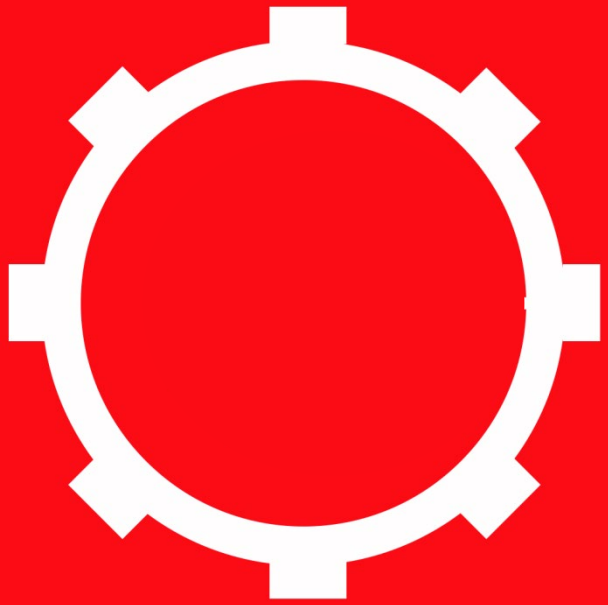

WDI
WISE DEVICE INC
PRECISION • FOCUS • AUTOMATION

PRECISION

WDI's emphasis on **Precision** in design, engineering, assembly and testing results in superior products and technology. Applying precision in all aspects of our business ultimately leads to customer satisfaction in components, systems and service.

FOCUS

WDI's main **Focus** is to deliver superior microscopy automation solutions. Success comes from focusing on building strong relationships with customers and partners, continually innovating our technology and constantly improving our manufacturing and business processes.



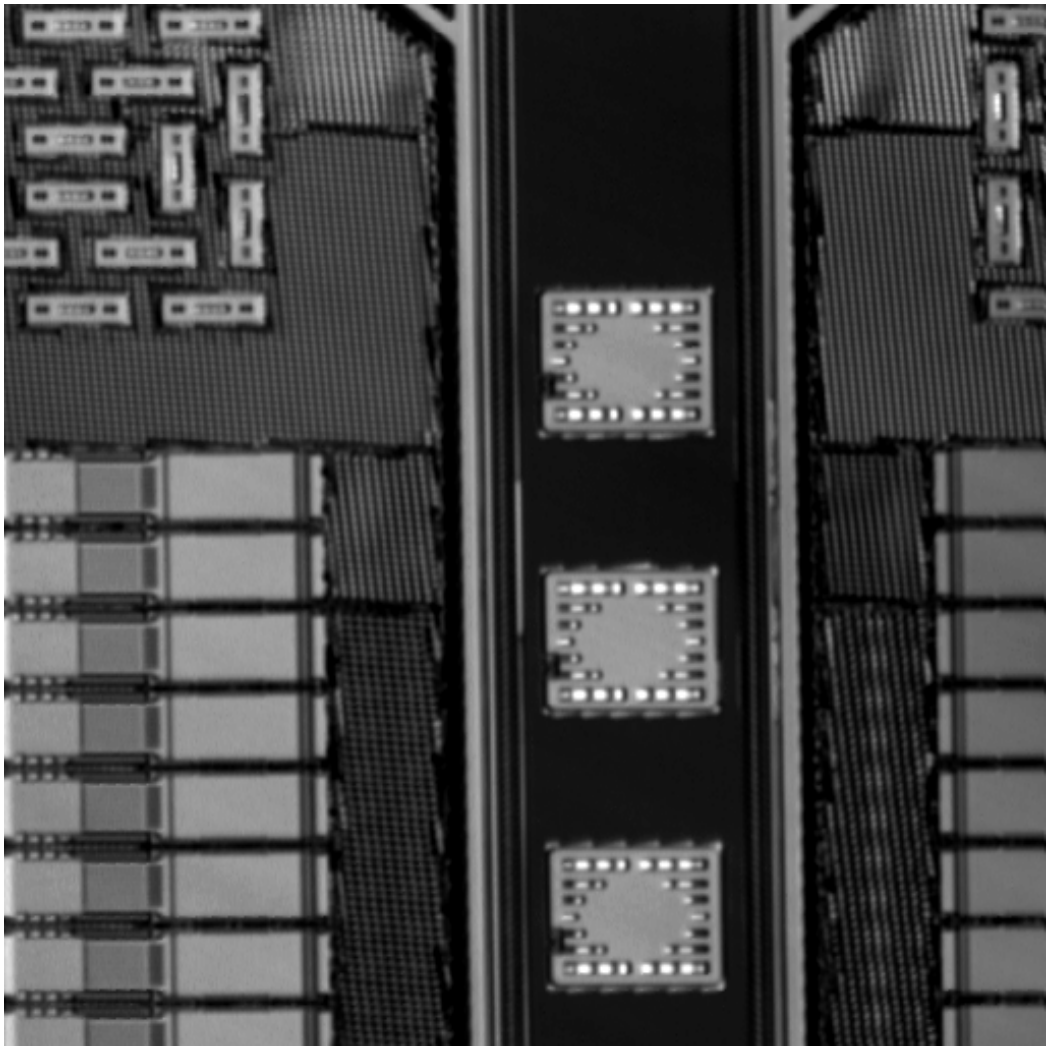
AUTOMATION

WDI's knowledge and experience in **Automation** technology and methods allows us to develop components and systems tailored to customer needs. The understanding of automation and its impact on applications and industry permits rapid engineering and manufacture of unique solutions.

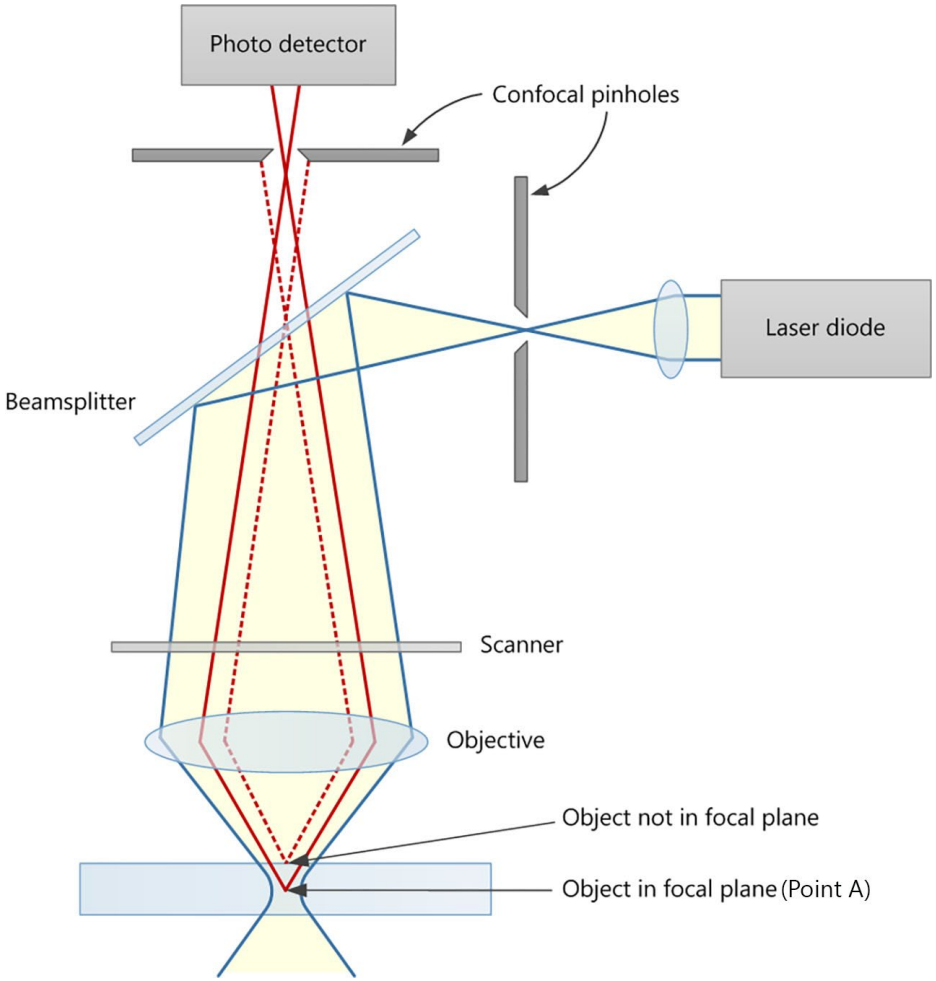
IR CONFOCAL MICROSCOPY

WDI's IRLC and LSCM systems employ a near-infrared (NIR) laser, specialized infrared optics, and confocal imaging technology to create the ideal nondestructive, semiconductor subsurface imaging tool. The technique has several advantages over conventional widefield infrared microscopy systems

