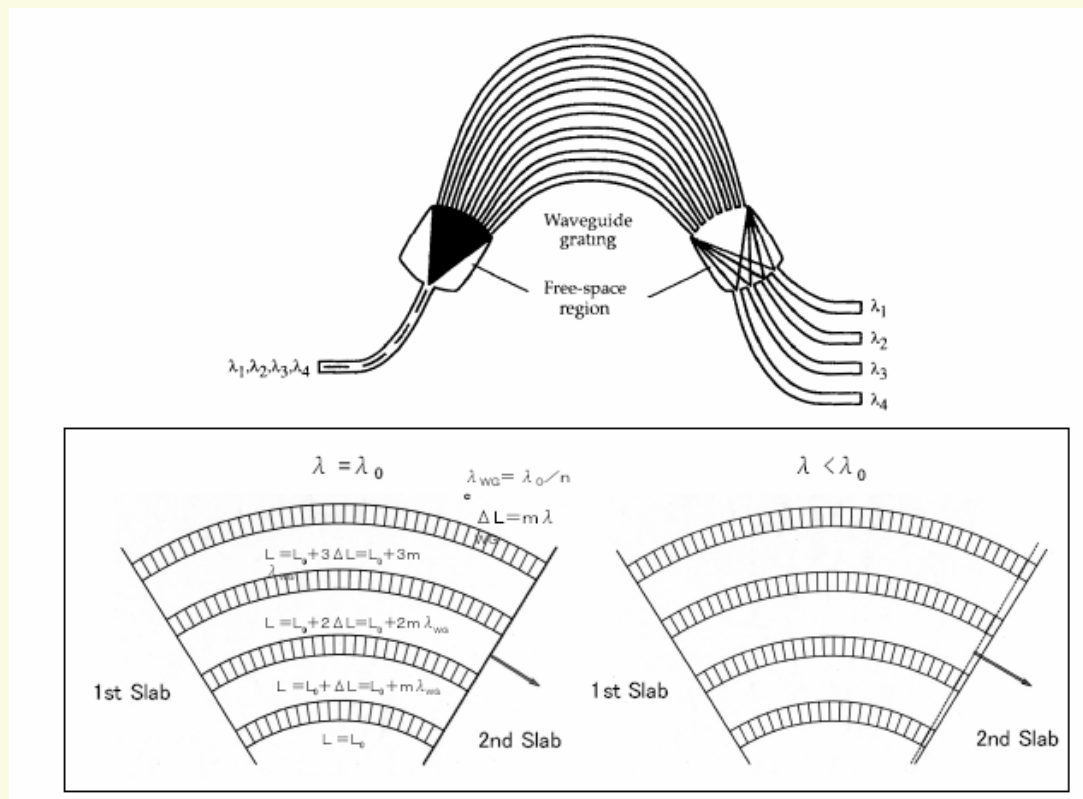
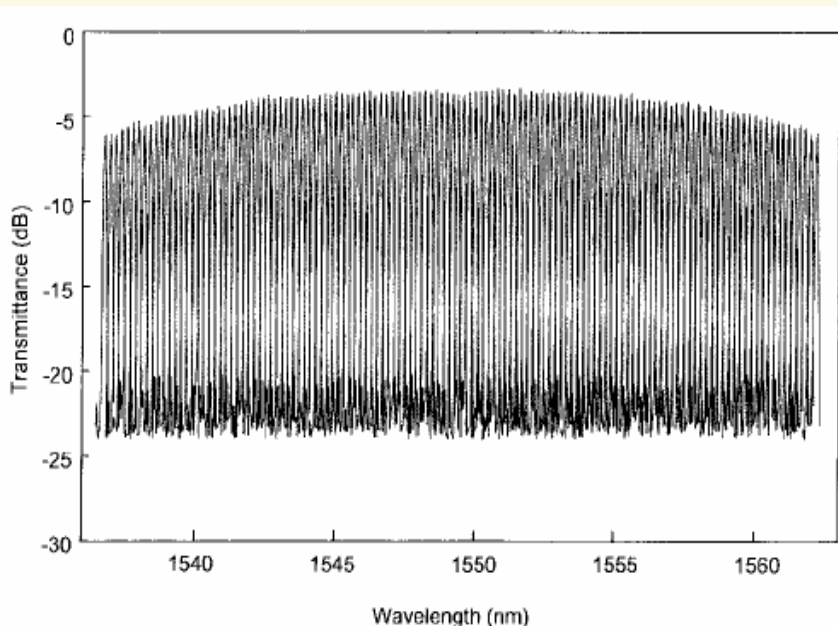
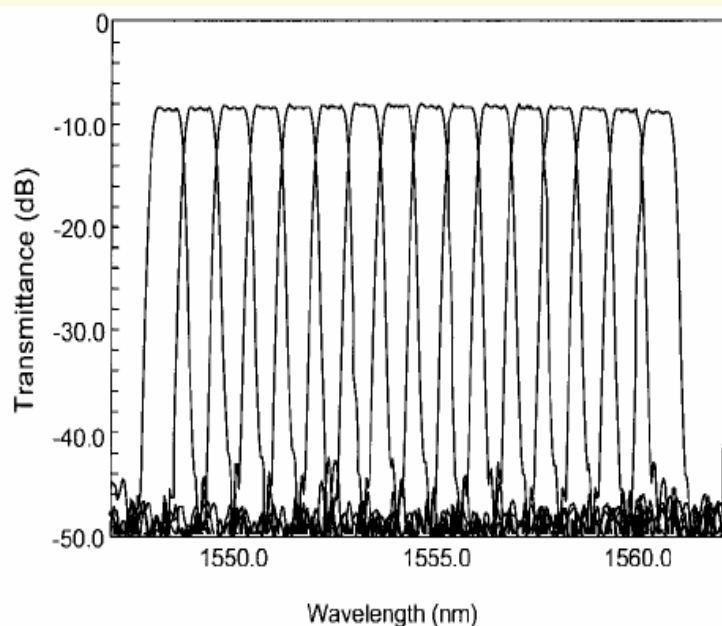


