Updated results of PIE metrics calculations

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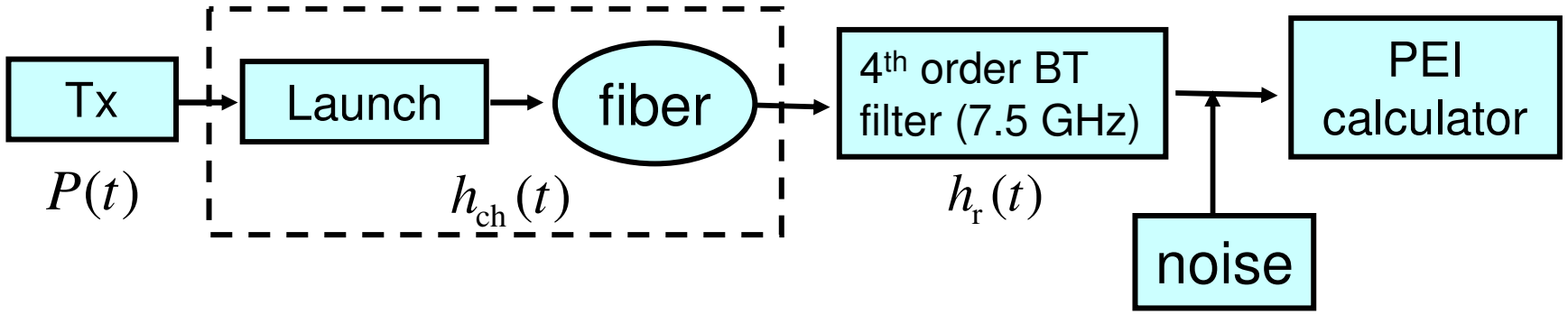
Outline

- The dependency of PIE metrics on input pulse shape and propagation distance were presented in Ottawa meeting
- The statistics of PIE metrics for Cambridge 81 fiber was presented
- PIE metrics of new 108 fiber are calculated

Simulation setup and PEI calculation



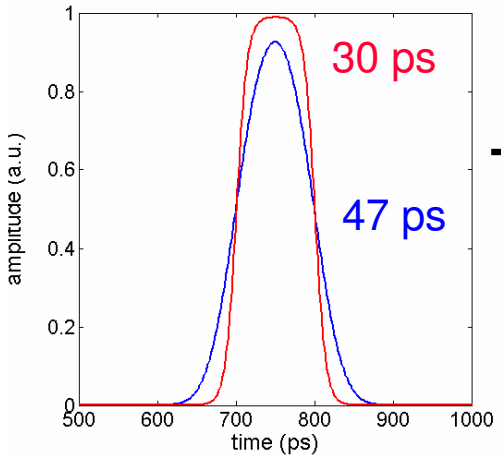
- Channel is simulated using and Cambridge new release (108 fibers)
- Composite pulse response $h(t) = p(t) * h_{ch}(t) * h_r(t)$
- Noise is a constant (bhoja_1_0704.pdf)

$$\sigma^2 = 10^{(\text{ESNR} - 2*\text{optical dispersion penalty})/10}, \text{where}$$

$$\text{ESNR} = 17\text{dB}\ (\text{BER} = 10^{-12});$$

$$\text{optical dispersion penalty} = 6\text{dBo}$$

Effect of input pulse width on PIE metrics



Select fiber

Cambridge release (108 fibers)

