ESNOG 24

Barcelona

El gran libro de los transceptores ópticos

Capítulo 1: FOIRL (1987)

…

Capítulo N+1: distancias geográficas de 100G a 400G

¿100G?
¿¿400G??
No me interesa, llámame más adelante.

Sí te interesa: hoy es algo que puedes hacer tú y no comprarlo a otros.

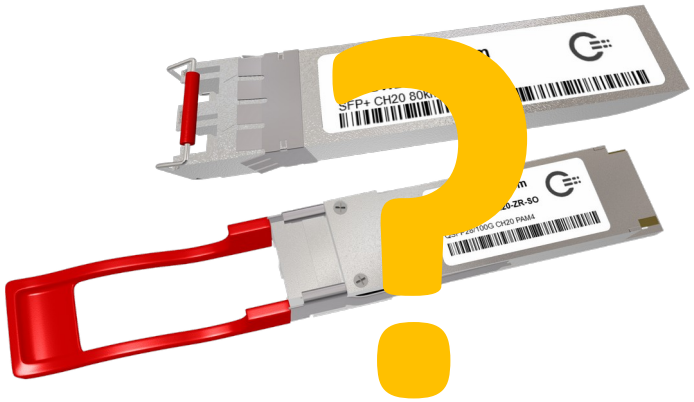
En capítulos anteriores:
De 1G a 10G

1G CWDM/DWDM

10G CWDM/DWDM

Fibra oscura

Multiplexor pasivo



25G

40G

100G

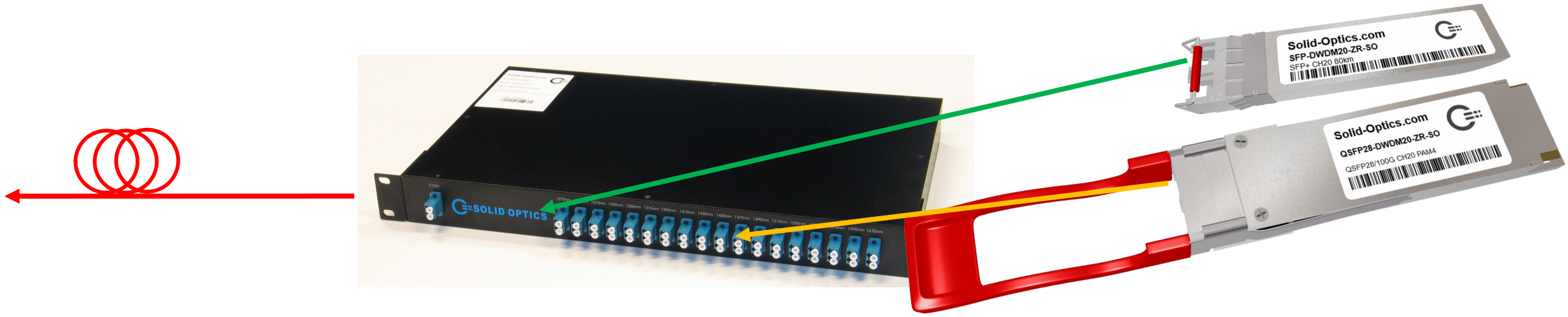
400G

Ingredientes

1 - Fibra oscura

2 - Multiplexor

3 - Transceptor (luz)



Ingredientes

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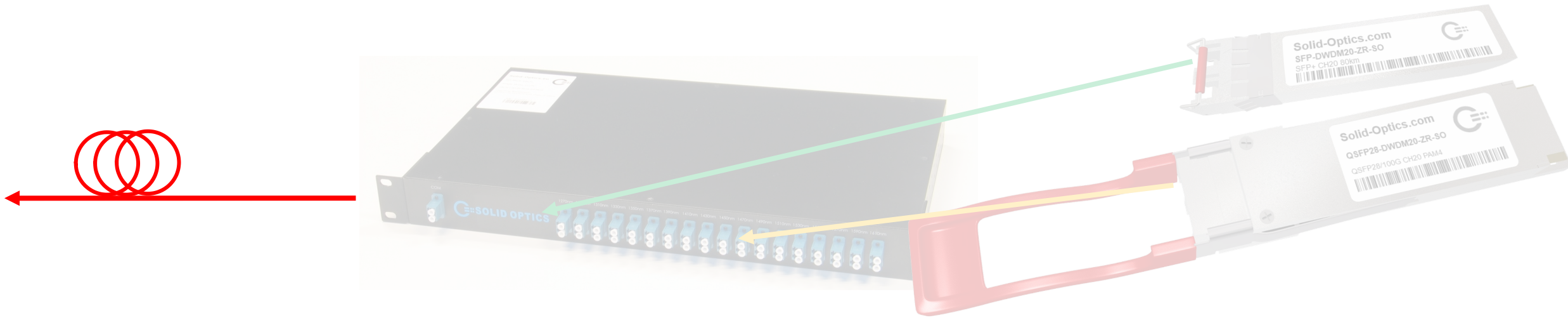
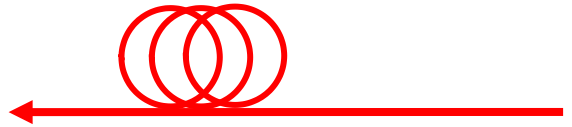
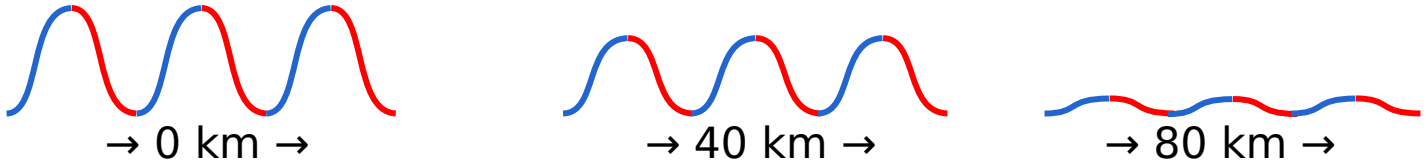


