

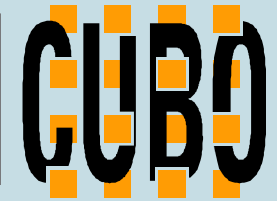
Compact Optical Multiplexers for LAN WDM

IEEE 802.3ba Task Force, Denver, July 2008

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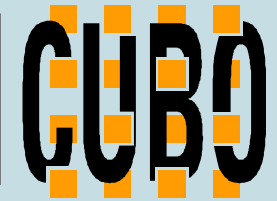
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Introduction




- This presentation is an update to the 100GE 10km SMF PMD Baseline Proposal as adopted in the May 802.3ba meeting
- The purpose of presentation is to demonstrate the feasibility of compact optical LAN WDM mux/demux as proposed to the task force in March

LAN WDM Proposed Specification Outline

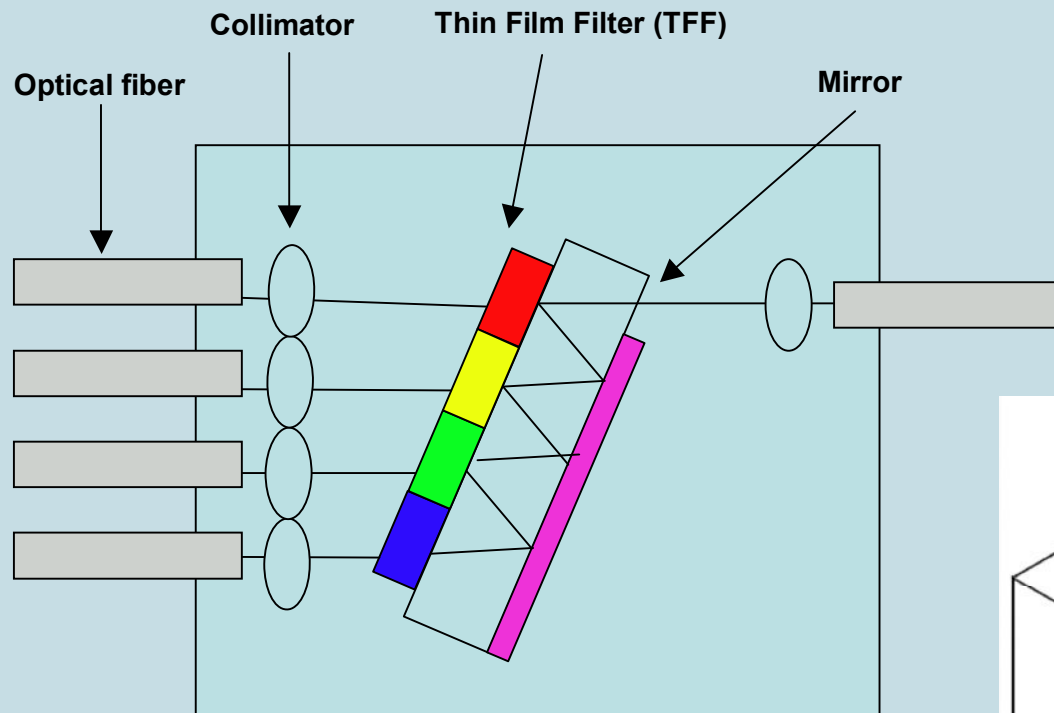


LAN WDM mux/demux as proposed to IEEE in March:
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Thin Film (TFF) Zig-Zag Mux/DeMux	LAN WDM $\geq 800\text{GHz}$
Insertion Loss Max	1.5 dB (0.9 dB typical)
Adjacent channel Isolation	30 dB
Non-adjacent channel Isolation	40 dB
Operating Temperature	-40°C to +85°C
Size: Mux	11 x 13 x 6.5 mm ³
Size: Mux/DeMux	13 x 13 x 9 mm ³
Reliability	Telcordia 1221
Cost	
Availability	Q2, 2008

