

BRAINFUCK

is also a programming language :-)

Channelmania!

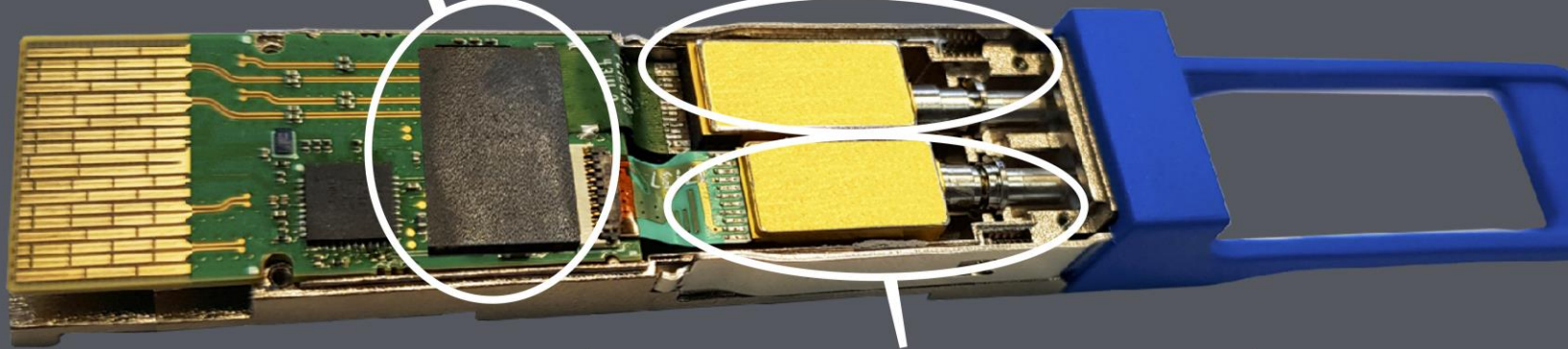
Future proof your DWDM network topology
while keeping it flexible for 1.6T



FLEXOPTIX

DigitalSignalProcessor

TRANSmitter



reCEIVER

Source / Laser

Bulky
Powerhungry
Troublesome to operate

Past

Present

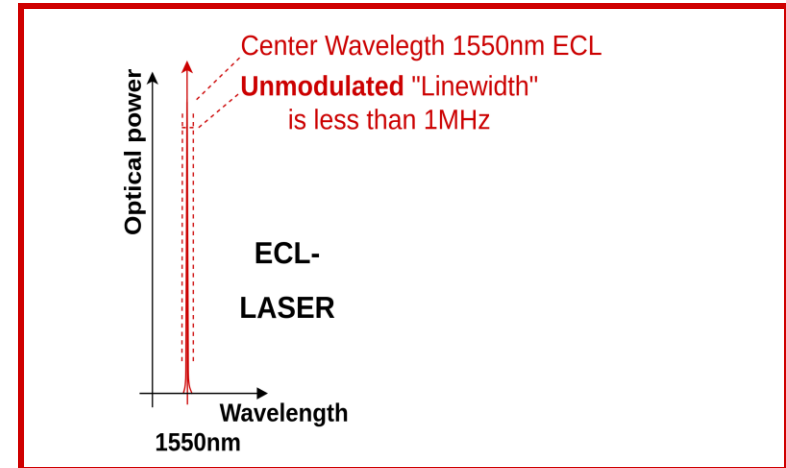
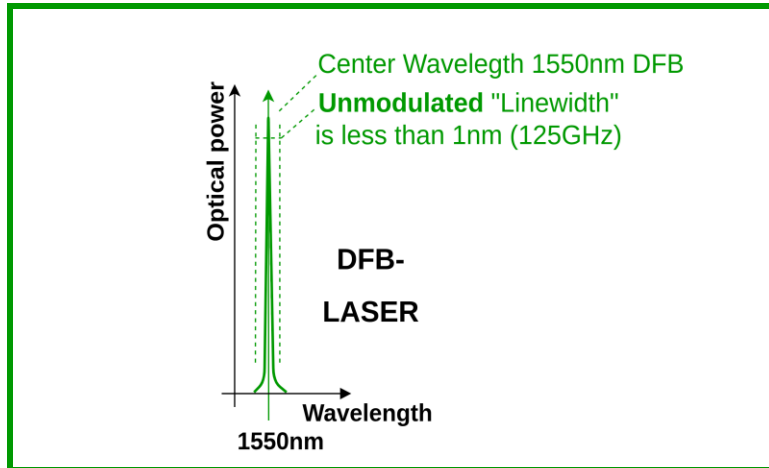
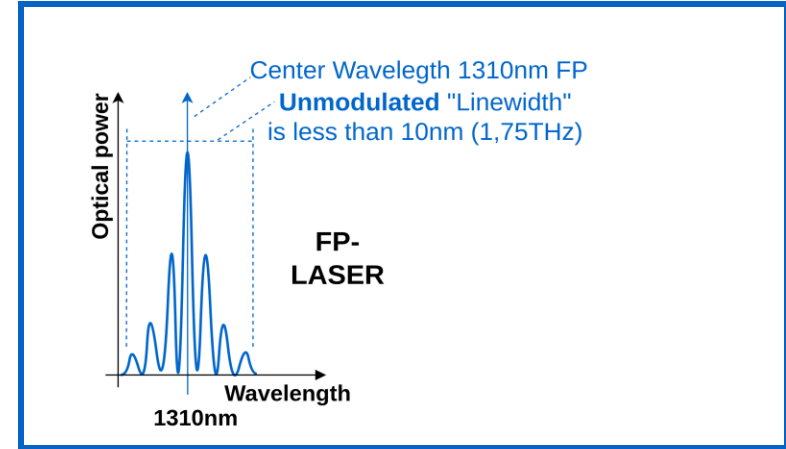
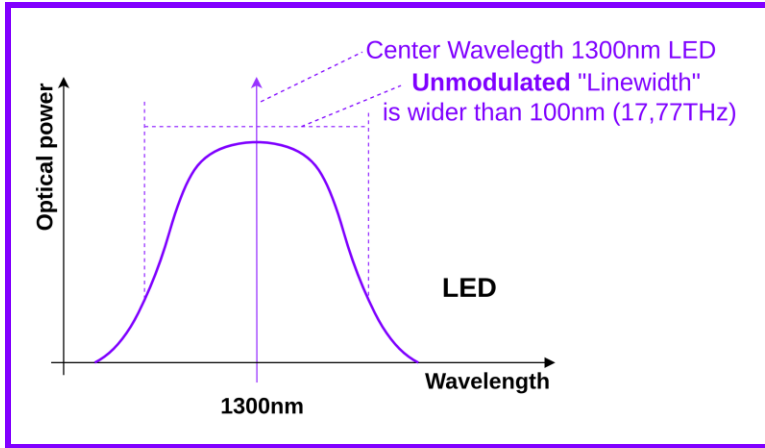
Small
Efficient
Reliable

1958: theoretical foundations for LASER
1960: first ruby LASER
1961: first HeNe LASER
1962: first semiconductor LASER

