

COMPLEX PHOTONIC SYSTEMS FOR VOLUME MANUFACTURING

Solutions to overcome challenges
in Optical Design, Assembly & Industrialization

Simon Schwinger
February 3, 2020

JABIL
OPTICS



OUR VISION

To be the most technologically advanced and trusted manufacturing solutions provider

JABIL

Our Company

50+

Years of Innovation

\$25.3B

FY19 Revenue

200k

Employees

100+

Sites

52M

Square Feet
Manufacturing

Our Markets



Consumer



Packaging



Energy



Printers



Smart Home
& Appliances



Retail



Healthcare



Automotive &
Transportation



Enterprise, Cloud &
Communications



Industrial
& Capital
Equipment



Defense &
Aerospace

Our Reach

INNOVATE

DESIGN

DEVELOP

MANUFACTURE

DELIVER

SERVICE

Our Approach



Empowered
Experts



Innovation
Acceleration



Engineering
Excellence



Manufacturing
Agility



Supply Chain
Orchestration

Our Difference

Global Operational
Excellence

Workcell Model

Sustainability

Supply Chain
Intelligence & Agility

Deep Technical
Expertise

Stable & Tenured
Management Team

Process Innovation

Distributed
Manufacturing

Integrity, Ingenuity
& Innovation

GLOBAL NEWS

PROFILE
DETAILS

Optical Design

Active Alignment (AA)

PROFILE
DETAILS
NOTES
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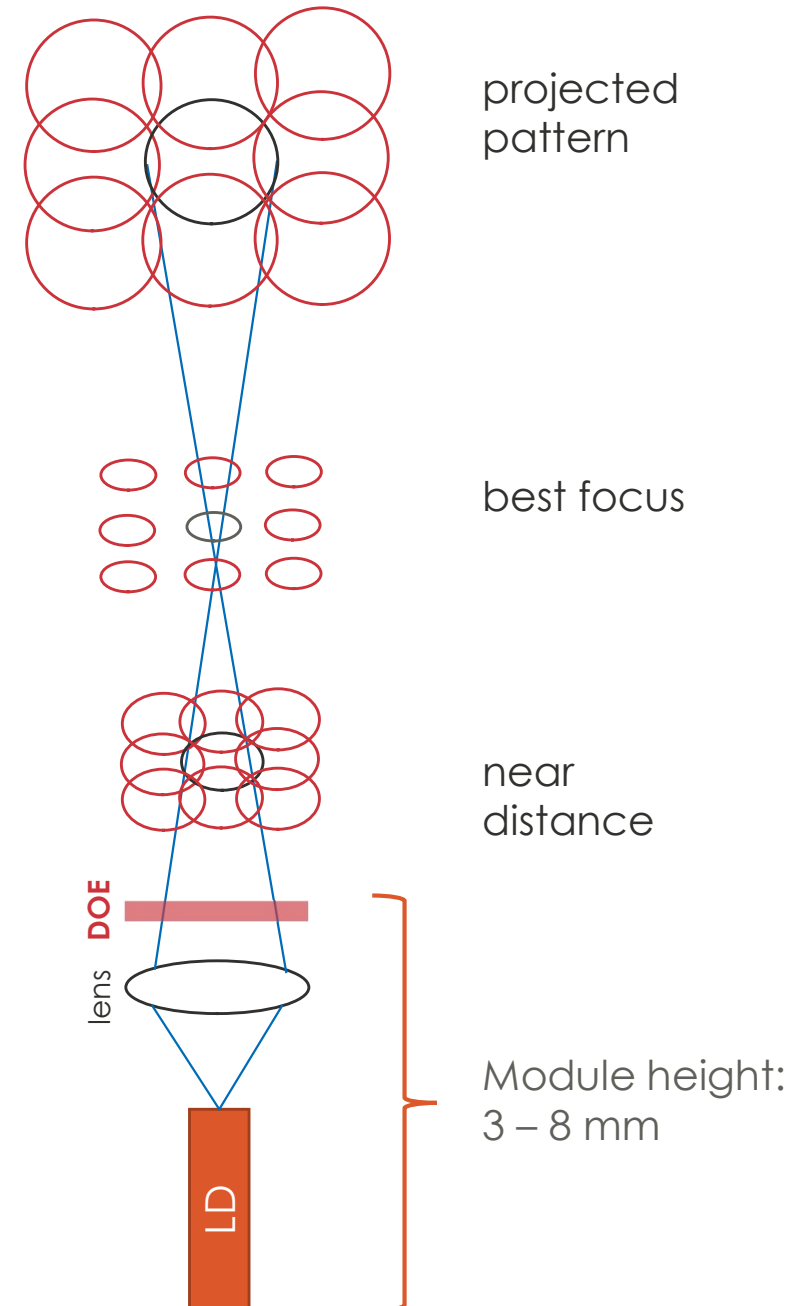
Optical Design

Active Alignment (AA)

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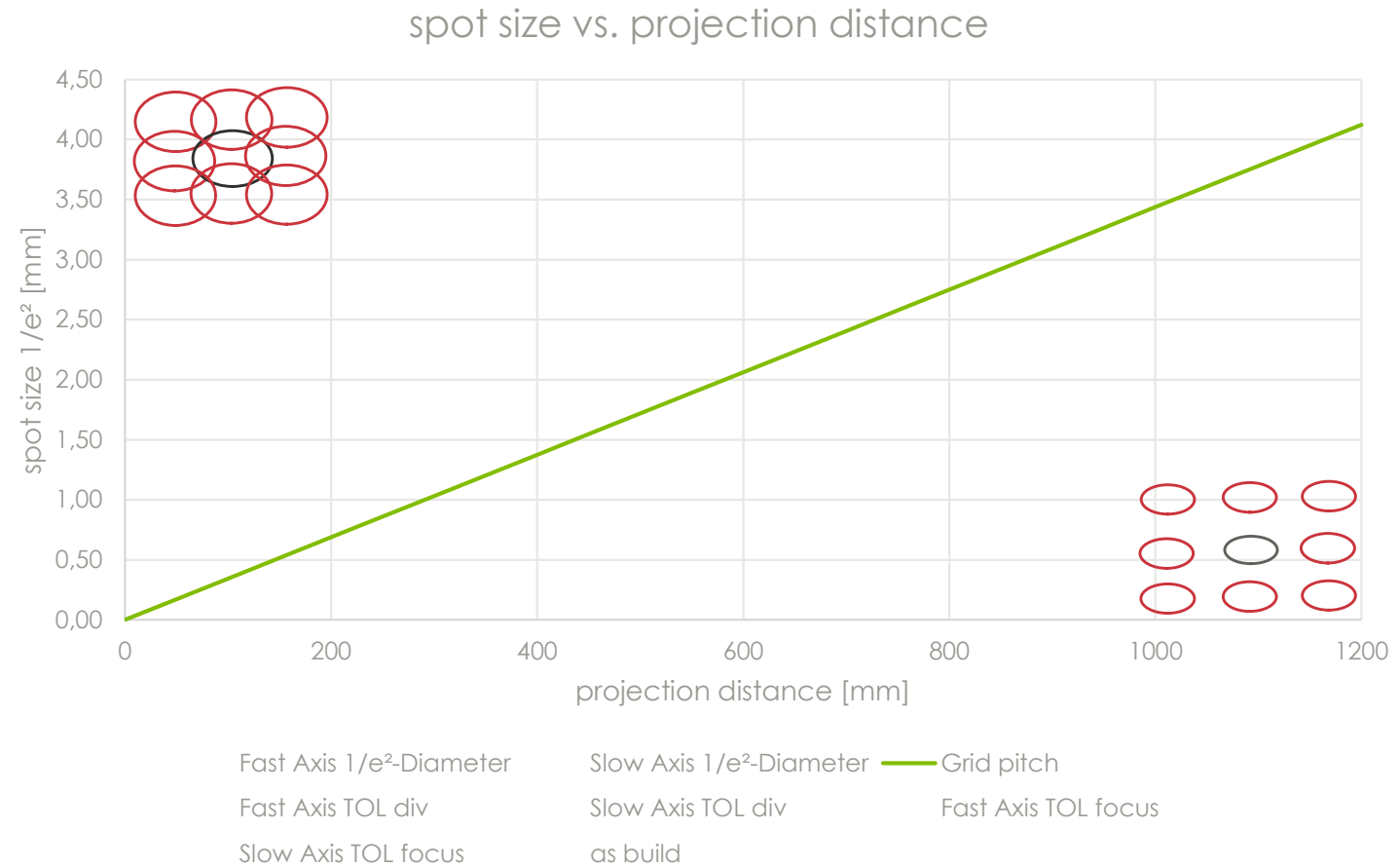
DOT PROJECTOR: CONFIGURATION

