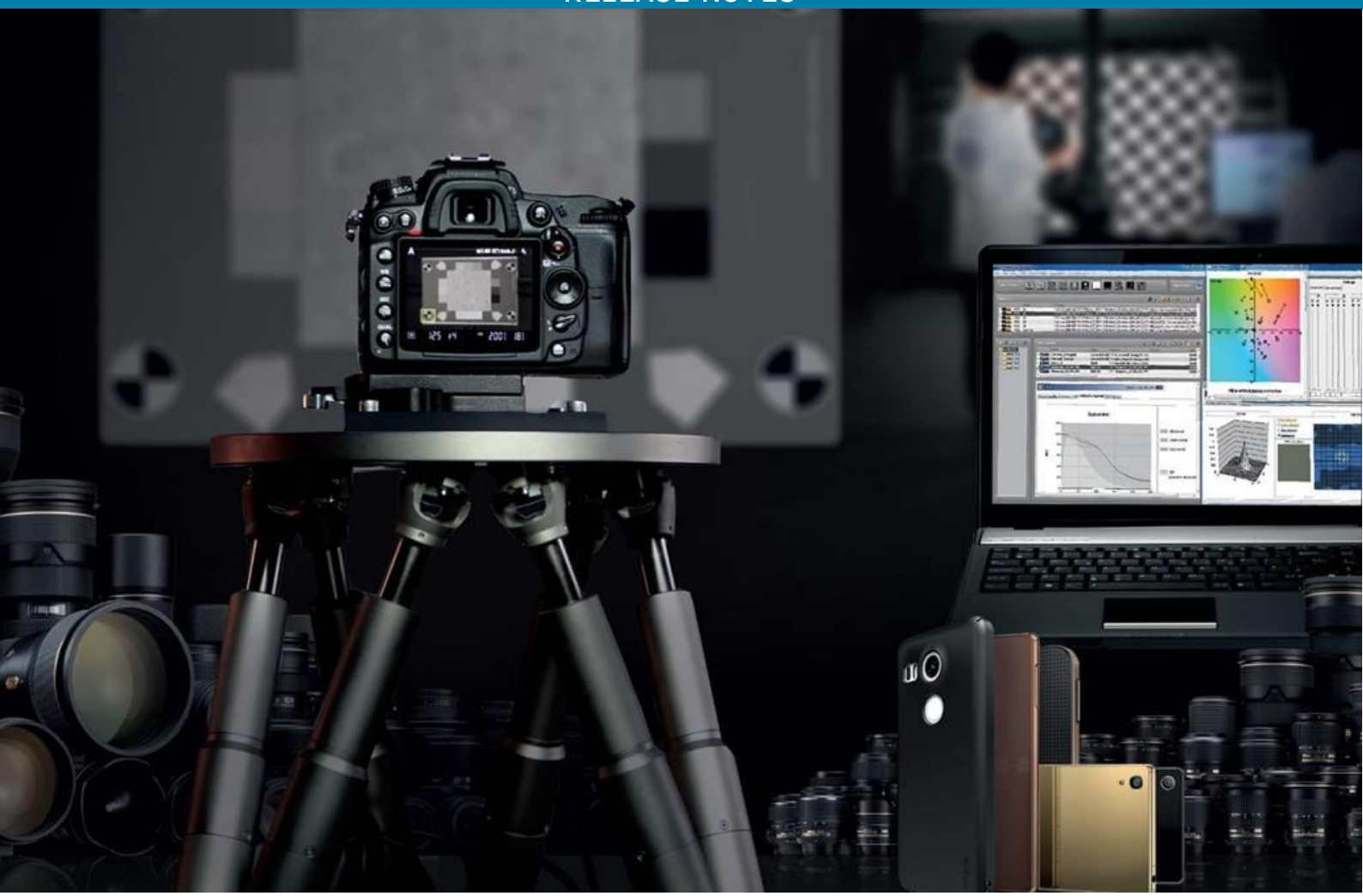
ANALYZER

by DXOMARK

V9.3.0

RELEASE-NOTES



Analyzer solution includes everything you need to reliably measure and analyze the imaging performance of any type of image capture device: testing protocols and methodologies, laboratory specifications and installation guidelines, data management and analysis software.

Analyzer is the only solution that can fully measure not just the quality of captured images, but also artifacts from electronic shutters, the effectiveness of 6-axis image stabilization systems, the geometry of dual-module cameras for 3D or stereoscopic vision, and the dynamic response of imaging devices to changing scenes and light levels. Coupled with Analyzer's ability to measure images the way consumers see them, it is possible to fully evaluate cameras and lenses in a way that predicts how they will perform in real world situations.

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1 - Software Installation

1.1 Analyzer Software Installation

We recommend using the final user account to install the software.

An installation manual (Software_Installation_Instructions.pdf) is available alongside the installer, which describes in detail how to install the different components.

This manual also shows how to handle installation without Internet connection, as well as some troubleshooting instructions, including how to verify if software components were successfully installed.

1.2 First launch and license

Once Analyzer has been installed, you can follow these steps:

1. Plug in the Analyzer USB dongle if you have one.
2. Launch Analyzer.
3. If a license is required, AZ License will appear and will let you guide you to the retrieval of a license code.

Contact support support.analyzer@dxomark.com if license registration fails or if you did not receive your license.

2 - Analyzer 9.3

2.1 Breaking changes

2.1.1 SingleColorMeasure can accept multiple ROIs patches as input now.

The "ROIPosition" input of SingleColorMeasure now accepts multiple ROIs. The output has now changed to reflect this behavior. It is now a dictionary with keys "ROI_0", "ROI_1", etc..., mapping to the corresponding results. When a single ROI is provided (legacy format [[X1, Y1], [X2, Y2]]), the return format has changed to this new format instead of the raw result values.
For more information, please refer to the Workflow Manager API documentation.

2.2 Performance improvements

2.2.1 Precomputing Gain Factors Using 1D LUT for ISO Gain Maps

To optimize image processing performance, we have transitioned to using precomputed 1D Look-Up Tables (1D LUTs) for ISO gainmap handling. This approach significantly reduces computational overhead during runtime by replacing dynamic gain factor calculations with efficient LUT-based retrieval.

2.2.2 Faster RGB to RGB colorspace image conversion 

A new class, RGBImageConverter, has been introduced for high-performance RGB-to-RGB color space conversion. This class executes 5 to 10 times faster than the convertImage2Srgb method in the ColorSpaceConverter class. Please refer to the API documentation for further details.

2.2.3 Faster LCG, Afhdrportrait and AutofocusHdr measurement

The LCG, AfhdrPortrait and AutofocusHdr measurements have been updated to use SingleColorMeasure with multiple ROI inputs. This optimization significantly reduces the processing time, resulting in an observed speedup of 30% to 60% for these measurements.

2.2.4 General improvement on all protection implementations

Protection implementation has been refactored to run faster on all measurements and instrument controls functions enabling up to 9 times faster execution on some measurements.

2.3 New features

2.3.1 Automotive IEEE 2020 CPI Measure 

IEEE 2020 CPI (Contrast Performance Indicators) measurement is now available. This measure is fully compliant with clause 8 Contrast Performance Indicators of the IEEE 2020 standard, published in March 2025. This measure outputs CTA (Contrast Transfer Accuracy) and CSNR (Contrast Signal to Noise Ratio) maps for raw and RGB images. For more information, please see the inline help of dxomark.automotive.cpi.P2020CpiMeasure and the automotive CPI manual.

2.3.2 Distortion, Lateral Chromatic aberration and Field of View can be measured using checkerboard chart

Checkerboard chart is now available in dxomark.core.measure.WideAngleDistortionMeasure. Chart type can be selected with the input "ChartType". Check the measurement documentation for more information.

2.3.3 Saturated area metric in Flare Measure

The output key "SaturatedAreaToLightSourceSizeRatio" has been added to FlareMeasure. It reports the ratio of the saturated area to the expected light source size when the light source is within the field of view. If the light source is out of view, the output is set to NaN.

2.3.4 New demokits for flare measurement

Two new demokits have been added, to help with choosing exposure parameters for flare measurement:

- Flare\demokit_flareOutField_exposure.py: selects the best exposure for flare out of field of view
- Flare\demokit_flareInField_exposure.py: selects the best exposure for flare in field view

2.3.5 Diffraction Limit MTF can be computed in MTF measurement

Diffraction Limit MTF can now be computed in dxomark.core.MTFMeasure, under output key "DiffractionLimit". For this output to be computed, the following input keys need to be specified: "Aperture",, "SensorPixelPitch", "DiffractionLimitWavelength". Check documentation for more information.

2.3.6 New input for MTF calibration reference size

A new input "ReferenceSizeInPixels" has been added to dxomark.core.measure.MTFMeasure. This input can be used to apply MTF calibration when automatic chart detection does not work, for example when using user-defined ROIs.

2.3.7 New target type for Noise Measurement

A new target type, dxomark.core.measure.TargetType.CustomPatches, can be used for noise measurement. This enables noise measurement on any kind of chart. When using this new target type, the inputs "PatchesPosition" and "PatchesLuminance" must be provided.

2.3.8 Color Fringing Measurement available in dxomark.core.measure

The Color Fringing Measurement is now available in dxomark.core.measure. For more information, please check the inline documentation of dxomark.core.measure.ColorFringingMeasure.

2.3.9 Color Fidelity output available in AfhdrPortrait photo and video measurements

Now, AfhdrPortraitMeasure and VideoAfhdrPortraitMeasure support the color fidelity analysis on the colorchecker chart of the setup.

It supports different input options for the color measurement, to handle different scenarios. For more information, please check the inline documentation of dxomark.core.measure.AfhdrPortraitMeasure or dxomark.core.videomeasure.VideoAfhdrPortrait.

2.3.10 Protocol Automation

2.3.10.1 Support of HDC for HarmonyOS devices for automation

It is now possible to automate shooting of images and videos for HarmonyOS devices by using HDC tools, like ADB for Android.

2.3.11 Instruments control

2.3.11.1 Closed loop for LED panels

LabManager now supports illuminance-based closed loop regulation of the LED panels through the API and the UI.
Users can tune the relative and/or absolute tolerance.