Fundamental considerations on setup

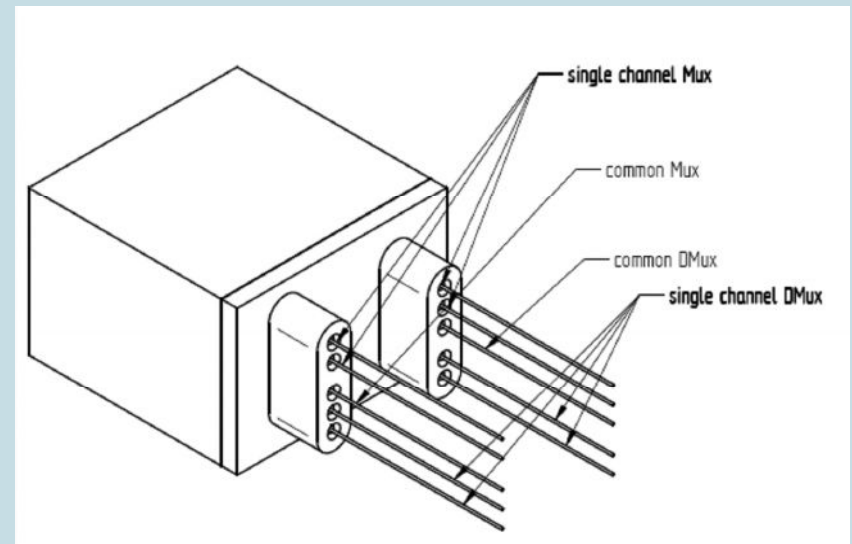
Compact Thin Filter Filter multiplexers are best realized in a direct bounce “zig-zag” optical setup.



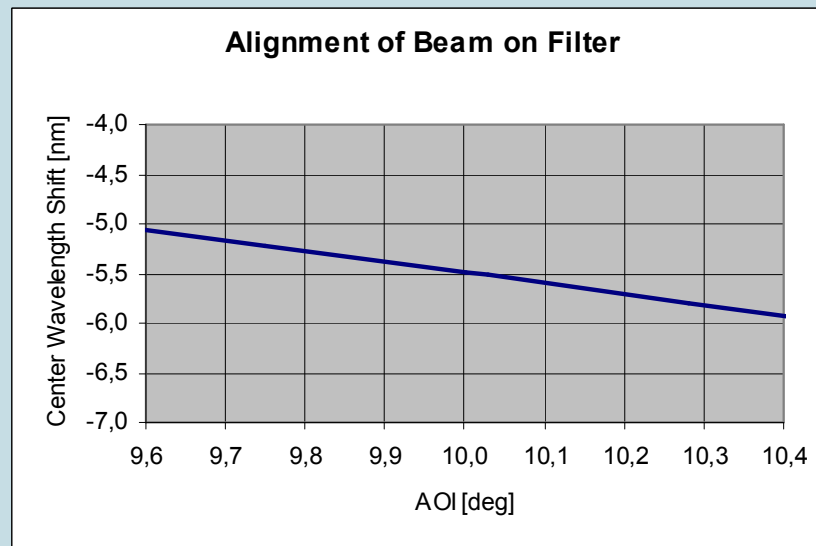
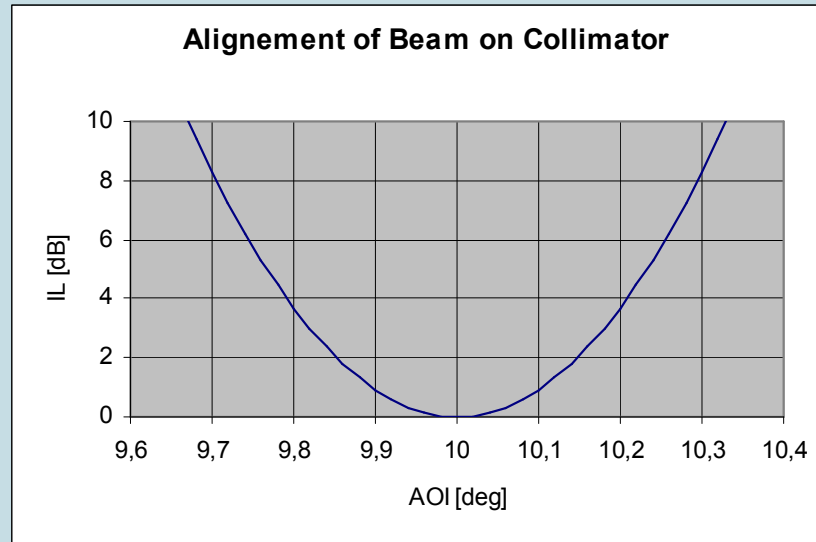
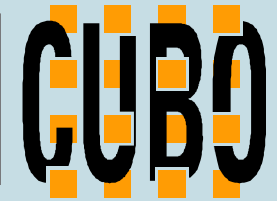
Typical dimensions of combined mux+demux: 13x13x9mm

