

# PIE Metric Comparison: 108-Fiber & Monte Carlo Delay Sets

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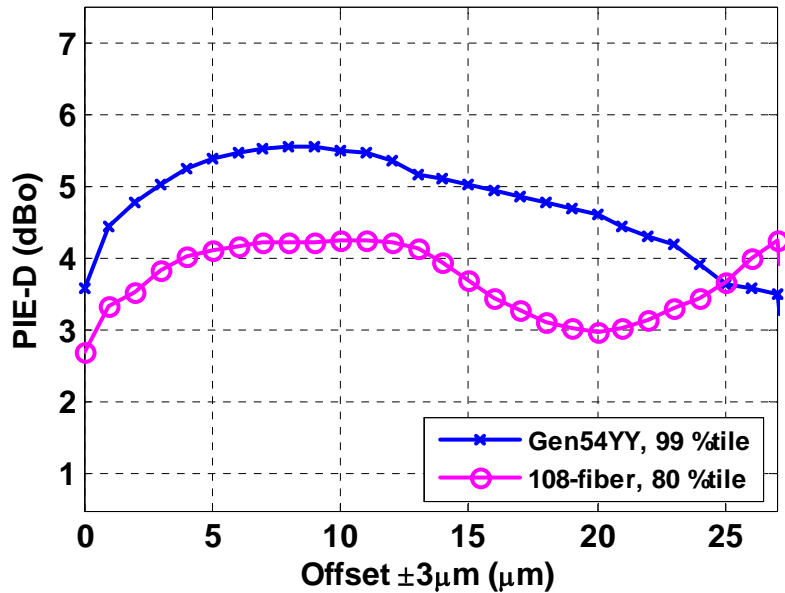
Scintera

# Simulation Parameters

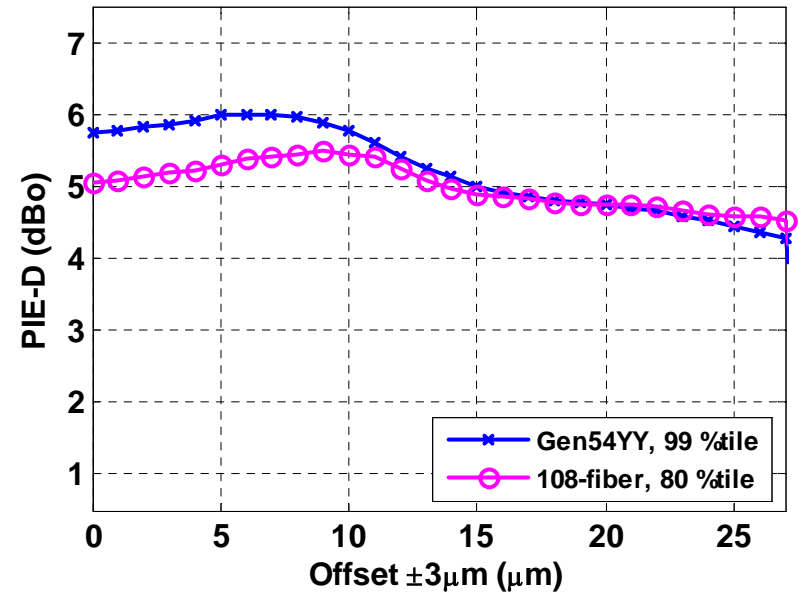
- Delay Sets
  - 108-fiber Release 2.1 (Cambridge)
  - 5000-fiber, Gen54YY (J. Abbott)
  - 18 mode-groups used in simulations
  - “Per offset” statistics unless otherwise noted
- PIE Metrics
  - 47.1 ps, 20%-80% Gaussian Tx filter
  - 7.5GHz, 4<sup>th</sup>-order BT Rx filter
- Connector scenario #1
  - 2 connectors with offset fixed at 7 $\mu$ m for both connectors
    - Use P. Pepeljugoski’s method to compute connector transfer matrix
  - Include only MPD diffusion effects, i.e. Ignore delay spread between connectors
  - Use with 108-fiber delay set
- Connector scenario #2 – “Monte Carlo”
  - 2 connectors with random offsets
    - Rayleigh distribution, mean= 3.58 $\mu$ m, truncated at 7 $\mu$ m
  - Include only MPD diffusion effects
    - Use P. Pepeljugoski’s method to compute connector transfer matrix
  - Use with Gen54YY delay set

