

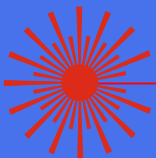
# **PANoptikUM**

## **d.o.o.**

### **Usposabljanje Inštalaterjev Telekomunikacijskih Kabelskih Sistemov**

#### **K a b l i   z   o p t i č n i m i   v l a k n i**

Predavatelj:      Roman LOŽAR  
E-mail:            roman.lozar@panoptikum.si  
Datum:             2001



**PANoptikUM d.o.o.**

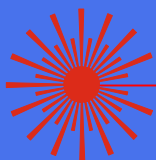


OPTIČNE POVEZAVE  
ZMOGLIVOSTI in  
PRIMERJAVA

POLAGANJE  
OPTIČNIH  
KABLOV

ZAKLJUČEVANJE  
OPTIČNIH  
KABLOV

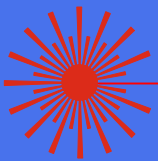
MERITVE  
OPTIČNIH  
KABLOV



**PANoptikUM d.o.o.**



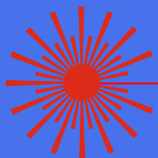
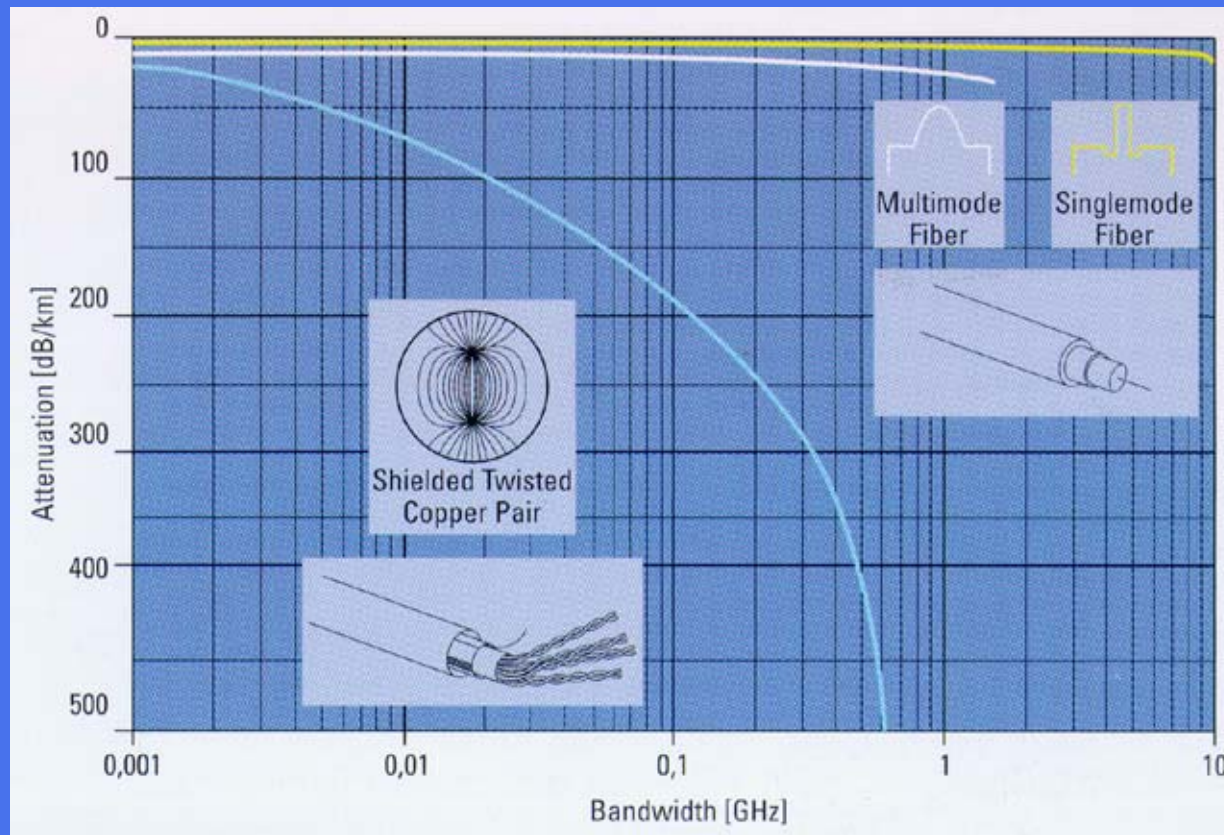
# Informacijska avtocesta



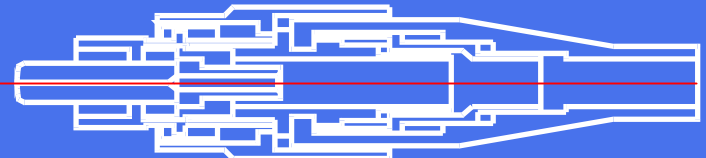
**PANoptikUM d.o.o.**



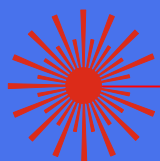
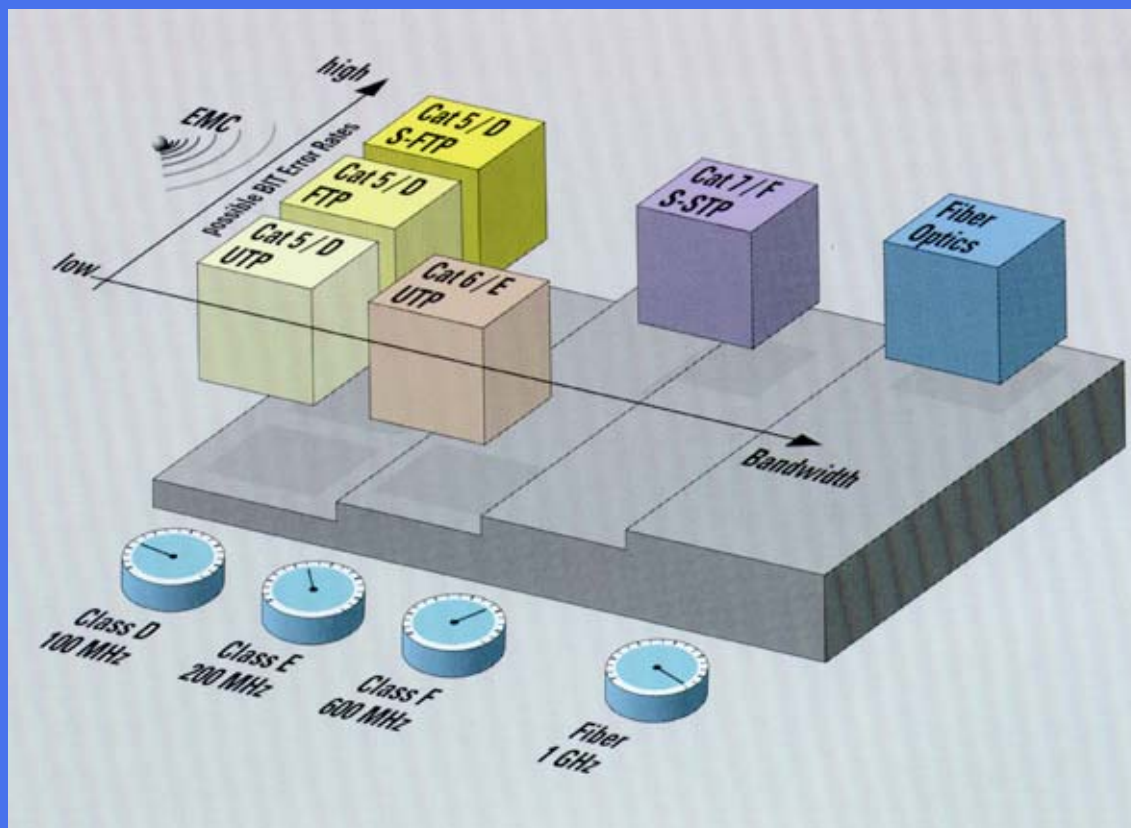
# Primerjava pasovne širine med STP in optičnim kablom



