

# Smarter Cuts, Higher Yields: Advanced Laser Cutting Technology – DR Laser Kleave Series

DR Laser Singapore Pte Ltd

# Contents

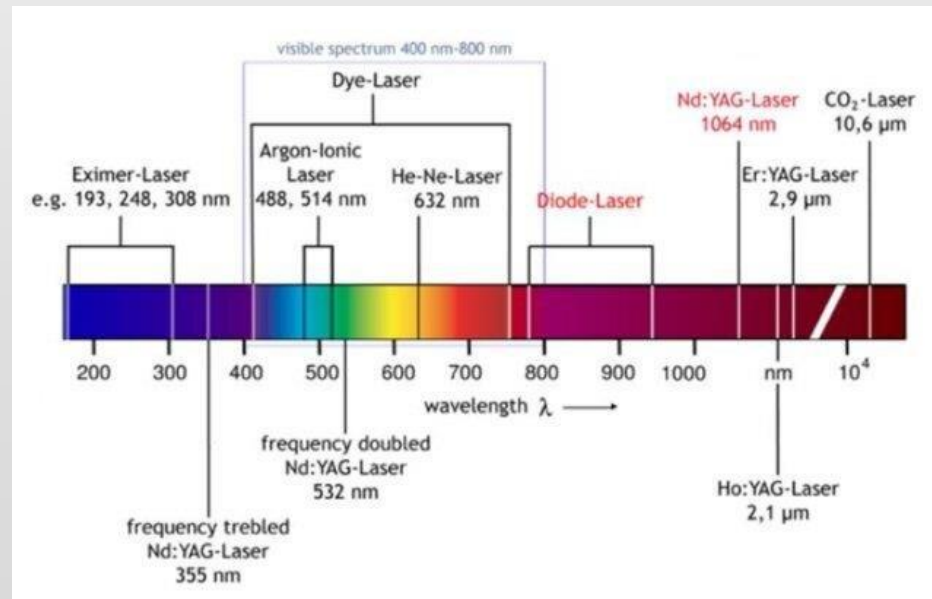
- Laser Basics
- Our Technology
  - Internal Dicing
  - Grooving
  - Ablation
- Application & Usage
- Cutting Workflow & Example
- Our Product & Winning Features
  - Product Specifications
  - System Architecture
  - Our Winning Features
- DR Laser's Strength

# Laser Basics - Properties

- What is Laser Technology ?

**LASER** stands for *Light Amplification by Stimulated Emission of Radiation*

- **Monochromatic:** single wavelength
- **Coherent:** light waves move in phase
- **Collimated:** travels in a straight line with minimal divergence

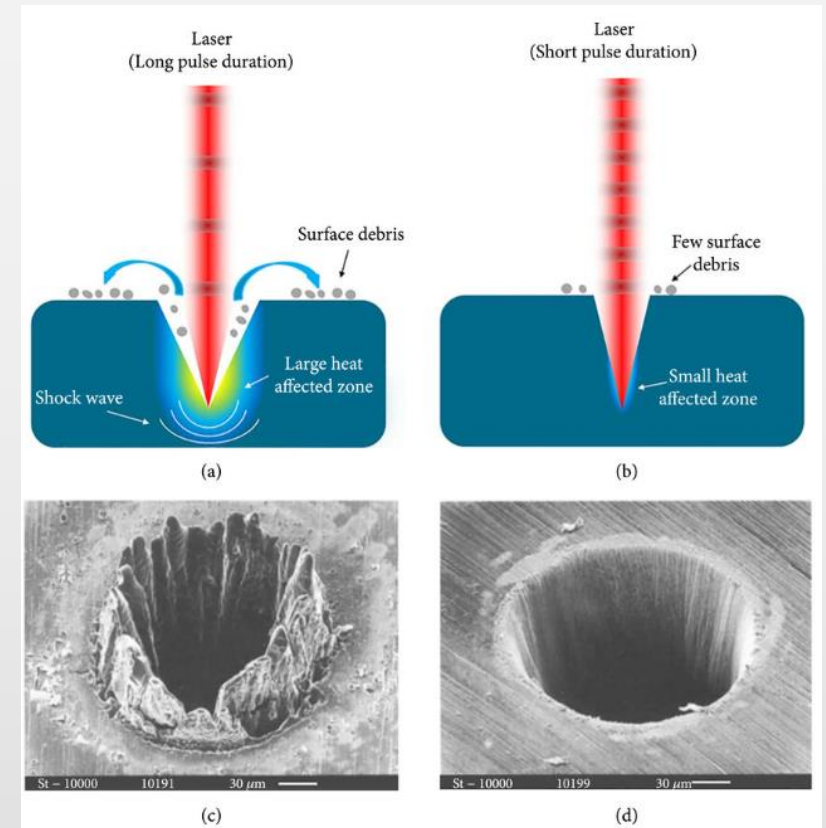
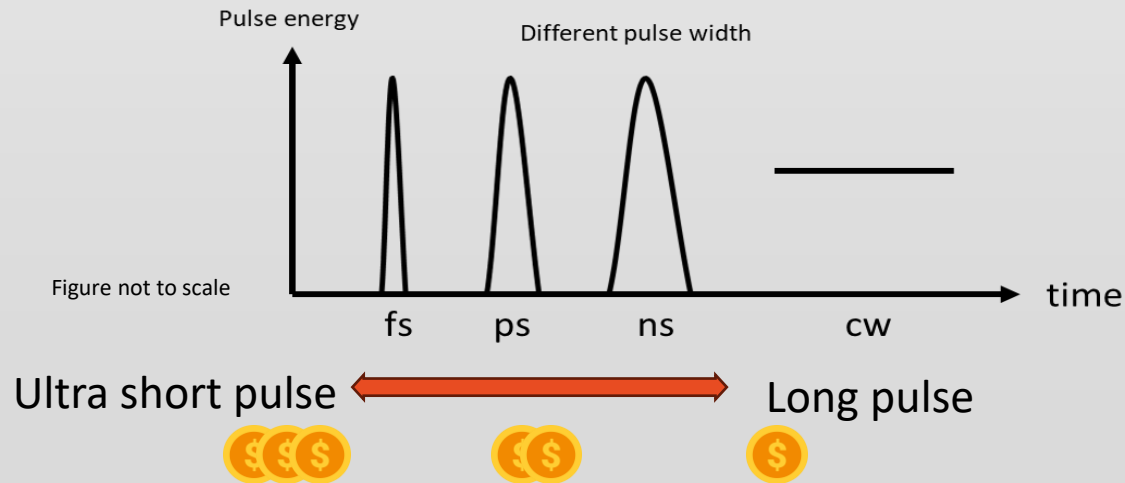


# Laser Basics – Energy & Wavelength

- Why Lasers for Cutting ?
  - **Non-contact processing:** no mechanical stress introduced on the material
  - **High precision:** micron-level accuracy
  - **Versatility:** can cut, drill, mark, or engrave a wide range of materials
  - **Controlled energy:** short-pulse and ultra-short-pulse lasers allow *cold cutting*, minimizing heat-affected zones
  
