

Comb based WDM for 100 GE Applications:

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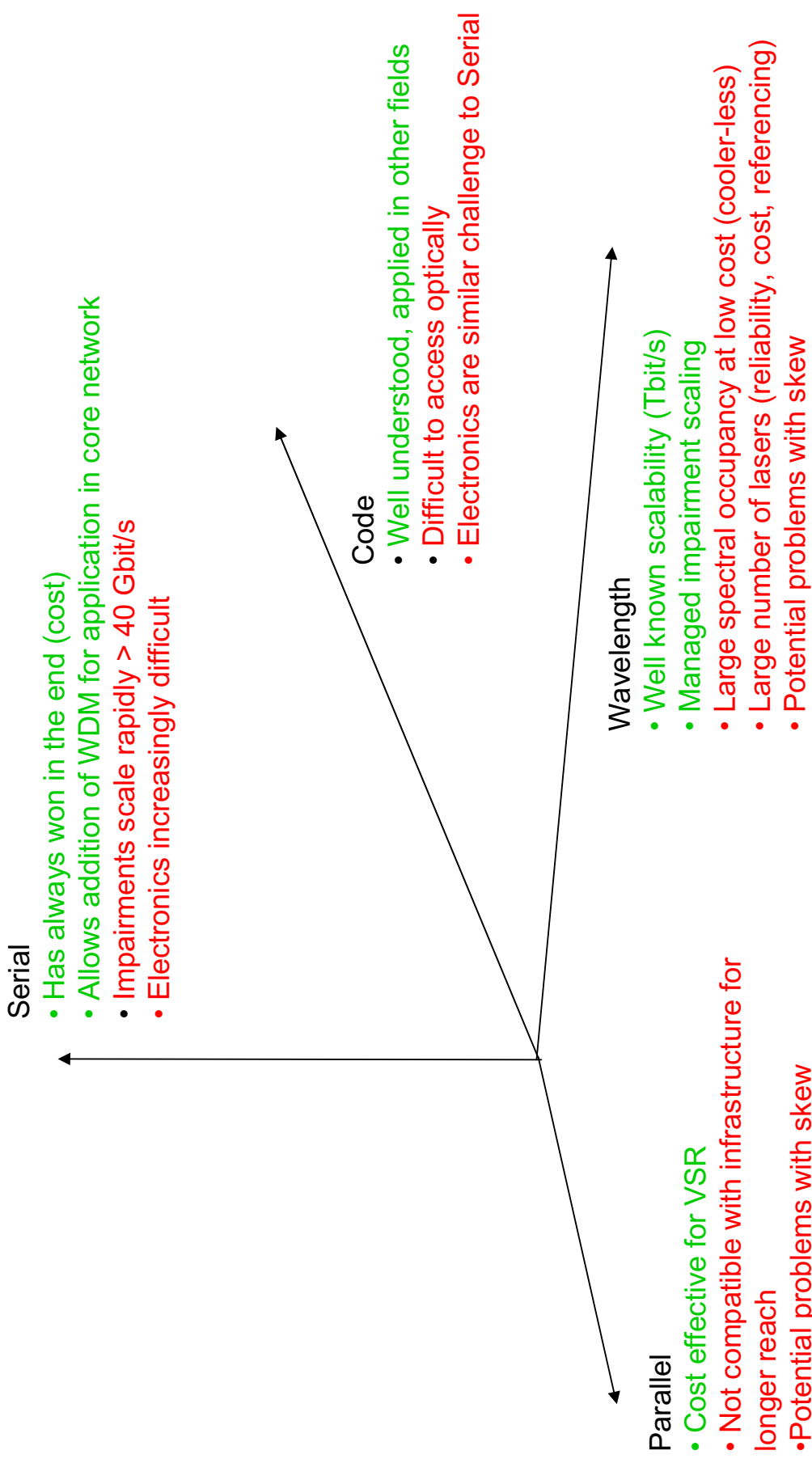
Ellis et al



Outline

- Trade off's facing 100 GE
- Proposed alternative implementation
 - Special case: Coherent WDM
- The 5 Criteria

Challenges



Challenges

Serial

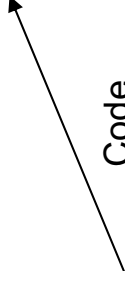


Ideal target

- Single laser
- Managed impairment scaling
- Low spectral occupancy (cooler-less)
- Fixed relative path delays (skew)

