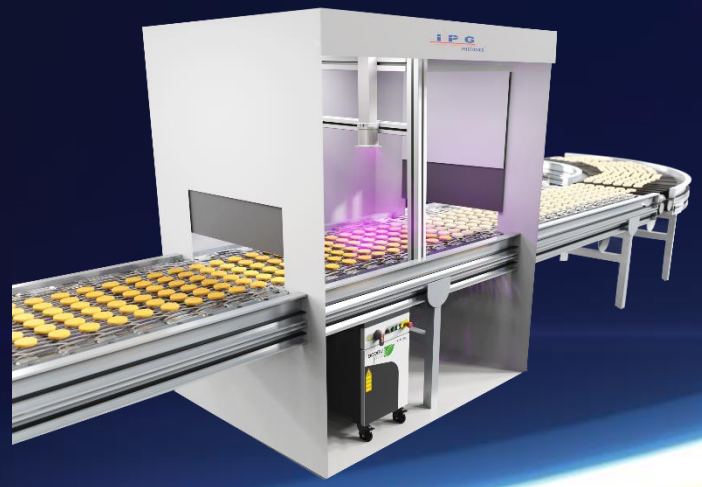
Laser Solutions for the Food & Beverage Industry

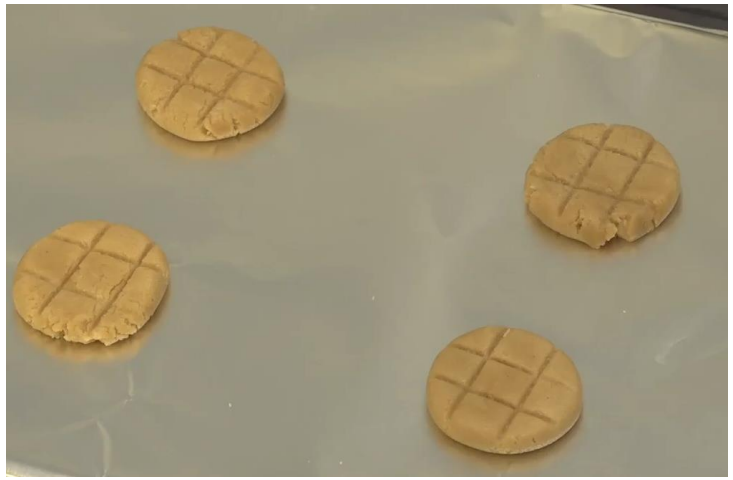
Presented by Toby Strite, April 8th 2024
Solutions Theater, Track B at 10:10 AM



