

Long reach 10GEPON PHY ($\geq 20\text{km}$)

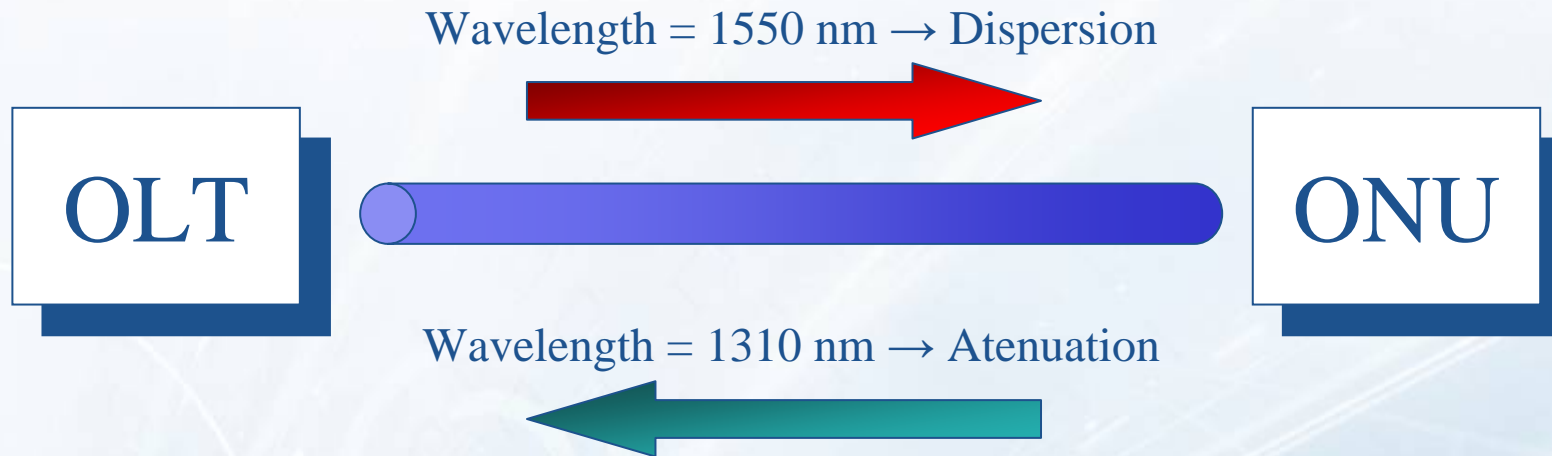
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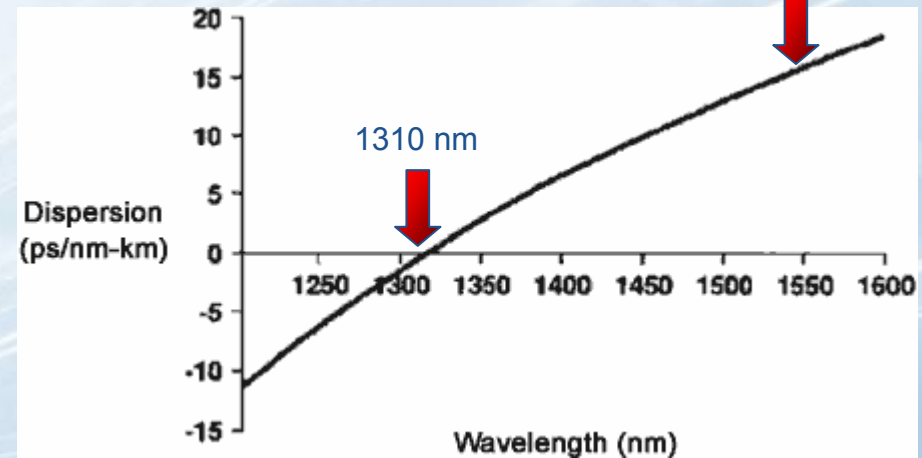
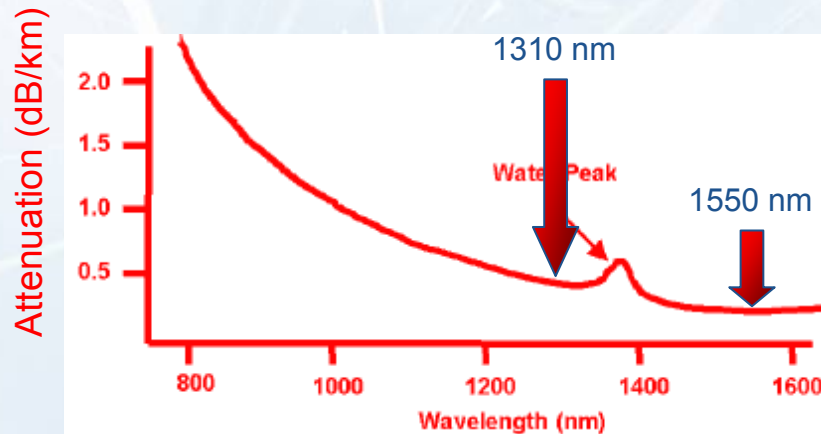


