

Optimizing a long-range camera requires an impossibly deep lab. However, our new compass automated testing bench lets you compute MTF measurements at infinity on the axis and for the whole field of view (up to 320°), and can be used to evaluate flare as well.

### Key features

ANALYZER's MTF collimator measurement setup precisely characterizes MTF in the whole field of view.

- ⇒ Easy, fast and repeatable characterization of sharpness for all positions in the field, thanks to the compass setup table, accurate motorized optical bench
- ⇒ Automatically detects relevant test chart patterns and reports results with no operator intervention
- ⇒ Performs measurements on RGB and RAW images (.jpg, .tiff, etc.)
- ⇒ Python API provides measurement automation capability
- ⇒ Can measure cameras with resolutions from 1280 x 720 to 50 Mpix, and fields of view up to 320°

### Available measurements

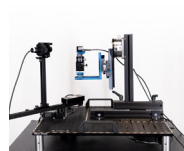
- ⇒ Sagittal and tangential sharpness metrics for each collimator position in the field
- ⇒ Evolution of sharpness metrics in the field

### COMPASS SETUP

The collimator MTF measurement uses the COMPASS setup associated with a dedicated collimator to perform the MTF evaluation.

DXOMARK's COMPASS is a multiple measurement setup composed of a camera holder set on a 6-axis alignment stage and an automated rotation arm that places a collimator at the desired angle.

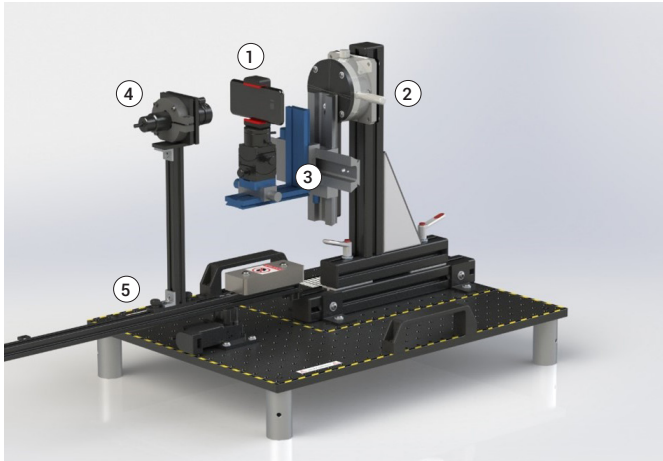
Several kinds of light sources and collimators can be placed on the COMPASS arm, depending on the required measurement (MTF at infinity, flare, etc.).



- Automated rotation of the collimated light source with high precision (0.03°).
- A Python API controls the arm's rotation to automate shooting from all angles.

MTF COLLIMATOR MEASUREMENT HARDWARE

Collimator on COMPASS Setup



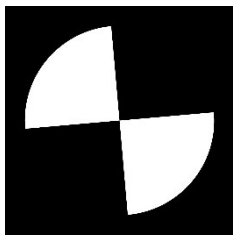
- ① Device under test, ② Indexed rotation stage to change from horizontal to vertical and diagonal axis,
- ③ 6 axis alignment stage equipped with 1/4 in. ISO 1222 compatible screw, designed to support any camera and demoboard,
- ④ Collimated light source
- ⑤ Motorized arm for rotating the light source

Required equipment

COMPASS setup

Collimator light source (COL50\_001, or COL100\_001)

Light source specification



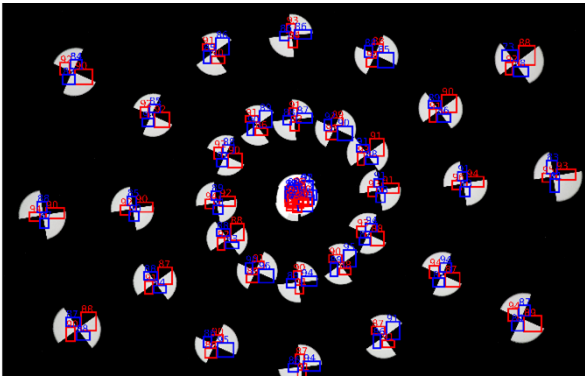
Slanted Edge Target

Focal Length	50mm	100mm
Aperture	f/2.8	f/3.3
Slanted edge target size	Ø12mm	Ø12mm
Controller power input	24 V/DC 1A	90/260 V/AC 250mA
Light type	Adjustable LED	Adjustable LED
Color temperature	6200K	6200K
FOV (Size of the target as viewed by the camera)	10°	6°
Maximum frequency (Guaranteed maximum angular frequency of the camera to achieve accurate MTF measurements. For instance, a Full HD camera with a diagonal field of view of 120° will have a maximum resolution of 0.1 cycle/arc minute)	>2cy/arcmin	>4cy/arcmin

