Fraunhofer
Heinrich Hertz Institute

STAN - The Stereoscopic Analyzer

Manual: version 2.10-0-1-Z

STAN Manual STAN version 2.10-0-1-Z

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Introduction

The STAN (Stereoscopic Analyzer) is an assistance system for stereo shootings and 3D productions. An image-based scene analysis estimates in real-time the stereo geometry of the two cameras in order to allow an optimal alignment of the cameras and lens settings directly on the set. It automatically eliminates undesired vertical disparities between the two views, through an electronic image rectification process. In addition it detects the position of near and far objects in the scene, derives the optimal interaxial distance and gives alerts if synchronization problems occur.

Figure 1 illustrates the Graphical User Interface of the Stereoscopic Analyzer. The GUI allows an easy overview about all important stereoscopic parameters. The input images can be monitored in a variety of visualization modes.

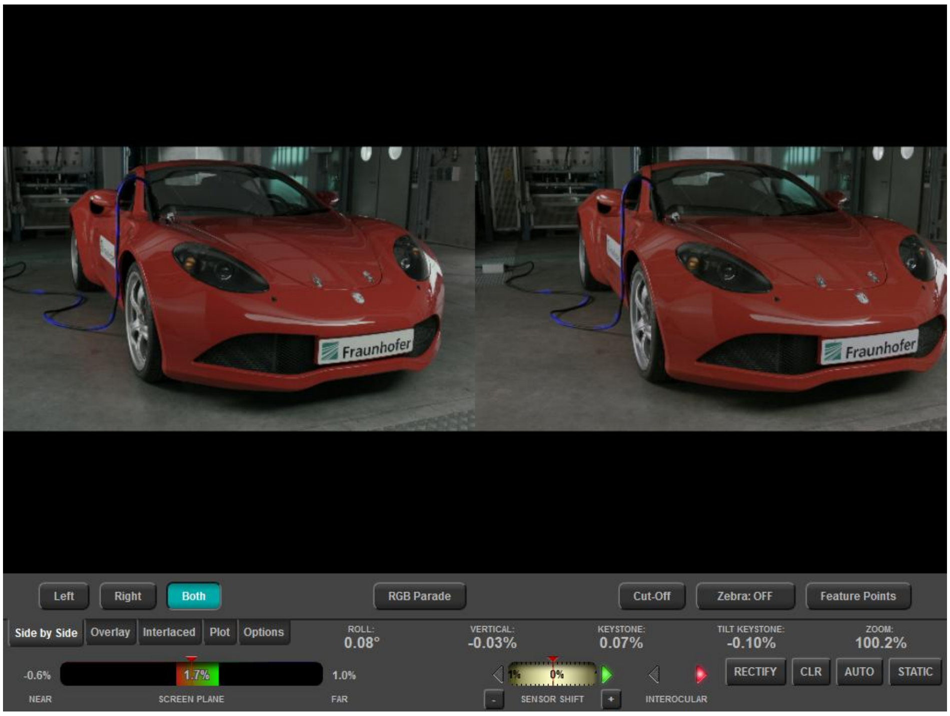


Figure 1: STAN's Graphical User Interface (GUI)

First Steps

Select Input Device

If your PC system has more than one HD-SDI ***Input Device***, choose the appropriate capture board from the Drop Down. Figure 2 illustrates this process.

Supported capture boards are:

- DVS Centaurus II
- DVS Atomix
- DVS Atomix LT
- Blackmagic Design DeckLink HD Extreme 3D

Figure 2: Input Device selection: *Options* → *Video* → *Input Device.*

The options menu is automatically opened after the start of the application when no camera signal matching the current Input Raster could be detected. After changing the *Input Device*, click *Restart*.

Select Input Raster

In a first step, the proper Input Raster needs to be chosen. The Input Raster is a combination of the resolution, the frame rate, and the scan mode (progressive or interlaced). Select the ***Options*** tab and use the drop-down menu to choose the ***Input Raster*** as shown in Figure 3. Briefly, the Input Raster must match the configuration of the Monitor Output or the Recording Output of your cameras.

The Input Raster can be selected in the ***Options*** tab. Within the ***Options*** tab, select the ***Video*** tab.

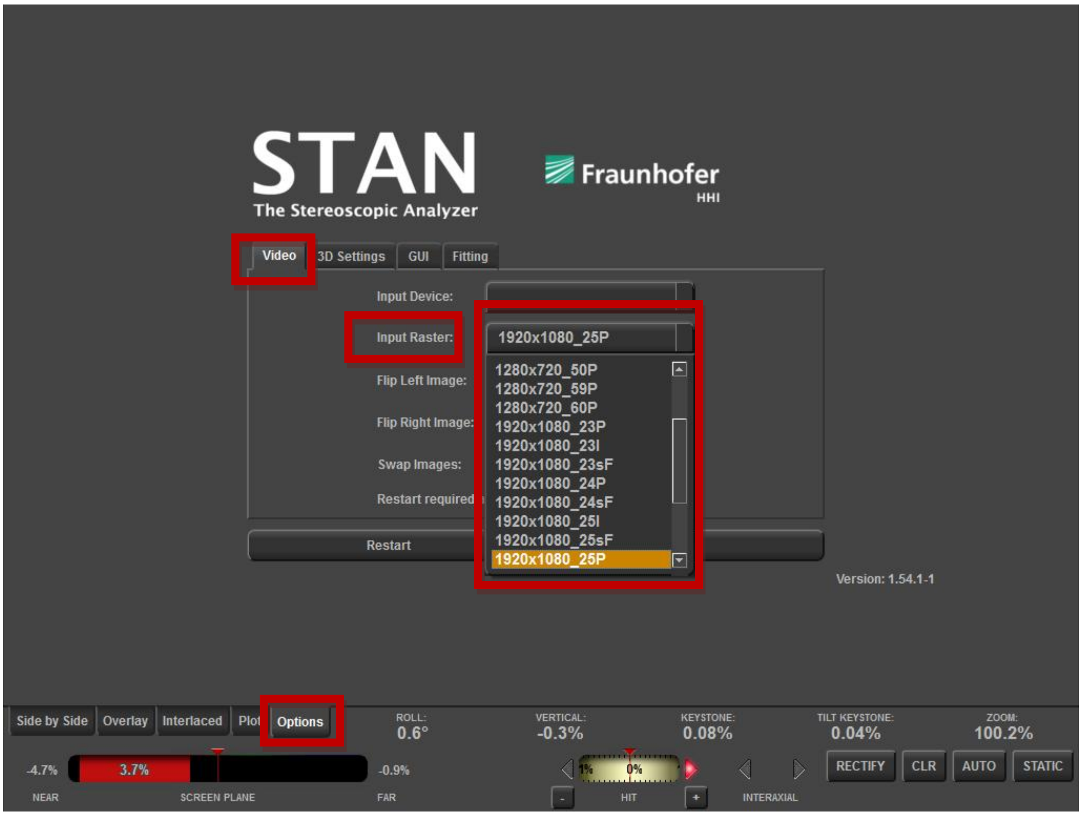


Figure 3: Input Raster selection: *Options* → *Video* → *Input Raster*

The options menu is automatically opened after the start of the application when no camera signal matching the current Input Raster could be detected. After changing the raster, click *Restart*.

After the first start the STAN shows the video settings in the ***Options*** tab. It is necessary to select the proper ***Input Raster*** from the cameras. All supported ***Input Rasters*** can be found in the ANNEX. Please note that some video equipment cannot distinguish between a ***psF-Raster*** (progresseive scan mode using two fields as done in interlaced mode) and an ***Interlaced-Raster***. The psF-Raster is widely used by Sony cameras but is not specified in SMPTE 292M.

Adjust Vertical and Horizontal Flip

When using a mirror rig, you will need to flip one or both cameras vertically or horizontally. Before you can start working with the STAN. Figure 4 shows an example of a stereo pair which needs a vertical flip to be applied on the left image. The left camera image was flipped by using a mirror rig.

Figure 4: Unmodified camera signals. The left image is flipped due to the use of a mirror rig while shooting the content. Using the *Side-by-Side* view mode, one can easily perceive which flipping option is necessary.

We know choose the appropriate flipping in the Options menu as shown in Figure 5 and Figure 7. In our example we need to flip the left image vertically.

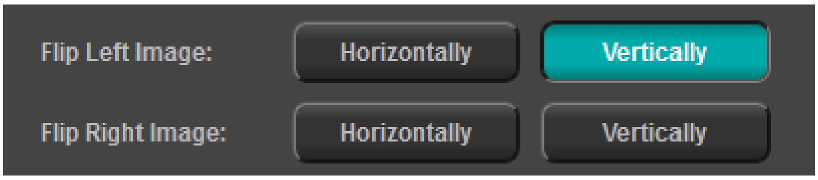


Figure 5: Select the appropriate flipping in the Options menu. In our example, the left image needs to be flipped vertically. Changes apply immediately.

After applying the flip, we switch back to the ***Side-by-Side*** view mode to check the result of the flipping settings as illustrated in Figure 6. Apparently, we do now have a valid stereo pair.

Figure 6: Stereoscopic image pair. The left image has been flipped vertically to compensate for flipping introduced by the mirror rig. You can start using the STAN now.

Some stereo rig configurations might require to flip both cameras vertically and one camera horizontally.

