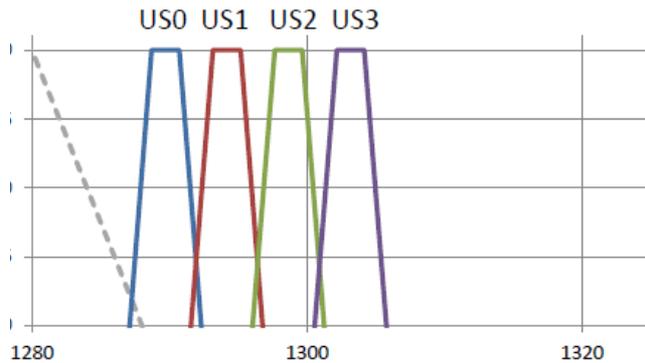


# Upstream wavelength plan comparison

- Ed Harstead
- March 2017

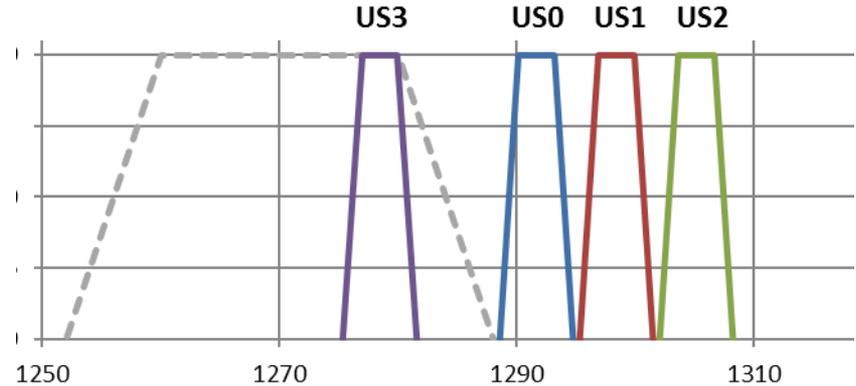
# WDM co-existence plans

Plan A guo\_3ca\_1\_0117



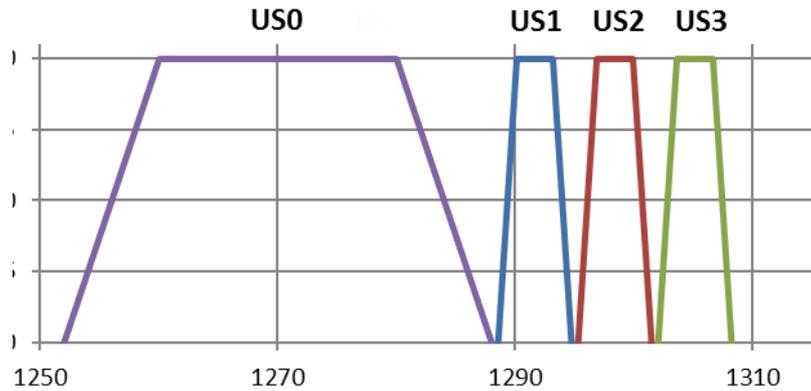
Convergence option #1 (guo\_3ca\_1\_0317)

- WDM co-existence for 25G & 50G.
- TDM co-existence for 100G.

