

Interferometric Noise Penalty in SMF Links - Experimental Results and Comparison with Theory

Petar Pepeljugoski
George Sefler

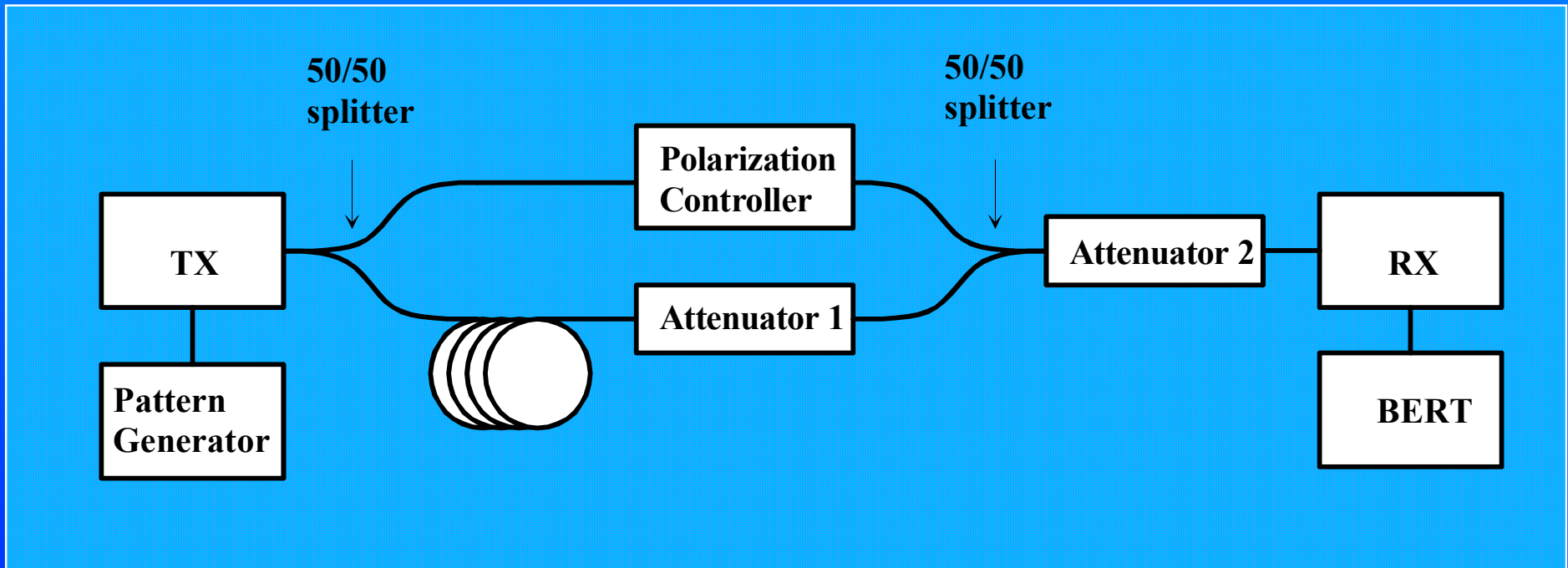


Outline

- **Measurement Setup**
- **Comparison of measured and calculated penalties for 3dB and 3.7 dB extinction ratio**
- **Conclusion**
- **Proposed solution**

Experimental Setup

- setup closely follows analytic model
- worst case IN controlled with polatization controller

