orbotech
A KLA Company

KLA

Photonics in the Digitization of the Electronics Industry

Dr. Avi Gross | Corp. EVP, CTO and Head of Innovation

August 30th, 2019

Orbotech at a Glance

Founded in 1981 in Israel

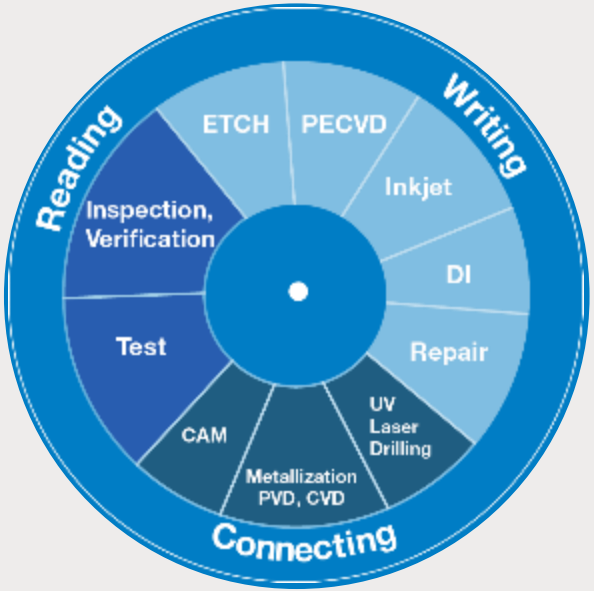
Multiple Industries

PCB - Printed Circuit Boards

FPD - Flat Panel Display

SDD - Semiconductor - MEMS, RF, Power

Advanced Packaging



> $1B Revenues in 2018

2,700 Employees

50 Offices (**20** in China)

3 Divisions

R&D

700 Scientists & Engineers

R&D Spending

13-15% of revenue - Consistent Investment through ups & down cycles

Global Presence

- 50 offices worldwide close to customers sites
- 2,700 employees
- Headquarters and main R&D in Israel