- Which wavelength is suitable for what material ?
  - **UV** → silicon, epoxy moulding compound, PCB
  - **Green** → silicon, metals
  - **IR** → ideal for glass and transparent materials

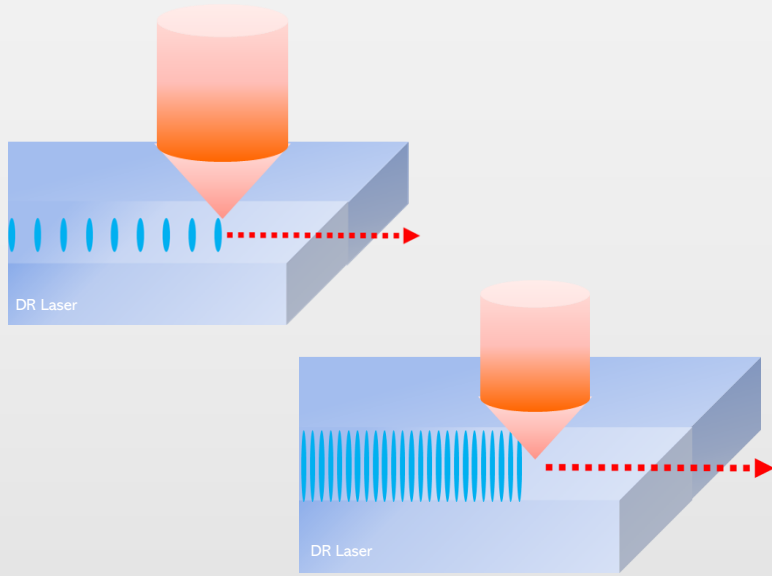
# Laser Basics - Duration

- What laser type is suitable for what application ?
  - **Continuous wave (CW) laser** → welding / cutting of large sheet metals
  - **Nanosecond pulsed laser** → conventional laser processing technology
  - **Picosecond / Femtosecond (ultrafast) pulsed laser** → “cold cutting” with minimal heat-affected zone (HAZ); **emerging technology**
- Pulse width effect



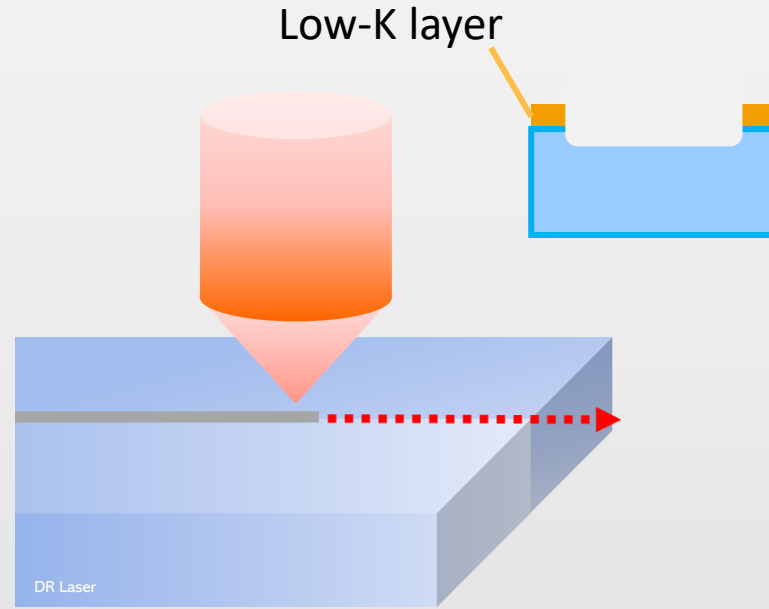
[https://www.researchgate.net/figure/Schematic-of-laser-interaction-with-materials-under-different-pulse-durations-a-long\\_fig1\\_356726054](https://www.researchgate.net/figure/Schematic-of-laser-interaction-with-materials-under-different-pulse-durations-a-long_fig1_356726054)

# Our Technology



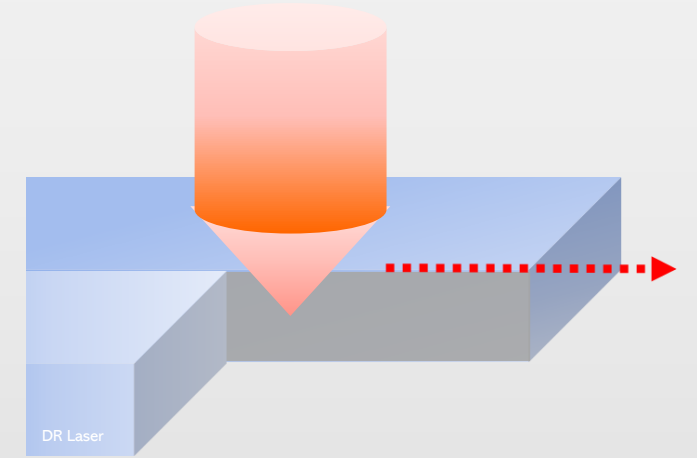
Internal Dicing

- Laser is **interacting within the substrate**, not on the surface
- Creates **internal modification layers** along the intended plane for separation
- Wafer is then separated mechanically or by expansion



