Potential solutions for >50G bidi objectives

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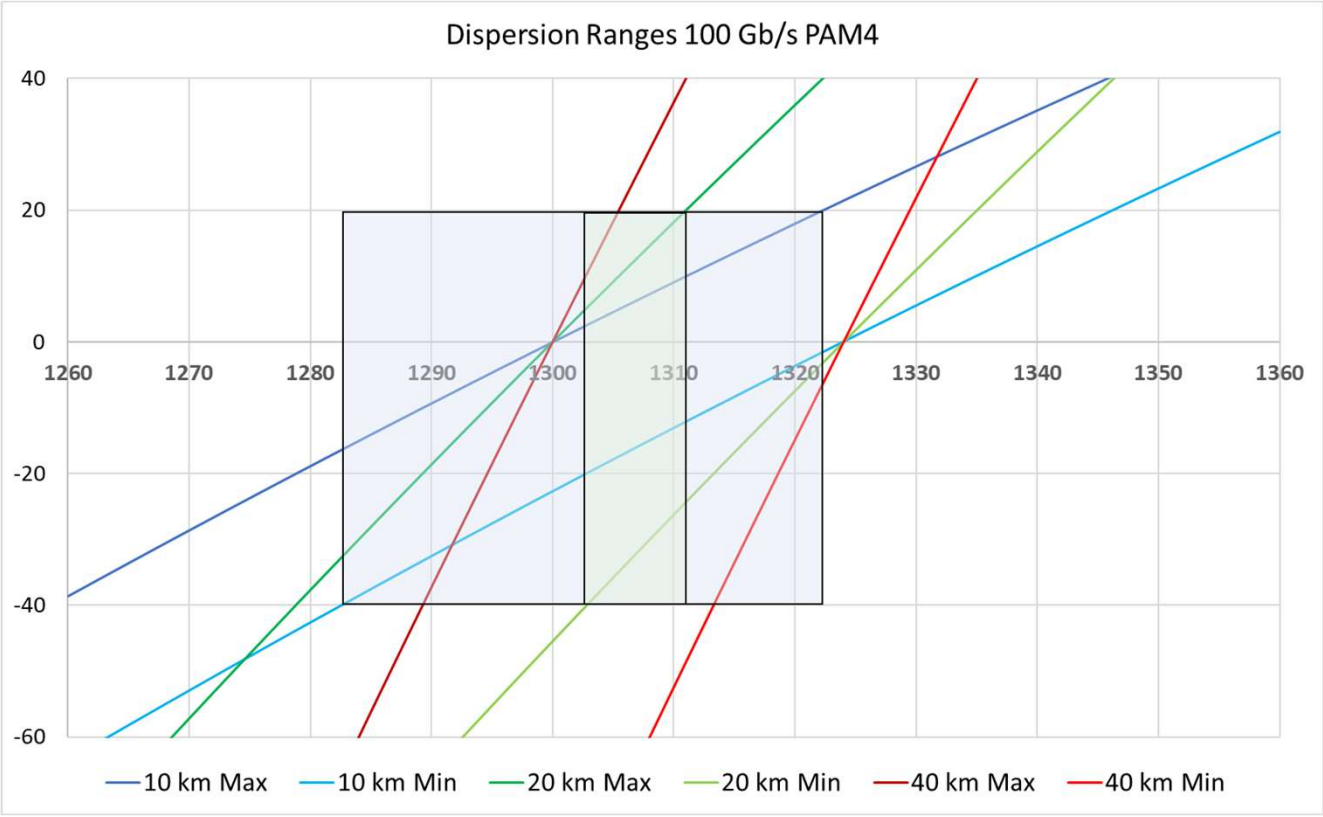
Common assumptions

- The following statements are (I believe) widely held
- Existing PMA and PCS layers will be reused
- The solution with the fewest channels is preferred
- IMDD is preferred over coherent
- CWDM has advantage over narrower channel spacings
- Existing wavelength plans will be reused if possible

Dispersion limitations for 100 Gb/s PAM4

- According to the work in 802.3cu, the tolerated dispersion range for 100 Gb/s PAM4 is -40 to +20 ps/nm (approximately, YMMV)

