MPN effects at high BER – test results

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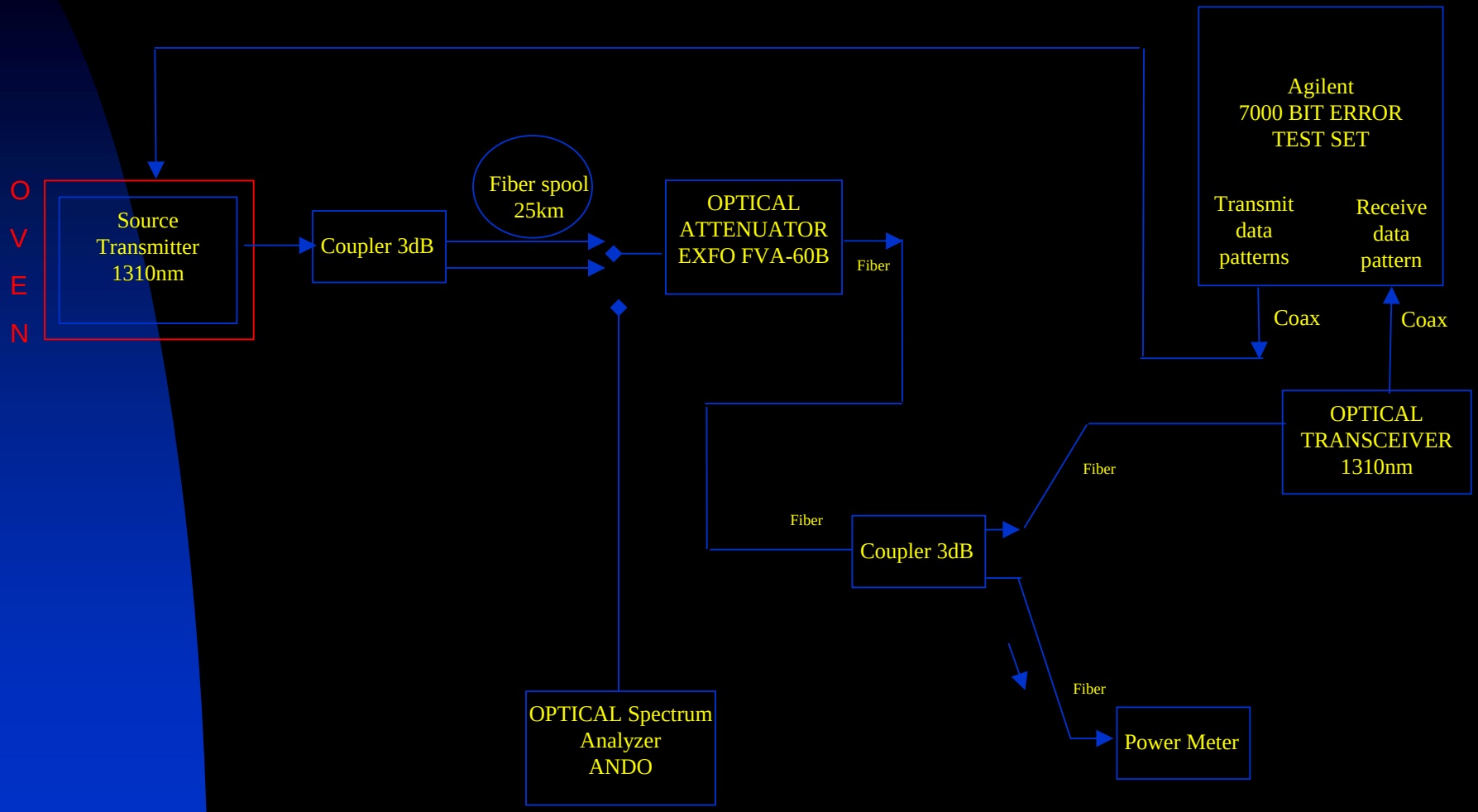
MPN Penalty at different BER - setup