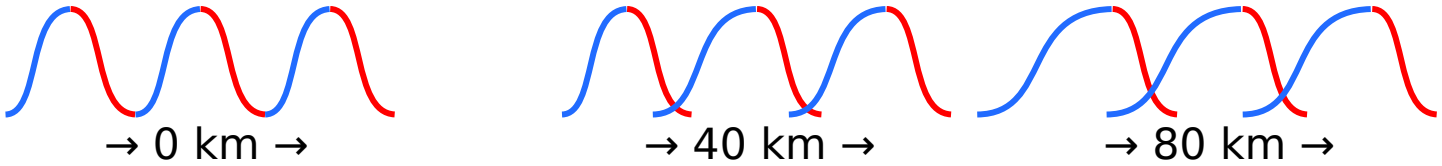
Fibra oscura



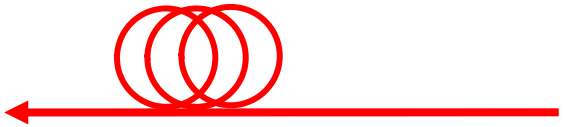
Atenuación



Dispersión

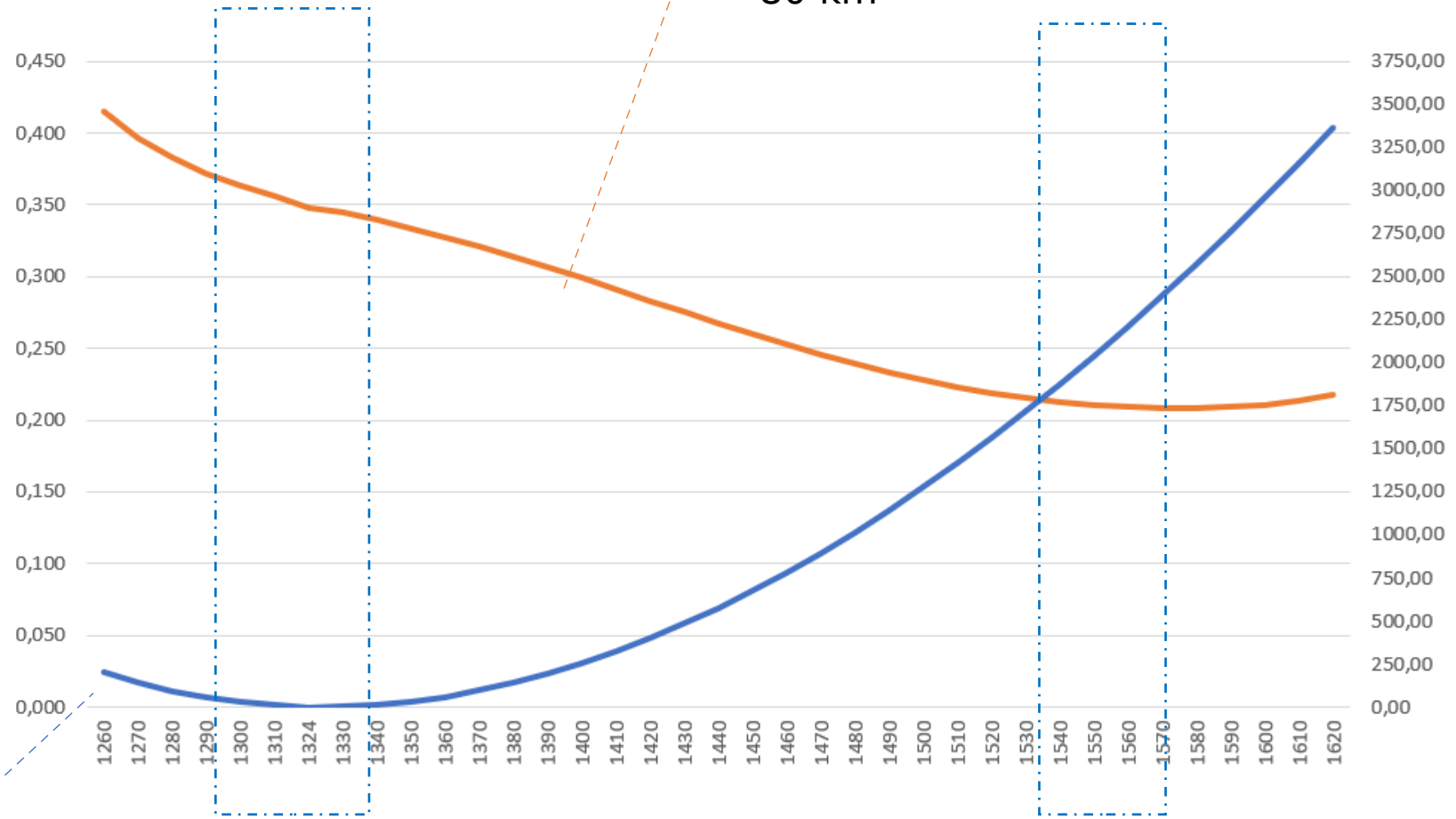


Fibra oscura



Atenuación

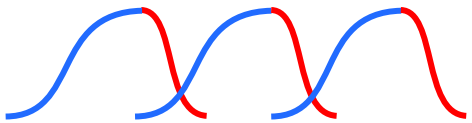
→ 80 km →



Ventana 1310nm

1550nm/DWDM

Dispersión



→ 80 km →

Ingredientes

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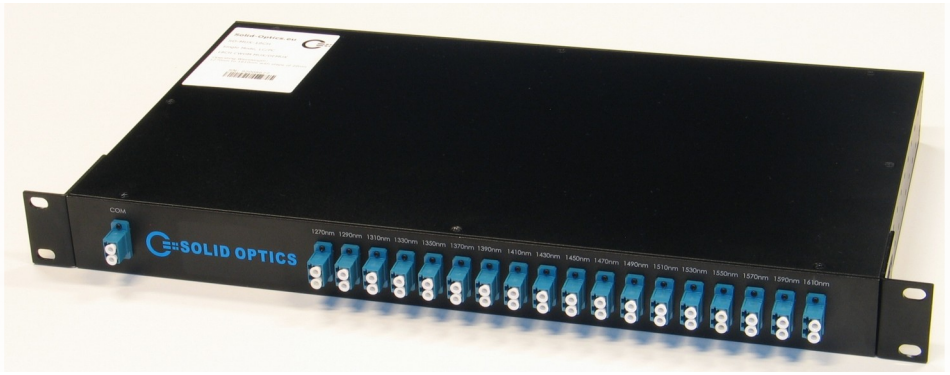
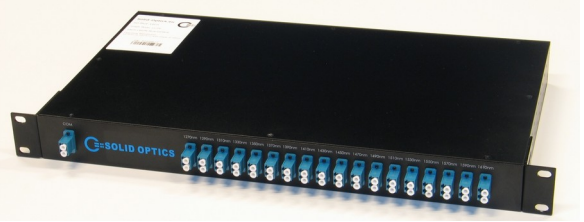