North America

Employees: 350
Offices: 4
CS Centres: 4
R&D Centre: 1
Production: 3

Europe

Employees: 530
Offices: 10
CS Canters: 5
R&D Centres: 2
Production: 3

Israel

Headquarters
Employees: 770
Main R&D & Production: 1

Pacific

Employees: 720
Offices: 22
CS Centres: 22
R&D Centres: 1

Asia East

Employees: 330
Offices: 13
CS Canters: 3
R&D Centres: 2
Production: 2

Our Flywheel Driving our Behavior

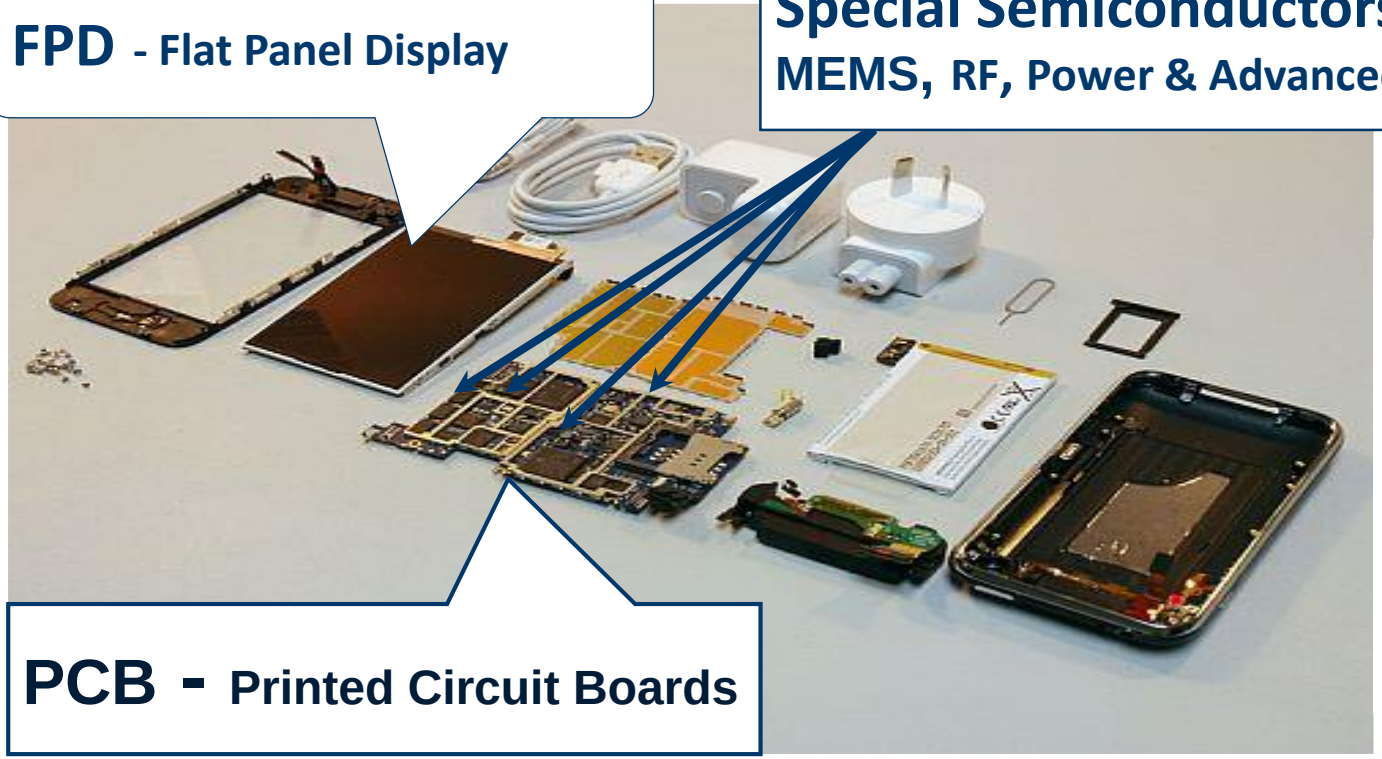
Our Strategic Objectives

Enable Customer Success	Innovate to Differentiate
Attract and Develop Talent	Enhance Productivity

The Markets - Virtually Every Electronic Device…

FPD - Flat Panel Display

Special Semiconductors -
MEMS, RF, Power & Advanced Packaging



PCB - Printed Circuit Boards

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Orbotech Solutions

PCB	FPD	SEMI


Laser Drilling


AOS


Direct Imaging


Inkjet


Plotting


CAM


AOI

Printed Circuit Boards


Test


Repair


Yield Mgmt


Metrology


AOI

Flat Panel Displays

First to market


Versalis


Release Etch


Etch


CVD


PVD

Semiconductors

Orbotech's - Core Technologies

Optics Camera

Fine Mechanics

Laser Scan Optics

Ink Jet Printing

Additive Manufacturing

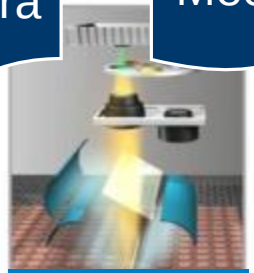
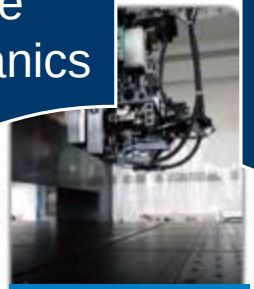