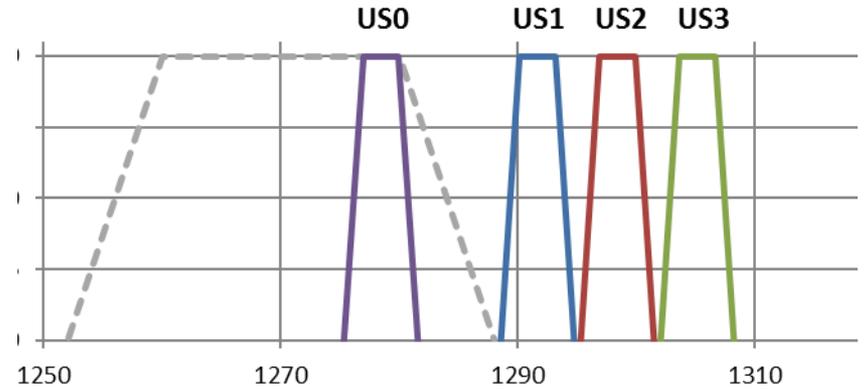


# TDM co-existence plans

Plan B harstead\_3ca\_1\_0117

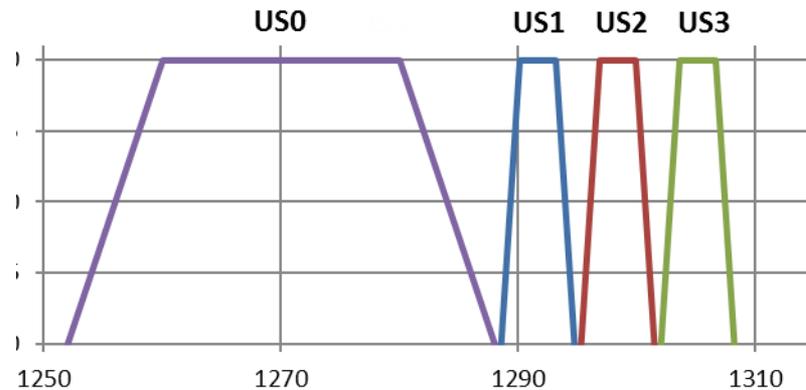


Convergence option #2 (guo\_3ca\_1\_0317)



# Compromise TDM/WDM plan

- 25G on US0: TDM co-existence
- 25G on US1:
  - WDM co-existence for 25G.
  - TDM co-existence for 50G & 100G.



(harstead\_3ca\_1\_0317)

# Comparison: all plans

Element	Co-existence 10G EPON:	Plan A guo_3ca_1_0117	Convergence option #1	Plan B harstead_3ca_1_0117	Convergence option #2	Compromise plan	
		WDM	WDM for 25G, 50G. TDM for 100G.	TDM	TDM	WDM for 25G. TDM for 50G, 100G. (1290 nm ONU)	TDM (1270 nm ONU)
25G power budget	Wider DS/US gap (about 12 nm): 0-0.2 dB advantage	no	no	yes	yes	no	no
25G power budget	To support 25/10 or 10/10 ONUs: One less filter in OLT (upstream): 0.5 dB advantage	no	no	yes	yes	no	yes
25/25 ONU	Potential use of uncooled DML: 33% optics cost savings	no	no	yes	no	no	yes
25G OLT	to support 10G upstream, additional 10G receiver and 1280/1290 nm filter	yes	yes	no	no	yes	no
25/50/100G OLTs	requires multi rate receiver (implementation risk?)	no	100G	25G, 50G, 100G	25G, 50G, 100G	50G, 100G	25G, 50G, 100G
100G ONU	Relaxed wavelength tolerance (3 nm vs. 2 nm): 25% transmitter cost savings	no	yes	yes	yes	yes	yes
100G OLT	1260-1280 receiver sensitivity (implementation risk?)	no	yes	yes	yes	yes	yes
Capacity	25G upstream capacity shared with 10G (1G)	no	100G	25G, 50G, 100G	25G, 50G, 100G	50G, 100G	25G, 50G, 100G
Operations	In PONs with no 25/10 ONUs, allow separate 10G OLT	yes	25G, 50G OLT	no	no	25G OLT	no
All	25G co-existence with GPON (US 1290-1330 nm). Improves the probability of a converged wavelength plan with ITU-T, driving higher volumes on common optics for lower costs	no	no	yes	yes	no	yes
Future	Leaves some or all of 1260-1280 nm for future use (when no 10G EPON co-existence requirement)	all	some	no	some	no	no

# Comparison WDM co-existence plans

Element	Co-existence 10G EPON:	Plan A guo_3ca_1_0117	Convergence option #1	Compromise plan
		WDM	WDM for 25G, 50G. TDM for 100G.	WDM for 25G. TDM for 50G, 100G. (1290 nm ONU)
25G power budget	Wider DS/US gap (about 12 nm): 0-0.2 dB advantage	no	no	no
25G power budget	To support 25/10 or 10/10 ONUs: One less filter in OLT (upstream): 0.5 dB advantage	no	no	no
25/25 ONU	Potential use of uncooled DML: 33% optics cost savings	no	no	no
25G OLT	to support 10G upstream, additional 10G receiver and 1280/1290 nm filter	yes	yes	yes
25/50/100G OLTs	requires multi rate receiver (implementation risk?)	no	100G	50G, 100G
100G ONU	Relaxed wavelength tolerance (3 nm vs. 2 nm): 25% transmitter cost savings	no	yes	yes
100G OLT	1260-1280 receiver sensitivity (implementation risk?)	no	yes	yes
Capacity	25G upstream capacity shared with 10G (1G)	no	100G	50G, 100G
Operations	In PONs with no 25/10 ONUs, allow separate 10G OLT	yes	25G, 50G OLT	25G OLT
All	25G co-existence with GPON (US 1290-1330 nm). Improves the probability of a converged wavelength plan with ITU-T, driving higher volumes on common optics for lower costs	no	no	no
Future	Leaves some or all of 1260-1280 nm for future use (when no 10G EPON co-existence requirement)	all	some	no

