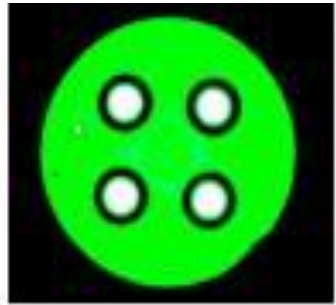


Development, Application and Commercialization Progress of MCF in China

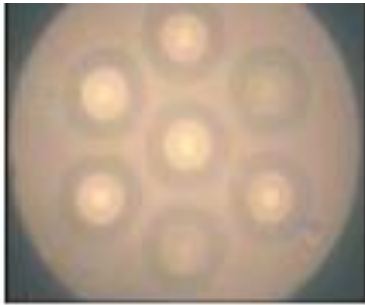
Shen Lei

Yangtze Optical Fiber and Cable Joint Stock Limited Company

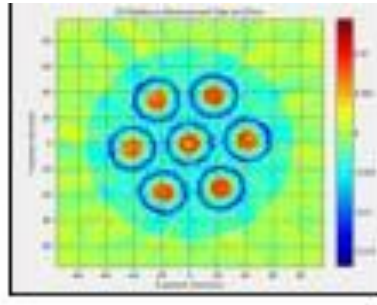
State Key Laboratory of Optical Fiber and Cable Manufacture Technology



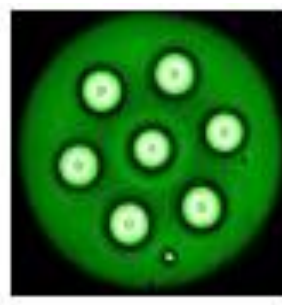
4core



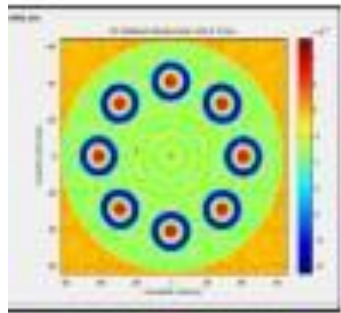
7core



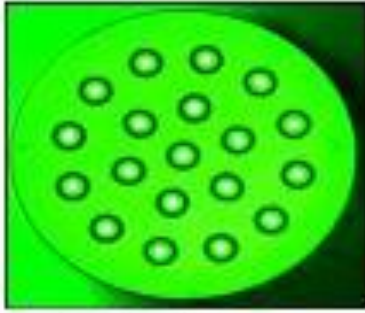
7core-6mode



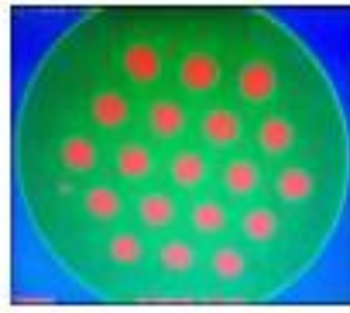
7core-OAM
(Orbital Angular Momentum)



