

Implementation of an Optical Add-Drop Prototype for a SDH and Gigabit Ethernet Optical WDM Link

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Work realised for the PT- Onode Project (P114)



Inovação



Outline

-  Introduction
-  Optical System Description
-  OADM (FBG) Characteristics
-  FBG Writing System
-  OADM Tests
-  Future Work

Introduction

Specify, implement and test a low loss and cost effective Optical Add-Drop Multiplexer (OADM) based on fiber Bragg gratings (FBG).

The choose of a solution based on FBG was taken based on previous results, which indicate that this solution is the most transparent, flexible and cost effective.

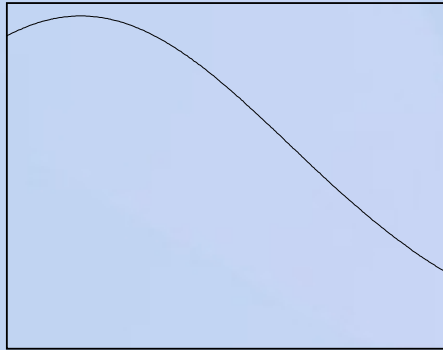
Obtain by simulation the required FBG characteristics that maximise the considered optical system performance.

Optical System Description

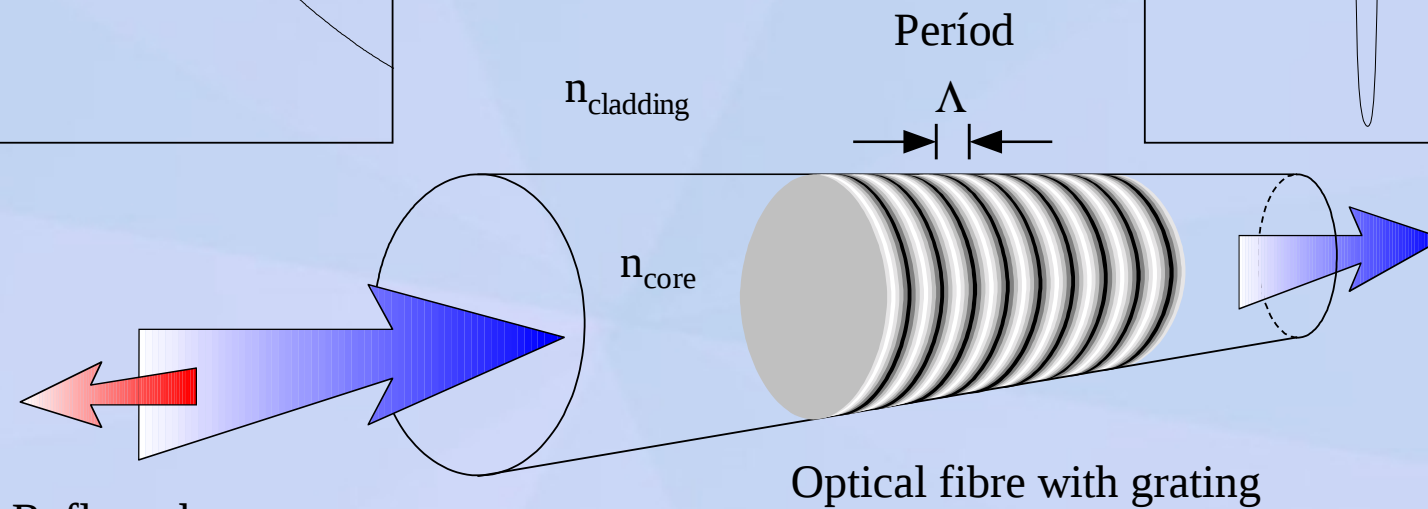
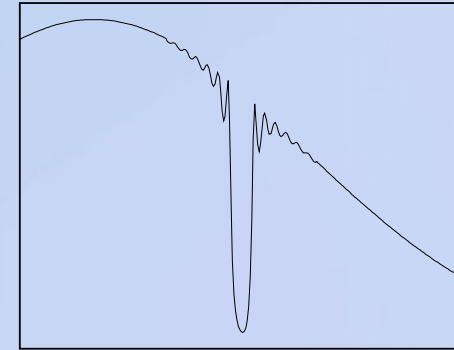
- 16 channels, 100 GHz spaced WDM system, working each channel at STM-16 (2.48832 Gbit/s) + FEC.
- Direct modulated semiconductor lasers, resulting in optical stream pulses with 2 mW average power, and 10 dB optical extinction ratio. The linewidth due to the chirp is 25 GHz.
- Propagation through a maximum distance of 60 km, over G-652 optical fiber. Without amplification.
- Direct detection through a PIN.

