VP User Guide

Version 8.1

June 2026

SINCE DAY ONE.

Chyron Virtual Placement User Guide • Version 8.1 • June 2026 • This document is distributed by Chyron in online (electronic) form only, and is not available for purchase in printed form.

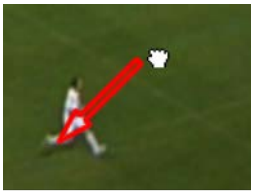
TABLE OF CONTENTS

APPLICATION WINDOW

Project

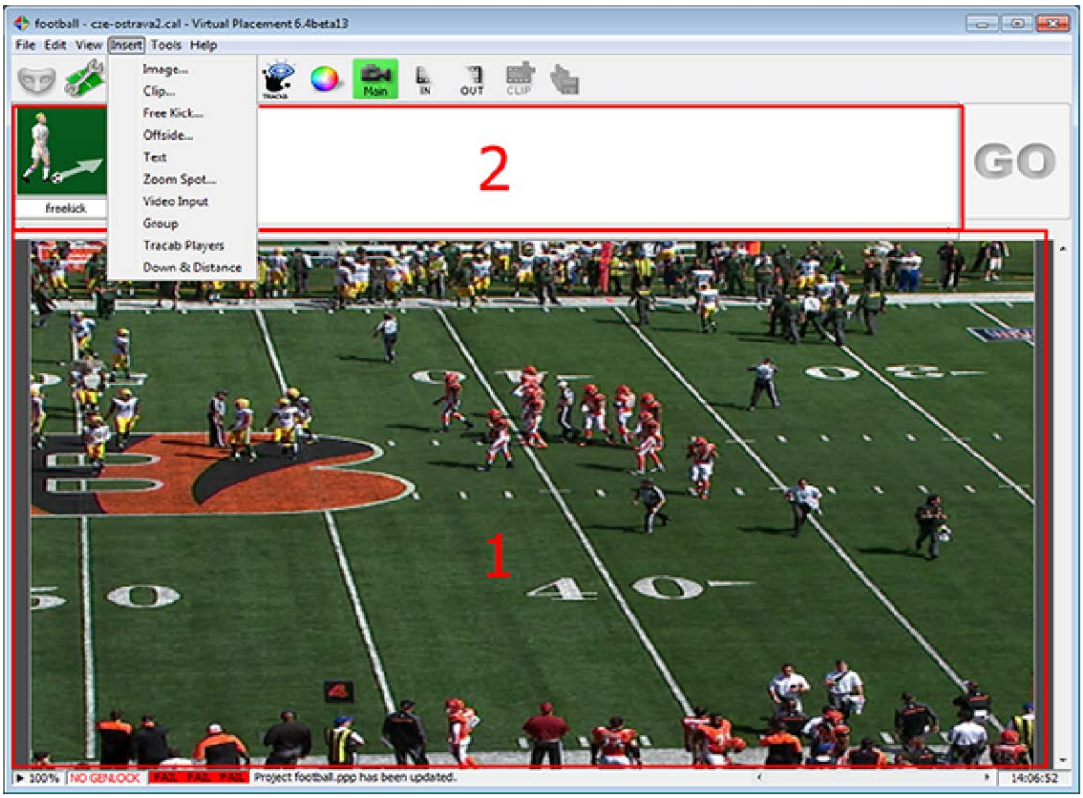
There is always one project active at a time. A project contains products and their parameters. You can save or load projects to/from a file. Graphics resources used in a project are only referenced to their original location on your hard drive.

Products contained in the project are shown as buttons in the Product bar (2). Products can be added to current project via Insert menu item. Product parameters can be changed via popup menu (use right mouse click) on the product button.



Products in the Product bar can be reordered by Drag and Drop gesture.

Video Preview



Video preview renders the scene, which includes video and graphics. The preview doesn't show exactly output of the system, video in the preview is scaled to fit the screen dimensions.

Preview is used to prepare the graphics for production (see Product chapter.)
It is possible to zoom the preview (via menu item View or keyboard shortcuts). When zoomed-in, you may need to view another area of the preview. Use the scrollbars or use drag by middle mouse button to pan the preview.

PRODUCT

Product is a container for graphics art that is going to be presented. Product button consists of two parts. An image button (1) and label button(2). The image button shows a thumbnail of the product. Label button shows product's name and indicates On-Air status by background color.

Insert product:
Use Insert menu in the application menu or in the popup menu for Product bar.

Delete product:
Use Edit → Delete menu item to delete last selected product or Delete menu item from popup of the product to delete.

Delete All selected products:
Use Edit → Delete All Selected to delete all selected products from the project.

Lock product bar:
Menu View → Ability to order products within the product bar and then lock the position of the product.

Select product:
Click the product button. The product starts to be rendered in preview. All other products will get unselected.

Click the products with CTRL key down to invert selection of a product. All other products keep their state.

Click two products with SHIFT key down to select all products between the two clicked. When you hover the product button, corresponding product is highlighted in the video preview - outline of the product is rendered in contrast color.

State of the products is reflected by the background color of the label button.

	Default state. The product is neither in preview nor in production. Only takes place in the product bar.
	Products in preview. You can manipulate them, but the product is not in production (not on air)

	Products in production. Product with defined on-air duration shows the time left as orange/red progress bar. After the product finishes playing, it automatically goes to state Preview-only.

When the product is in the preview, click the label button to set the desired product to production. All others will stop playing. To add a product to production together with other products, you have to hold CTRL key down before clicking the label button.

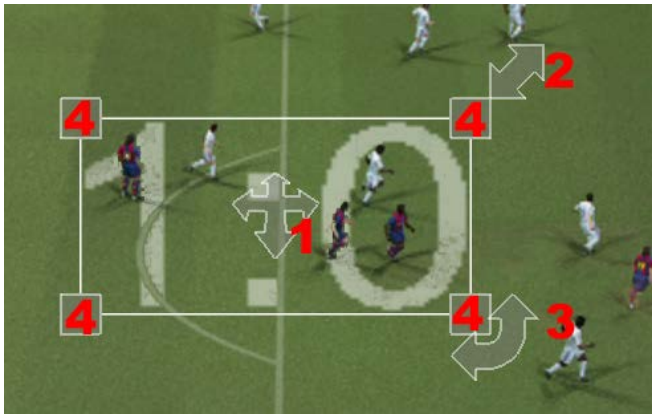
To put more products on-air at the same time, select them all with CTRL, so all are in the preview and use the GO button. There are several ways the production is finished.

- When your press the GO button again while in production
- After the duration of the product expires. This is a case of clips with non-loop behavior and products having set Duration property.
- Lost of tracking, for example scene cut in motion tracking.

Adjusting Position and Size
Select desired product. Drag it to desired position.
Some tracking types offers a special Perspective Move manipulator (see 1). Dragging the object by this manipulator moves the object with the current perspective defined by this product.

Use the resize manipulator (2) to adjust size (tip: hold CTRL to resize the product in one axis only). You can rotate the product by the rotation manipulator (3). The rotation is done either in pitch (pitch tracking), screen (most of tracking types), or content local space (most of tracking types, hold SHIFT).

There are also corner manipulators (4) for non-linear perspective skew. Holding SHIFT while dragging corner manipulator moves horizontal neighbor in a mirror direction. Holding CTRL moves vertical neighbor in parallel.

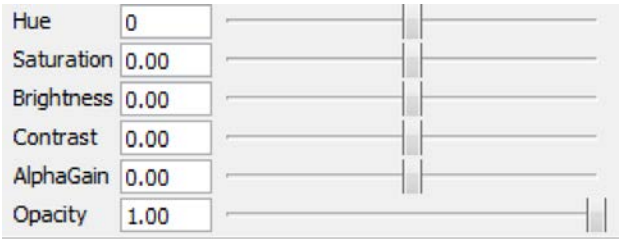


Billboard Manipulator
Billboard tracking type provides distinctive set of manipulators.
Use billboard area (1) to move the billboard around the pitch.
To change the size of a billboard, use the resize manipulator (2).
You can rotate billboard around its vertical axis by using rotation manipulator (3).

To adjust billboard height above the field, use the manipulator (4).

Tip: To lean billboard back or front, use Rotation value in the Geometry rollout.

Color Correction



This allows you to adjust the colors of the product to fit current scene.
Parameter **Alpha Gain** changes linearity of key channel. This can be used when a product is too transparent or not transparent enough.
Parameter **Opacity** changes transparency. Value 0 is fully transparent. Value 1.0 is fully opaque.

Tracking

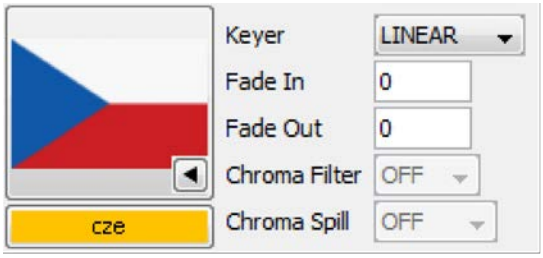
With tracking enabled the products can hold the position on the pitch where they were placed in the host environment.

None	Tracking is disabled. Camera movement has no effect on product position.
Motion	Motion tracking is used to keep graphic object in the position in the scene. The tracking relies on textured scene. Tracking works reliably when camera movement is smooth and scene background has textured surfaces. The tracking drifts over time.
Standby Motion	Combination of **None** and **Motion** tracking. When the product is in preview, but not on-air yet, it behaves like None. As soon as you put the product on-air, it begins to behave like Motion tracking. This type of tracking is useful to set precisely place where the production begins. Later, just press the GO button and the production will

	behave like motion tracked.
Anchor	Graphics keeps its position in the anchor scene. See Anchor Tracking chapter for more detailed information.
Pitch	Automated tracking and localization. Properly defined pitch or calibrated camera needed. See Camera Tracking for sports chapter .
Billboard	Similar to the Pitch tracking. The product stands-up vertically on the pitch.
Billboard Facing	The billboard is automatically rotated to always face the camera.

Keyer and Fade

Set a product to use chroma key by choosing one of the chroma keys available. Chroma keyers insert the graphics to the video only for areas where the color matches the settings of the keyers.



Chroma keyer

Chroma filter	During chroma key processing a filter is used to soften edges and reduce edge aliasing. Use “BLUR” to set it on
Chroma Spill	Used to prevent spilling of the background color on the edges of the keyed graphics. There are choices to prevent spill for the most used keying background colors.

Effects of the Filter and Spill suppression (keyed on green background):

1) Upper left image – both Filter and Spill suppression OFF
2) Upper right image – Filter OFF, Spill suppression GREEN
3) Lower left image – Filter BLUR, Spill suppression OFF
4) Lower right image – Filter BLUR, Spill suppression GREEN

You can get to the chroma key dialog through the chroma keyer button from the main toolbar. See more info in chapter Chroma Keyer.

Fade
Fade in/out are effects used at the beginning resp. end of the production. You can change the duration by setting new value to corresponding box. Mind that all values are in video field units.

Duration
You can specify the duration of production for several products without the need to end the production manually. Duration is set in field units. Mind that the real duration is this value plus duration of fade in/out.

File
Using this menu item in the corresponding product you can change the source file for the product (source image, clip, source free hand style...)
Although most product types do not follow file content change while in production, image products are able to update on-fly. Whenever the image file changes its content keeping the same size and packing, the image product is updated to reflect file change.

Production Type
Depending on the product type, it is possible to choose different mode of production control.

DIRECT	Production is controlled directly by the GO button.
AUTO	Selecting the product tells the system to start production whenever it becomes visible (see detection types). After the product goes out of view, the production automatically stops. To start/stop production, the product must become visible/invisible for at least *Decision Time* frames. Two different visibility detection types can be used: • *Tracking And Visibility* – to be put in production, a product must have tracking available and must be inside the viewport • *Tracking* – to be put in production, a product must have tracking available, no matter if it is visible inside the viewport. Pressing the GO button can be used to stop ongoing production. After eventually leaving the view and coming back, the production starts again automatically.
SEQUENTIAL (Group)	After pressing GO, group members with definite production time are produced one after one. Any members with infinite production time are produced in parallel.
PARALLEL (Group)	After pressing GO, production of all grouped products starts immediately.

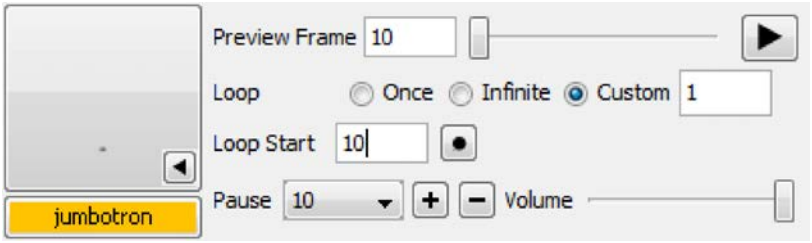
Geometry

Geometry rollout allows to change numeric geometry properties, like position and size. Depending on the tracking type, the editor uses different units.

Screen relative units *[-1,-1] left bottom, [1,1] right top corner of screen*	None, Motion, Standby-Motion, Anchor
Pitch meters	Pitch, Billboard, Billboard Facing

Clip

Clip parameter window allows to set basic clip properties.



Preview Frame	Select frame to be visible in preview window when clip is not playing.
Play ►	Play clip in preview window only. The clip will not be visible on video output.
Loop	• Once – Play clip once

	• Infinite – Play clip in a loop forever. Stop the payback by turning off production. • Custom – Play clip in a loop for defined number of iterations.
Loop Start	Set start point for looping. Frames before Loop Start are played once, the rest of the clip loops for defined number of periods set in the Loop property.
Pause	Set pause points in the clip. Clip playback automatically pauses at selected positions. To resume playback press “Go” again. To set a pause point, select preview frame to requested pause point and press **+** To remove a pause point, select the pause point in the selection box and press **-**
Volume	Changed audio volume. If the clip contains audio you can adjust clip volume to match the background audio levels. Slider has range 0 – 100%

Text

Content of the text and text properties can be edited in the Text editor. It is available in the popup menu of the Text product, or clicking on the small context button in the lower left corner of the product button. The context button gets visible after selection.

In the case of a text product, you're allowed to control formatting of the text. The text itself can contain special formatting sequences beginning with a backslash (\) character. See below the table of possible format sequences.

\<	Decrease kerning space between the two surrounding characters. Number of '<' means the amount of extra kerning. Sequence \< decreases kerning of one unit. Sequence /<<< decreases kerning of 3 units.
\>	Increase kerning space between the two surrounding characters. Number of '>. means amount of extra kerning as above.
\\	Backslash itself.
\s	Non breaking space.
\n	New line.
\uXXXX	Unicode character with XXXX unicode hex value.
\iu	The following text will be rendered as the upper index. To end the upper index part and continue with normal text, use \in switch.
\il	The following text will be rendered as a lower index.
\in	The following text will be rendered as normal text.

Text “Text\iuupper\illower\inIndex” will be rendered as:

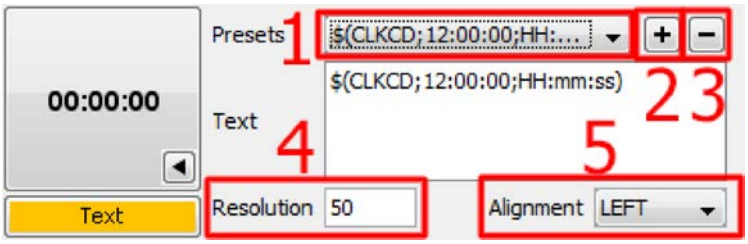
Usage of Application Variables
Text product allows you to use symbolic name of a variable, which is automatically translated to its value. Syntax of variable usage:
$(variable_name) will be translated to variable_value.
List of available variables is defined in Appendix C – Application Variables section.

Text presets
User Field Product = Virtual Placement allows you to prepare several version of text products. So you can have only one text product and switch between text strings.

In the text editor, you can see list of text presets (1). If you choose one of them, it will be copied to the text field and used in the text product. To add a text preset, just enter the text to the text field and press add button (2). To remove a preset, choose it in the list of presets and press the remove button (3).
Text presets are saved to the project file, so they are available only in one project.

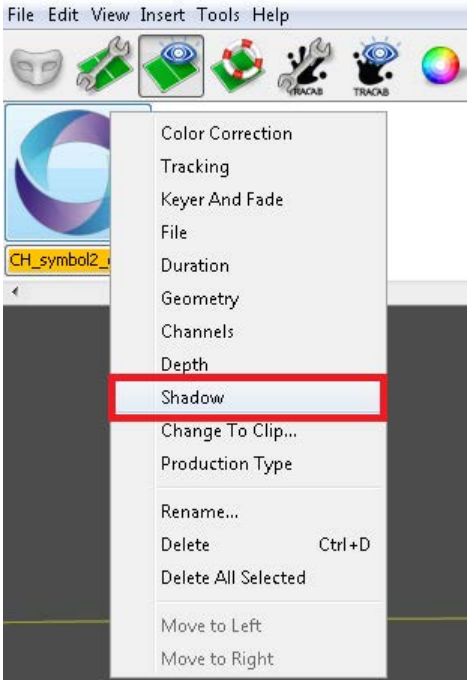
Resolution
The higher the value is, the smoother text will be displayed. Adjust the text resolution before production to fit the smoothness requirements.

Alignment
For one line texts the products have minimal bounding box and the alignment change doesn't take effect. For multiple line texts you can choose alignment.



Billboard Shadow

Billboard tracking provides the ability to apply a shadow to the billboard this can be found by right clicking the product and selecting shadow from the dropdown menu.



The shadow option provides the following settings in order to adjust the billboard shadow.

Enabled	Enables and disables shadow.
Texture	Select file for billboard shadow.
Opacity	Adjusting the transparency.
Offset	Ability to offset the shadow from the billboard.
Scale	Adjusting the size of the shadow.

3D Billboard

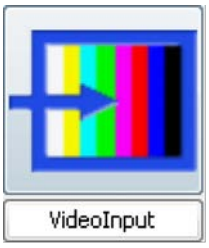
Billboard tracking provides the ability to apply depth of field to the billboard this can be found by right clicking the product and selecting depth from the dropdown menu.

Side Texture	Applies texture to 3D billboard.
Depth	Increase or decrease depth of field.
Opacity	Adjust how many side pixels are visible.

Video Input

Video input product allows to insert incoming SDI video feed into another feed. In the Video editor available from the popup menu of the product button you can choose video source for the product:

- background feed (equals to the actually selected camera)
- auxiliary video texture feed. This feed must be configured as texture feed and is not listed among other camera feeds.



Keying

There are 2 keying types associated with the Video input:
Keying on the background of another feed (Keyer and Fade popup menu item)
Using own key to remove background from the Video texture feed (Video Keyer popup menu item).

Setting chroma key for the video texture

Select the video texture feed in the camera selector in the main toolbar. The video texture is

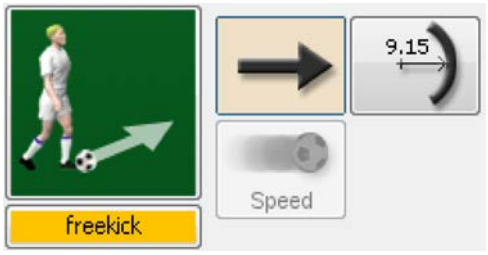
shown in the preview. Follow the instructions for chroma key picking in the Chroma Keyer chapter.

Cropping
The texture itself might contain unwanted artifacts on the edges. Open the editor using the Video Keyer popup menu item and set crop boundaries. Video space has range of -1..1 in both axes, having 0 in the middle. Set e. g. -0.8..0.8 to crop 10% on each side.

Free Kick

Freekick needs properly calibrated cameras.

Freekick has two modes of production: Radius and Arrow. To switch between modes, use freekick rollout buttons. Alternatively, you can use a Numpad-period keyboard shortcut.



Radius mode
Radius mode shows animated circle around the ball position which should be clear of defending players. The size is automatically computed from calibration to be exactly 9.15 meters (10 yards).

Arrow mode
Arrow is used to show an arrow and distance of the free kick position to the goal. Head of the arrow is automatically placed to the middle of the goal and text with distance is added automatically as well.

Distance label
In Arrow mode also label with distance of the ball to the goal is shown. The distance can be shown virtually on the pitch, next to the ball. Adjust label position using the mouse wheel.

2D title label
You can also use 2D title on the screen. To use this label mode, create new Free Kick product using the product editor for freekick. Guide to create 2D title is in the appendix of this document, Free Kick Style editor section.

Events
When freekick manipulator is moved, ball distance changes are sent in form of events.

```
<Event app="VP" source="freekick">
  <GoalDistance value="46.656567"/>
</Event>
```

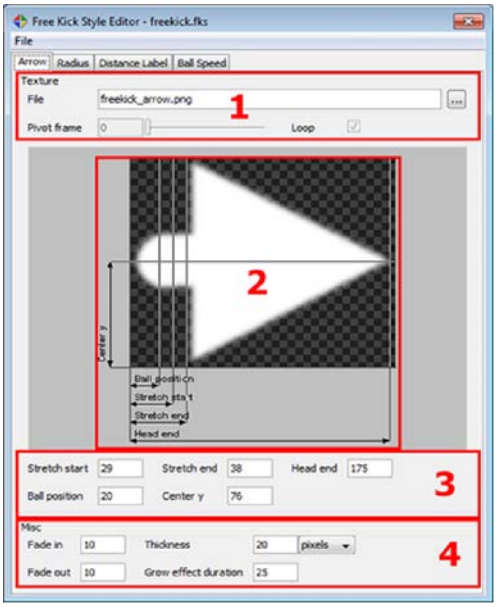
Ball Speed
If the ball speed is enabled (see Freekick Style Editor below), it is automatically computed during every freekick. The result is ready to use immediately after the kick. Computed value is shown in the freekick editor, next to the Arrow/Radius switch. Press the Ball Speed

button, and the label with the speed is shown. Production of Arrow/Radius is automatically finished.

The style of the label is configurable. To customize the label appearance, use the Free Kick Style Editor, described in the appendix.

Free Kick Style Editor

Free Kick style editor allows you to change the appearance of the free kick graphics. First open an existing freekick style or create a new one. Open and New actions are available in the menu. Change the setting and don't forget to save. As the style is customized, new freekick products can be created. Just select the appropriate freekick style during adding new freekick products. Freekick settings are copied to the freekick product during load, it means style change is not applied on other freekick products having the same style.

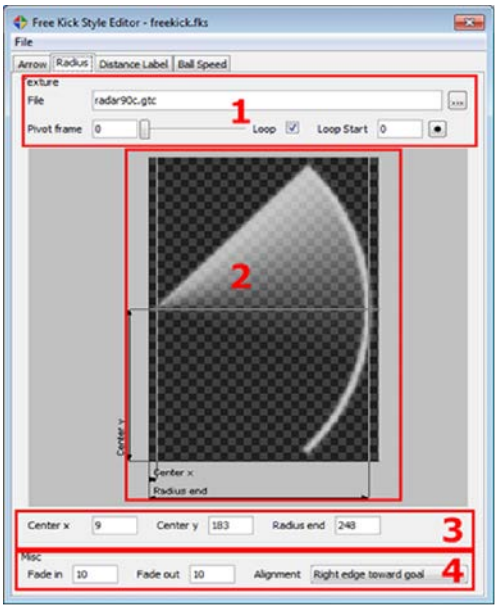


A. Arrow

1. Select arrow image/clip. The image should have “stretchable” areas. It means, area that is stretched to fit the distance from ball to the goal. In the case of clip you can choose play loops and preview frame (Pivot frame). (1)
2. Define image bounds and stretchable areas (Stretch start and Stretch end). You can do that in graphic preview (2) or numeric editors (3). In case of the image is not well

seen, you can swap between bright and dark background patterns via preview pop-up menu. This feature is available in all style editors with image or clip preview.

3. Set play options – Fade in/out, thickness and growth duration (in frames).



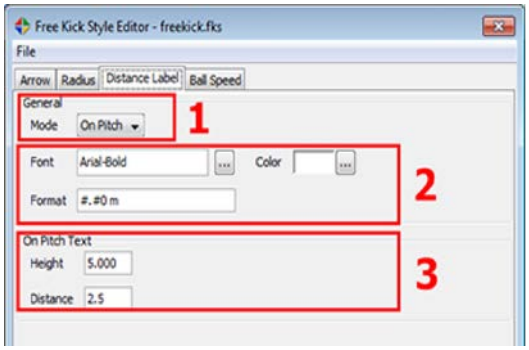
B. Radius

Shows 9.15 m (10 yards) radius around the ball.

1. Select clip to play. (1) It is recommended to enable loop for shorter clips. You can set Loop Start frame when loop is enabled. See Clip product for more information about Loop start. Pivot frame is equal to pause frame in case of no loop.
2. Set clip boundaries. Center is where the clip will be dragged. Recommended to keep the value in the middle of the clip frame.
3. Set fade in/out and alignment:Right edge toward goal: The radius 'points' to the middle of the goal.
   Pitch aligned: The radius is 'parallel' to the pitch side lines.

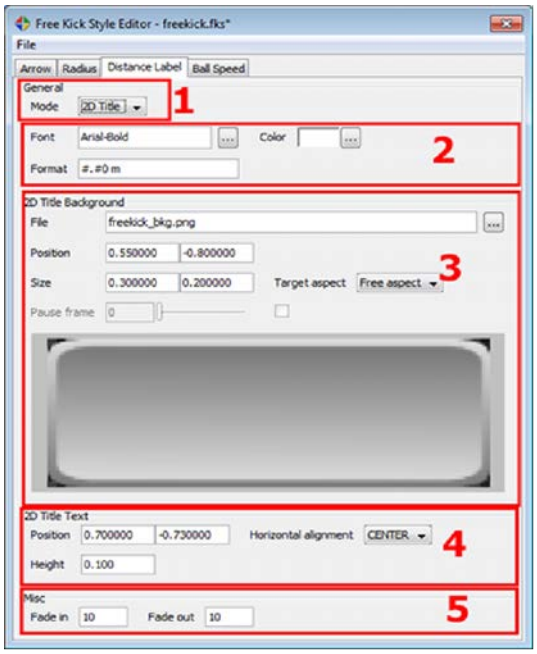
C1. Virtual Label

1. During the arrow production, a label with distance is shown. Select On Pitch (1) choice to have virtual text next to the ball.
2. Select font and color. Set format. Usually, accuracy to one decimal place is enough. Set format to “#.#0 m” for one decimal place.
3. Set text height and distance from the ball position.



C2. 2D Label

1. Select 2D title in the mode field.
2. Set text properties. Same as On Pitch Label.
3. Select image background for the title. Set size (pixels) and position of the label background. Position of the label is in normalized coordinates, it means <-1..1> in both x and y axis. [-1,-1] is in the lower left corner of the screen, [1,1] in the upper left corner. We prepare graphic and more intuitive 2D title adjustment.
4. Set position of the text. Position is set relative to the screen, it means the same way as point 3.
5. Set fade in/out.



D. Ball Speed Label

Customizing Ball Speed Label is pretty much the same as 2D Distance title. Editor for this property has the same structure and the fields have the same meaning.

Offside

Offside needs properly calibrated cameras. Also make sure, offside cameras are recorded (see Multiple camera I/O in this document and Installation Guide, section Cameras.) Offside is desired to be fully controlled from the MCS3 Jog/Shuttle.

Offside Workflow

1. Add offside product to the project. Offside is selected and put on air automatically to speed up the offside preparation. There's no need to select/put on air manually. Always the first (the left most in the product bar) is used.
2. An offside situation happens.
3. Stop the live feed using the STOP button on the Jog/Shuttle.
4. The camera is automatically switched to recorder so you can see the end of the recorded footage. At this point you can still switch between recorded cameras. The offside product is automatically selected and inserted into the video.

5. Jog back to the time of the offside.
6. Click at the last defending player. The offside line is placed at the position of the mouse. It can be adjusted after position has been set. The current timecode (Offside Time) is used as a pause point when the offside video is replayed.
7. The offside has been set. Jog back in time (~ 3 seconds) or use the Preroll button, which jumps specified seconds back (preroll time in seconds can be specified in Config Editor at tab Controller as value of action Preroll). This is to start the offside playback smoothly.
8. Press the ON-AIR button (W6)
9. Play the offside by the Play button. Playback speed is configurable and default value is 100%. You can set different speed from the application menu for playback actions or assign multiple playback actions with different speed to the Jog/Shuttle buttons. More in the Installation Guide, chapter Jog/Shuttle. Current speed, that will be used for playback, is displayed in the status bar during recorder-playback mode.
10. From actual point the playback begins and it is paused at Offside time defined in point 6. Here the playback smoothly stops. You can jog around to show the offside sequence slowly.
11. Press the Play button. It starts playback until the end of the recorded footage.
12. Press the ON-AIR button again or switch to live camera to finish the offside production.
13. You can export played footage as offside clip, and replay it later. The recorded footage is otherwise rewritten as you get back to live camera. See RAM Recorder chapter. The export process is executed on the background. So you can use the system while the exporting is still in progress.

Two offside lines in one clip
Fifa rules allow to have 2 offside situations, one after another. You can define 2 offside lines, one for each situation.

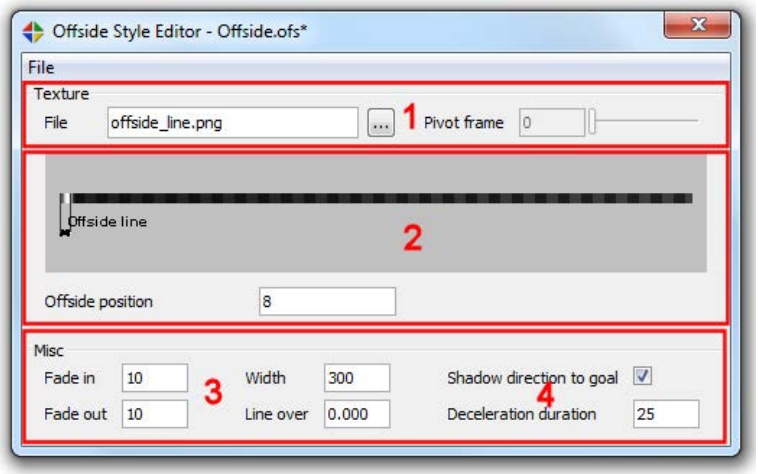
The workflow for the second line:
A. Follow steps 1-6 from above
B. Jog to the 2nd offside situation
C. Press Add offside button next to the Offside product button.
D. Click the last defending player again.
E. Follow the steps 7-10 from above
F. The playback is stopped on the first offside situation. Press play. The first offside fades out and the playback plays forward to the 2nd situation, where it smoothly stops and shows the 2nd offside line.
G. Follow the steps 11-13 from above.

During the offside production and preparation, you can see timeline with marked timecodes.
1) Timecode where the live playback was stopped and recorder activated.
2) Timecode, where the offside was placed
3) Timecode, where are you now in the recorded footage
4) Timecode, where automatic rewind is provided by pressing the Preroll button.

The timeline shows small white ticks corresponding to one second of the recorded footage.

Offside Style Editor
Offside style editor serves to customize offside graphics appearance.

1. Texture
   You can change the graphics of the offside line. Either still images or GTC clips are supported.
2. Offside line and offside shadowing.



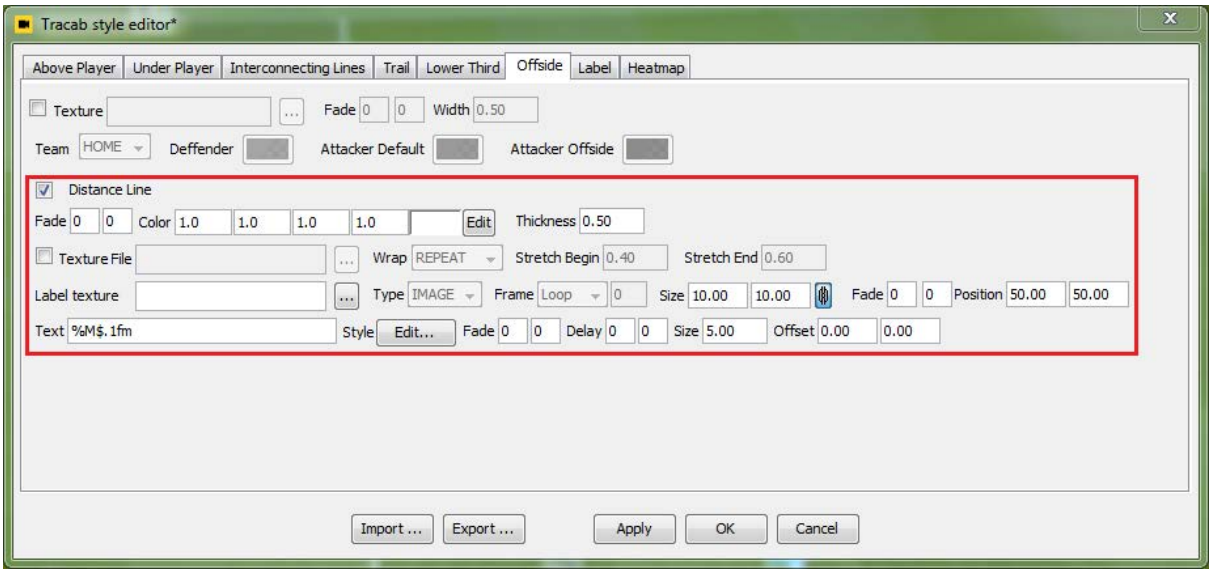
   Specify which part of the graphics should be used as line at position of the offside. The rest of the graphics will be stretched to fill the rest of the pitch.
3. Other settings
   - Fade in/out: fade of the graphic in field units.
   - Width – width of the offside graphics (line + shadowing). The line is drawn in perspective, the width value specifies the number of pixels of the offside graphics at the bottom of the screen.
   - Line over – when set to 0, the offside lines begins and ends at pitch side lines. You can set any value higher (in pitch meters), and the line will overlap side lines.
4. - Shadow direction to goal
   You can mirror offside graphics display. Set it checked, if you want to have the shadowing is drawn in 'offside area'. When unchecked, the shadowing is drawn in 'onside area'.
   - Deceleration duration
   Duration of play rate deceleration before auto-stopping at offside time.

The editor is not modal, sou you can have an Offside product in the product bar, open it's style file and when you save the changes and reselect the Offside product, you'll see immediately the effect.

See RAM Recorder section on how to store an offside clip for later replay.

Offside line also have the ability to show the distance between the player and the goal.

This is done using the Tracab product under the offside tab. (Tracab data integration is required)



Please refer to the Tracab Product setup section.

Offside2

A new implementation of Offside product focuses on the precision of the offside line. The user is required to choose the frame important for the offside situation and place defensive and attacking lines into the preview video.