Lasers I Solutions for the Food and Beverage Industry

Fast, Sustainable and Precise

Baking



Fast
- Peanut butter cookies in 90 sec

Efficient
- Heats the Product, not the Factory

Sustainable
- Low energy consumption
- No consumables or maintenance

Drying

Fast
- Dry apple slice in 10 min

Efficient
- “Cold Oven”, little waste heat

Precise
- Infrared metrology for temperature control

Cleaning

Fast
- 1,200 m^2/hr demonstrated

Effective
- Sterile, low contact angle

Sustainable
- No byproducts, low energy consumption

IPG Photonics At-a-Glance

1990
FOUNDED

~6,200
EMPLOYEES

20+
COUNTRIES

$1.4B
REVENUE

~100,000
LASERS SHIPPED

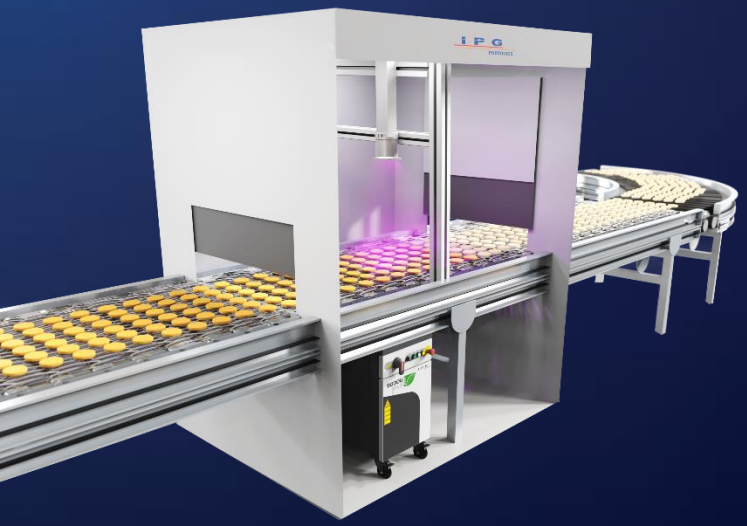
~9,000
TURNKEY LASER SYSTEMS SHIPPED

5,000+
CUSTOMERS ACROSS 6 MAIN INDUSTRIES
Based on 2023 Data

Nasdaq
IPGP
2004 IPO
Massachusetts HQ

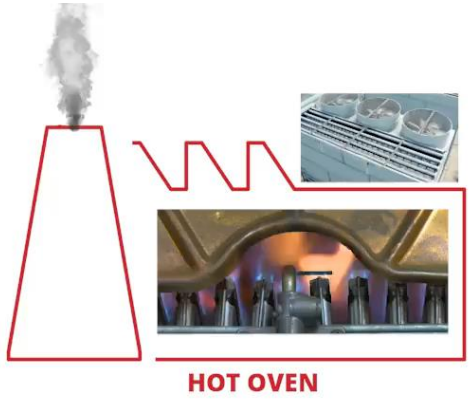
- World's largest volume supplier of Lasers to Industry
- Unique, vertically integrated Supply Chain
- Industry-leading earnings and cash flow

Laser Heater

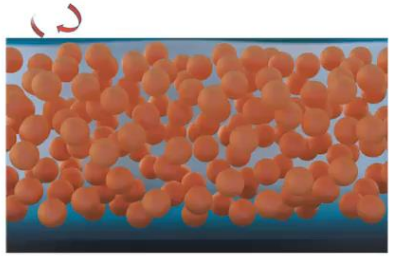


Laser Heater I Rethinking the Future

Lasers overtaking conventional ovens across many industries



HOT AIR
only dries the surface
which reduces throughput
and wastes energy



Sub-surface moisture requires time to be
drawn to the surface before it can be removed

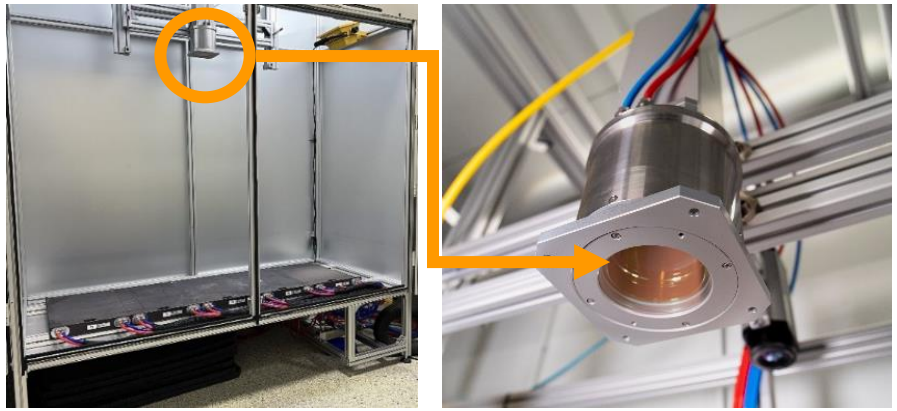
Food & Beverage Applications

- Pre-Heating
- Baking
- Drying

Industries engaging IPG

- Li-ion Battery
- Industrial Coatings
- Food & Beverage
- Chemical & Pharma
- Ceramics
- Silicon chipmaking
- Pulp & Paper

A ”Cold Oven” I DLS-ECO Laser Heater



DLS-ECO SERIES
“**Cold**” Oven Paradigm Shift

An Oven which isn’t Hot
- Heats only targeted material
- No thick oven walls
- Little heat radiates into the factory

