

SOA Gain Control at OLT

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Motivation

Two issues on SOA pre-amplifier were introduced at the last meeting in New Orleans. We studied solutions.

- Dynamic range over damage threshold of PD.

“SOA pre-amplified upstream signal power in 100G-EPON”, Hanhyub Lee

http://www.ieee802.org/3/ca/public/meeting_archive/2017/05/lee_3ca_1_0517.pdf

- Cross gain modulation from loud burst signal to weak burst signal.

“Analysis of Multi-channel Crosstalk with SOA as Pre-amplifier in 100G EPON”, Dekun Liu

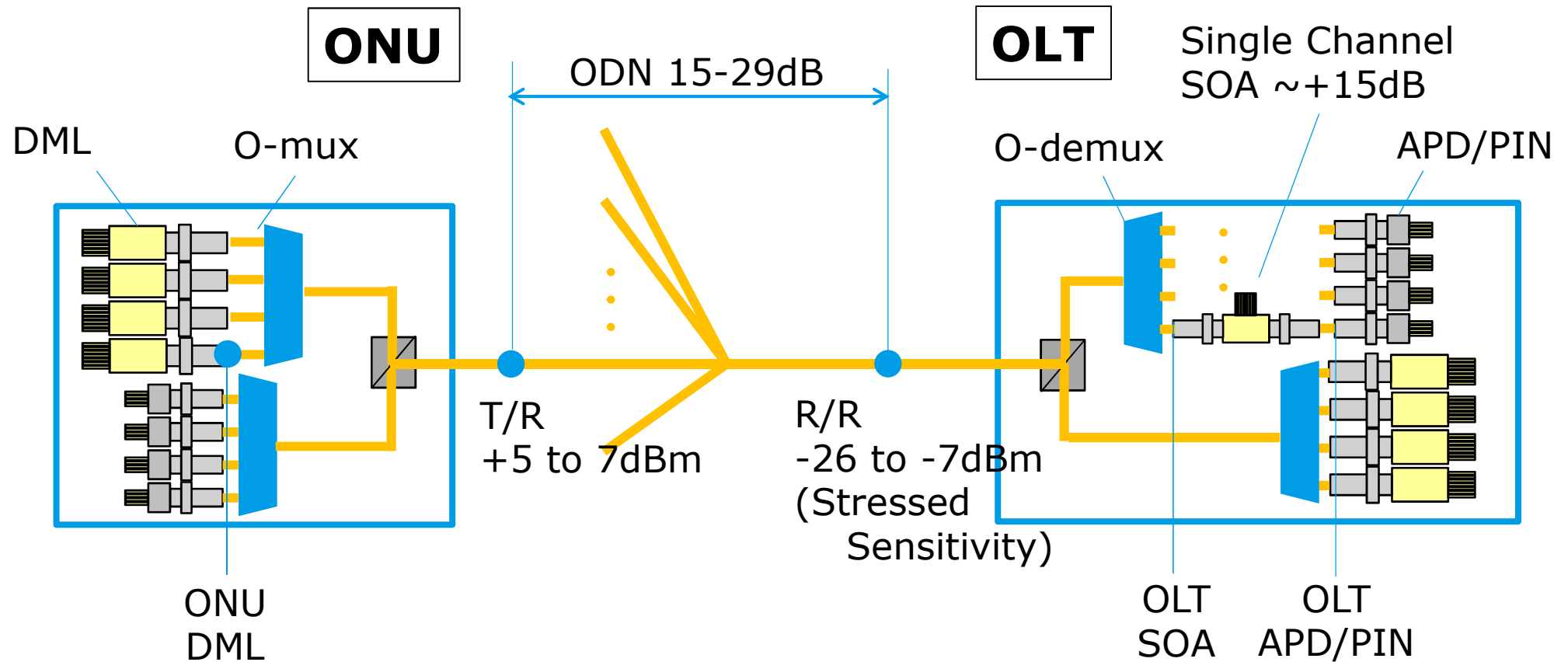
http://www.ieee802.org/3/ca/public/meeting_archive/2017/05/liudekun_3ca_1_0517.pdf

Solutions

- OLT: Single channel SOA + SOA Gain Control
 - No Cross Gain Modulation
 - OLT received power is adjusted by SOA gain control.

- ONU: Compensation of Channel Insertion Loss
 - SOA issues are caused by variations of the channel insertion loss (ChIL) between OLT and ONUs.