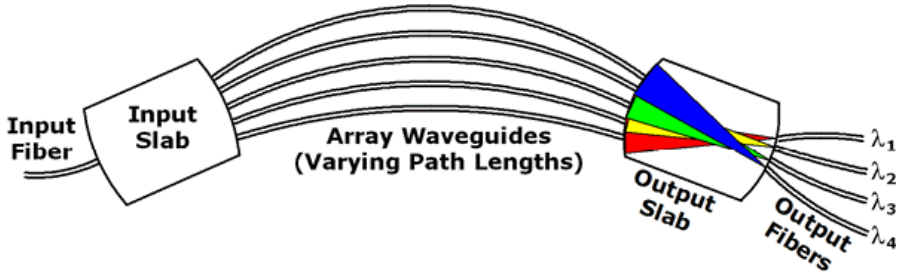
Multiplexores



2 tipos

- TFF en serie

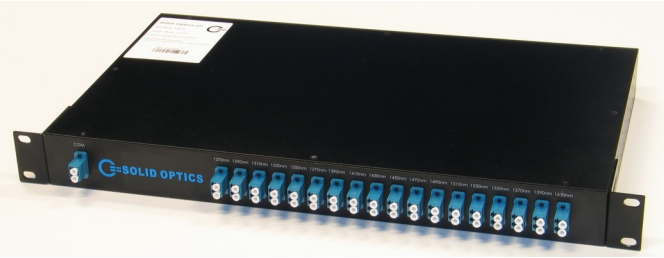
- AWG



95% del tráfico

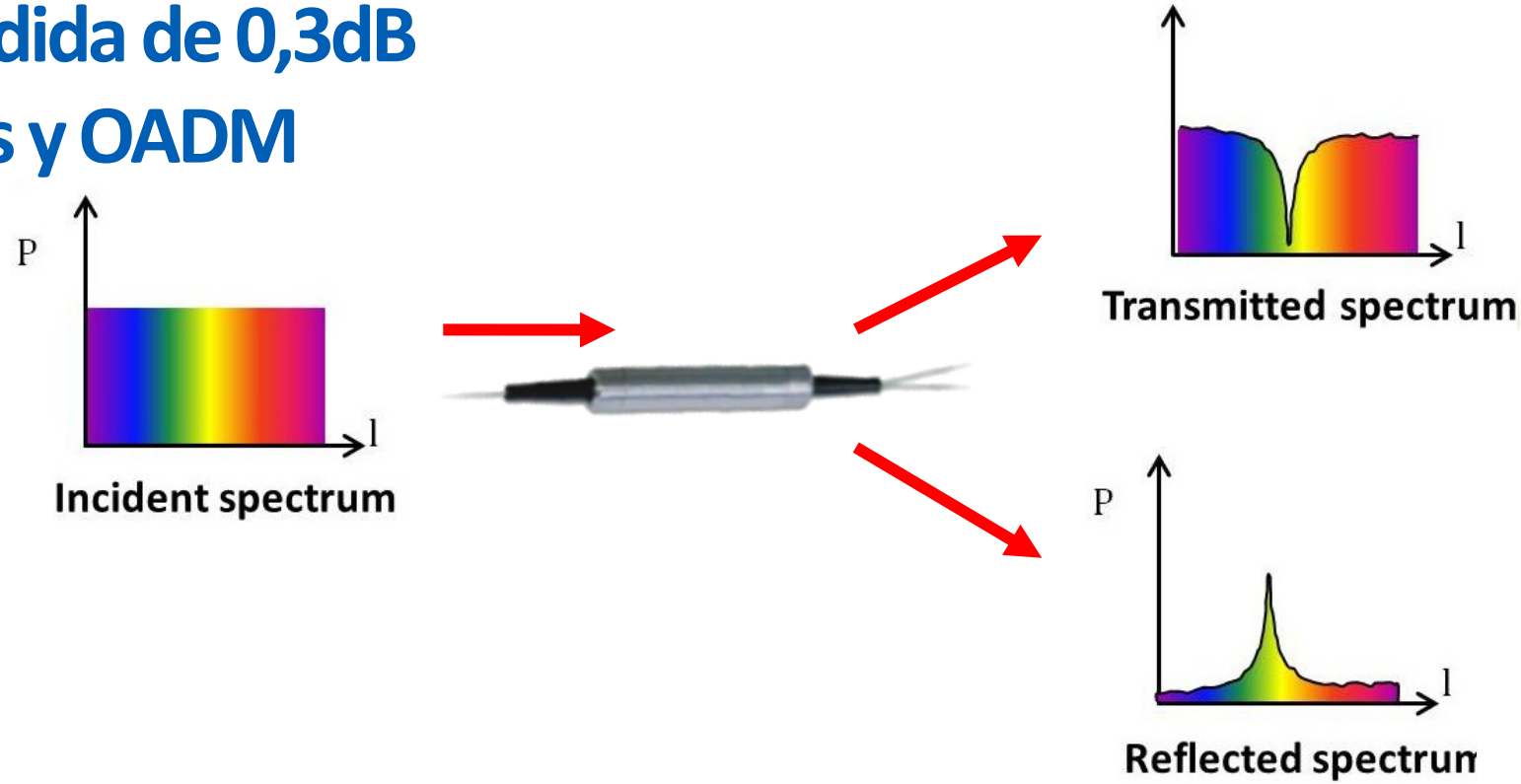
Multiplexores de 40 hasta 96 canales

Multiplexores

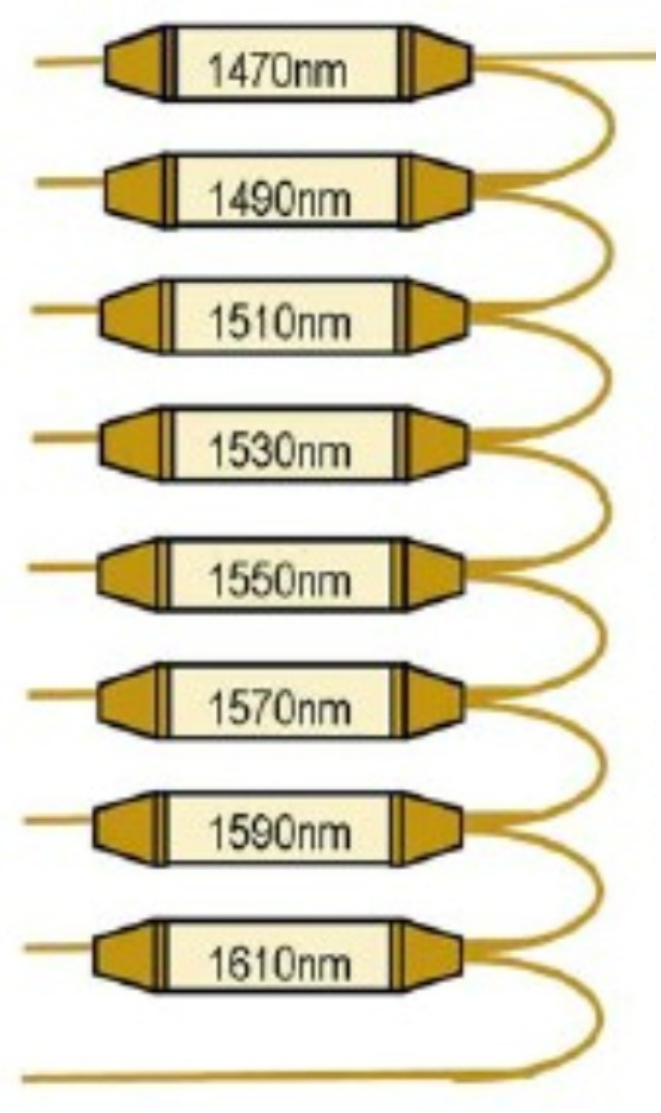


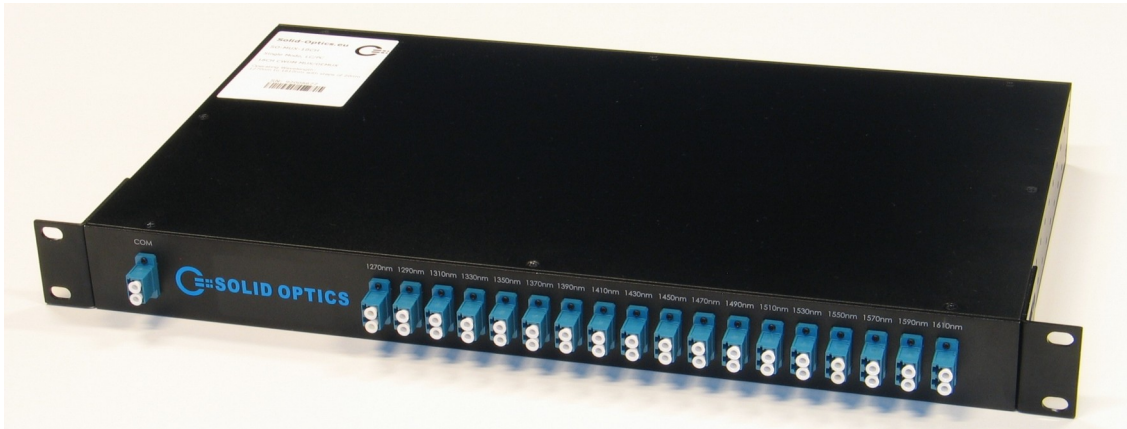
TFF: Thin film filter

- Tubos de metal o cristal 2cm*4mm
- 3 fibras: común / color / reflectada
- Cada tubo tiene una pérdida de 0,3dB
- 95% de los multiplexores y OADM