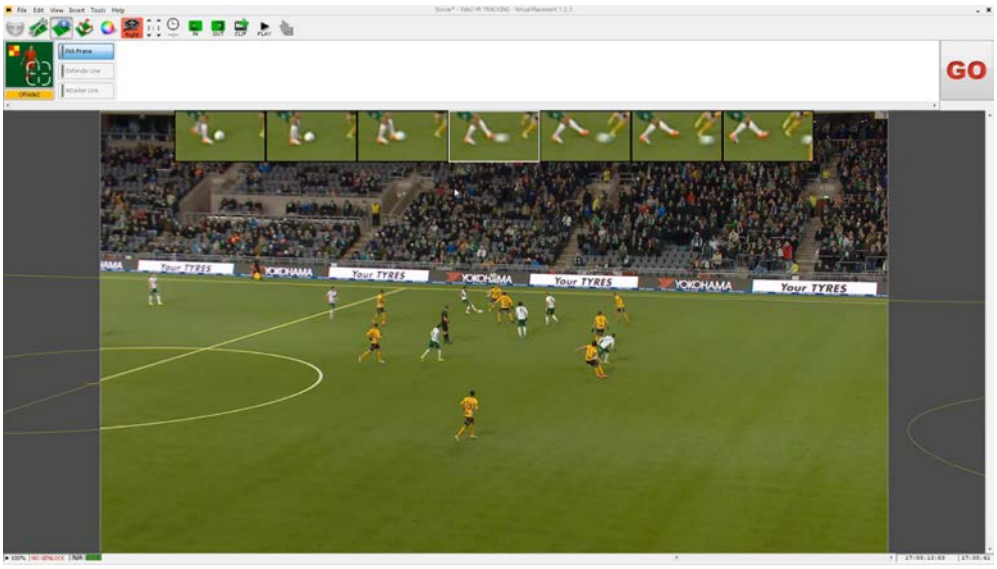
The Offside2 product might be disabled. You can enable it manually in the Config editor → Advanced tab. Find or add the '`Offside2`' product entry in the Products section and change value of 'enabled' attribute to '1'.

```
<Products>
   <Product enabled="1" type="Offside2"/>
</Products>
```

Offside Workflow

The entire workflow of the Offside2 product is split into three steps:

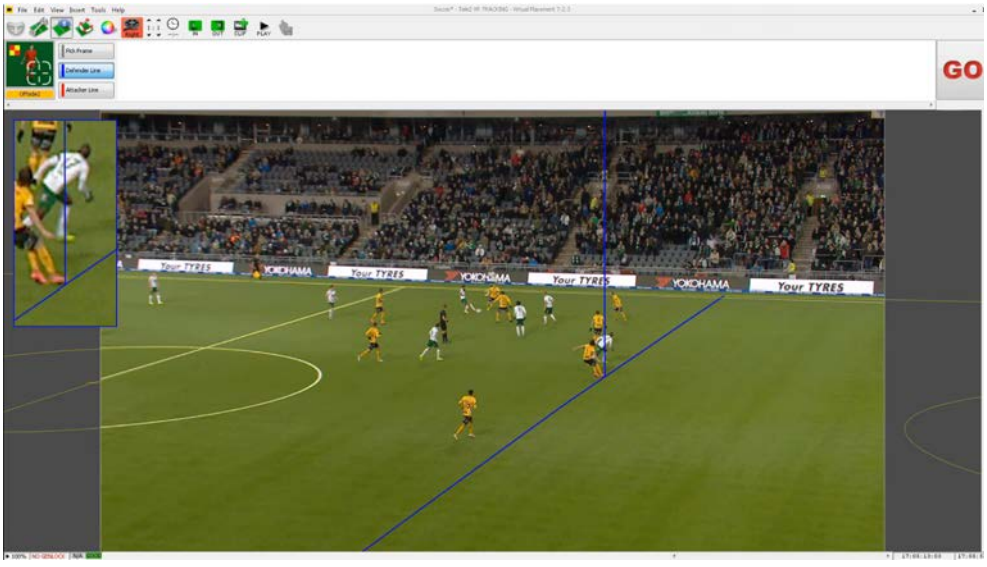
1- Locate the offside situation time



After stopping the video, the Offside2 product gets selected automatically. By clicking mouse into preview where the offside situation happened, the Pick Frame step gets activated. A strip of frames shows up atop of the preview window. The center frame is showing the current time whereas the surrounding frames are taken from the frames before and after offside situation. Clicking on non-center frame seeks to a time represented by the frame.

Clicking the central frame confirms the selection of the offside time and the product advances to the next step:

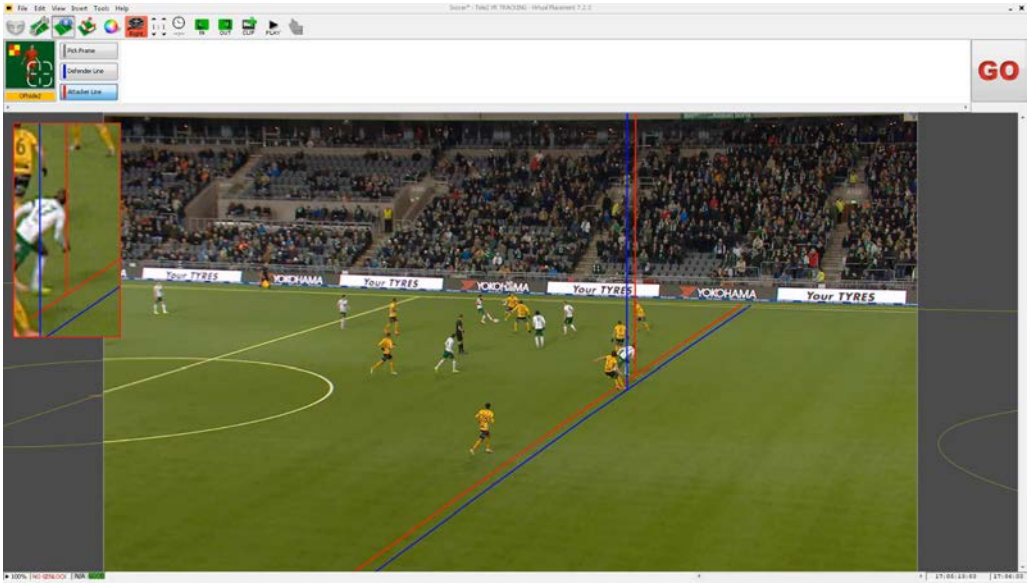
2- Place Defender line



Clicking into the preview windows places a defender line. It is possible to refine defender position by further clicking into the preview or by pressing and dragging the mouse. To provide better aid for exact placement of the line, a zoomed area shows in the preview, displaying the video area around the defender position. Note that the actual offside line is defined by the edge of the graphic line rather than its center.

When defender line is placed with satisfactory precision, clicking to the Attacker Line button in the Product bar advances to the last step:

3- Place Attacker line



Attacker line is placed in the same way as the Defender line.

Offside position defined from multiple angles

To increase the accuracy of the offside line, multiple angles can be used to triangulate a precise 3d point for the offside position.

Steps:

1. Select the appropriate frame of interest for the offside situation as per the above section for the Offside2 product.
2. Click the 3D button in the Product bar which enables ‘3D’ picking. Now click on a point on a player that is the part of the body related to the offside situation (this can be off the ground). For example upper body part. Note that the change here from 2D setup is that no line is visualized yet. Just the crosshair.
3. Change camera angle. Either by remote controller or by shortcut toolbar.
4. Clicks again on the same point on the player.
5. Once clicked the offside line is visualized. The line now does not go through the cross hair anymore as the line is placed on the ground, but the vertical line does.
6. Switch between the cameras shows the crosshair at the position where the user clicked. The position can be changed if required and the offside line is recalculated.
7. Operator can go back to 2D anytime by toggling off the 3D button

The above process should be used for both the attacking and defending lines and each have their own 3D button to activate this mode of selection.

The Virtual Placement Offside Line 2 has been ratified and certified by FIFA as an officially approved technology to be used to adjudicate offside lines in an official officiating capacity:

https://football-technology.fifa.com/en/resource-hub/certified-product-database/football-technologies/offside/certified-systems/

Down and Distance

Down and Distance is a product that displays Scrimmage and Down line in American football game. A feather graphic (a label showing the play number and Yards to go) is optionally shown.

Setup
Start a new instance of Virtual Placement, ensuring that Pitch Tracking with 3 cameras or Scene Tracking with 1 camera is selected in the config, also the Product Down and Distance will need to be active.
Correct Camera Calibration must be loaded (see Camera Tracking for sports).

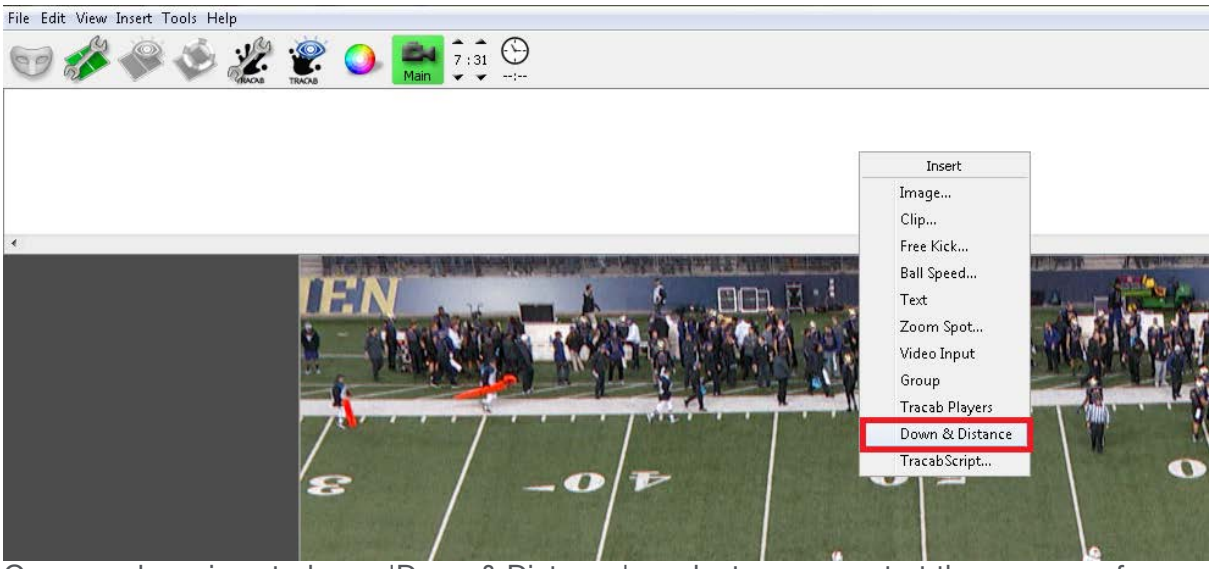
The Down and Distance product might be disabled. You can enable it manually in the Config editor → Advanced tab. Find the '`DownAndDistance`' product entry in the Products section and change value of 'enabled' attribute to '**1**'.

```
<Products>
   <Product enabled="1" type="DownAndDistance"/>
</Products>
```

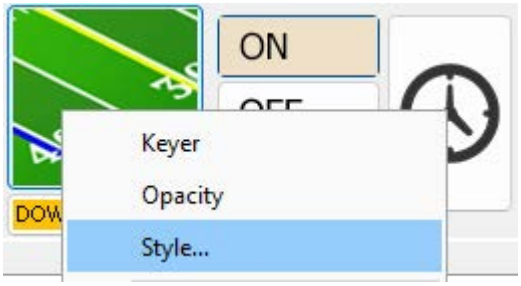
Setting up a new feather
Once Virtual Placement has been started, right click in the white space above the video preview and you will be presented with a list of products that you can insert. Pick 'Down & Distance' to insert a new instance of 'Down & Distance'

Predefined NFL feather textures as well as psd file are available at the Chyron Download Area (nfl_feathers_data.zip).

NB: Your list of products will vary depending on the products that are activated with your licence.



Once you have inserted your 'Down & Distance' product, you can start the process of setting up the style. You will now have the 'Down & Distance' product in the product workspace. To setup the style for this product, right click on the product (Drawing 2: Load Style) and pick 'Style'. From here you can load a style that has already been created or you can define the style manually in the Style editor..



Once you have selected the 'Style' option you will be presented with a pop-up to handle the style file to the selected product. From here you have 5 options:

1. Import – Load Style File to current product
2. Export – Save current settings to style file
3. Create the style manually or customize previously imported style
4. OK – Close dialog and confirm
5. Cancel – Close dialog and remove changes

Import

Importing will load a premade style to the selected product. Pressing import, will load a standard Windows file picker window. The style has a file extension of .fts, the default style is called 'down_and_distance.fts' and it is included in the football_default_data.zip which is available on the download area;

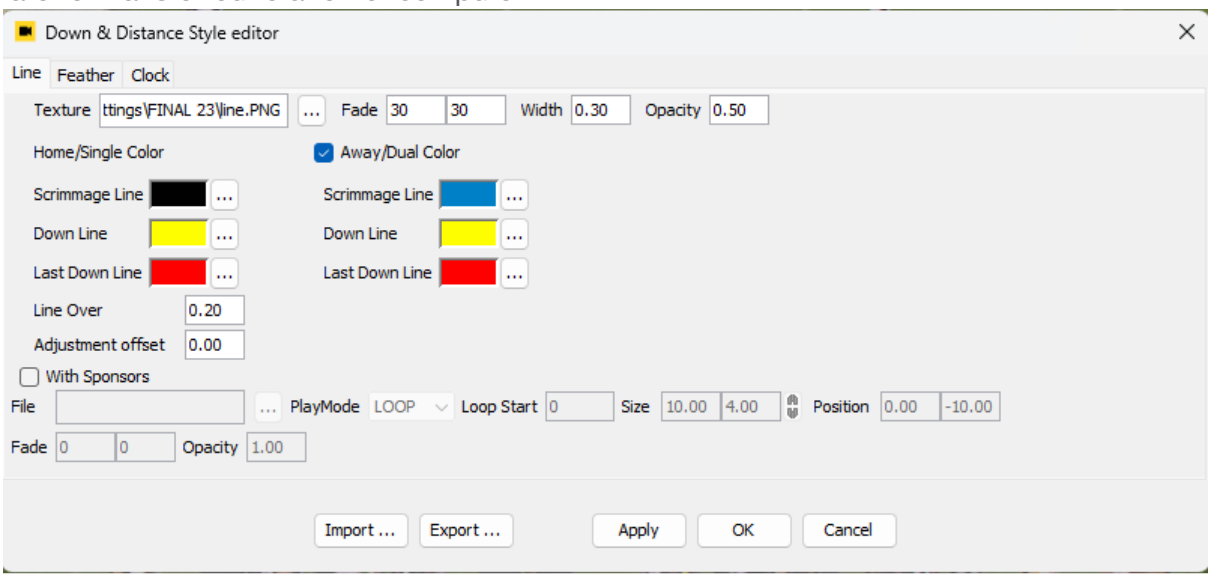
Press open to apply the style to the product. All the different products can have different styles applied to them.

Editing the style

The Style editor is open with default style properties. You can begin with those and adjust them or customize previously imported styles .

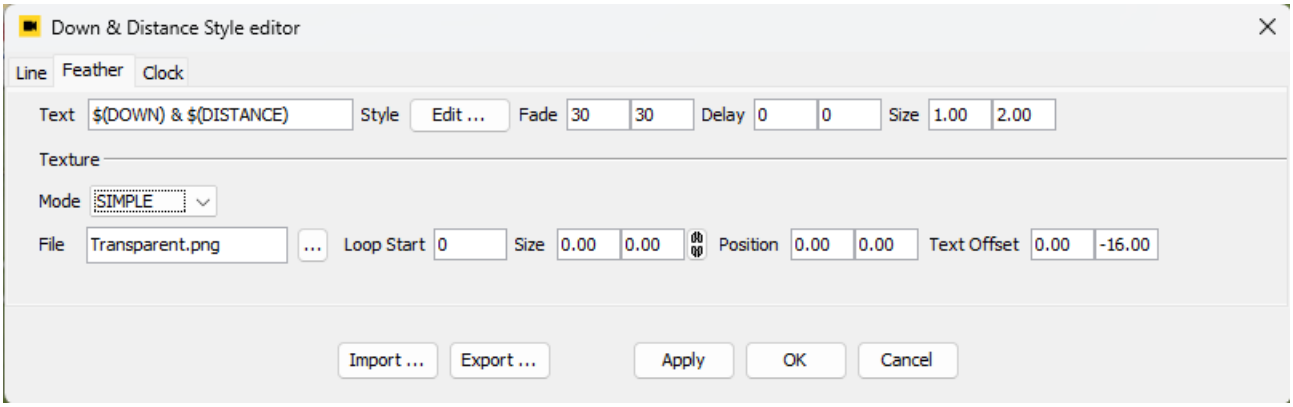
Export

Exporting will save content of the Style editor into a standalone file which can be imported later or transferred to another computer.



Line Properties

Fade In/Out	The duration of the fade when the graphic is sent on air and removed from the output. This is independent for both line and feather.
Texture/File	This is the name of the file, this should be in the folder “C:\Users\<user>\Documents\VirtualPlacementProjects” .png is the suggested format, although other file types that support alpha channels are supported. Default texture is placed in the football_default_data.zip which is available on the download area. The texture is vertically stretched to cover the width of the football field.
Width	The width of the line in meters.
Away/Dual Color	Enables using separate color when away team is selected
Scrimmage/Down line color	These are the RGB values of each of the 3 lines. The line of scrimmage is always the same color, and it's possible to set the down and distance color to be a unique color for the last down (4th down for NFL, NCAA). Option to use Away/Dual color to use team colored lines
Opacity	Opacity of the Down/Scrimmage line.
Adjustment Offset	This value is used when the virtual line covers a 5 yard line on the field. If so, the virtual line is shifted by a given offset (in meters). Negative values mean shifting to right on the right hand side of the field and to the left on the left hand side of the field
Line Over	Zero value means the virtual lines are drawn from right between the side lines. Non-zero value (in meters) means the virtual lines exceed computed field border.



Style Editor – Feather tab, Simple mode

Feather Text properties

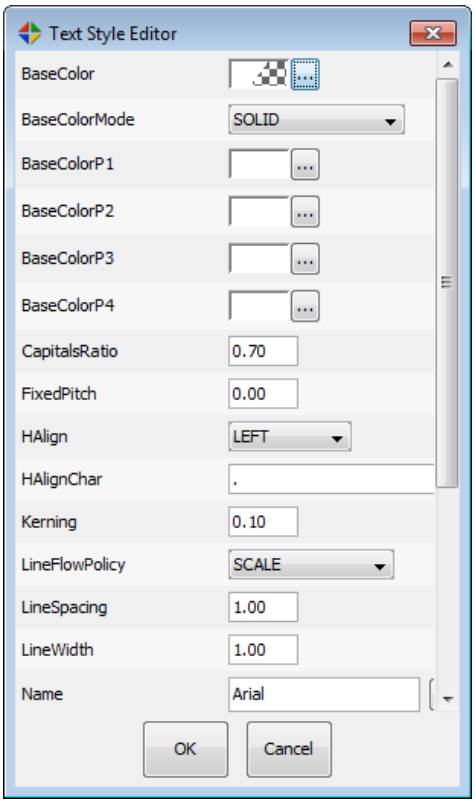
Text	Text on the feather.
Style	Editor to edit text styles.
Fade In/Out	Duration of the fade effect of the text background.
Delay In/Out	The production In/Out is delayed by specified number of video fields. The delay is between user action to start/stop production and time when the production start/stop sequence is launched (e. g. delay from request to start production and time when the graphics starts fading in).
Text Size	Width and height (in meters) of the text on the field.

Text
Default value to the Text field is $(DOWN) & $(DISTANCE). Fields '$(DOWN)' and '$(DISTANCE)' are replaced by their real values. You can skip one of those values if desired or e. g. change '&' to 'and' or replace the value with any text of your choice. You can also use any of the available variables (see Appendix C – Application Variables).

Customize Distance wording
Distance can have special values of 'goal' (down line equals to the Goal line) and 'inches' (Distance is less than 1 yd). Those values can be customized using formatting options of the Variables. Example:

$(DISTANCE;Goal)	Change 'goal' to 'Goal'
$(DISTANCE;Goal;Inches)	Change 'goal' to 'Goal' and 'inches' to 'Inches'

To edit text style simply click the Edit... button next to the Style label. A new dialog with editors for all available text properties appear.
Meaning of each field is described in the tooltip is shown when you hover the mouse cursor on the field for a moment.



Using capitals

If you want the text to be rendered in capitals, set a non-zero value to the Capitals ratio field.
Zero value makes all characters keep its upper/lower case form as defined in the Text field in the Style editor.
Other values cause all character to be rendered in upper case, but when the character was defined as lower case then this character is scaled down by the Capitals Ratio value.

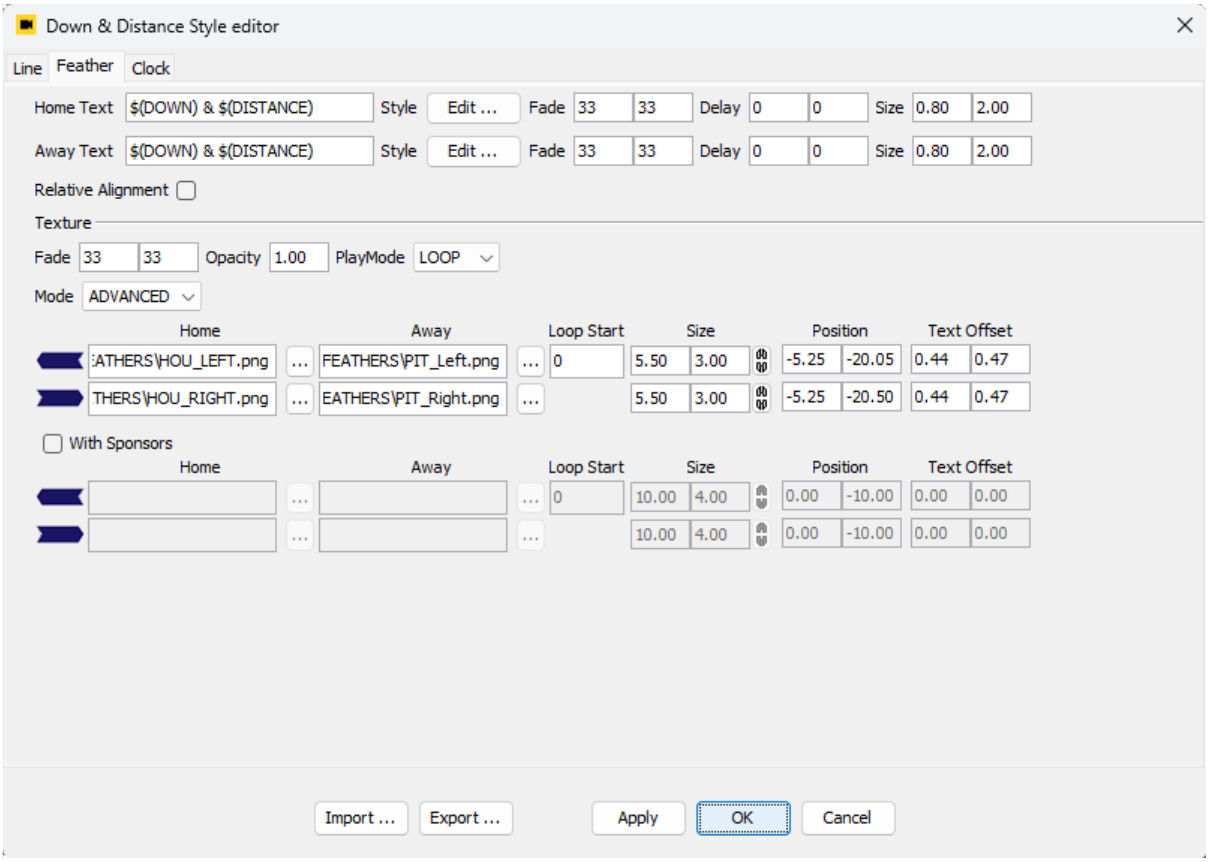
(e.g. set 0.7 to archive following effect: '3RD & 8').

Feather Texture properties

Fade In/Out	Duration of the fade effect of the feather texture.
Opacity	Opacity of the Feather texture line.
Play Mode	Used only when the feather texture is a .gtc clip. It can either loop from specified frame to the end of the clip or pause at specified frame. In Loop mode the clip starts to fade-out on user request to stop production. In Pause mode the clip is unpaused and plays to its end. Loop Start/ Pause Frame value is defined in the field bellow.
Mode	**Simple** – Only one texture for the feather is defined. Texture for opposite attack direction is simply horizontally flipped version of the original texture. Position on the field and text offset remains the same. **Advanced** – This mode allows to have different textures for both Home and Away team and for both attack directions. Correct texture

	is chosen automatically. In Advanced mode you can setup another set of four textures with sponsor logos etc. During production you can one-click switch between these sets of Feather textures.
Texture	Define image or .gtc texture of the feather. In **Simple mode** the texture is pointing from left to right. It is horizontally flipped for the other direction. In **Advanced mode** – first row of Home and Away textures are pointing to the left and in second row the textures are pointing to the right.
Size	Size of the feather on the field in meters.
Pause/Loop start	Used only when the feather texture is a .gtc clip. Meaning of the field is depended on current **Play Mode** setting. • Loop – the field has Loop Start label. The clip loops from here defined frame to the end. You can set fade-out as cut-out effect. • Pause – The clip plays and is paused at Pause frame. On cut-out command the clip is unpaused and plays to its end.
Position	These values adjust how far in space the object should be from the line of scrimmage (in meters). Use negative value in x to move the feather to left and in y to move the feather close to the camera. Positive values have opposite effect.
Text Offset	These values adjust how far in space the object should be from the Feather texture (in meters). Use negative value in x to move the feather to left and in y to move the feather close to the camera. Positive values have opposite effect.

Advanced Mode



Style Editor – Feather tab, Advanced mode

Additional feather text properties

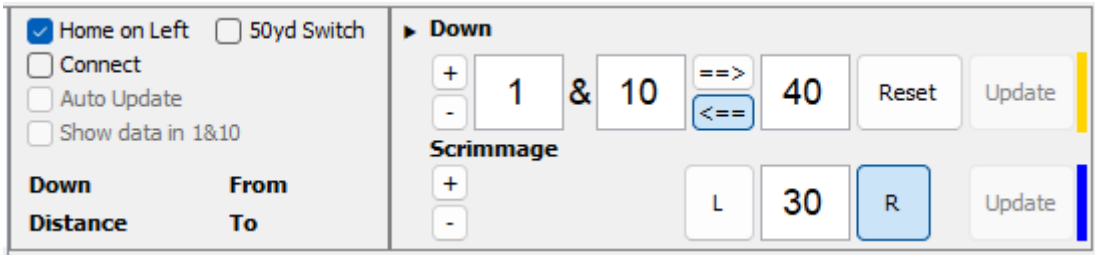
Relative Alignment	Option to have text follow the alignment of the arrow. Arrow facing left text is aligned left, if sides are switched alignment changes to right in order for text to follow the feather direction in all cases.

Sometimes the Simple mode is not suitable (example: different texture for each team is required or the texture contains text/logo, which may become unreadable when the texture is flipped). Advanced mode helps in such situations. You can have different texture for each team and for each attack direction. These textures are rendered without flipping, so logos and texts inside the textures will remain readable.

Sponsor mode allows to have another four version of the Feather texture with sponsor logos. During production you can easily switch Feather with or without sponsor. To enable this mode, simply check the 'With Sponsors' box.

Meaning of all fields in Advanced mode is the same as in Simple mode. Since the textures must not be symmetric, you can set position on the Scrimmage Line and offset of the Text individually for each Texture.

It is necessary to have correctly set side for Home team when using Advanced mode. Use the arrow button in the upper left corner of the Down & Distance editor to set the side. Make sure the item is checked when Home team plays from left to right and unchecked when Home team plays from right to left.



Changing Feather mode

You can change the production straight from the Down&Distance product button. Buttons Feather production modes are visible all the time the product is selected.

ON	Show Feather.
ON + S	Show Feather with sponsors.
OFF	Hide Feather. Only Down and Scrimmage lines are rendered.

Change of all modes can be mapped onto keyboard shortcuts in the config editor. List of available actions:

FeatherOFF	Hide Feather and text. Only lines are visible.
FeatherON	Show Feather.
FeatherONWithSponsors	Show Feather with sponsors.
FeatherOnOffSwitch	Hide Feather if visible or show when invisible.

These shortcuts change Feather mode in all selected products.

Changing feather position

The feather position on the Scrimmage line defined in style might be not suitable in all situations (e.g. the feather collides with players). To solve such situations you can have several feather positions predefined and change the position by a keyboard shortcut. Go to the Config Editor → Keyboard tab. Add action called **FeatherSetPosition**. Value of the action is the distance of the feather from the center of the field in meters (e. g. setting -15 sets the feather 15 meters from the field center closer to the camera).
You can have several actions defined with various positions.

Since Virtual Placement 7.6, it is possible to adjust feather position directly using a mouse or using keyboard shortcuts in user set increments.

Using a sponsor with Down and Distance

There are two ways to use a sponsors logo with the system. The first is to build the sponsors logo into the feather images. Then fill in the texture names into corresponding fields in the Style editor. The feathers with sponsors must not be in the Sponsors field in the

Style editor. You can use them in the Advanced mode without sponsors, but you will lose possibility to show regular feather without sponsors.
The second method is to create a new image product and have the tracking method set to 'pitch'. This will ensure the perspective is correct, but the logo will have to be positioned manually for each usage.

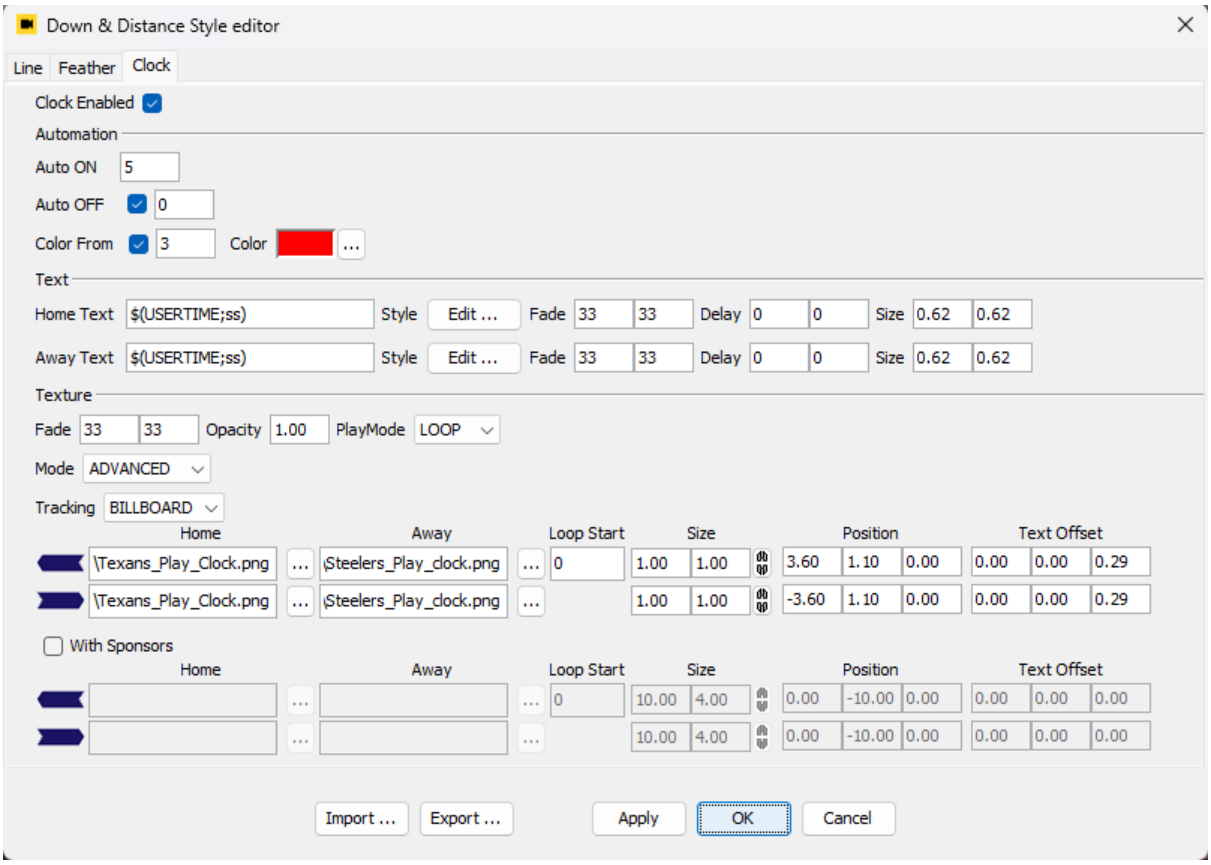
Play Clock

Play clock is valid between 2 plays. It shows time for the attacking team to snap the ball for the start of the next play.
The clock must be supported by currently used Down&Distance protocol (see Remote data source). The clock from the protocol is available as variable named USERTIME (see Appendix C – Application Variables for formatting options). Down&Distance data protocol must be set as time source for the User time (See Installation Guide, chapter Down & Distance online data).

Production of the clock is started automatically when the down-counting clock reaches defined trigger.

Production of the clock is stopped manually by repressing the clock button next to the Down&Distance product button or toggled using keyboard shortcut **SPACE**. The feather and the lines stay on-air.

Clock style



Enabled	Enable the whole clock functionality
Auto ON	Clock trigger. The gfx will be shown when play clock reaches this value.
Auto OFF	Clock trigger. The gfx will be removed when play clock reaches this value.
Color From	Value for when countdown changes text to user set color and if its activated.
Home Text	Home text to display.
Away Text	Away text to display.
Style	Editor to edit text styles for both home and away team.
Size	Size of the gfx element. Size units are dependent on Mode.
Position	Position of the background relative to the feather in XYZ
Text offset	Offset of the clock text from the clock background in XYZ
Mode	Production mode. • **Simple** – 3D clock gfx element used for both teams and both attack directions. The gfx uses pitch tracking and is keyed. The background is horizontally flipped when necessary. • **Advanced** – similar to Advanced mode in Feather tab. Each team and each attack direction uses different background and different positioning, texts. • **Advanced with sponsors** – Same as advanced, used when Feather sponsor mode is on. • On Screen – 2D clock gfx on the screen at fixed position.
Tracking	Billboard or model option for play clock to be standing up or displayed on the ground together with the feather

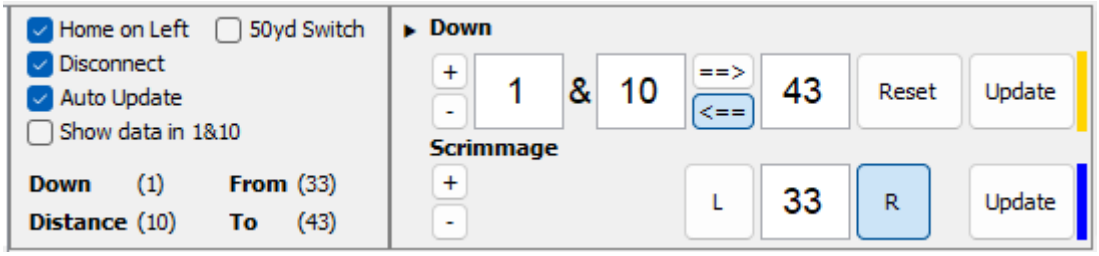
3D gfx elements use pitch tracking and are keyed.

