



Fly Elise-ng B.V.
Waterstad 31
5658RE Eindhoven
The Netherlands
Web: <http://fly.elise-ng.net>
Email: info@elise-ng.net
Tel: +31 (0)40 7114293

Fly Elise-ng
Immersive Calibration PRO
Step-By-Step Guide
Single Camera

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1 Introduction

This is a 10 minutes step-by-step guide for setting-up a seamless immersive projection using any type of continuous projection screen surface with one or more overlapping projectors.

The calibration produces perfectly aligned and geometrically correct image by taking into account the projector positions and the screen surface.

At the end of the calibration, Immersive Calibration PRO exports the warping and blending configuration that can be loaded and used in Immersive Display PRO for warping and blending the PC output image to get one seamless display.

For this calibration one web cam is needed. The camera needs to be positioned so that the camera can capture and “see” the complete projection screen including the projectors images on the screen. Because of this, this Single Camera calibration method is most suitable for calibration of multi-projector setups where the angle (field of view) of the projection screen does not exceed 160 degrees and the complete screen can be seen in the camera view.

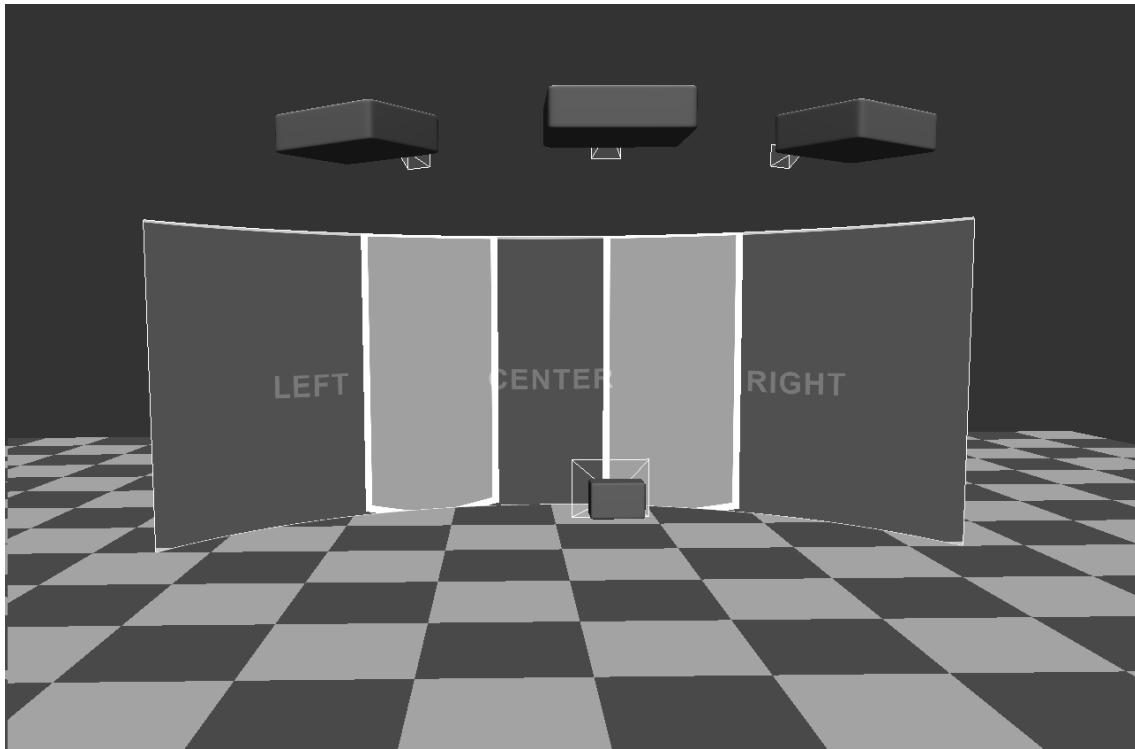
The Single Camera calibration is usable for creating:

- Game setups with single game camera view
- Video shows and presentations
- Windows 7/8/10 Desktop presentations
- Power Point and other interactive presentations
- Touch display walls and interactive floors.
- Etc...

For the purpose of this step-by-step guide we will use a cylindrical projection screen with the following parameters: horizontal angle 120 degrees, height 1.5 meters and radius 2.0 meters (diameter 40 meters).

The 3 BenQ 1024x768 projectors are positioned in such a way that the complete projection screen is covered by a projection images from projectors and that the projector images overlap by about 15%.

A Logitech Webcam PRO 9000 HD camera is positioned in front of the projection screen and can capture the complete screen.



Note: For the best calibration results with this Single Camera calibration method it is important that the projectors are positioned in such a way that the complete projector image “overshoots” the screen edges.

This Single Camera calibration method does not require the projection screen edges to be marked.

During the calibration process the software will make sure that the projected images is combined as one seamless image and this image is projected on the projection screen as one single “wallpaper”.

Immersive Calibration PRO Single Camera Step-By-Step Guide



Before calibration

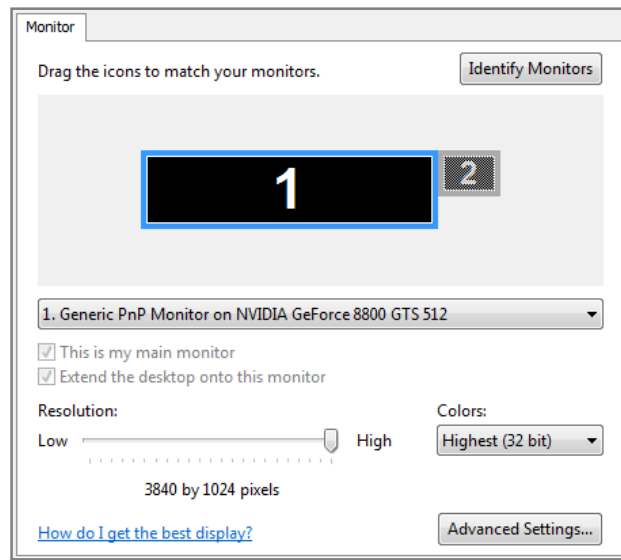


After calibration

2 Configure the PC displays

We will use single PC to perform the calibration:

The PC has at least 3 outputs connected to the 3 projectors. The displays must be configured as one wide display (3x1) created either by using Matrox TripleHead 2 Go or ATI Display Group or NVidia SLI Surround or NVidia Mosaic mode. Desktop and all other software will be stretched on this large extended display.



