Novel interconnect technology

Enabling ultra-high-bandwidth everywhere – from datacenter to edge

Intro Pitch Deck

Brian Cline, PhD
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Lumoniq – Our Story

(pronounced: loo·MAH·nik)

Formed at the intersection of computer- and communications-tech by two pioneers at the forefront of these fields.

Lumoniq uses metal wires and light in a new way **to move data 2,000× more efficiently** than similar technologies, increasing bandwidth capabilities while reducing power and size. This allows customers to **exponentially improve computer chip and system performance** in the age of rapidly increasing demand due to AI.

Jump to: *Meet the Leadership Team*

Industry Problem: Bandwidth Limits Today's Computer Chips/Systems

Bandwidth scaling hasn't kept up
(e.g., 2-year trends)

AI-Model Size	Compute	Bandwidth
↑12x	↑4x	↑1.3x

Higher Bandwidth now "costs" →
>loss, <distance, >power, >cooling … >>$$

Next gen AI: adding images/video to models
→ >100× more data!

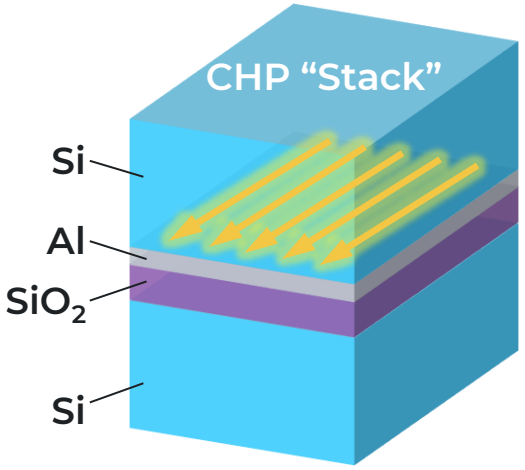
Conventional Interconnects over Copper: No Longer Sufficient to Meet Future Demand at All Levels

Our Solution: Solving Bandwidth Limits with Better Si-Photonics

Finally beating electronics at short distances (down to mm's)

Lumoniq's Si-Photonic Innovation: Coupled Hybrid Plasmonics (CHP)†

- Patented device & integrated circuit (IC) architectures
- Uses **metals and light** to move data with unprecedented efficiency
- Innovation eliminates metal-induced losses to create new modulators, detectors, etc.



Coupled Hybrid Plasmonics
Light confined by 1,000×‡
→ Devices shrink by 100×‡
→ Speed and power follows

Disruptive Performance, Minimized Adoption Barriers

- **40-100× less area**‡ (down to 2 μm²)
- **5-10× less energy**‡ (down to 10fJ/bit)
- **12× more bandwidth**‡ (up to 500 Gbaud)

Plus…

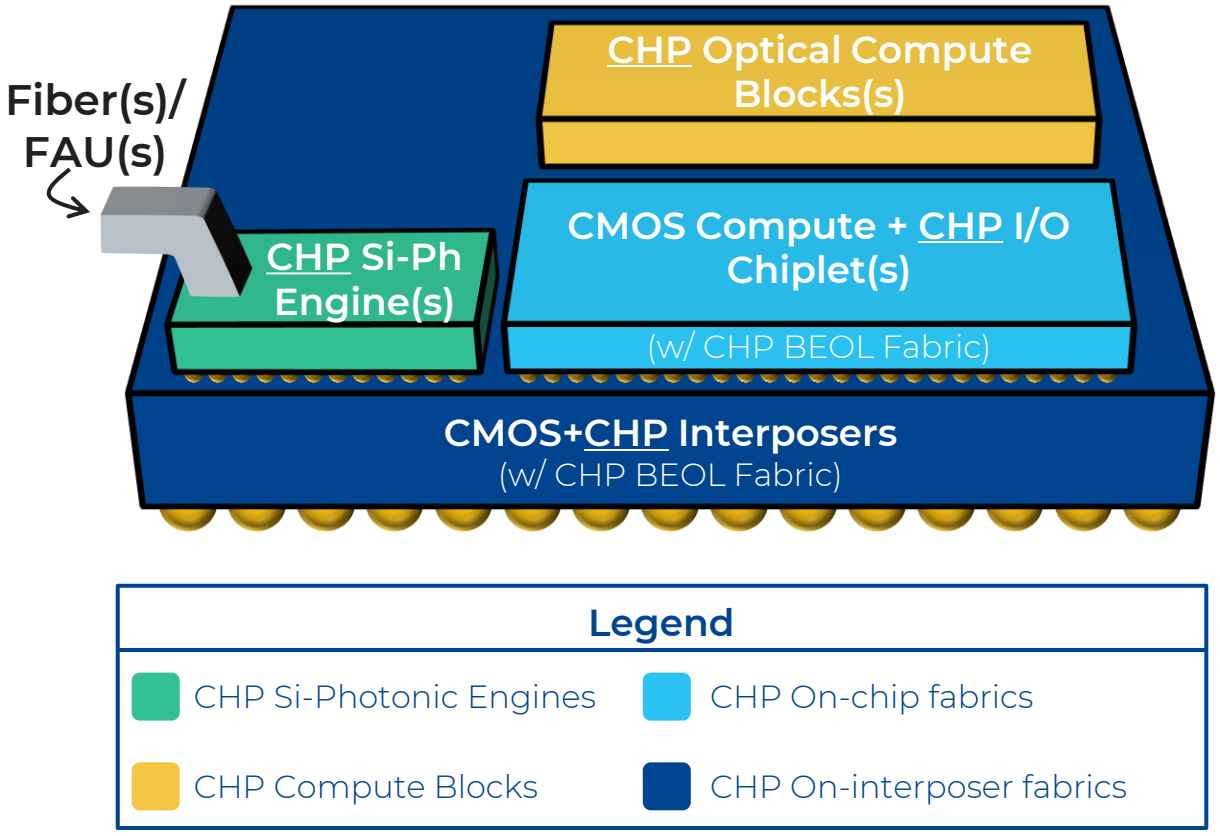
✓ Extends existing Si-Photonic ecosystem (same lasers, passives, etc.)
✓ Broadband (1.3-1.6μm near-infrared demonstrated)
✓ Temperature insensitive (tested over 0-100° C)
✓ Cheaper monolithic integration (CMOS BEOL Compatible)
✓ Seamless Si-Photonic coupling, low loss (1dB)