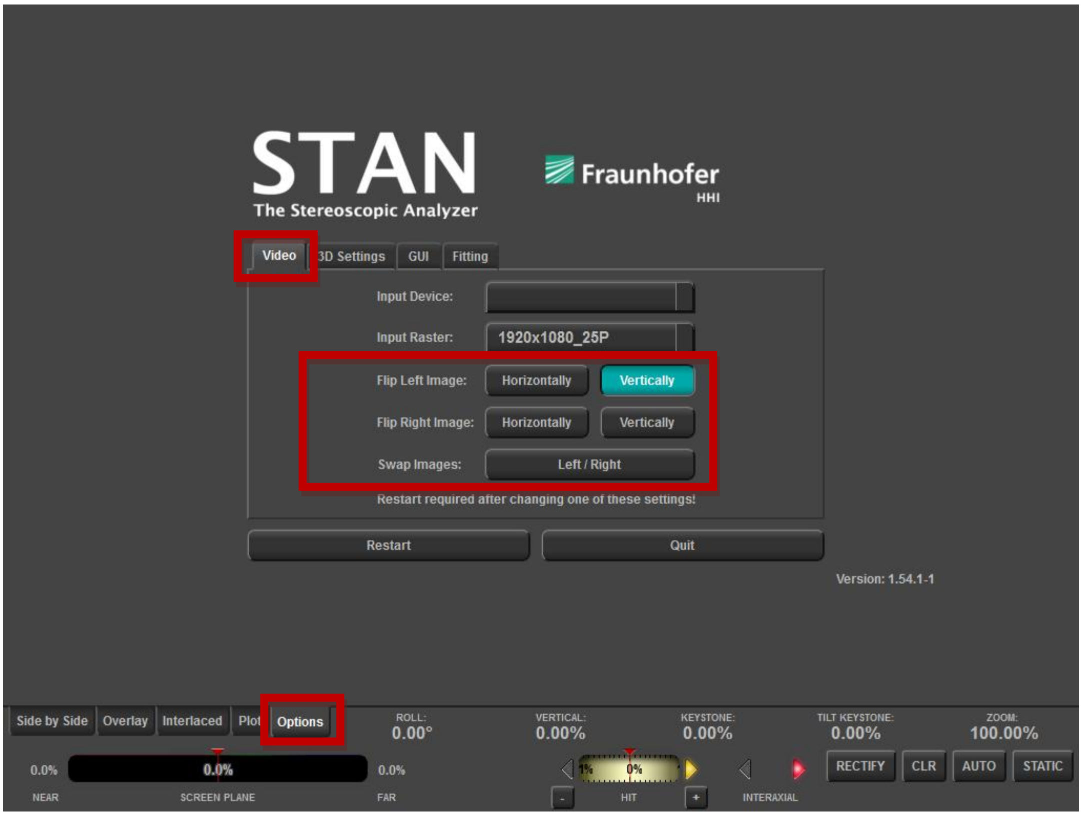


Figure 7: Vertically or horizontally flip the images when using mirror rigs. You can define the flipping in the menu:

Options → Video → Flip Left Image / Flip Right Image

As shown in Figure 7 you can also swap the left and right input channel. If for instance, the left camera is connected to the right STAN input channel (and the right camera to the left STAN input channel) you can use this feature to compensate this erroneous configuration. Figure 8 illustrates this process.

Figure 8: Swap the left and right camera input on demand. The changes apply immediately

When you change the flipping settings and/or the swapping settings, these apply apply immediately, i.e. no restart is required.

Calibrating your Stereo Rig

Mechanical Alignment

One of the main features of the STAN is to provide assistance for the mechanical alignment of the rig. In Figure 9 the results of the geometrical analysis are illustrated. In this example, ***Roll***, ***Vertical***, ***Keystone***, ***Tilt-Keystone***, ***Y-Offset*** and ***Zoom*** settings are being evaluated and displayed.

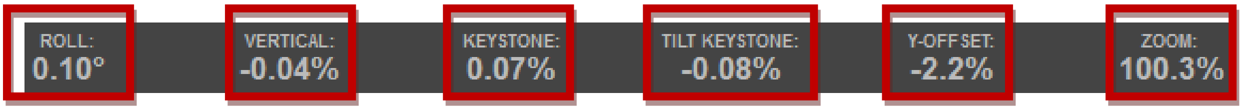


Figure 9: Displaying the parameters for the Mechanical Alignment.

To achieve an optimal mechanical alignment the red marked values in Figure 9 need to be calibrated as:

- Roll – 0°
- Vertical Offset – 0%
- Keystone – 0%
- Tilt Keystone – 0%
- Y-Offset – 0%
- Zoom Level – 100%

In general, during the setup and calibration phase, you should try to get near the above mentioned values. Depending on which stereo rig you use, it might happen that you need to calibrate some values iteratively.

To perform the adjustment, use the appropriate calibration knobs and/or screws on your stereo rigs, and turn them until all values are near the optimum.

In addition, you might want to get a visual feedback. To do so, choose one of the overlay modes in the Overlay menu as shown in Figure 10 to Figure 12.

Figure 10: The *Anaglyph Overlay* mode can be used to get a visual feedback of the quality of the mechanical alignment. Red or cyan lines around horizontal object borders in the image are clear indicators of the presence of vertical disparities and thus a poor mechanical alignment.

The ***Anaglyph Overlay*** mode is widely used to assist the calibration of the stereo rig. Red and Cyan border indicate differences between the left and the right image. This can be used to identify vertical disparities indicating a missing calibration of the stereo rig. Moreover, one can easily detect horizontal disparity and especially the convergence plane. This assists the stereographer the choose the right convergence angle or ***Horizontal Image Translation (HIT)***. One can choose between three Sub-Options:

- Input
- Program
- Preview

These options define, if the uncorrected image pair sill be shown in the anaglyph overlay ***(Input)***, or if electronically corrected images shall be shown (***Program*** and ***Preview***). ***Program*** refers to the correction parameters which are active on the HDMI-output while Preview applies correction matrices which become active when hitting the button ***Rectify***.

These Sub-Options are also available for the visualization modes ***Difference*** and ***Opacity Overlay***.

Figure 11: *Difference Overlay* Mode. The Difference Overlay Mode shows the luminance difference between the two images.

The ***Difference Overlay*** Mode is also widely used to perform the mechanical calibration of the rig and to choose a proper convergence plane. In the ***Difference Overlay*** mode, all objects in the convergence plane disappear. These regions are displayed in grey. Vertical or horizontal disparities yield to black and white edges around the objects.

