Cyclical AWG for Super-PON System

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Shijia Photons Technology

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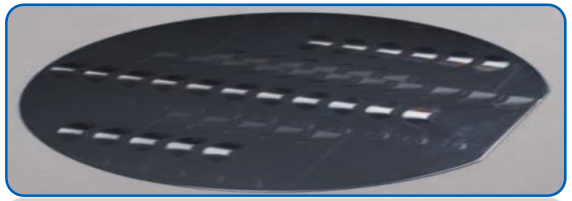
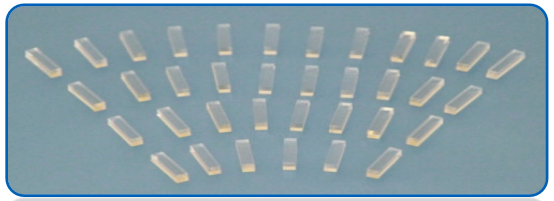
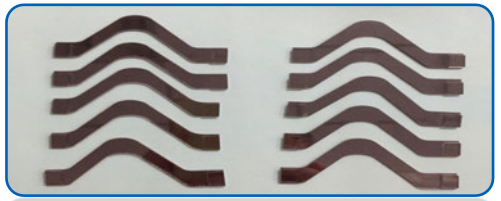




OUTLINE

1、Shijia Photons introduction

2、Cyclical AWG design

3、SiO_2/Si cyclic AWG fabrication

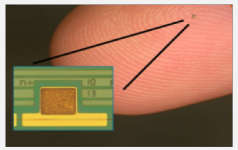
4、Conclusion

- Founded in 2010, 1500 employees, including 28 PhD
- 5,000 Si/Silica wafers, 900,000 PLC chips & 50,000 packages monthly
- AWG MUX/deMUX devices, FTTH modules, and 4x25Gb/s TOSA & ROSA packages
- Fabrication facilities, R/D & business centers in Hebi, Wuhan, Shenzhen, Wuxi and Silicon Valley

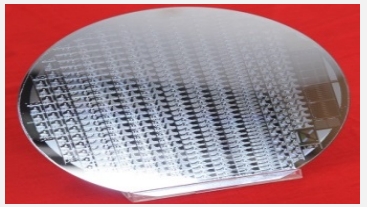
Wafers, Chips & Modules

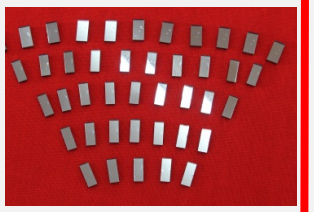
passive→active→optoelectronic integrated

