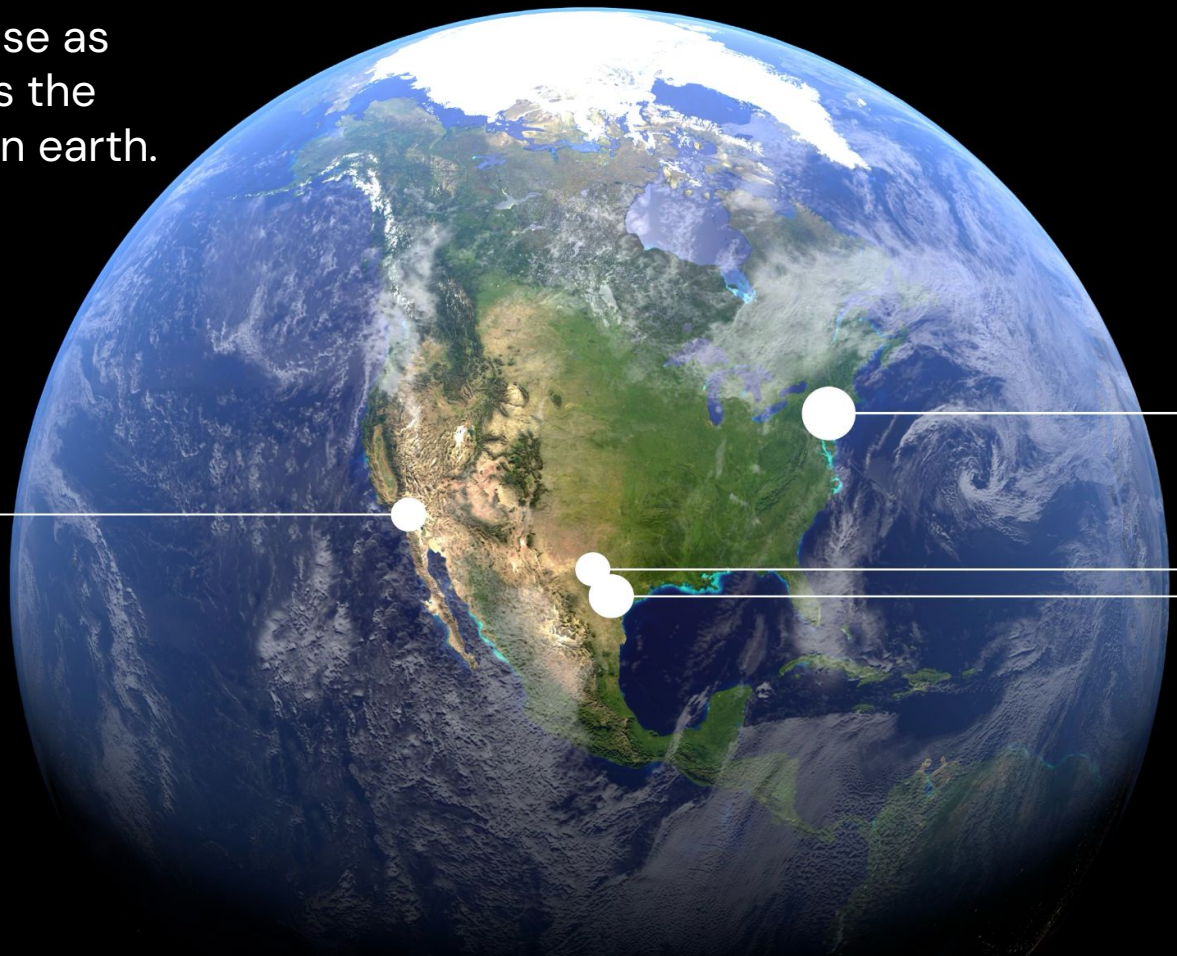
Transforming AI Infrastructure with 3D Photonics