Tx

Channel response

Convolution process

Optical pulses

Rx and PIE calculator

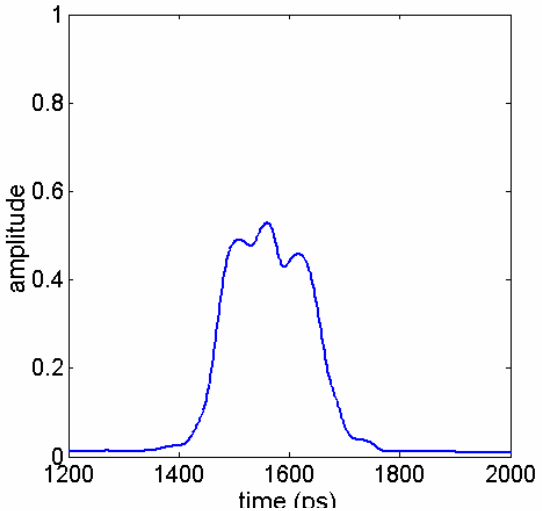
Choose the worst PIE from three offsets

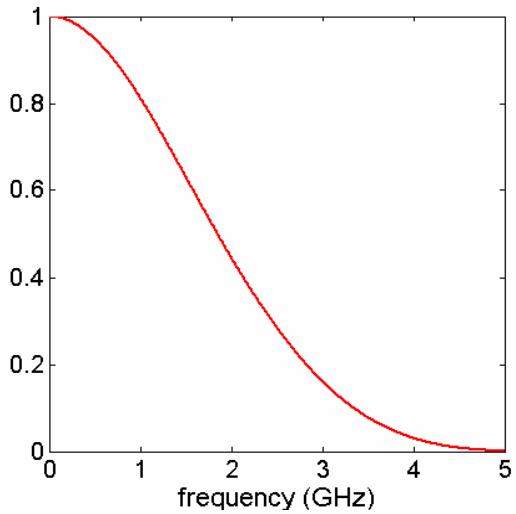
The process is repeated for all 108 fibers.

30 ps rising time is used in all simulations

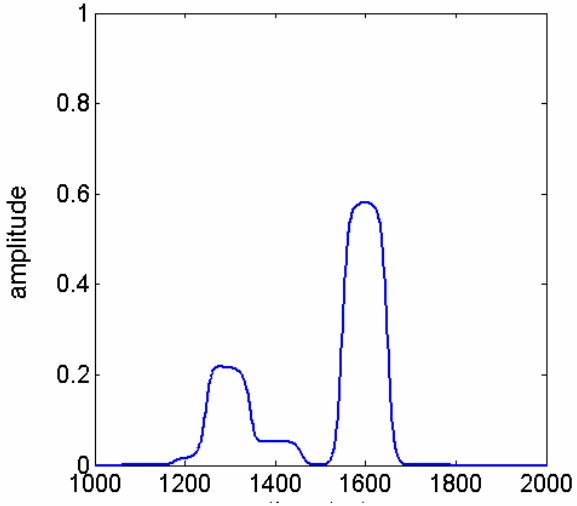
Pulse shape examples (300m)

