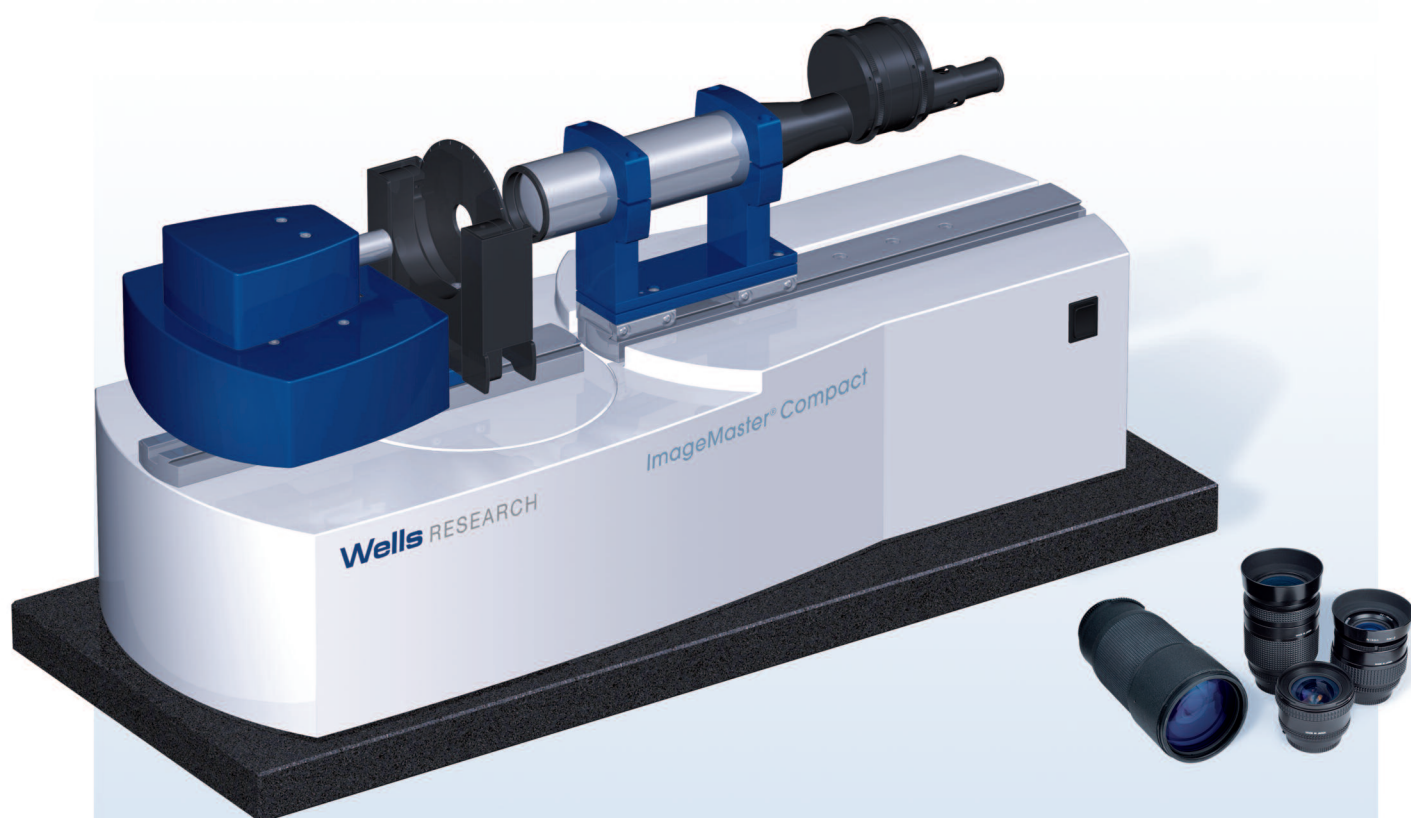


Wells RESEARCH
A TRIOPTICS COMPANY

ImageMaster® Compact

Efficient and Flexible MTF Test Station
for Use in Prototype and Small Serial
Production



ImageMaster® Compact

Compact and fully motorized MTF Test Station for use in prototype and small serial production

The ImageMaster® Compact is a turn-key, cost-effective, horizontal table-top instrument capable of measuring image quality (MTF) and other optical parameters. Its modular design permits testing of a wide range of lenses and optical assemblies. The light source and filters offer a large spectrum for measurements at various wavelengths and the characterization of longitudinal and lateral chromatic aberrations.