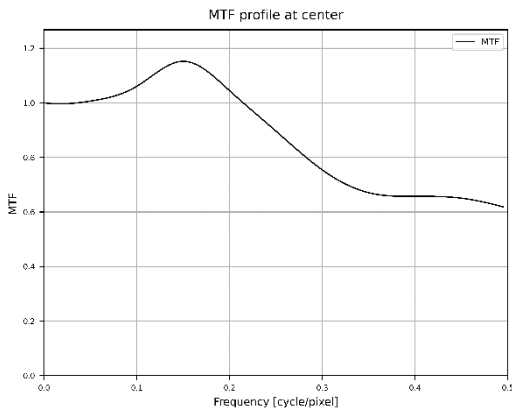
MTF COLLIMATOR MEASUREMENTS SAMPLES

## Analyzer Workflow Manager provides Python functions for processing image files

Example of synthetic fusion of collimator captures at different positions in the field, with regions of interest automatically detected



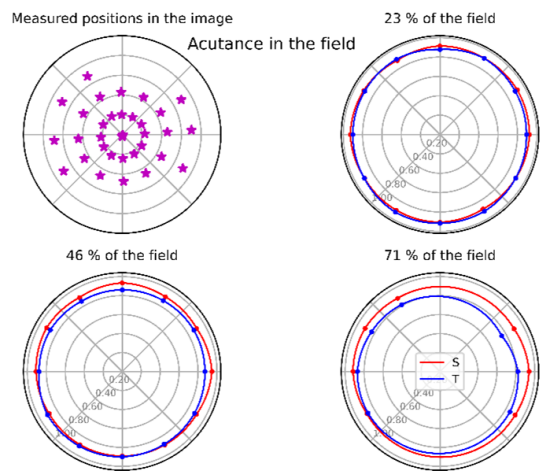
Example of MTF profile at center of the field



MTF profile for sagittal and tangential directions can be obtained for each position of the collimator in the field.

The evolution in the field of MTF related metrics can be computed and aggregated in the following type of graphs.

Example of acutance in the field measurement



In this example, a loss in acutance is visible between the center part of the field and the outer part. Tangential metrics are also falling faster than Sagittal ones.

Compliance with standards:  
MTF measurement is compliant with ISO 12233 and IEEE-CPIQ P1858

MTF COLLIMATOR MEASUREMENT ACCURACY & SPECIFICATIONS

For MTF curves, the measurement repeatability is  $\pm 4\%$  on average, with higher accuracy at lower frequencies, as shown in this table:

Frequency (cy/pixel)	Accuracy (RGB)
[0;0.1]	$\pm 2\%$
[0.1;0.3]	$\pm 4\%$
[0.3;0.5]	$\pm 7\%$

Repeatability of acutance measurements is  $\pm 0.04$ . However, this depends on the measured camera characteristics (autofocus accuracy and repeatability, mechanical vibrations).

The collimator on the COMPASS setup ensures repeatable conditions, allowing very good accuracy for the measurement:

Accuracy on collimator angular position is  $\pm 2$  arcmin ( $0.03^\circ$ ), and the collimator's light source illumination stability is over 95% for at least 30 minutes.

## Specifications

### CAMERA TESTING

**Min resolution:** VGA

**Max resolution:** up to 50Mpix

**FOV:** up to  $320^\circ$ , with no limitation for the lens distortion

**Focal length:** under 200mm (35mm equivalent)

**Spectral sensitivity:** measurements are designed for visible spectrum cameras

**Sensor:** Bayer filter sensor

**File formats:** jpg, bmp, png, tif

**Images:** RGB or 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),
  - **1440x800** or more VGA monitor, using a maximum of 125% DPI scaling,
- At least **three USB ports**

### LABORATORY REQUIREMENTS

**Laboratory minimum size:** 2 x 2m

**Temperature:**  $23^\circ\text{C} \pm 2^\circ\text{C}$  (ISO 554:1976)

**Humidity:**  $50\% \pm 20\%$  (ISO 554:1976)