

Next Generation Fibres Application for Advanced 5G and 6G Networks

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The background of the slide is a dark, abstract image featuring vibrant blue and purple light trails that resemble fiber optic paths or data streams. These trails curve and flow across the frame, creating a sense of dynamic movement and technological connectivity. The overall color palette is dominated by deep blues and purples, with bright highlights from the light trails.

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01

Background

Vision for Advanced 5G and 6G Networks

All kind of smart devices requiring ultra high speed wireless broadband.
We are entering a world with smart links.

“Information a finger away, everything in touch”



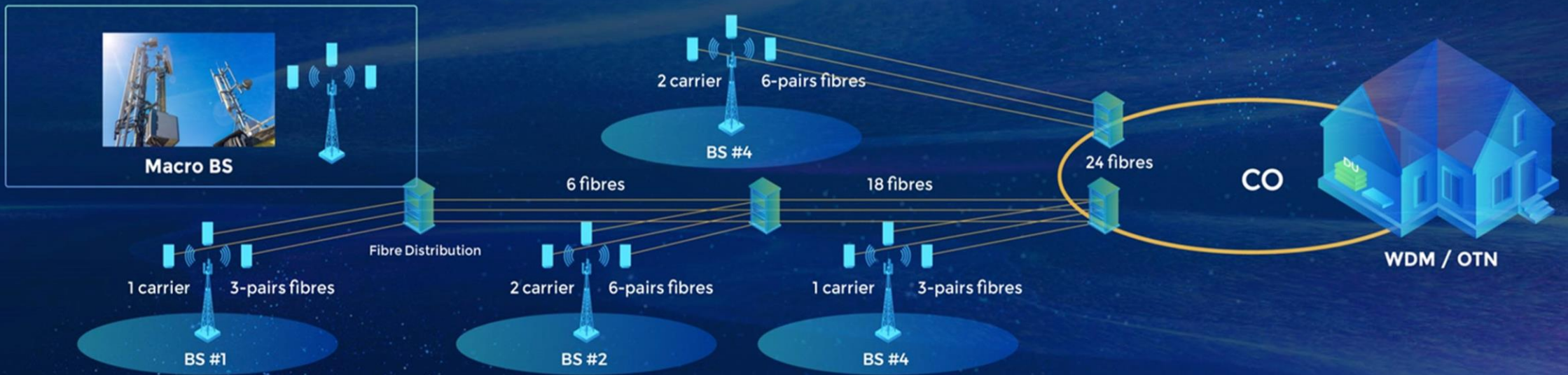
Data Source: Huawei

Smart Link Better Life.

- The world is ready to communicate wireless at very high speed with various kind of smart devices
- All information will be available to us and management by various Industries, Government, etc. will be more effective and efficient

Advanced 5G & 6G Networks Will Drive Fibre Demand

Advanced 5G and 6G will require more base stations and more fibres for high speed data transmission. Requirement of fibres supporting WDM solutions, Bend insensitive fibres ultra low latency fibres, low loss fibres, etc.



| Early stage of 5G (3.5GHz only)

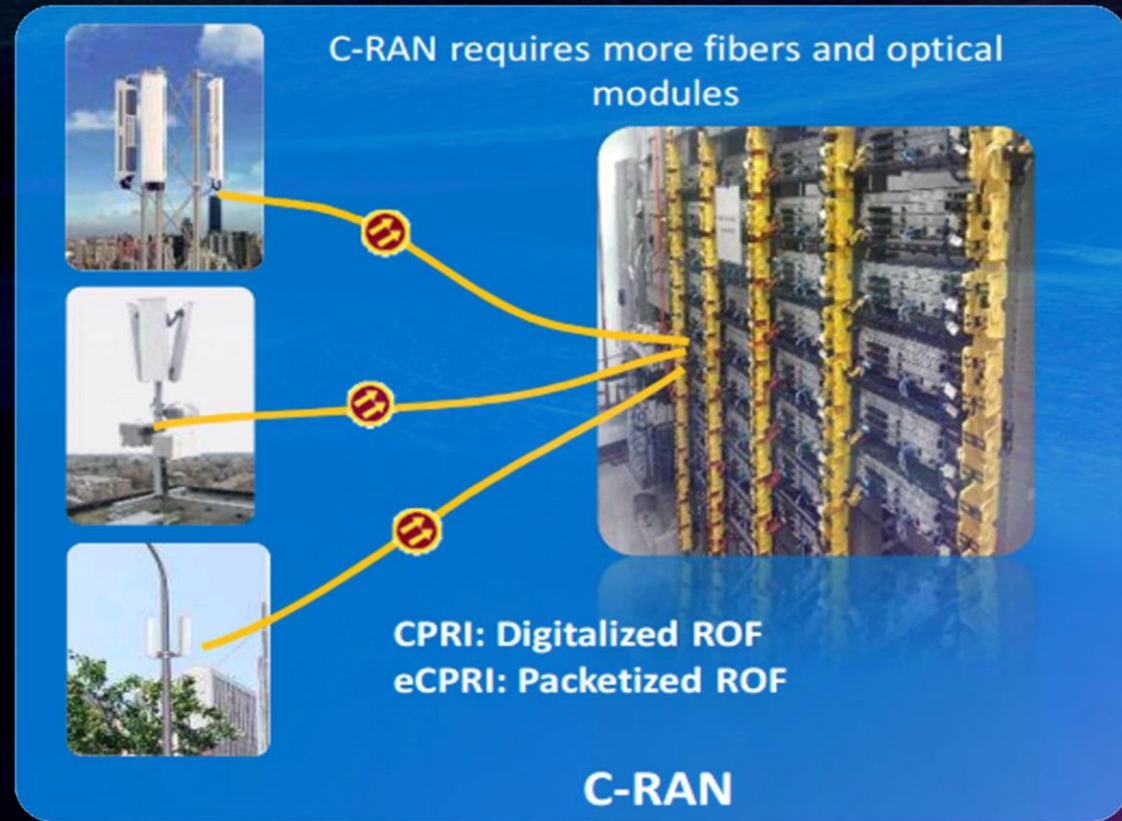
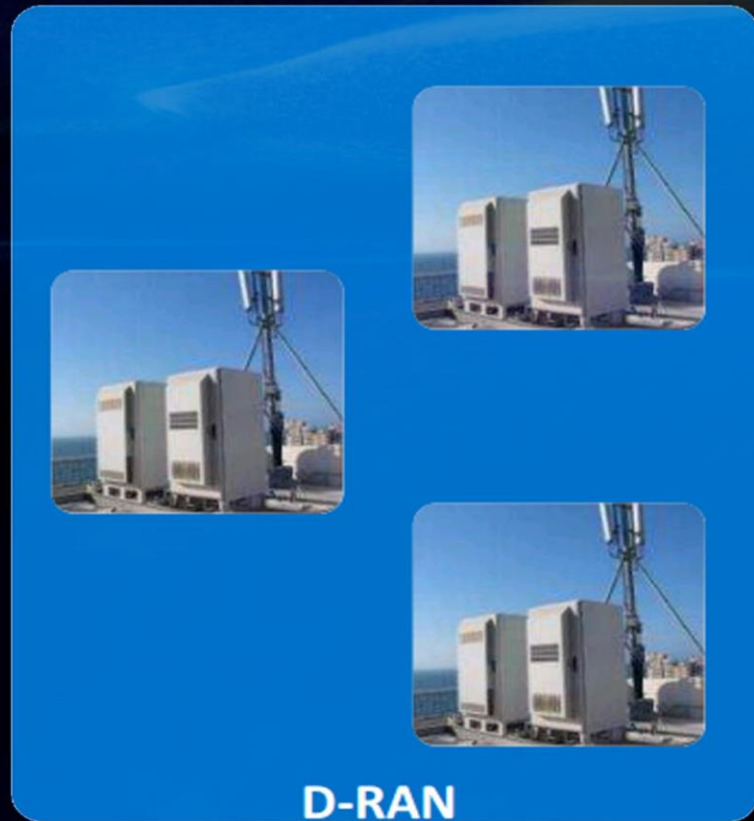
- 5G-only: 3 x Cells, 6 fibers (duplex)/ 3 fibers (BiDi)
- 3G/4G/5G co-site: accumulated