The standard instrument is configured for testing optical systems with object at infinity. A motorized pivot arm with measurement head

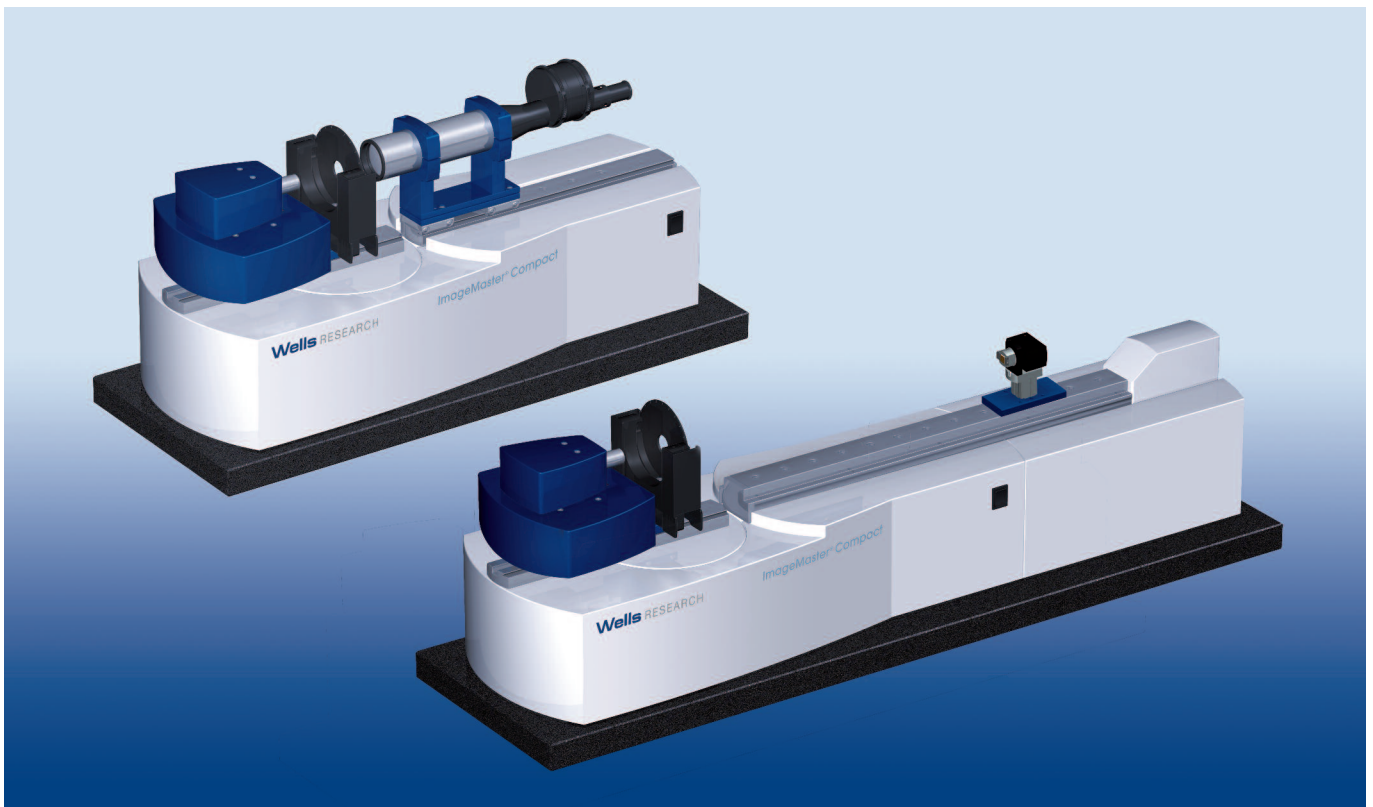
and sample holder rotates to quickly generate reliable on- and off-axis measurements.

An optional upgrade allows testing with object and image at finite conjugates, using an innovative approach called Finite Central set-up to permit a wide range of test parameters.

Changing between the infinite and the optional finite conjugate system is accomplished in just a few movements. The instrument can be reconfigured within a few minutes for testing different optical systems. ImageMaster® Compact also comes with the latest software, ensuring a user-friendly and reliable process for all measurements.

Applications

ImageMaster® Compact is capable of accurately measuring a wide range of smaller lenses and optical assemblies, including systems with a 90° fold.