Nick Harris, PhD
Founder, CEO

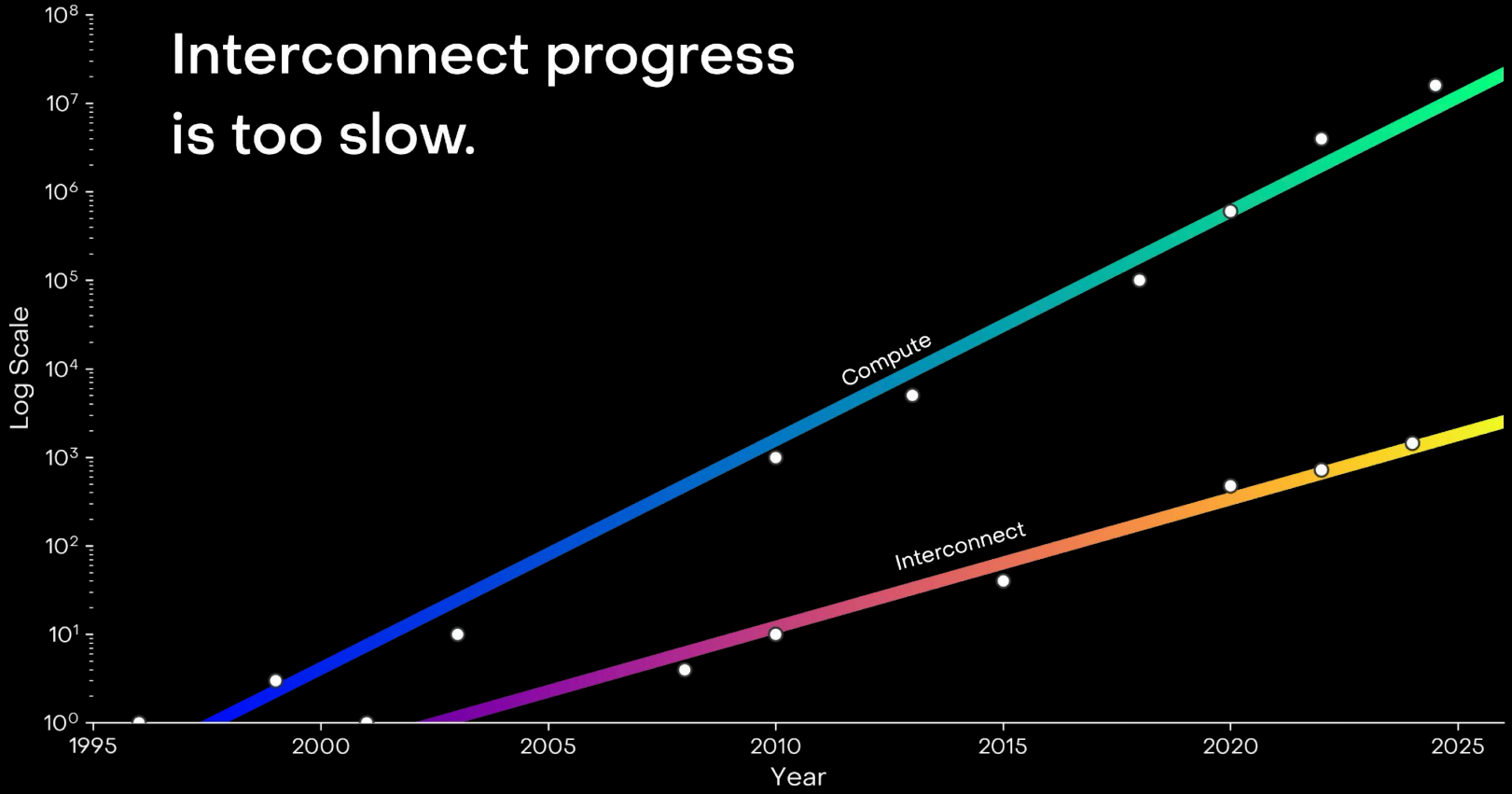
LIGHTMATTER

At a macro level.

Data centers use as much power as the largest cities on earth.