Angle of Incidence (AOI):

- Fundamental for size of multiplexer (lateral spacing needs to be bridged)
- Typical values: 10-14°

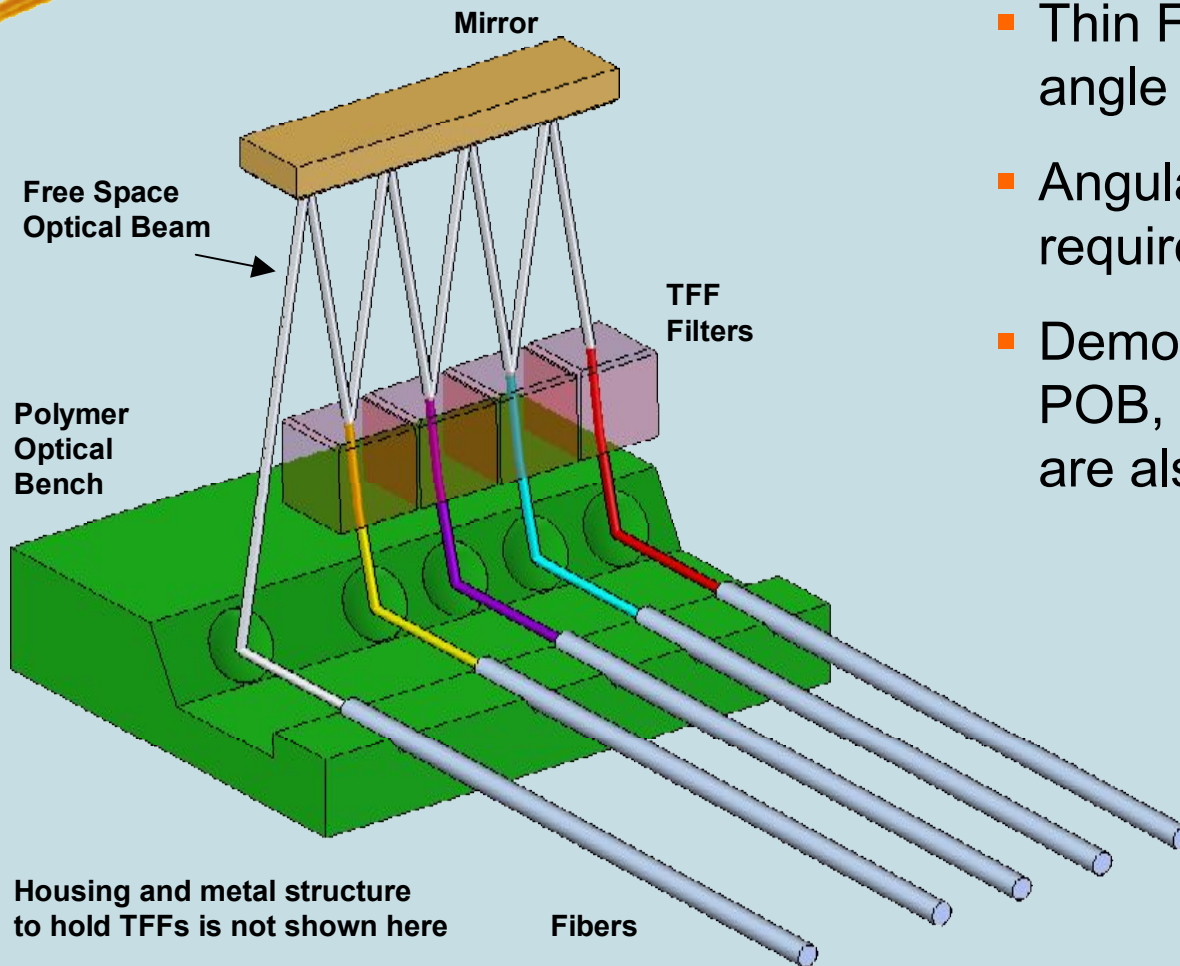
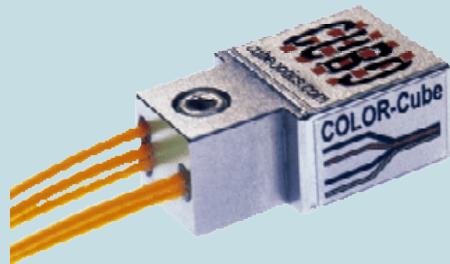
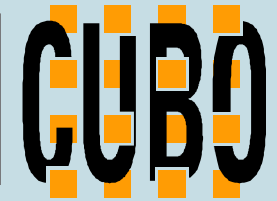