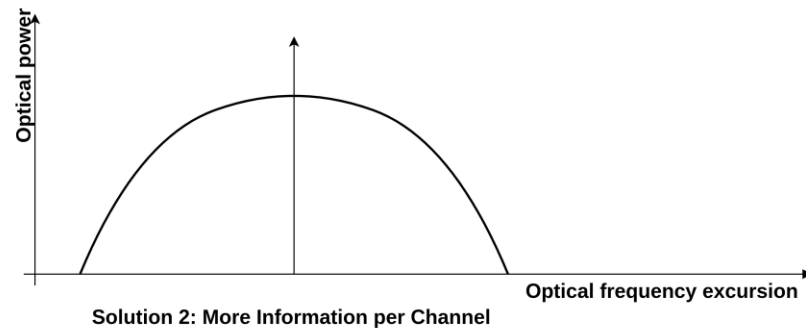
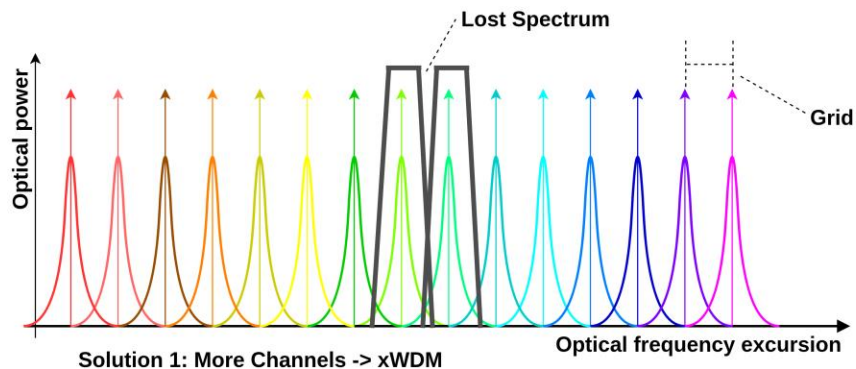
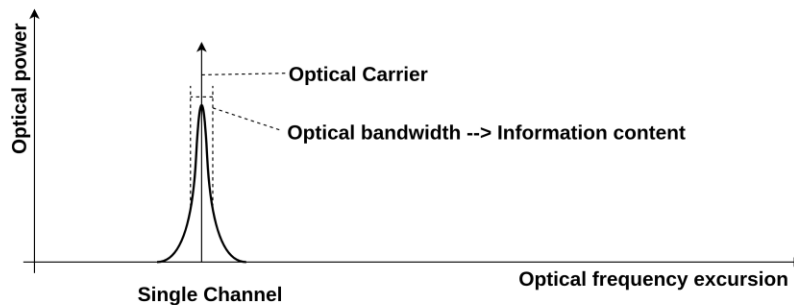
1970: first semiconductor LASER
@roomtemp.

late 1970s: semiconductor LASER
lifetime >1 Mio. HRS

Source Spectrum



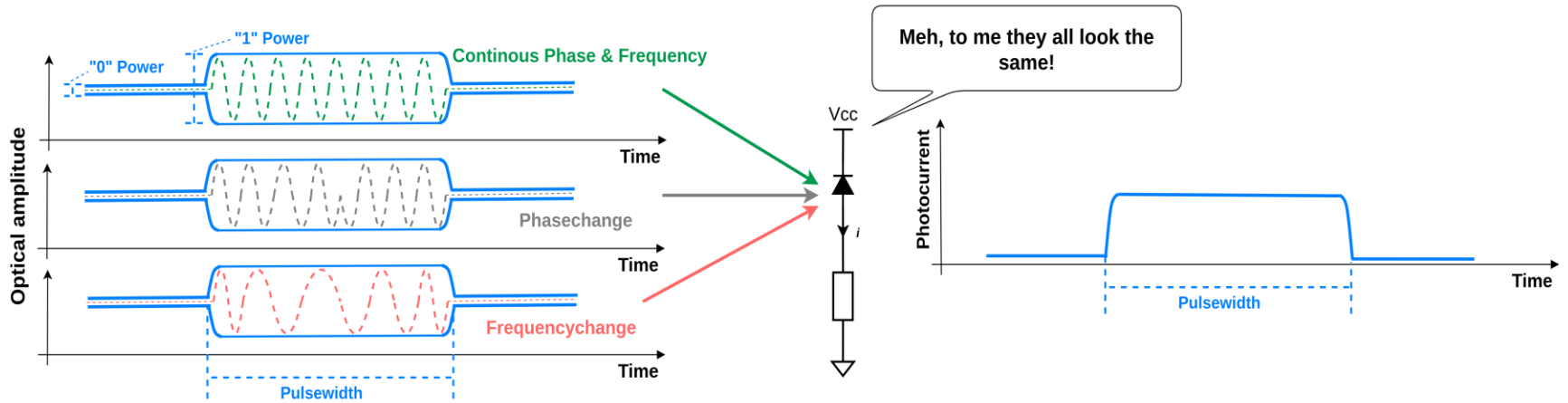
Increasing traffic per fiber



this was the easy part 1/3

now back to complex numbers ->

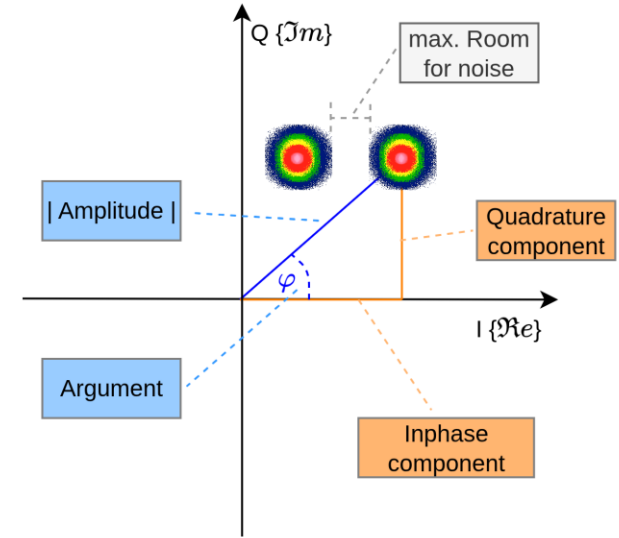
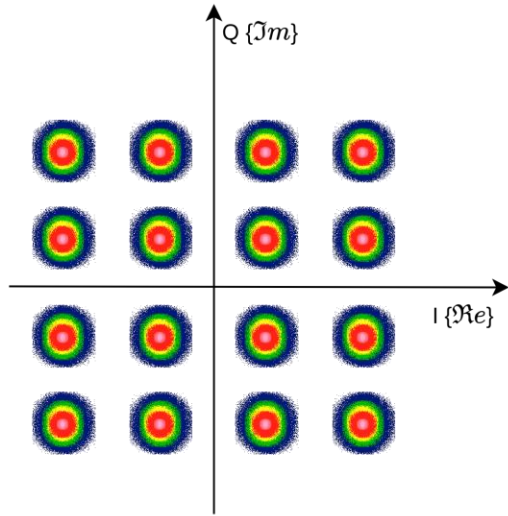
Limitations of On-Off-Keying with Direct Detection