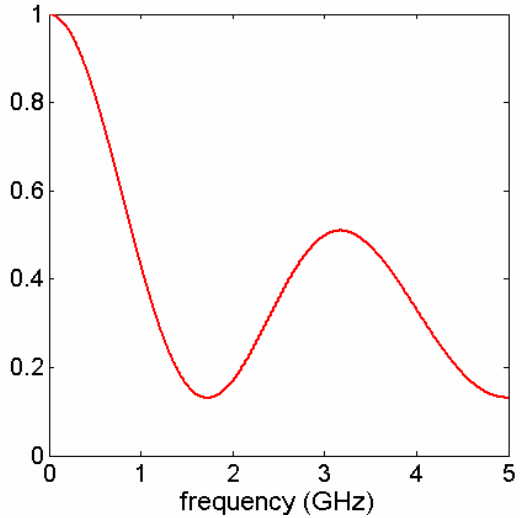
Offset launch



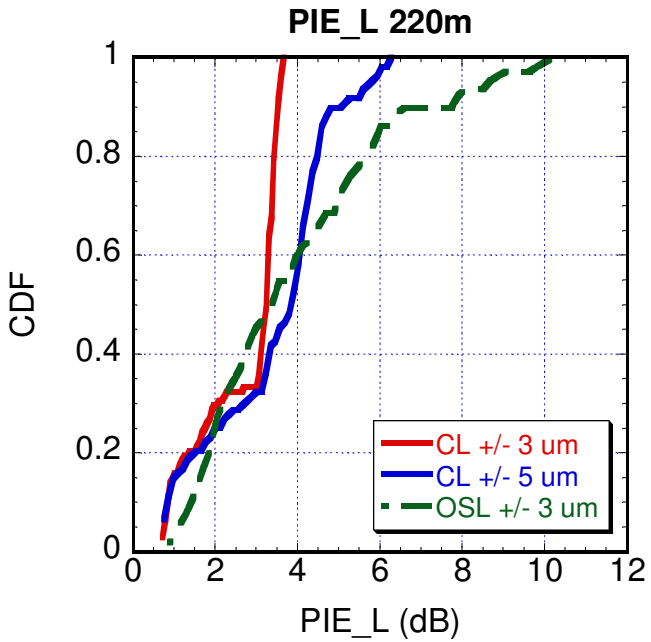


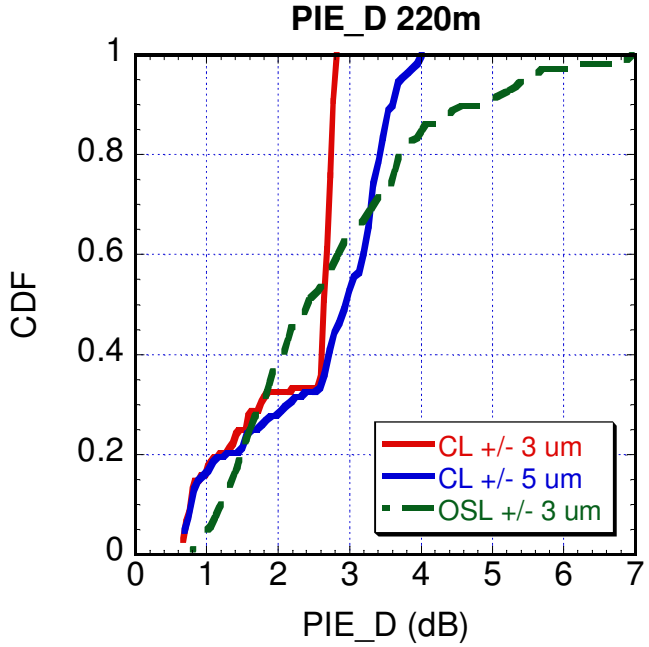
Center launch





PIE metrics of 220 m fiber

