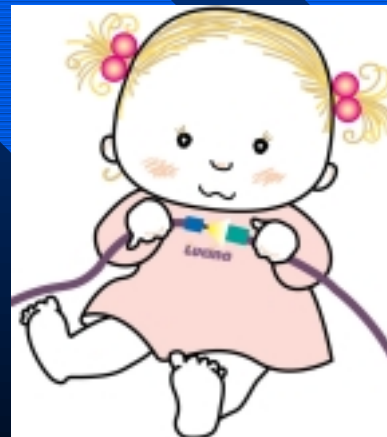




for user-friendly gigabitrate communications



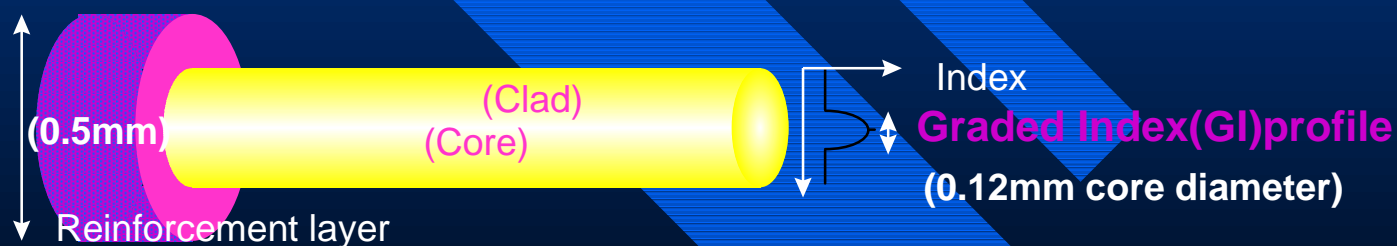
Presentation material

Contents

- What is Lucina™
- Advantages of Lucina™
- Performances of Lucina™
 - Available light source
 - High Bandwidth
 - Durability
 - Ease of wiring and ease of installing connectors
 - Inexpensive wiring construction cost
 - Compatibility with existing transceivers for MMF
 - Operability with existing LAN equipment
 - Power budget simulation
- Specifications of Lucina™ duplex cable
- Applications of Lucina™
- Records of installing Lucina™

What is Lucina™

- Lucina™ is a graded index-polymer optical fiber made of “CYTOP” perfluorinated polymer glass by collaboration with Prof.Koike of Keio University and Asahi Glass for the first time in the world. Lucina™ makes a new category optical fiber in premises which is different from glass optical fiber and conventional(PMMA) plastic optical fiber(POF). Lucina™ offers both high bandwidth over gigabitrate and inexpensive wiring construction cost realized from ease of connection and ease of wiring such like the copper cables.

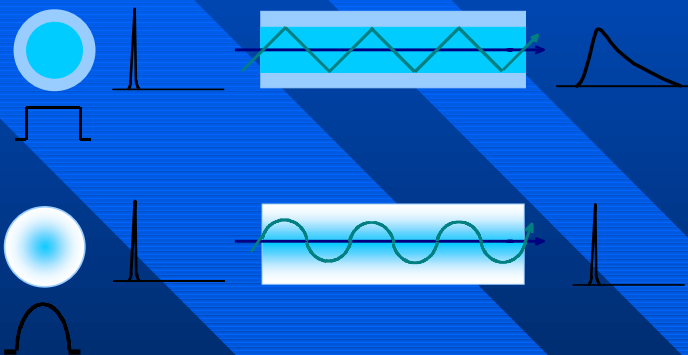


(Structure of Lucina™ fiber)