Y. Matsui, D. Mahgerefteh, X. Zheng, C. Liao, Z. F. Fan, K. McCallion, and P. Tayebati, "Chirp-Managed Directly Modulated Laser (CML)," IEEE Photonics Technology Letters, vol. 18, pp. 385-387, 2006

Transmission channel impairments in 10 Gb/s PON systems



Transmission @ 1550 nm with high dispersion

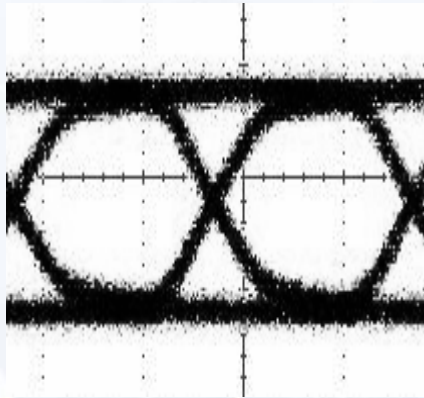


Figures from the website of IEC – International Engineering Consortium

Transmission channel impairments in 10 Gb/s PON systems

Eye patterns @ 10 Gbit/s using FP lasers

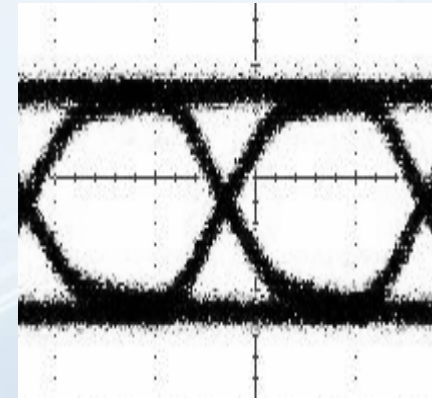
Eye pattern at TX



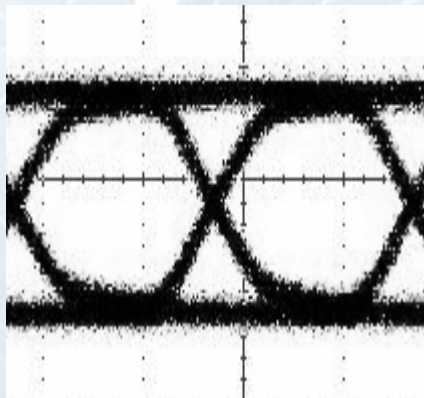
>20 km of SSMF
@ 1310 nm



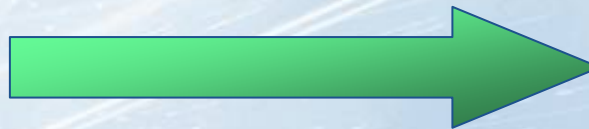
Eye pattern at RX



Eye pattern at TX



>20 km of SSMF
@ 1550 nm



Eye pattern at RX

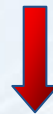
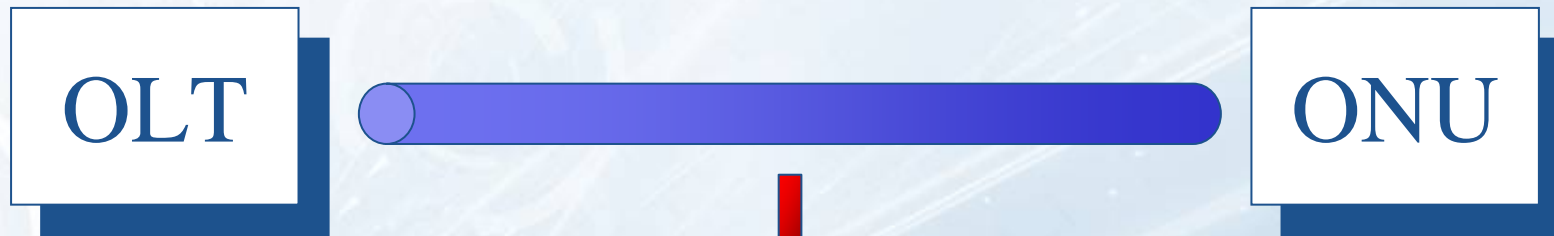


