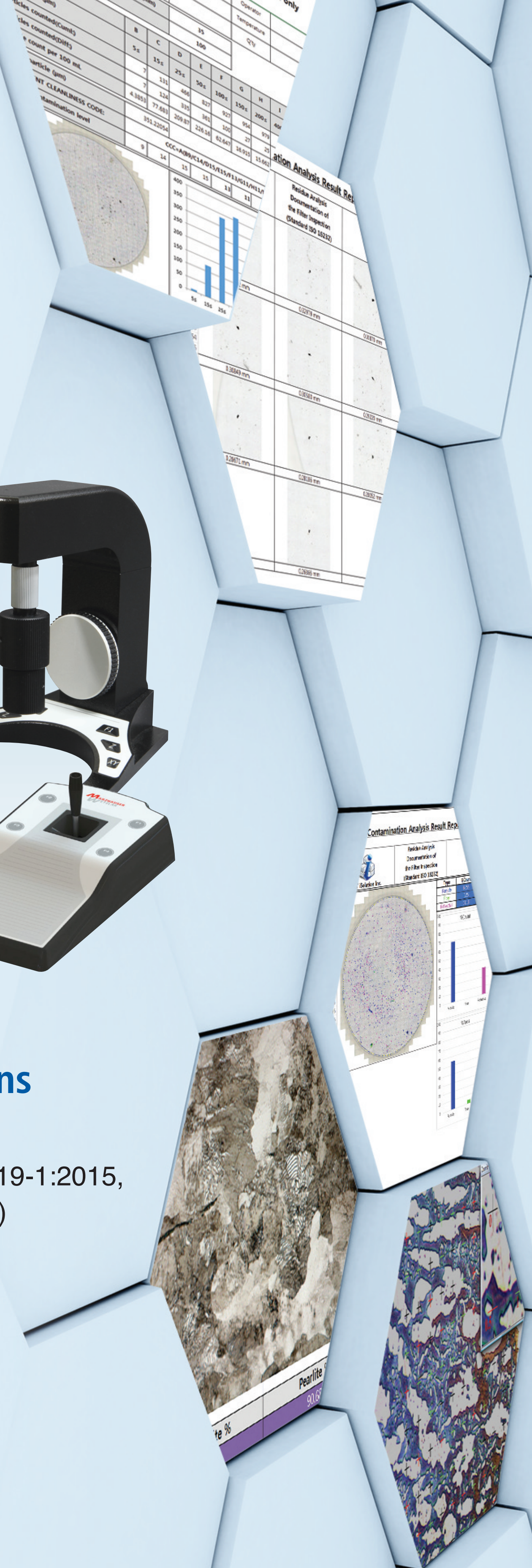


IMT Quick-Scan™

Motorized stage control applications

- Filter contamination analysis
  ISO 16232, ISO 4406-4407, NAS 1638, VDA 19-1:2015, STD 5091,52 (VDA 19 is a canceled standard)

One-Shot Solution™

for filter contamination analysis

- Type A
- Type B

We have the patents in the principle, method, and design for all one-shot solution™ type A and type B.

iMTechnology
(Image & Microscope Technology)

