



Challenges and New Developments in Die Sorting

Gerald Steinwasser –
Mühlbauer, Inc.



Mühlbauer Group Introduction



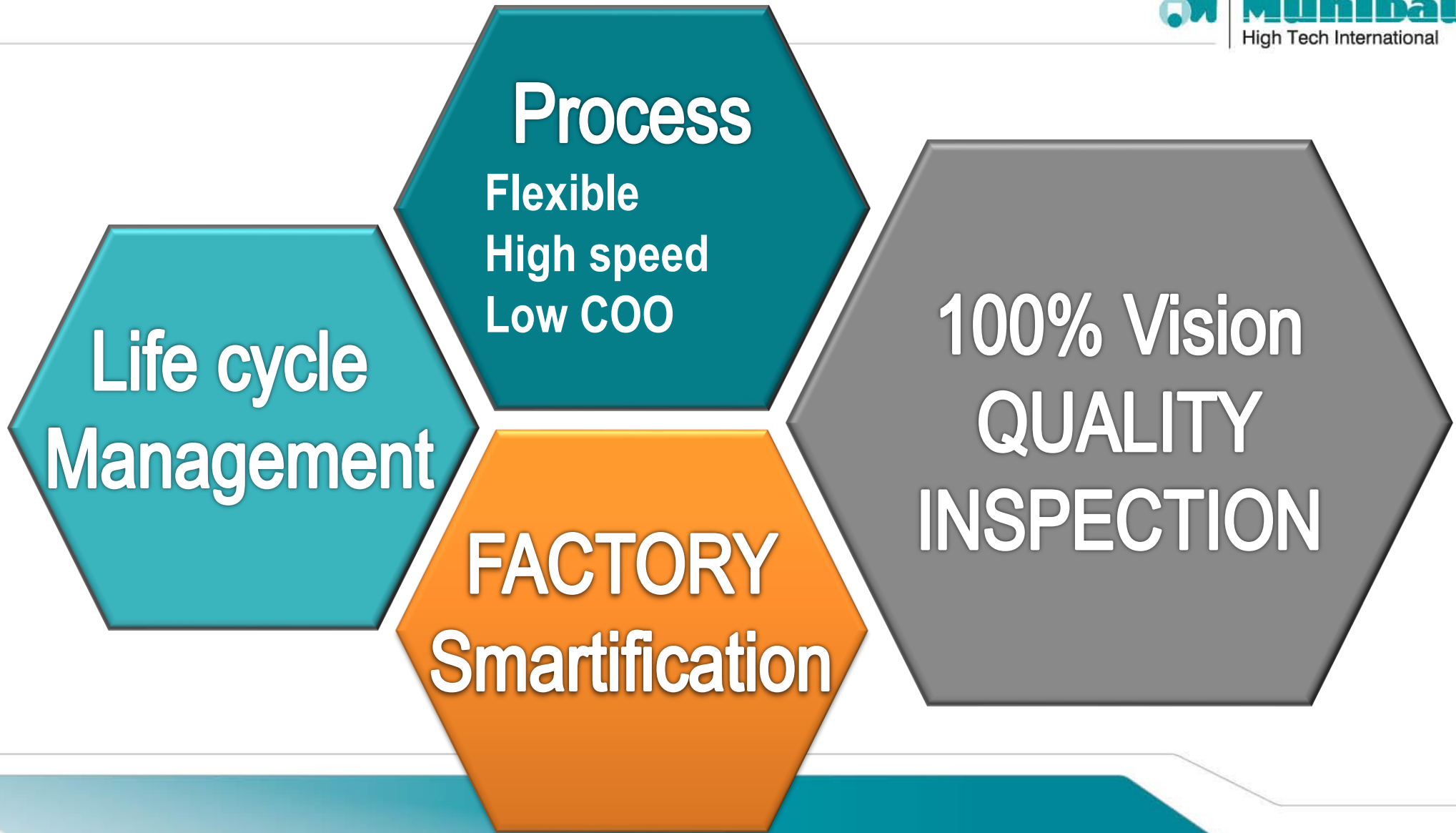
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- In-house precision-part production
- Provision of
 - High-end semiconductor & RFID systems
 - Reliable vision inspection technologies
 - Innovative ID document end-to-end-solutions
 - Secure access & border control systems



