

# TcpStereo for drones

## Stereo plotting over orientated photographs

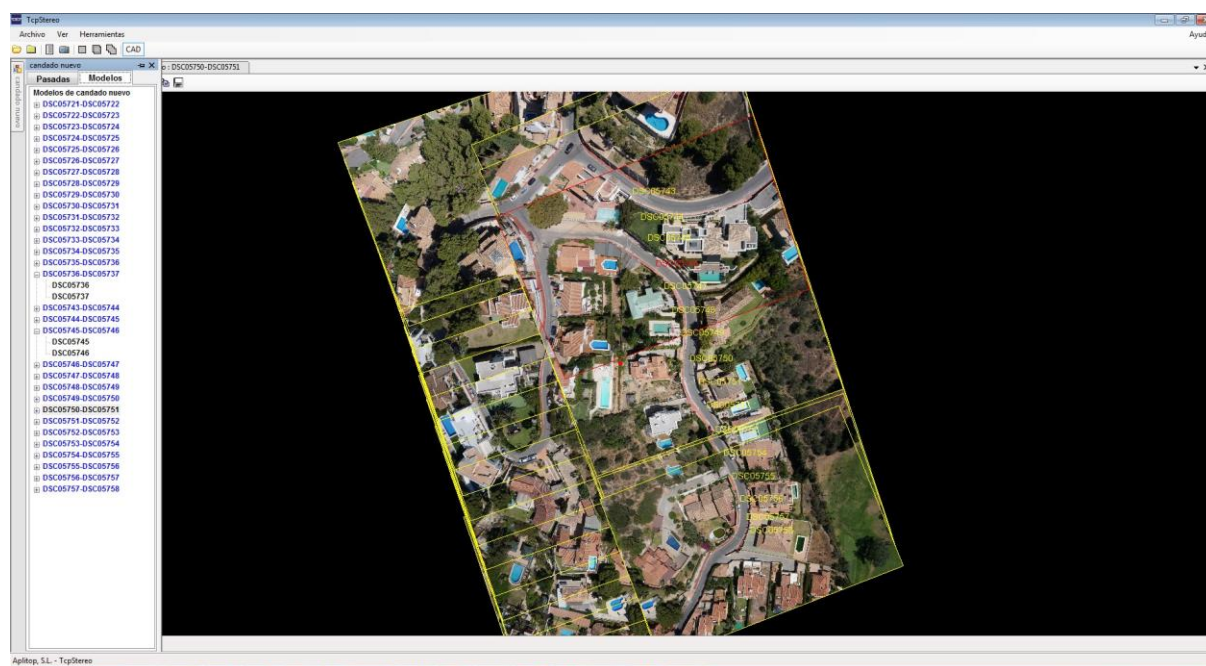
### Introduction

This system allows stereo plotting in CAD platform over aerial photographs with previously defined orientations.

It works from simple anaglyph glasses to professional stereoscopic vision hardware, and it's specially useful for photogrammetric surveys made with drones. It also can be used by public administrations, mining companies, landslide, hydrology, environment, town planning, etc.

### Data Entry

We must give the folder containing the image files and other data depending on the kind of project.



### Digital flights

We only have to import the exterior orientations file, and we will obtain automatically the camera parameters from the metadata contained in the photographs.

Import Pix4d data

Files and Folders Camera and Photos Strips and Models Conversion

Input data

Camera file... C:\PUB\Carlos\candado nuevo\1\_initial\params\candado nuevo\_calibrated\_internal\_camera\_parameters.CAM

Orientations file... C:\PUB\Carlos\candado nuevo\1\_initial\params\candado nuevo\_calibrated\_external\_camera\_parameters.TXT

Photos folder... C:\PUB\Carlos\candado nuevo\1\_initial\images\undistorted\_images

Flight Height (m) 144.020 Ground Height (m) 45.000

Output Data

Project folder... C:\PUB\Carlos\candado nuevo\TcpStereo

Project name Candado Nuevo

Pyramidal images

Resolution : ☐ Reduced (faster importation) ☒ Full (high quality images) ☒ Use existing pyramidal images

Importation events

| Event | Description |
|-------|-------------|
|-------|-------------|

<< Back Next >> OK Cancel

Different formats of exterior orientation file are admitted so the user can specify the columns that correspond to the photo-centers coordinates and the angles of rotation of the camera for each photography.

