



San Jose, CA

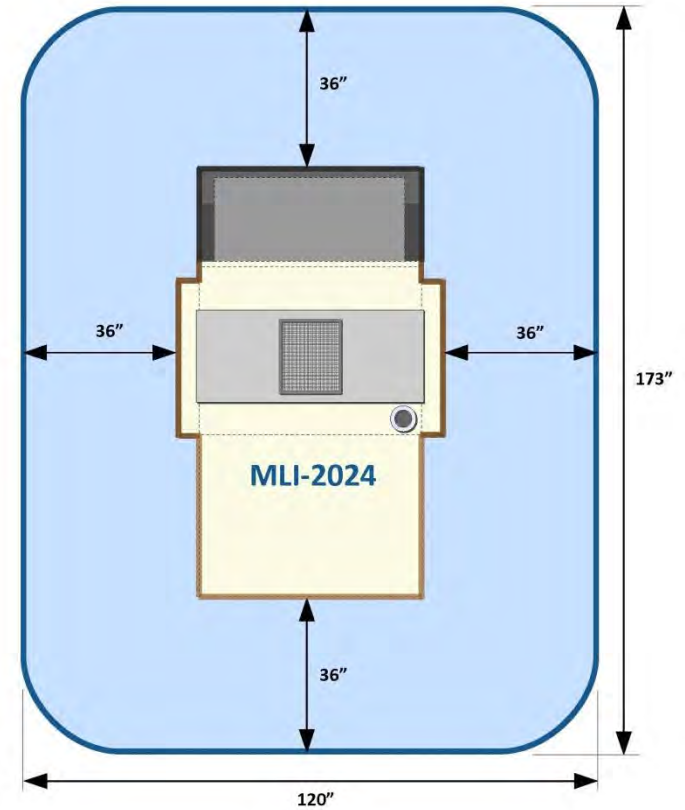
maskless
lithography

New Direct Imaging Technology

- ▶ Maskless Lithography's patented new process using DMDs (Digital Micro Mirrors) and "Grey Level Imaging" offers high speed production capability for imaging Printed Circuit Boards.
- ▶ While addressing the Industry's most demanding circuits, the Maskless system transfers CAD image data directly to ANY conventional Dry Film Resist with superior accuracy and unmatched throughput.