Downstream transmission in 10 Gb/s PON systems

Solution to the downstream transmission problem in 10 Gb/s PONs



Application of a dispersion tolerant optical transmitter at OLT (shared)

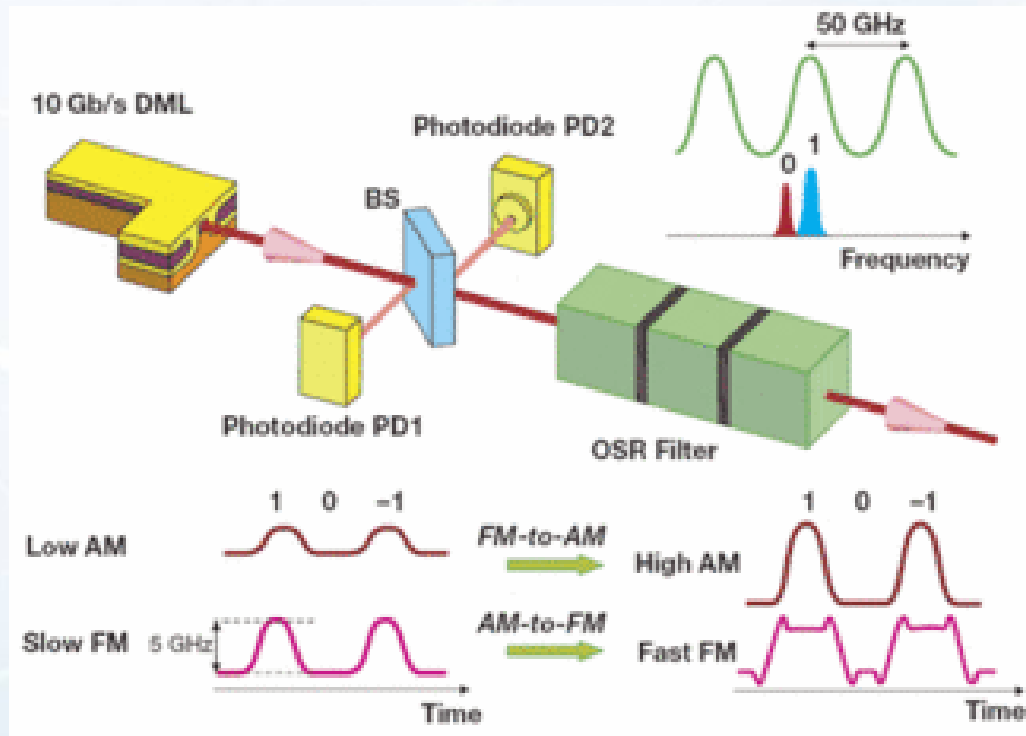


Complex transmitters (e.g. Duobinary) are too expensive and complex to implement in cost-sensitive PON systems



Chirp-managed directly modulated laser (CML)