**PANoptikUM d.o.o.**



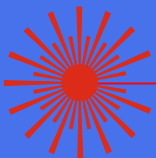
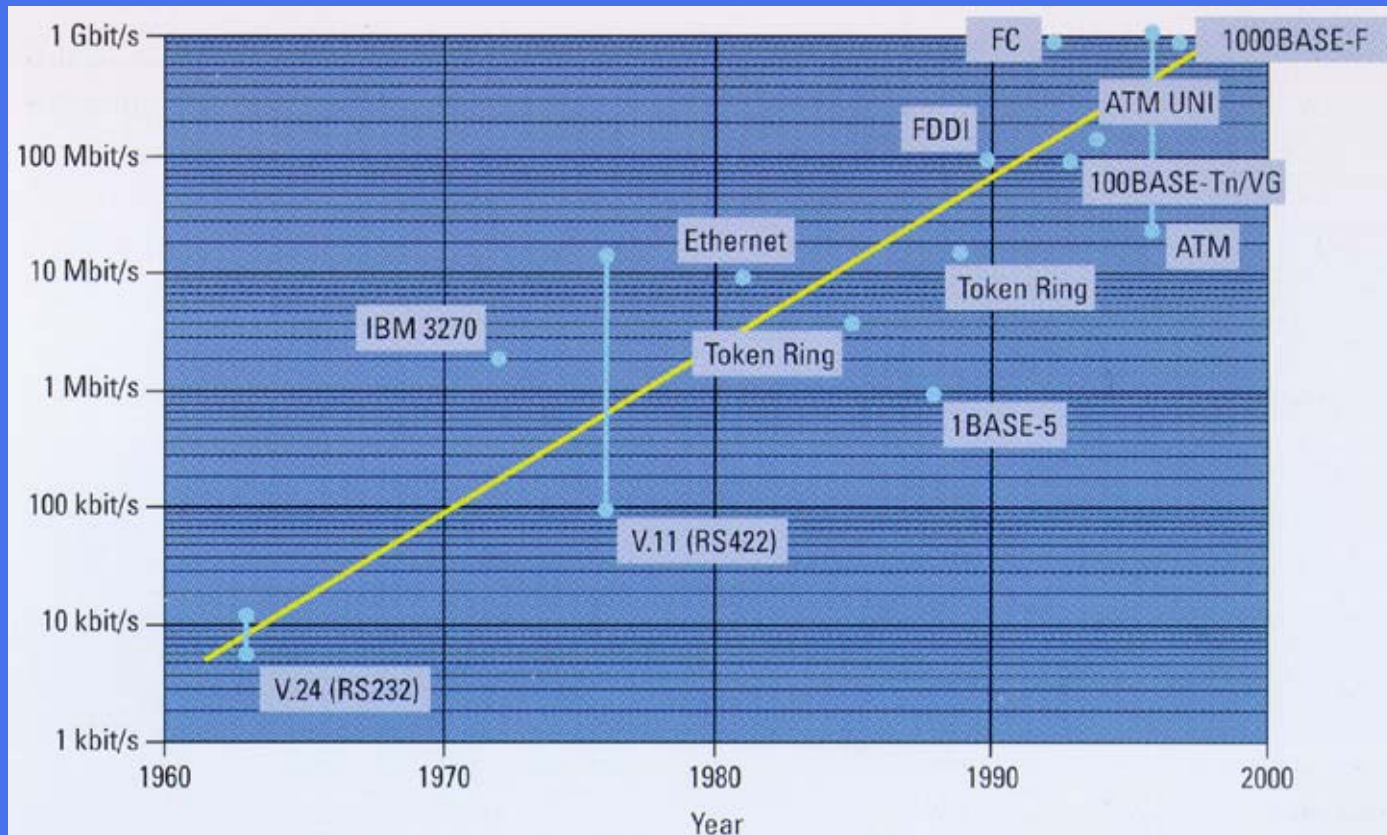
# Primerjava zmogljivosti med bakrenimi twisted pair kablji in steklenimi optičnimi kablji



**PANoptikUM d.o.o.**



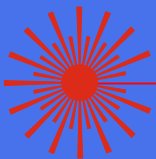
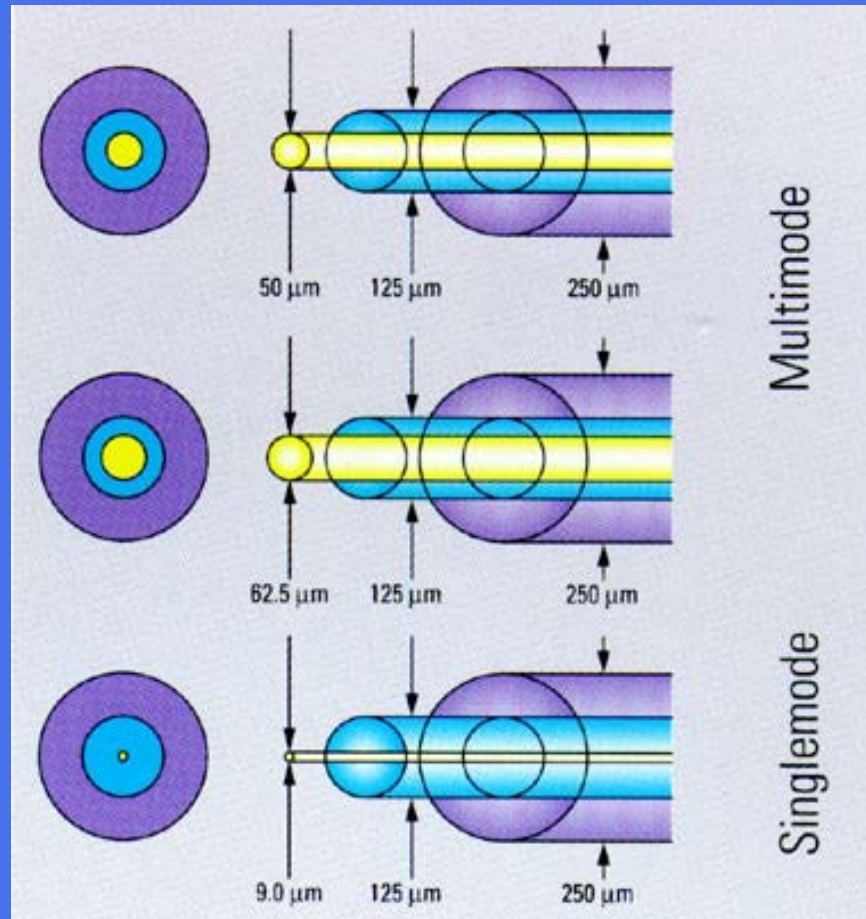
# Trendi v prenosu podatkov