Testing with object at infinity and the innovative Finite Central set-up

Examples range from high-performance photographic lenses to endoscopes, singlets, doublets, or molded plastic lenses such as cellphone camera lenses.

and selected to guarantee straightness, flatness, and stiffness. In addition, the stiffness and stability of the sample holder permits an azimuth change with low wobble.

System Components

Measurement Head

The measurement head features optics with negligible residual aberrations and with large numerical aperture. In co-operation with world-renowned companies, high performance objectives are specially selected for this component. The CCD camera is selected and tested in order to determine the precise MTF of the camera itself. Other camera selection criteria are: optimal resolution, low noise, and high dynamic range. To avoid any potential misalignment or focus error, a procedure has been developed to permit revalidation of the system in the field. This feature ensures excellent accuracy and repeatability.

Collimators

As a TRIOPTICS company, Wells Research offers a selection of the best collimators. Purchasers may choose the collimator with the focal length and clear aperture that best suit their needs. In addition, the collimator features a manual filter and reticle changer (motorization optional) allowing a variety of wavelengths and images to be used for analysis. A standard filter and selection of reticles comes with the instrument, but custom targets are also available.

Optical Bench and Stages

Highly accurate MTF measurements are made possible with the quality optical bench components of the ImageMaster® Compact. The guide ways, linear and rotary stages are especially tested

Measurements Performed

Image Quality:

- MTF at single point (Also MTF50)
- Plot of MTF vs. field
- Plot of MTF vs. focus
- MTF surface plot (MTF vs. field and focus)

Focal Lengths:

- EFL (or magnification in optional finite conjugate configuration)
- BFL, FFL

Other Parameters:

- Distortion
- Astigmatism
- Field curvature
- Plot of distortion vs. field
- Plot of chief ray angle vs. field
- Chromatic aberration (longitudinal)

Measurements available upon request:

- F number
- T number
- Relative illumination
- Transmission
- Off-axis vignetting
- Chromatic aberration (lateral)

Modular Design

Standard System Configuration:

The standard ImageMaster® Compact comes as an infinite conjugate system with:

- Collimator:
 - Focal Length: 300 mm
 - Clear Aperture: 50 mm
- Precise measurement head
- Fully motorized stages for focus and image height
- Motorized rotary stage for off-axis measurements up to ± 130 degree
- Manual sample holder
- Manual 6x reticle and filter changer

Reticle kit

- USAF reticle for setup, general purpose use
- 1 mm square box, 4 mm square box for EFL measurement
- Cross reticle for MTF measurement

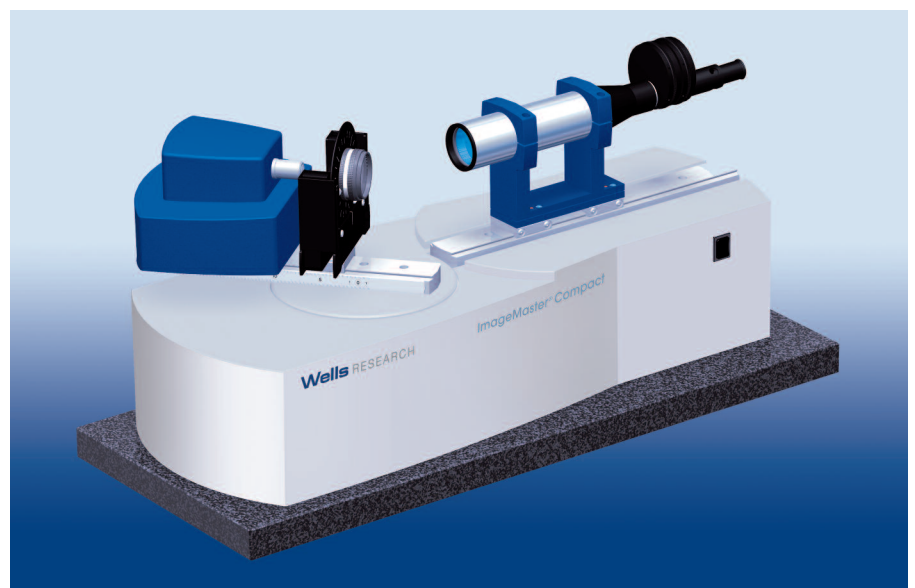
Filter kit

- Photopic eye filter
- Interference filter: green 546 nm
- Halogen illumination
- Adjustment kit
- Software
- Necessary accessories: PC, fiber cable, controller, etc.