† *Seminal Papers (from co-founders): [1] Lin, NanoLetters'20 [2] Lin, IEDM'20*
‡ *Compared to Si-Photonic based Micro-Ring Resonators (MRRs)*

Our Vision: All-Optical Systems

CHP → One Technology → Ultra-High Bandwidth Everywhere

The Future of Computer Chip/System Design with CHP



CHP Platform — **CHP Enables Multiple Product Families**

Si-Photonic Optical Engines
Product Family #1 (Scale-Out/Scale-Up)
- Co/near-packaged (CPO/NPO)
- On-board (OBO)

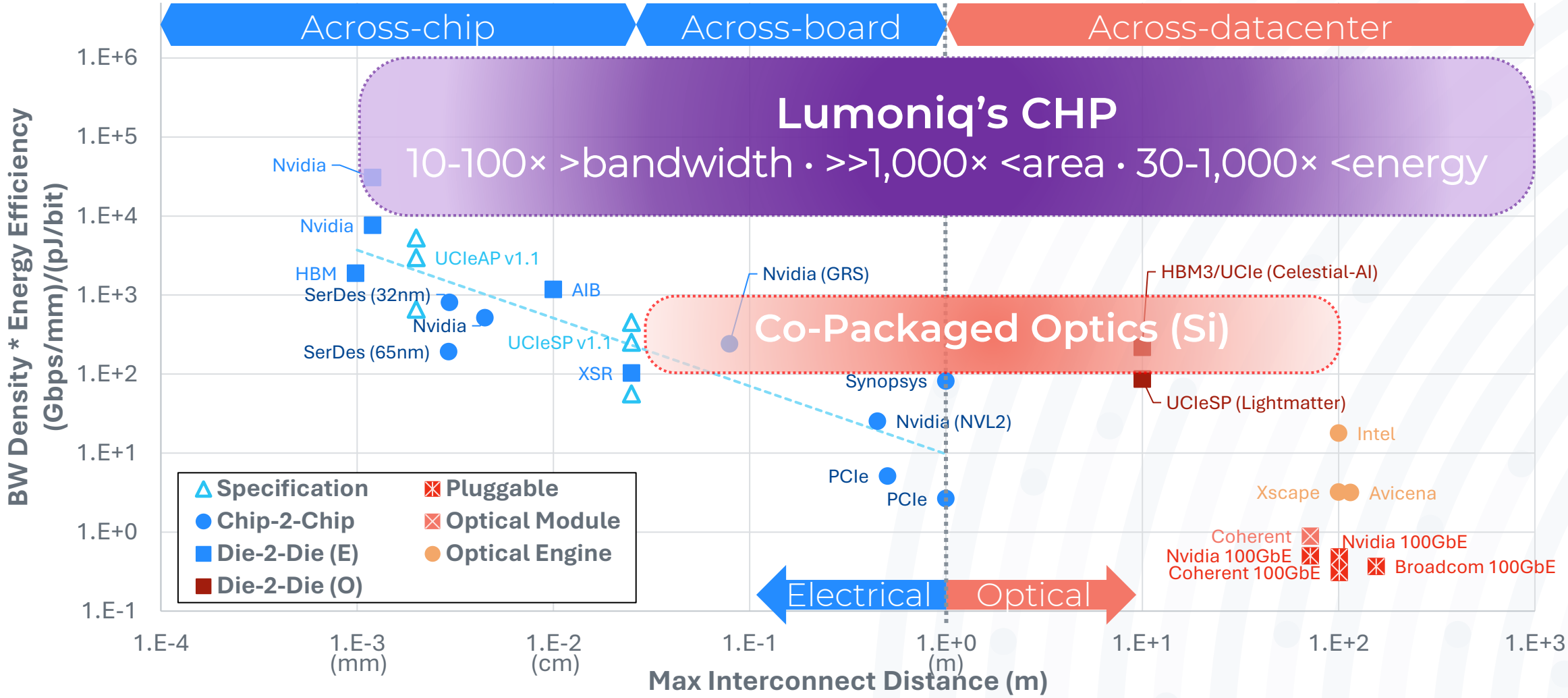
CMOS Interposers w/ CHP
Product Family #2 (Scale-In)
- Microelectronics/Semiconductors
- CMOS Legacy Node