Example Diagram of 100G Upstream



	O-mux	O-demux	Diplexer	ODN	TDP
Loss Penalty [dB]	1.5 (tentative)	1.5 (tentative)	0.5 (tentative)	29(PR30)	2.0(DML) (tentative)

Receiver Dynamic Range and SOA Gain Control

- Fixed SOA gain (~15dB) causes high APD/PIN input over damage threshold.
- "SOA Gain Control" reducing the gain for high power is one of solutions.

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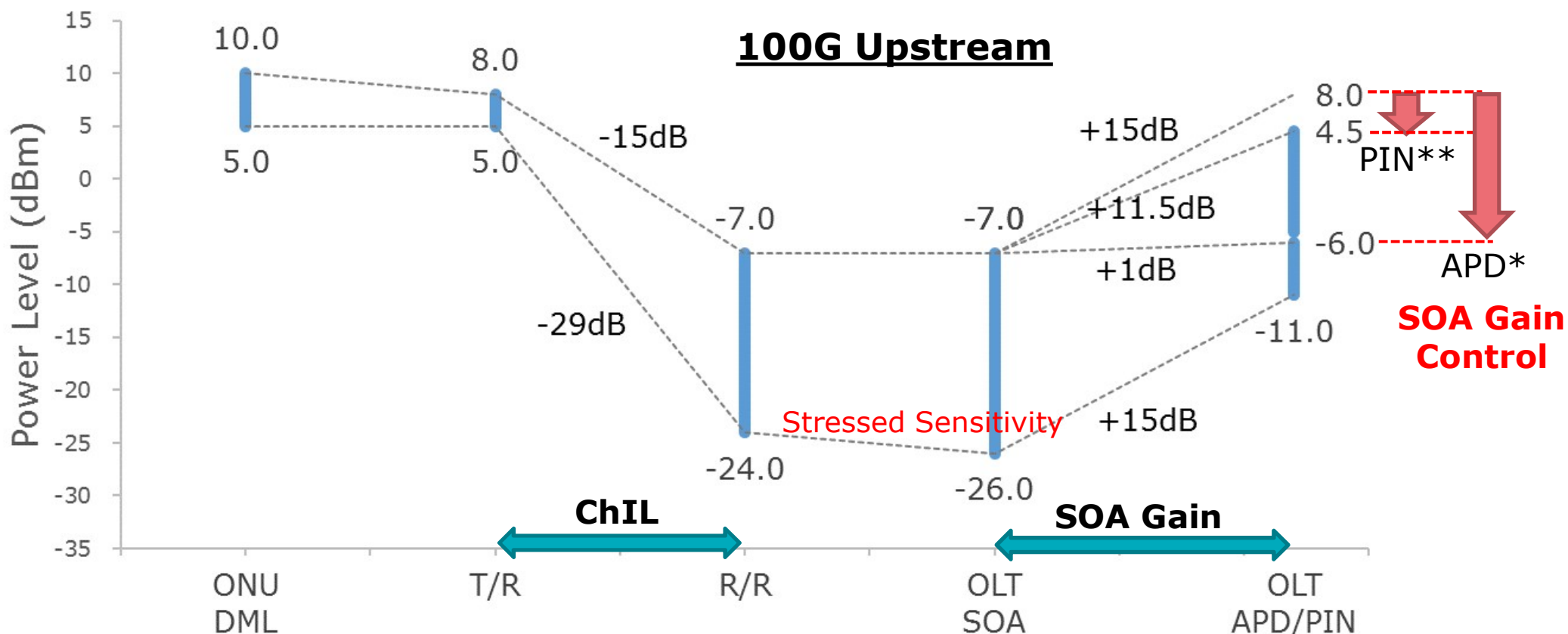
APD Overload=-6dBm*