FBG

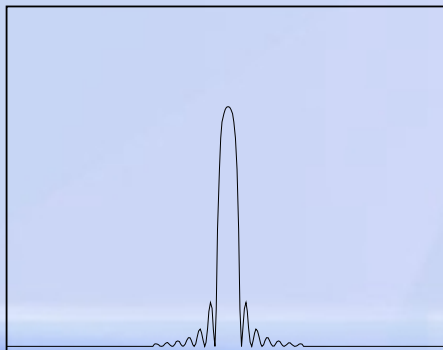
Broadband spectra



Transmitted spectrum

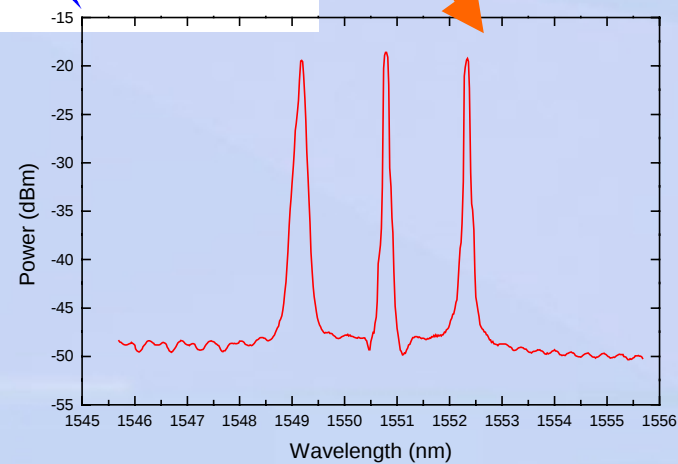
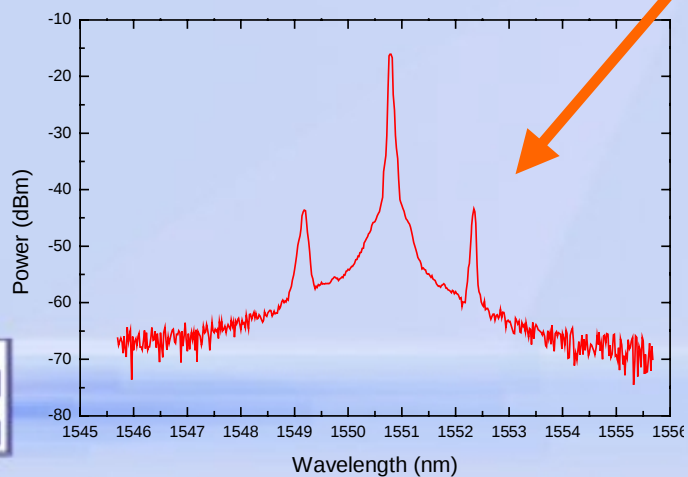
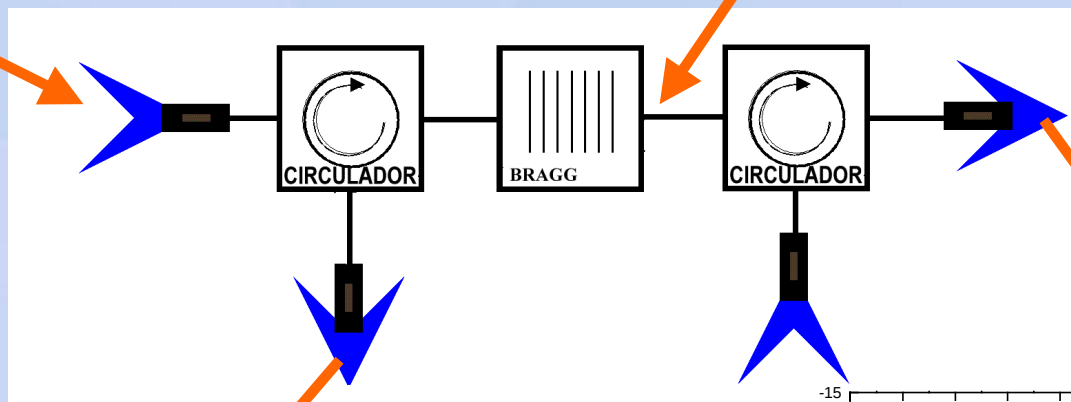
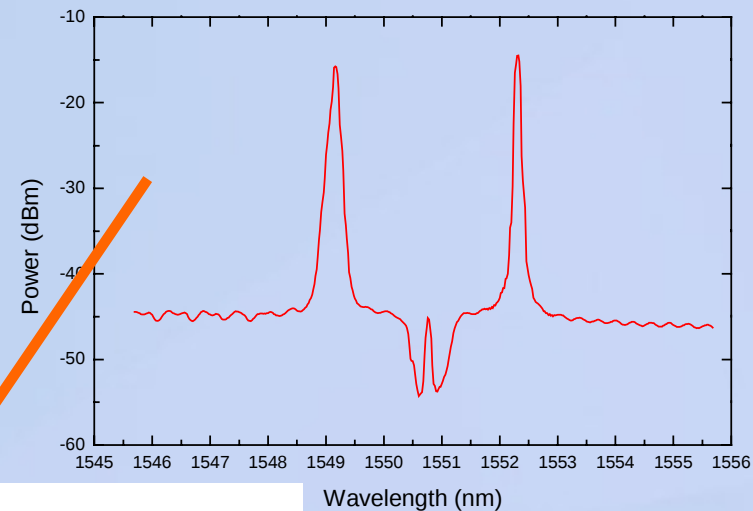
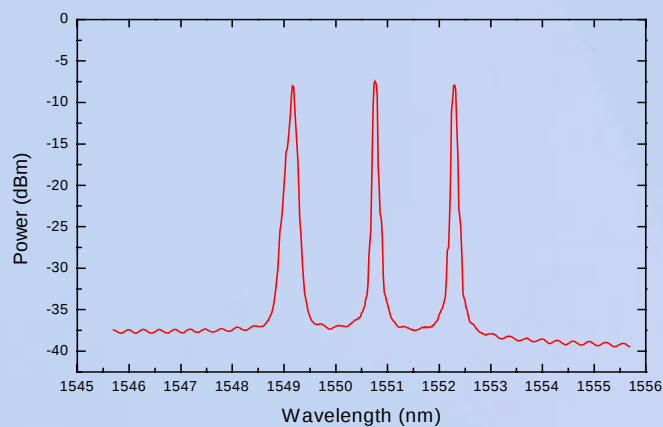


Reflected spectrum



Optical fibre with grating

OADM



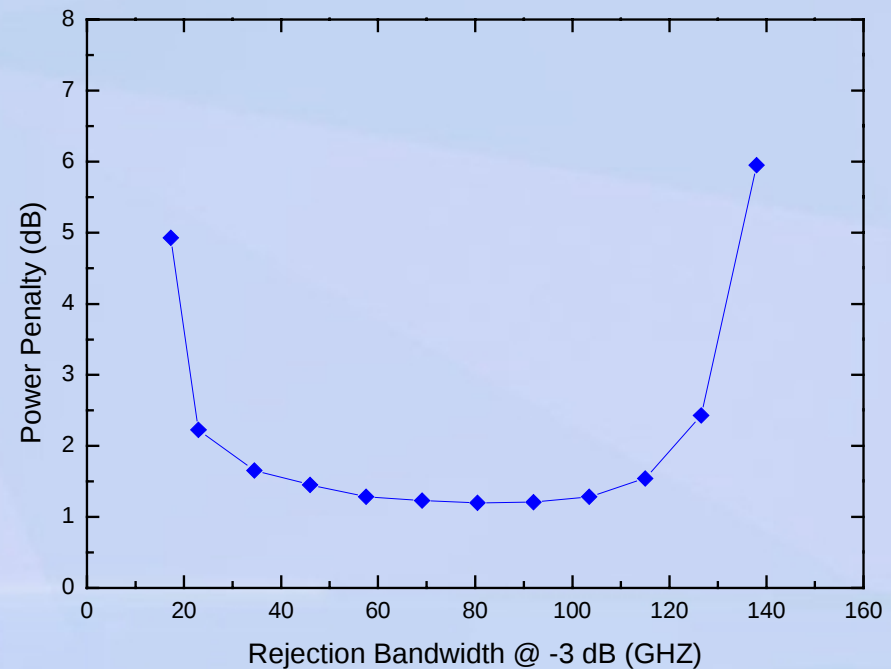
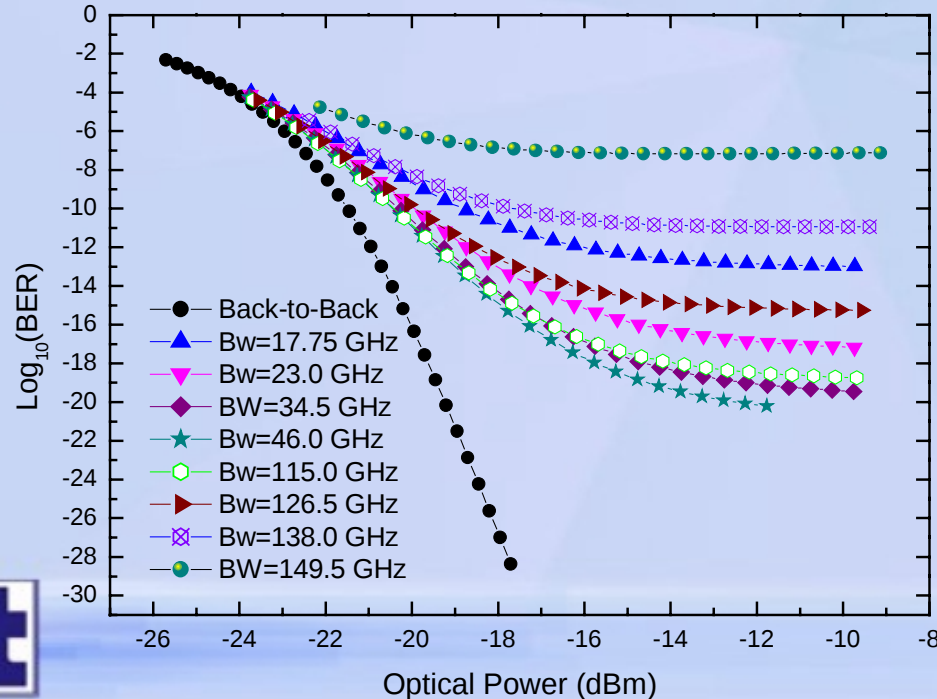
OADM (FBG) Characteristics

