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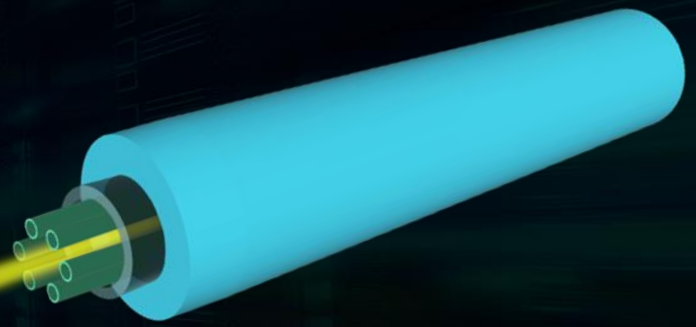
Accelerating 6G Deployment with Hollow Core Fiber Infrastructure



Enabling the next generation of AI compute by creating flexibility for data center deployment

Relativity Networks, Inc

- Relativity Networks, founded by Professor Rodrigo Amezcua, UCF/CREOL
- +20yrs of experience with high-power, hollow core fibers
- IP with anti-resonant fiber designs as well as active and passive components for high-power transmission
- A partnership with Relativity Networks is the path to innovation for the next generation fiber networks.

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Prysmian Partnership

- **Partnership established with Prysmian Group**
  - ~18B Euro publicly traded fiber and cable manufacturing company
- **15 year profit sharing arrangement**
  - Option for extension
- **Global operations to support scaling and increased capacity**
  - Domestic and Foreign production options
- **Initial HCF Production in Eindhoven, NL**
  - Five draw towers and support equipment commissioned
  - Multiple shifts in operation to meet market demand

“We believe we can teach Prysmian how to make our fiber faster than we can build the infrastructure ourselves” Jason Eichenholz, CEO

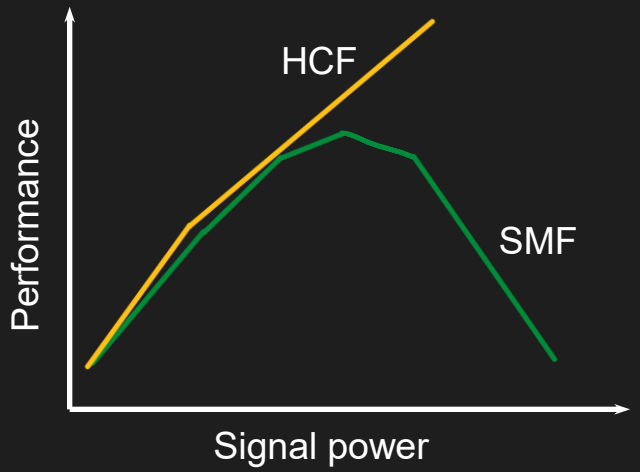
Hollow Core Fiber Advantages

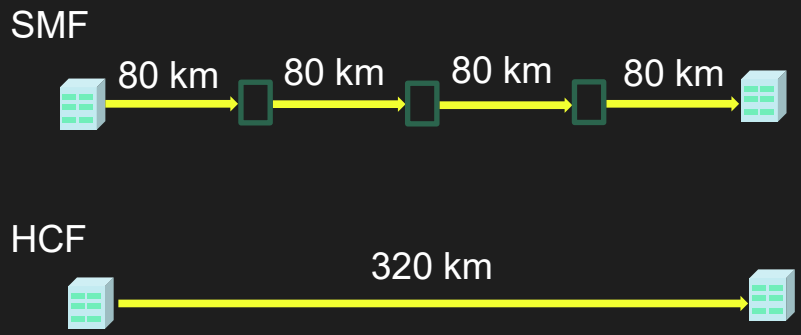
- Significant improvement over legacy hollow core fiber
- ~ 32% Lower latency than SMF
- High-power handling capability (kW)
- Almost non-existent non-linear penalty (1000x lower than SMF)
- Low-loss roadmap (0.15dB/km and lower)
- Very low chromatic dispersion
- Ultra-wide band designs possible

What would you paint with a blank canvas?