- The ability to acquire clear, high-resolution images from deep within Si and similar materials
- Deeper imaging through heavily doped substrates
- Improved spatial resolution
- Faster data acquisition



IR CONFOCAL MICROSCOPY

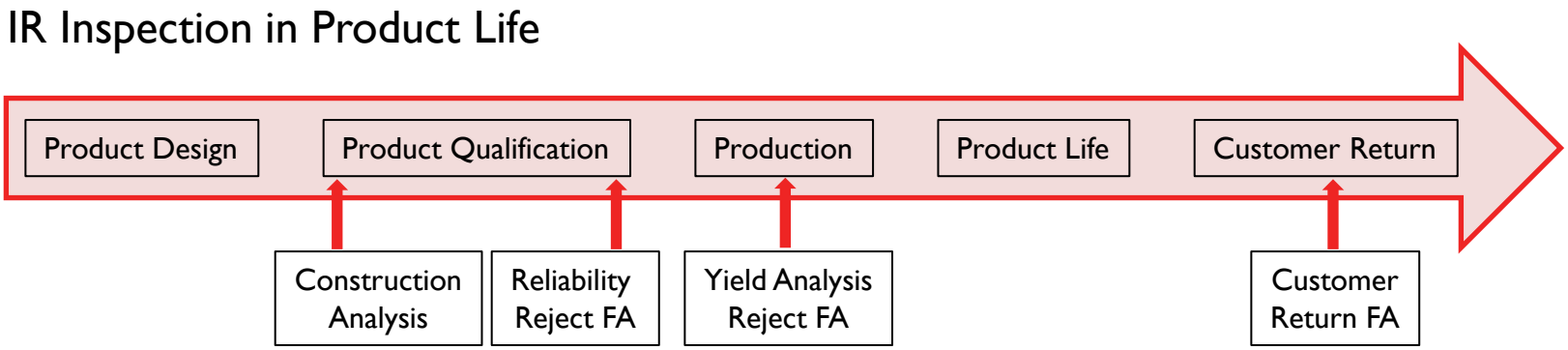


In a conventional microscope, when imaging a single point A on a sample, light reflected from other out-of-focus points is also collected. This reduces the contrast of the image, preventing the microscope from utilizing its full resolution. A confocal microscope solves this problem in two ways:

- a pinhole is placed in a plane optically conjugate to point A to block light from the out-of-focus points
- a light source is placed behind a second aperture, also in a plane optically conjugate to point A, such that the illumination from the light source is incident only on point A and not the out-of-focus points

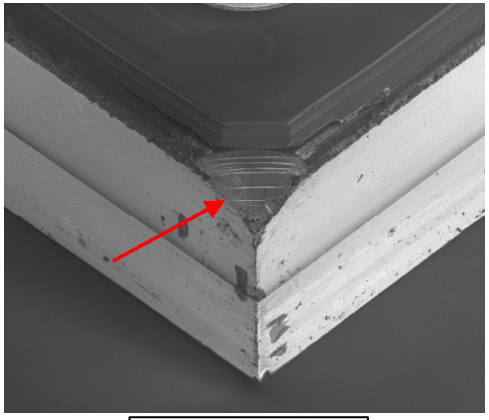
NIR INSPECTION FOR FAILURE ANALYSIS

NIR confocal microscopy is ideally suited for use at various points within the failure analysis (FA) workflow because it is non-destructive and allows inspection of both Si bulk integrity and active level/layer areas. The imaging technique has been applied to Flip Chip, WLCSP, and doped wafers. Other applications include integrity inspection after bonding, sacrificial oxide layer inspection after etching, inspection for chipping and cracks after grinding or dicing, and inspecting SIP (system in package), 3D mounting, or CSP (chip scale packages).

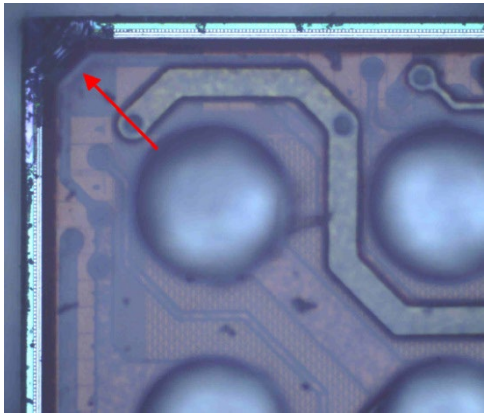


FRONT SIDE CHIPPING DEFECT

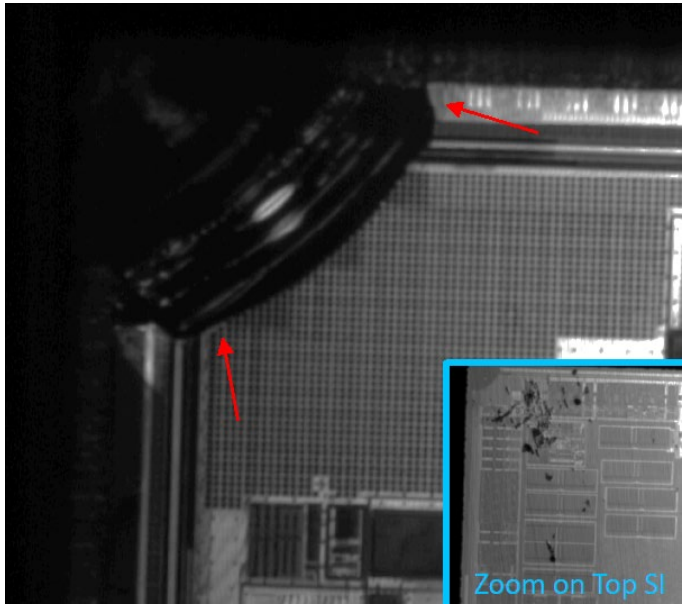
What	Chipping - Si bulk impacted if front side chipping (active level of die) a "Killer" defect
Where	Corners and sides - limited within sawing street or impacting die inside
How to Detect	Visual Inspection (if possible) , **IR Inspection**, SEM (can be destructive)
Why does it occur	External mechanical stress or handling, sawing issue, carrier cavity issue