The System



The System

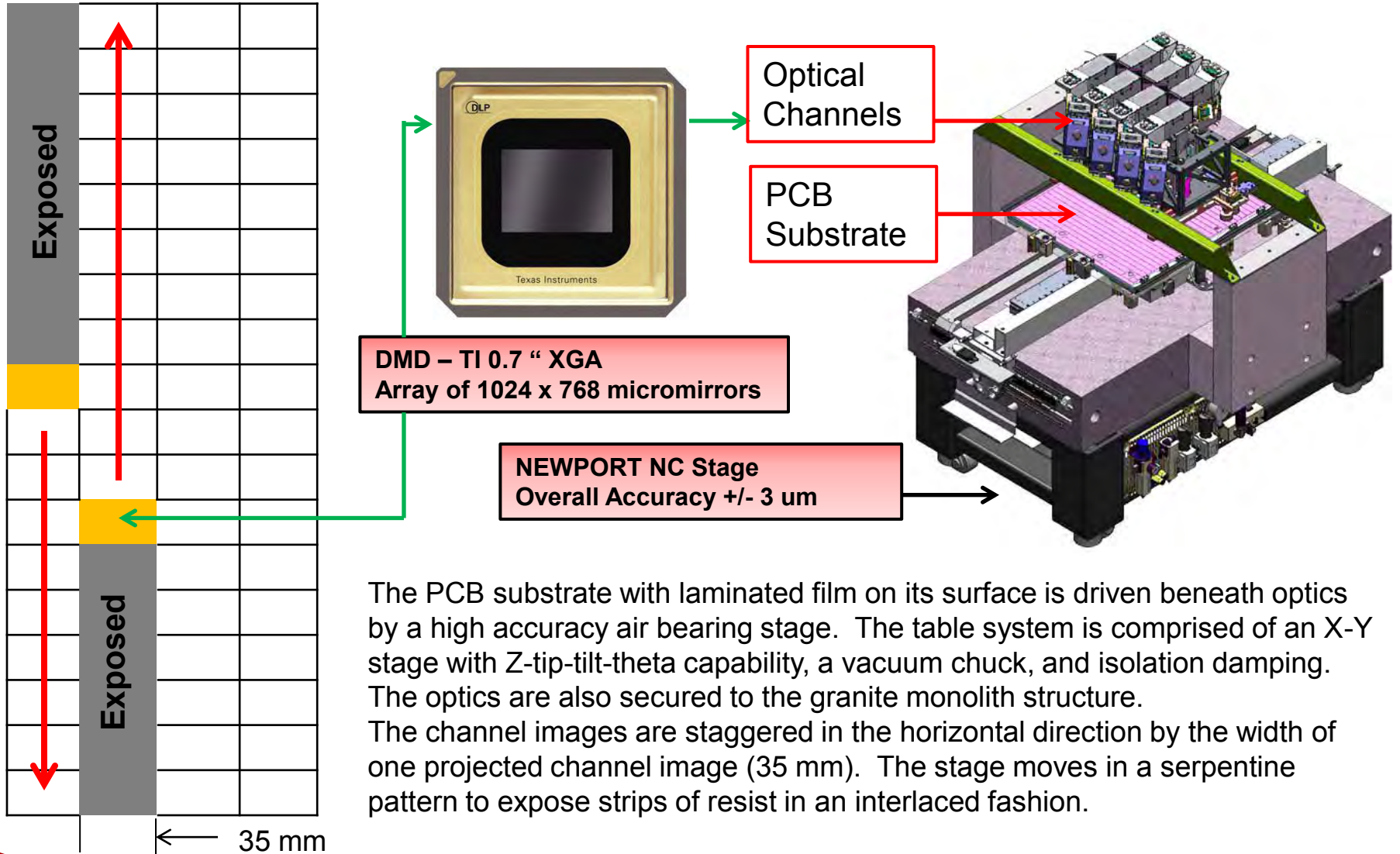


Environment



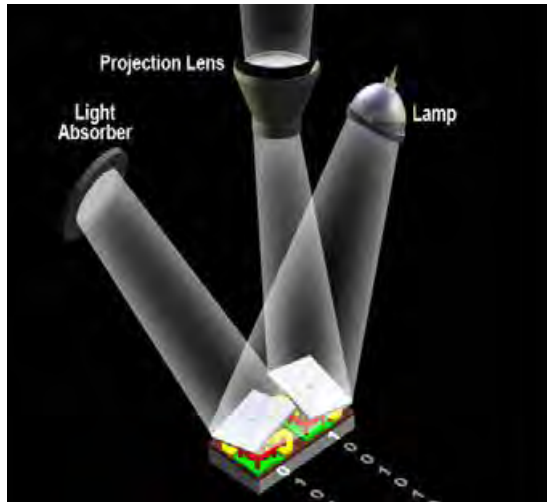
- Straightforward to operate
- Fits in the same space as a standard contact printer
- No special cleanroom required

The Key Components



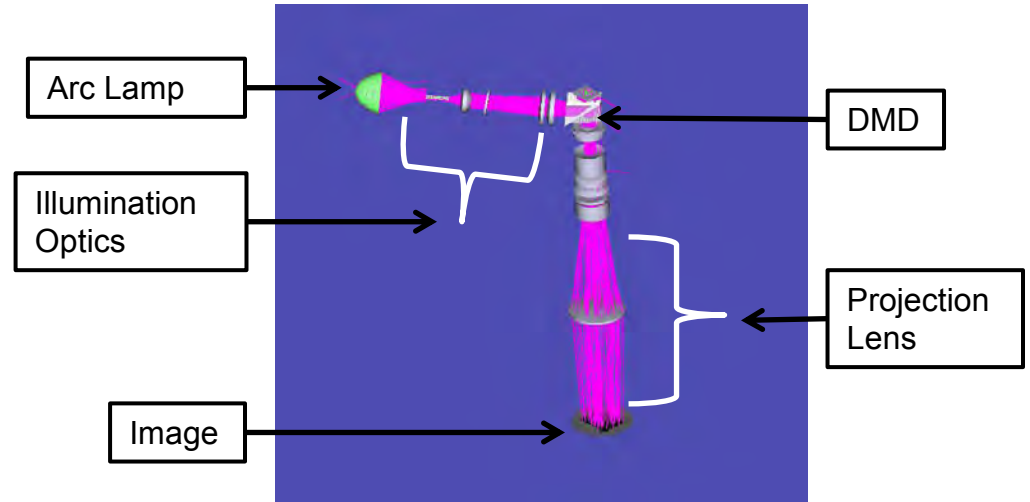
The PCB substrate with laminated film on its surface is driven beneath optics by a high accuracy air bearing stage. The table system is comprised of an X-Y stage with Z-tip-tilt-theta capability, a vacuum chuck, and isolation damping. The optics are also secured to the granite monolith structure. The channel images are staggered in the horizontal direction by the width of one projected channel image (35 mm). The stage moves in a serpentine pattern to expose strips of resist in an interlaced fashion.

The Key Components



DMD

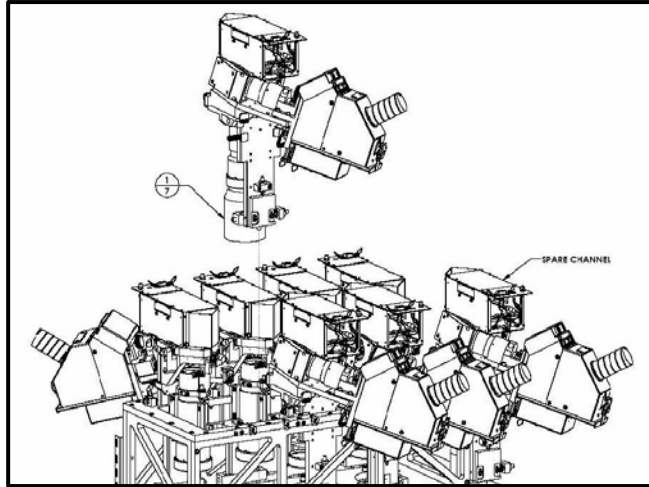
In the DMD, the mirrors are spaced on a 13.68 μm pitch, and flip about an axis at 45° azimuth. The mirrors can be in one of two rotation states, either $+11^\circ$ or -11° about the axis. Either state may correspond to the ON or OFF state depending upon the illumination.



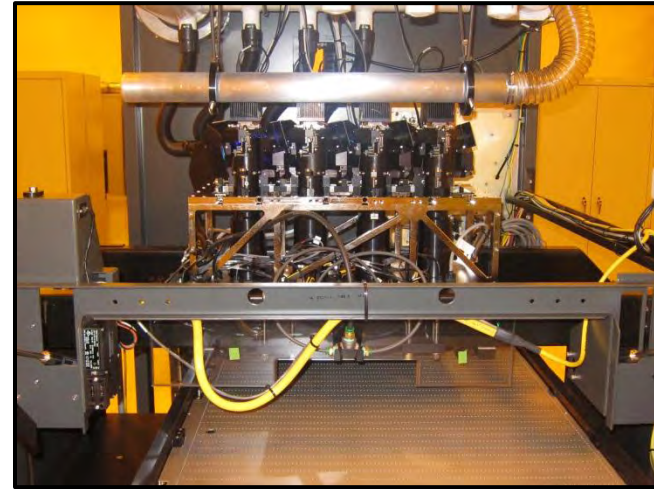
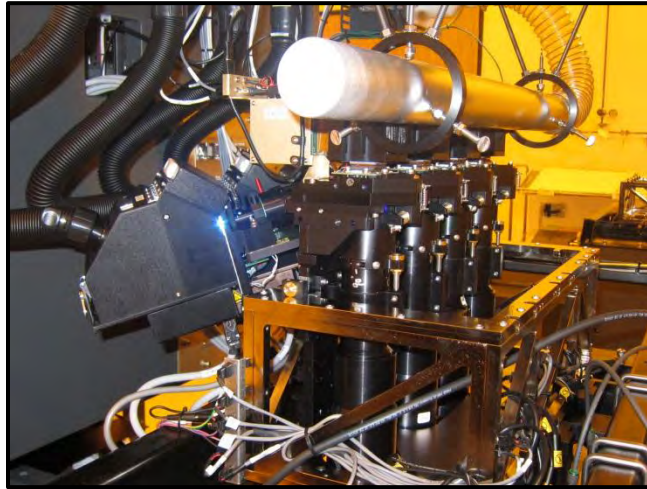
Optical Channel

