



Advanced USP laser-features for PV manufacturing

EPIC Online Technology Meeting on
Photonics for Solar Energy Systems

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Lumentum at a glance

>5000 employees

\$1.57B FY19¹ revenue
1. Fiscal year ended June 29, 2019

1900 patents

Leadership positions:

- Components for optical communications
- 3D sensing illuminators
- Lasers for materials processing



Telecom/Datacom



3D Sensing



Advanced Manufacturing



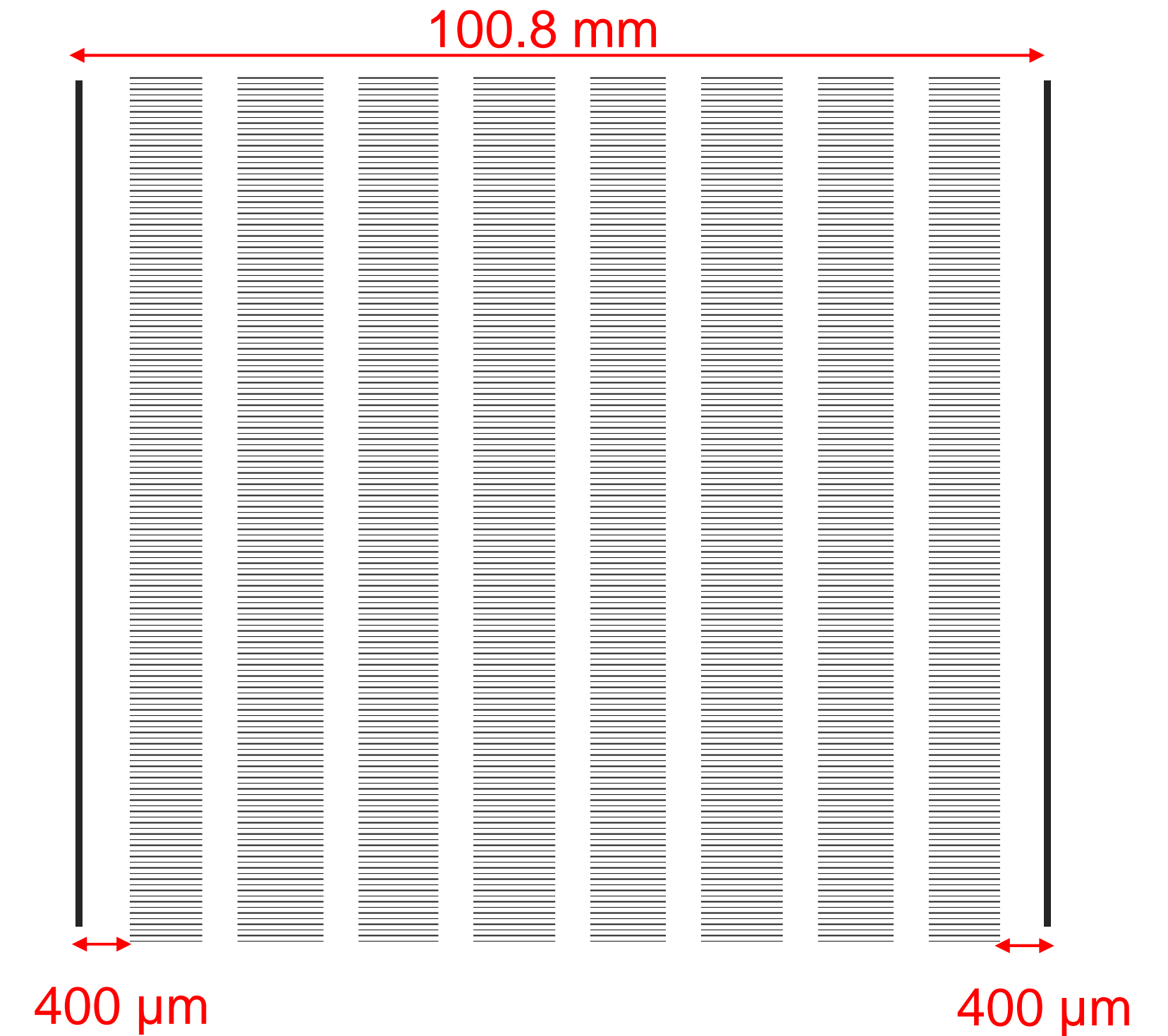
Precise high-speed thin-film removal
using ***AccuTrig™*** trigger-feature