SEM Inspection



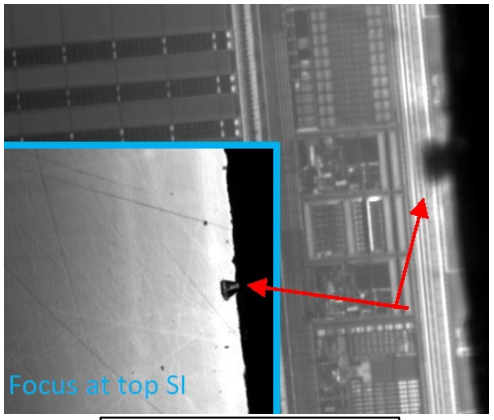
Optical Inspection



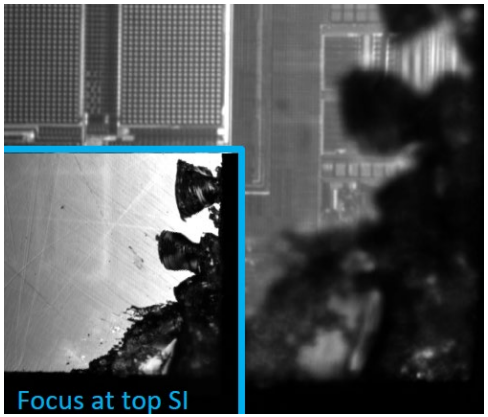
IR Inspection / 20X Magnification

BACK SIDE CHIPPING DEFECT

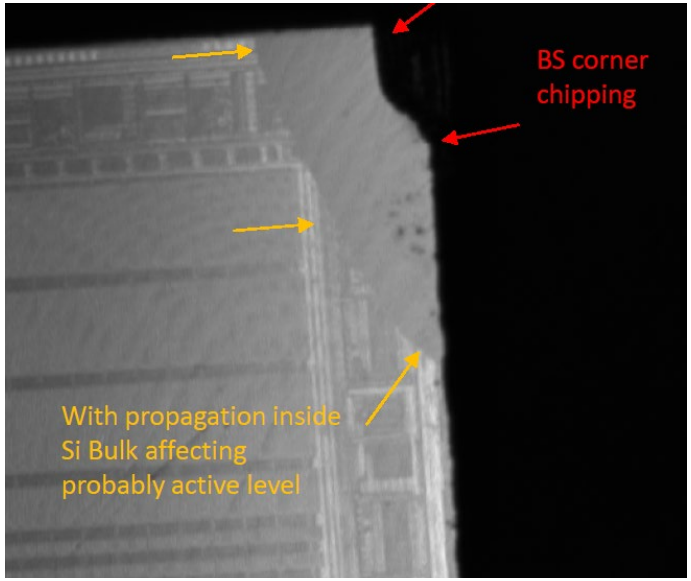
What	Chipping – affecting only bulk
Where	Corners and sides - limited to back side
How to Detect	Visual Inspection (if possible) , **IR Inspection**, SEM (can be destructive)
Why does it occur	External mechanical stress or handling, sawing issue, carrier cavity issue



IR Inspection / 10X
Focus at active level



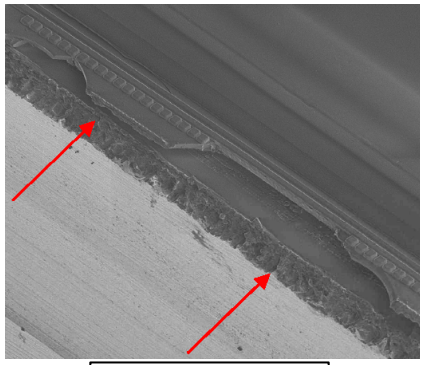
IR Inspection / 10X
Focus at back side level



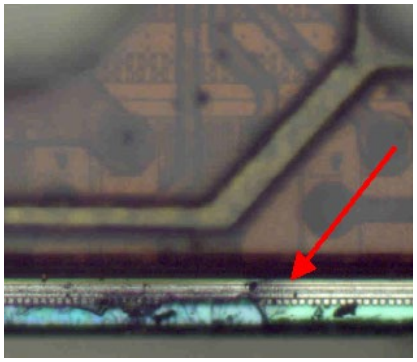
IR Inspection / 5X Magnification

PEELING DEFECT

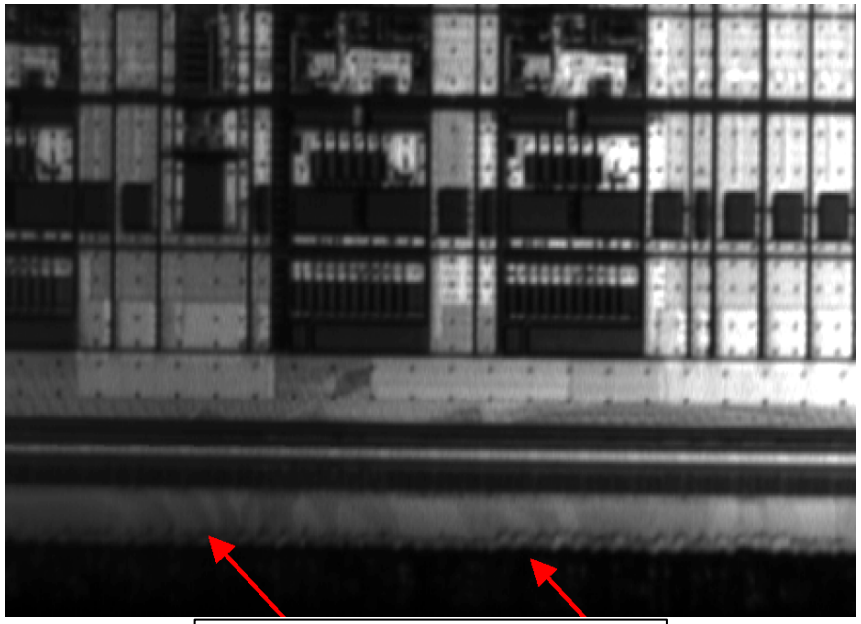
What	Peeling – Si bulk not impacted – top metallization impacted
Where	Corners and sides
How to Detect	Visual Inspection (if possible) , **IR Inspection**, SEM (can be destructive)
Why does it occur	Laser grooving, sawing or handling



SEM Inspection



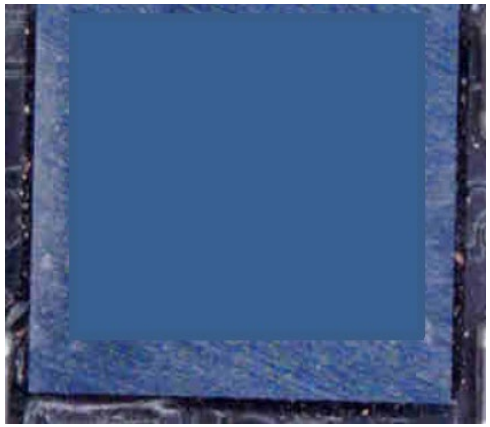
Optical Inspection



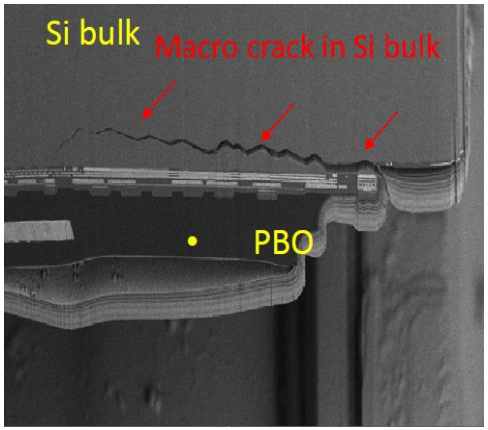
IR Inspection / 20X Magnification

SIDEWALL CRACK

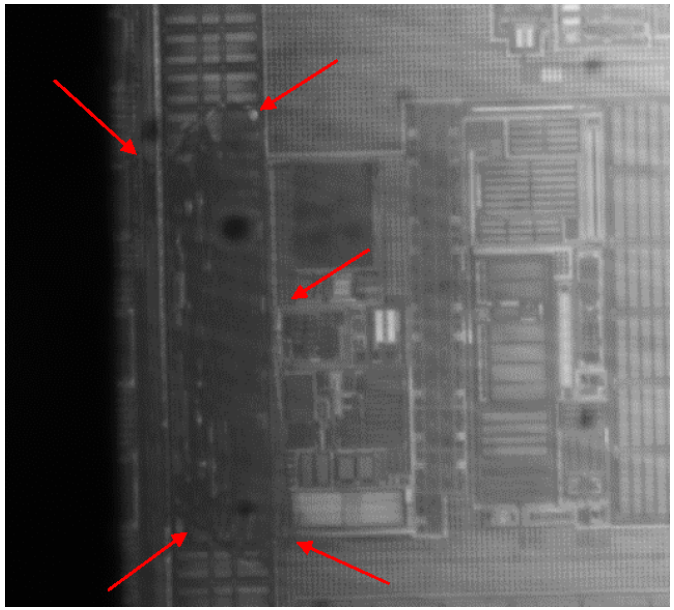
What	Crack affecting metallization and/or Si bulk (macro crack) –a "Killer" Defect
Where	Coming from die edge and propagating BEOL level or Si bulk level
How to Detect	IR (only if lower metallization or Si bulk impacted), then evidence and localization by destructive analysis (FIB Cross section)
Why does it occur	External mechanical stress or handling, sawing or laser grooving issue



