

# 25G/50G/100G EPON wavelength plan B

Ed Harstead, member Fixed Networks CTO  
Dora van Veen, Vincent Houtsma, Bell Labs

## **Supporters:**

Shawn Esser, Finisar  
Dekun Liu, Huawei  
Naoki Suzuki, Mitsubishi

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**Straw Poll # 1**

The 802.3ca standard shall specify wavelengths for 25G, 50G, and 100G systems in O-Band.

Yes: 15

No: 0

Not enough information: 9

Those voting “Not enough information” in Straw Poll #1 suggested the following information is needed to make a decision.

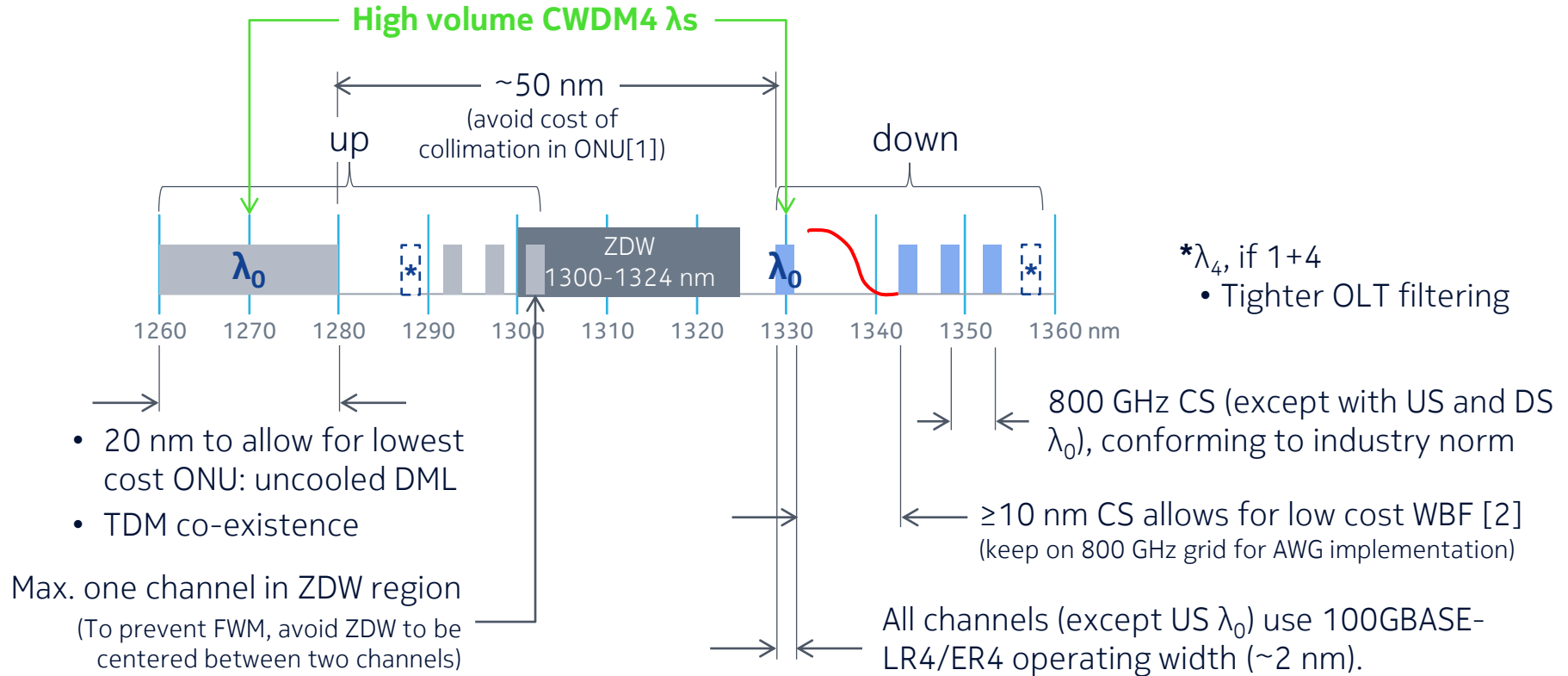
- 1) Exact (detailed) wavelength plan including support for coexistence (TDM or WDM).
- 2) Full cost comparison between all O-Band and other solutions.
- 3) More consensus in presentations.
- 4) Dispersion compensation analysis of all solutions.
- 5) Full power budget for full 100G system (including mux losses) and what is needed to close the gap.