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35,5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



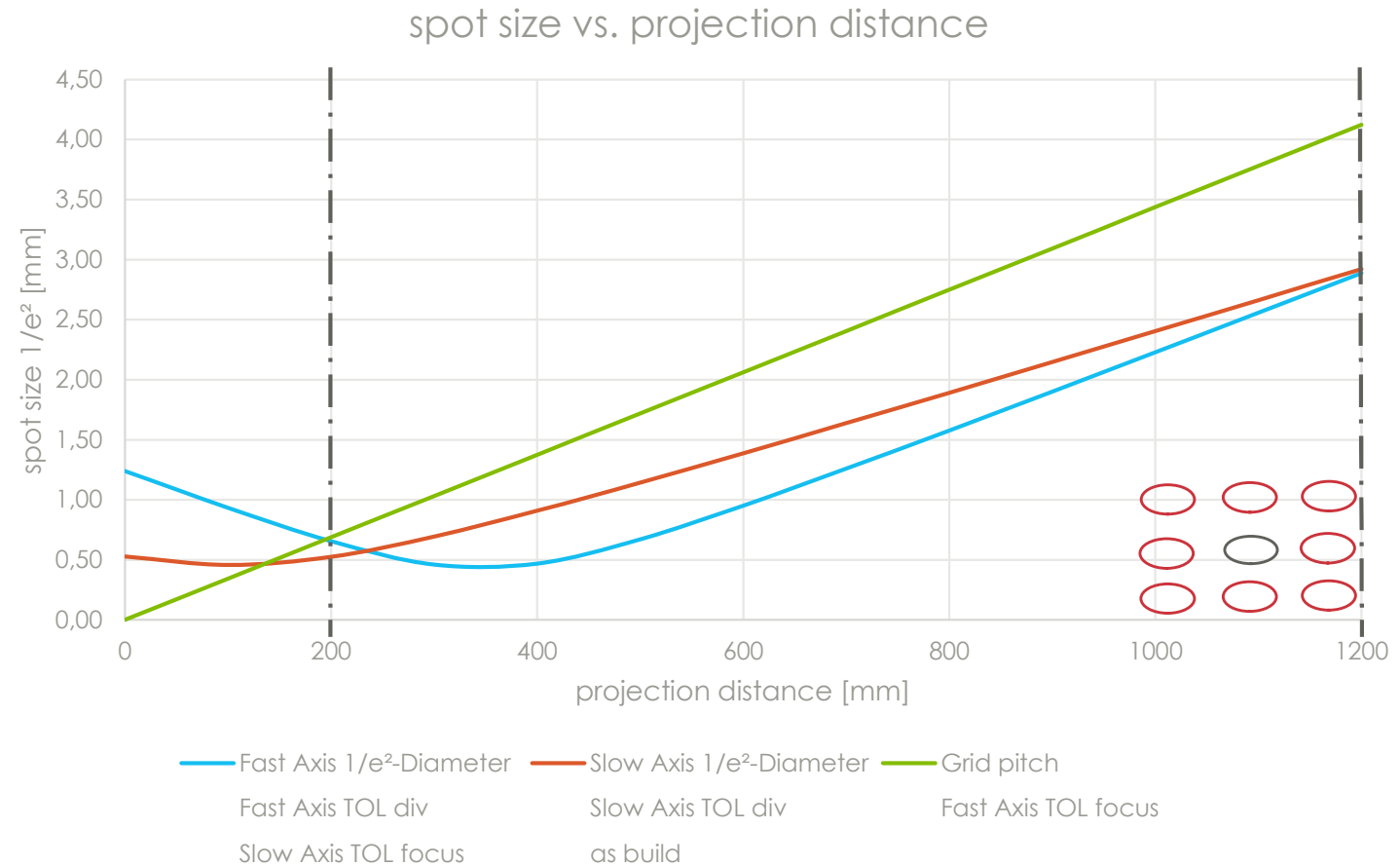
DOT PROJECTOR: GRID PITCH

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



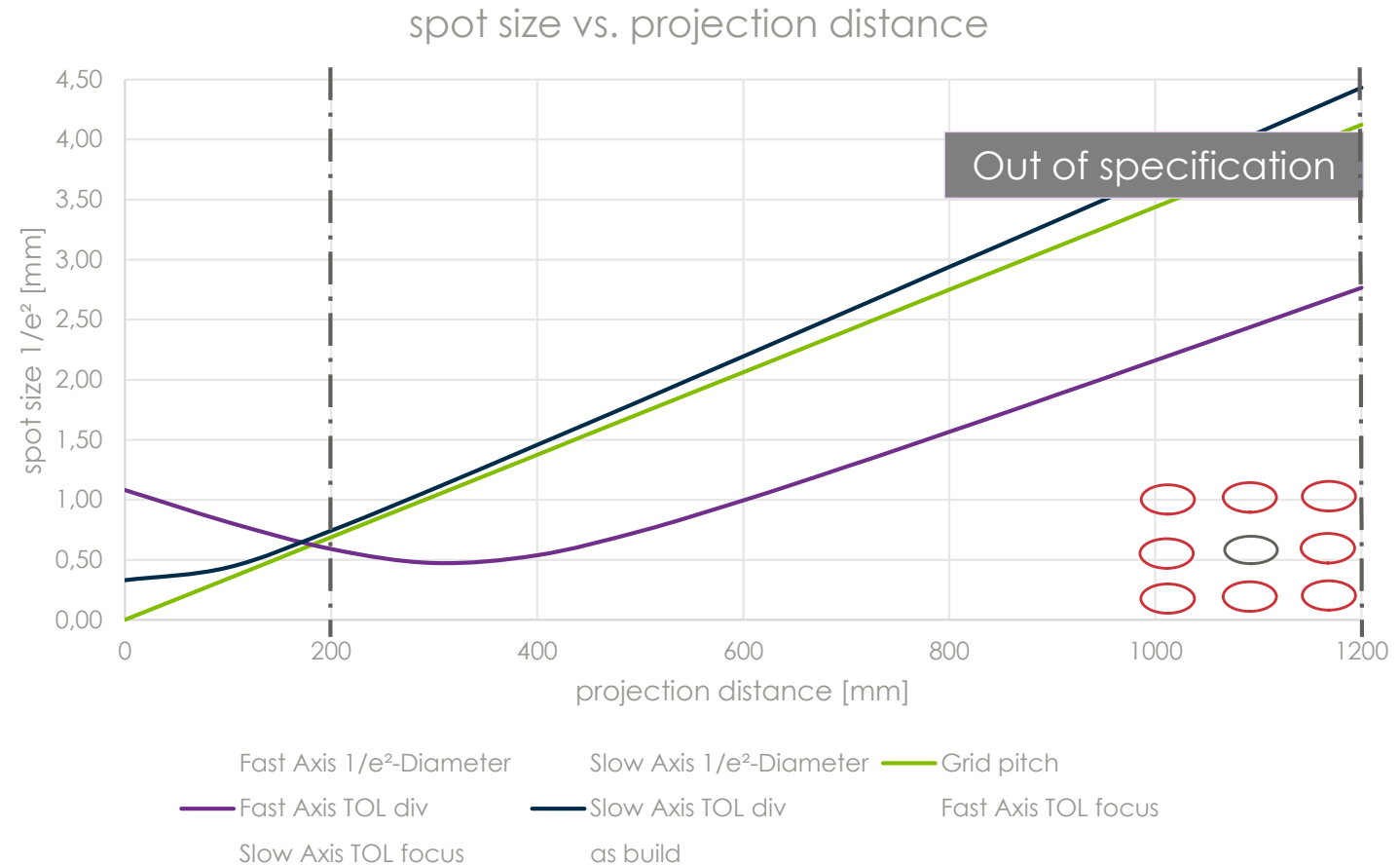
DOT PROJECTOR: FOCAL LENGTH

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



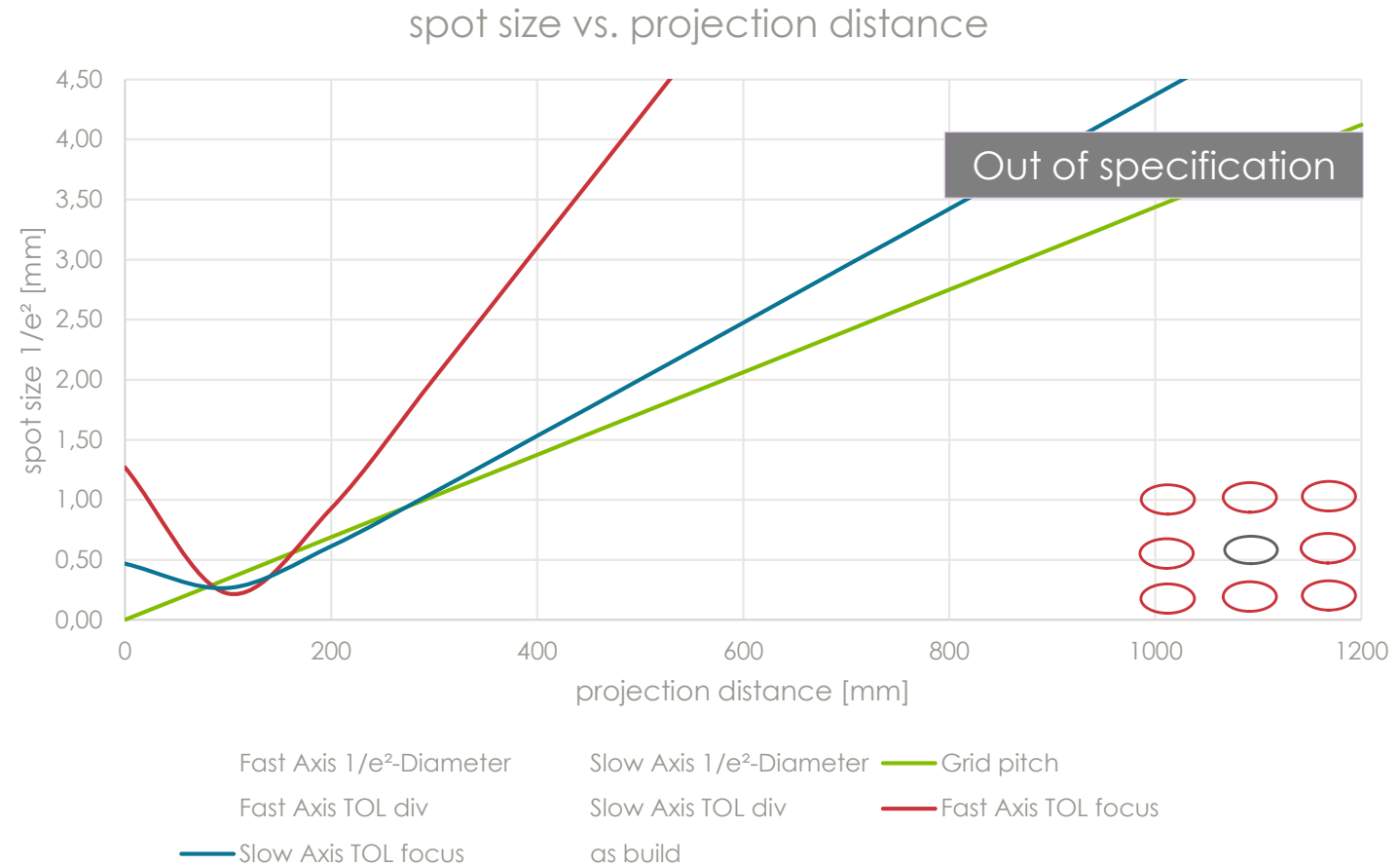