Optical Inspection



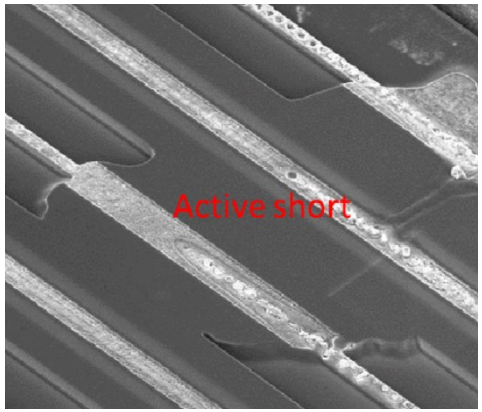
FIB X Section



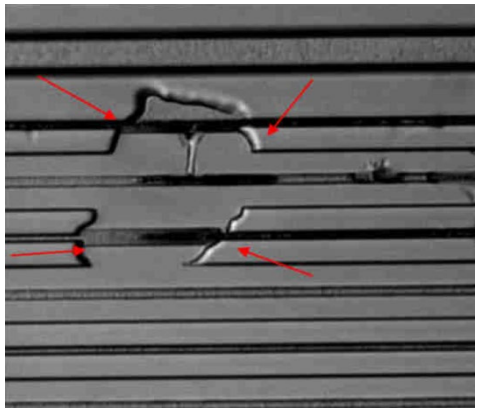
IR Inspection / 10X Magnification

TRANSISTOR DAMAGE DEFECT

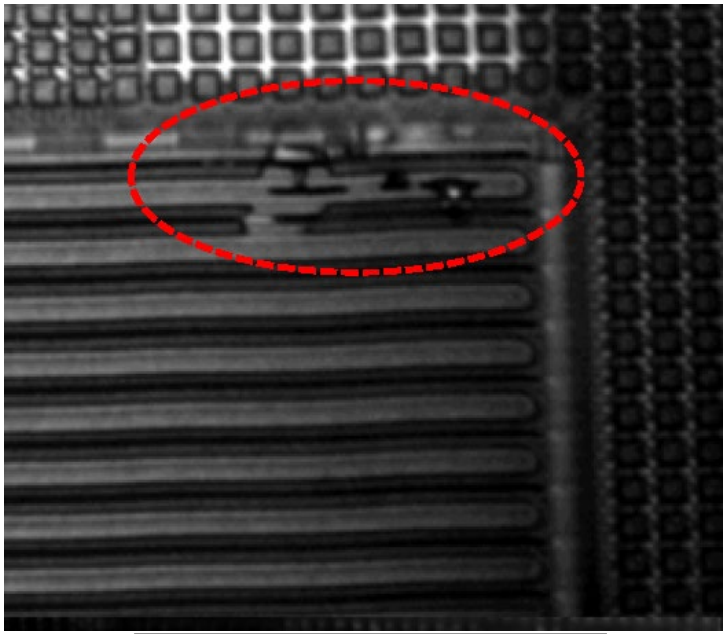
What	Damage in MOS structure
Where	Impacting gate oxide level
How to Detect	IR then destructive inspection/analysis with FIB cross section or die delayering
Why does it occur	EOS event



SEM Inspection after delayering



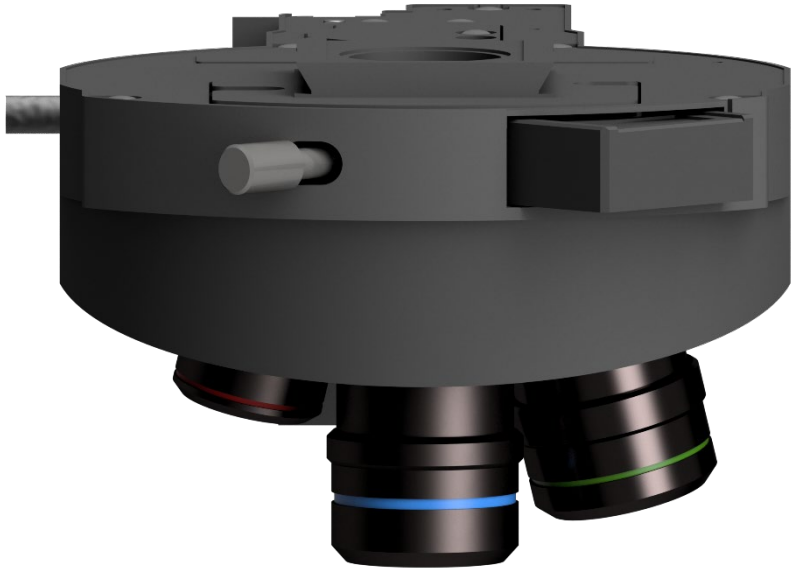
UV Inspection After delayering



IR Inspection after die extraction

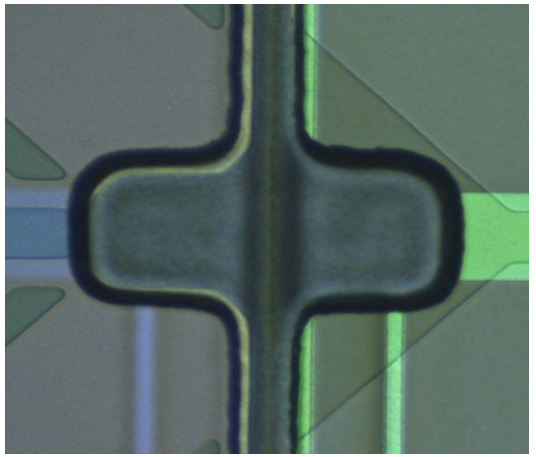
OPTIMIZED FOR IR IMAGING IN SILICON

To ensure the highest resolution and sharpest images, all system components, optical elements, and objectives have been designed and selected for optimal transmission of NIR wavelengths and imaging through Si. Features such as advanced contract enhancement and unique objective "correction collars", coupled with component automation for precision motorization of the objectives, XY stage, ND filters, Z position, and illumination, ensure accurate, fast and simple image collection.

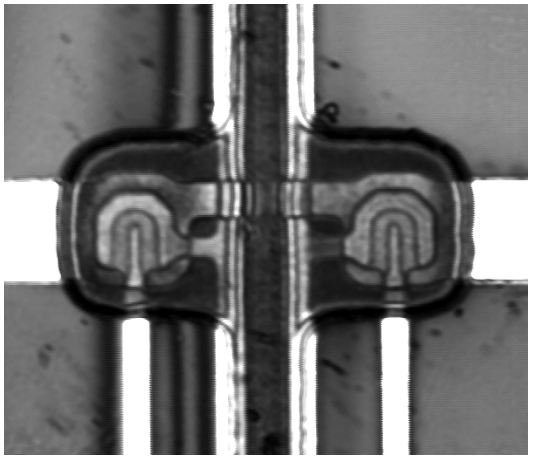


DUAL OBSERVATION

IRLC and LCSM systems include both a colour CMOS camera and NIR laser scanning confocal microscope. This combination allows imaging both at the surface and deep within a wafer or device. Switching between these observation methods is a one-click process. Since the systems utilize WDI's advanced autofocus (ATF), OOA (optical offset adjuster), and ZAA (Z-axis actuator) technology, the wafer or sample remains in constant focus regardless of changes in observation method or surface metrology, even during scanning.