Realisation

- Optimum point on the chart
- Different multiplexing approaches



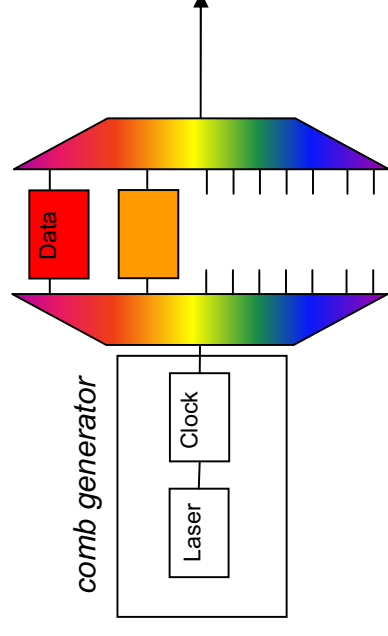
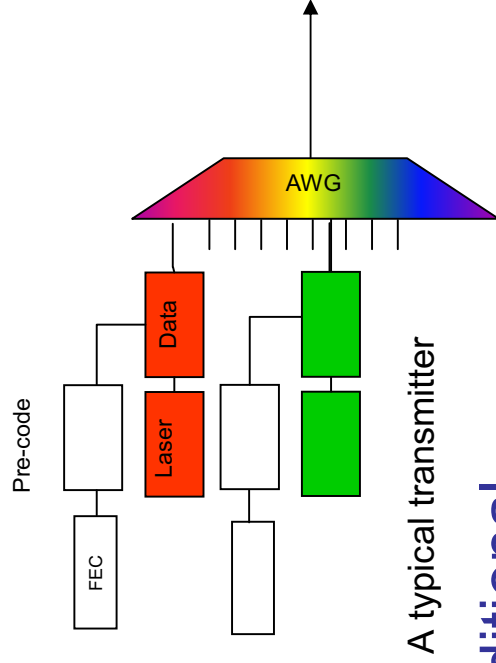
Code