to be precise



Higher order modulation constellations

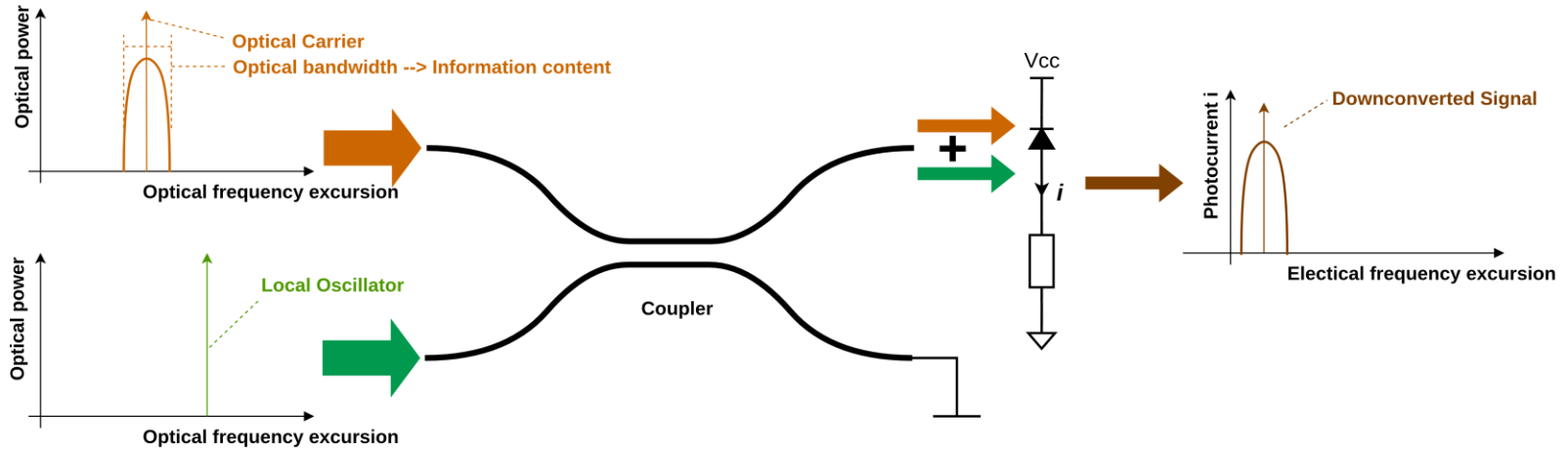


- 16 constellations equal 4 Bits
- Two of those patterns are sent on orthogonal polarizations
- 425Gbps @ 53.125GBd/s

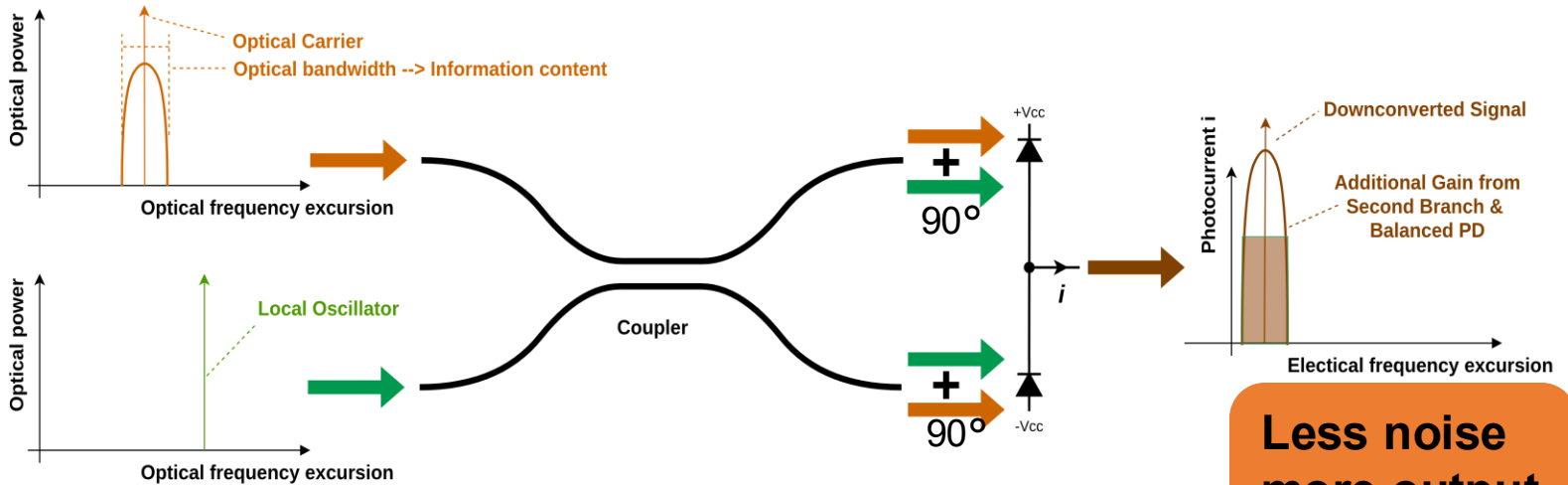
- Constellation can be expressed by either Amplitude and Argument or by the I & Q -components
- Less Room for noise, compared to OOK