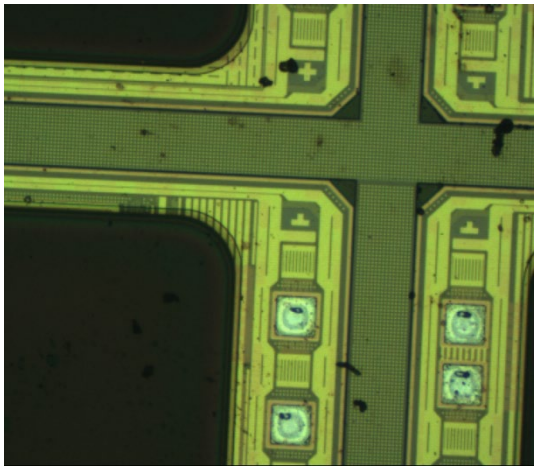


20X brightfield surface Image of (TFT) array with transistors hidden under the black matrix



20X NIR Confocal image of TFT array revealing the transistor structure beneath the black matrix

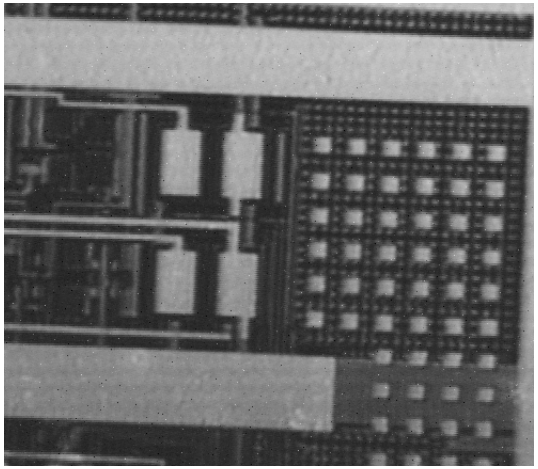
CIS DEVICE



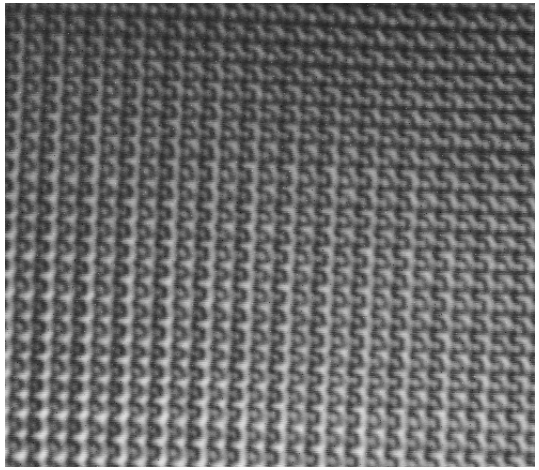
5X BF (Front)

- Many CIS devices include a protective film or CF layer over the pixel area
- Using IR Confocal the structures beneath these areas are clearly visible

20X LSCM (Front)

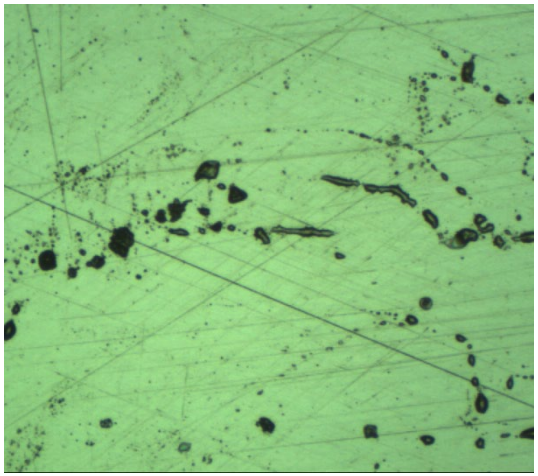


50X LSCM (Front)



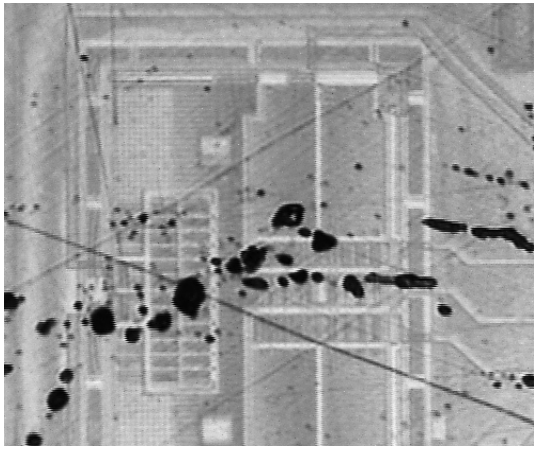
100X LSCM (Front)

MEMS DEVICE

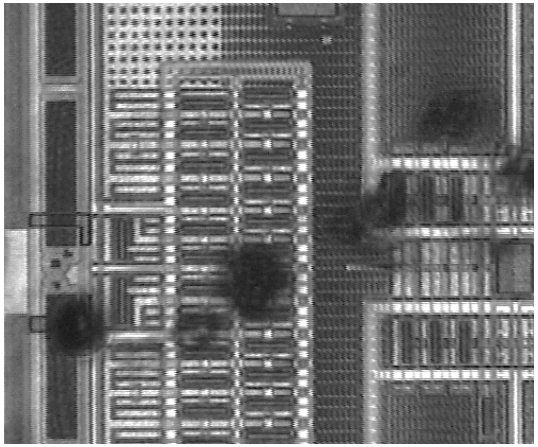


5X BF (Front)

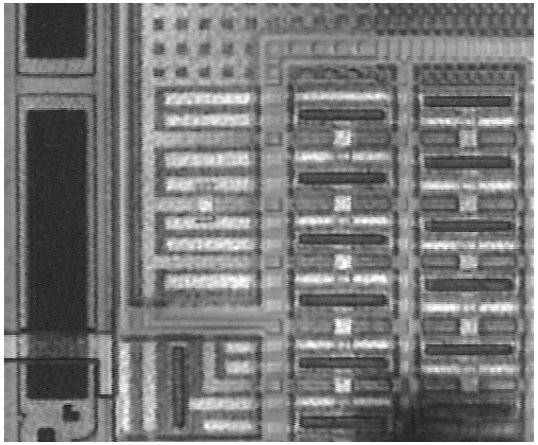
- Imaging using BF only surface detail is available
- Using IR Confocal MEMs structures beneath the surface are clearly visible



5X LSCM (Front)



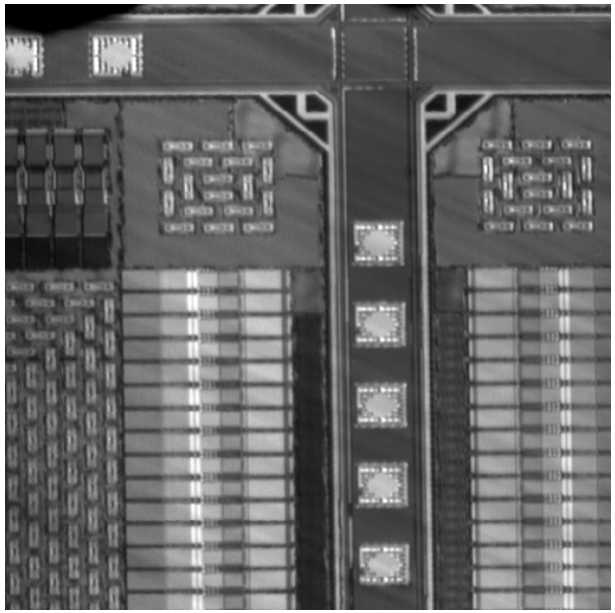
10X LSCM (Front)



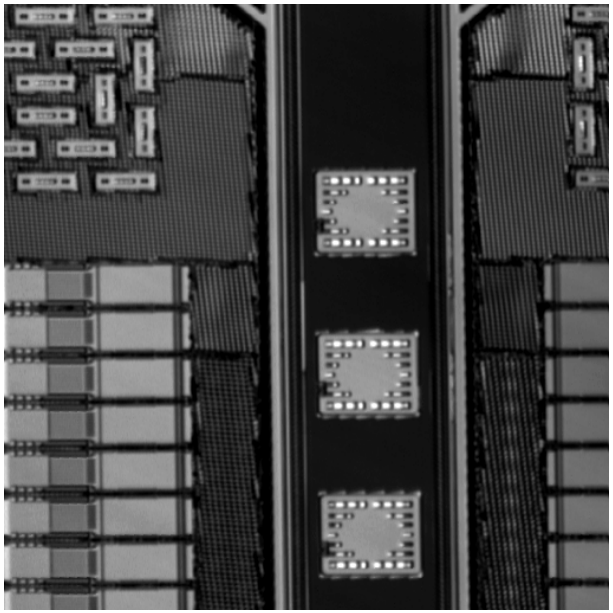
20X LSCM (Front)