Down and Scrimmage line position controls

The dialog is available in menu Tools → Down and Distance.

It allows to change position of both lines and number of play.

Remote data source



Data for the Down and Distance product (positions of the lines, play number..) might be obtained from an online source. **See Installation Guide for information about supported protocols and their configuration.**

Some fields might not be supported by all protocols. These need to be controlled by the operator (e. g. side of the field of the Scrimmage line).

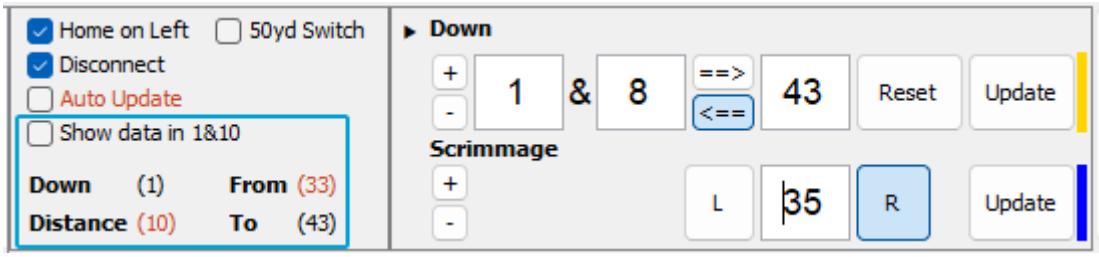
Supported protocols don't carry information about assignment of both teams to left or right hand side of the pitch. The operator must set the pitch side for Home team manually in the menu available from the Settings button.

In case the incoming data are incorrect or not suitable for the moment, you can anytime set the values manually. Once you do any manual change (or deselect the 'Auto' check box), the system stops using the values from the remote data source. Select the 'Auto' check box for transition back to automatic data reading mode.

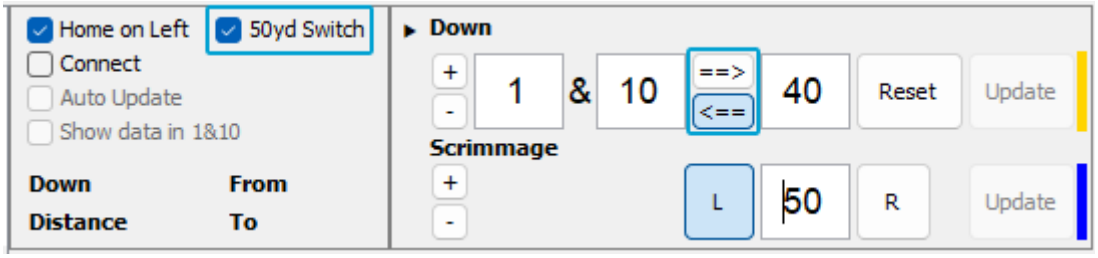
You can see the delivered data values above the edit boxes or inside the expanded menu (Optional).

Value that differs from the one used for graphics rendering are displayed with highlighted color.

There are two Update buttons. The upper one replaces current Down line position by the delivered value, the second one replaces position of the Scrimmage line.



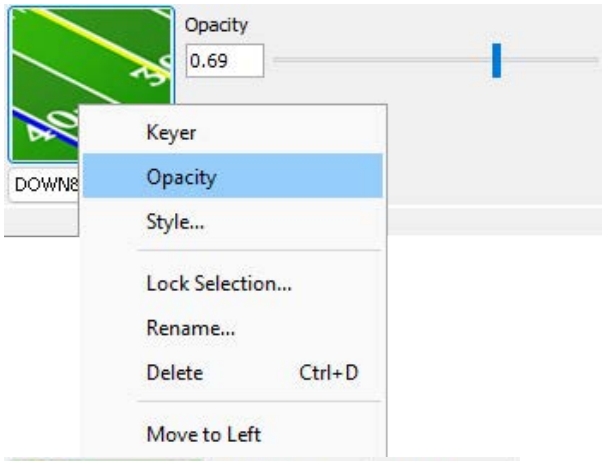
Fine adjustments of line positions
Sometimes you may need to quickly make a fine adjustment of the line position.
Using mousewheel
Just click in the field to adjust and scroll the mouse wheel while holding the Shift key down. With shift key down, the scroll step is 0.1 yd.
Using keyboard commands
Add 0.1 yds to the scrimmage line using **HOME** and -0.1 yds using **END** on keyboard
Add 1.0 yds to the scrimmage line using **PAGE_UP** and -1.0 yds using **PAGE_DOWN**
50 yd Switch
If data for down and distance is not available, users can activate the 50 yd switch for seamless crossing of the 50 yd line.



This allows users to cross the 50 yd line without having to switch between L and R by just scrolling the mousewheel up to go forward and mousewheel down to go backwards on the field, direction of play is controlled by the arrows.

Scrimmage line will never cross the down line and the tool will push the down line 10 yards forward automatically whenever scrimmage line hits the down line.

Adjust opacity of all graphics
From the popup menu for a Down & Distance product pick Opacity item. Opacity editor appears next to the Product button. Change the value to change the opacity of all graphics that belong to the Product.
Drag the slider to make the Feather and Lines more or less transparent.
This change has a multiplicative effect on opacity values of all single graphics elements previously set in the Style editor.



Different chroma keyer for Line and Feather
From the popup menu for a Down & Distance product pick Keyer item. The editor that appears contains the following items:

Line Key	Chroma Keyer instance for Scrimmage and Down line.
Feather Key	Chroma Keyer instance for Feather and text..
Chroma Filter	Edge aliasing filter (see Keyer and Fade).

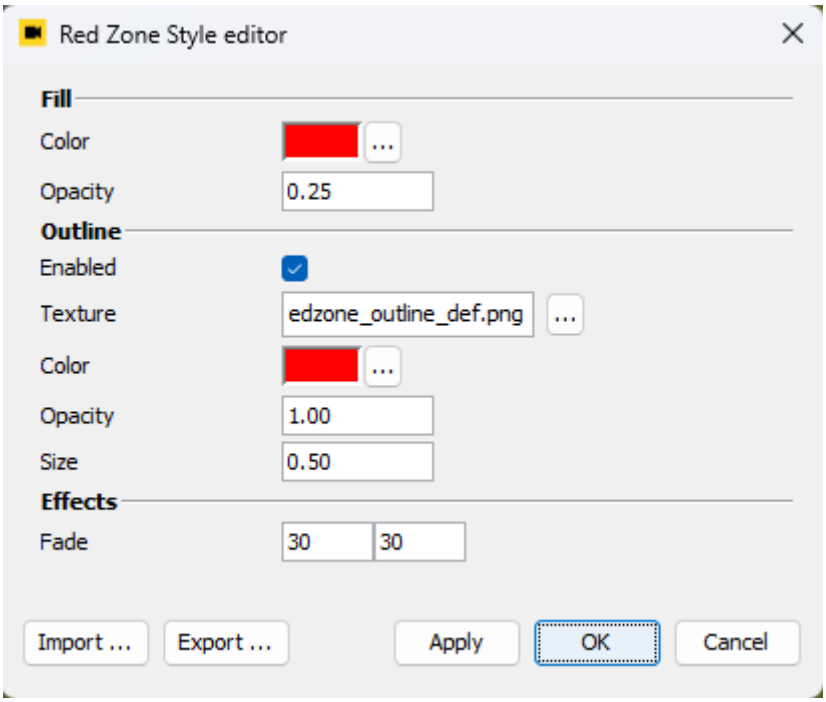
Red Zone

Product to highlight the red zone area in American football

Red Zone workflow

1. Set where the ball is placed on the field (max 20 yd line)
2. Activate RedZone tool, zone will by default appear on both ends of the field
3. Set it to only be shown on Left or Right side if needed
4. Deactivated RedZone when you want it to disappear

RedZone Style Editor



Meaning of the Style editor fields:

Color	Set color of RedZone fill.
Opacity	Opacity of the RedZone fill texture.
Enabled	Enabling outline of RedZone tool.
Color	Set color of RedZone outline.
Opacity	Opacity of the RedZone outline texture.
Size	Size of the RedZone outline texture.
Fade In/Out	The duration of the fade when the graphic is sent on air and removed from the output.
Import	Import saved settings for tool
Export	Export settings for tool

Field Goal Target

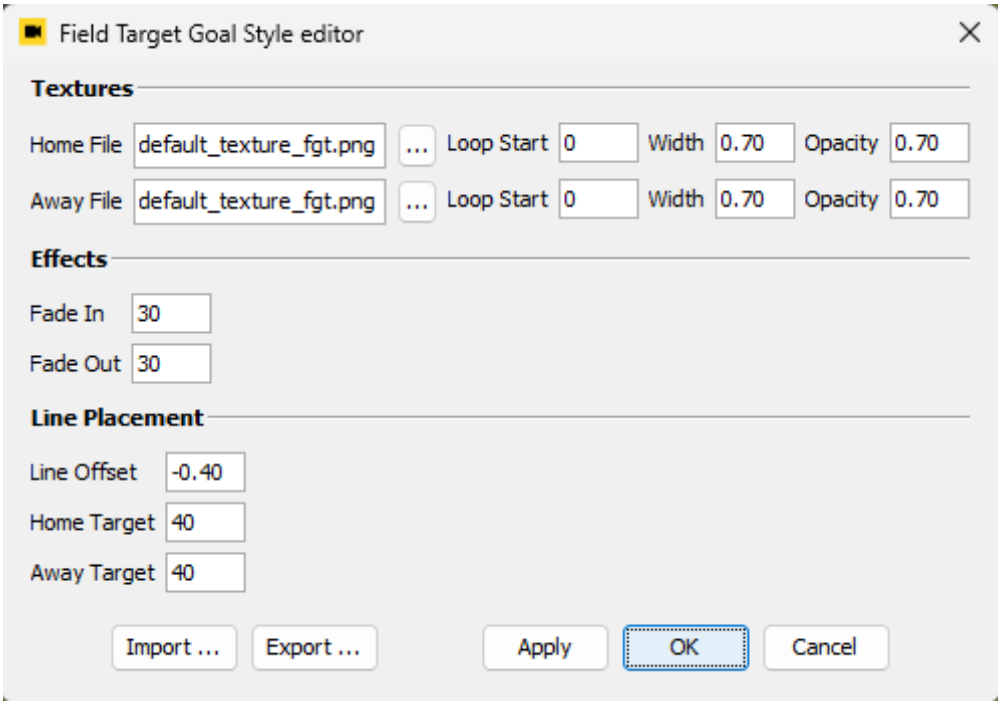
Product to highlight home and away teams field goal targets in American football

Field Goal target workflow

1. Select which sides field goal target you want to display by pressing **Home** or **Away**

2. Set attacking direction of team selected by pressing **Left** or **Right**
3. Activate Field Goal Target tool to put on-air
4. Deactivated Field Goal Target tool when you want it to disappear

Style Editor



Meaning of the Style editor fields:

Home/Away File	Set different textures for home/away team target lines, if generic texture is used set same in both
Loop Start	Set start point for looping. Frames before Loop Start are played once, the rest of the clip loops for defined number of periods set in the Loop property.
Width	Width of field goal target texture (in meters).
Opacity	Opacity of field goal target texture.
Fade In/Out	The duration of the fade when the graphic is sent on air and removed from the output.
Line Offset	This value is used when the virtual line covers a 5 yard line on the field. If so, the virtual line is shifted by a given offset (in meters). Negative values mean shifting to right on the right hand side of the field and to the left on the left hand side of the field
Home/Away Target	Each team's respective target line for field goals
Import	Import saved settings for tool
Export	Export settings for tool to saved file

Ball speed

This type of product is designed for measurement of ball speed during free kicks etc.
The product requires pitch tracking and camera recorder enabled. Tracking and keying are not supported.

Meaning of the controls shown next to the Product button:

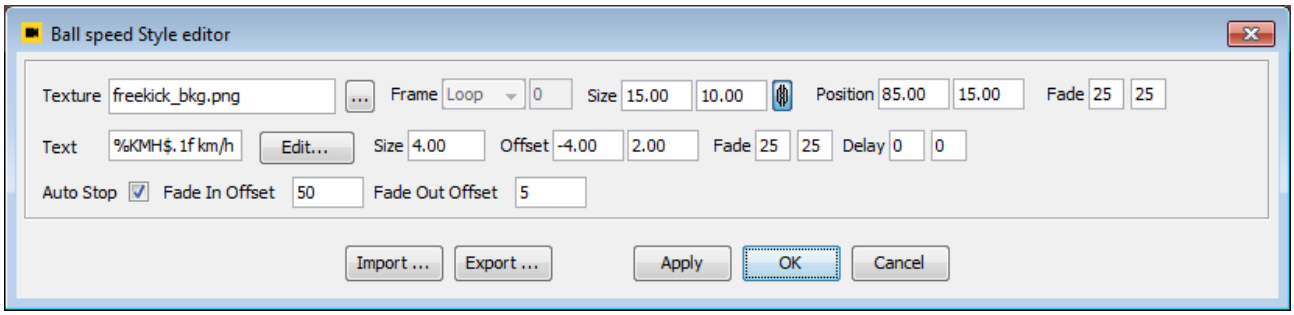
	Start point not defined. Click the ball at time of the kick.
	Start point defined. You can still redefine position of the ball. Press RESET to define the Start at other time.
	End point not defined. Click the ball at the end of the kick.
	End point defined at current time. You can still redefine position of the ball. Press RESET to start again.
	Both Start and End points are defined but none of them is equal to current time.
RESET	Reset Start and End points.

Ball speed workflow

1. Add Ball speed product to the project and setup its style. Only one Ball speed product can be selected at a time. Ball speed products can be selected only when a Recorder camera is actually selected.
2. Stop the live feed using the STOP button on the Jog/Shuttle (or use Camera button in the toolbar)
3. The camera is automatically switched to recorder so you can see end of the recorded footage. At this point you can still switch between recorded cameras.
4. Select the Ball speed product.
5. Define Start point: jog back to the time where the player kicks the ball and click the ball in the preview.
6. Define End point: jog to time where it is desired to stop the measurement (e. g. the ball leaves the field). Click the ball position on the ground. In case the ball is in the air, click approximately the point below the ball on the field.
7. Now cue back in the recorder footage where the video playback should start.
8. Press GO/ON-AIR button to start production.
9. Press Play button to start playback.
10. The graphics production starts certain number of video frames/fields prior to End point (see Fade In Delay in the Style editor).
11. The video might at End point (see Auto Stop in the Style editor). Press Play button to continue playback.

12. The graphics production ends certain number of video frames/fields after the End point (see Fade Out Delay in the style editor) or manually by unpressing the GO button.

Style editor



Meaning of the Style editor fields:

Texture	Background image/gtc clip below the speed text
Texture/Text Size	Size of the background [as a percentage of the screen]
Texture position	Background position [as a percentage of the screen]
Fade	Fade in/out [in frames/fields]
Text Offset	Offset from the background [as a percentage of the screen]
Text Delay In	The text production is delayed by specified number of video frames/fields
Text Delay Out	The text production cut-off is delayed by specified number of video frames/fields
Text	Text formatting string
Text style	Open Text style editor by the 'Edit...' button to modify the style (color, alignment...)
Auto Stop	When checked, the video playback will stop at End point of the kick. Press Play button to continue video playback.
Fade In Offset	Production start is computed from End point of the kick. Fade In Offset defines how many video frames/fields the production will start prior to End point (e. g. value 50 will start the production 1 second before the End point in 50 fps video format).
Fade Out Offset	Production end is computed from End point of the kick. Fade Out Offset defines how many video frames/fields the production will end after the End point (e. g. value 50 will end the production 1 second after the End point in 50 fps video format).

Text Formatting

Some graphics can contain a text field. There are values provided by the application that can be used in formatted string. See table of all supported variable names on page.

The format string is compatible with ANSI C printf() function. Example:

- `%MPH$.1f` – picks value “Speed in miles/hour” and uses one decimal point e. g. `'53.2'`

- `'Speed: %KMH$.0f km/h'` will be transformed to e. g. `'Speed: 53 km/h'`

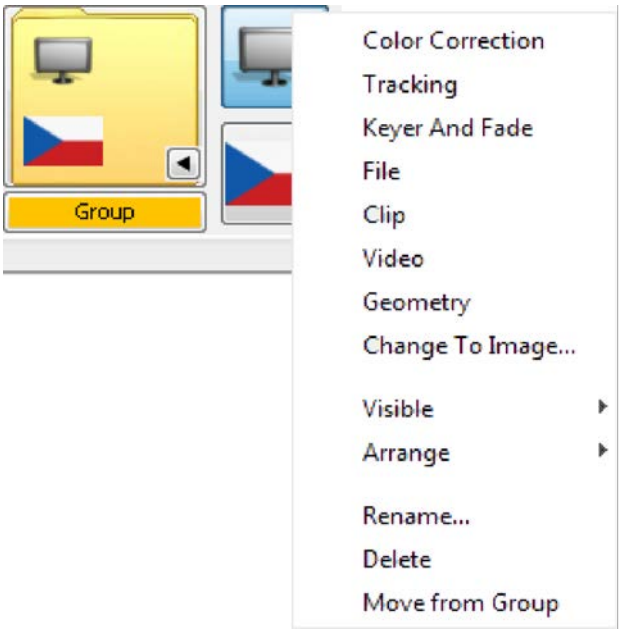
  Supported value names

KMH	Speed in km/h
MPH	Speed in miles/h
MS	Speed in m/s

Events
An event is being sent every time the ball speed changes:

```
<Event app="VP" source="BallSpeed">
  <BallSpeed value="12.18691"/>
</Event>
```

Group



Group is a generic product which contains multiple child products, and allow you to control multiple products by a single click. Group can contain only Images, Clips, Video Inputs and Text products.

Create a group using menu Insert → Group. A button with folder icon (1) appears in the product bar. At this time the group is still empty. You can add product into a group in two ways.

1. Move an existing product to a group. This can be done via Move to Group popup menu on group-compatible products (Image, Clip, Text, Video Input).
2. Use the popup menu on Group button, submenu Insert.

Remove or move-out one of child products can be done from the popup menu of the group button.
Group button contains small buttons (2) for each contained product. The button can be used to adjust product specific parameters, like e. g. Color Correction. It can be done in very similar way as described above in the Products section.

Adjust Position and Size

Hit the group button. All products appear on the screen. Adjust all products in the way described a few paragraphs above.

Adjust Child Order
If children products overlap, you can change the order of display from the child popup menu (3), using the item Arrange.

Make a Child Invisible
When a child is invisible then it is neither visible in the preview or on the output.
Group can be used for more complicated production scenarios. You might find useful to hide all but one selected child. This function is in View menu in the application menu bar,

item “Show Only Selected Child”. This hides the children from preview only. When you put the group to on-air then all children appears again (this functionality is turned off).

Show/Hide Child buttons
Each time the group is selected, the panel with child buttons appears. There is a switch to enable/disable automatic displaying of the child buttons. The switch is controlled by the small button with arrow icon in the lower right corner.

Sponsors

Products Offside and Free Kick allow to show additional graphics - sponsors. As a sponsor you can assign basic products like Image, Clip, Text or Video. Each sponsor can have it's own individual tracking.
There are two main stages for operating sponsor:

1. Editing stage
2. Production stage

Do not combine editing and production at the same time! Sponsor must not appear on-air. We recommend you not to operate in the sponsor editors during production.

Sponsor Editing
Editing stage serves for initial positioning of sponsors. Select one of the sponsors in the Sponsor editor.
FreeKick – you can see the sponsor immediately .
Offside – you will be guided to place the offside line first. System automatically chooses playback of one offside cameras. Now you can see the selected sponsor.

Sponsor Production
Production stage serves to put sponsors on-air. This stage is the same as regular production without sponsors.

FreeKick
Production start : Sponsors are shown immediately after you press the GO button.
Production end: Sponsor production is finished together with FreeKick. To finish production press the GO button again.

Offside
Sponsors are bounded the time you place the offside line.

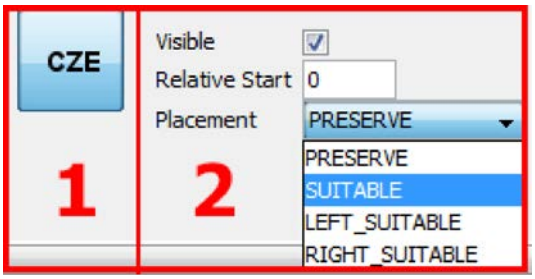
Usual offside workflow: Press STOP on remote control device. Go back in footage (preroll) and then press PLAY on remote control device.
Production start: Sponsors appear automatically in defined time before offside line appears.
Production end: Finish the production by one of these methods:

- setting of finite duration to the sponsor products (see Duration editor chapter)
- deselect Offside product (ESC key)
- switch camera.

Otherwise the sponsor production runs until you perform one of these actions.

Insert Sponsor
Sponsor actions are accessible via Sponsor menu items in the Offside/Free Kick popup menu. To add a sponsor, choose Insert Sponsor action. Select type of product you want to add.

Sponsor Editor
The Sponsor Editor is similar to Group children editor. From the popup menu of each sponsor you can access property editors, that are accessible in normal Image/Clip/Text/Video products (Color Correction, Tracking etc.).
Moreover, after Sponsor selection (1), Sponsor Property editor gets accessible (2). The editor offers few choices related to sponsor production only.



Visible – Says if the product should take place in the production. The item is useful, when you want to prepare for production of several sponsors, each at a different time. You can adjust all properties, and during the match just toggle the Visible flag to change actual sponsor, without need to adjust it's parameters during the match.
Relative Start – for Offside only (not accessible for Free Kick). For timing of production relative to time (in field units), when the offside line gets visible. To display sponsor 50 fields before the offside line starts to fade in, set "-50" to the edit box.
Placement – Offers automatic choice of area, where the sponsor will be displayed.

PRESERVE	No automatic placement. The sponsor appears where you place it.
	In case of Offside and tracking Pitch, Billboard, Billboard Facing: Sponsor holds relative distance to offside line. Position is horizontally flipped based on pitch side where is sponsor placed. Example: Sponsor is kept between offside line and the goal all the time, pitch-side independent.
SUITABLE	Tracking None Automatic left/right hand side displacement. The system decides where to place sponsor to avoid collision with Offside/FreeKick graphics. It uses Horizontal flipping method (applied to position of the sponsor only, the logo is naturally not flipped) to avoid collision. Example: You set sponsor to upper right corner of the video and choose

	SUITABLE placement type. If the Offside/FreeKick graphics is on the right hand side of the video, the sponsor is displayed in the upper left corner and vice versa.
LEFT_SUITABLE	Tracking None Similar rules as in SUITABLE are used. The system doesn't choose side, but whether to display the sponsor or not. If there's possibility of collision, the sponsor stays hidden. If collision is not detected, sponsor is displayed at left hand side (where you place it). Example: You may want to display sponsor either in upper left or lower right corner, collision-safe. Add two same sponsors, place them to desired places, distinguish them by the Placement property.
	In case of Offside and tracking Pitch, Billboard, Billboard Facing: Shows sponsor either on desired side or not at all.
RIGHT_SUITABLE	Opposite to LEFT_SUITABLE.
ROTATE_180	Only for Offside and tracking Pitch Very similar to SUITABLE. Moreover, the sponsor is rotated 180° counterclockwise when is automatically placed on the opposite side. The goal is to keep specific sponsor human readable. Example: You may have a sponsor with human-readable content. This choice will help to keep it readable.
FOLLOW	Only for FreeKick Enables following the ball position. You can change relative sponsor offset to the ball position by moving the sponsor. Change tracking causes sponsor re-arranging to the ball position to help user to set nice initial position.

Allowed combination of placement and tracking

OFFSIDE

Placement Tracking	PRESERVE	SUITABLE	LEFT SUITABLE	RIGHT SUITABLE	ROTATE 180
NONE	yes	yes	yes	yes	no
PITCH	yes	no	yes	yes	yes
BILLBOARD	yes	no	yes	yes	no
BILLBOARD FACING	yes	no	yes	yes	no

FREEKICK

Placement Tracking	PRESERVE	SUITABLE	LEFT SUITABLE	RIGHT SUITABLE	FOLLOW
NONE	yes	yes	yes	yes	yes
PITCH	yes	no	no	no	yes
BILLBOARD	yes	no	no	no	yes
BILLBOARD FACING	yes	no	no	no	yes

Script

Script product allows to delegate functionality of a product to custom JavaScript code. For example external Prime Engine can be used to render the product.

Creating Script product

- Choose new "Script..." product and select your .js file.
- New JavaScript product appears in product bar.
- At this moment the script is not loaded. Script is loaded/reloaded when product is selected/reselected.

Predefined objects and their method summary

Script	
`print(Object object)`	Print value of the object to standard output.
`printErr(Object object)`	Print value of the object to error output.
`connect(Dispatch source, Dispatch sink)`	Register callback. Sink object will events from source connection point.
`getGlobal(String name)`	Return global object with given name or null.
`setGlobal(String name, Object object)`	Set global object under given name. It is possible to delete global objects by choosing Tools → Delete global script objects.
`getService(String name)`	Return service object or null if service does not exist.
`dialog`	Dialogs provider, see **Dialogs** bellow

Product		
`setOnAir()`		Start production.
`setOffAir()`		End production.
`setOnAirUnpaused()`		Unpause paused product.
`setThumbnail(String absolutePath)`		Set thumbnail of the product button. Optional, product button has default thumbnail.
`getName()`		Returns name of product.
`control`		Handler for incoming events. Implementation is required to be set, see example below.
	`load()`	Called after product is selected.
	`unload()`	Called before product is deselected
	`play()`	Called to start production.
	`stop()`	Called to stop production with fade out effect.
	`stopImmediately()`	Called to stop production without fade out effect.

	`unpause()`	Called to unpause paused product.

Dialogs	
`message(String title, String text)`	Show message dialog.
`input(String title String text)`	Show input dialog. Returns entered string value.
`alert(String title, String text)`	Show alert dialog.

Product.control implementation is required and must be set. See this stub:

```
Product.control = new function() {
    this.load = function() {}
    this.unload = function() {}
    this.play = function() {}
    this.unpause = function() {}
    this.stop = function() {}
    this.stopImmediately = function() {}
}
```

ActionBox service

Creates action buttons next to product button firing events to script.

`add(String actionId)`	Add new action. Title is the same as actionId.
`add(String actionId, String title`	Add new action. If action with given actionId already exists, its title is changed to new one.
`remove(String actionId)`	Remove action.
`removeAll()`	Remove all actions.
`onAction`	Handler for receiving action events. Assign a function of object. The function receives actionId as a parameter.

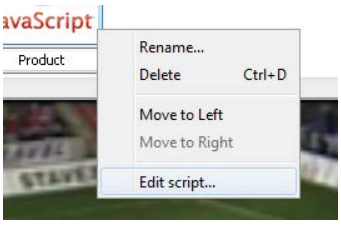
Example code:

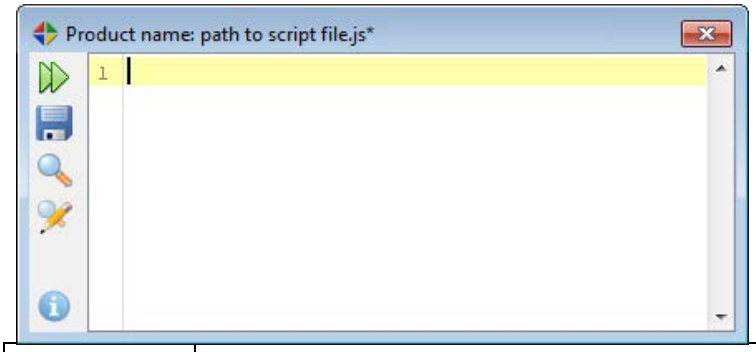
```
var actionBox = Script.getService("ActionBox")
actionBox.onAction = function(actionId) {
    // handle action
}
actionBox.add("a1", "Action1")
actionBox.add("a2", "Action2")
```

Result:

Script editor

Virtual placement contains built-in editor for script files.
Editor can be opened by clicking on “Edit script...” item in popup menu of the product.

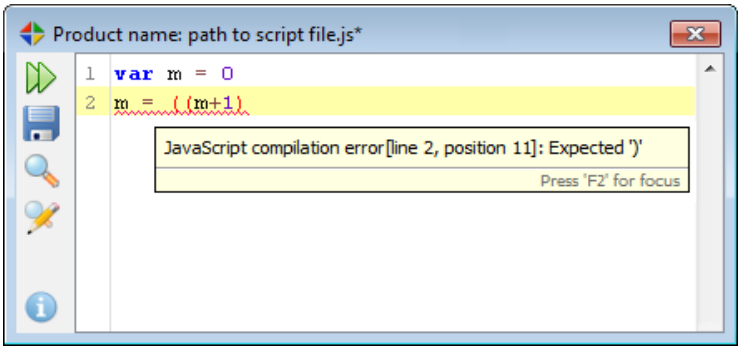




	Save to file and apply it. It re-selects the product if already selected.
	Save to file.
	Show find dialog.
	Show find and replace dialog.

	Show shortcuts dialog.

Script editor performs syntax validation. Syntax errors are displayed in tooltip when you place mouse over the red underlined text.



Prime Engine integration
There is a build-in support for GS2 Tk5. You can configure several title manager instances in config editor. All these instances are then injected into script as global variables.

Config XML fragment:

```
<Tk5>
  <TitleManager name="GS" address="localhost"/>
</Tk5>
```

The name attribute is the name of variable in the script where the title manager will be available.
When the address is not specified then Tk5's default is used. It is possible to have more than one connection to Prime Engine

Script can use standard COM event/sink mechanism to get events generated by Tk5. Use function `Script.connect()` to connect your event sink (implementation which receives the events) to event source (object which can generates the events). Example how to register onMessage event sink:

```
function MyCallbacks() {
    this.onMessage = function(msg) {
        // handle message
    }
}
Script.connect(GS.getClient(), new MyCallbacks())
```

Tracab Script

This type of product is based on Script product and provides extra access to Tracab service. This service is accessible via `Script.getService("Tracab")` call.

Tracab service

`getTeam()`	Return selected team.
`getSelectedPlayersCount()`	Return selected players count.
`getSelectedPlayerTeamId(int index)`	Return team ID of player at given index.
`getSelectedPlayerJerseyNumber(int index)`	Return jersey number of player at given index.
`getData(int teamId, int jerseyNumber, String attributeName)`	Return attribute value of player specified by given team Id and jersey number. If player is not valid or value does not exist null is returned. For attribute name syntax see Variables section in Tracab Player Tracking chapter. For example `TRACAB:myVariable`.
`onChange`	Handler for receiving selected players change event. Implementation example bellow.

Example

```
var tracab = Script.getService("Tracab")
tracab.onChange = function() {
    // handle event
}
```

Trajectory

Creates keyframe-animated trajectory, following e.g. ball.

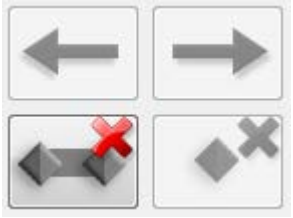
To create a trajectory product, a Trajectory Style file (.trs) has to be provided. Default .trs file is available on Download Area, packed into the default_data.zip archive.

To start keyframing a trajectory, enter recorded camera or clip. After selecting the product, locate the tracked object in video and click on it. A manipulator shows up. By jogging

forward and moving the manipulator, a trajectory animation is being keyframed. It is possible to jog back and refine the animation when needed.

Trajectory product button provides additional buttons for moving to previous/next closest keyframe, for removing all keyframes or for removing keyframe at current time.

The Trajectory product might be disabled. You can enable it manually in the Config editor → Advanced tab. Find the 'Trajectory' product entry in the Products section and change value of 'enabled' attribute to '1'.



```
<Products>

   <Product enabled="1" type="Trajectory"/>

</Products>
```

PRODUCTION

Select desired product (or multiple products with ctrl key down). Press the GO button. All selected products appear on-air (start to fade-in if defined).

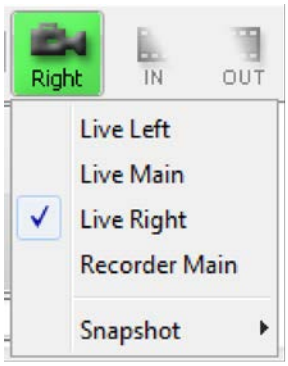
Production is stopped

- Automatically – when the product has finite duration – either clip without infinite loops or pause points, or other products with user predefined duration.
- Manually – press the GO button once again.
    - Products with out-animation start to animate out.
    - Products with fade-out start to fade-out.
    - When there is a paused clip in the production at its last pause point, it is unpaused and animation-out and fade-out of other products are scheduled so they finish production at the very same moment as the clip.

MULTIPLE CAMERAS

Virtual Placement allows usage of more camera inputs/outputs. Multiple cameras can be disabled in configuration file. Make sure, the camera I/O settings are properly configured. Configuration is described in the Installation Guide document.

You can switch between cameras using the camera selection menu in the application toolbar. Also you can assign Jog/Shuttle controller buttons to perform camera switch (more about action assignment in Function Assignment Customization section.)



Single channel rendering

Graphics is rendered to one camera only. Graphics with tracking set to Screen are rendered to actually selected camera stream. Graphics with other type of tracking are rendered to the camera stream which had been selected in time the Product was selected.

Multichannel rendering

Graphics are rendered to all camera streams. Supported tracking types are Scene, Pitch, Billboard and Billboard Facing. Products using other type of tracking are rendered in one camera only.
Objects on the pitch are rendered in correct perspective in each camera stream.

This enables the user to apply graphics to each camera in order to then switch between views and still maintain the graphics on each camera output.