Parallel

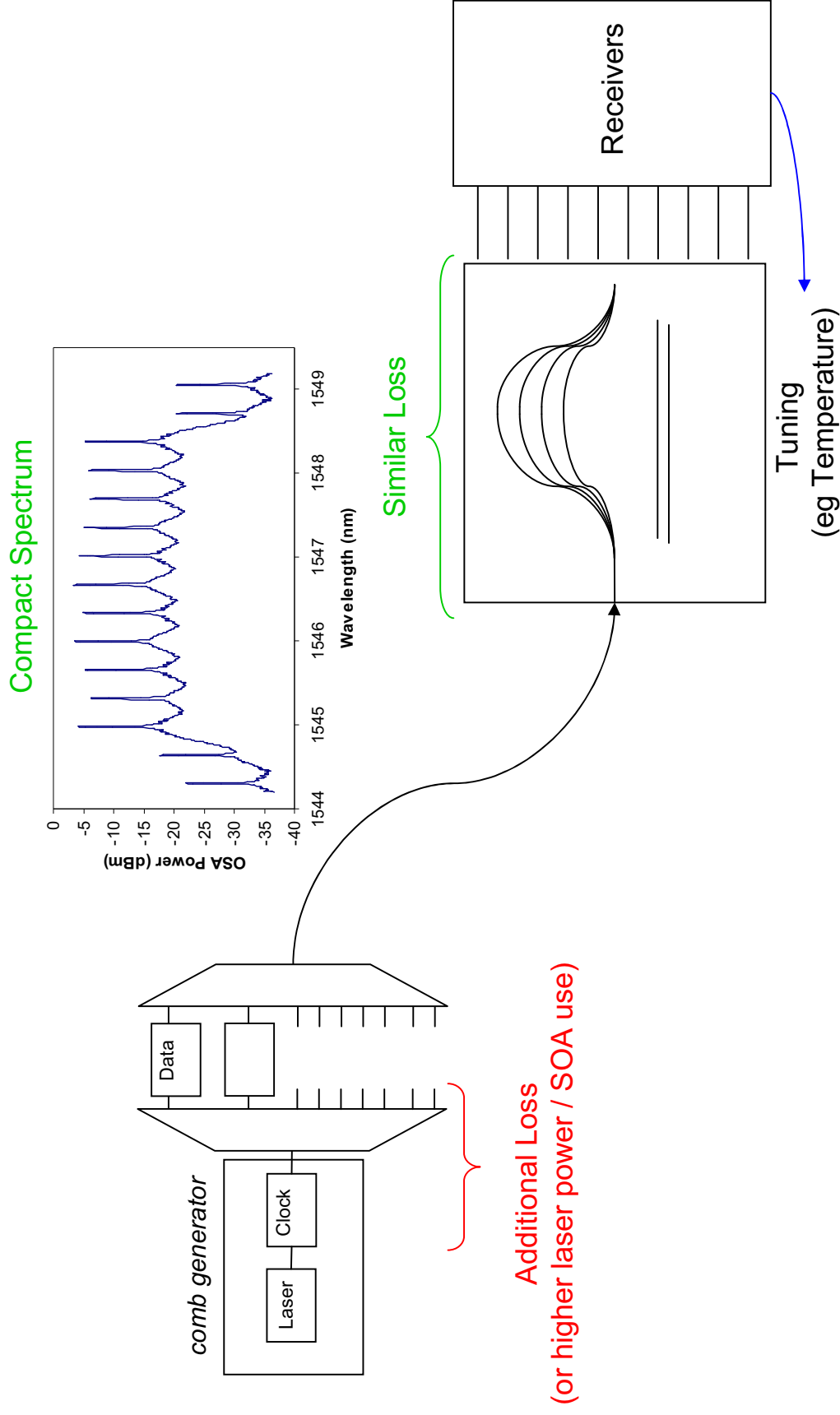
Wavelength

Frequency Comb - Principle

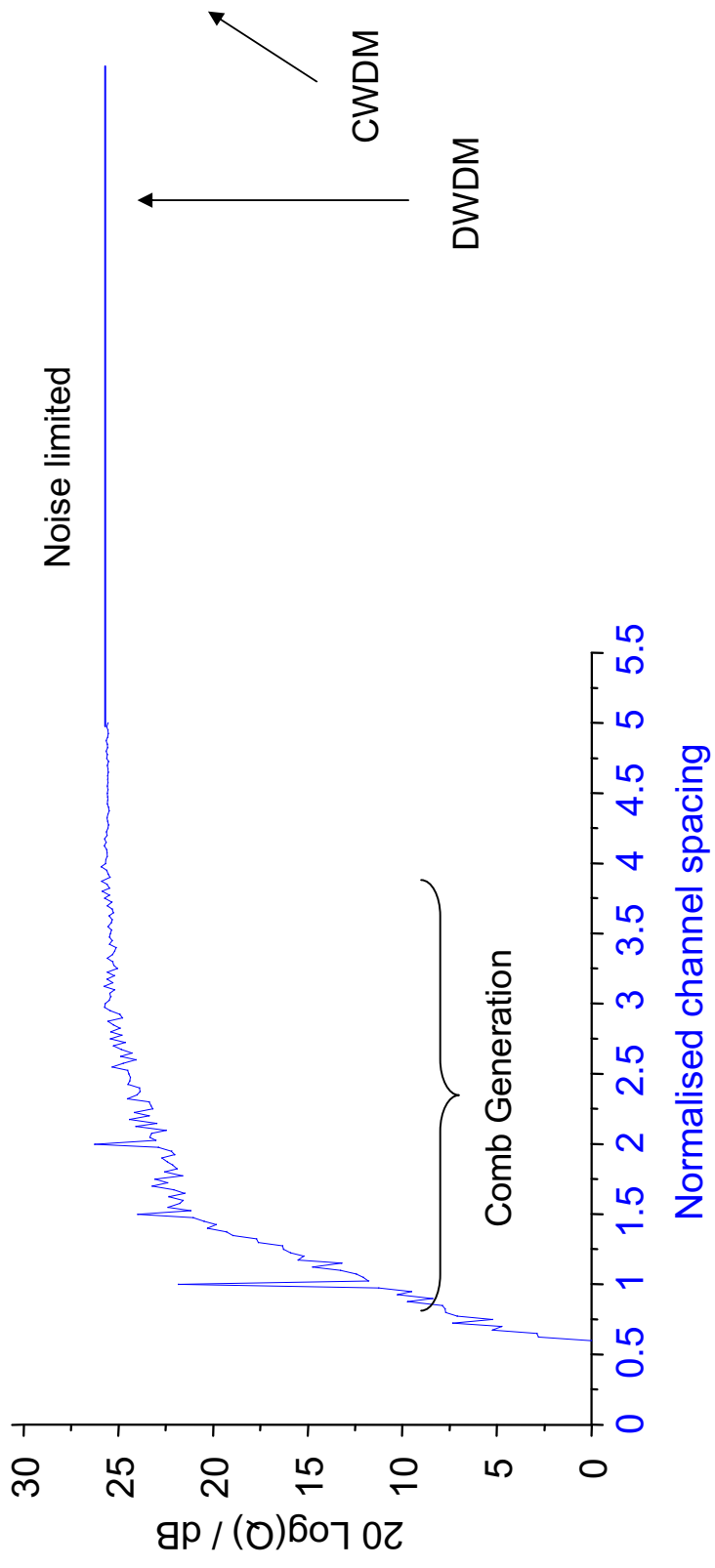


- **Traditional**
 - N Independent lasers
 - N Lockers with fixed DWDM demultiplexer
 - Moderate channel spacing with N tuneable receivers
 - or Wide channel spacing with CDWM demultiplexer
- **Comb Sources**
 - Single laser with RF referenced channel spacing
 - Single locker with fixed UDWDM demultiplexer