| More carriers, more BSs, more fibers

WDM
—
A Solution

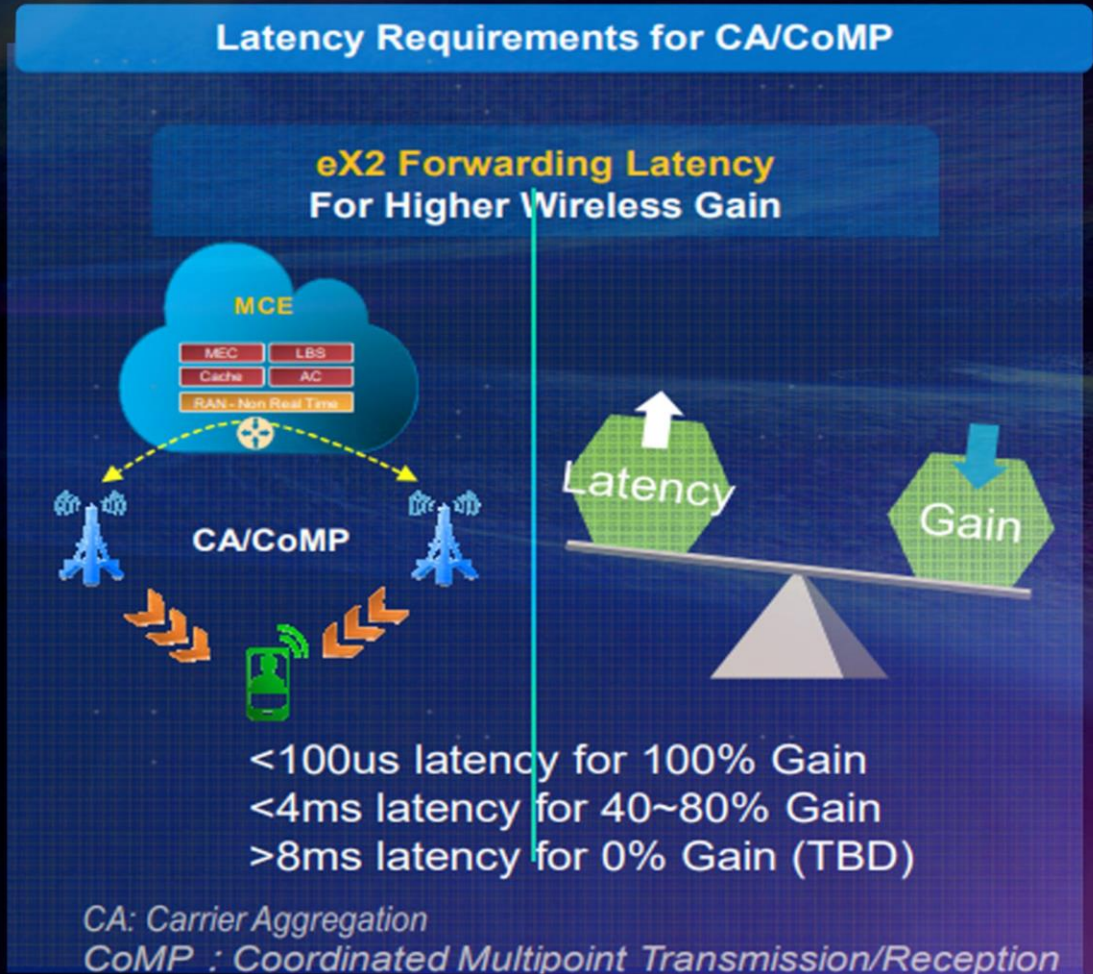
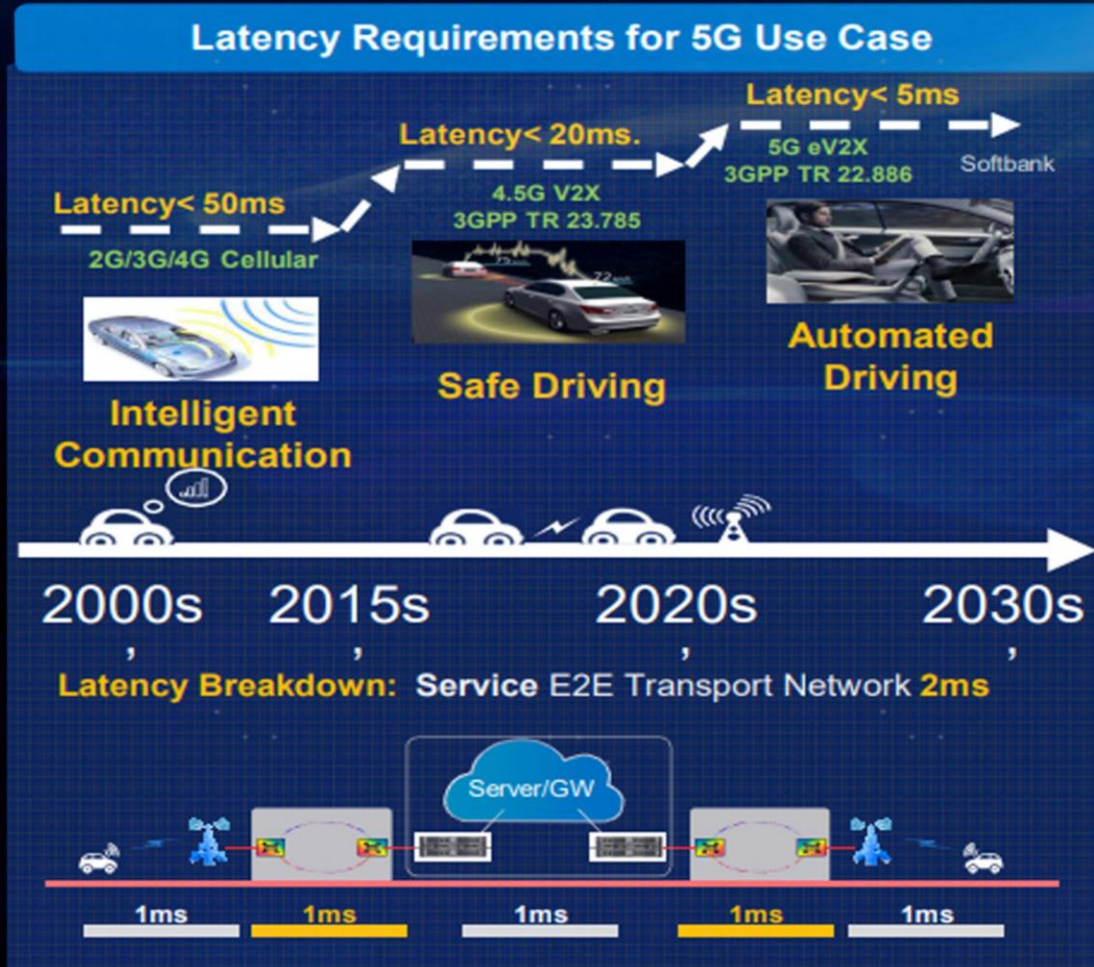
Importance of Bend Insensitivity for Long Term Reliability of Fibres

Cloud Radio Access Network (C-RAN) requires bend insensitive fibres for its noodle type wiring. C-RAN requires large quantities of fibres and optical modules.



Importance of Ultra Low Latency for 5.5G & 6G

Lowering latency increases wireless gain. Hollow core fibre latency level is around 3.3 $\mu\text{s}/\text{km}$ while solid core latency is around 5 $\mu\text{s}/\text{km}$.