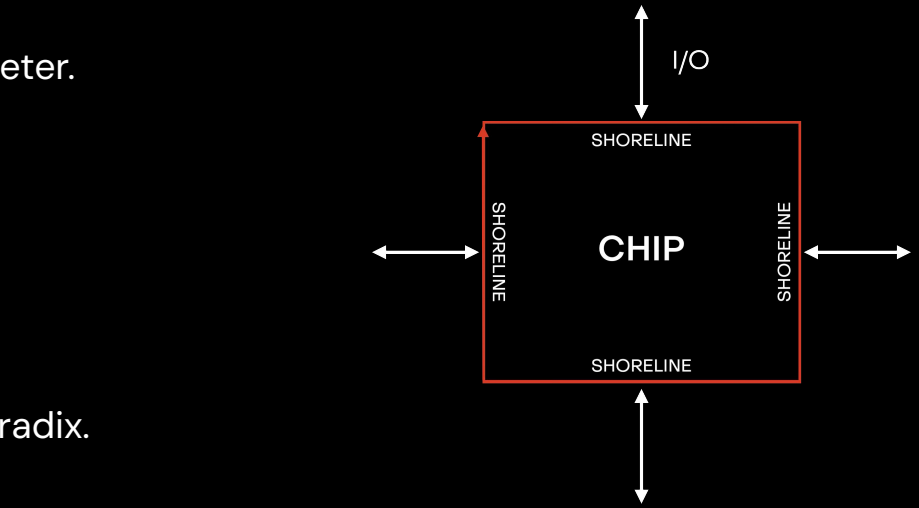
Interconnect progress is too slow.



Communication happens on the chip perimeter.
There's not enough shoreline.

FLOPS $\propto$ Chip Area (L^2)
IO Bandwidth $\propto$ Chip Perimeter (L)

We need >100x the bandwidth and >2x the radix.



Radix fights with bandwidth for shoreline.
A new paradigm is needed.

What does it take to build a “single-brain” 1,000,000 XPU datacenter?

Copper only laces ~100 chips together.

There’s not enough chip shoreline.

We need 100x more bandwidth.

A new paradigm is needed.

LIGHTMATTER

THE NEXT 1000X IN COMPUTE PERFORMANCE

Photonics is here.

100x

8x

2x

1x

IT'S TRYING TO GET HERE

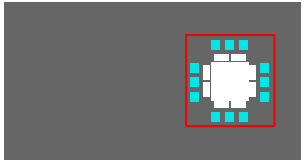
INDUSTRY IS HERE

GEN 4 3D Photonic Interposer

M-Series
L-Series

As low as 3 pJ/bit

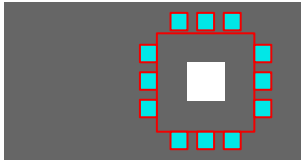
GEN 3 2D CPO Chiplet



Standard CPO

~6-10 pJ/bit

GEN 2 NPO



Most of what you've seen announced recently

~8-15 pJ/bit

GEN 1 Pluggables

~17-20 pJ/bit

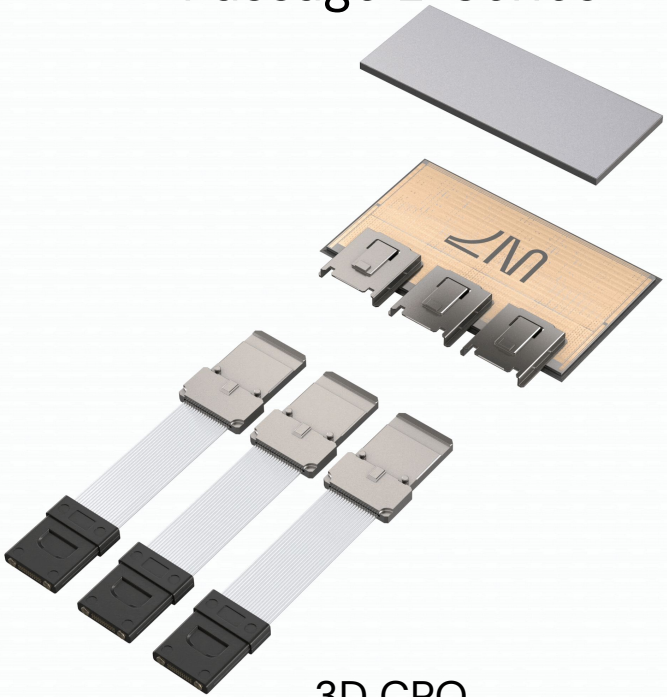
18 Inches

Legend

Optics

ASIC (XPU/Switch)