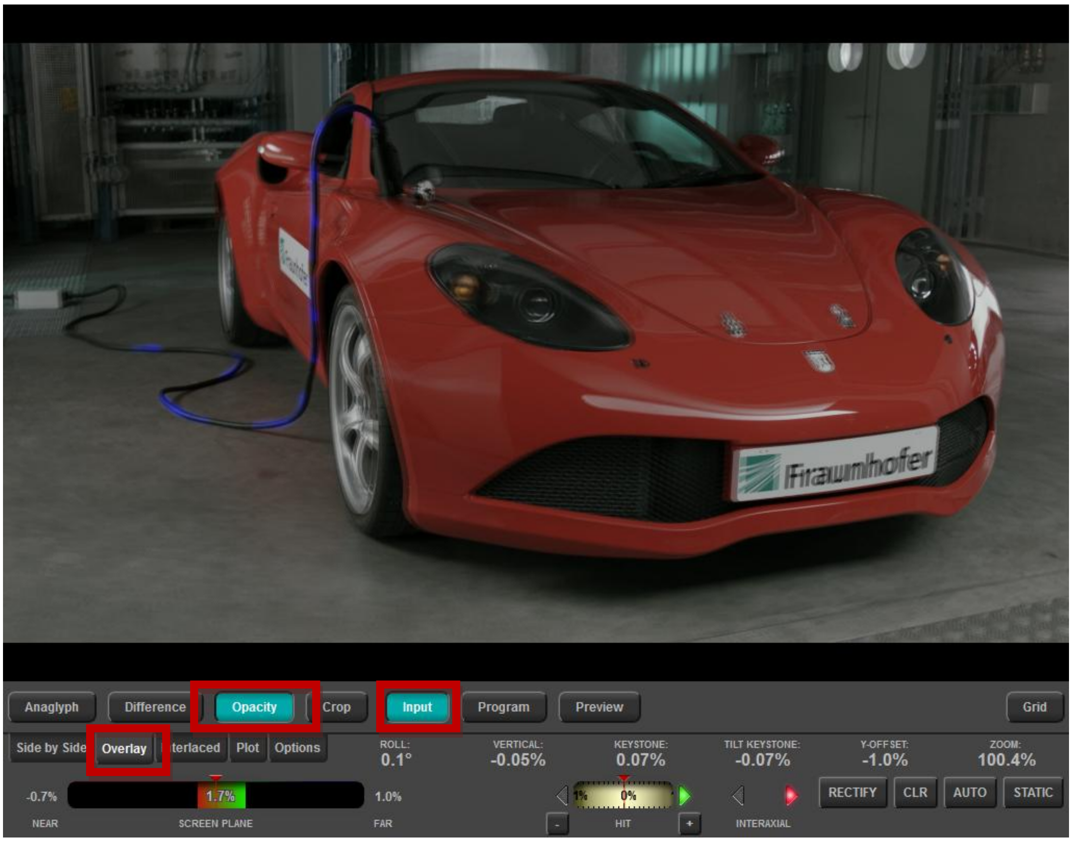


Figure 12: *Opacity Overlay* Mode

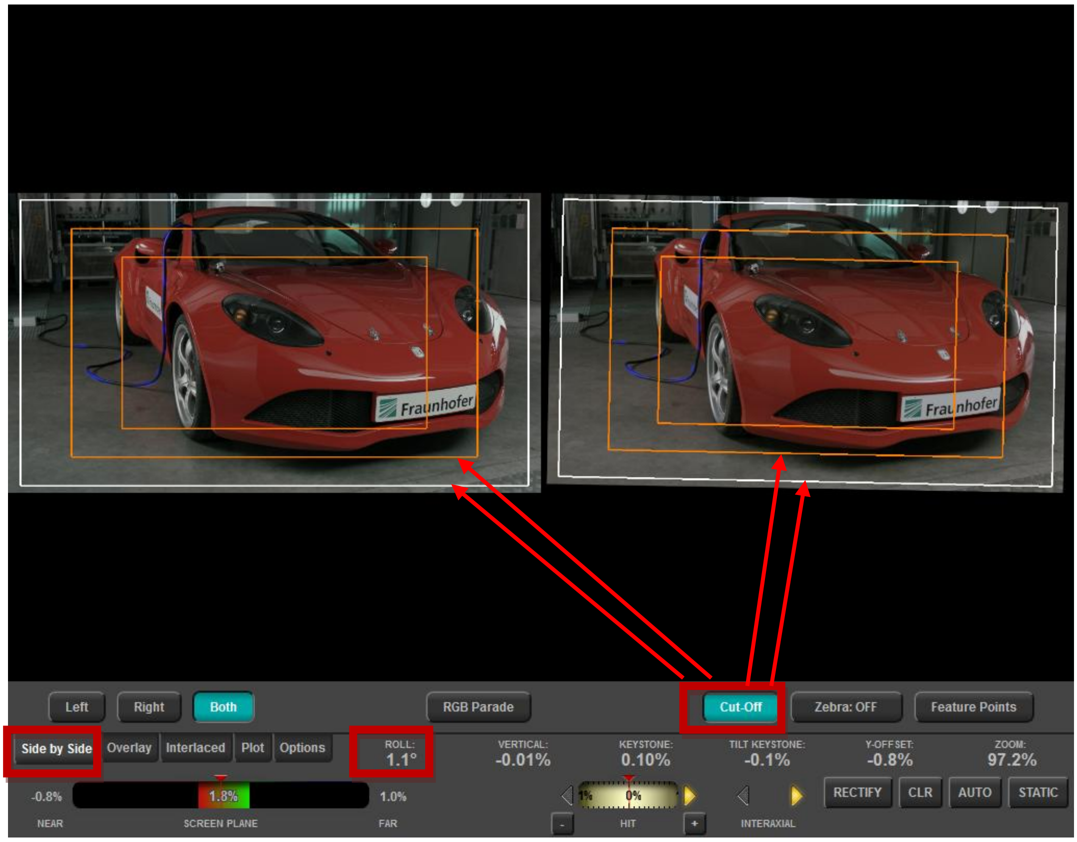
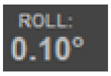


Figure 13: The *Cut-Off Area* mode combined with the *Side-by-Side* view mode allows for an optical feedback of possible calibration errors. In this example, the right camera suffers

from a 1.1° roll error. The white and orange rectangles ins the two images coincide with the current camera geometry.

Roll Error Adjustment



The ***Roll*** error refers to a roll of the right camera with respect to the left camera. To reduce the roll, error, you can turn the appropriate knob on your stereo rig (e.g. Quasar). A good calibration yields to values within a range of +/- 0.1° Roll error.

> ***Note:*** *If you have a roll error of 1 °, and an image height of 1080 pixel, you would have around 16 pixel of vertical offset at the left and right image borders. In comparison, a roll error does induce vertical disparities near the image center.*

Vertical Offset Adjustment

The ***Vertical*** offset is the mean disparity between the left and right image. It is measured in percent of the image height. To reduce the ***Vertical*** offset, you can adjust the **tilt** of one or both cameras.

> ***Note:*** *If you have a vertical disparity of 1 %, and an image height of 1080 pixel, you would have around 10 pixel of vertical offset.*

Keystone Error Adjustment

The ***Keystone*** error is induced by a convergent camera geometry. During rig calibration, one aims to bring both cameras in a parallel geometry. The cameras are parallel when the ***Keystone*** error vanishes.

Note: *When the **Keystone** error vanishes, the two cameras are in parallel position.*

Tilt Keystone Error Adjustment

A ***Tilt Keystone*** error indicates the presence of a strong tilt error. Similar to a convergence angle, a camera tilt also yields to a keystone. This effect can be observed for instance when a projector is displays an image onto a wall and the optical axis is not perpendicular to that wall. However, the ***Tilt Keystone*** error is usually very small and vanishes automatically when adjusting the ***Vertical*** offset.

Y-Offset Adjustment

The ***Y-Offset*** indicates a height difference between the two cameras. The result is measured in percent and refers to the ratio of height error and interaxial distance. If you have an interaxial distance of 100mm and STAN indicates a Y-Error of 1%, your cameras are 1 mm off in height.

STAN performs an image based measurement. For a robust measurement of the Y-Error, please make sure that STAN can find objects in different planes. In doubt, you can check using the ***Side-by-Side*** viewing mode with activated ***Feature Points*** display, if STAN finds feature points in different depth planes. We also recommend to minimize all other errors (e.g. ***Roll***, ***Vertical***, ***Keystone***, ***Zoom***, etc.) before minimizing the ***Y-Offset***. This will yield to more robust measurements.

Note: *If you have an interaxial distance of 100mm and STAN indicates a Y-Error of 1%, your cameras are 1 mm off in height. You cannot perform a Y-Error measurement with zero interaxial distance. For a robust measurement, you need an object tracked by the feature point detector near the camera, and also an object which is far away.*

Zoom-Level Adjustment

The ***Zoom-Level*** other than 100% indicates a mismatch between the two cameras' focal lengths, i.e. the two magnifications factors of the lenses are not identical. STAN measures the ratio between the two focal lengths and displays it in percent. To minimize the error, change the magnification factor of one of the two lenses, i.e. the zoom level, in case of fixed focal length lenses, you might try another pair of lenses which might have better matching focal lengths. Alternatively, you might move one camera along the optical axis. However, this introduces a small perspective error, which can be neglected in most cases. Try to bring the ***Zoom-Level*** in a region around 99.9 % and 100.1 %.

Note: *When STAN measures 101.0% percent* **Zoom Level***, the focal length of the right lens is by 1% longer than the focal length of the left lens. This will induce vertical disparities of ca. 5 pixels near the top and the bottom of the stereo images when using full HD resolution.*

Calibration Options

In the ***Fitting*** tab in the ***Options*** menu you can choose, which geometric parameters are important four your calibration process. In many cases, Roll, Vertical, and Zoom are sufficient to monitor, if the rig is still well calibrated, or if the mechanical calibration procedure needs to be performed again. Figure 14 shows the corresponding dialogue in the ***Options*** menu which is used to enable or disable the tracking of the different geometrical parameters. All parameters which are tracked, will also be shown in the bottom area of the GUI.

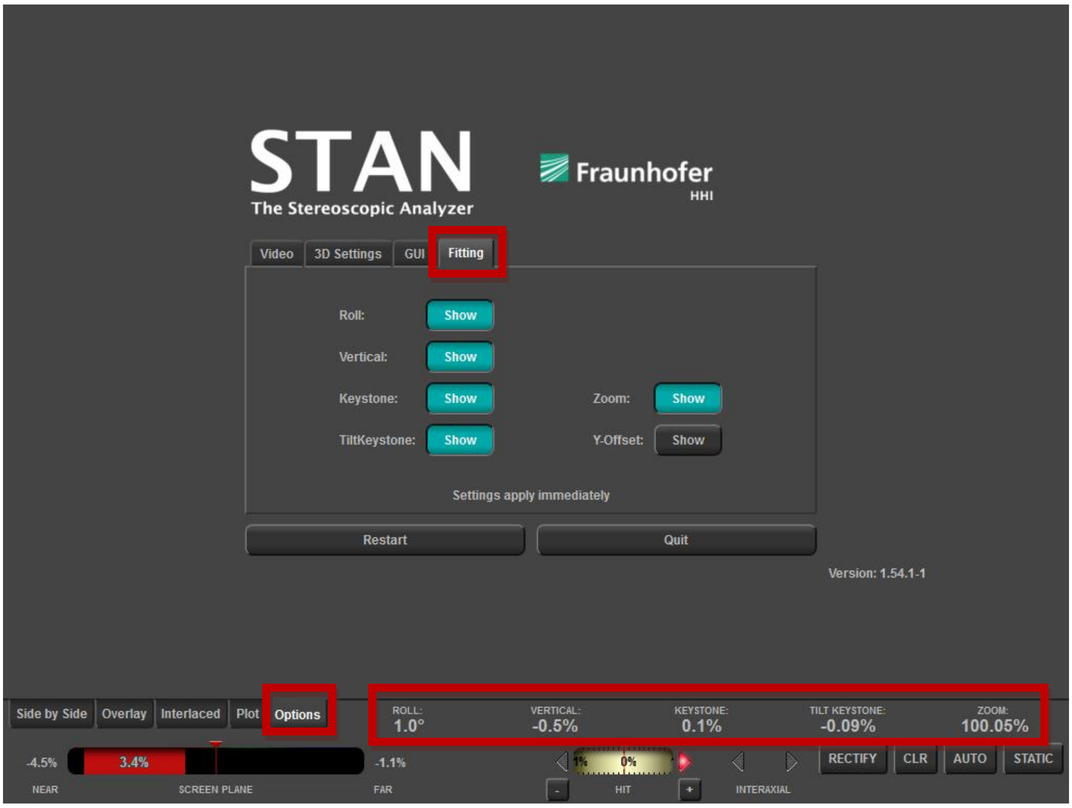


Figure 14: Select the geometrical parameters to track: *Options → Fitting → Roll / Vertical / Keystone / Tilt Keystone / Zoom / Y Offset*

Depth Volume adjustment

Measuring the Depth volume

A key benefit of the STAN is the intuitive and precise measurement of the current ***Depth Volume***. The value is shown in the center of the colored ***Depth Bar*** in the lower left region of the GUI. Moreover, the width of the ***Depth Bar*** is proportional to the depth volume. Figure 15 illustrates this relationship.