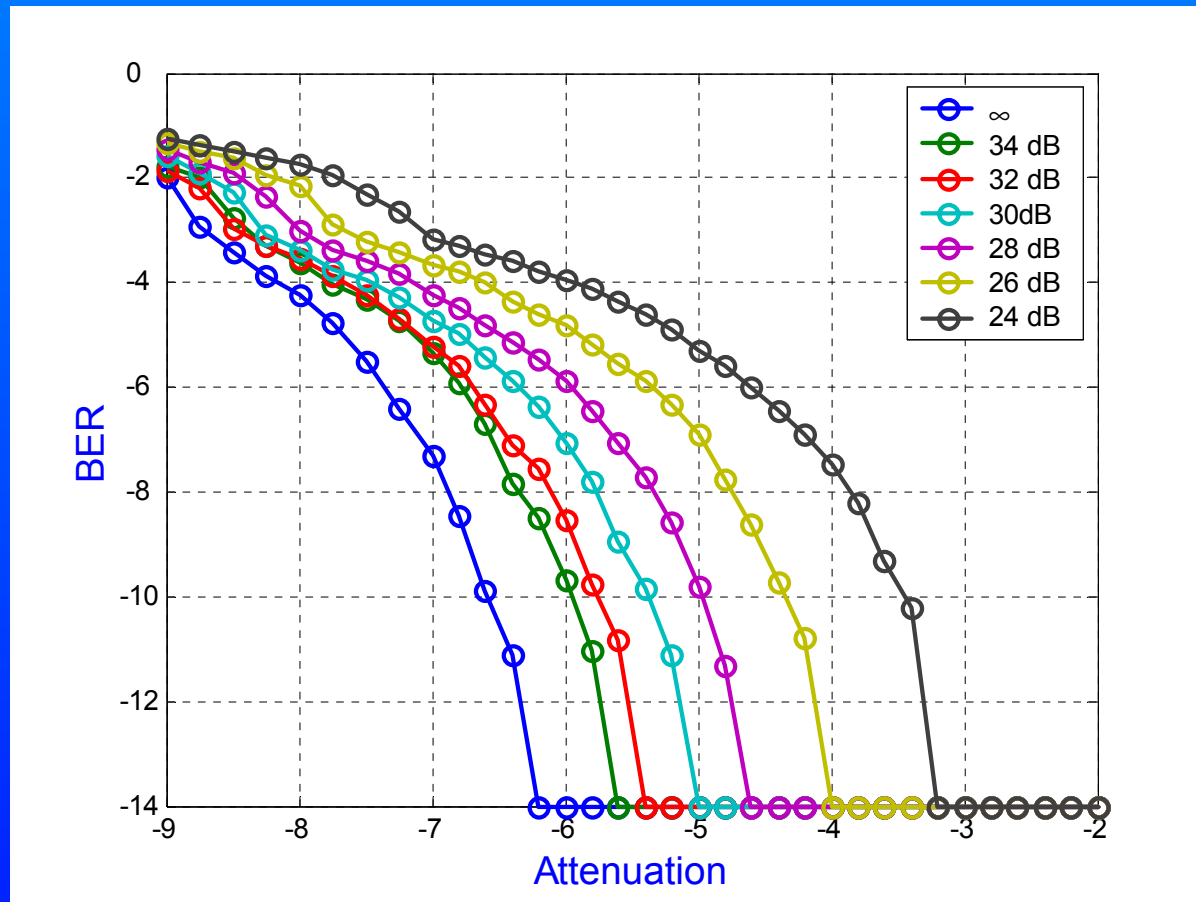


Calculation of IN

- Improved calculation follows formalism adopted by P. Legg (JLT. vol. 14, no. 9, pp. 1943-1954)
 - ▶ expressions for conditional error probabilities
- Takes into account ER, ISI

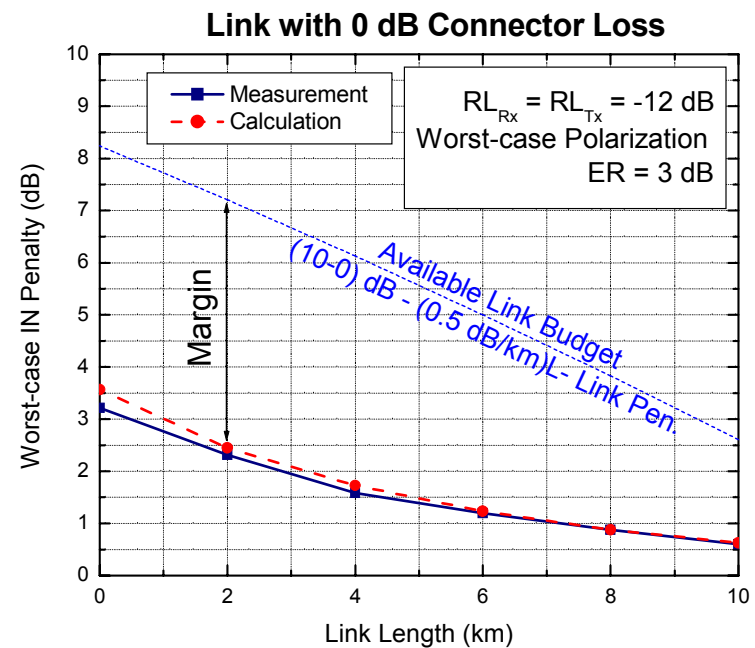
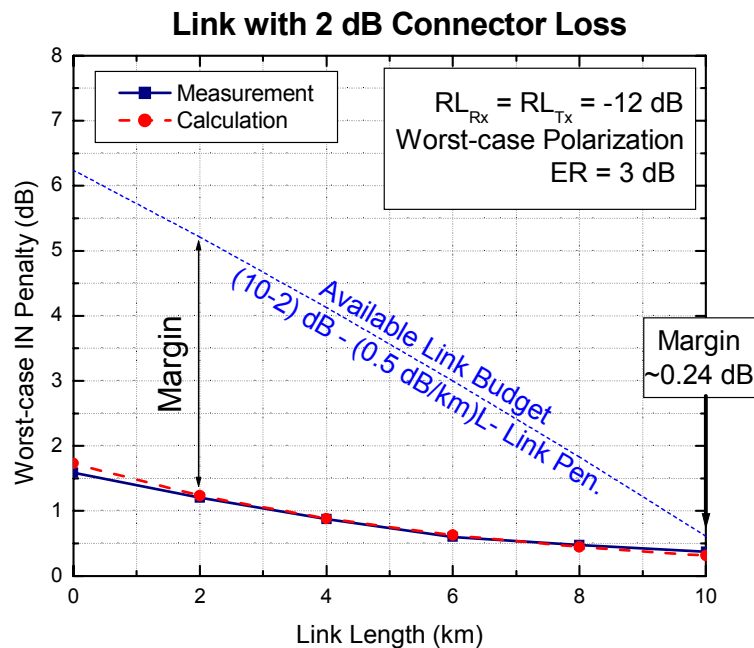
Interferometric Noise Penalty - 3dB ER