CMOS Chiplet w/ CHP
Product Family #3 (Scale-In)
- Microelectronics/Semiconductors
- CMOS Advanced Node

CHP Optical Compute
Product Family #4 (Compute)
- Microelectronics/Semiconductors
- (Node Agnostic)

Competitive Landscape & CHP Advantage

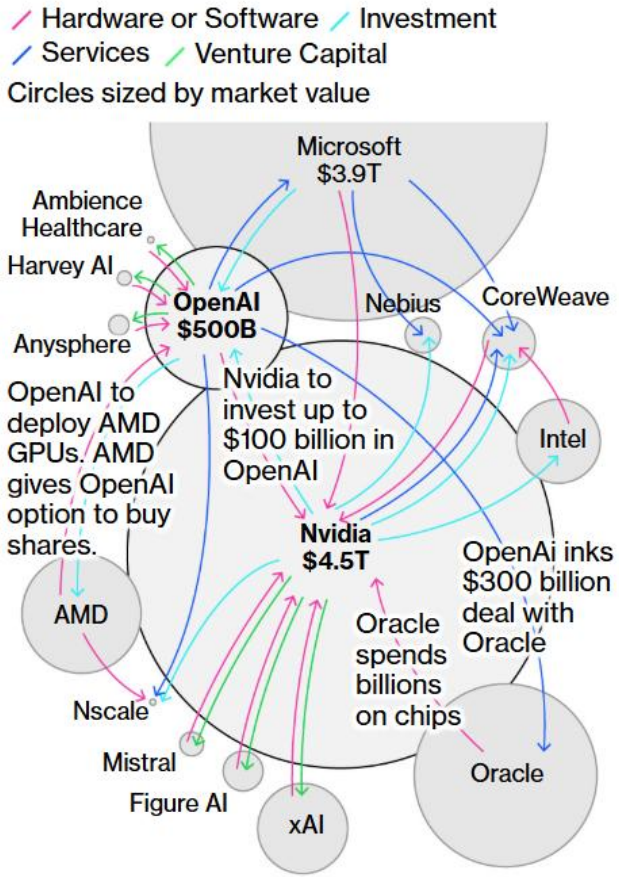
Lumoniq provides higher bandwidth everywhere … mm → m



AI is Driving Compute Infrastructure

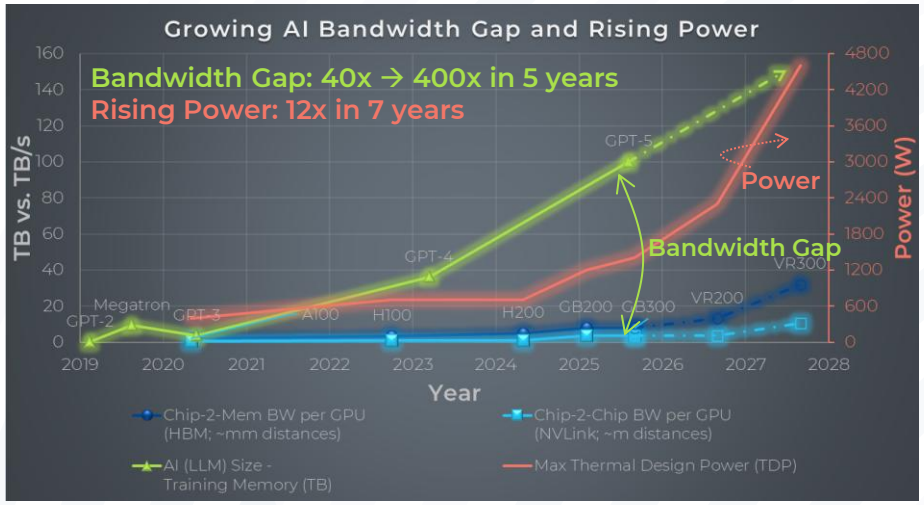
And Bandwidth, Power, and Resource requirements will break it without technology advancements