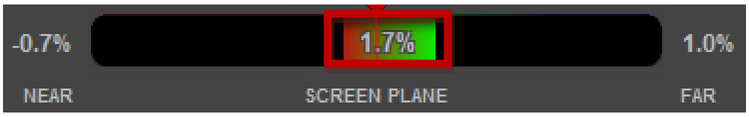


Figure 15: The *Depth Bar*: Measurement of the current Depth Volume. The Depth volume in this example is 1.7 % of the screen width.

Beside the depth volume, STAN is measuring the amount of depth before the convergence plane (i.e. Screen Plane) and behind the screen plane. These numbers are shown in Figure 15 above the captions ***Near*** and ***Far***.

Another way to measure the ***Depth Volume*** is to use grid lines. You can overlay grid lines. You can activate grid lines in the ***Overlay*** tab by pushing the ***Grid*** button. The position of the grid can be moved left and right using the slider as shown in Figure 16. Use the sensor shift (or HIT) to bring an object of interest (e.g. the nearest object) to convergence. Subsequently, you can measure the disparity, for instance of the far clipping plane. A horizontal disparity of 2% corresponds to the spacing between two grid lines.

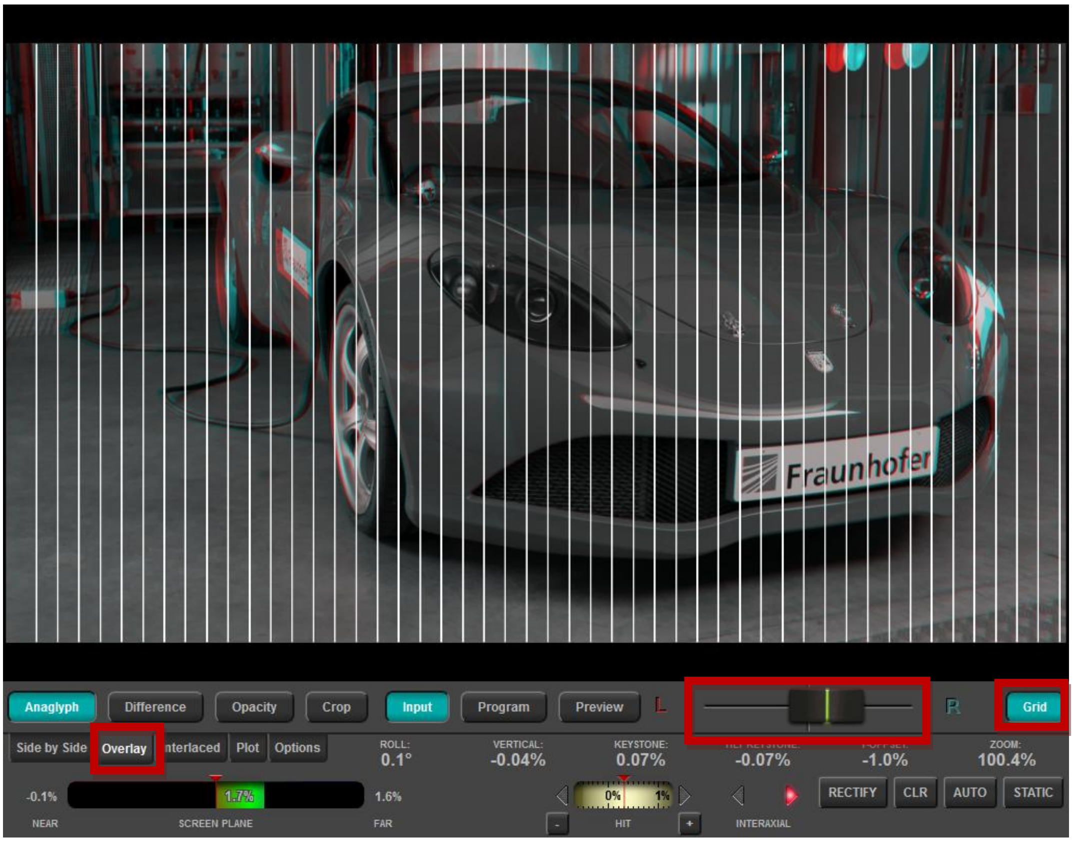


Figure 16: Grid lines applied to an Anaglyph Overlay image. Each grid line corresponds to a disparity of 2% of the image width. Use the slider to move the grid lines left and right. The sensor shift (or HIT) can be used to bring the near clipping plane or the far clipping plane to convergence.

The grid lines can be used to countercheck the automated depth volume measurement. However, the fastest and more precise way to check the current Depth Volume, is to read it right from the colored ***Depth Bar*** as shown in Figure 15.

Adjusting the Interaxial Distance / Stereo Baseline

Once the current ***Depth Volume*** has been calculated, you may want to adjust the interaxial distance in order to meet your ***Depth Budget*** requirements.

The ***Depth Volume*** is constantly measured by STAN and displayed as shown in Figure 15. If this number exceeds the ***Depth Budget,*** the STAN will give a feedback to increase or shorten the interaxial distance. This illustrated in Figure 17.

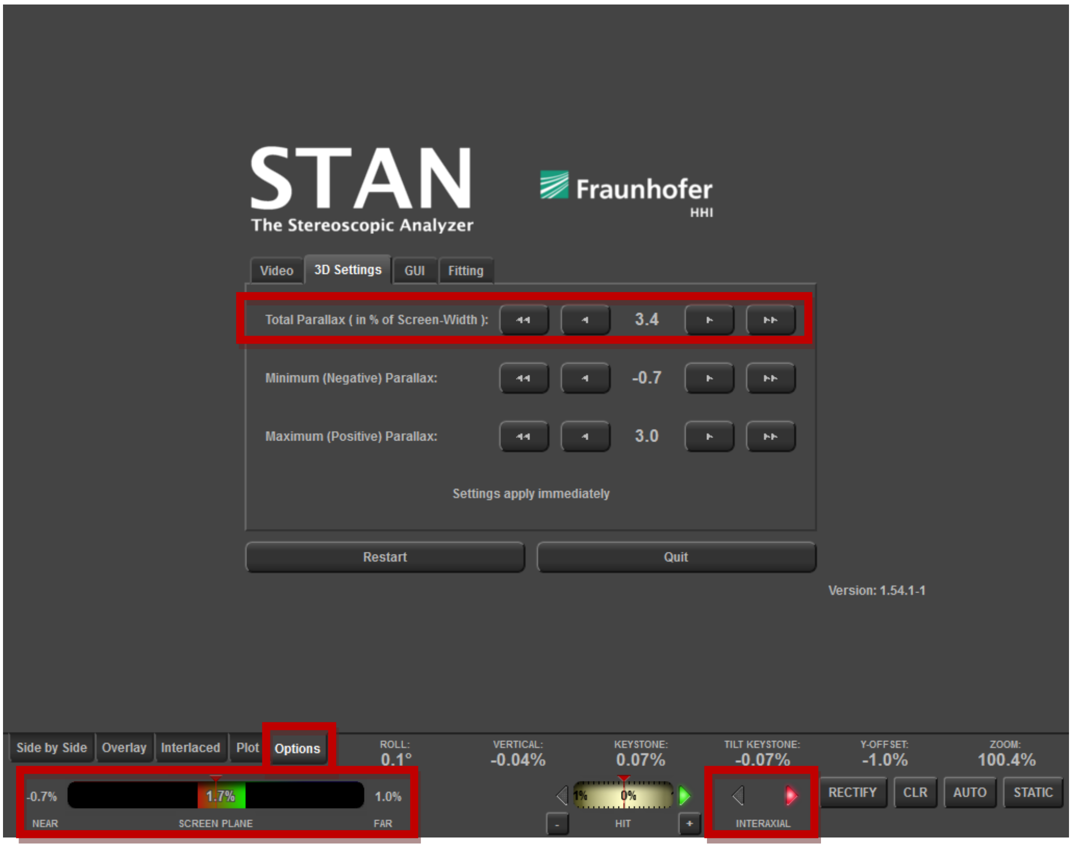
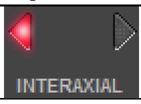


Figure 17: The Depth Volume (1.7 % in this example) is compared to the Depth Budget (Total Parallax to be defined in the Options menu). Subsequently, STAN derives, in which direction, the interaxial distance needs to be changed. In this example, the red arrow to the right indicates that the interaxial distance needs to be increased drastically. If you increase the Depth Budget (i.e. Total Parallax), STAN will take this into consideration and suggest higher interaxial distances.

> ***Note:*** *You can hide or show the interaxial distance advices and/or the interaxial distance gauge. To show the interaxial distance advices, go to* ***Options → GUI*** *and activate* **Interocular: Show**. *If you want to display the convergence plane gauge in the GUI, activate* **Interocular: Gauge** *in addition.*

The interaxial distance gauge shows the current motor position if a connection to the rig motors has been established. The colored arrows (left and right) indicate in which direction the interaxial distance should be moved to in order to get an optimal result. They can turn into red (very bad), yellow (bad) and green (good) or vanish (very good). The following table summarizes the different indicates and resulting advices.