 - Free running centre frequency with tuneable receiver (tracking one laser)

Frequency Comb System



Frequency Comb - Performance

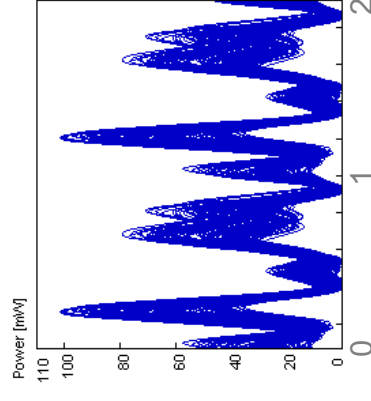


- Single stage Gaussian filter
- Performance enhancements at 1x channel spacing

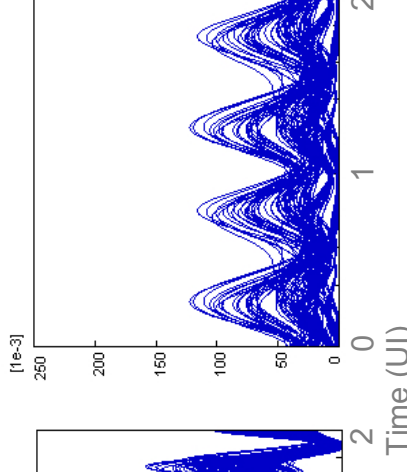
Special Case – “Coherent WDM”

Individual
Lasers

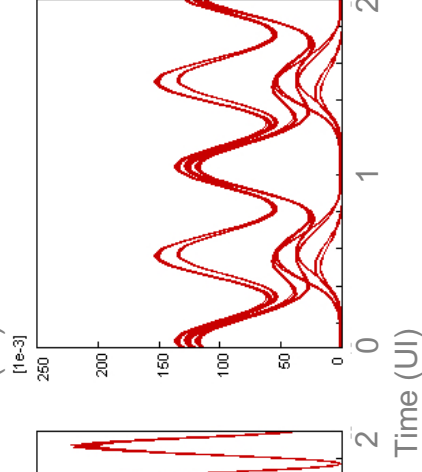
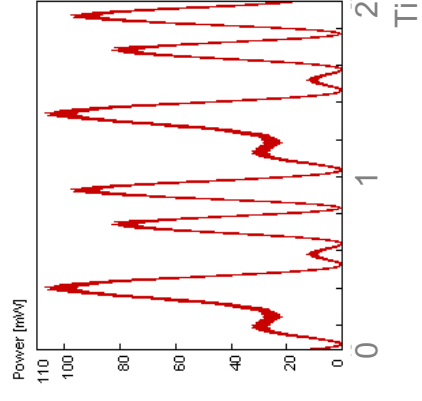
Modulator
Array Input