Lucina™ has graded Index profile and large core diameter



- Graded Index profile offers high bandwidth



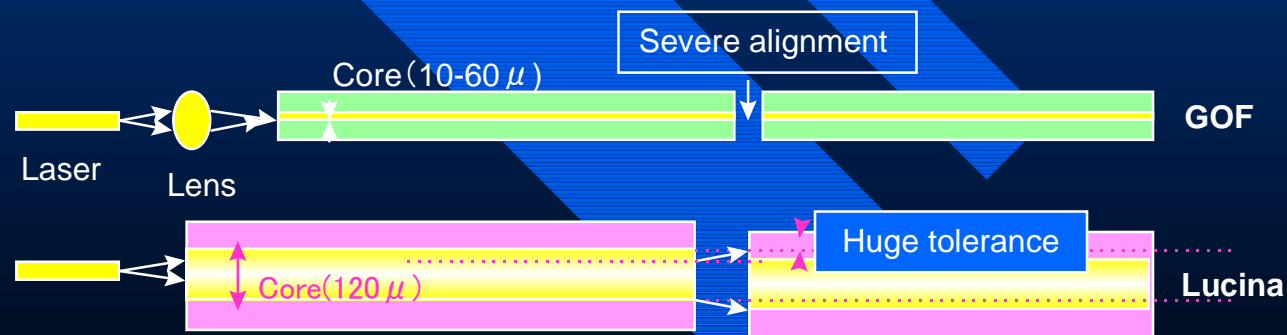
Step Index profile

Output signal spread by modal delay

Graded Index profile

Input signal kept without modal delay

- Large core diameter offers ease of connections



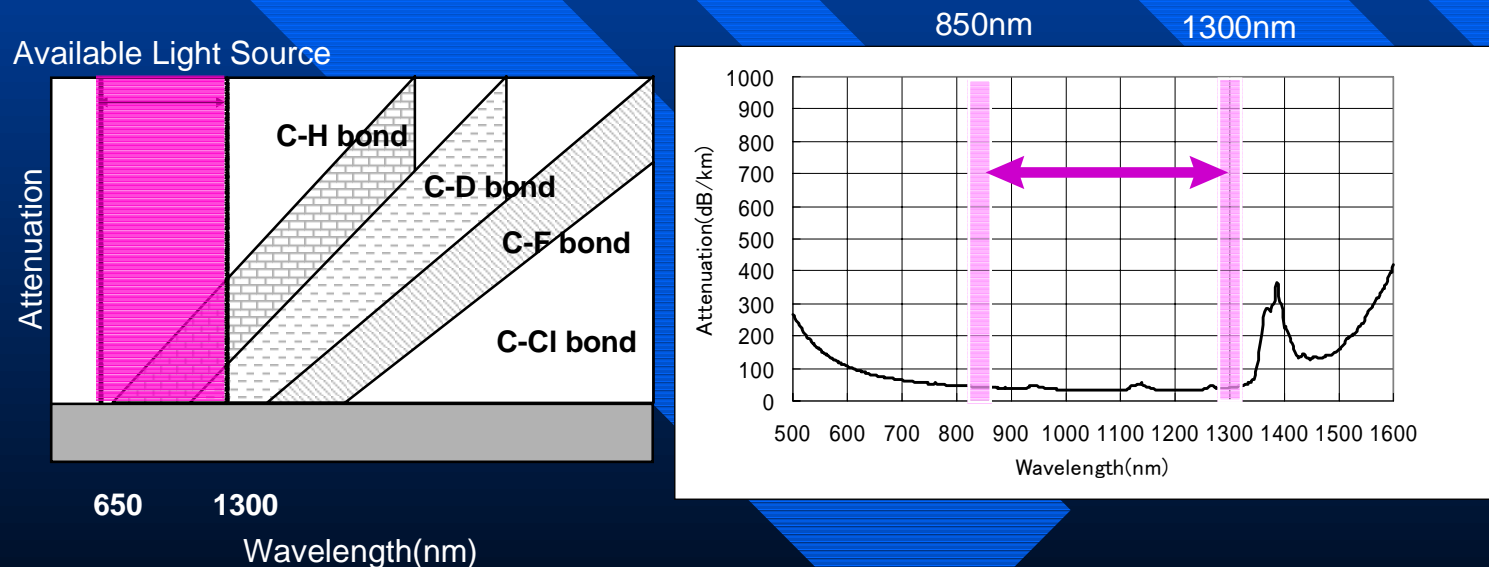
Advantages of Lucina™

- High bandwidth
 - 1-10 Gigabitrate at 100-200m
- Inexpensive installation cost
 - Ease of installing connectors
 - Ease of installing cable
- Operability with existing equipment
 - Available light source from 850nm to 1300nm wavelength
 - SC connectors for Lucina™
 - Inexpensive 850nm VCSEL and Silicon Pin-PD transceivers
 - Operability with Fast and Gigabit Ethernet, 10Gbit Ethernet in future Fibre Channel (250Mbps-2Gbps), ATM(125M-622Mbps) and IEEE1394 (S400) long equipment



Performances of Lucina™

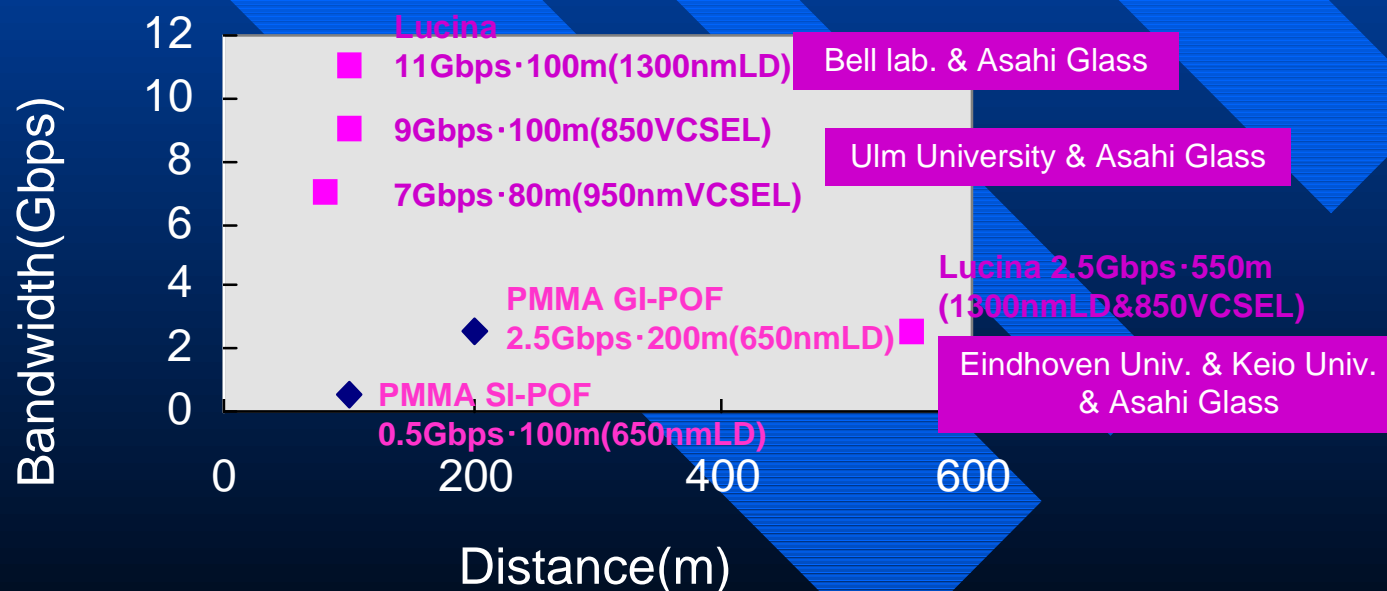
- Available light source
 - “CYTOP” perfluorinated polymer glass has excellent transparency from 850nm to 1300nm wavelength due to no Carbon-Hydrate(C-H) bond in it’s molecular structure.