Insertion Losses: Pass-through < 0.5 – 3.5 dB (FBG)

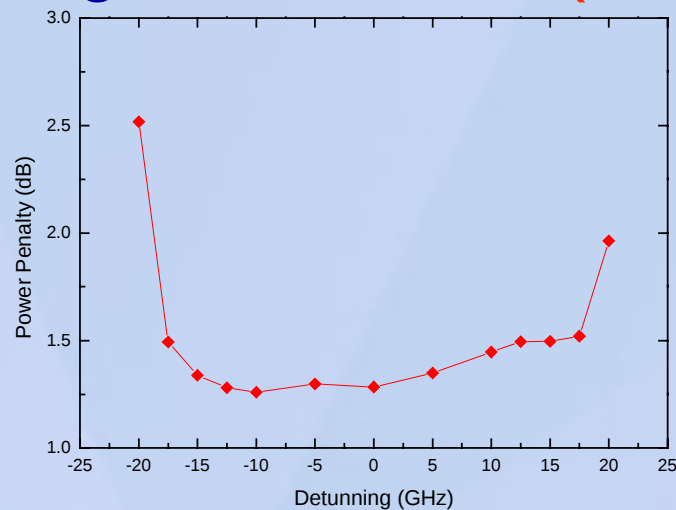
Drop < 6.5 – 9.5 dB (FBG)

Add < 3 – 6 dB (FBG)

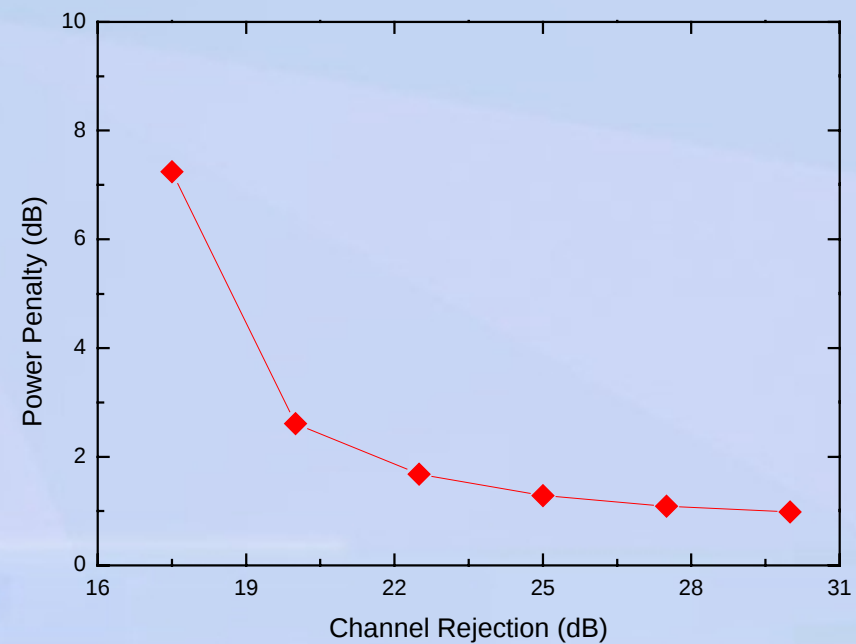
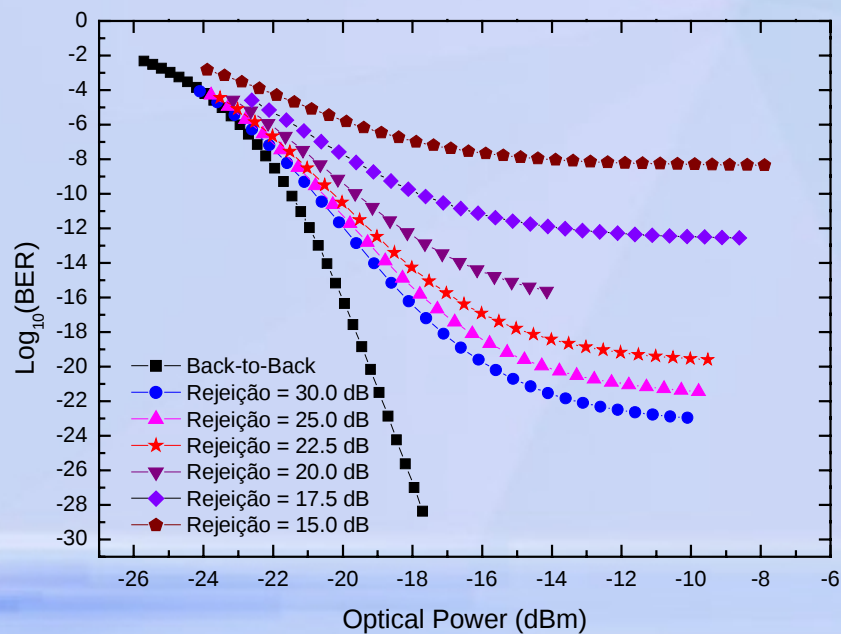
Rejection Bandwidth: > 50 GHz, < 110 GHz (P_p < 1.5 dB)