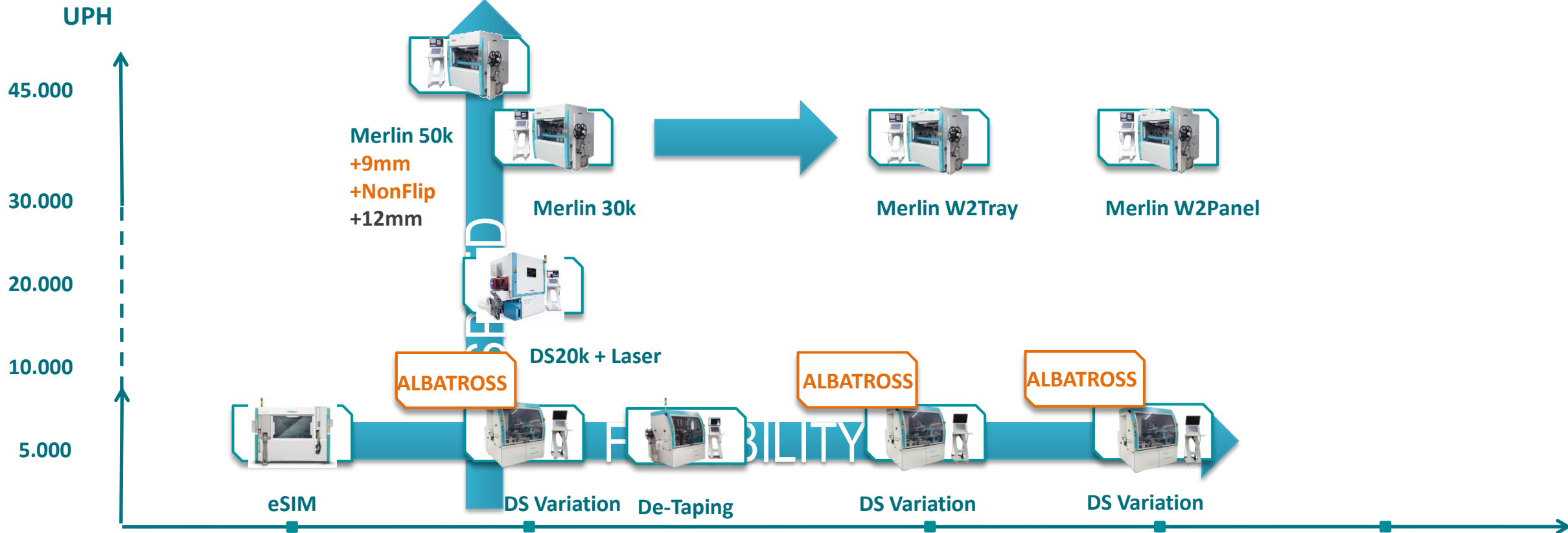


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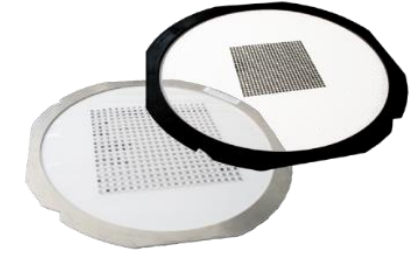




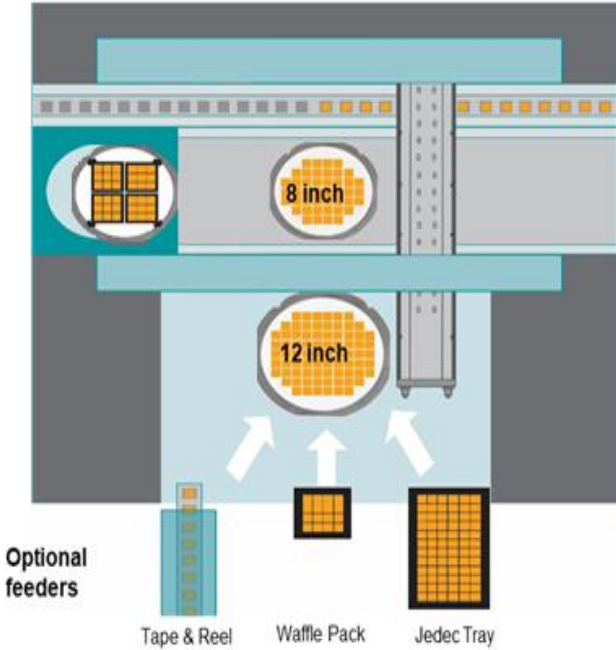
Process overview Pick & Place Technology



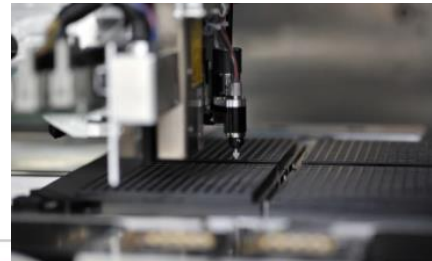
- Reconstructed wafer Indexer for up to 12" wafers



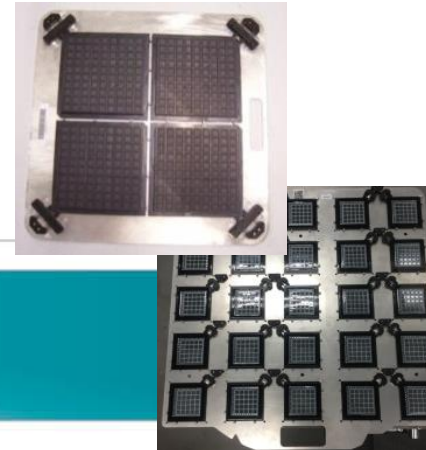
- Optional Waffle Packs / JEDEC Trays or Hoop Ring can be mounted onto adapter plate at input or output:



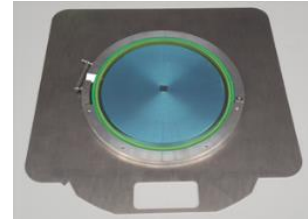
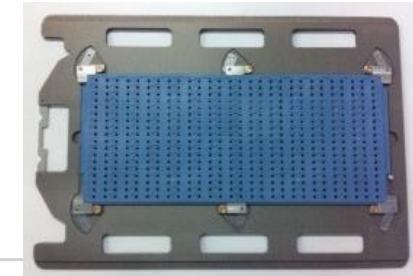
Pick from Waffle pack mounted on adapter plate



Waffle Pack adapter plates



JEDEC Tray adapter plate



DOUBLE AS FLEXIBLE

- Wafer / Hoop ring
- JEDEC Tray, T&R / DeTaping
- 12" Wafer / 0,3 – 35 / 45mm Die



Benefits: Bin Sorting

- MULTI OUTPUT STATION:
- 6* Tape & Reel
- 2* JEDEC Tray
- 12* Waffle pack
- Reconstructed Panel /5 μ m placement acc.
- Automatic Tool Changer





Smart Quality Sorter

- HIGH VOLUME MANUFACTURING → 450k / 650k a day
- Smart Intelligence = super fast product change over
- 12" Wafer / 0,2 – 7 or 9mm Die



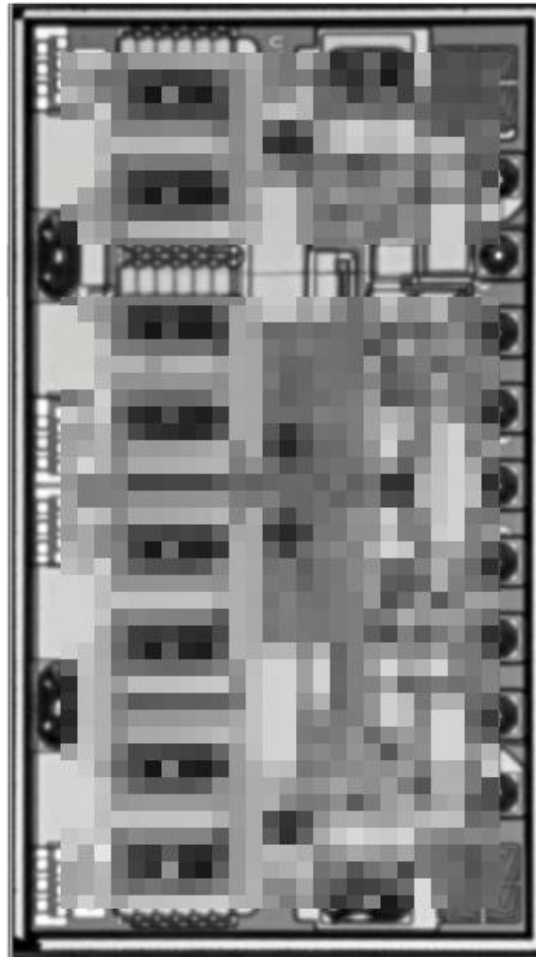
Quality, Speed & Automation

- 100% Quality with 6 Side Inspection
 - 15pic per die = 180pic per second
- Tape and Reel
- Reconstructed Wafer and Tray
- ONLINE IR INSPECTION, Sidewall and Backsite
- ARC AUTOMATION



Who can see the crack?

Die surface with standard coaxial light (pixelated to hide confidential details)

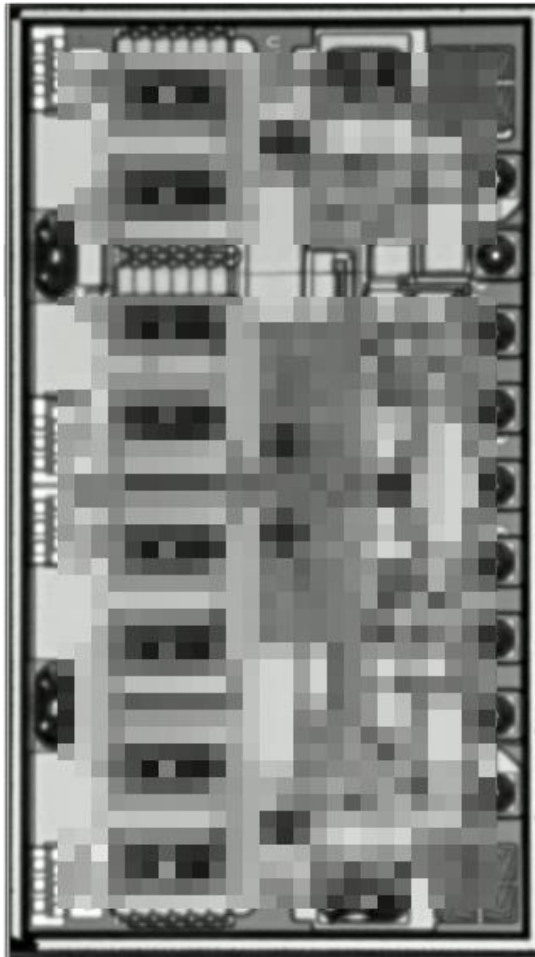


Backside (visible light)



Who can see the crack?