Image Acquisition



Fine Mechanics & Motion Control

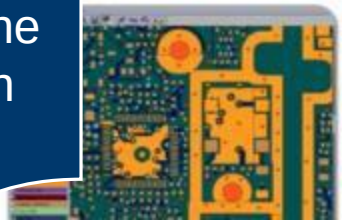
High Resolution Printing

InkJet Printing

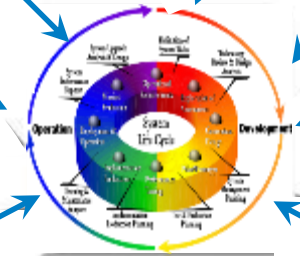
Laser Machining

Pulsed Lasers

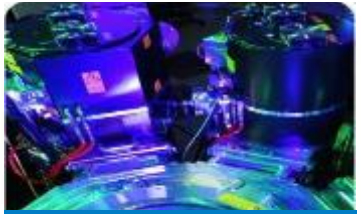
Machine Vision AI



Algorithms & Image Progressing



System Engineering



Wafer Processing

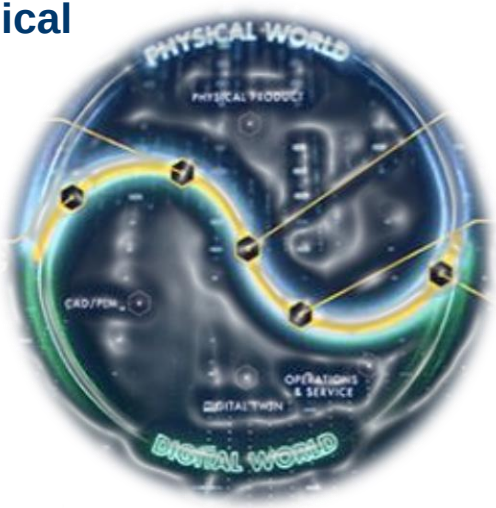
Plasma Vacuum

Smart Manufacturing

Fully-integrated, collaborative manufacturing systems that respond in real time to meet changing demands

Smart process on the PCB floor – Orbotech Tools:

- **The interface between the digital (virtual) world and the physical products <u>across the manufacturing floor</u>**
  - **Digital manufacturing process: from design to final product:**
    - **Fully computer controlled patterning**
  - **Yield management: hybrid approach**
    - **Traditional process combined with additive manufacturing capabilities**
  - **Feedback loops to control and manage quality and yield**

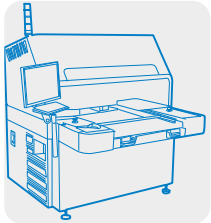


Smart yield management: Automatic Optical Inspection & Shaping (AOI&AOS)

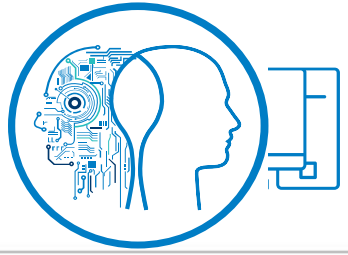
Feedback

Inspect and Measure → Analyze by AI On Shop Floor → Decide

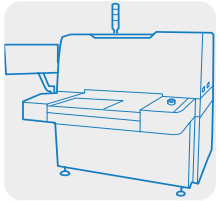
AOI



A.I.