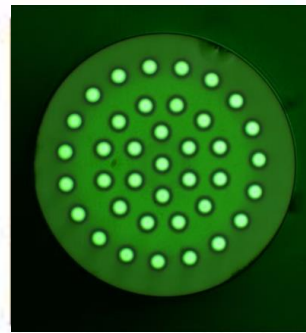
8core



19core-SMF



19cores-4modes



38cores - 6modes



50 Pbit/s can be achieved

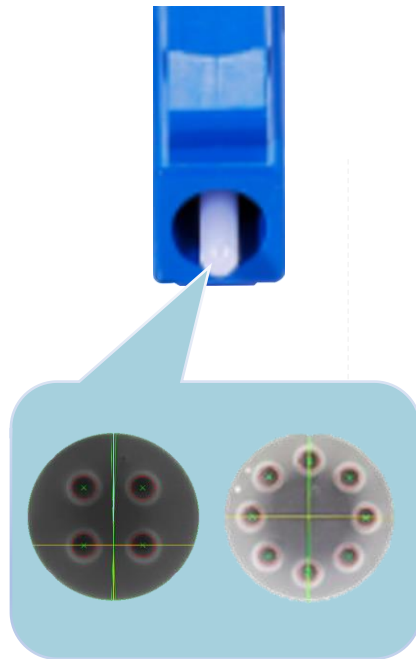


Continuous drawing length $\geq 1000\text{km}$

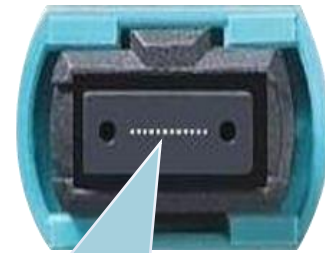
►► Technical Progress of MCF in China

MCF Connector

- Multi-core fiber connector can realize high-density optical connection.
- Marker in MCF is important for connectors.



MCF LC Connector

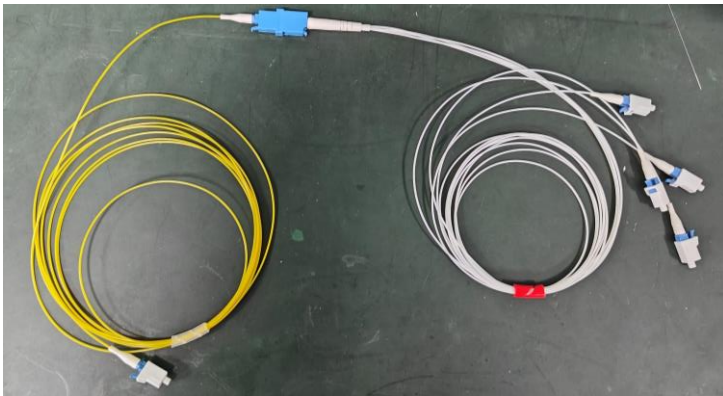


MCF MPO Connector

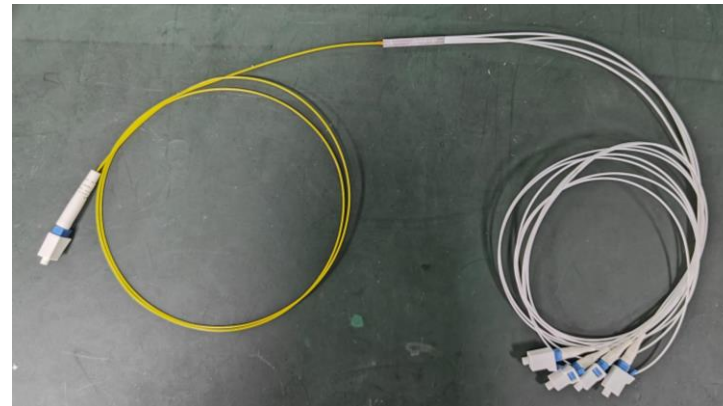
Connector type	MCF LC	
Typical Insertion Loss (dB)	0.12	
Maximum Insertion Loss(dB)	≤0.12 (60%)	≤0.35 (100%)
Repeat ΔIL(dB)	≤0.1	
High-low Temperature Cycle ΔIL(dB)	≤0.3	
Return Loss(dB)	≤-50(UPC)	≤-60(APC)

Connector type	MCF MPO	
Typical Insertion Loss (dB)	0.3	
Maximum Insertion Loss(dB)	0.7	
Return Loss(dB)	≤-50(UPC)	≤-60(APC)

- Multi-core fiber fan-in/fan-out devices can realize efficient coupling between MCF and SMF.
- FIFO' size is critical for high density datacenter's application.

