move the mouse over the graph area. The scaled x,y value are reported at the bottom right of the window. If you change the units on the main video window, the change will be reflected in the graph.

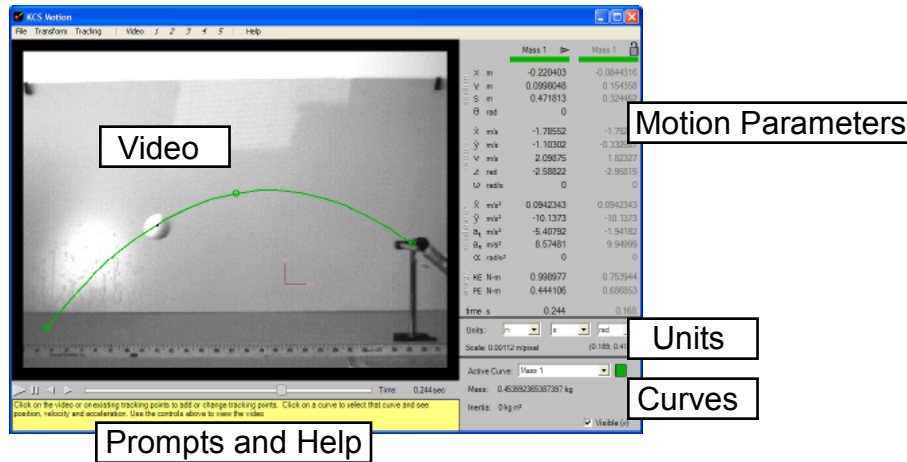


curves currently graphed

cursor location

KCS Motion Window






The video window, or KCS Motion window, is used to manage video, create tracking curves, and view motion parameter values. The window is divided into five areas as noted below.



Video

The video window displays the current video being analyzed. Tracking curves are superimposed on this video. Tracking points are indicated by small circles. The *active* tracking curve is drawn with a thick line. To active a curve, click on that curve. To add or edit tracking points for the active curve, click the mouse in the video window.

The video can be advanced and rewound using the controls at the bottom of the window. The time of the currently shown video frame is show in the bottom right of the window.

-  Play (p)
-  Pause (p)
-  Step one frame forward (> key)
-  Step one frame backward (< key)
-  Drag the slider to scrub through the video

Prompts and Help

This area displays tips for using the software. These tips change as the user enables different features. The area is also used to prompt the user for inputs.

KCS Motion Window (continued)

Motion Parameters

KCS Motion predicts the motion of an object based on its tracking curve. The predicted position, velocity and acceleration of the object associated with the active curve, at the current time in the video are displayed in the Motion Parameter area. In addition, the software stores previous values for comparison.

Name and color of the tracking curve corresponding to the values in the column

click on any value to copy it to the clip board

	Mass 1 ▶	Mass 1 🔒	
position	X m	-0.220403	-0.0844316
	y m	0.0998048	0.154358
	s m	0.471813	0.324462
	θ rad	0	0
velocity	\dot{x} m/s	-1.78552	-1.79268
	\dot{y} m/s	-1.10302	-0.332587
	V m/s	2.09875	1.82327
	$\dot{\Delta}$ rad	-2.58822	-2.95815
	ω rad/s	0	0
acceleration	\ddot{x} m/s ²	0.0942343	0.0942343
	\ddot{y} m/s ²	-10.1373	-10.1373
	\ddot{a}_t m/s ²	-5.40792	-1.94182
	\ddot{a}_n m/s ²	8.57481	9.94999
	$\ddot{\alpha}$ rad/s ²	0	0
energy	KE N-m	0.998977	0.753944
	PE N-m	0.444106	0.686853
time s	0.244	0.168	

locks the values in the second column

shifts the values to the second column

The first column displays values for the active tracking curve at current time with respect to current coordinate system and units. The column is updated as you advance through the video.

The second column displays previous motion value. Values in the first column are automatically shifted to the second column when you activate a different tracking curves, or when you press the ▶ button.

KCS Motion Window (continued)

Motion Parameters (continued)

position	x	x coordinate position
	y	y coordinate position
	s	distance along the path of the tracking curve
	θ	rotation
velocity	\dot{x}	x velocity
	\dot{y}	y velocity
	v	tangential velocity
	α	angular direction of the tangential velocity vector
	ω	angular velocity
acceleration	\ddot{x}	x acceleration
	\ddot{y}	y acceleration
	a_t	tangential acceleration
	a_n	normal acceleration
	α	angular acceleration
energy	KE	kinetic energy
	PE	potential energy
time		time corresponding to the measurements

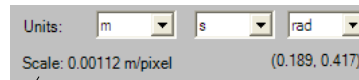
Note 1: All values are reported with respect to the current coordinate system and in the currently selected units.