Import Pix4d data

Files and Folders Camera and Photos Strips and Models Conversion

Camera

Focal Length (mm) 15.489 Principal point (mm) : Xc = -0.124 Yc = 0.150 Sensor size (mm) : Width = 23.333 Height = 15.556

Photos

| Photo  | X (m)      | Y (m)       | Z (m)   | Omega    | Phi      | Kappa    |
|--|------------|-------------|---------|----------|----------|----------|
| <input checked="" type="checkbox"/> DSC05716 | 379953.050 | 4064280.413 | 144.168 | 0.053177 | 0.004680 | 3.503582 |
| <input checked="" type="checkbox"/> DSC05717 | 379942.305 | 4064277.784 | 144.132 | 0.052229 | 0.005979 | 3.501153 |
| <input checked="" type="checkbox"/> DSC05718 | 379931.791 | 4064275.196 | 143.901 | 0.048219 | 0.018533 | 3.485904 |
| <input checked="" type="checkbox"/> DSC05719 | 379922.553 | 4064272.914 | 143.486 | 0.044420 | 0.037195 | 3.489061 |
| <input checked="" type="checkbox"/> DSC05720 | 379912.859 | 4064270.998 | 143.688 | 0.036322 | 0.045414 | 3.429891 |
| <input checked="" type="checkbox"/> DSC05721 | 379912.740 | 4064271.068 | 143.695 | 0.035170 | 0.044342 | 3.428459 |
| <input checked="" type="checkbox"/> DSC05722 | 379907.066 | 4064288.586 | 143.312 | 6.277310 | 0.024068 | 3.461118 |
| <input checked="" type="checkbox"/> DSC05723 | 379903.144 | 4064299.648 | 143.421 | 6.276929 | 0.023428 | 3.479770 |
| <input checked="" type="checkbox"/> DSC05724 | 379899.576 | 4064309.901 | 143.644 | 6.281951 | 0.022792 | 3.478029 |

☒ Select all Angles unit Radians

Importation events

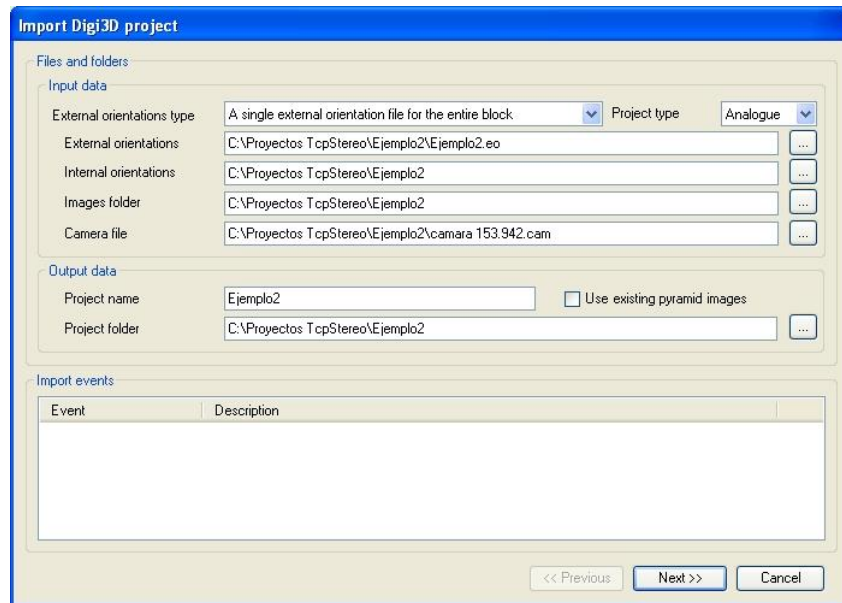
| Event | Description                   |
|-------|-------------------------------|
| INFO  | Read 43 exterior orientations |

<< Back Next >> OK Cancel

To finish the process of import, the parameters of the camera, the average height of flight and terrain are validated.