Single-Ended

Receiver

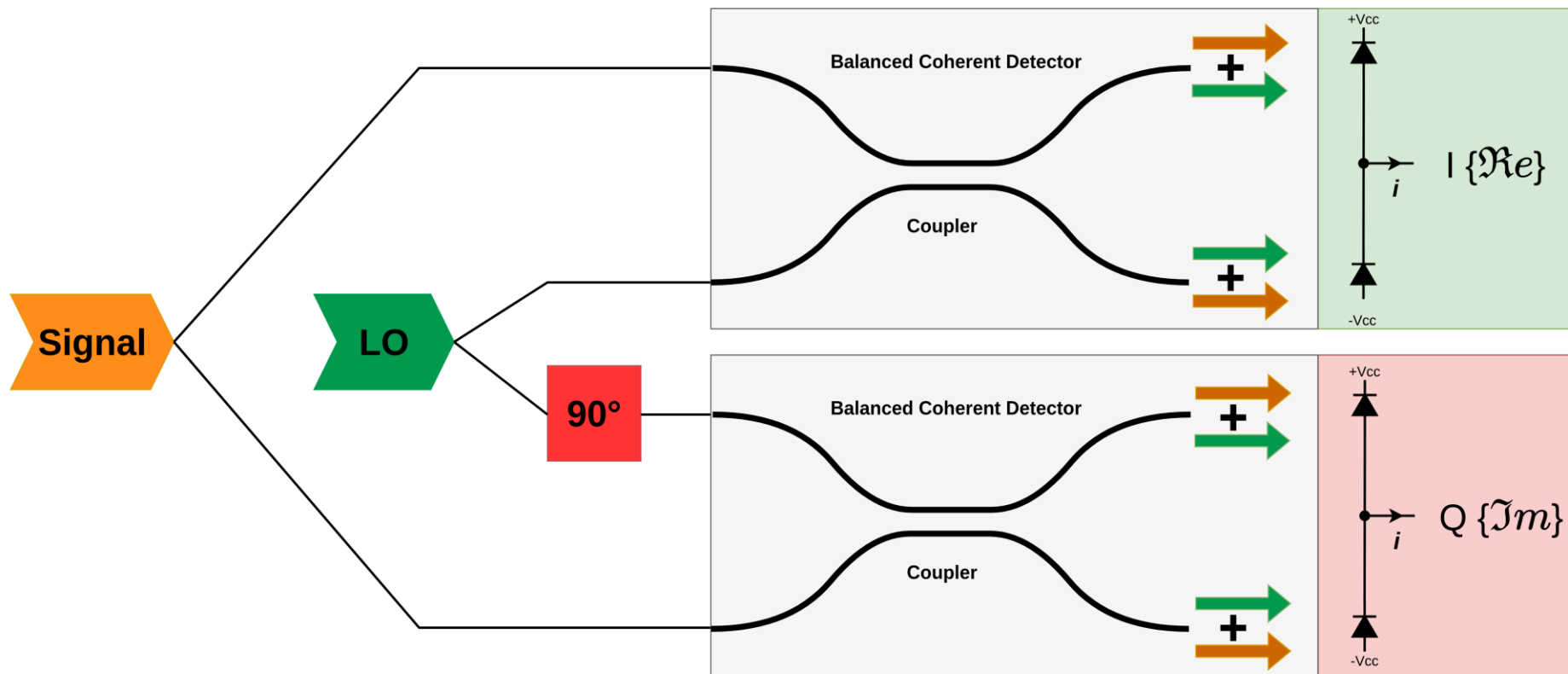


Balanced

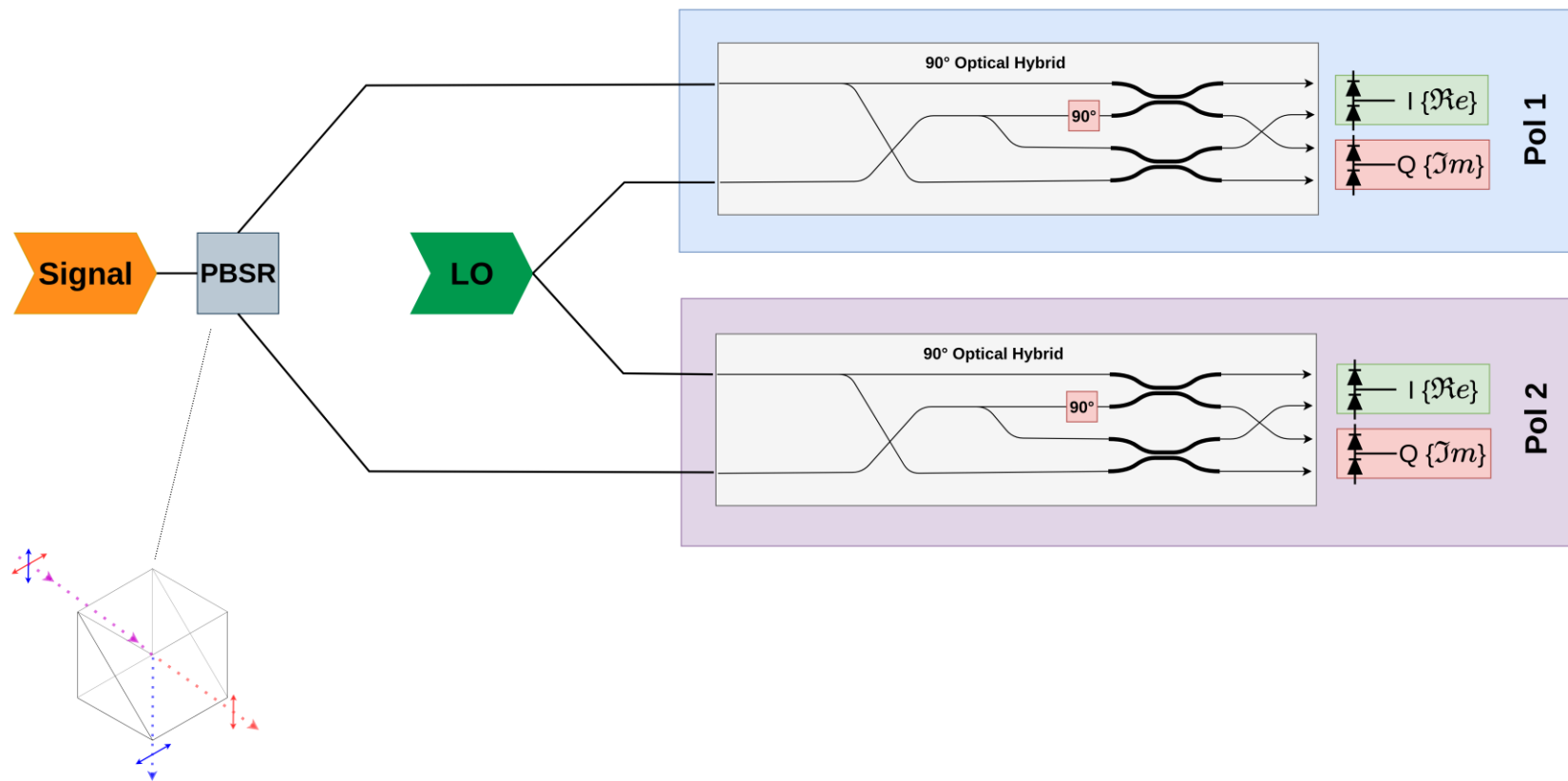


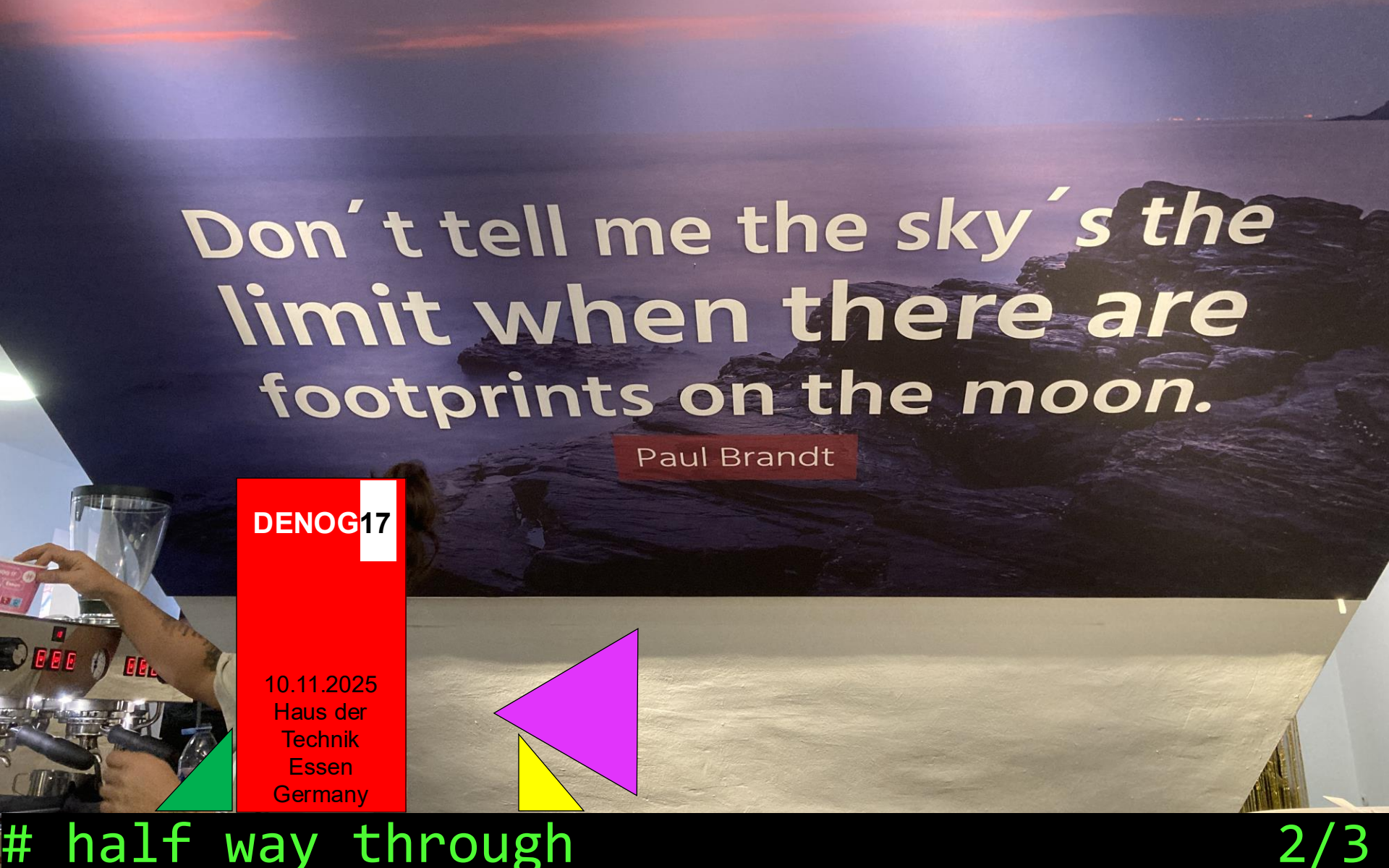
**Less noise
more output**

Phase-Diversity



Phase-&Polarization-Diversity





Don't tell me the sky's the
limit when there are
footprints on the moon.

