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Pre-coded NRZ and Electrical Duo-Binary Transmission in C and O-band at Data Bit Rates Up To 25 Gbit/s

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Abstract We present real-time transmission performance up to 25 Gbit/s for optical access networks.

- Based on pre-coded NRZ and electrical duo-binary modulations
- Using limited electrical bandwidth DML in C and O-band at transceiver
- And an electrical duo-binary receiver with an 8 GHz APD photodiode and a duo-binary to binary converter

Data bit rates evolution in the optical access network

- Presently PON solutions are based on NRZ modulation formats. [1-4]
- Standardization groups are working on 25 Gbit/s PON.
- Solutions proposed:
 - NRZ coupled with electrical equalization [5, 6]
 - Efficient modulation formats such as PAM-4 [7, 8] & duo-binary [9, 10]

EDB modulation format

- What is EDB ?

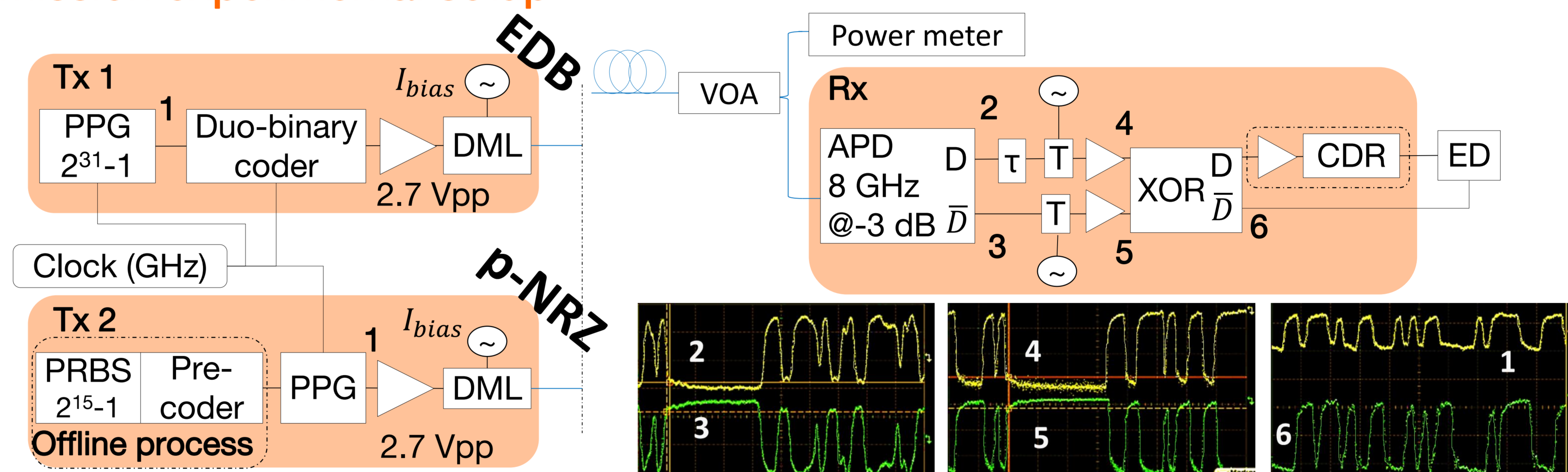
NRZ	EDB
0	0
1	+1 or -1
- Where ?
 - At Tx → coder
 - At Rx → 8 GHz APD
- How ?

