

19th June 2023

TDEC metric in 50G-PON

PhD student: Casasco Mariacristina

Supervisors: Prof. Roberto Gaudino, Prof. Valter Ferrero

Who I am and my PhD



- Electronic engineer
- XXXVII PhD cycle DET



Optical communications

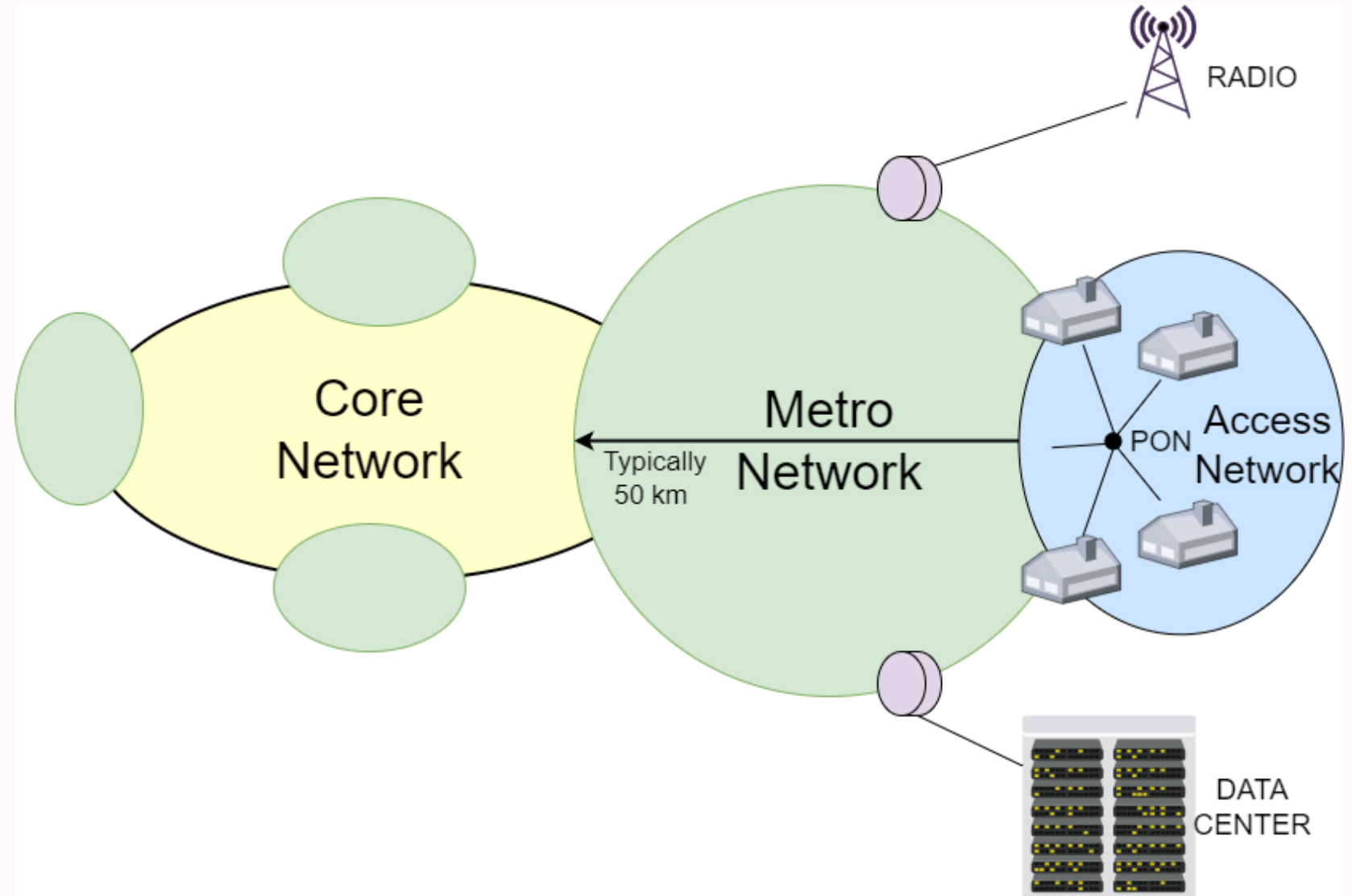
Access network

PhD Title:

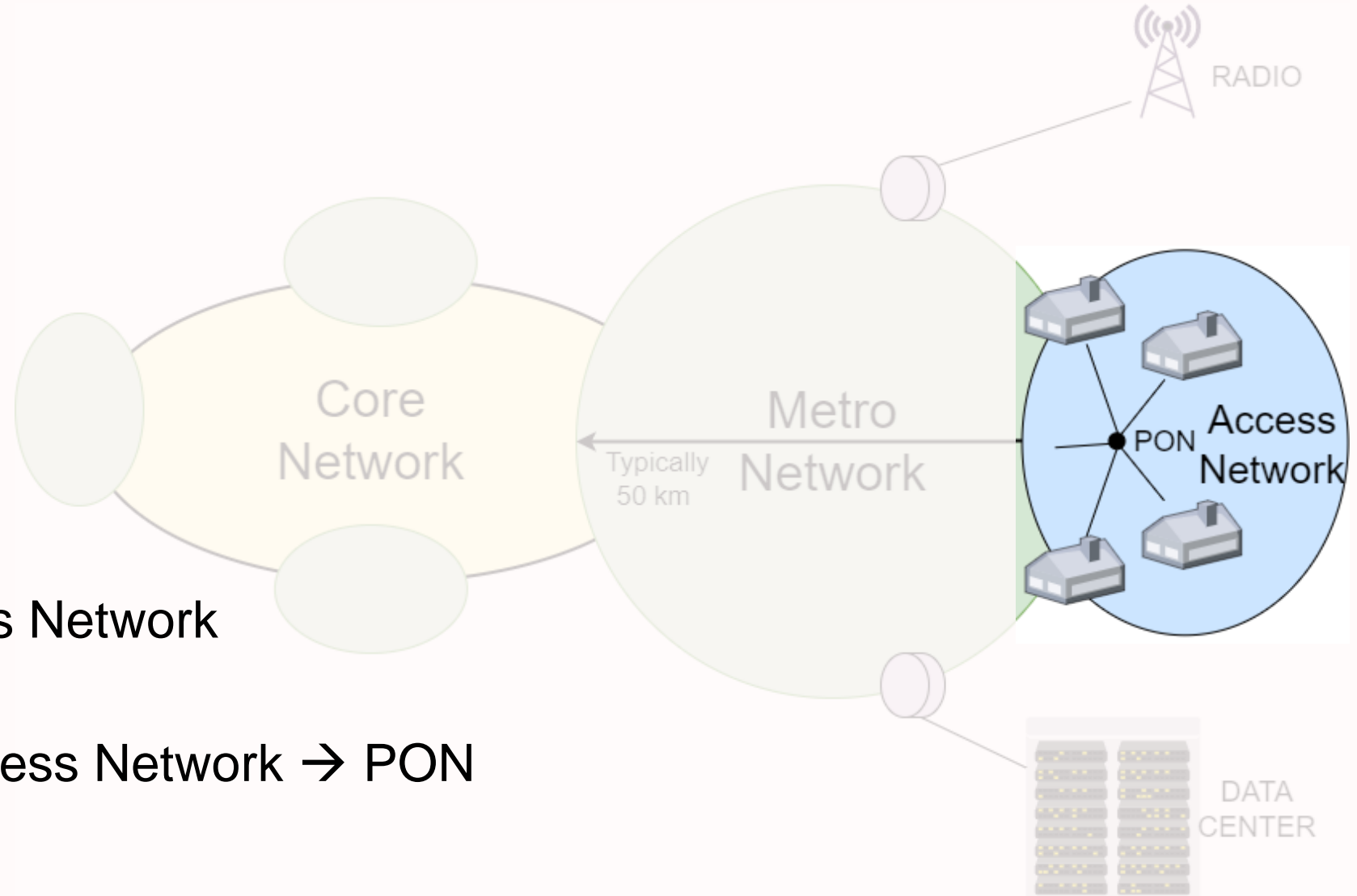
**Innovative technologies for optical
access towards 100 Gbit/s and beyond**