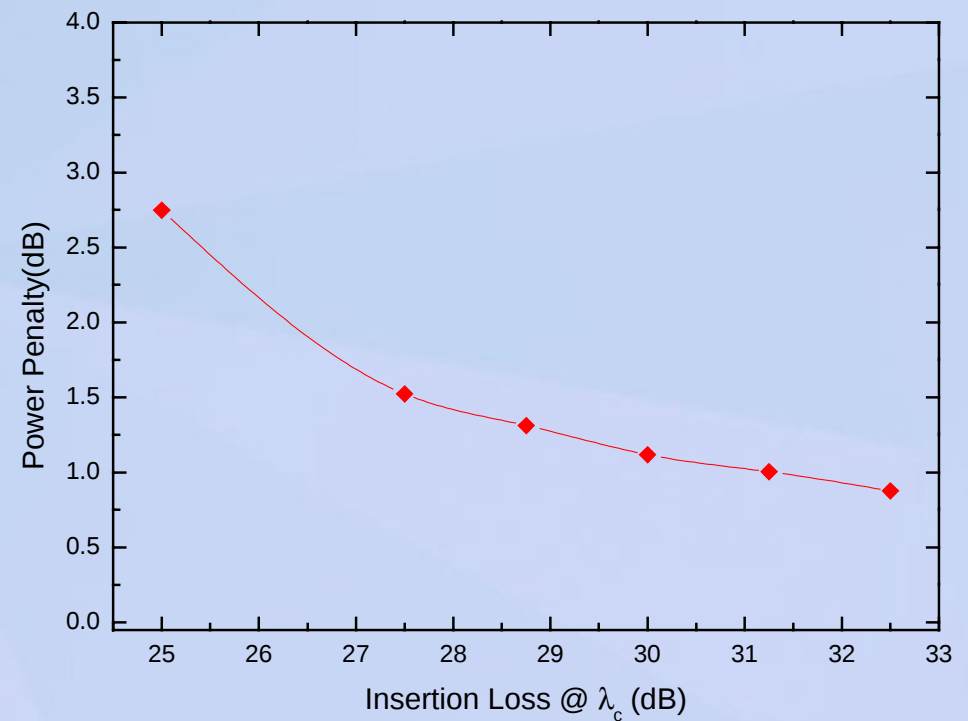
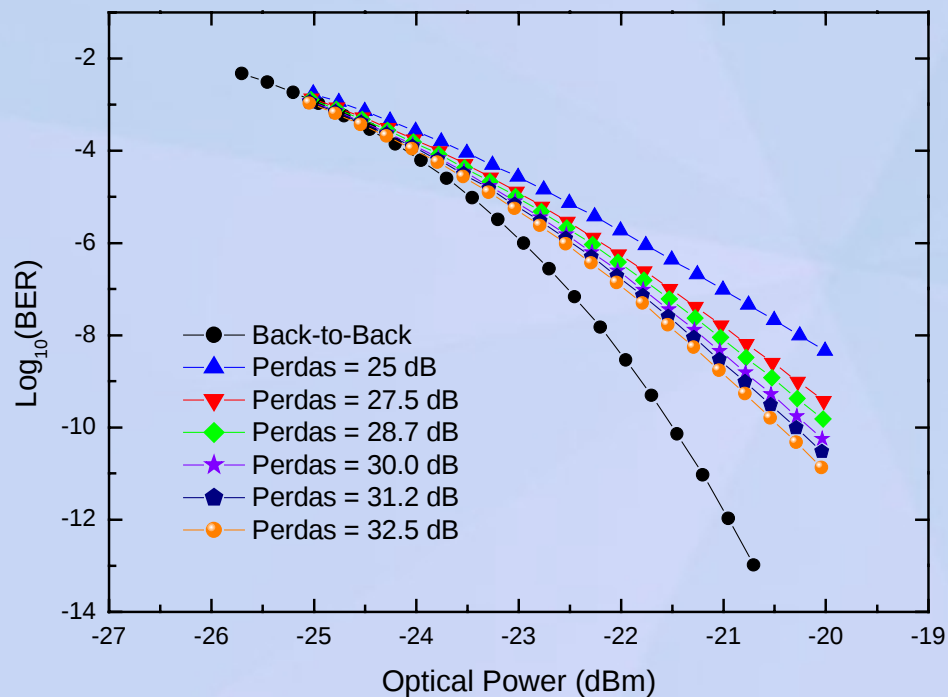
Detuning: $< \pm 15$ GHz (± 12 °C)



Rejection to adjacent channels: > 25 dB ($P_p < 2$ dB)