Pre-coder

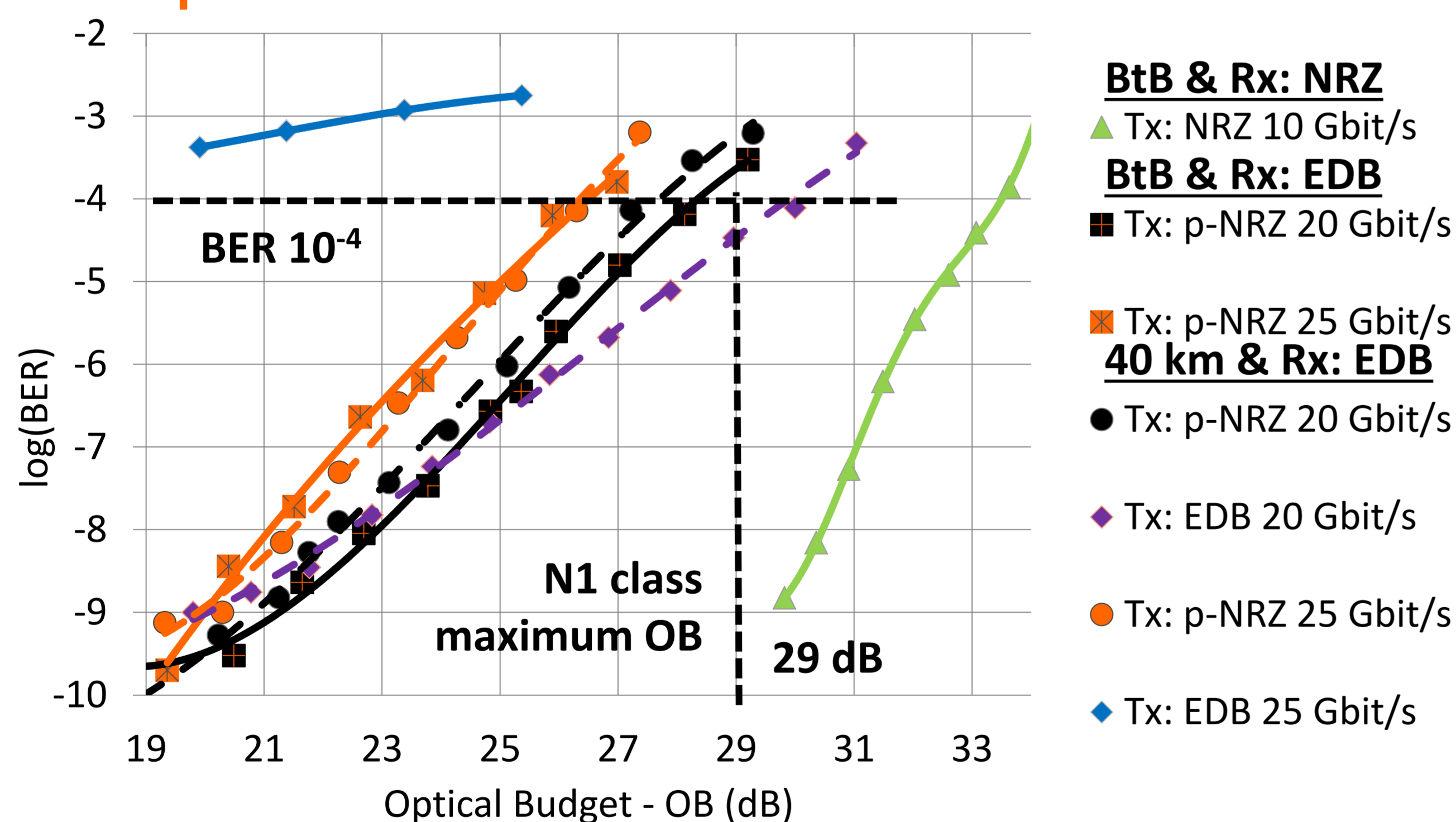
EDB electrical spectrum is compressed by a factor 2 compared to a NRZ signal at the same data bit rate [9]. Opportunity to re-use optical components already developed for 10 Gbit/s transmission.