"The AI Money Trail"†



The path to profitability is impossible or delayed due to bandwidth, power, heat, … that Lumoniq is solving

[Click image to link to full slide]



- **Bandwidth Gap (above)** minimally closed… by **ADDING MORE HARDWARE**
- **ADDING HARDWARE exponentially increases**
  - Power (right axis, above)
  - Space required (more real estate!)
  - Heat ⇔ Cooling (more power, more real estate!)

†OpenAI's Nvidia, AMD Deals Boost $1 Trillion AI Boom With Circular Deals - Bloomberg

Go-to Markets: >$100B I/O & Compute Products

2028 Market Projections

Phase 1: Datacom Solutions

Pluggables, CPO & "SerDes" Replacement

SAM: ~$12B Market[1,2,3]
19% CAGR

Phase 2: Coherent Transceivers

Long-distance comm's

SAM: $13B Market[1]
16.2% CAGR

Phase 3: End-to-end Optical Systems

Optical Compute & I/O

SAM: >$83B Market[4]
Growth: >$830B Chip

TAM ("Semiconductors"): >> $1 Trillion

[1] *Optical Transceiver Market*, Coherent Optical Transceiver Shipments, *Communications Market Overview*
[2] *Si-photonics and PICs - 2025-2034 Market Forecast*
[3] *High-end Interconnect IP Forecast 2022-26*
[4] *Semiconductor Market To Cross 1 Trillion By 2030*

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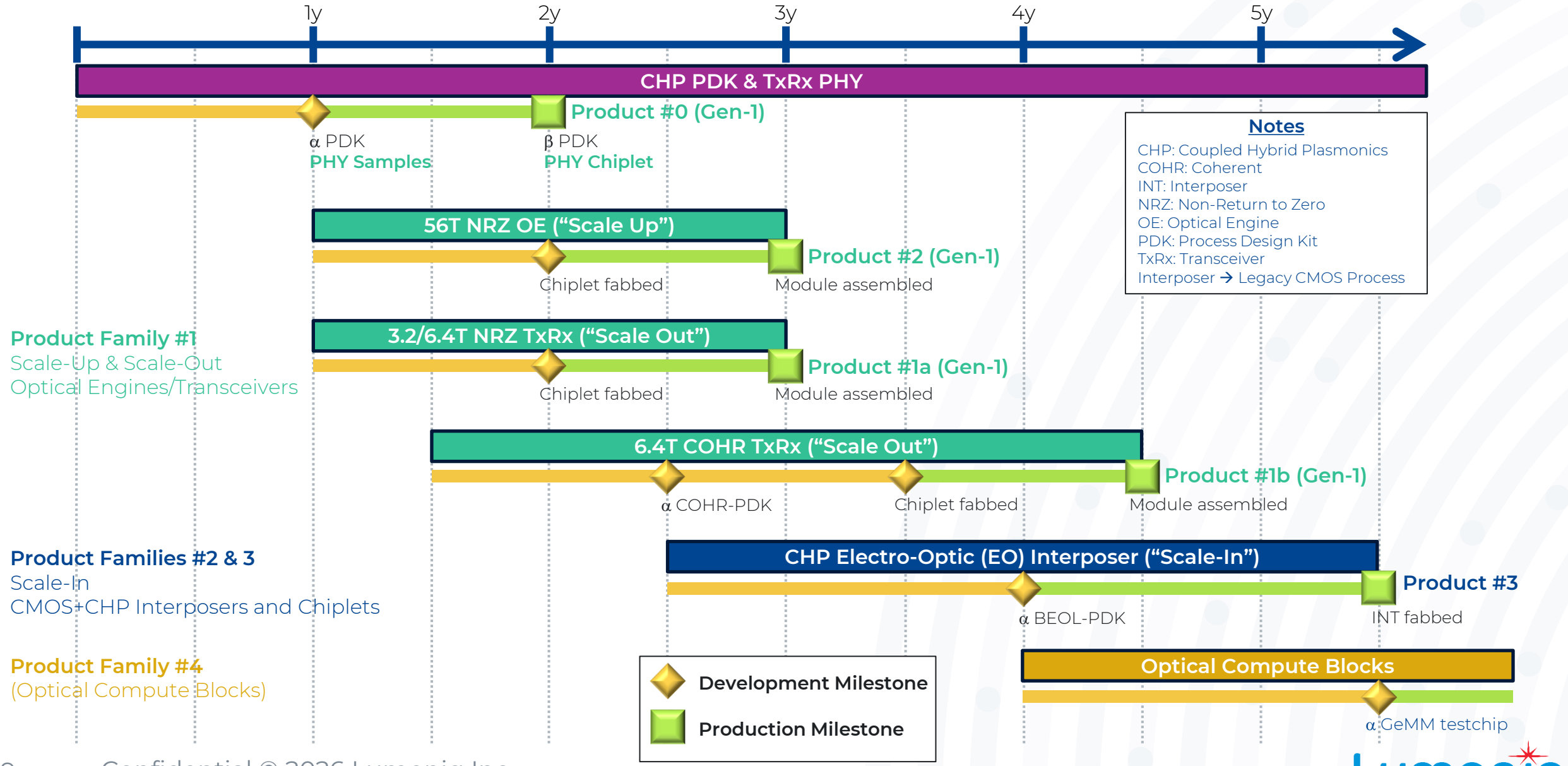
Product and Commercialization Roadmap