**PANoptikUM d.o.o.**



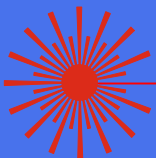
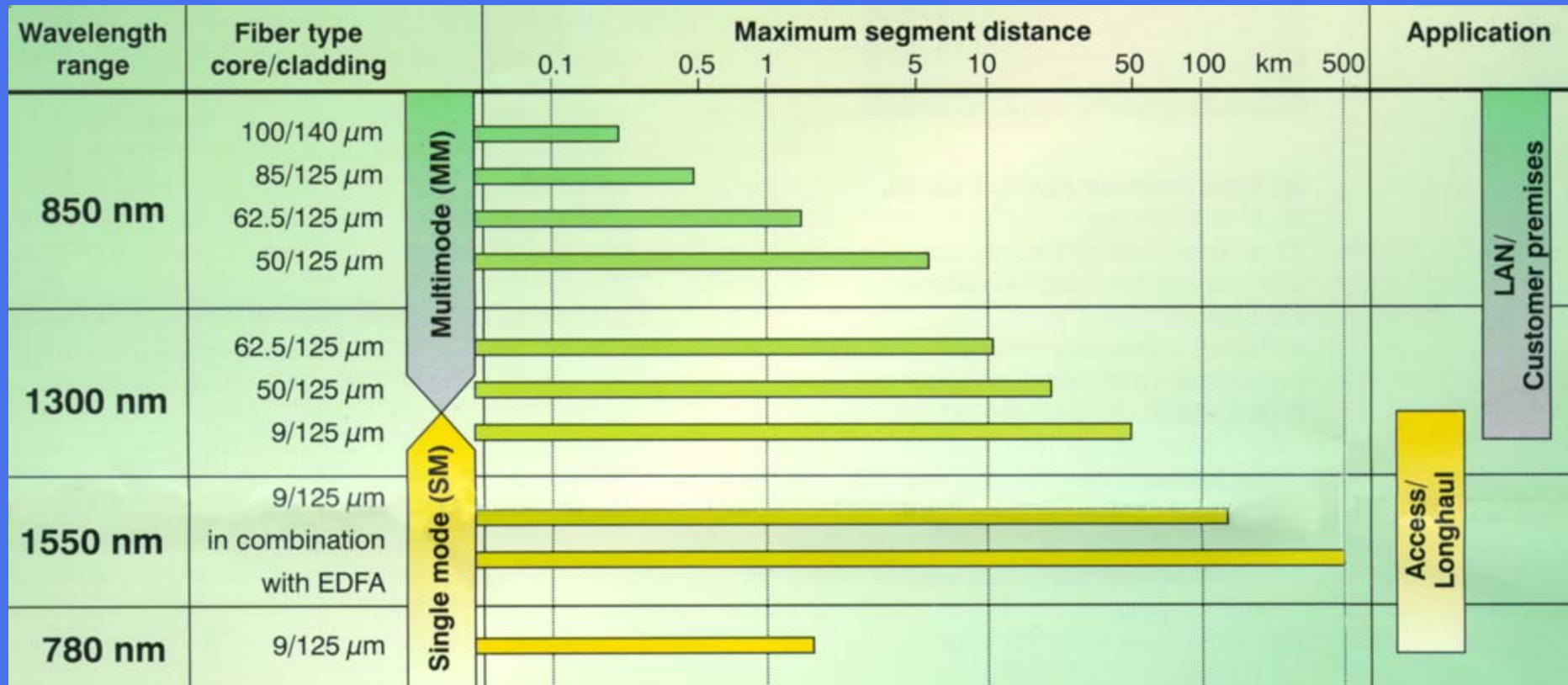
# Standardni tipi komunikacijskih optičnih vlaken



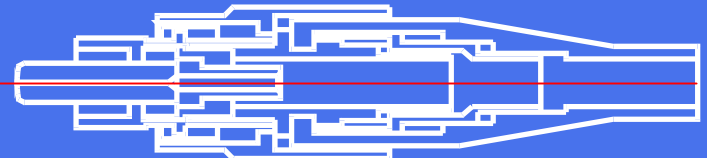
**PANoptikUM d.o.o.**



# Uporaba optičnih vlaken

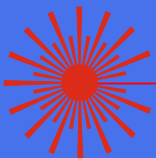


**PANoptikUM d.o.o.**

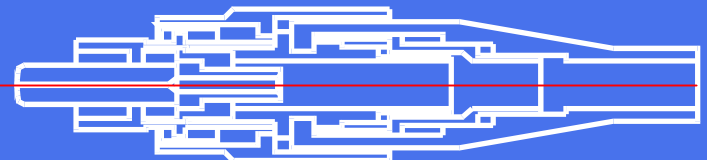


## Polaganje optičnih kablov:

- v kanal
- na polico
- v alkatno cev
  - spojke za alkatno cev
- sistemska rezerva
- možnost montaže konektorjev
  - minimalna dolžina kabla v omari + 3 m

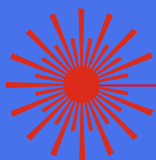


**PANoptikUM d.o.o.**



# Na kaj moramo biti pozorni pri polaganju optičnih kablov

- vlečna sila
- minimalni radij
  - med polaganjem
  - med obratovanjem
- zaščita kabla pred glodalci
- sistemska rezerva



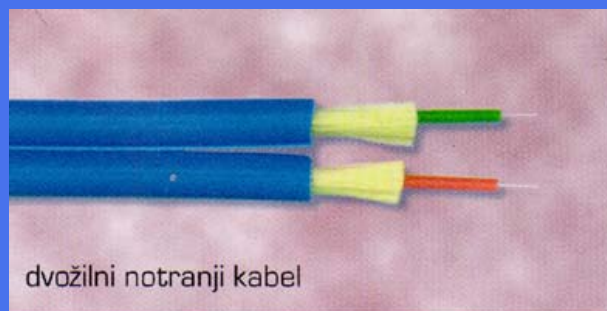
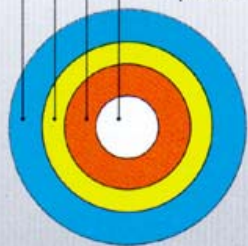
**PANoptikUM d.o.o.**



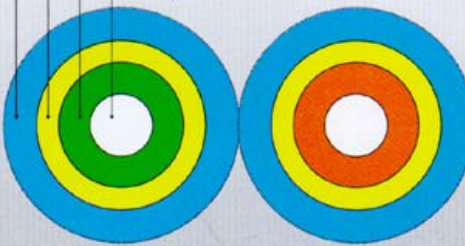
# Tipi optičnih kablov in konstrukcija



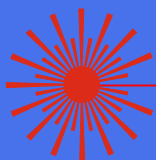
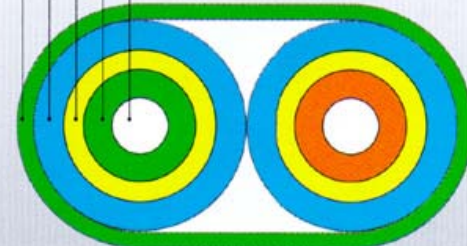
- zunanji plašč FR/LSOH
- aramidna vlakna
- tesna zaščita (nylon)
- optično vlakno



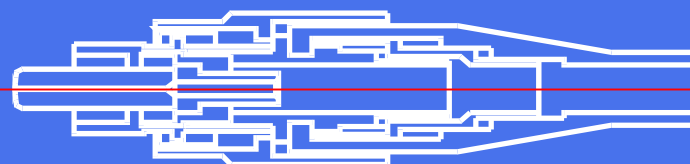
- zunanji plašč FR/LSOH
- aramidna vlakna
- tesna zaščita (nylon)
- optično vlakno