2.3.12 AZPhoto Application

2.3.12.1 Composite HDR measurement added in AZPhoto

Added Composite HDR measurement capability in AZPhoto with full Analyzer report reproduction. Users can load HDR files, run measurements, view detailed reports, and export results as PDF.

2.3.12.2 Blur measurement now in AZPhoto

Blur measurement is now available directly within the AZPhoto user interface.

2.3.12.3 Color Sensitivity measurement now in AZPhoto

Color Sensitivity measurement is now available directly within the AZPhoto user interface. In the image display, users can select a custom Noise curve corresponding to the device. This noise curve is an output of the Noise and SNR measure.

2.3.12.4 Distortion on Checkerboard chart now in AZPhoto

The Distortion and LCA measure were already supported on Dots charts, now it can also be performed on Checkerboard charts.

2.3.12.5 Custom patches tool in AZPhoto

Added a GUI tool in AZPhoto to edit sidecars and define custom patches for any image. Users can create, move, resize patches, with dynamic sidecar updates and parameter input per patch. Includes undo functionality for easy configuration.

2.3.12.6 Custom patches support in Transfer Functions and Contrast measurement

Users can now specify custom patches in Transfer Functions and Contrast measurement directly through the AZPhoto user interface. Users need to specify positions and one among reference luminance values, PatchesTransmittance and the LightSourceLuminance, or PatchesReflectance and the ChartIlluminance. The defined positions are automatically saved within the sidecar file, ensuring consistent and portable measurement configurations

2.3.12.7 Noise measure on any chart in AZPhoto

Added support for Noise & SNR measurement on custom charts in AZPhoto, using patches defined via INI file or defined in AZPhoto GUI.

2.3.12.8 DXM format support

Users can select DXM files as input for measurements that support this kind of input.

2.3.12.9 RAW format support

Users can select RAW files as input and AZPhoto will spawn a RawConverter tool to assist user converting raw file to CFA or DXM (for >16 bits precision).

2.3.12.10 Playback conditions

In the report, the playback conditions of the image on which the measure was applied (potentially with gain map applied) are now displayed.

In the image viewer, the playback conditions of the displayed image can also be seen.

2.3.12.11 CSV and XLSX export for tables

User can now right-click on tables in the measurement reports and export the data either as CSV or XLSX file.

2.3.12.12 Log / Linear switch in reports

User can now switch charts axis between log a linear in the measurement reports.

2.3.12.13 Input validation

Before launching the measure, AZPhoto will check that all necessary inputs are provided by the user and will prevent launching the measure.

2.4 Modified features

2.4.1 Automatic detection of edge orientation for MTF Calibration

In dxomark.core.measure.MTFMeasure, when using MTF calibration with user defined ROIs, the calibration is applied using detected horizontal or vertical edge orientation, instead of edge orientation from input.

2.4.1 AZPhoto Application

2.4.1.1 AZPhoto viewer image loading rework

Image loading is now managed through an internal framework, which improves consistency and maintainability across the application.

2.4.1.2 Unified behavior for manual markers for Noise and ColorFidelity

In AZPhoto version 9.2, there was a discrepancy in how manual markers were specified on the “ColorChecker” chart for Noise and Color Fidelity measurements. Specifically, Noise measurement required markers to be placed at the target corners, whereas Color Fidelity used designated marker points. This inconsistency has now been resolved, and both measurements use real marker positions when manually specified in the interface.

2.4.1.3 Image tool to input led timer calibration and capture

Now the Image tool to associate capture and calibration data for the Timer measure is more interactive.

2.4.2 Protocol Automation

2.4.2.1 Possibility to skip warmup

User has now the ability to skip warmup when launching Protocol automation shooting. This is available via a prompt after launching protocol automation shooting.

2.4.3 Minimum flare intensity value in Flare Measure

Flare intensity computation was improved to increase accuracy in low flare regions by reducing gray level clipping. For dB computation, a minimum flare intensity of 1e-8 is used, corresponding to -160 dB.

Consequently, the output key “SmallestMeasurableFlareIntensityIndB” has been removed.

2.4.4 Flare in field exposure module was moved

Flare in field exposure module was previously accessible in:

- dxomark.protocol.raw.flareexposureprotocol.FlareInFieldExposureTimeProtocol
- WorkflowManager command ‘flareexposureprotocol’

It has now been moved to: dxomark.core.measure.FlareInFieldExposureMeasure

A new demokit allows to use this new module: Flare\demokit_flareInField_exposure.py

The legacy module is still available. However, it is deprecated and will be removed in a future update.

Input keys “SourceCenterX” and “SourceCenterY” have been removed.

2.5 Known limitations

2.6 Bug fixes

2.6.1 AZPhoto

***6528:** Cannot open report after deleting custom viewing conditions
***6537:** HDRNoise patch positions wrongly displayed for DNG images
***6564:** Vignetting measure shows "the picture appears over/under exposed"
***6630:** AZPhoto keeps a handle on images even after removing them from Files to be processed list
***6652:** Incorrect error messages when opening images with incorrect extensions compared to their type
***6660:** In Report Compare mode, the color patch tables are not properly synchronized

2.6.2 AZLicense

***6552:** AZLicense does not always prompt automatically for some invalid licenses

2.6.3 HDR related

***6627:** LCG measure returns wrong value for ChartDynamicOnDisplay
***6683:** gain map in some Vivo X300Pro images cannot be read

2.6.4 Protocol automation related

***6379:** Protocol Automation fails when using adb for devices that do not have adb_screen_tap feature
***6604:** Videos shot by all video setups involving ALS/Lighting Control are too long
***6641:** As a User of Protocol Automation camerav6, I have incoherent light value when using the Gemini panel compared to Kinoflo

***6700:** Missing outputs in DmcMeasure for images of very bad quality prevents protocol automation Dmc aggregation
***11862:** In setup ZoomSmoothness, Kinoflo led panel turns off when it should not
***12319:** VideoDeadLeaves Texture aggregation fails if results are missing for some frames
***12270:** In Protocol automation AFHDR setup, motion blur measurement was incorrect on HDR images.
***12336:** Video color rendering score computation was incorrect due to the white point used. It is now fixed, and database scores have been updated.
***12477:** In setup Timing, rotated videos are not correctly supported
***12575**: Acutance metric and MTF not clipped for lowlight conditions for devices with variable resolution.

2.6.5 Documentations

***6311:** User Manual does not specify how Luminance channel is computed in NoiseMeasure
***6471:** AutofocusMeasure inline help and html doc is incomplete concerning output keys
***6599:** The Video Visual Noise measure does not document the patch order for all outputs
***6617:** Rolling shutter check in LED Universal Timer shots is not documented enough
***6628:** Documentation of VarianceMaps in VisualVideoNoise in the user manual is incorrect
***6758:** Output documentation for Protocol Automation Setup Video Dmc is incorrect

2.6.6 Others

***6642:** Memory leak of about 17MB of RAM when loading HEIC images
***6653:** MarkerPosition input is ignored in VideoFlickerMeasure

3 - Analyzer 9.2

3.1 Breaking changes

3.1.1 Old Analyzer GUI has been removed

The legacy Analyzer GUI application has been discontinued and is no longer included in the delivery package. Measurements can be launched using AZPhoto and AZVideo applications, which offer a modern interface, an enhanced user experience, and a wide range of new features designed to improve workflow efficiency.

AZPhoto and AZVideo do not offer the feature to export Excel files with measurement results. Results can be exported in json and pdf format.

Some measurements are not available in AZPhoto and AZVideo, please use python API dxomark.analyzer or dxomark.core packages:

REMOVED GUI MEASUREMENT	REPLACEMENT API MEASUREMENT
3D Calibration	dxomark.core.measure.StereoCameraCalibrationMeasure
Autofocus	dxomark.core.measure.AutofocusMeasure
Blur/Sharpness (BxU)	dxomark.core.measure.BlurMeasure
Color Fringing	dxomark.analyzer.opticsmeasure.fr
Color Sensitivity	dxomark.core.measure.ColorSensitivityMeasure
Dark Signal	dxomark.analyzer.photomeasure.ds
Effective Focal Length 2 shot method	dxomark.analyzer.opticsmeasure.efl
Fisheye Modulation Transfer Function	dxomark.analyzer.fisheyemeasure.fisheye_mtf
Flash	dxomark.analyzer.opticsmeasure.flash
HDR	dxomark.core.measure.CompositeHDRMeasure
ISO	dxomark.analyzer.photomeasure.iso
Noise on "Noise chart"	dxomark.core.measure.NoiseMeasure
Radial Modulation Transfer Function	dxomark.analyzer.opticsmeasure.radial_mtf
Row/Column Noise	dxomark.analyzer.photomeasure.rcn
Stabilization photo	dxomark.analyzer.videomeasure.stb
Stabilization video	dxomark.analyzer.videomeasure.video_stb
Tone Curve on "Noise chart"	dxomark.analyzer.photomeasure.tc
Video noise	dxomark.analyzer.videomeasure.video_noise

3.1.2 Some old dxomark.analyzer API measurements have been removed

Some old API have been removed, since they have replacements in the more versatile dxomark.core.measure API:

Removed API	Replacement API in dxomark.core.measure
dxomark.analyzer.opticsmeasure.bxu	BlurMeasure
dxomark.analyzer.opticsmeasure.mtf	MTFMeasure
dxomark.analyzer.opticsmeasure.vc	VignettingMeasurement
dxomark.analyzer.photomeasure.cf	ColorFidelityMeasure
dxomark.analyzer.photomeasure.cs	ColorSensitivityMeasure
dxomark.analyzer.photomeasure.dp	DeadMeasure
dxomark.analyzer.photomeasure.noise	NoiseMeasure
dxomark.analyzer.photomeasure.tex	TextureMeasure
dxomark.analyzer.calibration3dmeasure	StereoCameraCalibrationMeasure

3.1.3 "3D geometry" measurement replaced with new camera calibration measurement

Analyzer "3D geometry" measurement has been replaced with two new measurements:

- For stereo cameras: dxomark.core.measure.StereoCameraCalibrationMeasure
- For single cameras: dxomark.core.measure.SingleCameraCalibrationMeasure

These measurements are based on OpenCV camera models, and allow to perform stereo calibration, or single camera calibration.