Considerations on angular tolerances



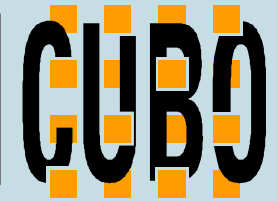
- In optical “zig-zag” setup respective angular alignment of filters and collimators is of critical importance.
- Typical an accuracy of $\pm 0.03^\circ$ needs to be achieved for low insertion loss.
- Sensitivity of filter center wavelength is much lower, e.g. $\pm 0.03^\circ$ leads to wavelength shift of < 0.05 nm
- Necessary angular tolerance is determined by insertion loss (not filter center wavelength)

Optical LAN WDM Mux/Demux: Setup

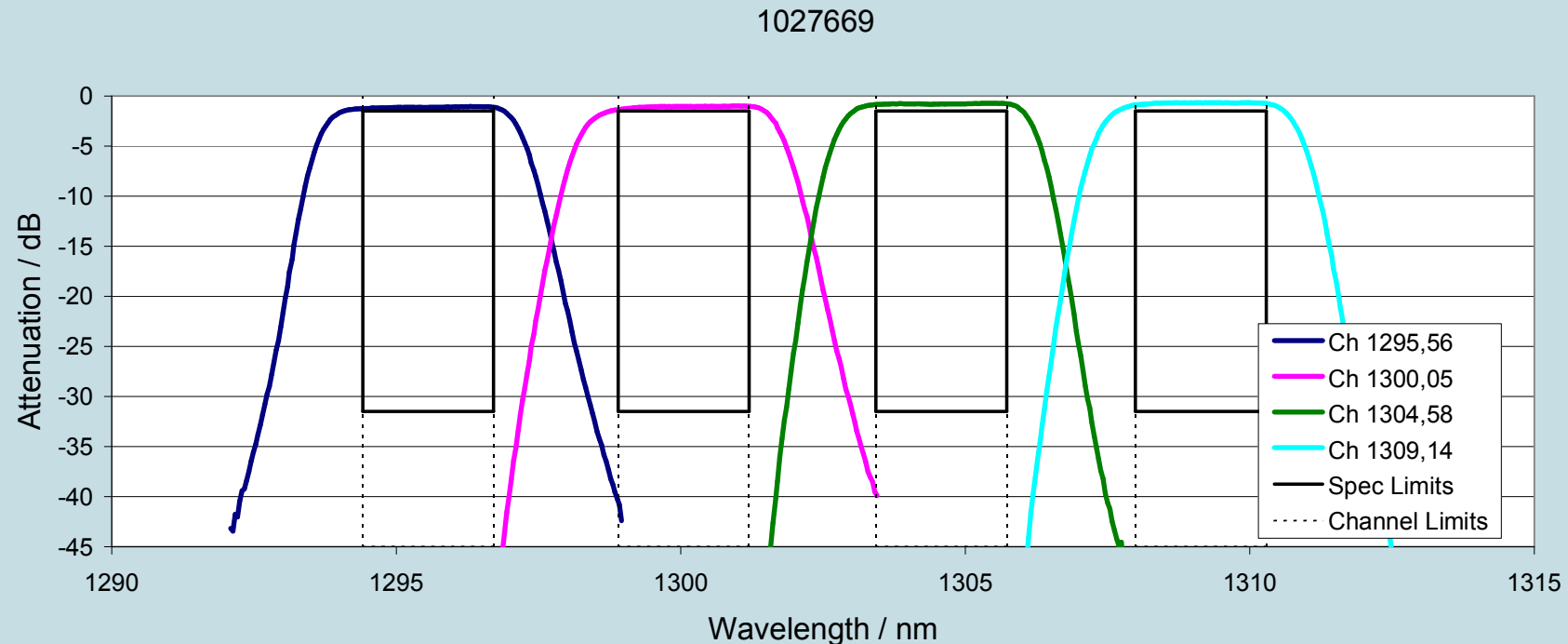


- Setup in Polymer Optical Bench (POB) technology
- Thin Film Filters with incident angle of 10°
- Angular tolerances are kept to requirements $\pm 0.03^\circ$
- Demonstration is not specific to POB, other multi-bounce setups are also applicable