Definition

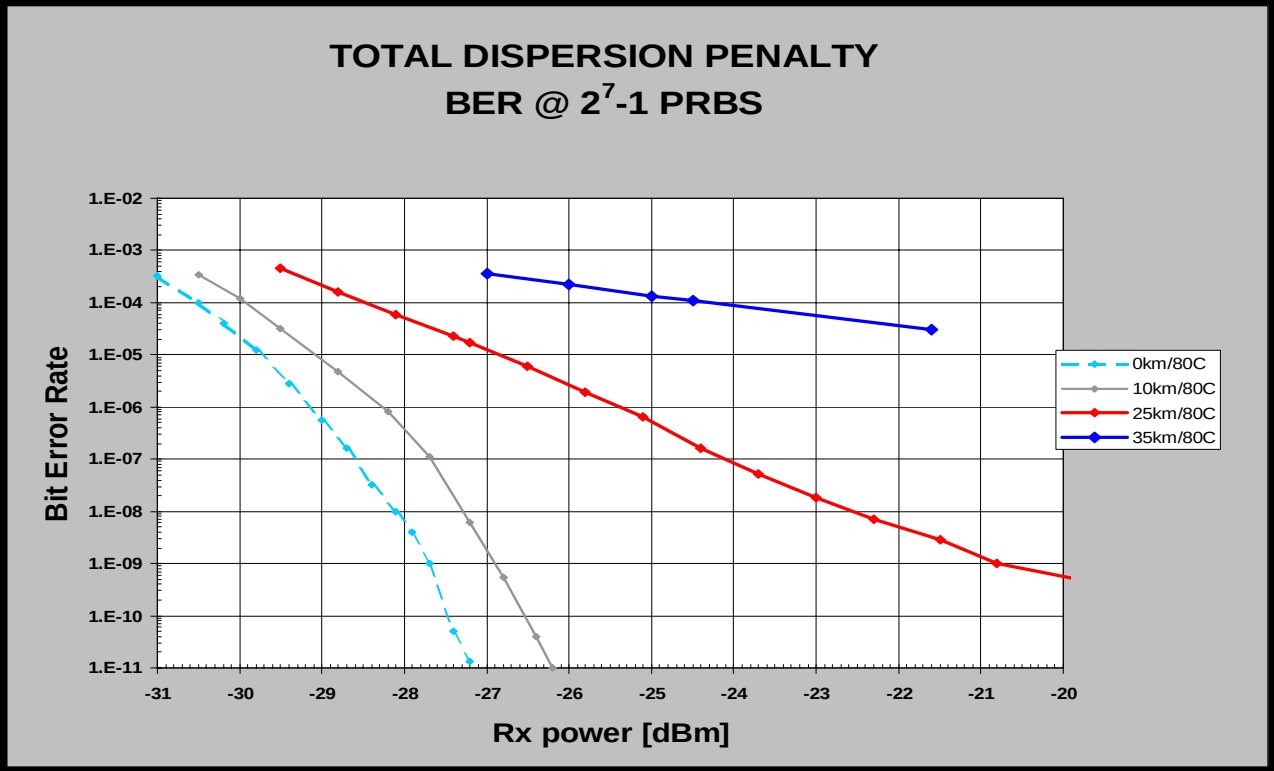
- Coding gain is the additional link budget, in dB, that can be achieved by working at 10^{-4} BER as compared to 10^{-12}
- Total Dispersion refers to combined ISI and MPN penalties

Proposed Measurement

- At each oven temperature measure spectral width and generate BER vs Popt for BER values $>10^{-4}$ and $<10^{-10}$, with and without various fiber length
- The actual value of the MPN penalty will be measured (for any BER in the above range)
- Total Dispersion [pS/nm] for each wavelength (temp) is known [using the known fiber characteristics and the measured wavelength and spectral width]