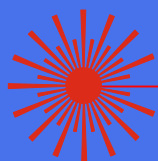
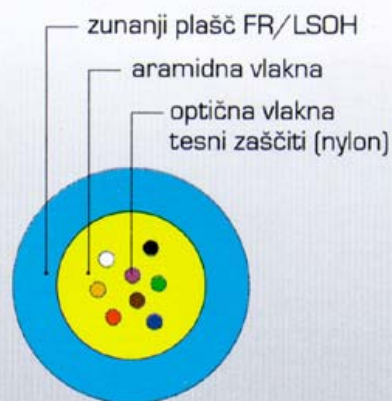
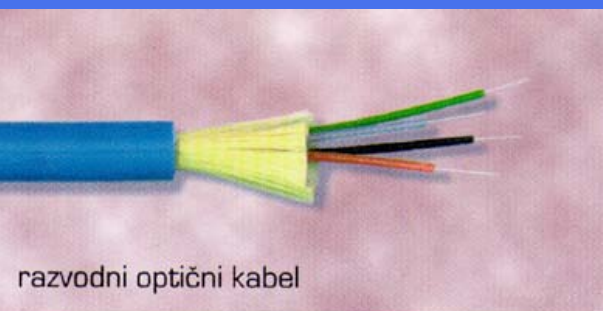
- dodatni plašč FR/LSOH
- zunanji plašč FR/LSOH
- aramidna vlakna
- tesna zaščita (nylon)
- optično vlakno



**PANoptikUM d.o.o.**



# Tipi optičnih kablov in konstrukcija

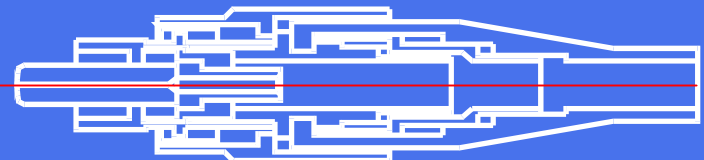
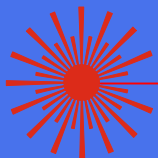


**PANoptikUM d.o.o.**



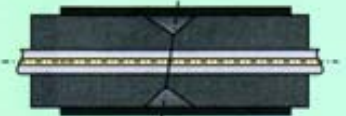

















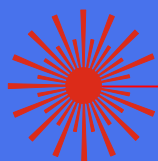
# Zaključevanje optičnih kablov

- direktna montaža (krimpanje)
  - z lepilom
  - brez lepila
- varjenje
- hladni spoji
- konfekcionirani kabli



# Optični konektorji

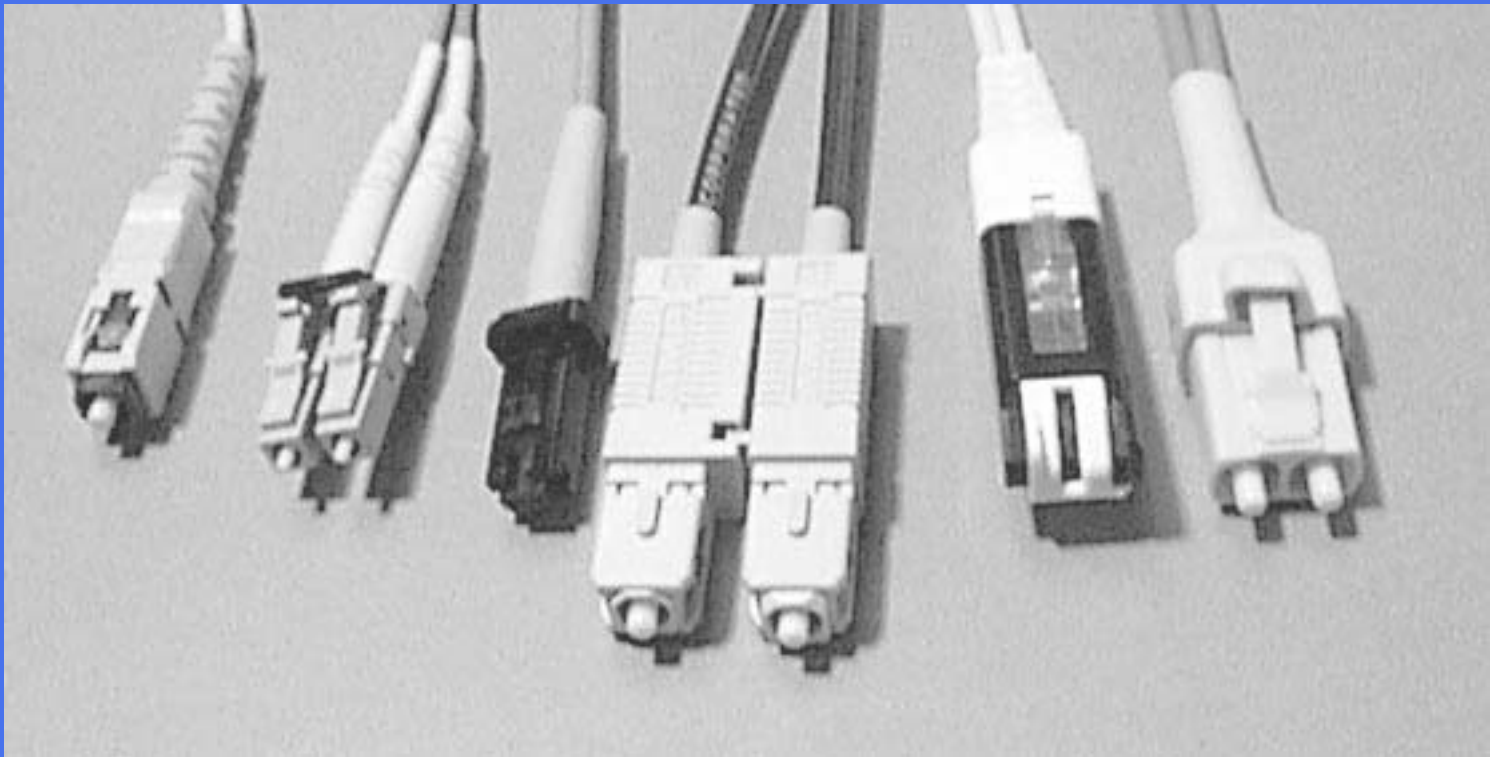
<b>Angled air-gap connector</b> <div><div>WAN</div><div>CATV</div></div>  <table><tr><td></td><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Air-gap</td><td>0.4 to 0.8 dB</td><td>&gt;60 dB</td></tr></table>				Insertion loss	Return loss	Air-gap	0.4 to 0.8 dB	>60 dB	<b>Physical contact connector .../PC</b> <div><div>LAN</div><div>WAN</div></div>  <table><tr><td></td><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Physical contact</td><td>&lt;0.5 dB</td><td>&gt;30 dB</td></tr><tr><td>Super</td><td>&lt;0.5 dB</td><td>&gt;40 dB</td></tr><tr><td>Ultra</td><td>&lt;0.5 dB</td><td>&gt;50 dB</td></tr></table>				Insertion loss	Return loss	Physical contact	<0.5 dB	>30 dB	Super	<0.5 dB	>40 dB	Ultra	<0.5 dB	>50 dB	<b>Angled physical contact connector .../APC</b> <div><div>WAN</div><div>CATV</div></div>  <table><tr><td></td><td>Insertion loss</td><td>Return loss</td></tr><tr><td>Angled (8° APC)</td><td>&lt;0.5 dB</td><td>&gt;60 dB</td></tr></table>				Insertion loss	Return loss	Angled (8° APC)	<0.5 dB	>60 dB
	Insertion loss	Return loss																														
Air-gap	0.4 to 0.8 dB	>60 dB																														
	Insertion loss	Return loss																														
Physical contact	<0.5 dB	>30 dB																														
Super	<0.5 dB	>40 dB																														
Ultra	<0.5 dB	>50 dB																														
	Insertion loss	Return loss																														
Angled (8° APC)	<0.5 dB	>60 dB																														
<div><div>SIMPLEX</div><div>DUPLEX</div></div>																																
VFO	EC/RACE	HRL-11	FC	ST	SC	D4	Biconic	DIN-LSA	E2000	Mini-BNC	F-SMA	Escon	SC Duplex	Duplex-MIC FDDI																		
																																