Optical LAN WDM Mux/Demux: Passband



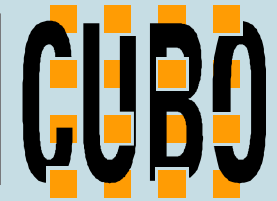
LAN WDM, 4 Channel, July 2008



Passband width set to 2.3nm around nominal center wavelength
1295.56, 1300.05, 1304.58, 1309.14nm

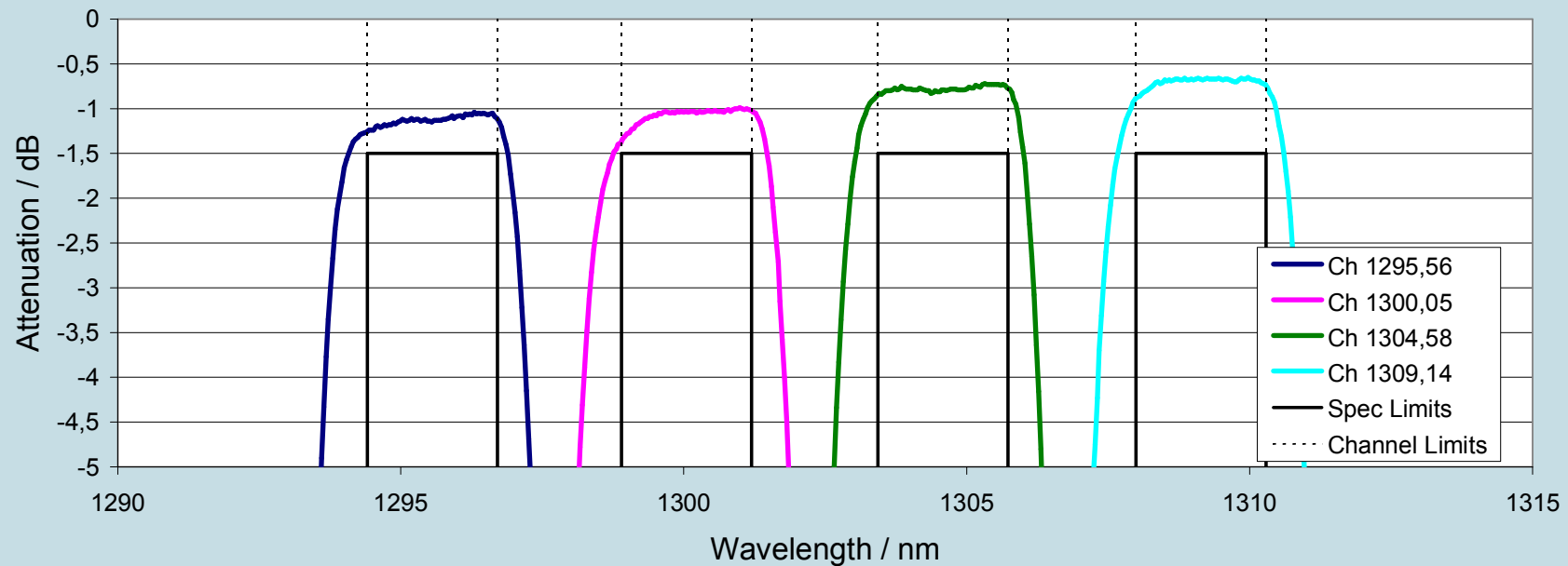
Assumed limits for passband width, insertion loss and isolation are shown by black rectangles

Optical LAN WDM Mux/Demux: Insertion Loss



LAN WDM, 4 Channel, July 2008

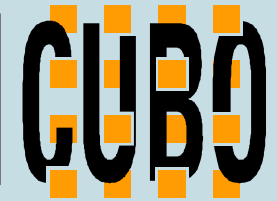
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Wavelength [nm]	1295.56	1300.05	1304.58	1309.14
Insertion Loss at 25°C [dB]	-1.26	-1.37	-0.87	-0.91
Insertion Loss (0°...70°C) [dB]	-1.38	-1.48	-0.90	-0.91