Performances of Lucina™

■ High bandwidth

- Lucina™ shows high bandwidth due to it's low material dispersion rather than it of glass and PMMA material.
- High bandwidth at both 850nm and 1300nm wavelength

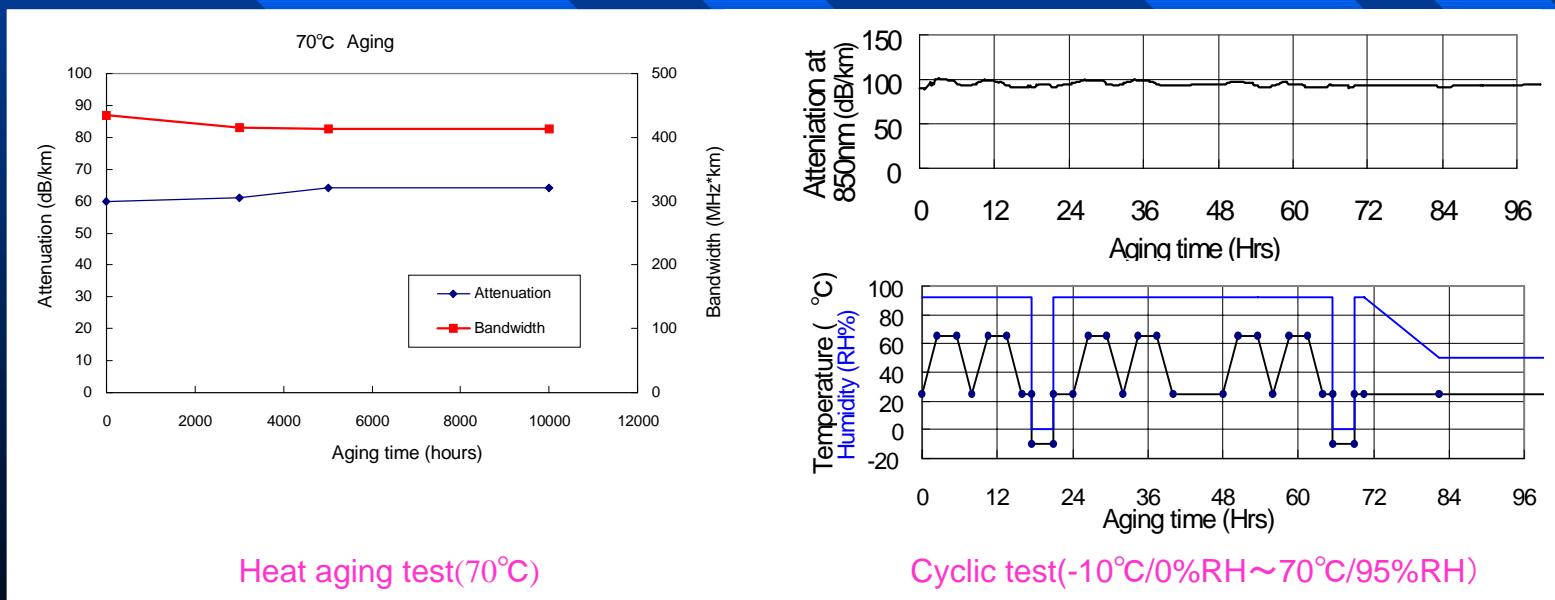


Performances of Lucina™



■ Durability

- Heat aging test at 70°C × 10,000hr is already confirmed with no degradation. Storing temperature in door is suggested from -10°C to 60°C in Bellcore.
- Heat/humidity cyclic test from -10°C/0%RH to 70°C/95%RH shows no degradation. Operating temperature in door is from 0°C to 55°C in Bellcore

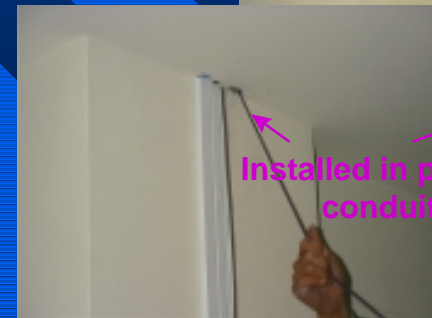
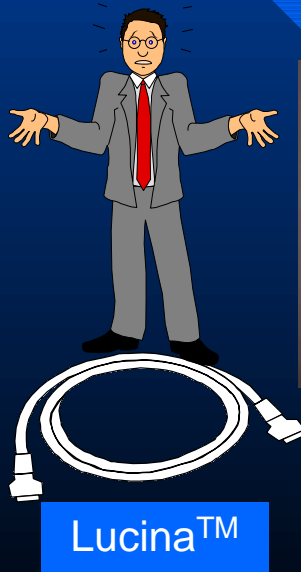