Standard Technical Specifications

Specifications	ImageMaster® Standard System
Setup	horizontal, collimator is fixed
Conjugate system	Infinite
Object angle	$\pm 130^\circ$
Collimator	EFL: 300 mm, CA: 50 mm with 6xRC/FC
Spectral range	450...750 nm; halogen
Image height	± 20 mm
Microscope	Zeiss 50 x NA0.7
EFL/MTF range	1 mm to 100 mm
FFL range	0 mm to 150 mm
MTF repeatability*	$\pm 1\%$
MTF accuracy*	$\pm 3\%$
Max. frequency	500 lp/mm
EFL accuracy	From 0.5...3 mm: $\pm 5\mu\text{m}$ From 3...100 mm: 0.2%
Distortion accuracy	< 1% without encoder
Size of base	~ 880 mm long, 360 mm deep, 435 mm tall
Max. weight	~60 kg

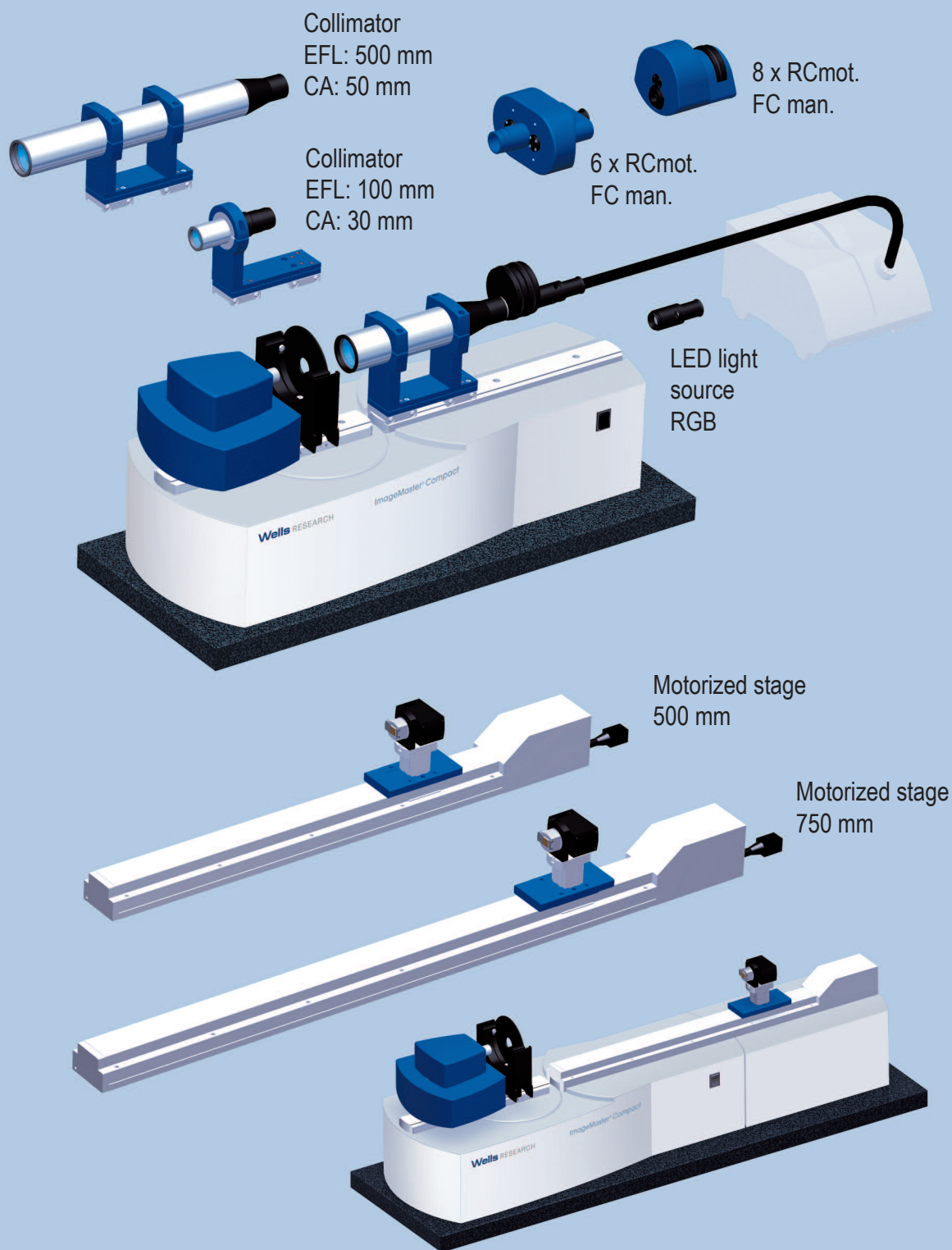
*directly traceable to international standards