AOS



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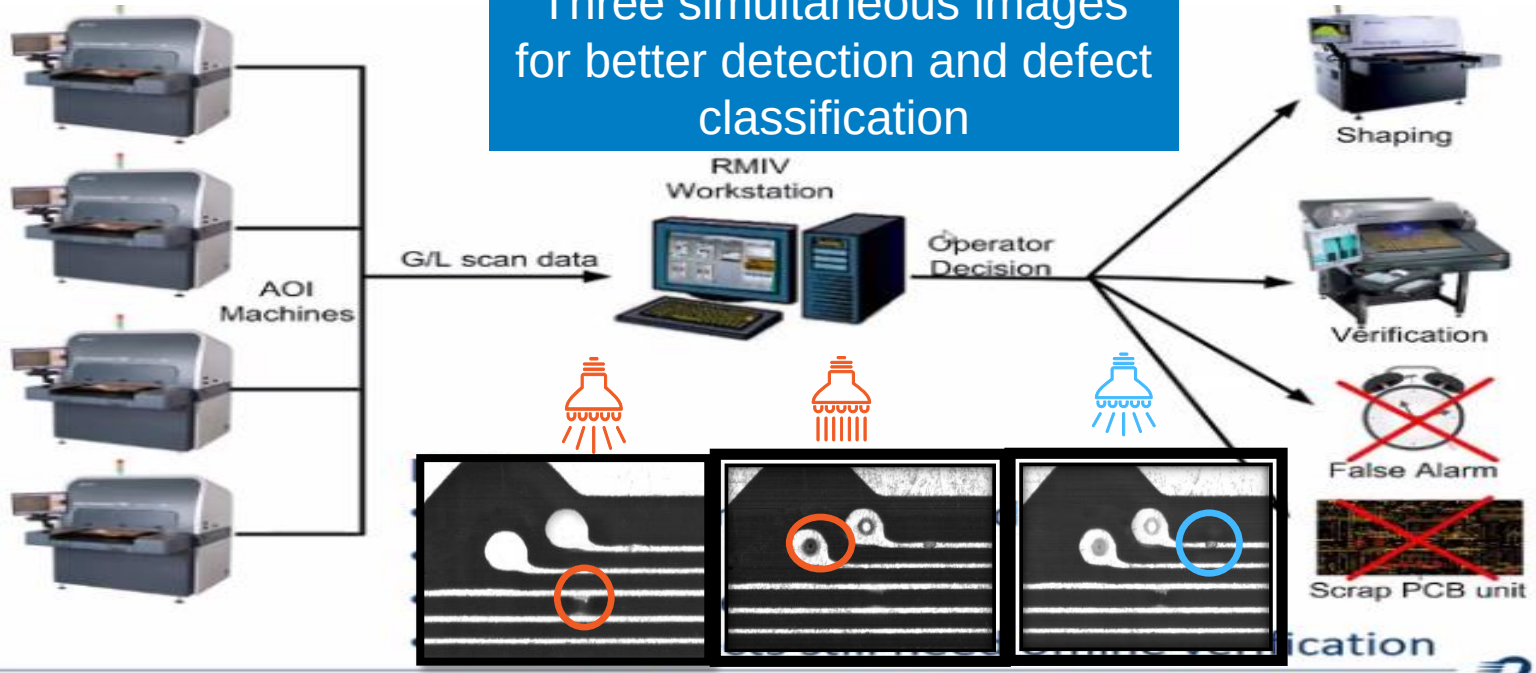
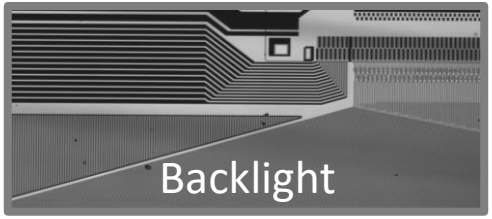
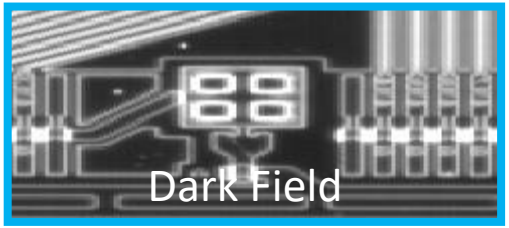
PCB – AOI Triple Imaging in one scan

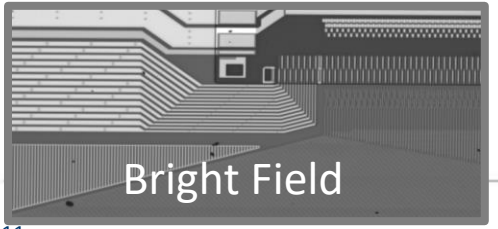
Three simultaneous images for better detection and defect classification