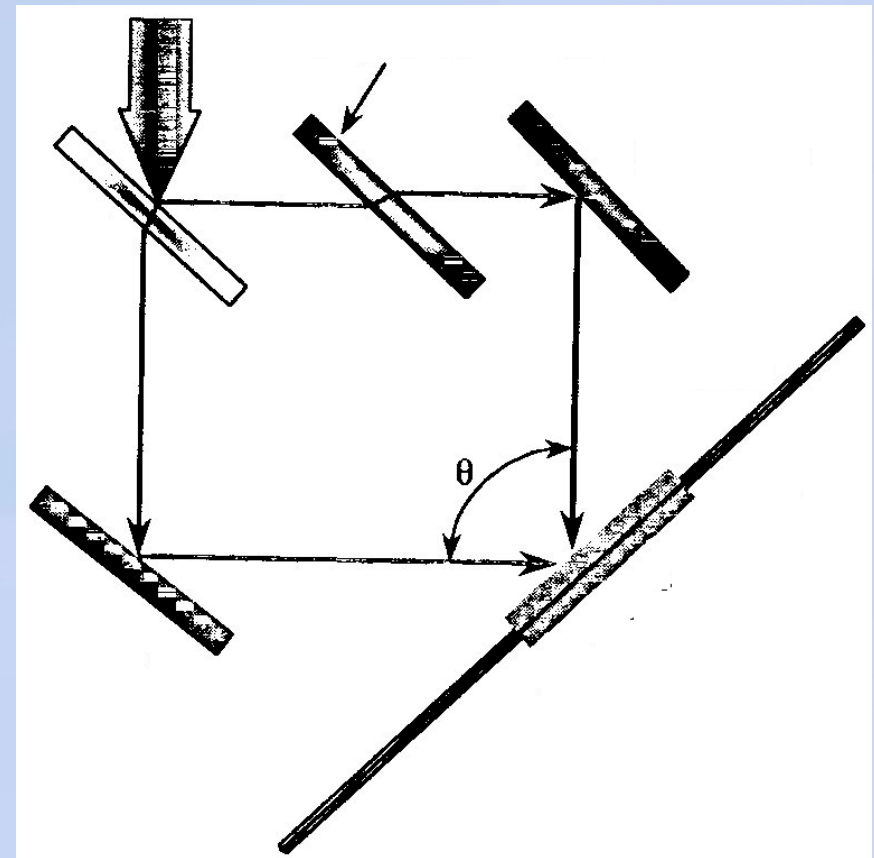


Pass – Trough insertion loss of the removed channel: > 30 dB

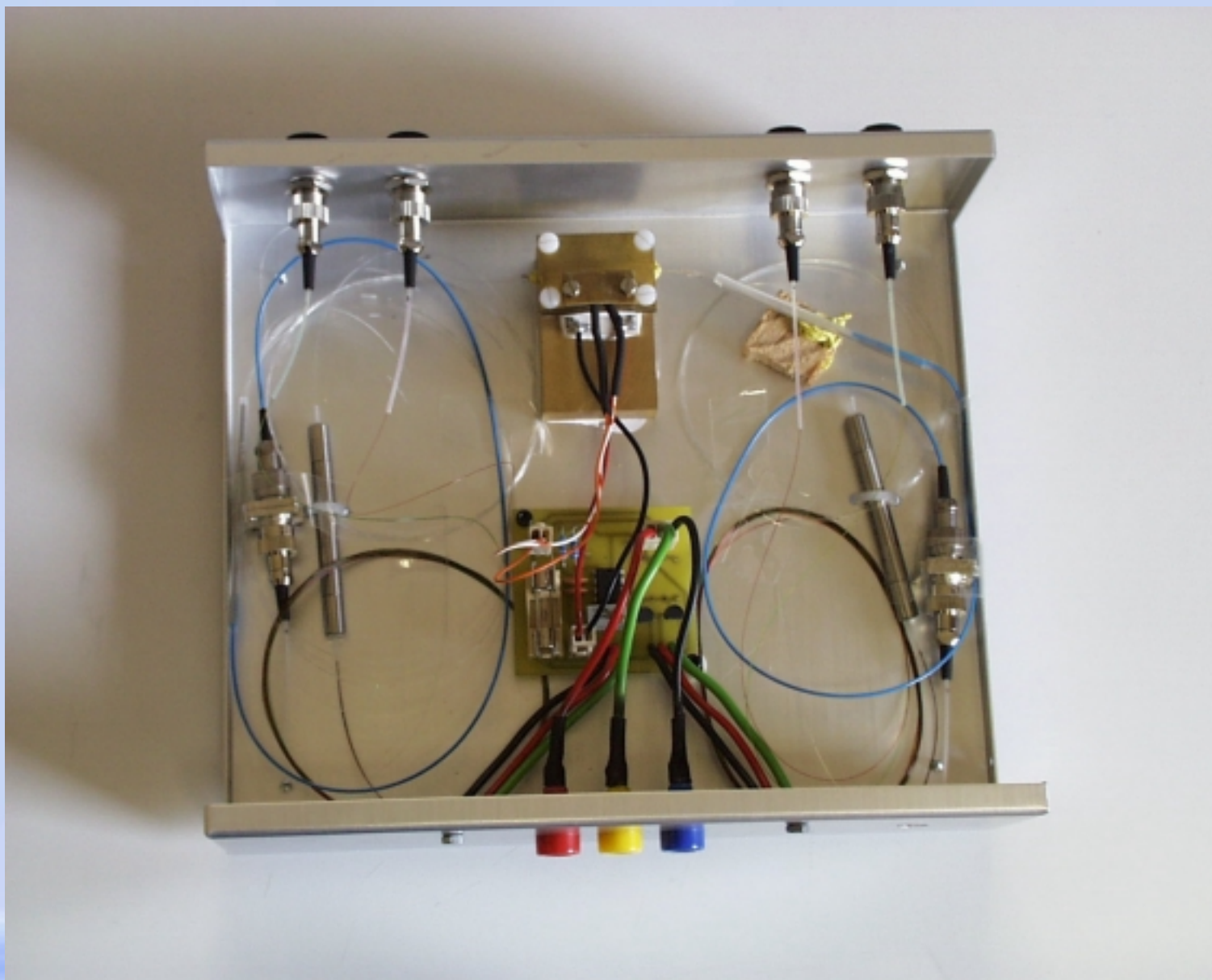


FBG - Writing

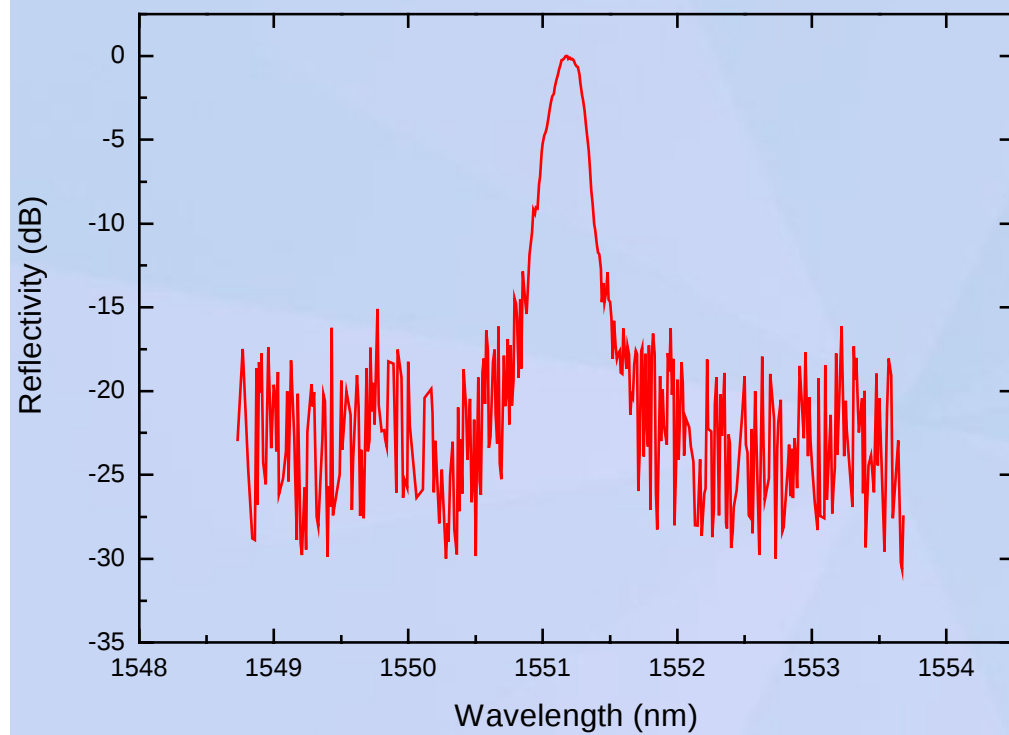
- Interferometric Technique
- Doubled Ar⁺ Laser (244 nm)
- High Photosensitive fiber - Doped with Ge and/or Hydrogenated)