Consumes energy only when on
- Off between batches
- Off overnight

Accessible
- Thermal process control

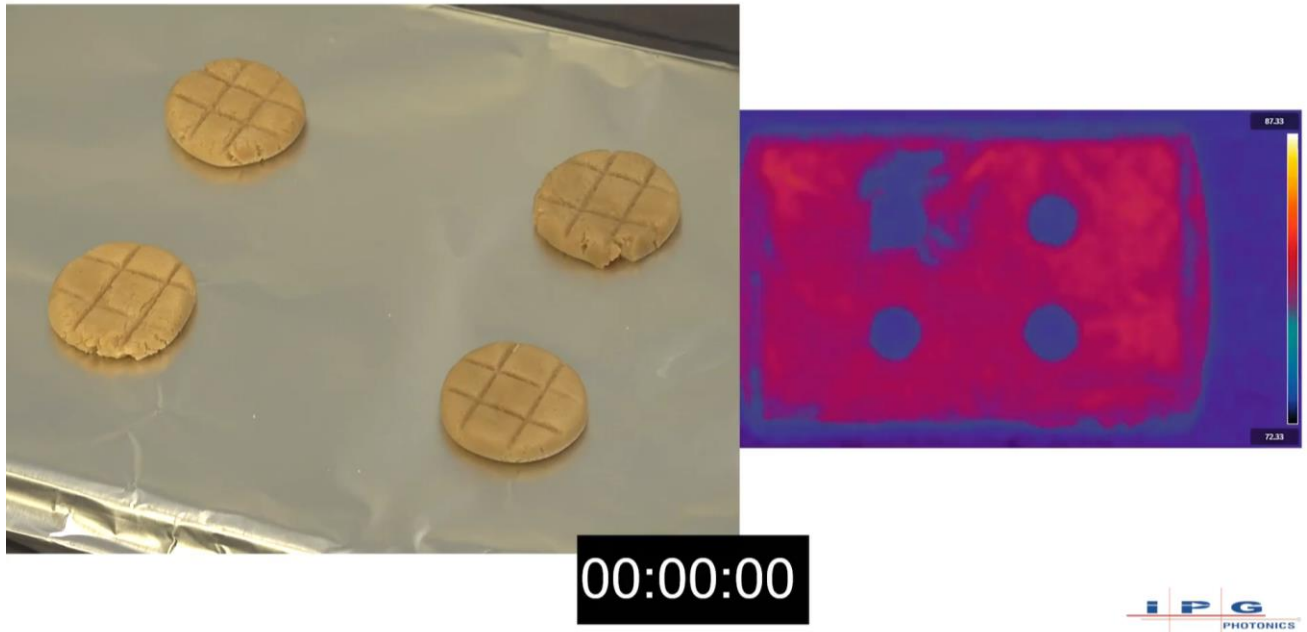
Baking I Peanut Butter Cookie Example

Peanut Butter Cookies

- Supermarket cookie dough
- Delicious after 90 sec at 290ºF

Manufacturer's Recommendation

- Preheat oven to 350ºF
- Bake 10-12 minutes



Drying I Apple Slice Example

Apple Slices

- Sliced around 1mm thickness
- Delicious after 10 min at 60ºC

DLS ECO

Apple Drying

IPG PHOTONICS

IPG PHOTONICS

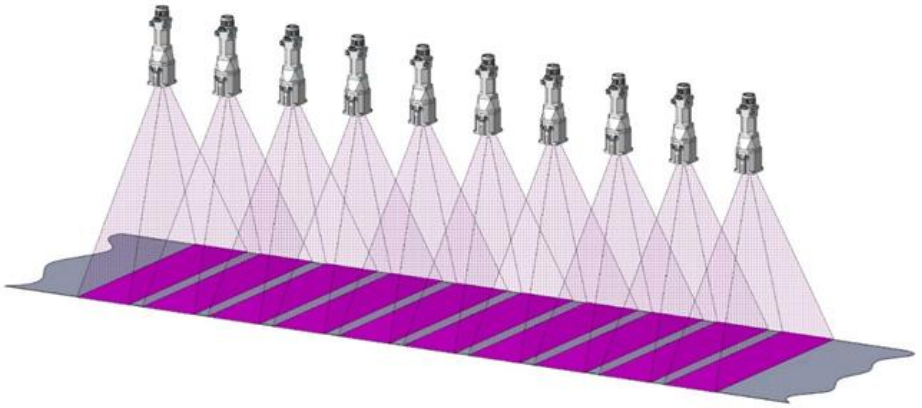
DLS-ECO Laser I Operating Advantages

Example from Lithium Ion Battery Factory

Energy Consumption - 500 kW Drying Oven

Replacement, Li-ion Battery, 90% utilization, US energy price

500 kW Dryer Optical Efficiency	DLS-ECO 55%	Non-IPG Laser 50%	IR Lamp 35%
Annual Energy Consumption (8000hrs/year)	**7.3 MW-hrs**	8.0 MW-hrs	11.4 MW-hrs