- Fiber designs can be tuned to any wavelength
  - 425nm, 850nm, 980nm, 1070nm, 1310nm, 1550nm
- Virtually unlimited power handling capability

SMF vs. RelNet HCF Performance





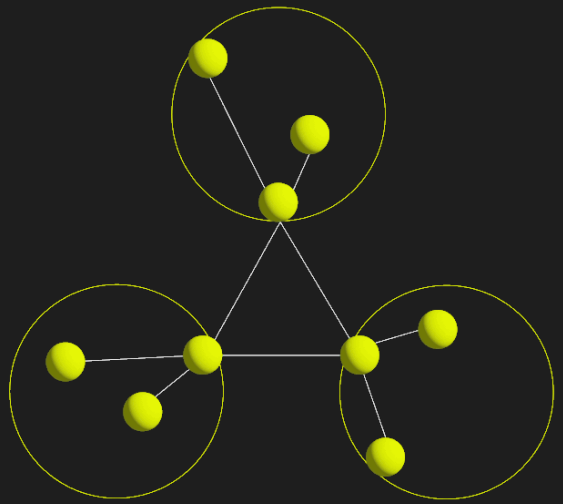
- HCF has a very little nonlinear effects (~1000 times lower than SMF)
- Enables transmission at a very high transmitted signal power

- Span length can be significantly increased due to low-loss and high signal power

Latency comparison: SMF to RelNet HCF

Distance (m)	SMF Latency (nsec)	HCF Latency (nsec)	Latency reduction (nsec)
1	4.9	3.3	1.56
10	49	33	15.6
100	489.7	333.3	156.3
1000	4,897	3,333	1,563
2000	9,793	6,667	3,127
10,000	48,967	33,333	15,634

Driving Down Latency is Easier than Finding Power



Availability Zones are a Latency-Defined Perimeter

- Availability zones have a pre-defined latency spec in order to keep them synchronous
- New Data Centers cannot be brought online if power is not readily available geographically
- Relativity's ***Patent-Pending Fiber*** increases transmission speed by **47% &** reduces latency by **32%** therefore increasing AZ's geographic footprint by **2.25x**
- New Data Centers can be brought online by relocating them closer to emergent power solutions within those larger AZ's

Product Roadmap - 1310nm/1550nm Fiber

- Fiber capacity ramping quickly
- Possibility for 100,000 km/yr in 2028

High-Power Transmission Via HCF

- +20yrs with air core fibers
- Experience w/ coupler designs to interface to any fiber type
- High-power connectors
- High-power sources/amplifiers

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Benefits of high-power, low non-linearities, low-dispersion

- Extend High-Speed PON distance and larger split ratio
- Higher-launch powers into HCF w/o non-linearity or chromatic dispersion penalty
- Wideband HCF designs cover the operating range

Experimental Setup

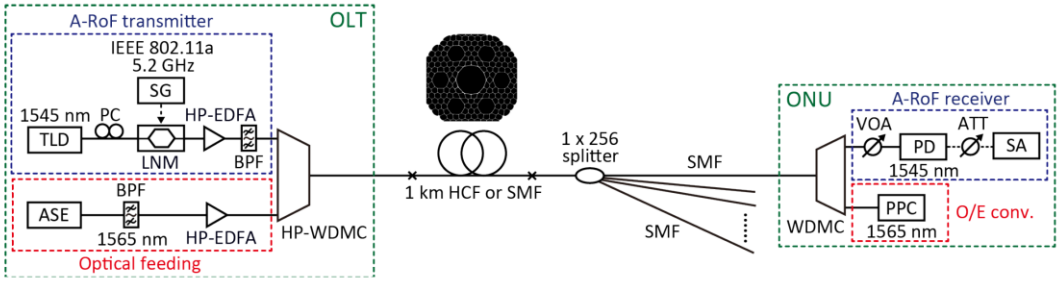
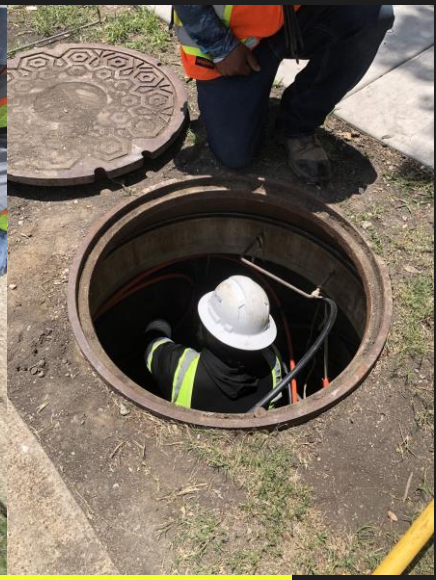


Fig. 1. Experimental setup for simultaneous data and power transmission using a 1 km HCF for 1:256 PON with optical powering. TLD: Tunable Laser-Diode, PC: Polarization Controller, SG: Signal Generator, LNM: $LiNbO_3$ Modulator, HP-EDFA: High-power Erbium Doped Fiber Amplifier, BPF: Band-Pass Filter, ASE: Amplified Spontaneous Emission source, HP-WDMC: High-Power Wavelength-Division-Multiplexing Coupler, VOA: Variable Optical Attenuator, PD: Photo-Diode, ATT: electrical Attenuator, SA: Signal Analyzer, PPC: Photovoltaic Power Converter. Inset shows cross section of 1 km HCF we used.