Each DMD is illuminated with UV light from a 200W mercury metal halide arc lamp, filtered to pass only the spectral region encompassing the mercury I (365 nm) and H (405 nm) lines. The light is conditioned to uniformly illuminate the DMD via an illumination scheme similar to that found in many commercial DLP[®] projectors.

Channel Optics

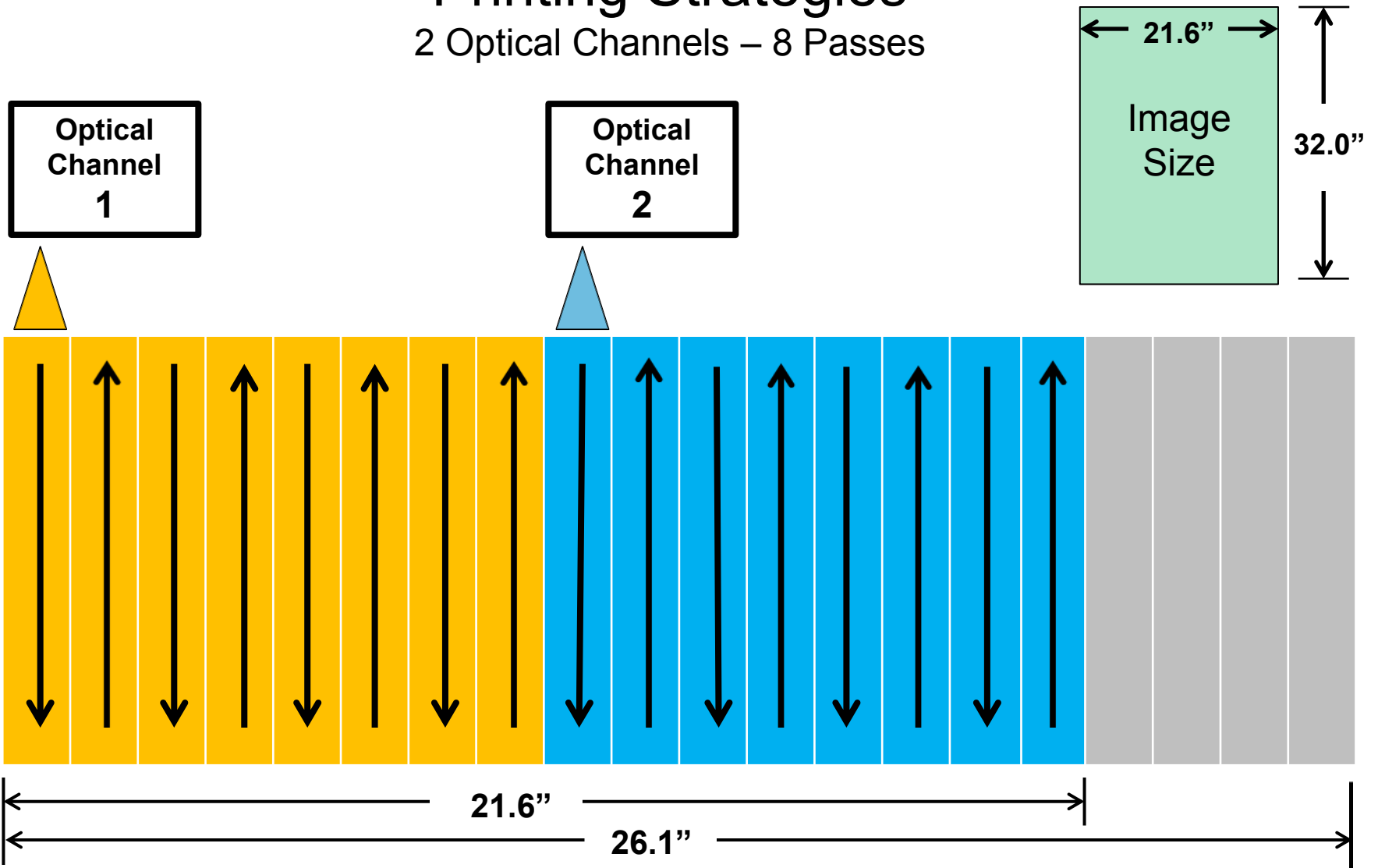


The number of optical channels can be varied to suit the print speed and cost requirements of the customer.



