ANALYZER
by DXOMARK

3D Camera module

This Module includes essential hardware and software for analyzing stereoscopic devices and camera arrays. Users can analyze the geometric camera parameters, the baseline, and the distortion of stereoscopic systems on pairs of photos.

The Module's configuration is very flexible so as to address a wide range of customer needs. It ranges from the simplest software + chart package to a comprehensive package that includes our lab system and automated lighting system.

Key features

- Delivers the relevant metrics for stereoscopic devices: baseline, geometric camera parameters, optical distortion. Performs all measurements in one go using two pairs of images of the test chart

- Includes high-quality test chart(s), recommended lab equipment, in-depth documentation, and the analysis software in one package

- Automatically detects relevant test chart patterns and reports results with no operator intervention

- Performs measurements on RGB (.jpeg, .tiff, etc.) or on RAW images

- Can measure cameras with resolutions from VGA to 50Mpix, and fields of view up to 140°

Available measurements

All the 3D/camera array measurements are performed using a Dot chart.

DOT CHART

- Baseline parameter
- Rotations and translations between the cameras (external parameters)
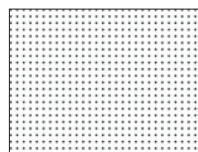- Focal length, principal point (internal parameters)

Application across many markets

The 3D/Array Camera Module is compatible with cameras designed for many applications and markets: photography (DSC and DSLRs), mobile (smartphone camera module), automotive (camera for ADAS system), surveillance (IP Camera, CCTV), medical, drones, wearables, etc.

3D/ARRAY CAMERA MODULE MEASUREMENT HARDWARE

Recommended lab environment

1200.00mm
1560.00mm
1785.00mm
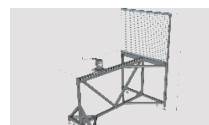720.00mm
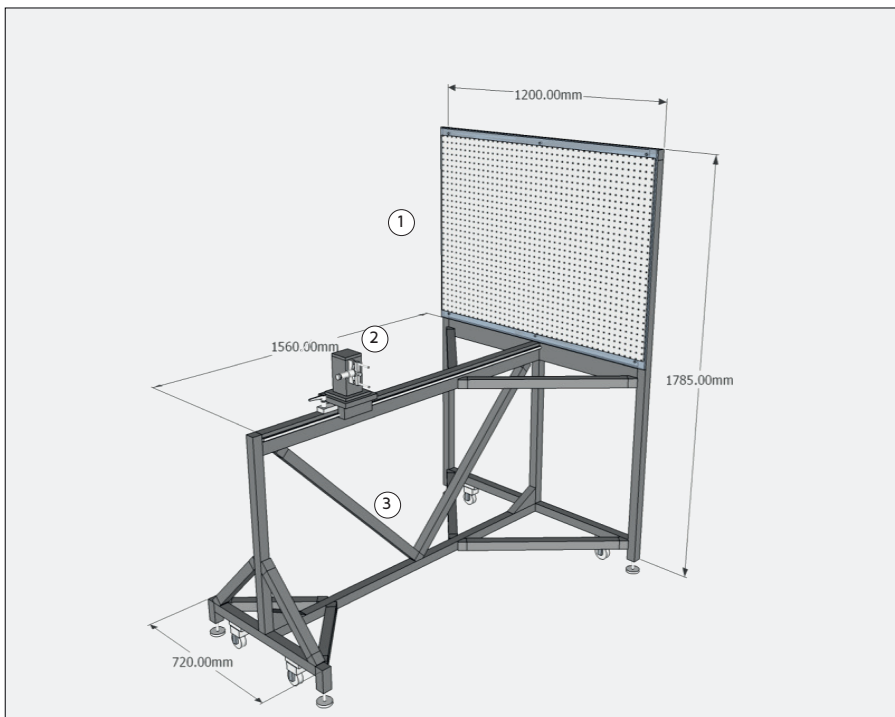
① Chart, ② Camera, ③ 3D bench