阵列波导光栅 (AWG)



- 导波光学器件，适合高信道数WDM系统
- 易于与其它导波光学器件集成
- 是WDM器件开发的主要方向
- 易于受温度，制作过程中引入的应力，入射光偏振态等的影响

AWG的滤波特性



16 channel 100GHz spacing AWG 128 channel 25GHz spacing AWG

- AWG本身是一个无源器件
- 由于易受温度影响，目前的商品化AWG一般均带有温度控制机构
- 关于AWG的各种无源温度和偏振补偿方案是目前AWG的研究热点



五、光纤传输与光网络技术的发展

- ❏ 光纤传输技术的发展
- ❏ FTTH
- ❏ 网络的全光化趋势

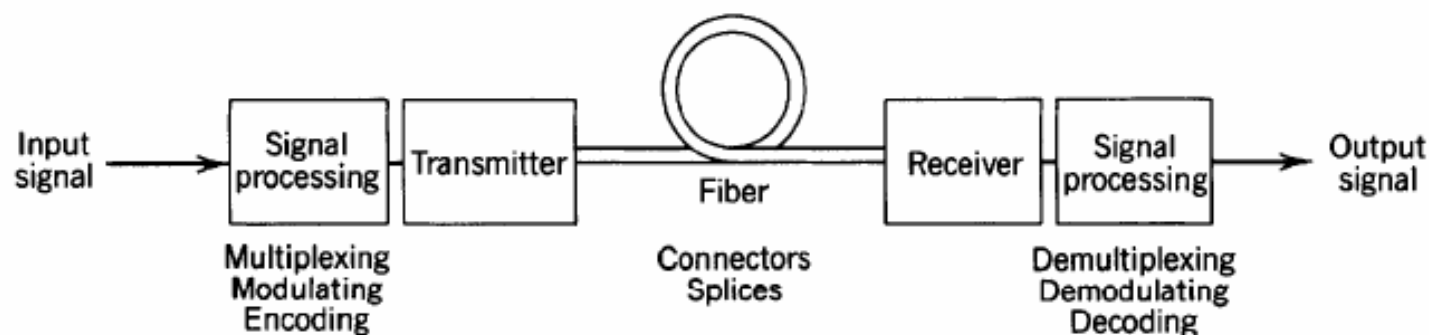
基本光纤传输系统

1970's

1980's

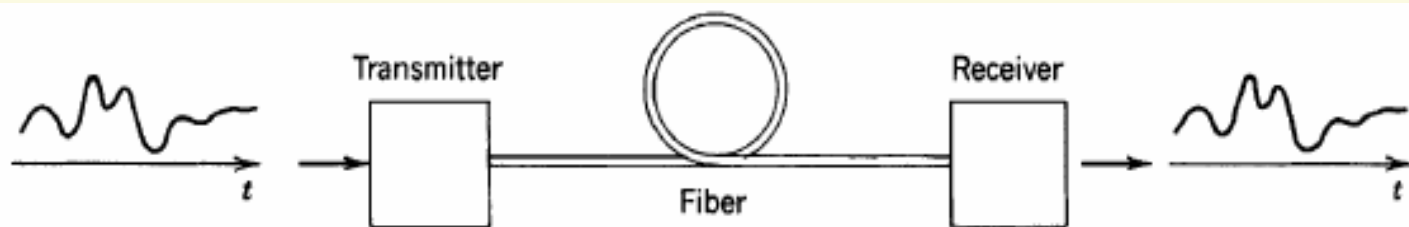
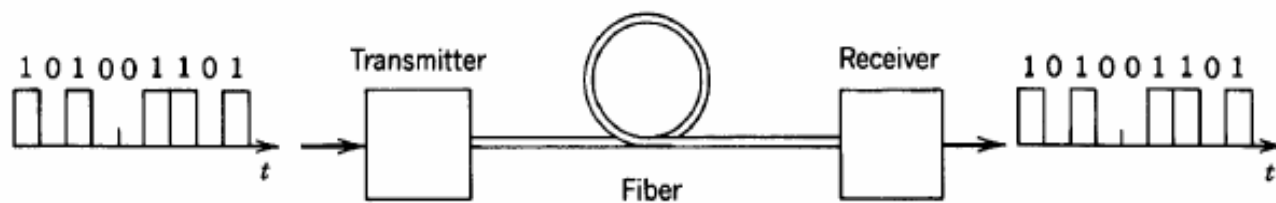
1990's

Wavelength λ_o (μm)	Fiber	Source		Detector
0.87	Multimode step-index	LED	AlGaAs	Si
1.3	Multimode graded-index	Laser	InGaAsP	<i>p-i-n</i>
1.55	Single-mode			Ge
				APD
				InGaAs