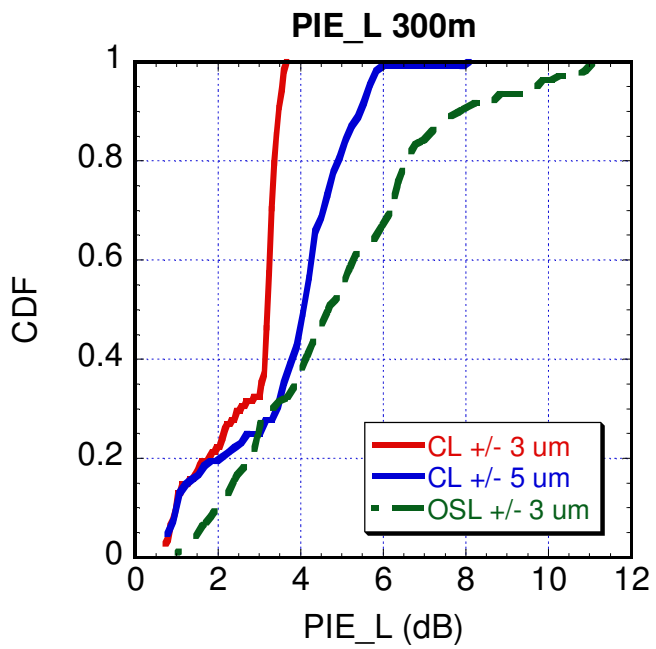


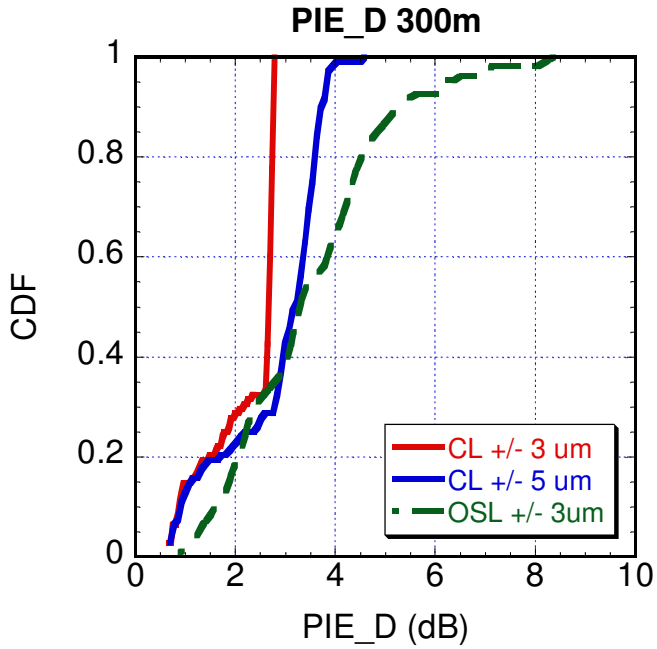


% of < 4.5 dB	PIE_L	PIE_D
CL +/- 3 µm	100 (100)	100 (100)
CL +/- 5 µm	86 (100)	100 (100)
OSL +/- 3 µm	65 (92)	89 (100)