DOT PROJECTOR: TOLERANCE DIVERGENCE

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



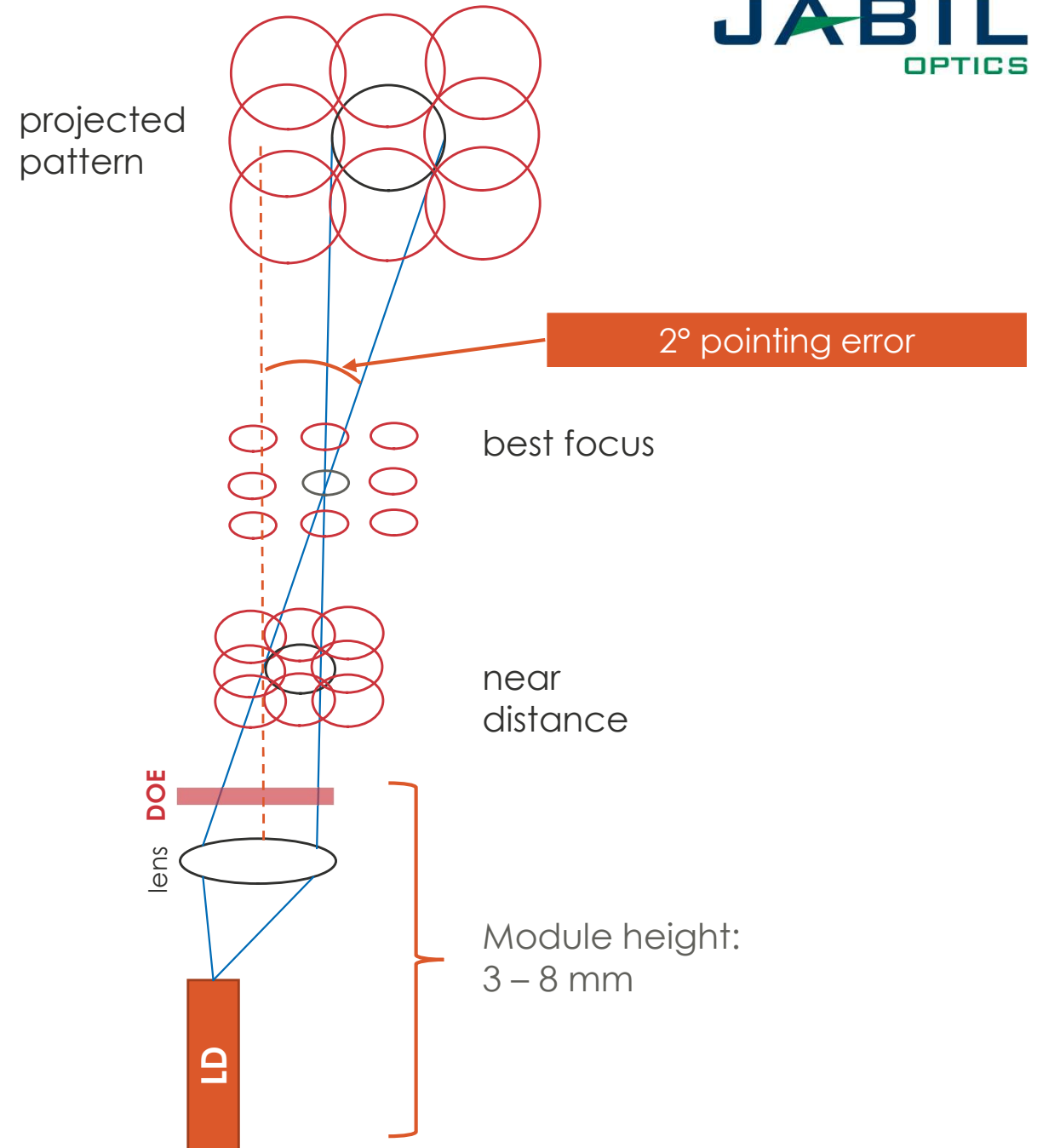
DOT PROJECTOR: TOLERANCE FOCUS WITHOUT ACTIVE ALIGNMENT

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



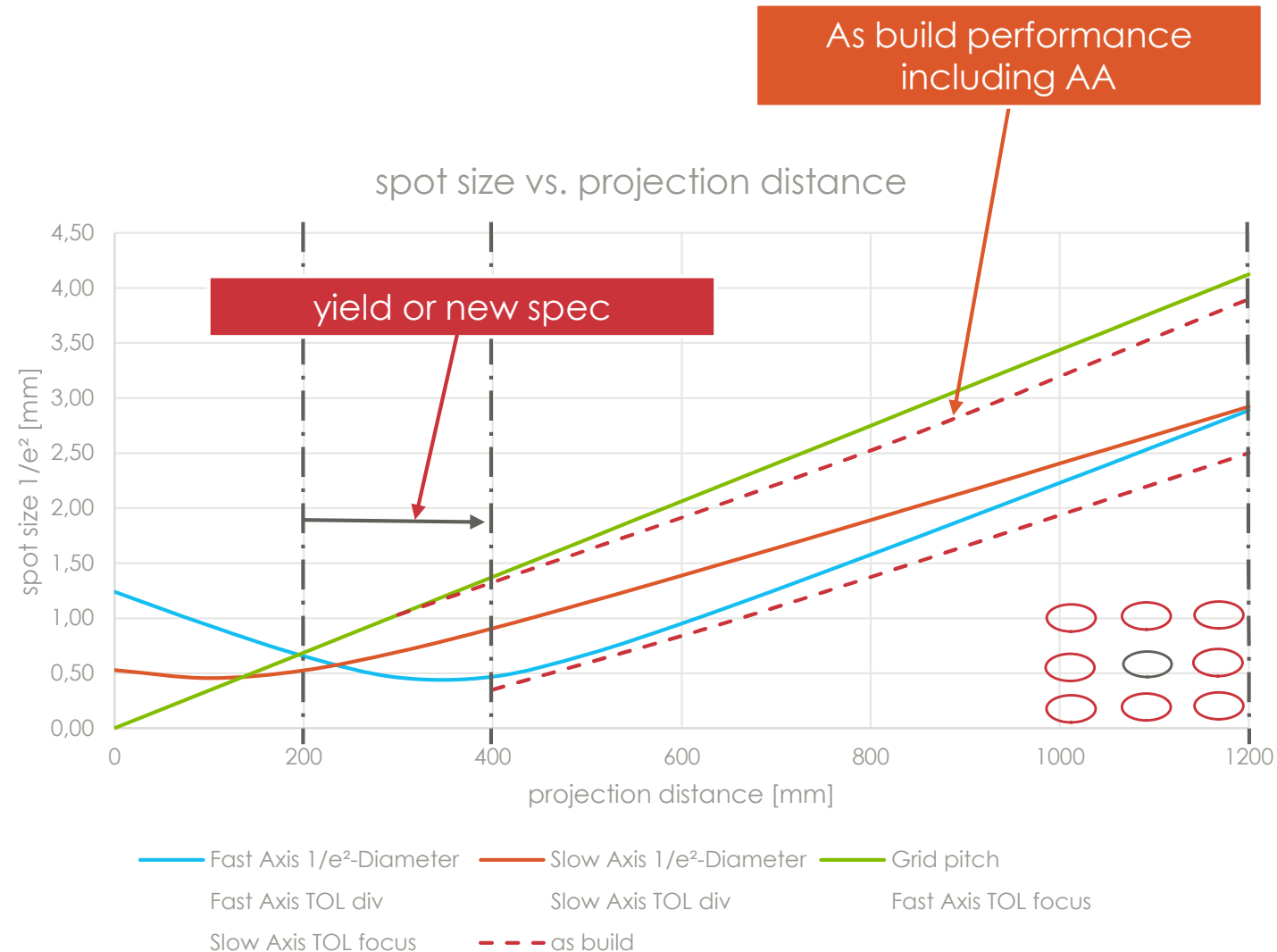
DOT PROJECTOR: SHIFT LD

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm



DOT PROJECTOR: AS BUILD PERFORMANCE

Parameter	Value
Wave length	IR 940nm
Focus distance	0.2m – 1.2m
Grid pitch	320 x 180
FoV	63° x 35.5°
LD	TO38:Ø 3.8mm / height ~3.3mm COS: 0.225 x 1 x 0.14 mm ³
Focal length	2.2mm
Divergence fast axis	17°±3°
Divergence slow axis	8°±3°
TOL focus without AA	30µm
Shift emitter point	80µm





Optical Design



Active Alignment (AA)

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ACTIVE ALIGNMENT (AA) FOR LIDAR & 3D SENSING USING PIXID PLATFORM



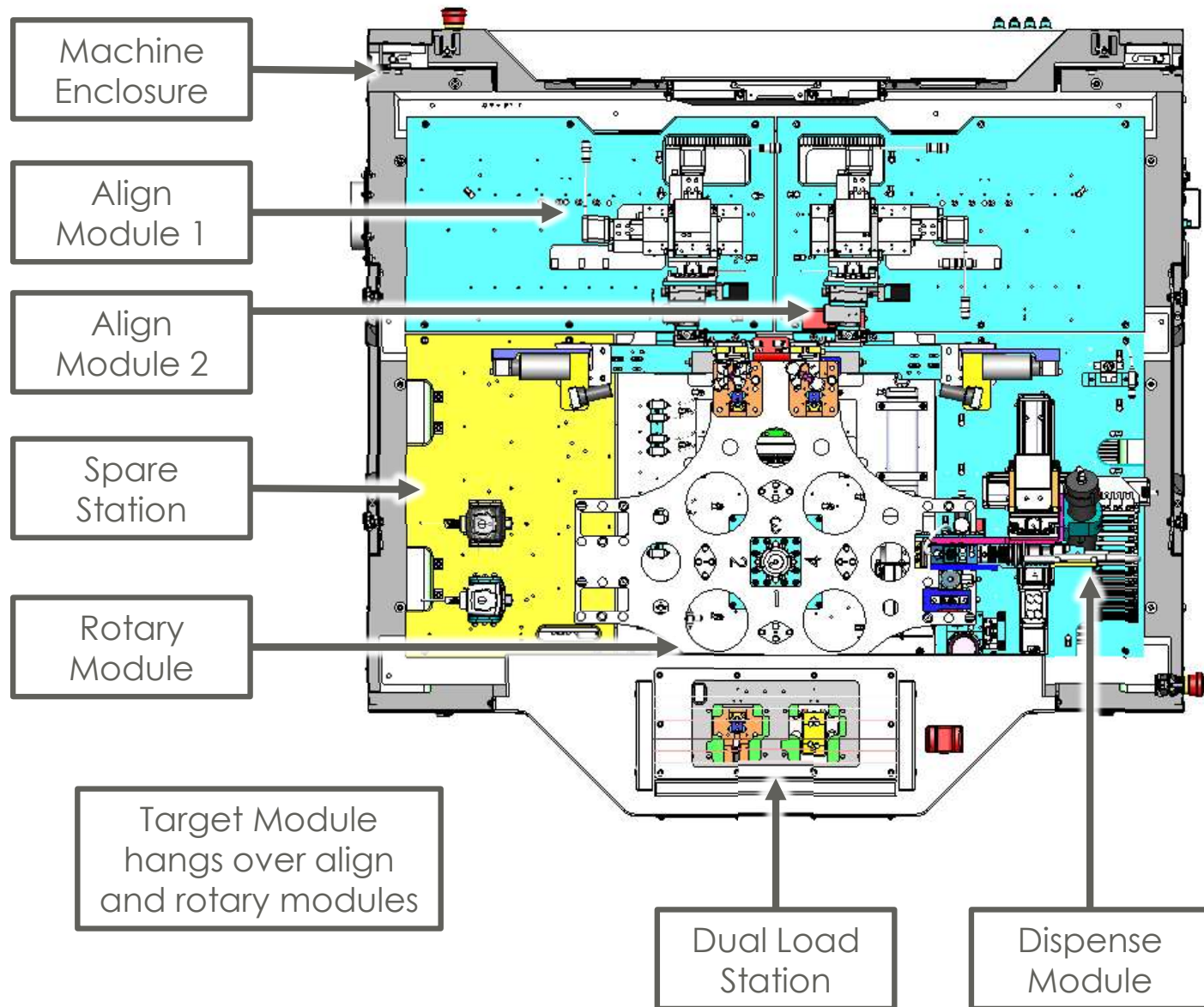
USE CASES

- Lens collimation
- Receiver alignment
- Structured light projection alignment
- Camera lens alignment for structured light inspection
- Module to module relative pointing (tip, tilt, rotation)
- Module to module baseline distance setting (XY)