## Wavelength Plan Inventory as of 7/27/16

	A	B	C	D	E	F	G
<b>ds0</b>	O	O	O	S/C/L	O	O	
<b>ds1</b>	O	O	S/C/L	S/C/L	S/C/L	L	
<b>ds2</b>	O	O	S/C/L	S/C/L	S/C/L	L	
<b>ds3</b>	O	O	S/C/L	S/C/L	S/C/L	L	
<b>ds4</b>	none	O or none	S/C/L or none	none	none	L	
<b>us0</b>	O	O	O	O	O	O	
<b>us1</b>	O	O	S/C/L	O	O	C	
<b>us2</b>	O	O	S/C/L	O	O	C	
<b>us3</b>	O	O	S/C/L	O	O	C	
<b>us4</b>	none	O or none	S/C/L or none	none	none	C	
<b>author</b>	JJ+FE+YG #1	EH #1	EH#2	JJ	DL	ED	

[kramer\\_3ca\\_5\\_0716.pdf](#)

# Plan B: All wavelengths in the O-band, but accommodating a low cost 25G EPON



[1] funada\_3ca\_1\_0316 (>35 nm), liu\_3ca\_2\_0516 (>40 nm)

[2] liu\_3ca\_3\_0716, harstead\_3ca\_1a\_0716