Modulator
Array Output

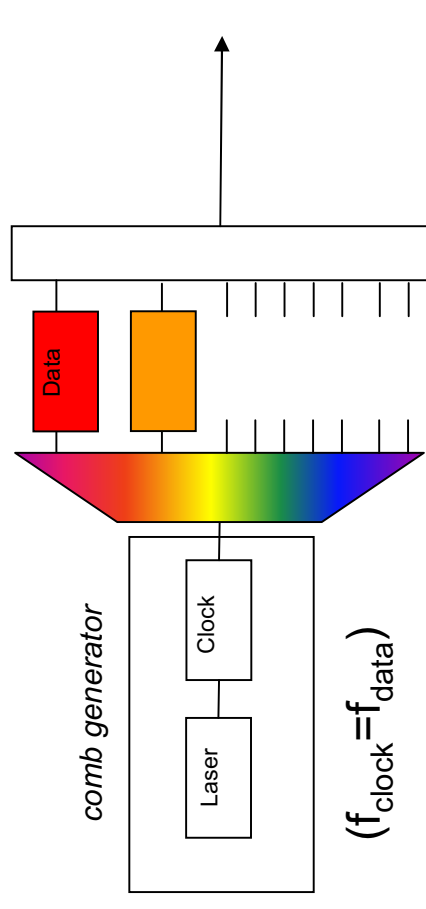


“Coherent WDM”

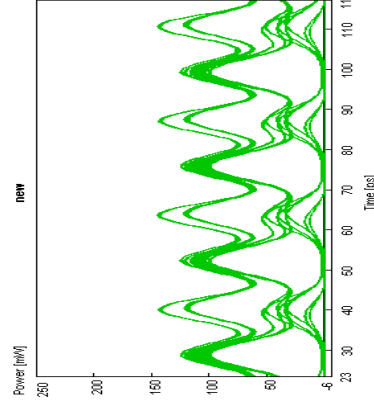
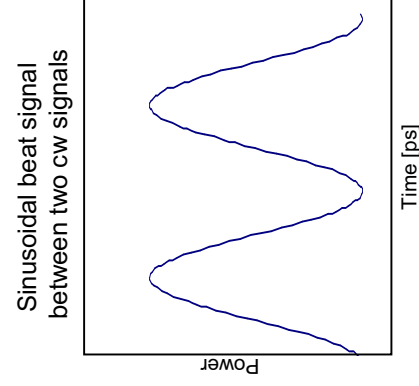
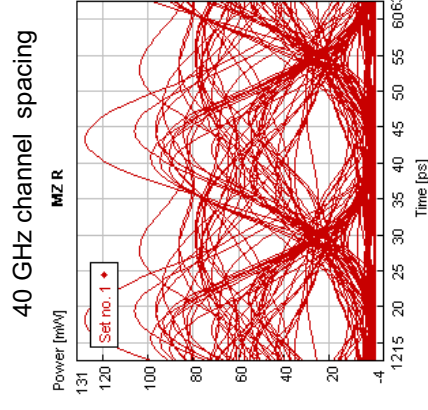
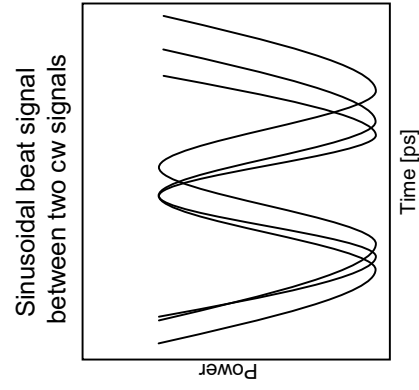