ImageMaster® Compact measuring at off-axis position



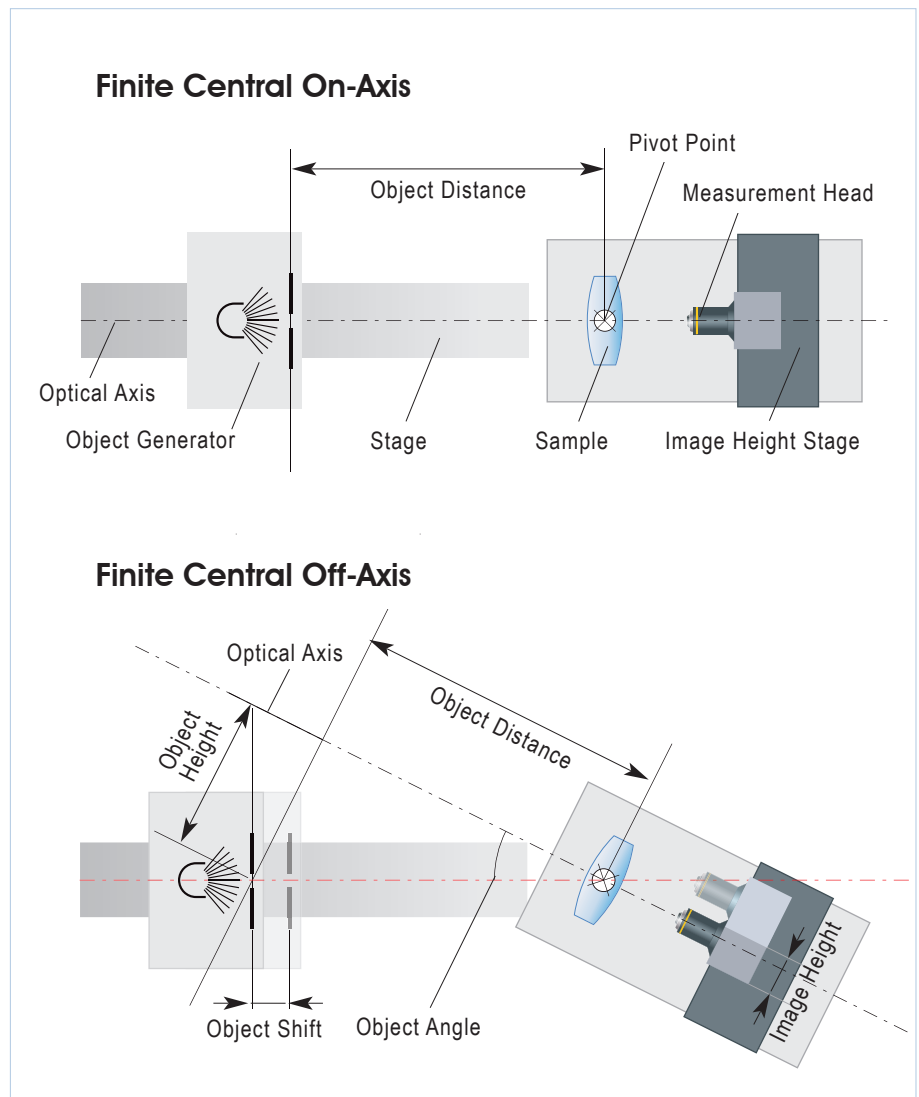
Option Modules



Optional Finite Conjugate Configuration

Changing between the infinite and the optional finite conjugate system can be accomplished quite quickly. The collimator is simply exchanged with a back-lit source mounted on a precise motorized stage. The instrument may then be operated in one of two modes: a typical orthogonal off-axis test mode (for field angles up to $\pm 45^\circ$), or the innovative Finite Central mode.

Orthogonal off-axis testing is ideal for relatively small object distances and modest field angles. When operated in Finite Central mode, ImageMaster® Compact is suitable for measuring very large distances and field angles.