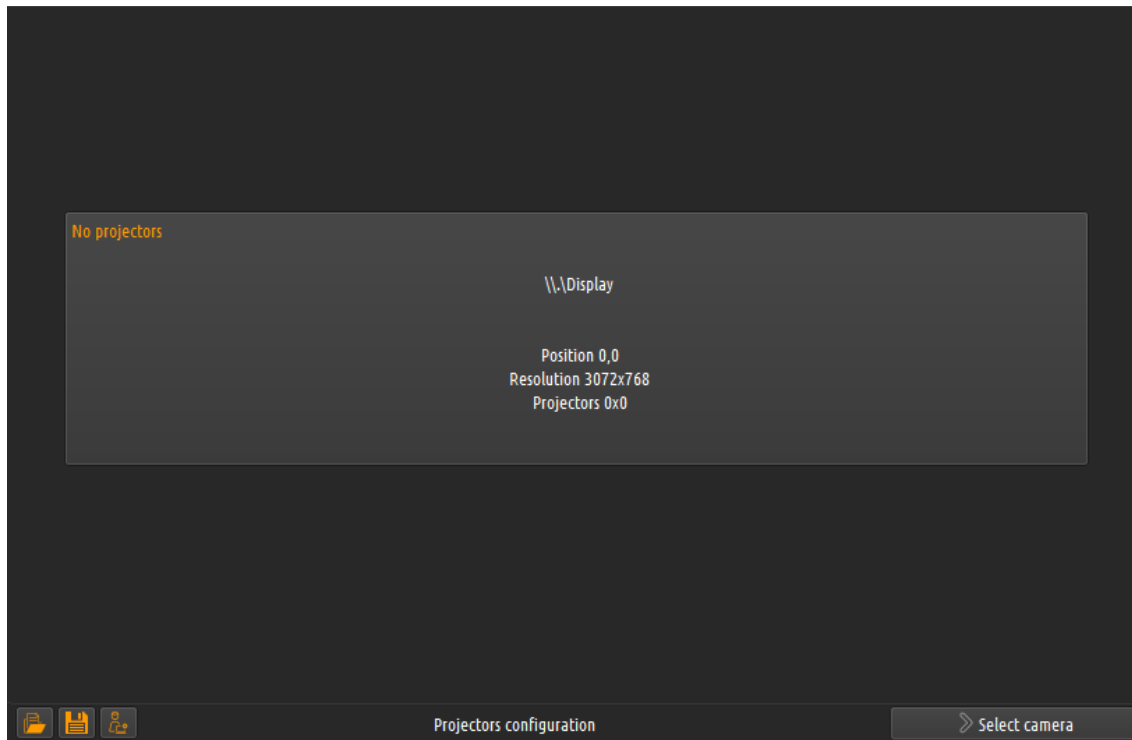
3x1 grouped display configuration

3 Start and configure the projectors setup

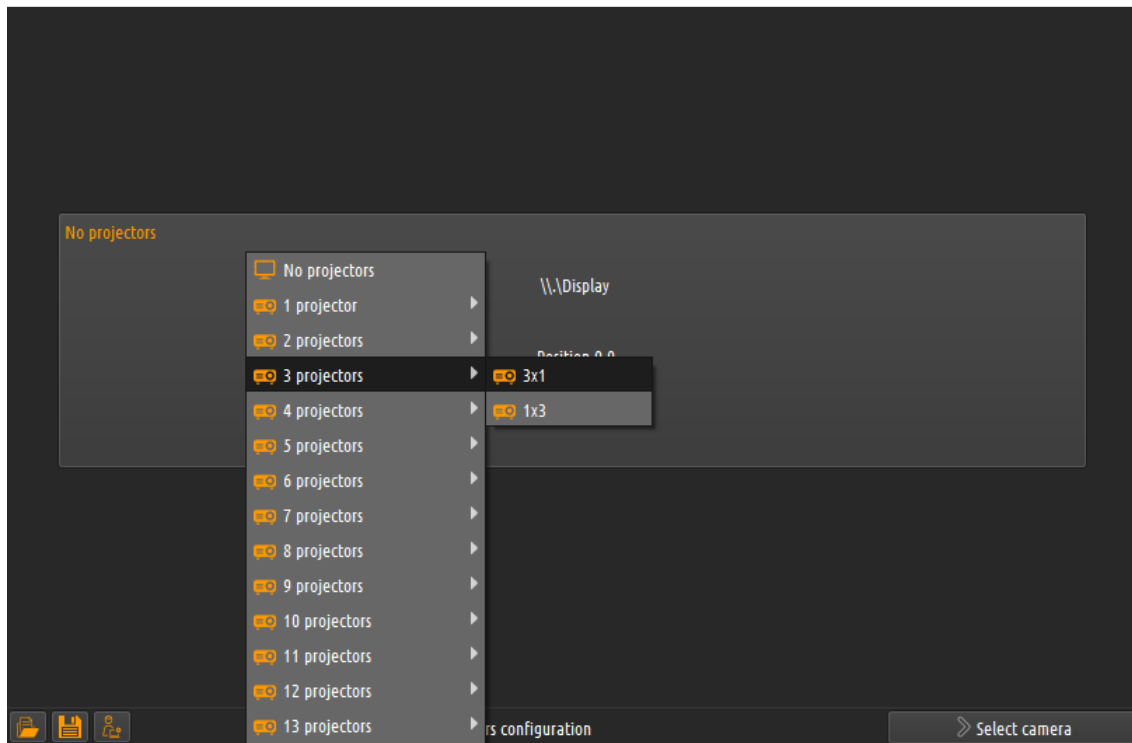
Use the Single.exe program to start Single Camera calibration.

A window will open to select the projectors configuration on the detected PC displays.

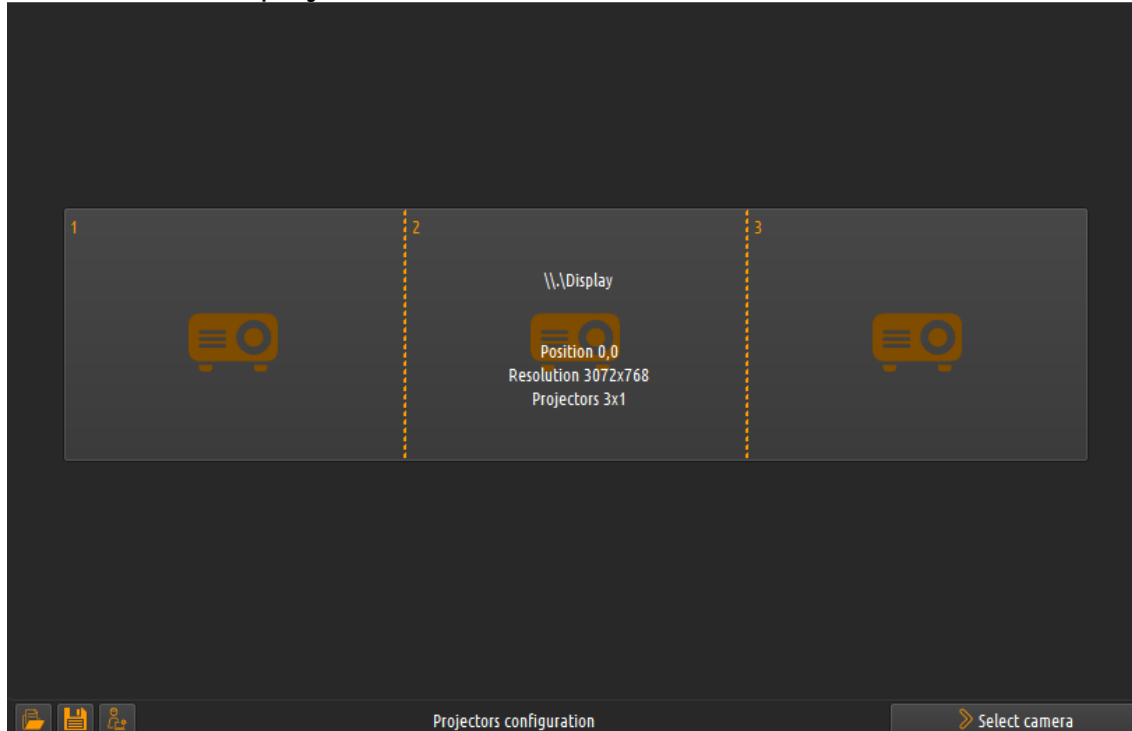
Because we have one large display connected to 3 projectors, we can set the projector configuration to 3x1. The projectors “identity” images will be shown on the display and the projectors.



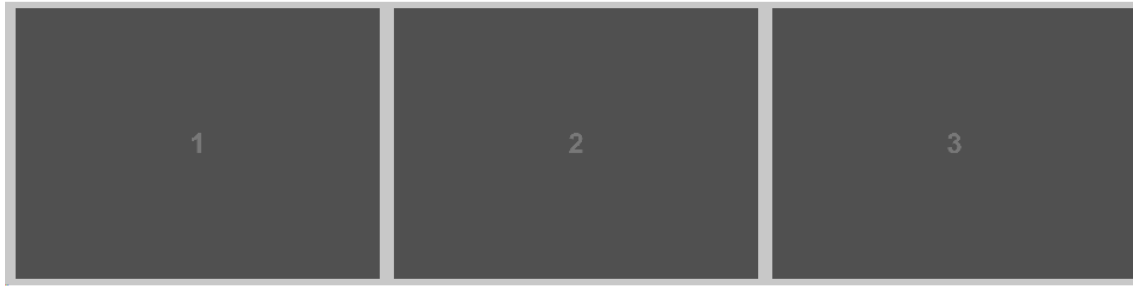
Right-click on the display that is connected to the projectors and select projector configuration 3x1 from the popup menu.