Die surface with standard coaxial light



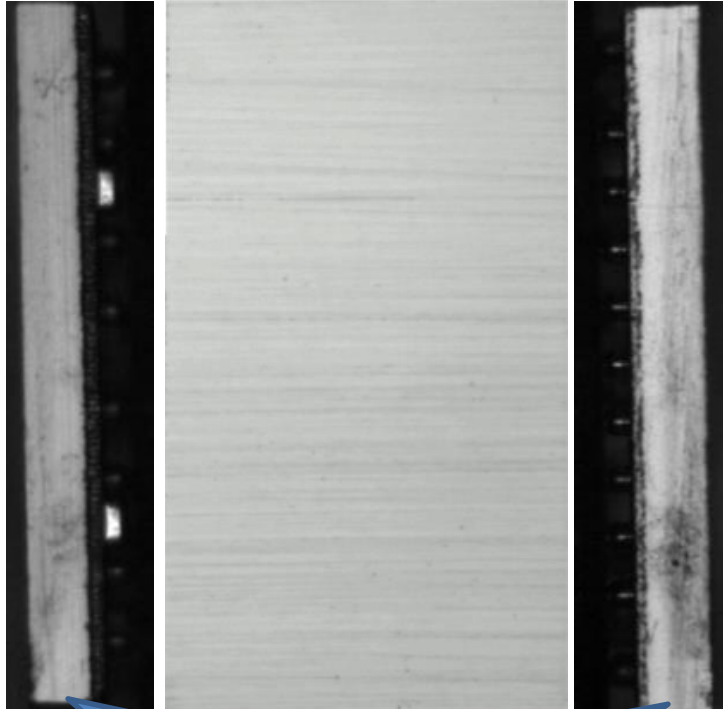
Backside with IR light
(pixelated to hide confidential details)



Adding side wall inspection

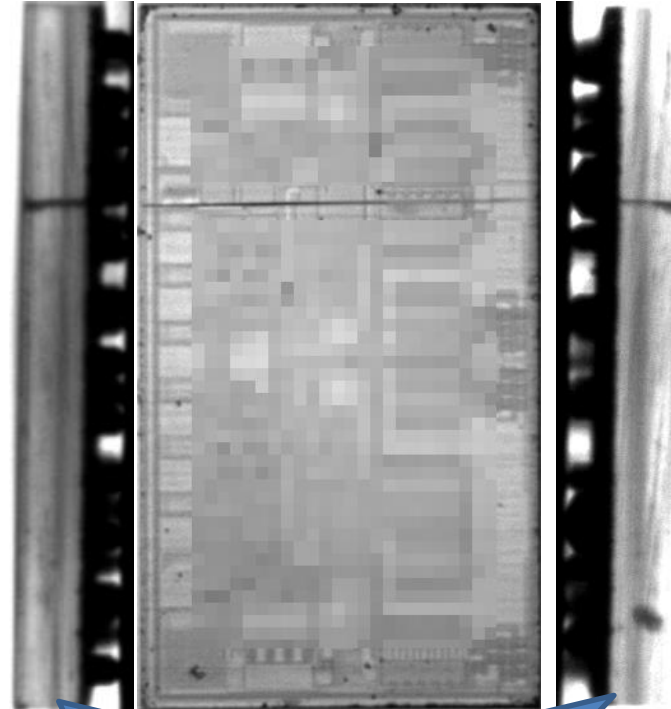
=> Only with IR light cracks can be seen well enough for reliable detection