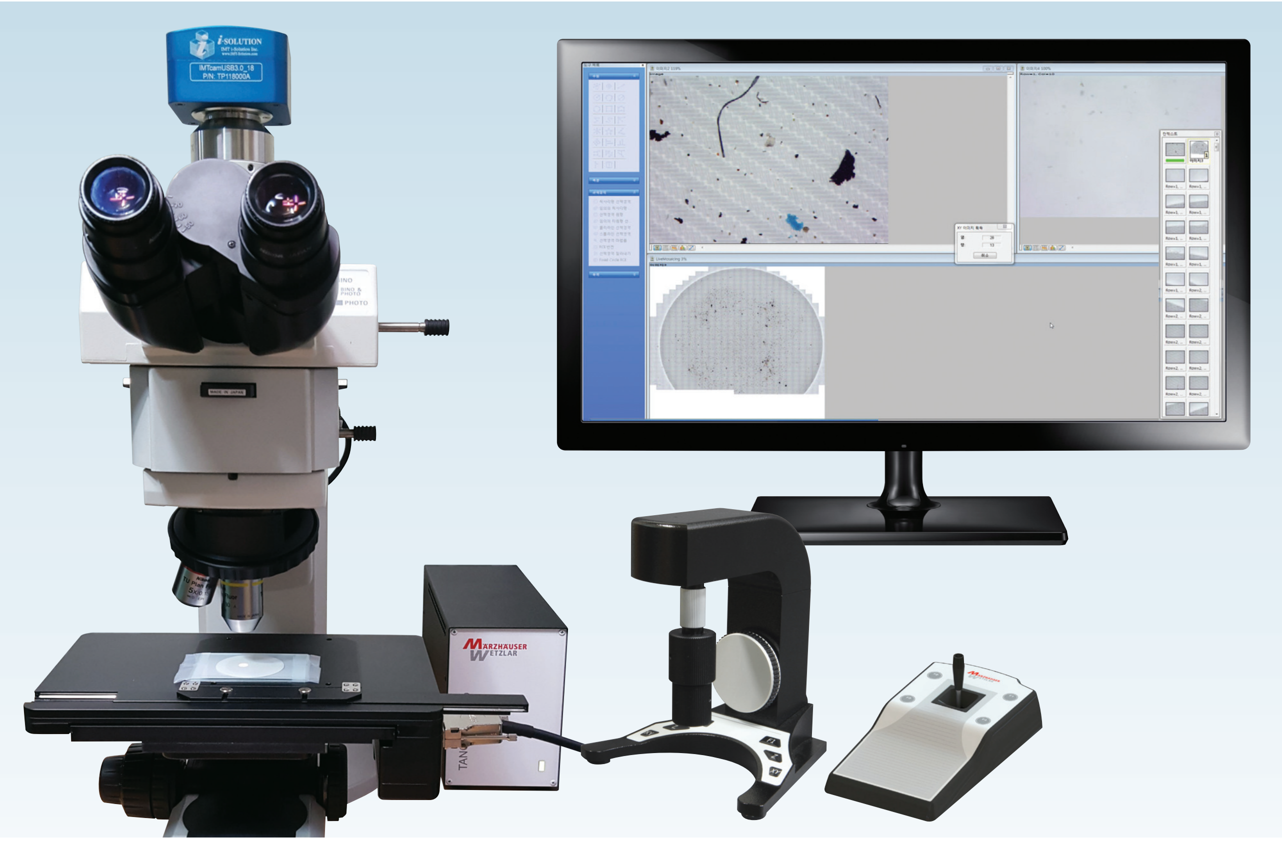
www.imt-digital.com
www.IMT-Solution.com

Filter contamination Quick-Scan™

Automatic analysis system for Filter contamination

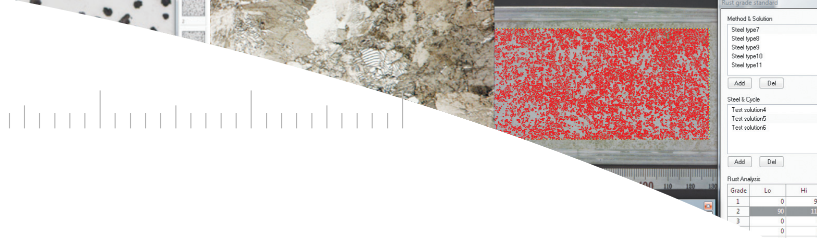
Filter contamination analysis based on ISO 16232 / ISO 4406-4407 / NAS 19-1:2015, STD 5091, 52
VDA 19-1:2015 (VDA 19 is a canceled standard)

Micro system



Four general requirements by VDA 19-1:2015 (Verband der Automobilindustrie: Quality Management in the Automotive Industry)

- The light optical analysis system fulfils the respective requirements
- The cleanliness specification only considers particles same and larger than 50 um (pixel resolution: 5 um/pixel or 0.2 pixel/1 um)
- The analysis filter is well-prepared with particles being evenly distributed and particle occupancy being not too high
- The task is performed by specially-trained skilled staff