Symbol	Indication	Advice
	The Depth Volume considerably exceeds the Depth Budget.	Strongly reduce the interaxial distance and/or increase the distance between

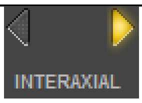
		stereo rig and the nearest object.
	The Depth Volume exceeds the Depth Budget.	Reduce the interaxial distance or increase the distance between stereo rig and nearest object
	The Depth Volume slightly exceeds the Depth Budget.	Slightly reduce the interaxial distance or increase the distance between stereo rig and nearest object
	The Depth Volume perfectly matches the Depth Budget	Optimal interaxial distance has been found. Keep shooting.
	The Depth Volume is slightly lower than the Depth Budget	You might slightly increase the interaxial distance in order to take full advantage of your available Depth Budget or bring the stereo rig nearer to the scene's nearest object.
	The Depth Volume is lower than the Depth Budget.	Increase the interaxial distance or reduce distance between the stereo rig and the nearest object in the scene.
	The Depth Volume is much lower than the Depth Budget. Objects might look flat, or your scene contains only a single depth plane.	Increase the Interaxial Distance or reduce the distance between stereo rig and the scene in order to bring depth into the scene.

Table 1: Description of the indications and advices given by STAN in order to find the best possible interaxial distance.

> ***Note:*** *The colors of the interaxial distance arrows depend on the 3D-Settings in the* **Options** *menu. The* **Depth Volume** *is compared to the* **Depth Budget** *and a corresponding suggestion is calculated.*

Adjusting the Convergence / Angulation

Beside the interaxial distance, the convergence plane is the next important stereoscopic parameter which needs to be set with care. STAN automatically calculates the position of the Depth Bracket, i.e. the relative position of the Depth Volume to the convergence plane. The amount of depth in front of the convergence plane and behind the convergence play are displayed as shown in Figure 18.

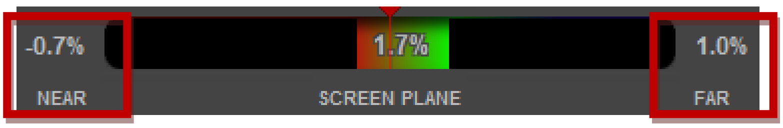


Figure 18: Positions of the near- and far clipping planes are shown in the GUI. The values are used to derive a suitable convergence plane.

In the ***Options* → *3D-Settings*** menu, you can specify the amount of depth you allow as positive and negative parallax. Negative values indicate a position in front of the screen plane, while positive values indicate a position behind the screen. When you set the Maximum (Positive) Parallax as shown in Figure 19 to 1.0 %, STAN gives the respective advice to the stereographer to make sure that the far clipping plane does not exceed that value. The same goes for Minimum (Negative) Parallax.

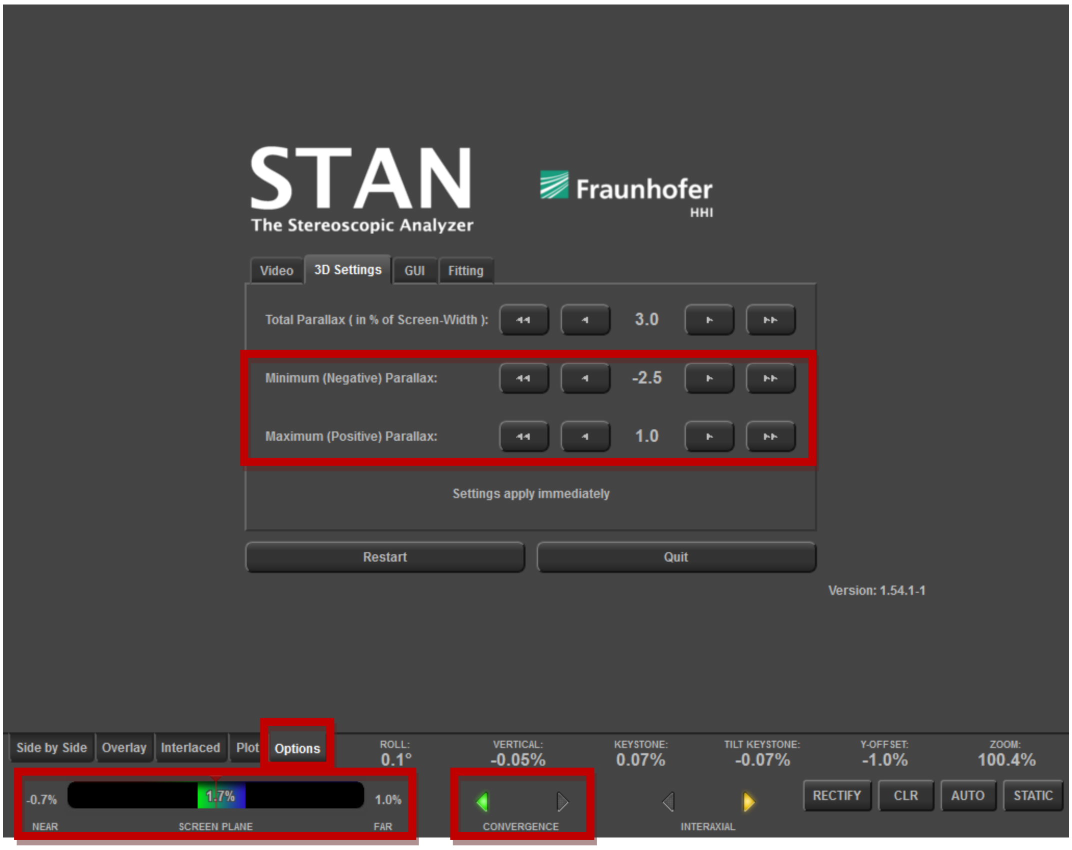


Figure 19. Control of the convergence plane and associated extremal values for the positive and negative parallax. The maximum parallax needs to be adapted to the projected screen size in order to avoid divergent eyes while watching. The minimum parallax should take care of possible frame breaking effect and this possible use of floating windows.

Note: *If you have for instance a screen of 10 m width and allow 6.5 cm positive parallax, you can easily calculate the maximum positive parallax in percent of the screen width:*

6.5/1000 = 0.65 %.

The settings chosen in Figure 19 will directly affect STAN's calculation of the best convergence plane. The respective advices are displayed as colored arrows next to the ***Convergence Distance*** gauge***.*** The following table explains the different advices:

Symbol	Indication	Advice
	The far clipping plane considerably exceeds the allowed positive parallax. Strong risk of eye divergence when shooting for a big screen.	Strongly reduce the amount of angulation, i.e. bring the cameras in a more parallel position. Use the ***HIT*** to shift the convergence plane in direction of the far clipping plane.
	The far clipping plane the allowed positive parallax. Moderate risk of eye divergence when shooting for a big screen.	Reduce the amount of angulation, i.e. bring the cameras in a more parallel position. Use the ***HIT*** to shift the convergence plane in direction of the far clipping plane.
	The far clipping plane slightly exceeds the allowed positive parallax. Small risk of eye divergence when shooting for a big screen.	Slightly reduce the amount of angulation, i.e. bring the cameras in a more parallel position. Use the ***HIT*** to shift the convergence plane in direction of the far clipping plane.
	The Depth Bracket is at the right position in 3D space.	Optimal convergence distance has been found. Keep shooting.
	The nearest object in the scene is slightly to close to the camera rig, i.e. the distance of the near clipping plane falls slightly below the minimal (negative) parallax. Slight frame breaking might occur.	Slightly increase the amount of angulation, i.e. bring the cameras in a more convergent position. Use the ***HIT*** to shift the convergence plane in direction of the near clipping plane.
	The nearest object in the scene is to close to the camera rig, i.e. the distance of the near clipping plane falls slightly below the minimal (negative) parallax. Frame breaking might occur.	Increase the amount of angulation, i.e. bring the cameras in a more convergent position. Use the ***HIT*** to shift the convergence plane in direction of the near clipping plane.
	The nearest object in the scene is slightly to close to the camera rig, i.e. the distance of the near clipping plane falls slightly below the minimal (negative) parallax. Strong frame breaking might occur. An accommodation-convergence conflict might occur.	Strongly increase the amount of angulation, i.e. bring the cameras in a more convergent position. Use the ***HIT*** to shift the convergence plane in direction of the near clipping plane.

Table 2: Description of the indications and advices given by STAN in order to find the best possible convergence distance.

Note: *You can hide or show the convergence plane advices and/or the convergence plane gauge. To show the convergence plane advices, go to* **Options → GUI** *and activate* **Angulation: Show**. *If you want to display the convergence plane gauge in the GUI, activate* **Angulation: Gauge** *in addition.*

Horizontal Image Translation (HIT) / Sensor Shift

An alternative way to change the convergence plane is to shift the two images electronically using a ***Horizontal Image Translation (HIT)*** or ***Sensor Shift***. The ***HIT*** is an active GUI element, you can change the current ***HIT*** using a Drag-and-Drop mouse operation, or by clicking the "+" and "-" Button. To display the Sensor Shift in the GUI, active the button ***Options→GUI →Sensor Shift: Show***. Figure 20 shows the ***HIT*** gauge in the GUI.