# PIE-D / 220m

FDDI Fiber, No Connectors, 220m



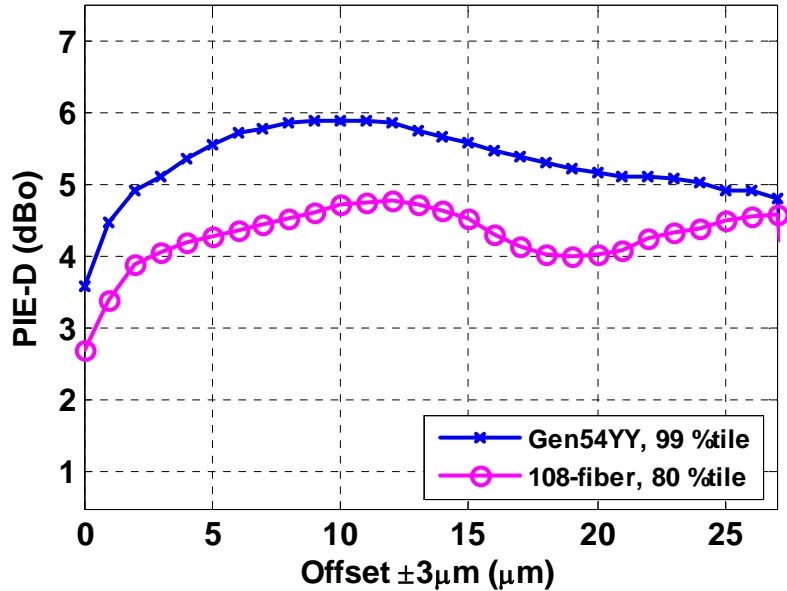
FDDI Fiber, 2 Connectors, 220m



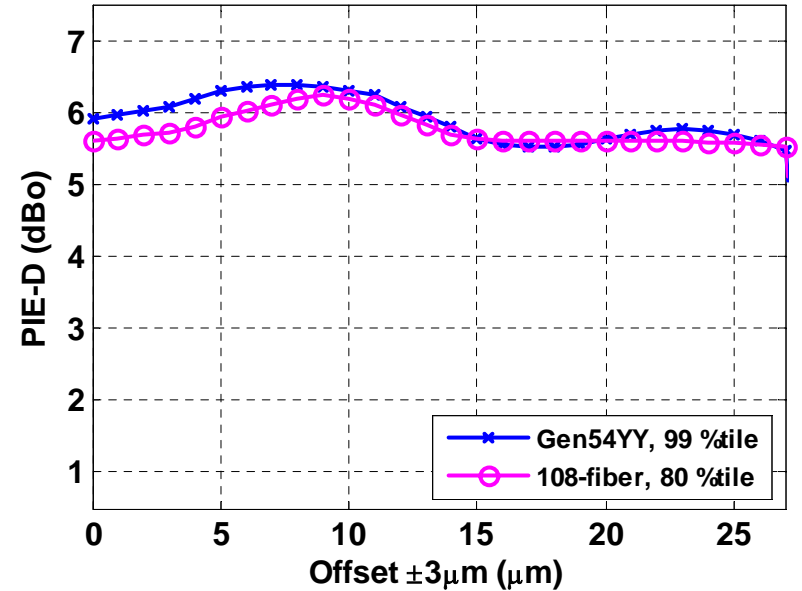
- Connectors impact performance of CL and OSL
  - Most noticeable for 108-fiber model
- Good agreement between delay sets across range of launch conditions (with connectors)

