

# Scaling LRM Length to Match PIE-D Capability & Failure Rate using FDDI Gen67 Fiber Set

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# OVERVIEW

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**The LRM standard and the Gen67 Monte Carlo modeling involve 3 parameters:**

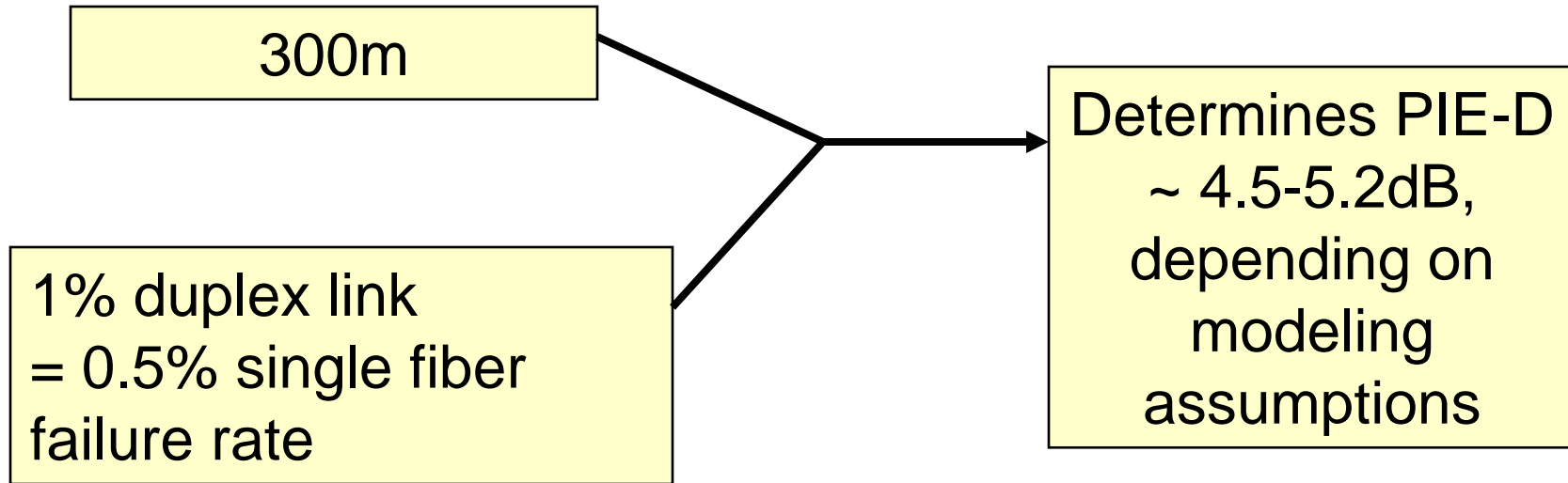
- 1. Link length**
- 2. PIE-D level {can also be finite equalizer penalty}**
- 3. % coverage of modeled links (or % failure)**

**If we specify an allowable % failure rate, and the PIE-D level we can support, this determines the link length we can support.**

**If we specify an allowable % failure rate and a link length, this determines the necessary PIE-D.**

# The values of two boxes determine the 3rd

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# Example Results from Gen67 Modeling

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**To give specific examples of how the 3 parameters are linked, we plot PIE-D vs link length for various single-channel failure rates.**

**For clarity for Example 1 we use**

- a. Gen67 data set**
- b. OFL BW>500MHz.km**
- c. 18um offset launch (Example 2– 4um)**
- d. no connectors**