Inspection with visible light



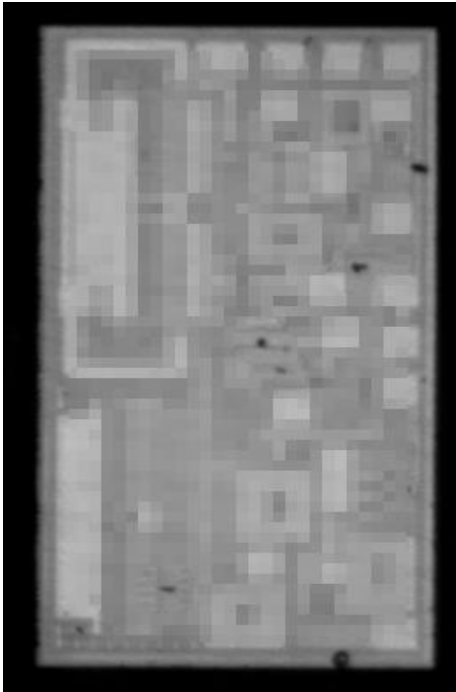
Side Wall Inspection

Inspection with IR light

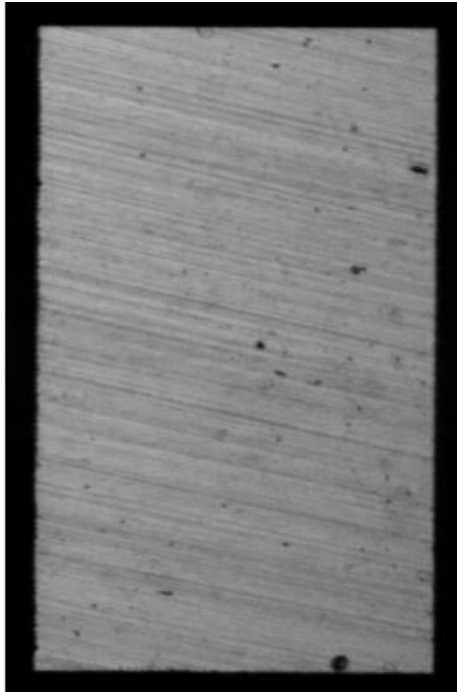


Side Wall Inspection

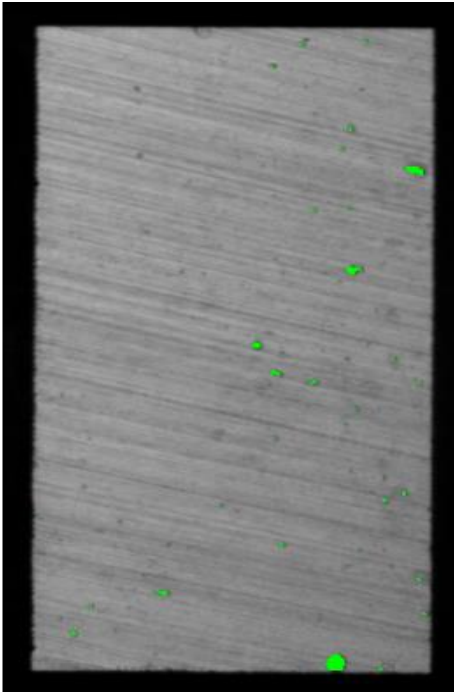




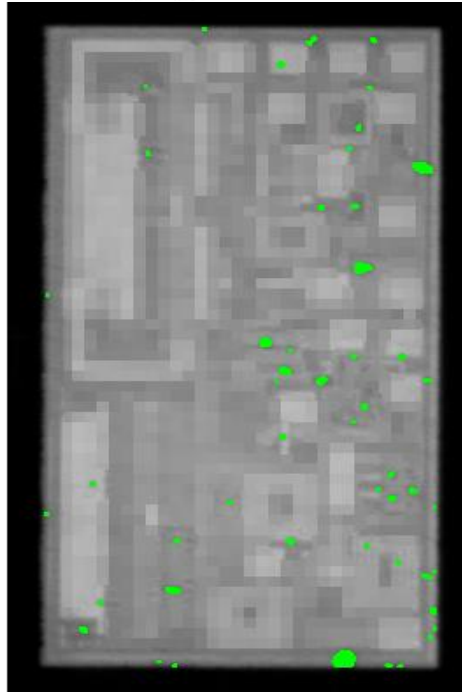
IR BSI with particles



Vis BSI with particles



Particles detected, acceptable on back side



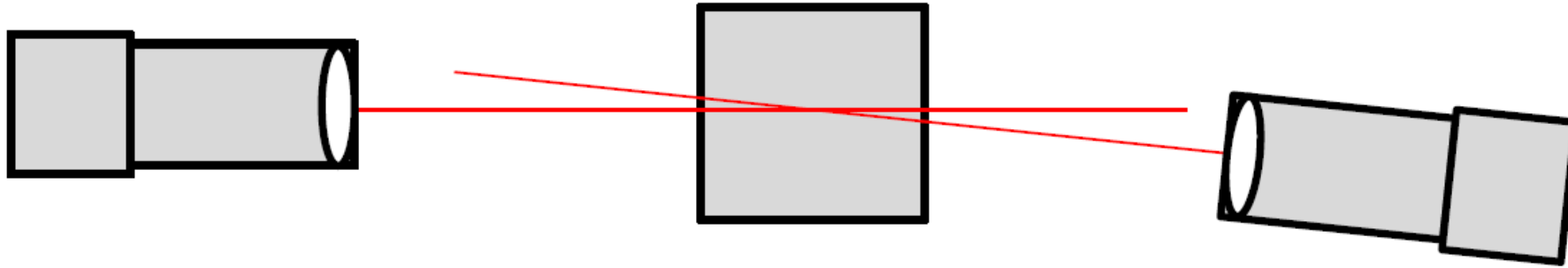
Detected particles as areas to ignore in IR picture
With filter: <3% reject, as particles on back side are ignored

Without particles filter:
30% reject due to particles

With filter:

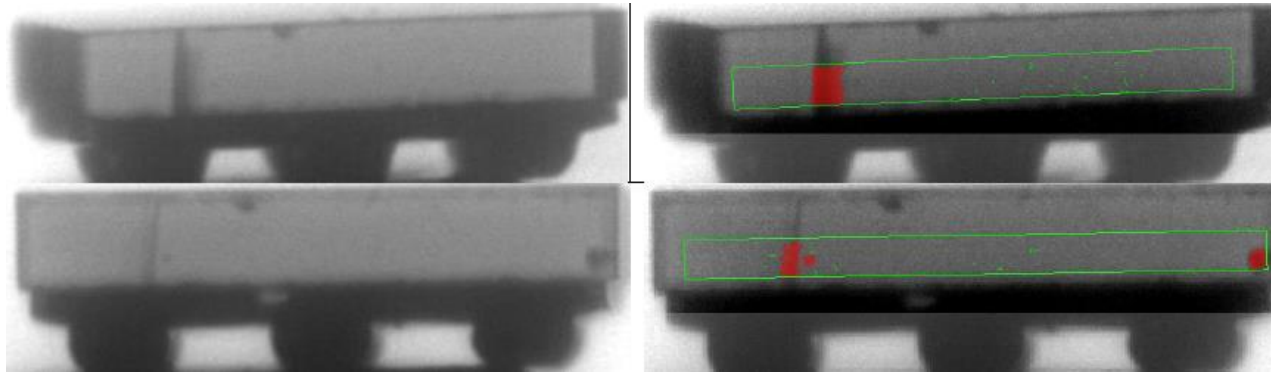


New: angle IR Sidewall



Contrast and size of crack depend on its direction.