Red number: percentage of <4.5 dB for 81 fibers

PIE metrics of 300 m fiber

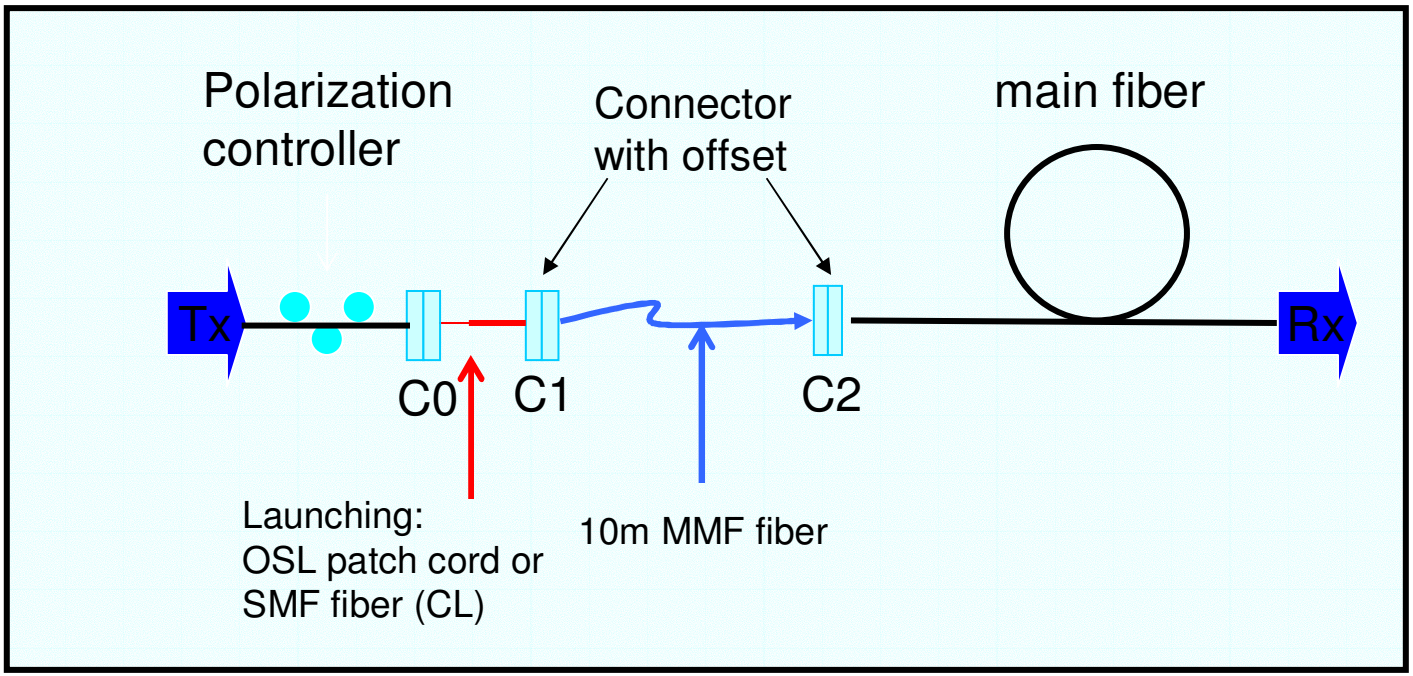




% of < 4.5 dB	PIE_L	PIE_D
CL +/- 3 µm	100 (100)	100 (100)
CL +/- 5 µm	71 (100)	99 (100)
OSL +/- 3 µm	47 (70)	79 (95)