Annual Energy Cost ($0.15/kW-hr)	**$1,090,909**	$,1200,000	$1,714,286
Annual Savings at USA Energy Rates	**$623,377**	$514,286	N/A

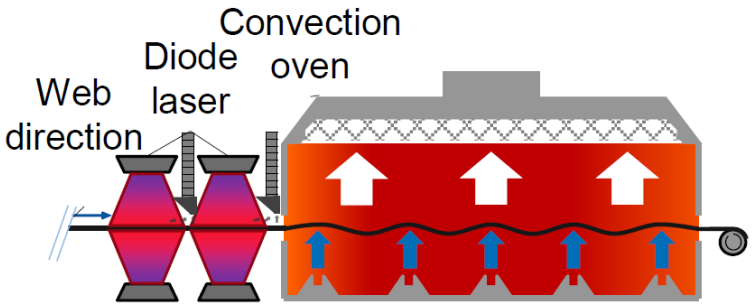
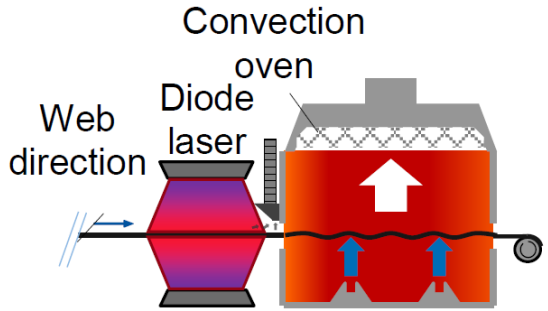


OpEx – Maintenance & Cooling

	DLS-ECO 55%	Non-IPG Laser 50%	IR Lamp 35%
Maintenance	**Zero planned maintenance - 7 years**	Replace Diodes every few years	Replace Lamps every 1 - 2 years
Thermal Management	**House Water**	Chiller, deionized water	Exhausts heat into Factory

DLS-ECO laser solution is maintenance free, easy to cool, requires less factory floor space

Hybrid Ovens I Retrofit / Upgrade Strategy

Use-Case	Throughput Increase	Footprint Reduction
Concept		

Retrofit – Laser pre-dried/heated product travels faster through existing long oven

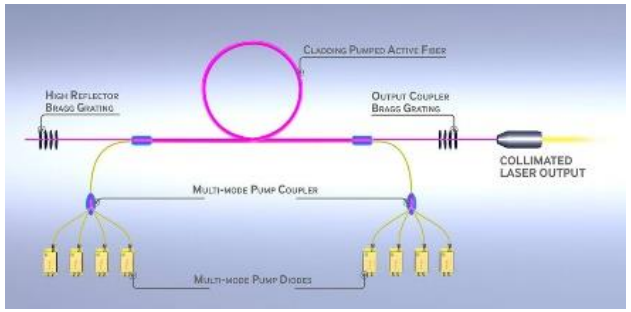
Green Field – Laser pre-heat enables shorter oven

Hybrid – Leverages fast, efficient laser pre-heat, preserves convection baking outcome