Note 2: Angular measurements are only valid if “Ignore Rotation” is disabled from the “Curve” menu, and the user has provided orientation data for each tracking point.

KCS Motion Window (continued)

Units

Set the units used to calculate the motion parameter values



current cursor location in scaled units with respect to the current coordinate system

Scale factor. This can be used to estimate the relative error of the measurements

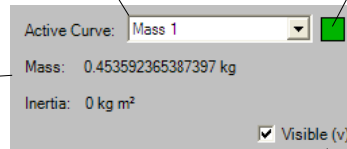
Curves

The parameter for the active curve are displayed in the curve area. The parameter value can be set by selecting *Change Curve Parameters* from the *Curve* menu.

name of the active tracking curve. You can change the active curve using this list or by clicking on the curve in the video window

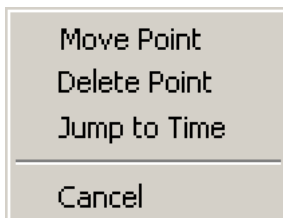
color of the active tracking curve. Clicking on this box opens the Curve Parameter dialog.

Mass and inertial associated with the tracking curve



indicates whether the active tracking curve is visible. "v" toggles this value.

Tracking Points Menu



The Tracking Points popup menu appears when you left-click the mouse in the video window. Use this menu to add, move and delete tracking points, and to jump to the time in the video when the point was placed. The menu is context sensitive and the menu items change depending on when and where you click.

Add Point

Use to add a new tracking point. You will see a round mark where you have added the new tracking point.

This option is only available if you have not already added a tracking point for the active curve at the current time. If you are attempting to add a new tracking point at a location very close to an existing point, even if the existing point corresponds to a different time in the video, the menu may not show the the Add Point options. To solve this, hide the active curve by pressing “v”, then add the point. Press “v” to make the curve visible again.

Hint: If you have enabled Rotation, you must enter both the mass location and its rotation. Hold down the shift key to lock the rotation angle at 45 degree increments.

Move Point

Use to move an existing tracking point. This option is only available if you have already added a tracking point for the active curve and are currently at the save video time.

To use this command, advance the video to the time when the desired point was added (use Jump to Time below). The tracking point will be highlighted. Click the mouse at the new location and select “*Move Point*”.

Delete Point

Use to delete an existing tracking point. Click on any tracking point and select “*Delete Point*” from the menu.

Jump to Time

Use to jump to the time in the video when the tracking point was added.

Graphing Window

Use graphs to plot or export data from tracking curves.

Menu options to export data and manage plot windows

Right-click on the graph to copy the point value at the cursor location to the clipboard

X	Y	Comments
0	Ball(1) PE] + Fall(1) CF]	0.51 PF
0.1	Ball(1) KE]	0.51 PF
0.2	Ball(1) PE]	0.51 PF
...
1	Ball(1) PE]	0.51 PF

constants that can be used in equations. Separate constants with a “,”

x, y axis data, plot line color and comments

zoom and scroll (also can drag mouse to zoom)

value at cursor location

double click on a line to add, edit or remove plots using the Plot Description dialog

Plot Description

Description: Color:

X-value:

Y-value:

+ x^ sq: time mass initial final initial final

Enter an equation for the X and Y axis. Use control above to insert values for mass parameters.
 F1: mass(x) > all mass > volume mass(initial) > starting < value

Plot line color and user comments
x-axis values (currently high-lighted)
y-axis values

Use to create expression for the x or y axis values. See Plot Expression. Press “Insert Mass Measurement” to insert the selected value into the high-lighted box

Use CTRL+0 to switch to the video (KCS Motion) window. Use CTRL+1, CTRL+2... switch to other graphing windows.

Graphing Window (continued)

Plot Expressions

Graph curves are created using mathematical expressions for the x and y axis. The expression can be made up of data taken from the tracking curves and scientific functions.

Tracking data is written using the following formats:

CurveName[mass]
 CurveName[inertia]
 or CurveName[time range, curve parameter]

CurveName = the name of the tracking curve

mass use to extract the mass of the object

inertia use to extract the inertia of the object

time range

initial = the value at the start of the tracking curve

all = all of the values of the curve parameter.