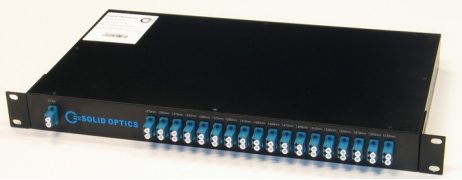


Multiplexores

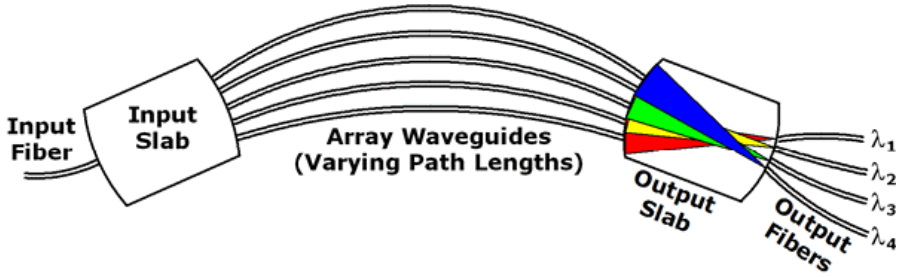




Multiplexores

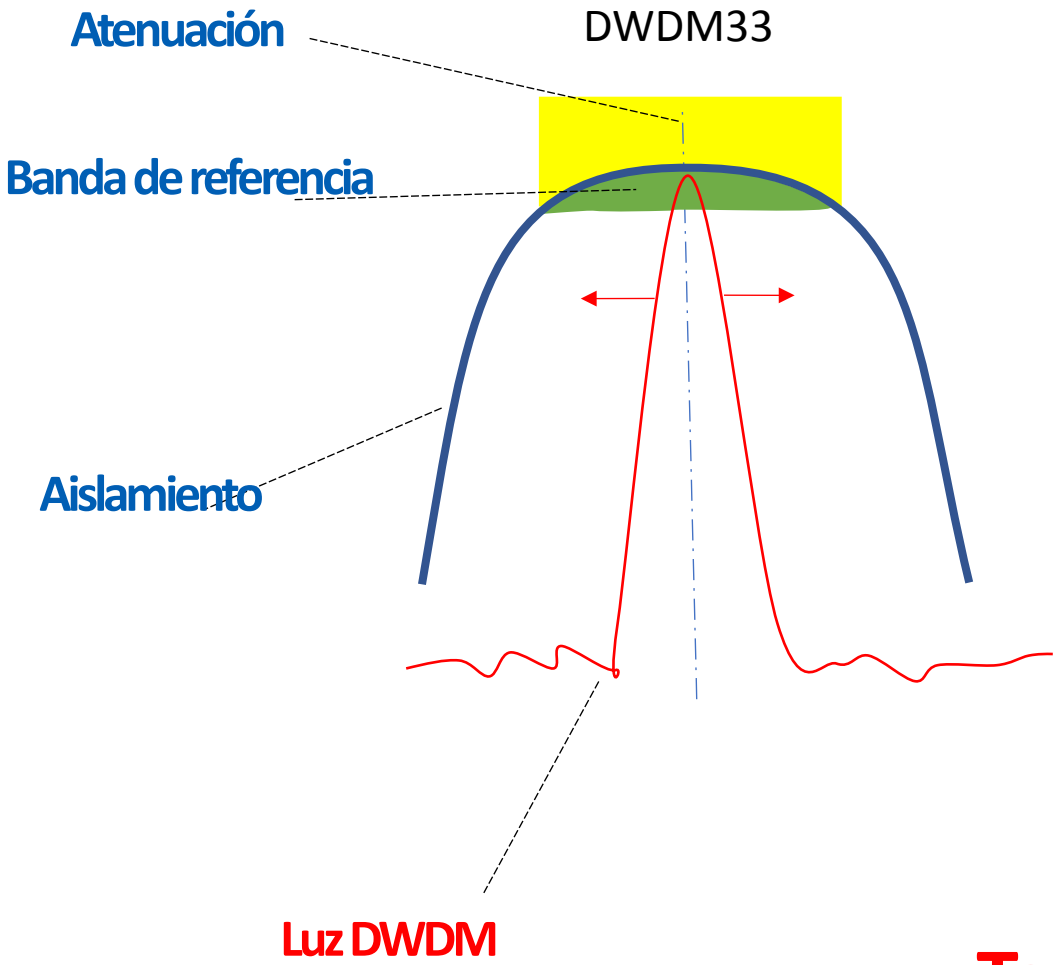


AWG: arrayed wave grading



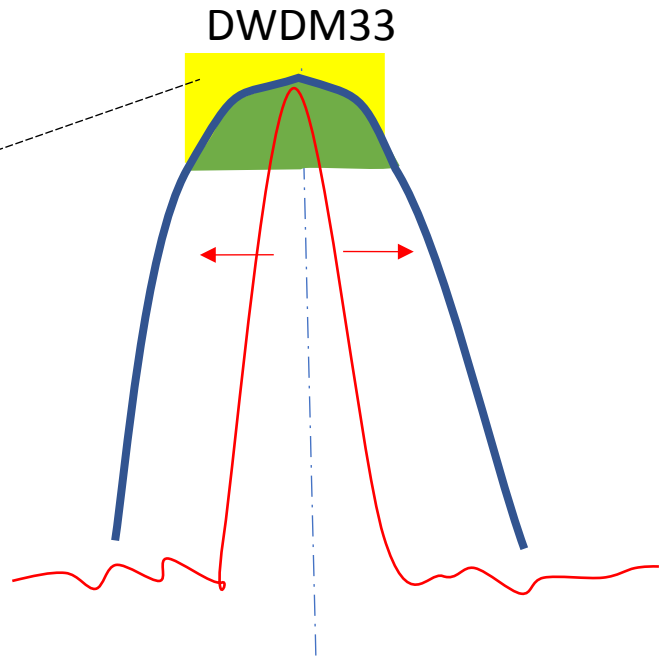
- Multiplexores de 40 hasta 96 canales
- Pérdida reducida (~ 3,0 dB por equipo)

