08/25/23

Wavelength Band Choice

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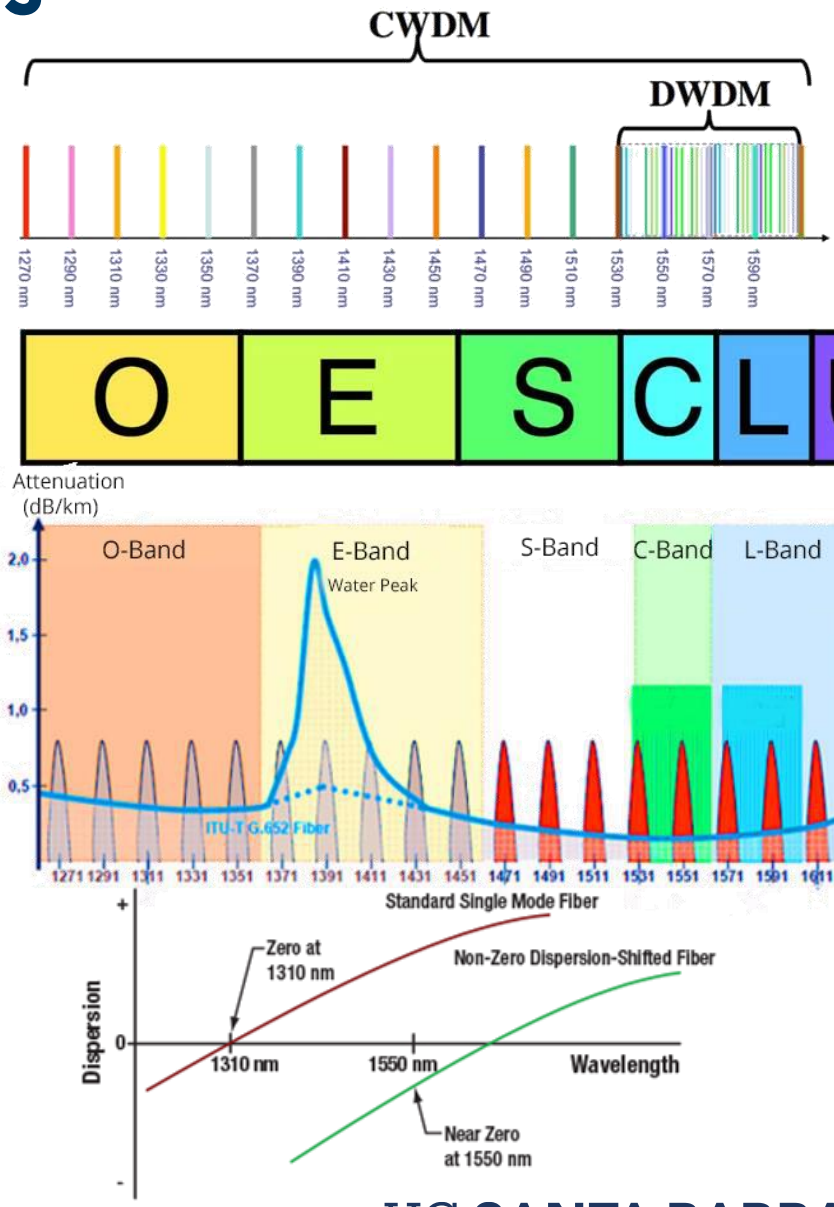
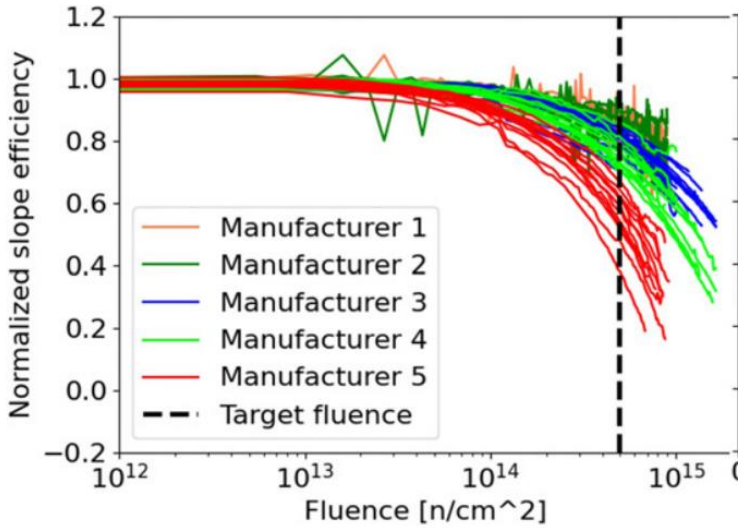
Color Theory: Wavelength Bands