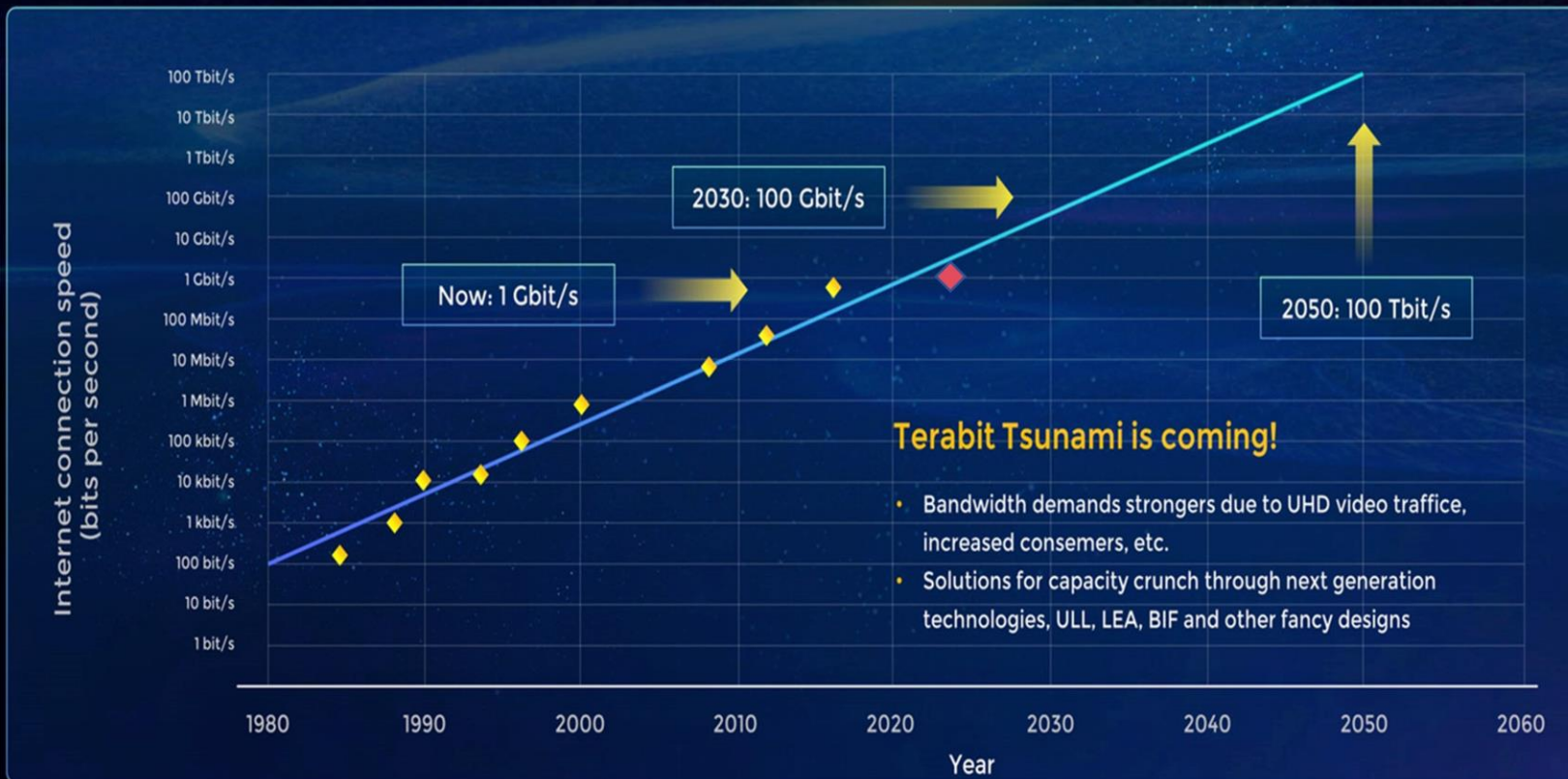
Importance of Low Attenuation Fibres in Advanced 5G Network

Ultra low loss fibres add great value to network cost reduction: 0.01 dB/km loss reduction results in 8-12 % cost per bit reduction due to:

- Longer repeater distance (long haul)
- Electrical power savings
- Reduction in components cost and increasing the life span of devices
- Allowing more channels per fibre due to lower non-linearity effects (especially in combination with large effective area fibres)

Wireless 5G Internet Speed behind Fixed Line Speed

Advanced 5G (5.5G) wireless internet speed should be matching the wired speed level of around 1 Gbps. By 2030 the internet speed level could reach 100 Gbps.

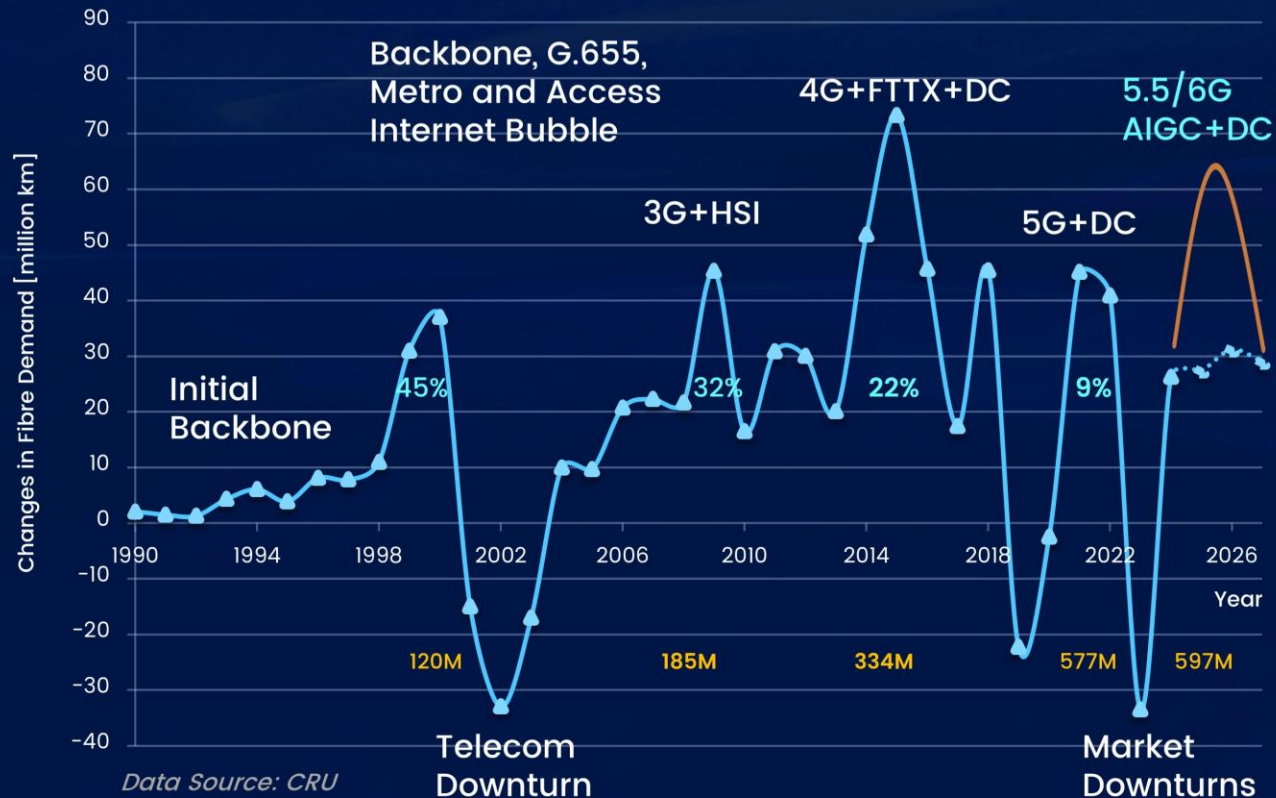


Wireless Internet speed estimation:

4G:	100 – 300 Mbps
5G:	> 100 Mbps
5.5G:	±1 Gbps
6G:	±11 Gbps (2030)
7G:	>11 Gbps

How New Technology/Products (Fibre&Transmission) Driving the Fibre Demand

Dynamics of world wide Fibre demand change over a period of 38 years



- After initial backbone deployment, we can clearly see strong demand peaks during new generation network technologies installation
- Demand getting stronger for each new generation technology except 5G: Little delayed ??
- The advanced 5G (5.5G) and AI generated contents could drive the market towards a 10 % demand peak in 2025-2027

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02

New Gen Fibres Application for Advanced 5G and 6G Networks

5G-Oriented Optical Networking Requiring Different Optical Fibre Types

YOFC has solutions for all kinds of Network



G.654.E: New Generation of Trunk Line & 5G Back Haul Optical Fibre

Advantages

Large Effective Area

Low nonlinear effect
Higher signal power

Ultra Low Loss

Long distance transmission
Low energy consumption

High Speed Transmission

Support 400G/800G/ future ultra high-speed transmission



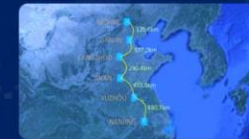
Global Cases

YOFC G.654.E optical fibre has been successfully applied in network infrastructure projects at home and abroad. Already supplied more than 3 Mkm.



China Telecom

2019
First fibre landline with 400Gb/s (1900km)



China Mobile

2016
400G fibre trunk line project (1539 km)



China Unicom

2015-2017
Land trunk line project with large effective area fibre



State Grid

±800kv UHVDC power transmission project between Northwest and Southeast



Philippine Converge

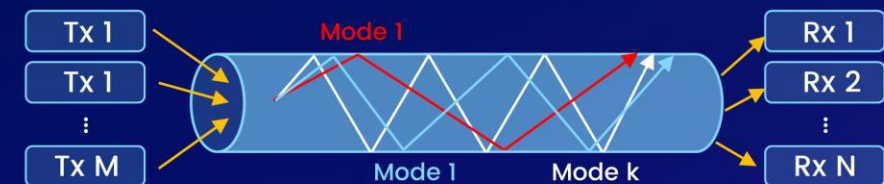
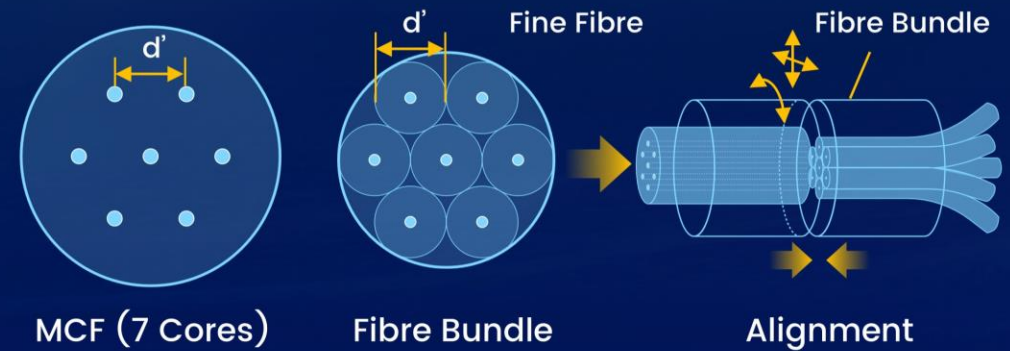
Connect Telstra's submarine cable landing station between Nasugbu and Cavite



Telefonica Brasil

First continental trunk line overseas

Principle of Space Division Multiplexing



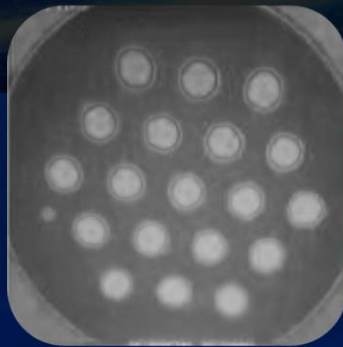
Multicore Fibre

YOFC have the full series SDM fibre products: multicore fibre, few modes fibre.

The self-development perform Tech. have enable the multicore fibre into large scale manufacturing.