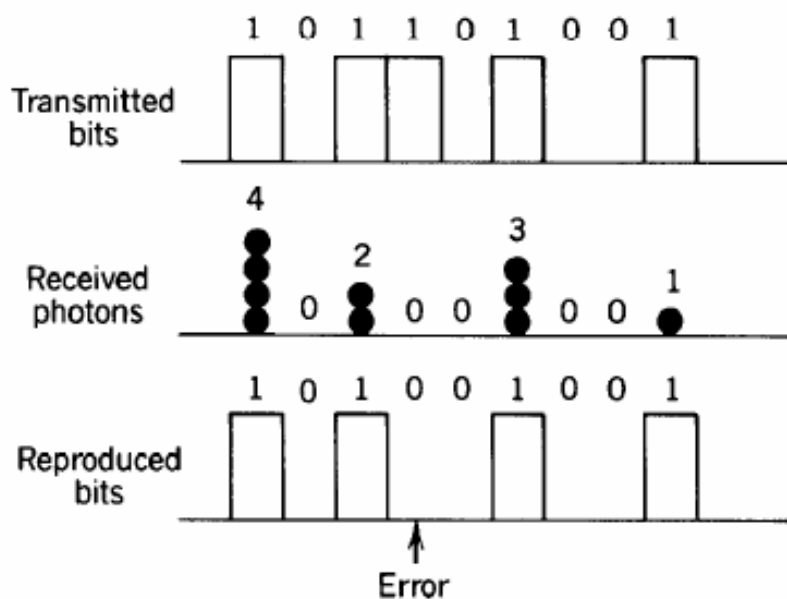


Digital Communication System

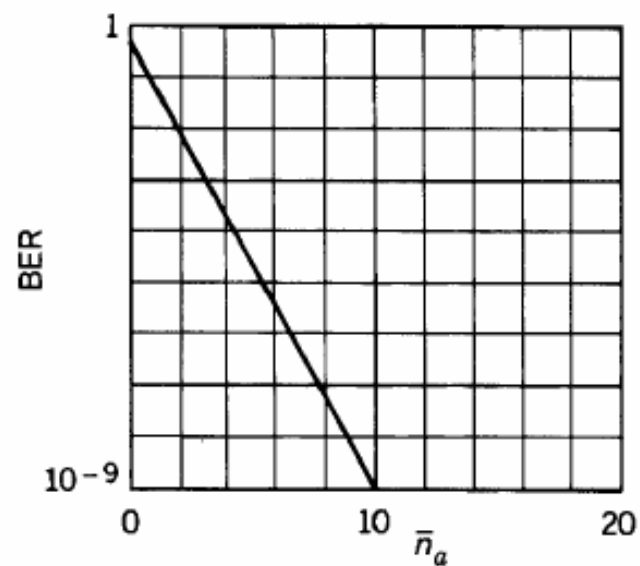
- Bit-rate-Distance product: LB_o
 - B_o : bit-rate in bits/s, L : distance