- TX
  - Generation (laser)
  - Modulation (MRMs)
- Link
  - Propagation (loss)
  - Amplification (gain)
  - Dispersion (wavelength)
- RX
  - Detection (photodiode)

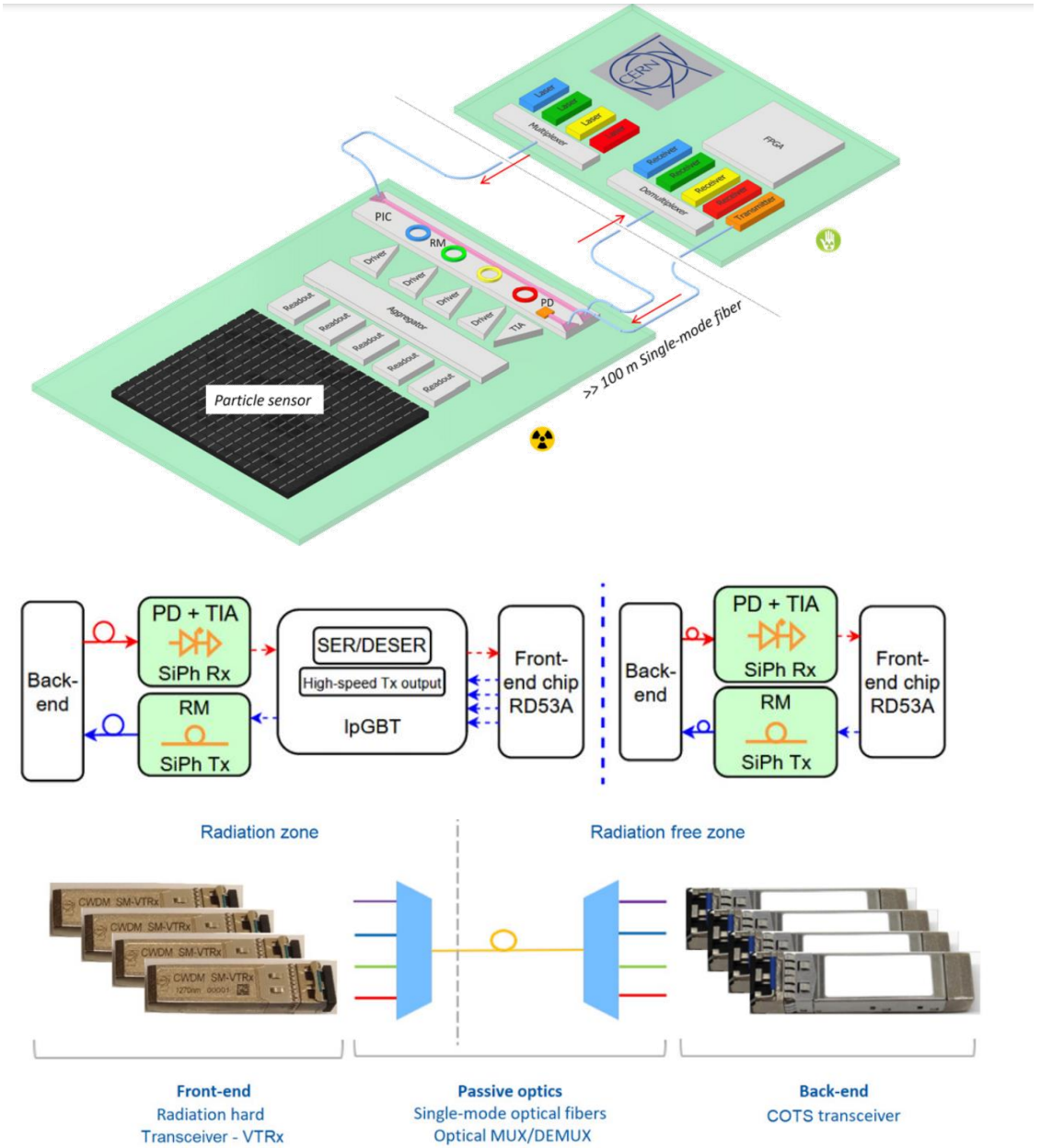


Link Overview

- From external optics to internal
- COTS laser components rad hard to 115 MRad



L. Marcon, TWEPP (2022)



T. Prousalidi, TWEPP (2022)

WDM Specs

- COTS state of the art (800G)
  - 8 lambda x 100 Gbps