Paul Brandt



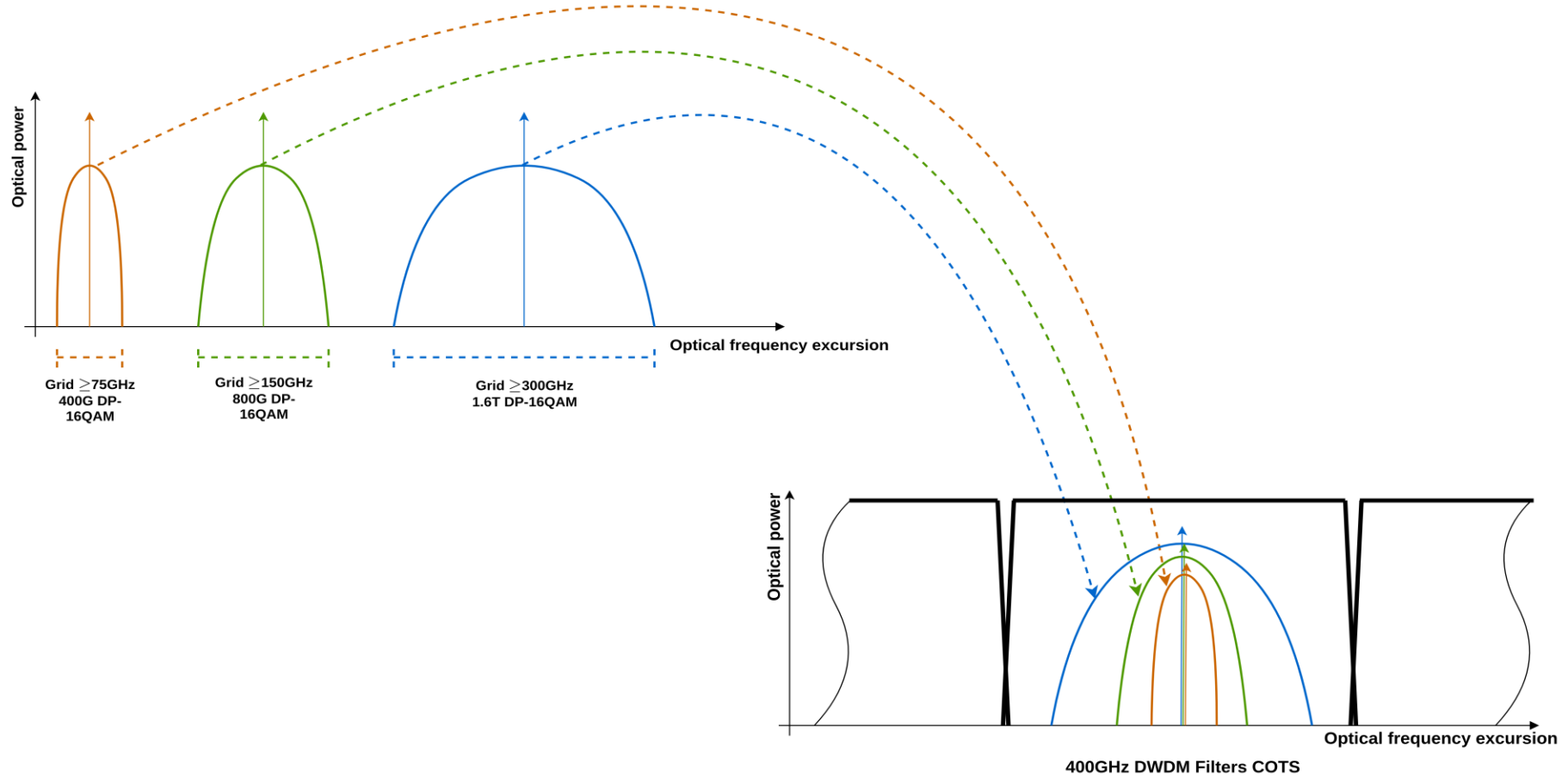
DENOG17

10.11.2025
Haus der
Technik
Essen
Germany

half way through

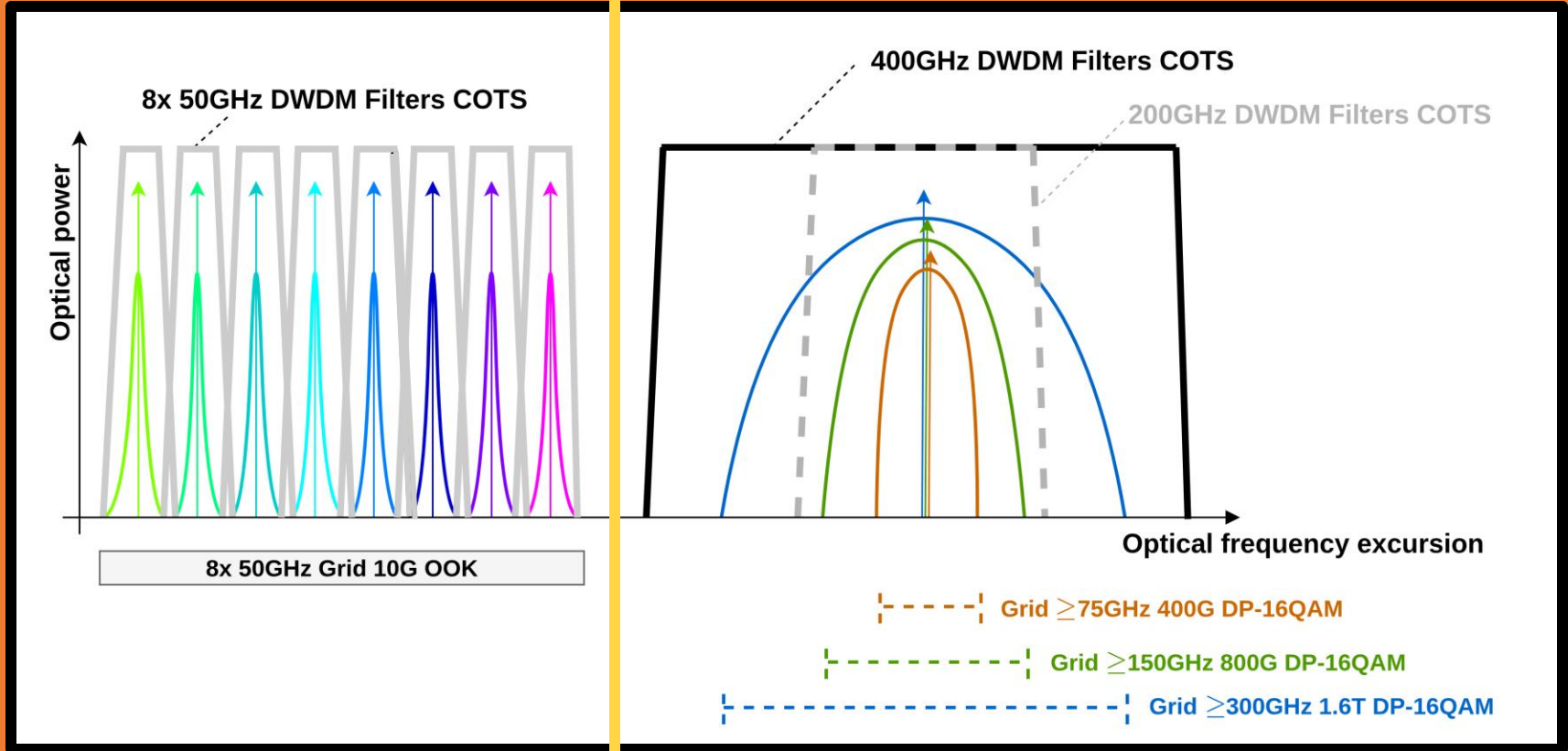
2/3

Coherent Detection Bandwidth



12 x 400GHz channels in C-Band

96 x 50GHz channels in C-Band

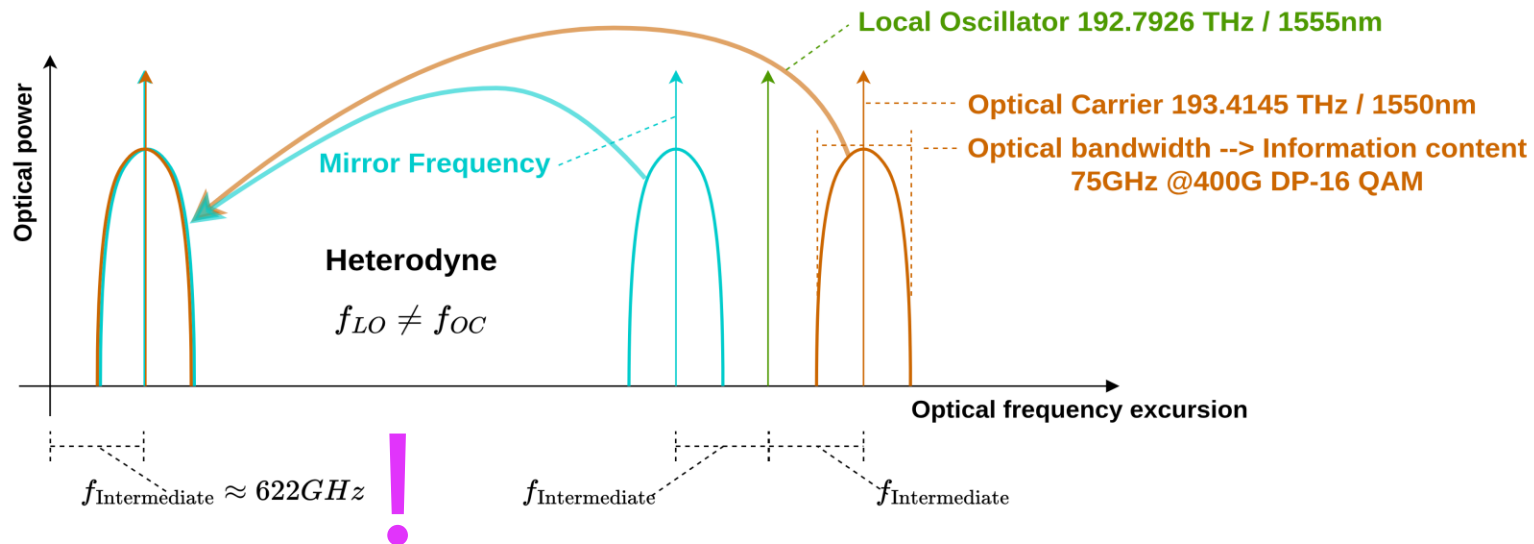


IL ~ 2dB

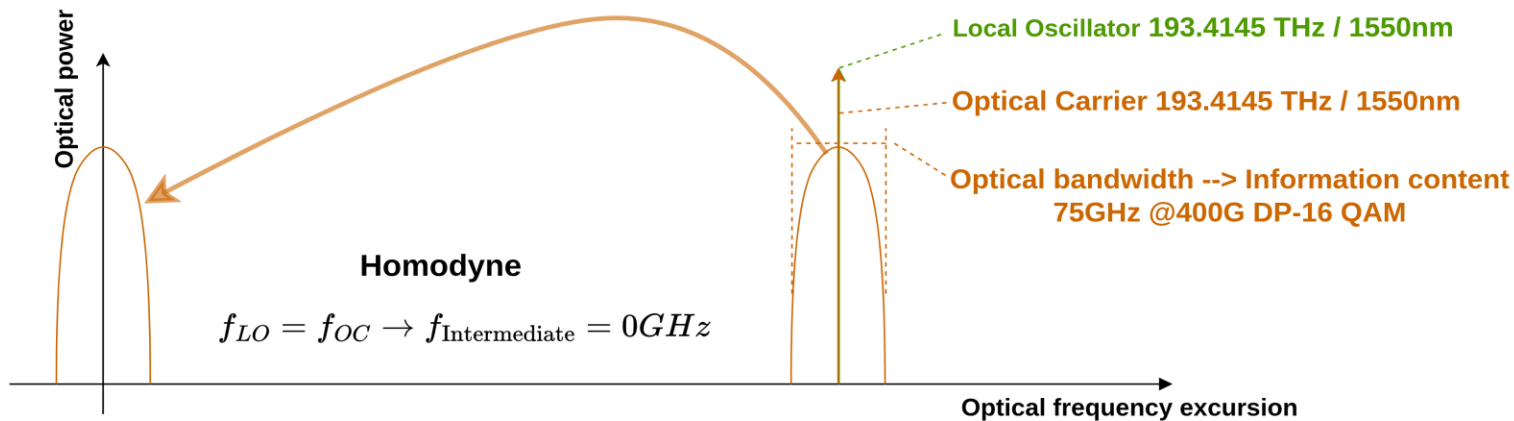