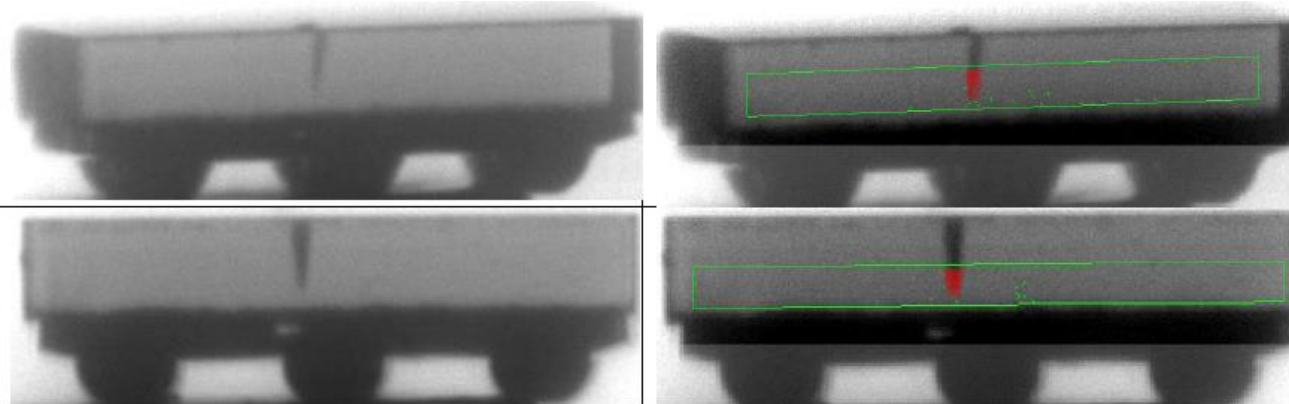
View with angle



Sometimes straight view gives better detectability, sometimes the angled view.