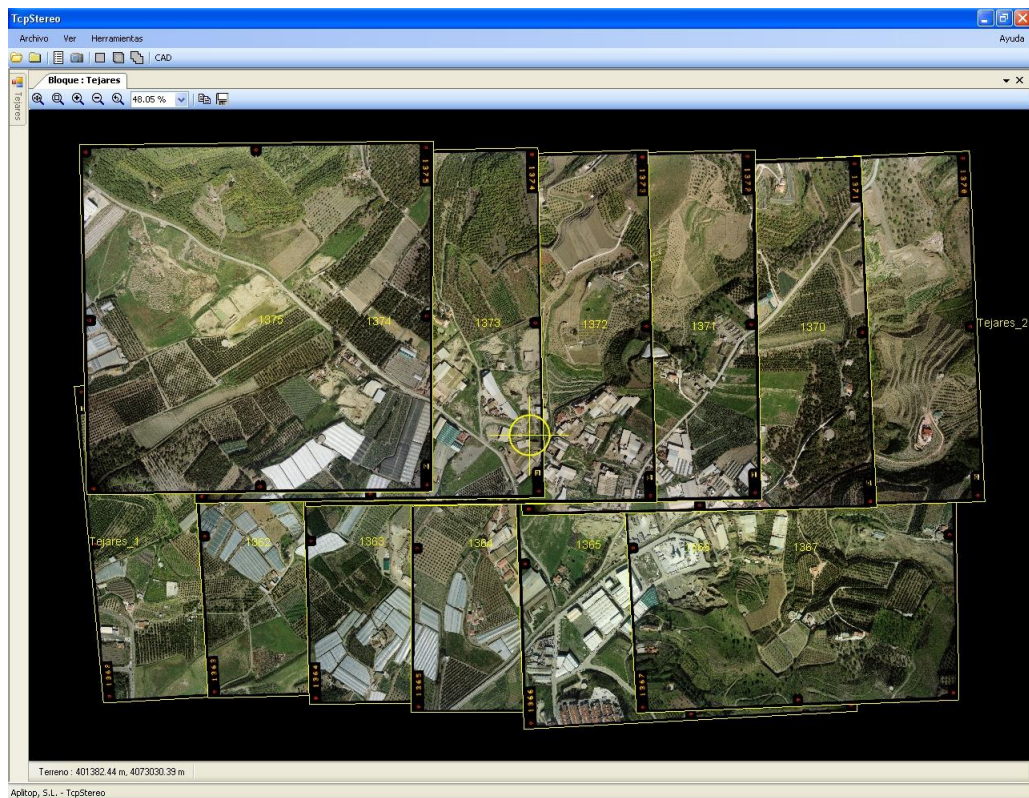
## Analog flights

In this case we will import one internal orientation file of Digi3D for image and one file with the exterior orientations. For it we have to specify the flight and other parameters of the camera such as, the focal length, the principal point, heights of flight and terrain.