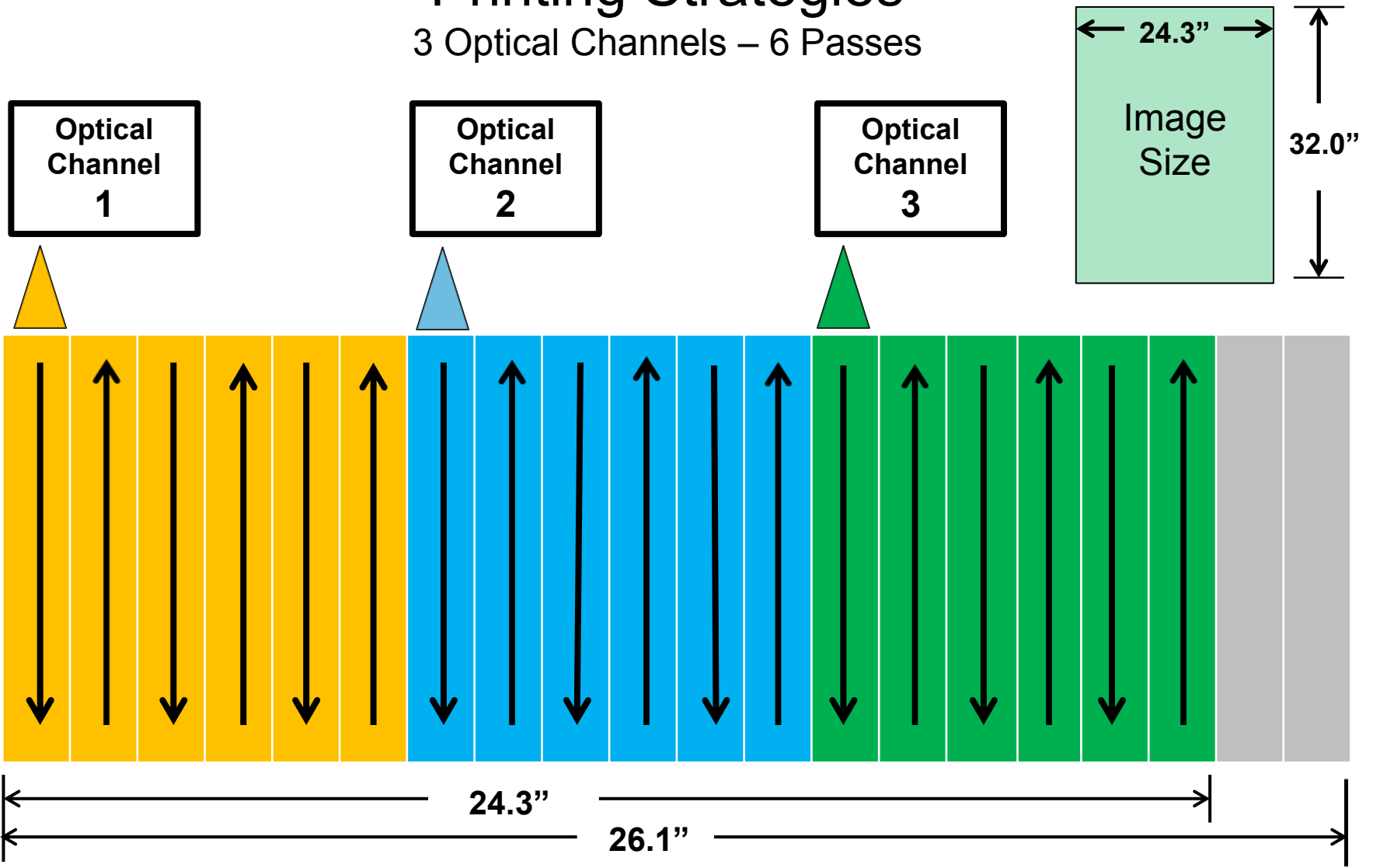
Printing Strategies

2 Optical Channels – 8 Passes



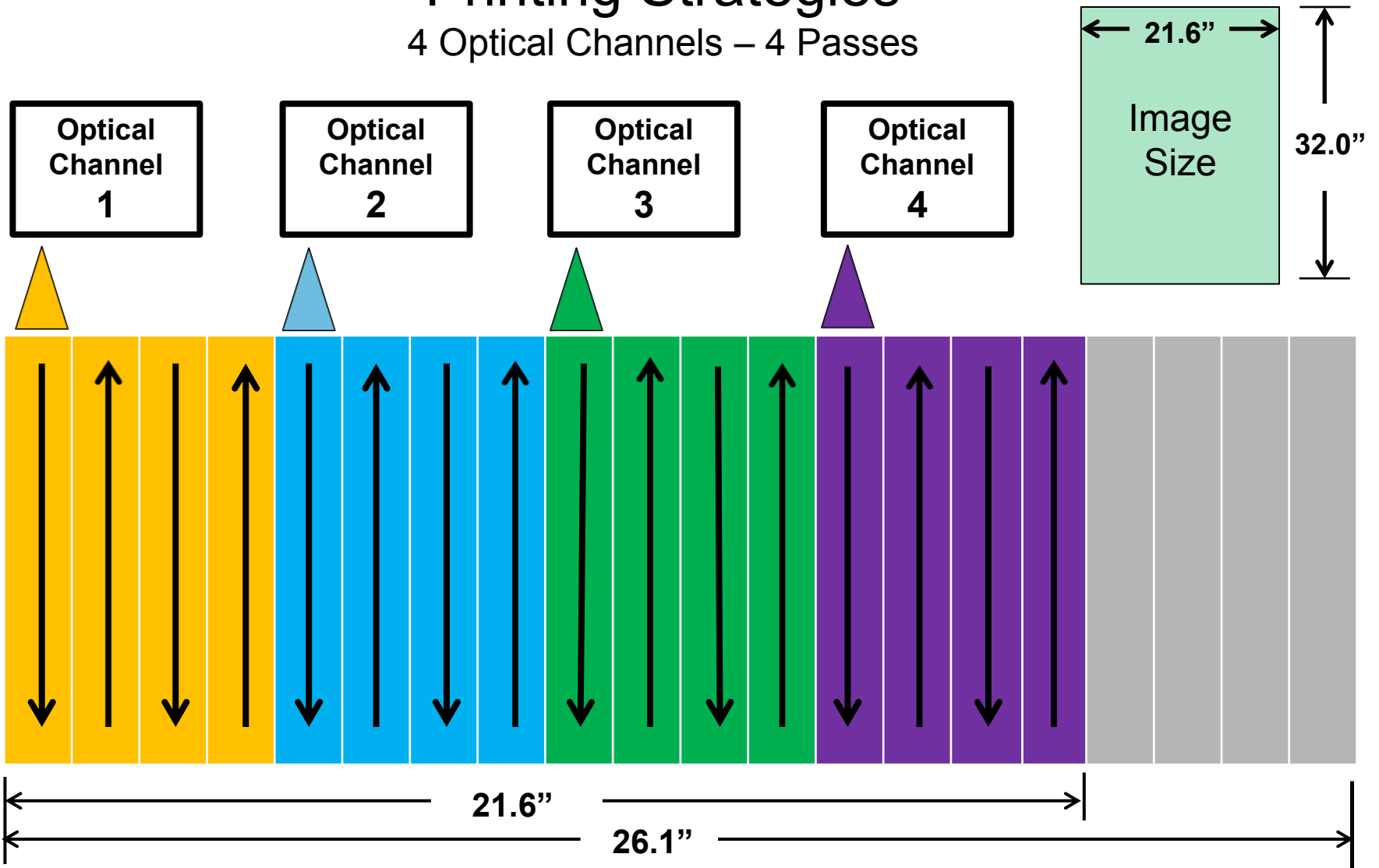
Printing Strategies

3 Optical Channels – 6 Passes



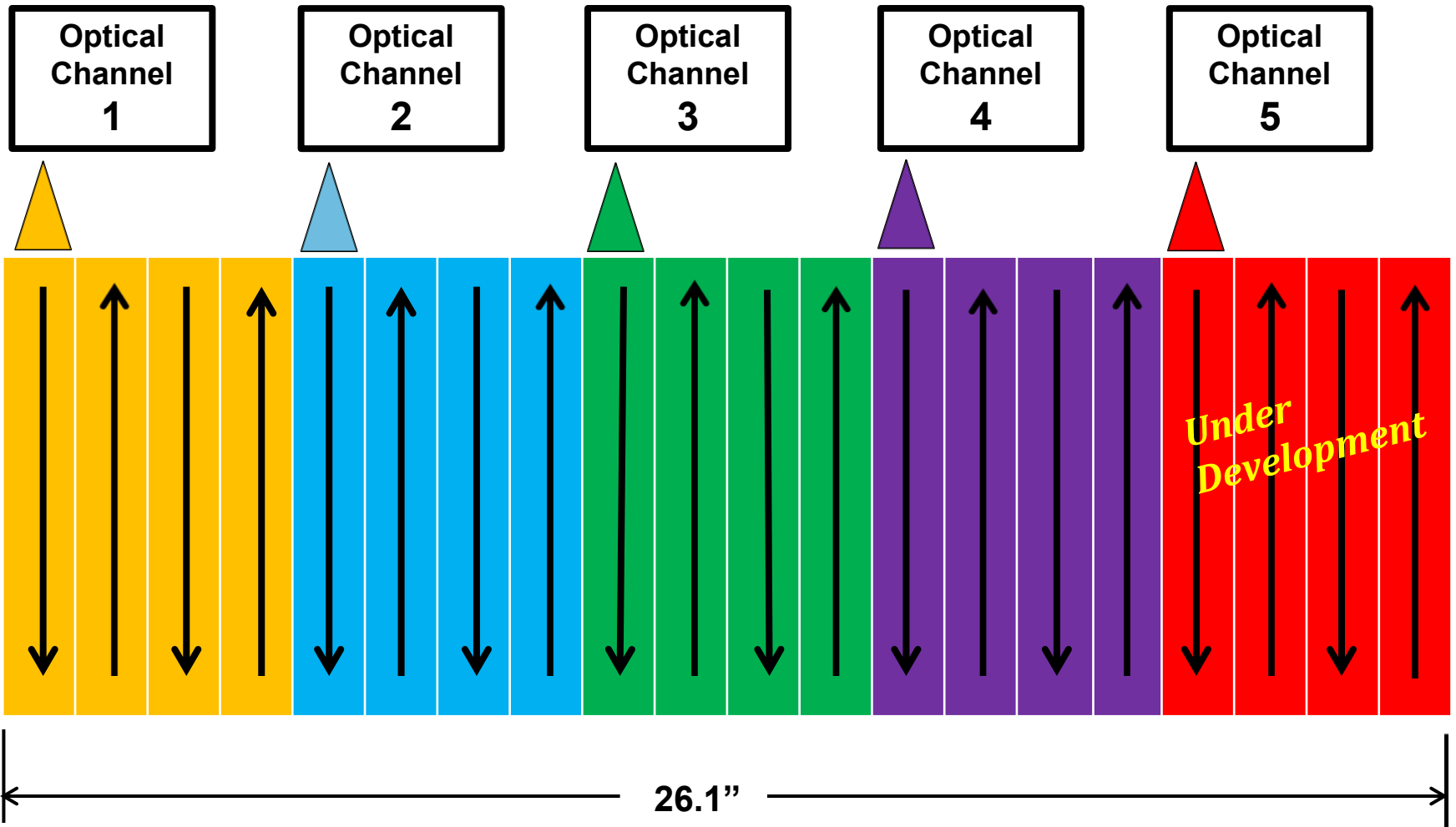