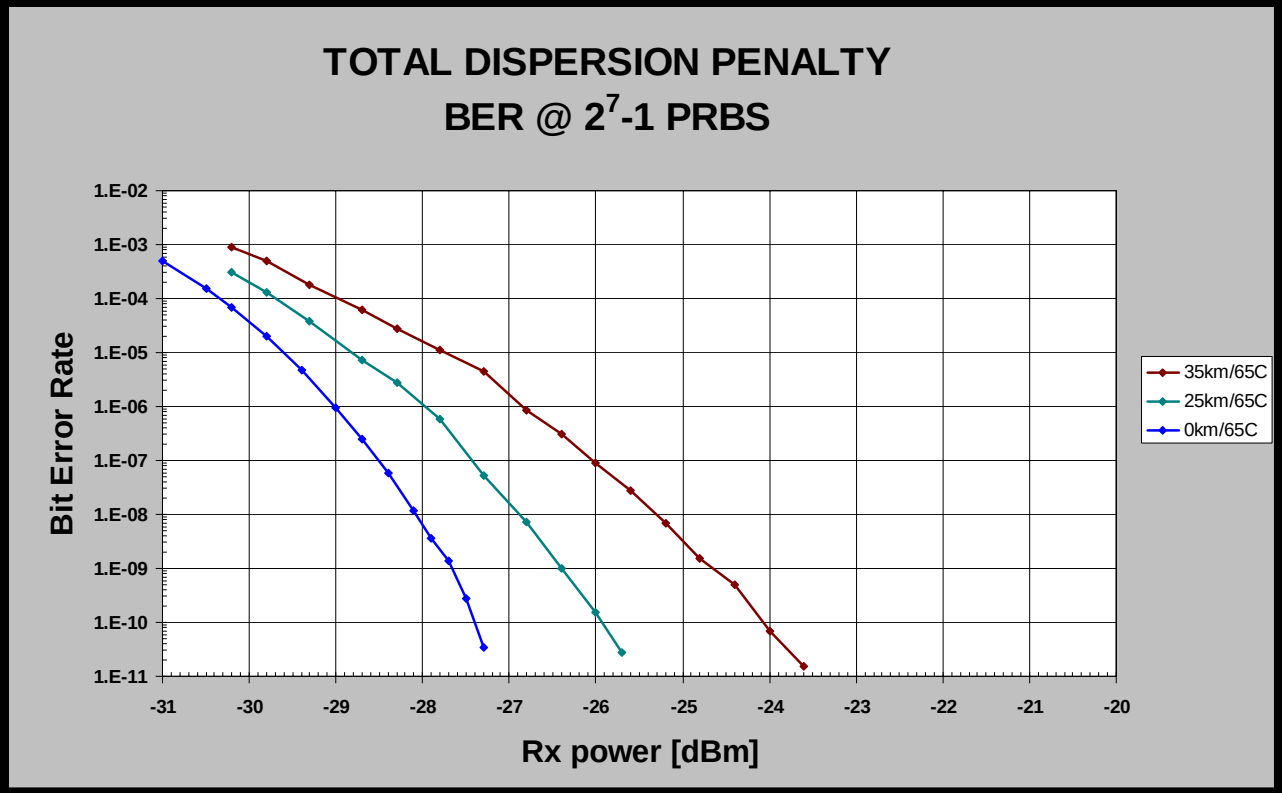
Results(1): Fixed temp variable L

- Coding gain increases with longer links (increased Dispersion)