Required equipment
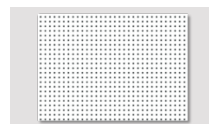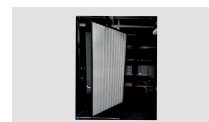

DOT Chart
(1200 mm x 900 mm)

3D bench accessories
(3mx3mx2.5m)
Manfrotto 405 Head
and PL410 plate + filter
holder + laser collimator
+ mirror

3D Camera Bench

Recommended equipment

REFLECTION LIGHTING

Multispectral Lighting
System (2 units)

Lightpanels Gemini
Soft 2x1 (2 units)

Accessories

**Gossen Luxmeter
- Mavolux 5032B**
+ luminance attachment
+ certificate

LEICA Laser Telemeter

Analyzer software processes test images automatically

Measurements provided by all purchased modules are available in this interface, and can be accessed from their respective charts. The results are displayed in the interface after processing, and can be exported in html, spreadsheet, or pdf formats.
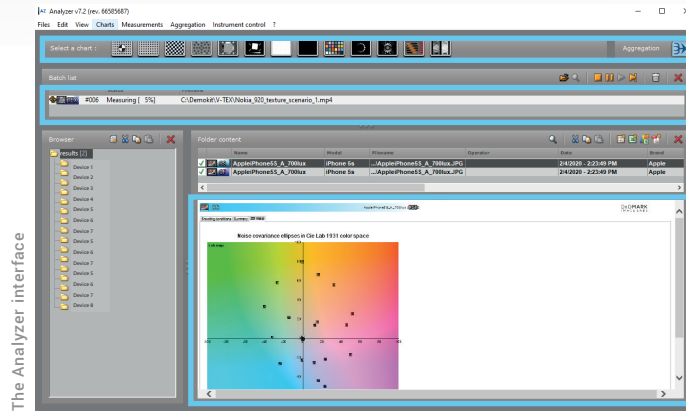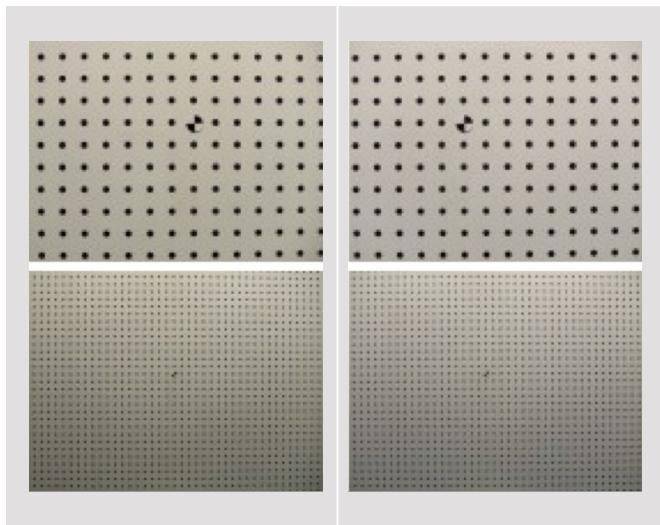

The Analyzer interface

Select chart to launch a new measurement

Batch processing of photos and videos
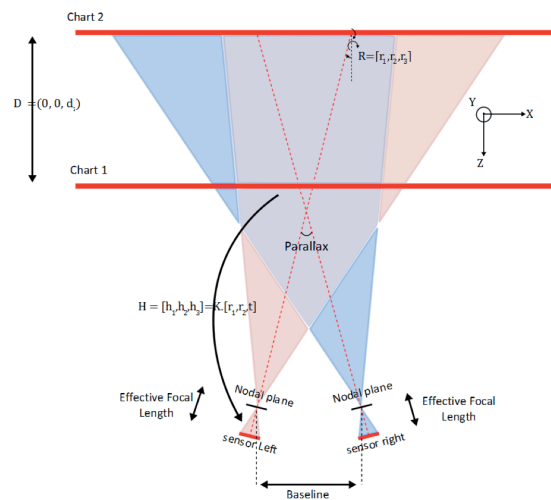
Results are available in datasheets