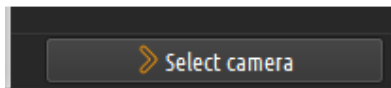
The displays will be configured in 3x1 mode and the projector numbers will be shown on the projectors.



Immersive Calibration PRO Single Camera Step-By-Step Guide

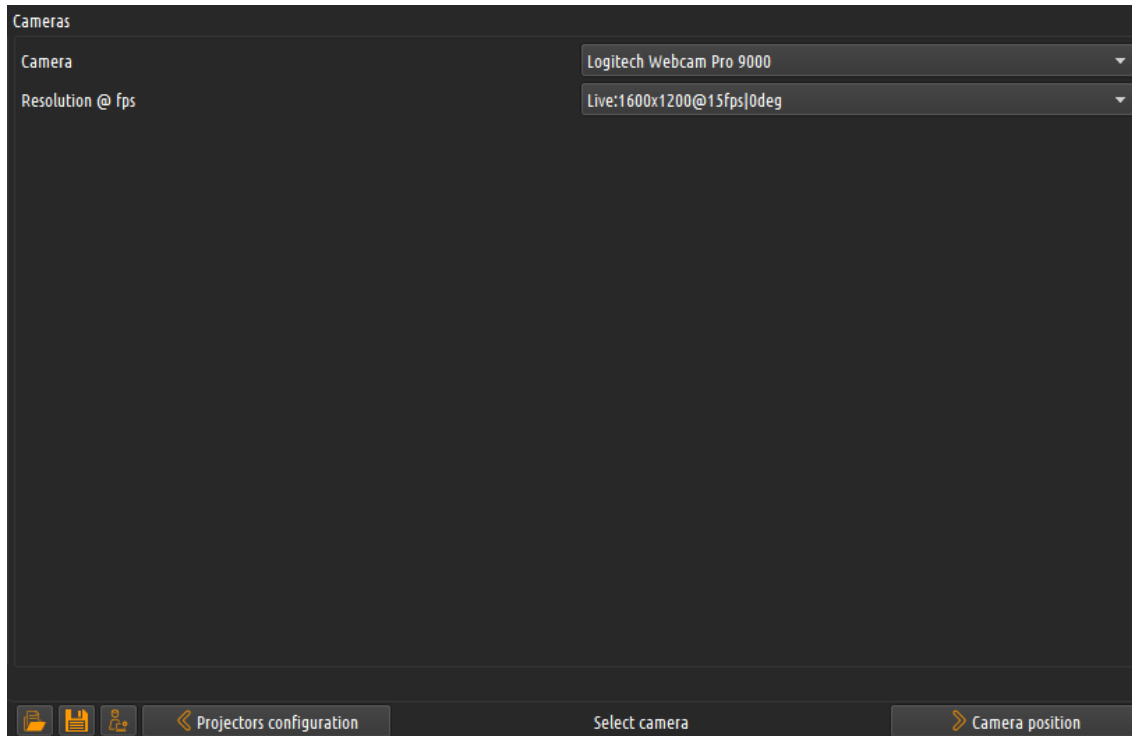


Press the “Select camera” button on the lower right part of the window to go to the camera selection window



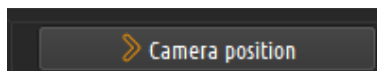
4 Camera selection

In the camera selection window all the connected webcams on the PC will be listed. If the camera is not listed, make sure that the camera is plugged in the USB port or try another USB port and restart the software.



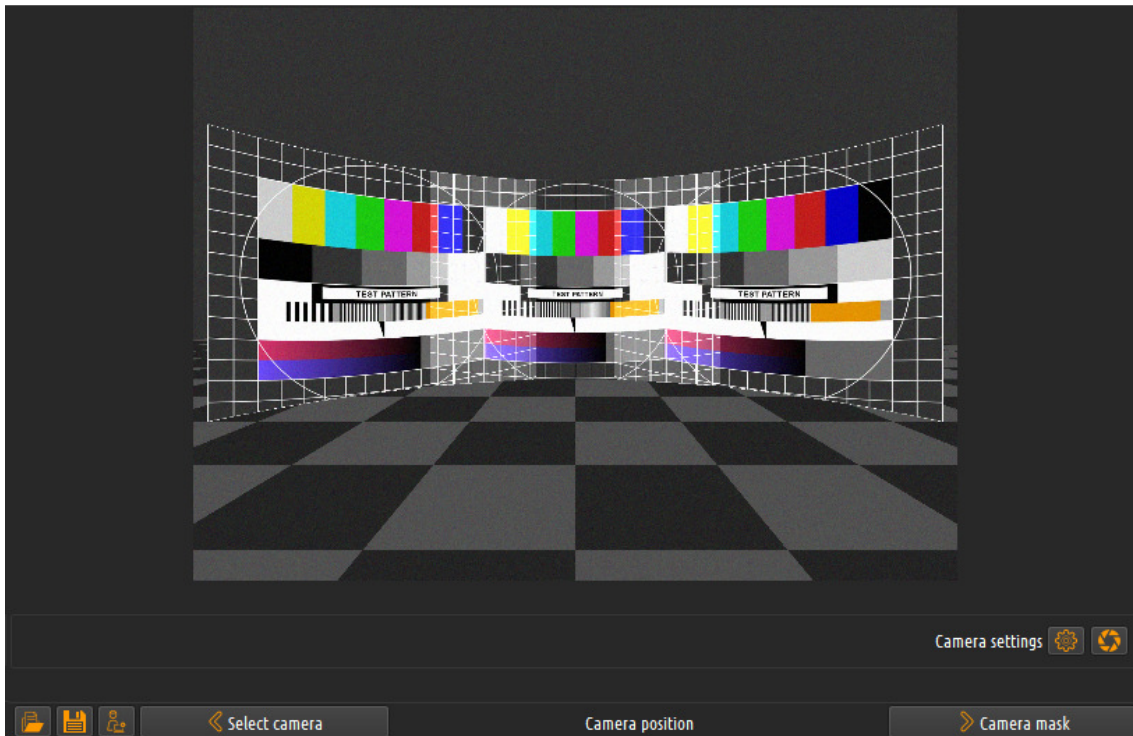
Select the camera to be used for calibration and select the highest resolution available from the camera. Although the software can be successfully used with standard definition webcams, it is highly recommended to use HD web cam. The cameras from Logitech and Microsoft are very good HD webcams.

Press the “Camera position” button on the lower right part of the window to go to the camera position and preview window.



5 Camera position and camera properties

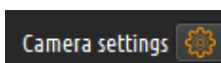
Position the camera so that the camera can capture the complete projection screen and the projection screens occupies a large portion of the camera image.



Note: The camera has to be fixed and should not be moved during the rest of the calibration.

For successful calibration it is important that all automatic camera features (auto-focus, auto-zoom, white balance, etc.) have to be turned off.

Press the camera properties button to open the camera properties window. This window is provided by the camera drivers and can look differently for different cameras.

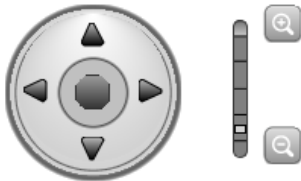


Immersive Calibration PRO Single Camera Step-By-Step Guide

Webcam Control

Advanced Settings

Device Info




Trouble being heard?
If you are having trouble with your microphone, you may have the wrong microphone selected. To select the right microphone, go to your video calling application and look for the microphone input setting.