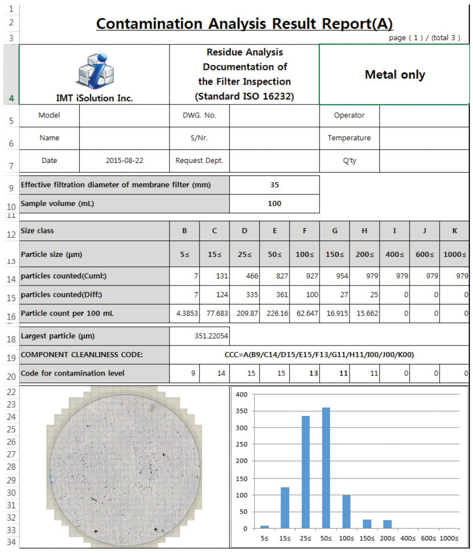
System components:

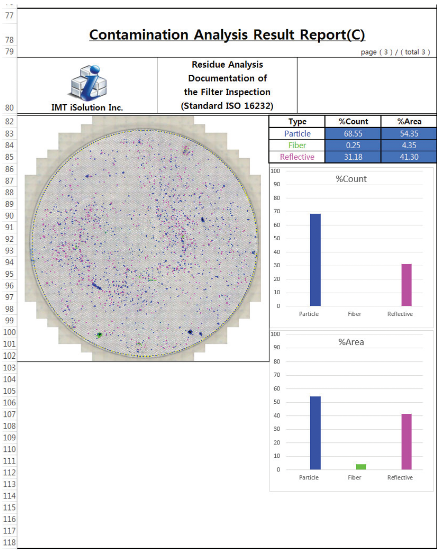
Option1: High power upright or inverted microscope with polarized light(using stereomicroscope or zoom lens is not recommended for finding and measuring particles smaller than 100um) + Motorized control stage + computer + DT-PA program. We recommend using Marzhauser, Prior Scientific, Ludl, and ASI stage.

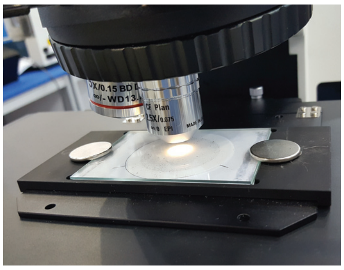
Option2: Stereomicroscope or Zoom lens with polarized light (recommended for finding larger size particles (over 100um) + Motorized control stage + computer + DT-PA program.

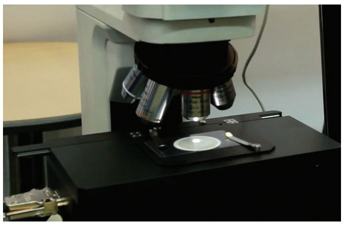
Filter contamination analysis based on ISO 16232, ISO 4406-4407, NAS 1638, VDA 19-1:2015, STD 5091,52(VDA 19 is a canceled standard)

- Extremely fast scanning: Scanning time while capturing image is quick and the result is precise.
- Automatic image overlap compensation: Data is accumulated and adjusted live to compensate for image overlap.
- Multiple scanning methods: Circular, rectangle, and square shape based on application needs.
- Theta compensation for camera and stage mis-alignment: Images are automatically compensated for camera and / or stage mis - alignment.
- Automatic shading correction: During scanning, shading correction is applied automatically.
- Automatic focus adjustment: During scanning, Z focus is adjusted automatically as the stage moves into the X and Y direction.
- Stage position memory: X / Y / Z stage positions are memorized for future recall.
- One click position recall: A single mouse click on the mosaic image brings the stage to the exact location for further observation, allowing the user to switch to a higher magnification objective lens more detailed inspection and image capture.
- Export to Excel template: Result can also be exported to customized Excel reports.
- Seeing results quickly: The largest particles are highlighted for better observation.
- Automatic detection Reflective(metal), Particles, and Fibers: Using reference image, Reflective(metal), Particles, and Fibers are defined and classified automatically.
- Workflow for easy and fast analysis.