Printing Strategies

4 Optical Channels – 4 Passes



Printing Strategies

5 Optical Channels – 4 Passes



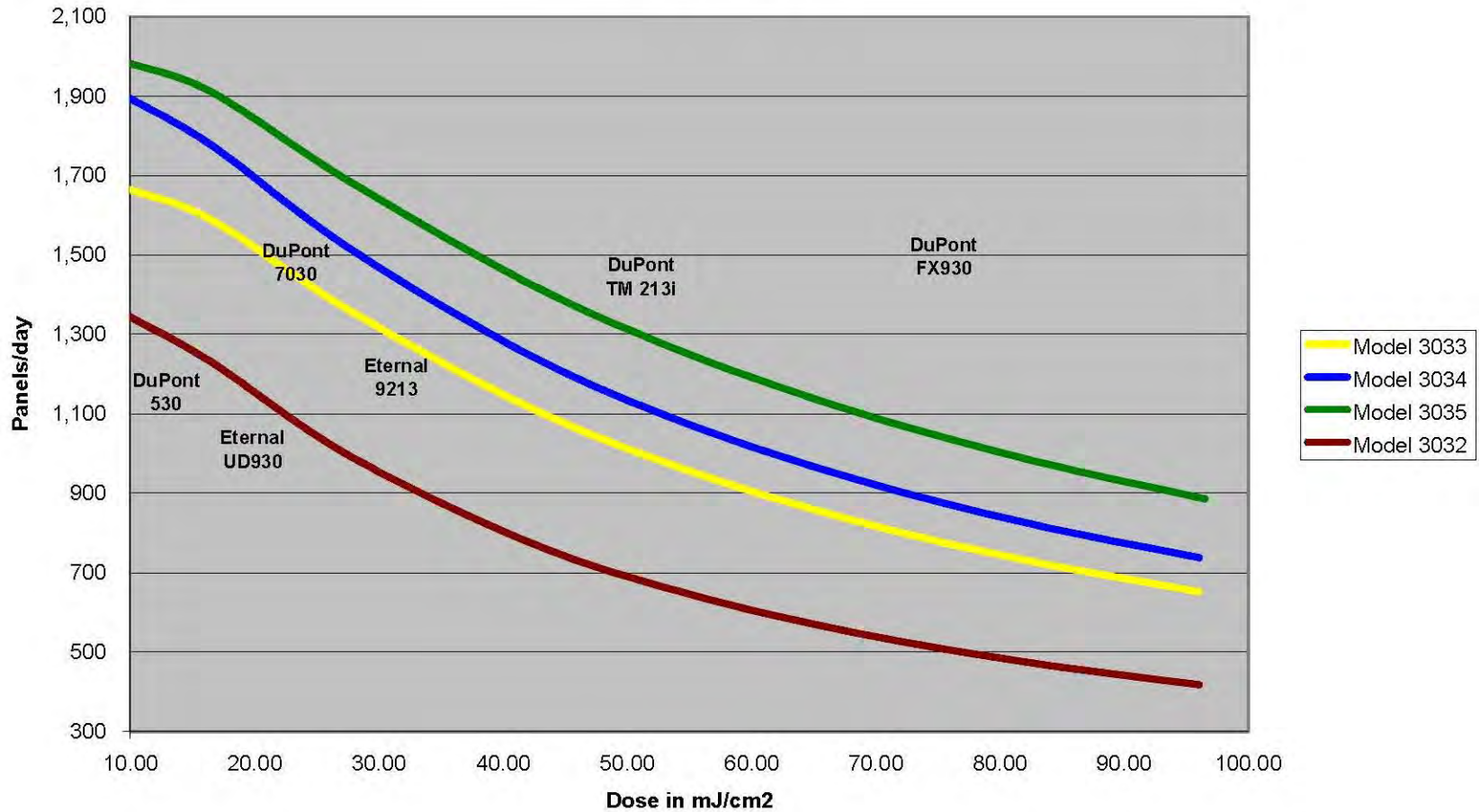
Capacity and Throughput

Calculation Assumptions

- ▶ Setup Time 60 seconds