☐ Follow my face

☐ RightSound

☐ Auto-focus



No Auto focus


Webcam Control

Advanced Settings


Device Info

Image Quality:
☐ RightLight


Exposure




Gain

☐ Auto


Brightness




Contrast



Color Intensity



White Balance

☐ Auto

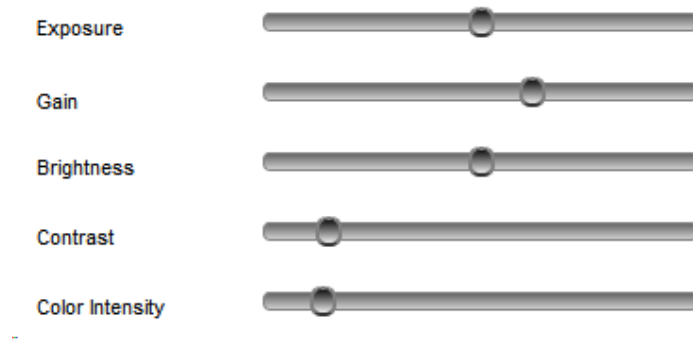
Anti-flicker:
☐ Off
☒ NTSC - 60Hz
☐ PAL- 50Hz

Image orientation:
☒ Normal
☐ Mirrored

No Auto Gain and Auto White Balance

Immersive Calibration PRO Single Camera Step-By-Step Guide

Use the camera controls to adjust the camera image for the best projector scanning and calibration results.

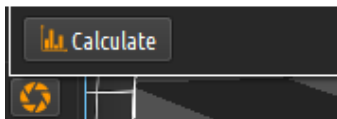


The primary control of the camera image is the “Exposure” control. Use the Exposure to get the most natural looking camera image.

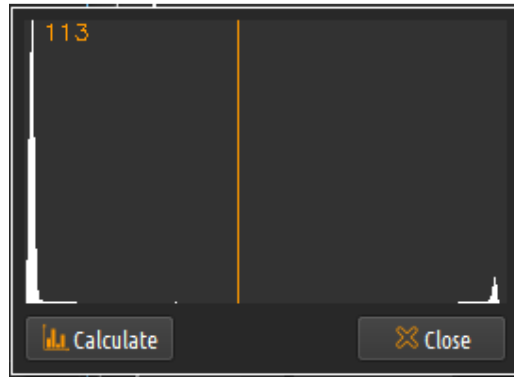
The camera image should look natural and should not be too dark, too bright or saturated. The black and darker colors and the white and brighter colors should utilize the complete camera colors range.

In order to help and facilitate the adjustments of the camera properties, the software comes with a tool called Histogram to evaluate and calculate the used camera dynamic range.

Select the Histogram button and press on the calculate button.

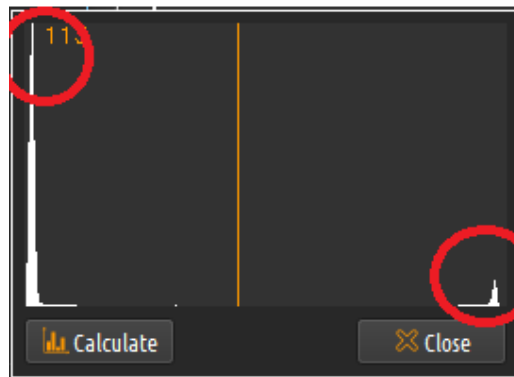


The software will project a number of patterns on the projection screen and will calculate the range between the dark colors and the bright colors as well as the middle distance.



Camera histogram

The camera histogram shows two peaks. The left peak is for the dark colors and the right peak is for the bright colors.

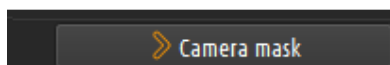


Camera histogram peaks

Use the camera properties (primarily the Exposure) to change the camera properties in such a way that the two peaks are as far as possible and that the orange line lies in the middle between those peaks.

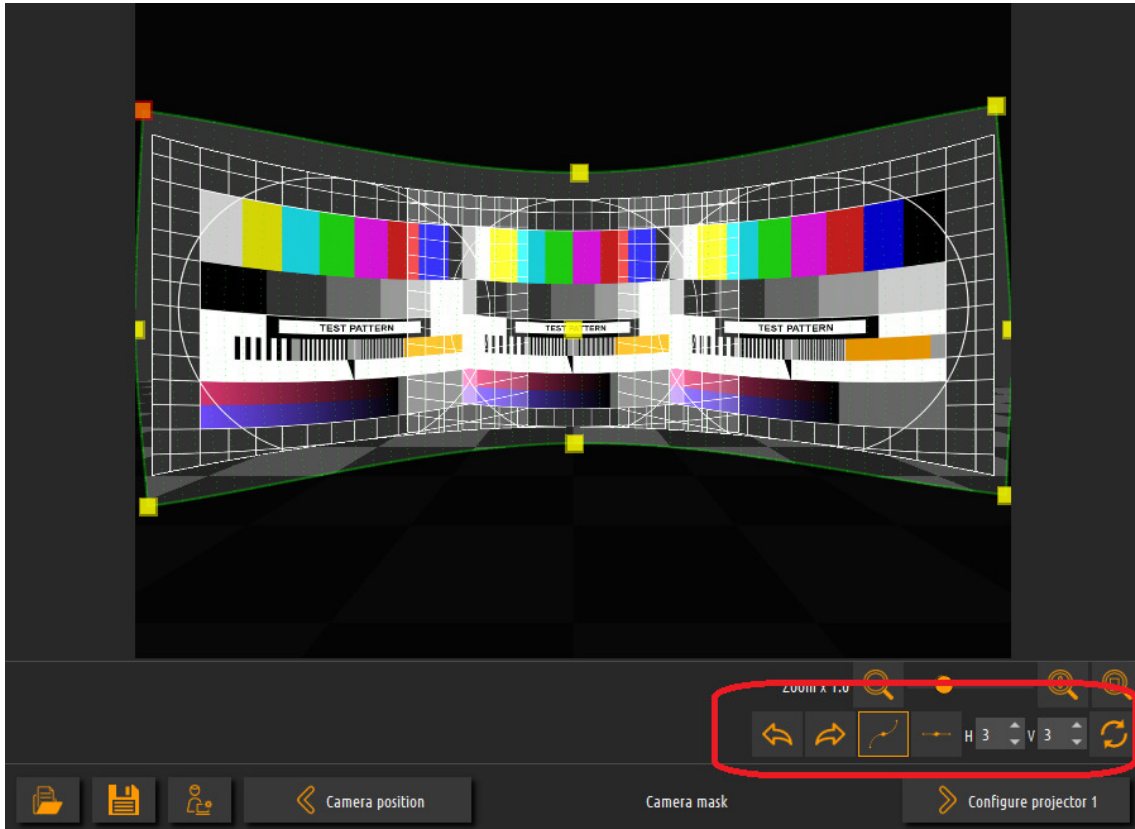
Note: Make sure that you recalculate the Histogram each time the camera parameters have been changed.

Press the “Camera mask” button on the lower right part of the window to go to the camera masking window