First Step: CHP Optical Engine Prototypes

Discovery Requests: Wafer-scale Demonstration

- **Met with numerous chip/datacenter companies**

- **Common request: wafer-scale test-chips/samples**
  - Signal integrity
  - At-speed test of bandwidth
  - Reliability
  - Variation tolerance
  - Low-voltage operation
  - “…when will the tapeout be…”

Seeking $0.9M: Develop, Manufacture Optical Engine Prototypes

Months

1 2 3 4 5 6 7 8 9

Process Bring-up (T0-M2)

- Build-up CHP layers and test each, individually
- **Milestone: Process flow established, tuned to target specifications**

Device Fabrication (M3-5)

- Fabricate ~10,000's of individual CHP devices and integrated circuits (ICs)
- Wafer probe & test devices across 4-5 wafers
- **Milestone: "Known Good Dies" (KGDs) identified**

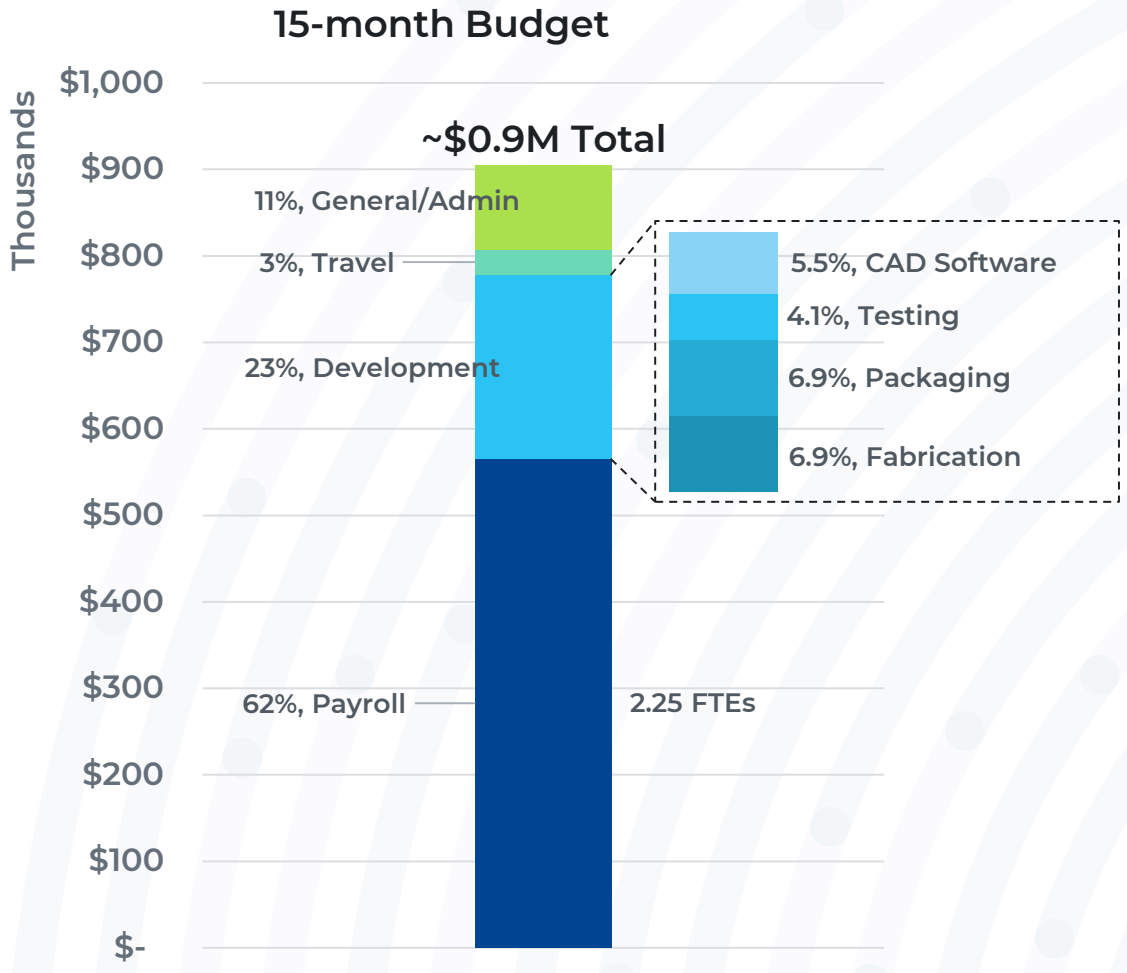
Device Packaging (M6-7)