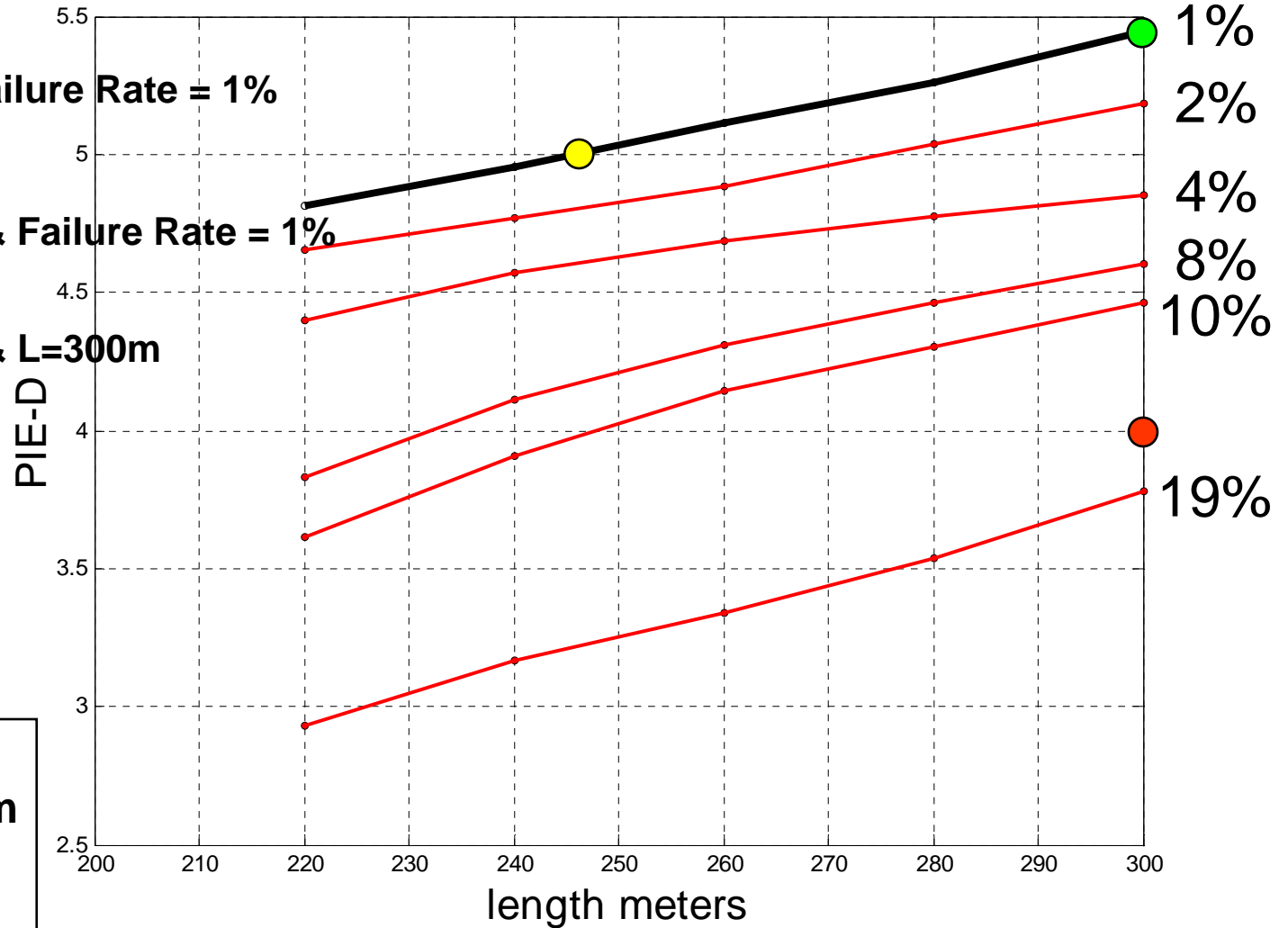
**The curves shift if the modeling assumptions change. (Example 3 – dual launch + connectors)**

# Example 1: PIE-D coverage vs. length (18um)

duplex link failure rates

Gen67 Fiber Set PIE-D

- Choose L=300m & Failure Rate = 1%  
→ PIE-D ~5.5
- Choose PIE-D=5dB & Failure Rate = 1%  
→ L~246m
- Choose PIE-D=4dB & L=300m  
→ Failure Rate ~16%