APD Damage Threshold=-5dBm

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PIN Overload=+4.5dBm**

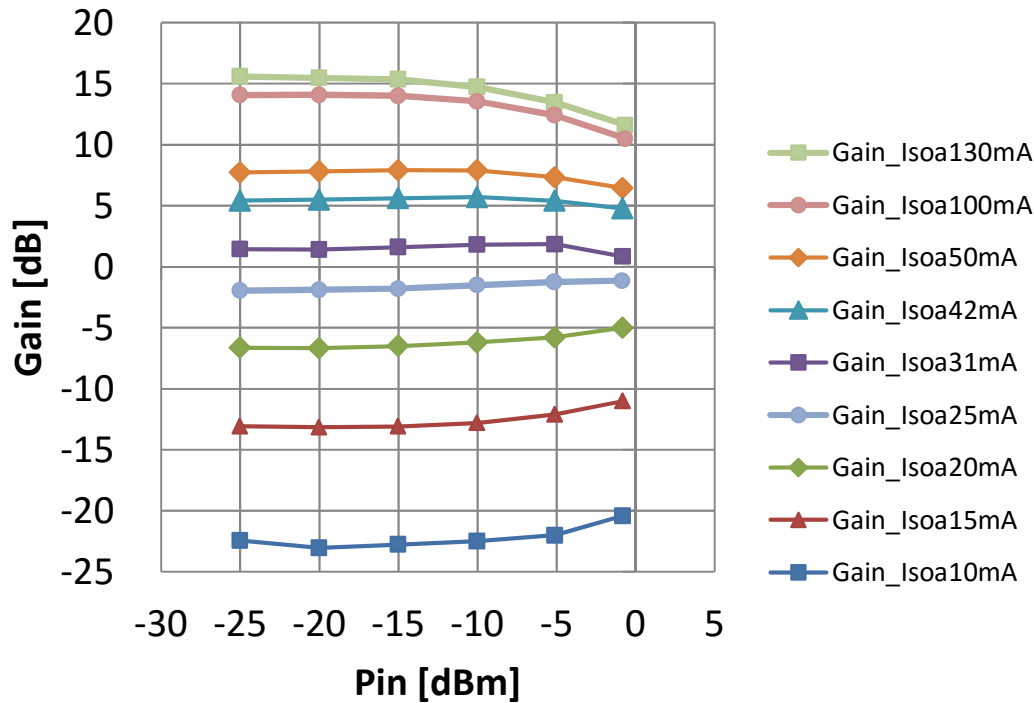
PIN Damage Threshold=+5.5dBm



SOA Current-Gain Characteristics

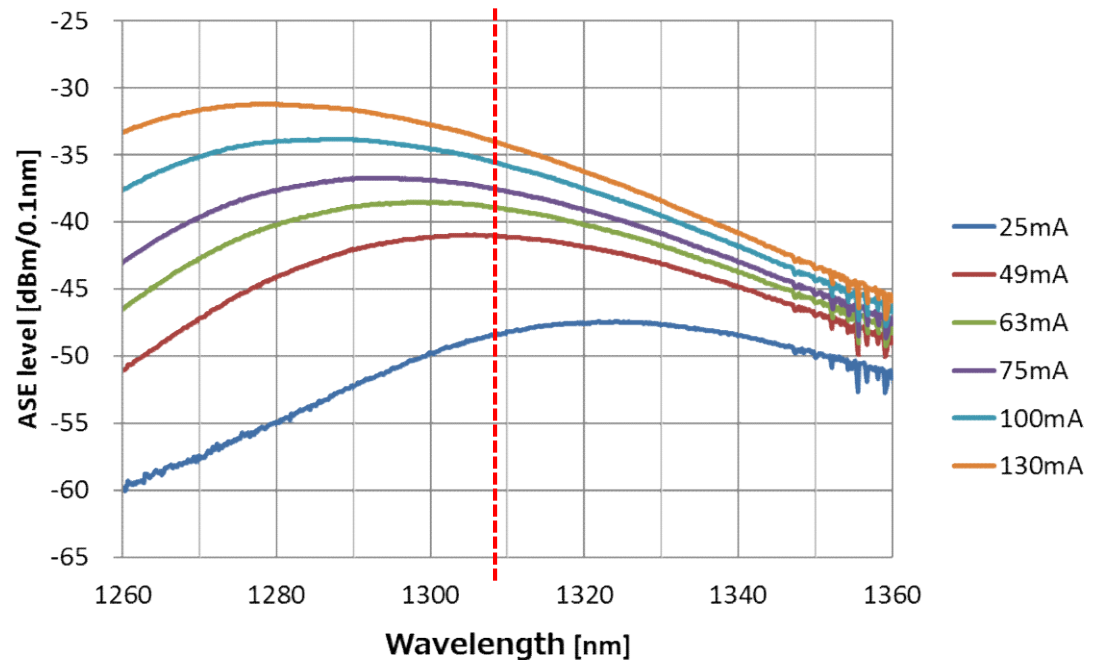
- SOA gain can be controlled by SOA current.
- Current-Gain characteristics has wavelength dependency.