Surface scribe / Grooving

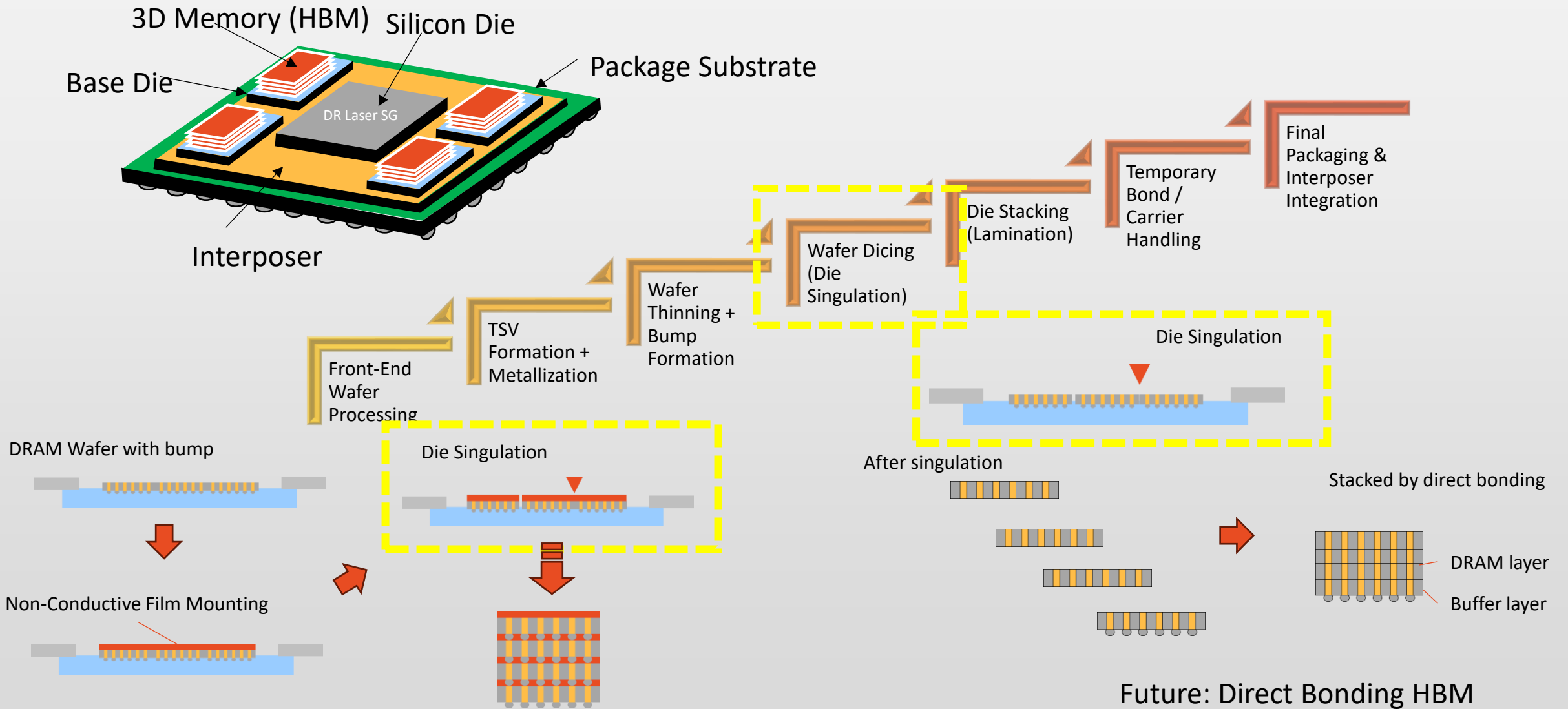
- Laser is used to **partially cut** into the wafer, creating a **groove or trench**
- Typically followed by mechanical breaking or blade dicing



Dicing / Full Cut

- Laser beam is applied **through the full thickness** of the wafer
- Material is removed directly by ablation (melting/vaporization)

# Application and usage : DRAM Die Application using TSV



# Applications and Usage

- **Semiconductor wafers**

- **Wafer Dicing**

- Cutting thin silicon wafers into individual chips with ultra-thin kerf to maximize yield
  - Example: used in foundries or IDM fabs producing 200 mm/300 mm wafers

- **Low-k and Fragile Material Processing**

- Cutting delicate substrates (low-k, GaAs, SiC) without thermal damage or cracking
  - Example: used in IC packaging for next-generation smartphones

- **Advanced Packaging & 3D IC**

- **Post-DBG (Dice Before Grinding) Dicing**

- Or, Cutting through wafers with DAF (Die Attach Film)
  - Example: used in high-yield packaging for consumer electronics

# Applications and Usage

- **MEMS & Sensors**

- Cutting delicate microelectromechanical structures without mechanical stress
- Example: used in making accelerometers, gyroscopes, or pressure sensors in automotive & IoT devices

- **Glass/Silicon Bonded Wafer Singulation**

- Cutting for sensor packaging
- Example: used in the production of automotive LiDAR sensor modules

- **RF Devices**

- Cutting for radio frequency components that are brittle and fragile
- Example: RF front-end modules for smartphones and 5G communication systems

- **SAW filter**

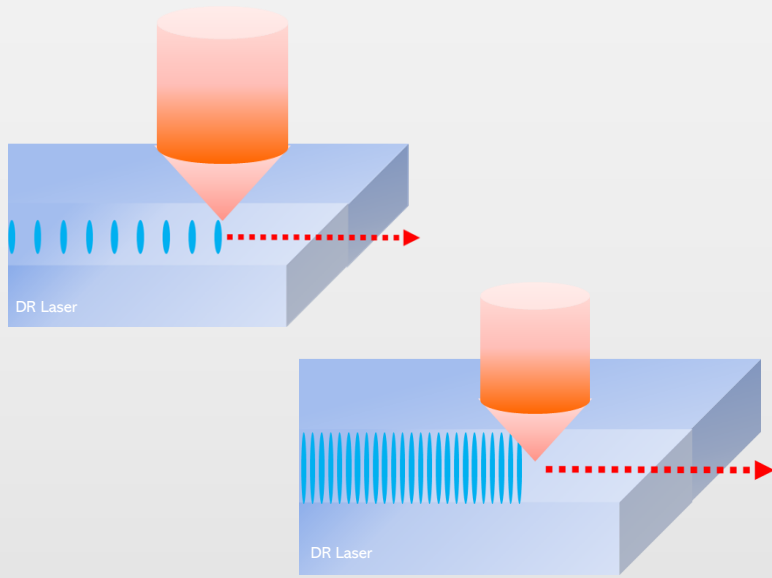
- Cutting for piezoelectric substrates that are sensitive to edge defects
- Example: SAW filters in wireless communication and mobile devices

# Applications and Usage

- **MiniLEDs & glass substrate/panel**

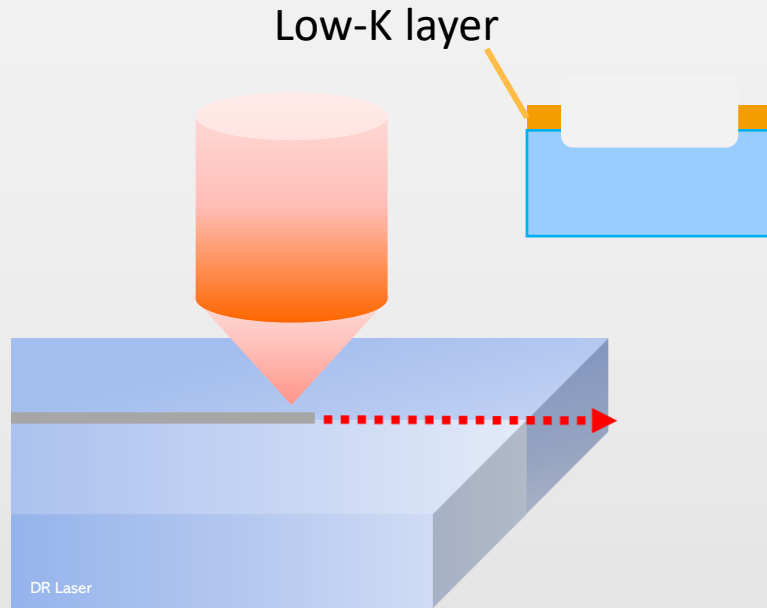
- Cutting sapphire substrates or glass
- Example: used in the production for LED wafers, smartphone cover glass, and optical lenses