- Package KGDs: add optical couplers, electrical connectors, and mounts for temp. control
- **Milestone: Packaged KGDs back from supplier**

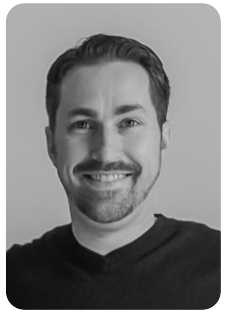
Chip Testing (M8-9)

- Electrical & Optical Testing – Bandwidth, Power, Insertion Loss, Temperature Stability, …
- **Milestone: Chip prototypes fully tested**

After Prototypes tested → 6-month fundraise
($0.9M runway = 15 months)



Lumoniq Management Team



Brian Cline, PhD

CEO, Founder

in, Google Scholar

TEXAS MICHIGAN

Professional Background: arm

- Next-gen computer design & tech-pathfinding
- Seasoned computer hardware pioneer
- Deep-tech intrapreneur
- IP Leader

Amr Helmy, PhD

CTO, Founder

in, Google Scholar

University of Glasgow

Professional Background: UNIVERSITY OF TORONTO hp Agilent

- Nano & quantum photonics
- Seasoned photonic pioneer
- R&D Industrial experience
- Award-winning Optica/IEEE Fellow/Member

Board of Advisors

Drew Perkins

Infinera ERIDU AI mojo

Dipesh Patel

arm

Tony Picard

imec cadence arm

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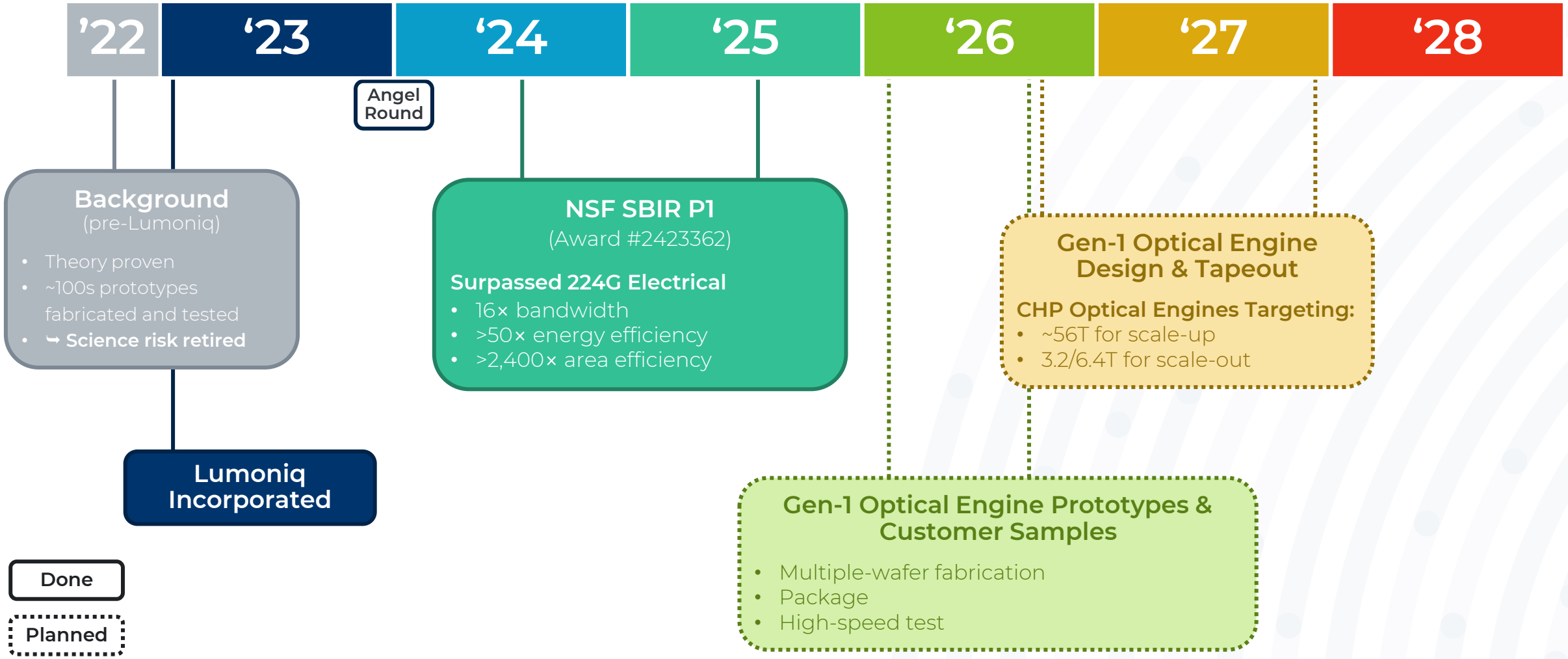
Current Status, Accomplishments, Timeline