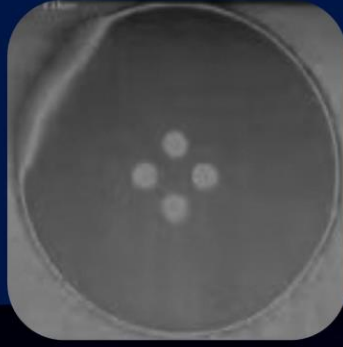
19-core Weakly Coupled Fibre



19-core & 3-mode SDM Fibre



4-core Weakly Coupled Fibre



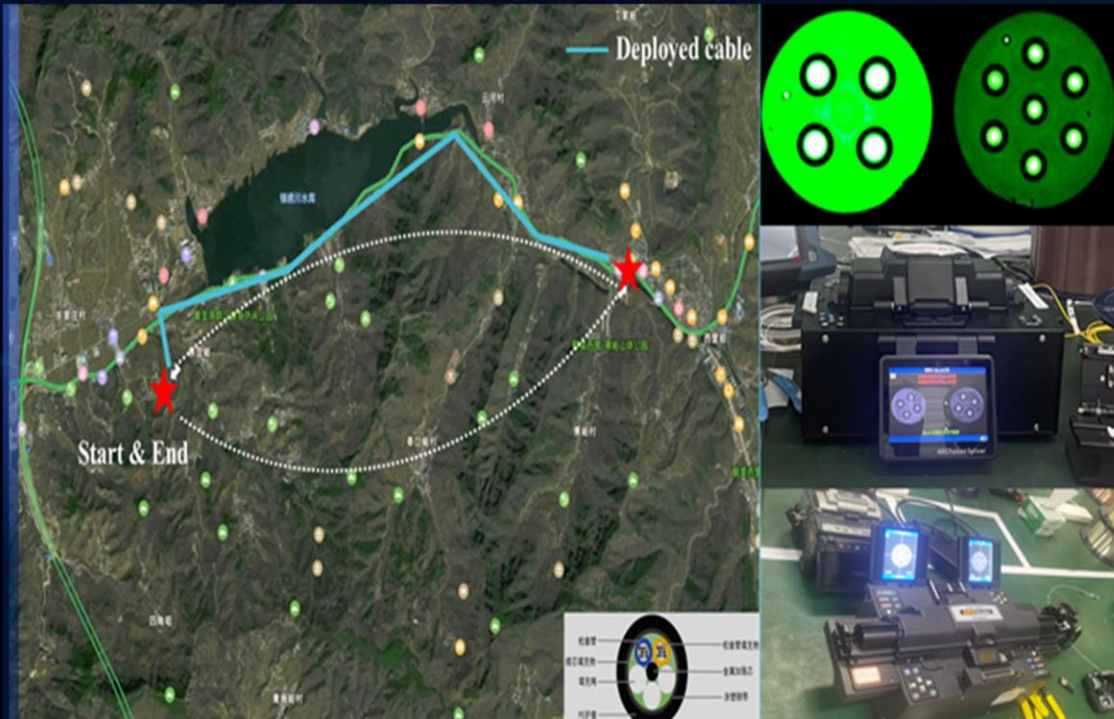
4-core Strong Coupled Fibre



7-core Preform:
150mm (Left) VS 80mm (Right)

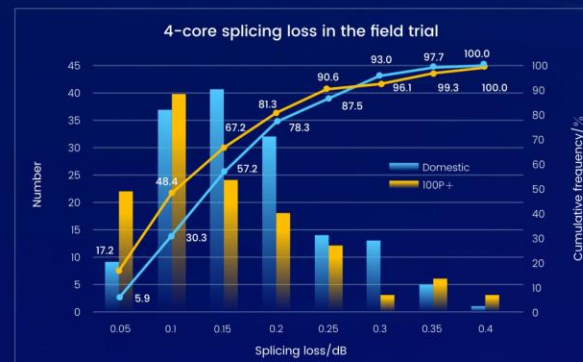
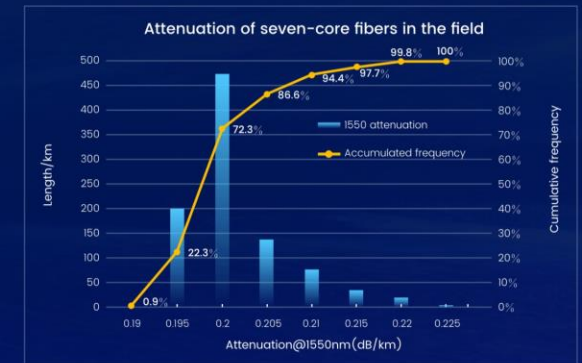
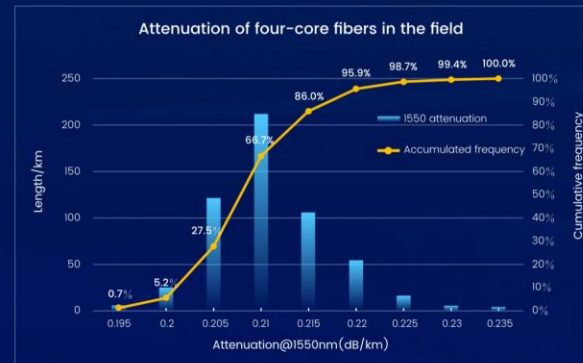
Multicore Fibre Field Trials in China

Cooperated with China Mobile, YOFC have made a 17.6km multicore fibre field trial in China. YOFC provided the total solution included MCF fibre, cabling, FIFO and field splicing service.

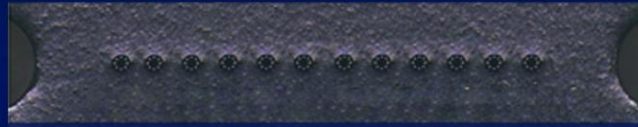
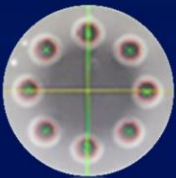
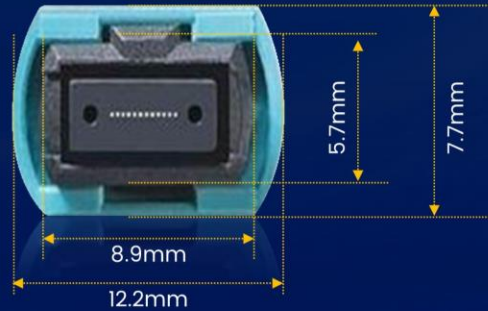


4/7 cores filed trials with China Mobile in Shandong: Cable length 17.6km, fibre cross-section, two types splicers