"Demonstration of High-Power PON for Higher Split Ratio and Optical Powering Using a Hollow-Core Fiber", M4I.4, Optical Fiber Communications Conference 2025

Fiber Cable Deployment Ready

- HCF cable has been installed at hyperscaler and major telecommunication company
  - Plumett IntelliJet Jetting Machine

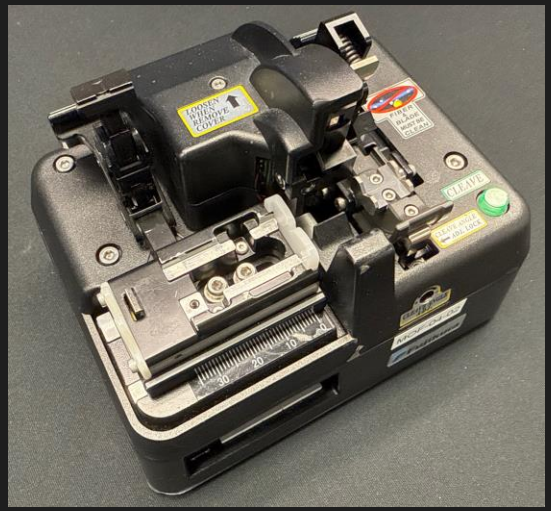


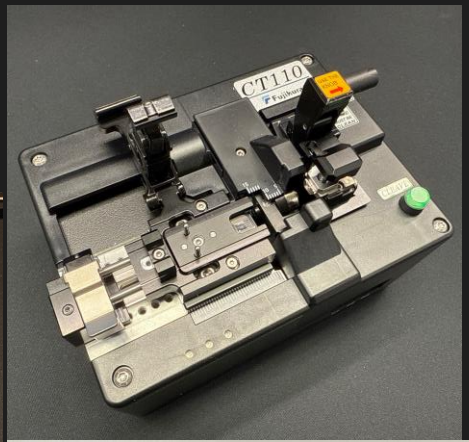
Building Eco-System of Partners

- Trusted Installation Partner
- Splicer & test/measurement partners
- Systems equipment providers – Ciena, Cisco, Infinera/Nokia, Adtran & others building systems to take advantage of HCF