Laser Heater I Mature Product Platform

Workhorse Industrial Fiber Laser with minor alterations

Industrial Fiber Laser



Industrial Diode Heater

Components for high brightness removed

Upgrade to diode lasers optimized for efficiency, driven at lower current

Transition from focus to projection optics

DLS-ECO I Turnkey Lab System

Class 1 fully enclosed DLS-ECO solution enables in-house R&D and applications development

- Class I certified – no additional laser safety requirements
- Integrates DLS-ECO laser
- Dual monitors for infrared and visible viewing
- Thermal control loop tightly regulates sample temperature
- Write, save, repeat and edit job files
- Manually adjustable z-axis
- Fume exhaust management, thermal cold-plate
- IPG chiller or house water cooling options

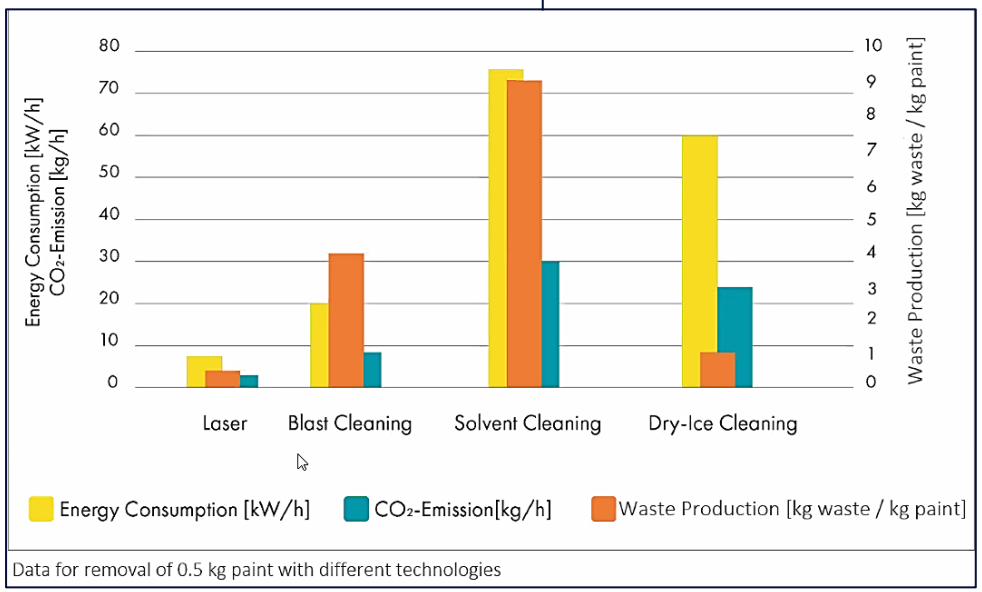
IPG PHOTONICS

Laser Cleaning

Laser Cleaning I Sustainable Alternative

Fast, Sterile, no Byproducts, Touch-Free, Selective & Safe

Touchless	Sustainable	Selective	Safe	Cost effective
No substrate damage	No chemical or blasting media required	Clean only where & what needs cleaning	Easy to operate, non-toxic & quiet	Maintenance free laser 100,000+ h