6 Camera masking

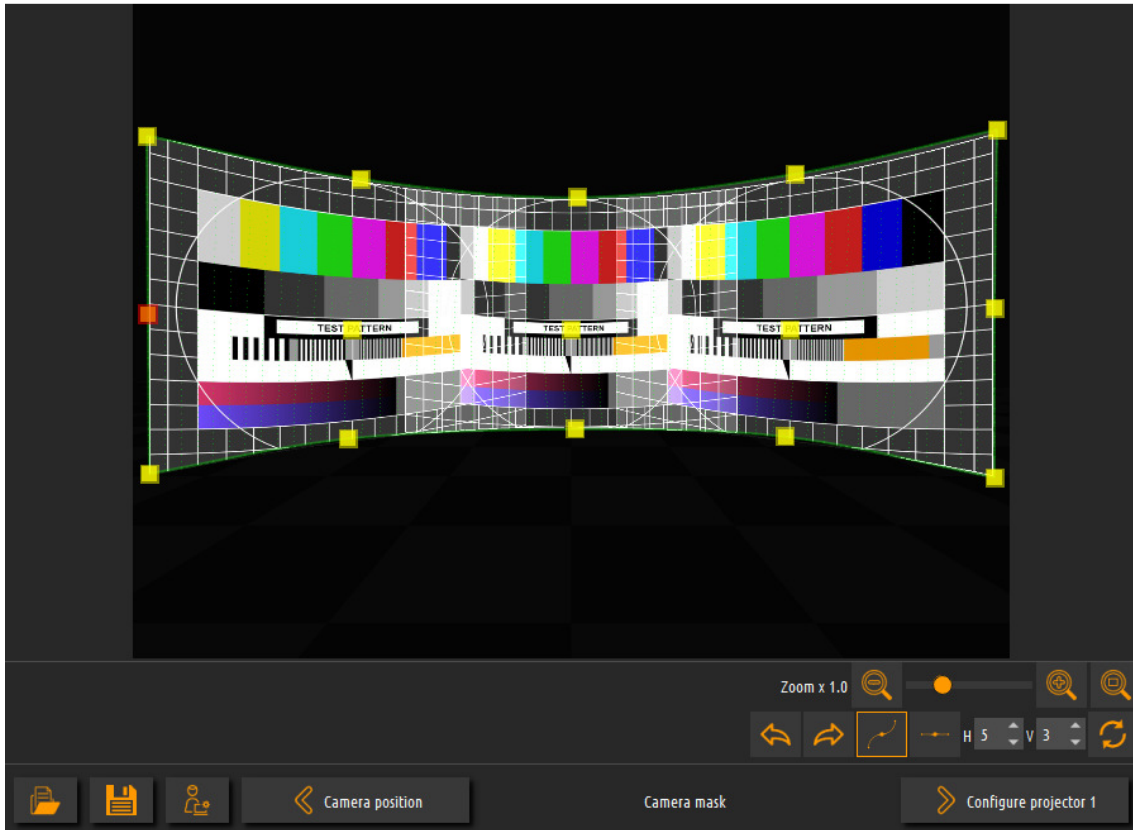
The camera masking is necessary to ensure that the calibration process will only focus on scanning of the projectors and calibrating of the screen projection surface.



Using the masking grid points ensure that the grid mask is aligned with the edges of the projection screen.

Use the grid properties function to add or remove grid control along the horizontal or vertical edges of the mask grid or to reset the masking grid.

Once the masking grid is aligned with the screen it can be saved to a file and used later for a new calibration or recalibration.

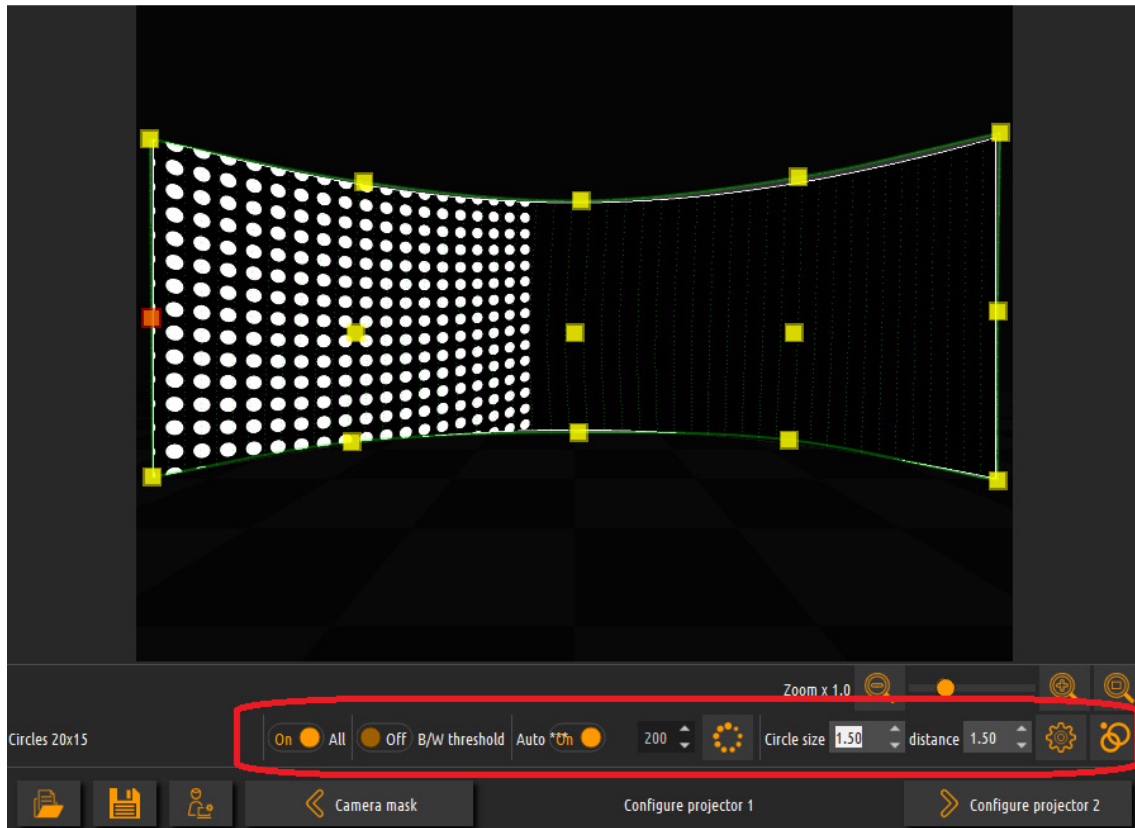


Aligned masking grid

Press the “Configure projector1” button on the lower right part of the window to go to the projectors scanning configuration window.

7 Projector scanning configuration

In the projector scanning configuration configures the size and the number of the white circles that will be used for scanning the projectors and calculating the calibration.



Projector scanning configuration

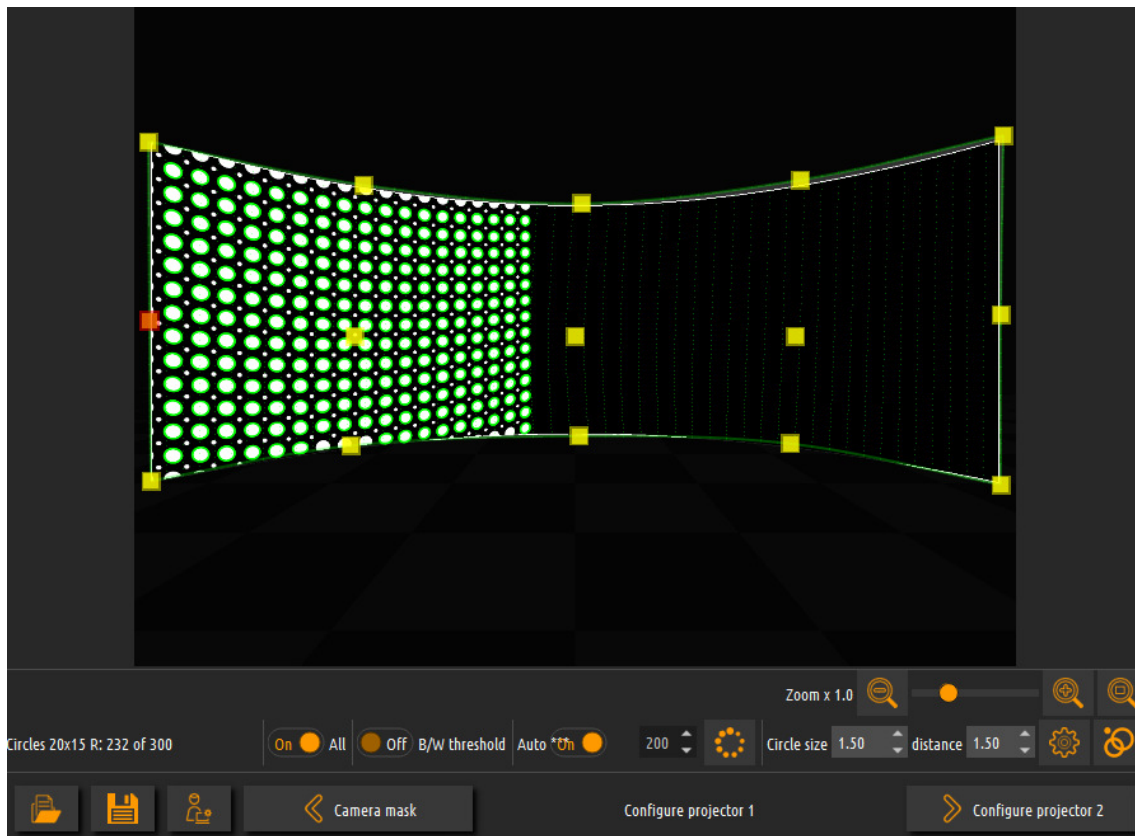
This can be configured for a single projector or for the all projectors at once.