IMAGING OF DOPED DEVICES

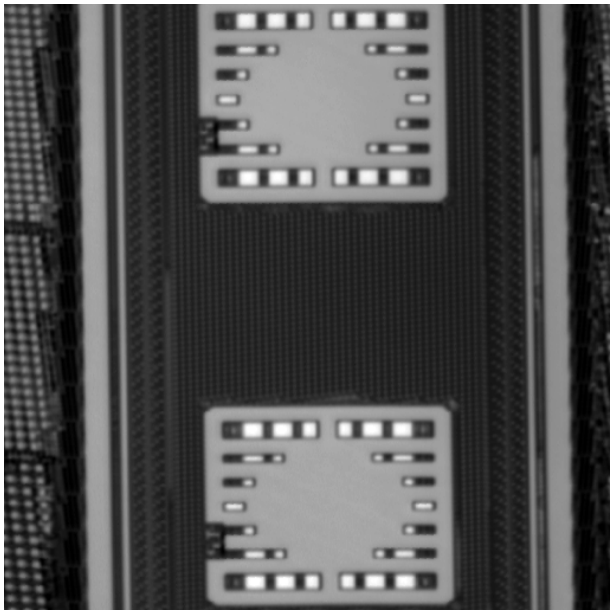
Due to light scattering, heavily doped wafers and devices may be difficult and often impossible to image with conventional widefield IR techniques, particularly if the active layer is deep. WDI's systems are dedicated to overcoming this issue, providing superior high quality, high resolution, subsurface images at all magnifications.



Doped silicon device image at
10X magnification 400 µm depth

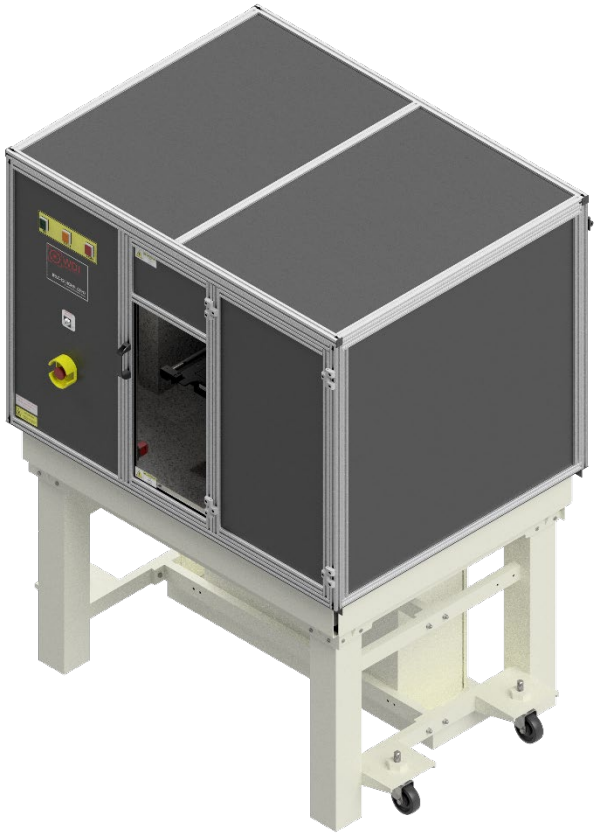


Doped silicon device image at
20X magnification 400 µm depth

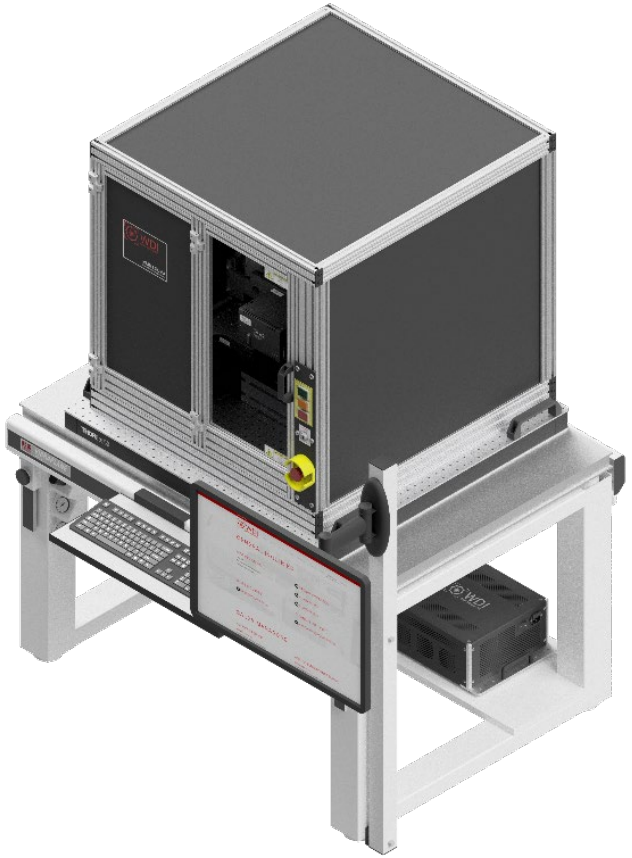


Doped silicon device image at
50X magnification 400 µm depth

WDI IR CONFOCAL SYSTEMS



IRLC SYSTEM

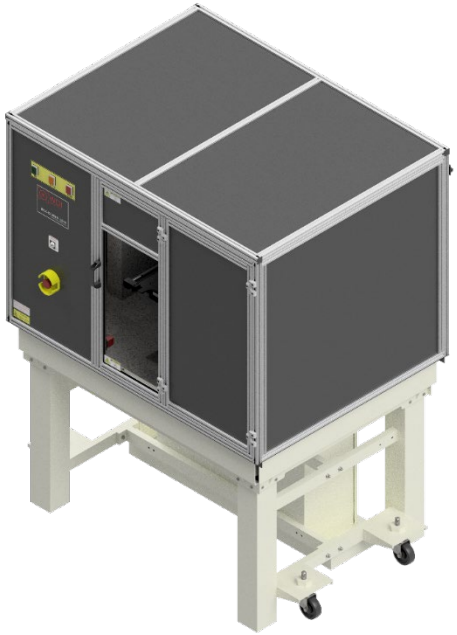


LSCM SYSTEM

IRLC SYSTEM

Now in its 3rd generation, WDI's flagship IR Laser Scanning Confocal Imaging System features a powerful combination galvo & resonance scanner and full automation of all components. It is ideally suited for automated non-destructive, high resolution, subsurface imaging of silicon wafers, IC chips, MEMS and other devices. The IRLC system offers the following features and benefits:

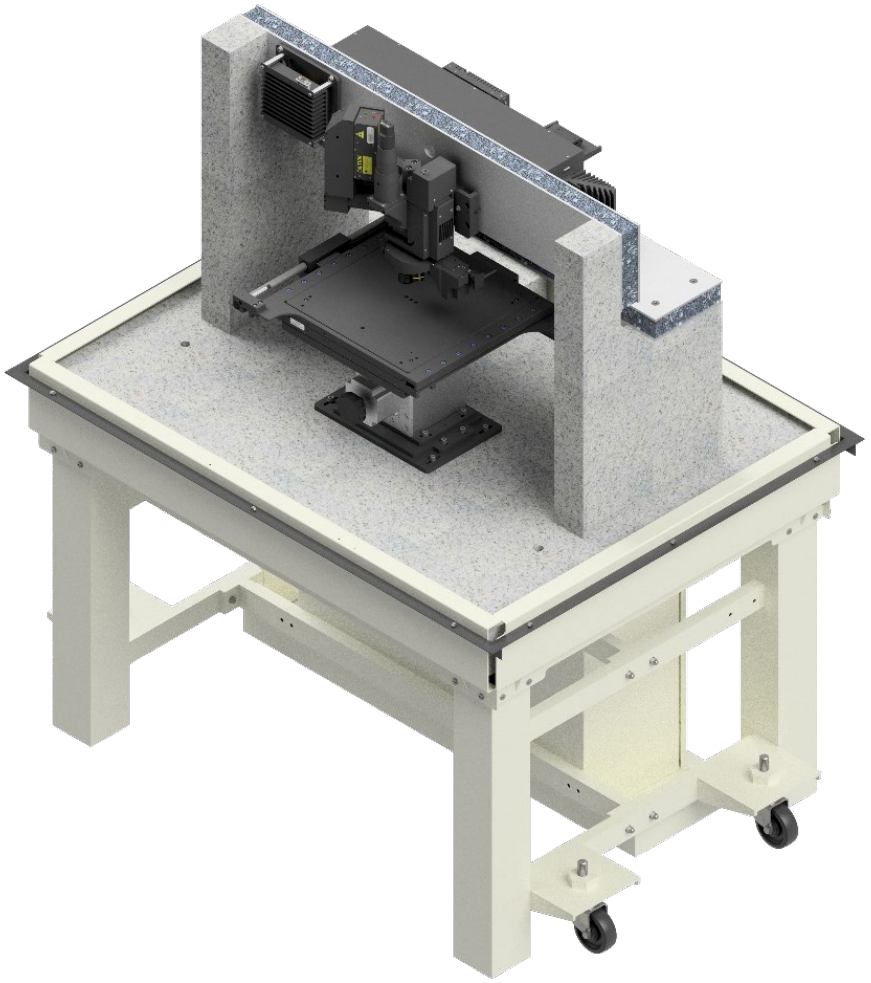
- Powerful confocal laser, galvo & resonance imaging at depth even in heavily doped substrates
- Autofocus and Optical Offset Adjuster ensure reliable focusing and tracking during in-depth imaging even while scanning
- Precise motorized 300mm XY-stage and Z-stage to accommodate a wide range of sample types and sizes
- Active anti-vibration table, granite structure and laser safe acoustic enclosure permit high resolution sub-micron imaging