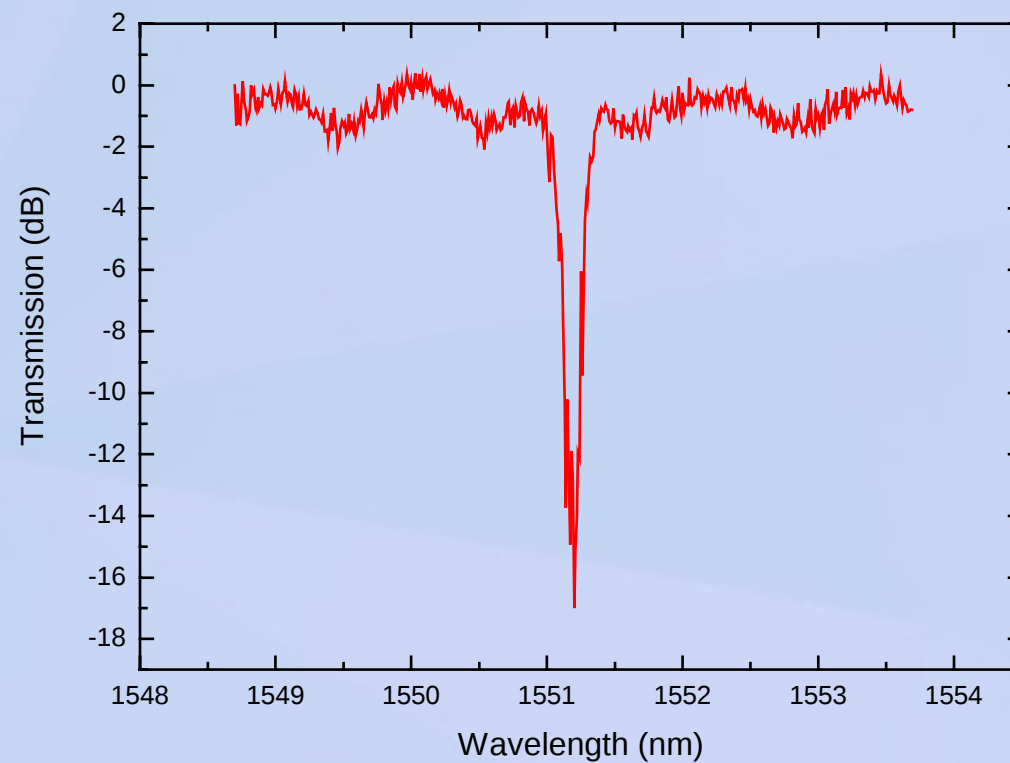
OADM Test



Reflectivity



Transmission

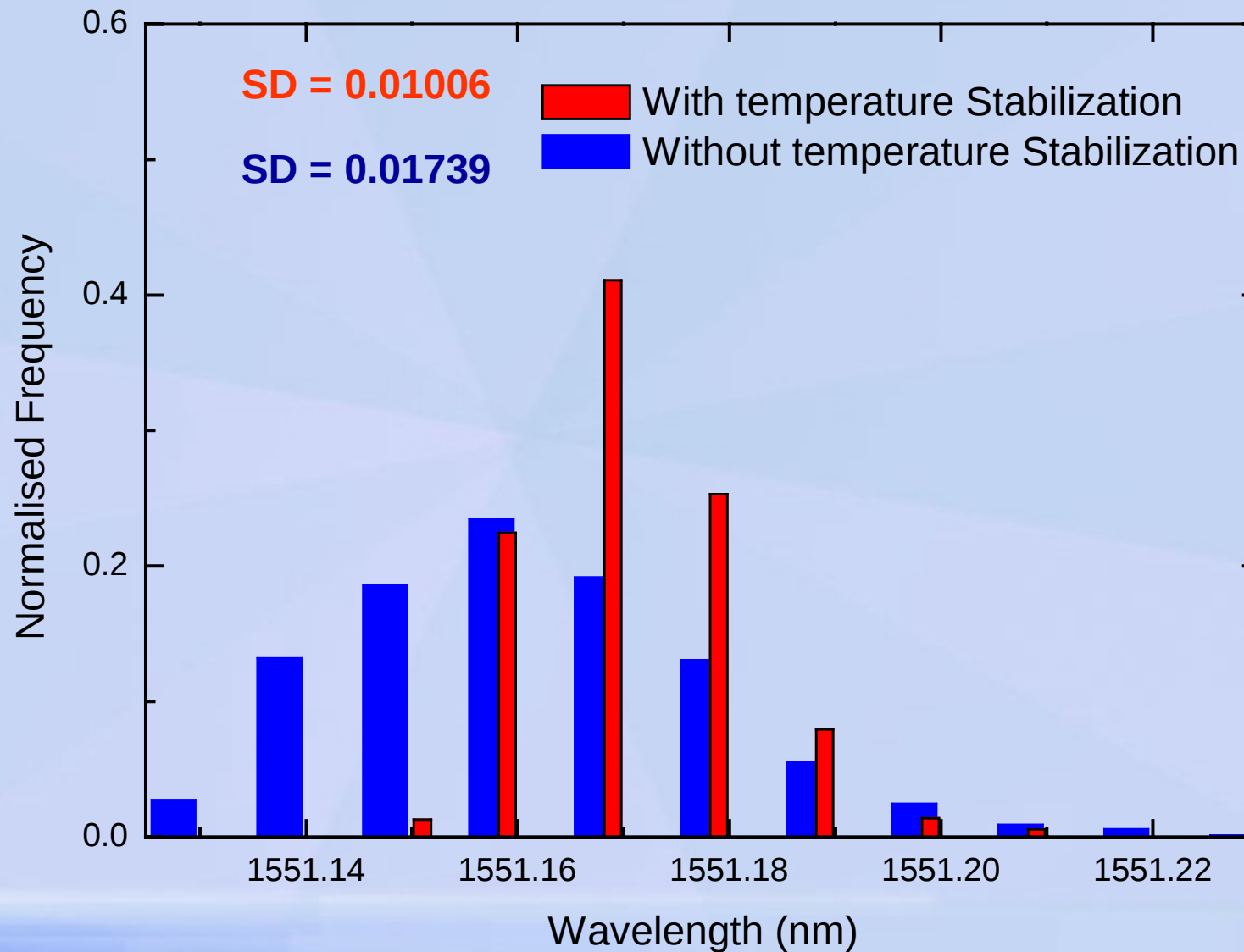


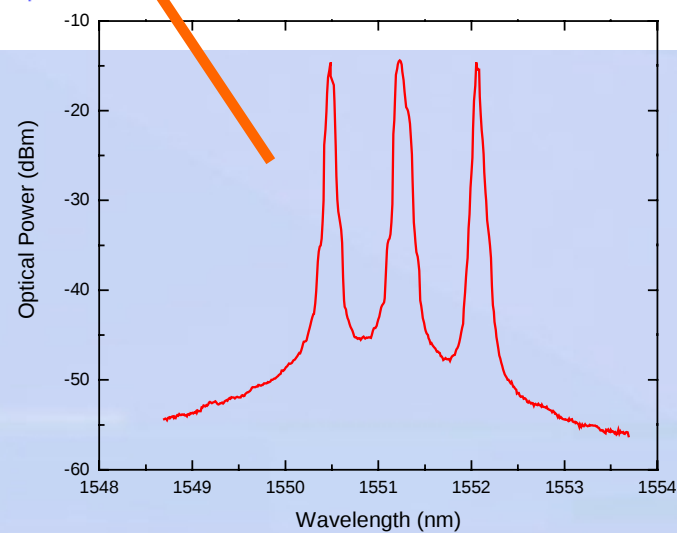