The default values for “Circle size”, “Distance” and “Max ratio” should be good to successful projector scanning.

Press the “Recognize circles button” to pre-scan the projectors and recognize the white circles.



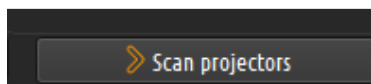
After the circles recognition, the recognized circles will be marked with green color and the not recognized circles will be marked with red color.



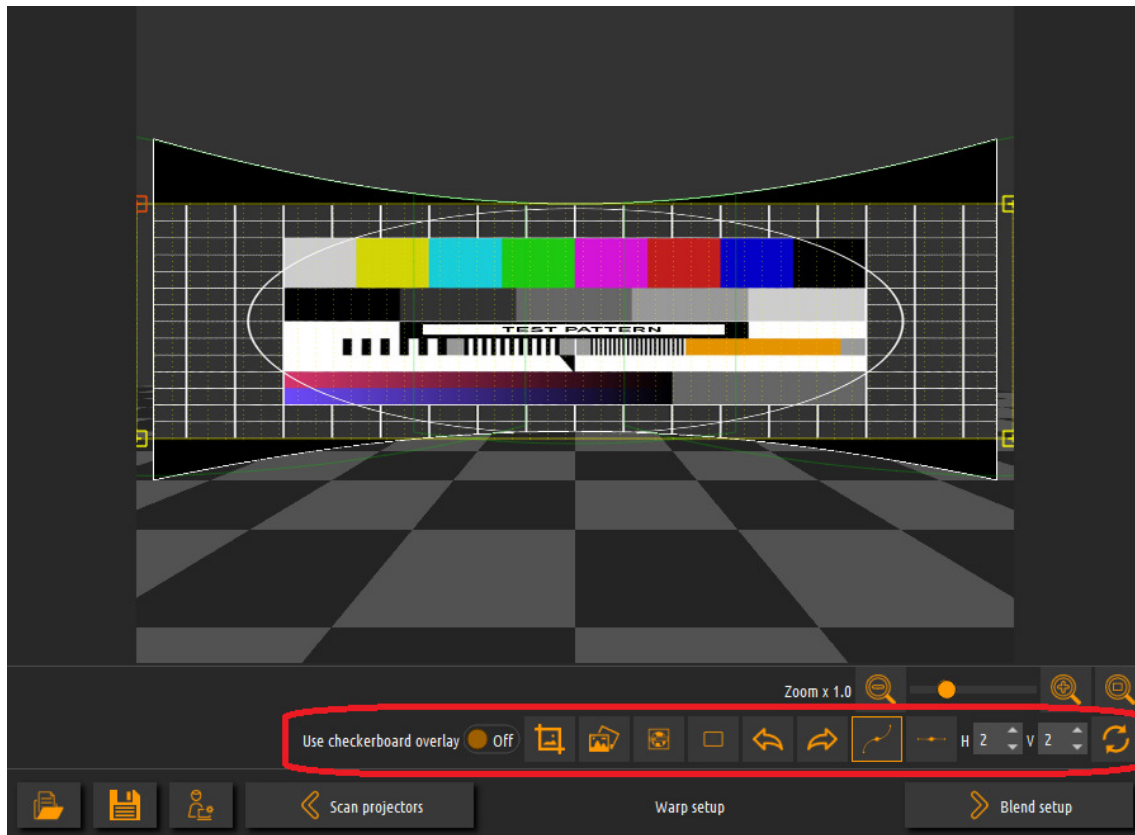
Use the "Circle size", "Distance" and "Max" ratio" to increase or decrease the number and the size of the circles to ensure that as much as possible whole circles are recognized and marked as green.

If there are still unrecognized red circles the software will reconstruct them during the scanning.

Press the "Configure projector2" button on the lower right part of the window to go to the projectors scanning configuration window for the next projector. Repeat the same steps for all projectors and press on the "Scan projectors" button to start the scanning and calibration process.



After the calibration is finished the software will create a combined rectangular projector image with minimal size to fit the screen.



Finished calibration

8 Warp setup

In the warp setup window use the warping grid to map the combined projector image on the projection screen.

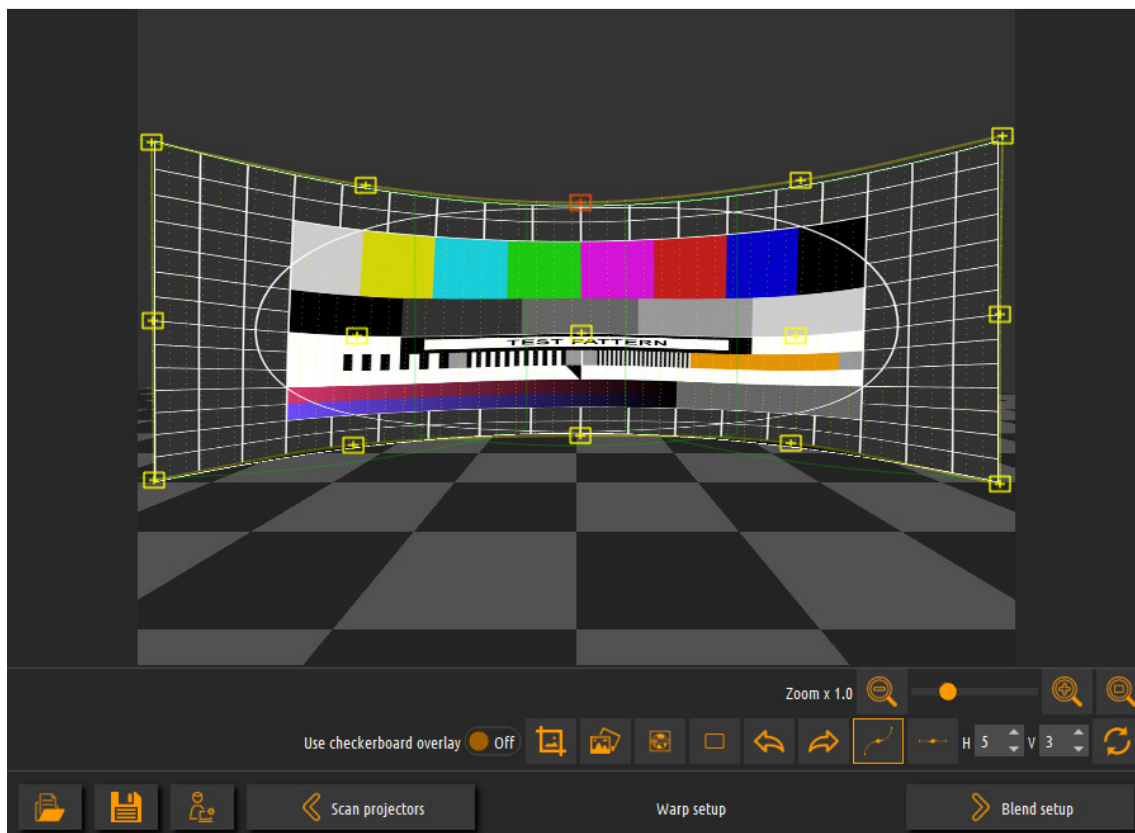
When the masking grid has been used to mask the projection scanning, the masking grid can be used to automatically map the projection image to the screen.

Press the “Take mask” button to take the mask grid and use it for screen mapping.



When the combined projection image is mapped to the projection screen use the grid control points to fine tune the mapping.

Add additional control points in horizontal or vertical direction to get more control on the mapping. Use the mouse or keyboard to move the grid control points.