Performances of Lucina™



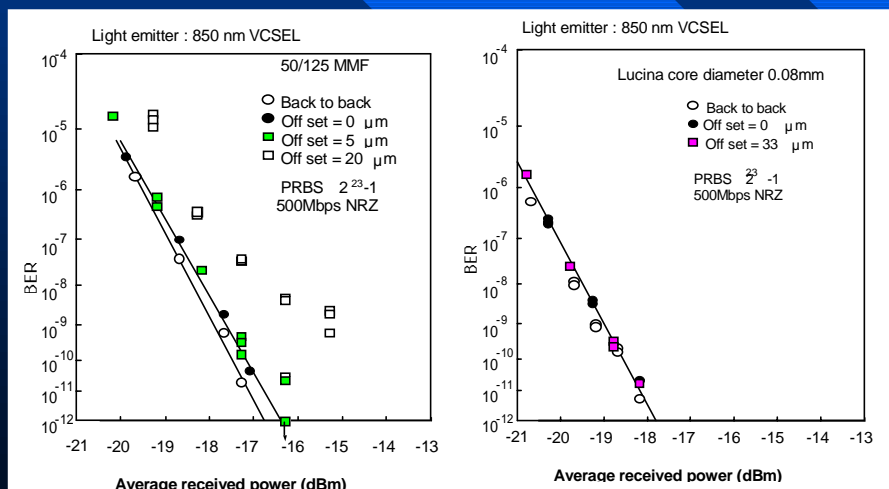
■ Ease of wiring

- No loss increment after compressive load at 140Kg/10cm and after 1,000 cycle flex with R15mm
- Guarantee R10mm bending under wiring condition and R30mm bending under permanent condition
- Lucina cable could be installed using conduit as same as UTP.



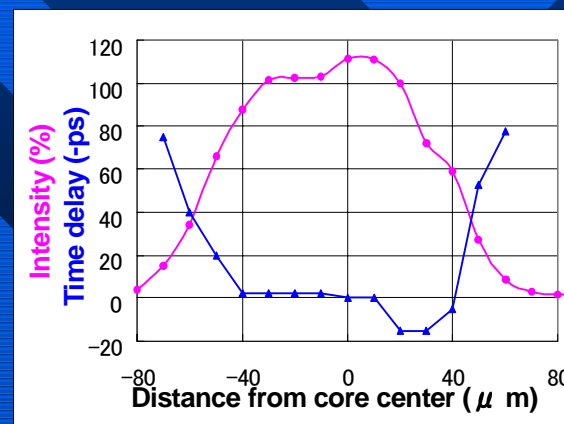
Performances of Lucina™

- Ease of connection (large core effects)
 - 83 μ core Lucina™ is not sensitive from degradation caused by the modal noise even if under 33 μ fiber to fiber misalignment.
 - Deferential mode delay (DMD) results after 100m transmission using 810nm laser diode show 120 μ core Lucina™ has 80 μ tolerance within 20 ps time delay condition.



50/125MMF

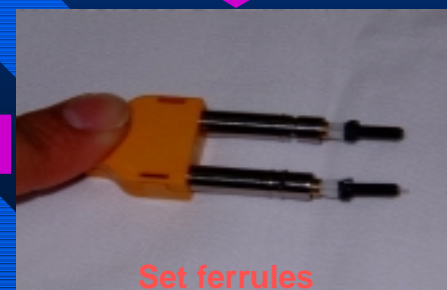
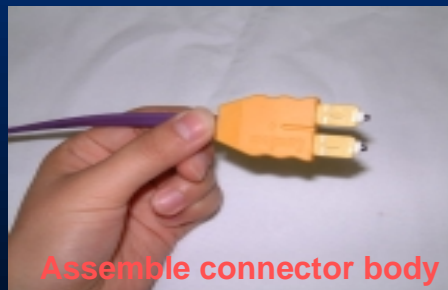
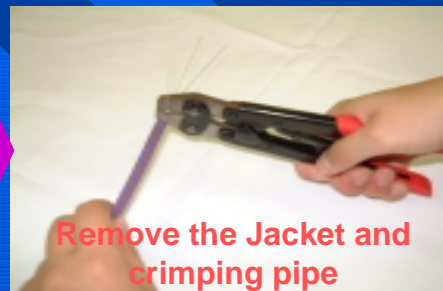
80/500 Lucina™



DMD results of 120 core Lucina™ 100m at 810nm wavelength

Performances of Lucina™

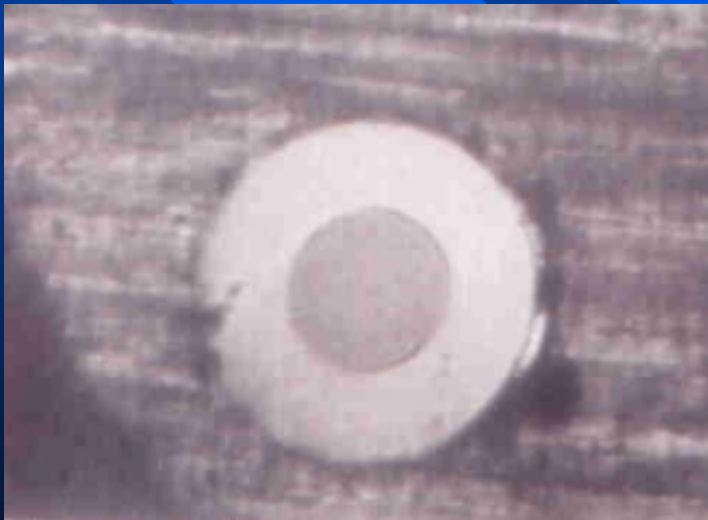
- Ease of connection(1 minutes connectors installation)
 - Installation SC connectors of Lucina™ is easy without expensive tool.