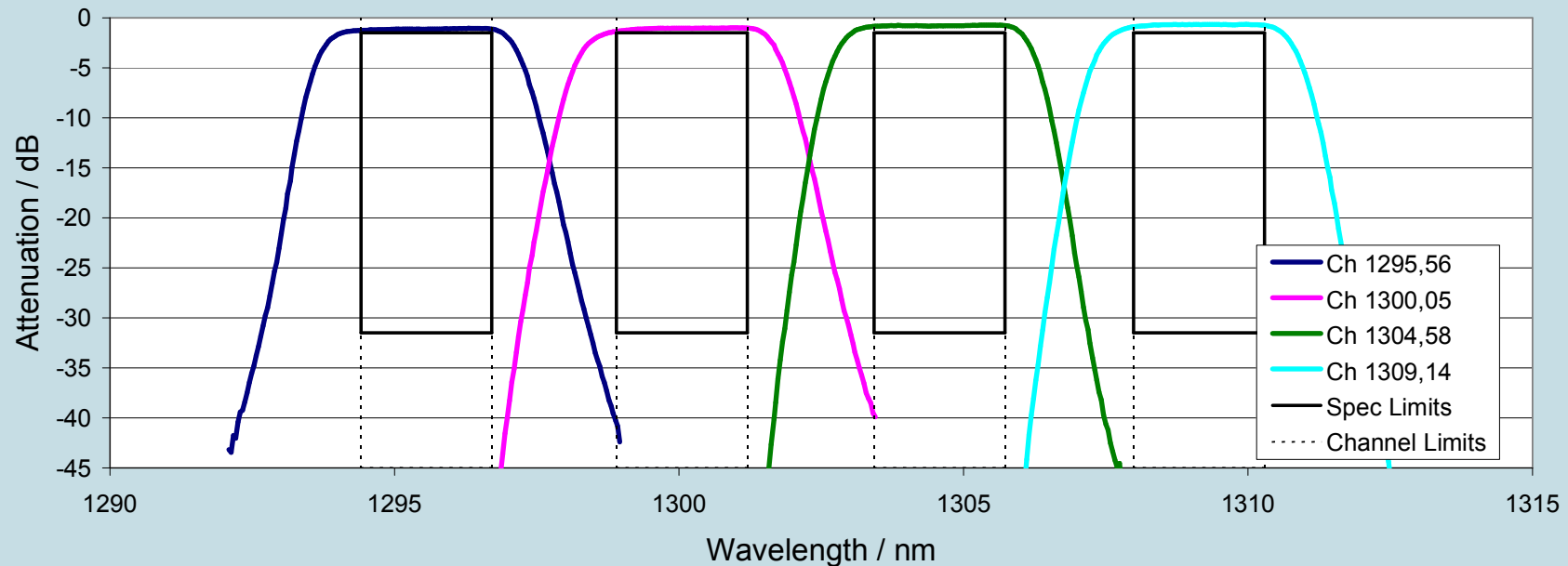
Meets target insertion loss < 1.5 dB

Optical LAN WDM Mux/Demux: Isolation



LAN WDM, 4 Channel, July 2008

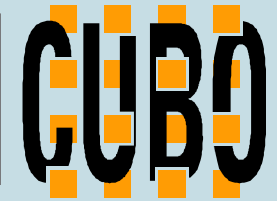
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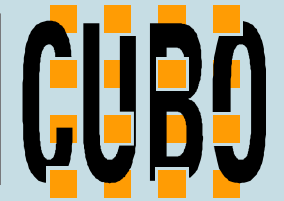
Wavelength [nm]	1295.56	1300.05	1304.58	1309.14
Isolation [dB]	39	38	>50	>50

Meets target isolation > 30 dB (adjacent channel)

Conclusion



- Specification values for LAN WDM mux/demux as proposed in March have been validated
- Direct-bounce 'zig-zag' optical setup is a viable approach.
- Close angular tolerances need to be kept to achieve low insertion loss.
- Difficulty is similar to CWDM filters being manufactured today and similar cost/yield is expected.
- Further investigations are necessary to define the best possible tradeoff between passband width, insertion loss and isolation.



Thank you!

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