Read documentation for more information:

- inline or html documentation for each of these measurements
- chapter "Stereo Camera Calibration" of Analyzer User Manual.

3.1.4 Input and Output keys renamed in WideAngleDistortionMeasure

Some keys have been renamed in `dxomark.core.measure.WideAngleDistortionMeasure`, in order to prepare for the measure to detect additional chart types (such as checkerboards) on which it will also be possible to measure distortion.

- Input keys:
  - 'DotSpacing' is renamed to 'PointSpacing'
  - 'DotDetectionType' is renamed to 'DetectionType'
- Output keys:
  - 'DetectedDots' is renamed to 'DetectedPoints'
  - 'TargetDots' is renamed to 'TargetPoints'
  - 'MatchedDots' is renamed to 'MatchedPoints'
  - 'DotsDetectionType' is renamed to 'DetectionType'
  - 'DotsNumber' is renamed to 'PointsNumber'

3.1.5 AZPhoto / AZVideo report encryption

Now, the report generated by AZPhoto and AZVideo are now only readable by their respective applications and no longer saved in human readable format. To access the raw output of the measure, you can export the report as JSON from the GUI or use the corresponding API module.

3.2 New features

3.2.1 AZFree Edition

AZFree Edition provides free access in AZPhoto to the following measurements:

- Color Fidelity
- Distortion and lateral chromatic aberration
- Edge SFR
- Transfer Functions and Contrast
- Noise and SNR
- Lens shading
- Texture and visual noise

To easily get started you can use demo images that are in C:/Users/Public/Pictures/AZPhotoSamples (this is the default folder when trying to add files from AZPhoto).

3.2.2 License Management Application

A new License Management application "AZLicense" handles the following:

- Online registration for AZFree users
- Online License retrieval for AZFree users
- Licenses activation

3.2.3 AZPhoto Application

3.2.3.1 On-boarding screen

First-time users now see an onboarding screen to help them navigate the app effortlessly.

3.2.3.2 Crop tool in AZPhoto

Now you can crop RAW images in AZPhoto application using CROP tool.

3.2.3.1 Ability to save the MTF ROI defined

Now AZPhoto saves into sidecar file all manual ROIs you defined in the GUI.

3.2.3.1 Enhanced Tool for Manual Marker Positioning

The latest update introduces improved manual marker positioning capabilities. Users can now specify an inverted marker position via the context menu within marker tools. Additionally, inverted markers feature a distinct GUI representation for better visualization and interaction.

3.2.3.1 Apply Gain Map

Now, you can select the "Apply Gain Map if available" before all measurements in AZPhoto.

3.2.3.2 SDR Preview

Now, a label explicitly states that HDR images are displayed as SDR only (but the measure can be performed on the HDR image)

3.2.3.3 Texture Preservation and Visual Noise measurement in AZPhoto

Now you can perform Texture Preservation and Visual Noise measurements in AZPhoto.

3.2.3.1 Tone Curve and Contrast measure on HDR noise chart

A new measure has been added to AZPhoto: Tone Curve and Contrast.
It currently only supports the HDR Noise chart but expect more charts to be supported in the future.

3.2.3.2 Compare reports functionality in AZPhoto application

Add a side-by-side comparison view for two measurement reports of the same measurement type.

3.2.3.1 Measure Report Explorer

Now, you can browse and organize measurements reports directly from AZPhoto using the build-in explorer.

3.2.3.2 Documentation in AZPhoto

Now all Analyzer documentation can be accessed through the "Documentation" button in the toolbar of AZPhoto.

3.2.4 PlotAll and SaveResults functions available in WideAngleDistortionMeasure 

WideAngleDistortionMeasure.SaveResults() saves all output to a json file, and distortion model to another json file.

3.2.5 Metrics selection for CompositeHDRMeasure and SingleImageHDRMeasure 

It is now possible to select which metrics to compute in the CompositeHDRMeasure and SingleImageHDRMeasure (dxomark.core.measure) using a new input named ``MetricsEnabled`` that accepts singular or merged values coming from the CompositeHdrMetrics enum (located in dxomark.core.measure).

3.2.1 Instrument control 

3.2.1.1 Universal Led Timer presets in LabManager

It is now possible to save a current Universal Led Timer configuration as a preset. All presets can be listed and their exact content retrieved and applied to a given Universal Led Timer, through the LabManager Python API via the `ledbox_interface` or through LabManager UI via the Universal Led Timer tab.

3.2.1.2 Support for Gossen MavoMaster in LightingControl

After adding support for the Gossen MavoMaster lightmeters in LabManager, we have now also added the possibility to use them transparently in Lighting Control.

3.2.1.3 Support for Kinoflo Celeb and Litepanels Gemini in Protocol Automation

Thanks to calibration via LabManager you can control DMX Lights in luminance rather than raw 8-bit value. This means that setups that support LabManager now support any DMX controlled LED panel and not only KinoFlo Celeb.

3.2.2 New automatic alignment measurement class, with support of more charts 

A new measurement class has been created for chart automatic alignment:
`dxomark.autoalignment.automatic_alignment.ChartAlignmentMeasure`

This measurement computes rotations and translation needed to align the camera to the chart, and supports three different charts:

- 78cm wide deadleaves chart (TU0003_78)
- 140cm wide visual noise chart (VNU0002_140)
- 42cm wide colorchecker frame with markers (FRAME_CC002)

Check measurement documentation for more information.

The old automatic alignment function only supports TU0003_78 chart. It is now marked as deprecated and will be removed in a future release:
`dxomark.autoalignment.automatic_alignment.getAlignmentCompensation`

3.3 Modified features

3.3.1 lcms2_fast_float_plugin

The lcms2_fast_float_plugin (version 2.17.2) has been integrated into the AZ project, ensuring improved computational efficiency.

3.3.2 Local Contrast Gain measurement for SDR images

The Local Contrast Gain (LCG) measurement can now be used on SDR images without the need of an HDR16 license.

3.3.3 Optimized import in WorkflowManager API

Now only required elements are loaded in memory when a module is imported for the first time in a python session. Previously all elements were loaded in memory. This enables shorter loading times for individual imports.

3.3.4 New gain map methods with automatic memory management added to image wrapper class

New functions Image.getGainMapMetadata and Image.getImageWithGainMap are added to the corewrappers Image class. Read inline help for more information.

3.3.5 Optimized PQ Transfer Functions Using 1D LUTs

We have transitioned to using curve-based 1D Look-Up Tables (1D LUTs) with linear interpolation for implementing transfer functions in the PQ (Perceptual Quantizer) color space. This approach has significantly improved performance, achieving up to a 7x speedup in both the Electro-Optical Transfer Function (EOTF) and its inverse.

3.4 Known limitations

3.4.1 Manuals not accessible from legacy instrument control applications

It is no longer possible to access manuals from the ? menu inside the legacy instrument control applications (Timer Pilor, Shaker, Lighting Control).
The manuals are accessible either in AZPhoto -> Documentation -> Instrument Control menu or in C:\ProgramData\DXOMARK IMAGE LABS\Analyzer\WorkflowManager\Lib\site-packages\dxomark\documentation\1_Instrument Control folder.

3.5 Bug fixes

3.5.1 AZPhoto

***6227**: Processing on Checked but Unloaded Images in PhotoViewer may fail

***6268**: Wrong tab focus in the top bar on some actions
***6317**: Custom Viewing conditions can sometimes be lost
***6427**: In Distortion LCA results, detected grid is not displayed for images with more than 8 bit precision
***6484**: Focus is on the wrong tab in the top bar when opening multiple reports simultaneously
***6468**: Exposure output is not displayed in DMC measure results

3.5.1 HDR related

***6181**: LocalContrastGainMeasure inputs and inline help are not correct
***6414**: PlaybackConditions are not preserved after Framework Image.resize
***6496**: Motion blur incorrectly estimated when applying gain map inside AutofocusHdrMeasure

3.5.2 Protocol automation related

***6487**: Setup inline help are not up to date
***6489**: AFHDR Portrait setup guides do not mention the optional DMX switch for the flare source HDR

3.5.3 Others

***5965**: The CSF in the HDRCompositeMeasure output does not include display MTF when "use display MTF" is selected
***6109**: Unnecessary warning message during distortion model estimation in WideAngleDistortionMeasure
***6111**: Wrong exposure check for more than 8bit RGB images in MTFMeasure
***6132**: "ColorCheckerMarkersList" input is ignored in SinglePersonVideoConfMeasure
***6143**: No error or warning is provided when wrong timestamps are used as input of VideoVisualNoiseMeasure
***6265**: SingleImageHDRMeasure returns erroneous patch order for the greyscale when the image is rotated by 90° or 270°
***6296**: AFHDRPortraitMeasure does not state that ini file is missing when OnlyProcessImagesWithIni is not set to false
***6412**: In LabmanagerUI, when switching between timing and flickering, the frequencies/calibration time for each line are mixed up
***6423**: Automotive setup guides do not provide accurate information on led panel settings
***6514**: VisualNoiseMeasure crashes when provided patch positions in the wrong order

4 - Analyzer 9.1.2

4.1 Breaking changes

4.1.1 Protocol Automation Camera v6 replaces Protocol Automation Camera v5 and selfie

Analyzer 9.1.2 provides the Protocol Automation Camera v6 scripts in Workflow Manager (Python API). The Protocol Automation Camera v5 and Selfie are no longer available.

Please refer to the Workflow Manager inline documentation and Protocol Automation setup guides for additional details.

To continue using Protocol Automation Camera v5 and selfie, please remain on Analyzer v9.1.1.

4.1.3 Removal of unused methods in Lightmeters interface in LabManager

`set_range` and `set_unit` methods were removed from the Lightmeters interface as they were not used.

In the `config.json` configuration file, the "gossen" entry is removed.

Supported Gossen lightmeters (MavoLux and MavoMaster) are now always setup in autorange mode, with the unit being in lx (or cd/m2 if the attachment is screwed on).

4.2 New features

4.2.6 Setup: AFHDR Portrait 

4.2.6.1 Measurement and aggregation available in SetupPhotoAfhdrPortraitEugene and SetupPhotoAfhdrPortraitDiana

In analyzer 9.1.1 the mobile protocols gained the ability to automate shooting the AFHDR Portrait setup. In 9.1.2 they can now also perform automatic measurement and aggregation.