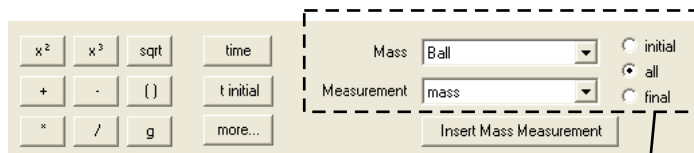
final = the value at the end of the tracking curve

curve parameter

values corresponding to position, velocity and acceleration of the tracking curve

In addition, the expression can use standard scientific functions.

You can enter expression manually or use the button below the combination of dropdown lists provided on the Plot Description dialog



additional functions and constants

Select the name of the tracking curve, the measurement parameter and the time range. The press Insert Mass Measurement to insert the value into the currently selected edit box.

Graphing Window (continued)*Plot Expressions*

Example plot expressions are given below. In all examples “name” is the name of the tracking curve created in the main video window.

x-y position of a mass

x-axis: name[all,x]

y-axis: name[all,y]

theoretical x-y position of projectile mass

x-axis: name[initial,dx/dt]*(t-t[initial]) + name[initial,x]

y-axis: $-0.5g(t-t[\text{initial}])^2 + \text{name}[\text{initial},dy/dt]*(t-t[\text{initial}]) + \text{name}[\text{initial},y]$

sin wave

x-axis: t

y-axis: sin(2000t)

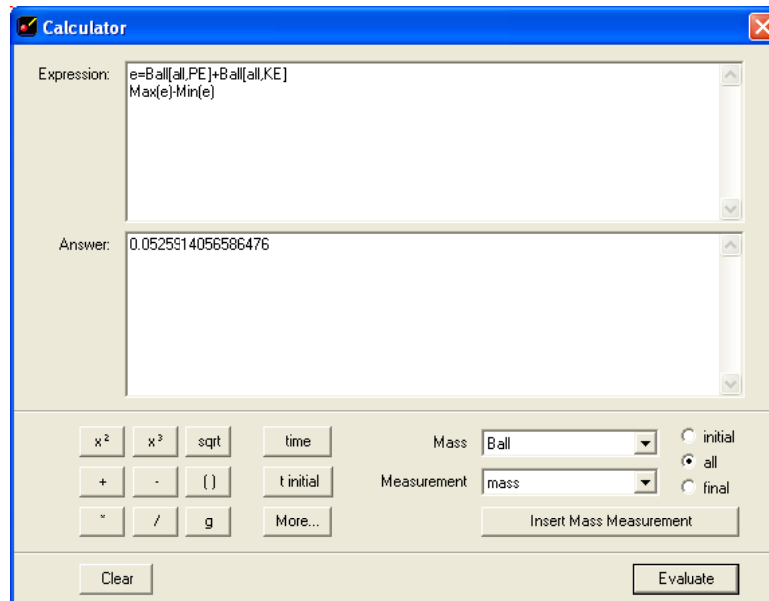
Plot expressions are evaluated using a special version of the MathTablet computational engine and follow the syntax allowed in MathTablet. Plot expressions can also use custom scripts created in MathTablet. These scripts must be stored in the mtlibs folder located in the applications program folder. The functions Min and Max, for example, are evaluated using MathTablet scripts. For more information on MathTablet visit <http://www.statsnow.net/mathtablet>

Graphing Window (continued)

Calculator

The calculator, available under the Plots menu, can be used to perform numerical calculations on motion data. Enter the expressions in the Expression window. Separate expressions with a Return. Expressions follow the same syntax as plots discussed on the previous page. You may also assign variables in your expressions. However, you should avoid using variable names which are the same as motion parameters. Press Evaluate to evaluate all of the expressions and display the results from the last expression.

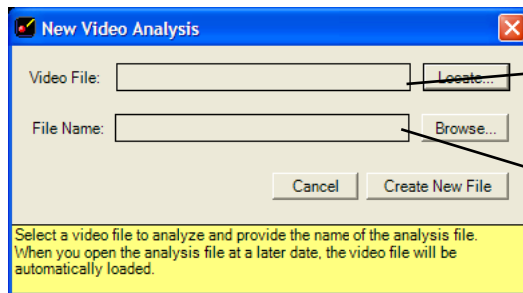
The calculator can perform vector and scalar operations. For example, $\text{Ball}[\text{all}, x]$ is a vector of ball x locations corresponding to the vector t . Evaluating the expression t will result in vector of all the values in t . Evaluating $3t$ will yield a vector of three times that. In order to evaluate $t+3$ you need to write $\text{Vector}: t+3$ because 3 is a scalar value.