CML transmitter Operation principle



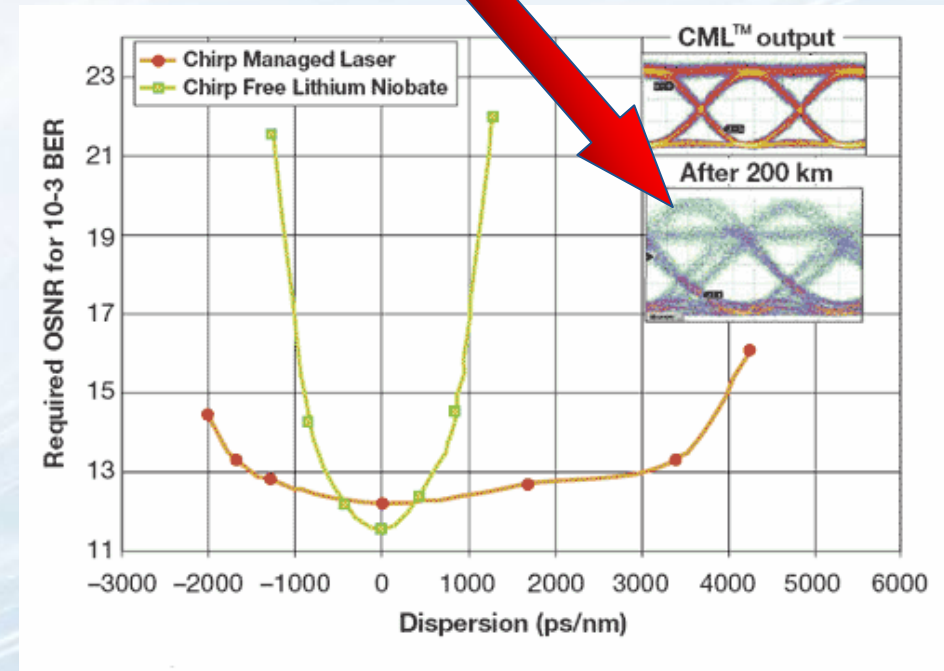
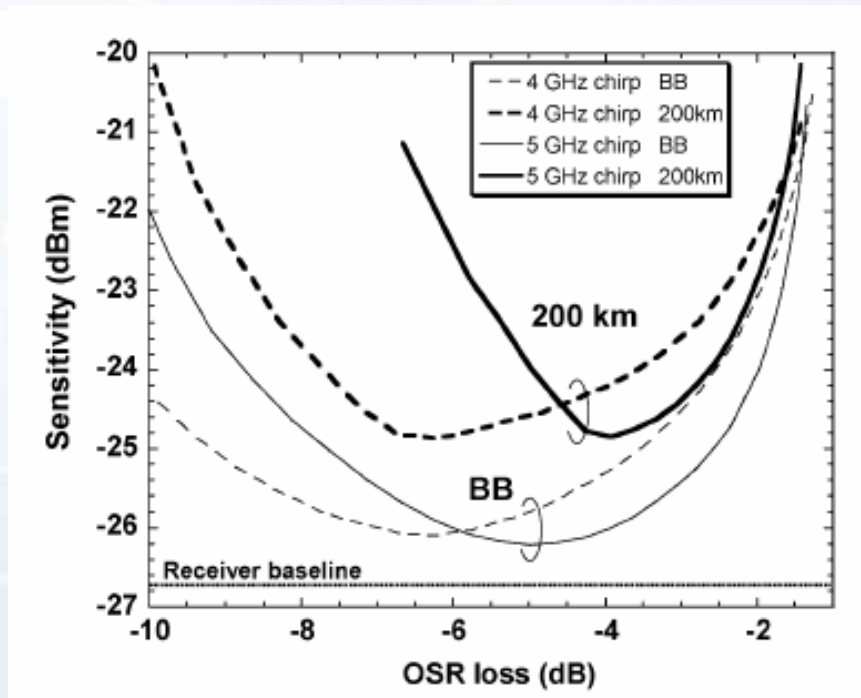
Source: Lightwave Fibre Systems: "Chirp-managed-laser technology delivers > 250-km reach"

Main characteristics:

- Integration of an optical filter with the directly modulated laser (DML)
- Reduction of the occupied spectrum to one half
- Conversion of FM to AM allowing high extinction ratio signals

Downstream transmission in 10 Gb/s PON systems

OPEN EYE PATTERN AFTER 200 KM OF SSMF



Source: Lightwave Fibre Systems: "Chirp-managed-laser technology delivers > 250-km reach"

Downstream transmission in 10 Gb/s PON systems

❖ Main features of CML:

- covers short, medium and long haul transmission range > 20 km;
- mitigates limitations of standard electro-absorption modulators (broad spectrum associated with transmission chirp);
- based on a combination of DFB and optical spectrum re-shaper (OSR), forming CML laser unit;
- **performance comparable with duo-binary transmitters but smaller TX size and lower power consumption;**
- **easily adjustable to meet any target transmission range within 200 km span;**
- **applicable to OLT cards, since @ 1550 nm transmission window is subject to dispersion related issues;**
- dispersion issues are not applicable to ONU modules, unless transmission window defined in a region different than 1310 nm.