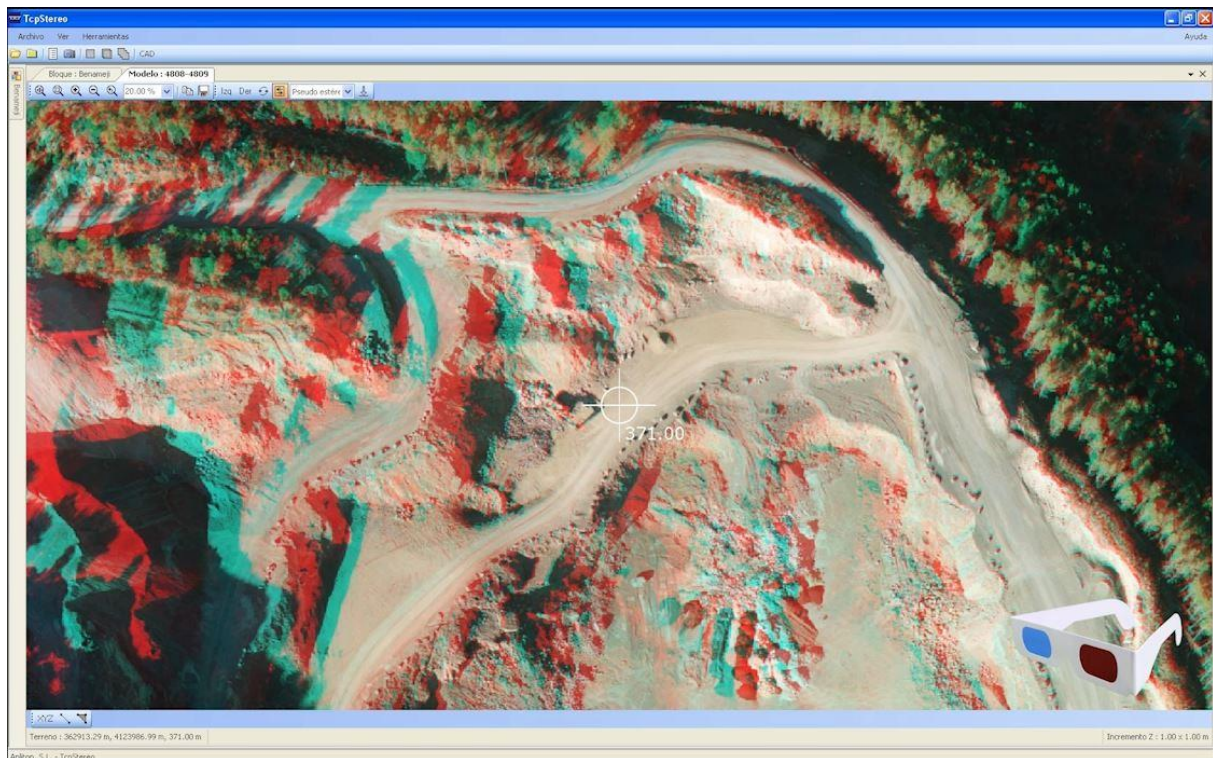
## Images Management

In the definition of the project, the images are converted to a pyramidal format to optimize the output during the visualization. The images are organized in strips, models and block, which can be activated simultaneously in different windows of the application.

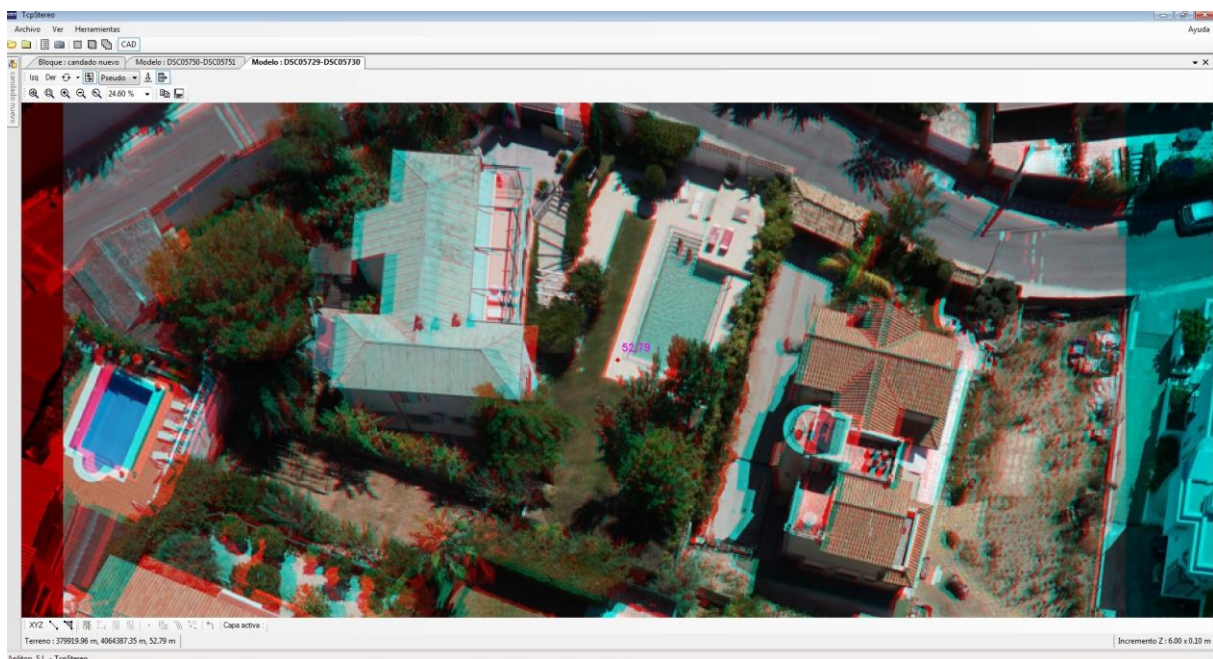




In the toolbar we find tools for zoom, pan, scale change, mini-map. Also it allows copying the current image to the clipboard or recording it in disk.