File Menu

New Video Analysis (CTRL+N)

Use to create a new video analysis. The video analysis file (.vaf) includes a reference to the actual video file used in the analysis plus all of the scaling, tracking and graphing information you added.



name of the video file

name of the analysis (vaf) file

Open Video Analysis (CTRL+O)

Use to open an video analysis you've already created.

Save Video Analysis (CTRL+S)

Saves scaling, tracking and graphing information used to analyze a video. File are also automatically saved when you exit the program or open a new video analysis file.

Save Video Analysis as...

Saves the scaling, tracking and graphing information using a specified file name

Properties...

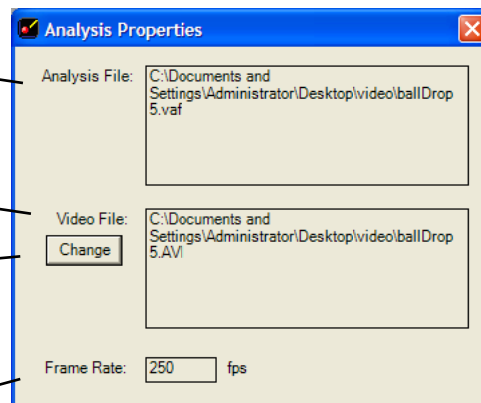
Displays file properties. Can also be used to change the video file associated with the current video analysis file (vaf).

name of the analysis (vaf) file

name of the video file

change the name of the video file associated with the current analysis file

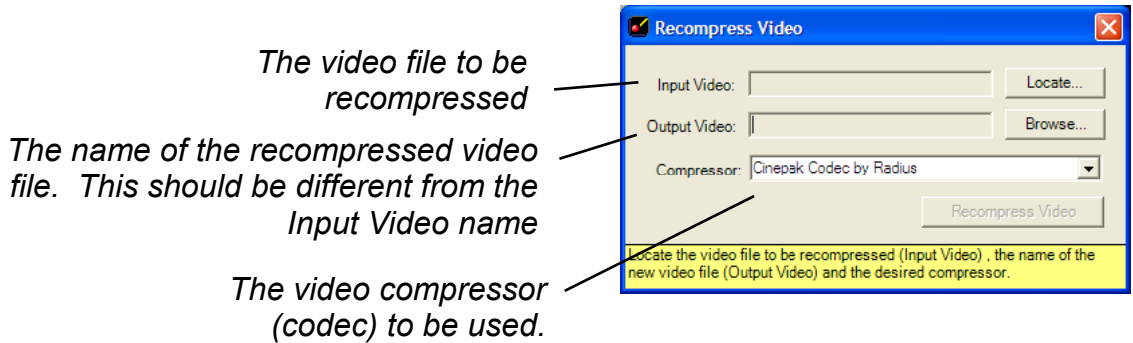
frame rate of the video file



File Menu (continued)

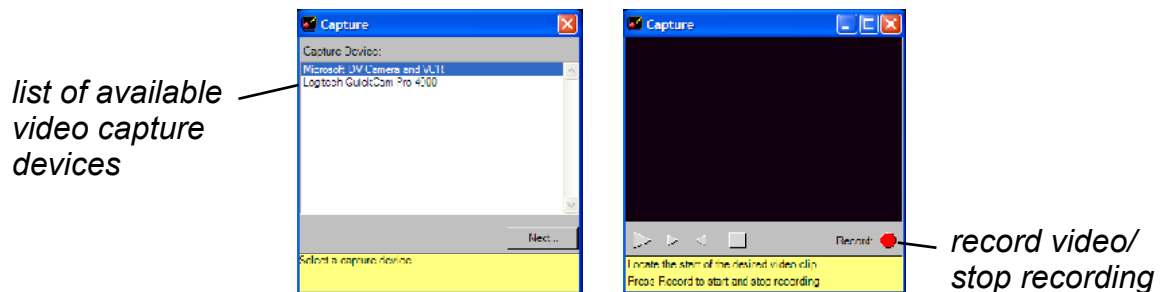
Recompress Video...