[3] he\_3ca\_1a\_0716.pdf, harstead\_3ca\_1a\_0716

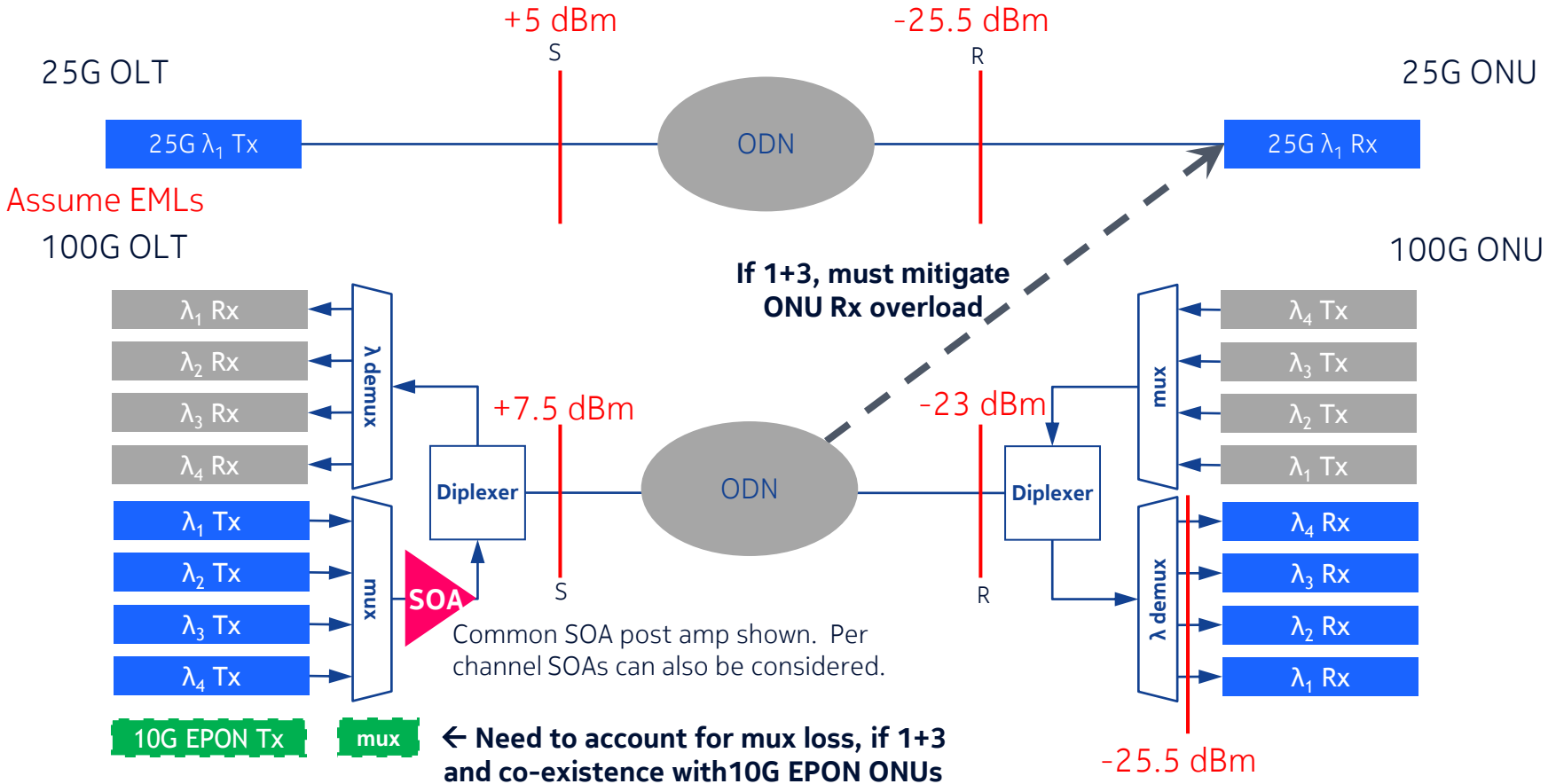
Power budget

# Assumptions

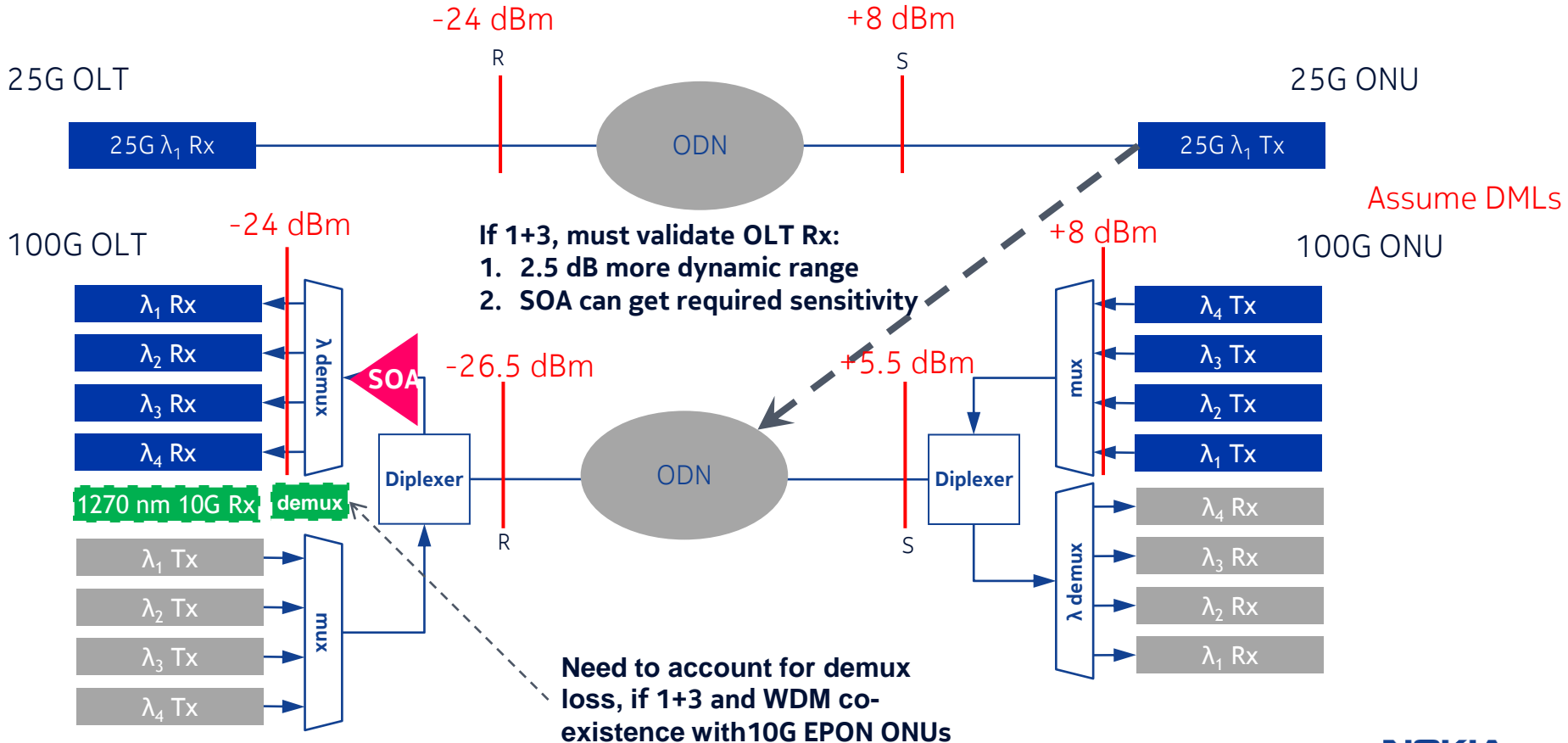
- 100G mux and demux nominally add ~2.5 dB insertion loss each.
- A cost-optimized 100G EPON puts all optical amplification in the OLT
- Downstream TDP = 1.5 dB, upstream TDP = 3 dB (same as 10G EPON, but to be confirmed)
- PR30 loss budget
- There will be 1 dB FEC coding improvement in the downstream relative to 10G EPON (to be confirmed)
- 1 dB improvement in PR30 APD receiver performance vs. 10G EPON + 5 dB penalty for 25G (per NeoPhotonics yield analysis, in [harstead 3ca 1a 0516.pdf](#).)
- Launch power values from [harstead 3ca 2a 0716.pdf](#)