Please refer to the Workflow Manager inline documentation for `SetupPhotoAfhdrPortraitEugene` and `SetupPhotoAfhdrPortraitDiana` for additional details.

4.2.6.2 VideoAfhdrPortraitMeasure

This new measurement performs the AFHDR Portrait analysis on videos using the AFHDR Portrait setup. The analysis includes the following measurements:

- Timing measurements
- Exposure on face
- Local Contrast Gain measurement
- Face detail preservation measurement
- Visual Noise measurement

Please refer to the Workflow Manager inline documentation for additional details.

4.2.6.1 New Protocol Automation SetupVideoAfhdrPortrait

In addition to the new measurement VideoAfhdrPortraitMeasure, a new protocol automation setup has been made available to automate shooting perform the measurement and compute the aggregation of results.

Please refer to the Workflow Manager inline documentation the related Protocol Automation setup guide for additional details.

4.2.7 HDR metrics and measurements support 

4.2.7.1 ISO 21496-1 gain map support

HEIC, HEIF and JPEG files following ISO 21496-1 encapsulation of HDR gain maps are now fully supported.

4.2.7.2 Gain map handling for devices from Apple iPhone 14 and below using iOS 18.x

Images from Apple iPhone 14 and below using iOS 18.x are fully supported.

4.2.7.3 Basic support to save HDR images as AVIF

Images (inside `dxomark.corewrappers.Image` objects) can be saved to AVIF files. This method supports saving HDR images with ITU-T H.273 Coding Independent Code Points (CICP) colorimetry metadata. For more detailed information, see the inline help of the `Image.saveImage` method.

4.2.7.4 Automated adaptation of the white point luminance inside measures

It is now possible to activate automated adaptation of the white point luminance to the exposure of the chart inside several measures:

- **`VisualVideoNoiseMeasure`**
- **`VisualNoiseMeasure`**
- **`TextureMeasure`**
- **`AutofocusHdrMeasure`**
- **`AfHdrPortraitMeasure`**
- **`SingleImageHdrMeasure`**
- **`CompositeHdrMeasure`**
- **`CloseUpTextureNoiseMeasure`**
- **`VideoAutofocusHdrMeasure`**

This is controlled in all these measures using three new inputs:

- **`ExposureCorrection`**
- **`ExposureCorrectionPatchIndex`**

- `ExposureCorrectionTargetLightness`

This automatically determines a value for the **`WhitePointLuminance`** parameter (which cannot be used together with these options), which is particularly useful for images where the observer would be expected to have an adaptation state far from an average SDR display: this includes HDR images, or SDR images that are heavily under- or over-exposed.

For more detailed information, see the inline help in each measurement.

4.2.8 New ForceMarkerDetectionOnEveryFrame feature for video measurements

Now you can use "ForceMarkerDetectionOnEveryFrame" input in video measurements. When set to False, the measurement performs marker detection on every frame using local search around the last known position from previous frames when available. The processing time is short. When set to True, the measurement performs full marker detection without a priori knowledge of the approximate position of the markers. The process takes more time but enables detection of marker when there is large difference in positions between frames.

4.2.9 Instrument control

4.2.9.1 Gossen MavoMaster support in LabManager

Added support of Gossen MavoMaster lightmeters in LabManager, on top of already supported Gossen MavoLux devices. Control is transparent through the Lightmeters interface using the Python API or the LabManager UI.

4.2.9.2 Gossen MavoMaster support in LightingControl

Added support of Gossen MavoMaster lightmeters in LightingControl, on top of already supported Gossen MavoLux devices. Lightmeter selection, calibration, manual control and closed loop control behave the same way as for the Gossen MavoLux lightmeters.

4.2.10 Dark Signal Map support in FlareMeasure

New "`DarkSignalMap`" input added to `dxomark.core.measure.`**`FlareMeasure`** and `dxomark.core.measure.`**`FlareAggregation`**. This input allows compensating black level per pixel of the flare subsampled image, instead of globally. Dark signal map can be computed with `dxomark.core.measure.`**`FlareDarkMeasure`**.

4.2.11 Support of a mask to reduce size of brightest patches for DR170dB setup

`dxomark.automotive.dynamicrange.`**`P2020DynamicRangeMeasure`** now supports the use of a mask to reduce the size of the brightest patches. A new input "`SetupType`" allows to select the type of setup:

- "DR170dB" for the default configuration (without mask)
- "DR170dB_with_mask" when using the mask.

Check the setup guide for more information.

4.3 Modified features

4.3.1 Noise score unreliability warning in DmcMeasure

`dxomark.core.measure.DmcMeasure` outputs a warning when the noise score may be unreliable due to excessive noise in the image.

4.3.2 New output "PercentageOfSaturatedPixels" in FlareMeasure

Now, `dxomark.core.measure.FlareMeasure` and `dxomark.core.measure.FlareAggregation` return the percentage of saturated in the output, with output key "`PercentageOfSaturatedPixels`"

4.3.3 MTF computed on luminance channel for RGB images

Now, `dxomark.core.measure.MTFMeasure` return results on a luminance channel. Luminance channel is computed as specified in ISO12233:2023 standard.

4.3.1 HDR Noise chart support in LCG measure

The LCG (Local Contrast Gain) measure now supports the HDR Noise chart.

4.4 Known limitations

4.4.1 ForceMarkerDetectionOnEveryFrame and wide angle distortion compensation on VisualVideoNoiseMeasure

ForceMarkerDetectionOnEveryFrame and wide angle distortion compensation are currently incompatible on VisualVideoNoiseMeasure. Setting ForceMarkerDetectionOnEveryFrame to True will disable wide angle distortion compensation.

4.4.2 Timing measure on tone mapped images

Timing measure can sometimes provide incorrect results on images tone mapped from HDR content.

4.5 Bug fixes

4.5.1 HDR related

#6153: ColorSpaceConverter.convertImage2sRGB was providing invalid pixel values for colors that were originally out of the sRGB gamut
#6236: No usable error was provided when trying to load a broken heic image
#6238: SetSdrDisplayLuminance was not working properly when applied on videoStreamHDR
#6240: SetSdrDisplayLuminance was not working properly in VideoColorStability and VideoColorFidelity measures
#6252: ColorSpaceConverter.convertXYZToRGBImage inline documentation was incorrect
#6258: when opening an HDR image, incorrect SDR diffuse white was assumed
#6318: jpg images with gain map were not seen as such consistently when using multiprocessing/threading to open the images
#6361: Android Ultra HDR 3-channels gain map was not correctly applied
#6362: Confusing error message was shown sometimes when opening a jpg image with gain map
#6380: Multi-channel gain map was applied on XYZ channels instead of linear RGB ones

#6460: Timing measure provided sometimes incorrect results on HDR input

4.5.2 Protocol Automation

#6210: Subsequences were not usable for protocol automation video when using MLS
#6230: Wrong device battery level was reported during protocol automation

4.5.3 Others

#6237: Online help was not available in python console for some measurements
#6241: Incorrect netmask of network interface was sometimes used when configuring MLS
#6346: Parsing ViewingConditions as Inputs in VisualVideoNoiseMeasure was returning an empty dictionary for Spatial Noise
#6357: A memory leak was corrected in SingleImageHDRMeasure
#6437: On high resolution images, DMC measure was sometimes returning wrong results for resolution estimation

5 - Analyzer 9.1.1

5.1 Bug fixes

5.1.1 Protocol Automation

#20110: fixed Protocol Automation that was not working unless HDR16 module was purchased

5.1.2 LabManager

#20160: fixed typo in functions to claim and release access to MLS in LabManager
#20160: fixed freeze when performing MLS calibration using LabManager in Protocol Automation
#20182: fixed several issues with MLS detection and serial connection using LabManager in Protocol Automation

5.2 Modified features

5.2.1 LabManager

Device network connection rework to make connection to device in same subnet on multiple Ethernet card more reliable.
(Affects mostly hexapod and MLS control)

6 - Analyzer 9.1.0

6.1 Breaking changes

6.1.1 MotionBlurMeasure and AutofocusHdrMeasure 

The `MotionBlurMeasure` has been updated to be consistent with other measures:

- The **`ImageCharacteristics`** input has been replaced by **`Img`** or **`ImgObj`**, similar to other measures.
- The **`ReferenceTemplateCharacteristics`** input has been removed, as well as the corresponding input in `AutofocusHdrMeasure`.
- The **`Roi`** input is now optional, with the default value automatically determined from the Dead Leaves marker positions.

6.1.2 VideoStream 

The deprecated VideoStream class was removed from Workflow Manager. In addition, “LEGACY” type value was also removed from VideoStreamType. You should use VideoStreamHDR and VideoStreamType.HDR instead.

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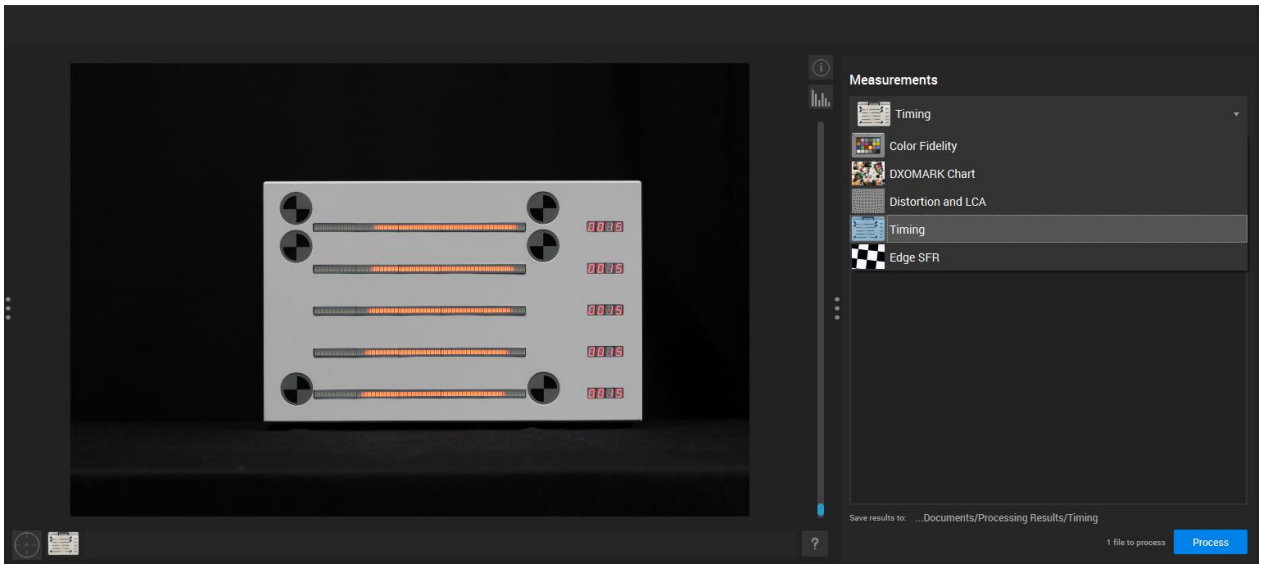
6.2 New features

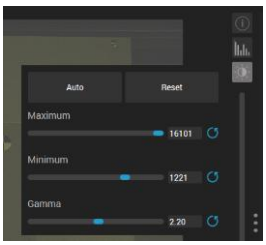
6.2.1 AZPhoto Application

The AZPhoto application now includes several new measures in the 9.1 release.