General research scenario

- Metro
 - 50 km
- Access → PON
 - 20 km



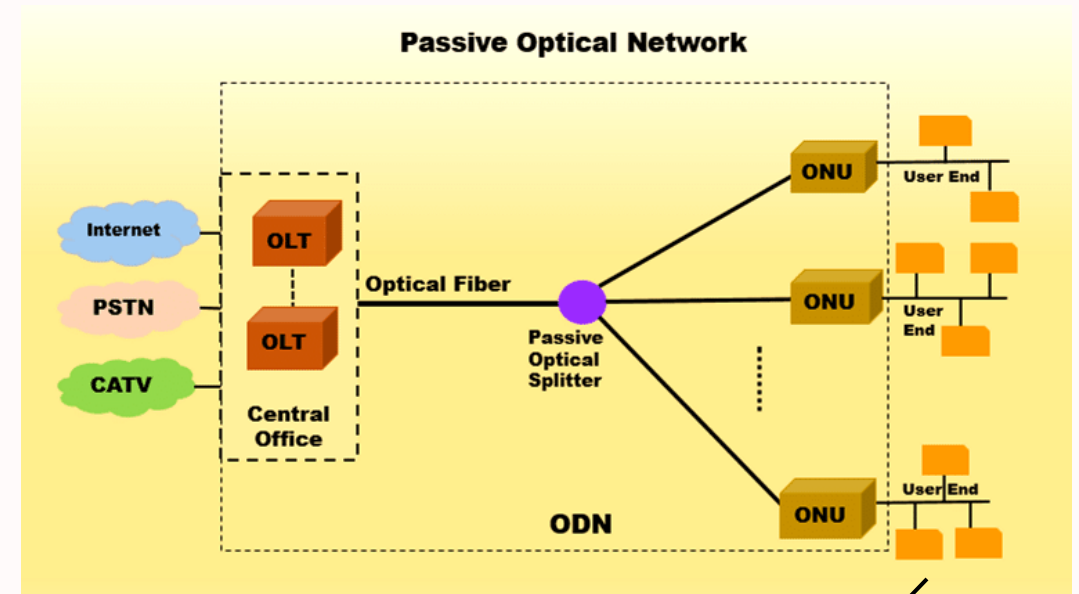
- Metro
 - 50 km
- Access → PON
 - 20 km



My research field → Access Network

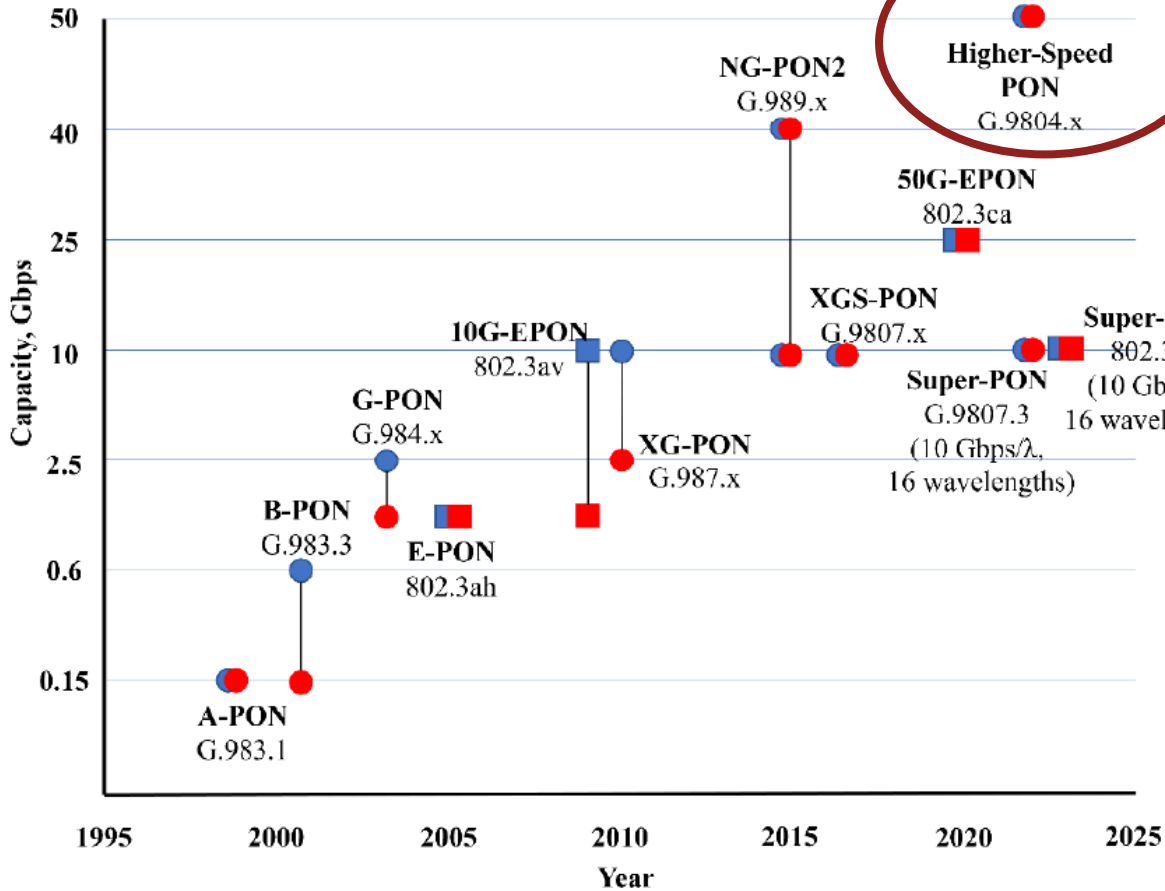
Architecture behind the Access Network → PON