Position-jitter improvement with *AccuTrig*

Task

- Dotted dashed lines $L_{\text{tot}}=100$ mm, dash $L=600$ μm
- Dot-spacing: 100 μm
- Moving spot velocity: 25 m/s
- Sidelines 400 μm next to dotted line start/end



Position-jitter improvement with *AccuTrig*

Task

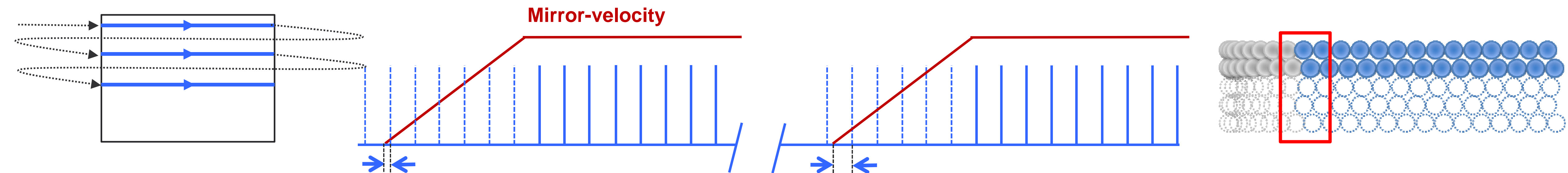
- Dotted dashed lines $L_{\text{tot}}=100$ mm, dash $L=600$ μm
- Dot-spacing: 100 μm
- Moving spot velocity: 25 m/s
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Issue

- Unacceptable position-jitter of individual dots $> \pm 50$ μm

Reason

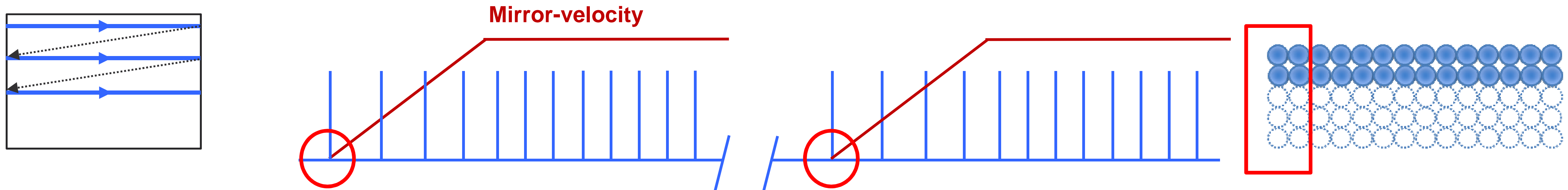
- beam-delivery and laser not synchronized \rightarrow position-jitter by gating constant pulse-train



Position-jitter improvement with *AccuTrig*

Solution: *AccuTrig* – true USP laser triggering

- Receiving pulses when beam-delivery demands them
- timing-jitter: ± 12.5 ns \rightarrow theoretical position-jitter for $v=25$ m/s: ± 0.3 μ m
- Energy-stability: 2% (rms) under arbitrary timing conditions