AWG: ventana de transmisión



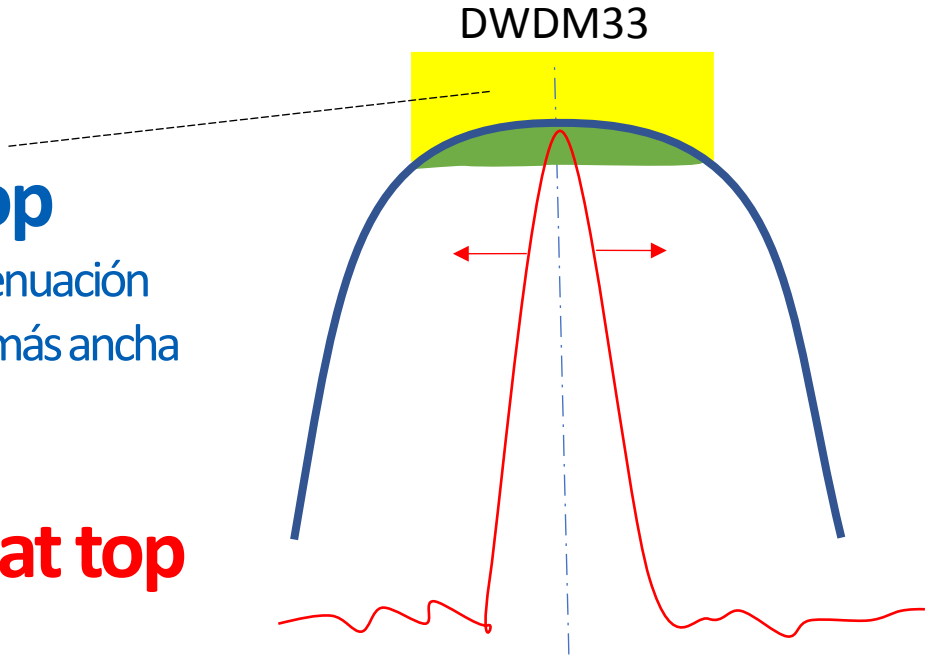
Gaussian Fit

- Atenuación reducida
- Banda más estrecha



Flat top

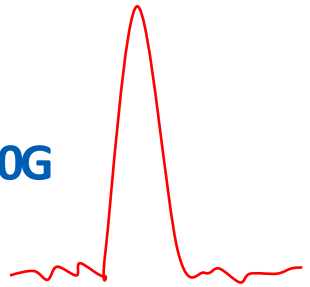
- Más atenuación
- Banda más ancha



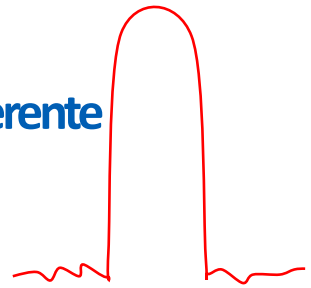
Todos los TFF son Flat top

Tipos de onda

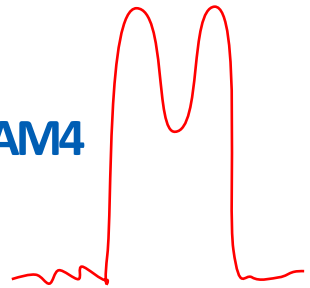
DWDM 10G



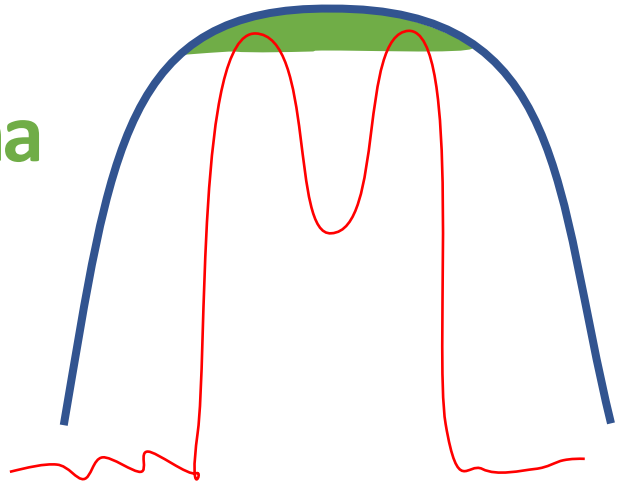
100G Coherente
200G
400G



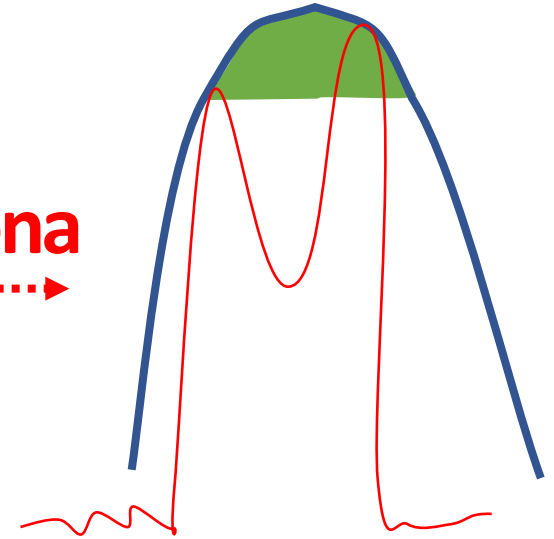