- Timing (dxomark.core.measure.TimingMeasure)
  - This measure requires images to be accompanied by a valid sidecar file on load. A valid sidecar file shall contain at minimum a 'TimeBoxCalibration' field correctly filled.
- Distortion and LCA (dxomark.core.measure.WideAngleDistortionMeasure)
- Edge SFR (dxomark.core.measure.MTFMeasure)



Additionally, the image viewer now contains a new feature for previewing RAW images. A contrast button, as seen in the right-hand image, will open, on hover, a widget allowing the user to change the contrast of the displayed image. It is important to note that this will not affect the processing of said image.



6.2.2 HDR metrics and measurements support

6.2.2.1 Local Contrast Gain measure

LocalContrastGainMeasure evaluates the local contrast preservation capability of an imaging system. The measurement uses a robust estimation of the local OOTF of the device to measure the gain between an infinitesimal contrast in the scene and its representation on the display. It is available both as a standalone measure in the Workflow Manager and as an additional output of several other measurements.

Please refer to the Analyzer User Manual and the WorkflowManager inline documentation for further details.

6.2.2.2 Motion Blur measure

The Motion Blur measure now supports HDR inputs. A new input `UseImageColorMetadata` makes the measure interpret colorimetry metadata in the input image, which makes the measurement more robust. This input is not turned on by default yet but will be in a future release.

6.2.2.3 Realistic Mannequin measure supports HDR image as input

The Realistic Mannequin measure supports HDR image as input now. The input HDR image will be converted to SDR image using a tone mapping before the measurement.
Two new input parameters enable to select the tone mapping and its corresponding additional options. These inputs are: `'ToneMappingType'` and `'ToneMappingOptions'`. Currently only tone mapping ITU BT2446-1 method A is supported. Please refer to the WorkflowManager inline documentation for more details.

6.2.2.4 DMC measure supports HDR image as input

The DMC measure supports HDR image as input now. The exposure and ruler measurements will be performed on the original HDR image. For the AI-based metrics (detail preservation and noise quality metrics), the input HDR image will be converted to SDR image using a tone mapping before the measurement.
Two new input parameters enable to select the tone mapping and its corresponding additional options. These inputs are: `'ToneMappingType'` and `'ToneMappingOptions'`. Currently only tone mapping ITU BT2446-1 method A is supported. Please refer to the WorkflowManager inline documentation for more details.

6.2.2.5 VideoDmcMeasure supports HDR Video as input

VideoDmcMeasure supports HDR video as input now. As for DMC measure, two new input parameters enable to select the tone mapping and its corresponding additional options.

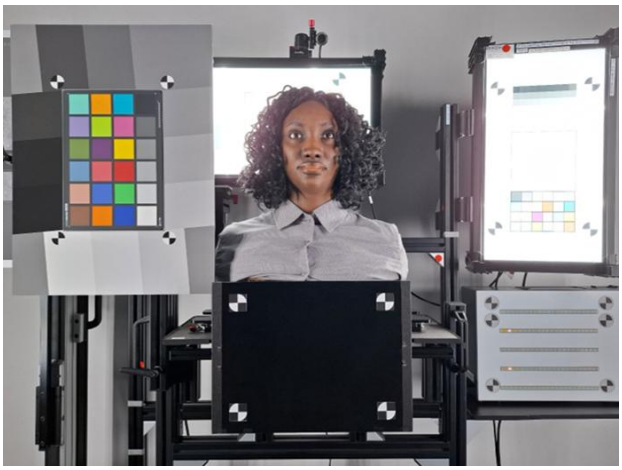
6.2.2.6 ISO 21496-1 gain map support

HEIC files following ISO 21496-1 encapsulation are supported partly. All images except those with alternate color space different than base color space or with more than 8bits gain maps are now supported.

6.2.3 New AutofocusRMMeasure 

The new AutofocusRMMeasure is introduced in Analyzer 9.1. This new class aims to measure the autofocus, where the timing is measured on the LED Universal Timer and the sharpness metric is measured on the realistic mannequin.
Please refer to the WorkflowManager inline documentation for further details.

6.2.4 New setup: AFHDR Portrait



6.2.4.1 AFHDR Portrait setup

We are introducing a new versatile setup. The purpose of this setup is to analyze the following camera device characteristics:

- The speed and the precision of the autofocus on a face and in different dynamic range and exposure conditions
- Exposure on face in HDR and SDR conditions
- Local contrast gain at different levels of the dynamic range of the image
- Face detail preservation
- Visual noise (on the greyscale chart surrounding the color checker chart)
- Flare (analysis of the impact of the flare source on the new flare chart)

6.2.4.2 AfhdrPortraitMeasure

This new measurement performs the AFHDR Portrait analysis using the AFHDR Portrait setup. The analysis includes the following measurements:

- Autofocus measurement on a realistic mannequin
- Timing measurements
- Exposure on face
- Local Contrast Gain measurement
- Face detail preservation measurement
- Visual Noise measurement

Please refer to the WorkflowManager inline documentation for additional details.

6.2.4.3 New Protocol Automation AfhdrPortrait

In addition to the new measurement AfhdrPortraitMeasure, a new protocol automation setup has been made available to automate shooting in predefined exposure, dynamic range, shaking conditions.
For the moment, only the automation of shooting part is available. The measurement and aggregation part will be released in the next version.

6.2.5 VideoTimingMeasure and VisualVideoNoiseMeasure supports markers positions for all frames as input

In TimingMeasure, `'CoordinatesMarks'` input can now be used to provide marker positions for selected frames.
In VisualVideoNoiseMeasure, `'MarkerPosition'` can now be used to provide marker positions for selected frames and `'PatchesPosition'` to provide patches position for selected frames.
Please refer to the WorkflowManager inline documentation for further details.

6.2.6 Add the possibility to modify the sdrDisplayLuminance value of the image playbackConditions

A new function setSdrDisplayLuminance is added in the corewrapperImage class. This new function enables us to modify the sdrDisplayLuminance of the playbackConditions of an SDR image. This action will modify the hdrHeadroom, peakDisplayLuminance and transferFunctionPeakLuminance values. Note: This method is not supported for HDR images.
Please refer to the WorkflowManager inline documentation for further details.

6.2.7 Add the possibility to set custom playbackConditions in VideoStreamHdr and modify the sdrDisplayLuminance of the custom playbackConditions

A new function SetPlaybackConditions is added in VideoStreamHDR class, this function enables us to set custom playbackCondtions, and it will apply to all frame of the video.
A second function SetSdrDisplayLuminance Is also added in VideoStreamHDR class. This action will modify the hdrHeadroom, peakDisplayLuminance and transferFunctionPeakLuminance values. User should first manually set a PlaybackConditions to the video stream, then use the function SetSdrDisplayLuminance(). Note: This method is not supported for HDR video.
Please refer to the WorkflowManager inline documentation for further details.

6.2.8 New VideoAutofocusHdrMeasure

The new VideoAutofocusHdrMeasure class performs the video analysis of the AFHDR (autofocus HDR) setup, based on texture, visual noise, motion blur, SingleImageHdr, local contrast gain and timing measurements.
Please refer to the WorkflowManager inline documentation for additional details.

6.2.9 Instrument control

6.2.9.1 DMX LED panels control in illuminance

Previously the LED panels (LitePanels Gemini and KinoFlo Celeb) could only be controlled in raw intensity value. With a new calibration in LabManager, user can now control the DMX panels using a target illuminance in cd/m².
Please refer to the LabManager inline documentation for more details.

6.2.9.2 Support of USB DMX adapter in LabManager

LabManager now supports all DMX adapters distributed by DXOMARK, connected either with Ethernet or with USB.
Please refer to the LabManager inline documentation for more details.

6.2.9.3 Full support in LabManagerUI

LabManagerUI now supports all instruments involved in protocols distributed by DXOMARK.

- Hexapod
  LabManagerUI now offers full support of the hexapod. Monitor motions available in LabManager, visualize motion, load and unload motion device controller and run motions directly from the web interface.
- AMO
- Digital Trigger
- DMX lights
  From LabManagerUI it is now possible to control LED panels (LitePanels Gemini or KinoFlo Celeb) in 8- and 16-bits modes. For advanced use you can also control individual DMX addresses in 8 bits.

6.3 Modified features

6.3.1 New MTF output 

MTF 20% has been added under the name “At20” and “At20-mm” to the output of the following measurements:

- MTFMeasure
- TextureMeasure
- CompositeHDRMeasure
- SingleImageHDRMeasure

Check measurements documentation for more information

6.3.2 New AutofocusMeasure input 

A new input ImgObjList has been added for AutofocusMeasure. This input allows users to provide a list of already opened image objects to the measure.