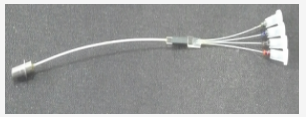
DFB LD chip/OSA



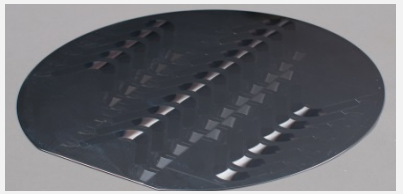
mini AWG

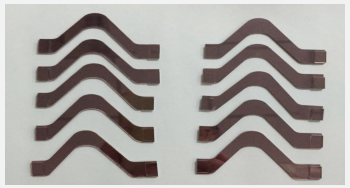




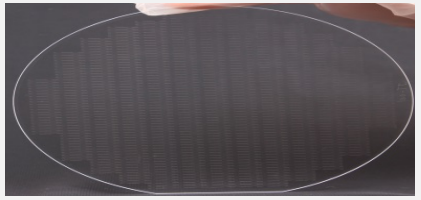


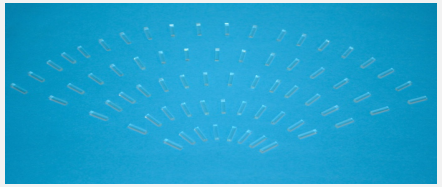
PLC AWG

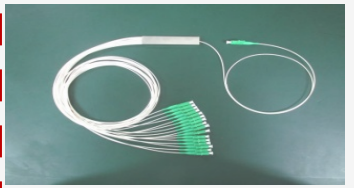




PLC SPLITTER







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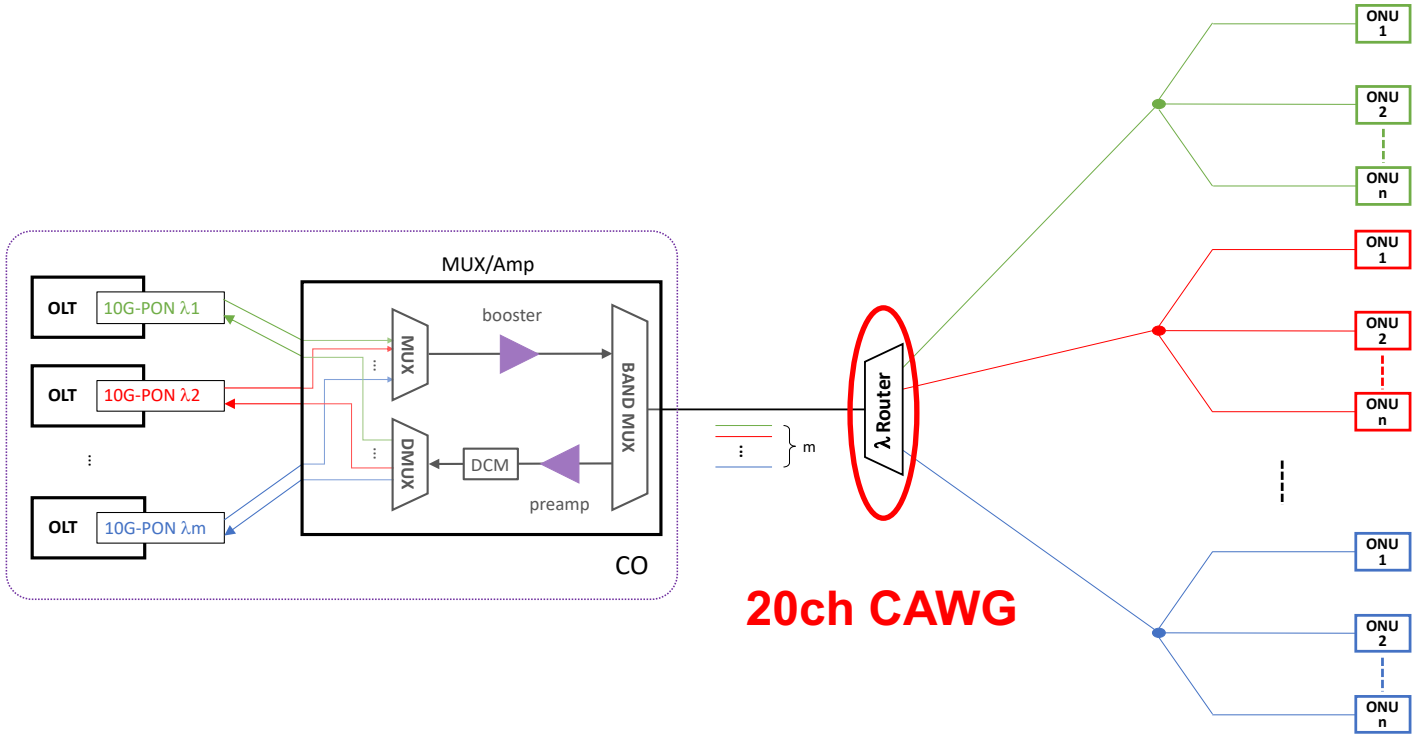
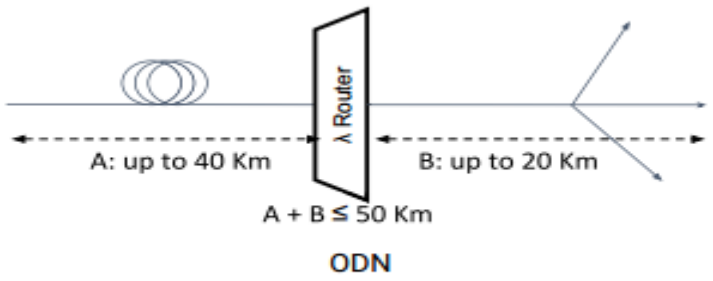
Super-PON System