IRLC SYSTEM

IRLC General System Specifications

- Galvo/Resonance Laser Confocal Scanner
- 1155nm 500mW Laser
- Motorized Variable Attenuator & Detector
- ¼ Wave Plate Contrast Enhancement
- Motorized Z Jack for course focus
- Motorized Hybrid ZAA fine focus
- ATF6 660nm Autofocus + Optical Offset Adjuster
- Motorized Objective Turret
- 5X, 10X, 20X, 50X, 100X IR Objectives
- Motorized XY 300mm Linear Stage
- WLED & CMOS Camera for bright field
- Laser Safety Acoustic Enclosure
- Granite Base and Gantry Risers
- Active Anti Vibration Isolation Table
- Laser Marking (Optional)



IRLC SYSTEM SPECIFICATIONS

Category	Item	Specification
General System	System Laser Class	Class 1 (Laser Safety Enclosure)
	Observation Methods	NIR Laser Scanning Confocal & Conventional Bright Field
	Electrical	3 Separate AC outlets, 100-240 V, 50/60 Hz, single phase
	Current	13.0 A total system
	Operating Temperature	10°C to 30°C ambient
	Operating Humidity	10% to 70% non-condensing
	Weight	900 kg
Motorized Objective Turret	Objective Capacity	6 RMS Thread
	Objective Change Time	1 Second adjacent objectives
Motorized Z Jack	Travel	50 mm
Structure	Base	4" Granite Base
	Risers	2" Granite
	Anti Vibration Table	Welded Steel

IRLC SYSTEM SPECIFICATIONS

Category	Item	Specification	
Motorized Z Actuator	Type	Hybrid 1/32 Stepper and Piezo	
	Travel	10 mm	100 µm
	Resolution	0.157 µm	10 nm
	Maximum Speed	10 mm/sec	100 mm/sec
	Maximum Acceleration	100 mm/s2	1000 mm/s2
	Position Feedback	ATF6 Sensor	
	Motion Controller	MCZ	
	Maximum Load	3.5 kg	
Motorized XY Stage	Type	Linear Motor	
	Travel	300 mm X 300 mm	
	Repeatability	0.1 µm	
	Accuracy	0.5% (Full Travel)	
	Resolution	0.1 µm	
	Settling Time	25 ms (50 µm move, 150 g load)	
	Maximum Load	1 kg	

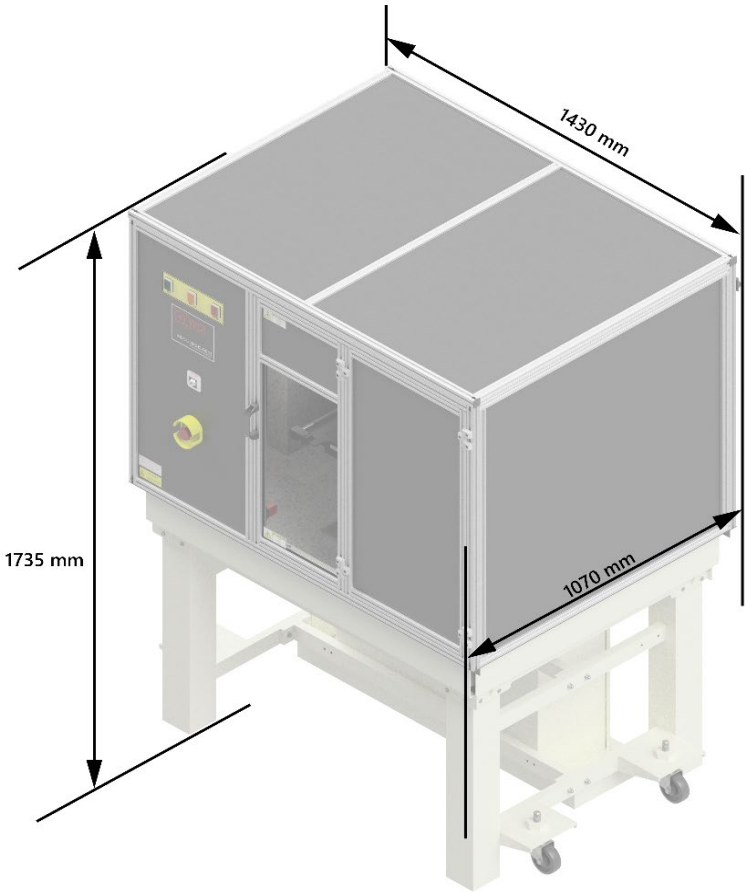
IRLC SYSTEM SPECIFICATIONS

Category	Item	Specification
Brightfield Imaging	Illumination	1 Amp White LED
	Camera	1/2 inch 2 MP CMOS
	Resolution	2592 X 1944
	Frame Rate	10 FPS Full Resolution
	Bit Depth	10 Bits
	Pixel Size	4.2 µm X 4.2 µm
Confocal Imaging	Laser Type	Single Mode Laser Diode
	Maximum Laser Power	500 mW
	Wavelength	1155 nm
	Typical Spectral Width	5.0 nm
	Detector Spectral Response Range	900 nm ~ 1700 nm
	Resolution	512 X 512
	Bit Depth	14 Bits
	Pixel Size	7.5 µm (Virtual Pixel)
	Frame Rate	Up to 30 FPS Full Resolution

IRLC OBJECTIVE SPECIFICATIONS

Category	5X	10X	20X	50X	100X
Numerical Aperture	0.1	0.3	0.45	0.65	0.85
Working Distance	23 mm	18 mm	8.3 mm	4.5 mm	1.2 mm
Field Number	22	22	22	22	22
Resolution @ 1155 nm	7.05 μm	2.35 μm	1.57 μm	1.08 μm	0.83 μm
Correction Collar	No	No	Yes	Yes	Yes
Thickness Correction			0 ~ 1.2 mm	0 ~ 1.2 mm	0 ~ 0.7 mm