COTS = Commercial-Off-The-Shelf

downconverted signal

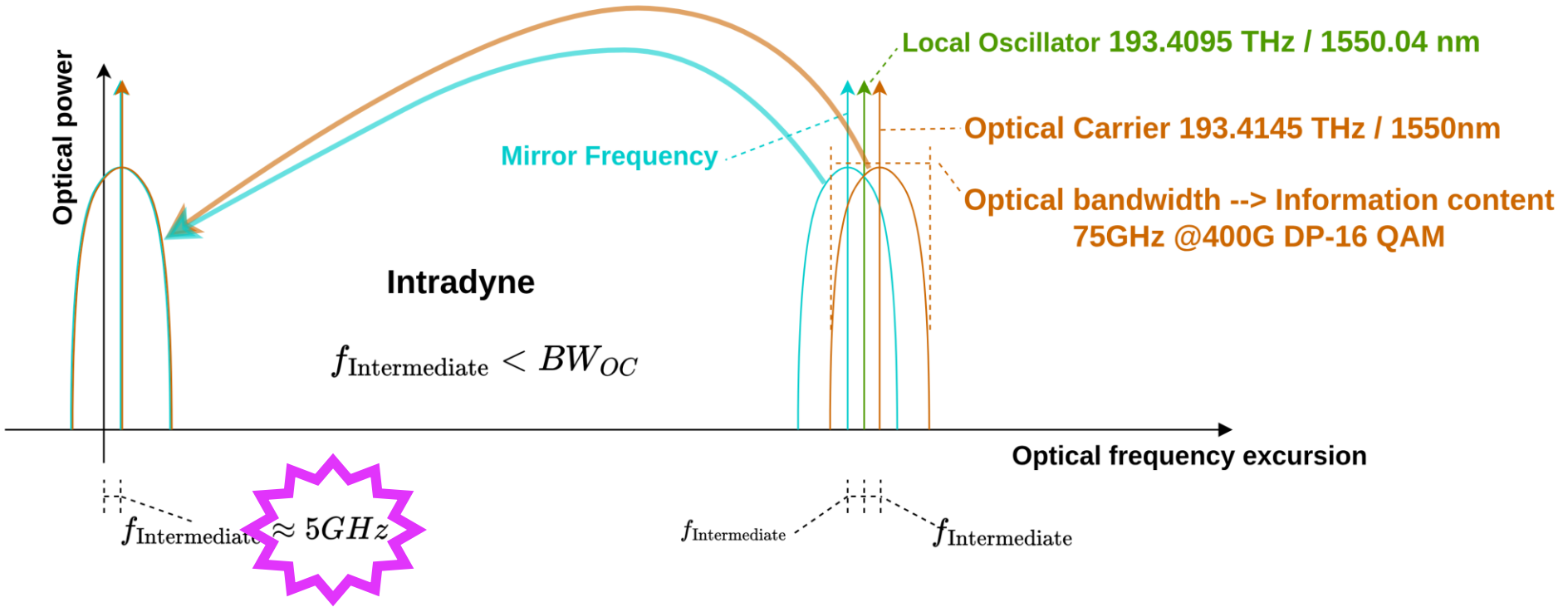
Heterodyne



Homodyne



Intradyne Detection

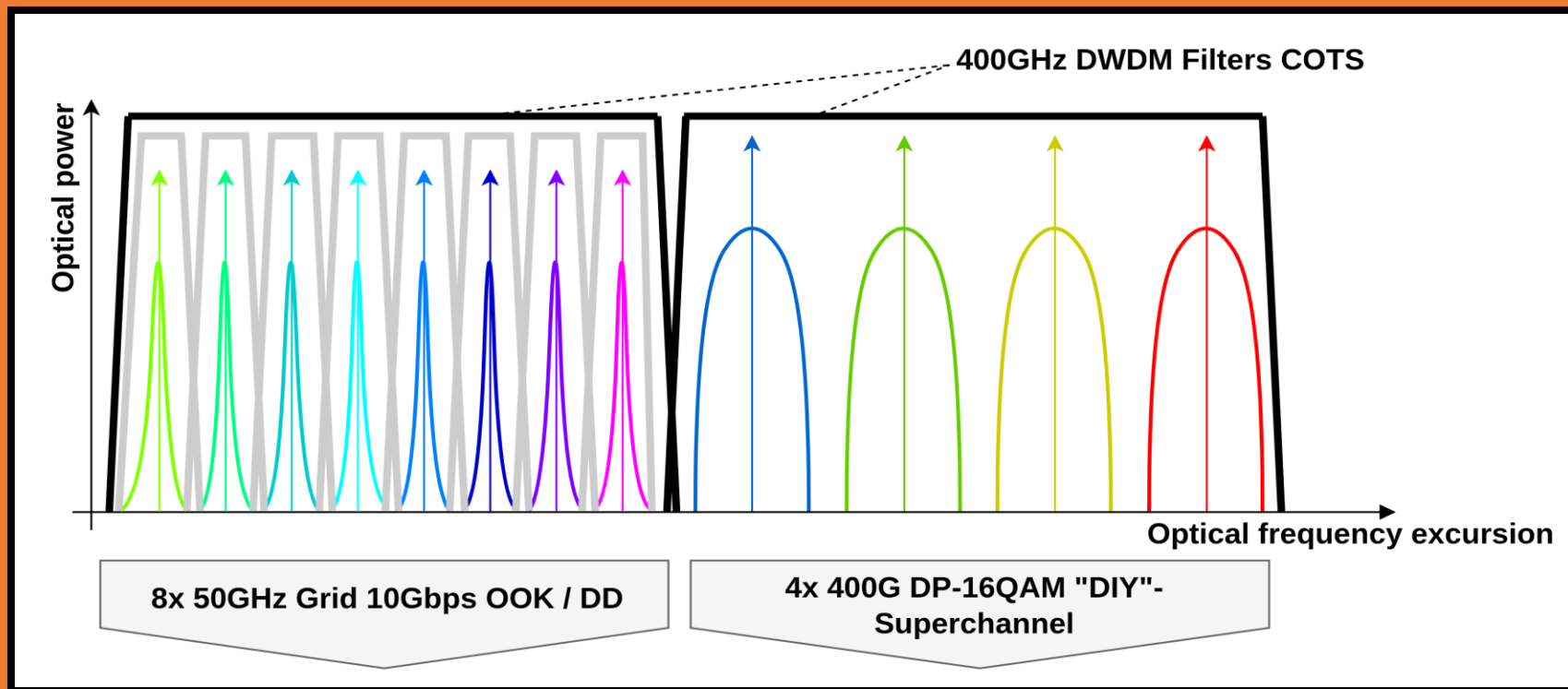


we made it

to the moon



Coherent Detection DIY-Superchannels

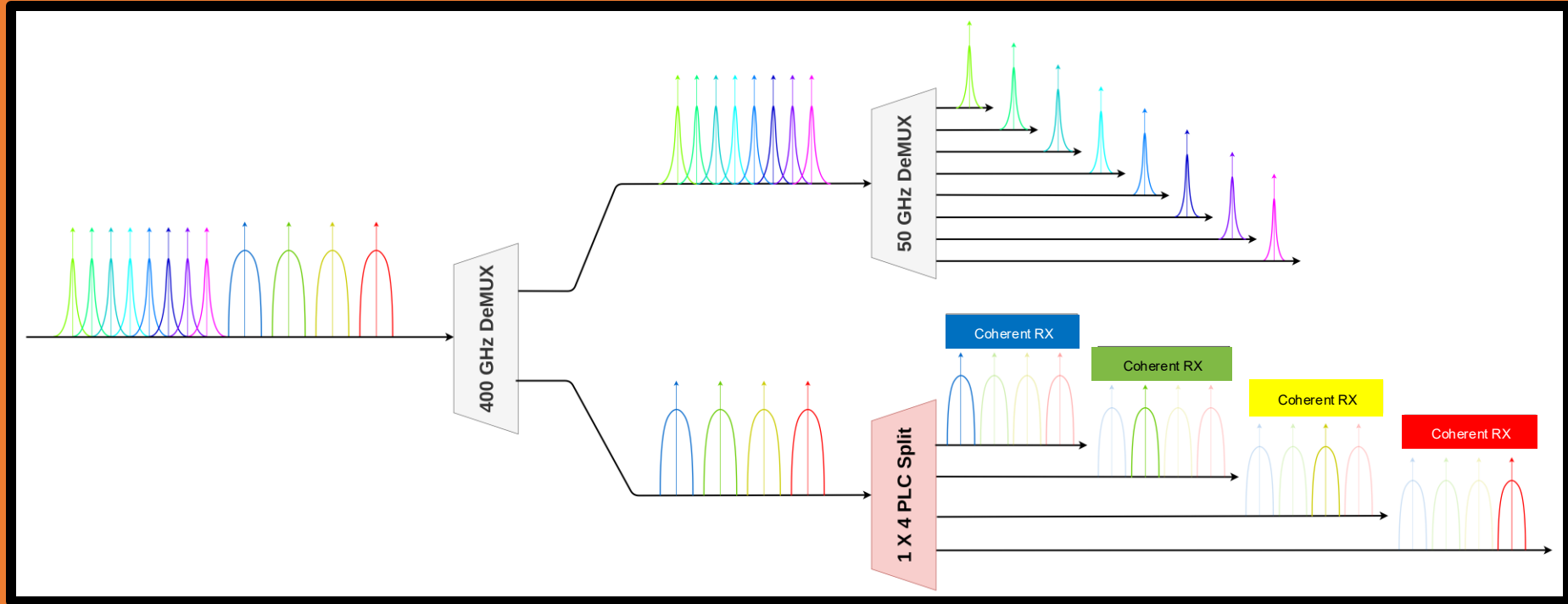


Run the subband through
regular 50GHz DWDM
MUX / DeMUX

Use cheap PLC 1x4 /
4x1 splitters to combine