	AVP <sub>min</sub> (dBm)	ER (dB)
EML	5	8
cooled DML	8	6

# Downstream optical levels (per harstead\_3ca\_1\_0916).



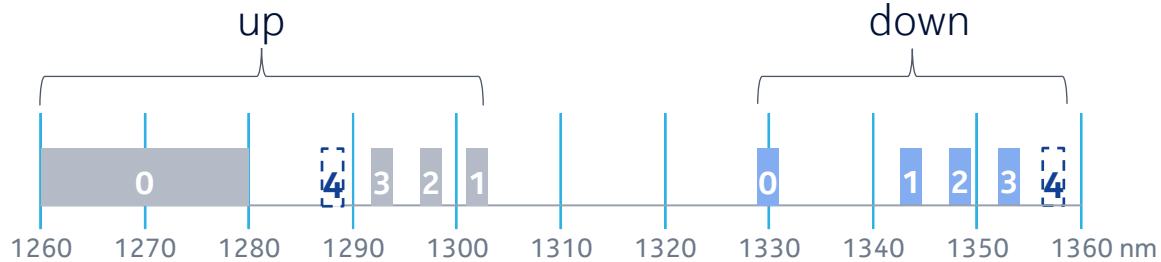
# Upstream optical levels (per harstead\_3ca\_1\_0916).





Center frequencies/wavelengths

# Plan B: Center frequencies/wavelengths



Wavelength (nm)	Frequency (THz)	1+3 Plan	1+4 Plan
1260-1280		US 0	US 0
1288.32	232.7		US 4
1292.77	231.9	US 3	US 3
1297.24	231.1	US 2	US 2
1301.75	230.3	US 1	US 1
1328.87	225.6	DS 0	DS 0
1343.16	223.2	DS 1	DS 1
1347.99	222.4	DS 2	DS 2
1352.85	221.6	DS 3	DS 3
1357.76	220.8		DS 4

## Guidelines:

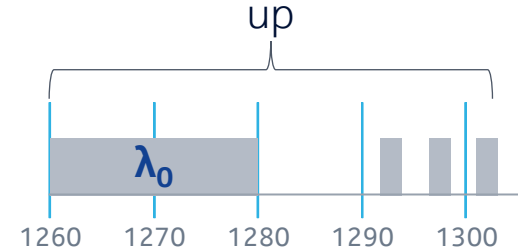
- Other than US  $\lambda_0$ , use frequencies on DWDM grid
- Upstream: put  $\lambda_1$  and  $\lambda_2$  at longest wavelengths to ease cost of 50G filtering.
- Downstream: put  $\lambda_1$  and  $\lambda_2$  at shortest wavelengths to minimize 50G TDP

Adjustments can be made for finer optimization

100G OLT SOA pre-amp implementation, if 1+3

## Plan B: 100G OLT SOA pre-amp implementation, if 1+3

Input from Tomoyuki Funada, Sumitomo:



### 1. SOA bandwidth:

- SOA gain and  $P_{\text{sat}}$  have wavelength dependency, therefore Plan B might need two pre-amp SOAs in order to cover all 4 upstream wavelengths 1260-1300. This will require more investigation.