- Bit Error Rate (BER) $BER = \frac{1}{2}p_1 + \frac{1}{2}p_0$
- Receiver Sensitivity $P_r = h\nu\bar{n}_0B_o$



Receiver Sensitivity



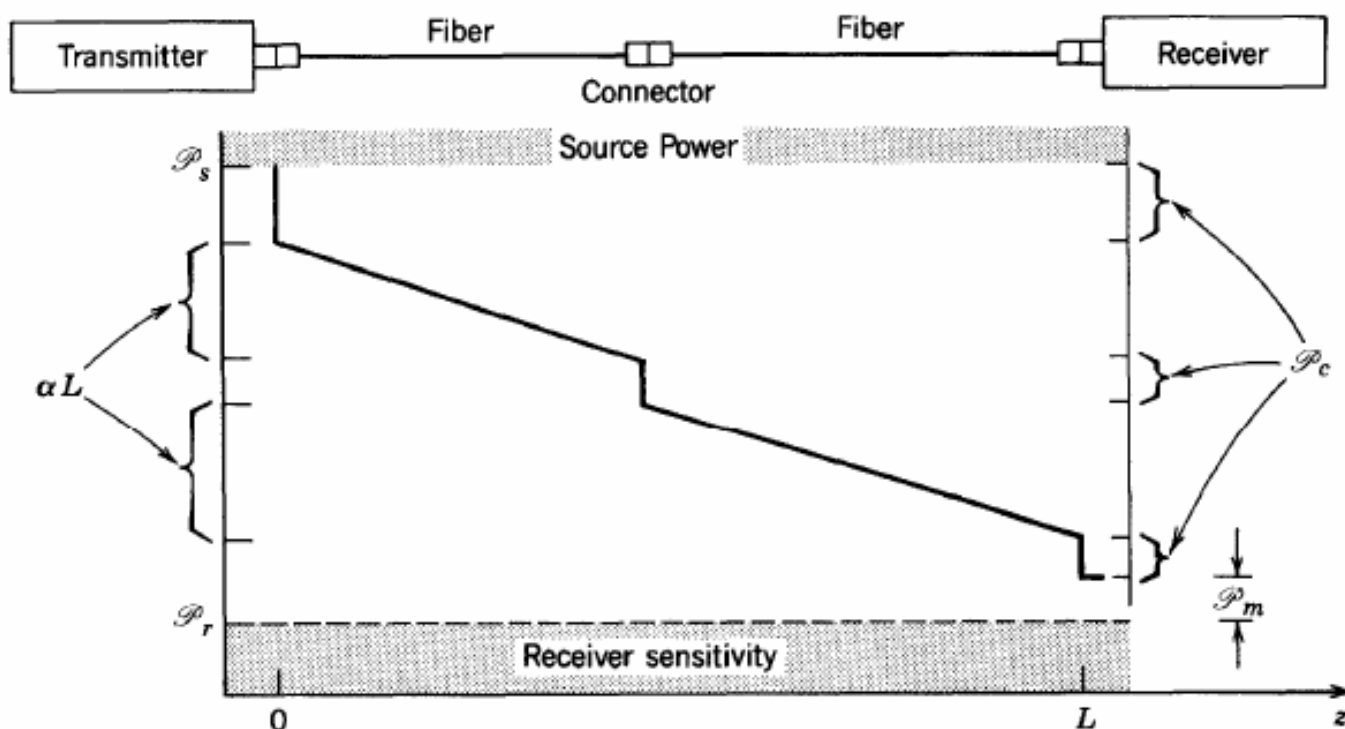
(a)