# Technology and Applications



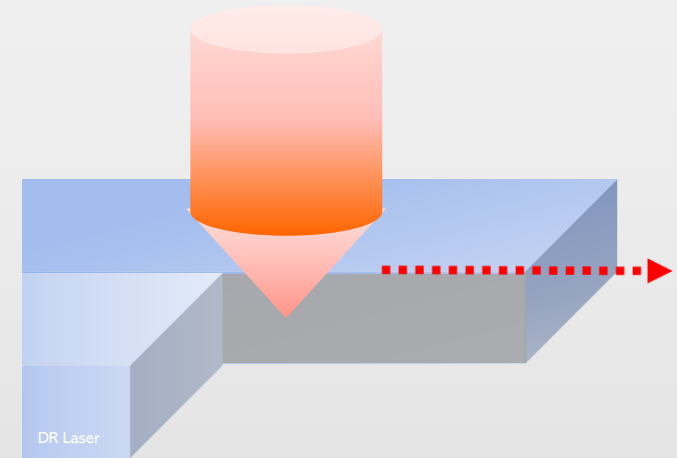
Internal Dicing

- Brittle materials
- Silicon, GaAs, sapphire
- Mini-LEDs



Surface scribe / Grooving

- low-k materials
- 2.5D Advanced Packaging
- Logic IC / HBM



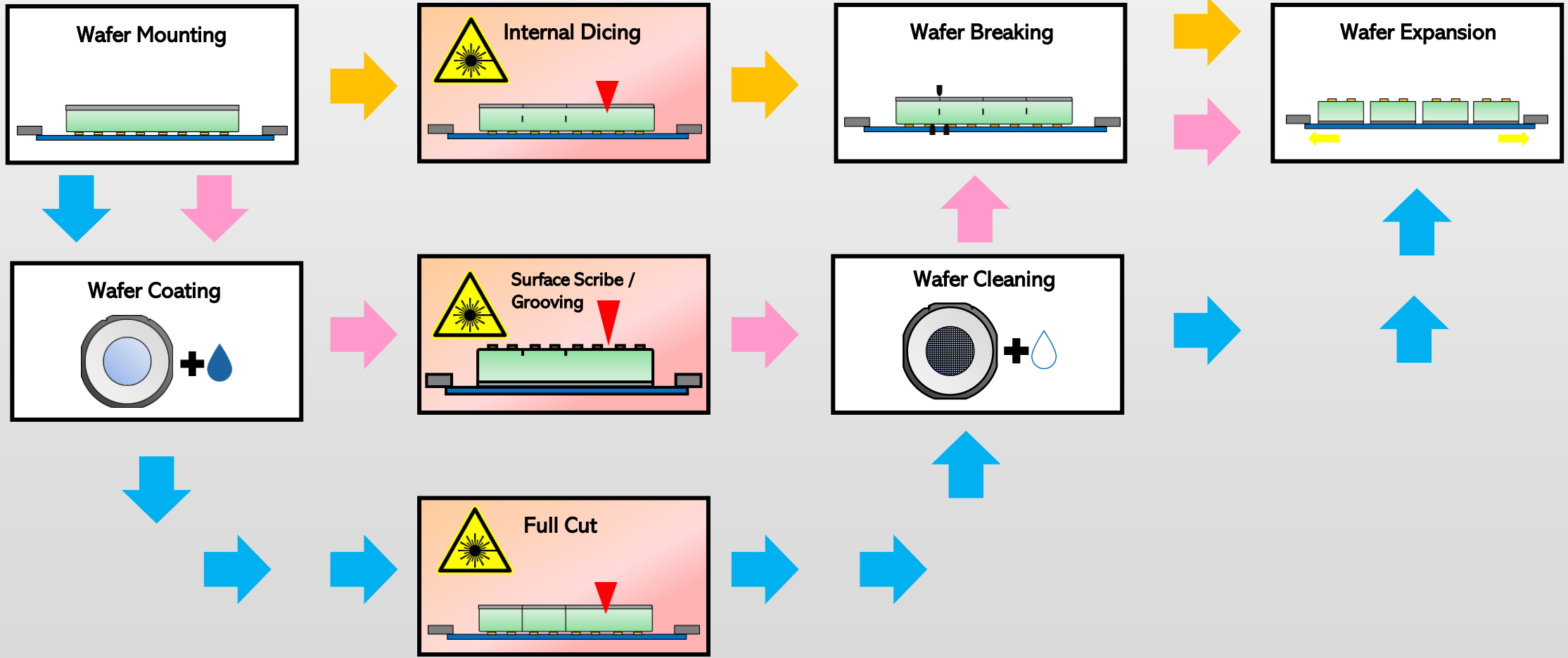
Dicing / Full Cut

- Smartphone panel glass
- Ultra-thin silicon wafers
- 2.5D Advanced Packaging
- HBM
- Mold / resin package dicing