SOA Gain (Tsoa:40degC)



SFP28
 $\lambda = 1309.768\text{nm}$

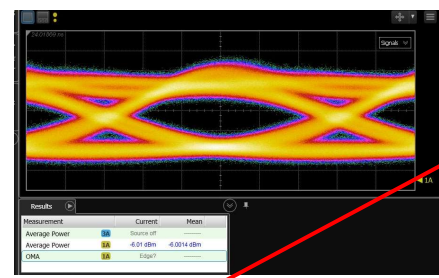
ASE level (Tsoa:40degC)



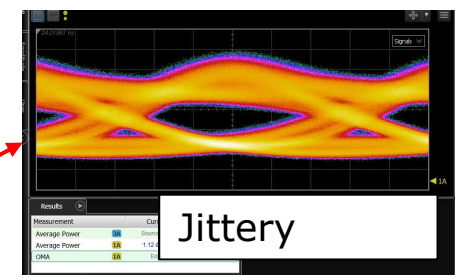
SOA Gain Control

SOA output eye is good in low gain operation for high power input.

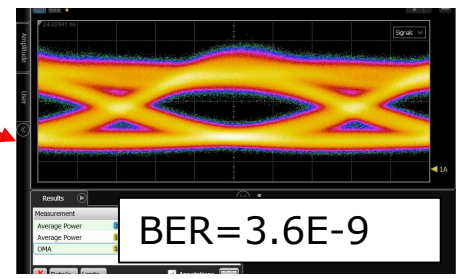
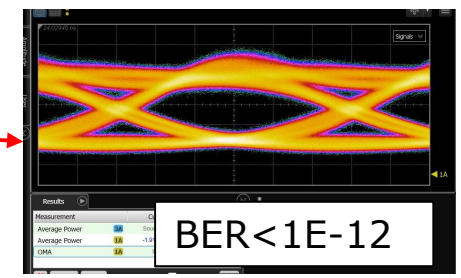
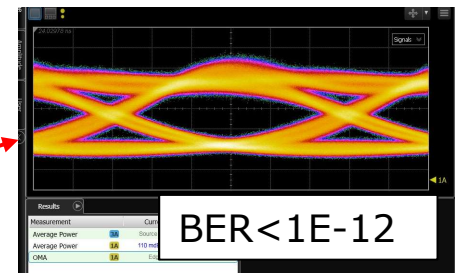
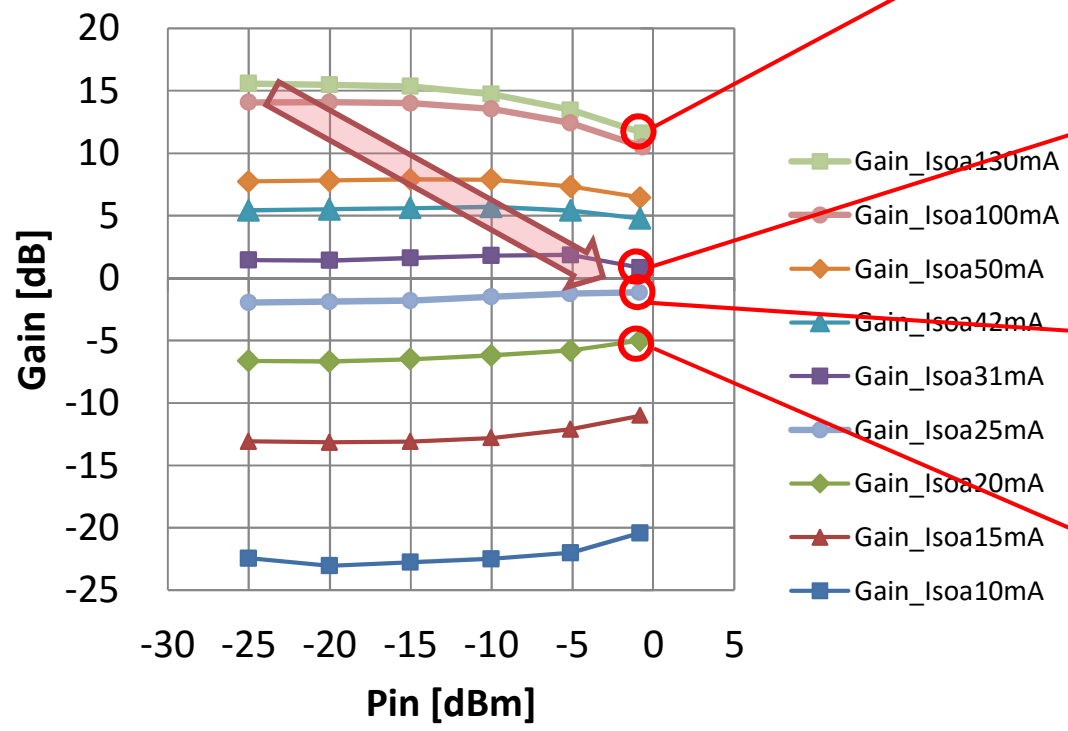
SOA Input (-0.8dBm)