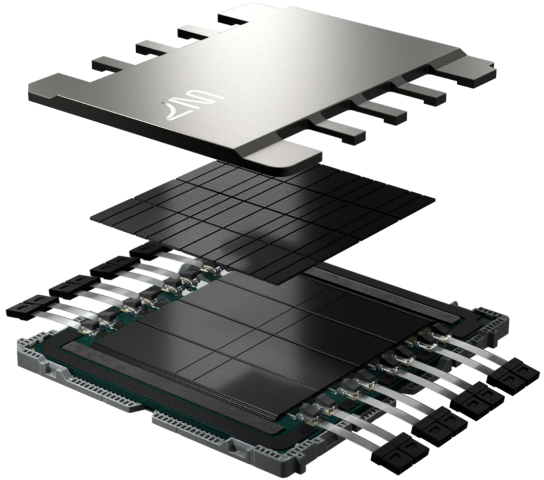
Passage L-Series



3D CPO

Available 2026

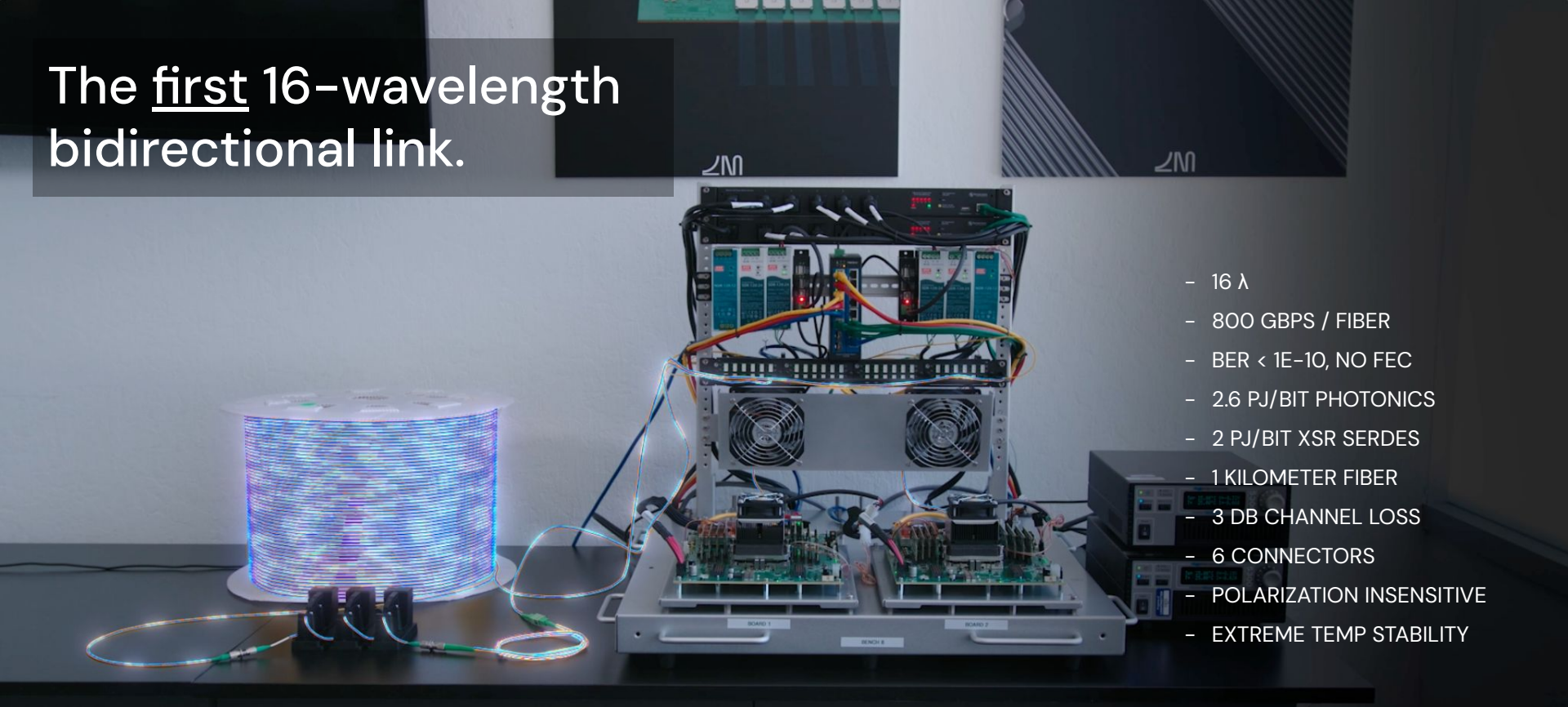
Passage M-Series



Photonic Interposer

Available Now

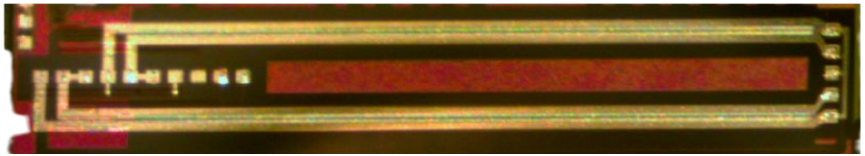
The first 16-wavelength bidirectional link.



- 16 λ
- 800 GBPS / FIBER
- BER < 1E-10, NO FEC
- 2.6 PJ/BIT PHOTONICS
- 2 PJ/BIT XSR SERDES
- 1 KILOMETER FIBER