Red number: percentage of <4.5 dB for 81 fibers

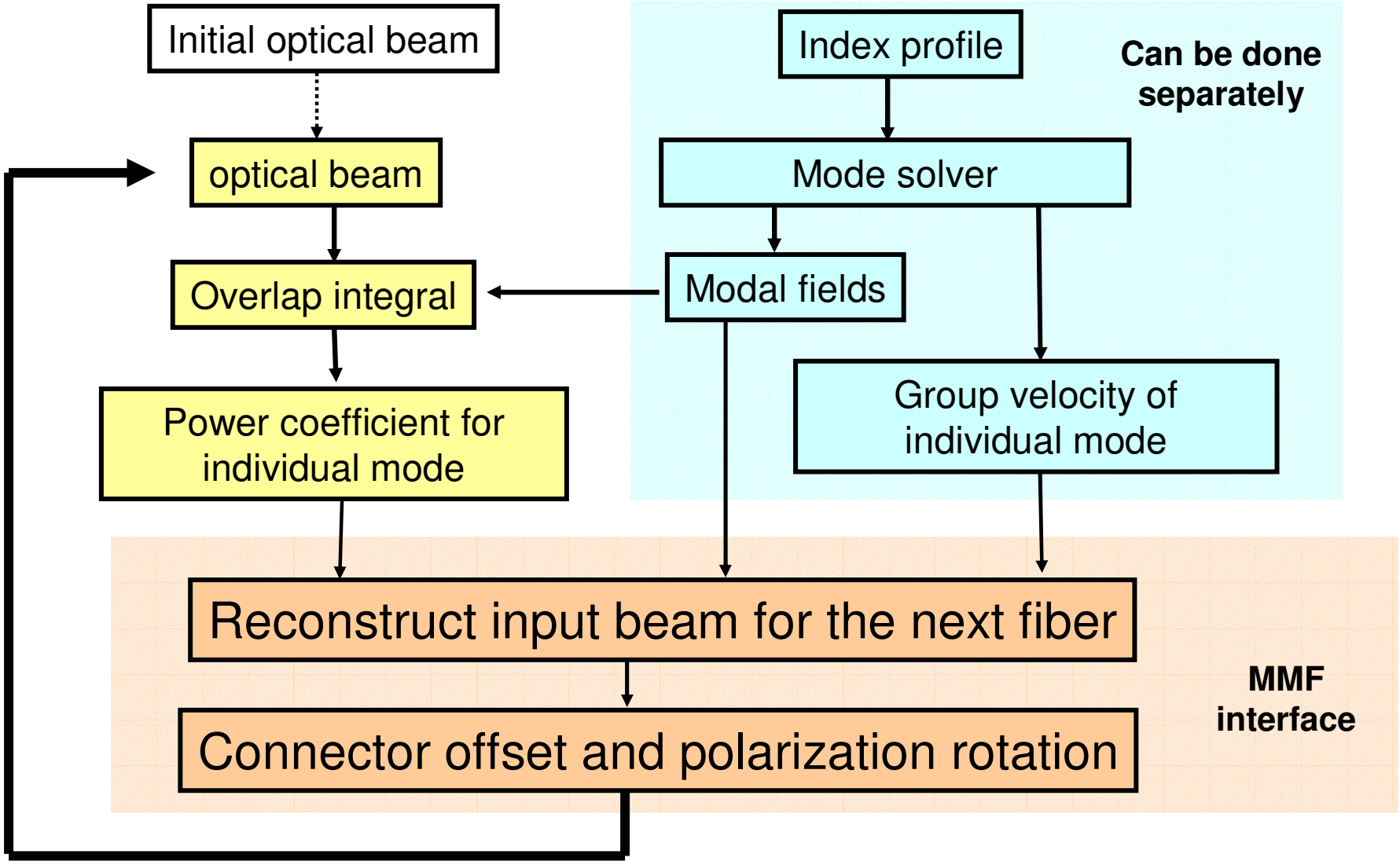
Proposed multimode fiber link



Case I : C1 = C2 = 5 µm

Case I : C1 = C2 = 7 µm

Channel modeling using in-house simulator

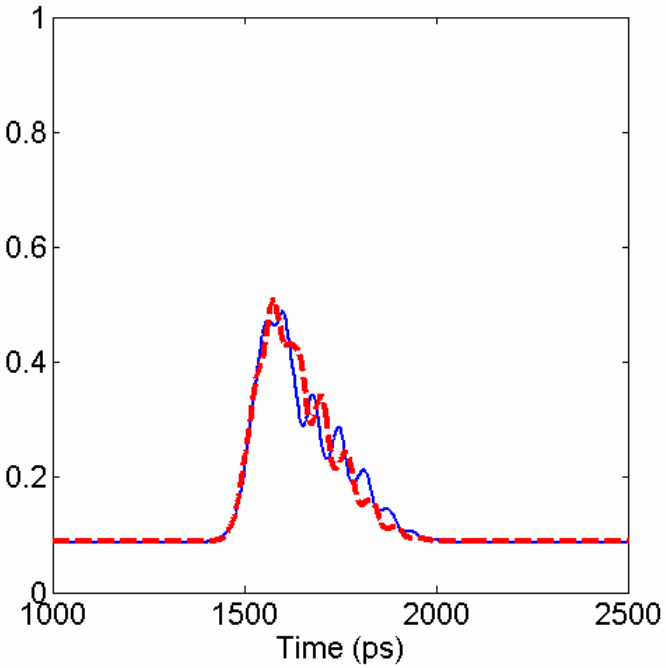


Baseline pulse shape comparison

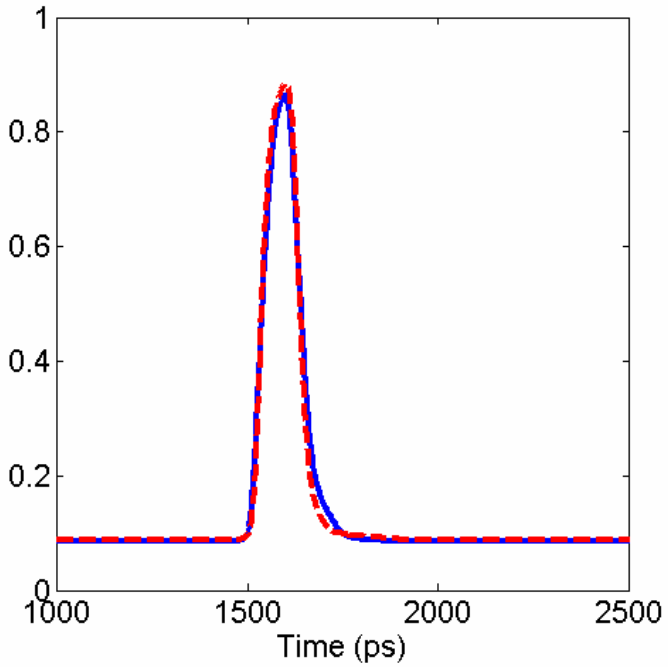
Optium in-house simulator

Cambridge release 3.1

Fiber 15, offset 17 µm

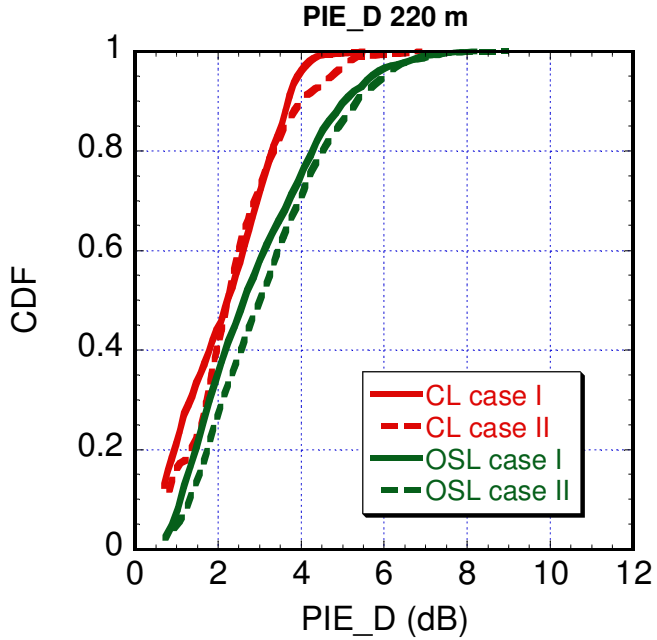