AOI for FPD: Advanced Multi-Modality







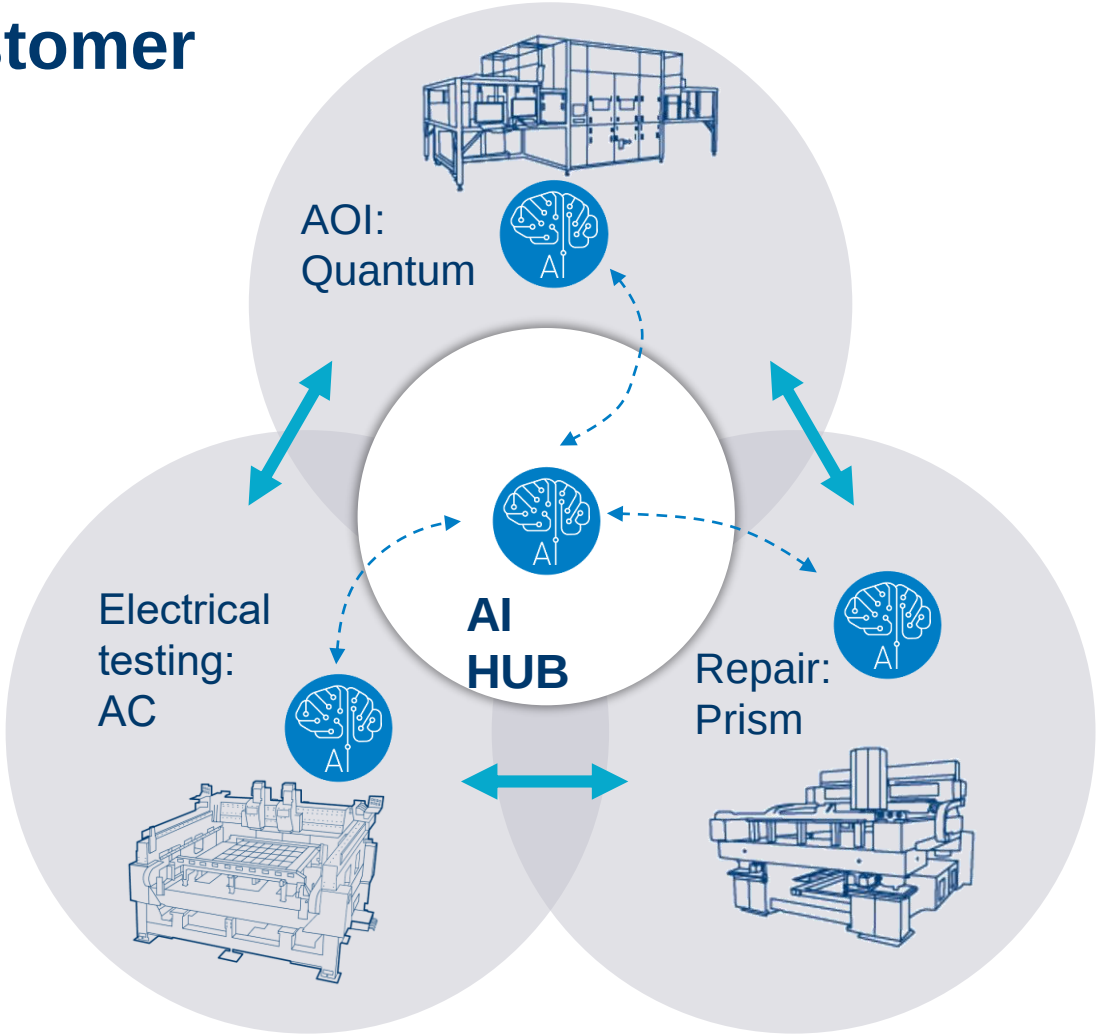
FPD Fab - Value to Customer

Yield Improvement

Labor Reduction

Fast Ramp-Up

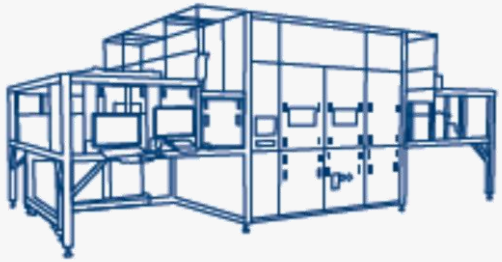
Early Alert



AI for Automatic Defect Classification

Application:

Advanced Video & In-Scan Classification based on Multi Modality information + Video