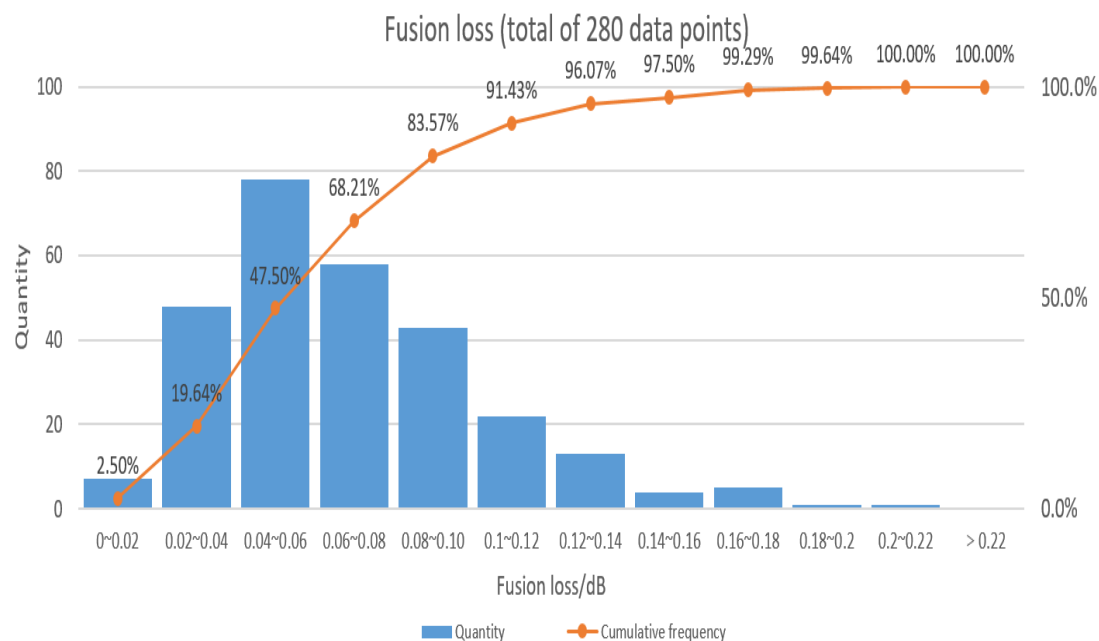


Type	4-core MCF FIFO
Size	6mm×10mm×25mm



Type	4-core MCF FIFO
Size	3.3mm×3.8mm×30mm

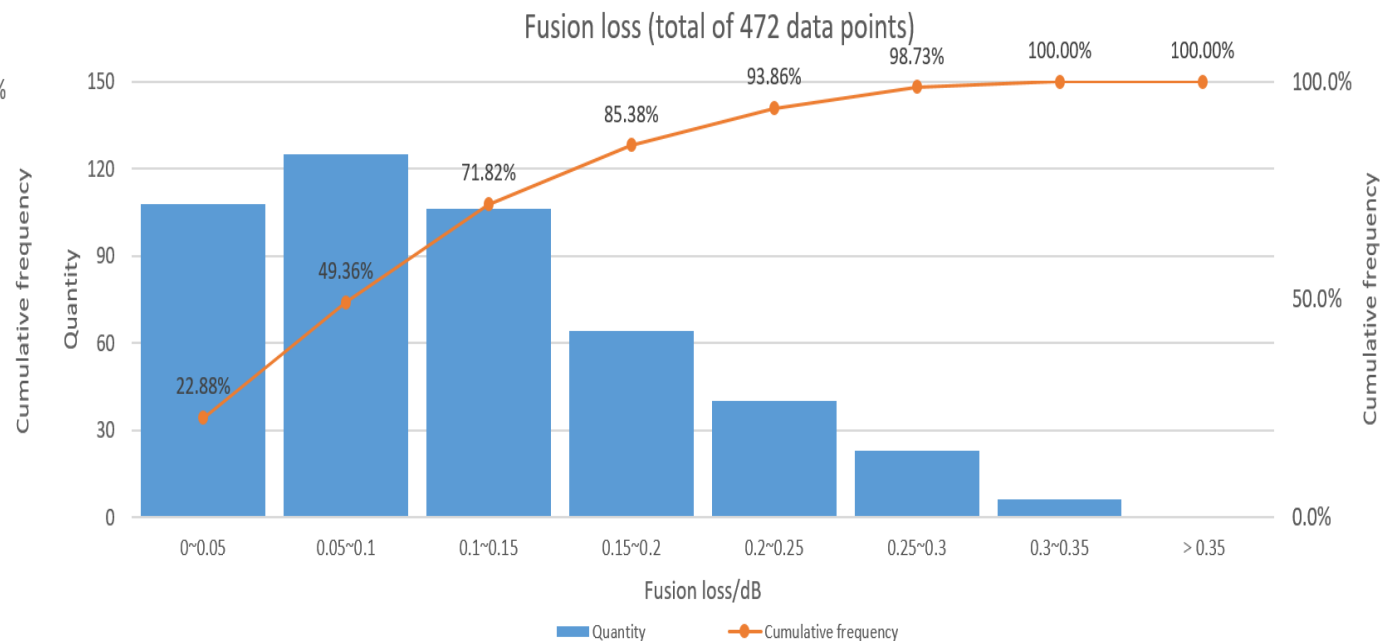
Typical Insertion Loss (dB)	0.25
Maximum Insertion Loss (dB)	≤0.5
Return Loss (dB)	≤ -55
Inter-core Crosstalk (dB/10km)	≤ -55