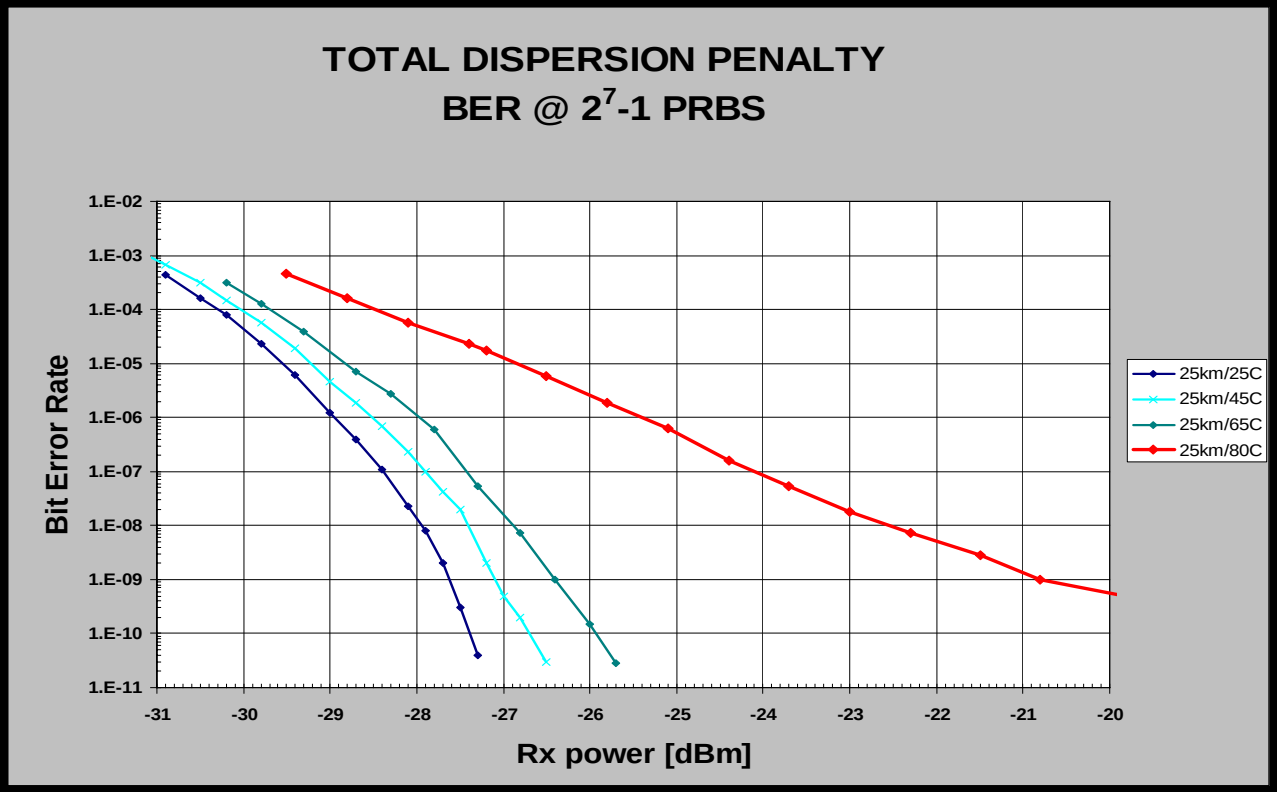
Results (2) : Fixed temp variable L

- Coding gain increases with longer links (Increased Dispersion)



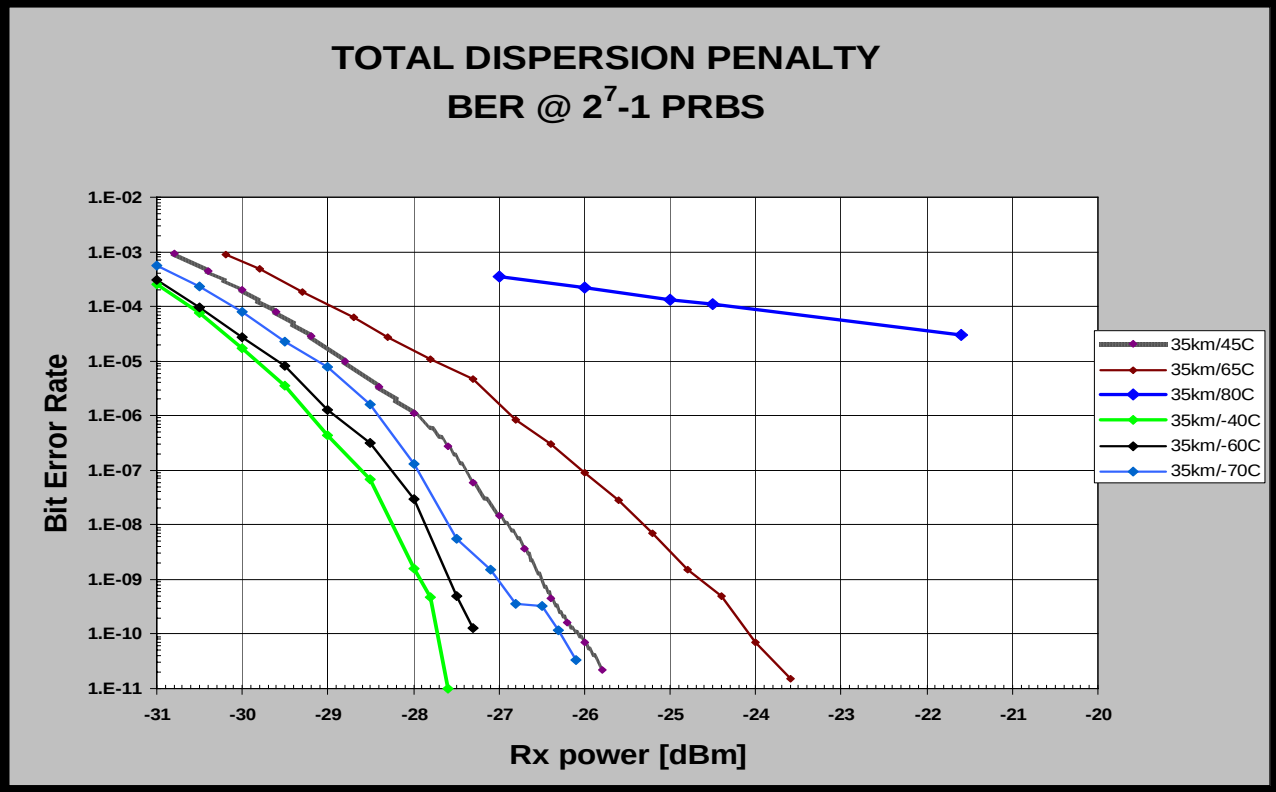
Results (3): Fixed L variable Temp

- Coding gain increases with increased Dispersion (increased temperature)