Multichannel rendering is disabled by default. You can enable rendering to multiple parallel streams in the Config editor (use corresponding configuration preset)

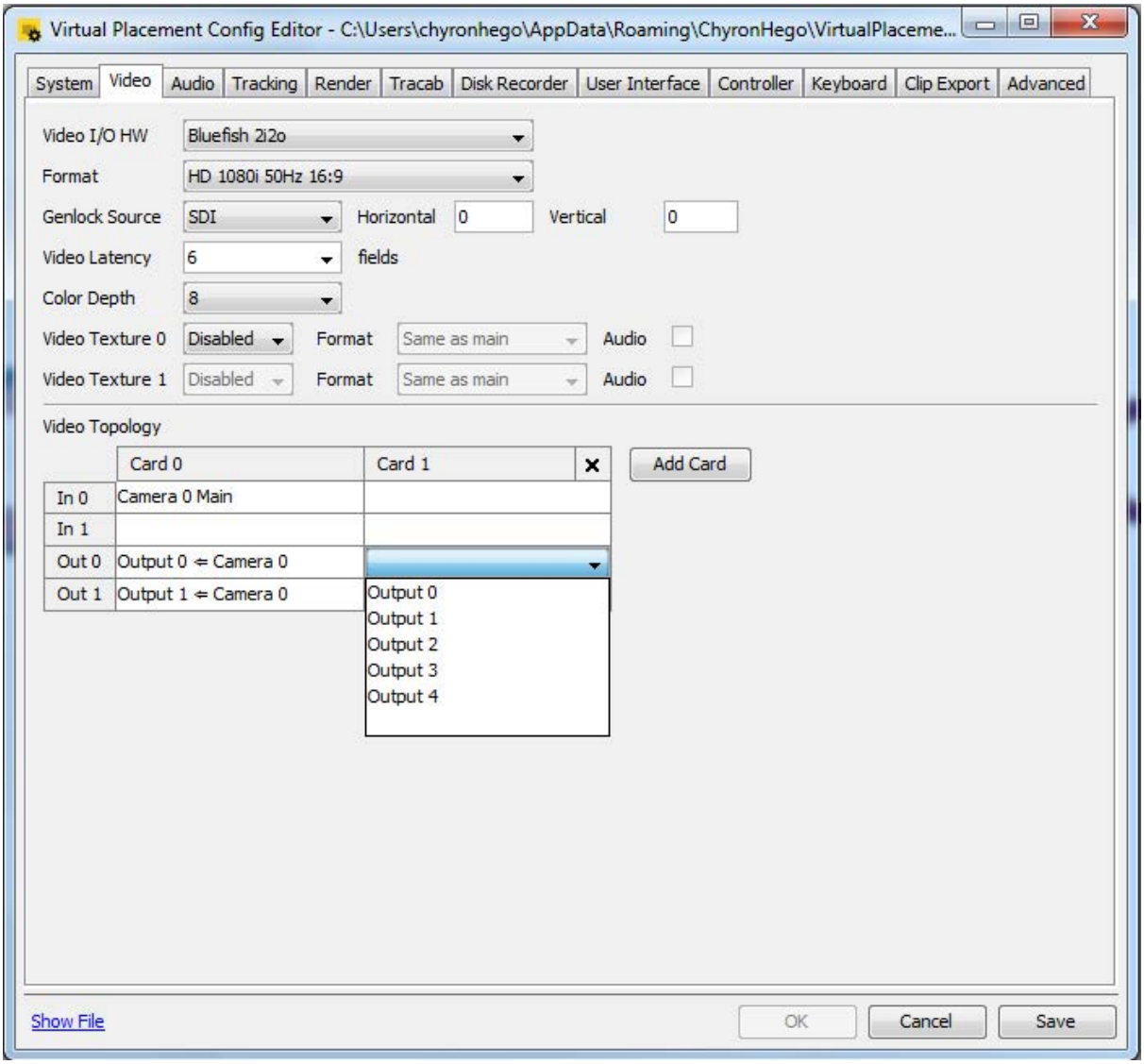
MULTIPLE CAMERA OUTPUT

Virtual Placement has the ability to take a single video source in and then output multiple feeds with different graphics on each output. This workflow enables virtual graphics to be targeted to a specific region or platform.

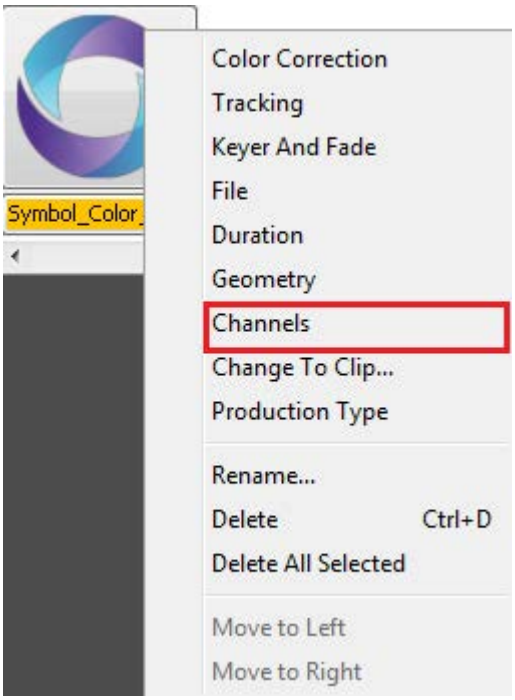
To enable multiple outputs within Virtual placement, launch the configuration editor and select the video tab.

Configuration for multiple outputs is supported on either one or multiple I/O cards.

A drop down menu is available by clicking the on the Field under the card that you want to assign the output too.



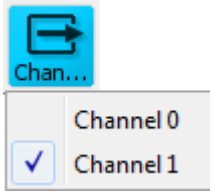
Within Virtual placement select a product that you want to assign to an output channel.



The user is then able to assign the available output channels to each product. Virtual placement has the ability to assign multiple products to one channel.

The available channels will be listed beside each product.

Once assigned the user is able to switch output channels within the Virtual Placement preview window in order to see which graphic is being displayed. On each of the individual channels.



Multichannel rendering
Graphics are rendered to all camera streams. Supported tracking types are Scene, Pitch, Billboard and Billboard Facing. Products using other types of tracking are rendered in one camera only.
Objects on the pitch are rendered in the correct perspective in each camera stream.

CAMERA TRACKING FOR SPORTS

Generally, tracking means that when you place a product to a certain place (e. g. center ellipse of the pitch), it will stay there, no matter where the camera looks. It can also be out of view range. On the other hand, a non-tracked production will stay on it's place relative to the screen (e. g. always in left upper corner of the screen). When you have tracker product for virtual production, it will automatically correct perspective without need to set the perspective „by-sight“. Just set position.

You may ask, how the tracker knows where the pitch is and which direction the camera moves. That's why we have to calibrate the camera first and determine the relationship between the pitch and the camera. Once the camera is calibrated, the tracker continually recognizes actual camera parameters. As we know the position of the pitch in every moment, you can set up and run production by a few mouse clicks. Everything necessary has been already prepared for you in the background.

Once the calibration is done (follow the Camera Calibration section), you can save it to a file. It is not recommended to use older calibrations (from a previous game) for the next match at the same stadium as the probability that all the cameras are at the very same position is very low. In case the cameras are located on a movable spot (lifting floors etc.), it is recommended to watch camera positions during the match (especially before games and after breaks). If a camera position changes and the tracking quality is poor, you may have to recalibrate the concerned camera. We recommend being ready for such situations (especially in the case of cameras on lifting floors) and let the camera operator know you may need his assistance short before the game.

Last used calibration is automatically loaded after the application is started. In case of system restarts, you do not have to load it manually. Actually loaded calibration is displayed in the application title bar.

Calibrations are saved with current video setting context. You cannot load calibration previously done in different video format.

Virtual Placement is designed to be used in various workflows from upstream to downstream productions. This provides greater flexibility during the production workflow, Pitch and Scene tracking support the downstream workflow. The downstream workflow provides the user with the ability to take a clean or program feed with the various camera angles, and then apply the appropriate graphics to each angle.

There are several options for downstream workflow to suit different infrastructure setups.

- MODEM - An upstream Virtual Placement calibration is embedded in an audio channel and read by downstream Virtual Placement instance
- VANC - Where upstream Virtual Placement calibration is embedded as vertical ancillary data (VANC) and read by downstream Virtual Placement instance
- GPI TONE - A downstream instance of Virtual Placement analyses a spare audio channel where the GPI trigger is present

Note: Downstream workflows require a license.

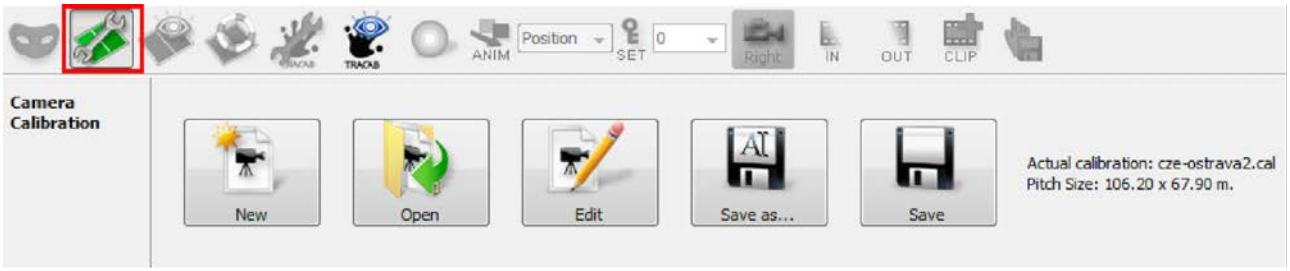
For more information on downstream workflows please contact Sports_Product@Chyron.com

PITCH CALIBRATION

Camera Calibration

Camera calibration feature for sports is optional. It is available only if you have a license for this feature.

For precise tracking and product placement in correct perspective you have to calibrate cameras. You can get to the calibration dialog using calibration button in the toolbar. Calibration dialog appears in the Product bar.



Open existing calibration
If the cameras have been calibrated already for the particular stadium and the calibration has been saved, you can just load it using Open command from the Calibration bar or Calibration menu. It is strongly recommended to verify the match of the existing calibration. Go through the calibration process straight to the verification part and follow the instruction in the verification section.

Create new calibration
Select New calibration from the calibration editor or Calibration menu. Select the appropriate pitch from the available types.

Soccer - Suitable for main and offside cameras. Tracks all pitch lines.

Football license

Soccer center - Center camera can be tracked with only central part of the pitch. The calibration is much easier then in the full soccer pitch.

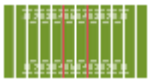
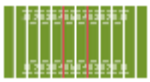
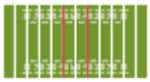
Football license

Tennis - Suitable for camera behind base line.

Tennis license

Badminton pitch - Suitable for camera behind base line.

Tennis license

	**Rugby League** - Wide and middle zoom cameras are supported. Tracks all pitch lines. Beware this pitch is not compatible with Rugby Union.	 Rugby license
	**International Rugby** (Rugby Union).	 Rugby license
	**NFL** – American Football. The field is NFL approved.	 Rugby license
	**NCAA** – American Football. The field is NCAA approved.	 Rugby license

Calibration
For all cameras do following (1):

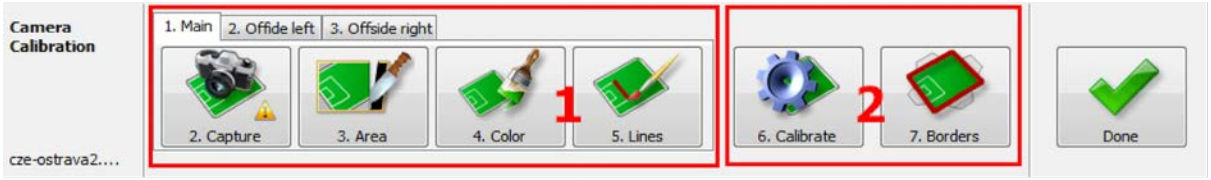
- Capture Frames
- Define Line correspondences
- Set Pitch Color
- Configure Active Image Area

And follow with steps common for all cameras (2):

- Calibrate all cameras at once
- Define pitch borders (not available for all pitch types)

When the first step is done, press the Calibrate button. The calibration engine calibrates all cameras at once. When the calibration succeeds, and you are satisfied with the result, press Done button. You return here and continue with borders definition (Borders button).

Capture frames for calibration
There are several screen previews in the list (1). Go through the list, move the camera and find shots as much close to the ones in the list as possible. Every time you find corresponding angle of view from the camera, press the Capture button (2). Small camera in the corner indicates the frame has been captured successfully. After capture verify quality of capture frame. In case the frame is blurred, drop the frame using the Remove button (4), which appears after the frame was captured. You don't have to keep order of frames given by the preview images.
After all frames has been captured, press the Done button to proceed back to camera selection and following calibration phases.
Generally not all presented views must be captured. Higher number of corresponding views will give you higher probability of good match and better tracking quality.



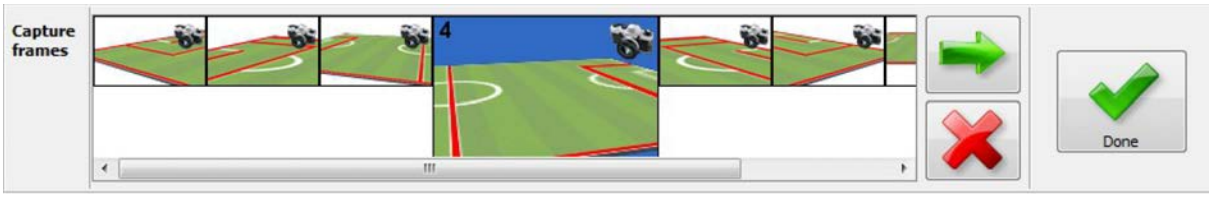
Line calibration

Select a line (point) in the model (1) and draw corresponding line on the pitch in the video.

The most important lines for each frame are drawn in white color in the model (1). Make sure, all important lines are calibrated. In case of the unimportant lines, higher number of definitions implies lower probability you will have to return and correct them. But it is not necessary.

It can happen, only part of a line is visible in the video frame. In this case just draw line in the video for the visible part of the pitch line. Don't skip it.

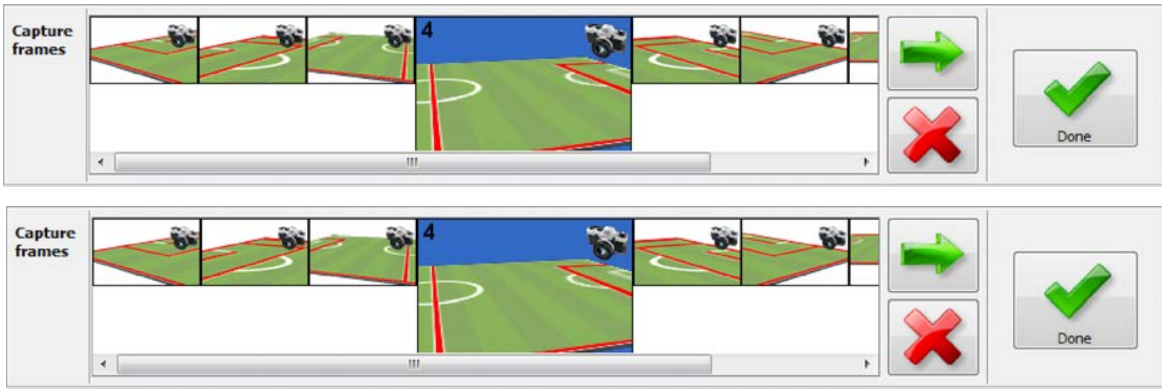
Actually selected line is red colored in the model. Repeat calibration step for all previously captured frames.

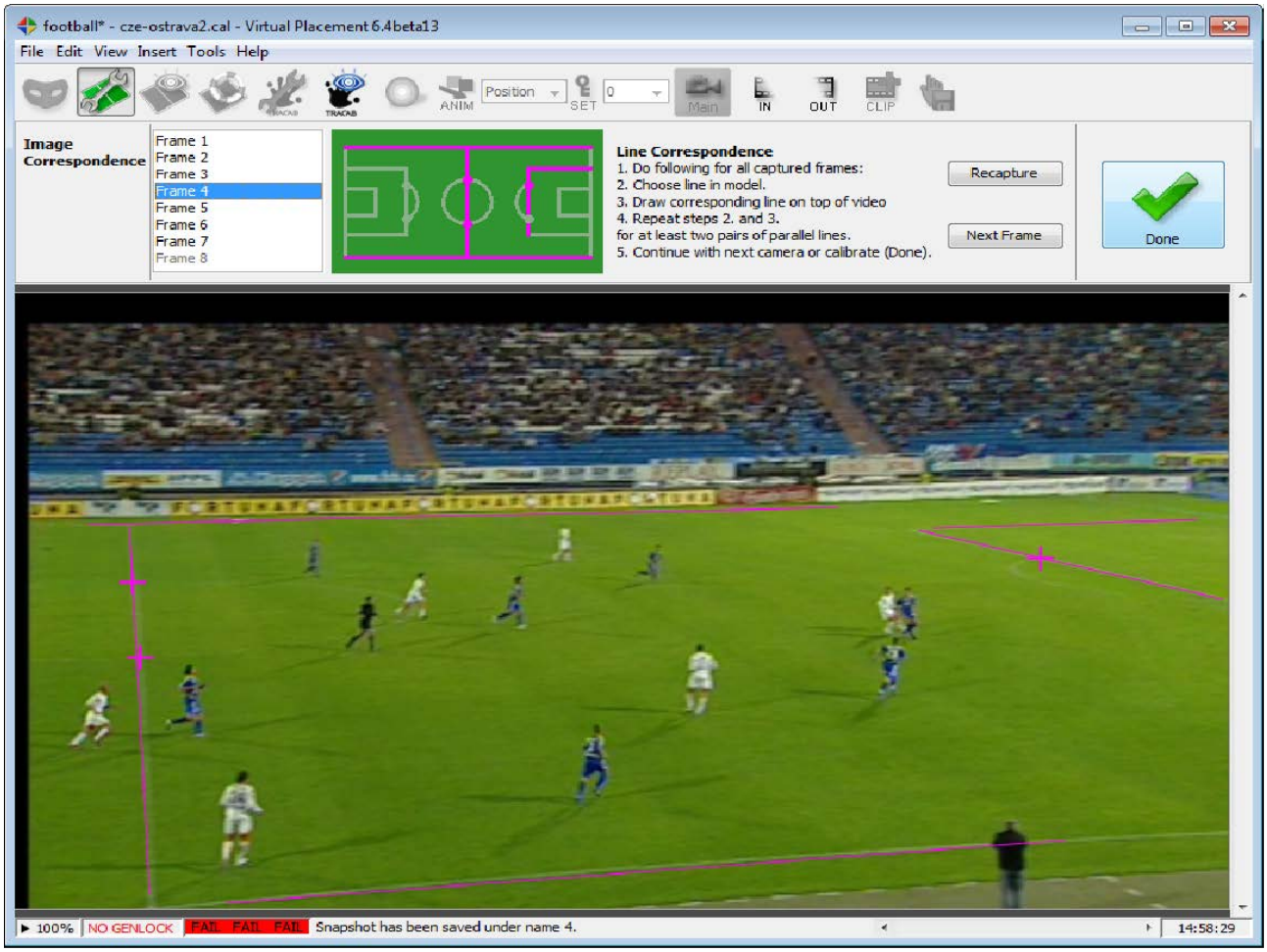


To go to next frame, press the Next Frame button. You can delete already defined lines/points from the pop-up menu above the model pitch resp. To remove all lines at once, there's 'Remove all' function accessible from popup menu triggered outside any pitch line/point. You can also redefine any line. Just select the line in the model, it appears in the video and draw the line again on the desired position. When you're done, press Done button and return back to the main stage.

How to draw calibration lines over pitch lines

The calibration line should be as close as possible to the real pitch line. The length of the calibration line does not necessarily be the same as the real line. Because of camera lens distortion and pitch curvature the lines in video are not straight. It is therefore sometimes impossible to draw the calibration line to exactly match the pitch line. In this case try to





draw the line shorter in the middle, most straight segment of the real line. See following examples:

This picture demonstrates wrong calibration line. The line on the sides does not match.

This picture demonstrates wrong calibration line. The line in the middle does not match.

This picture demonstrates proper calibration line. It is shorted but matches the pitch line well.

American Football Point correspondence guidelines

Calibration of field for American Football (NFL, NCAA) needs certain points correspondences to be defined. These points are located at intersection of the solid 5 yard

lines with 1 yard hash marks.

Sidelines
Sidelines for American Football and similar fields that use very thick Sidelines need the calibration lines to be drawn over the inner side of the pitch line. Example:

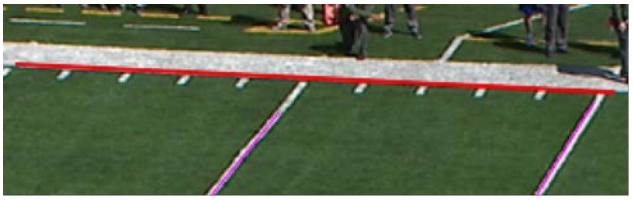
Good	Bad
	

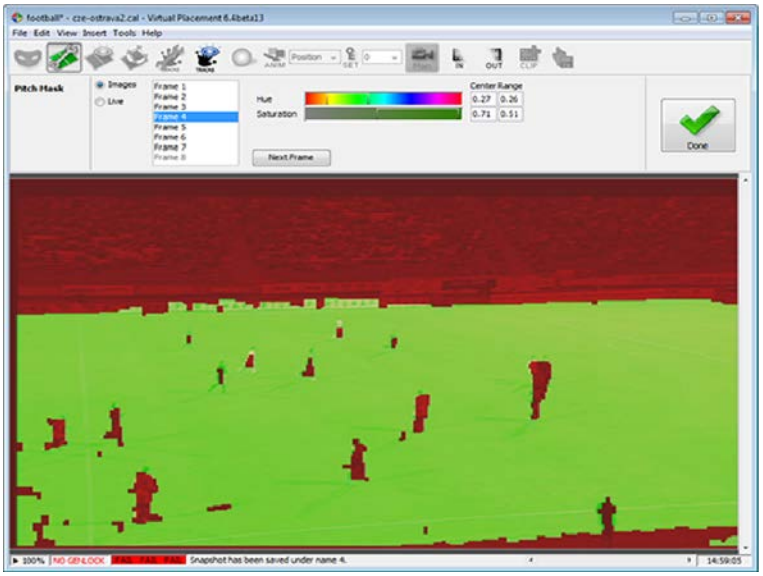
Image correspondence in soccer center calibration

The soccer center pitch has very simplified calibration. Because the amount of information that can be extracted from the image is much lower than in normal soccer pitch tracking, extra attention must be paid during the calibration.

To calibrate it properly, please follow these rules:

- The center line must always be calibrated. If the line is curved in the image (due to the lens distortion or pitch curvature) then it is better to draw the line closer to the center then to line ends in the image.
- At least one horizontal pitch edge line must be calibrated. Either the top or bottom. There are four points in the UI for the center circle. You must calibrate all of them. It is important to place the points on the circle in the image. It is not so important where on the circle the point is. It just needs to have 4 points on the circle roughly equally spaced.

Calibration of pitch grass color



Correct setting of the pitch mask is very important for correct functionality of the tracking. It is fully independent on the chroma keyer used for graphics insertions.

1. Set the pitch mask color to fit the grass color. You can do it from live input or from images captured in previous step (Capture images)
2. Check the mask periodically during the game. When the light conditions change, alter the mask to fit actual pitch color.
3. Check the mask when the tracking becomes inaccurate.

You are allowed to adjust only Hue/Saturation. Change those values until you find good result for all examined images. Suitable pitch mask is shown in the picture below.

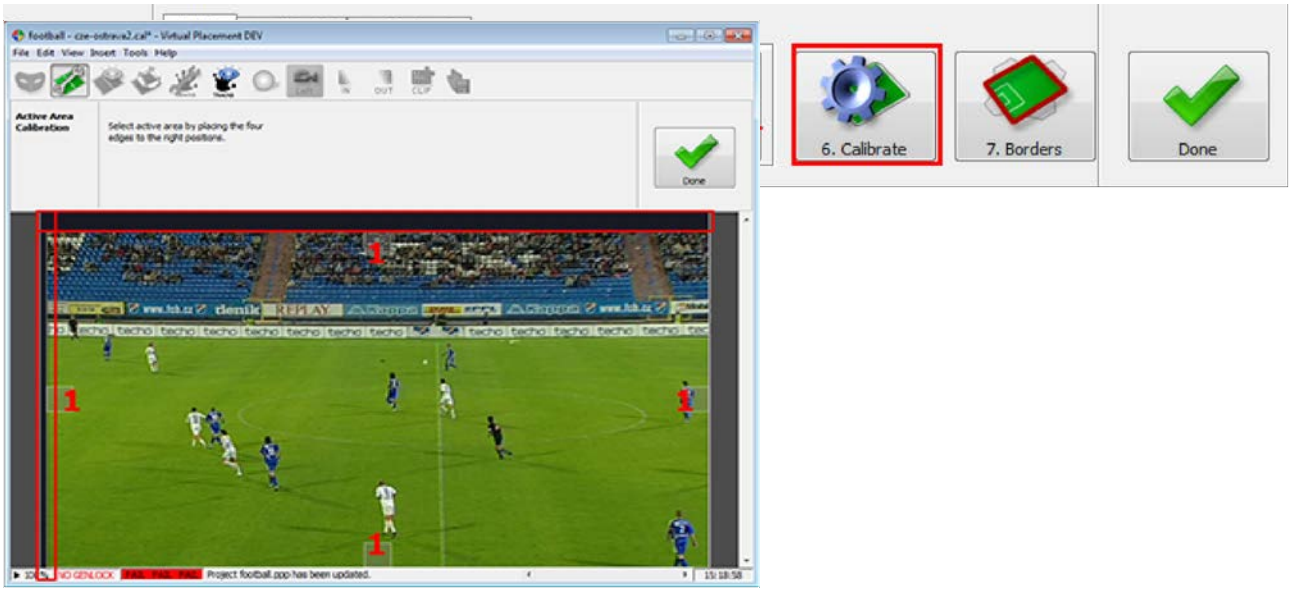
Calibration of active picture area

In case, the input video contain black border or any mess, don't forget this step. Otherwise the black borders can negatively influence tracking quality.
Get to the active area calibration from cameras panel. You can see a rectangle enclosing

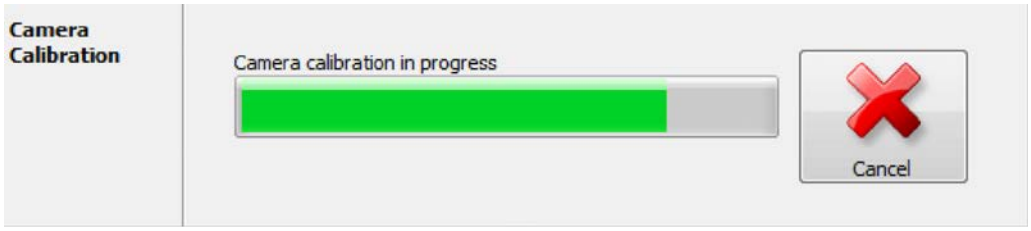
the whole video area. Drag the four draggers (1) in the middle of each side so the rectangle covers only active area. Black borders (2) are drawn with hatched-pattern.

Calibration

When all the camera-wise steps are done, for all cameras you wish to be tracked, continue to the calibration process.

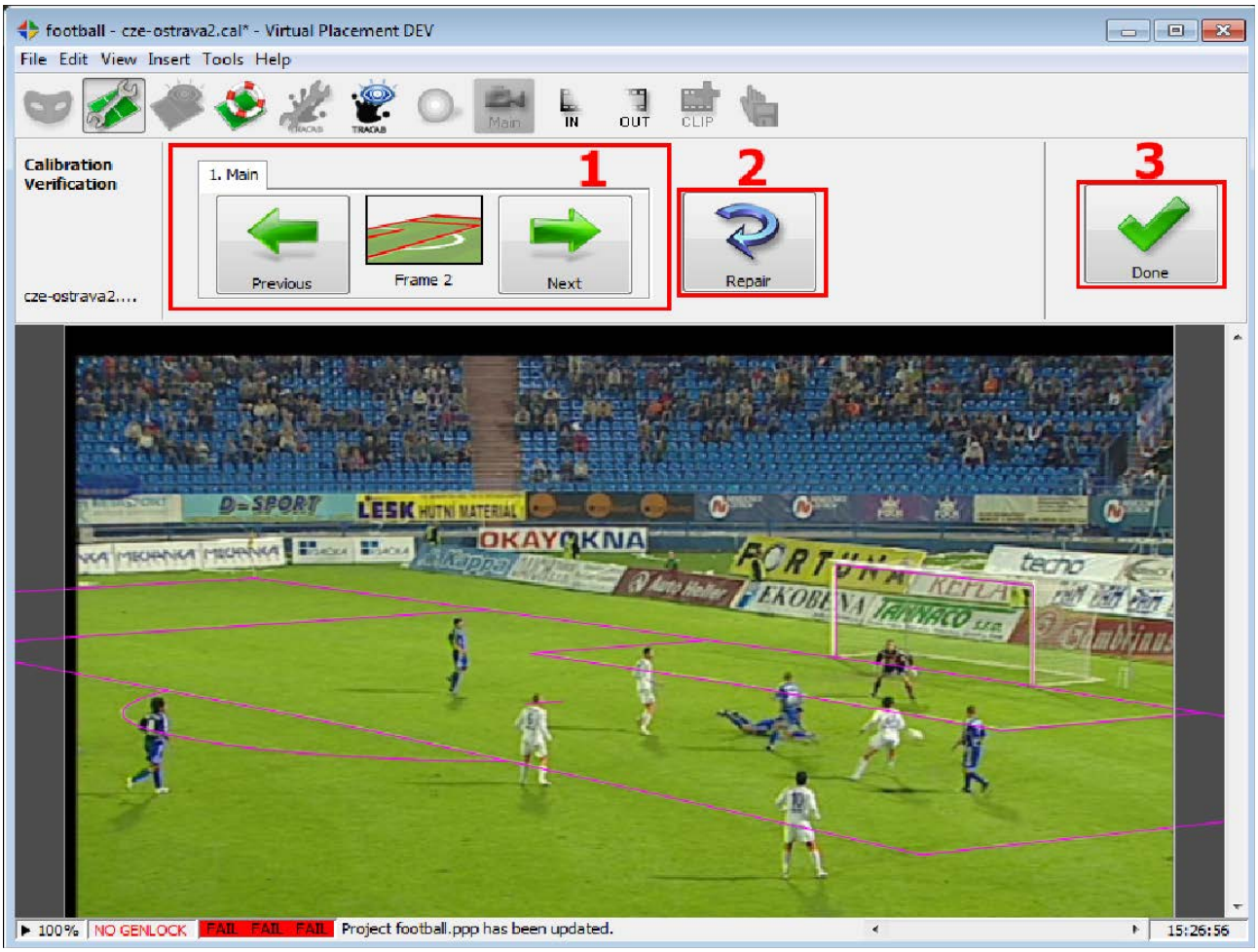


Screen with calibration progress appears.
The duration of calibration process depends on number of calibrated cameras and pitch type. It could be from 5 seconds to 3 minutes.



Verification of the result

Go through all frames of all cameras using the Navigation panel (1) in the list and check the quality of the match between computed and real pitch lines. Computed lines are shown in the video yellow colored. If this happens or quality of match is poor (computed lines don't fit the real ones), go back to the previous section “Calibration” using the Repair button (2) and redefine the correspondences. In case the calibration cannot be computed for the next set of correspondences, try to recapture the problematic frame.
When the calibration results match, press the Done button to go to the main stage and continue with border calibration.



Calibration of pitch borders
This stage gets enabled after successful calibration.
The border calibration is made on pitch top-view, which is generated during the calibration from the captured images. You can also see the result of the calibration, yellow pitch. This pitch should fit the real pitch lines.
The pitch area, beyond the lines, can contain some additional advertisement or other objects like roof of the substitute bench etc.

How to calibrate pitch borders
This step is for the camera tracker to let it know where to look for pitch lines. Define the border **on the edge of pitch grass**. Don't follow the pitch lines. If any advertisement lies between the pitch line and the grass edge, draw the line between the pitch line and the advertisement.
Properly defined grass borders are very critical when the lines are badly visible. Please have a look at the picture below to learn how the borders should be well defined.

In the pitch-side selector (1) select area containing such objects. Draw a line in the video between that object and pitch line (2). Switch area (1) to define borders for other sides. Repeat for all cameras.

Basics of the line painting mechanism:

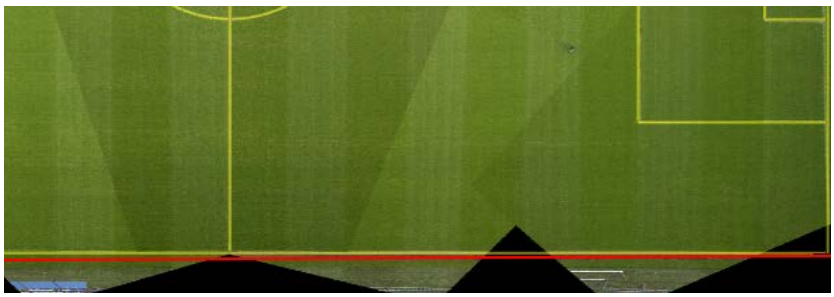
Define new line	Simply draw a pointed line.
Extend existing line	Click on one of the end points and continue with the line.
Change shape of existing line	Select point on the line and move the point. The line is divided
Remove existing line	Drag the end point above the start point and release the mouse. Or use clear function from the pop-up menu on the area buttons (1).
Finish existing line	Click on the end point. Or change border area (1).

The result should like shown on following picture (the red lines).

Good and bad practices in calibration border

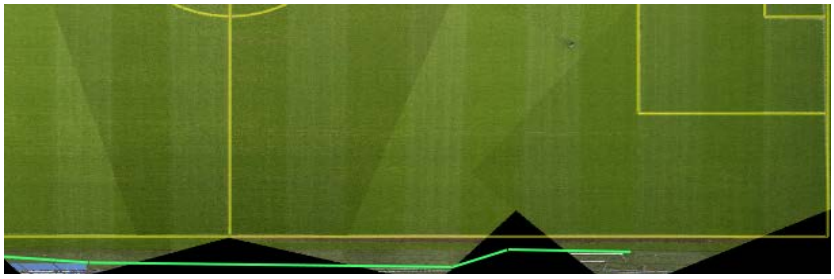
BAD

The line too close to the side line. There is no reason.



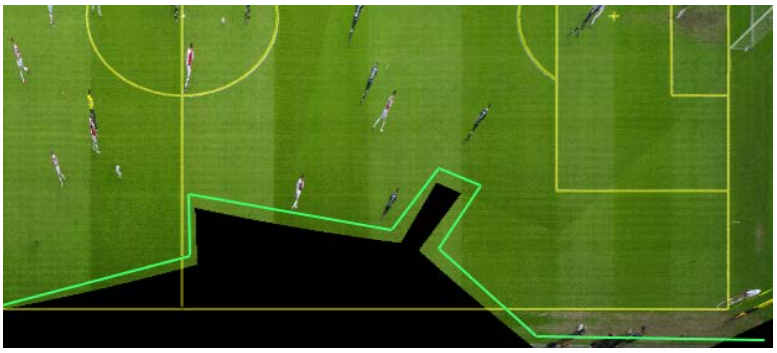
GOOD

Make the line as far as possible from sideline



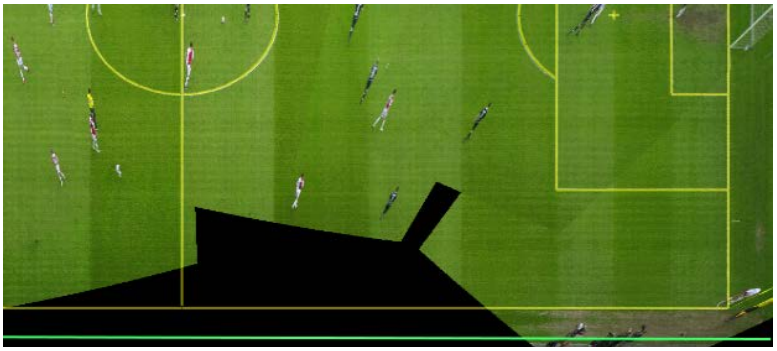
BAD

Do not try to follow the missing part of the pitch. There is nothing wrong with the pitch, you just don't see it.