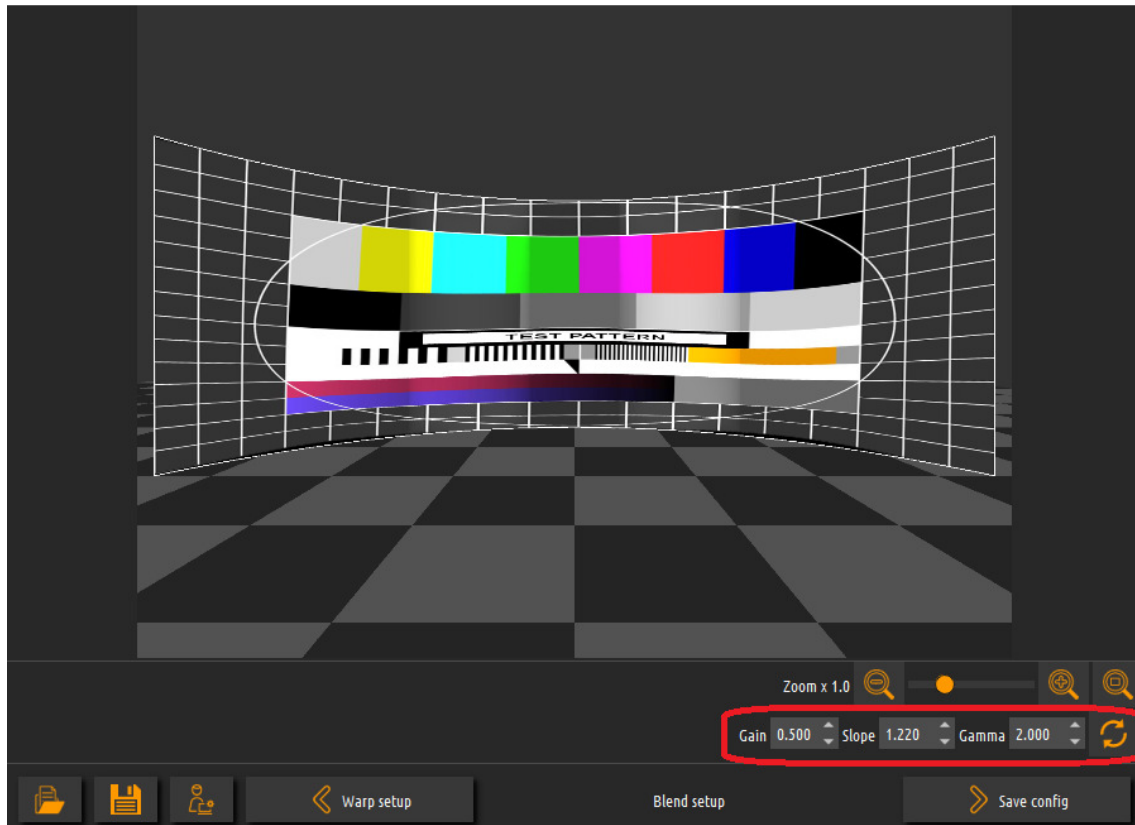


The projection screen will show the combined warped and blended test image.

Press the “Blend setup” button on the lower right part of the window to go to the blending configuration window.

9 Blend setup

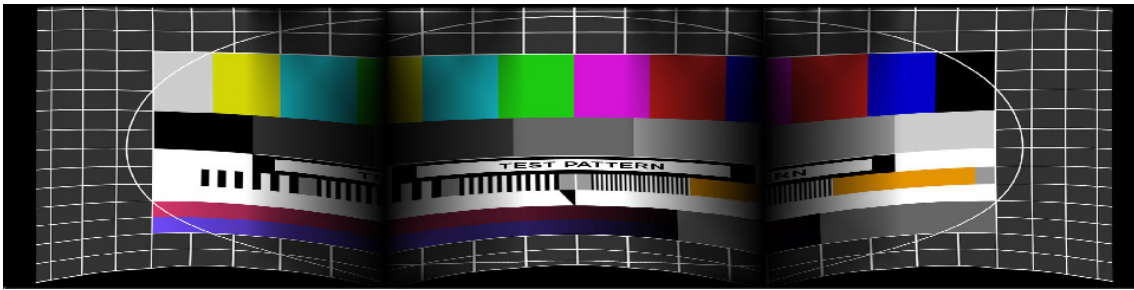
In the blend setup window the soft-edge blending parameters can be adjusted to fine tune soft-edge blending regions and to make sure the images from multiple projectors are perfectly blended.



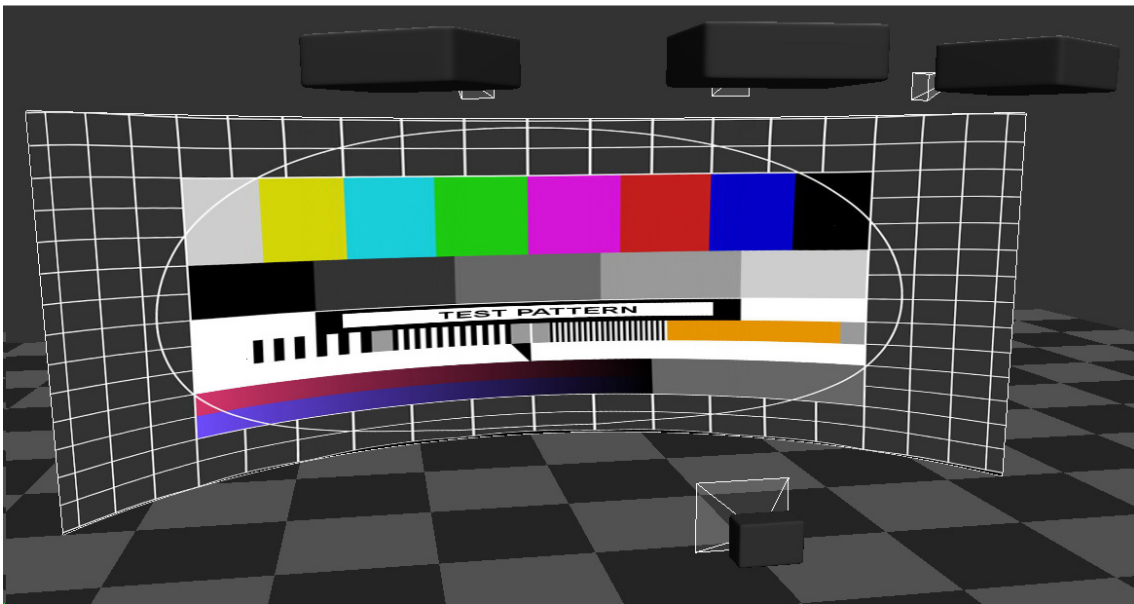
The default blending parameters have been chosen to fit most of the projectors and projection screen. However, if the overlapped regions after the scanning are brighter or darker, it is only needed to use slightly change the “Gamma” parameters in order to achieve the perfect blending.

The “Gain” and the “Slope” parameters can be used in more advanced blending configurations.

This is the last step in the automatic multi-projector calibration. The output of the projectors is warped and edge-blended so that when the projectors project on the projection screen they will produce one single projected image.