- ▶ Lot Size 20 panels / lot
- ▶ Hours per day 20 (for production)
- ▶ Panel Size 18" x 24"

Capacity and Throughput

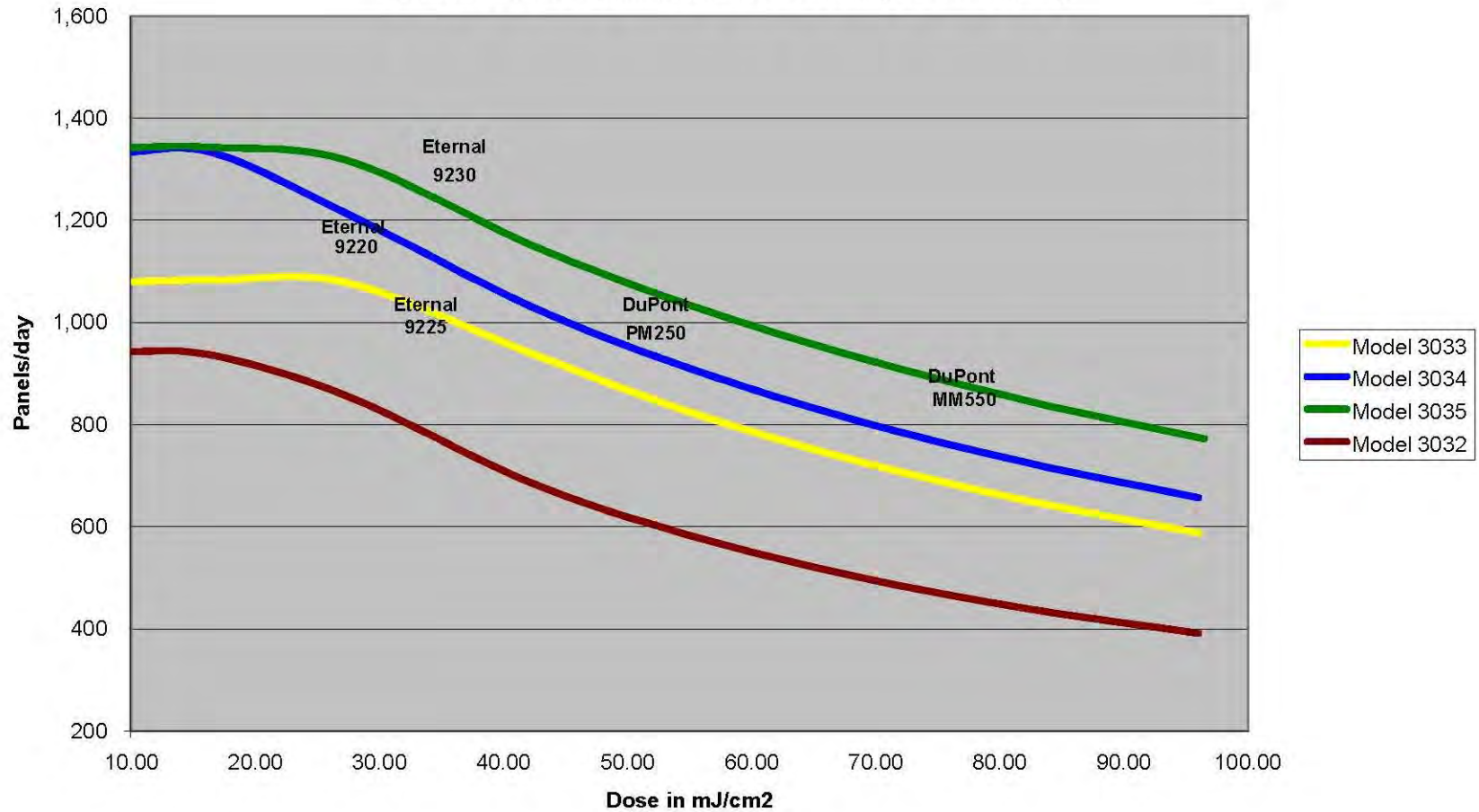
Maskless Lithography, inc.
Comparative Throughput for 18" x 24"
Innerlayer Panels