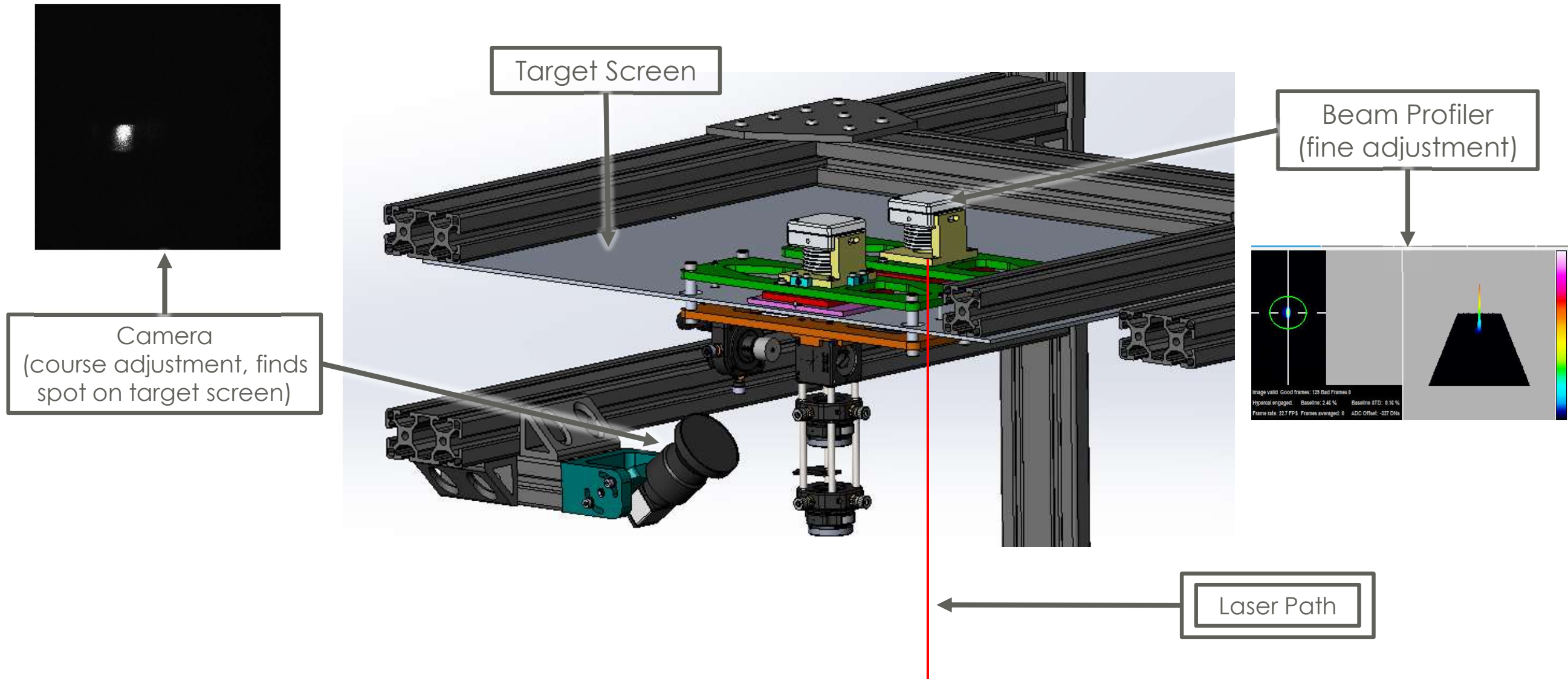
FEATURES

- Single or dual head - 6 axis Active Alignment
 - 0.2um linear resolution
 - 0.01deg angular resolution
- Automated adhesive dispense with post dispense inspection for quality control
- Customized AA feedback systems and AA algorithms
- Automated UV curing
- Systems delivered with turnkey process for high volume manufacturing

PIXID MACHINE LAYOUT FOR DUAL HEAD LASER PROJECTION MODULE AA



DUAL HEAD LASER PROJECTION MODULE AA FEEDBACK SYSTEM



LASER COLLIMATION OPTIMIZATION

PIXID 300 PRO 09:04:42 TEST MODELPM ACCESS LEVEL: ENGINEER TCP OK: NO

Program | Dispense | **Align** | Production

Align Count 0 Repeatability

Characterize Aligns 1

Final Test Count 0 Stability

Teach Reads 100 Intv (sec) 1.0

Return Lens Cure and Ungrip After Align

Grab Image Gripper Open

Motion | Rotary | Dispense | Align Theta | **Align XYZ**

Speed 5 Incr Move

Align X 3.3127 0.0010

Align Y 12.2719 0.0010

Align Z 2.9497 0.0100

Process Information

Align module ready.

Dispense module ready.

Rotary module ready.

Graph | Align Live | Align Frame | Down Live | Down Frame

Image valid Good frames: 129 Bad Frames 0
 Hypercal engaged Baseline: 2.46 % Baseline STD: 0.16 %
 Frame rate: 22.7 FPS Frames averaged: 0 ADC Offset: -327 DNis

Area a: 240726.687	Area b: 83490.506	Running #1 LCM.7	Exposure
2Wua 897.1 um	2Wva 340.5 um	Xc -0.7 um	<input checked="" type="checkbox"/> Auto Shutter
2Wub 543.0 um	2Wvb 194.8 um	Yc 431.2 um	0.49 ms
		Major 897.2 um	Start Capture
		Minor 358.9 um	Stop Capture
		Eff_2W 544.3 um	Setup
		Mean 806.3 um	
		Ellip. 0.40	
		Orient. -0.7 deg.	
		ADC Peak % 87.4%	

1500.0/div | P = 68.8 % | E 800.0/div | P = 68.6 %

Status | Align | Timing | **Production** | Machine | **Operation**

	Pos	Work ID	Status	Code	Extra
Dispense	2	N/A	NO DUT	N/A	N/A
Align	1	7146	PASS	OK	OK
Spare	4	N/A	NO DUT	N/A	N/A
Load	3	N/A	NO DUT	N/A	N/A

ALN DRY RUN
 EPK DRY RUN
 UV1 UV2
 LOAD VAC

Main Motion I/O Patterns Params

LASER PROJECTION MODULE TESTING



P000 500 PRO 10:47:04 PROCESS: P500A ACCESS LEVEL: ENGINEER ROBOT OK: YES TCP OK: YES

Program Dispense Align Production

Dispense Fixture 1 Z Pos 24.332 Do Not Park After Prime

Tip Feed Fixture 2 Z Pos 17.282 Dispense Continuously

Advanced Prime Head 1

Head 1 Reset Charge Head 1

Reset Prime

Motion Target Rotary Dispense Align Theta Align XYZ

Speed 5 Incr Move

Align X 31.2700 0.0000

Align Y 29.3000 0.0000

Align Z 30.0000 25.0000

Process Information

Align module ready.

Dispense module ready.

Rotary module ready.

Status

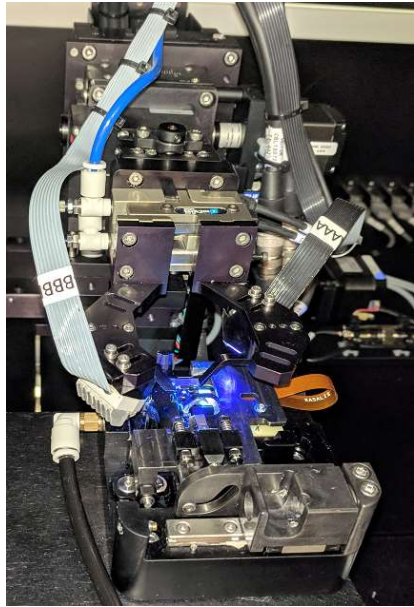
	Align	Timing	Production	Machine	Operation
Reset					
Dispense	1	N/A	NO DUT	N/A	N/A
Align	4	N/A	NO DUT	N/A	N/A
Spare	3	N/A	NO DUT	N/A	N/A
Load	2	N/A	NO DUT	N/A	N/A