6.3.3 New AutofocusHdrMeasure inputs 

Three new inputs have been added for AutofocusHdrMeasure:

- ImgObjList: this input allows users to provide a list of already opened image objects to the measure.
- ApplyGainMapIfAvailable: this input is optional, with its default value set to False. When set to True, it will apply gain map to the list of input images if a gain map is available. If ImgObjList is the input and images are HDR, then the gain map has already applied to the images.
- GainMapApplicationOptions: this input is a dictionary which contains several different options when we apply gain map. For now, only PeakDisplayLuminance option is available.

Please refer to the WorkflowManager inline documentation for further details.

6.3.4 LabManagerUI

6.3.4.1 Save graphs

Users can now save illuminance and spectrum graphs directly from the web interface "Live" section, either as image or as raw data in a JSON format.

6.3.4.2 MLS calibrations

The organization of the MLS calibration in the web interface was reworked to better represent their interactions.

6.3.5 MLS calibrations 

6.3.5.1 Ultra low-light control of the MLS

An optional dedicated calibration has been added to achieve better uniformity in LED 2700K 0.1lux. It can be launched either through perform_ultra_low_light_calibration method of dxomark.labmanager.interfaces.mlsinterface.MlsInterface or through the LabManagerUI.
Please refer to the LabManager inline documentation for more details.

6.3.5.2 Calibration report

The calibration report is a simple procedure to assess the system performance. It generates a JSON file with the measured spectrums at different conditions.
Please refer to the LabManager inline documentation for more details.

6.3.6 MLS closed-loop control stable

New ways were added to check if an ongoing closed-loop regulation is stable or not:

- First a new method **LabManagerClient.mls_interface.is_closed_loop_stable**.
- Second a new input to **LabManagerClient.mls_interface.set_illuminant**
  - if **timeout** is set, then the function call will return when the closed loop has stabilized or when timeout is reached.

Please refer to the LabManager inline documentation for more details.

6.3.7 Simplified LabManager configuration

We removed some keys from the LabManager **config.json** file by scanning the computer for that information instead of relying on user interaction. Specifically:

- **amo.AmsNetID** and **amo.AmsPort** were removed. Now the user only needs to declare the AMO in TwinCat during the installation.
- **artnet.ip** was removed since LabManager scans the connected hardware for DMX adapters. Users can use a specific one or let LabManager use the default one (first Ethernet detected or first USB detected).
- **artnet.default_dmx_universe** was removed and 1 is now default in LabManager. Users can specify a custom universe in all function calls if needed.

Please refer to the LabManager inline documentation for more details.

6.3.8 RAW image support in WideAngleDistortionMeasure

WideAngleDistortionMeasure is now capable of measuring distortion and lateral chromatic aberration in RAW images up to 32-bit.

6.4 Known limitations

6.4.1 Incorrect ICC profile information in AZPhoto for HEIC/AVIF files

In AZPhoto, ICC profile information is always displayed as sRGB for HEIC/AVIF files whatever the real profile embedded. This only affects the displayed information in AZPhoto as the embedded ICC profile is correctly interpreted during the measurement phase.

6.4.2 Protocol Automation

6.4.2.1 Setup Video DMC, DMC Zoom and DMC Zoom Smoothness with MLS

The setups SetupVideoDmc, SetupVideoDmcZoom and SetupVideoDmcZoomSmoothness support the MLS but can only be run as full scenario. Subset is currently not supported with MLS on these setups

6.4.2.2 Folder creation on DMC Zoom and DMC Zoom Smoothness protocols

On these 2 protocols an issue prevents them to run correctly if the “distance” folder does not exist: **{protocol}\Photo\PV\DMC_ZOOM\{distance}**

The user must create this folder according to the used distance (either the **distance_to_chart** parameter, or the distance entered in the prompt)

The subfolders (**{Condition}\{Holder}**) will be created automatically when using ADB. Otherwise, they must also be created manually.

6.4.2.3 MLS calibration

If the MLS calibration is obsolete (MLS position has been changed for example) or missing, the protocol will not be executed correctly. As a workaround the user can manually run a MLS calibration before launching the protocol again.

6.5 Bug fixes

6.5.1 General

#5788: Too many unnecessary logs were present in stdout when using WorkflowManager
#5809: Fix a memory leak when using ViewingConditions
#5993: Using an image object with DmcMeasure was neither working nor documented
#6031: FaceExposureMeasure does not support HDR input
#6056: improve general robustness in Video measurements
#6065: Error map pixels are slightly misplaced in WideAngleDistorsion output
#6072: FOV map is computed on wrong positions in the case of a WideAngle camera
#6102: sidecar files for Color Sensitivity may not be correctly interpreted by WorkflowManager
#6108: NaN values in non radial max values of WideAngleDistorsionMeasure results
#6124: MeanRGB (in SingleColorMeasure) has wrong range if bitdepth is more than 8 bits
#6151: VisualVideoNoiseMeasure does not take correctly MarkerPosition as inputs
#6190: SingleImageHDRMeasure detects patches in wrong way for TOP_CHART

6.5.2 Documentation

#5953: VisualNoiseMeasure inline help is not well formatted
#6021: Add an explanation about how to give a color reference in Video ColorChecker protocol
#6024: Fix alphabetical order in WorkflowManager API html documentation
#6127: Add some needed clarifications on ColorSpaceConverter inline help
#6137: Fix some dead links in manuals

6.5.3 LabManager

#5909: When calibrating the MLS there was no error raised if the wrong unit was configured in Jeti spectrometer
#6003: Fix a crash in Server when no device was connected

6.5.4 AZVideo

#5982: Custom Viewing Conditions are deleted when re-opening settings tab
#6000: VideoDMCMeasure does not check result before trying to create the graphs when loading a previously saved report
#6002: Controls on VideoTexture measure are corrupted

6.5.5 AZPhoto

#5848: Histogram got issues when loading 10-bit or 12-bit or RAW images

#5999: DMC Measure only takes RBG images and will now fail gracefully if an incorrect image is provided.
#6012: Fix an unwanted graph resize when hovering ROIs in Color Fidelity report visualization.

7 - Analyzer 9.0.1

7.1 New features

7.1.1 MLS support in CameraV5 protocols

Since Analyzer V9.0 release MLS devices are supported in some protocols. The following protocols are concerned:

- Photo
    - AFHDR
    - DMC
    - DMC Zoom
- Video
    - DMC
    - DMC Zoom
    - DMC Zoom Smoothness

7.1.1.1 Automatic detection

The scripts that run these protocols should automatically select your current lighting system based on heuristic, but sometimes this mechanism fails to behave correctly.
In this case, it is possible to force lightings system to use in a protocol you can add an optional setting to run the protocol.
This setting is called “use_mls”, and takes a Boolean (“True”, or “False”) value, and is passed to run() method through “options” parameter (see concerned protocols documentation for further details).

7.1.1.2 Scripts update

In order for automatic lighting system to work (in all protocols), Python scripts need to follow more closely Python correct development requirements. This translates in your scripts by having the code in a code block defined by “*If __name__ == “__main__”:*” statement.
You can see examples in the documentation of all concerned protocols.
Do not hesitate to contact the support (support.analyzer@dxomark.com) in case you have issues with this change.

7.2 Bug fixes

7.2.1 Protocol Automation

#6069: Fix aggregated outputs for Zoom protocols in Protocol Automation
#6018: waitTime argument was not taken into account for AFHDR automation

7.2.2 AZPhoto

#6033: User was unable to load any images without HDR16 license bit

8 - Analyzer 9.0.0

8.1 Breaking changes

8.1.1 FlareMeasure 

The IEEE-P2020 standard committee has decided to replace the “flare attenuation” metric with “flare intensity”. The flare measurement now includes flare intensity output keys. See the API documentation, and Flare user manual for more information.

Some output keys have also been **removed** from `FlareMeasure`:

- `IlluminanceMap`
- `MaximalIlluminance`
- `MeanIlluminance`
- `FlareAttenuationMap`
- `LargestMeasurableFlareAttenuationdB`
- `SmallestMeasurableFlareAttenuationdB`

`FlareMeasure.SaveAll()` and `FlareSensitivity.SaveAll()` functions have been renamed to `SaveResults()` in order to be more consistent with other measures, and the `"customName"` parameter has been removed.

The `"MinimalFlareAttenuationIndB"` output is now computed as minimal flare attenuation on the whole flare map, instead of percentile 1% in the previous version. Values may differ. Similarly, `"MaxFlareIntensityIndB"` is computed as maximum flare intensity on the whole flare map.

8.1.2 MtfCollimatorMeasure 

The input `"UserSpecifiedROIs"` of `MtfCollimatorMeasure` is renamed to `"PatchesPosition"` in order to be more consistent with other measures. Additionally, its structure has changed. For a complete description about its structure, see the inline help of `MtfCollimatorMeasure.Inputs`.

The output `"ROI"` is renamed to `"PatchesPosition"`, and now uses the same format as the input.

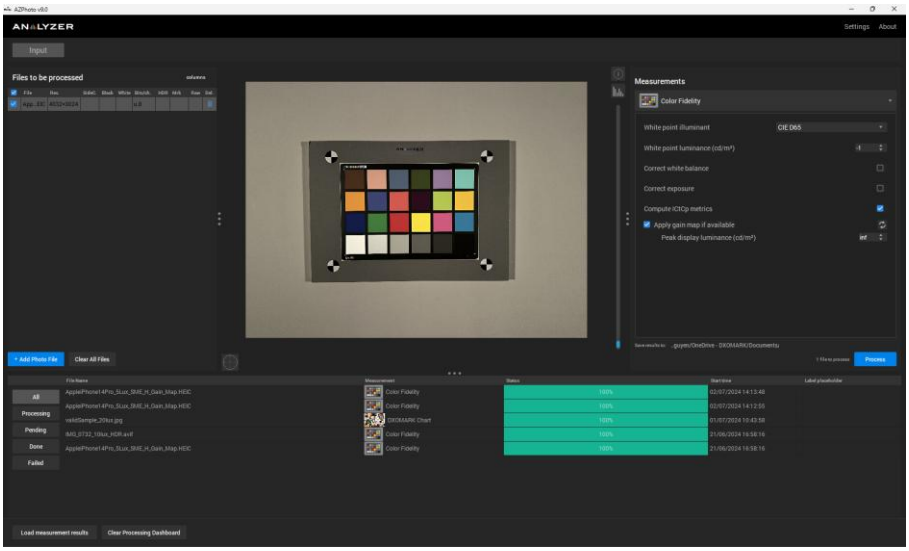
8.1.3 P2020NoiseMeasure 

The optional input key `"ForceSaturationToMaxSignal"` has been replaced by `"SaturationLevel"` in P2020 Noise measurement. This new input allows users to define a custom saturation level for the test images, it is particularly useful for the computation of saturation related metrics in the case that cameras have non constant saturation.