			.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC	.../PC																		
			.../APC	.../APC	.../APC			HRL-10	.../APC				.../APC																			



**PANoptikUM d.o.o.**

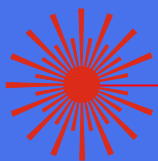


# Optični konektorji nove generacije

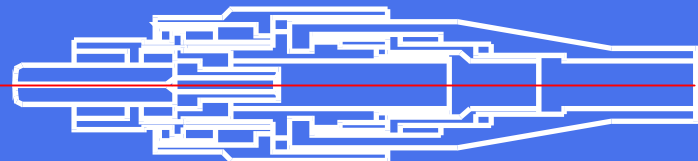


Od leve proti desni:

SC-DC, LC, MT-RJ, Duplex SC, Volition in Opti-Jack



**PANoptikUM d.o.o.**



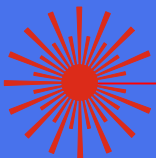
# GIGA bit Ethernet

## za krajše razdalje

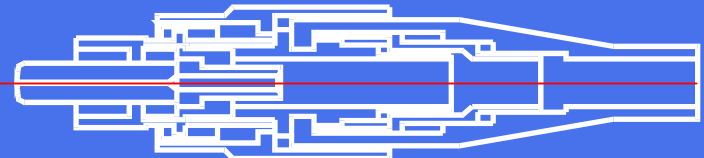
Tip vlakna	Pasovna širina pri 850nm	Razdalja	Razpoložljiva moč	Izgube na kablju	Izgube na spoju/zvaru
62.5um	160MHzokm	220m	3.23dB	0.83dB	1.5dB
62.5um	200MHzokm	275m	3.21dB	1.03dB	1.5dB
50um	400MHzokm	500m	3.43dB	1.75dB	1.5dB
50um	500MHzokm	550m	3.93dB	1.93dB	1.5dB

## za daljše razdalje

Tip vlakna	Pasovna širina pri 1300nm	Razdalja	Razpoložljiva moč	Izgube na kablju	Izgube na spoju/zvaru
62.5um	160MHzokm	550m	4.02dB	0.83dB	1.5dB
50um	400MHzokm	550m	2.42dB	0.83dB	1.5dB
50um	500MHzokm	550m	3.54dB	0.83dB	1.5dB
9um	n/a	5000m	4.73dB	2.5dB	2dB

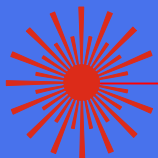


**PANoptikUM d.o.o.**

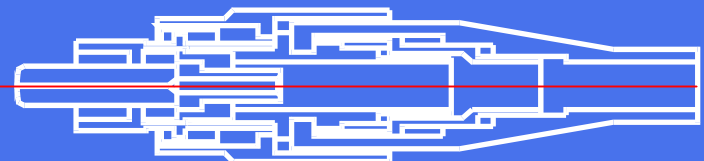


# Gradniki v optičnih mrežah

- zaključni kabli (pigtail)
- priključni kabli (patch cord)
- optični kabli
- optični delilniki
  - 19"
  - stenski

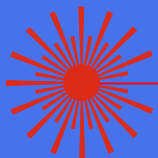


**PANoptikUM d.o.o.**

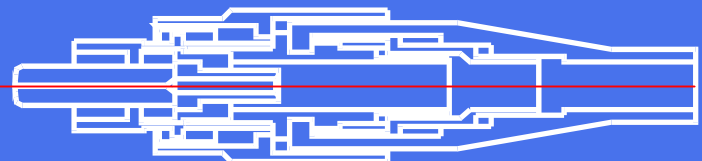


# Testiranje in meritve optičnih povezav

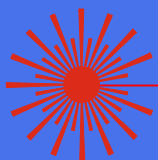
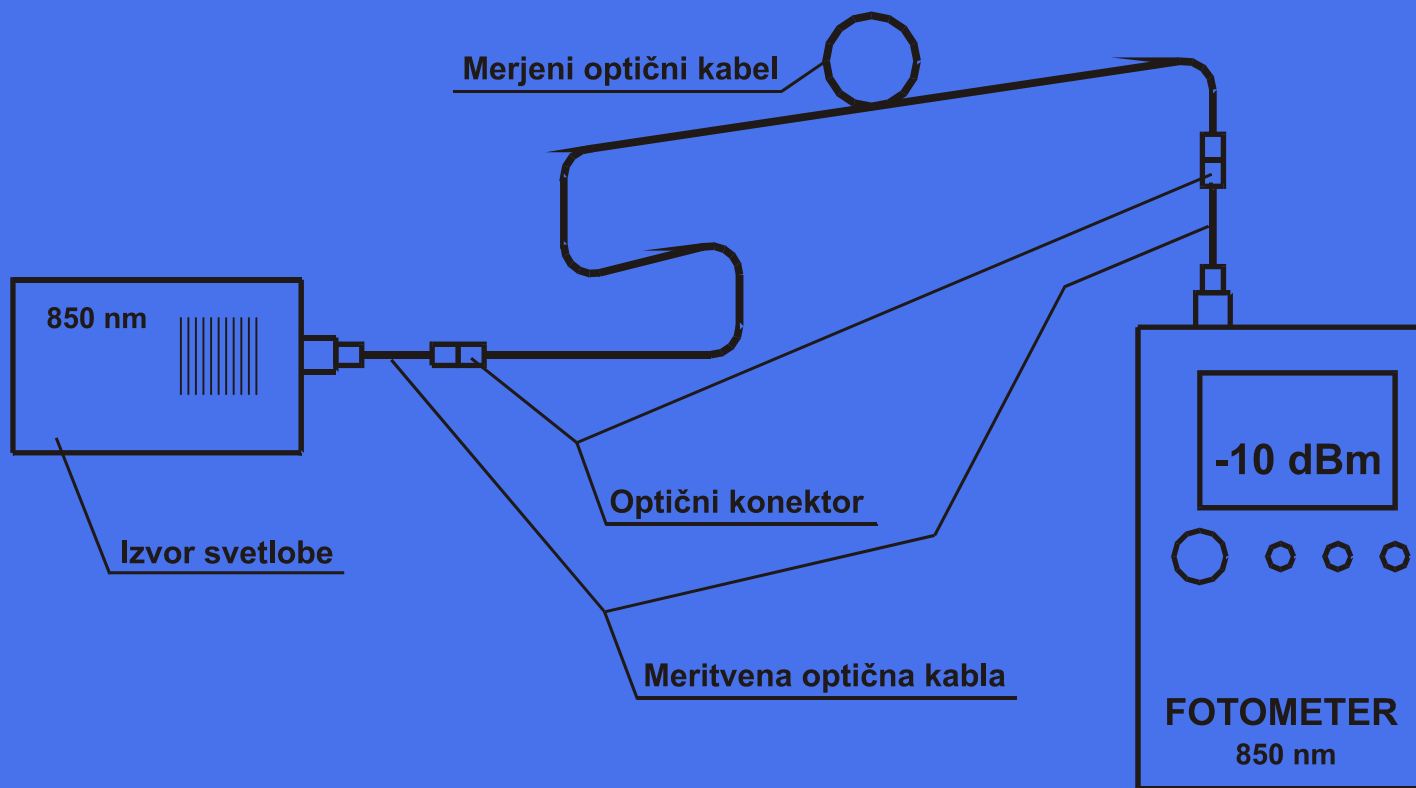
- priključitev opreme
- baterija
- merjenje izgub s fotometrom
- optični reflektometer (OTDR)