Main Motion IO Patterns Params

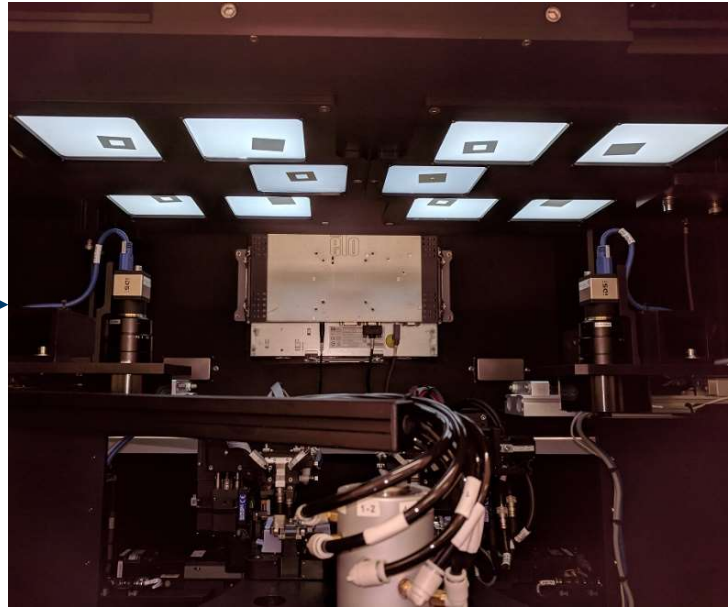
MODULE ASSEMBLY AND INTEGRATION FOR 3D SENSING



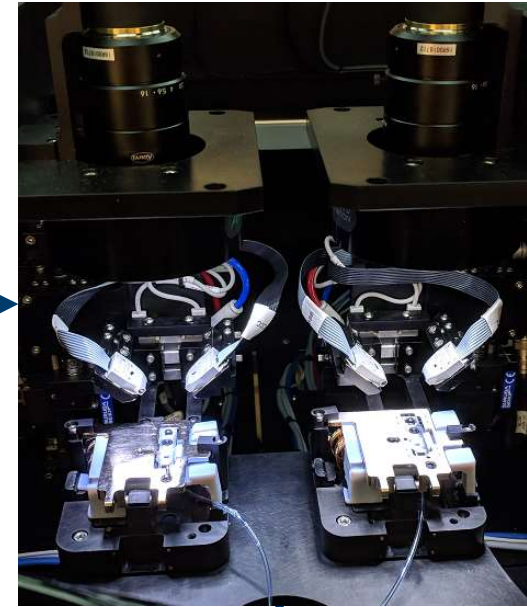
NIR/RGB CCM AA
(focus and pointing)



NIR CCM to RGB CCM Alignment
(pointing and baseline distance)



LPM to NIR AA
(pointing and baseline)



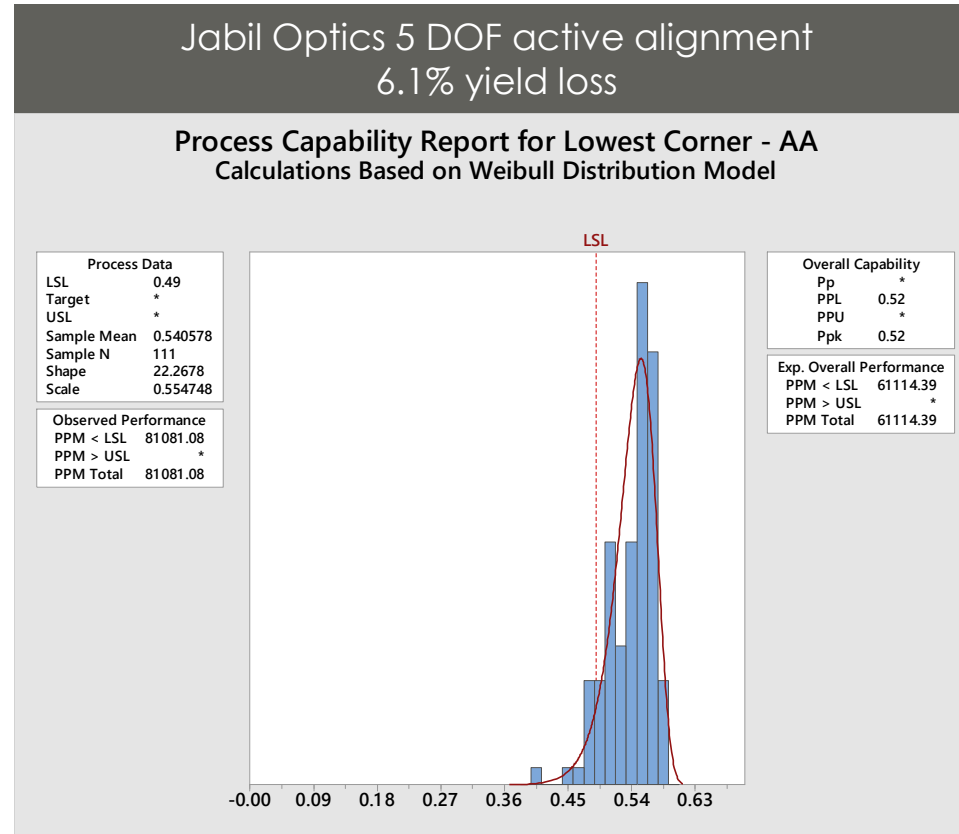
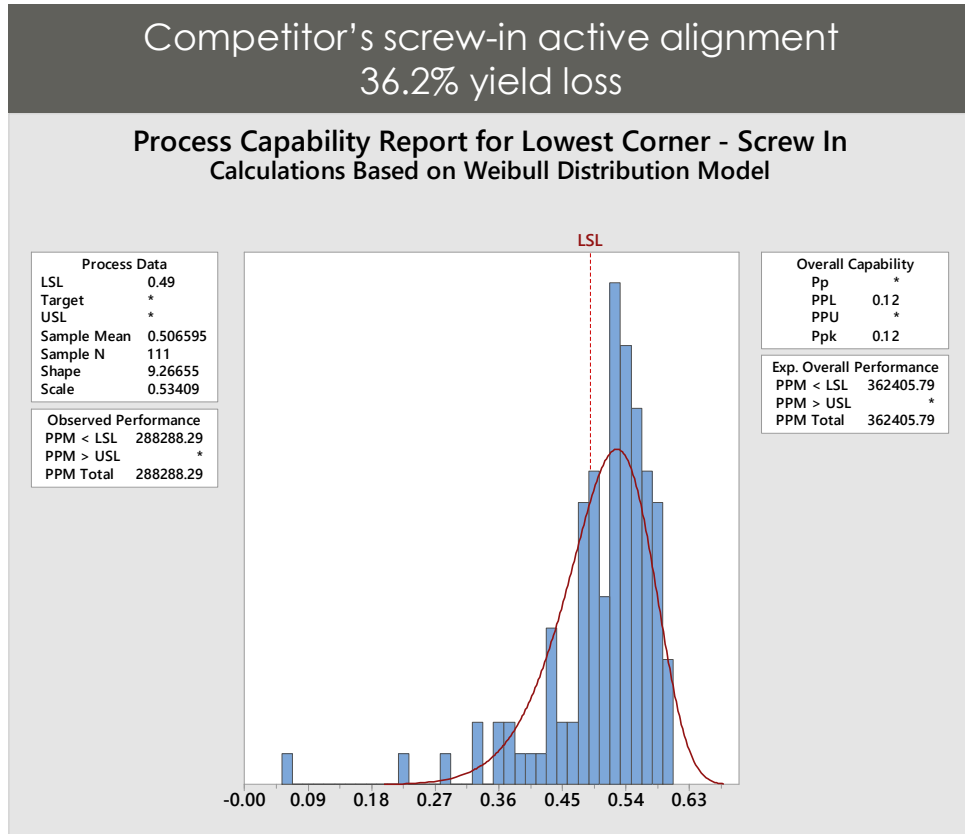
LPM AA
(collimation and XY)