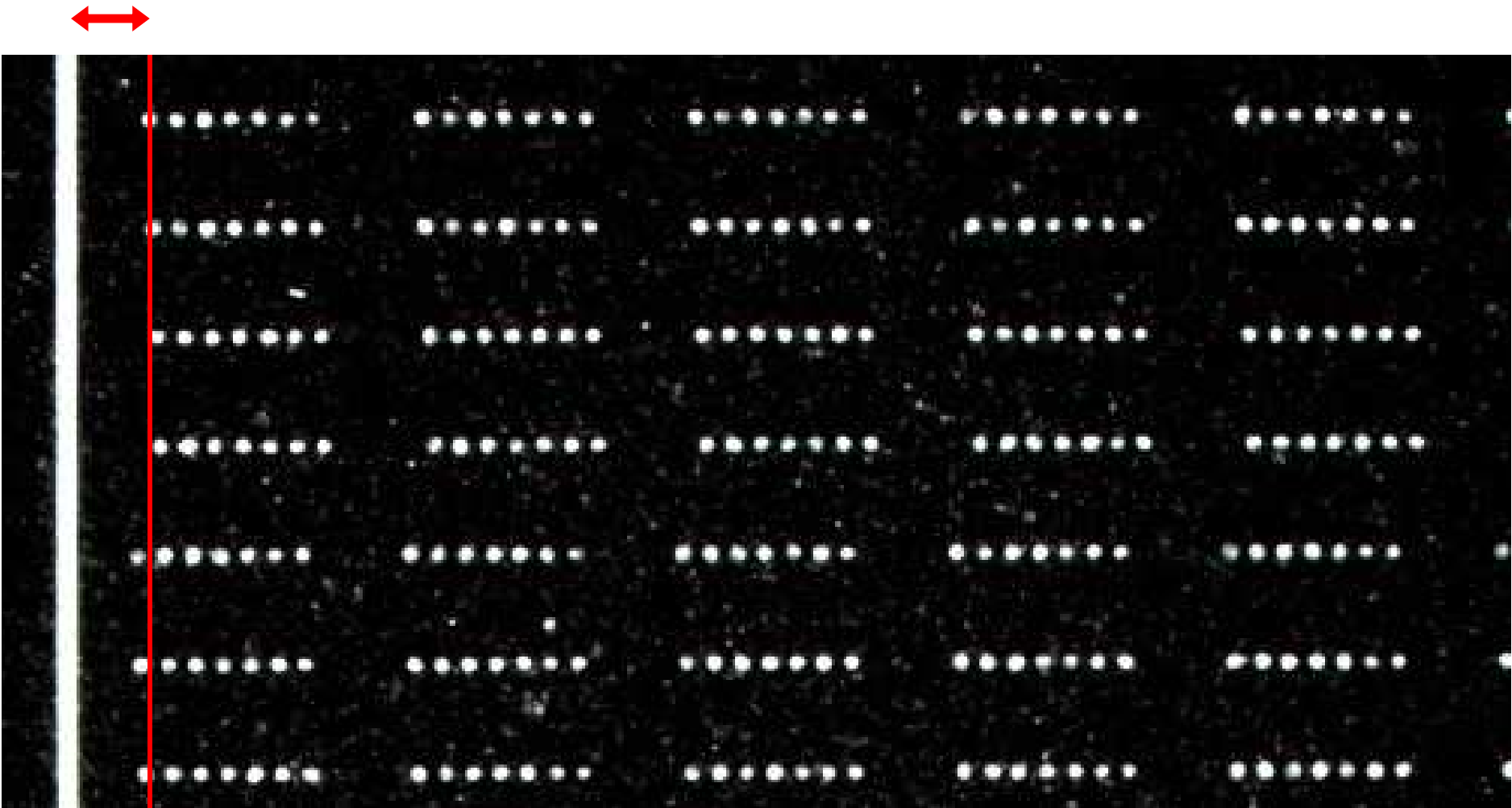


Position-jitter improvement with *AccuTrig*

Without *AccuTrig*:

Position-jitter
 $\pm 50 \mu\text{m}$

Absolute position!



With *AccuTrig*:

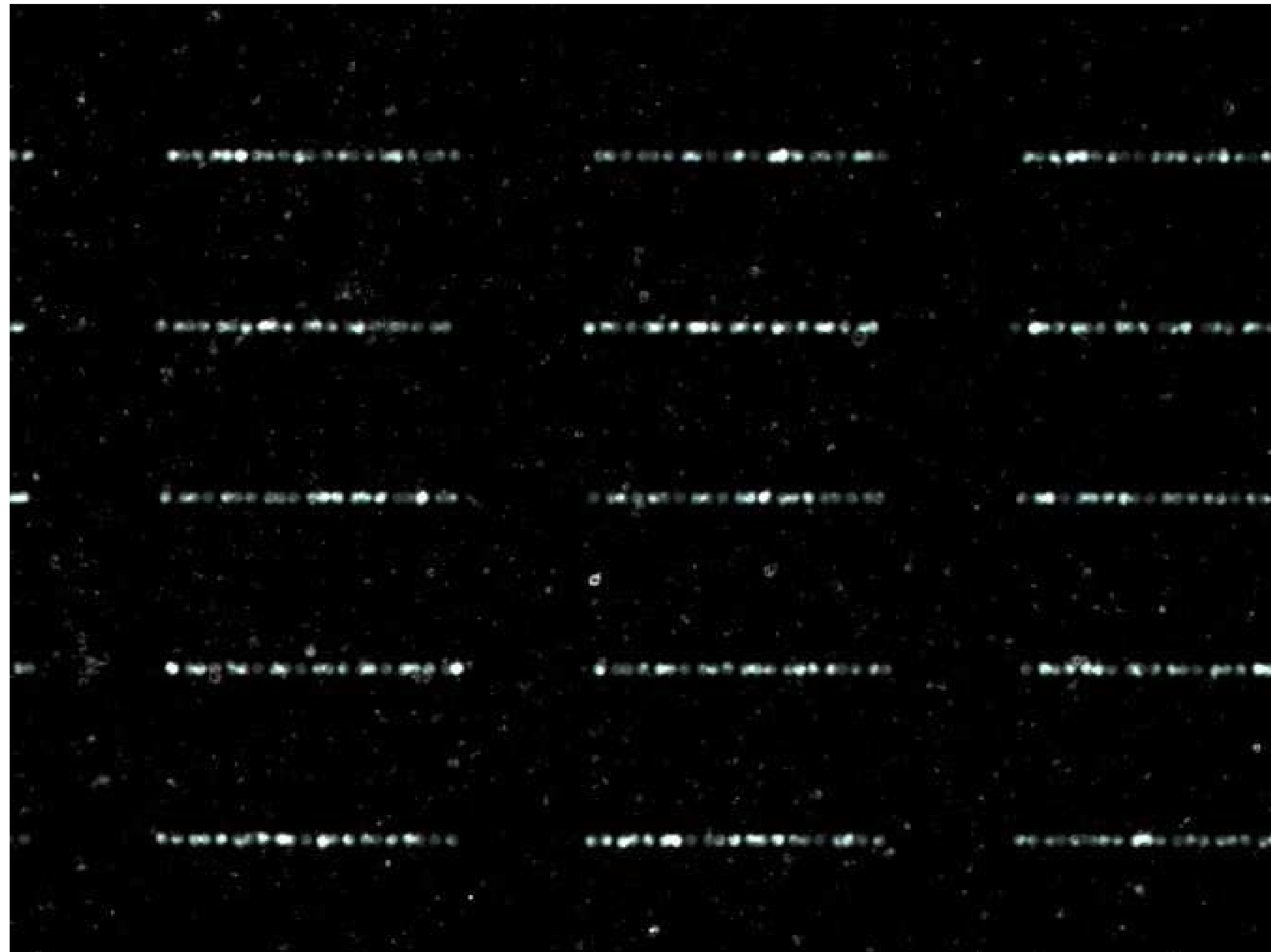
Position-jitter
 $\ll 5 \mu\text{m}$



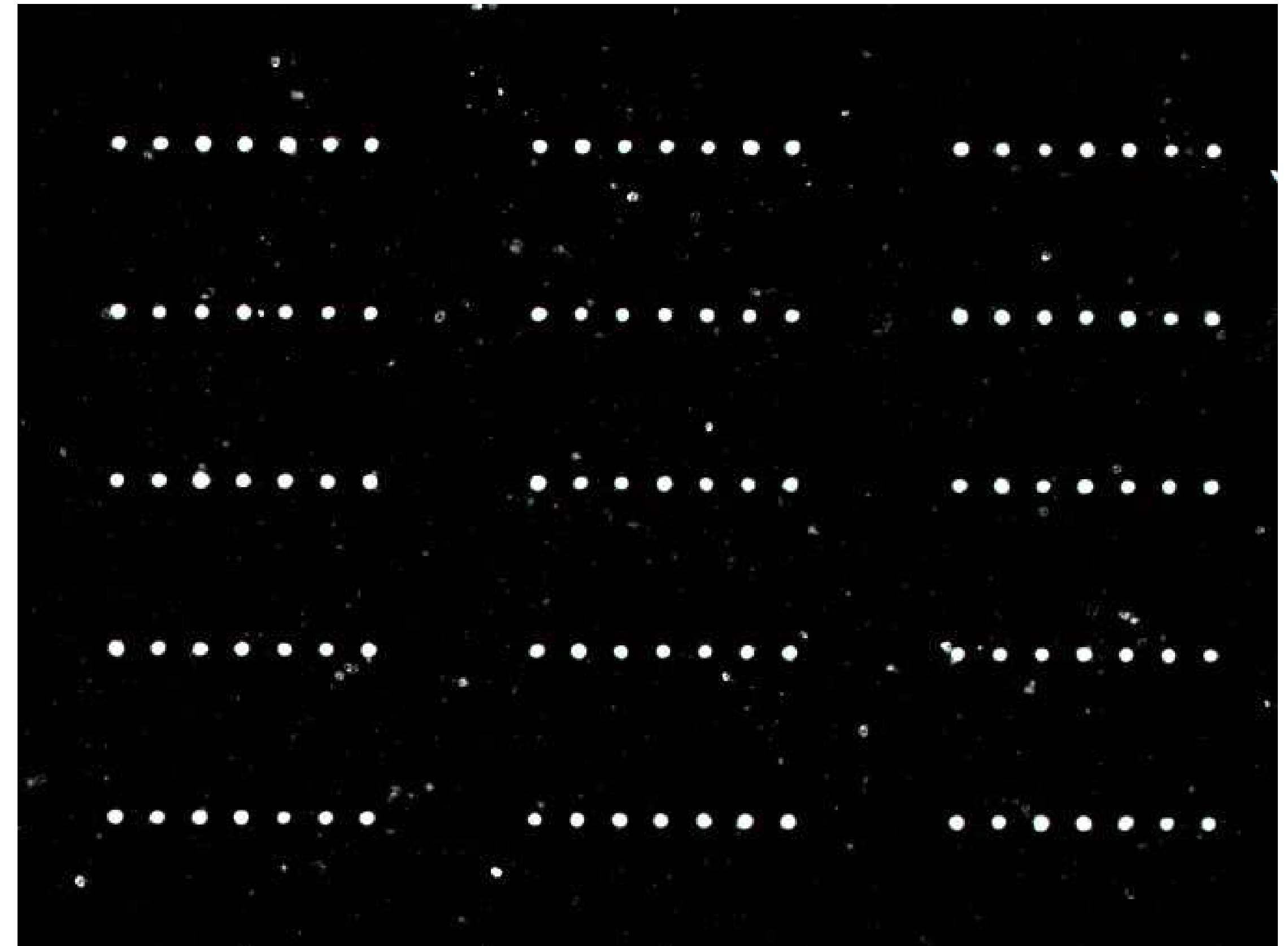
Reproducibility

Same lines, 3 overscans:

Without *AccuTrig*



With *AccuTrig*



PicoBlade[®]3 Performances



	PicoBlade 3
Output power	Up to 180 W
Pulse repetition rate	Single-shot to 8 MHz
Pulse energy	Single pulse > 350 μ J MegaBurst [™] > 1 mJ
Pulse width	~10 ps
Dimensions	750mm(L) x 244mm(H) x 600mm (W)
Wavelength	1064 nm, 532 or 355 nm
M ²	~ 1.2
FlexBurst [™]	Arbitrary control of each pulse
AccuTrig [™]	Real triggering up to 2 MHz
SYNC	High-speed polygon scanning

Repetition Rate	Average Power, W 1064 nm
400 kHz	≥ 150
1 MHz	≥ 160
8.2 MHz	≥ 170

Repetition Rate	Average Power, W 532 nm
400 kHz	≥ 100
1 MHz	≥ 70
8.2 MHz	≥ 25

Repetition Rate	Average Power, W 355 nm
400 kHz	≥ 50
1 MHz	≥ 30
4 MHz	≥ 10

What can we do for you?

- Lumentum can support you early in the process of solving your manufacturing challenges
- With our in-house AppLab we can support process-development and feasibility-studies
- We offer flexible USP-lasers with high-end features, developed to increase throughput

What can you do for us?

- We are interested in sophisticated spatial beam-shaping solutions for
 - Flattop (homogeneity, edge-steepness, efficiency)
 - multi-beam splitting with high energy uniformity
 - Reconfigurable/programmable solutions (SLM)
 - Easy to implement for industrial applications
- Tell us the laser-requirements for your specific applications to influence our product development roadmap

Thank you