**Gen67**  
**OFLBW>500MHz.km**  
**No connectors**  
**18um offset**

# Example 2 PIE-D coverage vs. length (4um)

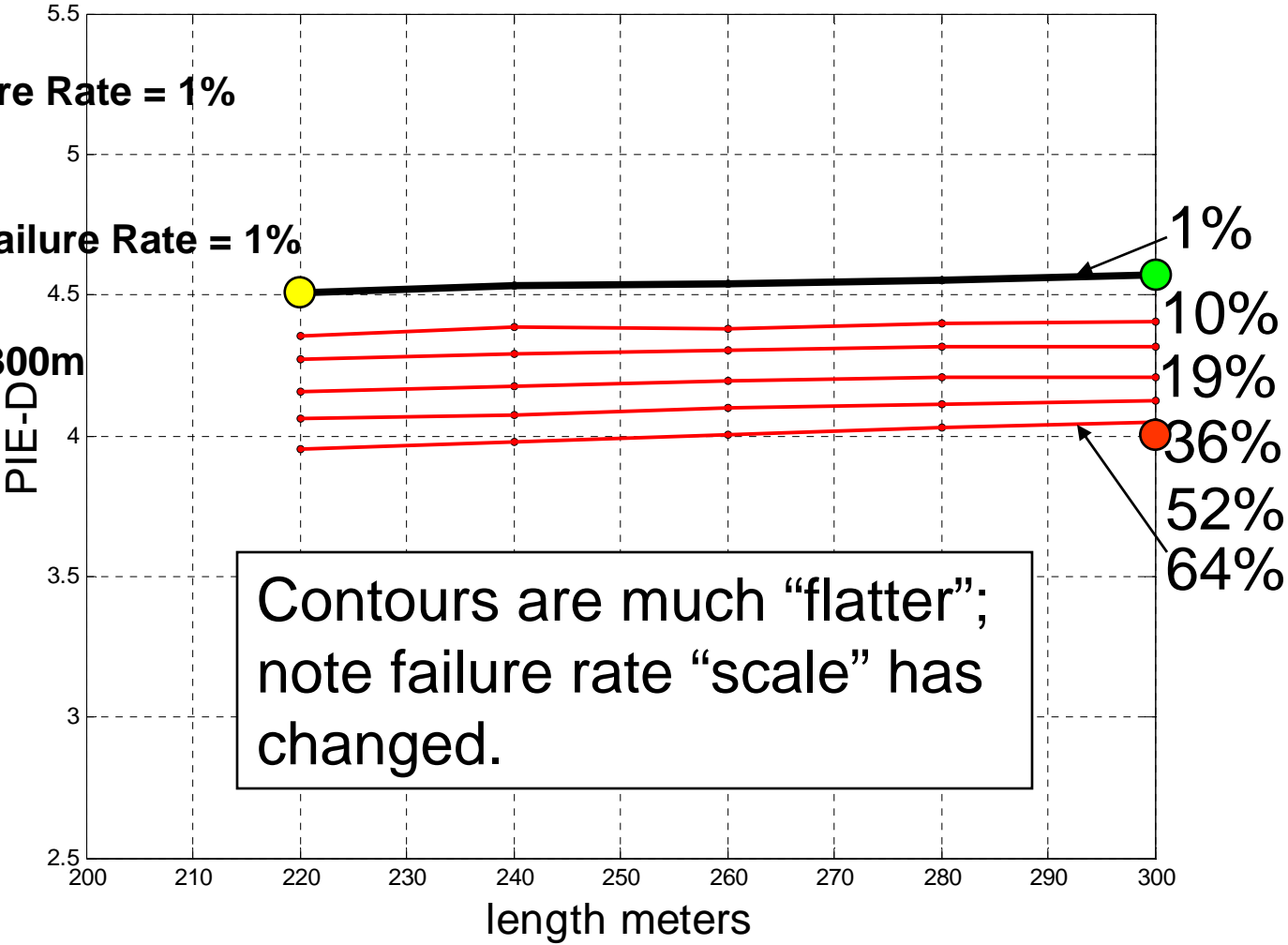
duplex link failure rates

Gen67 Fiber Set PIE-D

● Choose L=300m & Failure Rate = 1%  
→PIE-D ~4.6dB

● Choose PIE-D=4.5dB, Failure Rate = 1%  
→L=220m

● Choose PIE-D=4dB, L=300m  
→Failure Rate >64%



Contours are much “flatter”; note failure rate “scale” has changed.