EDB and pre-coded NRZ (p-NRZ) transmission experimental setup

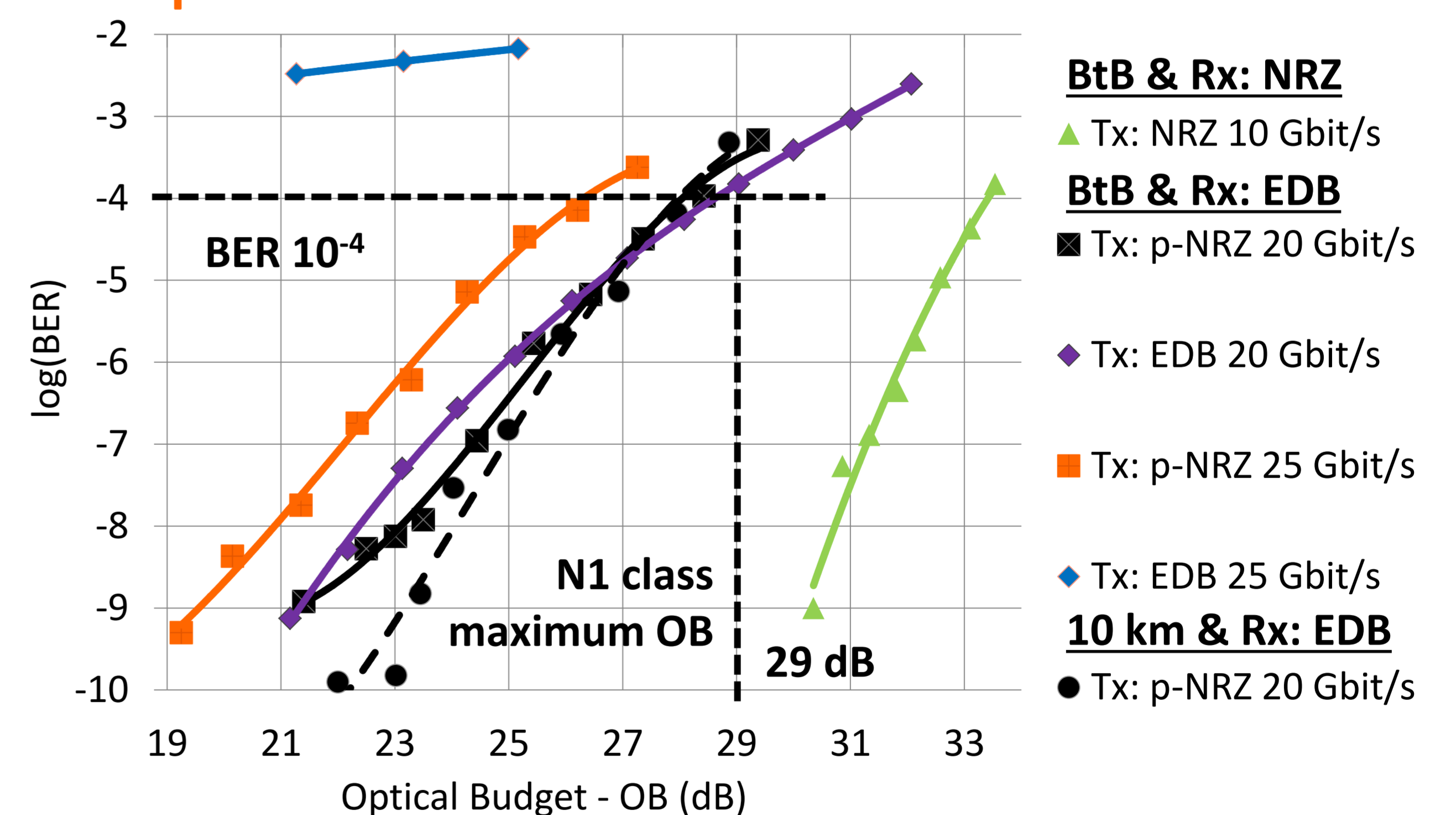
- Tx: 14/16 GHz C/O band DML
- Rx: 8 GHz APD/TIA → EDB detection
- Duo-binary to NRZ decoder: APD out and out + limiting amplifiers + XOR gate



O band performance



C band performance



Conclusion

O-band transmission

At 25 Gbit/s, up to 40 km propagation with 26.5 dB OB using pre-coded NRZ emission.
 At 20 Gbit/s, up to 40 km propagation with 28 dB OB using EDB & pre-coded NRZ emission.

C-band transmission

Performance is worse due to chromatic dispersion. At 20 Gbit/s, up to 10 km propagation with 28 dB OB with pre-coded NRZ emission. Use pre-equalization and mitigation techniques to increase performance.

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