Indoor Application

Avg: 0.07dB

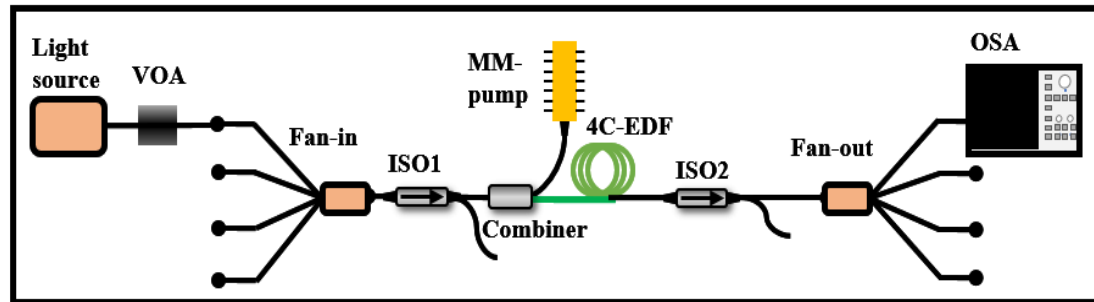
Max: 0.22dB



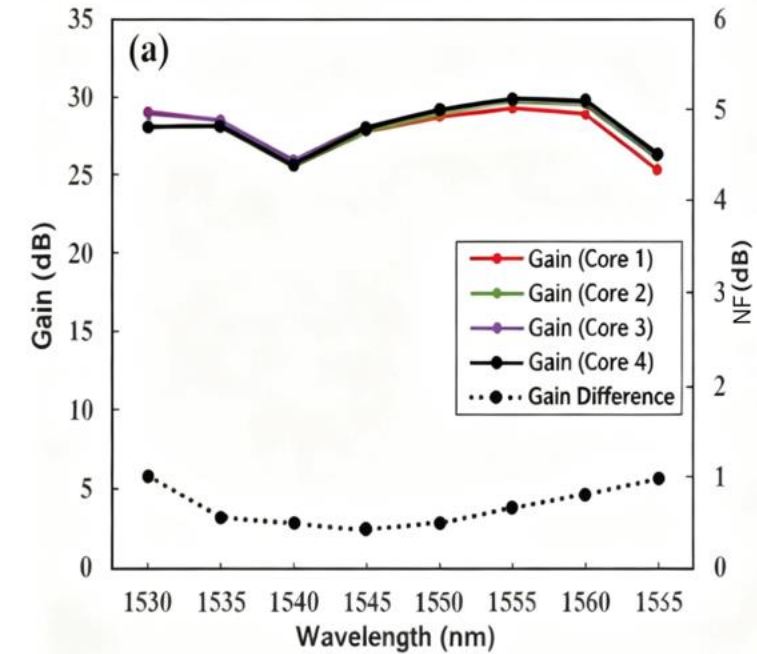
Outdoor Construction

Avg: 0.12dB

Max: 0.35dB