The models can be visualized in stereo by low cost systems based on transmitters and active glasses, or mirrored screens and polarized glasses. Also it allows the pseudo-stereo view (superposed images) in conventional equipments, and can be viewed stereo using anaglyph glasses (two colors).

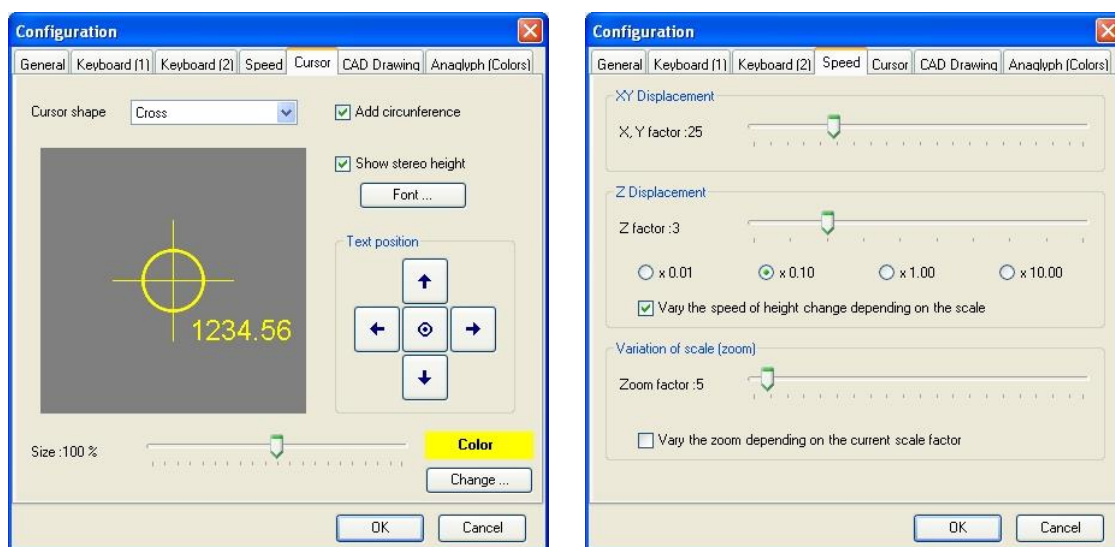


With the program we can see several stereoscopic models at the same time, pass automatically from a model to another one following the movements of the user in the terrain. And also it is possible to know the real coordinates of the terrain and the height; also we can measure 2D and 3D distances, slopes and elevation differences, perimeters and areas.