# General Laser Cutting Workflow

- ➡ Internal Dicing
- ➡ Surface Scribe / Grooving
- ➡ Full Cut

**DR Laser**  
Proprietary laser dicing



Remarks: Wafer facing up / down depends on customer practices

# Our Product

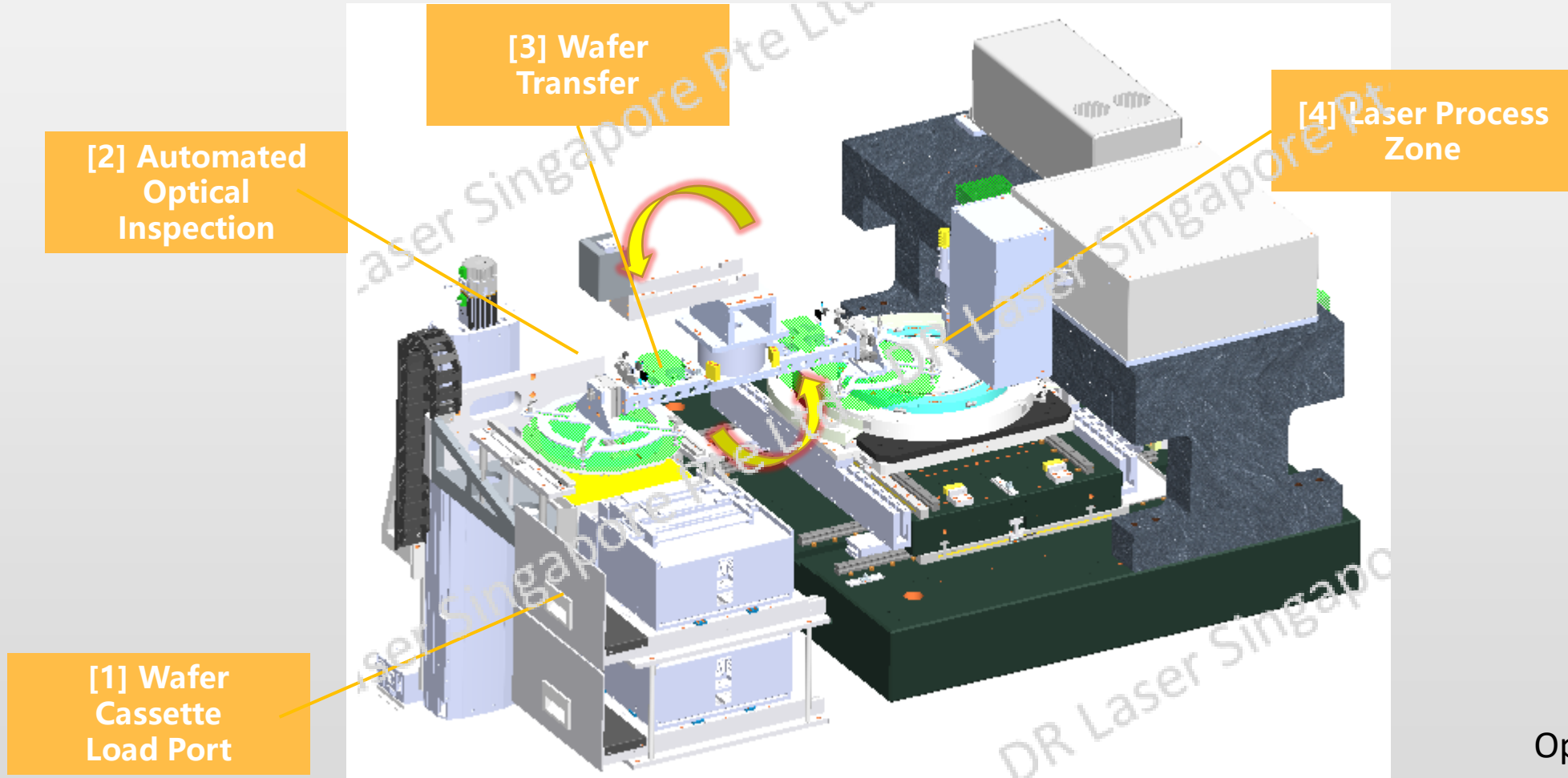
## Kleave300



### Equipment Specifications – Key Features

<b>Model Name</b>	<b>Kleave300</b>	
<b>Max Workpiece Size</b>	Φ300 mm	
<b>Load Port</b>	Metal Frame Wafer Cassette	
<b>X-axis (Chuck table)</b>	Processing range	310 mm
	Moving speed	10 ~ 800 mm/s
	Indexing resolution	100 nm
	Position accuracy	±5 μm
<b>Y-axis (Chuck table)</b>	Processing range	310 mm
	Moving speed	10 ~ 800 mm/s
	Indexing resolution	100 nm
	Position accuracy	±5 μm
<b>Z-axis</b>	Moving resolution	100 nm
	Repeatability accuracy	±2 μm
<b>θ-axis (Chuck table)</b>	Max. rotating angle	100 deg.
<b>Equipment dimensions (W×D×H), excluding chiller</b>	1,750 mm × 2,250 mm × 2,250 mm	
<b>Equipment weight</b>	Approx. 2,500 kg	
<b>Main Options</b>		
<ul style="list-style-type: none"><li>• Integrated coater &amp; cleaner</li><li>• Choice of different dicing engines for silicon, glass, sapphire</li></ul>		