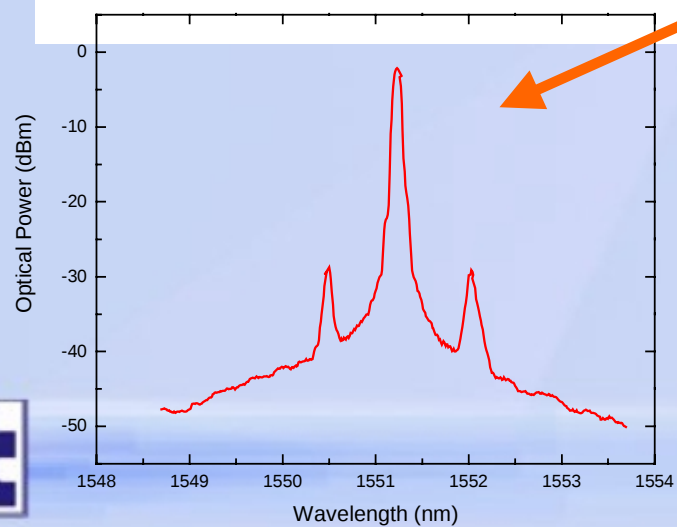
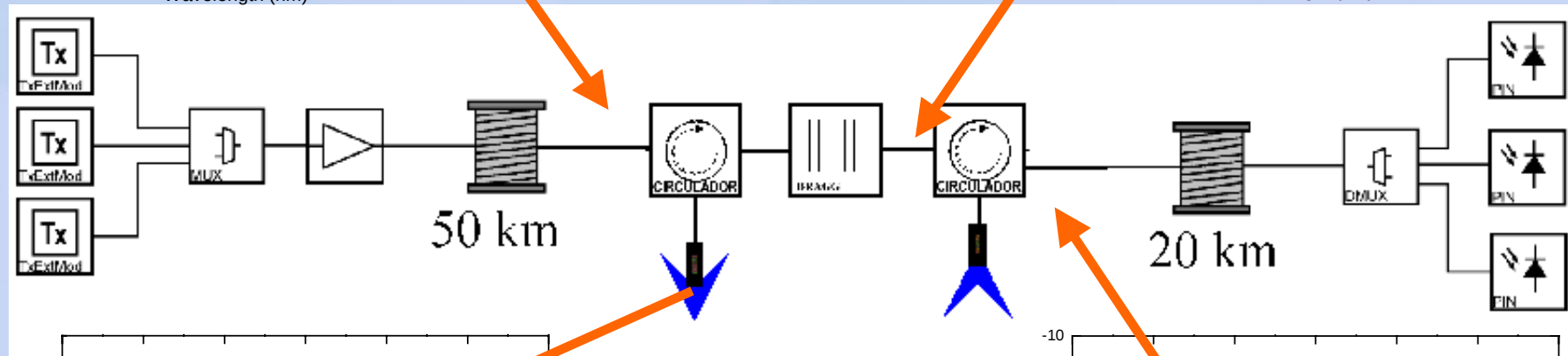
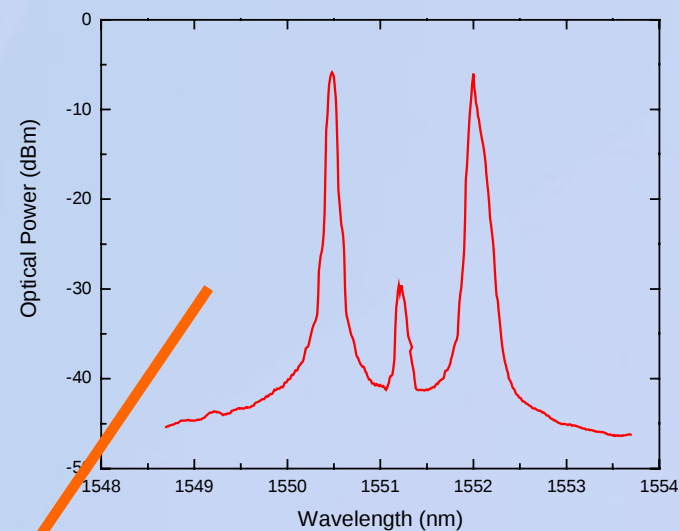
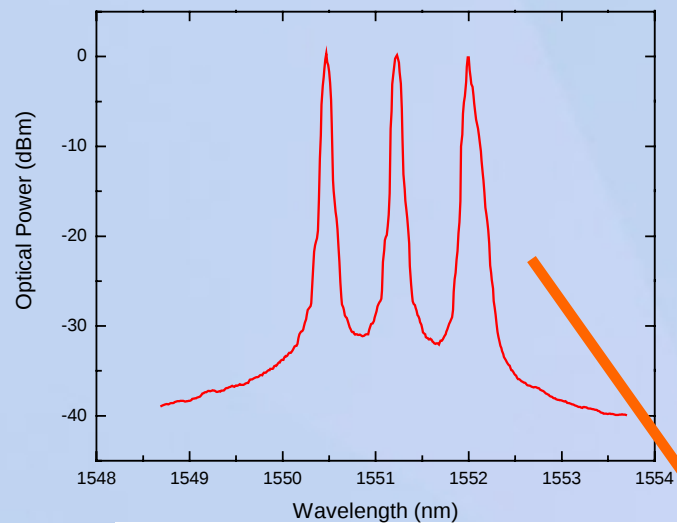
Characteristics