- 3 DB CHANNEL LOSS
- 6 CONNECTORS
- POLARIZATION INSENSITIVE
- EXTREME TEMP STABILITY

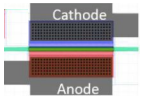
<5 pJ/bit has arrived.
Partners are invited to visit our rack-scale validation lab.

MZM



5000 µm

EAM



50 µm

MRM

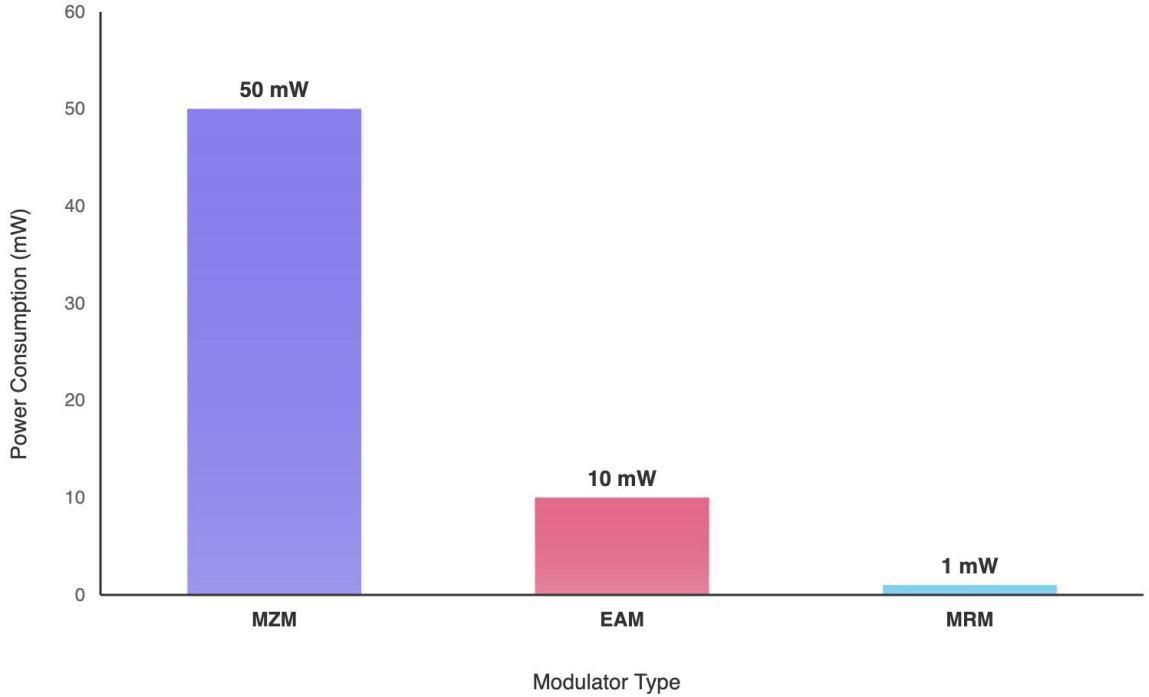
5 µm

AT THE HEART OF PHOTONICS IS THE MODULATOR

MRMs are extremely small.