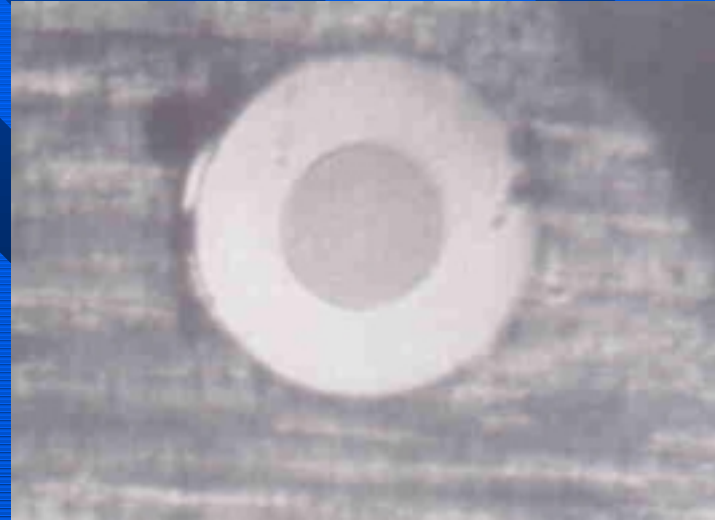
- Solvent splice under development

Performances of Lucina™

- Ease of end face treatment offers ease of connecterization
 - End face of Lucina could be flat by razor cutting. If you fail to cut Lucina, polishing 2-3 times by 0.3 μ sandpaper is convenient.



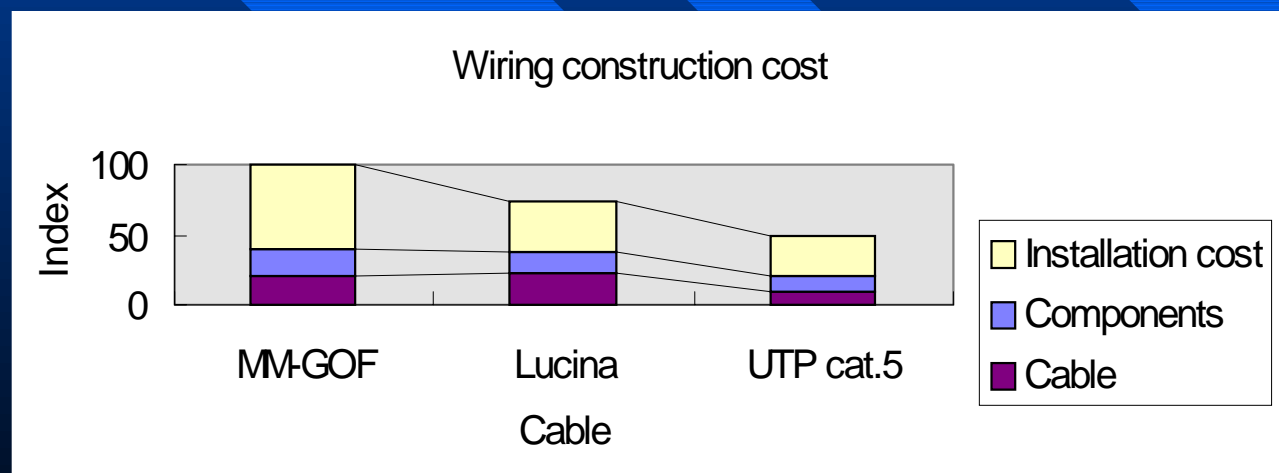
Cutting by razor knife



Polishing by 0.3 μ sandpaper

Performances of Lucina™

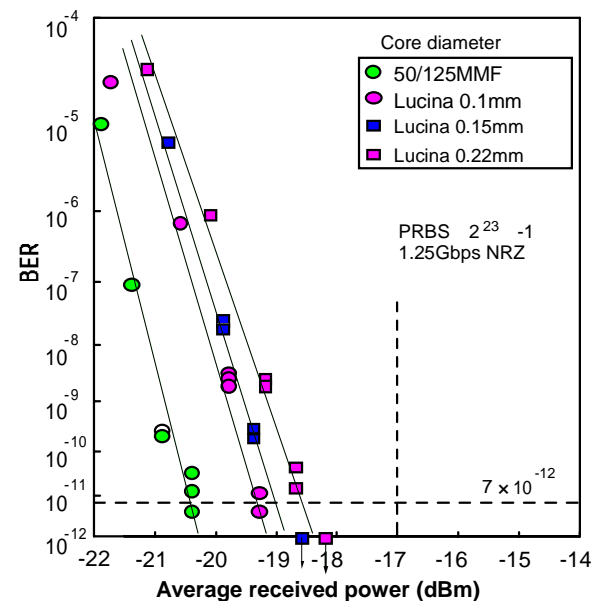
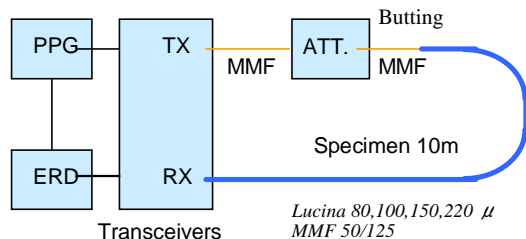
- Inexpensive wiring construction cost
 - Cable and connectors installation cost is about 60% of total wiring construction cost in the case of multi mode glass optical fiber.
 - Lucina™ could reduce cable and connectors installation cost dramatically.
 - Lucina™ offers 70-80% of total MM-GOF wiring construction cost



Performances of Lucina™

- Compatibility with existing transceivers
 - 850VCSEL transceivers for Gigabit Ethernet and 1G Fibre Channel are inexpensive solution for gigabitrate communications with Lucina™.
 - Core diameter of Lucina™ depends on small PD diameter(100micron).