Distortion

In the example, two pairs of images were taken with a stereoscopic device at distances of 400 mm and 800 mm from the chart.
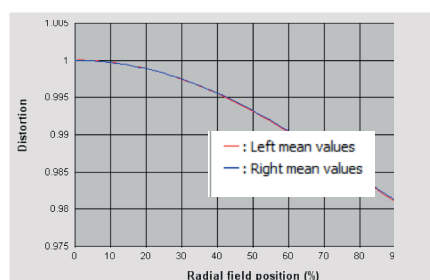

Geometric camera parameters

With these two shots taken at an interval of D = 800−400 = 400 mm, it is possible to determine the internal and external geometric parameters of a stereoscopic device:
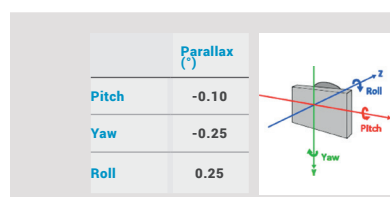

Distortion curves

Analyzer measures the distortion for each camera. Here it is around 1%, and it is almost the same for both cameras :

Camera pose orientation

Analyzer measures the difference in orientation between the cameras. Here it is quite low, as expected from a rectified camera:

	Parallax (°)
Pitch	-0.10
Yaw	-0.25
Roll	0.25

Camera pose translation

Analyzer measures the translations between the cameras and the baseline (i.e., the distance between the optical centers of the stereoscopic device's two cameras). Here Analyzer has measured the baseline at 75.43 mm, and the translation is almost zero along the y and z axes:

	Offset (mm)		
Center X	75.43		
Center Y	-0.47	Baseline	75.43
Center Z	-0.51		

Measurement accuracy

Camera pose parameters

The following table shows the measurement accuracy between manual focus (with no focus change) and autofocus modes.

Accuracy table given for an orthogonality error up to 5°, a translation rail linearity of less than 2 mm per meter, a distance error of 1 mm, and a baseline between 10 mm and 100 mm:

	Focal length error	Baseline error	Baseline error
No focus change	±0.5%	±0.03°	±0.2 mm
Focus change	± 4%	±0.03°	±0.8 mm

Distorsion

Accuracy of the geometric distortion measurement is directly proportional to the image resolution, according to the formula (± 0.5 pixel x 100) / (image height in pixels).

Examples:

- **For a 4064 x 2704 -pixel image:** the accuracy of the positional error measurement is ± 0.02%

- **For a 2272 x 1704 -pixel image:** the accuracy of the positional error measurement is ± 0.03%

- **For a VGA image (640 x 480 pixels):** the accuracy of the positional error measurement is ± 0.1%

Specifications

Camera-under-test specifications

Min resolution: VGA

Max resolution: up to 50Mpix

FOV: up to 140°

Focal length: down to 4mm (in 35 mm format)

Spectral sensitivity: measurements are designed for visible-spectrum cameras

Sensor: Bayer filter sensor

File formats: jpeg, png, tif, and many RAW formats (latest release notes provides a list of supported RAW formats)

Platform requirements

PC-type computer with the following minimum configuration:
− **Intel Core i5 Fifth generation® processor** or higher,
− A version of **Windows 10® 64 bits** operating system,
− **4 GB of RAM** or more,
− At least **64 GB of free disk space** to operate the software,
− **A video card with 3D driver**, compatible with DirectX 12 and OpenGL 3.0 (in Remote Desktop or Virtual Machines you may experience graphical glitches depending on the renderer used),
− **1440×800** or more VGA monitor, using a maximum of 125% DPI scaling,

At least **three USB ports**

Laboratory requirements

Laboratory minimum size: 4.5 x 5m
RAL9005 matte paint for walls and ceiling
Dark gray antistatic carpet on the floor
Temperature: 23°C ± 2°C (ISO 554:1976)
Humidity: 50% ± 20% (ISO 554:1976)