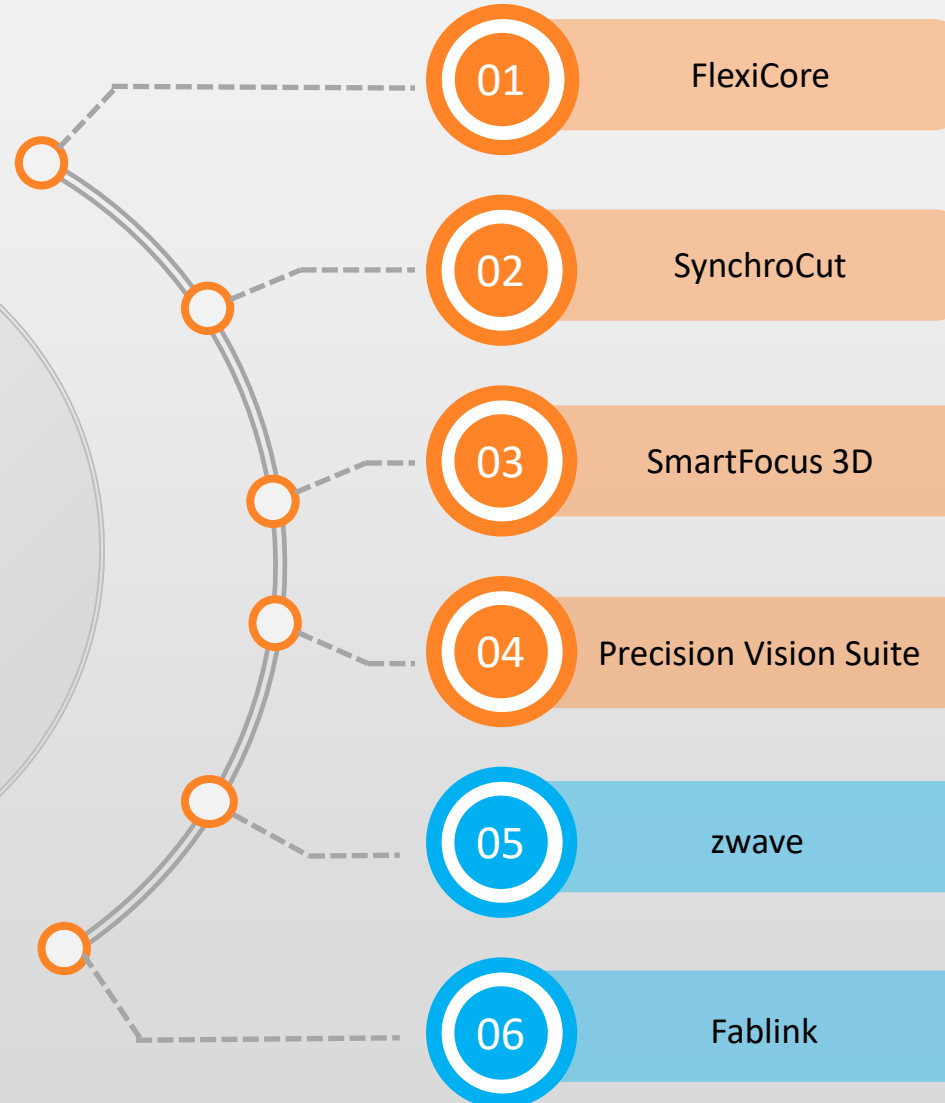
# System Architecture



Optional Features:  
Coater & Cleaner

Remarks: For Reference Only, actual configuration may vary

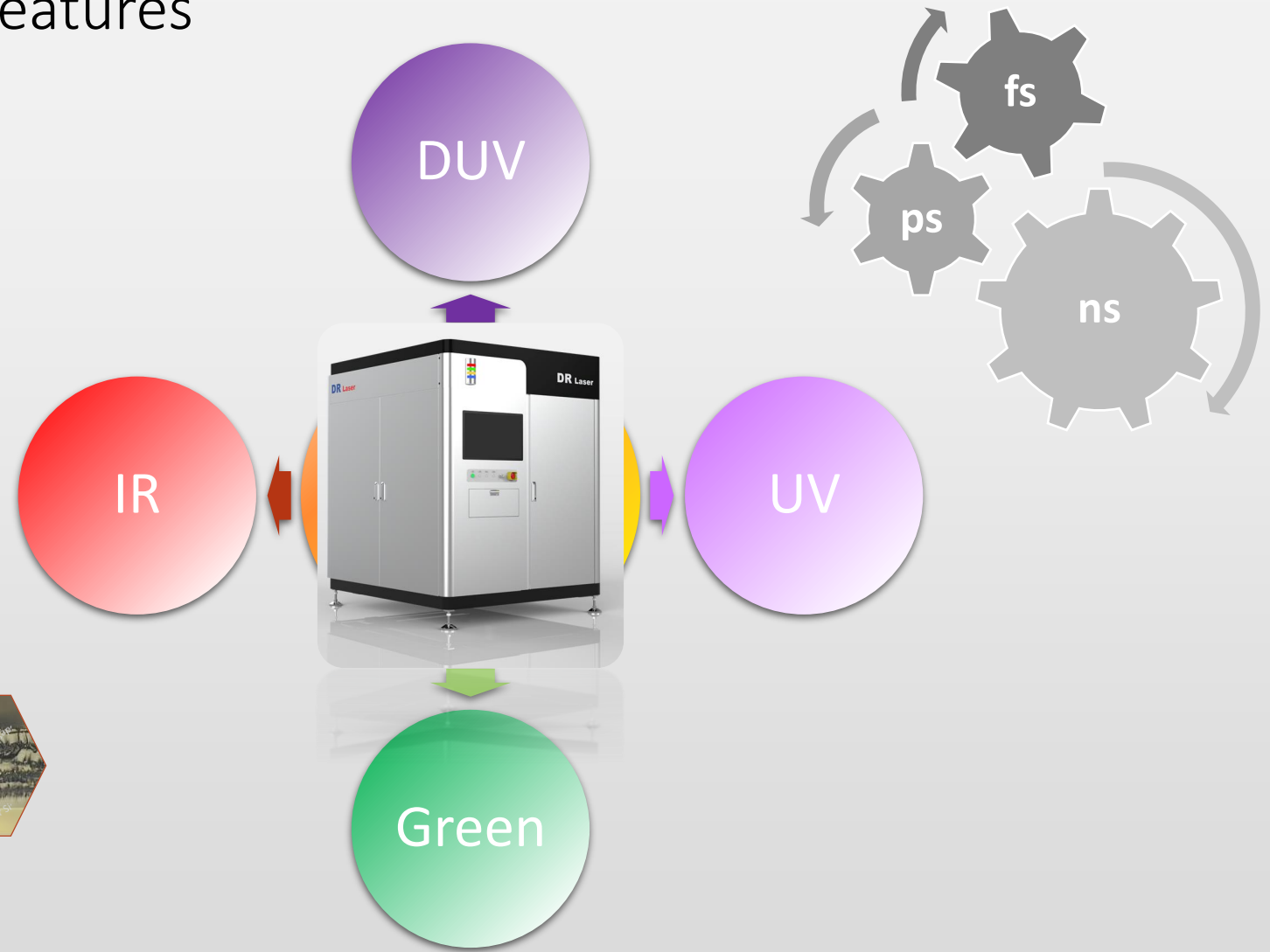
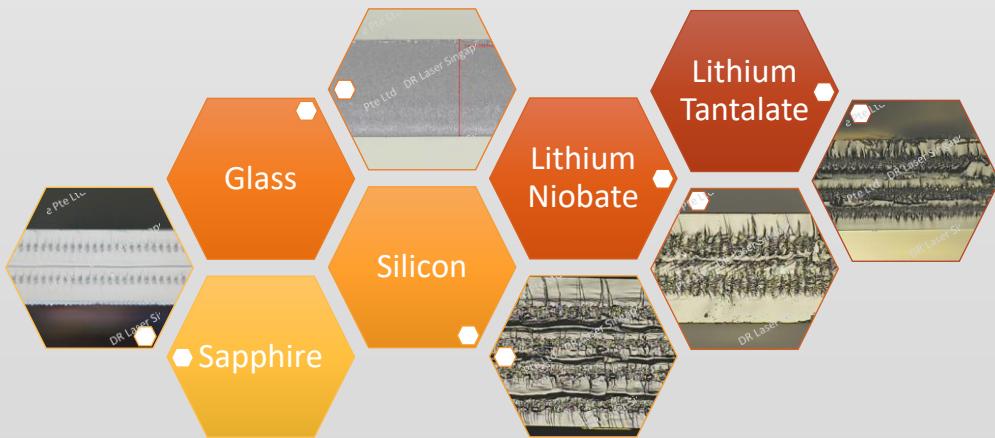
# Kleave Series Product Winning Features



- Can be adopted with multiple laser engine for different kinds of process requirements
- Advanced synchronization between laser pulses and motion control, ensuring precise kerf alignment and smooth cutting at high speeds
- 3D wafer profile measurement with smart focus adjustment
- Integrated vision control system, safeguards quality in real time, reducing errors and maximizing yield.
- All-in-one platform with recipe control, centralized operations and built-in analytics. Ensures uptime, trust, and scalability across every site
- Delivers centralized recipe governance and remote operations with secure, on-prem data control and enterprise-grade integration