Use to recompress a video file using a different codec. This is useful if you need to remove interlacing in a video file or compress the video so it requires less disk space. Note that not all codecs are able to compress all video files. In general, cinepak provides good performance for use in KCS Motion.



Capture Video

Captures video using one of the video devices installed on your computer. Select one of the installed capture devices. Then press record to start and stop video capture.



Addin Menu Items

Any folder you add to the KCS Motion program folder will also show up on the file menu. When you select the menu item, KCS Motion will launch the application inside of the folder that is named the same as the folder.

Transform Menu

Fix x-y Aspect

Use to correct the x-y scaling (aspect ratio) on video. This scaling is usually automatically corrected by the operating. If the video is stretch horizontally or vertically use this command to measure two item of equal length in the horizontal and vertical axis and correct the x-y scaling.

Fix Distortion

Use to adjust the distortion parameters. The software overlays a grid on the video. Adjust the slider at the bottom of the screen, and move the dot and the center on the screen until parallel lines in the video are parallel to those on the distortion grid. You may not be able to match the video distortion exactly to the distortion grid. Concentrate on matching the distortion in the area of the video you will be using for the analysis.

Scale From Points...

Use to set the scaling for the video based on the length of a known object. Click the mouse on the endpoints of an object of known length. Then enter the actual length of the object. Enter the length using the same unit as you have selected for measurements. This is usually the most accurate way to set the scaling.

Scale From Drop...

Use to adjust the scaling for the video based on a free falling object. Advance the video to the start of the objects free fall and mark its center. Advance the video a time about halfway through the object's free fall. Mark the object center and this time. Advance the video to a time near the end of the object's free fall points. Mark this final point. The software will assume the object is falling at 9.81m/s^2 and calculate the video scale accordingly.

Set Axis Orientation...

Use to set the orientation and location of the coordinate system used for measurements in the analysis. You can change the coordinate system at any time. Analysis values will be updated as you change the coordinate system.

Hint: Hold down the shift key to lock the rotation to 45 degree increments.

Move Origin...(CTRL+M)

Lets you move the coordinate system without changing its orientation.

Transform Menu (continued)*Attach Axis to Active Curve*

Attach the coordinate system to the active curve. Use to create a moving coordinate system. Motion parameters are then reported with respect to the moving coordinate system. When reporting relative motion parameters, the word “relative” appears above the motion parameter values. To detach the coordinate system, use Set Axis Orientation or Move Origin.

Set Time=0

Shifts the time scale on the video so that $t=0$ occurs at the current frame.

Zoom (100%) (z)

Toggles between 100% zoom and the user set zoom level (see below). Use the arrow keys or scroll bars to scroll in video. If the entire video can not be seen at 100% zoom level, the video is scaled to fit the window.

Increase Zoom (+)

Use to increase the user zoom level.

Decrease Zoom (-)

Use to decrease the user zoom level.

Measure... (m)

Use to measure the length and angular orientation of a line. The measurements are show in the units display area.

Cross-Hairs (x)

Toggles between the cross and target cursor.

Set Start Frame

Set the starting frame for the video. Use this and *Set Stop Frame* to crop out portions of the video you do not need to use. This action does not change the original video.

Set Stop Frame

Set the last frame to be played in the video.

Transform Menu (continued)

Reset Start/Stop Frame

Resets the start and stop frames so that the entire video can be played.