DWDM PAM4



Flat top: funciona



Gaussian Fit: no funciona



Ingredientes

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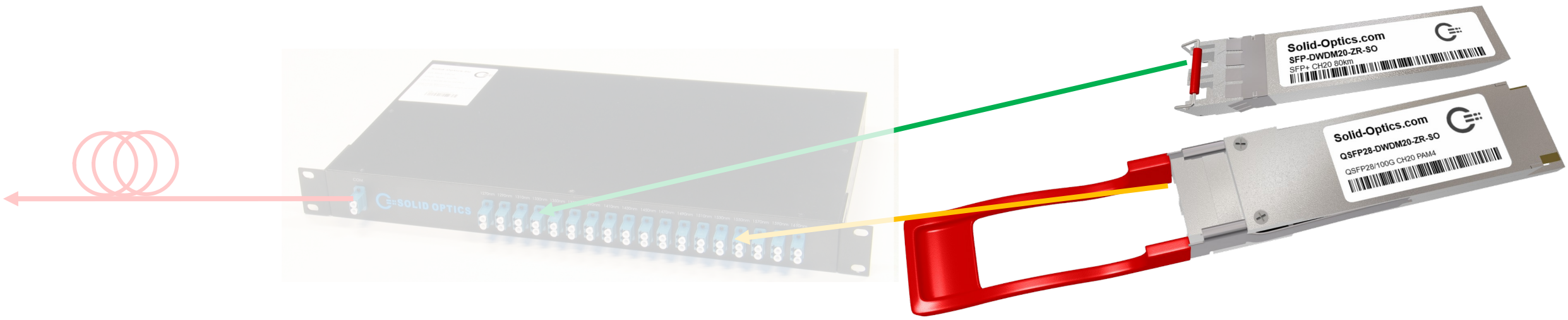
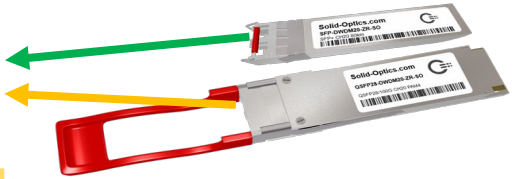
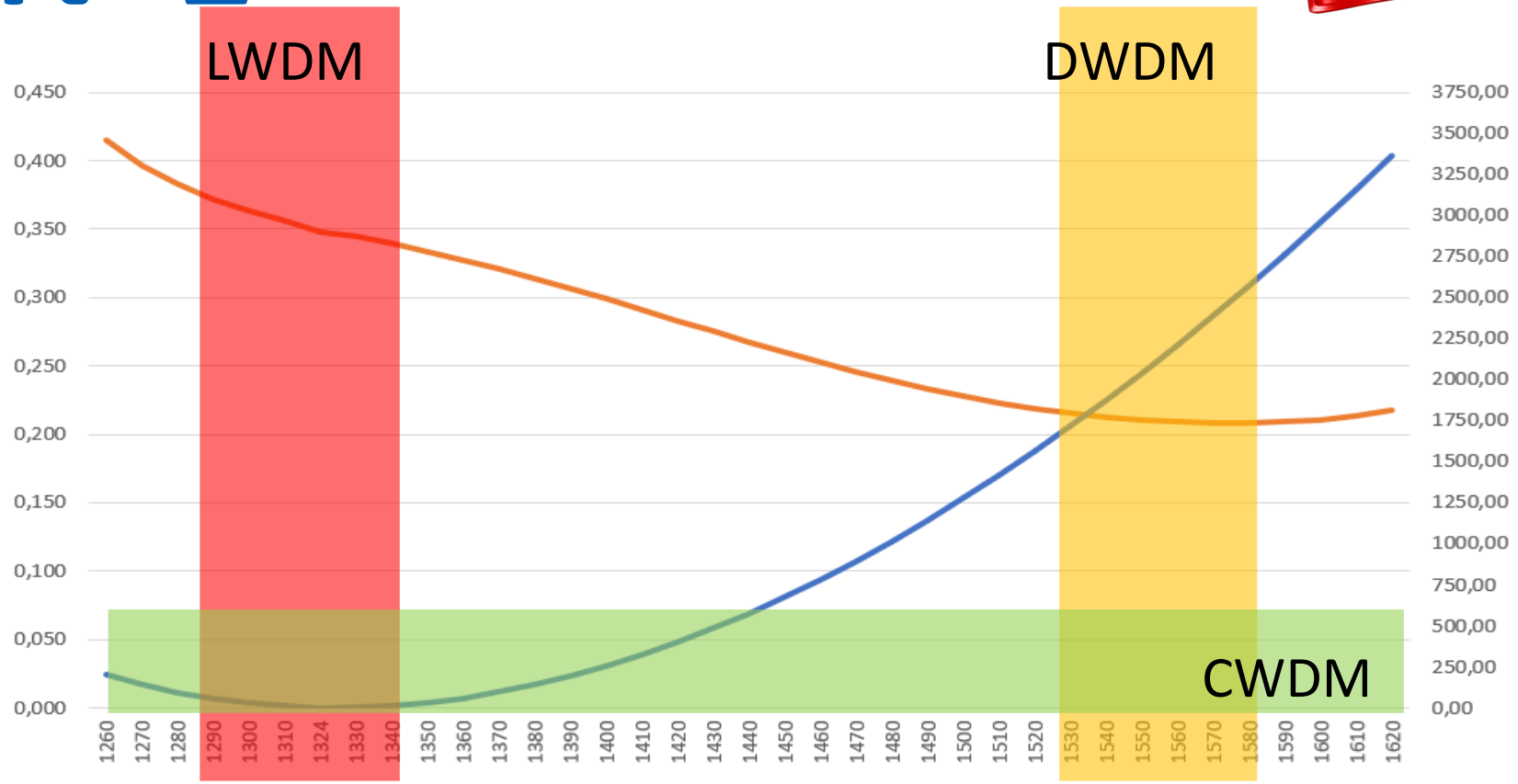


Capítulo N+1

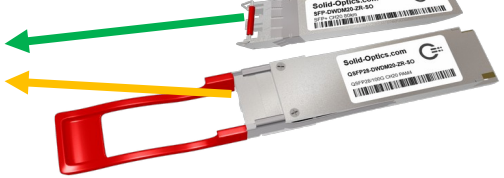
Tablas ITU





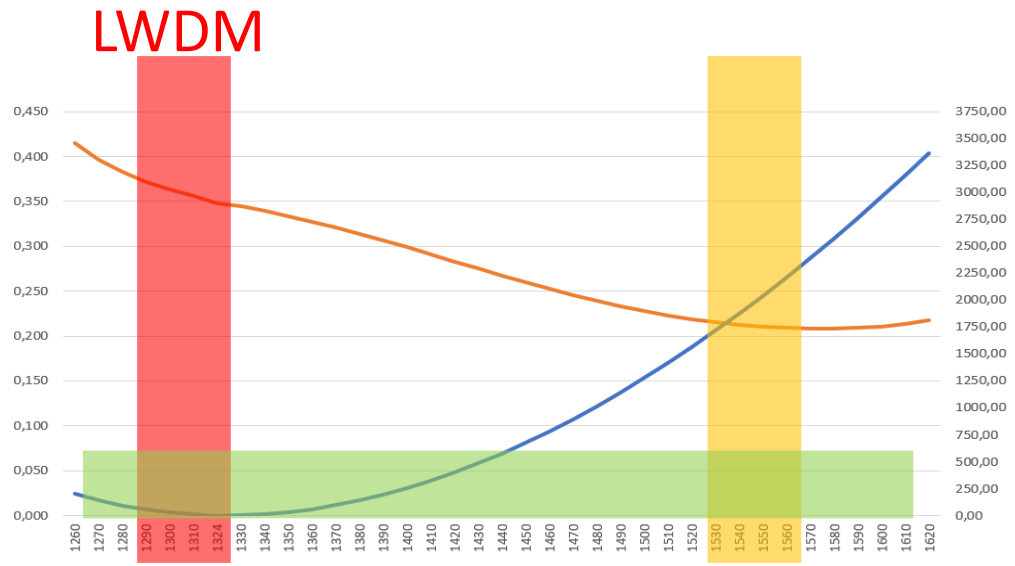
	Atenuación	Dispersión	10G	25G/100G
DWDM	Baja	Elevada	80km	15km
LWDM	Elevada	Baja	40km	40km