8.2 New features

8.2.1 New AZ Photo application

AZ Photo is the new graphical user interface dedicated to photo measurements.



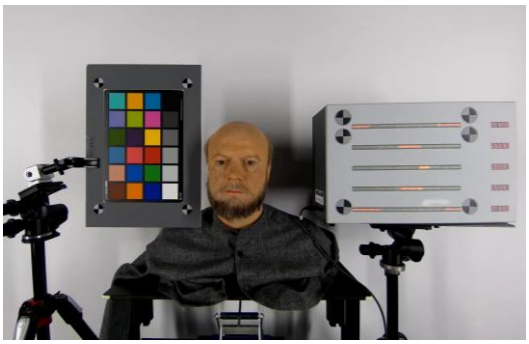
This new interface provides easy to use reports for the following photo measurements in Analyzer 9.0, with more to come in future releases:

- Color Fidelity, with HDR support (**`dxomark.core.measure.ColorMeasure`**)
- DXOMARK chart (**`dxomark.core.measure.DmcMeasure`**)

Note that the legacy graphical interface ("Analyzer") is still available for the transition period; it is however considered deprecated and will be removed once all measurements are available in AZ Photo and AZ Video. It will also provide no access to new inputs, outputs or features that have been added recently (such as HDR support).

8.2.2 Single Person Video Conference Measure (SPVC)

This new measure is available in Workflow Manager, and is designed to perform video analysis of the following setup using one of the available realistic mannequins:

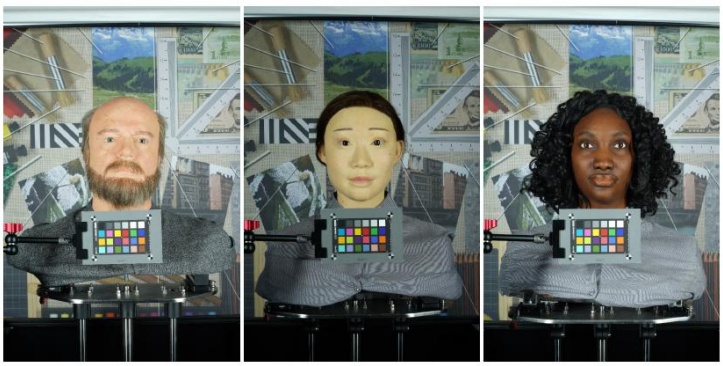


See `dxomark.core.videomeasure.SinglePersonVideoConfMeasure` for more information about this measure. In particular, the following outputs are available:

- Face exposure
- Face detail preservation
- Video Timing
- Video Color fidelity
- Video Exposure convergence
- Video Color stability

8.2.3 New model for Realistic Mannequin measure

The Realistic Mannequin (RM) Detail Preservation Metric is a learning-based method that assesses the level of perceived texture on a face in a controlled portrait setup environment. This measure is available in Workflow Manager in `dxomark.core.measure.RealisticMannequinMeasure`.



A new trained model has been added, with the following improvements from the previous model:

- Support for the dark skin tone realistic mannequin "Diana".
- Wider coverage in image quality levels, with a much greater range of very low quality and very high quality devices in the annotated training set.
- New output for aligned quality metrics, allowing comparisons between all realistic mannequin models ("Eugene", "Sienna" and "Diana").

Users can manually select the model by setting the input key `"RealisticMannequinVersion"` to one of the options below.

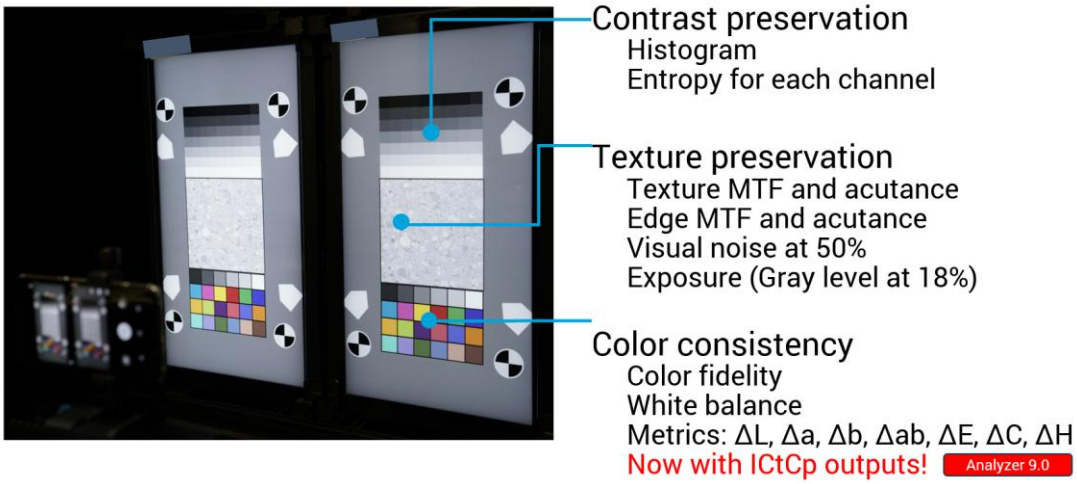
- `RealisticMannequinModelVersion.RM_V1`:
  Previous model supporting Eugene and Sienna, default value.
- `RealisticMannequinModelVersion.RM_V2`:
  New model supporting Eugene, Sienna and Diana.

The selected version of the mannequin will appear in the output dictionary as `"RM_V1"` or `"RM_V2"`.

The Analyzer manual and Workflow Manager API documentation have been updated to provide detailed information about the new model.

8.2.4 Composite HDR measure

The "HDR Composite" measure performs comparison between two images (reference and tested sample) of two composite charts (left and right) placed side by side, in terms of color differences, sharpness, contrast and noise.



Previously only available in the legacy "Analyzer" interface, this measure is now available in the Workflow Manager API at **`dxomark.core.measure.CompositeHDRMeasure`**.

This new API also provides access to color difference metrics compatible for HDR-encoded images in the ICtCp color space.

The Analyzer manual and Workflow Manager API documentation have been updated to provide detailed information about the use of this measure.

8.2.5 Flare

8.2.5.1 Flare Intensity

Flare Intensity metrics as defined in IEEE P2020 draft have been added to the flare measure outputs. See the flare user manual and API documentation for more information.

8.2.5.2 NIR Flare measure

So far, the flare measure quantifies the performance of a device in terms of flare using a visible light source. The measure has been extended to measure stray lights using near infrared (NIR) light sources. It is done using the class **`dxomark.core.measure.FlareMeasure`**.

8.2.5.3 Flare Aggregation

Flare aggregation (aggregation of the flare measurement for all angles of a camera) is now available using the class **`dxomark.core.measure.FlareAggregation`**. See the API documentation for more information.

8.2.5.4 New inputs and outputs in FlareMeasure and FlareAggregation

The **`FlareMeasure`** and **`FlareAggregation`** measurements have new inputs and outputs.

A new output has been added under the key **`"CdfFlareIntensityIndB"`**, giving the cumulative distribution function of flare intensity in dB.

A new input has been added under the key **`"FlareIntensityThresholdIndB"`**. When provided, a percentage of the image that is above this value will be output under the key **`"PercentageOfImageWithFlare"`**.

8.2.6 HDR formats and color management support  

Analyzer 9.0 has a lot of improvements related to HDR support!

8.2.6.1 Support for Apple iOS 18 HEIC gain map image format

Support for HEIC gain map images generated by Apple devices using iOS 18 (following standard draft ISO/CD 21496-1) is added.

This joins the existing support for Apple (pre-iOS 18) and UltraHDR (Android) still image formats that incorporate gain maps. Gain maps allow these devices to store both HDR and SDR renderings in the same file while retaining backwards compatibility with SDR displays.

8.2.6.2 Considering the peak display luminance when computing HDR gain maps

It is now possible to provide the target peak display luminance as input when HDR gain maps are applied. For example, this allows measurements as if the image was seen on a 1000 nits display, even if the fully-applied gain map image can go up up to 1800 nits.

In the case of UltraHDR images, the computation is performed according to the corresponding specification since such a possibility was described there. As for Apple images, the provided luminance is used for computing the headroom and the latter overrides the one specified in the MakerNote values described in the Apple documentation, and looks visually identical to the rendering of the Apple Photos software.

8.2.6.3 Processing 3-channel UltraHDR gain maps, with gamma not equal to 1.0

The single-channel limitation in UltraHDR gain maps has been removed. Also, if gamma is not equal to 1.0, such images are accepted, and the corresponding correction is applied. Such images can be generated by some third-party software like Adobe Photoshop.

8.2.6.4 Improved color space conversion tools

The class **`dxomark.corewrappers.ColorSpaceConverter`** is now the recommended way to perform color conversion between different color spaces (such as: Nonlinear RGB, Linear RGB, CIE-XYZ, CIE-L*a*b* and IC_TC_P). This new colorspace converter supports images loaded using **`dxomark.corewrappers.Image`** ; image value ranges and memory allocation are now managed automatically.