MINIMIZING ENERGY CONSUMPTION

Smaller and lower power

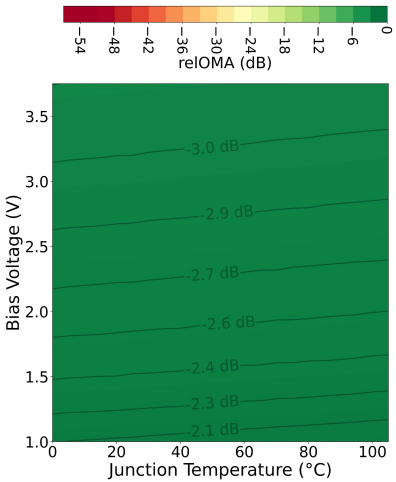


LIGHTMATTER MRM CONTROL TECHNOLOGY

Rock-solid MRMs in extreme thermals

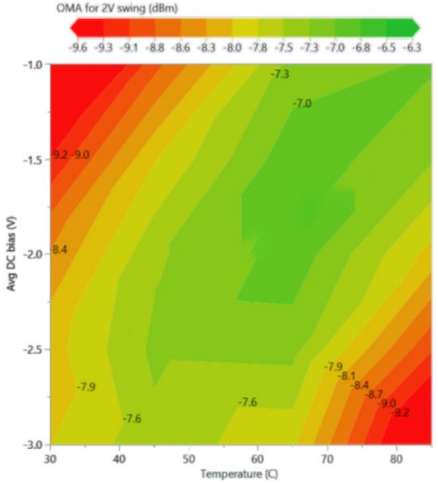
MRM

LIGHTMATTER CONTROL TECHNOLOGY



- Thermally stable
- C, O band support
- 5dB transmit eff. loss
- It is a multiplexer!
- Backed by top foundries