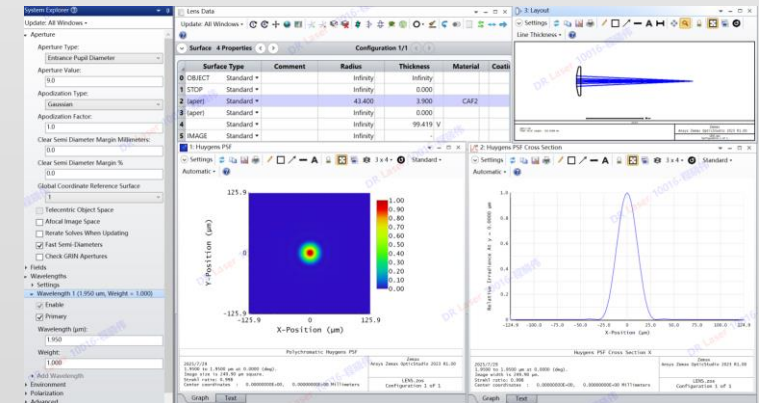
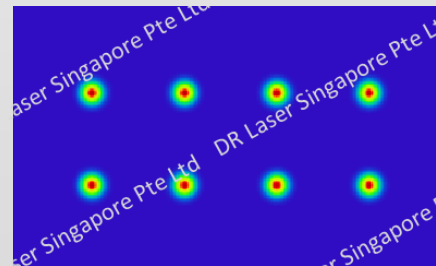
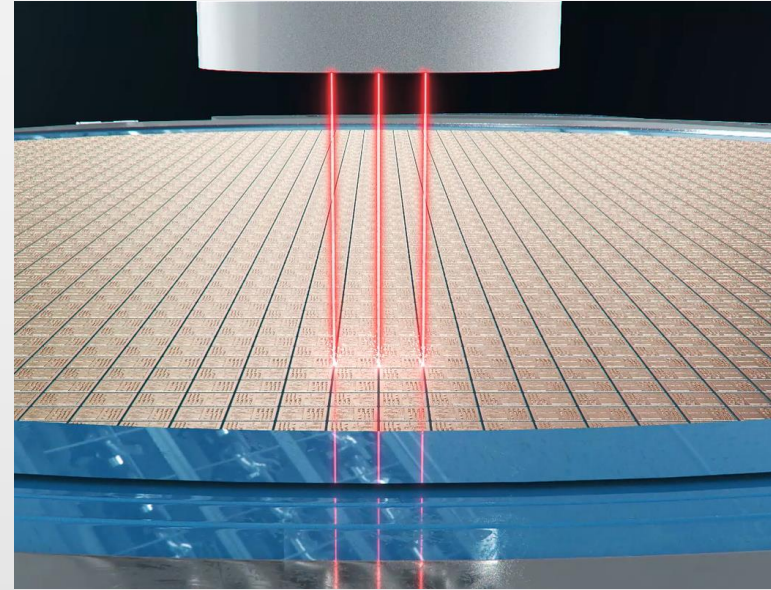
# Kleave Series Product Winning Features

- FlexiCore
- Designed with a highly adaptable architecture that can be seamlessly integrated with multiple laser engines
- Adopt DR Laser proprietary laser know-how, optical path design
- Supports a wide range of laser processes



# Kleave Series Product Winning Features

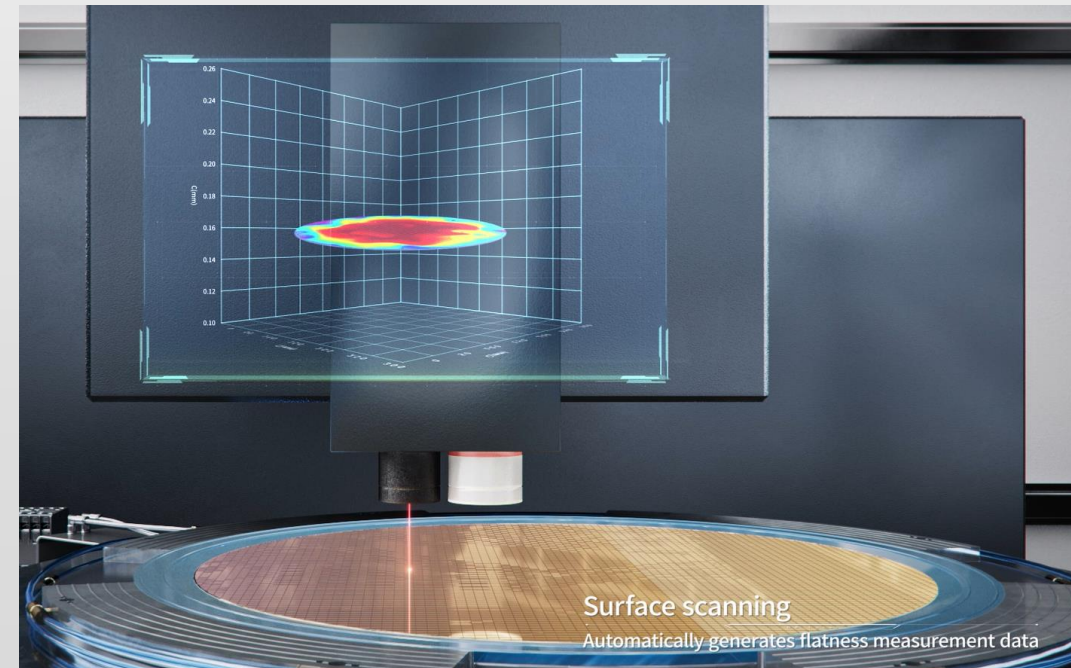
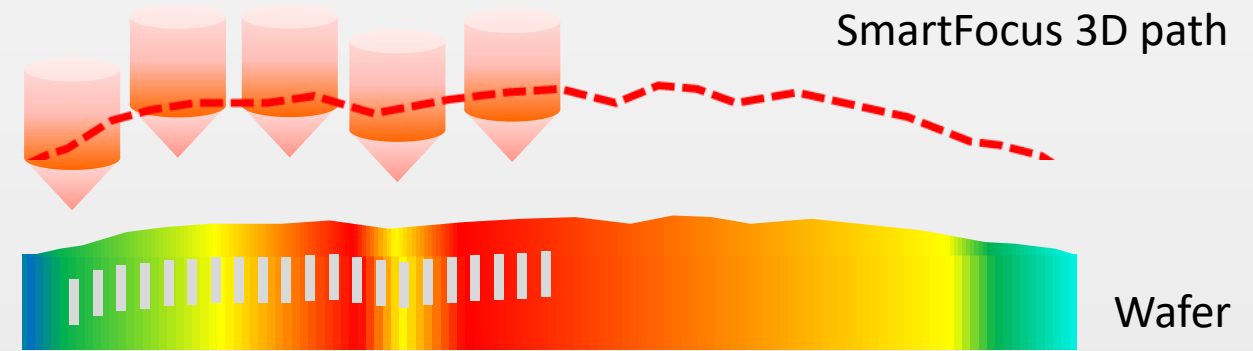
- SynchroCut
- Real-time alignment of vision with stage movement
- Multi-street cutting in a single operation
- DR Laser proprietary beam shaping technology
- Supports high-throughput production without compromising accuracy
- Ideal for fine-pitch wafer dicing and advanced packaging processes



Beam Shaping Technology

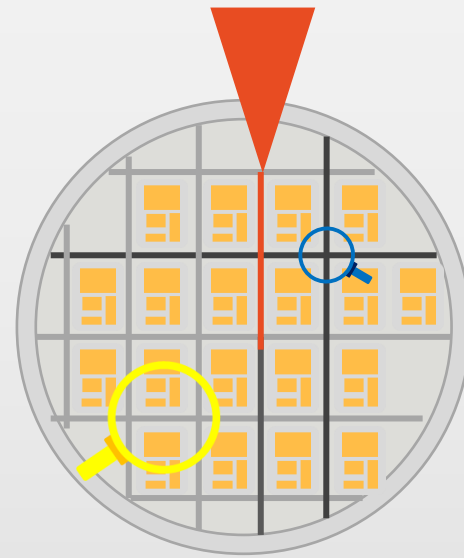
# Kleave Series Product Winning Features