Multiplexores LWDM

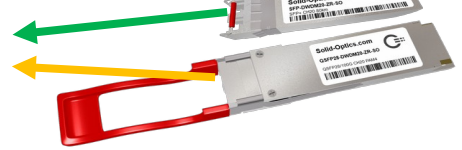


Nueva banda ITU

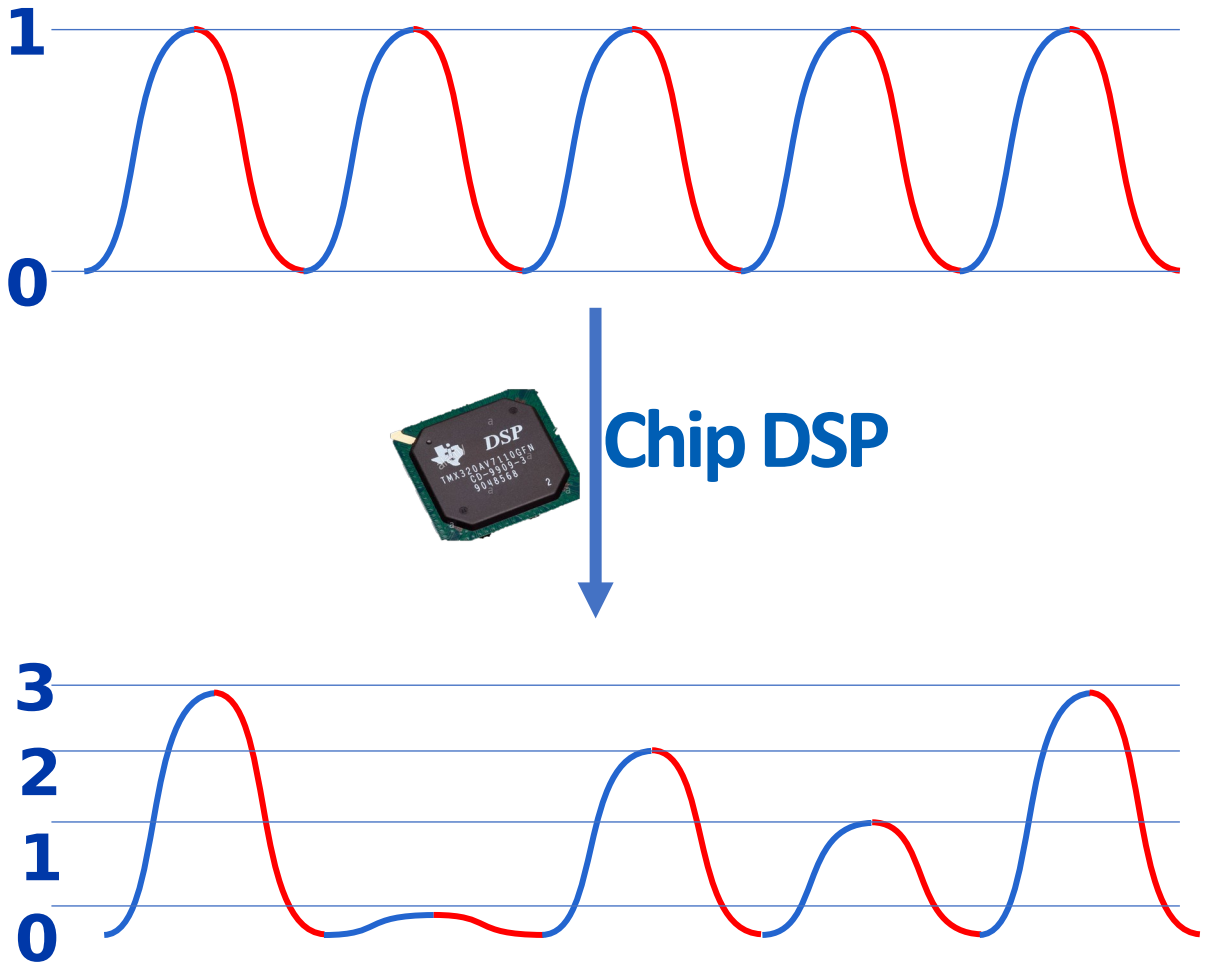
- 8 lambdas en la ventana 1310nm
- 8 x 25G hasta 40km
- Ópticas y multiplexores normales
- Ampliable a 8 x 100G (algún día)
- Empleada para 5G



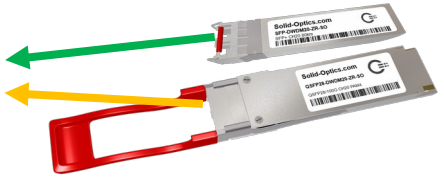
Modulación y 100G Coherentes



- Más información por cada impulso
- Necesita mucha potencia para ser procesado (Wátios)
- Por ejemplo CFP2 DCO = 20 Wátios
- QSFP28 está limitado a 4,5 Wátios
- Se requiere una “caja” activa externa

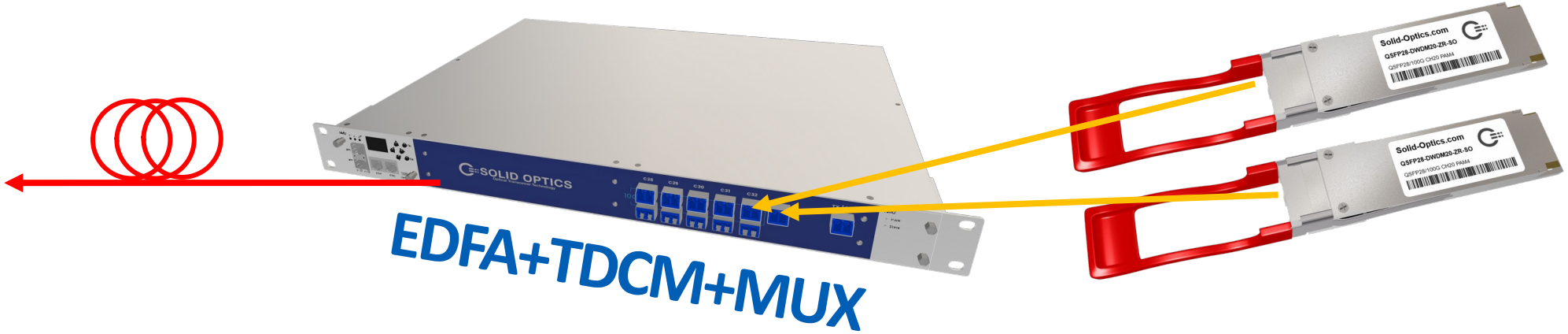


QSFP28 DWDM



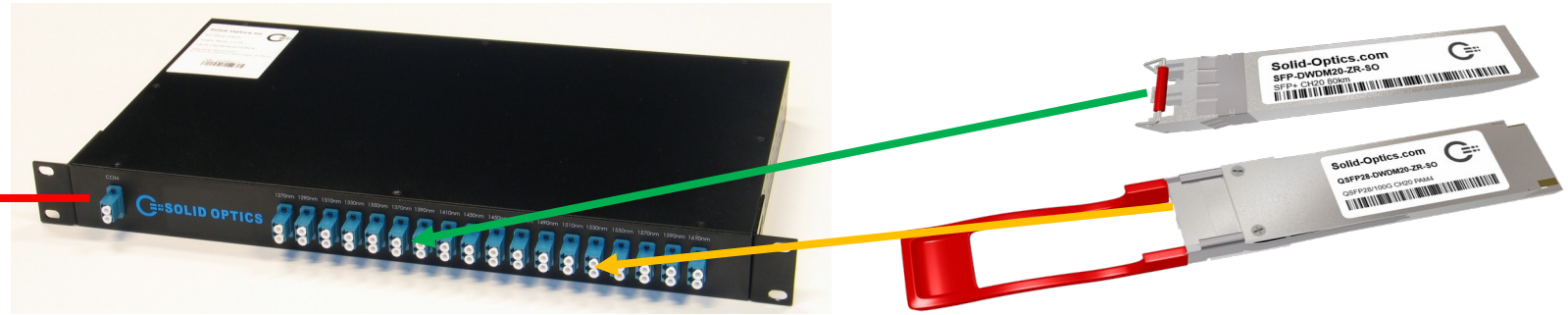
- 100G DWDM en formato QSFP28
- Modulación PAM4
- Debido a la modulación no hay power budget
- Requiere amplificación EDFA para funcionar
- Requiere compensación de dispersión cromática
- La solución más barata para multiplexar 100G
- Empujado por Microsoft → Inphi