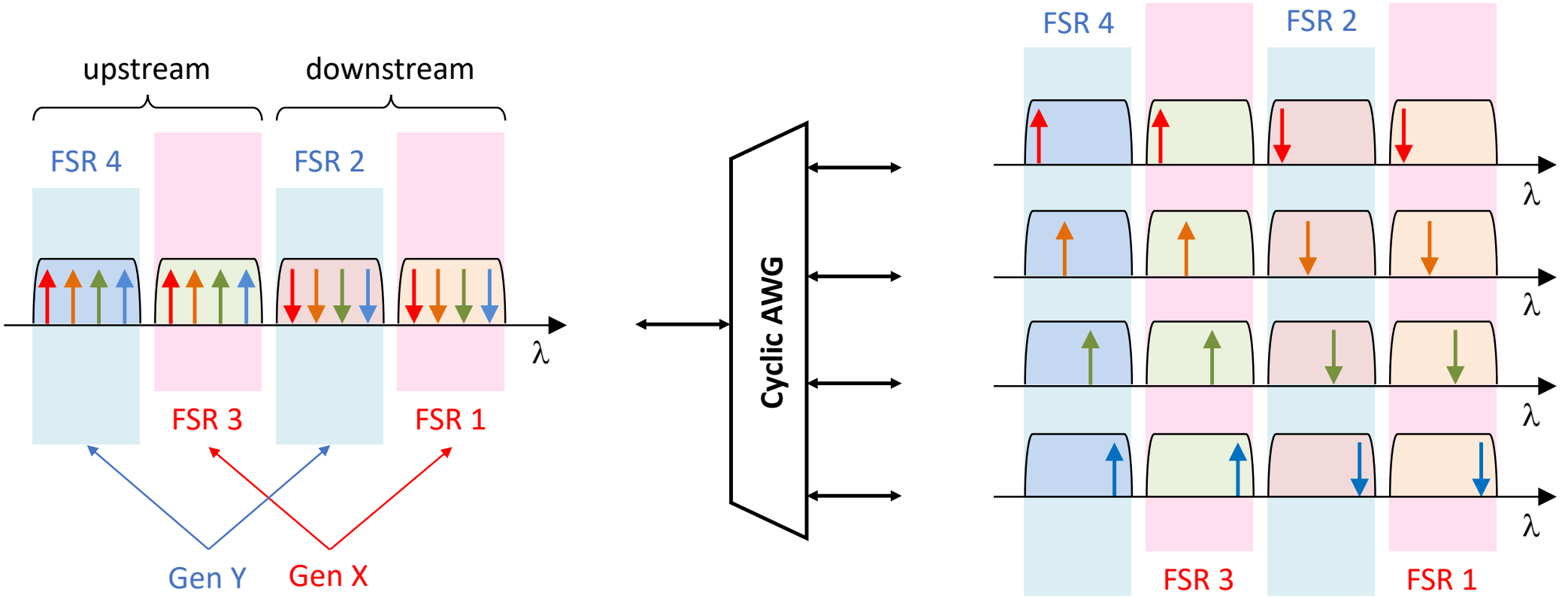
20ch CAWG



λ Router IL =6.6dB

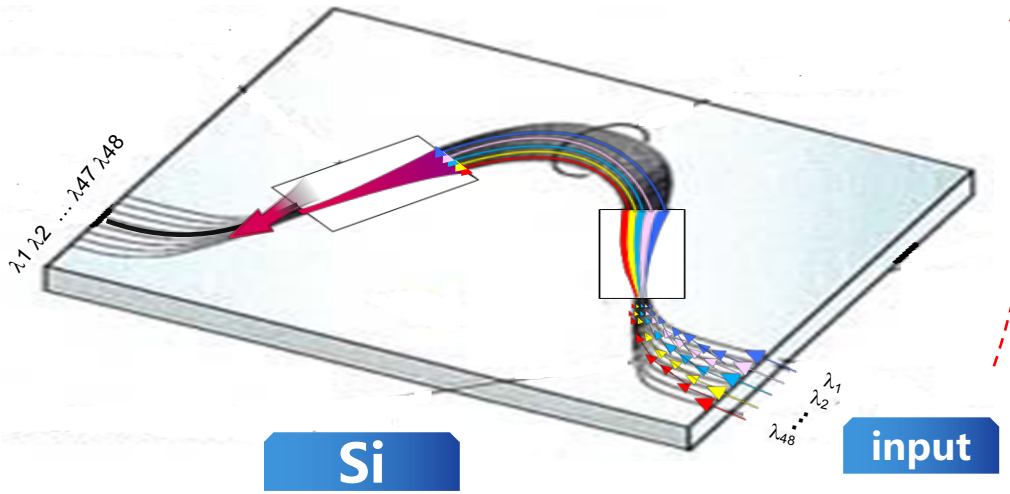
Loss budget (Worst case)		
Components	Loss Max (dB)	Comment
50km Fiber	12	0.24dB/km
λ Router	6.6	4 to 6.6
1x64	21.5	
Total	40.1	