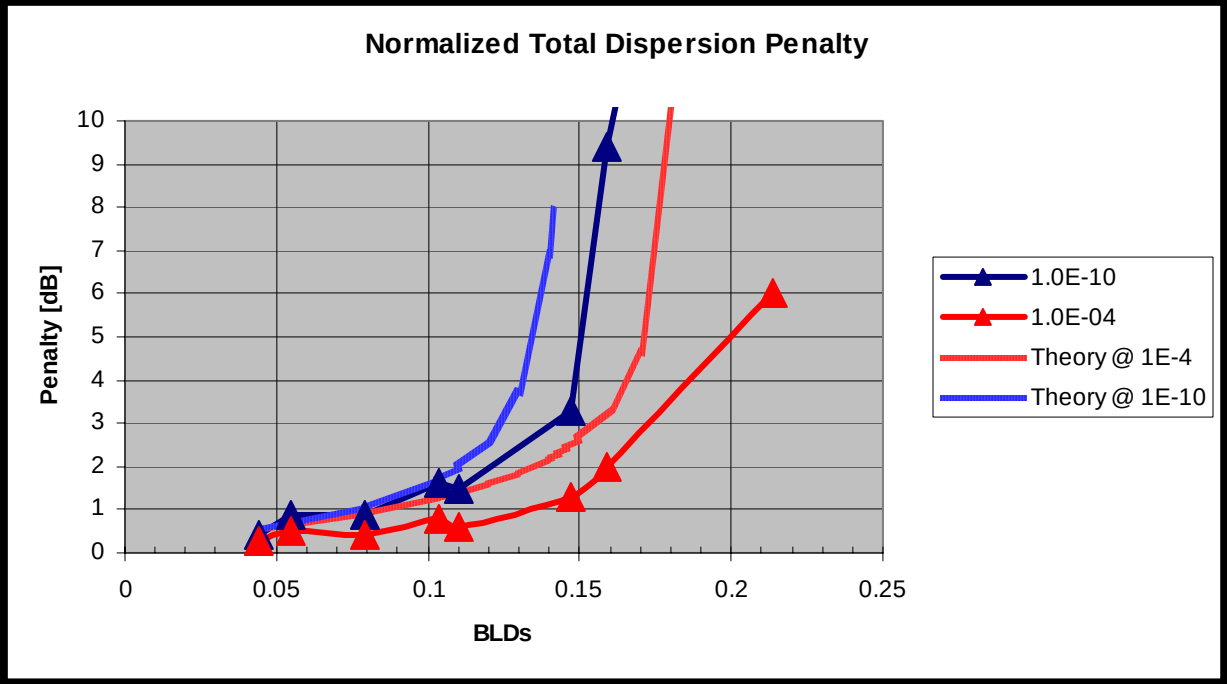


Results (4): Fixed L variable Temp

- Coding gain increases with increased Dispersion (higher and lower temperatures)



Results (5): Compare to Theory



- Theory calc includes ISI and MPN per Agrawal
- Data includes different temp and different length
- This plot equivalent to a “horizontal cut” at 10E-4 and 10E-10 BERs of previous Penalty vs Rx Pwr plots

Some results from Plots

- Results (1) T=80C

Length	CG(dB)	P@10E-4
0Km	3.5	30.5dBm
10Km	3.8	-30.0dBm
25Km	>10	-28.5dBm
35Km	>>10	-24.5dBm

Results(5) Plot:

For a 1.5dB penalty, length can be increased by about 35% with FEC which corrects 10E-4 to 10E-10. (Our FEC corrects to10E-12)

- Results(2)T=65C

Length	CG(dB)	P@10E-4
0Km	3.2	-30.3dBm
25Km	3.5	-29.8dBm
35Km	5.5	-29.0dBm

Conclusions:

- FEC effectiveness increases with increased normalized dispersion (i.e., increased length, fiber dispersion, spectral width or increased bandwidth).
- At high BER (10^{-4}) the actual performance is better than theory and better as compared to low BER (10^{-10})