(b)

Design Strategy

■ Power budget



Design Strategy

- Power in dBm units

$$\mathcal{P} = 10 \log_{10} P \quad P \text{ in mW} \quad \mathcal{P} \text{ in dBm}$$

- Power budget

$$\mathcal{P}_s - \mathcal{P}_c - \mathcal{P}_m - \alpha L = \mathcal{P}_r \quad (\text{dB units})$$

$\mathcal{P}_s$ is the power of the source (dBm)

α is the fiber loss in dB/km

$\mathcal{P}_c$ is the splicing and coupling loss (dB)

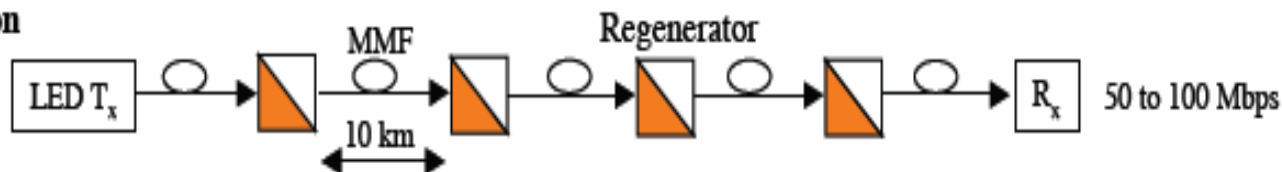
$$\mathcal{P}_r = 10 \log \frac{\bar{n}_0 h \nu B_0}{10^{-3}} \text{ dBm}$$

$$L_0 = \frac{1}{\alpha} \left(\mathcal{P}_s - \mathcal{P}_c - \mathcal{P}_m - 10 \log \frac{\bar{n}_0 h \nu B_0}{10^{-3}} \right)$$