	MMF	Lucina		
Core diameter (micron)	50	100	150	220
Injected Power A(dBm)	-7.0	-6.6	-6.6	-6.7
Min. Received power B(dBm)	-20.0	-19.3	-18.9	-18.5
Power budget (A-B)	-13.0	-12.7	-12.3	-11.8



Performances of Lucina™

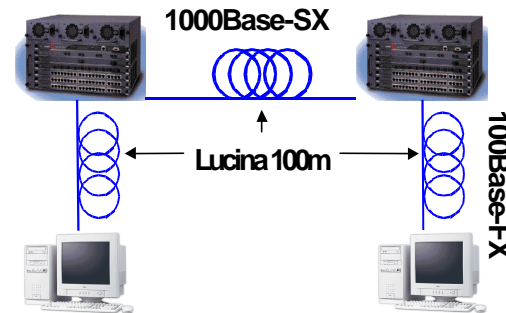


- Operability with existing LAN equipment
 - Fast and Gigabit Ethernet

Data transmission test results using Gigabit Switches and Lucina

Gigabit Ethernet Switches		Lucent	Cisco	HP
1000Base-SX	output power after 100m Lucina transmission	-14.5dB	-14.4dB	-13.7dB
	Rx min. received power	-17dB	-17dB	-17dB
	64k bite ping data transmission	good	good	good
100Base-FX	output power after 100m Lucina transmission	-19.5dB	-23.9dB	-25.8dB
	Rx min. received power	-31.5dB	-29dB	-31dB
	64k bite ping data transmission	good	good	good

Attenuation of Lucina; 70dB/km at 850nm and 50dB/km at 1300nm
Operating room temperature



- 10Gbps Ethernet(future)
- Fibre channel: 250Mbps-2Gbps
- ATM: 125Mbps-622Mbps
- IEEE1394: S400 long



Gigabit Ethernet switch

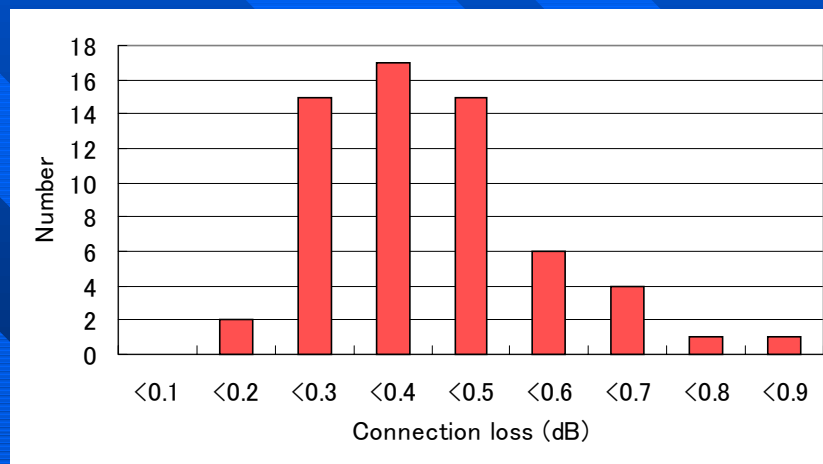


IEEE1394 Repeater

Performances of Lucina™

■ Fiber-fiber connection loss

- SC-SC connectors
- Plastic ferrules
- Available receptacle
- N=61
- Average loss; 0.39dB
- Worst case; <0.9dB



■ Power budget simulation of Gigabit Ethernet transceivers

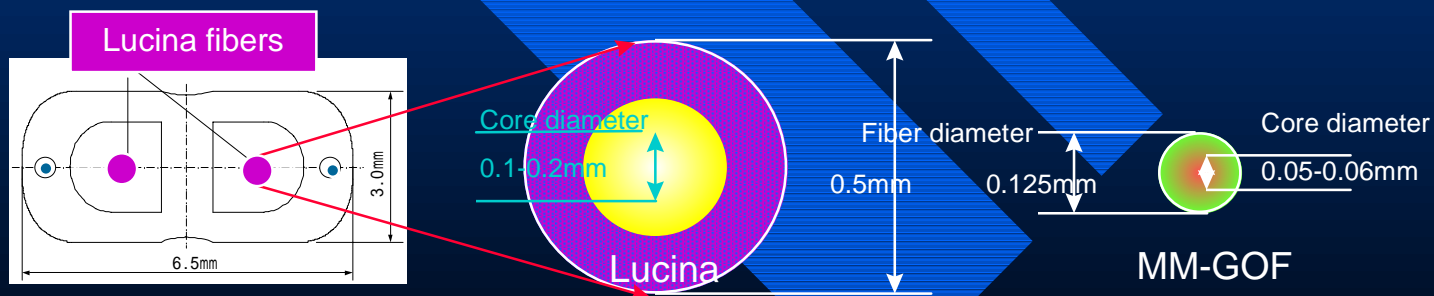
- 100m of 50dB/km cable: 5dB → 2.5dB(25dB/km at 2001year)
- 2 connections: 0.9dB × 2
- Bending loss(>R30mm): 0.3dB
- Margin: 0.4dB
- Total: 7.5dB → 5.0dB
- 7.5dB for 1000Base-SX(850VCSEL) Transceivers

Specifications of Lucina™ cable



■ Duplex cable specification

NA	0.185
Attenuation(tentative)	<50dB/km(850+1300nm)
Tension member	Steel wire
Maximum tensile load	220N
Bending loss(R30mm)	<0.2dB/km
Bandwidth	200MHz•km
Operating temperature	0~70°C
Storage temperature	-20~70°C
Application	Indoor use