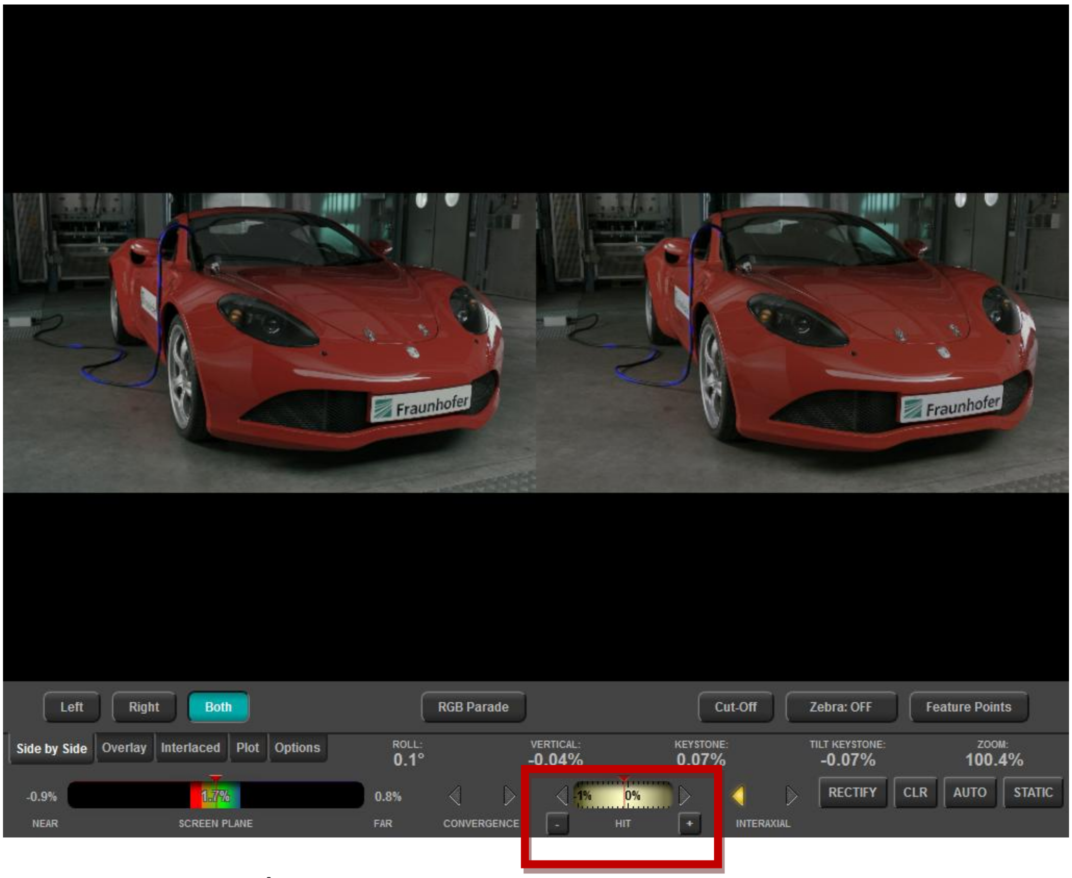


Figure 20: Sensor Shift / Horizontal Image Translation (HIT). You can change the current HIT using a Drag-and-Drop mouse operation or by clicking on the "+" and "-" Buttons. The HIT gauge is activated by clicking the flowing button: ***Options → GUI → Sensor Shift: Show***

Visualization of the Depth Structure

A key feature of the STAN is the ability to visualize the depth of the scene elements directly in the GUI. This allows the stereographer to identify objects in the scene which are within or outside the desired depth volume.

To activate the visualization of the depth activate the Button ***Options* → *Side-by-Side* → *Feature Points*** as shown in Figure 21.

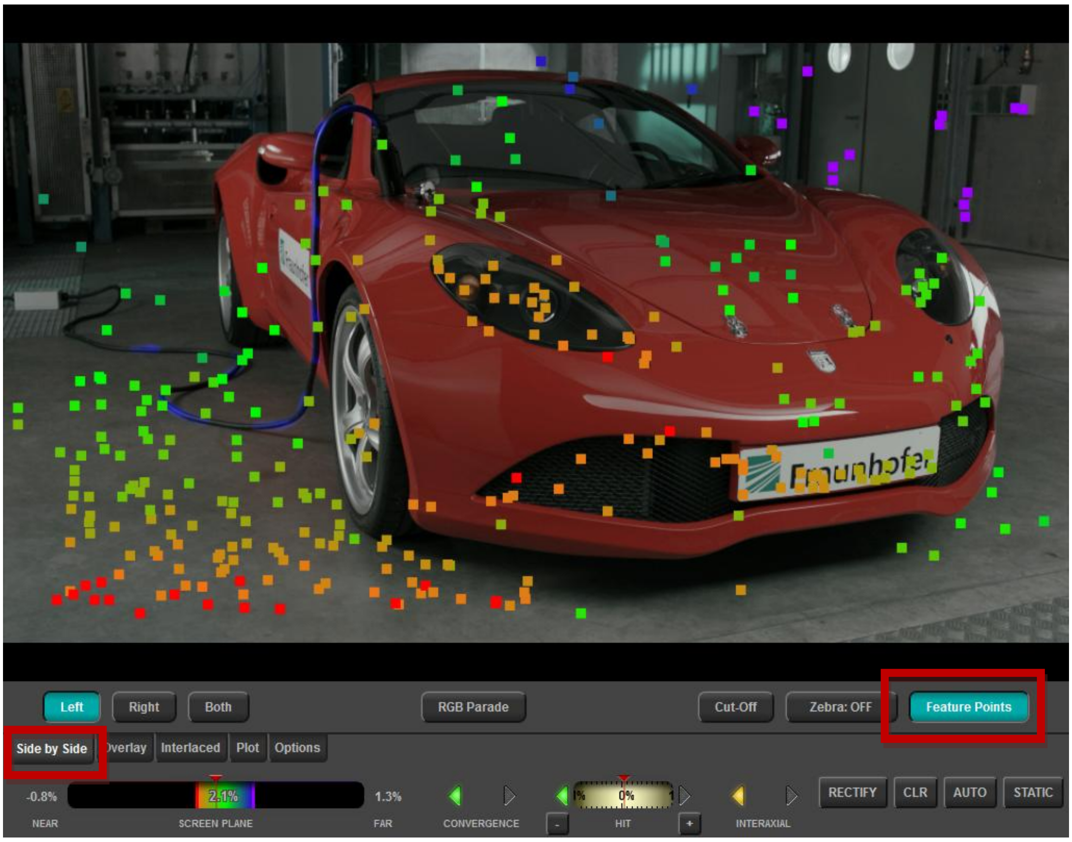


Figure 21: Feature Points are used to visualize the Depth structure of the scene. Green points lie within the Depth Budget as specified in Options→ 3D Settings menu. Red points have exceeding negative parallax, while violet colored points have exceeding positive parallax. The color code is the same as the one used in the Depth Bar.

The feature points are colored. Their color depends on their depth in the 3D-scene and the chosen depth range parameters. Points marked in violet have an exceeding positive parallax (behind the screen plane) while points marked in red indicate an exceeding negative parallax (in front of the screen plane).

Points marked in green lie within the Depth Budget as defined in Figure 19. Objects in this zone will be comfortable to watch. It is recommended to keep all parts of the screen in the "green zone", i.e. within the Depth Budget.

> ***Note:*** *The colors of the feature points depend on the* **Depth Budget** *defined in the menu* **Options → 3D Settings.**

Color Adjustment Assistance

Color Temperature assistance

When using a mirror rig, the color temperatures will slightly between the two cameras. To visualize the color temperatures you can enable the ***RGB-Parade*** in the ***Side-by-Side*** view mode as shown in Figure 22.

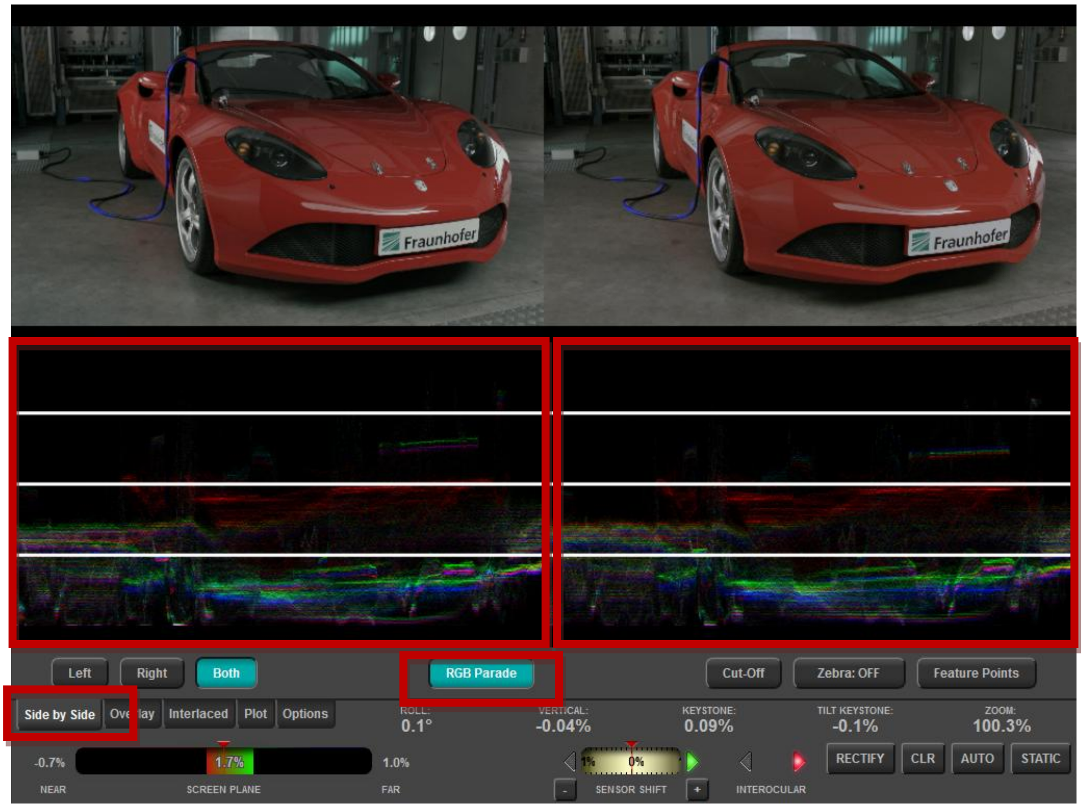


Figure 22: RGB-Parade. This visualization options is useful to match the color temperatures and/or the iris settings of the two cameras.