- **P**assive **O**ptical **N**etwork (**PON**):
 - Fiber-optic telecommunications technology
 - From 15 years → most **used** architecture for optical access network (FTTH replaced copper-based systems)
 - Physical layer upgrade → **ITU-T & IEEE** standard

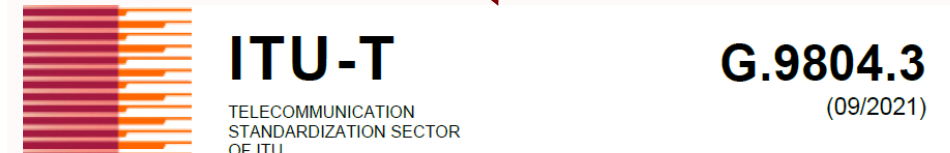


FTTH = Fiber To The Home

PON evolution standards



- ITU-T
 - DS
 - US
- IEEE
 - DS
 - US



ITU-T
TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

G.9804.3
(09/2021)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

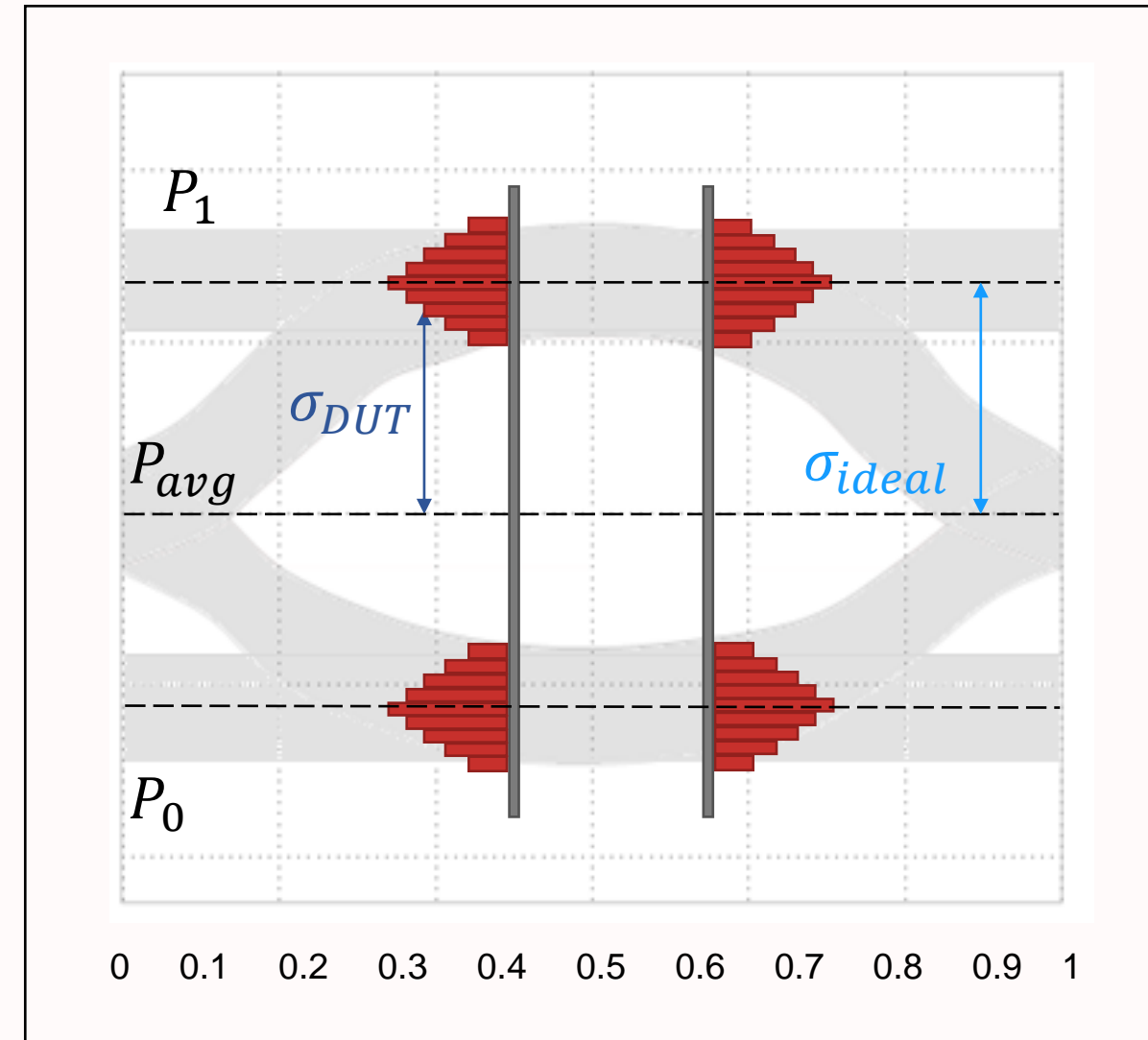
Access networks – Optical line systems for local and access networks

50-Gigabit-capable passive optical networks (50G-PON): Physical media dependent (PMD) layer specification

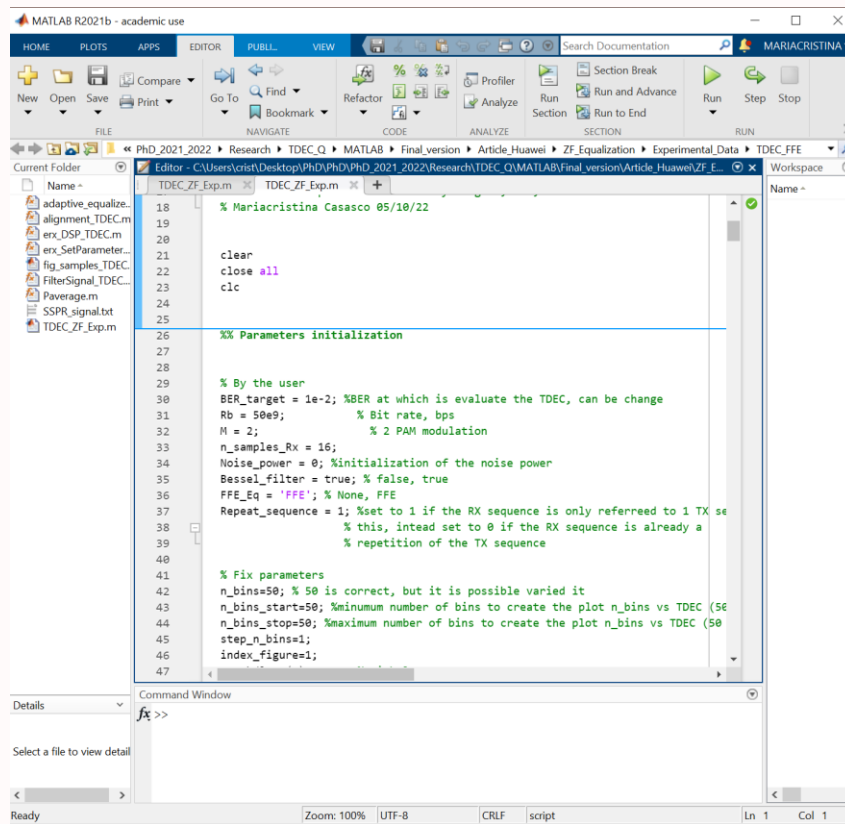
9.2.7.8 Transmitter and dispersion eye closure