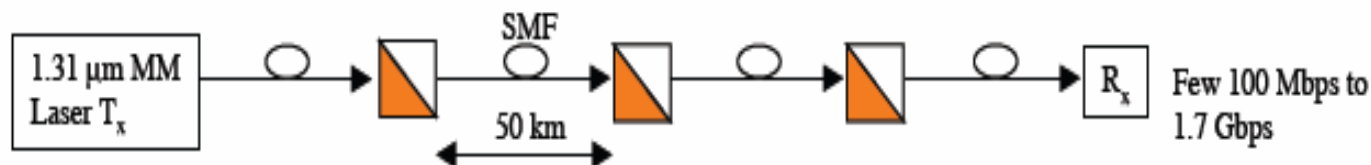
单波长光纤传输系统

Capacity and Repeater Spacing

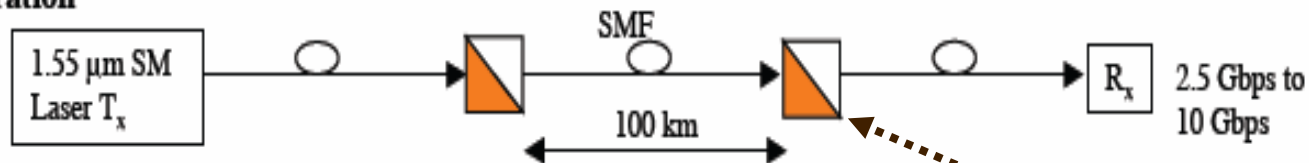
1st Generation



2nd Generation



3rd Generation

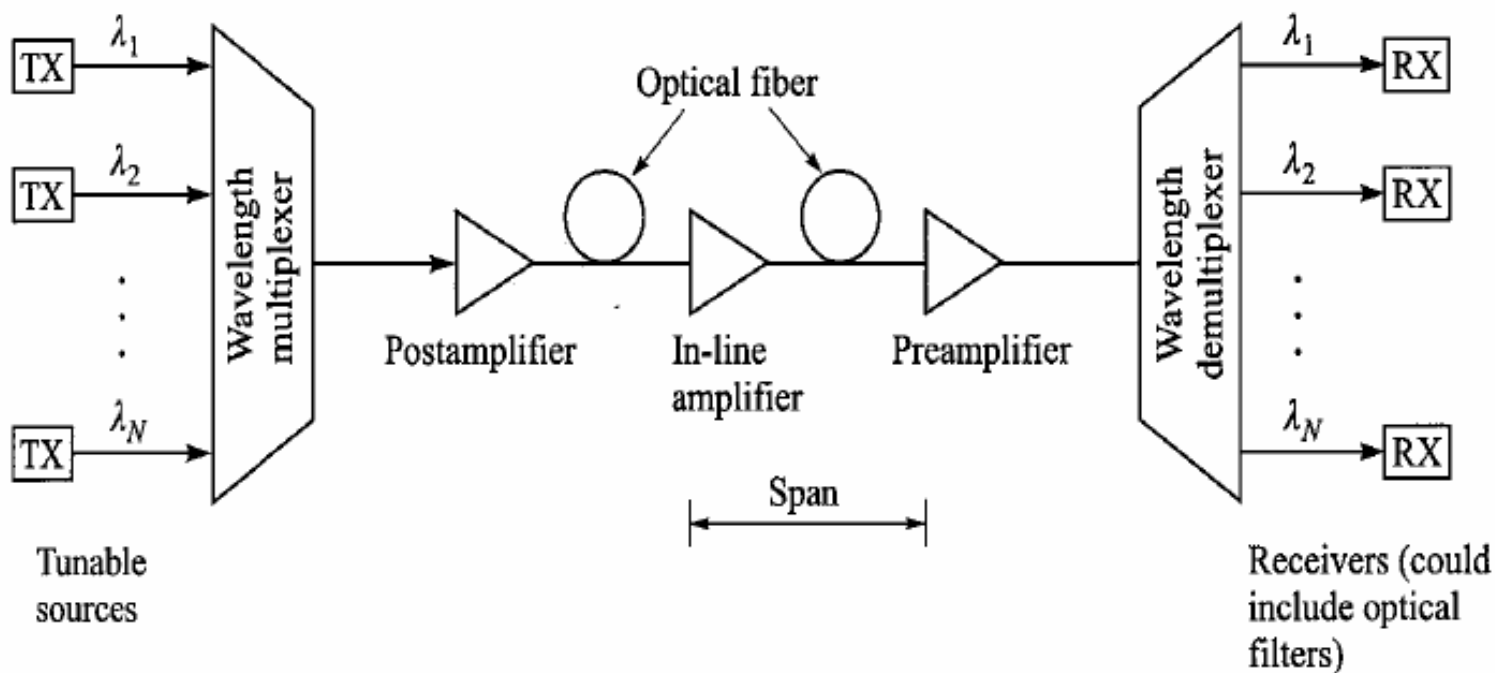


O-E-O电光再生中继

EDFA与波分复用光纤传输系统

EDFA不仅使光纤通信系统不再需要再生中继，实现了光信号传输的全光化，更重要的是使WDM成为可能。

WDM Transmission System



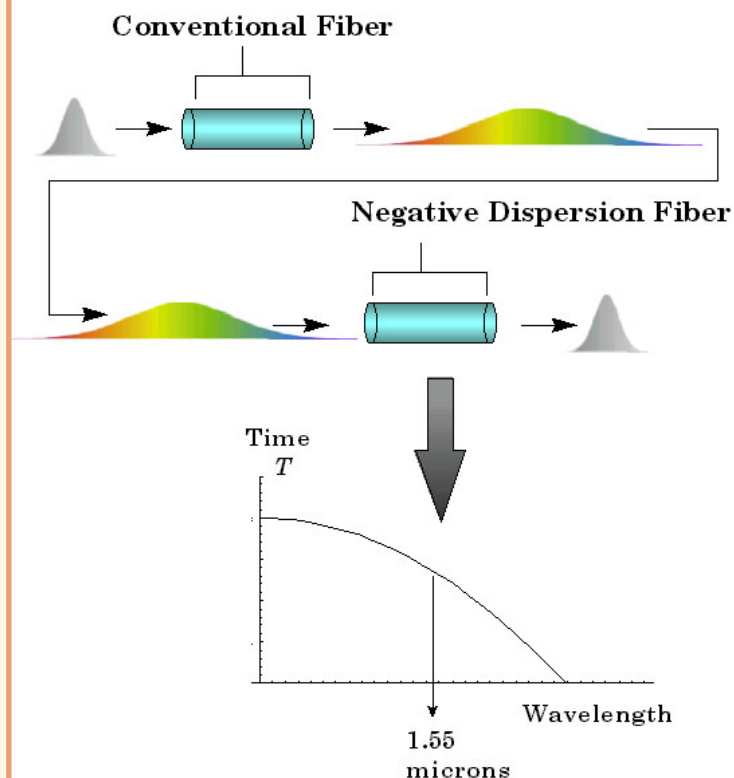
光纤色散补偿技术

EDFA克服了光纤损耗的影响，光纤色散成为限制光信号传输的最主要因素。各种光纤色散补偿技术是1990's光纤领域的最热门课题

Dispersion Compensation

- By joining fibers with CD of opposite signs (polarity) and suitable lengths an **average dispersion close to zero** can be obtained; the compensating fiber can be several kilometers and the reel can be inserted at any point in the link, at the receiver or at the transmitter
- Dispersion compensation devices (**chirped fiber Bragg gratings**)

Negative Dispersion Fibers



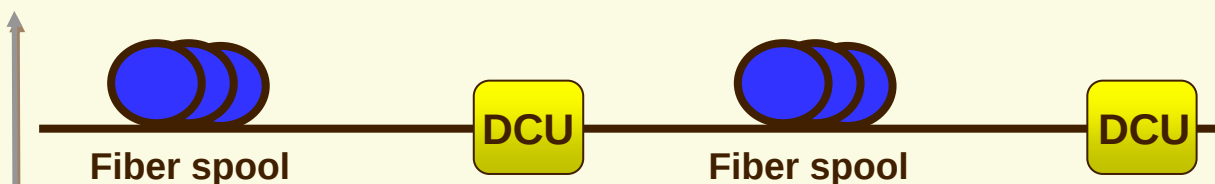
多波长系统色散管理

Dispersion



Saw Tooth Compensation

Dispersion



Total dispersion averages to $\sim$ zero