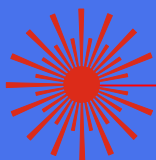
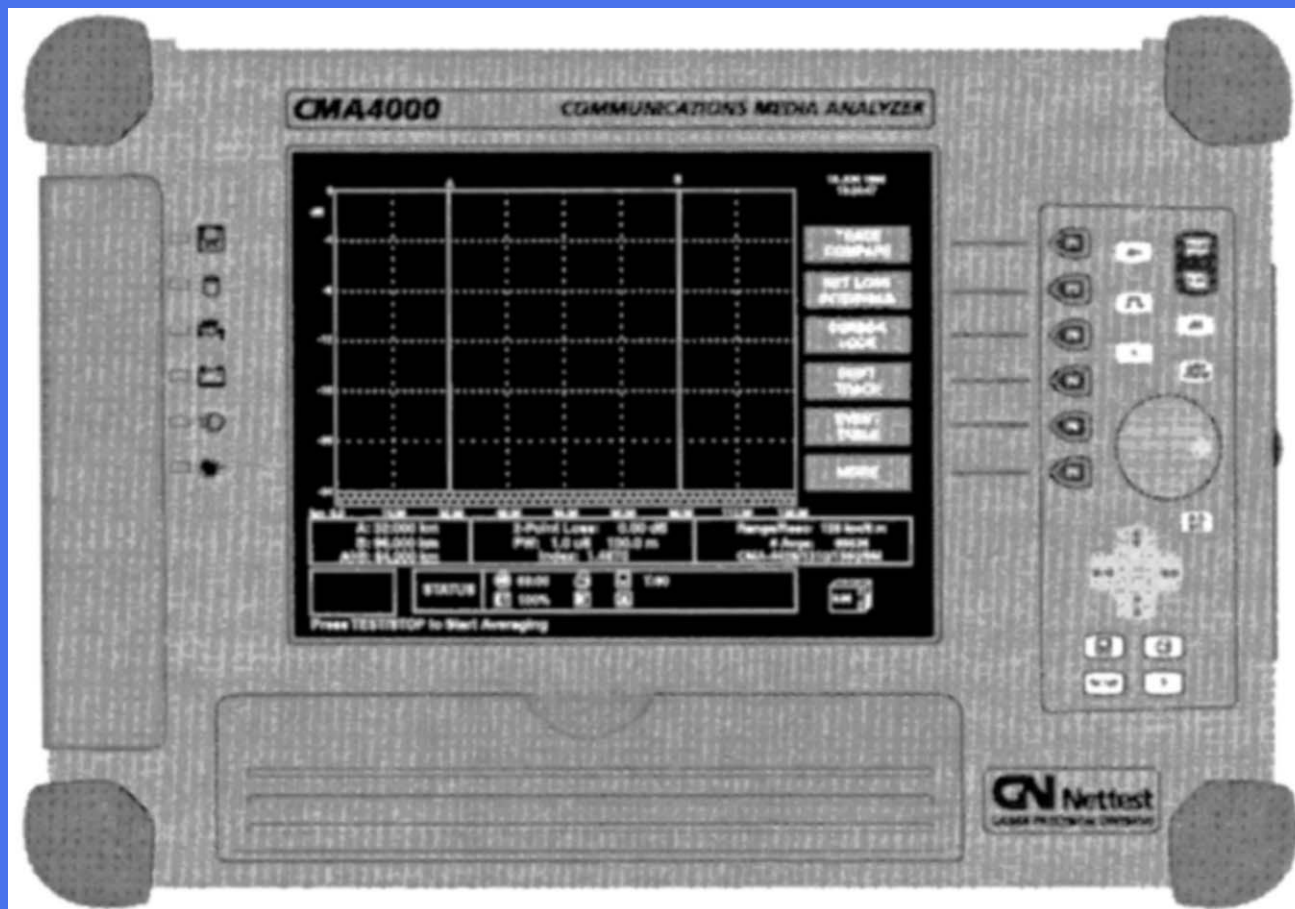
**PANoptikUM d.o.o.**



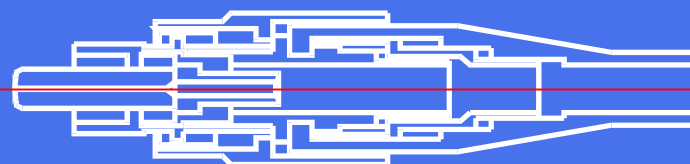
# Merjenje izgub s fotometrom v dB



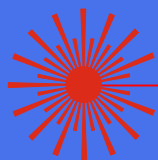
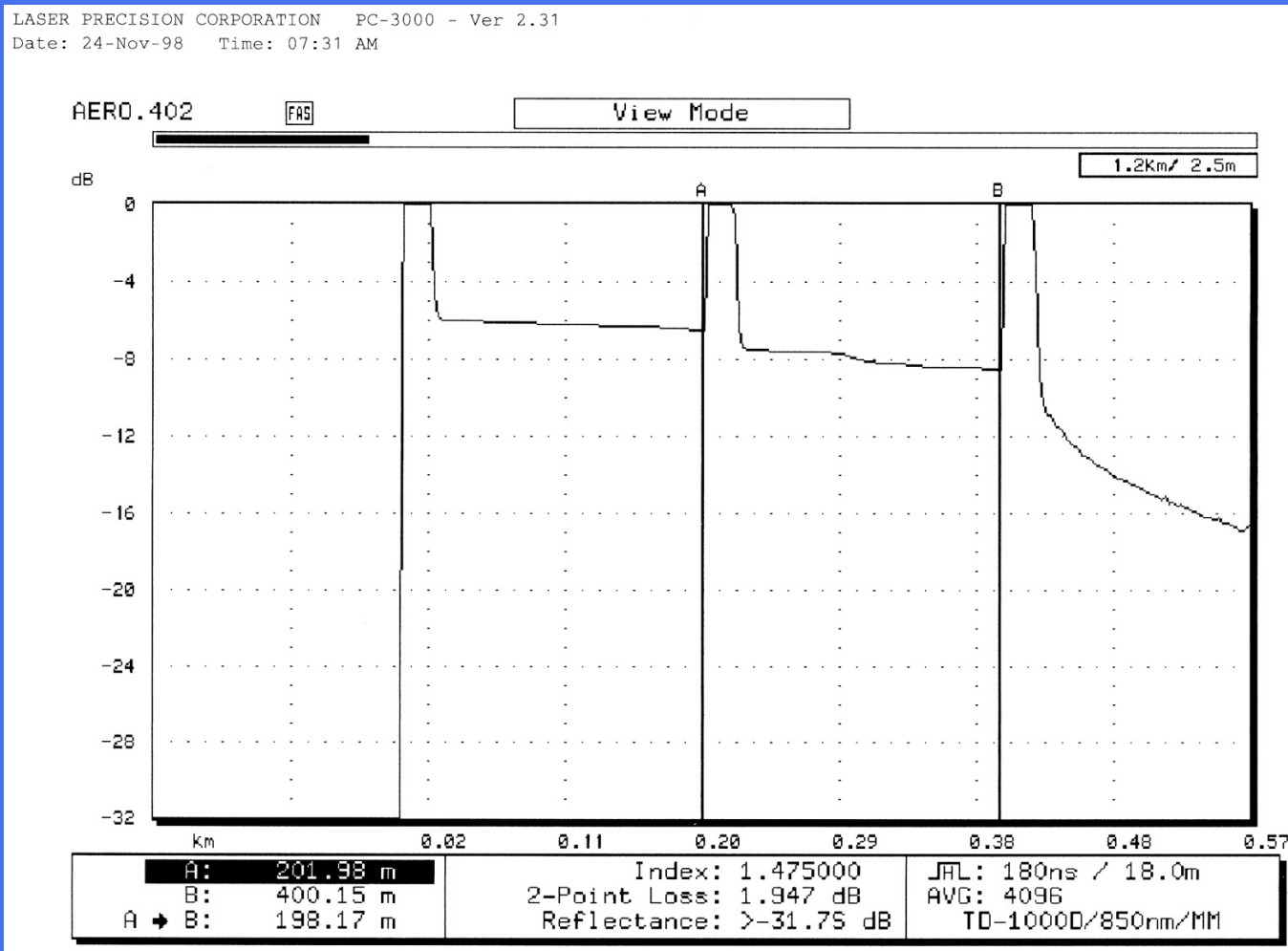
# Merjenje dolžine optične trase in slabljenja s optičnim reflektometrom (OTDR)