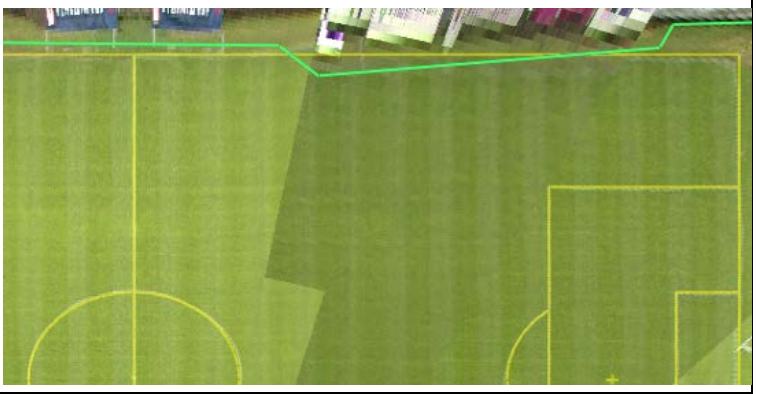
GOOD

Do not make the border or make your guess what can be there. It is better not to have border then to have wrong border.



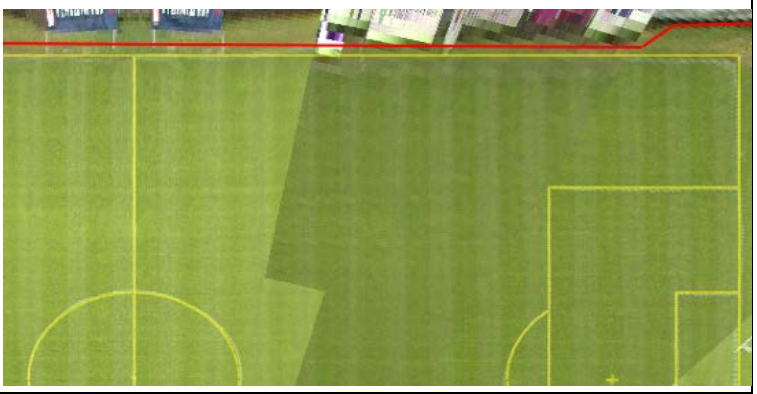
BAD

Calibration is not accurate. In this case some part that lies outside the pitch is projected into the pitch. Do not try to cut off this bad projection.



GOOD

Make you best guess where the advertisement ends and where the grass begins. Put the line as close as possible to advertisement and as far as possible away from pitch.

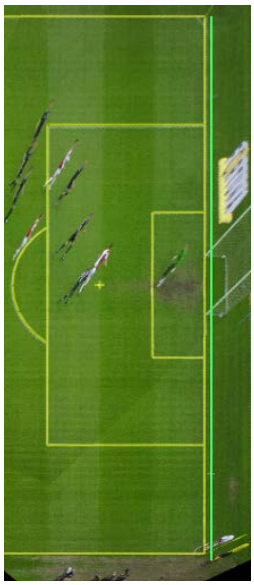
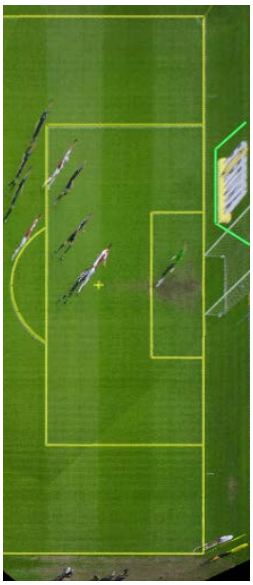


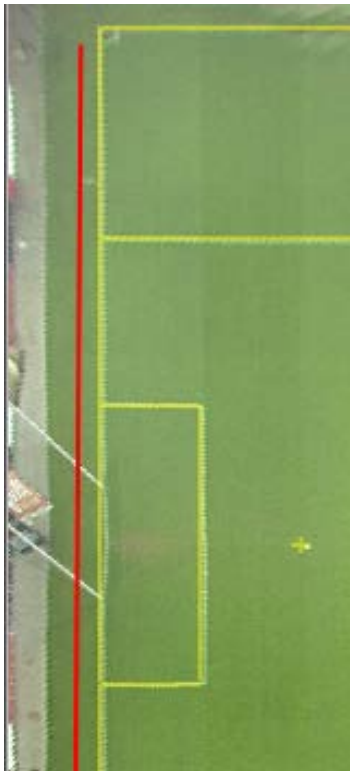
BAD

The advertisement is cut off but you cut off too much. If you cut it off the tracker will not be able to find the pitch line and the tracking quality will be

GOOD

Cut off only the part that is close to the pitch. In this case there is only a small banner that can confuse the tracker. Cut off the banner and keep the grass as much

lower. 	as possible. 
BAD Do not cut off green pitch when there is nothing wrong there. Camera tracker is reluctant to look for the side line because the calibration tells it there is something there.	**GOOD** Keep as border as big as possible. In this case the border line can be moved altogether. There is no reason to define it. 

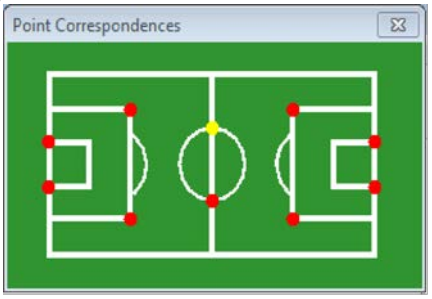


Semi-automatic Pitch Tracking

Sometimes can happen, the tracking gets lost. It might be caused by badly visible lines, the camera must not have any line the current view etc. Nevertheless Virtual Placement allows you to work with products localized on the pitch in such situation as well. If you reach any scene, where the tracking is lost or incorrect, simply switch to the semiautomatic tracking. This correction is very fast.

Starting Semi-automatic Tracking

This type of tracking is started by definition of the first point. You can use points shown in the following dialog. The points in the video are selected by the right mouse button. You can do that anytime you want, when a valid camera calibration is loaded.



1. Select with right mouse button a point in the video, corresponding with one of the points shown above. The Point Correspondence dialog is displayed. Select the same point in the top dialog.
2. You should see yellow pitch on the top of video, showing the computed position of the pitch. If it approximately fits the pitch, you

can set the product and begin with production. If not, repeat step 1 for one more point.

3. The tracking is set, adjust the product and put it on-air.
4. When the production is done, you must manually switch back to the automatic tracking. You can do that by pressing the semi-automatic button in the toolbar, which is flashing during the time, when semiautomatic tracking is on (1).
5. Anytime you want to use the semi-automatic tracking again, just begin from 1.

As you can see in the following picture, two points should be enough to define the pitch. Semi-automatic tracking is designed for short productions (like free kick) and might get inaccurate after longer time.

Don't forget every time after productions switch back to the automatic mode.

Control of the semiautomatic tracking is designed for very fast use. The graphic operators will master the setting very quickly and will be able to prepare the production within 3-4 seconds, even when the tracking gets lost.

Tracking status

During production you can oversee the current tracking status. The tracking results depends on video quality, lines visibility and calibration quality. The status is just an indicator for operators. Most of the time the tracking should be good. Actual tracking status is shown for each camera. Order of the cameras is same as in the Camera button popup menu. If a Live camera is selected, the info is shown for all live cameras. If a Recorder camera is selected, info for Recorder cameras is shown.

The tracking status has following states:

FAIL

Fail = No tracking, the system cannot recognize the pitch. You cannot place any objects on the pitch.

WEAK

Weak = Pitch was recognized short while ago but is not recognized now. The system tries to recover in the background. The tracking quality may vary is this state. It is acceptable to have this tracking state for short periods of time.

GOOD

Good = Pitch tracking works reliably. You should see this status most of the time during production.

SEMI

Semi = Semi-automatic tracking. To disable it,select „rescue circle“ button on the toolbar.

N/A

N/A = Tracking information is not available.

Display tracking result

All the time you can see the actual state of the tracking. Press the Show pitch button. The system draws pitch lines to the video (to preview only, video output not affected). Those lines should fit the real pitch lines. Displaying of the tracking result can be disabled by clicking the Show pitch button again.

Pitch color

When you choose “Display tracking result”, it may happen the lines might be poorly visible due to color conflict of the lines and the real environment (real pitch color). You may change the color of the drawn pitch outline in main application Menu → View → Pitch Color.

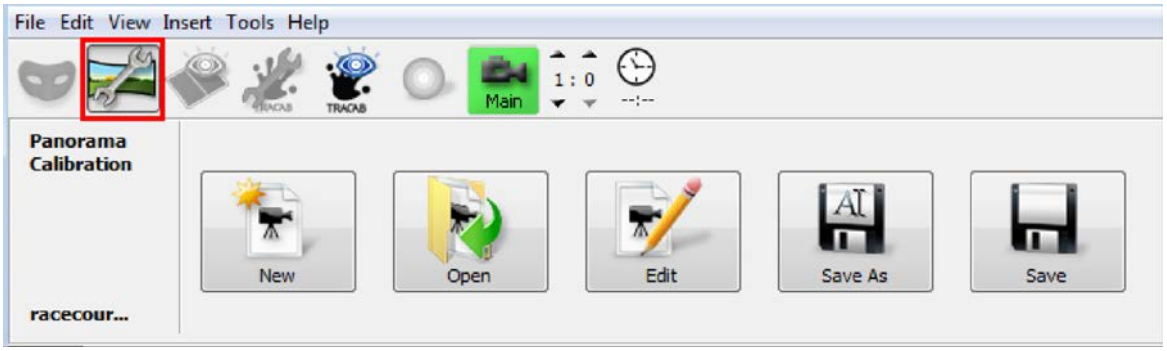
SCENE TRACKING

Scene tracking is very similar to Camera Tracking for sports. It allows you to put Products on the pitch. The system keeps it on the same place while the camera moves.
Unlike Camera Tracking for sports, Scene Tracking is more universal type of tracking, but requires certain knowledge of the field to be provided by the user during calibration.

Scene Tracking requires license.

Calibration Editor

Press the Scene calibration editor button in the toolbar to open/close the editor.



Initial screen of the editor

New – creates new Scene calibration.

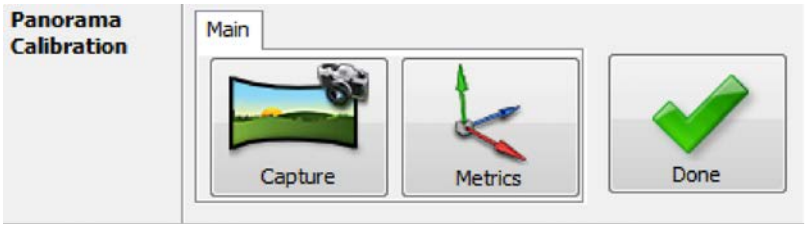
Open – opens an existing scene calibration. Scene calibration files have .scal suffix.

Calibration folder is accessible via Start → Virtual Placement → App Directory → Scene Calibrations.

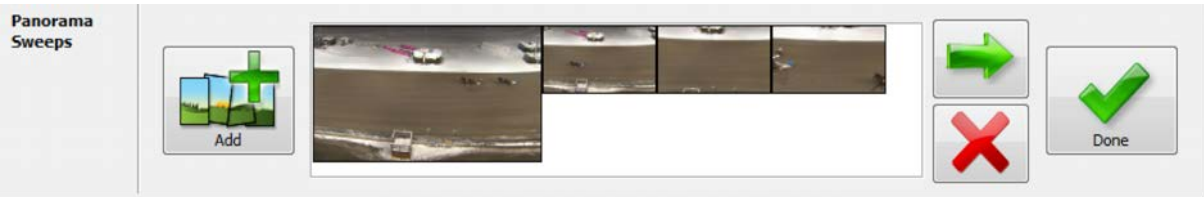
Edit – edit current calibrations.
Save/Save as – save current calibration into a file.

Panorama Calibration

Scene calibration consists of a Panorama and Metric. Metrics definition and calibration need the panorama to be built first. Press Capture button to go to Panorama Sweeps screen.



Panorama Sweeps



This screen shows list of captured sweeps (represented by thumbnail of their first frame). Selected sweep is displayed in bigger size.

 Add new sweep. This will take you to the Panorama Sweep Capture screen.

 Select next sweep.

 Delete currently selected sweep.

 Generate panorama and go back to the Panorama Calibration screen. Panorama generating might take a while.

Panorama Sweep Capture

This screen will help you to setup the camera and get ready for the next sweep capture.

 Start capturing sweep.

 Go back to Panorama Sweeps screen.

 Preview of camera zoom for this sweep. The preview is shown on the SDI output only, so the camera crew can see the requested zoom level.
The button is not present during the first sweep, since the camera is required to be zoomed-out to its maximum.

Guidelines for sweep capturing

- Zoom out the camera to the maximum for the first sweep
- Point the camera at the finish line or other significant point close to the camera.
- Start capturing sweep.
  - **Don't change zoom level** during the sweep.
  - Follow the track with the camera.

- **Keep the track focused** during the sweep.
- Make sure there's **no motion blur** – when the light conditions are poor, make sure the pan is slow.

We recommend to make the camera pan in counter clockwise direction.
When you return to the point where the pan started, press the Finish button.
Repeat the capture sweep procedure for another zoom level.
All sweeps should start at the same point.
When zoomed-in, we are more interested in advertisement and similar significant objects rather than mud/grass on the track.

We need a minimum of 5 sweeps with different zoom settings, and as many as are necessary to cover the range from max zoomed out to as tight as you would want to go with virtual graphics.

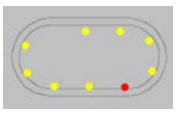
Panorama metric

The metric contains real world coordinates of few significant points and images of placement of these points. The metric can contain wire-frame model of the track.
By default, the calibration contains empty metric

- Import – Import metric from a file (.met file).
- Export – Export metric to a file.
- Edit – Edit current metric. Go to the Panorama Metric Designer screen.
- Calibrate – Calibrate the metric. Available only when a metric has been defined.
  Done – Return back to the Panorama Calibration screen.

Panorama Metric Designer

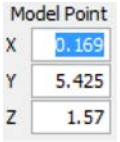
This screen helps you to design metric for the environment.
It contains following controls:



Model preview. When a wireframe for the model has been imported, top view of the track is shown.
Additionally it contains all added model points. The points are clickable so you can verity their location in the video preview.
Currently selected point is displayed in red.

 Add a metric point. Define its position in the Model point editor.

 Remove currently selected metric point.



Model point editor. Shows real world coordinates of the point [in meters].
Coordinate system origin is user-selectable (e.g. middle of the track, finish line etc.)
X,Y coordinates are on the surface of the environment, Z coordinate means altitude above the ground.

Point preview in the template image. You can change detail of the view by the Wide and Detail buttons.

 Import wireframe from a file.

 Finish metric definition and go back to the Panorama metric screen.

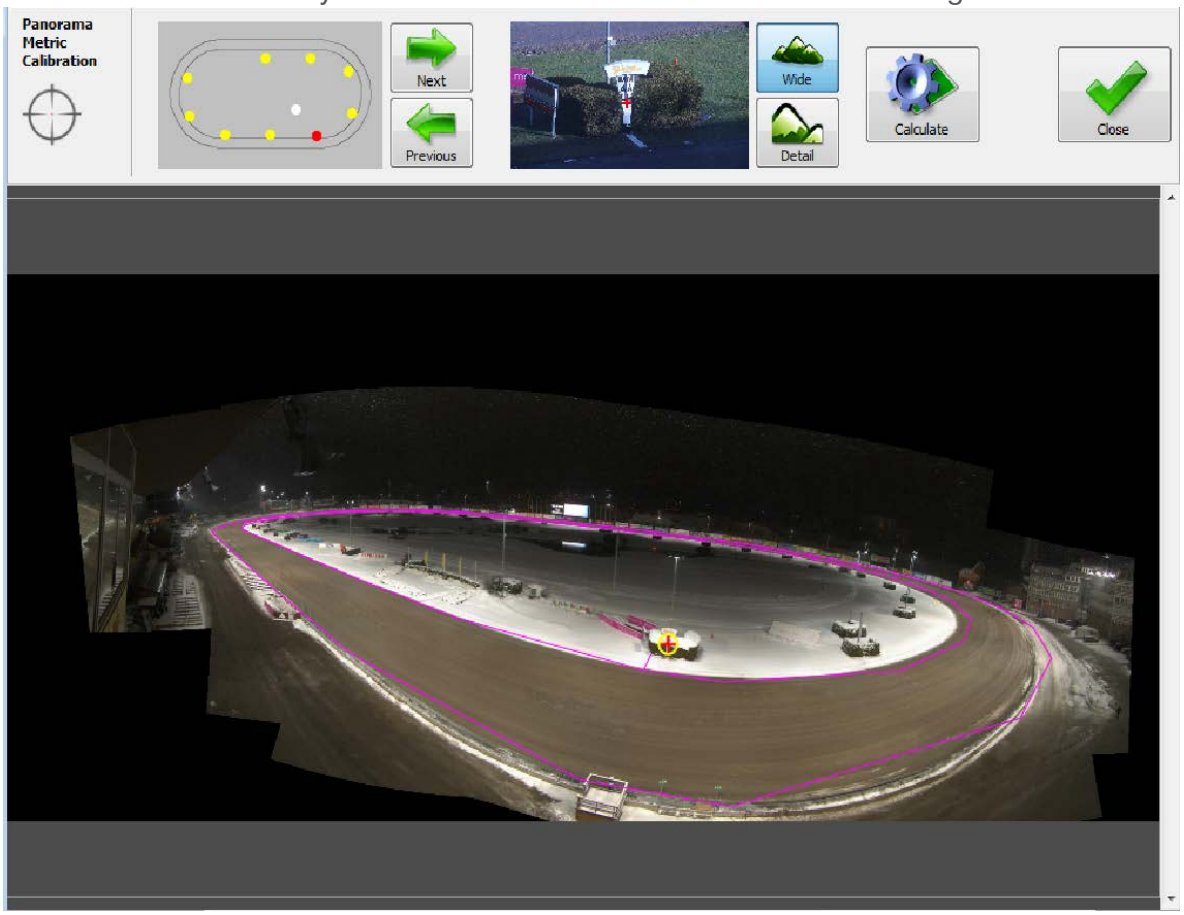
Wireframe
We accept .svg or .obj files with the wireframe model. SVG files can be used for planar models whereas .obj file format allows to define 3d wireframe models. Scale of the wireframe model must correspond to the real-world environment. Origin of the wireframe model must correspond with the origin chosen for the metric points.
The wireframe serves for visual verification of the calibration quality only. It is highly recommended to have a simplified model the environment.

Guidelines for metric definition

- Localize several points in the environment. The points should be distributed along the whole track.
- Press Add point button
- Fill in coordinates of the point
- Click on the point in the panorama. The video zooms in to allow you fair position corrections.

Panorama Metric Calibration

The last step is locating the metric points in the video. The workflow and the look of the Calibration screen is very similar to the one in the Panorama Metric Designer.



Calibrating the points

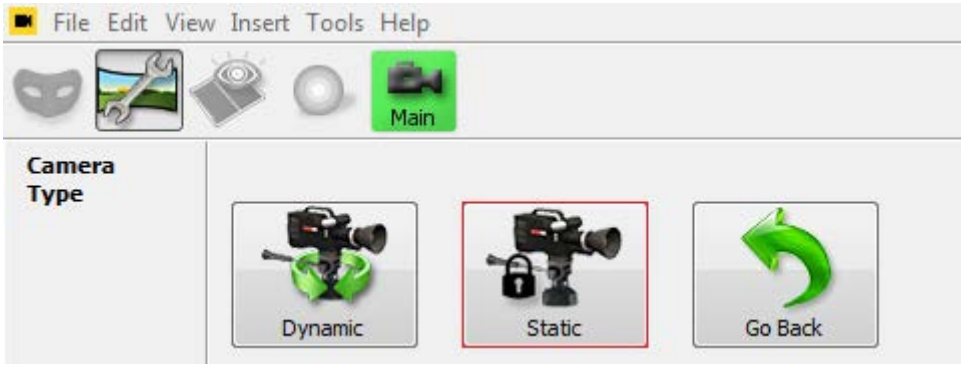
- Select a point in the model preview (non-calibrated points are rendered in white, calibrated points in yellow, actually selected point in red color).
- Click the point in the panorama (the template preview in the toolbar will guide you). The system switches to Detail view automatically to allow you fine positioning of the point in the video.
- Select the precise position of the point.
- Continue with the next point.
- Once you have all points placed in the video, press Calculate button (the process might take a while).

When the metric is successfully calibrated, the application starts rendering the wireframe, if defined. You can verify the quality of the calibration.

The point selected in the video is rendered as a cross. Projection of the real world point into the video is rendered as a circle. In ideal case these two points point to the same spot in the video.The last step is locating the metric points in the video.
The workflow and the look of the Calibration screen is very similar to the one in the Panorama Metric Designer.

Scene Tracking Static Camera

Scene tacking can also be used with a fixed camera, this enables the user to account for lens distortion during tracking. Calibration process is very similar to the dynamic camera workflow.



Calibrating the Static Camera

- Select static from camera type.
- Capture single frame from incoming video feed.
- Select lens distortion in order to apply a line to the captured frame. This line should be placed near the edge of the image.
- The line can then be adjusted using the Slider provided (shown in the image below)

Note

The position of the line can sometimes vary depending on the image and also the lenses that are used on the cameras.

ANCHOR TRACKING

Anchor tracking is a special type of tracking and automatic production.
During the pre-production setup, select the scene where you want to insert graphics and calibrate the scene. Run tracking editor of the desired product, set anchor w17ith name of the earlier calibrated scene. Adjust the product.
During production, when the scene is recognized in the video feed, the graphic object it's automatically put into the scene. No human interaction is needed. The object keeps its position and size relative to the scene. The object is automatically hidden when scene cut is detected.

Anchor tracking is mutually exclusive with sport pitch tracking. Choose the tracker by setting the right profile in the config editor.

Anchor Tracking requires a license.

Anchor calibration editor is accessible via Anchor calibration button in the toolbar. The same button is used to close the editor. When the editor is active, an additional anchor tracking related toolbar appears at the end of the main toolbar.

Functionality of the buttons in the toolbar

Show/Hide the anchor calibration editor.

Show anchor frame for selected products. The button is available only when the editor is closed, and the selected products have common anchor set as tracking type.

Show live video feed in the preview in case any anchor frame is selected, or immediate Capture current frame in case no anchor frame is selected.

Captures current frame. This button is available only when displaying live video feed.

Removes all mask areas from currently selected Anchor. This button is available when an Anchor is selected and a mask has been defined.

Undo last change.
If previous operation was adding mask, the mask is removed.
If previous operation was Remove all mask, the removed masks are added back.

 Resets counters for anchor statistics.

 Recapture selected anchor. This button is available when an Anchor is selected.

1. Capture the anchor frame
   Use toolbar buttons to show live video feed in the preview and capture desired frame.
   The application offers to set name for the anchor. The name must be unique. The image should not have motion blur (camera should be still) and the camera zoom should be as close as possible to shots in which you will insert graphics.
2. Calibrate the anchor frame
   Select the anchor frame in the Anchor calibration editor. It appears in the preview. To provide better tracking efficiency you need to create an tracking mask. When the captured video frame contains objects that are dynamically changing (such as players, video screen, …) it can degrade the tracking quality. Now draw rectangular regions over the regions that can change. These areas won't be used to detect the scene in the video feed.

When scene included in anchor frame changes you should recapture and recalibrate it. For example the scene changes from 1st half to 2nd half in soccer game as spectators can leave the arena or change their seats.

Popup menu items for Anchor frames:

- **Rename** selected anchor frame. Products linked to this anchor will be updated to keep using this anchor.
- **Delete** selected anchor frame.
- **Delete all** anchor frames.
- **Export** selected anchor frame. See Import/Export of anchor frame chapter.
- **Import** selected anchor frame. See Import/Export of anchor frame chapter.
- **Import** as new. See Import/Export of anchor frame chapter.
- **Replace** selected anchor frame. See Recapture anchor frame chapter.

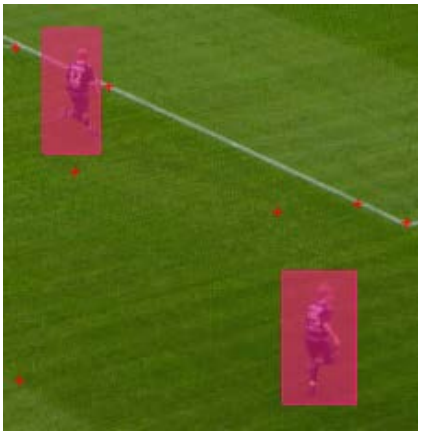
Mask

Mask allows manually select area which will not be used for tracking. Anchor tracking is based on comparing reference frames with live video input. When reference frame contains dynamic parts than there parts can never help the tracker, rather the opposite. During the mask setup, the system show points (red crosses) interesting for the tracker. Where these points are in area that are not suitable for tracking then add a mask rectangle over it.

Guidelines how to set the mask

- Make mask rectangle to just convert the dynamic part.
- Do not mask spectators when the camera is wide. The spectators are small and do not have any negative impact on tracking.
- Make mask over keyed graphics, such as timing and score titles. (This only happens when you are using dirty feed as your input). Beware that the mask has to be added in both anchor frame and in production mask for tracking and insertions.
- Make mask over players.

- Make mask over LED boards on the pitch.
- It is not required to make pixel perfect mask.
- Do not mask the whole image.
- When you mask large portion of the image the tracking won't be reliable at the area.



Warning indicator
Warning indicator can appear on anchor frame thumbnail when the image or the mask is wrong. Try to capture new image or change the mask.

Correct image masks

Incorrect image mask
Mask does not cover timing and score title that disrupts the matching - mask the timing graphics (The timing graphics has to be also masked in Tracking and Insert area for production). The mask could mask you points on the pitch that could be used for matching – split the mask to several pieces.

Import/Export of anchor frame

There are Import/Export features accessible in the popup menu in the Anchor editor. These are useful to reuse previous anchor setting, share the setting among several computers etc. Exported and imported are also positions of all products bound to the exported frame.

- **Export** – exports selected anchor frame into a standalone file (.afe). The file contains the anchor and position of all products tracked using this anchor.
- **Import** – imports previously exported anchor from chosen file (multiple files selection is supported). Following update rules are applied:
    - Anchor with same name already present is overwritten. Including source image and all masks.
    - Products update their position if:
        - They have tracking set to the same anchor
        - They had tracking set the same anchor during export
        - They have same name
- **Import as new** – imports previously exported anchor from chosen file.
    - Unlike Import, anchors are not overwritten but added. New name is generated for them.
    - Like in Import, there might be products bound to the anchor and exported with the anchor. They would update their position (according to update rules in Import). Using 'Import as new' doesn't change their position itself, but these products are cloned and the position of clones is updated. Cloned products are tracked using the newly imported anchor.
    - This operation adds anchors or products and has no effect on existing products or anchors.
- **Import from Image** - creates anchor frame from ordinary image file (.jpg, .png etc.). Useful for pre-production preparations when only photography of the target scene is available.

Recapture anchor frame

There's possibility to replace source frame of an anchor. Products linked to the anchor will be automatically updated (position and size). The system computes difference between the previous and the recaptured anchor and adjusts their placement. In most cases (when the new frame is similar to the previous one), no further position and size adjustments will be necessary.

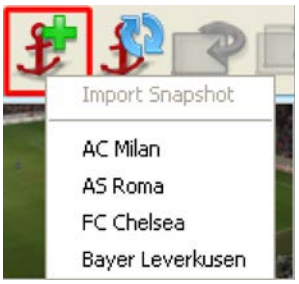
1. Select the anchor to recapture.
2. Press 'Recapture selected anchor' button in the toolbar. Live input appears in the preview.
3. Capture desired frame by the Capture button in the toolbar.
4. If the difference between the two frames is computed, products are updated automatically.
5. If not, an info dialog appears. You may still choose to replace the frame anyway, in this case update position and size of the linked products manually.
6. Set anchor mask for the new frame.

Create anchor from snapshot

It is possible to create an anchor from existing snapshot.

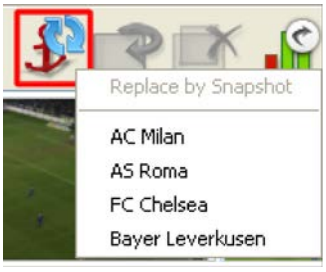
Import Snapshot

Use popup menu of the Show live video feed button. New anchor will be created from the selected snapshot and will be added to the list of anchors.



Replace Anchor by snapshot

Select Anchor to replace and use popup menu of the Recapture selected anchor button. Source image of the Anchor will be replaced by the one taken from the snapshot. The system tries to update all products linked to the Anchor (position and size).



Performance notes

- Anchor tracking requires computer with at least 8 CPU cores in total (2x quad core or 2x dual core with hyper threading enabled).
- Every anchor frame adds some processing load to the system. Keep the number of anchor reference frames as low as possible. Remove unused frames.

Anchor usage statistics

In the anchor editor, next to the anchor preview, there's a bar showing recognition statistics. The bars show how many times each anchor was recognized, in percentage relative to the best one. Bars of rarely used anchors are drawn in red.

The counters can be reset via the Reset counter button in the toolbar. It resets counters for all anchors. On every change you make to the anchor (redefine mask), counter for the changed anchor is reset.

List of linked products
Hover over the anchor name label in the anchor editor. Tooltip containing list of products linked to the hovered anchor is shown.

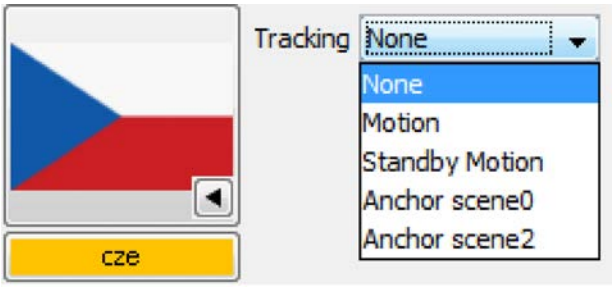
Exclusive Visibility Group

It is possible to attach products to "Exclusive Visibility Group". This feature guarantees that only one product in the group is visible at a time. For example you have 2 products, each product has different anchor reference frame. Both anchor frames cover the similar place in front of camera. If you attach both products to the same exclusive visibility group, then the system never show both products on air even if both anchor frames are tracked (visible). The product that was visible earlier keep visible in the group. When the tracking is lost for such product, then other products from the group have a chance to show up. Exclusive groups are numbered 1..n.

Setup the product for anchor tracking

When you want to use anchor tracking for your product. Follow these steps:

1. Choose tracking type to anchor
   Select the product and open tracking editor. Select anchor of desired name in the list of tracking types. During listing among the anchors, the anchor reference image is shown in the preview.



2. Adjust the product
   a. Select product you want to insert. The 'Show Anchor Image' button in the toolbar gets enabled. Press the button, the anchor associated with selected products appears in the preview.
   b. Adjust position, size and other parameters of selected product.
   Once you positioned your product, leave the anchor preview by the same toolbar button. This show the live feed again.
3. Note: The button 'Show Anchor Image' is cannot be pressed (is disabled) when no product is selected, or selected product has no anchor tracking selected, or anchor frame does not exist (was removed). Please check the tracking types of selected product and or anchor frames.

Tracking availability

Anchor tracking is available when the system recognizes the reference frame in the incoming video feed. All products linked to the anchor get visible in the preview. Press “GO” to show the products on-air. Products with available tracking (visible in the preview or on-air) have small anchor in the upper right corner of the Product button.

Every time the system recognizes the reference frame the product is automatically placed into the live image. Operators can then show this product on air using “Go” button.

Perspective

You can define perspective for each anchor. Then it can be used to achieve correct perspective distortion of the graphics.
The perspective is based on Vanishing point(s) definition for the real scene. Then the system can make sure, the vanishing points of the graphics and the scene are equal.
The perspective is saved together with the anchor.

Define Vanishing points

Activate the anchor preview. Two Vanishing point buttons appear next to the Anchor preview button.
If the vanishing point has been defined, the icon changes to indicate that it is ready to use.

Operation pattern:
Select one Vanishing Point button.

Draw pair of lines into the video preview. These two lines must be parallel in the real scene.

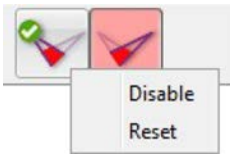
Select the second Vanishing point button and draw another pair of lines in the preview. Again, this second pair of lines must be parallel in the real scene. Moreover, the second pair of lines should be perpendicular to the first pair of lines.

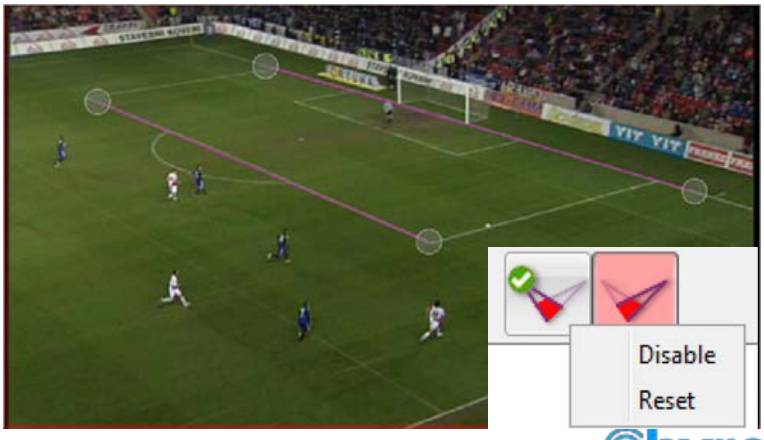
Generally, the second vanishing points is not needed to be defined. With one point perspective the system shows perspective hint in one axis of the graphics only.

During Vanishing point definition the graphic is hidden. Unselect the Vanishing point button to go back to graphics adjustment mode.

There is popup menu available for each button:
Disable – Disables the vanishing point. Definition of the point is kept. Since then, the point is handled as undefined. The point is re-enabled by pressing the button again.

Reset – Clears the lines defining the point. You can redefine the lines.





Perspective use
The perspective setting is available in anchor preview only. Vanishing point buttons must be unpressed and at least one Vanishing point must be defined.

Adjusting graphics by corner manipulators
When you drag or hover one of the corners of a product, the system provides hint where the corner should be placed to fit the perspective (see the magenta-color lines).Automatic snap: drag the corner manipulator close to the computed position. It will jump to computed position automatically.