# PIE-D / 300m

FDDI Fiber, No Connectors, 300m

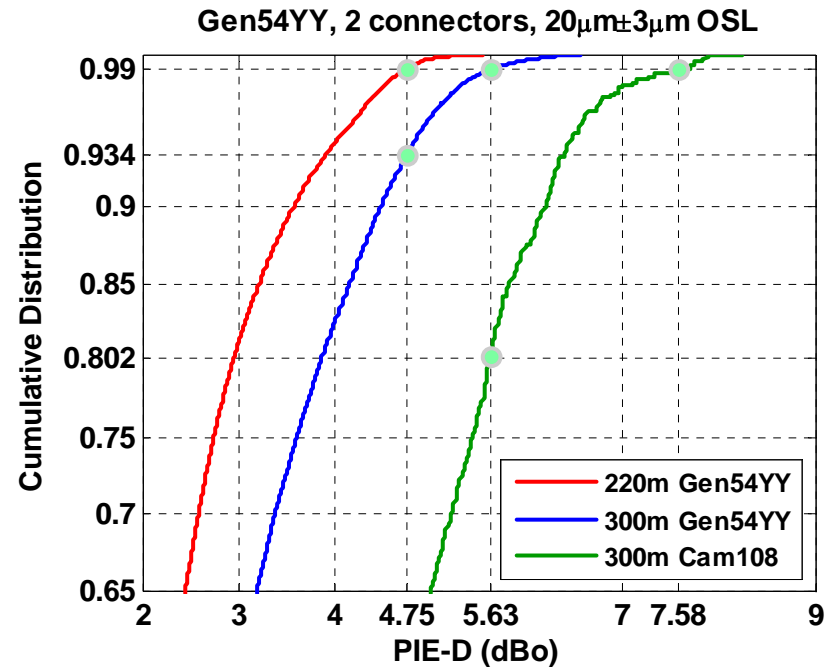
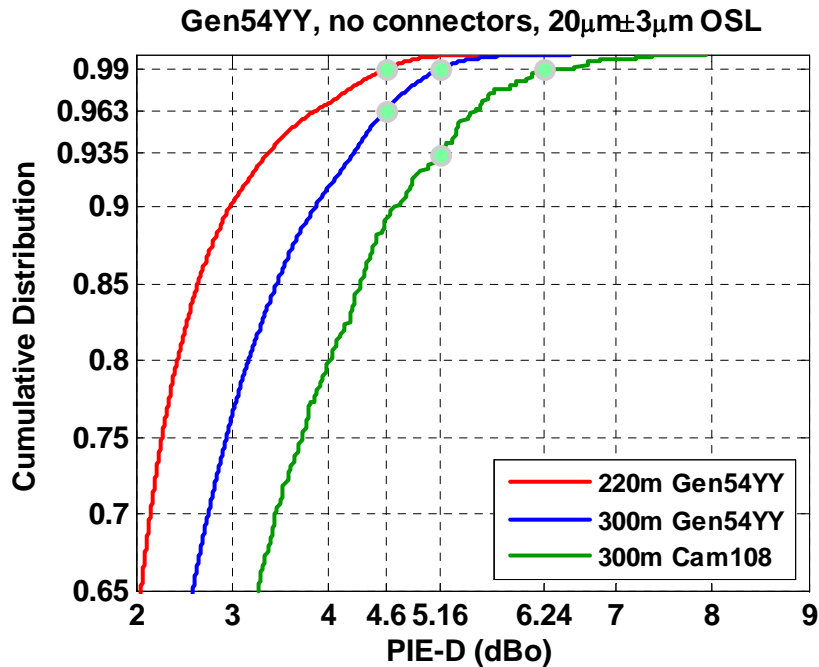


FDDI Fiber, 2 Connectors, 300m



- Connectors impact performance of CL and to lesser extent OSL
- Excellent agreement between delay sets across range of launch conditions (with connectors)

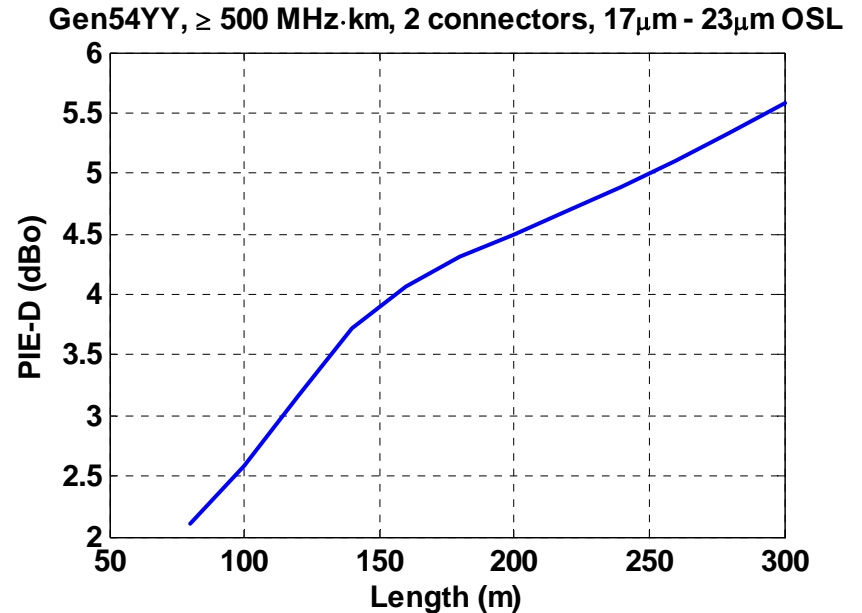
# PIE-D Distribution



- Monte Carlo 99<sup>th</sup> percentile  $\approx$  108-fiber 80<sup>th</sup> percentile
- $\sim 5.6$  dB PIE-D channel metric @ 300m
  - $\sim 1.3$  dB increase over original estimates using Cambridge 65-fiber delay set

# PIE-D vs. Length

- PIE metric does not increase linearly with distance
- ~ 1 dB increase from 220m to 300m
- PIE metric vs. distance requires further study



# Summary

- Monte Carlo and 108-fiber delay set show similar results
  - Need to exclude  $< 500$  MHz·km fiber from statistics
  - 80<sup>th</sup> percentile of 108-fiber close to 99<sup>th</sup> percentile Monte Carlo
- Connectors
  - Increase the channel metric by  $\geq 1$  dB
  - Minimize the advantage of any conditioned launch (CL or OSL)