EAM

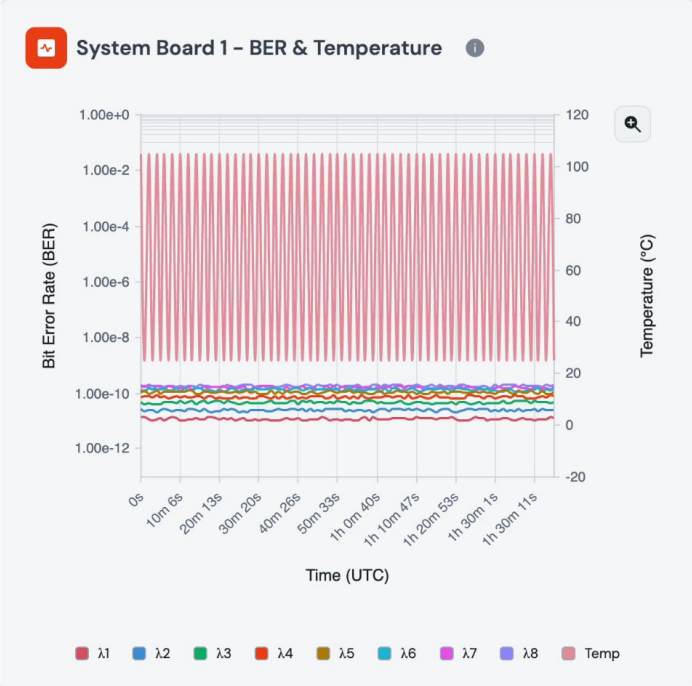


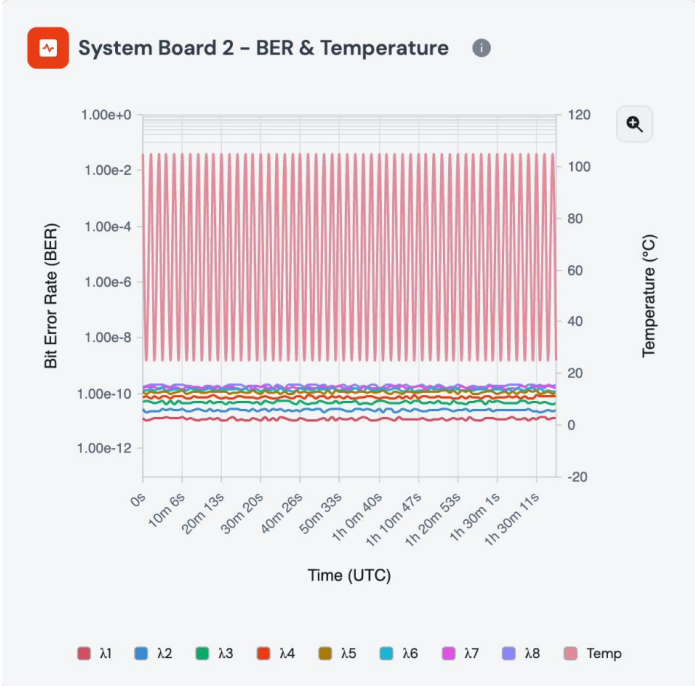
- Thermals unstable
- No O band support
- 10dB transmit eff. loss
- Requires external mux
- Exotic processing for SiGe

SOURCE: CELESTIAL AI

STABILITY ACROSS EXTREME TEMPERATURE CYCLES

Rock-solid thermal data



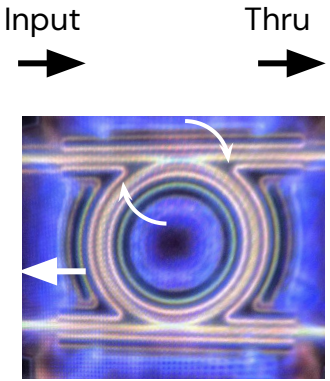


LIGHTMATTER LINK PLATFORM

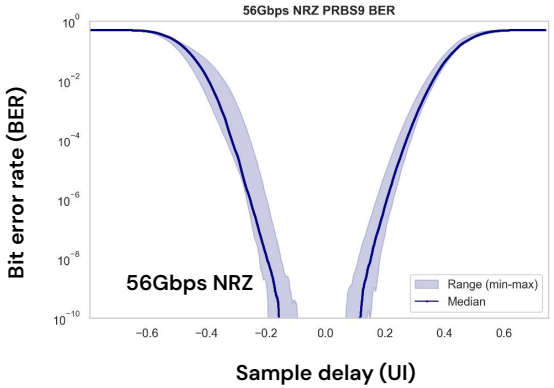
- 16 λ Bidirectional
- 25° →105→25°C
- FEC-less BER => $1e^{-10}$
- Off-shelf XSR SerDes
- 800G on one fiber
- Standard SM fiber
- Polarization insensitive
- 1 km fiber spool
- 6 Connectors

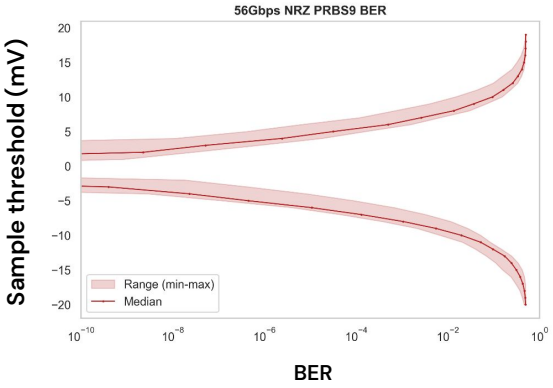
Ultracompact transmitter and receiver

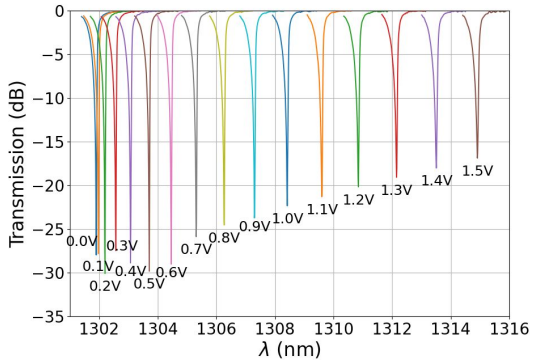
Lightmatter microrings with inductorless driver and analog front end enable **0.006 mm²** Tx + Rx area.