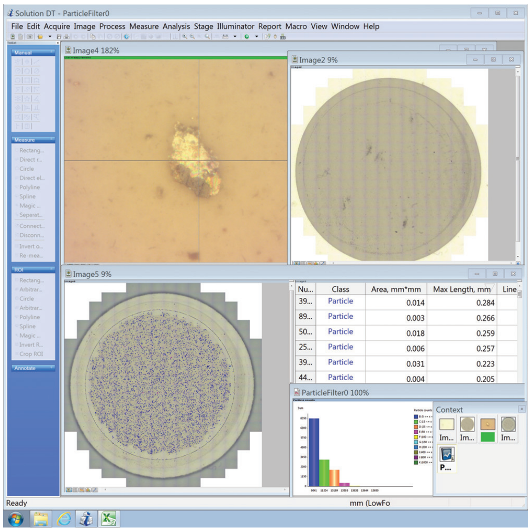


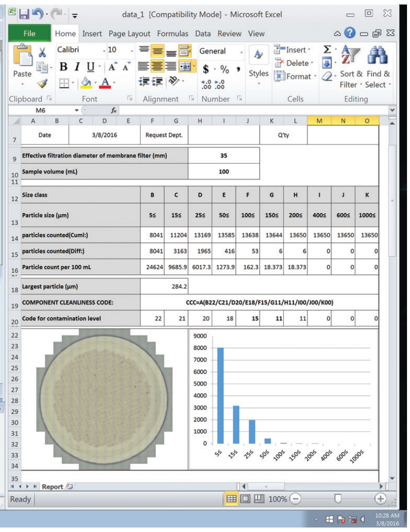


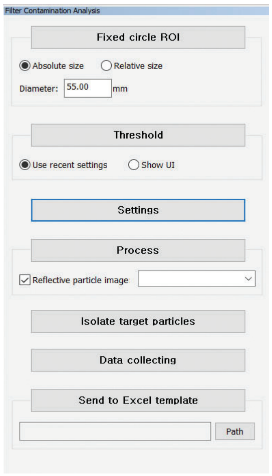


• Report based on industry standards

• Detection and classification of Particle, Metal, and Fiber







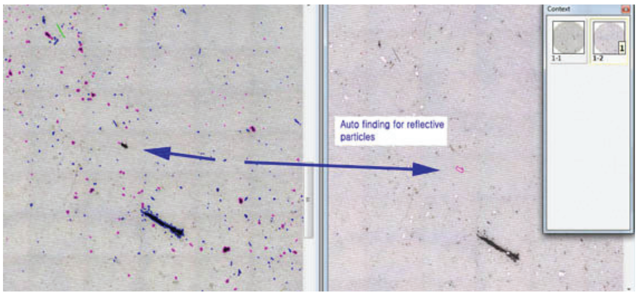
• Workflow for easy and fast analysis

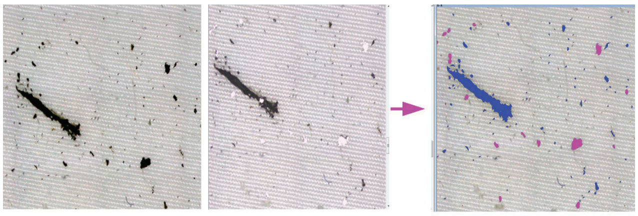
• Largest particles or metals are highlighted

• Customized classification by request

Automatic Detection of Metal Particles (Two different methods can be used selectively)

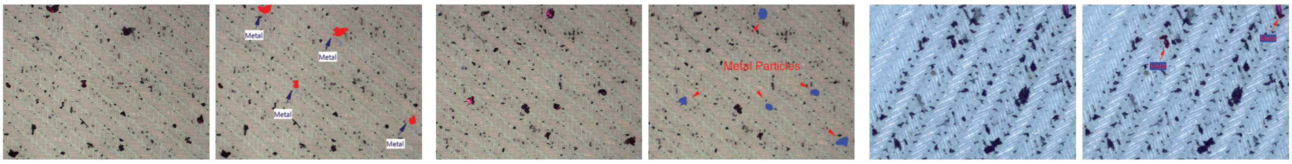
- Simple thresholding methods in ordinary image analysis routines are not enough to define organic and inorganic objects such as metallic and non-metallic objects. We incorporate special algorithms for finding visual textural differences and other parameters in defining and classifying metallic and non-metallic objects having similar color and brightness.