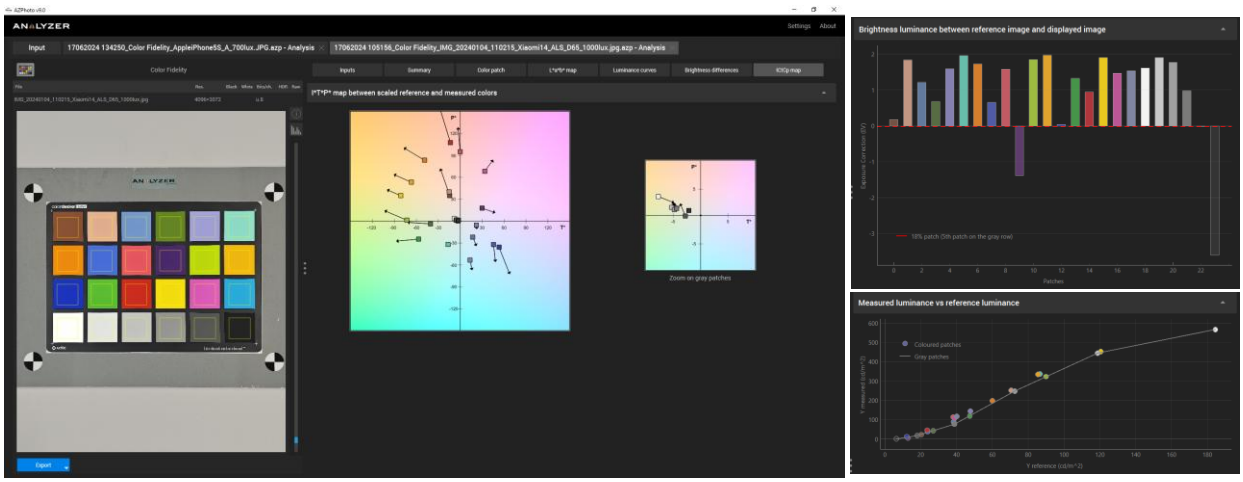
The conversion tools previously available in **`dxomark.core.measure.ColorSpaceConverter`** are fully replaced by this new class and are considered deprecated.

8.2.7 HDR metrics and measurement support

Analyzer 9.0 continues the work on supporting HDR-encoded formats in all measurements and analysis tools.

8.2.7.1 Color Fidelity reports for HDR-encoded images in AZ Photo

AZ Photo supports Color Fidelity reports for HDR images encoded using either one of the supported ISO 22028-5 compatible HDR formats (using ITU-T H.273 CICP metadata with the HLG or PQ transfer functions, such as AVIF/HEIF/PNG), or one of the supported gain map formats.



The generated reports provide visualizations of IC_TC_P and CIE-XYZ metrics, allowing the user to analyze and compare different HDR formats, or even between HDR and SDR formats.

8.2.7.2 ICtCp output available in more measures

Several measures that output CIE-L*a*b* related metrics have been modified to also output IC_TC_P related metrics when using input setting **'ComputeHdrMetrics'** as True.

The concerned measures are:

- AutofocusHDRMeasure
- ColorMeasure
- CompositeHDRMeasure
- DmcMeasure
- FaceExposureMeasure
- PortraitHDRMeasure
- PortraitTimingColorMeasure
- PortraitTimingColorSelfieMeasure
- SingleColorMeasure
- SingleImageHdrMeasure
- TextureMeasure
- VideoColorFidelityMeasure
- VideoColorStabilityMeasure
- VideoDmcMeasure
- VideoExposureConvergenceMeasure
- VideoTextureMeasure

8.2.7.3 DeltaCSITP and NESITP outputs for IC_TC_P computation

Several additional outputs, including ΔC_{SITP} and NE_{SITP}, are now available when computing IC_TC_P metrics (input setting **'ComputeHdrMetrics'** as True in supported measurements).

These metrics take into account the linear "exposure" correction of reference IC_TC_P value respect to the measured luminance value. More details are available in the Color Fidelity part of the User Manual.

8.2.7.4 New convergence thresholds for Video Exposure Convergence measure

In the Video Exposure Convergence Measure, IC_TC_P exposure convergence metrics are computed with adapted thresholds and not with the L*a*b* thresholds.

8.2.7.5 sRGB linearization in Photo and Video Vignetting measures

A new optional input **"UseImageColorMetadata"** has been added to **VignettingMeasure** and **VideoVignettingMeasure** in Workflow Manager.

This inputs directs the measure to perform sRGB linearization before performing the measurement, allowing comparison of results generated from files with different color encodings (e.g. one SDR image and one HDR image). By default, it is set to False.

8.2.8 Additional instrument control in LabManager

8.2.8.1 Hexapod interface

It is now possible to control a PI Hexapod (H-811, H-840 and H-860 models) using the Hexapod interface Python API in LabManager.

Features directly overlap everything that the Shaker software can already do, which includes:

- Adding, removing, listing wave motions (move motions are no longer supported as they are deprecated in the PI control API)
- Running / stopping / progress of loaded motions
- Moving to a given position
- Moving to neutral / shipping / rest predetermined positions
- Setting and getting the pivot point position

8.2.8.2 LED Universal Timer interface

It is now possible to control a LED Universal Timer mark I/II using the Ledbox interface Python API in LabManager.

Features directly overlap everything that the Timer Pilot software can already do, which includes:

- Setting a configuration in timing or flickering modes
- Retrieving a set configuration
- Setting led line period, intensity, duty cycle, phase values independently
- Setting 7-segment display intensity (not independent) and values
- Starting and stopping the monitoring of autofocus captures when used together with a Digital Trigger in autofocus triggering mode, a Digital Probe and an AMO

8.2.8.3 Digital Trigger interface

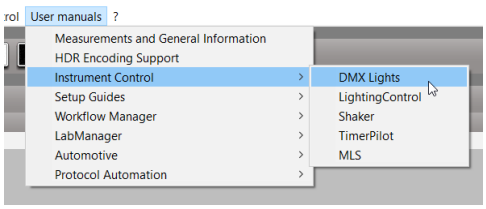
It is now possible to control a Digital Trigger using the Digital Trigger interface Python API in LabManager.

Features directly overlap everything that the Timer Pilot software can already do, which includes:

- Triggering a single shot on a device under test
- Starting and stopping the autofocus triggering mode

8.2.9 LitePanels Gemini user manual

A new user manual has been written for the LitePanels Gemini fixtures. It has been merged with the already existing Kino Flo user manual under the name DMX Lights, aggregating all resources about DMX light fixtures.



This user manual is available through the Analyzer GUI under the “User manuals” > “Instrument Control” > “DMX Lights” menu.

8.2.10 Jeti Specbos 2501 spectrophotometer support

On top of the Jeti spectraval 1501 and 1511 spectrophotometers, LabManager now officially supports the Jeti Specbos 2501 through the ***spectrophotometers_interface***. The same commands are all available for this new device, that features the same technical specifications as the Jeti Spectraval 1511 spectrophotometer.
WARNING: the serial number used to control a spectrophotometer through the ***spectrophotometers_interface*** has changed to match the serial number printed on the side of the device.

8.3 Modified features

8.3.1 Linearity calibration of the MLS speed up

The linearity calibration can now be performed in 3 hours 20 minutes using the JETI spectrophotometer (20 minutes using the CSS45 spectrophotometer) instead of 17 hours.

8.3.2 P2020DynamicRangeMeasure

A new optional input **“SaturationLevel”** has been added to P2020 Dynamic Range measurement. This input allows users to define a custom saturation level for the test images, it is particularly useful for the computation of dynamic range metrics in the case that cameras have non constant saturation.

8.4 Known limitations

8.4.1 White point value in ICtCp and ComputeHdrMetrics

The `"WhitePoint"` input has a different interpretation for ICtCp metrics than it has for CIELAB-based metrics. While the results are technically correct, they might be of difficult interpretation because of several color adaptations that occur.

When using the `"ComputeHdrMetrics"` option in any of the measures, it is recommended that the input `"WhitePoint"` is left to its default value (D65). Furthermore, when interested in chromatic differences in ICtCp it is recommended that the references be provided directly using this color space.

8.4.2 Measurement ROIs sometimes incorrectly positioned in AZ Video preview

In AZ Video, when viewing results of measurements performed using previous version of AZ Video (8.0 to 8.4), measurement ROI positions will be incorrectly displayed in the video preview if the videos have a rotation tag. The measurement results are still correct, only the display is affected. To have proper ROI positions in the display preview, measurements have to be launched again using AZ Video 9.0.

8.4.3 Viewing Conditions in AZ Photo and AZ Video

In AZ Photo and AZ Video, custom Viewing Conditions are lost if the user goes back to settings panel after validating them. They can still be used in the measurement if the user does not go back into settings panel after adding them.

8.5 Bug fixes

8.5.1 General

#4047: Improve the maker detection in some corner cases
#5444: fix the CSF normalization factor in acutance when another CSF is used
#5453: fix a random crash in ViewingConditions when image object is loaded in input dict
#5535: improve the installation of a new version when a WorkflowManager virtual env is still running
#5542: fix the low quality of few pictures in the 3D geometry chapter of main Analyzer manual
#5547: fix the computation of the MTF curve in FocusRangeMeasure
#5583: fix the display of numerous logs about ImageAutoOrientation errors
#5730: fix a crash in MtfComputeLsfTransition
#5753: fix a bad memory management in VideoVignetting leading to high memory usage
#5766: improve the removal of outliers in WideAngle LCA measurement
#5771: fix the management of CFA files saved with NumpyImage in LCA measurement
#5810: fix a memory leak in some processings
#5921: fix a misleading documentation for TCGamma22 input in MTFMeasure
#5954: fix the inline help of AFHDR measurements

8.5.2 AZVideo

#5289: fix a case where the tooltip was staying on screen
#5290: fix the synchronization of the timeline and the video preview and chart

#5354: fix the wrong orientation of the overlay over videos with orientation tag
#5400: fix time pointers stuck on the left
#5402: fix a warning when loading measurement report
#5417: fix drop list stuck on wrong value for Visual Video Noise measurement
#5433: fix the preview frame still visible after having removed the video from the list
#5434: fix a random crash when launching a processing
#5462: improve the display of elapsed time
#5568: improve the smoothness of video preview
#5574: improve the management of trying to open a removed video
#5943: fix a crash when launching AZVideo while an instance is already running

8.5.3 LabManager

#5706: fix the issue to have to rerun the spectrum calibration when adding a preset for MLS
#5707: fix the launch of linearity calibration when spectrometer measurements are displayed in the UI
#5857: clarify the naming restrictions for MLS custom presets
#5919: fix the calibration steps about NIR

8.5.4 Collimator

#5715: clarify the Compass procedure to go back to storage position when using the collimator
#5725: fix wrong ROI detection with collimator in presence of hot pixels
#5726: fix the management of UserSpecifiedROIs input when using Collimator measurement

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