Applications of Lucina™



■ Premises network

- 100M-1G-10G Ethernet LAN applications
- Fiber to the desk and centralized network administration
- Real time video conference

■ Storage area network

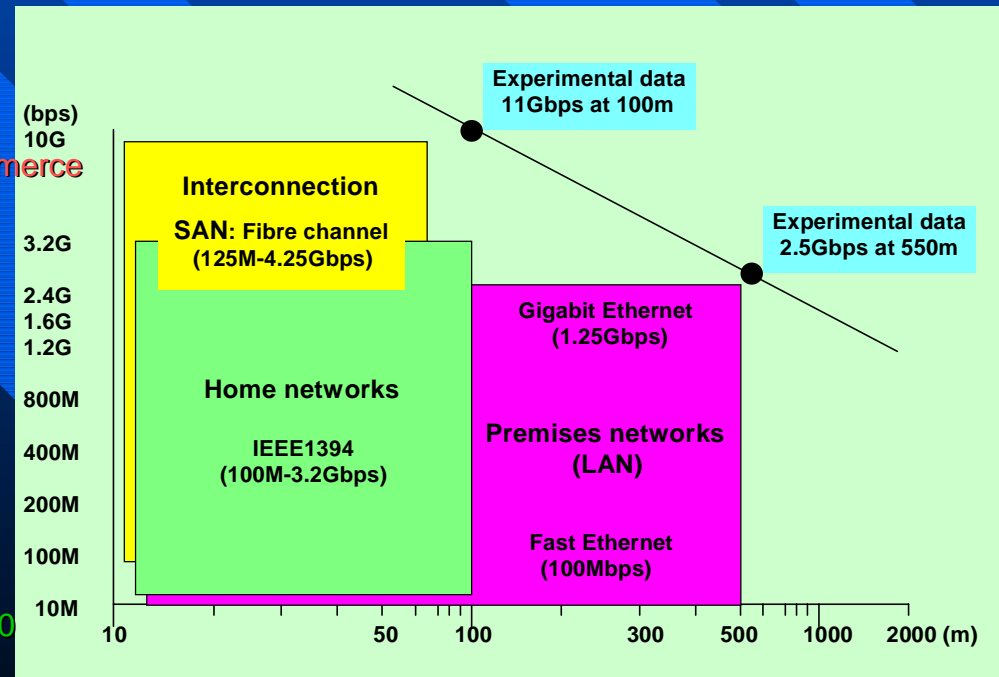
- Fibre channel application
- Data warehousing and e-commerce

■ Interconnections

- Central office equipment
- Computer clustering
- Factory Automation

■ Home network

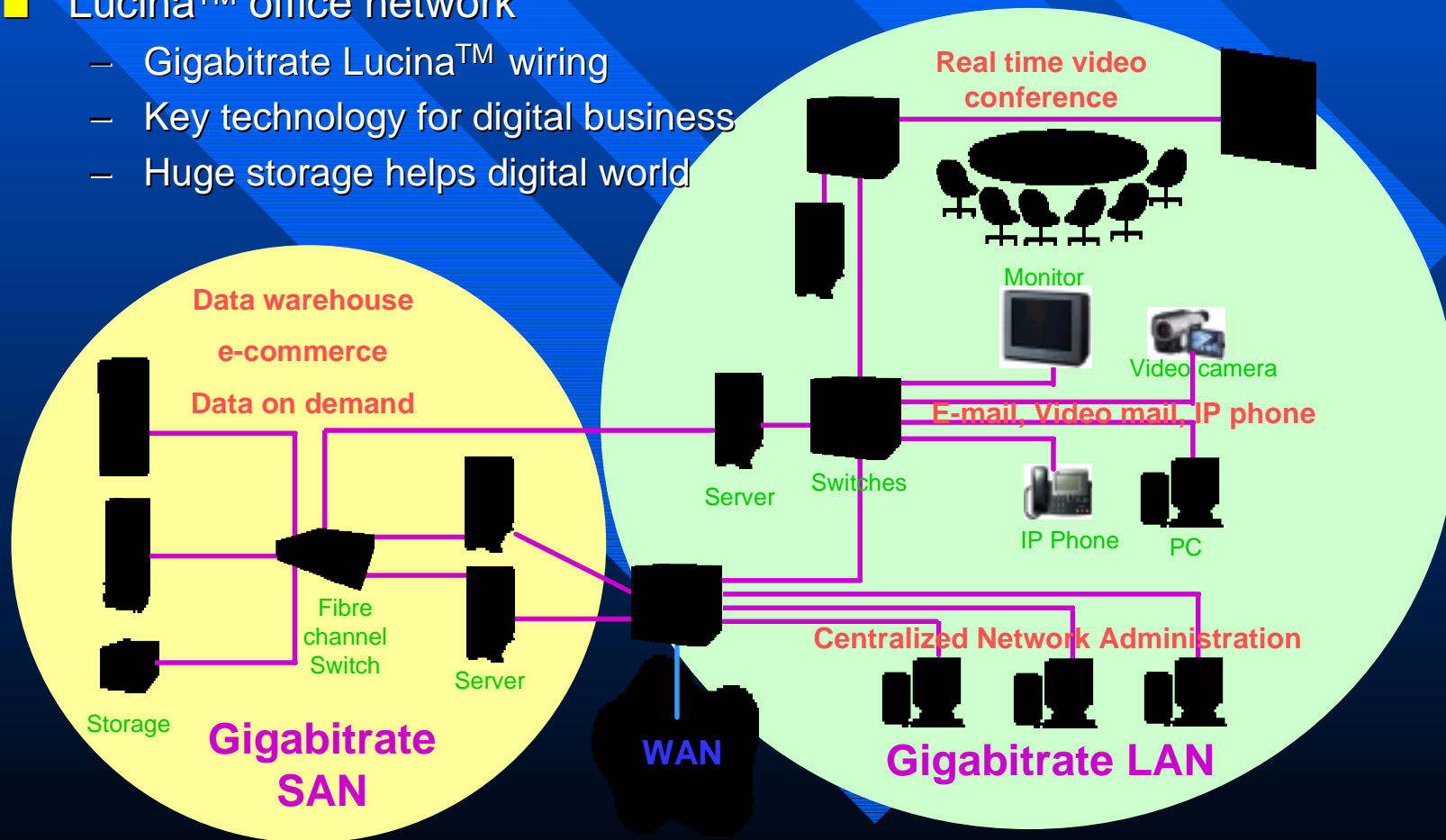
- Video and voice over IP
- Digital broadcasting
- Interactive Internet service
- GBEthernet/IEEE1394/USB2.0