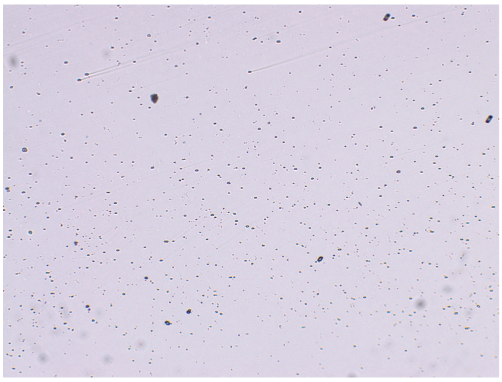
Original image　Reference image　Classified image

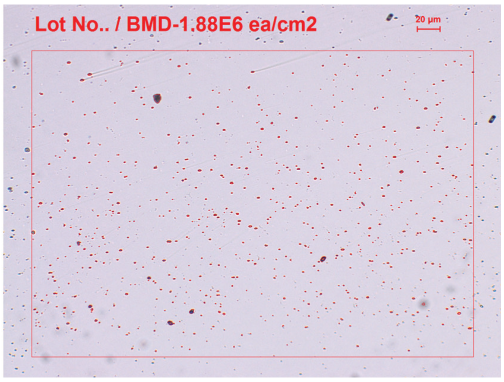
Pink: Reflective(metal)
Blue: Particle(non-metal)



Customized Particle Analysis

- Analysis can be applied to a comppposite image or within a selected field of interest (FOI). Annotations such as text and scale bars can be added to the image for more detail.



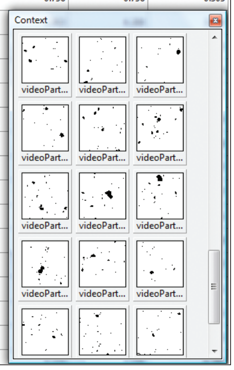


Particle Shape and Size Analysis

- Particles over several images are characterized on the basis of shape and size. Customized parameters for selecting and sorting the data are available, producing volume distribution and other statistics. The Particle Gallery shows each object's shape in each classification range in the data collector table. All resulting data as well as the Particle Gallery can be exported to MS Excel by a simple mouse click.

Statistics	Image Name	Object View	Equal Circle Diam	Min Feret Diam	Max Feret Diam	Avg. Feret Diam
Min	0.000	0.000	1.271	0.098	0.796	0.505
Max	0.000	0.000	114.691	102.757	166.021	136.665
Mean	0.000	0.000	7.796	6.122	9.582	8.040
Std.Dev.	0.000	0.000	10.550	9.365	14.914	12.436
Variance	0.000	0.000	111.302	87.712	222.443	154.662
Skew	0.000	0.000	4.697	4.668	5.099	4.922
Excess	0.000	0.000	32.845	32.189	37.843	35.092
Var.Coeff.	0.000	0.000	135.309	152.962	155.645	154.669
Sum	0.000	0.000	6463.649	5075.737	7943.763	6665.649
# Samples	10	829	829	829	829	829
# Blocks	10	10	10	10	10	10
95% confidence	0.000	0.000	0.602	0.535	0.852	0.710
Relative accuracy	0.000	0.000	7.730	8.739	8.892	8.836