Schematic diagram of multi-core EDFA



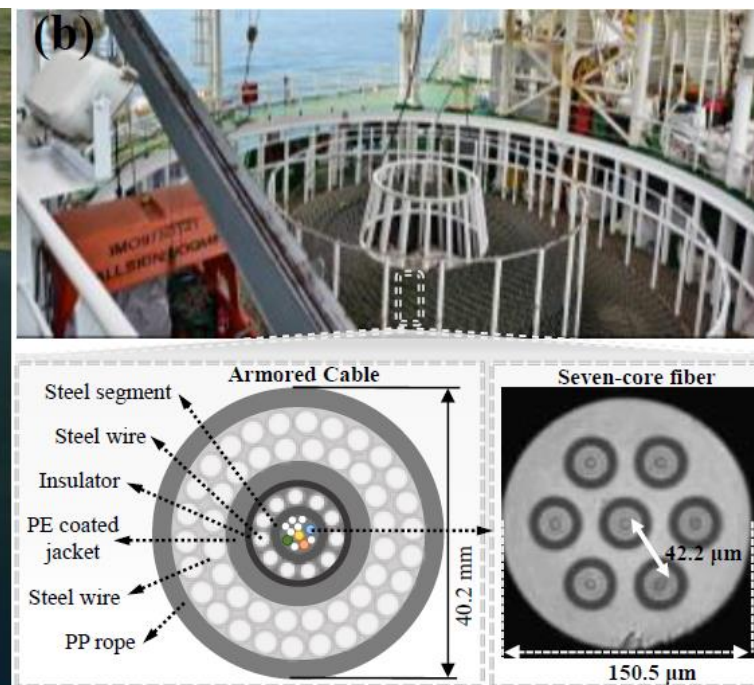
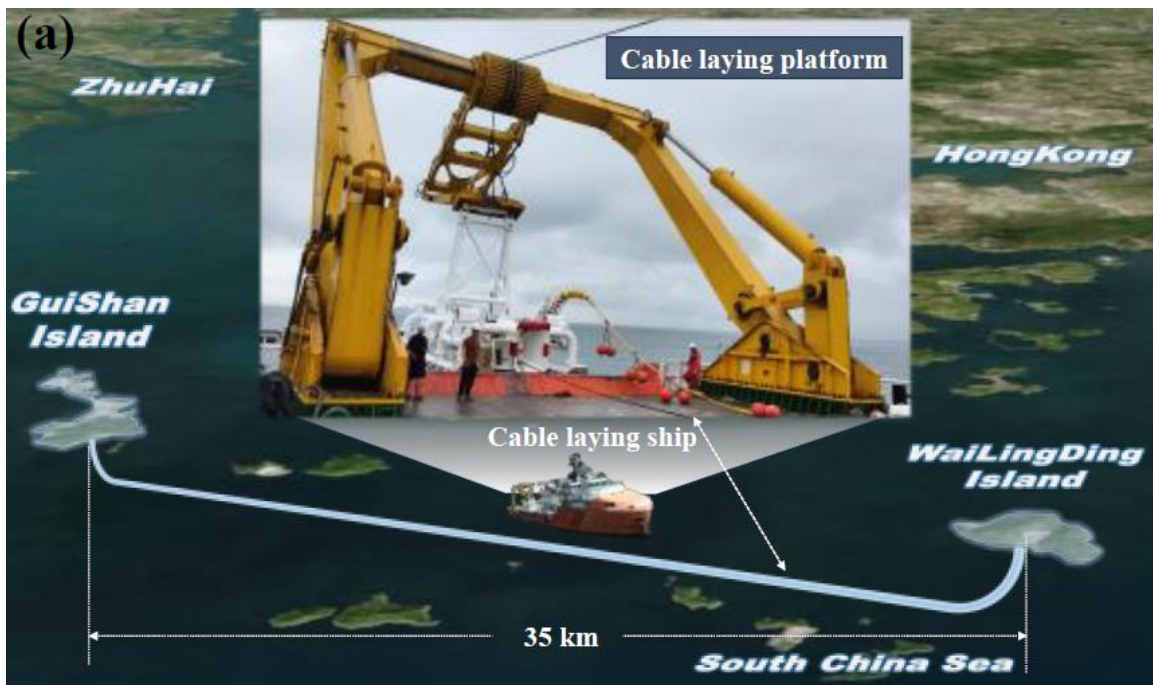
MC-EDFA
Gain: $\geq 25.5\text{dB}$, $\text{GD} \leq 1\text{dB}$