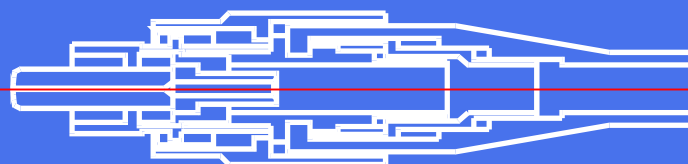
**PANoptikUM d.o.o.**



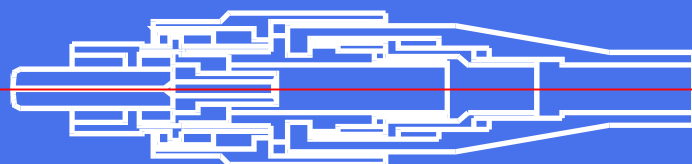
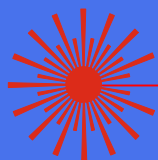
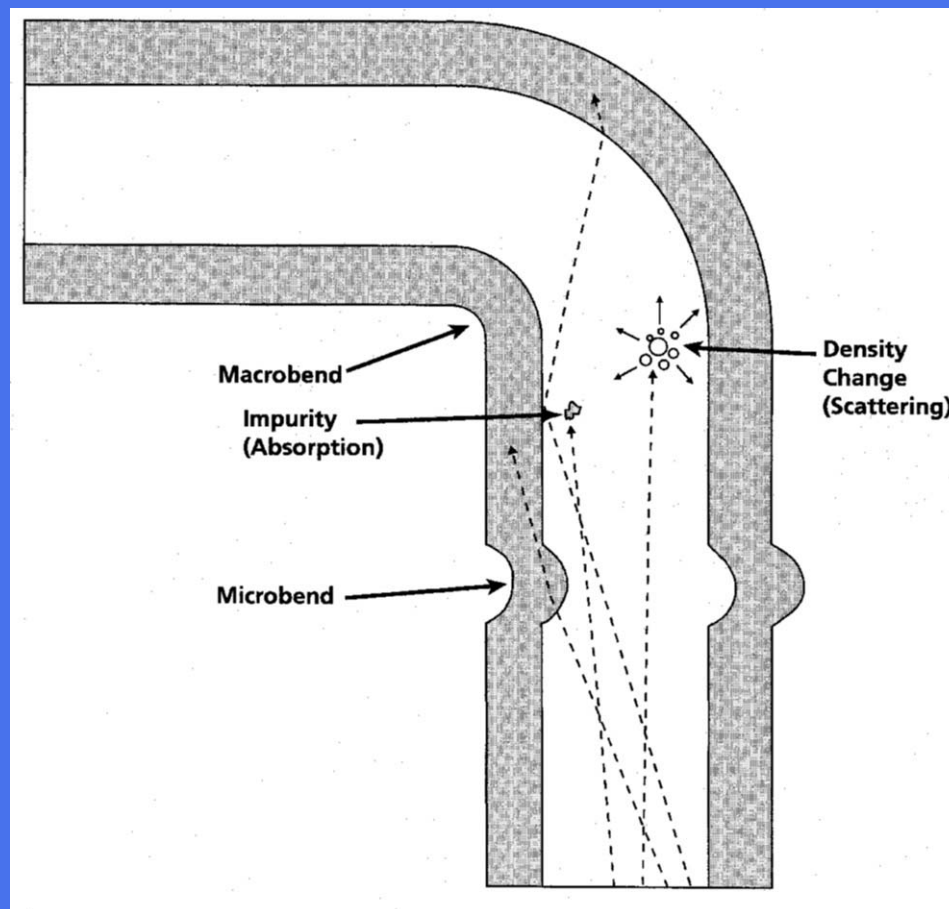
# Slika optične trase



## PANoptikUM d.o.o.

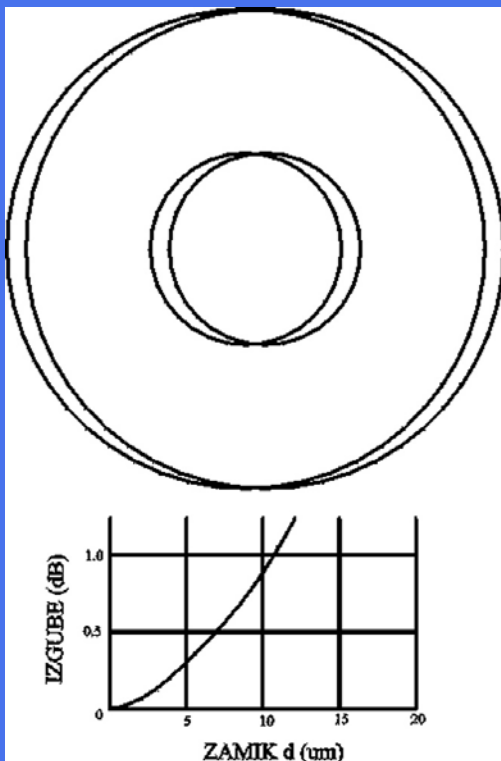


# Vzroki za nastanek izgub pri polaganju in zaključevanju optičnih kablov

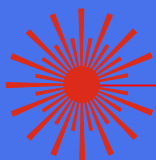
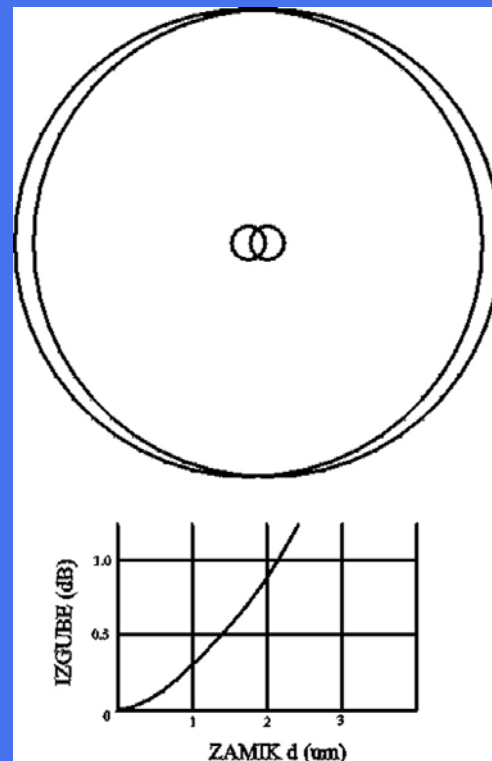