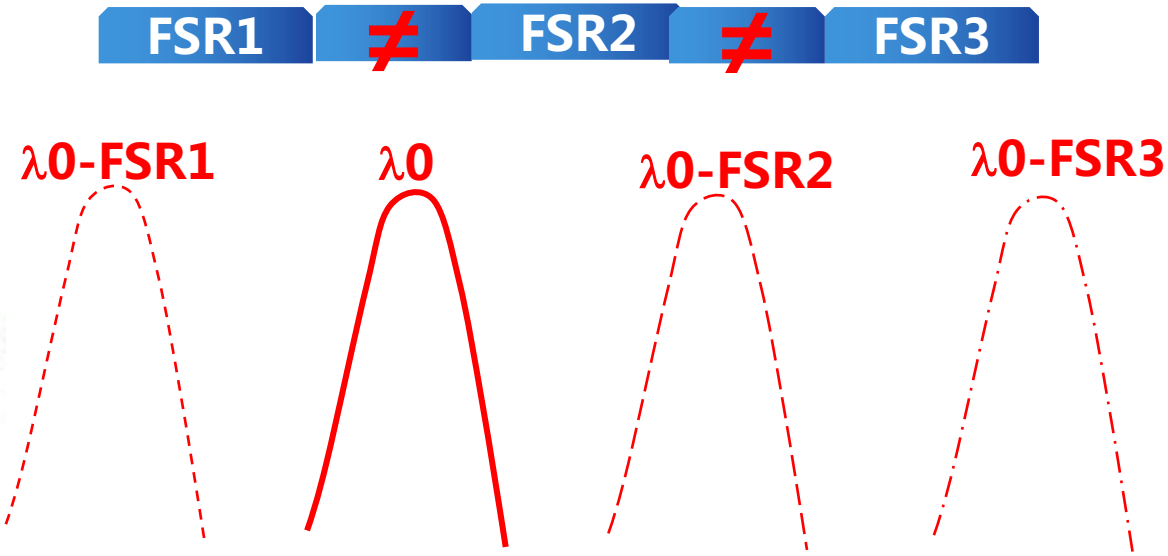
Super-PON: CAWG



4 FSRs, 20 channels in each one

CAWG Operation





FSR: Free spectral range

CWL AWG Solutions

Cyc2 can have 100GHz frequency space, but FSR of other cycles is 0.172nm, 0.175nm, and 0.18nm

$$FSR = \frac{\lambda_0}{m}\frac{n_c}{n_g}$$

According to silica/silicon index difference 0.75%, AWG FSR equation, the m of cyc1-cyc4 are 87/86/85/84

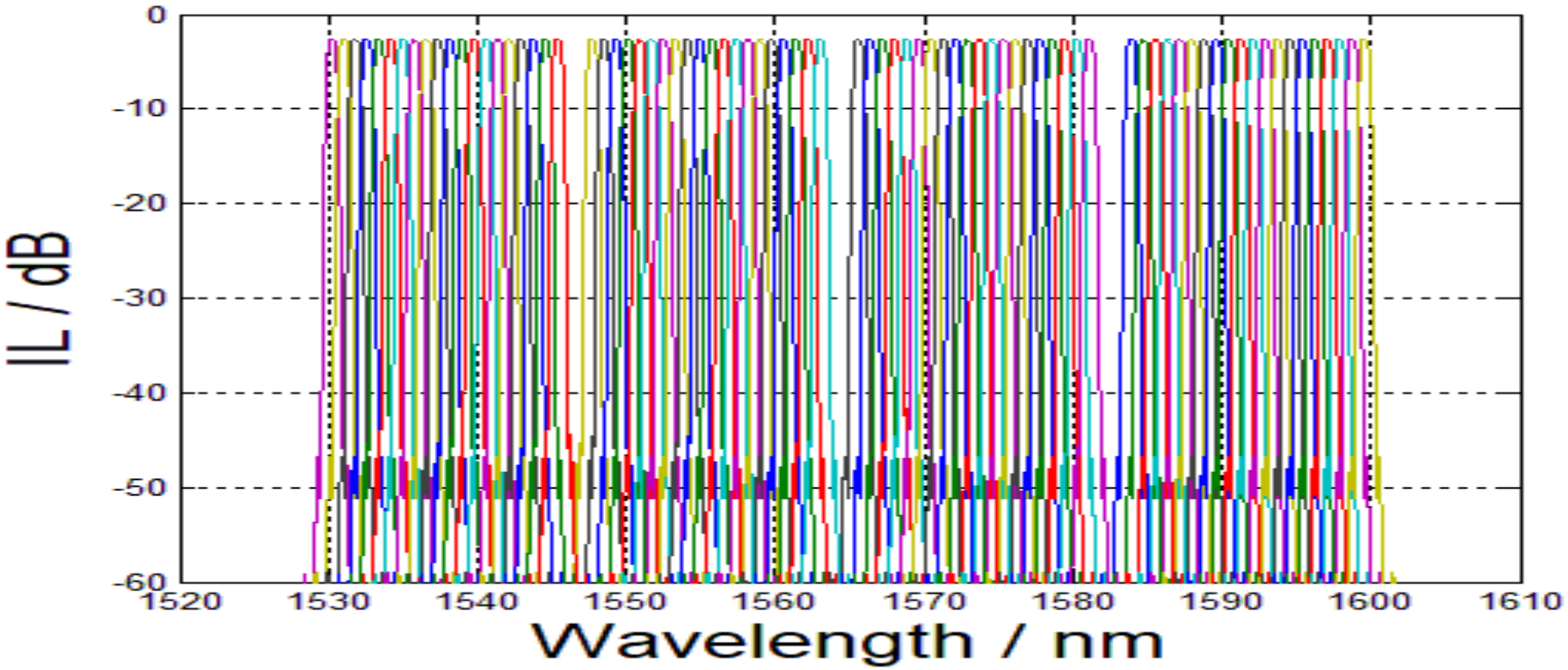
$$n_g = n_c - \lambda\frac{dn_c}{d\lambda}$$