Summary

Compute & I/O hardware → approaching limits

Lumoniq's solution → >2,000× benefit/advantage

Best-in-class photonic products → >$800B chip market

→ Finally enables end-to-end optical systems from compute to I/O

The Lumoniq Solution

Enables multi-generational interconnect scaling roadmap for computing systems & unlocks new ways to build the computers of tomorrow

What we're looking for

Investors/partners that are:

- *Passionate about hardware*
- *Understand ecosystems*
- *Can help us validate our vision and fill gaps*

Thanks!

For more information, email:
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Backup

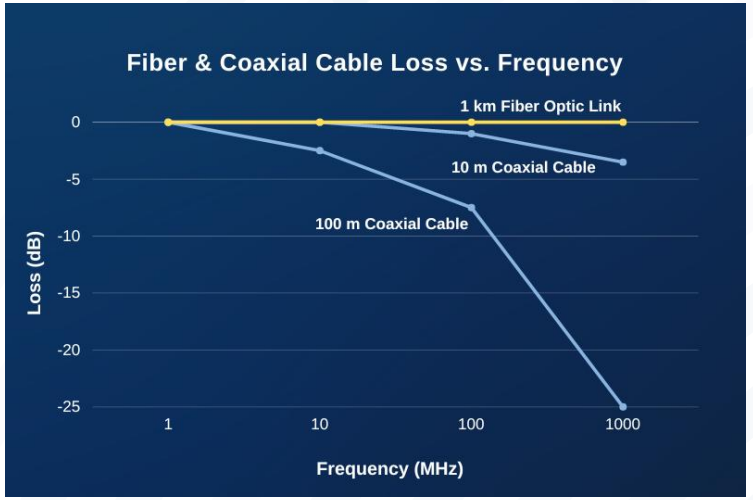
Photonics' decades-long pursuit down to "chip range"

"Chip range" – mm~m

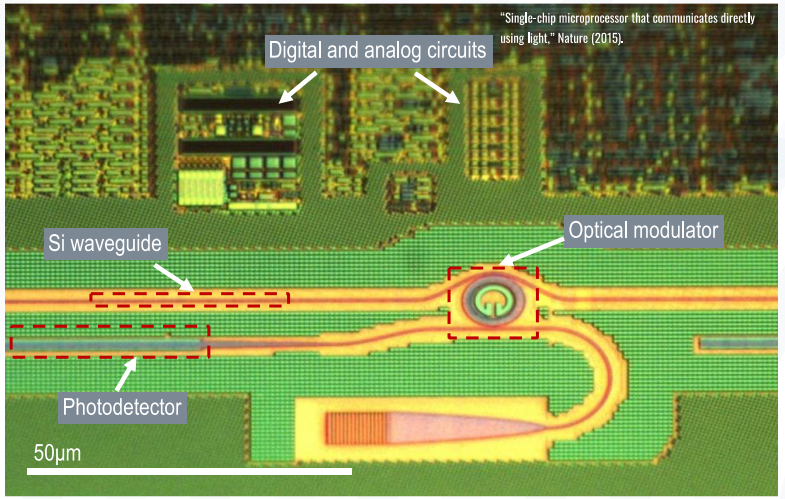
- **Photonics → long-haul (~km) solution for 25+ years**