IRLC DIMENSIONS



Separate table/desk for PC, Keyboard, Mouse and Display not shown

LSCM SYSTEM

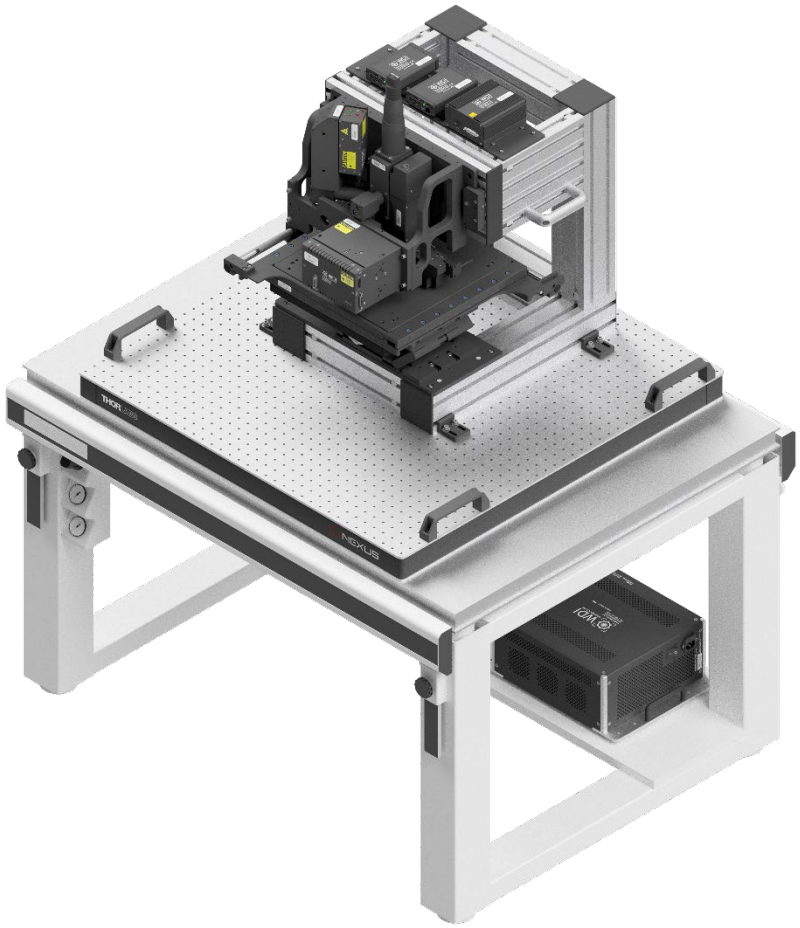
Now in its 2nd generation, WDI's LSCM IR Laser Scanning Confocal Imaging System features a powerful combination galvo & resonance scanner and automation of key components. It is ideally suited for the non-destructive, subsurface imaging of silicon wafers, IC chips, MEMS, solar panels, and other devices. The LSCM system offers the following features and benefits:

- Powerful confocal laser, galvo & resonance imaging at depth even in heavily doped substrates
- Autofocus and Optical Offset Adjuster ensure reliable focusing and tracking during in-depth imaging even while scanning
- Precise motorized 200mm XY-stage and Z-stage to accommodate a wide range of sample types and sizes
- Breadboard base, extruded aluminum structure and laser safe acoustic enclosure

LSCM SYSTEM

LSCM General System Specifications

- Galvo/Resonance Laser Confocal Scanner
- 1155nm 500mW Laser
- Manual ND Filter selection
- ¼ Wave Plate Contrast Enhancement
- Manual Z jack for course focus
- Motorized ZAA fine focus
- ATF6 660nm Autofocus + Optical Offset Adjuster
- Motorized Objective Turret
- 5X, 10X, 20X, 50X IR Objectives (100X Optional)
- Motorized XY 200mm Linear Stage
- WLED & CMOS Camera for bright field
- Laser Safety Acoustic Enclosure
- Extruded Aluminum Base and Risers
- Active Anti Vibration Isolation Table (Optional)



LSCM SYSTEM SPECIFICATIONS

Category	Item	Specification
General System	System Laser Class	Class 1 (Laser Safety Enclosure)
	Observation Methods	NIR Laser Scanning Confocal & Conventional Bright Field
	Electrical	3 Separate AC outlets, 100-240 V, 50/60 Hz, single phase
	Current	13.0 A total system
	Operating Temperature	10°C to 30°C ambient
	Operating Humidity	10% to 70% non-condensing
	Weight	
Motorized Objective Turret	Objective Capacity	6 RMS Thread
	Objective Change Time	1 Second adjacent objectives
Manual Z Jack	Travel	25 mm
Structure	Base	Extruded Aluminum
	Risers	Extruded Aluminum
	Base	Breadboard

LSCM SYSTEM SPECIFICATIONS

Category	Item	Specification
Motorized Z Actuator	Type	1/32 Stepper
	Travel	10 mm
	Resolution	0.157 µm
	Maximum Speed	10 mm/sec
	Maximum Acceleration	100 mm/s2
	Position Feedback	ATF6 Sensor
	Motion Controller	MCZ
	Maximum Load	3.5 kg
Motorized XY Stage	Type	Linear Motor
	Travel	200 mm X 200 mm
	Repeatability	0.1 µm
	Accuracy	0.5% (Full Travel)
	Resolution	0.1 µm
	Settling Time	25 ms (50 µm move, 150 g load)
	Maximum Load	1 kg

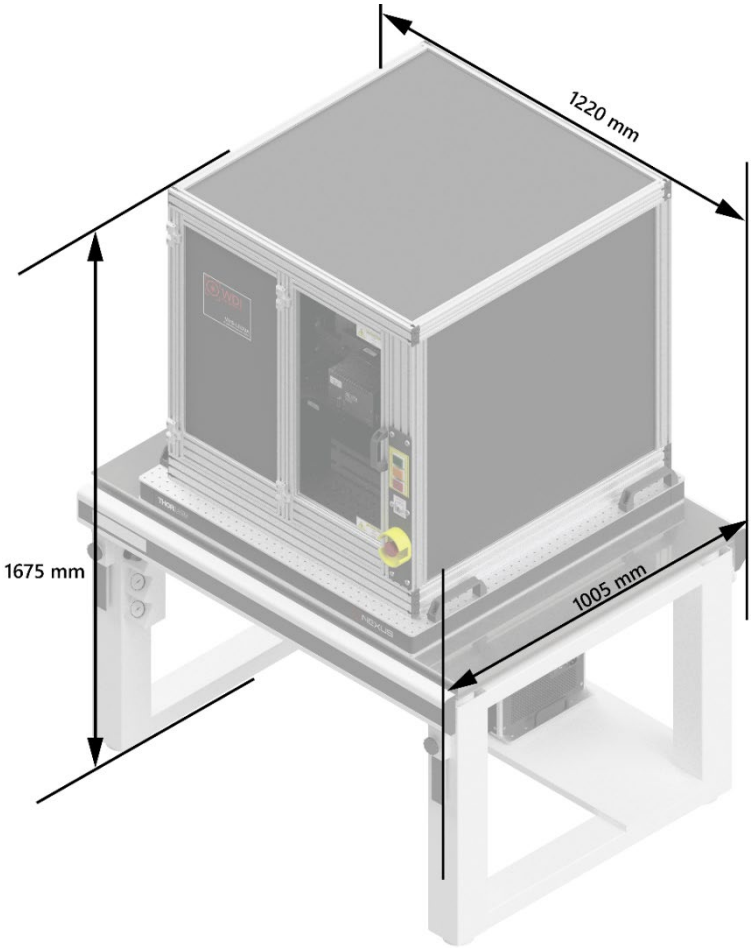
LSCM SYSTEM SPECIFICATIONS

Category	Item	Specification
Brightfield Imaging	Illumination	1 Amp White LED
	Camera	1/2 inch 2 MP CMOS
	Resolution	2592 X 1944
	Frame Rate	10 FPS Full Resolution
	Bit Depth	10 Bits
	Pixel Size	4.2 µm X 4.2 µm
Confocal Imaging	Laser Type	Single Mode Laser Diode
	Maximum Laser Power	500 mW
	Wavelength	1155 nm
	Typical Spectral Width	5.0 nm
	Detector Spectral Response Range	900 nm ~ 1700 nm
	Resolution	512 X 512
	Bit Depth	14 Bits
	Pixel Size	7.5 µm (Virtual Pixel)
	Frame Rate	Up to 30 FPS Full Resolution

LSCM OBJECTIVE SPECIFICATIONS

Category	5X	10X	20X	50X	100X
Numerical Aperture	0.1	0.3	0.45	0.65	0.85
Working Distance	23 mm	18 mm	8.3 mm	4.5 mm	1.2 mm
Field Number	22	22	22	22	22
Resolution @ 1155 nm	7.05 µm	2.35 µm	1.57 µm	1.08 µm	0.83 µm
Correction Collar	No	No	Yes	Yes	Yes
Thickness Correction			0 ~ 1.2 mm	0 ~ 1.2 mm	0 ~ 0.7 mm

LSCM DIMENSIONS



Separate table/desk for PC, Keyboard, Mouse and Display not shown

Shown with optional antivibration table

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