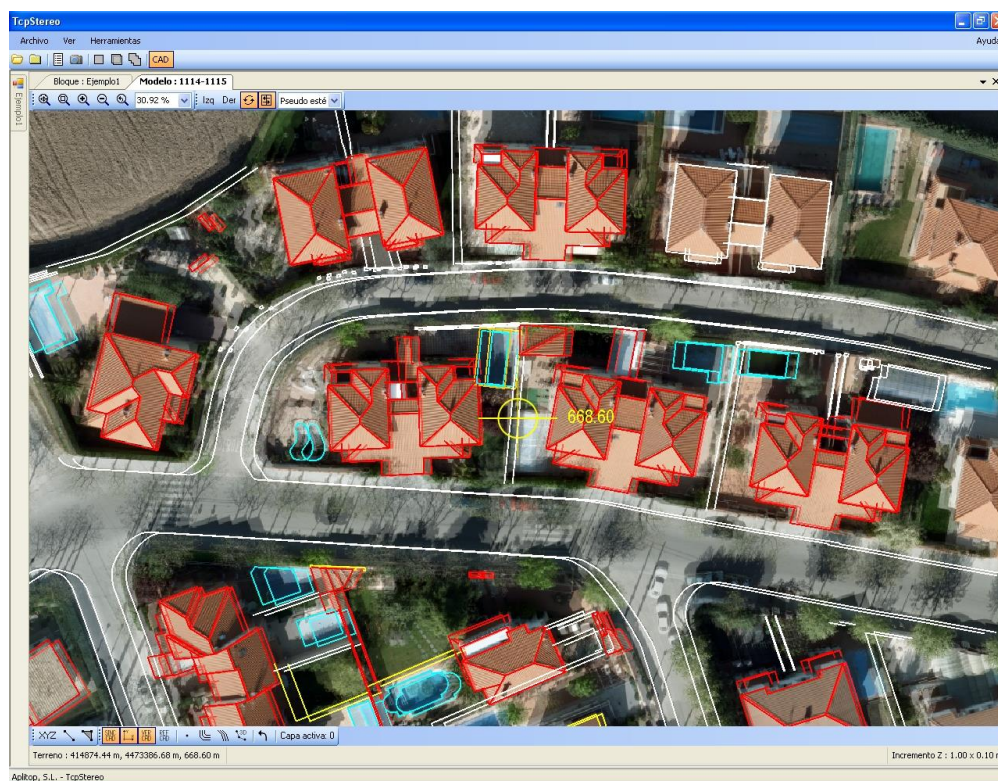
## Configuration

We can personalize some characteristics of the application: the functions of the keyboard, speeds of the displacements in horizontal, vertical and height, the properties of the cursor (form, size, color, height text, etc.), and the way CAD drawings are represented on the stereo.

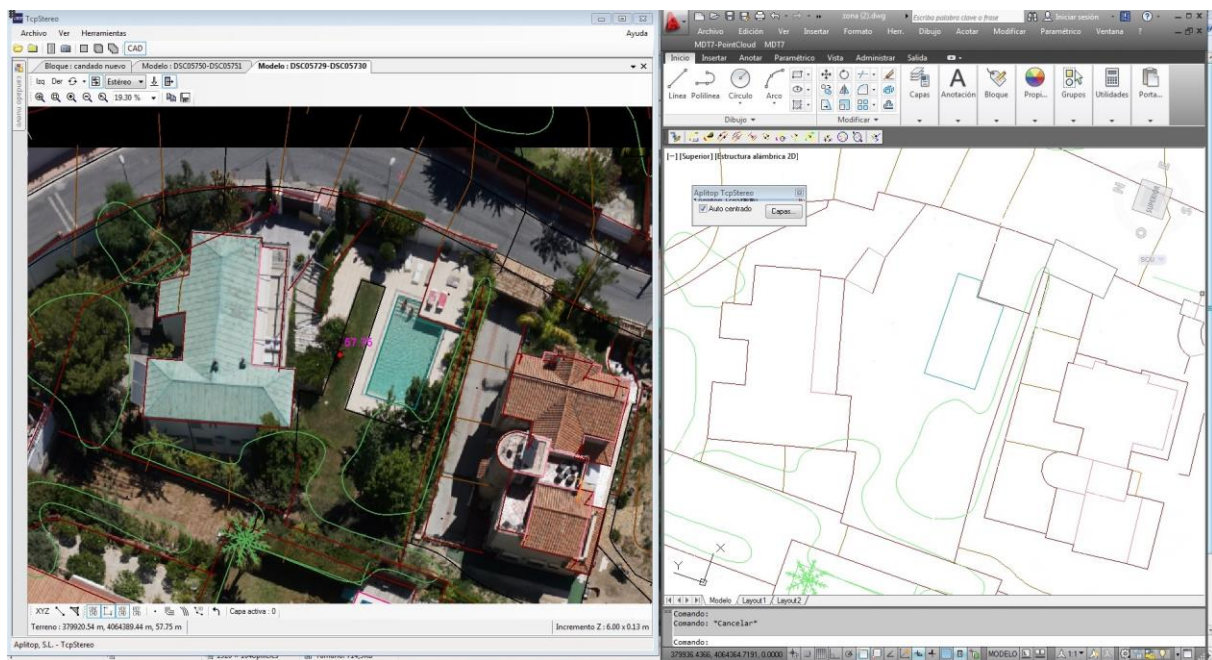


## CAD Synchronization

The program can be synchronized with some versions of AutoCAD and Bricscad, and by this way we can draw objects with constant or changeable height by means of the stereo mode and with the same coordinates.