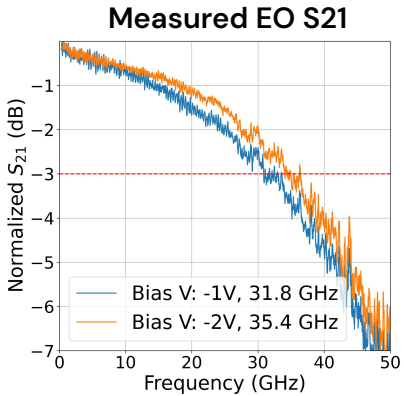


Diameter ~ 15um



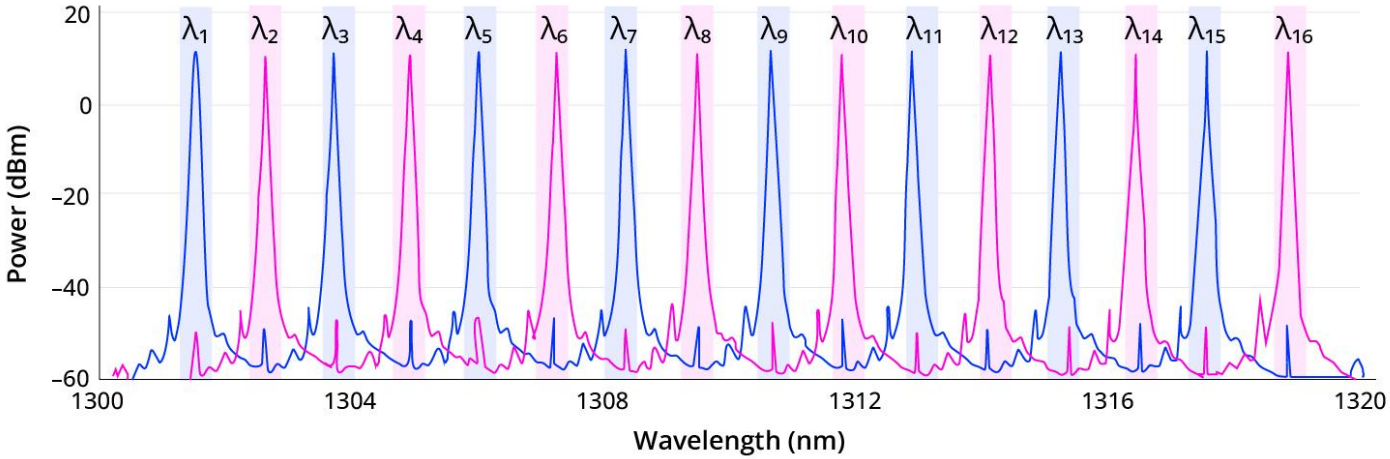






POWERED BY GUIDE™

A single integrated laser



POWERING 32 TBPS

MULTIPLE ROADMAP GENERATIONS HERE TODAY

Enabling all link formats

STANDARDS COMPLIANT

OR

CUSTOM ADVANCED

Bandwidth	Modulation	Number of Wavelengths	Transmission Type	WDM Type
56 Gbps	NRZ	16	Bi-directional	DWDM
56 Gbps	NRZ/PAM4	16	Uni-directional	DWDM
112 Gbps	PAM4	16	Uni-directional	DWDM
224 Gbps	PAM4	4	Bi-directional	CWDM
224 Gbps	PAM4	4	Uni-directional	CWDM

800 Gbps and 1600 Gbps per fiber already available. Leapfrog with Lightmatter.

Watch M1000 unveil at HotChips.