  - 4 lambda x 200 Gbps
- TeraPhy by Ayar Labs (1.6T)
  - 16 lambda x 25 Gbps
  - 8 fibers x 200 Gbps

	O Band	C Band	
CWDM	1271 1291 1311 1331	1511 1531 1551 1571	1471 (S) 1491 (S) 1591 (L) 1611 (L)
DWDM	Not Standardized	0.4 nm → 32 channels in FSR 0.8 nm → 16 channels in FSR 1.6 nm → 8 channels in FSR	

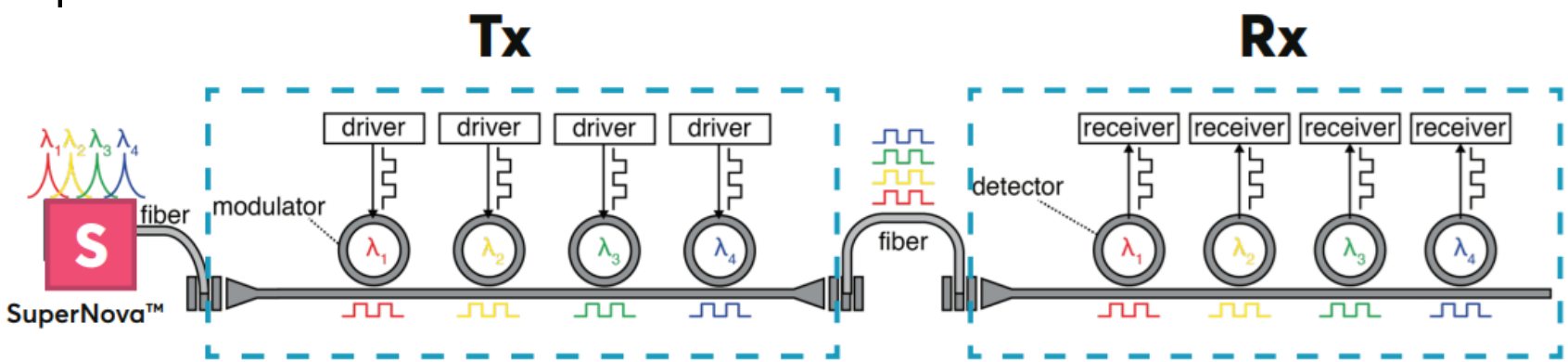


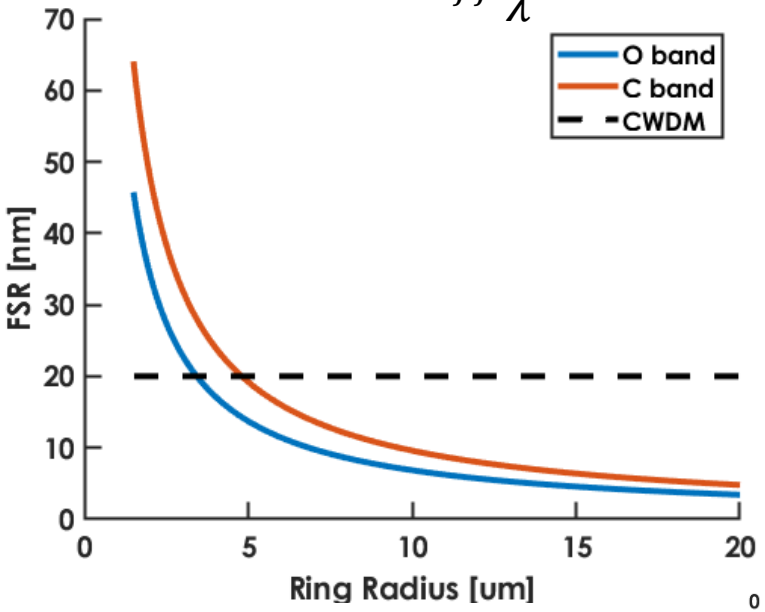
Figure 7 - TeraPHY™ Tx and Rx Channel Abstraction