Cleaver Hardware

- Commercial products tested with HCF

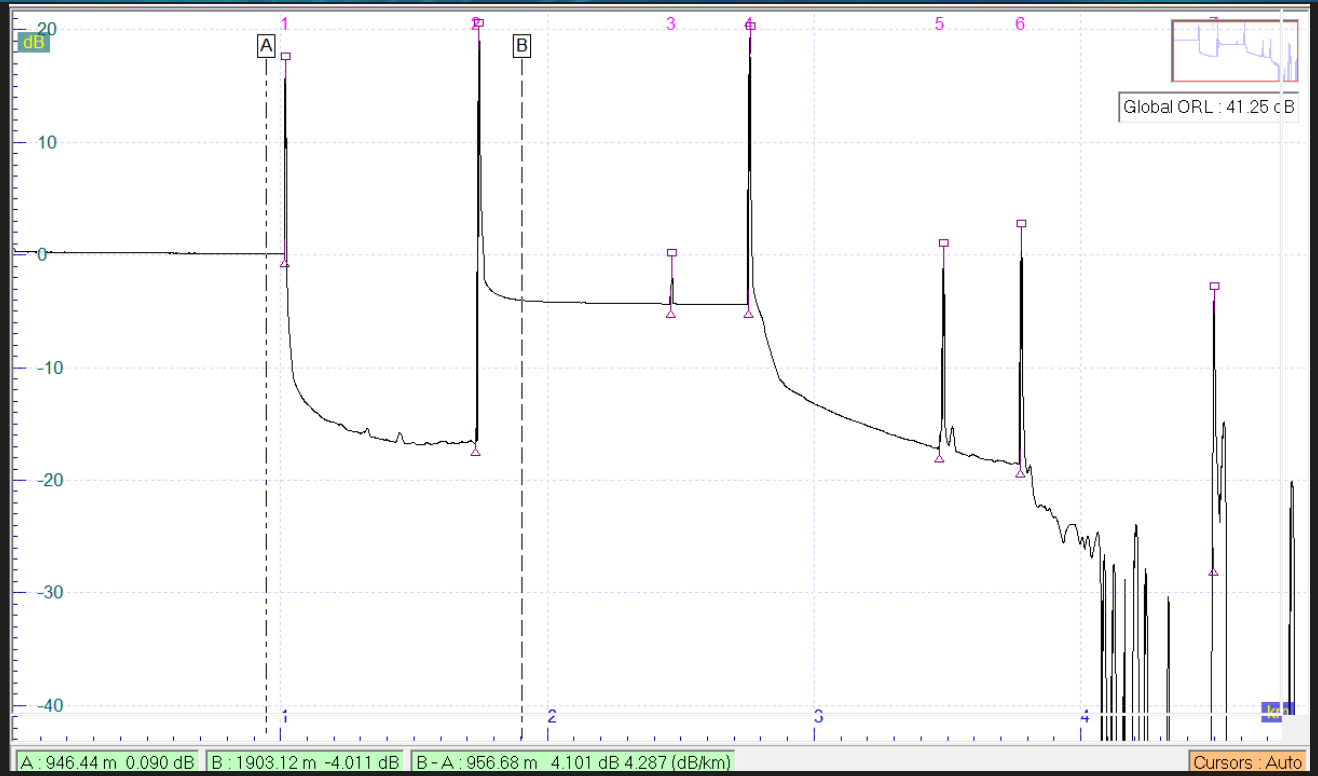




Specialty Splicer Hardware

- Commercially available Splicer capable for HCF

Standard OTDR measurement of HCF



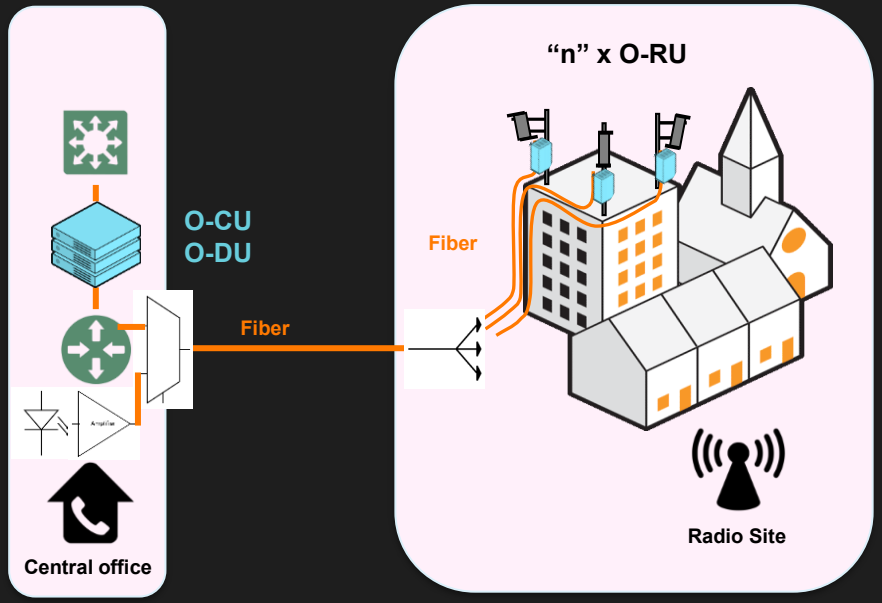
Comparison of 5G vs. 6G KPIs

- Challenges in Improvement
  - Not just one metric, but all metrics need advancement
- Goals for Network Enhancement
  - Faster network
  - More responsive network
  - More reliable network
  - More efficient network

Table 1: 5G vs. 6G Key Performance Indicators (KPIs)			
KPI	5G Target	6G Target	Order of Magnitude Improvement
Peak Data Rate	20 Gbps	1 Tbps (1,000 Gbps)	50x
User Experienced Data Rate	100 Mbps - 1 Gbps	10 Gbps - 100 Gbps	10x - 100x
Latency (Air Interface)	~1 ms	< 100 µs	>10x
Reliability	99.999% (5 nines)	99.99999% (7 nines)	100x
Connection Density	106 devices/km²	107 devices/km²	10x
Mobility Support	up to 500 km/h	up to 1,000 km/h	2x
Spectral Efficiency (Peak)	~30 bps/Hz	>60 bps/Hz	>2x
Energy Efficiency	Baseline (x)	10x - 100x	10x - 100x
Sources: Gemini AI			

6G Proposal – Leveraging HCF Advantages

- Enable 6G goals
  - Sustainability
  - Power reduction
  - μ-cell deployment
- Latency advantage
  - Extend fiber distance from CO from 20km – 30km
- Power handling capability
  - Launch kW – PoF
- Superior Transmission Medium
  - RFoF at THz Frequencies



*Images modified from ECOC 2025 Workshop:15 MOPA presentation

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