TX and split RX

Note: Blake Willis
achieved optimum
performance @
100GHz spacing

Flexible Network Architecture



hint: make a frequency plan for your spans

our way to the universe

Coherent Detection is robust
and awesome

Foundation for Colorless are
Balanced-receiver

400GHz MUXes will make your
network flexible

800G Coherent ZR+
DD and OSFP is available

Think in **THz** and **GHz**
NOT in nm or channelnumbers
any longer



12,8T liquid cooled XPO is approaching

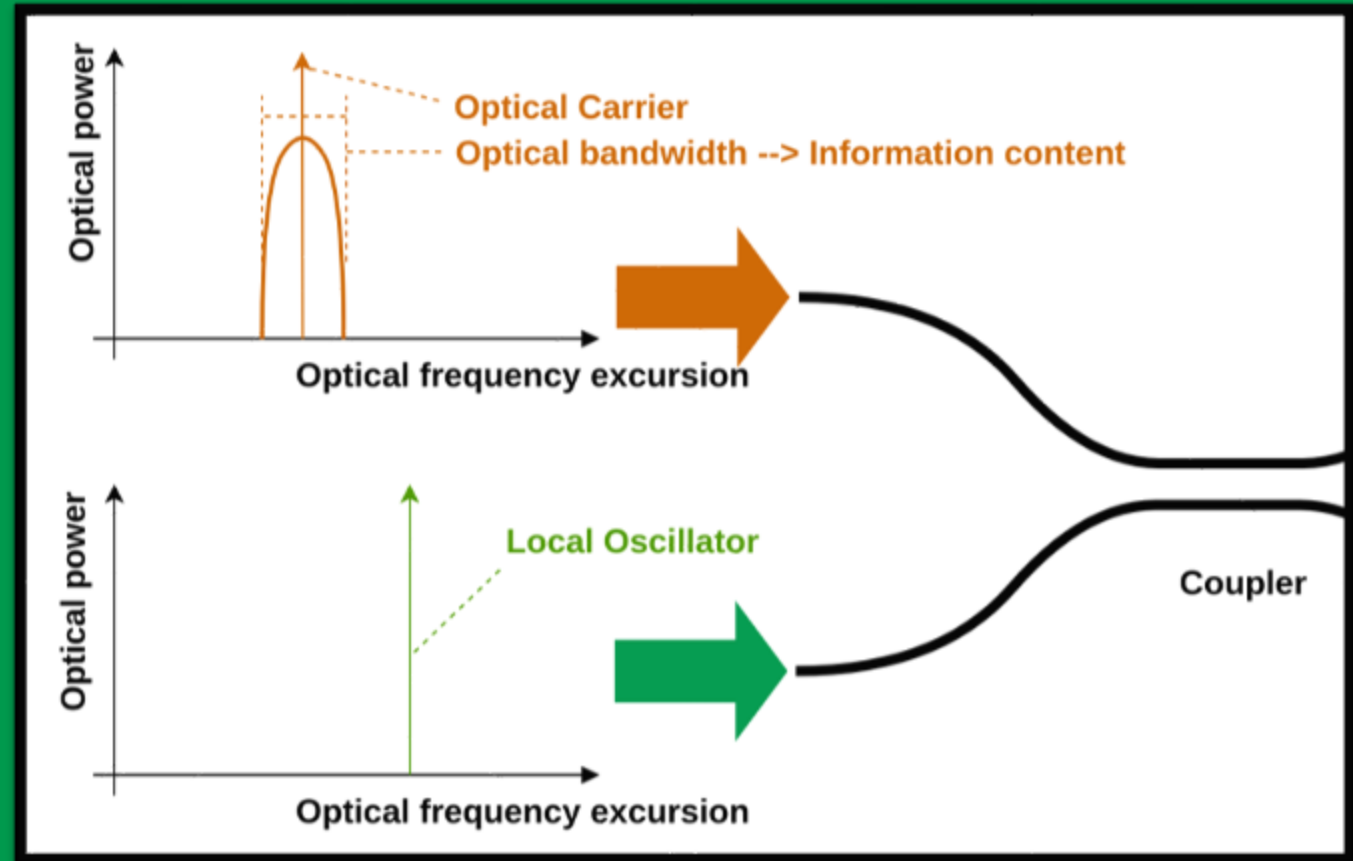
MY CONCLUSION

I can't wait for the next social
today!



Coherent BIDI

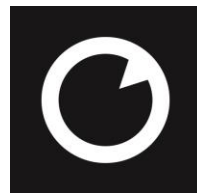
requires a 2nd
laser source for
RX Local
Oscillator



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FLEXOPTIX