Capacity and Throughput

Maskless Lithography, inc.
Comparative Throughput for 18" x 24"
Outerlayer Panels

(includes 4 point alignment with data re-scaling on each surface)



Capacity and Throughput

Imaging Throughput—Inner Layer (18" x 24" Panel)										
	Prints per Hour *					Est. No. of Panels / Day *				
Resist Sens. (mJ/cm ²)	10	20	30	40	50	10	20	30	40	50
MODEL 3032	140	120	100	80	70	1325	1200	950	825	700
MODEL 3033	175	160	140	120	105	1650	1500	1300	1125	1000
MODEL 3034	200	180	160	130	110	1900	1725	1450	1275	1150

* assuming 6 seconds operator time

Panel Registration

- ▶ Panel Registration

Inner Layer

“Hole Free” front to back registration is automatically maintained through the Maskless patented alignment technology.

Outer Layer

For outer layer or HDI alignment, the unit uses CCD cameras to first capture mechanical or laser drilled holes, then rescales the customer data for a precise fit on the substrate.

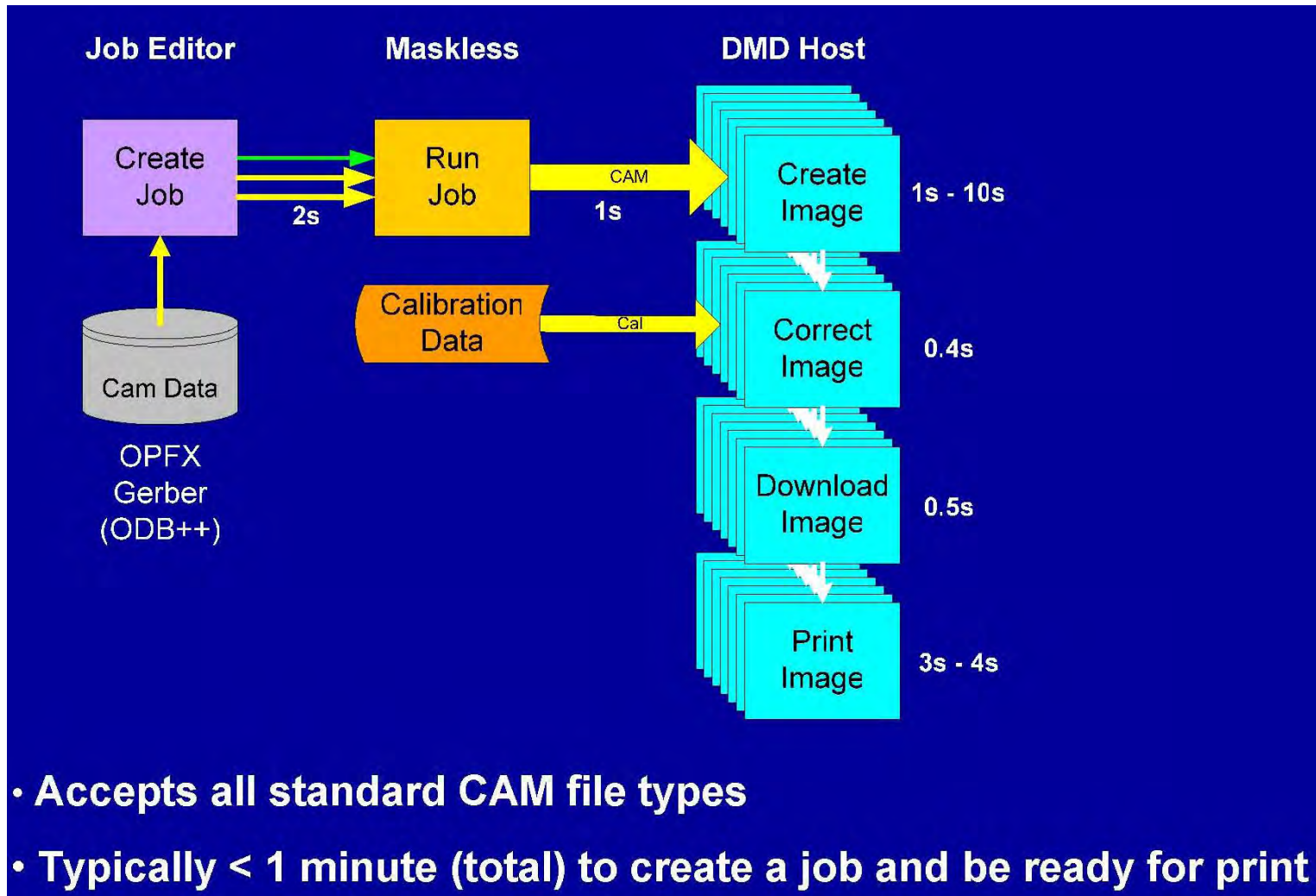
- ▶ Auto Calibration

The system self calibrates the unit for dimensional accuracy by periodically re-aligning to reticule target images embedded on the vacuum chuck, which is mounted directly to the stage. There are also two (2) UV cameras that monitor each of the Optical Modules to maintain power intensity.