		0.172	0.175	0.180			
	15.16	15.332	15.507	15.687			
		等频率间隔					
	cyc1	cyc2	cyc3	cyc4	FSR1	FSR2	FSR3
ch1	1545.393	1563.047	1581.109	1599.594	17.654	18.062	18.485
Ch10	1538.175	1555.747	1573.725	1592.123	17.572	17.978	18.398
ch20	1530.233	1547.715	1565.602	1583.907	17.482	17.887	18.305

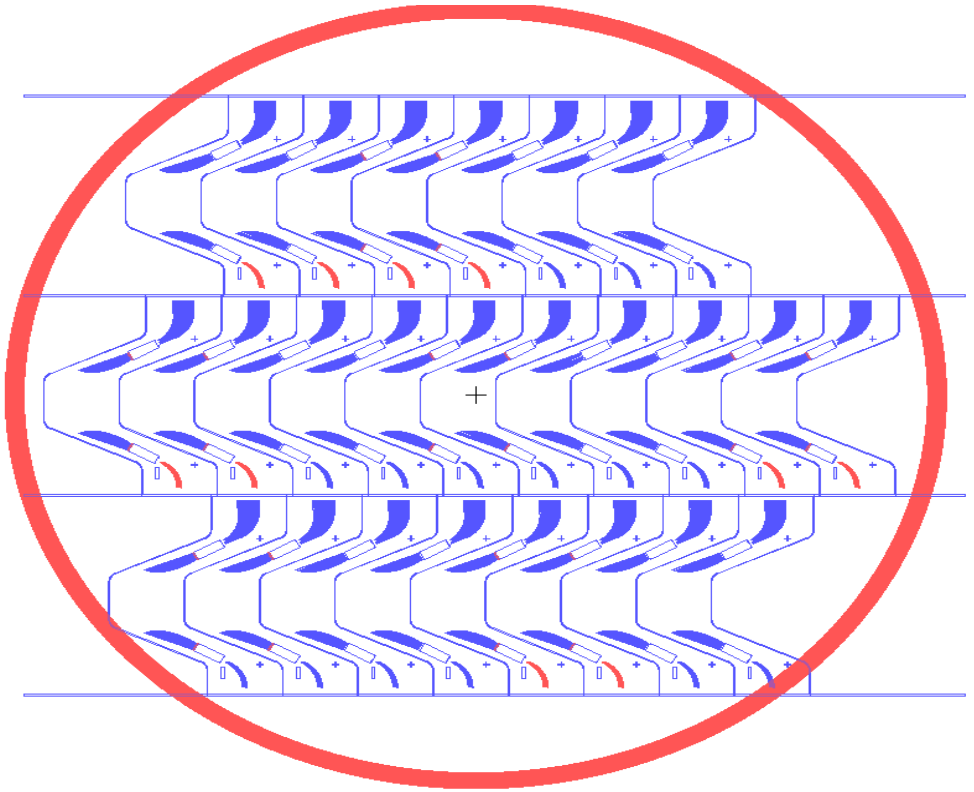
Ch1		191.8	1563.047
Ch2		191.9	1562.233
Ch3		192	1561.419
Ch4		192.1	1560.606
Ch5		192.2	1559.794
Ch6		192.3	1558.983
Ch7		192.4	1558.173
Ch8		192.5	1557.363
Ch9		192.6	1556.555
Ch10		192.7	1555.747
Ch11		192.8	1554.940
Ch12		192.9	1554.134
Ch13		193	1553.329
Ch14		193.1	1552.524
Ch15		193.2	1551.721
Ch16		193.3	1550.918
Ch17		193.4	1550.116
Ch18		193.5	1549.315
Ch19		193.6	1548.515
Ch20		193.7	1547.715