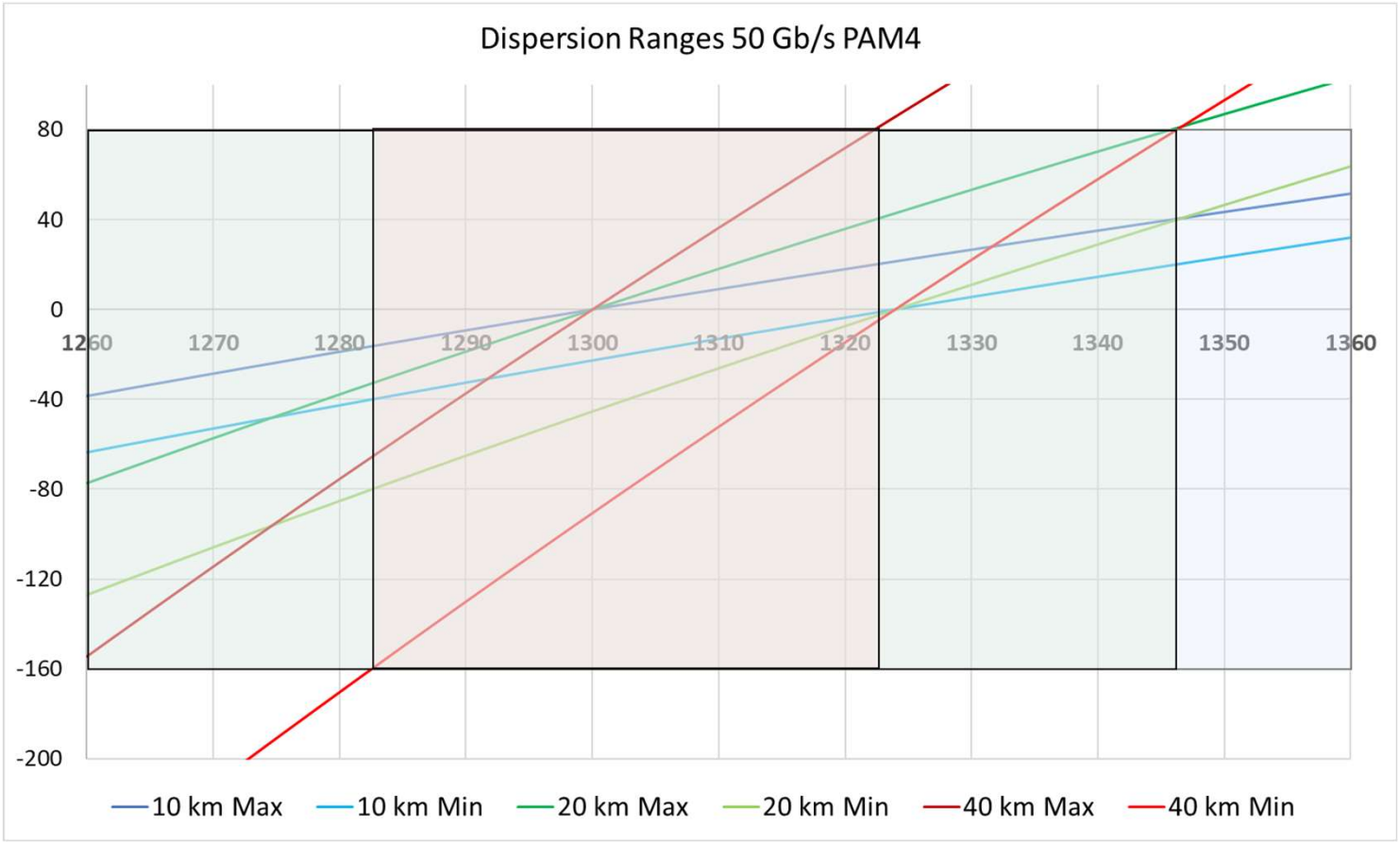


Dispersion limitations for 100 Gb/s PAM4

- Based on the dispersion ranges for G.652 fiber:
- At 10 km, the wavelength range is 1283 to 1322 nm
  - For 100G, two channels of CWDM: 1290 and 1310 nm
  - For 200G, four 10 nm channels: 1285, 1295, 1305, 1315 nm (?)
- At 20 km, the wavelength range is 1303 to 1311 nm
  - For 100G, two 800 GHz channels: 1304.5 and 1309 nm
  - For 200G, four 400 GHz channels: 1304, 1306, 1308, 1310 nm
- At ~30 km, the wavelength range vanishes < nothing works

Dispersion limitations for 50 Gb/s PAM4

- Assuming the usual 4x scaling, 50 Gb/s PAM4 tolerates -160 to 80 ps/nm



Dispersion limitations for 50 Gb/s PAM4

- Based on the dispersion ranges for G.652 fiber:
- At 10 km, the wavelength range is 1260 to 1360 nm
  - For 100G, four channel CWDM: 1270 through 1330 nm
  - For 200G, eight 10 nm channels: 1270 through 1340 nm (?)
- At 20 km, the wavelength range is 1260 to 1346 nm
  - For 100G, four channel CWDM: 1270 through 1330 nm
  - For 200G, eight 10 nm channels: 1270 through 1340 nm (?)
- At 40 km, the wavelength range is 1283 to 1322 nm
  - For 100G, four 10nm channels: 1290 through 1320 nm (?)
  - For 200G, eight 800 GHz channels: 1286.5 through 1318 nm (?)

Speeds vs. objectives

Speed Per lane	10 km 100G	20 km 100G	40 km 100G	10 km 200G	20 km 200G	40 km 200 G
100 Gb/s	CWDM	800 GHz	NP	10 nm	400 GHz	NP
50 Gb/s	CWDM	CWDM	10 nm	10 nm	10 nm	800 GHz

- 100 Gb/s per lane appears optimal for 10 km
- 50 Gb/s per lane appears the only choice for 40 km
- For 100 Gb/s 20 km, 50 Gb/s could be a good choice
- For 200 Gb/s 20 km, more study is needed to compare

Final Thoughts

- The above figures and analysis was done “back of the envelope” using previous results in an approximate way
  - While inaccurate, this should be good enough to point us towards the right direction in terms of solutions
- More detailed simulation of the likely candidates is needed to improve the accuracy of the analysis
  - Considering not only dispersion, but also other effects such as nonlinearity, multi-path interference, and so forth
- And then ultimately lab verification would be wonderful

Thank you

Any questions?