Wavelength Filtering

$$\theta = \beta L = (kn_{eff})(2\pi r) = \frac{2\pi}{\lambda} n_{eff} 2\pi r = 4\pi^2 n_{eff} \frac{r}{\lambda}$$

$$\theta = 2\pi m = 4\pi^2 n_{eff} \frac{r}{\lambda} \qquad m = 2\pi n_{eff} \frac{r}{\lambda}$$

- Free spectral range (FSR)
  - Distance between adjacent resonances
  - Limits amount of channels per given spacing
- Everything is temperature dependent!



$$\text{FSR} = \frac{\lambda^2}{n_g(2\pi r)}$$

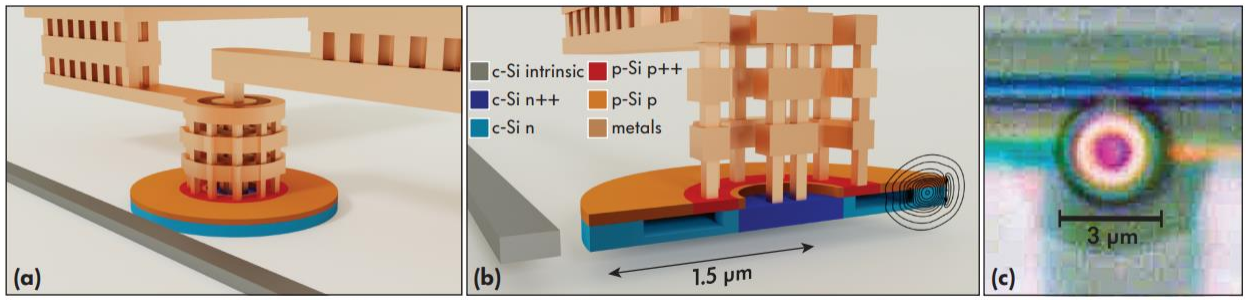
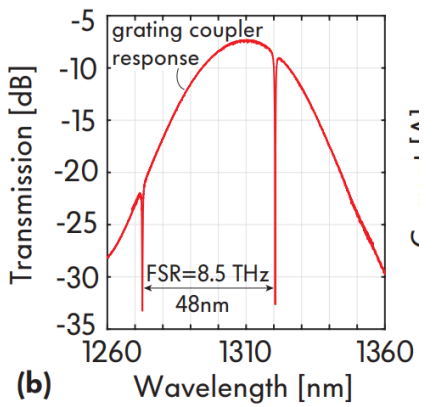
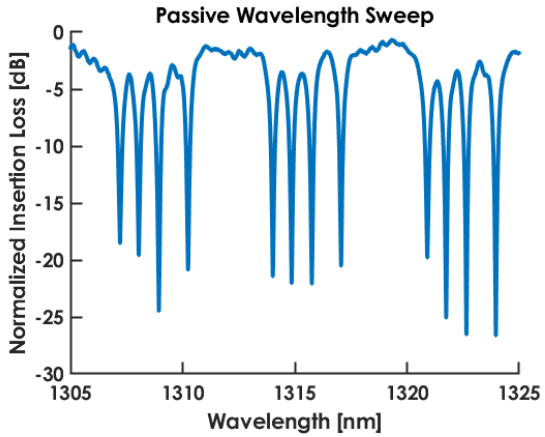


Fig. 1: (a) Perspective view of the MOSCAP modulator and its (b) cross-section. (c) Optical micrograph of the fabricated device.