Coherent WDM - Principle

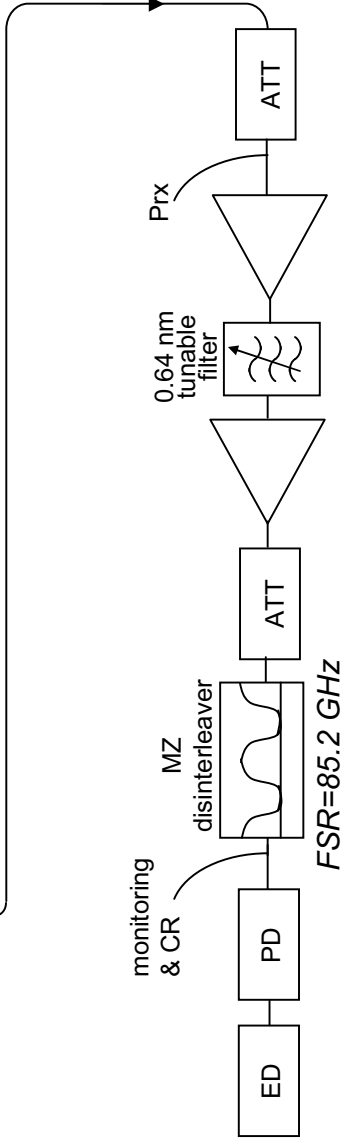
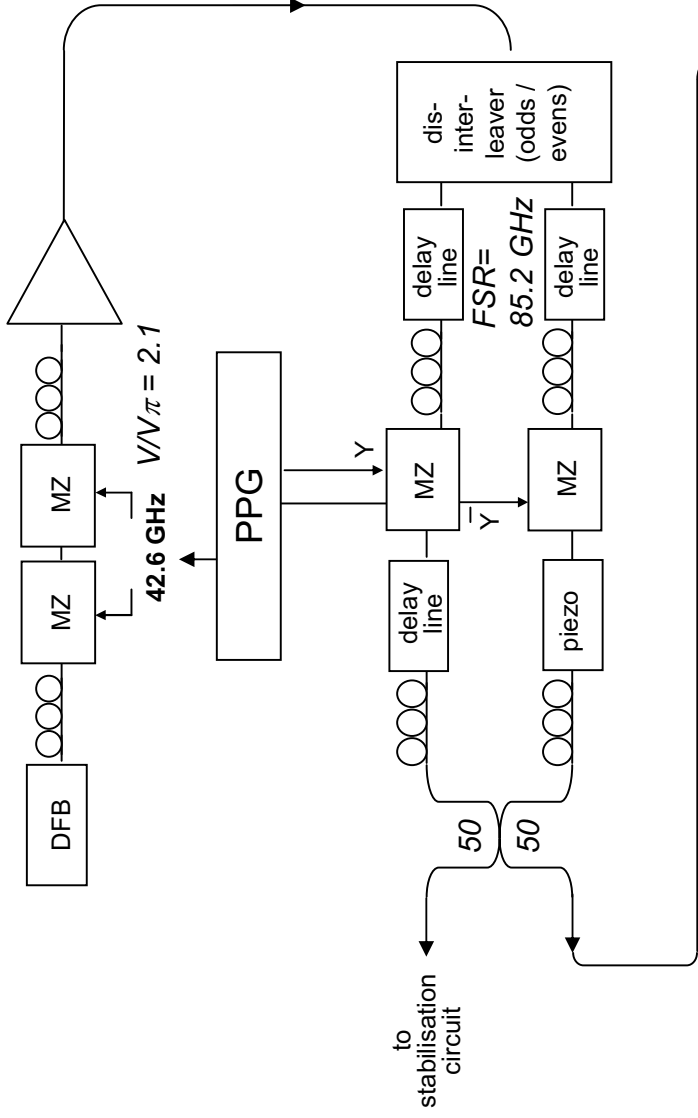
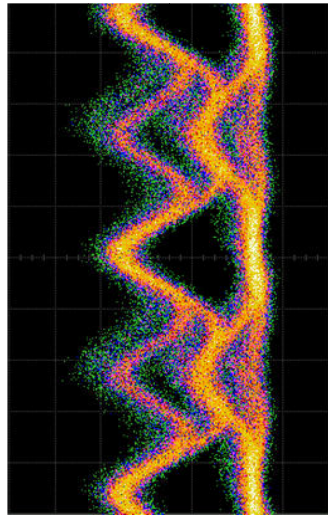
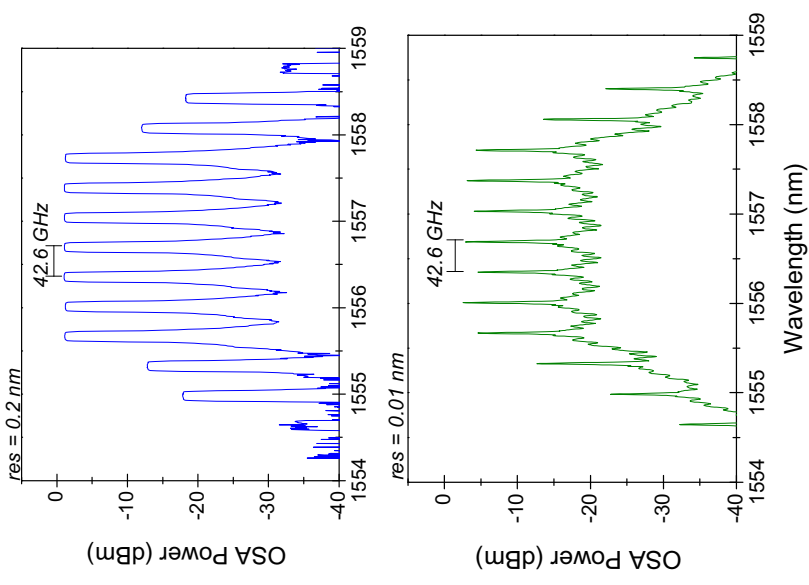
Coherent WDM transmitter