AWG FSR and central wavelength can be adjusted by adjusting ng and nc

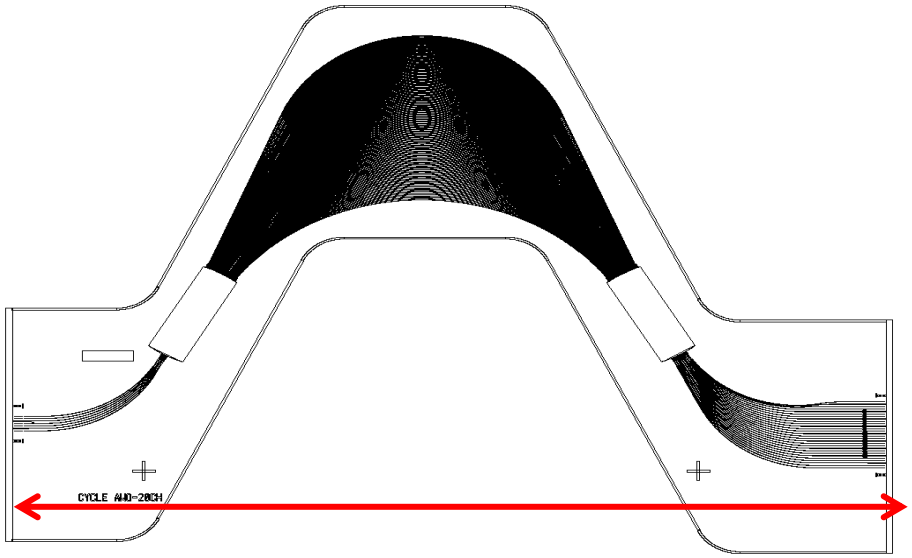
Simulation spectra



20ch Cyclic AWG layout



Cycle AWG wafer



Cycle AWG chip

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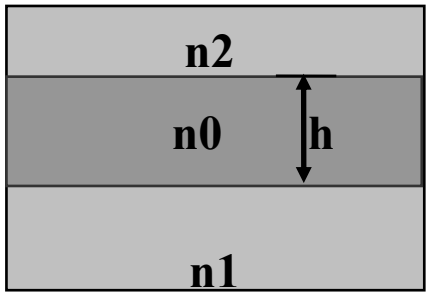
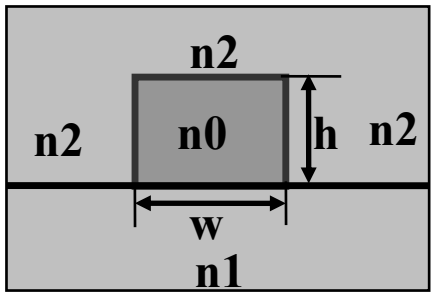
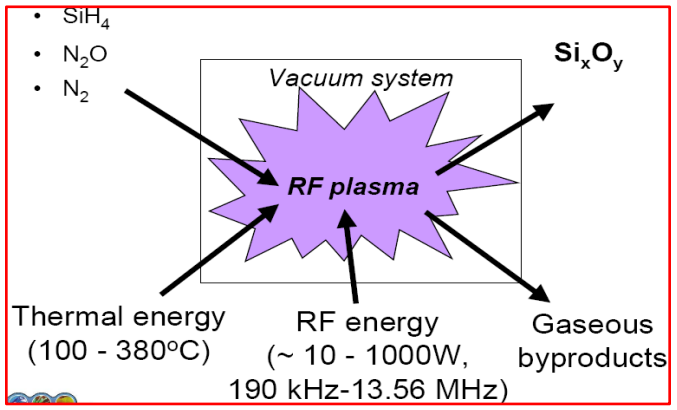
0.75% SiO_2/Si waveguide process