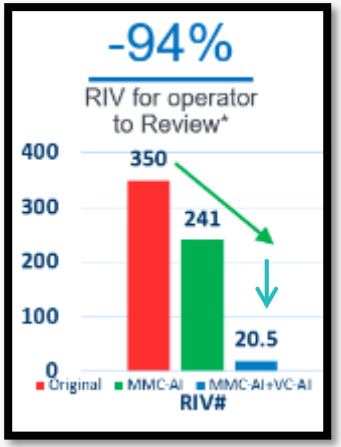


Value

Operational efficiency:
Save operators cost

Early Alarm for process events

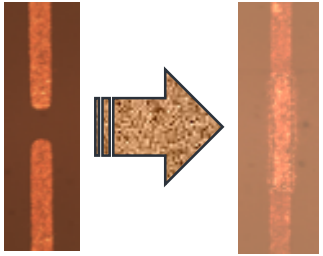
Yield Improvement:
RIV Killer rate capture increasing
Reduce operator mistakes



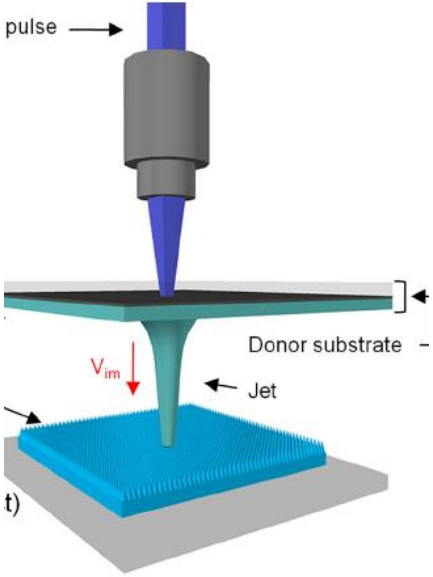
Current Process Shaping Products

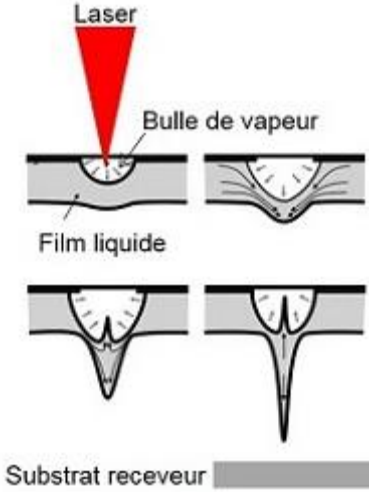
PCB shaping

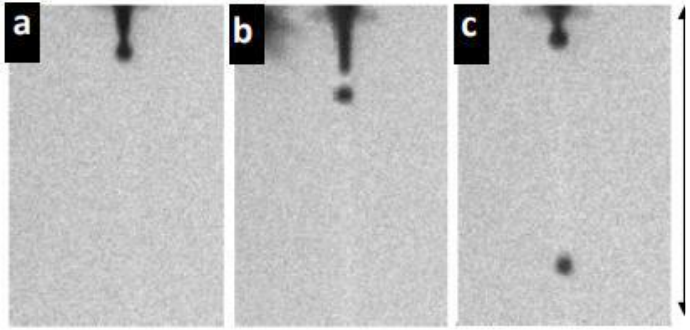
- Restructuring of defective copper patterns by laser ablation and molten metal droplet deposition