Number : Block	.	Object View	Equal Circle Diam	Min Feret Diam	Max Feret Diam	Avg. Feret Diam
691 : 9			3.114	0.796	6.416	4.322
692 : 9			6.098	4.561	7.345	5.903
693 : 9			2.697	1.593	2.518	2.089
694 : 9			1.271	0.796	0.796	0.505
695 : 9			1.271	0.796	0.796	0.505
696 : 9			4.120			
697 : 9			6.031			
698 : 9			11.584			
699 : 9			9.766			
700 : 9			7.192			
701 : 9			1.798			
702 : 9			3.241			
703 : 9			2.010			
704 : 9			15.390			
705 : 9			6.847			
706 : 9			2.982			
707 : 9			8.809			
708 : 9			3.919			
709 : 9			10.092			
710 : 9			6.483			



One-Shot Solution™

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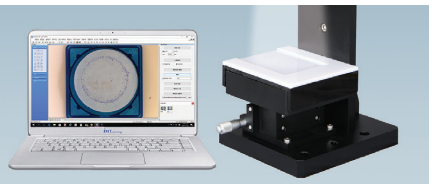
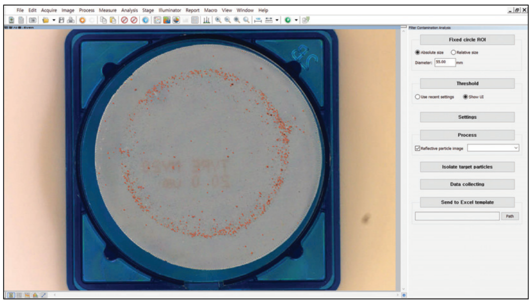
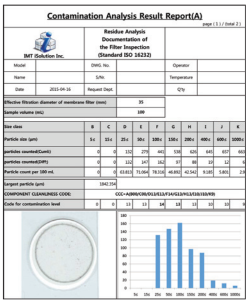


Automatic analysis system for filter contamination

Filter contamination analysis based on ISO 16232, ISO 4406-4407, NAS 1638, VDA 19-1:2015, STD 5091,52

System components: One-shot machine + Software + PC





Contamination Analysis Result Report(A)

page (1) / (total 2)

IMT iSolution Inc.		Residue Analysis Documentation of the Filter Inspection (Standard ISO 16232)			
Model		DWG. No.		Operator	
Name		S/Nr.		Temperature	
Date	2015-04-16	Request Dept.		Q'ty	

Effective filtration diameter of membrane filter (mm)	35
Sample volume (mL)	100

Size class	B	C	D	E	F	G	H	I	J	K
Particle size (μm)	5≤	15≤	25≤	50≤	100≤	150≤	200≤	400≤	600≤	1000≤
particles counted(Cuml.)	0	0	132	279	441	538	626	645	657	663
particles counted(Diff.)	0	0	132	147	162	97	88	19	12	6
Particle count per 100 mL	0	0	63.813	71.064	78.316	46.892	42.542	9.185	5.801	2.9
Largest particle (μm)	1842.354									
COMPONENT CLEANLINESS CODE:	CCC=A(B00/C00/D13/E13/F14/G13/H13/I10/J10/K9)									
Code for contamination level	0	0	13	13	14	13	13	10	10	9

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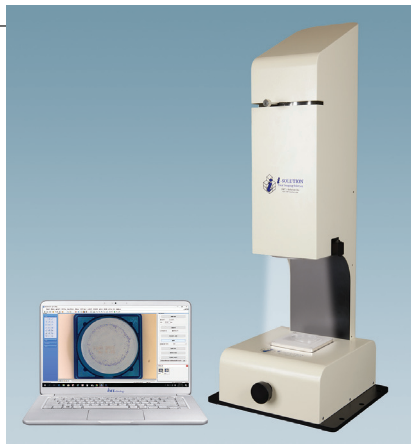
- The analysis filter is well-prepared with particles being evenly distributed and particle occupancy being not too high
- The task is performed by specially-trained skilled staff