Straight view

View with angle

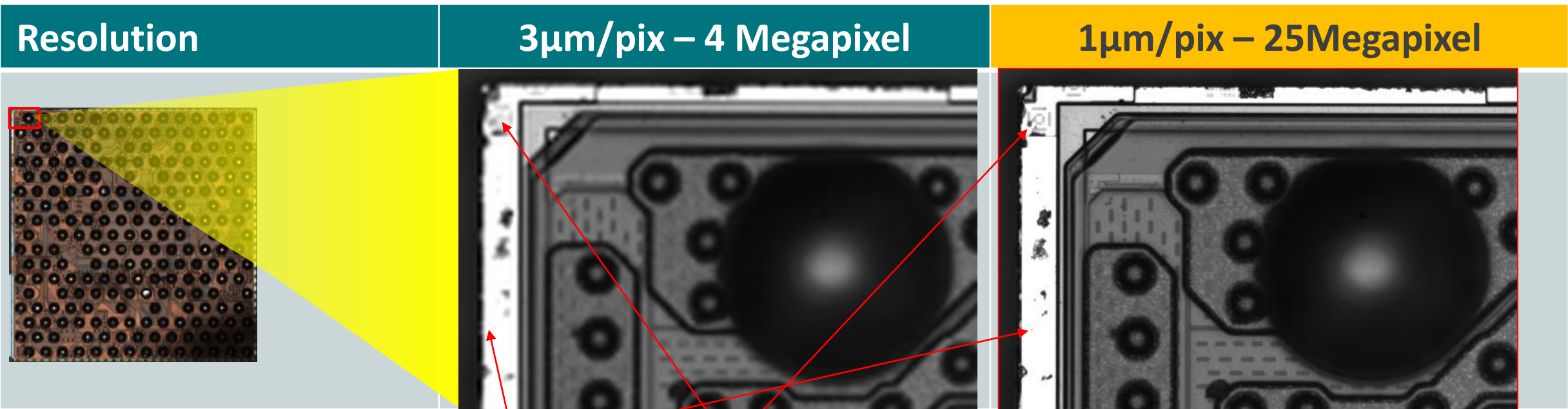


Using both gives the best reliability

Straight view



Higher resolution → inspection quality



Impossible to detect small defects or check control pattern

Higher resolution at → full speed ← for → all d



TRACEABILITY of Products, Quality and Machine Status

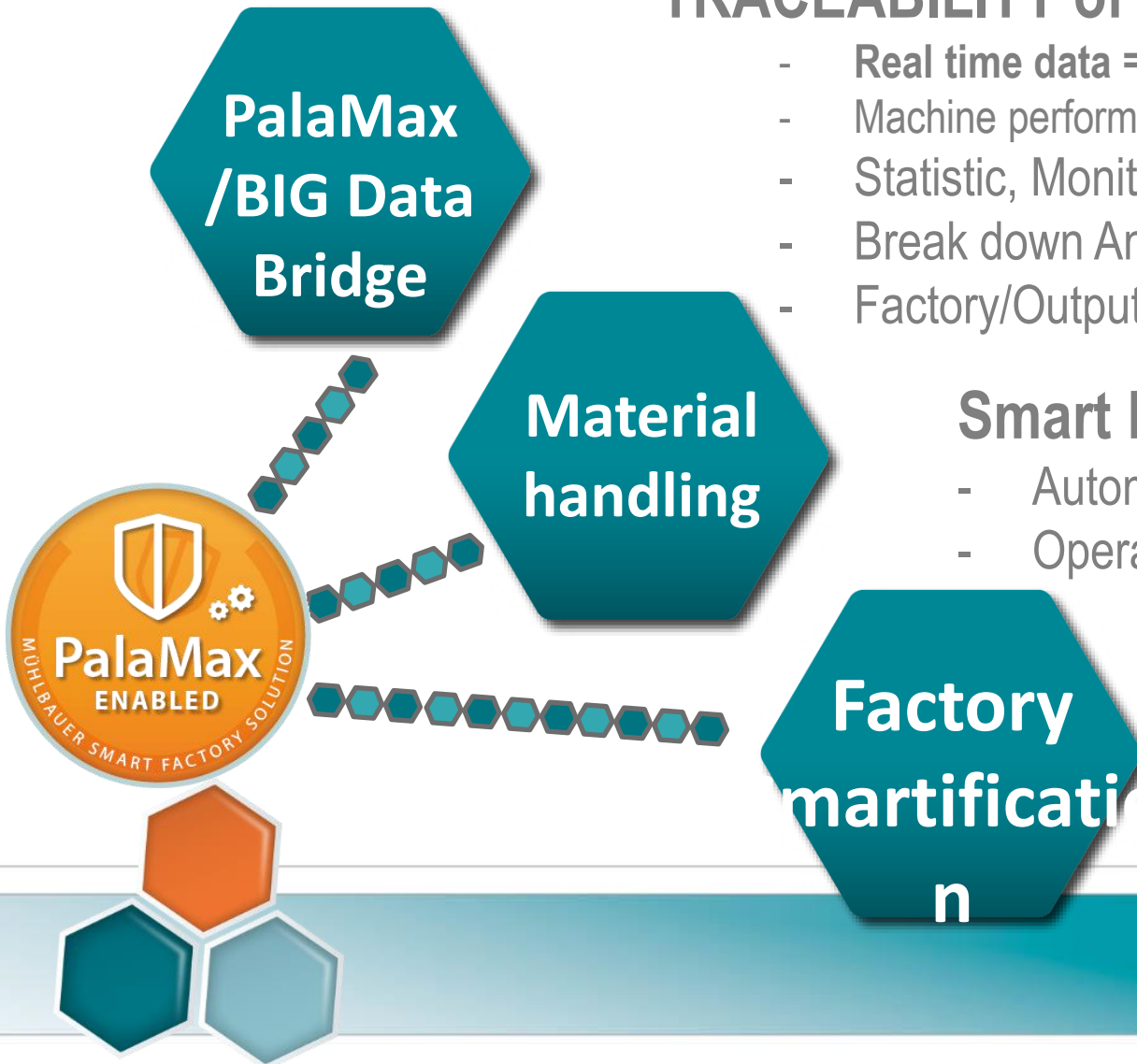
- Real time data => OPC/UA
- Machine performance & Product quality
- Statistic, Monitor, Reporting
- Break down Analysis
- Factory/Output Improvement

Smart Material Management

- Automatic Material Management (Wafer / Reels) by AIV / OHV
- Operator assisted product change over

Smart Product change over

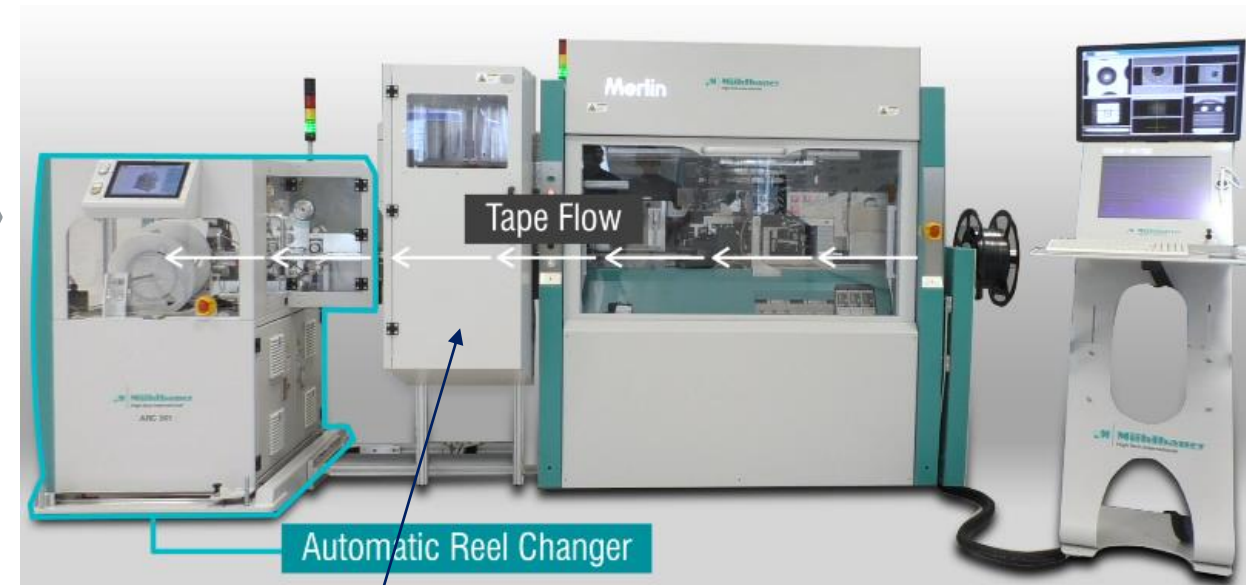
- Smart Product Change over, RMS
- Predictive Maintenance