Transmitter and dispersion eye closure (TDEC) is a parameter used to characterize the quality of an optical transmitter. It measures vertical eye closure based on histogram data from eye diagrams captured in an oscilloscope with an optical-to-electrical converter. Within the test instrument, filtering is implemented to limit the bandwidth to that defined by a reference receiver. Furthermore, equalization of the captured (and filtered) waveform is performed inside the instrument using a virtual

- **T**ransmission **D**ispersion **E**ye **C**losure:
 - **Metric** introduced by IEEE 802.3 and then adapted by ITU-T G. 9804.3 for **50G-PON**
 - Evaluates the **performance** of a **transmission** system
 - Expresses a **penalty** (dB) with compared to an ideal transmitter
 - **Cheap** method



Code implementation



```

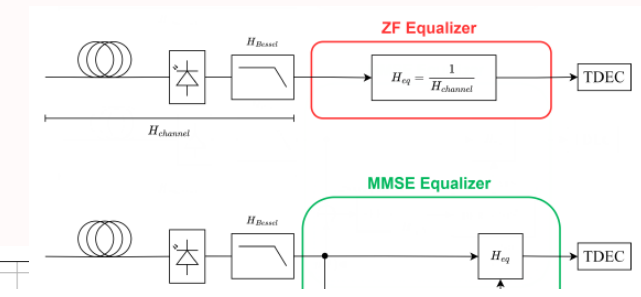
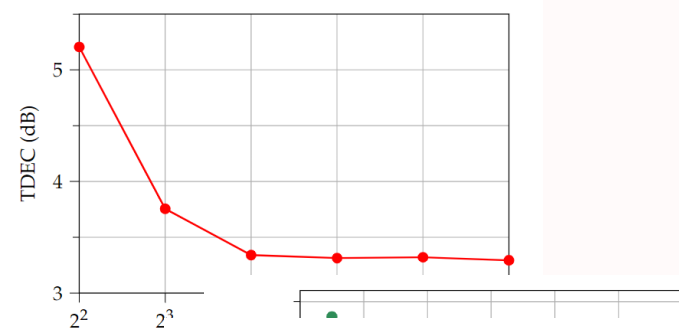
clear
close all
clc

%% Parameters initialization

% By the user
BER_target = 1e-2; %BER at which is evaluate the TDEC, can be change
Rb = 50e9; % Bit rate, bps
M = 2; % 2 PAM modulation
n_samples_Rx = 16;
Noise_power = 0; %initialization of the noise power
Bessel_filter = true; % false, true
FFE_Eq = 'FFE'; % None, FFE
Repeat_sequence = 1; %set to 1 if the RX sequence is only referred to 1 TX seq
% this, instead set to 0 if the RX sequence is already a
% repetition of the TX sequence

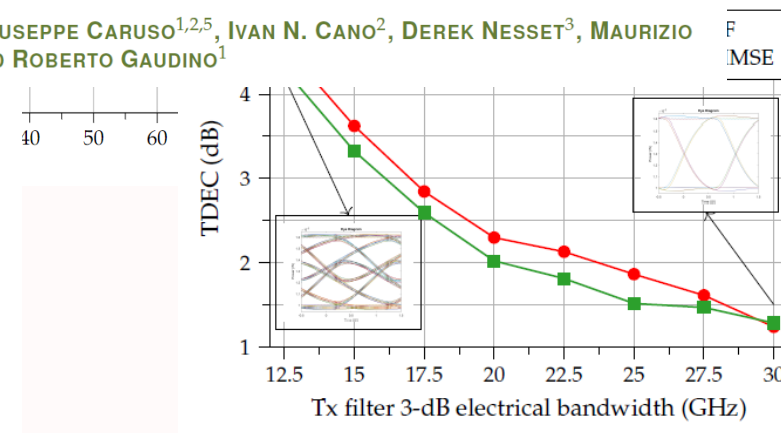
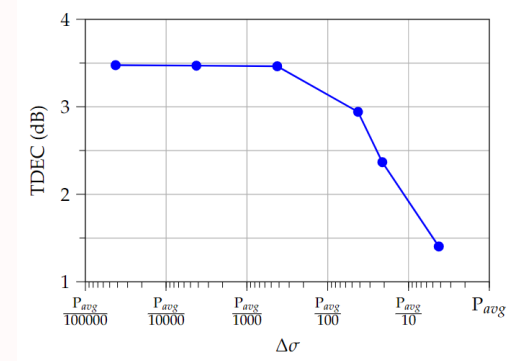
% Fix parameters
n_bins=50; % 50 is correct, but it is possible varied it
n_bins_start=50; %minimum number of bins to create the plot n_bins vs TDEC (50)
n_bins_stop=50; %maximum number of bins to create the plot n_bins vs TDEC (50)
step_n_bins=1;
index_figure=1;
    
```