Projected images from the projectors



Projection on the screen

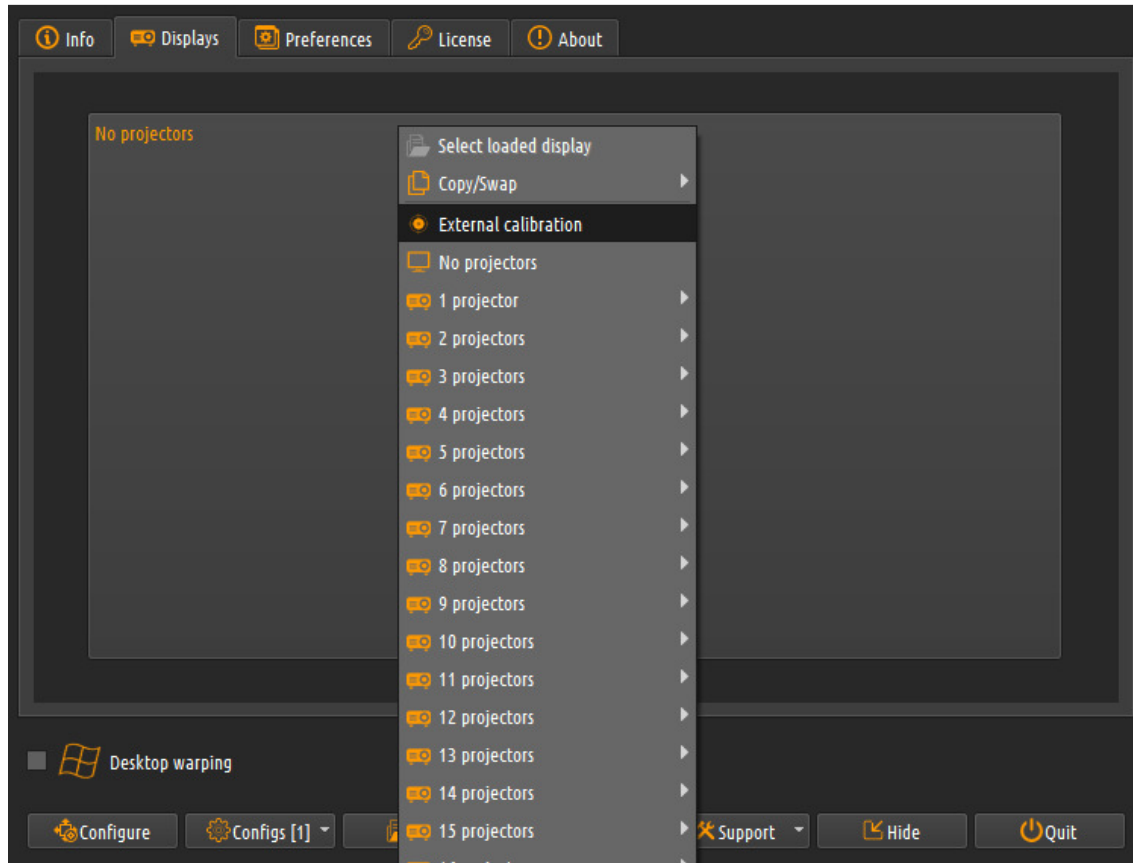
Press the “Save config” button on the lower right part of the window save the calibration results as *.procalib file that can be loaded in Immersive Display PRO.



Note: If running on Windows 8 or higher, make sure that you save the *.procalib file in the Immersive Display PRO installation folder (<Program Files>/Immersive Display PRO/) to ensure that the desktop warping will be able to find the saved file.

10 Load and use calibration results

Start Immersive Display PRO, and click on the display that has been used to calibrate.



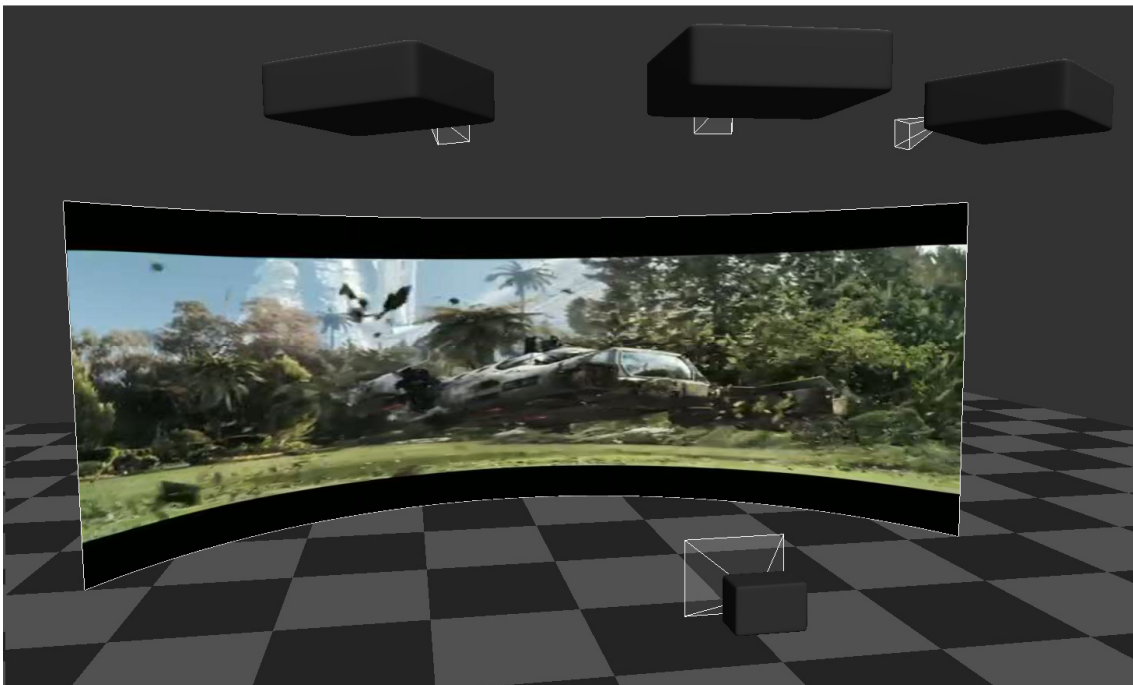
Select External calibration and select the just saved *.procalib file. Press the Save button and enabled the desktop warping.

The complete windows desktop will be warped and blended on the projection screen.

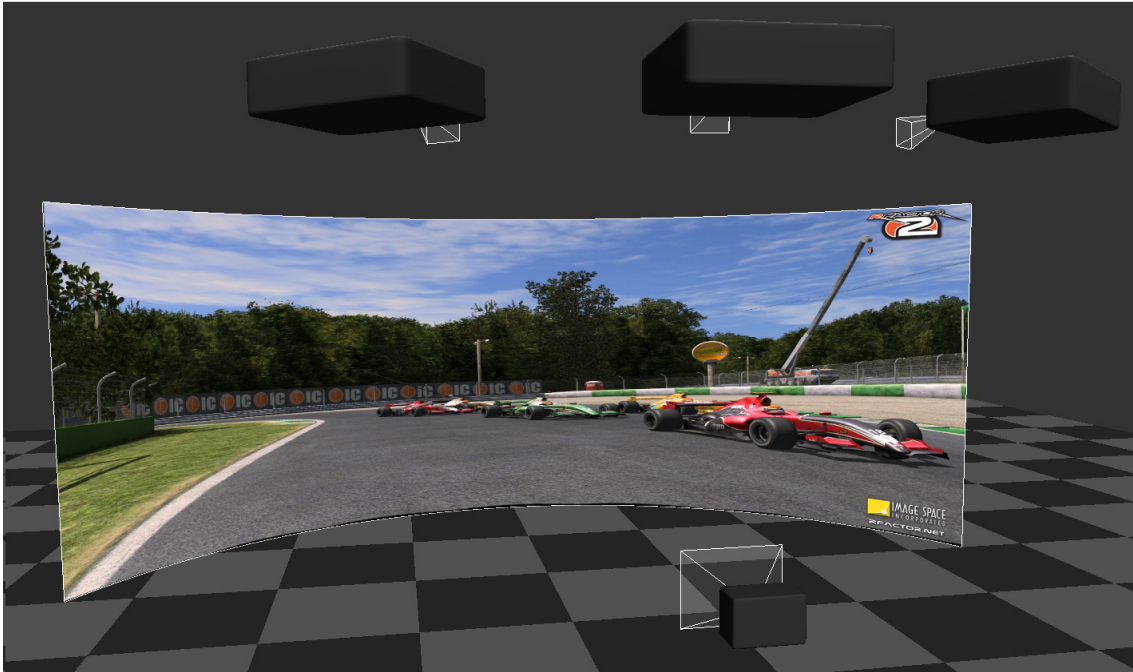
All applications started on the desktop will be automatically edge-blended.



Windows desktop warping



Movie player



Racing game