►► Application: Submarine

Massive Capacity Boost

Superior Space & Weight Efficiency

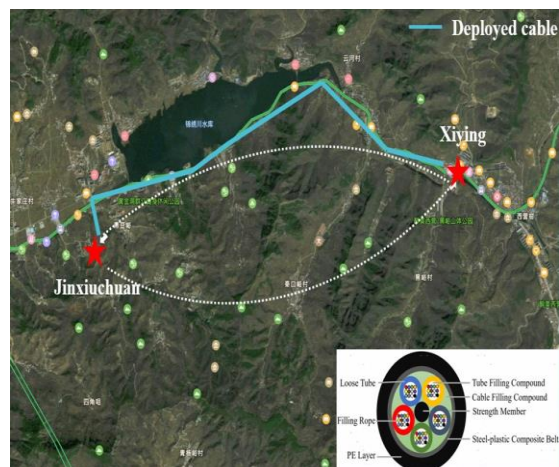
Lower Energy Consumption



In 2025, a 7-core fiber submarine cable has been deployed in the South China Sea, establishing an ultra-large-capacity and ultra-long-distance submarine network. (From WaiLingDing Island to GuiShan Island)

OECC-PDP-2025

Application: Terrestrial



2023
Shandong Jinan
17.6km
8*4core-MCF
8*7core-MCF



2025
Jilin Changchun
33km
4*4core-MCF
4*7core-MCF
4*FMF



2024
Guangdong
160km
4*4core-MCF
4*7core-MCF
4*FMF

2025~2026
Hongkong
40km
4*4core-MCF
4*7core-MCF
4*FMF
(under construction)

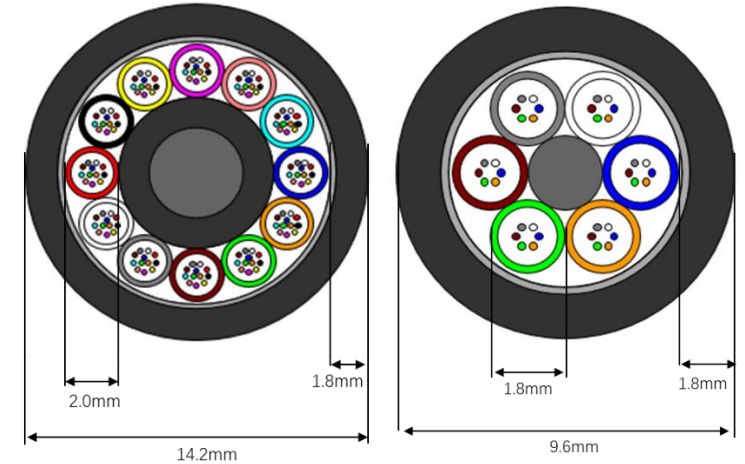
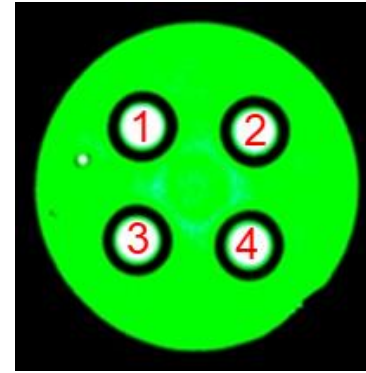


2026
Guangdong
1160km
4*4core-MCF
Att: < 0.165dB/km
(under construction)

►► Application: Inter-connection of DC



A cable using 36 four-core fibers (MCFs) to achieve 144 cores **reduces the overall cable cross area by 45.7%** compared to a conventional 144 single-mode fiber cable.