Code optimization

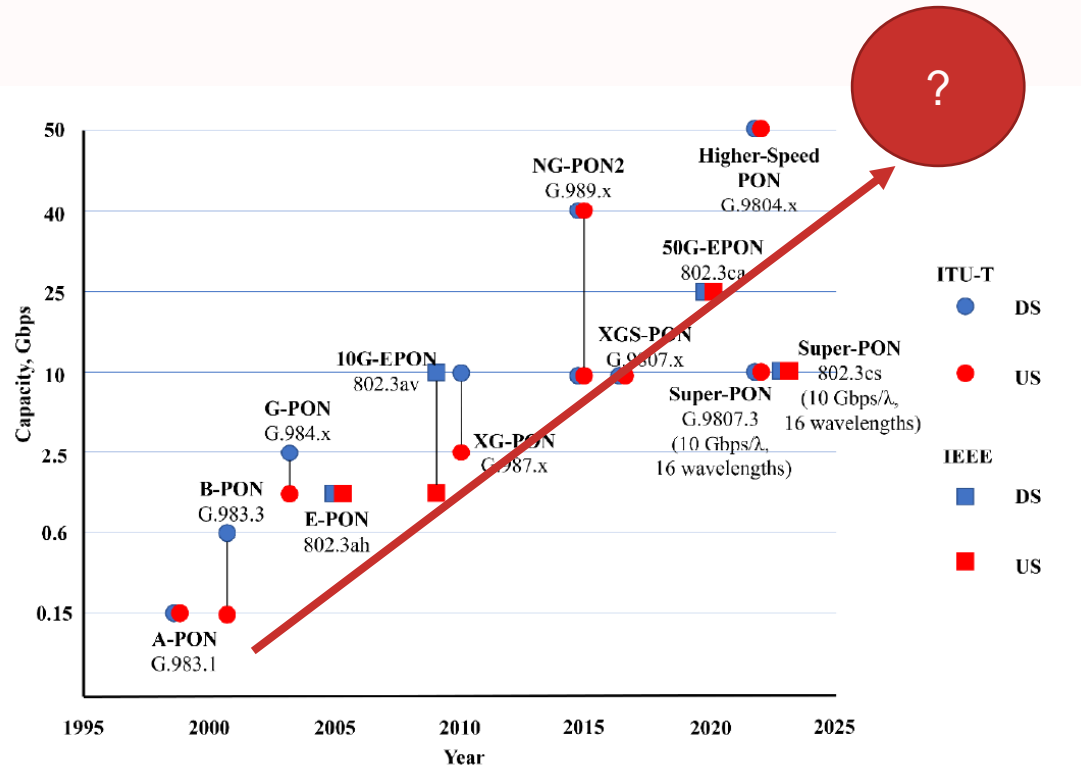


TDEC metric in 50G-PON: analytical and experimental investigation on several implementation aspects

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PhD Title: Innovative technologies for optical access towards 100 Gbit/s and beyond



Direct Detection → Coherent Detection

Amplitude

Phase,
amplitude
polarization

Experimental Demonstration of a 400 Gb/s Full Coherent Transmission in an in-field Metro-Access scenario

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THANK YOU
FOR YOUR ATTENTIONS!

QUESTIONS?