Data for removal of 0.5 kg paint with different technologies

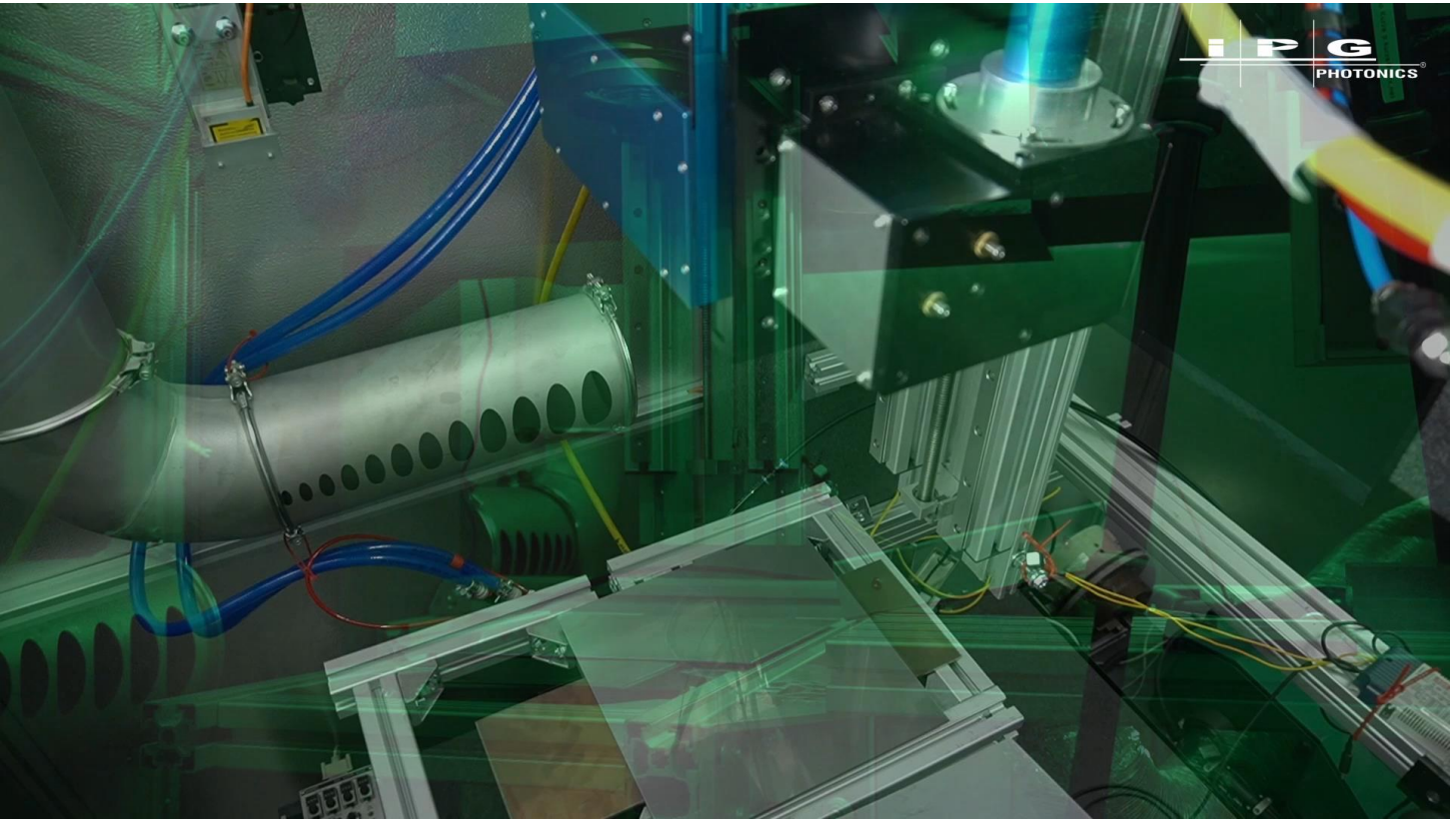
No more sandblasting dust

No more chemicals

No noisy ice cleaning

Laser Cleaning I Speed Record

200 milliseconds to degrease an 8.5”x11’ metal surface



High Speed Scanner

- Degreasing and drying (lightest cleaning tasks) are scanner-limited
- New scanners unlock full potential of laser cleaning
  - Laser spot moves >1 km/sec
- This cleaning demo amounts to 1,200 m^2/hour!