The RGB Parade helps to see how the colors differ. The RGB-Parade consists of three histograms, one for Red, Green, and Blue. The histogram counts the number of dark and bright pixels, column by column. For instance bright areas in the image will yield to a histogram where many pixels will be colored in the uppermost quadrant. Low light regions will cause pixels in the lowermost histogram.

Note: *To get familiar with the RGB-Parade, select* ***Side-by-Side→ Both*** *and then click the* ***RGB-Parade*** *button. You can now pan the cameras and/or change the iris settings and observe the reaction of the histogram.*

Brightness Assistance

In order to shoot good 3D content, it is necessary to keep the Iris settings of the two lenses synchronized. Moreover for later color grading it is necessary to avoid over-saturated regions. STAN offers the ***Zebra*** visualization tool, which colors nearly saturated regions (Zebra 70%) or oversaturated regions (Zebra 100%) in violet. Figure 23 illustrates this feature.

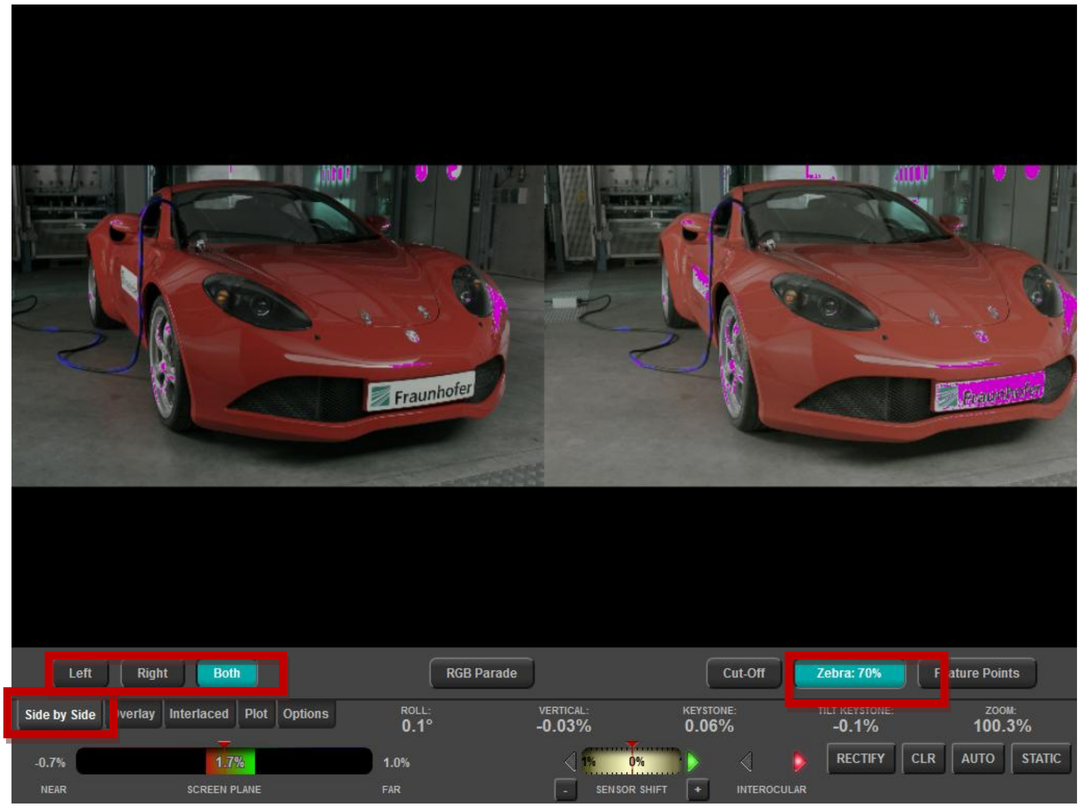


Figure 23: Brightness Assistance. The *Zebra* Button in the *Side-by-Side* menu has three states: Off (no visualization), *Zebra 70%* (regions are colored which achieve 70% of the maximum brightness), and 100% (over-saturated regions are colored, i.e. clipping occurs in these regions).

Additional visualization modes the ***Interlaced → Stripes*** mode and the ***Interlaced → Checkerboard*** mode. The ***Stripes*** mode is shown in Figure 24. Color and aperture differences are easy to recognize in this view mode. Additionally, you can find easily overview horizontal disparities in this view mode. Moreover, the ***Interlaced*** mode is useful, when you want to check the synchrony of the two cameras. When you pan the rig back and forth, you can observe any delay between the two cameras, as the stripes would then move with a certain delay.

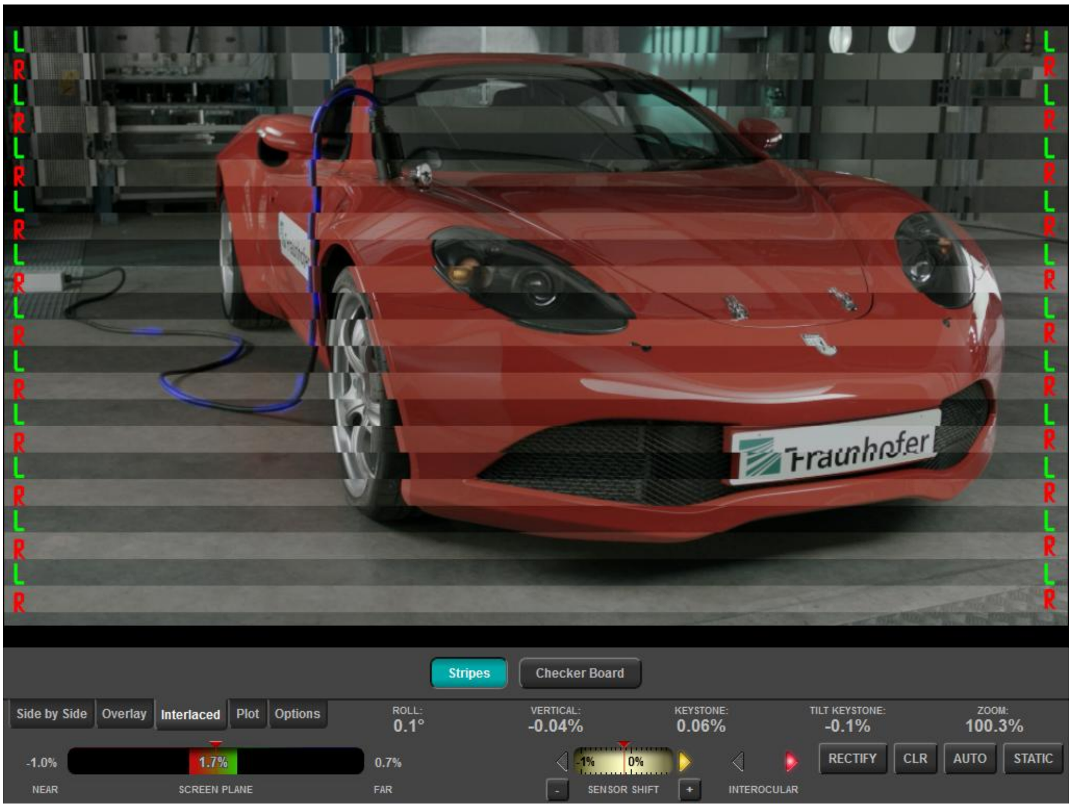


Figure 24: The *Stripes* visualization mode can be active in the *Interlaced* tab. Color and aperture differences are easy to recognize in this view mode. Additionally, you can find easily overview horizontal disparities in this view mode.

Electronic Image Alignment

Even after a careful calibration, residual alignment errors might occur. When using fixed focal length lenses, it is not possible to equalize the focal length mechanically. In addition some stereo rigs do not offer the degrees of freedom to calibrate the roll or other important alignment angles.

STAN can perform an electronic image alignment for the ***Overlay*** modes (i.e. ***Anaglyph***, ***Difference***, ***Opacity*** overlay) and the ***HDMI Output***.

To control the electronic image alignment, STAN has four buttons in the lower left part of the GUI as shown in Figure 25.