Gen67  
OFLBW>500MHz.km  
No connectors  
4um offset

# Example 3 PIE-D coverage vs. length (dual launch)

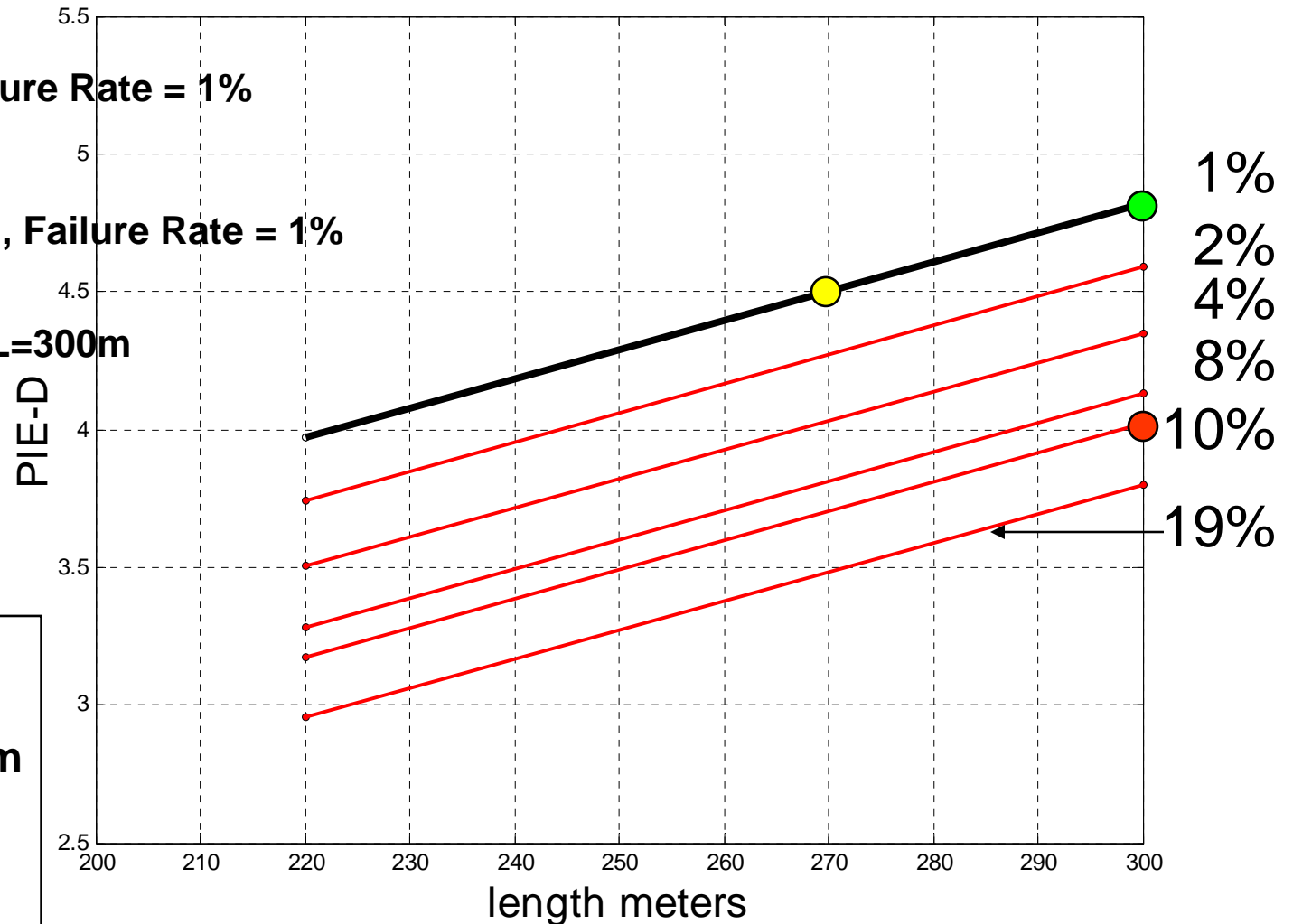
duplex link failure rates

Gen67 Fiber Set PIE-D

● Choose L=300m, Failure Rate = 1%  
→PIE-D=4.82

● Choose PIE-D=4.5dB, Failure Rate = 1%  
→L=270m

● Choose PIE-D=4dB, L=300m  
→Failure Rate~10%



**ESTIMATED**  
Gen67  
OFLBW>500MHz.km  
WITH connectors  
Dual launch  
Using OFS Results

# Conclusion

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**The 3 parameters (PIE-D, link length, %failure rate) are not independent. Once two are chosen, the 3<sup>rd</sup> is determined.**

**If we chose % failure rate based on IEEE norms then there is a tradeoff between the targeted link length and the required PIE-D.**

**We should use this approach as a tool to understand the tradeoffs between PIE-D, link length, % failure rate**