Type A

Telecentric lens

- Optical magnification: 0.16x
- WD: 240mm
- DOF: 6mm
- Optical distortion: 0.01%
- FOV: 75mm x 50mm
- Camera: 20MP 1 inch sensor size USB3.0 interface
- Windows OS: Win10/ 8.1/ 7
- ISO 16232, ISO 4406-4407, NAS 1638, VDA 19-1:2015, STD 5091,52 (VDA 19 is a canceled standard)
- Auto and fixed method for light and thresholding
- Export to Excel template: Result can also be exported to customized Excel reports.
- Seeing results quickly: The largest particles are highlighted for better observation.
- Automatic detection of Reflective(metal), Particles, and Fibers
- Workflow for easy and fast analysis



Type B

Telecentric lens

- Optical magnification: 0.26x
- WD: 130mm
- DOF: 1.6mm
- Optical distortion: 0.03%
- FOV: 50mm x 35mm
- Camera: 20MP 1 inch sensor size USB3.0 interface.
- Windows OS: Win10/ 8.1/ 7
- ISO 16232, ISO 4406-4407, NAS 1638, VDA 19-1:2015, STD 5091,52 (VDA 19 is a canceled standard)
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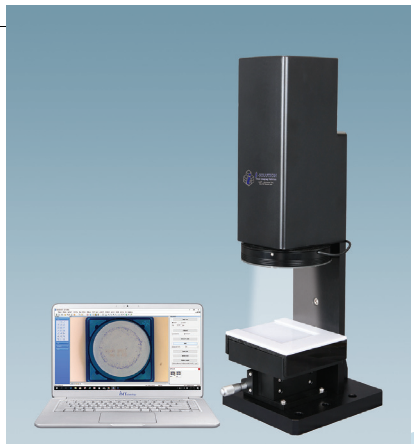

The Advantages of Telecentricity

Provided by Edmund Optics

The ability to quickly perform repeatable, high accuracy measurements is critical to maximize the performance of many machine vision systems. For such systems, a telecentric lens allows the highest possible accuracy to be obtained.

Zero Angular Field of View: Parallax Error Elimination

Conventional lenses have angular fields of view such that as the distance between the lens and object increases, the magnification decreases. This is how the human vision behaves, and contributes to our depth perception. This angular field of view results in parallax, also known as perspective error, which decreases accuracy, as the observed measurement of the vision system will change if the object is moved (even when remaining within the depth of field) due to the magnification change. Telecentric Lenses eliminate the parallax error characteristic of standard lenses by having a constant, non-angular field of view; at any distance from the lens, a Telecentric Lens will always have the same field of view. See Figure 1 for the difference between a non-telecentric and a telecentric field of view.

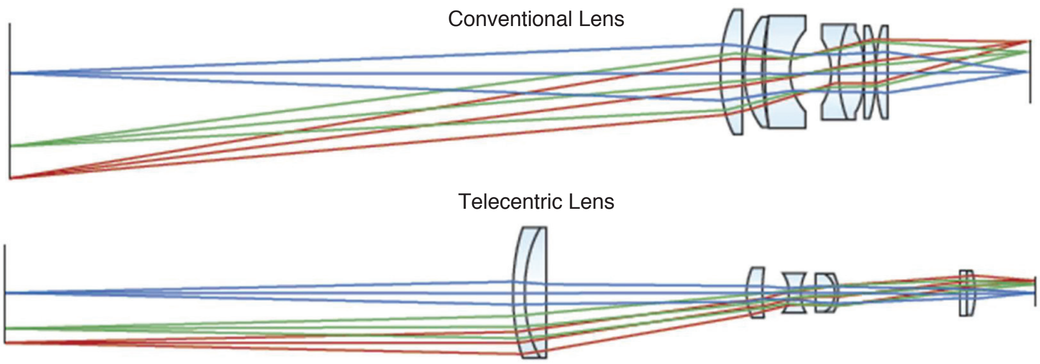

Figure 1: Field of View comparison of a Conventional and Telecentric Lens. Note the conventional lens°Øs angular field of view and the Telecentric Lens's zero angle field of view

A Telecentric Lens's constant field of view has both benefits and constraints for gauging applications. The primary advantage of a Telecentric Lens is that its magnification does not change in respect to depth. Figure 2 shows two different objects at different working distances, both imaged by a Fixed Focal Length (non-telecentric) Lens (center) and a Telecentric Lens (right). Note that in the image taken with a Telecentric Lens, it is impossible to tell which object is in front of the other. With the Fixed Focal Length Lens, it is quite obvious that the object that appears smaller is positioned farther from the lens.