250 FPS (CTRL+1)

30 FPS (CTRL+2)

10 FPS (CTRL+3)

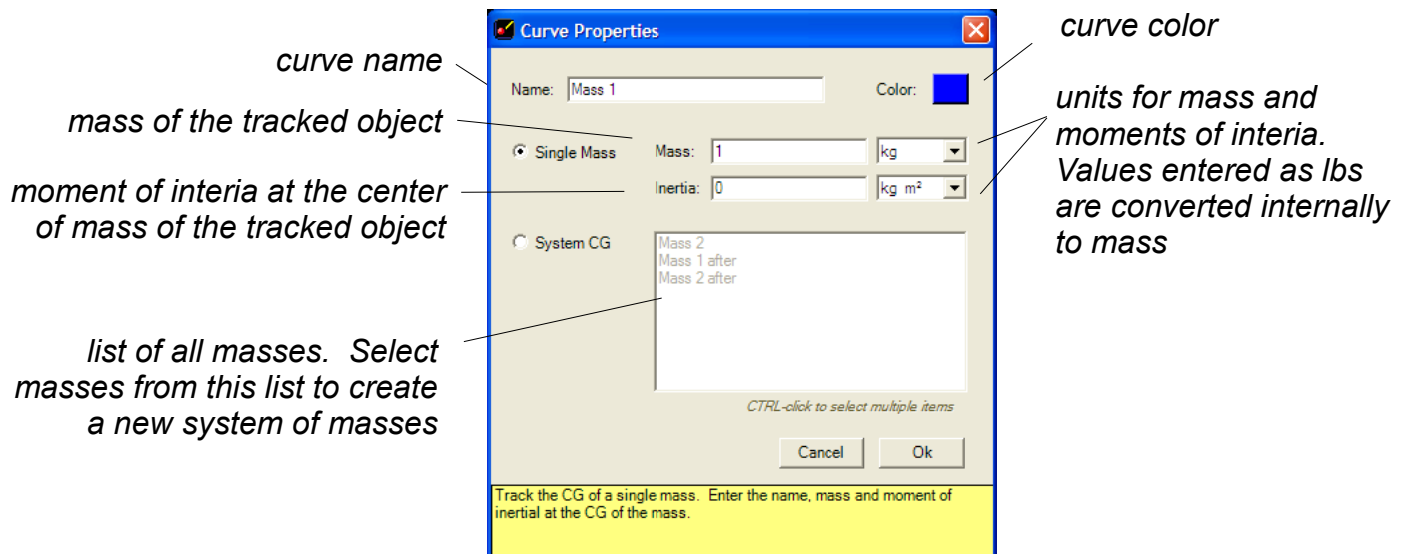
Sets the speed at which the video will be played. The speed listed first is always the native speed of the video.

Tracking Menu

New Curve...(CTRL+Shift+N)

Creates a new tracking curve and opens the curve properties dialog. Tracking curves can be for a single mass or for center of gravity of a system of masses. If the curve is for a single mass, you must supply the mass and inertia values, and mark tracking points in the video window. If the tracking curve is for a system of masses, you must specify which masses are to be included in the system. KCS Motion then automatically generates the tracking curve.

Note: Tracking points for mass curves are indicated with circles. Tracking points for a system of masses are indicated with squares.



Change Curve Parameters...

Opens the curve properties dialog. See above.

Ignore Rotation (CTRL+R)

Forces the rotation tracking to be zero. Use this setting when you are only tracking the position and not rotation of an object. This is the default setting. When unchecked you must specify the position and rotation for each tracking point.

Snap to Origin

Forces all tracking points to be placed on the current origin. This is useful if you are tracking only the rotation of an object. Place the origin at the center of the object's rotation and enable Snap to Origin.

Tracking Menu (continued)

Delete Active Curve

Deletes the currently highlighted tracking curve.

Delete All Curves

Deletes all the tracking curves.

Show All Curves (CTRL+Shift+H)

Makes all tracking curves visible

Hide Other Curves (CTRL+H)

Hides all but the currently active tracking curve. You can hide/show only the active curve by pressing “v”.

Invert Color (CTRL+i)

Changes the color of the axis and tracking markers

Windows Menu



Video (CTRL+0)

Bring the KCS Motion program to the front.

Graph 1 (CTRL+1)

Graph 2 (CTRL+2)

...

Clicking on a number bring the appropriate graphing window to the front. If the value is in italic, the graphing window is not being used. If you click on a graphing window number from inside of the same graphing window, the window is hidden.

Summary of Keyboard Short-cuts

CTRL+N	New video analysis
CTRL+O	Open a video analysis file
CTRL+S	Save current video analysis file
CTRL+M	Move coordinate system without rotating it
z	Toggle the zoom between 1x and user set zoom
+ or =	Increase user zoom
- or _	Decrease user zoom
m	Measure the distance between two point
x	Toggle between the simple cursor and the target cursor
p	Play/Pause video
> or .	Advance video one frame
< or ,	Move video back one frame
CTRL+Shift+N	Create a new tracking curve
CTRL+R	Ignore/Use orientation when tracking
CTRL+H	Hide all but the active tracking curve
CTRL+Shift+H	Show all tracking curves
v	Hide/Show the active tracking curve
i	Invert the color of the tracking point and coordinate axis
CTRL+E	Show the expression calculator (Graphing windows only)
CTRL+R	Refresh the graph (Graphing window only)
CTRL+0	Show the main video window ¹
CTRL+1 to CTRL+5	Show the corresponding graphing window ¹

¹ keystroke works from both the video window and any graphing window