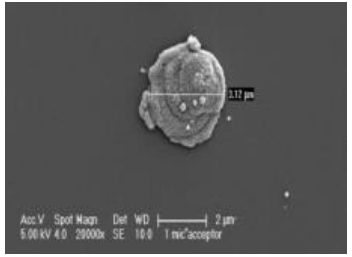


The Laser Assisted Process for Metal Deposition



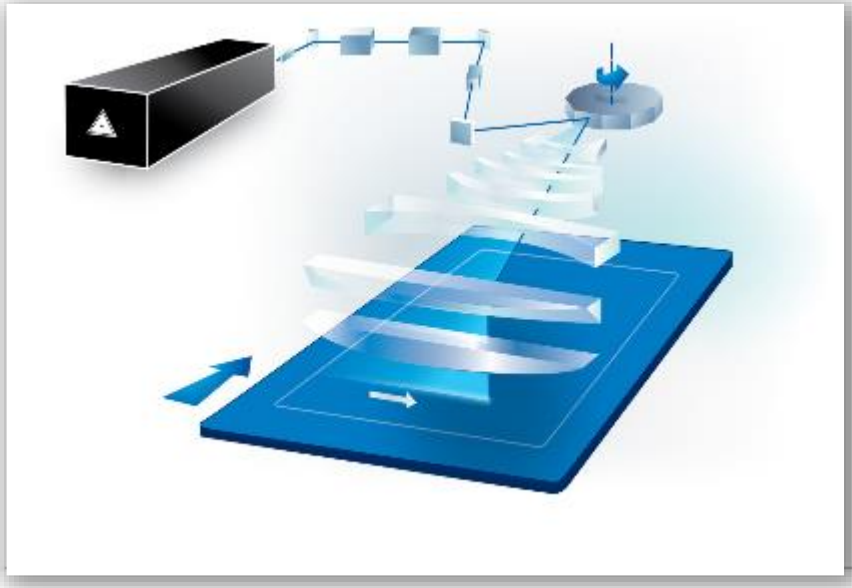






Orbotech Laser Direct Imaging Technology

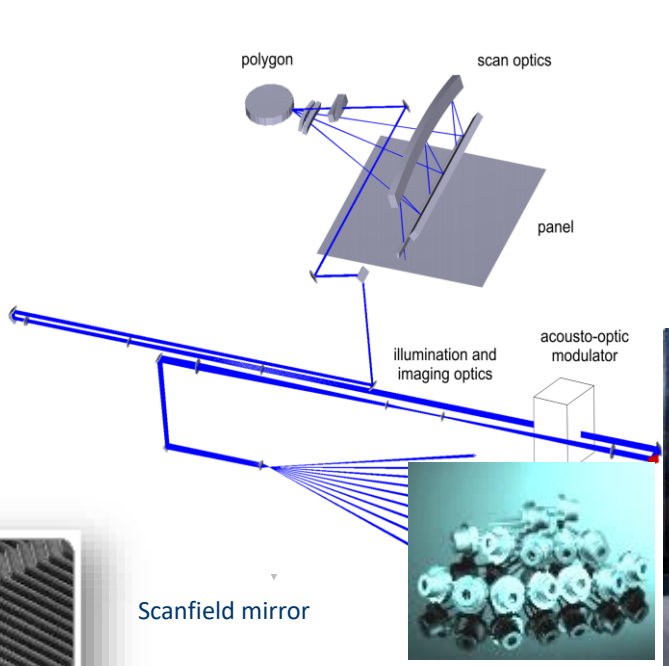
Laser Imaging tool to directly pattern the Printed Circuit
From SW design to the photoresist using Laser Scanning technology

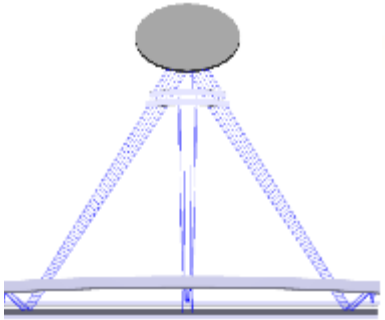


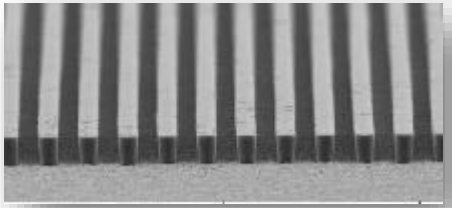
Laser Scan Advantage in DI: Largest Field of View

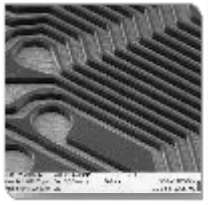
Advantages of Polygon scanners:

- Line scan optics: cost effective lenses with very large field of view (80,000 resolution spots)
- Diffraction-limited Depth of Focus
- Efficient use of laser power









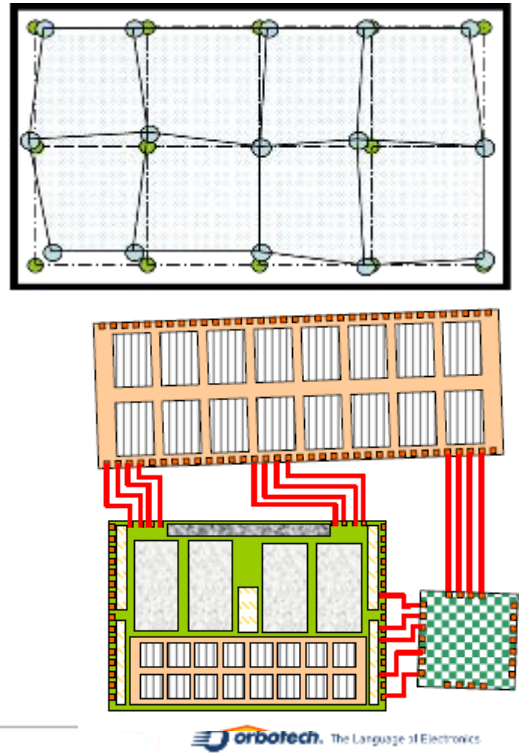
Largest Advantage of DI – Solves Distortion of Substrate

Challenge: during buildup substrates have non-linear distortion

Solution: global and local alignment of new pattern to underlying key features

How: Acquire registration information of substrate targets optically

- Use real-time transformation to adjust the data to the observed underlying feature
- Redesign pattern to correct distortion errors without breaking design rules



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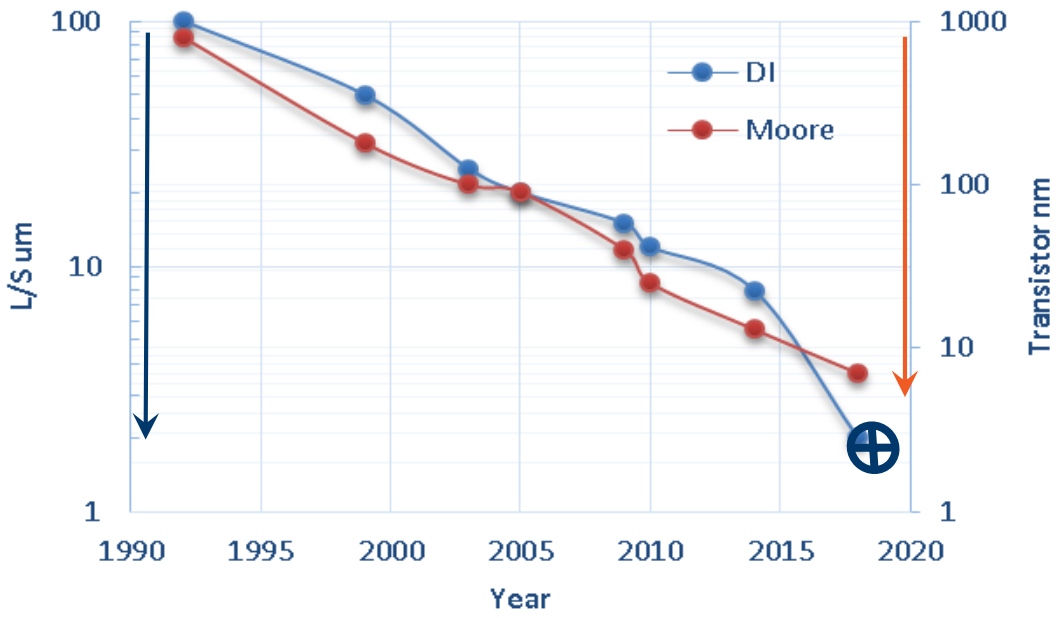
Future of DI Resolution



Thank you

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