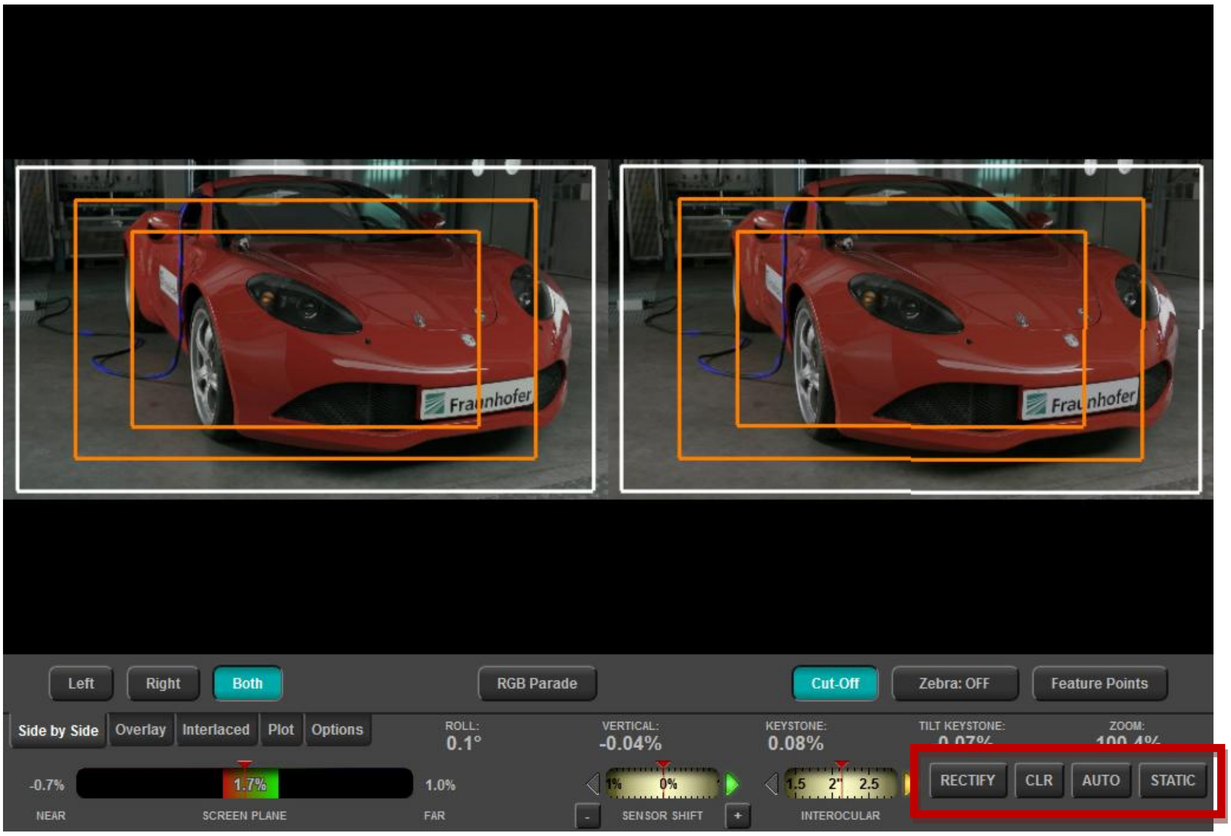


Figure 25: Electronic Image Alignment (Rectification)

The buttons and their usage will now be described.

RECTIFY:

When pressing this buttons, STAN calculates the best geometric corrections parameters once. This correction applies to the HDMI-Output. The settings will be used unless **CLR** (Clear) is pressed or ***RECTIFY*** is hit again.

CLR (Clear):

This button deletes the current correction parameters. The original unmodified images are displayed at the HDMI Output.

AUTO:

STAN constantly updates the geometrical correction parameters. This is useful when using poorly calibrated zoom lenses which induce different vertical disparities depending on the zoom level.

STATIC:

Once you have calibrated your rig, hit **RECTIFY**, and the **STATIC**. From now on, STAN displays only the remaining geometrical errors after the electronic image alignment. Use this button to check, if your calibration is still valid, or if you have to recalibrate your rig.

STAN – Specifications

HD-SDI Input Formats

1280x720_23P	1920x1080_23P	1920x1080_25P
1280x720_24P	1920x1080_23I	1920x1080_29P
1280x720_25P	1920x1080_23sF	1920x1080_30P
1280x720_29P	1920x1080_24P	1920x1080_29I
1280x720_30P	1920x1080_24sF	1920x1080_29sF
1280x720_59P	1920x1080_25I	1920x1080_30I
1280x720_60P	1920x1080_25sF	1920x1080_30sF

Working Directory

The STAN software is located in a working directory containing the executables and the data files.

Linux: /opt/HHI/STANapp

Executables: /opt/HHI/STANapp/bin/STANapp

Config file: /opt/HHI/STANapp/conf/stanapp-config.xml

Windows: C:\Program Files\Fraunhofer HHI STANapp\

Executables: C:\Program Files\Fraunhofer HHI STANapp\bin

Config file: C:\Program Files\Fraunhofer HHI STANapp\conf\stanapp-config.xml

Config File settings

Some advanced settings can only be changed in the config file. You can edit the config file using any text editor. Make sure that the editor saves the file as ASCII file and not in any binary format. The keywords are case sensitive.

The config file has an XML-Tree structure which makes it easy to understand. The uppermost tree element is <stan>. The parameters are organized in sub-nodes. As an example, the parameter to width of the GUI window s:

```
<stan><gui><dialog><Width>1024</Width>
```

In the following we discuss some advanced parameters.

> ***Note:*** *Quit STAN using* ***Options → Quit*** *before changing config file settings. The new settings will apply after the next start of the application*

Width and Height of the GUI:

stan → GUI → dialog → Width

stan → GUI → dialog → Height

Enable HDMI-Output

stan → GUI → renderer → Show → true

stan → ctrl→ DeliverToRenderer → true

When both settings are set to true, STAN will activate the HDMI-Output window. Change back both settings to **false**, when you do not need the HDMI-Output.

Width and Height of the HDMI-Output Window:

stan → GUI → renderer → Width

stan → GUI → renderer → Height

HDMI-Output mode:

stan → GUI → renderer → OutputCombineMode

possible settings are:

0 – Top Bottom

1 – Line interlaced, odd lines correspond the left image

2 – Line interlaced, even lines correspond the left image

3 – Anaglyph

6 –Luminance Difference

7 – Left only

8 – Right only

7 – Opacity Overlay

Width and Height of the HDMI-Output Window:

stan → GUI → renderer → Width

stan → GUI → renderer → Height

Side-by-Side HD-SDI Input:

stan → grabber → SideBySideInput→ [true|false]

Auto-Rescaling for HDMI-Output

stan → warping → MinScaling → [1.00 .. 1.10]

stan → warping → MaxScaling → [1.00 .. 1.10]

This will rescale the output when using HIT or apply geometrical corrections in order to avoid black pixels. The rescaling occurs in the border between MinScaling and MaxScaling.

Auto-HIT

stan → depthrange → DoAutoSensorShift→ [true|false]

Scan can automatically keep your scene within the desired Depth Budget and apply an Auto-HIT. Do enable the Auto-HIT set this settings to **true**. STAN will drive the settings between:

stan → depthrange → MinSensorShift and

stan → depthrange → MaxSensorShift.

The values are represented in percent (%) of the image width.

The update rate can be controlled with:

stan → motor→ AutoSensorShiftAdjustmentSpeed→ [0.01 .. 0.1]

Motor Control

To enable the communication between STAN and the receiver box for Element Technica motors, activate this feature in the config file.

stan → modules → SimulateCamMotor → false

stan → motor → ETRigControllerPresent → true

stan → warping → ETRigControllerComPort→ COM[1|2|3|…]

The COM port has different naming under linux.

When the connection has been established, STAN can read the current motor positions and display them in the INTERAXIAL gauge and the CONVERGENCE gauge.

Auto-Interaxial

stan → depthrange → DoAutoInterocular→ true

Make sure to enable Motor control first. STAN will drive the motor for the interaxial distance according to the settings made in ***Options →3D Settings***.

STAN drives the motors in a range between:

stan → motor→ MinInterocularNormalizedET and

stan → motor→ MaxInterocularNormalizedET.

The motor speed can be controlled with:

stan → motor→ AutoInterocularAdjustmentSpeed → [0.01 .. 0.1]

Auto-Convergence

stan → depthrange → DoAutoConvergence → true

Make sure to enable Motor control first. STAN will drive the motor for the convergence angle (angulation) according to the settings made in ***Options →3D Settings***. Make sure to enable only Auto-HIT **OR** Auto-Convergence.

STAN drives the motors in a range between:

stan → motor→ MinConvergenceNormalizedET and

stan → motor→ MaxConvergenceNormalizedET.

The motor speed can be controlled with:

stan → motor→ AutoConvergenceAdjustmentSpeed → [0.01 .. 0.1]

Depth Plane Parallax Range

In the GUI, the Depth Bar shows the colored bar in a range between

stan → depthrange → MinShownParallax and

stan → depthrange → MaxShownParallax and

The values are represented in percent (%) of the image width.

STAN Processing Speed

There are different settings to optimize the update rate of the GUI, the feature detector and the calibration precision.

The resolution of the image in the GUI can be changed by:

stan → dialog → GuiSubsamplingFactor → [1|2]

1 – high resolution, slower visualization

2 – lower resolution, faster visualization

The precision of the feature detection can be steered by:

stan → algo → SubsamplingFactor → [1|2]

1 – high precision, slower processing

2 – lower precision, faster processing

Additionally, you can change optimize other precision parameters of the feature detector.

stan → algo → SamplingDistance→ [1|2|3]

1 – high precision, slower processing

2 – moderate precision, faster processing

2 – low precision, very fast processing

stan → algo → MaxFeatures→ [1000 .. 10000]

1000 – low number of feature points, fast processing

5000 – high number feature points, normal processing speed

10000 - high number of feature points, slow processing

stan → algo → RansacIterations→ [100 .. 1000]

100 - moderate outlier rate, very fast processing

400 - low outlier rate, fast processing

1000 - very low outlier rate, moderate processing speed

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