Automatic setting
Hover the translation manipulator in the center of the product. The system provides hint around the whole product that fits the perspective. Now you can press shortcut for the 'Set Perspective' action. The graphics will fit the hint rectangle. The action is also available in main menu Edit → Set Perspective and include current keyboard mapping. The menu action works when only one product is selected.
Also the shortcut can be used without hovering the product when only one product is selected.

One vanishing point perspective
When only one vanishing point is defined, the system provides hint in one axis of the graphics only.
Hover or drag one of the corner manipulators. Lines from the vanishing point is drawn. The line connects positions, where the corner can be placed to fit the perspective. Snap to the line during corner dragging is also provided.For one point perspective the automatic setting is not available.

PROGRAM — ISO COMPARISON

The 8.1 release introduces a new program-to-isolated camera comparison workflow that supports Virtual Placement as a downstream solution. The workflow reduces delay and helps ensure the correct calibration is loaded when a camera goes to air on the VP output

In this specific setup the isolated camera is coming in to VP on the first input **<AuxCameraIds value="0"/>** and the PGM feed is coming in on the second input **<CameraId value="1"/>**.

The delay between PGM feed and the isolated camera can be set but in most cases the PGM already adds a natural delay in comparison to the isolated camera so **<Delay value="60"/>**

- Can be set to 0 as a starting point when setting up.
- Delay is set in frames/fields

To add the function into VP this following code needs to be added to the advanced section of the config editor:

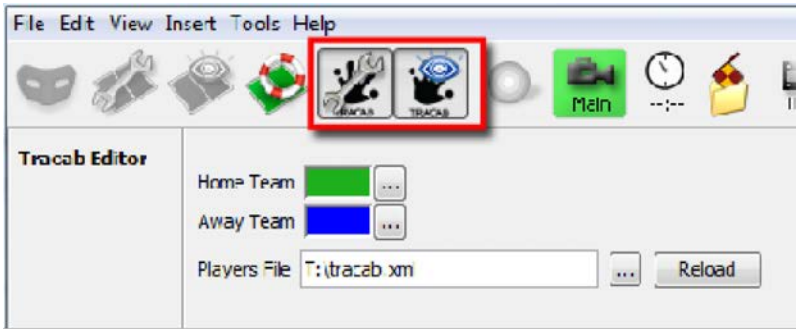
```
<MixedFeedTracker>

    <CameraId value="1"/>

    <AuxCameraIds value="0"/>

    <!-- approx. 1 second delay for 59.94 Hz -->

    <Delay value="60"/>

</MixedFeedTracker>
```

TRACAB PLAYER TRACKING

This product integrates Tracab player tracking technology with Virtual Placement. Tracab system provides information about players positions. This can be used to visualize player attached graphics.
Before using this product you are required to do manual configuration. See Installation guide for more details. Once configuration is done you should be able to add this product to your project.

Tracab Settings editor
You can set two team colors. These colors helps you recognize the teams. The colors are only used in the preview or in the UI. The color is never used in final video rendering. The setting is stored in application wide storage, not in project file.
Players Definition File editor allows you to choose a file containing player lineup.

Player Selector and Player Icons
Enable or disable Tracab Player Selector and Player Icons. Player lineups are shown next to the preview window and player icons show up in the preview.



Player Icons
Under each tracked player, small rectangle with player number is rendered. There is a thin color bar at the top of the player icon that indicates player team. If the target has no team assigned then no color is rendered. If no jersey number is assigned then no number is shown.
The player icons and can be selected/unselected by clicking a mouse.
The icons are clickable even when jersey number or team is not assigned to the player. Then you can show graphics for these players without need to assign jersey number in Tracab system. Selection is visible in preview only and there's 'X' mark rendered for

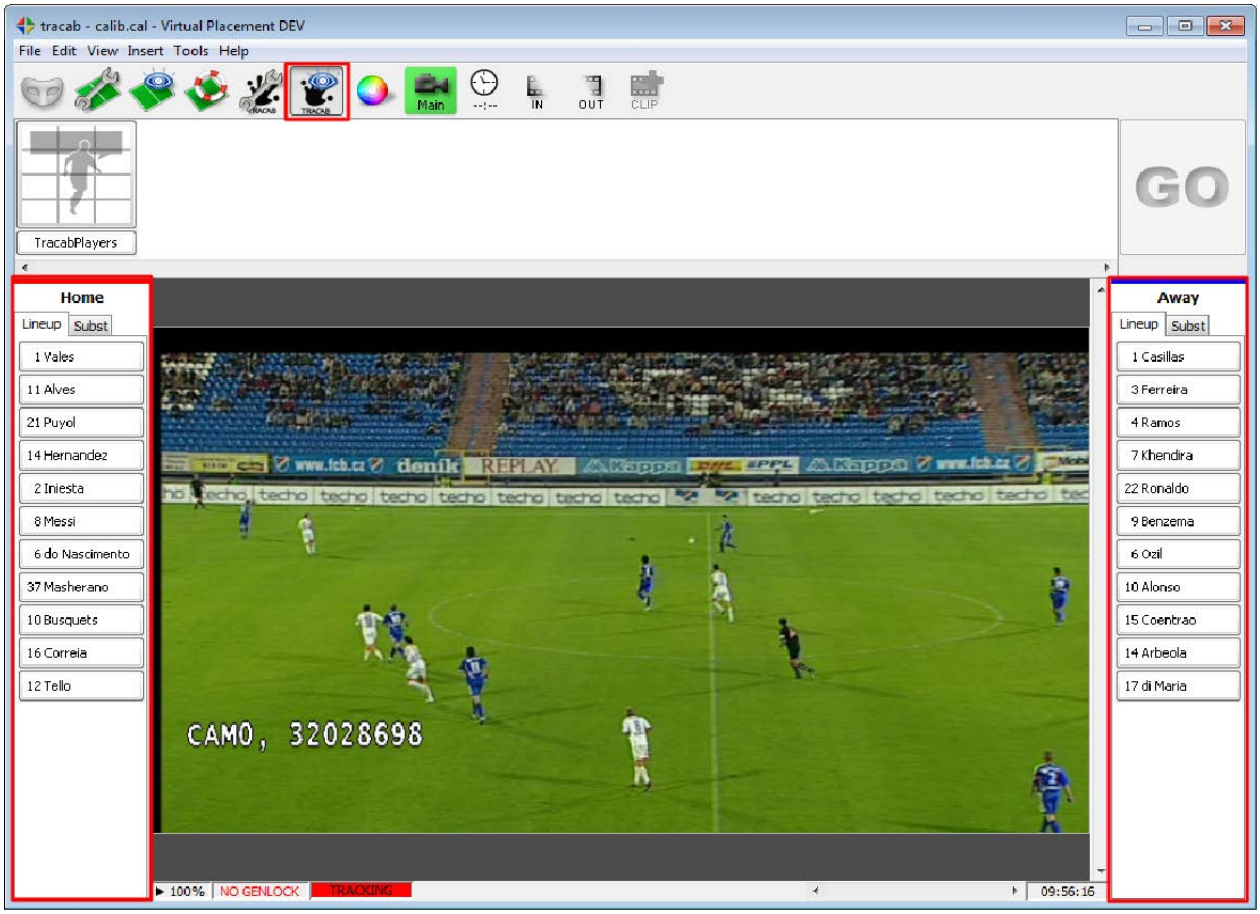
unassigned players on the Product button.

Tracab Player Selector
The selector contains 2 panels on both sides of the video preview, with buttons for all players defined in Players Definition File.The buttons serve for fast selection of players and load the selected into a Tracab Players product. The selector contains all players from Players Definition File in given order.
Selection in the tracab selector is cleared each time the Selector is open. Additionally you can clear the selection from popup menu invoked anywhere above the Selector.

Selection Workflow

1. Select players you would like to load into the product (in the Tracab Player Selector or click the Player Icons.
2. Press Tracab Players product button – selected players are loaded and visualized on the product button.

When the Player selector is visible, all clicks to the product will update players assigned to the product. To select the product, click the Product button with CTRL key down, click the bottom button of the Product button or close the Player Selector.



Players Definition File
Information about available players are delivered via xml file. Specify the file in the Tracab Settings editor. The file has following structure:

```
<Tracab>
 <HomeTeam>
```

```
    <Group name="Lineup">
      <Player jerseyNo="2" lastName="Vales" myVariable="25"/>
      <Player jerseyNo="1" lastName="Alves" myVariable="26"/>
      …
    </Group>
    <Group name="Subst">
      <Player jerseyNo="2" lastName="Ferreira" age="31"/>
    </Group>
  </HomeTeam>
  <AwayTeam>
    <Group name="">
      <Player jerseyNo="2" lastName="Ferreira" age="31"/>
      <Player jerseyNo="3" lastName="Ramos" age="28"/>
     …
    </Group>
  </AwayTeam>
</Tracab>
```

Mandatory elements and attributes are bold. Except those, you can add any attributes to the Player element of your choice. All attributes can be referenced in the Style editor and rendered in the Player graphics.
The players can be divided into several groups. Each group of players is displayed in its own tab in the Player selector. When each team contains only one group, the tabs stay hidden.

A third party application can send updated data via an XML, which Virtual Placement can read automatically if the auto update is enabled within the Tracab editor.

Product Button

Player tracking product can render graphics attached to individual player. The graphics is customized by style. The style is user editable.
The thumbnail of the button is composed dynamically, according to elements actually enabled in the style.

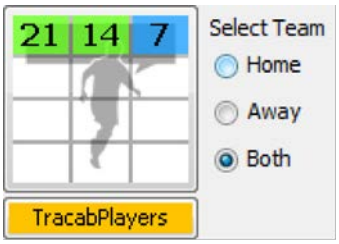
The thumbnail contains player numbers assigned to this product. Each player number has background assigned to its team (see Tracab Settings editor.)

Team Editor

Team editor is accessible from the popup menu of the Product Button. You can reserve the Tracab players to single team only. When a team is specified, the product will contain only players from selected team. This filtering rule is applied during selection only (see Selection Workflow).

Style editor

The player is visualized according to the defined style. The style is embedded inside the product and therefore stored in the project file. If you want to share the style you can export and import the style to/from a separate file.
Style editor is accessible from the popup menu of the Product Button.



The graphics is composed of several parts. Each part can be disabled/enabled. You can use either image file or GTC clip file. The system can automatically recognize the file type. For clip you can define a loop start frame. This is useful when your clip has a in-animation to show the graphics and then a looping part to be used during the presence on the screen. There is a short fade-out when taking the graphics off air.

This icon on the tab means that part of the graphics defined in the tab is enabled and will be rendered.

Additional lines can be added to the above player text providing greater flexibility when creating top fonts.

Variables

Text and File fields may contain a variable, which is later replaced by its value.

`$(TRACAB:myVariable)`	Replaced by value of myVariable attribute defined for each player in the Players Definition File
`$(TRACAB:TEAMID)`	Replaced by team identifier. TEAMID is NOT a reference to attribute name, but is replaced by following constant: 1 – for Home team 2 – for Away team

Variable can reference value of any attribute of the Player element defined in Players Definition File. When the variable is used in File field, you must specify, whether the referenced file is an image or a GTC clip.

Text Formatting

Some graphics can contain a text field. There are values provided by the application that can use used in formatted string. See table of all supported variable names on page .

The format string is is compatible with ANSI C printf() function. Example:

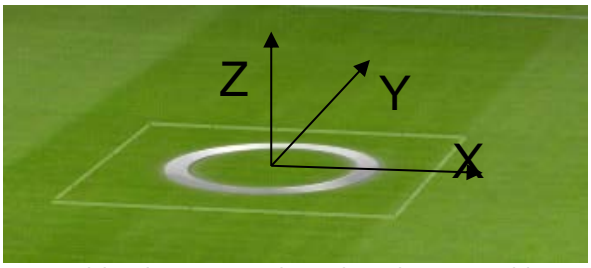
- `%.0f` - no decimal digits (e.g. 10).
- `%.1f` - one decimal place after the decimal point (e.g. 10.1).
- `%MPH$.1f` – picks value “Speed in miles/hour” and uses one decimal point formatting.

Supported value names

KMH	Speed in km/h

M	Distance in meters
KM	Distance in kilometers
MI	Distance in miles
YD	Distance in yards
FT	Distance in feet
MPH	Speed in miles/h
MS	Speed in m/s
P*id*	Custom property of given ID. The ID is a number.

Element - Graphics under the player



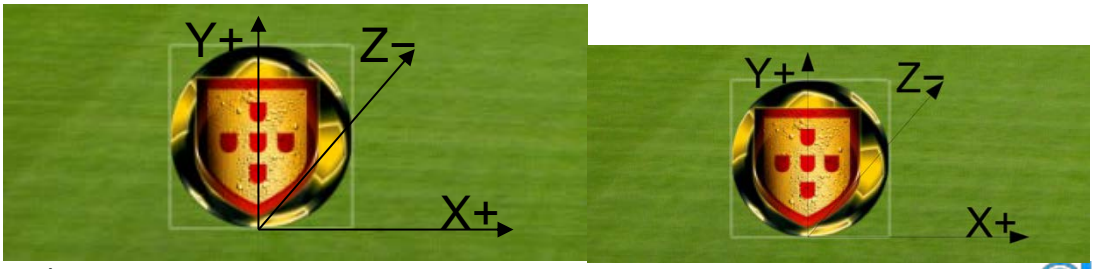
The graphics is centered on the player position.
The tracking type is "Pitch".
Keyer is set to chroma keyer. When multiple chroma keyers are in use, you can select the keyer instance in popup menu "Keyer" for the Tracab product.

Colors
Original colors: No effect will be applied.
One color: White color in the graphics is replaced by user defined color.
Three colors: RGB colors are replaced by three user defined colors.

Opacity applied to the image/gtc clip.

Size
Fixed: Graphic element keeps constant size defined in the style editor [in meters].
Scale: Scale the graphics to another player. You can choose among Closest opponent, Closest teammate and Next selected player.
Player 2 coords: you can define point in the texture of the 2nd player [in range <0, 1> for both x and y where [0, 0] is lower left corner of the texture]. Center of the texture is under the 1st player.

Element - Graphics above the player



The plane with the player graphics automatically rotates in Y axis to face the camera. The graphics is centered in X and touches the pitch at the player position.

Keyer type is linear.
The visibility order is fixed so the image/clip is always behind the jersey number. The order cannot be changed. The Z coordinate does not have any effect on the ordering.

Colors
Original colors: No effect will be applied.
One color: White color in the graphics is replaced by user defined color.
Three colors: RGB colors are replaced by three user defined colors.

Opacity applied to the image/gtc clip.

Minimum Size - You can specify minimum size of the graphics. It is guaranteed, the graphics is never scaled down under the specified value. Minimum size is set in percents of the screen size (0 means disabled, value of 100 means full screen size.)

Text delay in
When a non-zero value is set, the text production begin is delayed (by specified number of video fields.) After that time, the text begins to fade-in.

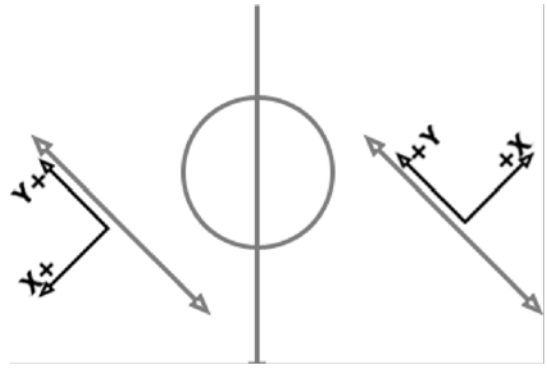
Text delay out
When a non-zero value is set, the text production is finished at after given number of video fields from the stop production command (incl. fade out.)

Loop/Pause - Can be applied on .gtc clip.
Loop – specify frame, where the loop begins. When in on-air, the clip will loop from the loop begin to the end of the clip.
Pause – specify frame, where the clip is pause when on-air. Press the GO button again to play the clip to the end. Allows to have animated out-effect.

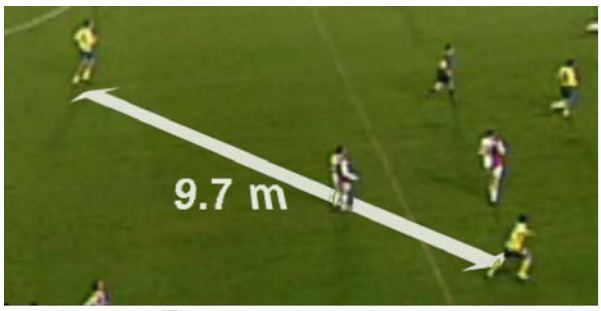
Text can have named values. See Text Formatting.
Distance Measuring
Absolute - Length of player's trace form the start of the match.
Elapsed - Length of player's trace form the moment the product gets on-air.

Text Style – see Text Style.

Element - Interconnecting lines
Connects selected player by lines. Lines are rendered in the pitch plane. Lines can be optionally textured.Players are connected in the order as they were selected.



Optionally you can enable rendering of distance between the players. The distance is rendered next to the center of the line (if the center of the line is on the left side of the pitch, the text is rendered on the left hand side as well, and vice versa). You can specify offset from the centre



of the text. The offset is set in meters from the center of the interconnecting line in the coordinates of the line. The orientation of the coordinate system depends on the side of the pitch. The text can be placed on the pitch, in upright billboard mode, or billboard facing mode, which always faces the camera.
Text can have following named values (presented in order). See Text Formatting.

M	Meters
KM	Kilometers
MI	Miles
YD	Yards
FT	Feet

Text Style – see Text Style.

Fill - Creates fill polygon with specified color between selected players. When the fill is combined with Interconnecting lines, an extra line is added between the first and the last player, so the lines form outline of the polygon fill.

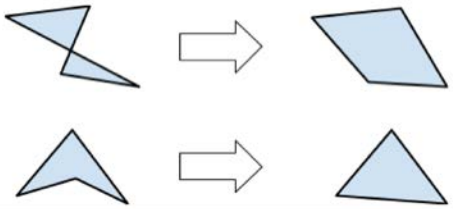
Convex Hull – Ensures the Interconnecting lines from a convex polygon (not crossing each other). Applies only when the Interconnecting lines are closed (Fill is enabled.)

Fixed Point - Allows the user to select a fixed point within the image, and the assign additional points to moving targets.

Element - Trail
Draws trajectory of a player. The trajectory is rendered in the pitch plane.

Like the Interconnecting line, the trail can be optionally textured.

Trail type



FROM_START	The trail is drawn from production start to current player's position.
TO_END	The trail is drawn from current player's position to the end (shows where the player will run). This mode is available when production start and end is known (see Video file Recorder, Game Actions).

Element - Lower third
Displays label with actual performance information for actually selected player(s).

- All graphics used in Distance and speed are positioned in screen coordinates.
- Tracking and chroma keyer is disabled.
- Position of the background image/gtc clip means position of its center. Position of the text is defined by offset from the background position to the pivot of the text. The pivot is dependent on the text alignment and is computed from its bounding box (middle of the left side for left aligned text).
- Text can have named values. See Text Formatting.

Distance Measuring

- **Absolute** - Length of player's trace form the start of the match.
- **Elapsed** - Length of player's trace form the moment the product gets on-air.
- **Difference** – Distance between two players.

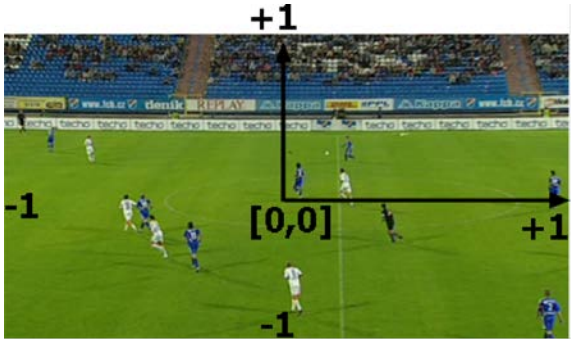
Screen coordinate system
The center of the system is in the middle of the screen, with coordinate [-1,-1] in the lower left corner, and [1,1] in the upper right corner.

Text delay in
When a non-zero value is set, the text production begin is delayed (by specified number of video fields.) After that time, the text begins to fade-in.

Text delay out
When a non-zero value is set, the text production is finished at after given number of video fields from the stop production command (incl. fade out.)

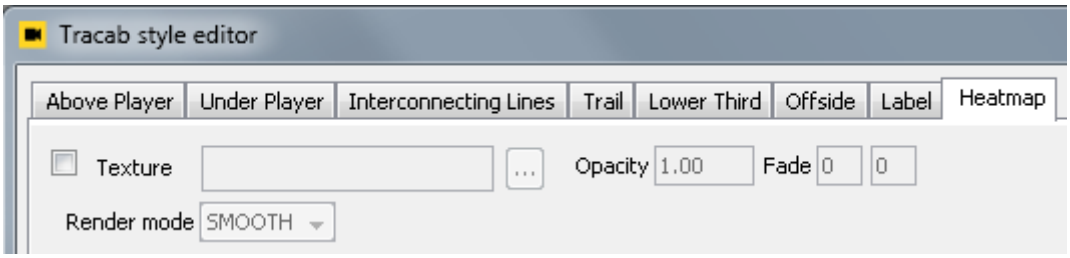
Text Style – see Text Style.

Element - Offside
Displays 2 lines, one on position of the last defender, one on position of the attacker closest to the opponent's goal line. When the attacker is in potentially positive offside position, the attacker line might be drawn using different color. Offside ignores players actually assigned to the product, the players concerned are picked automatically.



Style

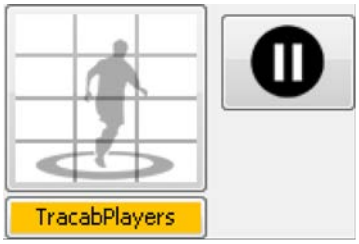
- **Texture** – Offside line texture. The texture is stretched vertically to cover the whole pitch width and horizontally to fit specified width.
- **Width** – Width of the lines on the pitch (in meters).
- **Defender** – color of the line drawn on position of the last defender.
- **Attacker default** – color of the line drawn on the position of the attacker closest to opponent's goal line, not being in offside position.
- **Attacker offside** - color of the line drawn on position of the attacker in potential offside.
- **Team** – Attacking team. The attacking line is drawn for attacker from this team, the defender line is drawn for player from the opponent's team. Use two Tracab Players products with different Team set to cover offside for both teams.
- **Heatmap** — Virtual placemen has the ability to show a heatmap under players when integrated with a Tracab system. The heatmap functionality will only work with live data from Tracab (using TDC 4.5.9.2 or later), this capability is not supported in replay mode.



Texture – Select graphic file for heatmap texture
Opacity – Adjust the transparency of the texture
Fade – In/Out dissolves for texture

Render mode – Smooth will soften the squares for a more fluid look to the heatmap (as default).
– Tiles will maintain the squares edges for a more chequered look to the heatmap.

Automatic playback pause



Set pause point at the time of an Offside situation (use Pause button next to the product button). During playback, the video will stop at this point.
The stop point is shared for all Tracab Players products. However, the stop point can be stored to a clip (see Video file Recorder, 'Store product selection to the clip' toolbar button). Once the clip is recalled, the product is automatically selected and saved pause point is activated.

Text Style

Text style is placed in a standalone .xml file (having TextStyle root element). The style is referenced from the Distance and Speed Style editor. Style may contain following properties of the text.

FontHAlign	Horizontal alignment { LEFT | CENTER | RIGHT | DOT_FIRST | DOT_LAST }
FontHAlignChar	Horizontal alignment character
FontVAlign	Vertical alignment { TOP | CENTER | BOTTOM | FIRST | LAST }
FontLineSpacing	Relative line spacing. Value 1.0 means spacing by the height of the font.
FontLineFlowPolicy	Behavior for lines wider then defined limit. { DONT_CARE | SCALE | UNIFORM_SCALE | SOFT_NEWLINE | HARD_NEWLINE | SOFT_SKIP | HARD_SKIP | SINGLE_LINE }
FontLineWidth	Line width limit. (see FontLineFlowPolicy)
FontFixedPitch	Fixed character pitch. (disables kerning defined by font).
FontKerning	Additional kerning.
FontCapitalsRatio	If enabled (value > 0) then all characters are made capitals. The original non capital letters are rendered smaller. This value defines factor for that scale.
FontName	Name of the font. All system fonts are available.
FontResolution	Font texture resolution in pixels. It should approximate match the pixel size on the screen.
FontBaseColorMode	Coloring text mode. { SOLID | CHAR_4POINTS | LINE_4POINTS | GLOBAL_4POINTS | LINE_2GRADIENTS }
FontBaseColor	Color to be used when mode is SOLID
FontBaseColorP1	Color for gradient coloring
FontBaseColorP2	Color for gradient coloring

FontBaseColorP3	Color for gradient coloring
FontBaseColorP4	Color for gradient coloring
FontOutlineSize	Size of outline in pixels. Set to zero to disable outline.
FontOutlineColor	Outline color.
FontShadowOffset	Relative offset of shadow to normal text.
FontShadowBlur	Amount of blur of the shadow.
FontShadowColor	Shadow color.

Example:

```
<TextStyle>
   <FontHAlign value="RIGHT"/>
   <FontCapitalsRatio value="0.7"/>
   <FontName value="Arial-Bold"/>
   <FontResolution value="70"/>
   <FontBaseColor value="[0.29,0.32,0.69,0.84]"/>
 </TextStyle>
```

FEATURES

Virtual Video Screen (Jumbotron)

The video screen object allows you to enhance the production with big virtual video wall. The video screen is made of two components:

- **Clip**: The look of the video screen is made by the clip file. The clip defines the opening/closing animation and the overall design of the video screen. The clip also defines how the video signal is inserted into the clip images
- **Live Video Input:** The video is delivered to computer as SDI signal and mixed with background clip.

Video Screen Configuration

You have to configure video texture. This configuration must be done manually.

Open `config.xml` (Use shortcut accessible via `Start → Programs → Virtual Placement → Config Editor`)

Navigate to section VideoTexture and change the setting based on following tips:

```
<VideoTexture>
    <Enabled value="1"/>
    <WithAlpha value="0"/>
    <CardId value="0"/>
    <ConnectorId value="1"/>
</VideoTexture>
```

The card Id/ connectorId depends on your HW configuration. If you have one Bluefish SD DualLink Pro card, then the CardId is 0 and ConnectorId is 1. (ConnectorId 0 is used for main video input).

Once you modify the file, restart User Field Product = Virtual Placement. You can verify the video texture functionality by adding product „Video Input“. You should see the picture that comes on SDI input.

Video Screen Preparation

The clip can be designed and rendered using 3DS Max 7 or newer. The rendered image sequence must be converted to GTC file use GTC Clip Convertor 2.0 or newer. See page

Appendix A – GTC Video Warping Support for more details.

Video Screen Production

To show the video screen you need the clip file (GTC), properly configured User Field Product = Virtual Placement and valid SDI signal.
When you load a valid clip file the system automatically recognize that the clip contains information about insertion of video feed. The clip is then mixed with video in both preview and main output. Once the clip is loaded, the production is then exactly the same as normal clip file.

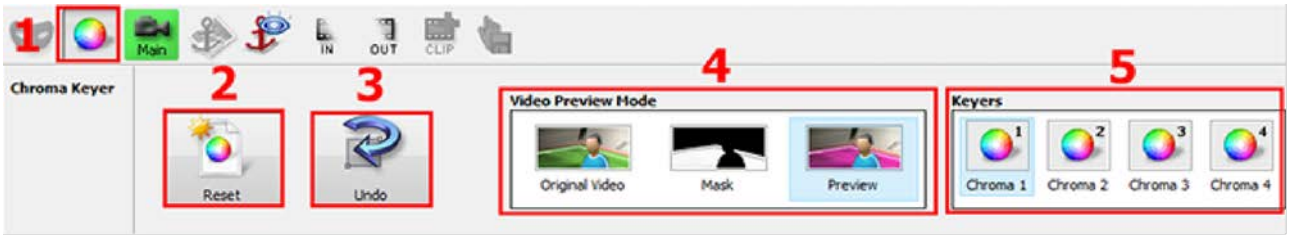
Video Screen Settings

There are some options that can be adjusted inside the warping clip's Video editor.

Video Feed	Background	Background video is used as the effect video.
	Input 1	Video texture input (see config.xml) is used as a video source.
Warp Mode	DEFAULT	Video feed color is combined with a gtc clip color. Allows to create e.g. shadow on the video area.
	BLEND	Useful when there are some semi-transparent areas of video. Handles premultiplied aux alpha better than BLEND.
Warp UV Source	TEXTURE	Aux UV channel of gtc clip is used as a warp effect UV source.
	CONTENT	Bounding rectangle of the clip defines mapping UV coordinates. No need to have aux UV channel in gtc clip. Useful for video masking.

Chroma Keyer

To adjust keyed colors for the chroma keyer, display the Chroma Keyer Editor using the Chroma Keyer button (1) in the main toolbar.



The editor contains button for removing the whole chroma key setting for current chroma key instance (2), button to Undo the last pick (3), 3 preview modes (4) and 4 chroma key instances (5).
First, select the instance you want to edit. The instances are independent on each other, each product can use different chroma key instance. The chroma key instance can have user defined name. Rename action is accessible from the popup menu for each instance.

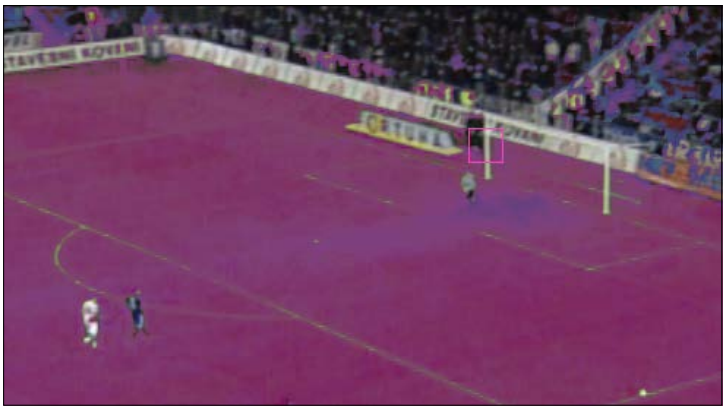
All the time the editor is active, you can pick the chroma color in the video preview. The picked area used to recompute the keyer color is drawn as square. You can adjust its size by mouse wheel. Currently picked color is added to the set of existing colors. The color setting is camera-wise and must be set for all live cameras individually. Recorder uses color settings from it's live camera.

There is a Copy&Paste feature accessible from the main menu or keyboard shortcut. Copy and Paste operations are invoked in context of currently selected chroma key instance. They don't affect other instances. Settings for all cameras are copied/pasted.

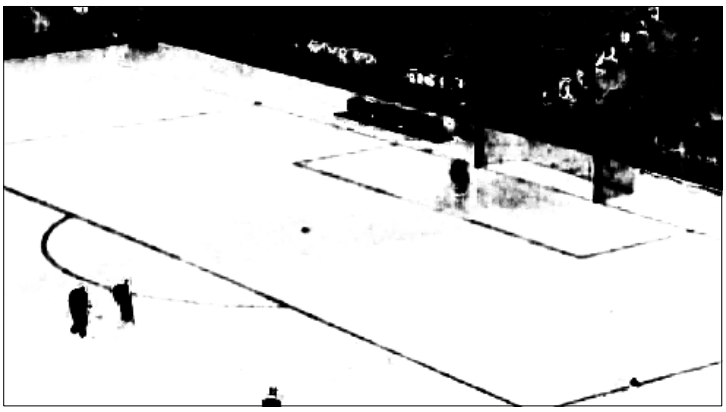
Export/Import
You can export the keyer setting into an external file of your choice (.chr). This allows you to create collection of settings in pre-production time, and switch the setting during production. Or share the settings among several computers.
Export and import is done on the selected chroma key instance, the others are not affected. Exported is only setting for the currently selected camera, and import replaces setting selected camera only as well.

Try to pick colors that are similar by one pick. If the colors inside the picking area differ too much then make two picks.

The best way to set the chroma key correctly is using one of the keyer preview modes.
Mask: Shows the keyer mask. The white areas will be used for keying and will be replaced



by a product. The black areas will keep the original color and won't be used for keying.
Preview: Shows combination of mask and original video, which makes the picking easier. Partially transparent color shows the areas which will be keyed.

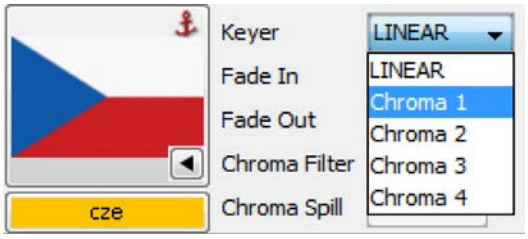


Keyer Setting

1) Select one chroma key instance
2) Select one of the preview modes.
3) Resize the picking area by the mouse wheel so it covers as large an area as possible for picking.
4) Pick one of the 'dirty' regions which you would like to be keyed, but is not covered by the keyer color yet.
5) Repeat steps 2-3 until the chroma keyer colors contains all desired colors for keying
6) Repeat steps 4-4 for all live cameras.
7) Repeat steps 1-5 for desired number of chroma key instances.

Choose chroma key to use

Each product can use a different chroma key, the list of chroma keys available is in the Keyer & Fade editor accessible from each product's popup menu.



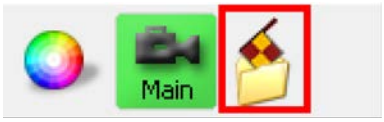
Automatic (Adaptive) Chroma Keyer

If Adaptive keyer has been enabled, the Chroma key editor will only show the key that has been generated automatically. It is not possible for you to add or remove Chroma keyer colors when adaptive keyer is enabled but adaptive keyer can be disabled in runtime.

Recorder

Virtual Placement comes with a built-in disk recorder. You can switch from live feed to recorded footage using the Camera button in the Toolbar. The Recorder mode allows the use of all the production tools available in Live. You can go through recorded footage using the Jog/Shuttle device.

Jump to time (time of the day of the target record) function is available in the main Menu → Tools.



RAM Recorder

The built-in video recorder set to RAM mode doesn't have large capacity. Ram recorder is useful for quick replays (typically an offside situation).