- Bandwidth = 0.25 nm
- Central wavelength (25 ° C) = 1551.19 nm
- Drop channel IL = 0.46 dB
- Passing channels IL = 1.00 dB
- Drop adjacent channels rejection = - 26.03 (± 100 GHz)
- 31.16 (± 200 GHz)
- Passing channels IL = 1.00 dB
- Add channel IL = 1.7 dB
- IL @ central wavelength = 26.38 dB

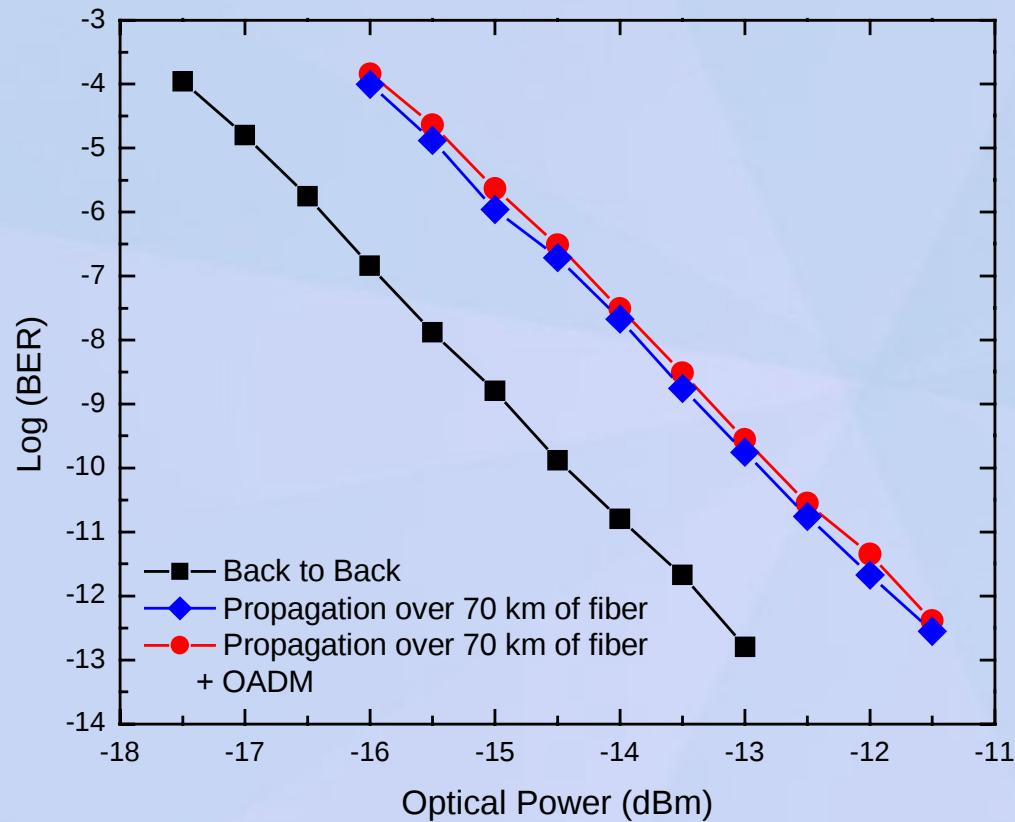


Wavelength Stability

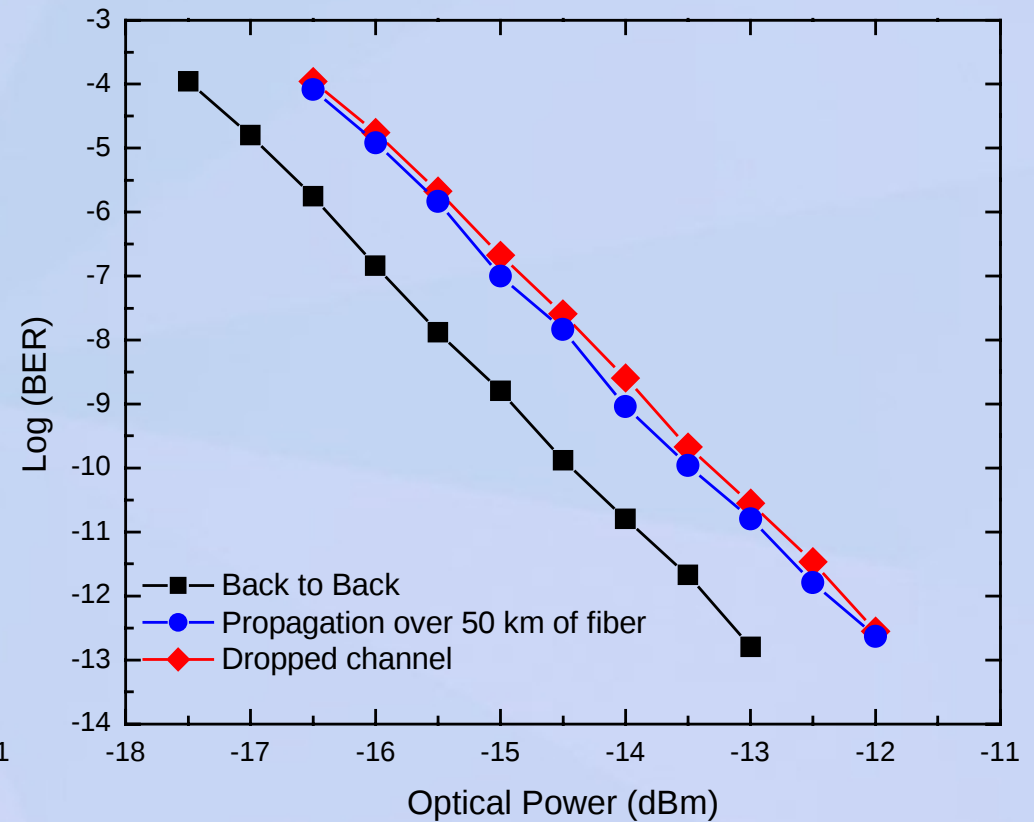




Pass



Dropped



Future Work

📄 Test the OADM in a controlled environment chamber to verify the wavelength stability over a 50 ° C temperature range.

📄 Use a FBG manufactured at the Physics Department - UA.

Thank You