Regular WDM transmitter at narrow spacing

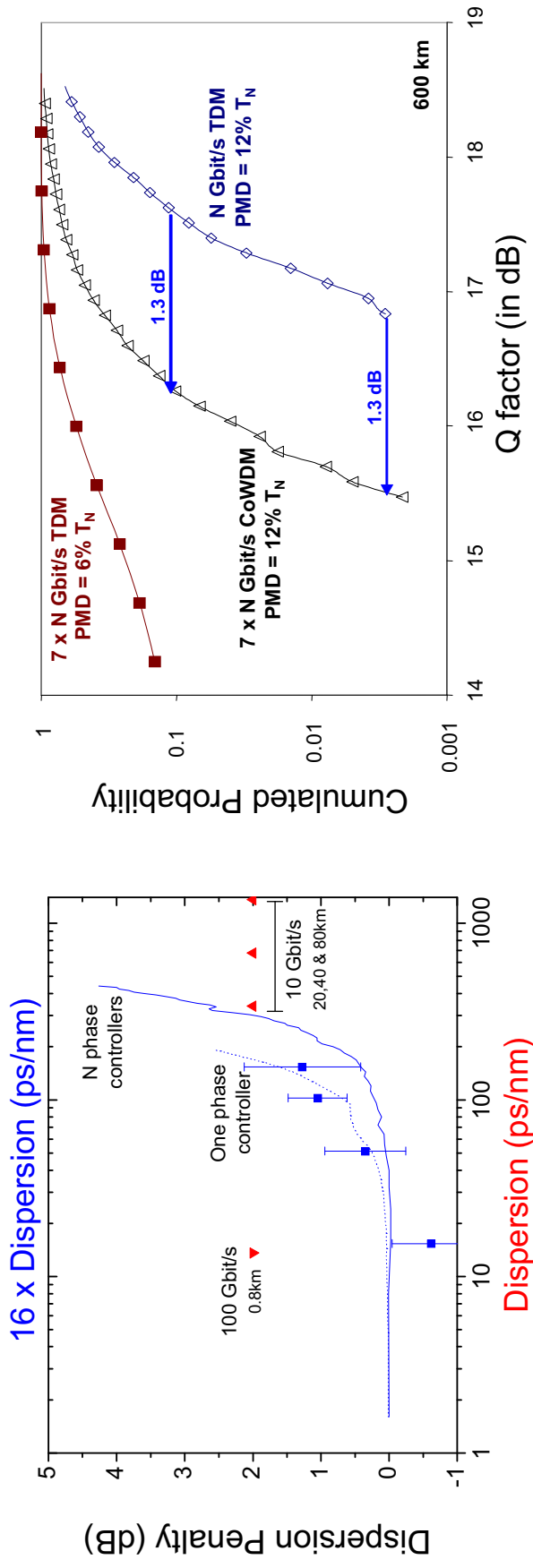


Experimental verification (7 x 42.6 Gbit/s)



FSR=85.2 GHz

Impact of Dispersion



- 40 Gbit/s Coherent WDM data normalised to 10 Gbit/s
- Offers excellent dispersion tolerance

The 5 Criteria

- **Broad Market Potential**
 - Suitable approach for 2km, 10km, 40km and regional applications
 - Multiple implementations possible
- **Compatibility**
 - Same compatibility as other WDM solutions
- **Distinct Identity**
 - !
- **Technical Feasibility**
 - Good transmission performance
 - Same issues as other photonic integrated circuits
- **Economic Feasibility**
 - Avoids use of expensive high speed electronics
 - Avoids excessive spectral occupancy in regional applications

Summary

- **Introduced comb based WDM**
 - **Special case: Coherent WDM**
 - Good transmission performance
 - Low skew (PIC plus narrow spacing)
 - Minimises component count
- **Allows otherwise conflicting requirements to be met**
- **Possible serial implementation of 100 GE**