Applications of Lucina™



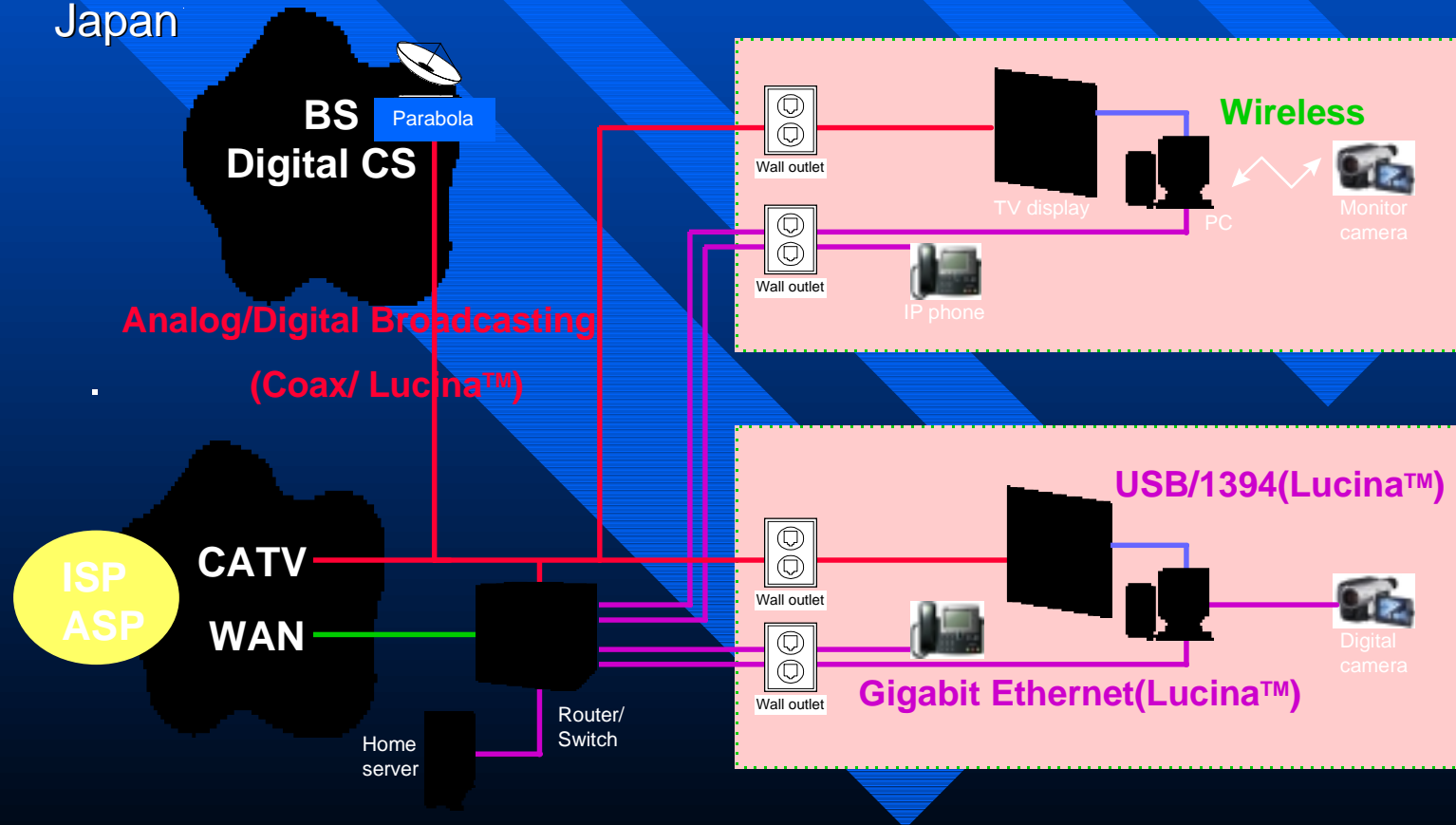
- Lucina™ office network
 - Gigabitrate Lucina™ wiring
 - Key technology for digital business
 - Huge storage helps digital world



Applications of Lucina™



- Lucina™ home network using Gigabit Ethernet for condominium in Japan



Records of installing Lucina™



AGC R&D center
June/1999



AGC head office
December/1999



Electronics company
December/1999



Network integrator office
March/2000



Keio University computer
center March/2000



K2 town campus
April/2000



Real estate office
May/2000



Security company
August/2000