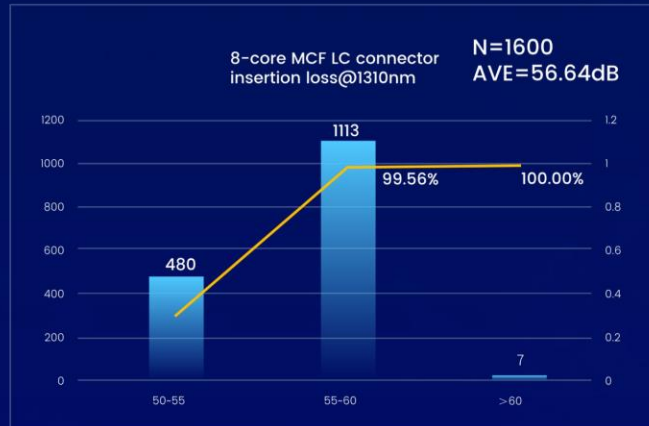
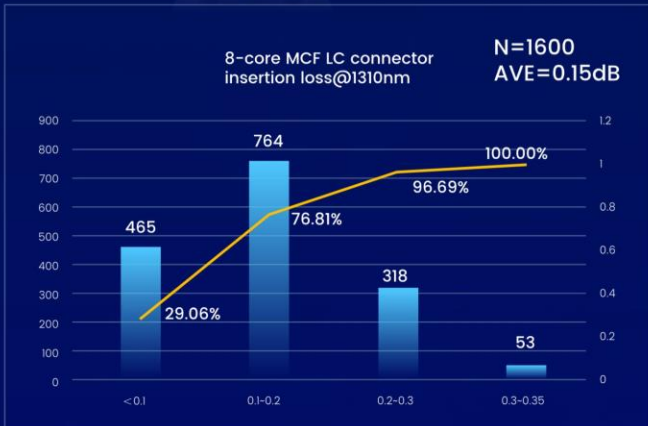
YOFC MCF field trials: 4core and 7core MCF cable Att. In the field 4core and 7core MCF splicing loss with different types splicers



Multicore Fibre Connectors R&D



One MPO 12×8=96 Channel



Connector Type	MCF LC	
Typical Insertion Loss (dB)	0.15	
Maximum Insertion Loss(dB)	≤0.15 (60%)	≤0.35 (100%)
Repeat ΔIL(dB)	≤0.1	
High-low Temperature Cycle ΔIL(dB)	≤0.3	
Return Loss(dB)	≤-50 (UPC)	≤-60 (APC)

Connector Type	MCF MPO	
Average Insertion Loss (dB)	0.8	
Return Loss(dB)	≤-50 (UPC)	≤-60 (APC)

YOFC Multicore Fan-In-Fan-Out R&D

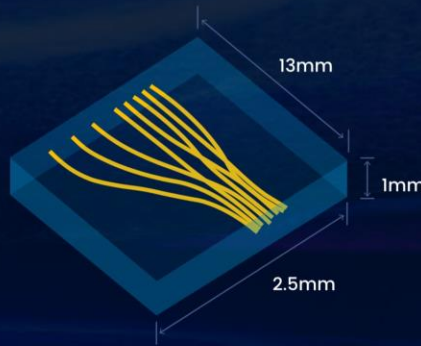
At present, MCF FIFO adopts fused taper type and 3D waveguide.