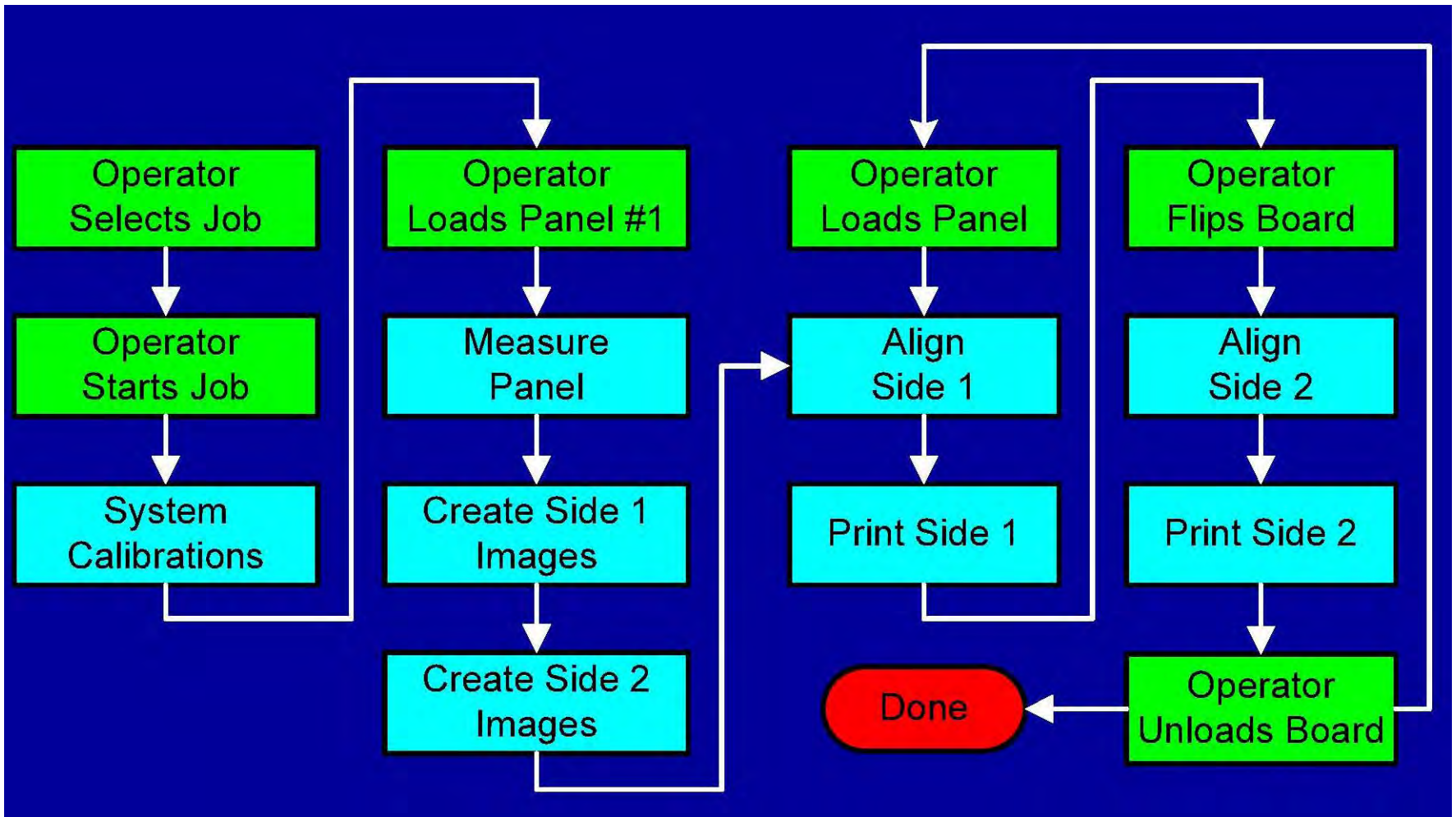
Specifications and System Performance

- ▶ **Minimum Feature Size**
 - 50um LWS, depending on photoresist capacity
- ▶ **Depth of Focus**
 - +/- 100um
- ▶ **Front to Back Registration**
 - 12.5um
- ▶ **Resolution**
 - 0.27um
- ▶ **Edge Roughness**
 - +/- 2.5um
- ▶ **Maximum Substrate Size**
 - 660mm x 813 for Model 3033 and Model 3034 (**26" x 32"**)
 - 550mm x 813 for Model 3032 (**21.6 x 32"**)
- ▶ **Maximum Substrate Thickness**
 - 8.0mm
- ▶ **Average Data Prep Time**
 - 4.7 seconds before printing can begin
- ▶ **Data Compatibility**
 - Gerber, OPFX

Job Data Flow



Inner Layer Job Flow



Job Interface

Job Editor [Close]

File Options Download About Exit

Job

Job Name: 27040 Customer: Maskless Corporation

Panel Count: 24 Priority: Medium

Panel

Panel Type: 18 x 24 Resist Type: TM213i

Panel Size: 18.2 inch 24.3 inch Layer Type: Inner

Print

Scale: 1.00081 1.00091 Print Size: 18.5 inch 24.5 inch

Layer

	Valid	Layer	File	
Side #1	<input checked="" type="checkbox"/>	4	27040@4-03	
Side #2	<input checked="" type="checkbox"/>	5	27040@5-04	

Cost of Ownership

Model #	Annual Service Cost	
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MLI 3032	\$ 5,840	1,200 lamp hour life x 2 channels
MLI 3033	\$ 8,760	1,200 lamp hour life x 3 channels
MLI 3034	\$ 11,680	1,200 lamp hour life x 4 channels
MLI 3035	\$ 14,600	1,200 lamp hour life x 5 channels

Summary

- ▶ Lowest Cost of Ownership
- ▶ High Speed Digital Imaging
- ▶ Modular Systems from 2 to 5 Optical Channels
 - Field Upgradeable

THANK YOU