In addition a drawing can be loaded in the CAD. Over the stereo model the drawing's layers in which the user is interested can be showed, supporting the pan and center of the drawing automatically.

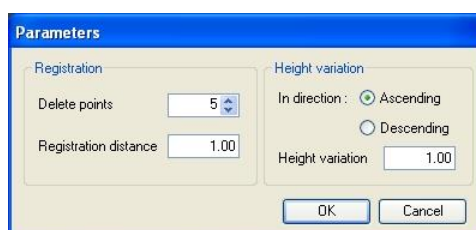


Over the stereo viewer we can:

- Measure 2D and 3D distances
- Measure slopes and elevation differences
- Measure a 3D perimeter and the area contained in it
- Place the viewer in specific terrain coordinates

We can do the following functions in the CAD from TcpStereo:

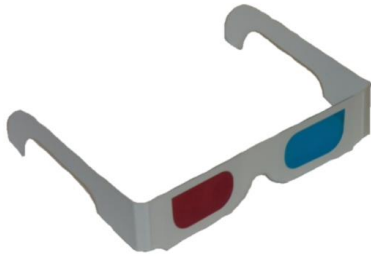
- Rotation of the drawing: It turns the view of the drawing in the CAD to make it coincide with the stereo model's one.
- Show drawing: It shows the selected layers of the CAD's drawing on the stereo.
- Simple Drawing: draw 3D points and polylines in the CAD from points designated on the stereo model.
- Continuous Drawing 2D: It allows drawing 2D polylines in the CAD moving the mouse (sketch), from some functioning parameters given by the user. It is suitable for the creation of contours.
- 3D Continuous Drawing: It allows one to draw 3D polylines in the CAD moving the mouse and changing the height, interpolating the height of the points of the polyline depending on the points designated by the user



## Stereoscopic Vision Systems

There are two kinds of stereoscopic vision systems:

- Passive systems, which uses polarized glasses or glasses with filter.
- Active systems, which uses shutter glasses, an IR emitter and a high frequency monitor (100 – 120 Hz).



In the first category, and using common graphic cards, it can be used the anaglyph method, consisting on multiplexing a pair of images by wavelength using colored filter glasses (usually red and cyan, red and green or red and blue).

Among passive stereo systems we can also find solutions consisting on a polarized monitor and polarized glasses, giving horizontal interlaced stereo.

Another passive system is based on two conventional LCD monitors placed in right angle, with a polarized crystal mirror in its bisector, a signal inverter and polarized glasses, giving stereo by cloning video signal.



*Signal inverter*



*Polarized glasses*

Among active systems, there are several solutions in market, for instance **Nvidia 3D Vision** system, which allows to see stereo with a variety of Nvidia graphic cards and high frequency LCD monitors.



*Nvidia 3D Vision Glasses and IR emitter*

## System Requirements

TcpStereo is compatible with all these systems, if they meet the following requirements and appropriate drivers.

|                            |   |
|----------------------------|---|
| Stereoscopic vision system | Anaglyph glasses<br>High frequency monitors and active glasses<br>Monitors with interlaced stereo and polarized glasses<br>Dual monitor systems with mirror glass and polarized glasses |
| Graphical card             | For anaglyph stereo:<br>- Any mark / model supporting OpenGL 3.0<br>For other stereo viewing systems:<br>- NVIDIA Quadro FX or higher<br><br>Minimum 1 Gb Mb dedicated memory           |
| Memory                     | Minimum Physical memory 2 Gb  |
| Processor                  | Dual-core 2 Ghz or higher   |
| Other peripherals          | Mouse or pointing device  |
| Operating system           | Windows XP, Vista, 7, 8, 8.1, 10 (32 bits)  |
| CAD (optional)             | AutoCAD 2009 to 2016<br>Bricscad V.9 to V.15  |

*Visit our web site for further details*

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