China Mobile (Tianjin)

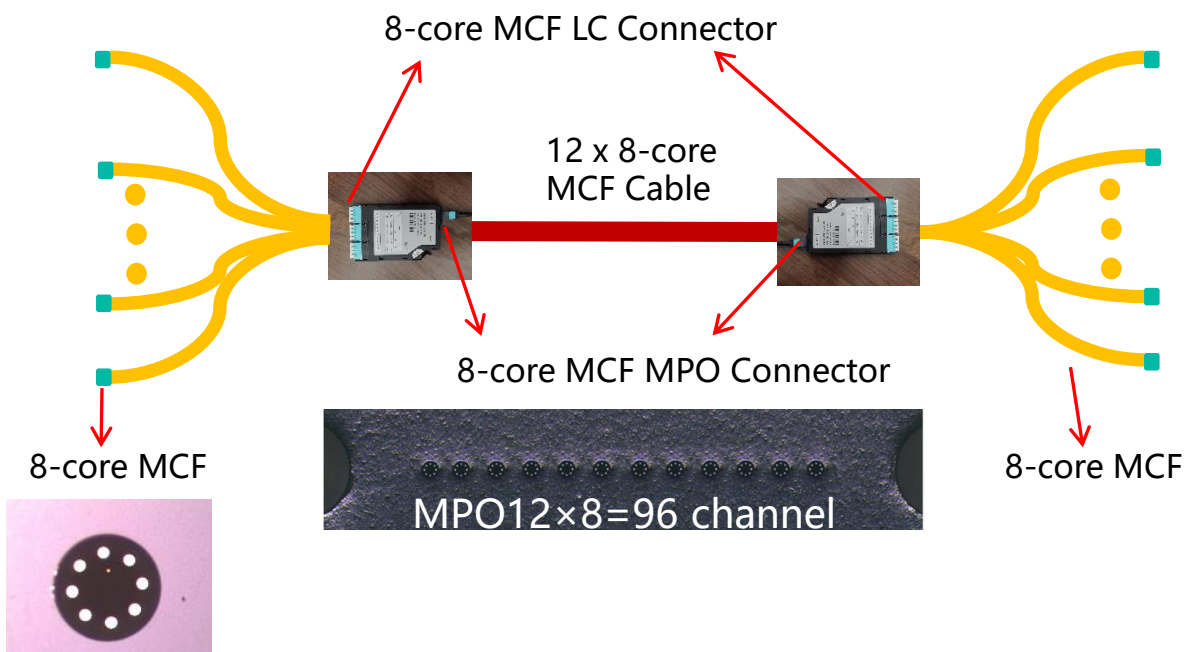
Connection between data center buildings

36 x 4-core MCF

less than 1km

►► Application: Intra-connection of DC

High - Density Access



	Conventional Fibre	8-core MCF
Fibre	96 fibres	12 x 8-core MCF
Cable		
Backplane		
Panel		
Rack Unit	0.5U~1U	0.25U
Cable Weight	X	0.125X

Density Multiplier, Space Savings

►► Application: Intra-connection of DC

AI DC



AI DC: scale-up, scale-out

High-density wiring

Possible applications:

- Intra- and Inter-Rack Connectivity
- VCSEL array
- MicroLED technology

304 channel MicroLED based CMOS transceiver IC with aggregate 1 Tbps and sub-pJ per bit capability (OFC 2024)

Micro-LED for short distance optical links with low power consumption (Optics Letters)

►► Conclusions and Considerations

- The technology of MCF fibers, cables, and components is developing rapidly and becoming increasingly mature, enabling large-scale applications in the future.
- Terrestrial Applications :
 - Key issues: splicing loss and engineering deployment convenience.
 - Deployment is currently limited to specific scenarios.
- Submarine Cables:
 - It has promising application prospects in submarine cables due to its superior space and weight efficiency, as well as lower energy consumption.
- Data Centers :
 - Although there are limited commercial applications yet, MCF is expected to achieve the most significant scale in data center applications in the near future.
- Standardization Roadmap: 2 and 4 cores → 7, 8, 19... cores?

The background features a series of overlapping, semi-transparent geometric shapes in various shades of teal and green. These shapes include circles, triangles, and polygons, creating a layered, abstract effect. The colors range from a deep teal on the left to a lighter, more vibrant green on the right.

Thanks!