Fused Taper FIFO



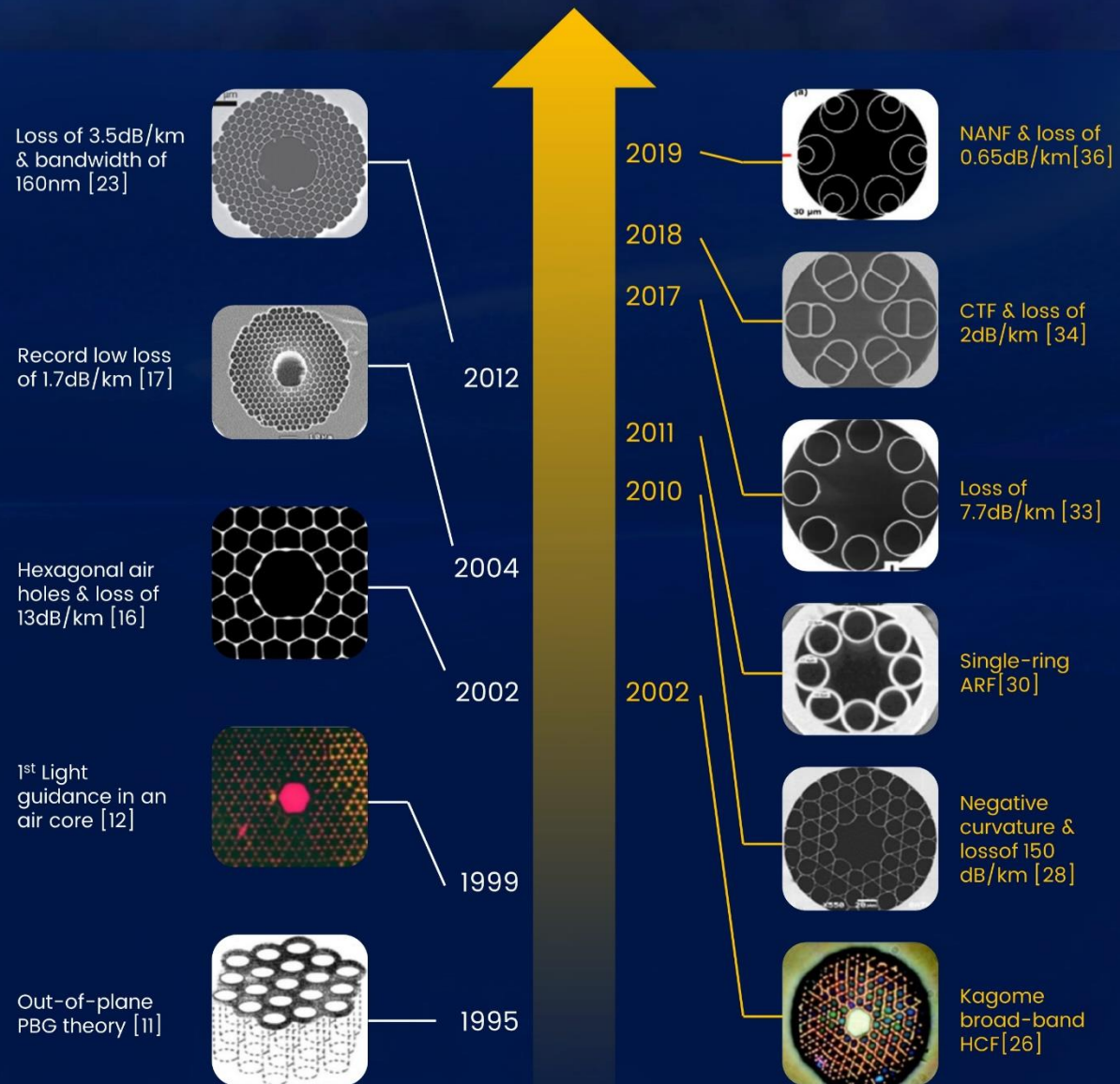
3D Waveguide FIFO



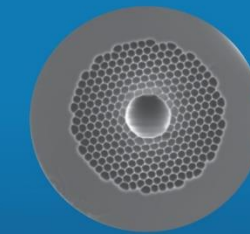
Type	Fused Taper	3D Waveguide
Typical Insertion Loss (dB)	0.5	1.0
Maximum Insertion Loss (dB)	≤ 1.0	≤ 1.5
Return Loss (dB)	≤ -50	≤ -50
High-low Temperature Cycle Δ IL (dB)	≤ 0.5	≤ 0.5
Core-to-core Crosstalk (dB/10km)	≤ -45	≤ -45

FIFO Delivery Status	Sample Available	Small Batch Delivery	Small Batch Delivery	Bulk Delivery from Next Year
Fibre bundle FIFO for 4-core MCF	Max IL ≤ 1 dB Crosstalk ≤ -45 dB	Max IL ≤ 0.8 dB Crosstalk ≤ -45 dB	Max IL ≤ 0.5 dB Crosstalk ≤ -45 dB	Max IL ≤ 0.5 dB Crosstalk ≤ -45 dB

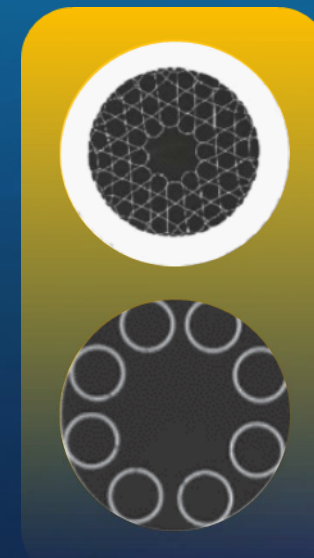
Hollow Core Fibre R&D & History



← Photonic Bandgap Fibre



Hollow Core Fibre: "Super Fibre"



HCF Advantages

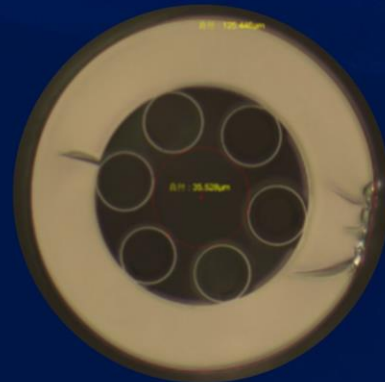
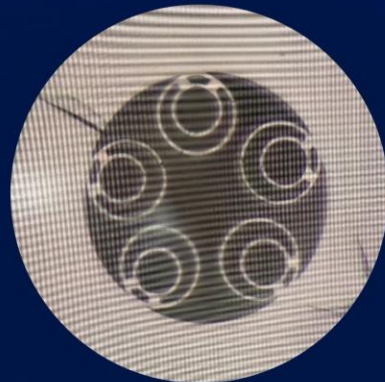
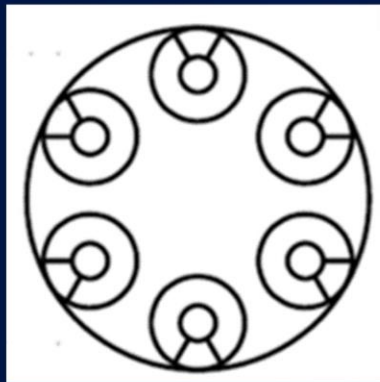
- ✓ Lower latency (31 % lower)
- ✓ Lower loss (future < 0.1 dB/km)
- ✓ Wider band
- ✓ Low nonlinearity
- ✓ Radhard
- ✓ Lower dispersion
- ✓ Insensitivity for environment temperature



Hollow Core Fibre Plan

- ✓ R&D for lower attenuation and lower cost in large scale production
 - New HCF structure design is ongoing
 - HCF can be ready for commercialization in 2025
- YOFC will ramp up the field trial for specific applications (high power laser delivery, DCN, etc.) with customers. HCF fibre will be very useful for RAN-network due to low latency and other advantages. Low attenuation fibre can save lots of power

YOFC new structure design of HCF:
design schematic and section profile fibre



YOFC HCF future target
is to reach attenuation
< 0.20 dB/km and
increase supply lengths

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03

Joint Innovations and Conclusion

Joint Innovations and Conclusion

- YOFC has all kinds of optical fibres and optical components solutions for the advanced 5G and 6G networks construction.

- YOFC's proposal to customers is joint innovation to provide customized fibres and components to reduce cost.



YOFC

YOFC
Smart Link Better Life.

THANKS!

YOFC is always committed to connecting every corner of the world with optical fibres.