SOA Output



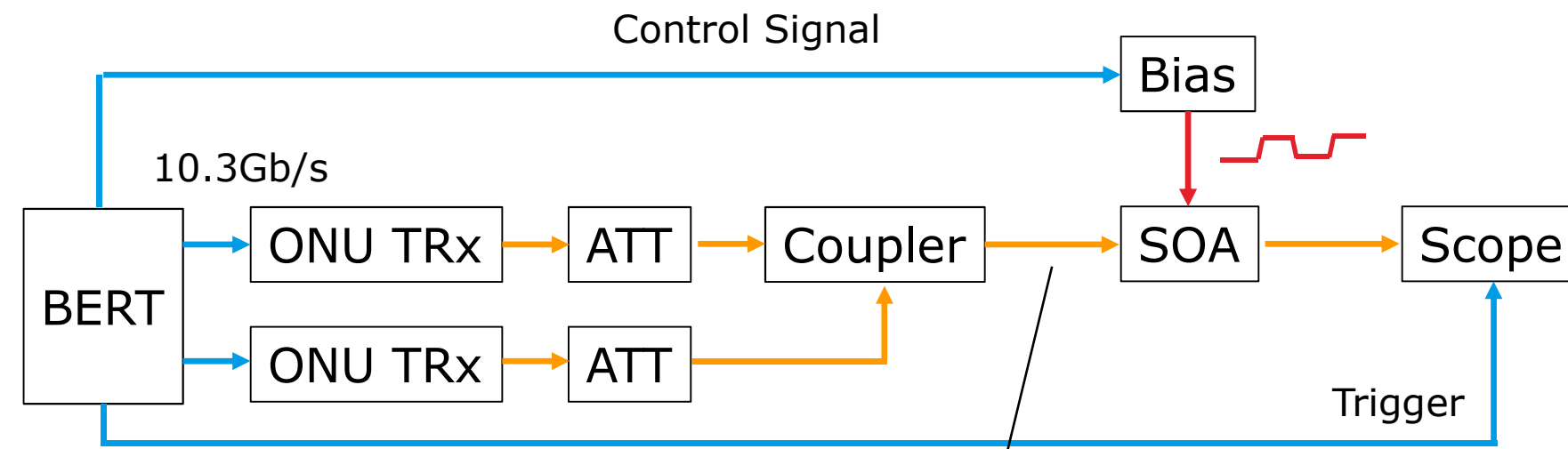
SOA Gain (Tsoa:40degC)



Optical Source: SFP28 DML/PIN 25.8Gb/s, $\lambda=1309.768\text{nm}$

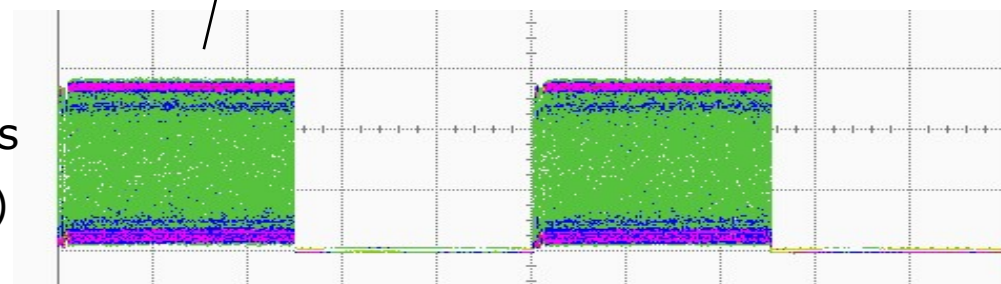
Example of SOA Gain Switch in Burst Mode

Applied pre-determined SOA current in BM and observed SOA output in BM.