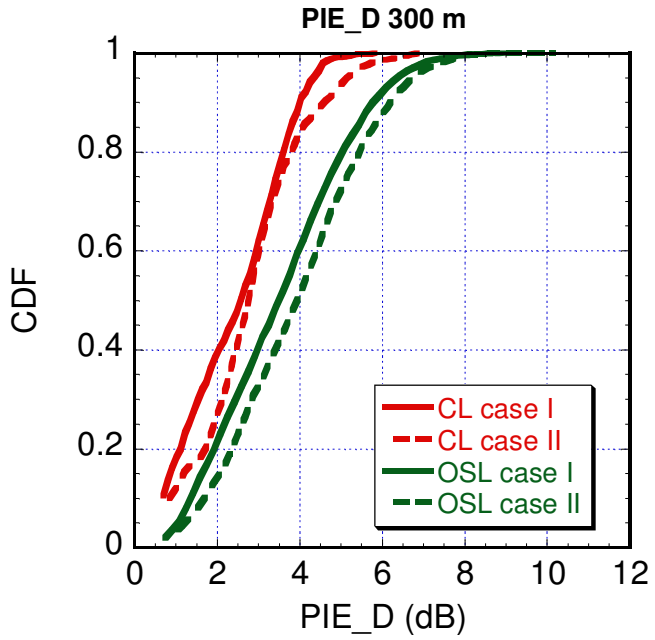
Fiber 63, offset 17 µm



18 modal groups are included

Comparison of PIE_D metrics





% of < 4.5 dB	220m	300m
CL case I	99.2	97.9
CL case II	93	89
OSL case I	84.2	72
OSL case II	79	60

Conclusion

- PIE metrics of offset launch degrade as the distance increase.
- PIE metrics for center launch is not sensitive to the change of fiber length.
- With multiple offset connectors in the link, center launch experience less PIE penalty