Solid Optics ofrece una solución “todo en uno” de hasta 16 x 100G



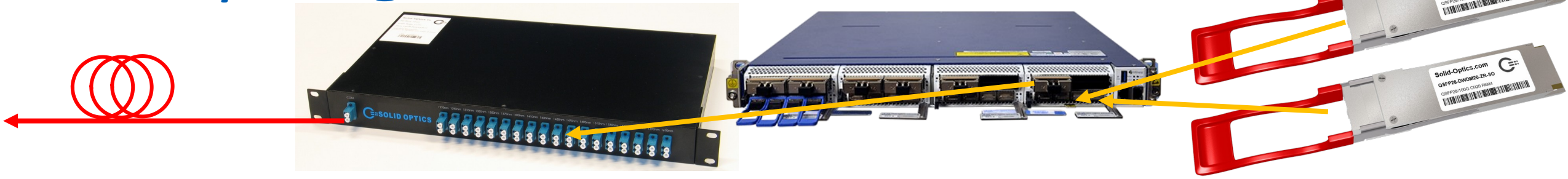
Resumiendo

LWDM / 8 x 25G @ 40km



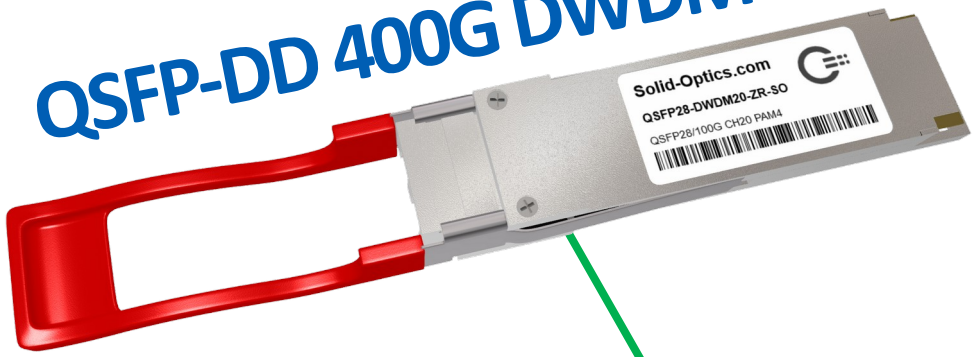
QSFP28 / 100G @ 80km

CFP2-DCO / 100G @ 120km



¡400G ZR a la vista!

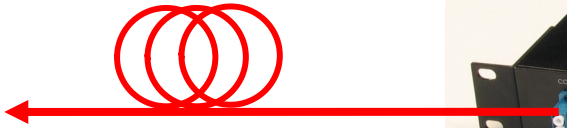
QSFP-DD 400G DWDM



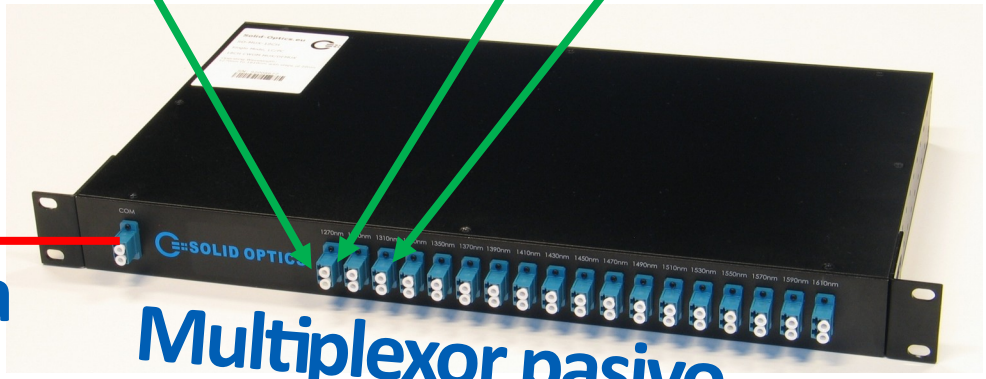
1G DWDM ZR

10G DWDM ZR

400G DWDM ZR

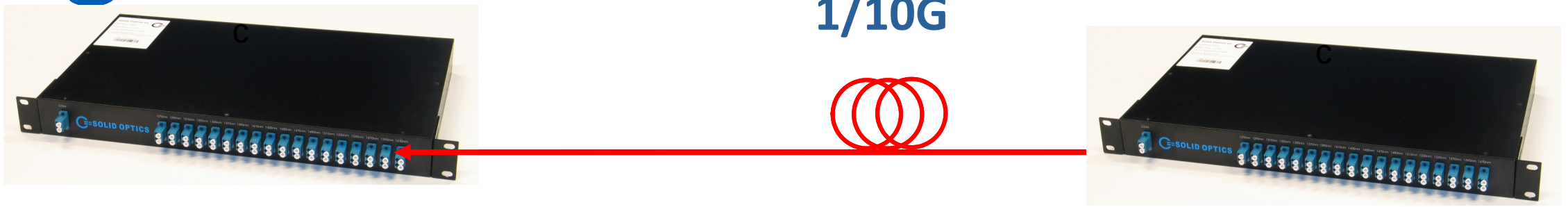


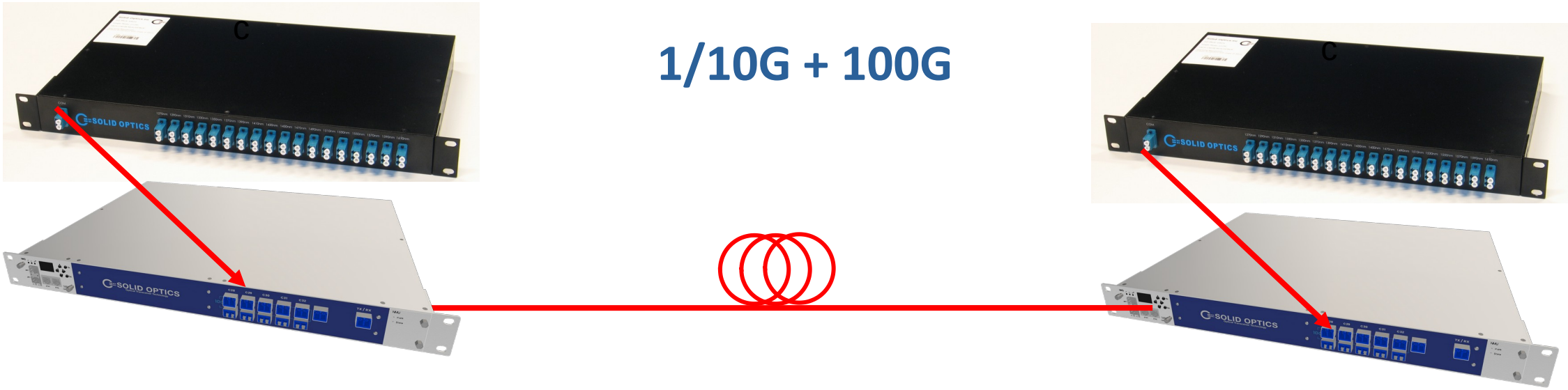
Fibra oscura



Multiplexor pasivo

Migración





SOLID OPTICS
FIBER OPTIC MODULES

Preguntas

Amedeo Beck Peccoz
amedeo@alturnanetworks.com