ONU TRx: 10G-EPON (1270nm)

Burst Signals
(SOA Input)

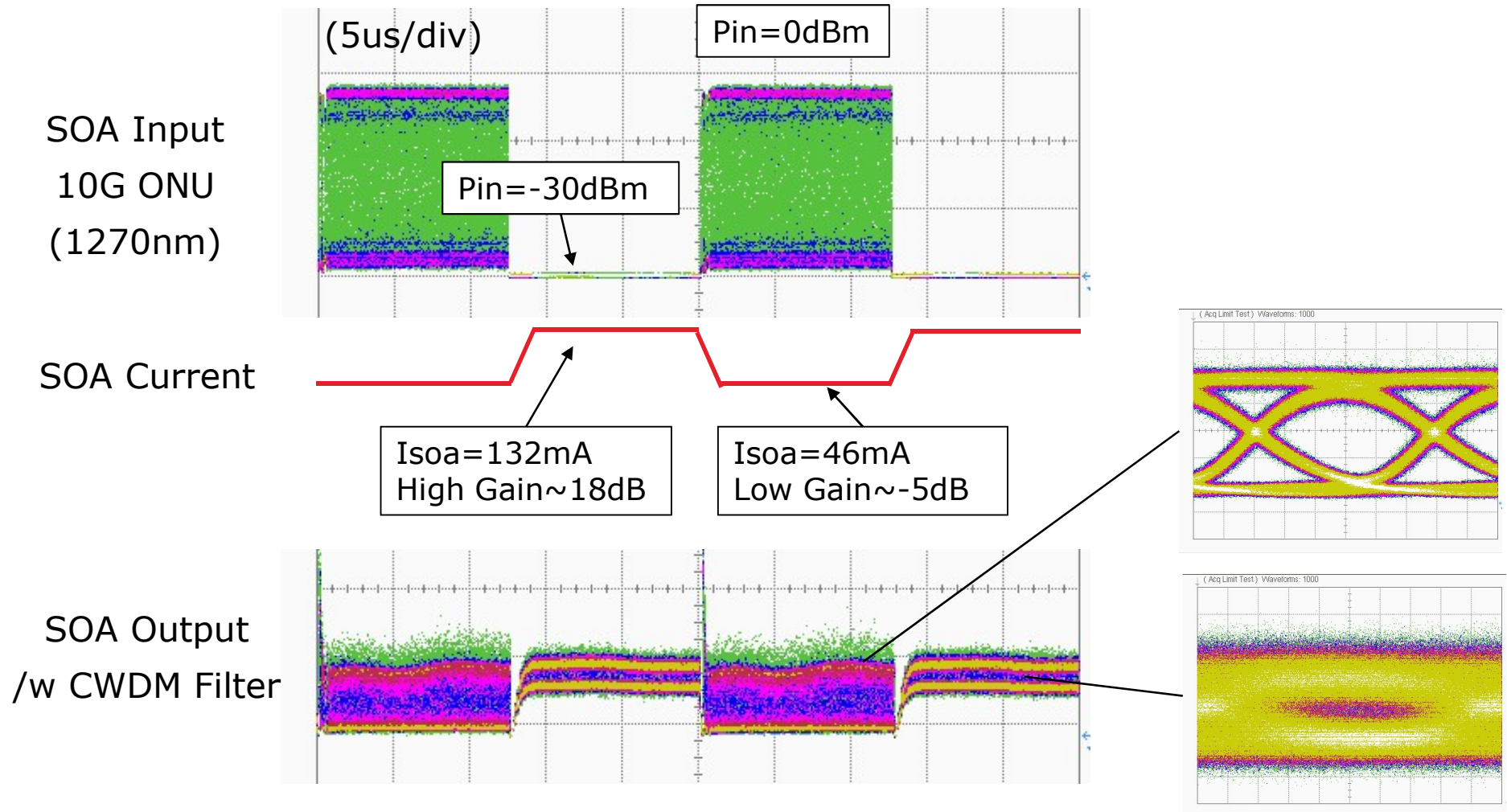


SOA Current



Example of SOA Gain Switch in Burst Mode

- SOA gain is changing in BM.



Summary

- Studied “SOA Gain Control” for Single Channel SOA at OLT.
- SOA gain switch itself would be possible.
- But “SOA Gain Control” is still challenging in BM. Need to detect the received power, determine and control the proper gain enough fast in burst mode.
- Additional Sync Time would be necessary.