Integrated 3D Sensing Module
(NIR CCM, RGB CCM, LPM)



ACTIVE ALIGNMENT CAPABILITY ANALYSIS



	Screw In	Jabil Optics AA
Ppk	.12	.52
PPM Defects	362,405 PPM	61,114 PPM

YIELD IMPACT CONCLUSIONS
 Screw In – 36.2% Yield Loss
 Jabil Optics AA – 6.1% Yield Loss

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Jabil Optics

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✉ ☎

WHAT JABIL OPTICS CAN DO FOR YOU...

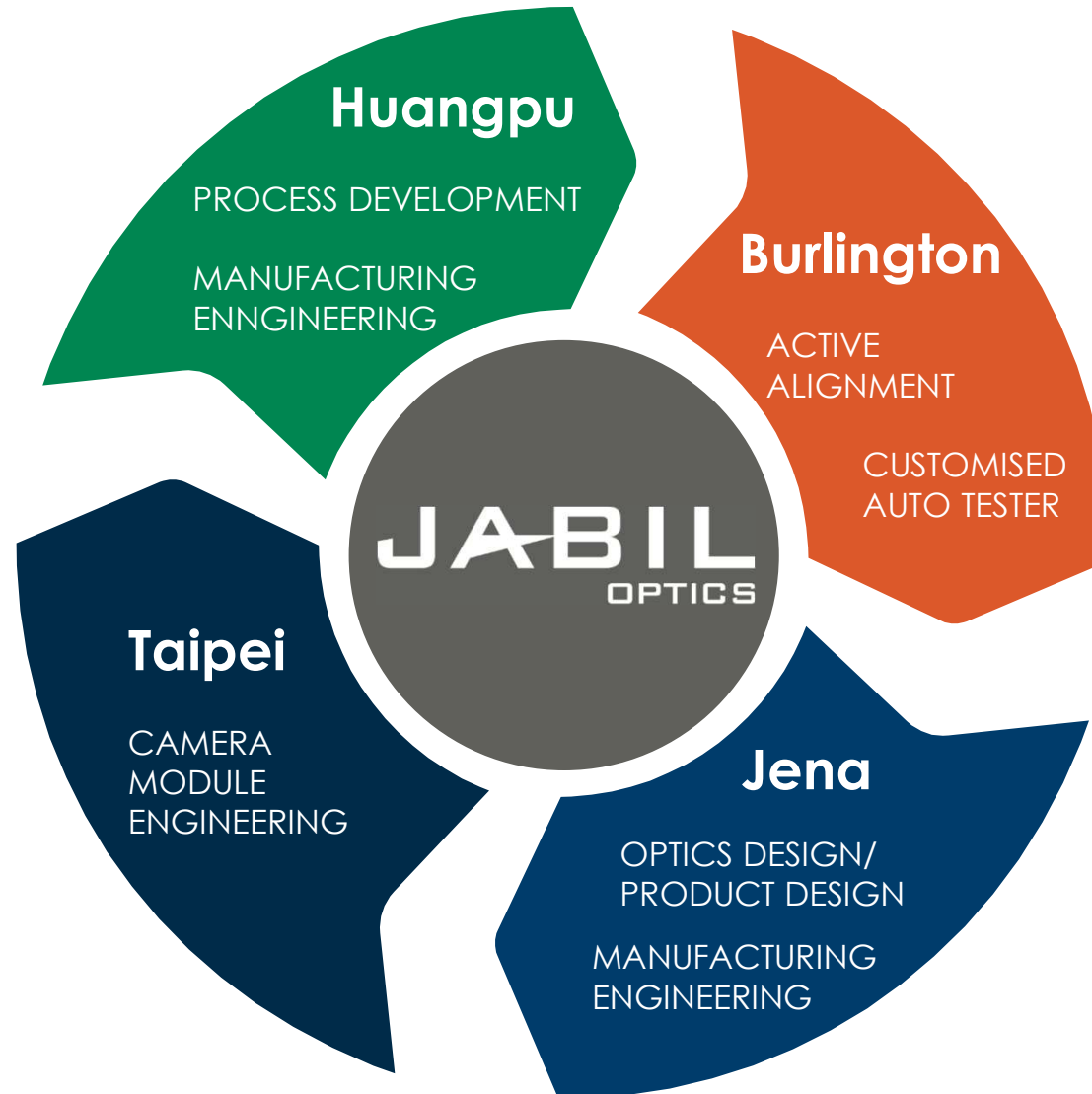


PROCESS DEVELOPMENT

- Advanced process solutions
- Optimal material and component selection
- Customized adhesive solutions
- Equipment guidance and selection

MANUFACTURING ENGINEERING

- Design and procurement of optical lens assemblies and sub-assemblies
- New product introduction
- High-volume production of optical solutions
- Final goods assembly
- Test
- Pack-out



ACTIVE ALIGNMENT

- Active alignment
- Precision components placement
- Lens assemblies
- Gluing technologies
- Chip-on-board, Chip-on-flex
- Chip-on-stiffener, FlipChip
- Wire-bonding and ACF bonding
- Assembly automation

PRODUCT DESIGN

- World class optics design
- Electrical engineering
- Design for high-volume manufacturing
- Design to cost

WHAT YOU CAN DO FOR JABIL OPTICS...



Enable
**cutting edge
technologies**

Have
**strong
brands**

Fund
**innovative
products**

Seek a strong
**manufacturing
partner**



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JABIL SUCCESS STORIES...

<https://www.jabil.com/case-studies.html>

<https://www.jabil.com/case-studies/case-study-magic-leap.html>

<https://www.jabil.com/news/innoviz-technologies-announces-after-market-lidar-solution--inno.html>

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THANK YOU



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MORE LIGHT



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