- **Photonic speed/power/area/cost scaling << CMOS**
  - Devices are constrained by diffraction-based physics
  - Led to large market barriers (vs. electrical/copper):
    - ✘ 10× lower reliability
    - ✘ 10-100× higher power and cost
    - ✘ Temperature sensitivity & crystalline-Si reliance
  - **Even scale-out/back-end roadmap beyond 1.6T is difficult** (e.g., lane bandwidth, power, thermals)

➡ **Today, 200G electrical/copper still wins <~m**

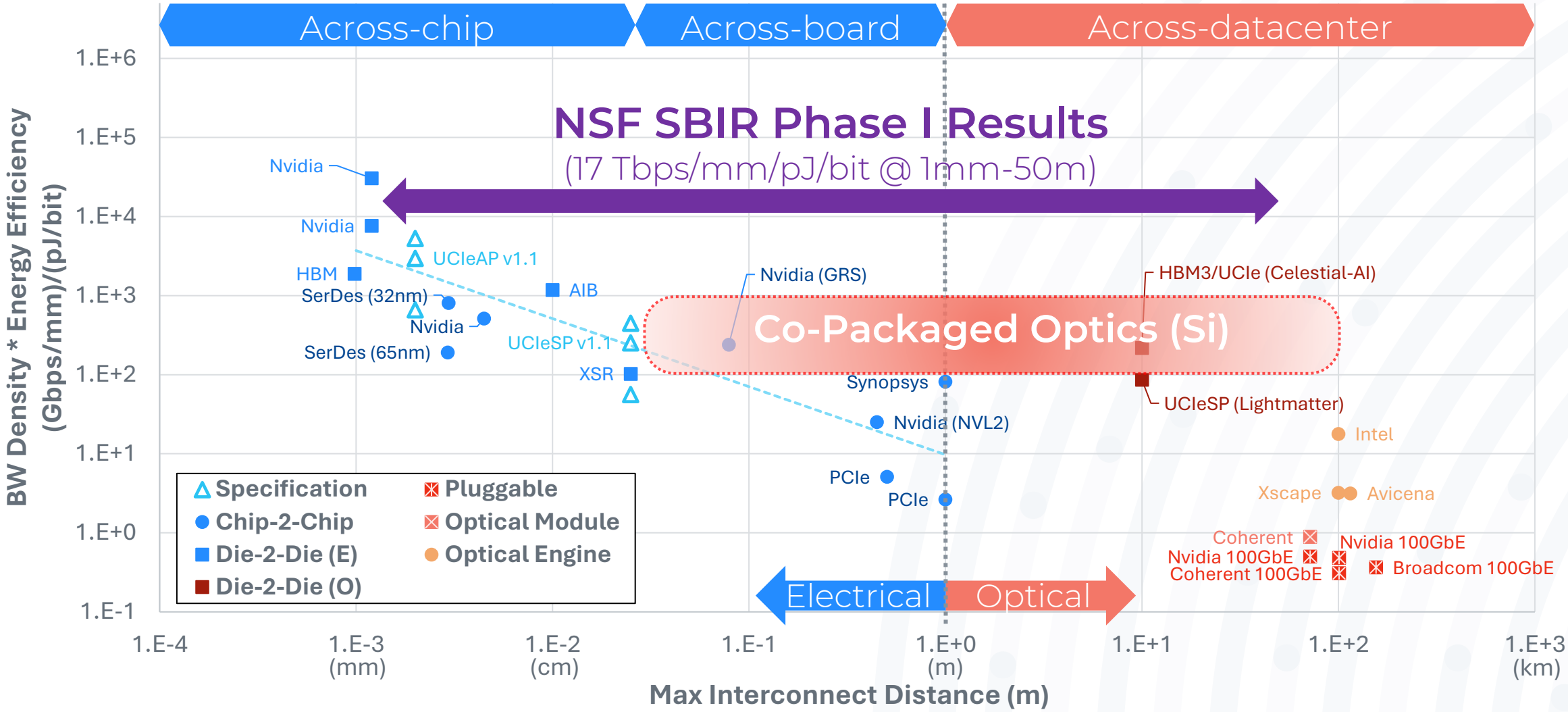


Huge copper losses from speed and distance [Ref]



~100× size-difference between photonics and electronics

Competitive Landscape & CHP Advantage



AI Bandwidth Gap and Rising Power (full slide)