RAM clips export

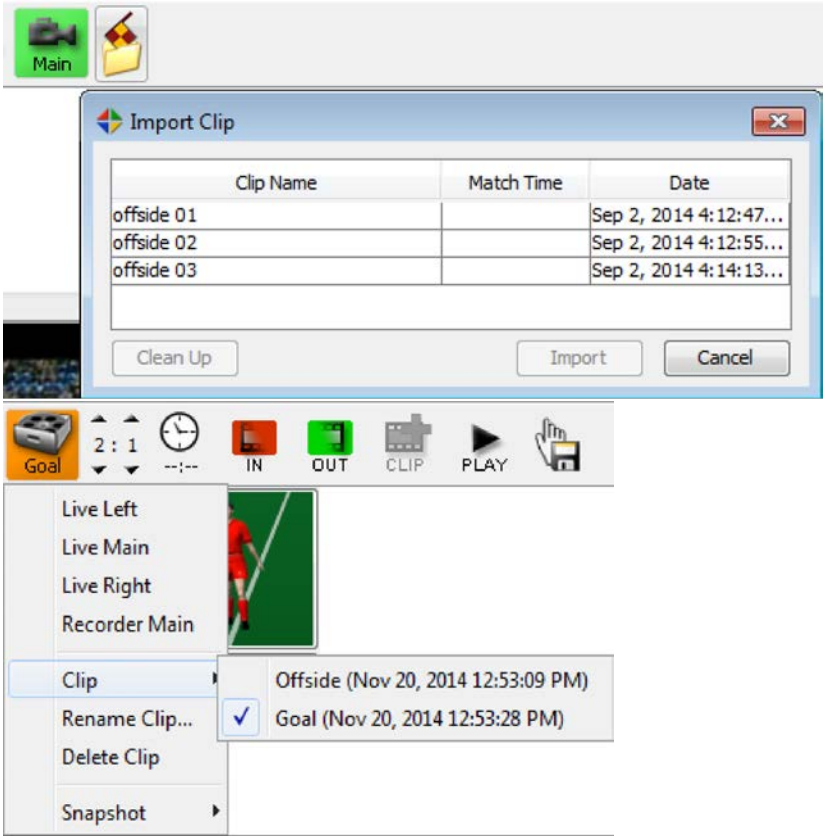
It might be useful to store the current clip for later playback, e. g. for highlights after the match. If you're in an offside clip, which you would like to save for future use, press the export clip button. A dialog with export progress appears. The operation may take a while, about 10 seconds for HD clips. The clip is exported including data to replay the offside. The export process is executed in the background. You can use the system normally during the export. Length of the exported clip is the same as recorded footage available for offside production, in default about 30 seconds.
The clips are exported in internal format and can be played in Virtual Placement only.

Stored RAM Clips Playback

Exported clips dialog can be invoked from the exported clips button or from JLCooper Jog/Shuttle controller by pressing button W4 (default function). The dialog allows simple clip administration (remove, rename).
Before import, make sure the calibration corresponding to the source footage is loaded. As the clip is loaded, you can do usual operations available during offside production.
Important note: The clip is exported including all tracking data which are used for playback. If the tracking is incorrect, you can override the saved data with semitracking. Mind, you can use either saved or semitracking data only! Semitracking in clip doesn't restart tracker to produce exact automatic data as you're used to it from live cameras!

The exported offside clips dialog could be controlled also using JLCooper Jog/Shuttle as shown on the following schema:

Video file Recorder



Recorder set to Video file allows to use larger video file than RAM mode.

When part of recorded footage is marked as Clip, it is locked and never overwritten. Not locked footage is periodically overwritten.
Each clip is defined by its In and Out point. These points can be redefined later.
Existing clips are accessible from the menu for Camera button. For better orientation the menu contains date and time when the clip was created.
Once the clip is selected, its name is rendered on the Camera button.
The clip might be locked in all available recorded cameras (depends on the configuration, see Installation Guide, chapter 'Recorded Clips'. You can switch between cameras using the camera popup menu or keyboard / Jog Shuttle mappable actions.

Create clip

Mark In and Out point of the clip and press Create clip button. The clip is created and recalled.
Clip can be created with only In or Out point. Mark one of the points and press Create clip button. The system automatically computes the complementary point according to the default duration specified in config and creates a clip. In this case the clip is not automatically recalled.
When a clip is selected you can Delete and Rename the clip from the Camera button menu.
You can map actions to set In/Out point to the Jog/Shuttle controller.
There's also FastJogSwitch action mappable to the Jog/Shuttle controller, which accelerates jog and shuttle for faster navigation in the recorded footage.

Toolbar buttons

The point is not defined. Press the button to define In/Out point.

The point is already defined. You can still press the button to redefine the In/Out point. Current timecode differs from In/Out point of the clip.

The point is already defined. Current timecode equals to the In/Out point of the clip.

Create clip with previously defined In/Out points.

Store product selection to the clip.

Play recorded footage.

Stop playback. When pressed in Live, recorder camera is selected.

Clip Playback

Select the clip in the Camera button menu and press play. Start point of the clip is cued. Playback stops on the End point of the clip. You can go over the In/Out using the Jog Wheel.

Start and End points of the clips is computed from its In/Out point after Preroll and Postroll are applied.

You can map actions to select a clip to the Jog/Shuttle controller.

Preroll and PostRoll

When the Preroll or Postroll is defined, the playback of the clips starts or ends beyond In/Out point of the clip. You can change the value in the Config editor, in the Advanced tab:

```
<RecordedClips>
        <Preroll value="250"/> <!-- seconds * fps -->
        <Postroll value="250"/>
</RecordedClips>
```

Production selection stored in Clip

State of selected products is stored into a clip when the clip is created. On clip recall, all products are deselected, the products stored to clip are selected.

Products are referenced by their names in the clip. Having multiple products with same name may lead to unexpected results.

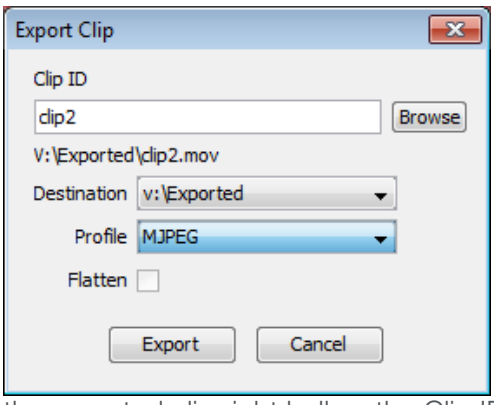
Clip export

Clips can be exported from the Video file into standalone file which can be played by any video player.

Export is available in the Camera button menu when a clip is selected.

Export dialog
Displays and allows to edit properties of the exported clip.

Clip ID
File name for the exported clip. Destination folder is added automatically if not specified. File extension is added automatically according to selected export profile. You can see full path to



the exported clip right bellow the Clip ID edit box.

Destination
You can have several predefined export settings (configurable in the Config Editor) and switch quickly among them. Destination contains path to export folder and predefined Profile.

Profile
You can have several profiles defined (with different parameters for the output codec). These profiles can be added and edited in the Config editor.
Export fails when there are invalid parameters set for the profile. Usually with error “Operation not permitted”.
Some of the codecs (like DnxHD, ProRes) are not available until a valid license is present. These licenses are distributed within Virtual Placement license.

Exporting
The process itself is blocking - a dialog with progress of the export is shown and prevents any action that would corrupt the exported clip. Once the export is finished, the clip is ready for playback in any media player.

Tracking data
Exported clip can contain information about tracking, players movement etc. These data are stored as metadata in the exported clip file. The data are present when:
this information is available (the tracking is not disabled)
selected file format supports storing metadata (currently only .mov is supported)
Tracking data might be used later when the clip is imported into Paint.

Game Actions

The idea of Actions is to mark start and end of interesting segments during the match.

Later you can navigate through the Actions and create Clips from the Actions.
Unlike Clips, the action is defined just by marks in the recorded footage. Until no Clip is

created from the Action, the footage remain unlocked (might be overwritten) and all Actions are lost when the application is closed.
Production in a Actions works the same way as for Clips.

Toolbar Buttons

Show Action toolbar via 'View → Action Toolbar' menu item.

In/Out point has not been defined.

The In/out point has been defined.

Create clip from currently selected Action. The clip is selected and ready to play.

Use IN/OUT point buttons to define start and end of the Action.

Sequence	**Meaning**
IN, OUT	Mark in and out of the Action.
IN, IN	Redefine in to current timecode.
OUT, OUT	Redefine out to current timecode.
IN ,OUT, IN	Mark in and out of the Action, mark in for the next Action.

Navigation

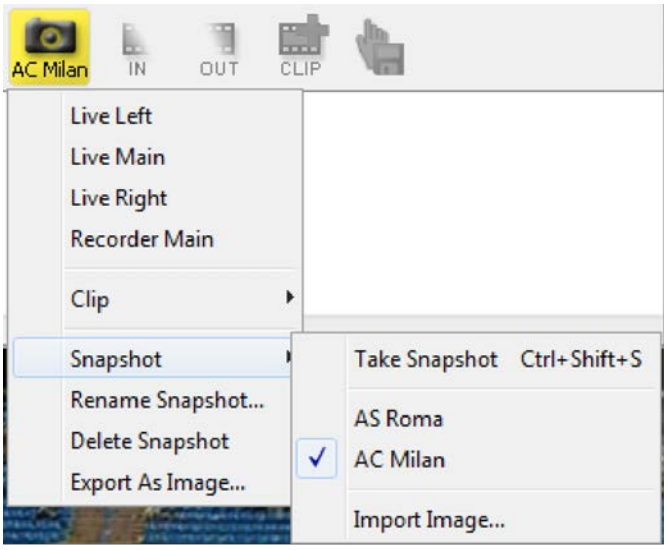
There are actions mappable to the Keyboard shortcuts or MCSP Jog/Shuttle buttons.

Available Actions

ActionBegin	Mark IN.
ActionEnd	Mark OUT.
ActionJumpToFirst	Go to first Action.
ActionNext	Go to next Action.
ActionPrevious	Go to previous Action.
ActionToClip	Create Clip from current Action.

Camera Snapshots

You can create snapshots from the live camera feed. It is helpful to create or tune graphics, without live input at time of preparing. In the office you can load snapshot of real stadium, and arrange graphics for the next production. You will get immediate feeling “how it looks like”, without any additional source of video stream.



You can see the snapshot with the graphics at the video output line. See installation Guide, Snapshots chapter.
Snapshots are controlled by the Camera button in the main Toolbar.
Snapshot menu item shows previously taken snapshots. It contains only those, which have been taken using the same Video Format, that is used for current session.
To load one of them, just select the corresponding menu item. Leave it by selecting one of Live cameras in the menu.

Snapshot Import/Export

Snapshot images can be exported or imported to/from image file. Supported are common image formats (.jpg, .png etc.).
The export and import of snapshot image causes lots of certain information that are normally stored in snapshots. Data like chroma keyer setting and tracking data are not exported.

Score Widget

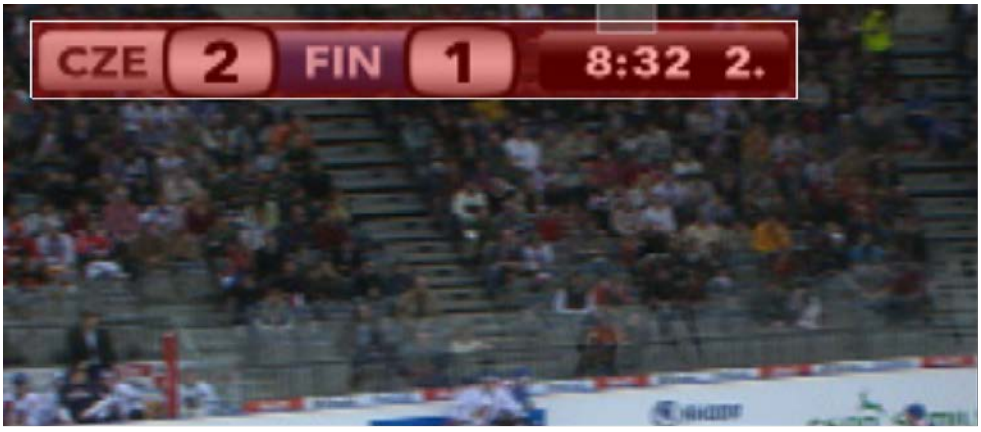
The Score Widget is here for you to ease up production containing actual score. You can change score very simply by clicking the increase/decrease button.

Score Widget sets application variables SCORE1 and SCORE2 to the value shown on the widget.
See Appendix C – Application Variables.section and Text Product section to learn how you can use those variables in the production.

Mask

The mask setting has allows to define portions of video screen that will be excluded from tracking and inserting any of your graphics.

This mask is useful when you want to not overlay your graphics over timing and score graphics already present in the video. The same area is also very good to exclude from tracking. Black borders around the video should always included in the mask. Especially when doing graphics of already letterboxed video.



The Mask is visualized permanently as a red transparent color over the video.

Insert area setting is stored in the project, so it will change when other project is loaded. You can prepare several masks in your project. The masks could be then switched by keyboard shortcuts Ctrl-1 up to Ctrl-9. Switching the masks can be done even if the mask editor is not open.

You can define the Mask in two ways:

- Rectangular area drawn manually
- Loading mask stored in an image file

Mask editor

Click the Show Mask editor button in the toolbar.

The editor contains thumbnails of all masks available for current project.

When the editor is open, an additional toolbar appears next to the main toolbar.


Show/Hide the Mask editor


Add Image mask. File chooser appears to browse for the mask file.


Removes all negative regions from currently selected Area Mask. This button is available when the Area mask is selected.

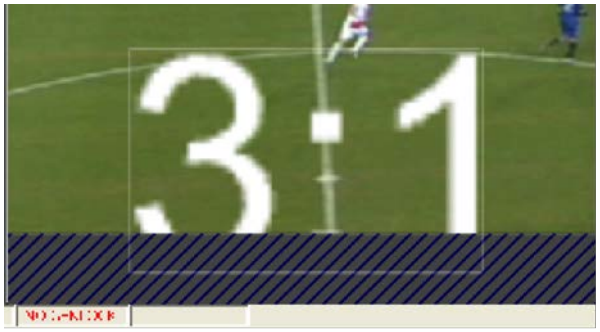

Undo last change.

- If previous operation was adding mask, the mask is removed.
- If previous operation was Remove all mask, the removed masks are added back.

Area mask

Select the Area mask item in the editor. (first on the image above)
There is a rectangle with 4 manipulators (1) in the preview window. Set them to define a bounding rectangle where the products can be shown. Graphics outside this area won't be visible.
The global rectangle defines positive region, where the rendering will be performed, but sometimes you may want to define negative sub-regions, to keep them clean of product rendering (2).
In this case, just press left mouse button in the preview and draw the desired negative rectangle during Insert area editing.

Insert area not set



Insert area set to follow the black region

Negative region set on the score bar

No negative region set

Image Mask

When the mask is more complicated you can prepare your own image masks in advance. First prepare the mask. Create a gray-scale image with the same resolution as set in your system. The black pixels makes normal graphics insertion and those that are tracked. The white pixels makes the graphics invisible and are ignored by the tracker. You can use Black/White gradient to control the opacity of graphics insertion. Save the mask into a PNG file and copy into your project directory. The mask image can look like this:

You can remove the image mask from popup menu of an Image mask item.

AutoMask

Automatic masking provides a more automated process for masking out and replacing elements within the video feed.

Typically It can be used on lower third or game clock area within the incoming video feed.

In this mode a mask is selected from a predefined sets of masks, the mast selection is then done automatically according to the Mask templates that were available.

The mask must have the same name as It's counterpart template image In order for Virtual Placement to replace the image.

To add a mask with its template open mask editor click an mask button and pick a mask image, template images will be searched and associated automatically

Supported file formats are TGA,PNG,RGB and JPG.

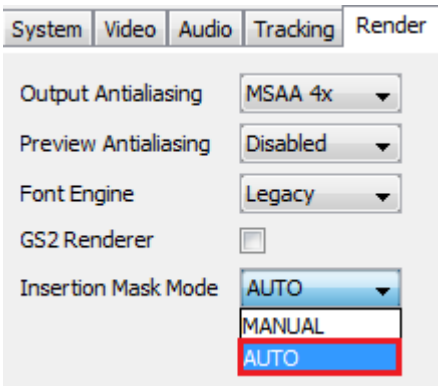
Example:

Image mask path:
C:/User/User/Documents\VirtualPlacementProjects/mask/ImageMask.png

Template path:

C:/User/User/Documents\VirtualPlacementProjects/mask/templates/ImageMask.png

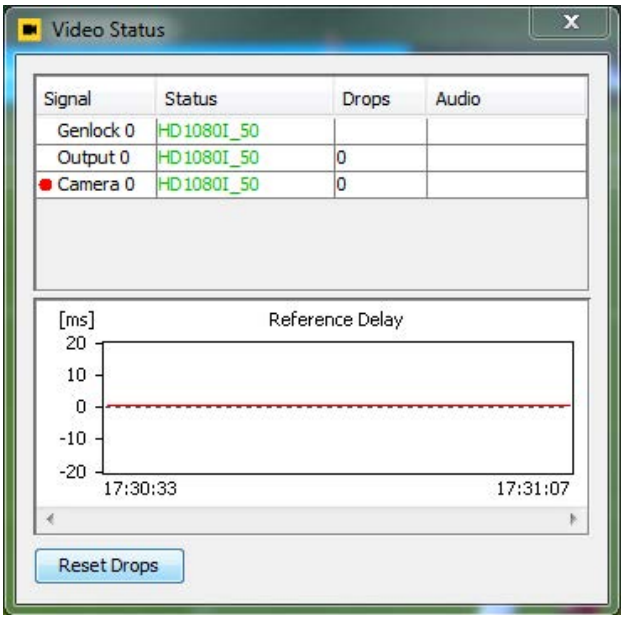
In order to enable auto masking,Select the virtual placement config editor and the click the Render tab.



It is possible to override automatic mask selection by invoking SelectMaskOverride/DeselectMaskOverride actions. See Actions.html documentation for detailed info about these actions.

Video Status Dialog

Open the Video Status Dialog via Tools → Video Status menu item.



The upper part of the dialog contains table with:

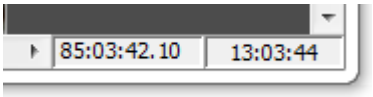
- All available (connected) signals .
- Their actual video format.
- Their audio status (Volume Unit meter). If audio channel count is 4 or less, horizontal audio bars are used, in the case of channel count is greater than 4 and up to 16, audio is rendered to smaller vertical bars.
- The amount of Drop frames.

Reference delay

The plot displays delay between input signals and genlock. Well synchronized inputs with genlock result in delay values close to 0. Constant value other than 0 can be compensated by Genlock setting in the Config editor. Increasing, decreasing or wobbling chart indicates that the input is not synchronized with genlock.

Time Status

Status bar shows both Video timecode and System time.



Video Timecode
Shows video timecode of the video frame currently displayed in the preview formatted human-readable form. This timecode is an internal timecode without real meaning, but might be helpful for navigation in the recorded footage.

JLCooper Jog/Shuttle MCS3 Control

Function Assignment Customization
You can change functionality connected with the buttons. To do that, modify function assignment in the config file. See Installation Guide with more accurate description and list of available functions.

Controller Setting
Mind that JLCooper Jog/Shuttle needs specific installation. See Installation Guide for more information.

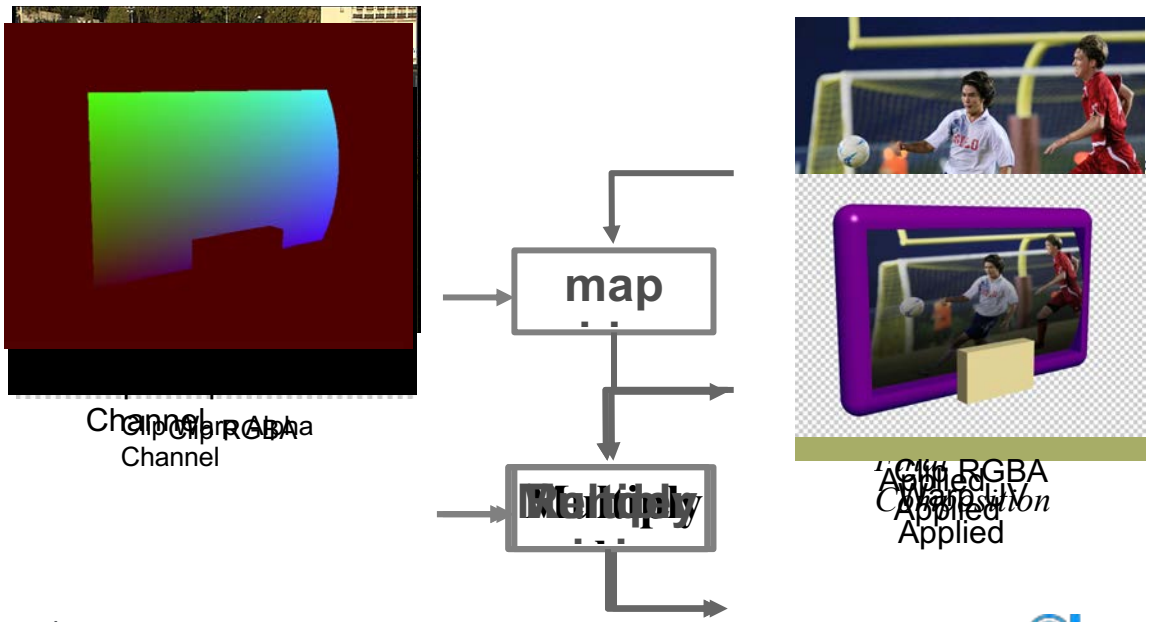
Error reports

In case of problems with functionality of Virtual Placement please don't hesitate to contact us at: support@chyron.com.
Please don't forget to attach log file, which is located at `C:\log\Chyron\VirtualPlacement.txt`.

APPENDIX A
GTC Video Warping Support

Since version 2.0, GTC Clip Convertor application allows to embed video warping channel into the clip. Warping allows to combine clip graphics and video data coming from secondary video input during production. Effects like virtual screen can be realized with that.

Video Warping overview



Warping Clip Creation

To create GTC clip containing warping channel, the artist creating the clip in a 3D rendering application must render two sets of images:

- primary clip RGBA .tga, .png, ...
- video warping .rla

Video warping images must contain following channels:

- alpha channel defines where the video input is visible inside the clip area
- UV channel defines how the video input rectangle is mapped into the clip area

Tips for using 3ds max To Create Warping Clip

1. **Rendering RGBA frames**

   - Preferred RGBA format is TGA that allows to disable premultiplied alpha.

   - To get correct shading of the video surface, material of the video surface should have following parameters:

Ambient	black
Diffuse	textured, all white texture
Specular Level	0

2. **Rendering video warp frames**

   - To get correct warp alpha channel, any objects occluding the video surface must have applied ***matte*** material. A ***receive shadows*** object property must be disabled. Objects that do not occlude video surface at any moment should be set ***non-renderable***.

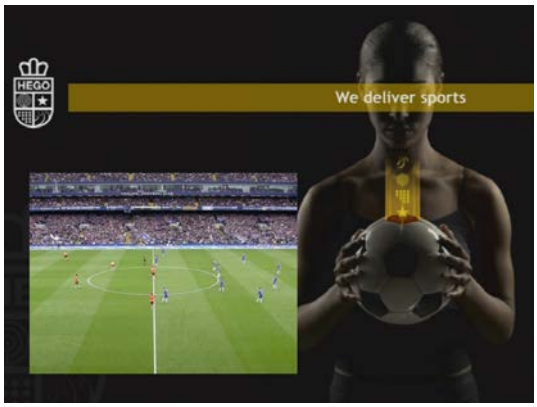
   - In order to get correct UV mapping on the output, an object within scene that will serve as video surface must have applied texture. UV mapping can be set up precisely using ***UVW Map*** modifier.

   - It is useful to adjust UV mapping to slightly extend the video surface (5% on each side). Doing this crops black border that often occurs in video signal.

APPENDIX B
Pop-out Effect Scene Tutorial

In this tutorial, you will learn how to create a simple pop-out effect using 3ds max. The tutorial requires basic knowledge of the 3ds max application workflow.

What is Pop-out effect



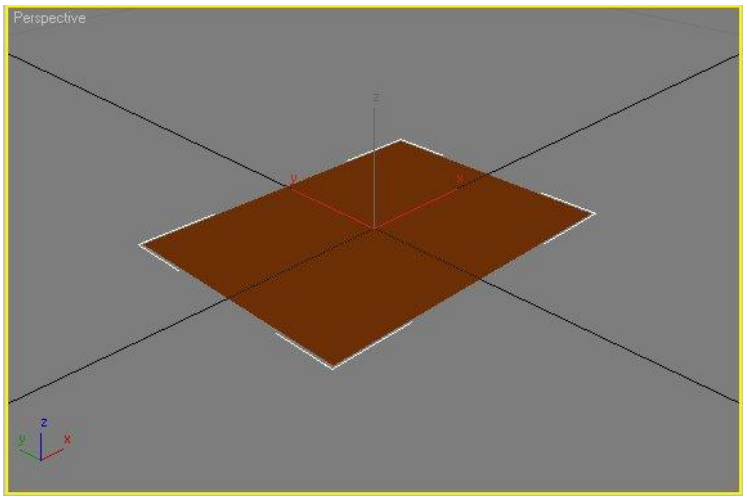
→

Input video Output video

The effect can do whatever transformation like stretch, cloth effect, explosion.

Create video surface

The essential part of the scene is video surface object. User Field Product = Virtual Placement uses video surface to display input video stream.



1. Choose Create > Standard Primitives > Plane. In the Keyboard Entry rollout, set plane parameters:

   Length: 9
   Width: 16

Click Create button.

The Length and Width parameters are chosen to match the video aspect of the output clip. For 4:3 aspect, use a Length=3, Width=4 values.

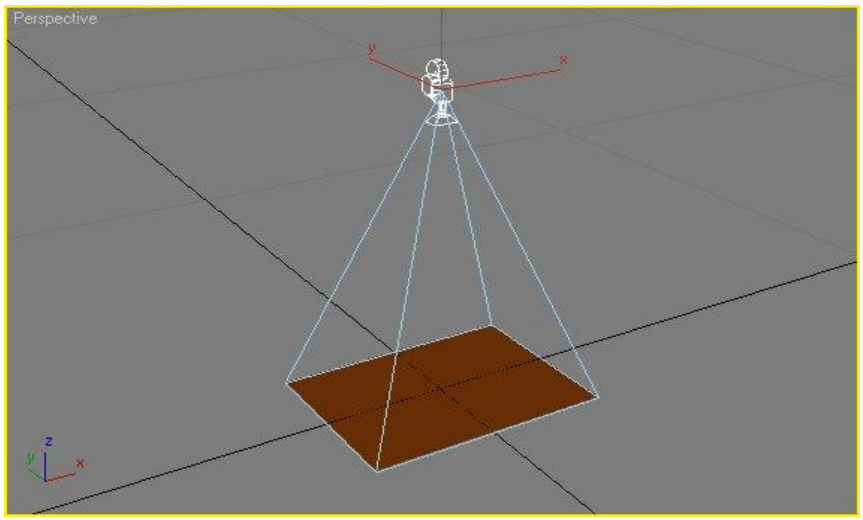
2. Rename created plane object to VideoSurface.

3. Adjust following parameters of the VideoSurface:

   Length Segs: 1
   Width Segs: 1

4. Apply an UVW Mapping modifier onto the VideoSurface (Modifiers > UV Coordinates > UVW Map). Keep default modifier parameters. The UVW mapping controls future mapping of the video input stream onto the plane.

Create And Setup Camera



1. Create a free camera object (Create > Cameras > Free Camera). Pick somewhere to scene to create camera.

2. Set rotate mode  . In the transform type-in, set rotation angles to all zeroes.

3. In the Parameters rollout, adjust camera FOV to 40 degrees.

4. Set translate mode  . In order to align the VideoSurface with the camera view precisely, it is important to set up the camera distance from the surface. Using basic math, for given FOV and surface width, we compute camera distance as

$$distance = width/(2 * tan(FOV/2))$$

For FOV = 40, use following table to decide camera distance:

video surface dimension (width, length)	camera Z distance
16 x 9	21.980
4 x 3	5.495

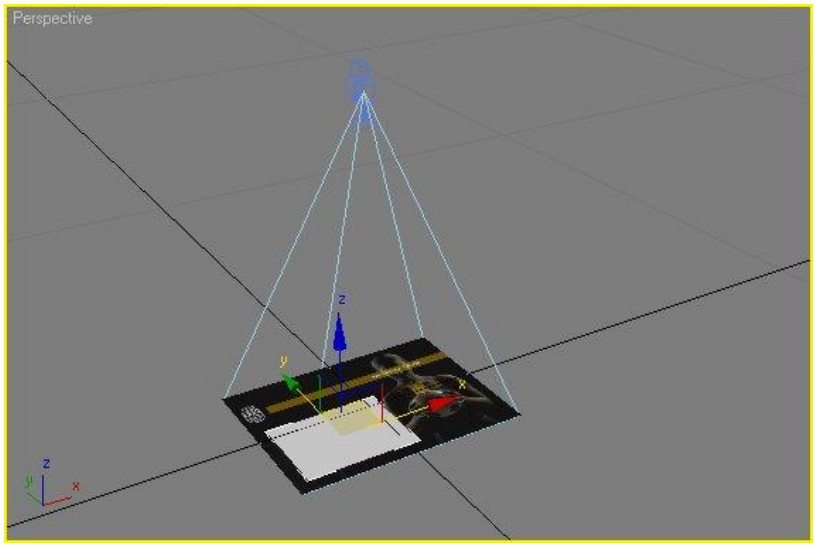
Set the distance to the transform type-in – e.g. X=0, Y=0, Z=21.980.

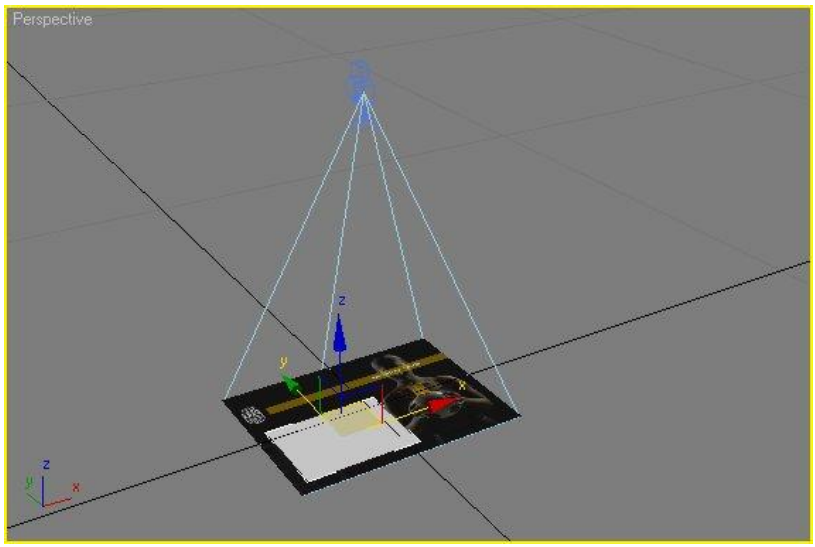
Create Background Plane

In the following step, we create a background image plane.

1. Select VideoSurface object. Choose Edit > Clone. In the popup dialog, choose a Copy clone mode.
2. Rename the object to a Background.
3. Move Background slightly away from the camera to be behind the video surface from the camera point of view. Also, slightly increase it's size to cover whole camera field of view (it is possible to apply the same math we used to compute right camera – video surface distance).
4. Apply a background material (color/texture) to the Background object.

Animate VideoSurface





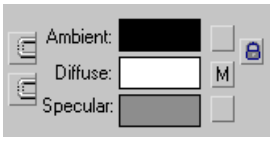
Now we create very simple animation of the video surface. In practice, it is possible to apply any 2D/3D animation/distortion to the surface.

1. Enable Auto Key function in 3ds max.
2. Move time slider to frame 50.
3. Scale the VideoSurface object to desired size and place it to desired position over the background. Moving the time slider, the VideoSurface should be shrinknig from full-size (time 0) to chosen final position (frame 50).
4. Disable Auto Key.

Setup Video Surface Material

1. Open Material Editor (Rendering > Material Editor). Choose any unused material.
2. Make sure the material shader type is Blinn.
3. Disable interlock of ambient and diffuse colors. Disable interlock of ambient and diffuse map.

4. Make sure the Specular Level value is set to 0.



5. Set ambient color to black.
6. Set diffuse color to white. Assign a bitmap containing single white pixel (white.png) to the diffuse color.
7. Select a VideoSurface object, assign a material to it  .

Set up Scene Lighting

In order to avoid darkening of a video when the effect is applied, the VideoSurface color must be pure white in non-shaded areas. To achieve that, we have to set up a light source.

1. Create new directional light (Create > Lights > Standard Lights > Directional). Pick somewhere into scene to create the light.
2. Set rotate mode  . In the light's transform type-in, zero-out all rotation angles. The light should be aiming to the same direction as the camera.
3. Position the light to cover all objects in the scene by it's light cylinder.

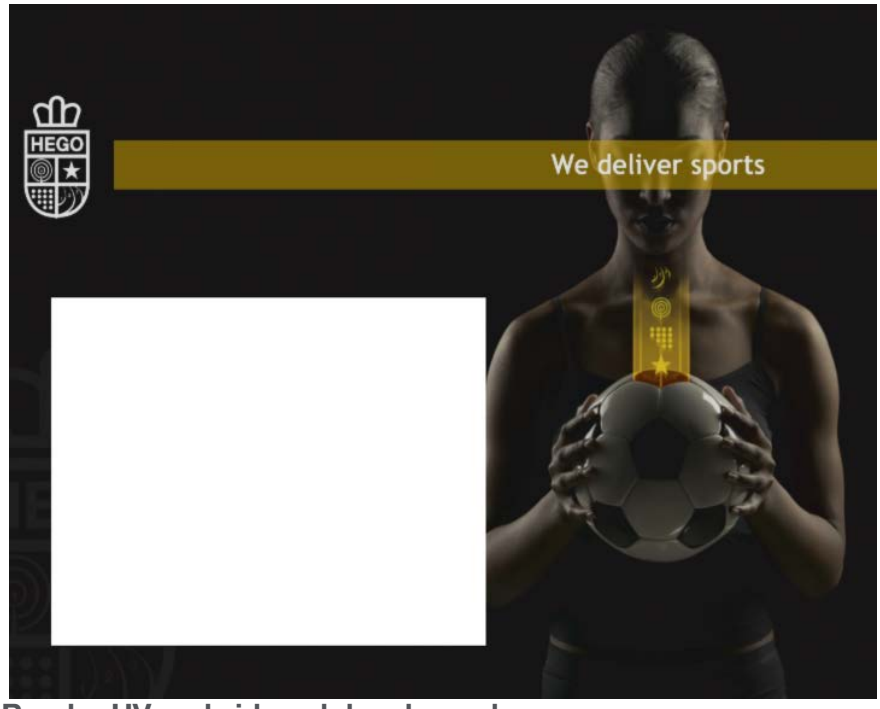
Render RGBA channels

Open *Render Scene* dialog. In the *Output Size* box, change type to Custom.