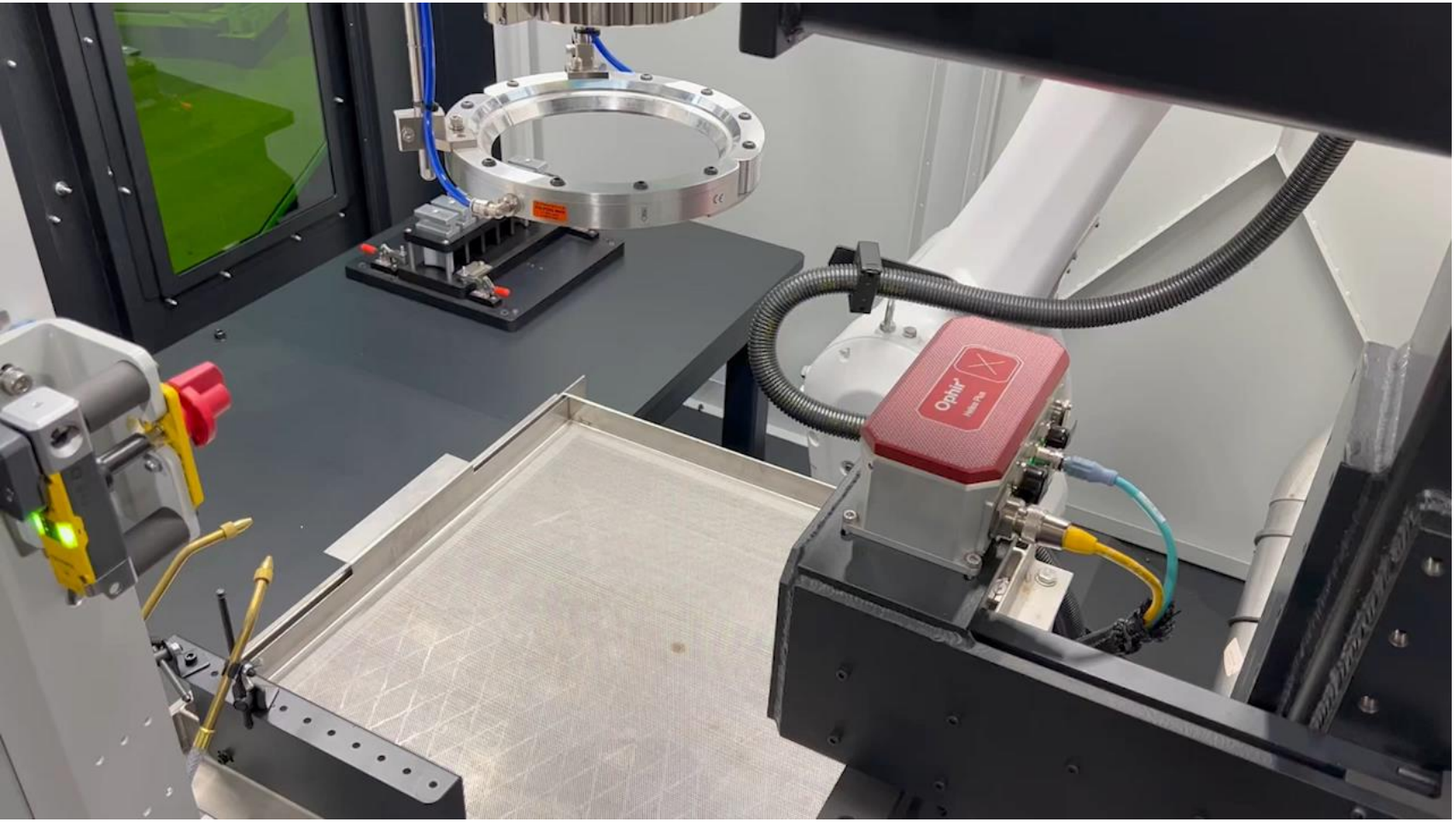
Laser Cleaning I Bakeware Example

Fast, Sterile, no Byproducts, Touch-Free, Selective and Safe

Clean enough to eat off…

Laser Cleaning I Suited for Automation

Fast, Sterile, no Byproducts, Touch-Free, Selective and Safe



Aerospace Turbine Example

- Robotic Cleaning Cell
- High Value parts refurbished
- Touch-free, laser cleaning is efficient, extends part life
- No by products, ablated coating is sequestered by fume management system

Laser Cleaning I Mature Portfolio

Components

- Nanosecond Pulsed Lasers
- Scanning Beam Delivery

Systems and Software

- Robotic and Cartesian
- Recipe Library
- Automated Toolpath Calculations

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