- SmartFocus 3D
- Multi-axis autofocus system compensates for wafer bow and thickness variation
- Maintains consistent spot size and energy delivery across the workpiece
- Reduces scrap by ensuring complete, uniform cuts
- Critical for ultra-thin wafers, MEMS, and advanced substrates

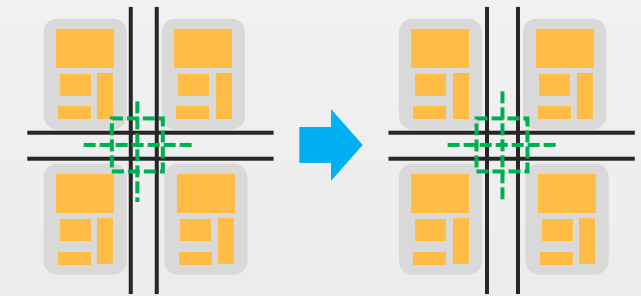
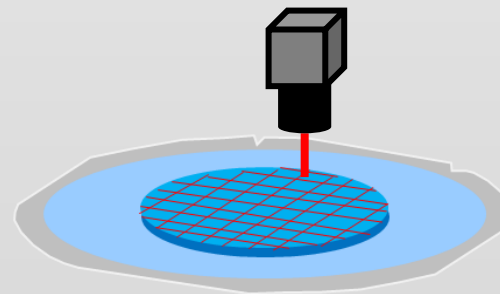


# Kleave Series Product Winning Features

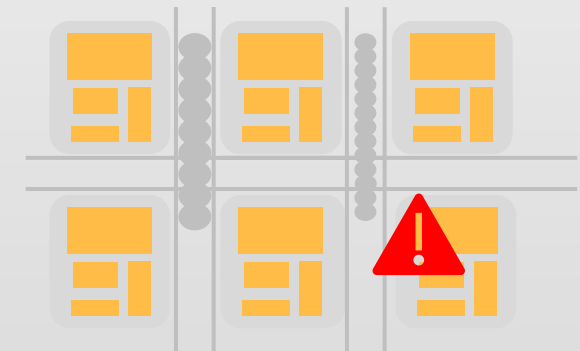
- Precision Vision Suite
- In-line groove width detection ensures uniform trench profiles for packaging
- Syncho-alignment corrects for wafer warpage and street deviation
- Immediate corrections keep processes stable and wafers within specifications
- Maintains perfect street alignment and uniform kerf width



Precision Vision Suite



Syncho-alignment



Kerf width / groove width detection

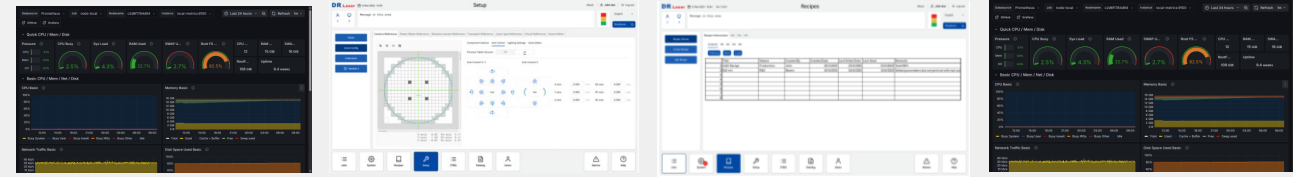
# Kleave Series Product Winning Features

- zwave Software
- Govern every recipe, trust every run (Control & Analytics)
  - Full versioning with rollback: Every change tracked; revert in seconds.
  - Lot/wafer linkage: Production data tied to the exact recipe version for audit & QA.
  - Faster ramps: Golden-recipe management, A/B diffs, staged rollout (dev → qual → prod).
  - Built-in SPC: Cpk/Ppk dashboards, outlier tagging, drift alerts, and cross-tool/lot correlation
- Keep tools running (Uptime & Flow)
  - Rapid recovery: Clustered services, snapshots, and fast restore keep lines moving
  - Fewer clicks, fewer errors: Searchable histories, recipe diffs, and batch actions speed routine work

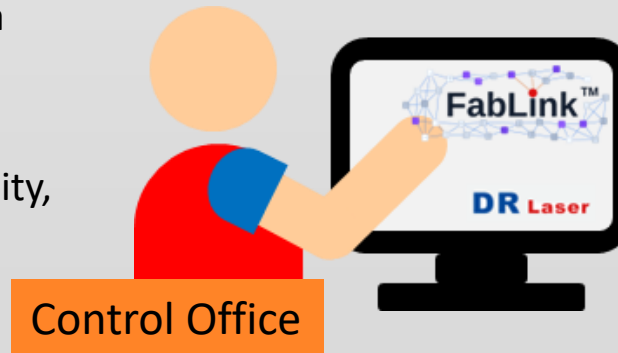


# Kleave Series Product Winning Features

- FabLink
- One command center (Centralized Ops & Remote Assist)
  - Single hub: Managed recipe import/export with approvals.
  - Fab & bay view: Live status of all Zwave™-enabled tools—on the floor or from central engineering.
  - Safe remote actions: Level 0/1 manual interventions with interlocks and authorization.
  - Offline engineering: Build/validate recipes on server data—no tool downtime.
- Secure by design, open at the edges (Security & Scale)
  - On-prem by default: Your data stays inside your intranet unless you choose otherwise.
  - Enterprise login: Role-based access & audit logs via OIDC/SSO.
  - Open integration: SECS/GEM, OPC UA, REST APIs; data-lake ready when you want it.
  - Multi-site ready: Site-aware tenancy—global visibility, local control.



Production Line



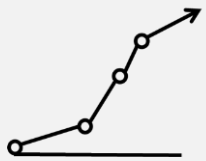
Control Office

FabLink™

# DR Laser's Strength

## Proven Technology, Trusted Worldwide

### Scale & Market Leadership



**10000+**

Laser equipment

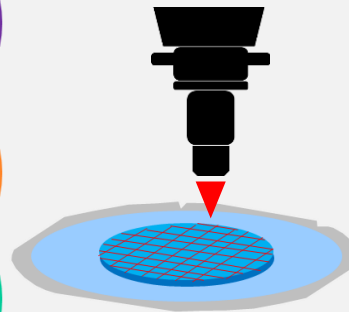
**5000+**

Nano second laser equipment

**2000+**

Picosecond laser equipment

### Innovation & Technology Depth



### Strategic Partnerships



**Your Trusted Partner  
Open to Work with you  
&  
growing together**

# DR Laser

**Your trusted partner in high precision laser solutions**