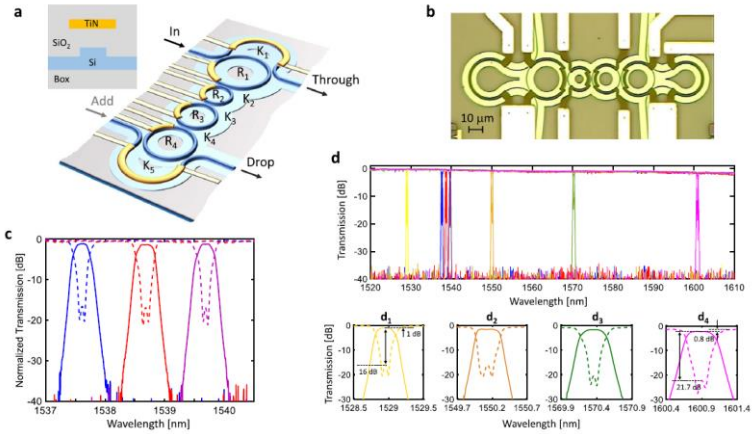
H. Gevorgyan, et. al., OFC (2021)



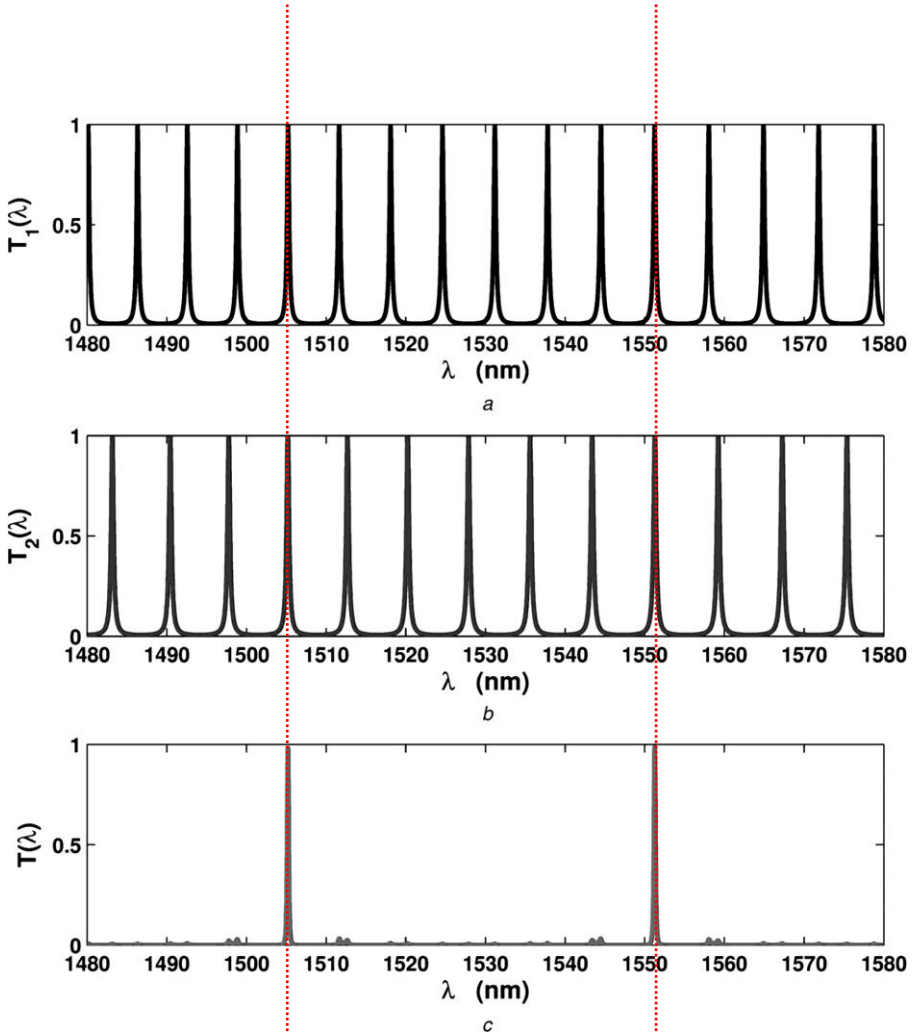


Vernier Filtering

- Convolution of two unequal FSR filters
  - Peaks only appear on aligned resonances
  - Alignment is sensitive and temperature dependent



Morichetti, F., et. al., *Nat Commun* 12, 4324 (2021).



A. Nougaoui, et al., IET Optoelectronics (2015).