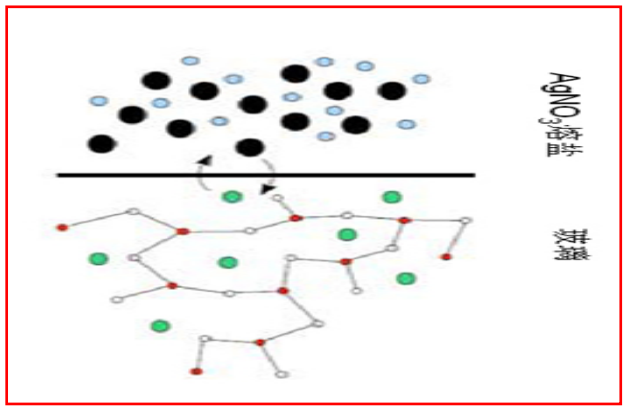
Slab waveguide



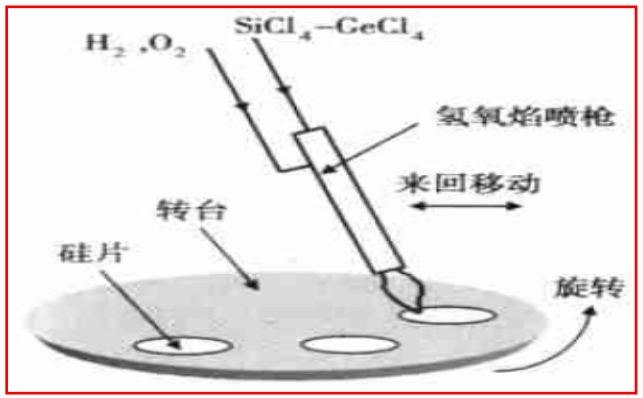
strip waveguide



PECVD + ICP

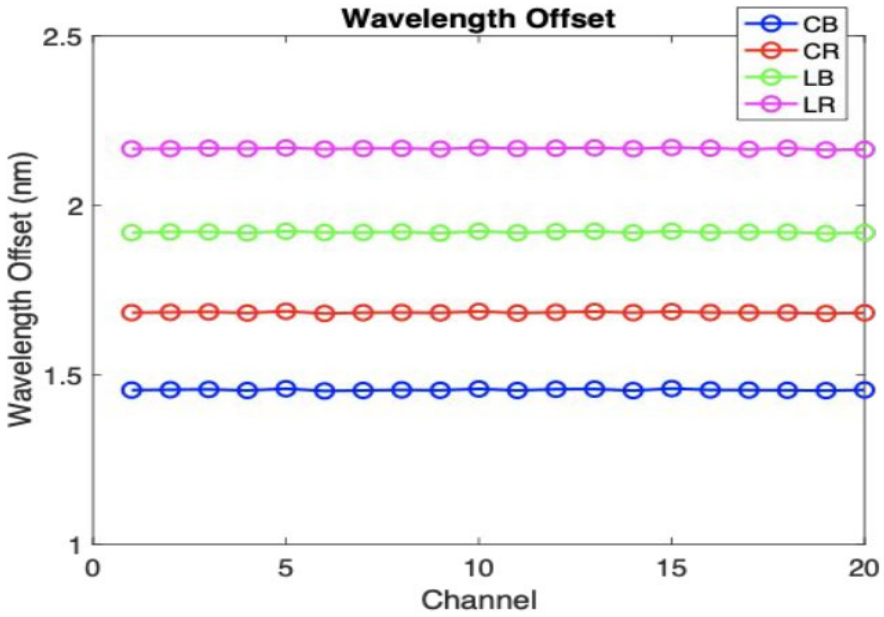


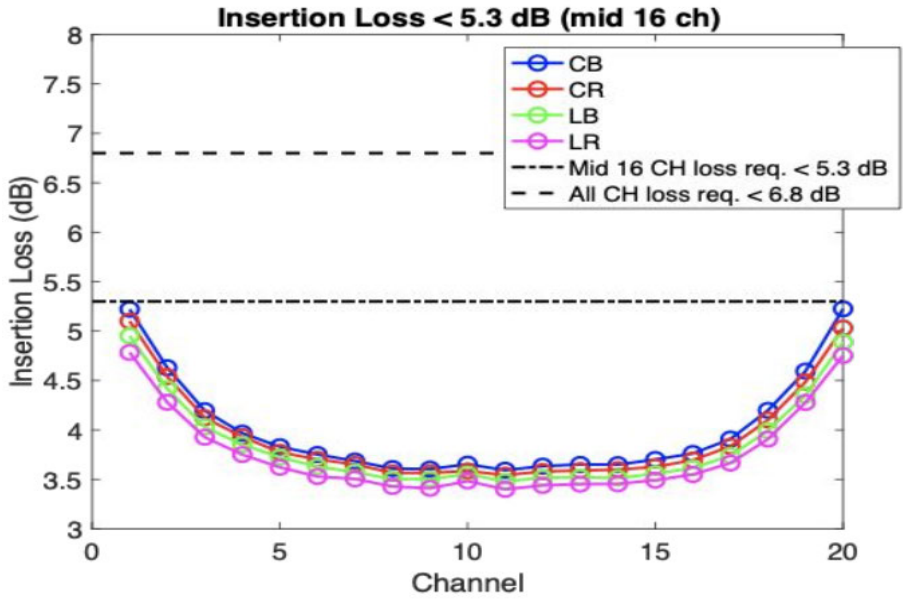
ion exchange



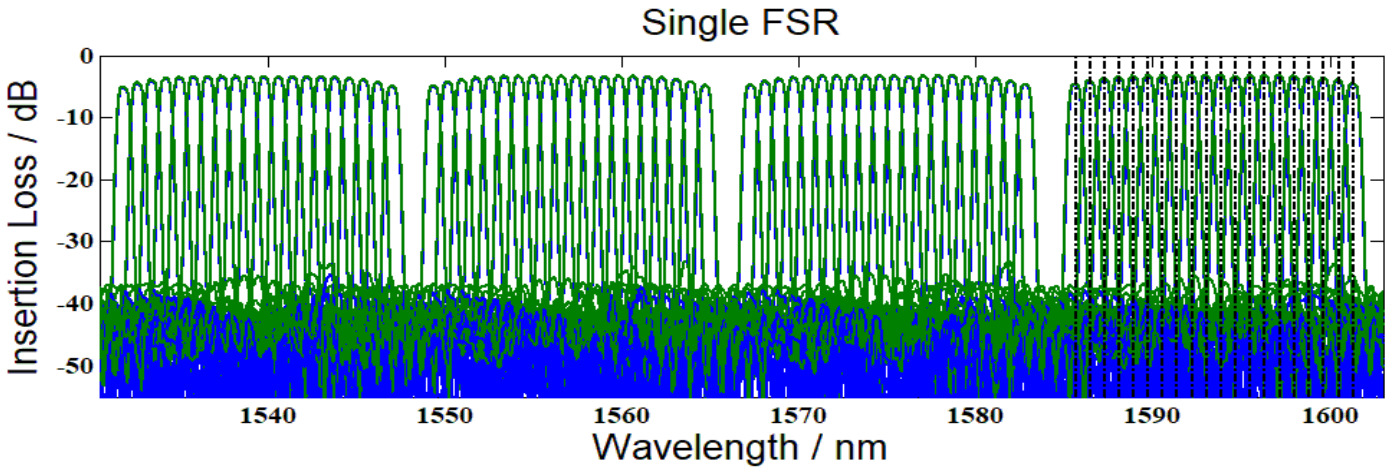
FHD + ICP

Chip test spectra

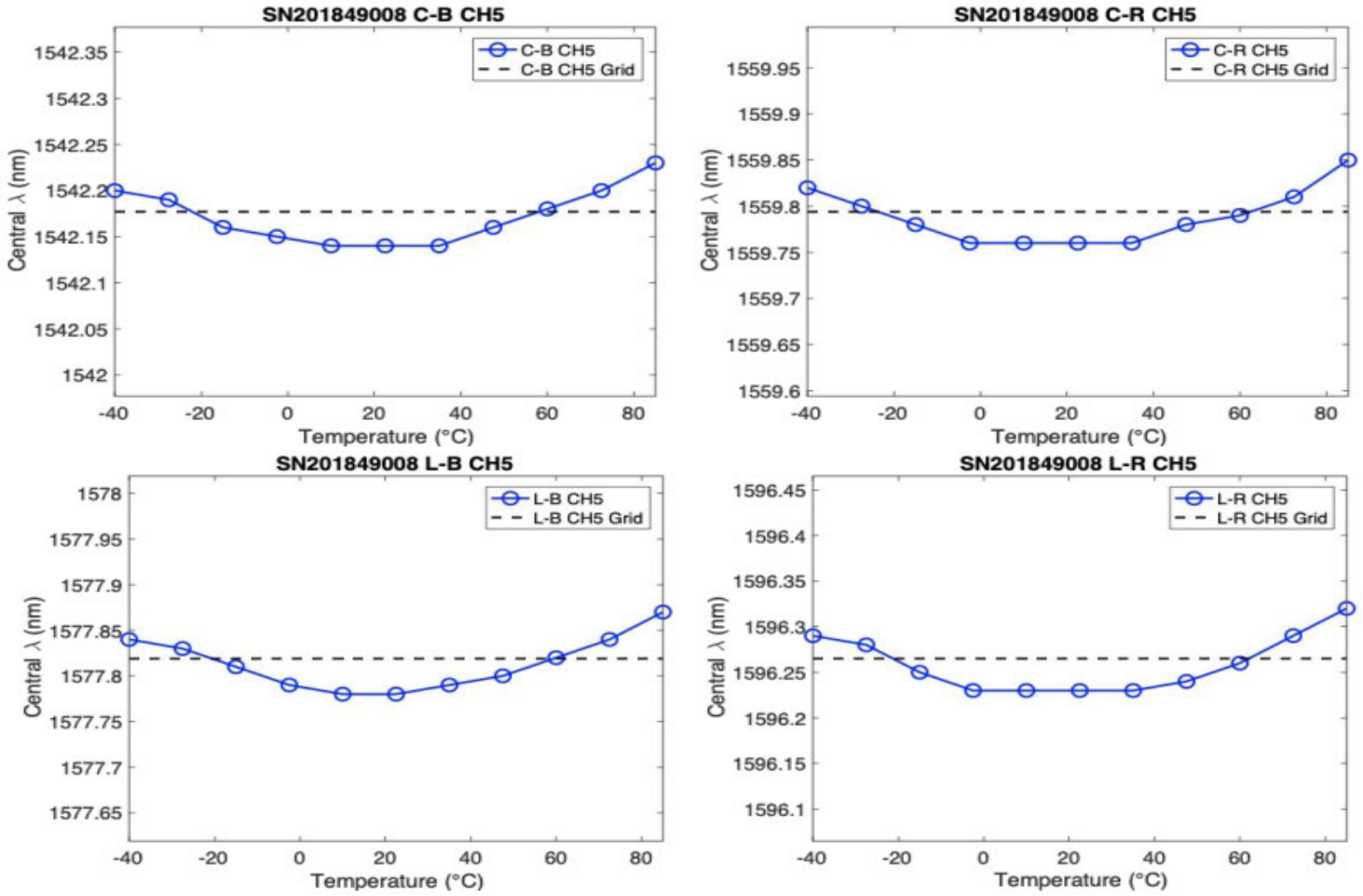




20ch IL= 3.5dB-5.3dB



Athermal AWG



Channel 5th wavelength accuracy: ±50pm(-40 - 85 ^{0}C)

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Conclusion

1、The wavelengths of a cyclic AWG can be adjusted by tuning the AWG layout parameters

2、A cyclic AWG with 4 FSRs is feasible using PECVD + ICP process

3、A cyclic AWG can be made athermal

Thanks