# Izgube na spojih

**Mnogorodovno  
50 mikronsko vlakno**



**Enorodovno  
10 mikronsko vlakno**

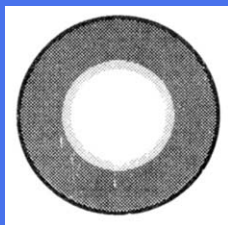


**PANoptikUM d.o.o.**

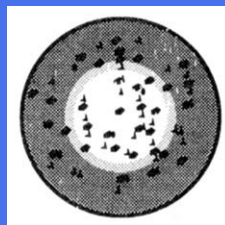


# Prikaz različno izdelanih konektorjev

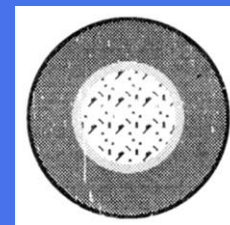
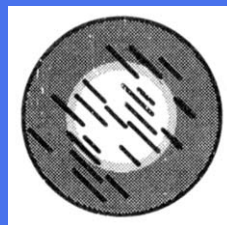
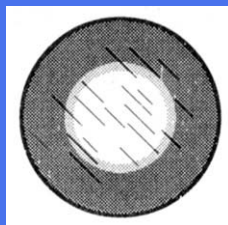
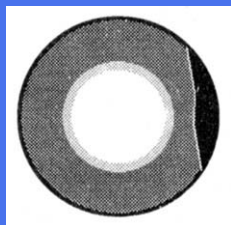
dober



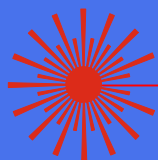
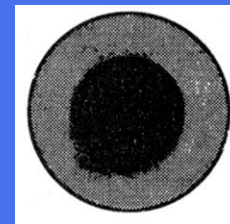
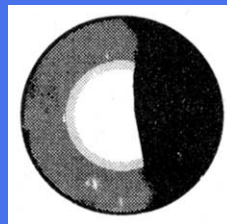
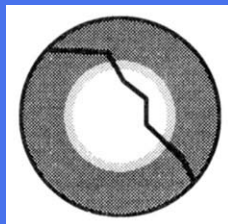
čiščenje



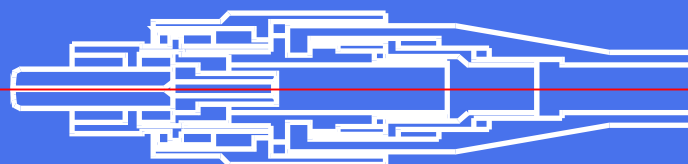
ponovno poliranje



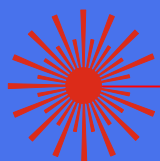
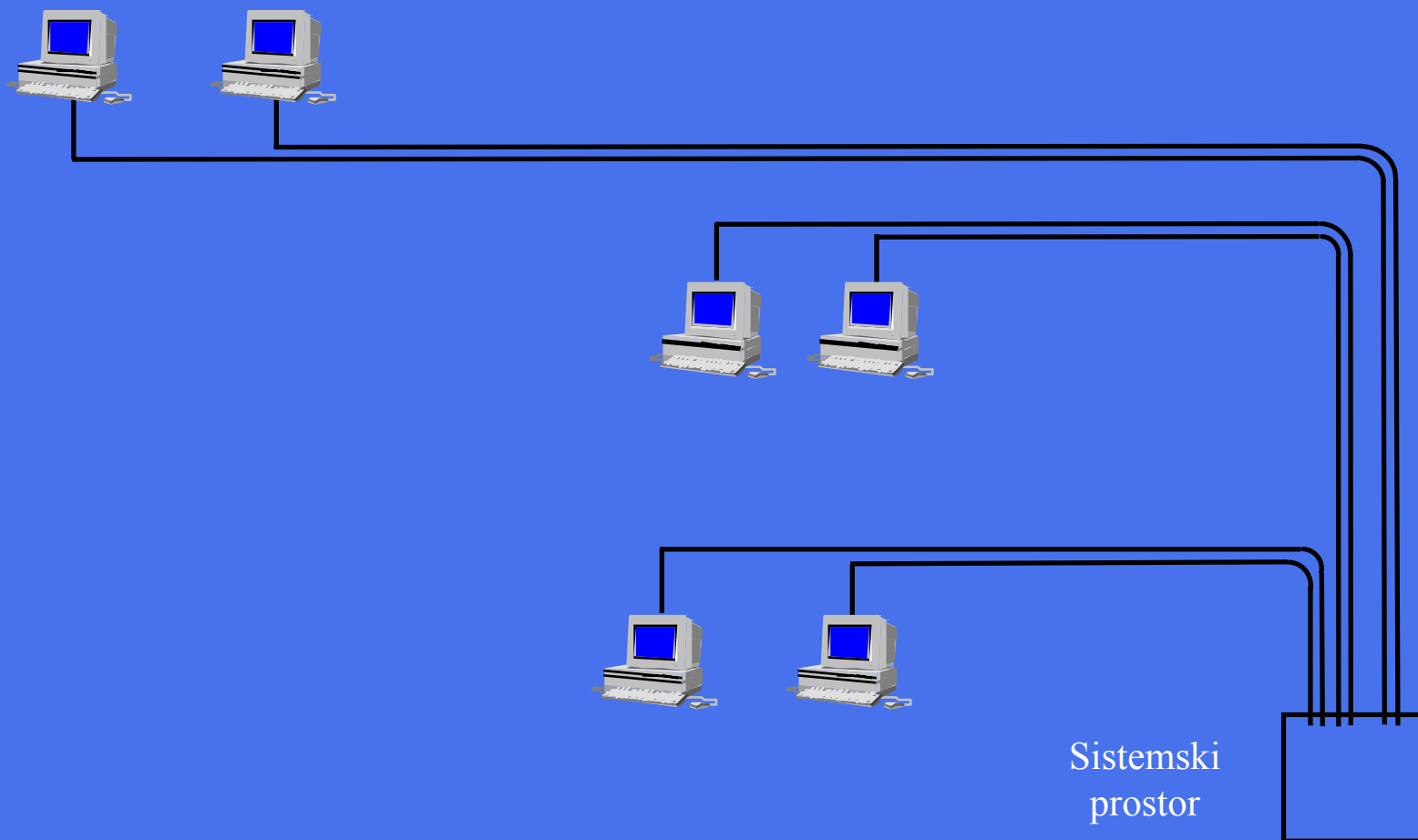
zanič



**PANoptikUM d.o.o.**



# Fiber to the desk



**PANoptikUM d.o.o.**