Principle of the innovative Finite Central mode

Standard Technical Specifications

Specification	Finite Central mode	Orthogonal off-axis mode
Magnification range	0.001 - 0.5	0.001 - 0.5
Object distance stage	500 mm / 750 mm motorized	500 mm / 750 mm manual
Positioning accuracy	± 0.02 mm	n/a
Object height	n/a	± 250 mm motorized
Positioning accuracy	n/a	± 0.02 mm
Object distance	5 - 500 mm / 5 - 750 mm	5 - 500 mm / 5 - 750 mm
With object angle: $\pm 35^\circ$	5 - 405 mm / 5 - 610 mm	5 - 355 mm
With object angle: $\pm 45^\circ$	5 - 350 mm / 5 - 530 mm	5 - 250 mm

Software

Wells Research PixelScope software provides user-friendly controls and permits operators to make reliable measurements without the need for advanced knowledge.

Four levels of user access are defined:

- Administrator: creates user accounts and sets password access
- System Engineer: can access component settings and configure
- Test Supervisor: can create project test procedures and operational sequences
- Test Operator: can perform specified tests and generate reports and certificates

Two types of data files are generated by PixelScope:

Project files are used to document and repeat a single measurement or measurement sequence.

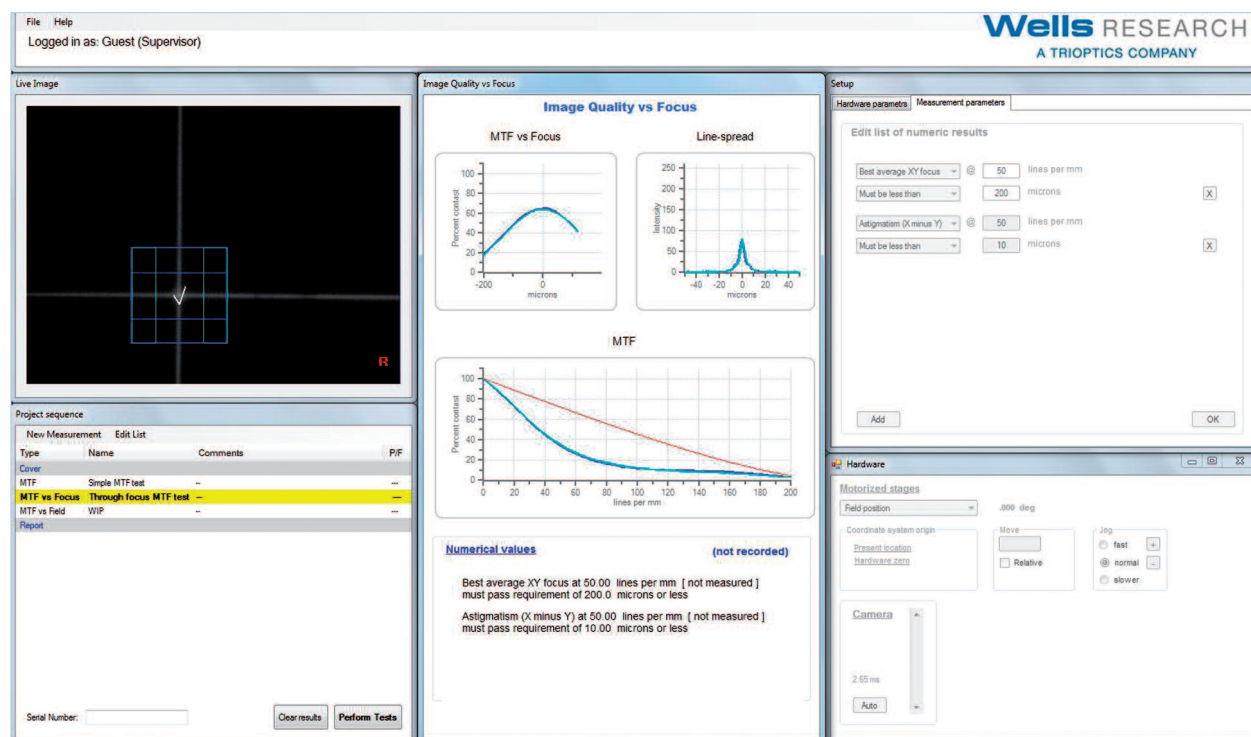
Data include:

- Project type (e.g. single lens test)
- Hardware setup parameters (collimator EFL, camera pixel size, etc.)
- Sequence of measurements to be performed 1 (e.g. MTF measurement)
- Setup parameters (e.g. measurement direction, target type)
- Selected results and criteria

When loaded by a Test Operator, Project files permit consistent and reliable measurements to be generated.

Test certificates (or measurement reports) store the actual setup information and results of performing the measurements specified by a Project file. Data include:

- Operator name
- Time of day
- Lens serial number
- Comments entered by operator
- Measurement criteria and results



The PixelScope Software

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