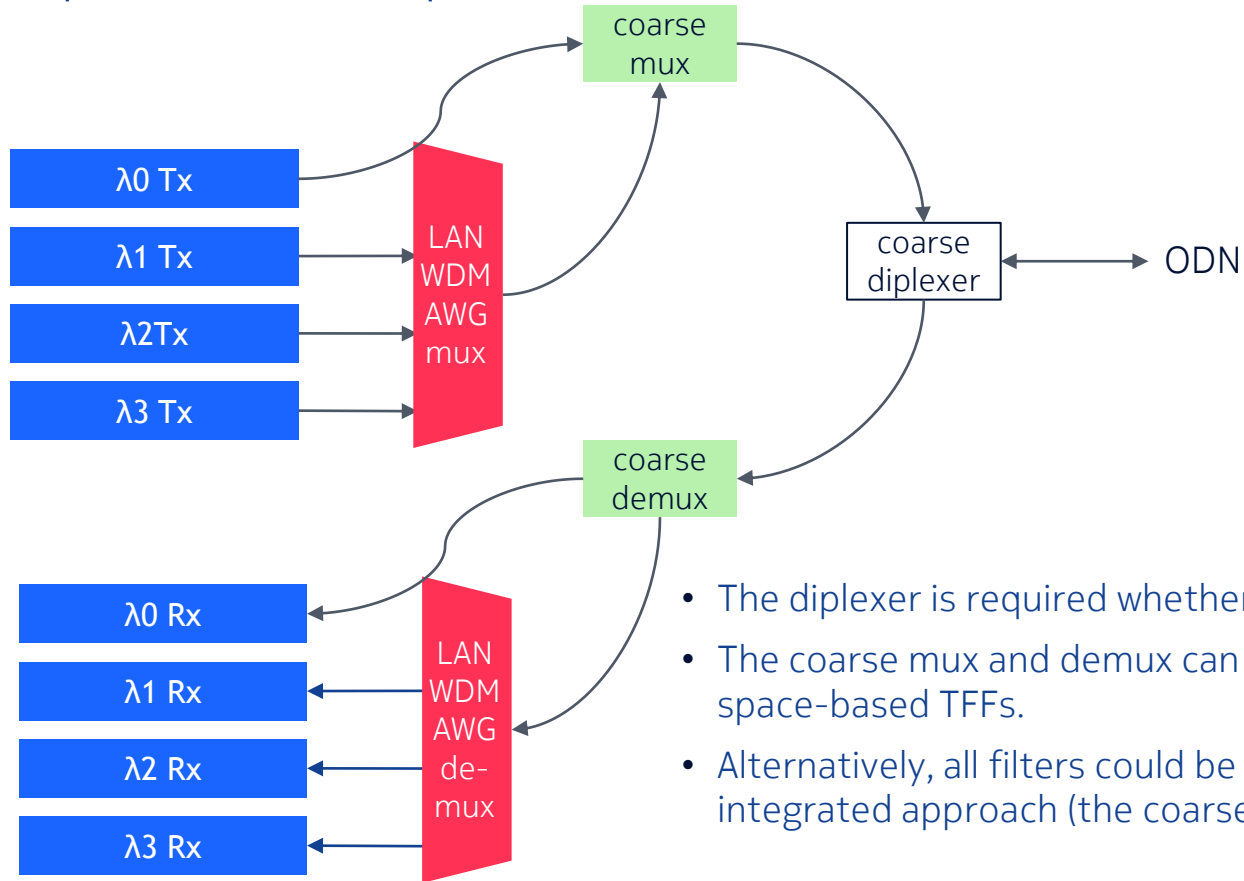
### 2. Wider operating wavelength range of upstream $\lambda_0$

- $\lambda_0$  has a 20 nm wide wavelength operating range. This will require a 20 nm pass band allowing 20 nm of SOA ASE noise. This will limit the OLT  $\lambda_0$  receiver sensitivity improvement that can be obtained with the SOA preamp\*.

\*maybe to only 1-2 dB better than APD

**NOKIA**

# Plan B: possible filter implementation (1+3)



- The diplexer is required whether 1+3 or 1+4
- The coarse mux and demux can be fiber based or free-space-based TFFs.
- Alternatively, all filters could be implemented in a fully integrated approach (the coarse filters as MZIs.)