MATERIAL MANAGEMENT

Consideration of Production Materials:

- Wafer in a Cassette (input)
- Can Automatically be Loaded with
 - AIV (Automatic Intelligent Vehicle)
 - or TOP LOADER via
 - Load Port solution



External Auto Wafer Changer / Load Port

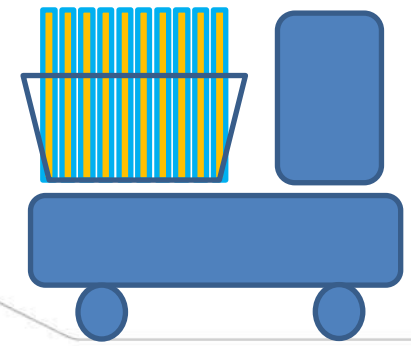
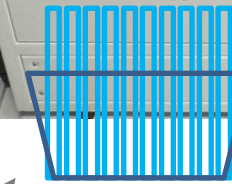
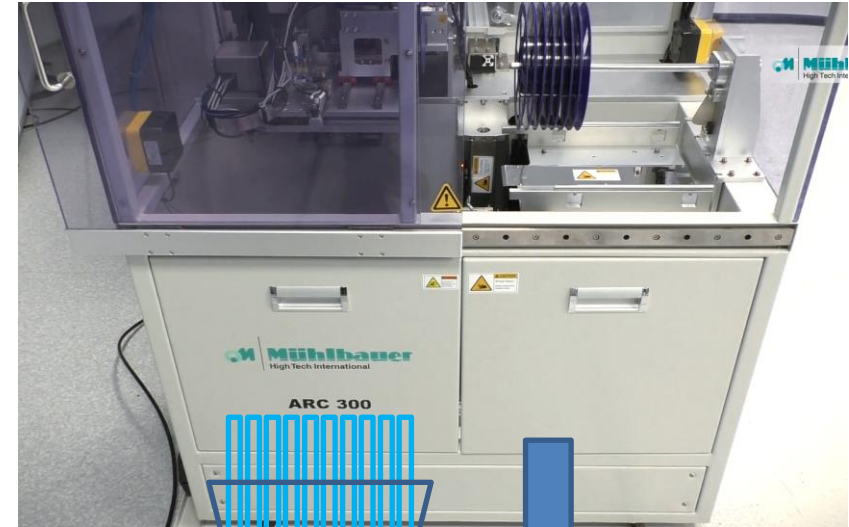


Factory Smartification



MATERIAL MANAGEMENT : OUTPUT REEL CONCEPT

- Software connection between die sorter and fleet manager via PalaMax
- AIV pick drawer box from warehouse
- Bring to die sorter by AIV
- Arrive and communicate with die sorter
- Change the empty cassette to a new cassette with new wafers automatically



Reel size
input/output
Batch type?



Factory Smartification



“CENTRAL CONTROL ROOM”

- Remote machine operation
- Save 50% TECHs on floor

MACHINE TRACEABILITY IN REAL TIME

- Detailed reporting tools
- Drill-down data analysis
- Identify error reasons and their root causes
- Improve production behavior
- Smart Factory / AIV communication

PRODUCT TRACEABILITY

- Drill-down analysis
- Get the VALUE of Vision inspection
- Identify reject reasons and their root causes



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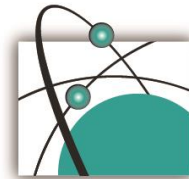
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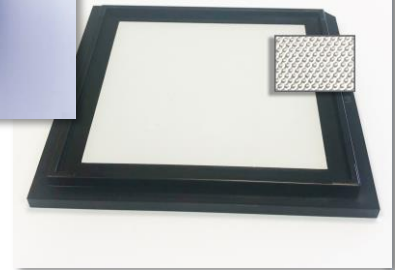
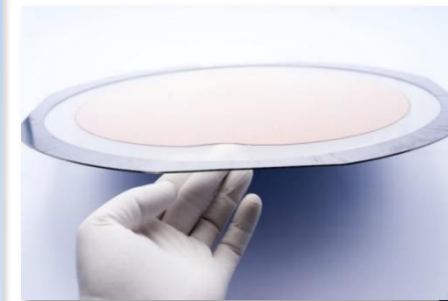
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