Use following settings to render to different target formats:

	Width	Height	Pixel Aspect	Note
SD 576 (PAL) 16:9	720	576	1.4222	
SD 576 (PAL) 4:3	720	576	1.0667	
SD 576 (PAL) 16:9	1024	576	1.0	can affect resulting effect quality, horizontal downsampling is necessary
SD 576 (PAL) 4:3	768	576	1.0	can affect resulting effect quality, horizontal downsampling is necessary
SD 486 (NTSC) 16:9	720	486	1.2	
SD 486 (NTSC) 4:3	720	486	0.9	
SD 486 (NTSC) 16:9	864	486	1.0	can affect resulting effect quality, horizontal downsampling is necessary
HD 1080	1920	1080	1.0	
HD 720	1280	720	1.0	

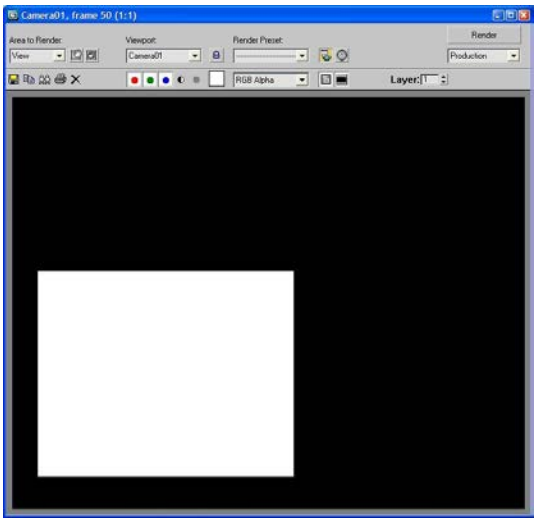
Render a scene animation to standard RGBA output (e.g. png file sequence).

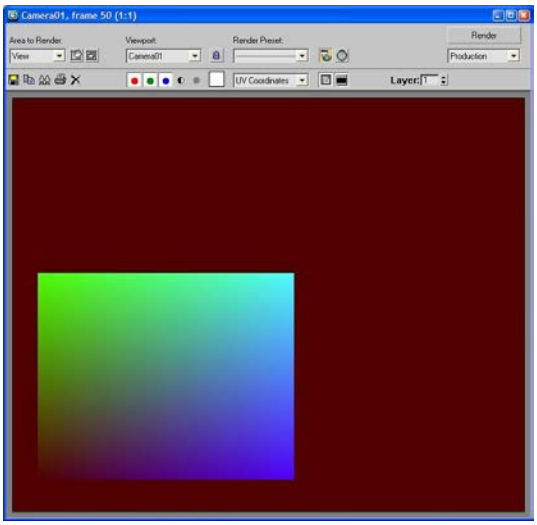


Render UV and video alpha channels

1. Hide any objects in the scene except the VideoSurface object and the objects that can potentially occlude the VideoSurface.
2. In a Material Editor, select any unused material. Change material type to Matte/Shadow (Material > Change Material/Map Type... > Select Matte/Shadow). Make sure that the Opaque Alpha check box is not checked.
3. Apply the material to any objects that can occlude the VideoSurface (there are none in our basic scene).
4. Render the scene again, this time, use a RLA output format, with following settings:
    - Bits per channel: 8
    - Store alpha channel: enabled
    - Premultiply alpha: disabled
    - Optional channels: UV Coordinates

Resulting image should look like following (RGB Alpha and UV Coordinates, respectively):





Create a .gtc clip

1. Open GTC Clip Convertor application.
2. Browse rendered .png file as a primary clip source file name.
3. Enable the Warp Enable check box.
4. Browse rendered .rla file as a warp source.
5. Step through the application, creating the clip when finished.

APPENDIX C
Application Variables

User Field Product = Virtual Placement maintains a list of variables that you can use in the production. Typically, you can use the variables in the Text product, where the variable name is automatically translated to its value.

List of available variables:

Variable	Description
$(SCORE1)	Value of score 1 from the score widget
$(SCORE2)	Value of score 2 from the score widget
$(CLK;<time_format>)	Clock <time_format> is optional, if missing, default local time format is used. See time format letters for available formatting. Examples: $(CLK) $(CLK;HH:mm) $(CLK;HH:mm:ss) $(CLK;hh:mm a)
$(CLKCD;<finish_time>;<time_format>)	Countdown clock until <finish_time>.. <time_format> is optional, if missing, default local time format is used. See time format letters for available formatting. Examples: $(CLKCD;19:00;HH:mm) $(CLKCD;19:00:00;HH:mm:ss) $(CLKCD;7:00 PM;hh:mm a)
$(CLKCU,<start_time>;<time_format>)	Count up clock from <start_time>. <time_format> is optional, if missing, default local time format is used. See time format letters for available formatting. Examples: $(CLKCU;19:00;HH:mm) $(CLKCU;7:00 PM;hh:mm a)
$(USERTIME;<time_format>)	User time adjusted via toolbar time button. <time_format> is optional, if missing, default local time format is used. See time format letters for available formatting. Examples: $(USERTIME) $(USERTIME;HH:mm)

	$(USERTIME;+ m:ss)
$(HEIGHTMEASUREMENT)	Value calculated from product HeightMeasurement. The value is height in fixed format with one decimal place, unit cm.
$(DOWN)	Current down number (in the form of text string, e.g. '3rd'). Available only when Down and Distance is enabled.
$(DISTANCE)	Current distance of the Scrimmage line to the Down line. Available only when Down and Distance is enabled.
$(DISTANCE;Goal;Inches)	Current distance of the Scrimmage line to the Down line with customized wording.

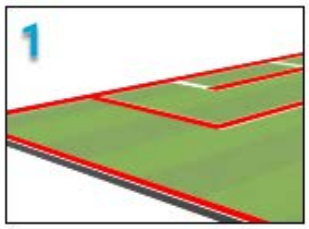
Usage of the variables is described in the Text product section.
The text products are updated immediately when the variable value changes.
List of available time format letters:

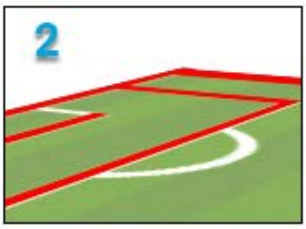
Letter	Date or time component	Examples
G	Era designator	AD (G)
y	Year	1996 (yyyy), 96 (yy)
M	Month in year	July (MMMM), 07 (MM), 7 (M)
w	Week in year	27 (w)
W	Week in month	02 (WW), 2(W)
D	Day in year	189 (D), 08 (DD)
d	Day in month	10 (d), 01 (dd)
F	Day of week in month	3 (F)
E	Day in week	Tuesday (EEEE), Tue (E)
a	Am/pm marker	PM (a)
H	Hour in day (0-23)	0 (H), 00 (HH)
k	Hour in day (1-24)	24 (k), 08 (kk)
K	Hour in am/pm (0-11)	00 (KK), 0 (K)
h	Hour in am/pm (1-12)	12 (h), 01 (hh)
m	Minute in hour	30 (m) 02 (mm)
s	Second in minute	55 (ss)
S	Millisecond	987 (SSS)
z	Time zone	Pacific Standard Time, PST, GMT-08:00
Z	Time zone RFC-822	-800

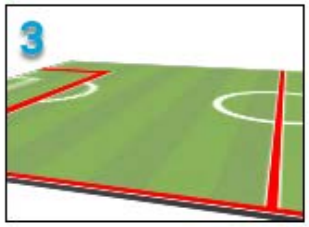
Pattern letters are usually repeated, as their number determines the exact number of digits.

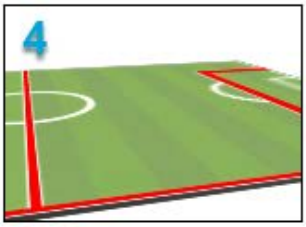
APPENDIX D
Soccer Calibration Images

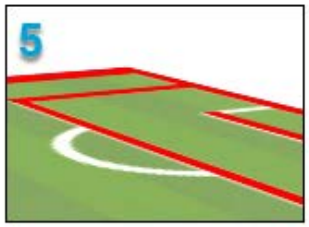
Center camera reference for soccer calibration.

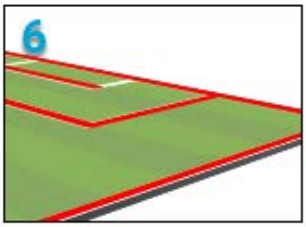


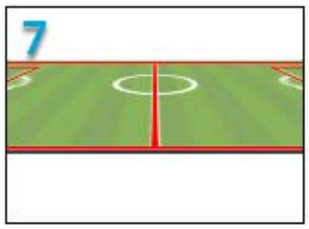


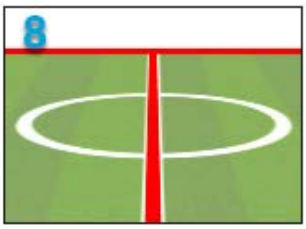


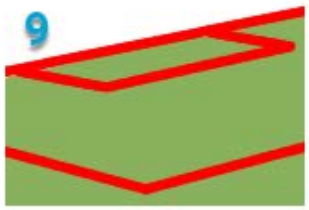


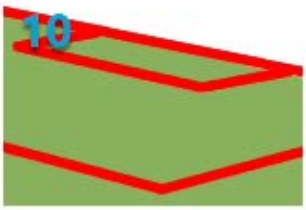




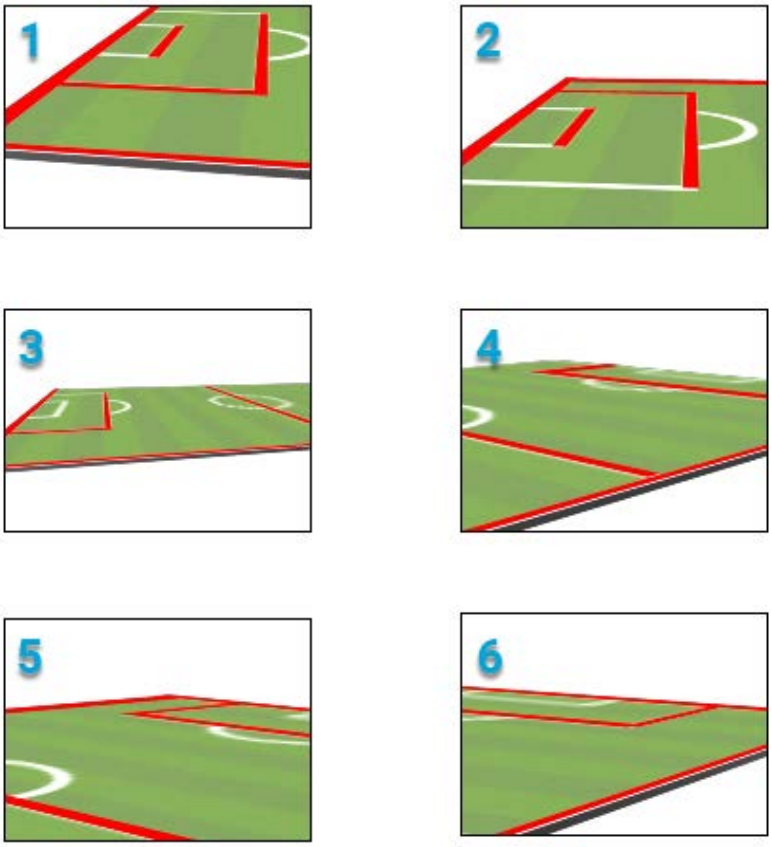




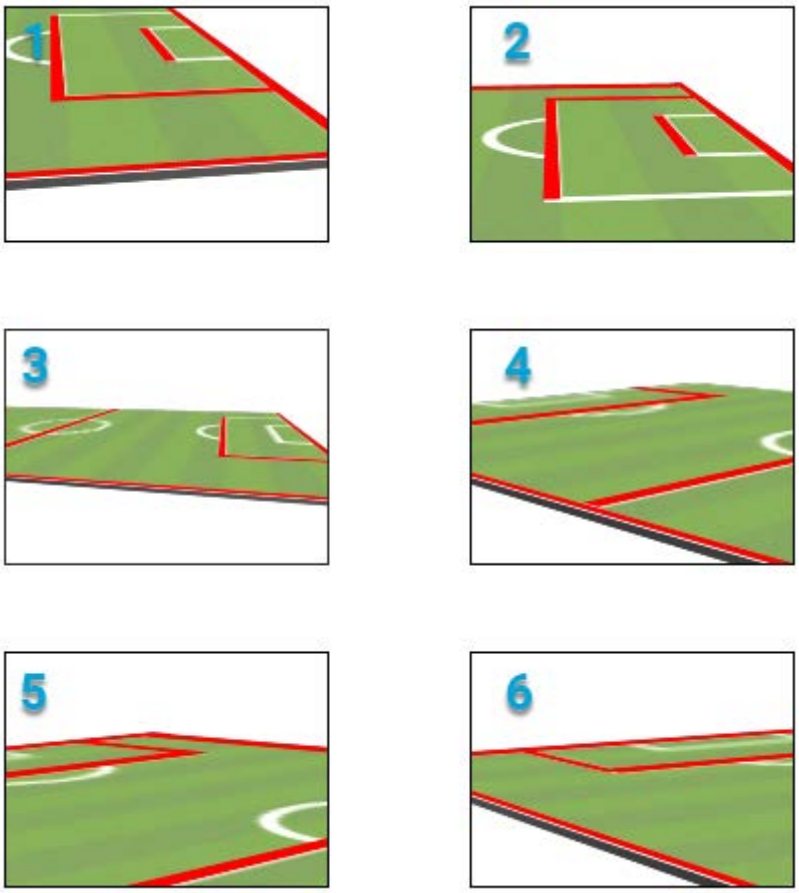




Left camera reference for soccer calibration.

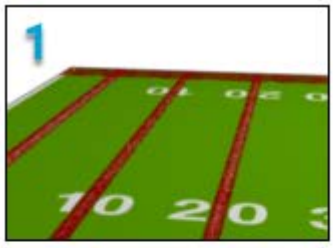


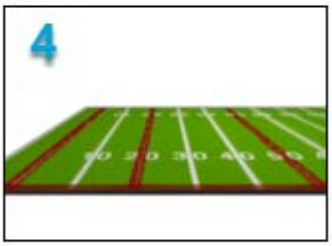
Right camera reference for soccer calibration.

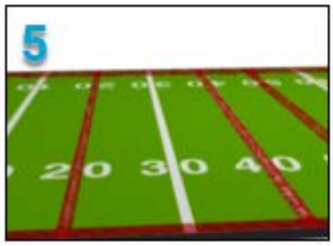


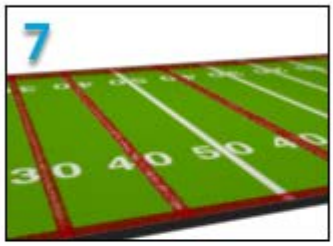
APPENDIX E
Football Calibration Images

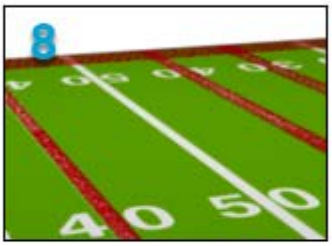
Game 1 (Left) camera reference for NCAA/NFL football calibration.

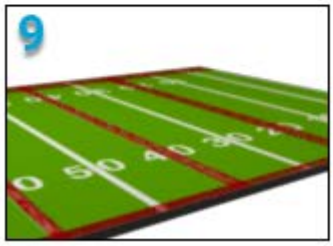


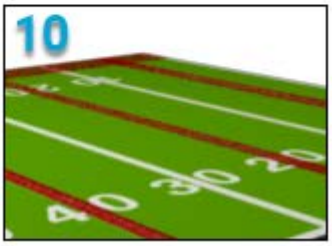




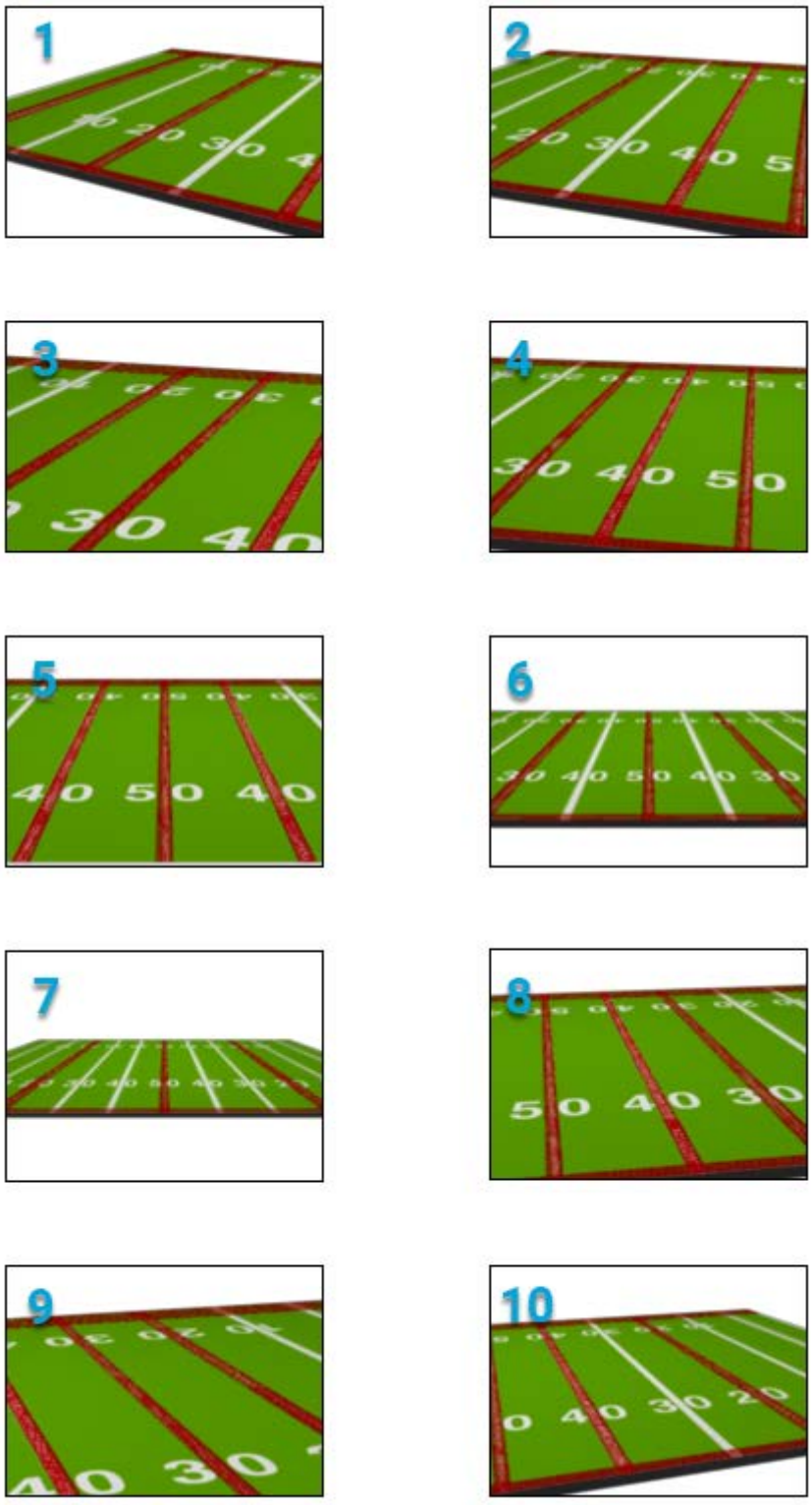




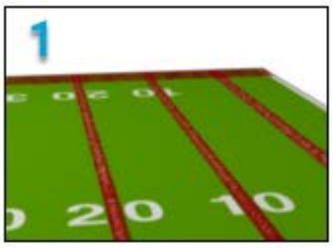




Game 2 (Center) camera reference for NCAA/NFL football calibration.

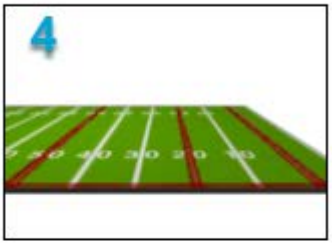


Game 3 (Right) camera reference for NCAA/NFL football calibration.

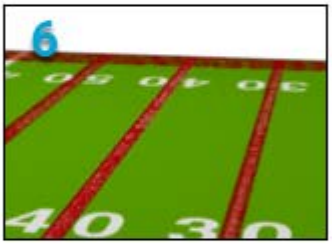

1

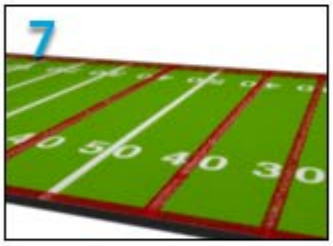

2


3

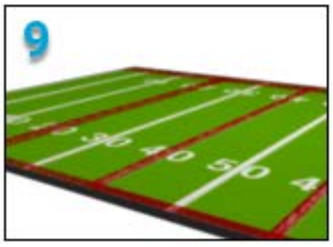

4

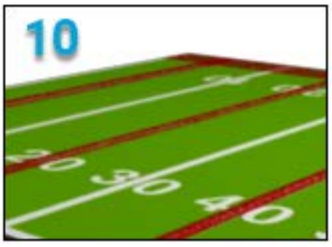

5


6


7


8


9


10

Licenses

FreeImage Public License - Version 1.0

1. Definitions.
1.1. "Contributor" means each entity that creates or contributes to the creation of Modifications.
1.2. "Contributor Version" means the combination of the Original Code, prior Modifications used by a Contributor, and the Modifications made by that particular Contributor.
1.3. "Covered Code" means the Original Code or Modifications or the combination of the Original Code and Modifications, in each case including portions thereof.
1.4. "Electronic Distribution Mechanism" means a mechanism generally accepted in the software development community for the electronic transfer of data.
1.5. "Executable" means Covered Code in any form other than Source Code.
1.6. "Initial Developer" means the individual or entity identified as the Initial Developer in the Source Code notice required by Exhibit A.
1.7. "Larger Work" means a work which combines Covered Code or portions thereof with code not governed by the terms of this License.
1.8. "License" means this document.
1.9. "Modifications" means any addition to or deletion from the substance or structure of either the Original Code or any previous Modifications. When Covered Code is released as a series of files, a Modification is:
A. Any addition to or deletion from the contents of a file containing Original Code or previous Modifications.
B. Any new file that contains any part of the Original Code or previous Modifications.
1.10. "Original Code" means Source Code of computer software code which is described in the Source Code notice required by Exhibit A as Original Code, and which, at the time of its release under this License is not already Covered Code governed by this License.
1.11. "Source Code" means the preferred form of the Covered Code for making modifications to it, including all modules it contains, plus any associated interface definition files, scripts used to control
compilation and installation of an Executable, or a list of source code differential comparisons against either the Original Code or another well known, available Covered Code of the Contributor's choice. The Source Code can be in a compressed or archival form, provided the appropriate decompression or de-archiving software is widely available for no charge.
1.12. "You" means an individual or a legal entity exercising rights under, and complying with all of the terms of, this License or a future version of this License issued under Section 6.1. For legal entities, "You" includes any entity which controls, is controlled by, or is under common control with You. For purposes of this definition, "control" means (a) the power, direct or indirect, to cause the
direction or management of such entity, whether by contract or otherwise, or (b) ownership of fifty percent (50%) or more of the outstanding shares or beneficial ownership of such entity.

2. Source Code License.
2.1. The Initial Developer Grant.
The Initial Developer hereby grants You a world-wide, royalty-free, non-exclusive license, subject to third party intellectual property claims:
(a) to use, reproduce, modify, display, perform, sublicense and distribute the Original Code (or portions thereof) with or without Modifications, or as part of a Larger Work; and
(b) under patents now or hereafter owned or controlled by Initial Developer, to make, have made, use and sell ("Utilize") the Original Code (or portions thereof), but solely to the extent that any such patent is reasonably necessary to enable You to Utilize the Original Code (or portions thereof) and not to any greater extent that may be necessary to Utilize further Modifications or combinations.

2.2. Contributor Grant.
Each Contributor hereby grants You a world-wide, royalty-free, non-exclusive license, subject to third party intellectual property claims:
(a) to use, reproduce, modify, display, perform, sublicense and distribute the Modifications created by such Contributor (or portions thereof) either on an unmodified basis, with other Modifications, as Covered Code or as part of a Larger Work; and
(b) under patents now or hereafter owned or controlled by Contributor, to Utilize the Contributor Version (or portions thereof), but solely to the extent that any such patent is reasonably necessary to enable You to Utilize the Contributor Version (or portions thereof), and not to any greater extent that
may be necessary to Utilize further Modifications or combinations.

3. Distribution Obligations.
3.1. Application of License.
The Modifications which You create or to which You contribute are governed by the terms of this License, including without limitation Section 2.2. The Source Code version of Covered Code may be distributed only under the terms of this License or a future version of this License released under Section 6.1, and You must include a copy of this License with every copy of the Source Code You distribute. You may not offer or impose any terms on any Source Code version that alters or restricts the applicable version of this License or the recipients' rights hereunder. However, You may include an additional document offering the additional rights described in Section 3.5.
3.2. Availability of Source Code.
Any Modification which You create or to which You contribute must be made available in Source Code form under the terms of this License either on the same media as an Executable version or via an accepted Electronic Distribution Mechanism to anyone to whom you made an Executable version available; and if made available via Electronic Distribution Mechanism, must remain available for at least twelve (12) months after the date it initially became available, or at least six (6) months after a subsequent version of that particular Modification has been made available to such recipients. You are responsible for ensuring that the Source Code version remains available even if the Electronic Distribution Mechanism is maintained by a third party.
3.3. Description of Modifications.
You must cause all Covered Code to which you contribute to contain a file documenting the changes You made to create that Covered Code and the date of any change. You must include a prominent statement that the Modification is derived, directly or indirectly, from Original Code provided by the Initial Developer and including the name of the Initial Developer in (a) the Source Code, and (b) in any notice in an Executable version or related documentation in which You describe the origin or ownership of the Covered Code.
3.4. Intellectual Property Matters
(a) Third Party Claims.
If You have knowledge that a party claims an intellectual property right in particular functionality or code (or its utilization under this License), you must include a text file with the source code distribution titled "LEGAL" which describes the claim and the party making the claim in sufficient detail that a recipient will know whom to contact. If you obtain such knowledge after You make Your Modification available as described in Section 3.2, You shall promptly modify the LEGAL file in all copies You make
available thereafter and shall take other steps (such as notifying appropriate mailing lists or newsgroups) reasonably calculated to inform those who received the Covered Code that new knowledge has been obtained.
(b) Contributor APIs.
If Your Modification is an application programming interface and You own or control patents which are reasonably necessary to implement that API, you must also include this information in the LEGAL file.
3.5. Required Notices.
You must duplicate the notice in Exhibit A in each file of the Source Code, and this License in any documentation for the Source Code, where You describe recipients' rights relating to Covered Code. If You created one or more Modification(s), You may add your name as a Contributor to the notice described in Exhibit A. If it is not possible to put such notice in a particular Source Code file due to its
structure, then you must include such notice in a location (such as a relevant directory file) where a user would be likely to look for such a notice. You may choose to offer, and to charge a fee for, warranty, support, indemnity or liability obligations to one or more recipients of Covered Code. However, You may do so only on Your own behalf, and not on behalf of the Initial Developer or any Contributor. You must make it absolutely clear than any such warranty, support, indemnity or liability obligation is offered by You alone, and You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of
warranty, support, indemnity or liability terms You offer.
3.6. Distribution of Executable Versions.
You may distribute Covered Code in Executable form only if the requirements of Section 3.1-3.5 have been met for that Covered Code, and if You include a notice stating that the Source Code version of the Covered Code is available under the terms of this License, including a description of how and where You have fulfilled the obligations of Section 3.2. The notice must be conspicuously included in any notice in an Executable version, related documentation or collateral in which You describe recipients' rights relating to the Covered Code. You may distribute the Executable version of Covered Code under a license of Your choice, which may contain terms different from this License, provided that You are in compliance with the terms of this License and that the license for the Executable version does not attempt to limit or alter the recipient's rights in the Source Code version from the rights set forth in this License. If You distribute the Executable version under a different license You must make it absolutely clear that any terms which differ from this License are offered by You alone, not by the Initial Developer or any Contributor. You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of any such terms You offer.
3.7. Larger Works.
You may create a Larger Work by combining Covered Code with other code not governed by the terms of this License and distribute the Larger Work as a single product. In such a case, You must make sure the requirements of this License are fulfilled for the Covered Code.

4. Inability to Comply Due to Statute or Regulation.

If it is impossible for You to comply with any of the terms of this License with respect to some or all of the Covered Code due to statute or regulation then You must: (a) comply with the terms of this License to the maximum extent possible; and (b) describe the limitations and the code they affect. Such description must be included in the LEGAL file described in Section 3.4 and must be included with all distributions of the Source Code. Except to the extent prohibited by statute or regulation, such description must be sufficiently detailed for a recipient of ordinary skill to be able to understand it.

5. Application of this License.

This License applies to code to which the Initial Developer has attached the notice in Exhibit A, and to related Covered Code.

6. Versions of the License.
6.1. New Versions.
Floris van den Berg may publish revised and/or new versions of the License from time to time. Each version will be given a distinguishing version number.
6.2. Effect of New Versions.
Once Covered Code has been published under a particular version of the License, You may always continue to use it under the terms of that version. You may also choose to use such Covered Code under the terms of any subsequent version of the License published by Floris van den Berg
No one other than Floris van den Berg has the right to modify the terms applicable to Covered Code created under this License.
6.3. Derivative Works.
If you create or use a modified version of this License (which you may only do in order to apply it to code which is not already Covered Code governed by this License), you must (a) rename Your license so that the phrases "FreeImage", `FreeImage Public License", "FIPL", or any confusingly similar phrase do not appear anywhere in your license and (b) otherwise make it clear that your version of the license contains terms which differ from the FreeImage Public License. (Filling in the name of the Initial Developer, Original Code or Contributor in the notice described in Exhibit A shall not of themselves be deemed to be modifications of this License.)

7. DISCLAIMER OF WARRANTY.
COVERED CODE IS PROVIDED UNDER THIS LICENSE ON AN "AS IS" BASIS, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES THAT THE COVERED CODE IS FREE OF DEFECTS, MERCHANTABLE, FIT FOR A PARTICULAR PURPOSE OR NON-INFRINGING. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE COVERED CODE IS WITH YOU. SHOULD ANY COVERED CODE PROVE DEFECTIVE IN ANY RESPECT, YOU (NOT THE INITIAL DEVELOPER OR ANY OTHER CONTRIBUTOR) ASSUME THE COST OF ANY NECESSARY SERVICING, REPAIR OR CORRECTION. THIS DISCLAIMER OF WARRANTY CONSTITUTES AN ESSENTIAL PART OF THIS LICENSE. NO USE OF ANY COVERED CODE IS AUTHORIZED HEREUNDER EXCEPT UNDER THIS DISCLAIMER.

8. TERMINATION.
This License and the rights granted hereunder will terminate automatically if You fail to comply with terms herein and fail to cure such breach within 30 days of becoming aware of the breach. All sublicenses to the Covered Code which are properly granted shall survive any termination of this License. Provisions which, by their nature, must remain in effect beyond the termination of this License shall survive.

9. LIMITATION OF LIABILITY.
UNDER NO CIRCUMSTANCES AND UNDER NO LEGAL THEORY, WHETHER TORT (INCLUDING NEGLIGENCE), CONTRACT, OR OTHERWISE, SHALL THE INITIAL DEVELOPER, ANY OTHER CONTRIBUTOR, OR ANY DISTRIBUTOR OF COVERED CODE, OR ANY SUPPLIER OF ANY OF SUCH PARTIES, BE LIABLE TO YOU OR ANY OTHER PERSON FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY CHARACTER INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF GOODWILL, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, OR ANY AND ALL OTHER COMMERCIAL DAMAGES OR LOSSES, EVEN IF SUCH PARTY SHALL HAVE BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. THIS LIMITATION OF LIABILITY SHALL NOT APPLY TO LIABILITY FOR DEATH OR PERSONAL INJURY RESULTING FROM SUCH PARTY'S NEGLIGENCE TO THE EXTENT APPLICABLE LAW PROHIBITS SUCH LIMITATION. SOME JURISDICTIONS DO NOT ALLOW THE
EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT EXCLUSION AND LIMITATION MAY NOT APPLY TO YOU.

10. U.S. GOVERNMENT END USERS.
The Covered Code is a "commercial item," as that term is defined in 48 C.F.R. 2.101 (Oct. 1995), consisting of "commercial computer software" and "commercial computer software documentation," as such terms are used in 48 C.F.R. 12.212 (Sept. 1995). Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4 (June 1995), all U.S. Government End Users acquire Covered Code with only those rights set forth herein.

11. MISCELLANEOUS.
This License represents the complete agreement concerning subject matter hereof. If any provision of this License is held to be unenforceable, such provision shall be reformed only to the extent necessary to make it enforceable. This License shall be governed by Dutch law provisions (except to the extent applicable law, if any, provides otherwise), excluding its conflict-of-law provisions. With respect to disputes in which at least one party is a citizen of, or an entity chartered or registered to do business in, the The Netherlands: (a) unless otherwise agreed in writing, all disputes relating to this License (excepting any dispute relating to intellectual property rights) shall be subject to final and binding arbitration, with the losing party paying all costs of arbitration; (b) any arbitration relating to this Agreement shall be held in Almelo, The Netherlands; and (c) any litigation relating to this Agreement shall be subject to the jurisdiction of the court of Almelo, The Netherlands with the losing party responsible for costs, including without limitation, court costs and reasonable attorneys fees and expenses. Any law or regulation which provides that the language of a contract shall be construed against the drafter shall not apply to this License.

12. RESPONSIBILITY FOR CLAIMS.
Except in cases where another Contributor has failed to comply with Section 3.4, You are responsible for damages arising, directly or indirectly, out of Your utilization of rights under this License, based
on the number of copies of Covered Code you made available, the revenues you received from utilizing such rights, and other relevant factors. You agree to work with affected parties to distribute responsibility on an equitable basis.

EXHIBIT A.
"The contents of this file are subject to the FreeImage Public License Version 1.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://home.wxs.nl/~flvdberg/freeimage-license.txt
Software distributed under the License is distributed on an "AS IS" basis, WITHOUT WARRANTY OF ANY KIND, either express or implied. See the License for the specific language governing rights and limitations under the License.

ABOUT US

Chyron is ushering in the next generation of storytelling in the digital age. Founded in 1966, the company pioneered broadcast titling and graphics systems. With a strong foundation built on over 50 years of innovation and efficiency, the name Chyron is synonymous with broadcast graphics. Chyron continues that legacy as a global leader focused on customer-centric broadcast solutions. Today, the company offers production professionals the industry's most comprehensive software portfolio for designing, sharing, and playing live graphics to air with ease. Chyron products are increasingly deployed to empower OTA & OTT workflows and deliver richer, more immersive experiences for audiences and sports fans in the arena, at home, or on the go.

CONTACT SALES

EMEA • North America • Latin America • Asia/Pacific
+1.631.845.2000 • sales@chyron.com