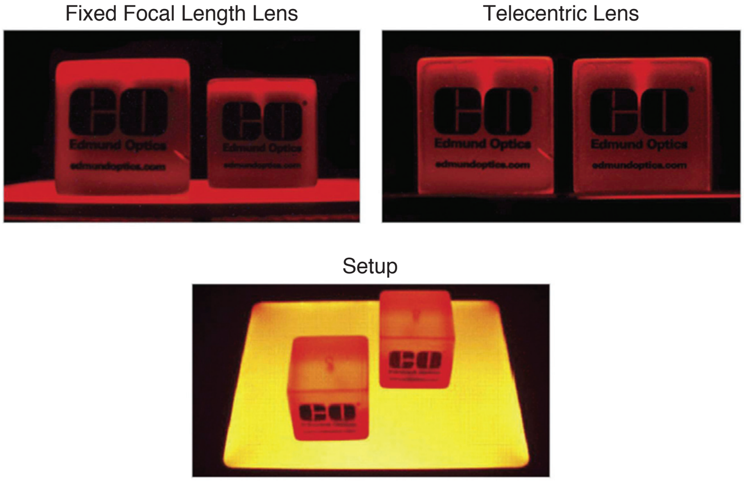

Figure 2: The Angular Field of View of the Fixed Focal Length Lens translates to Parallax Error in the Image and causes the two Cubes to appear to be different sizes

Telecentricity and Distortion

Another advantage of using Telecentric Lenses in metrology applications is that Telecentric Lenses typically have lower distortion values than Fixed Focal Length Lenses. Distortion causes the actual position of an object to appear as though it is in a different location, which can further decrease measurement accuracy. For example, Figure 5a shows jumper pins on a circuit board that has been imaged by a Fixed Focal Length Lens with high distortion. The distortion, coupled with the parallax error inherent to non-telecentric lenses, makes the pins toward the edge of the image appear as though they are bent toward the center. When looking at the same pins with a Telecentric Lens, as in Figure 5b, it is apparent that the pins are indeed straight.

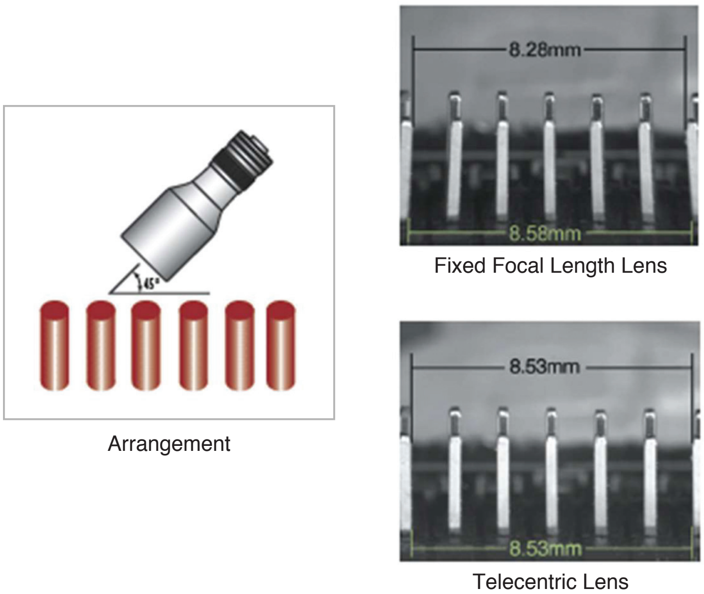

Figure 5: Comparison of Jumpers on a Circuit Board. Figure 5a shows an image that has been taken with a Fixed Focal Length Lens. Figure 5b shows an image that has been taken with a Telecentric Lens. Note that the pins do not appear bent in the telecentric image

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