# Comparison TDM co-existence plans

Element		Plan B harstead_3ca_1_0117	Convergence option #2	Compromise plan
	Co-existence 10G EPON:	TDM	TDM	TDM (1270 nm ONU)
25G power budget	Wider DS/US gap (about 12 nm): 0-0.2 dB advantage	yes	yes	no
25G power budget	To support 25/10 or 10/10 ONUs: One less filter in OLT (upstream): 0.5 dB advantage	yes	yes	yes
25/25 ONU	Potential use of uncooled DML: 33% optics cost savings	yes	no	yes
25G OLT	to support 10G upstream, additional 10G receiver and 1280/1290 nm filter	no	no	no
25/50/100G OLTs	requires multi rate receiver (implementation risk?)	25G, 50G, 100G	25G, 50G, 100G	25G, 50G, 100G
100G ONU	Relaxed wavelength tolerance (3 nm vs. 2 nm): 25% transmitter cost savings	yes	yes	yes
100G OLT	1260-1280 receiver sensitivity (implementation risk?)	yes	yes	yes
Capacity	25G upstream capacity shared with 10G (1G)	25G, 50G, 100G	25G, 50G, 100G	25G, 50G, 100G
Operations	In PONs with no 25/10 ONUs, allow separate 10G OLT	no	no	no
All	25G co-existence with GPON (US 1290-1330 nm). Improves the probability of a converged wavelength plan with ITU-T, driving higher volumes on common optics for lower costs	yes	yes	yes
Future	Leaves some or all of 1260-1280 nm for future use (when no 10G EPON co-existence requirement)	no	some	no

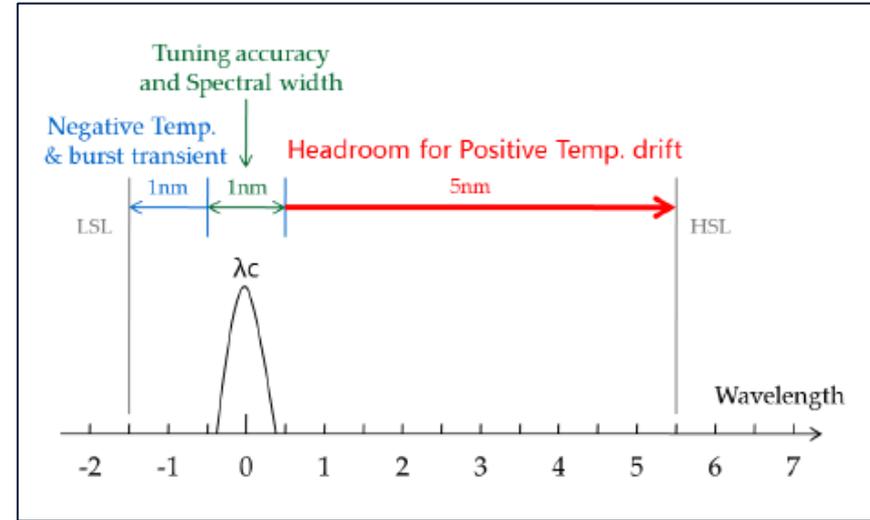
# Summary

- Upstream and downstream wavelength plans can be optimized separately
- Comparisons between (various) WDM co-existence and TDM co-existence upstream wavelength plans are presented
- The compromise TDM-WDM plan can support both the delineation of 10G/25G of WDM co-existence and the lower cost implementation of TDM co-existence.
- The compromise plan compares pretty favorably to pure WDM and pure TDM co-existence plans in each case

# USO wavelength tolerance: 7 nm

- Proposed in zhang\_3ca\_1\_0317 as a cost reduction: should be quantified
- It could apply to
  - Convergence option #1
  - Plan B
  - Convergence option #2
  - Compromise TDM/WDM plan
- Comparison:

Parameter	USO wavelength tolerance		
	2-3 nm	7 nm	20 nm
Uncooled DML?	No	No	possible
25G ONU laser cost	Highest	Medium	Lowest
SOA+PIN performance relative to 2-3 nm (approximate)		-0.5 dB	-1.5 dB



zhang\_3ca\_1\_0317

} bonk\_3ca\_1\_0117

**NOKIA**