- IN penalty 3.2 dB with maximum polarization alignment - leaves ample of positive margin for 24 dB RL and shortest links
- IN penalty 0.6 dB for longest links with no connector loss - leaves 2dB margin



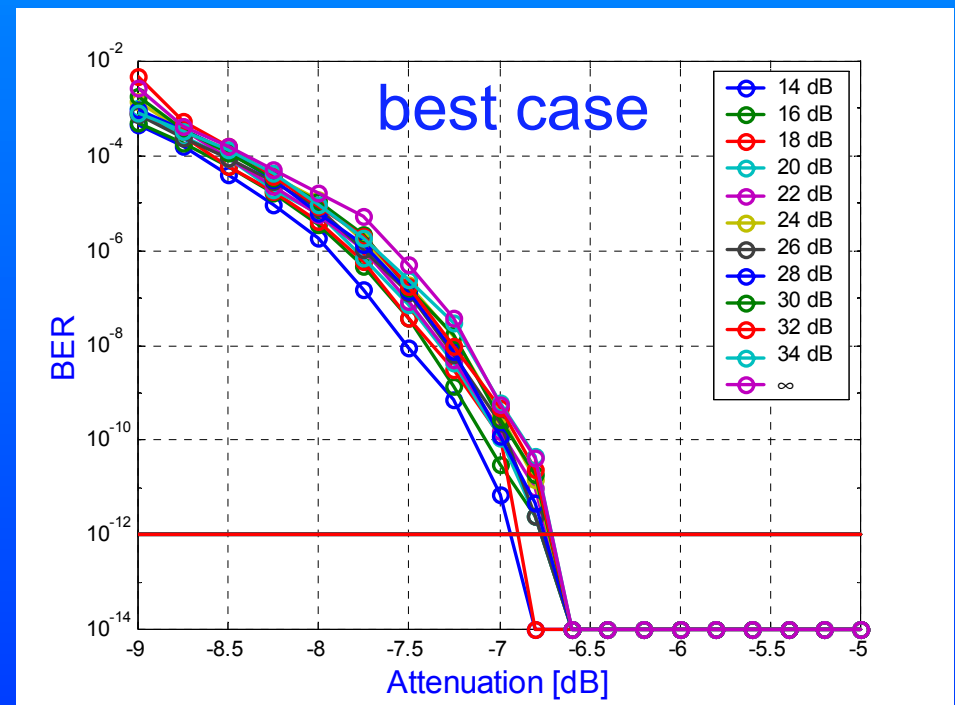
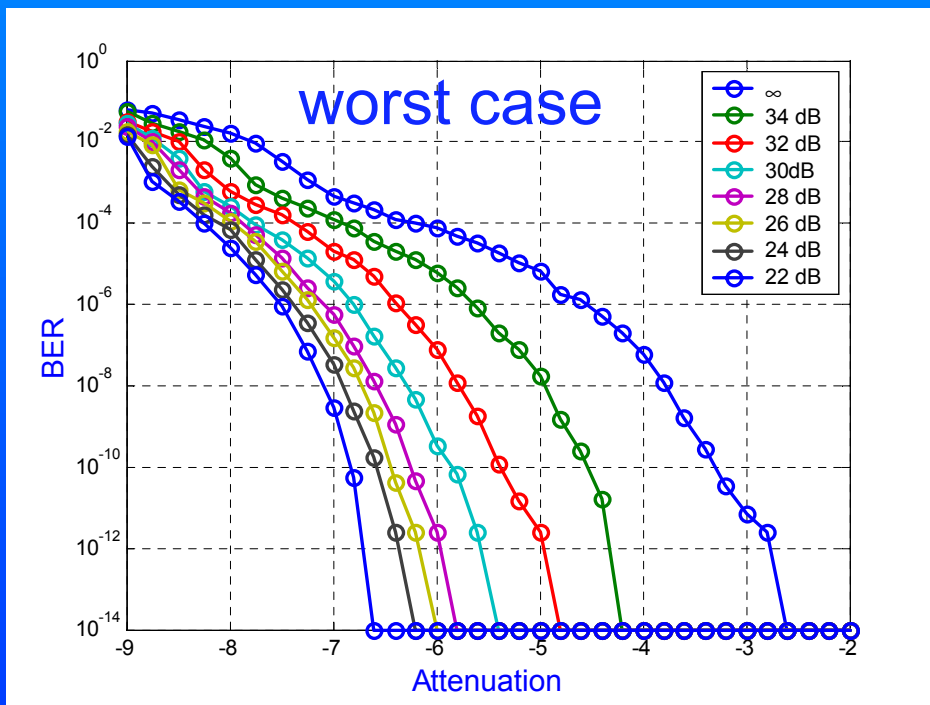
Comparison of Measured and Calculated Interferometric Noise Penalty - 3dB ER

- 0 or 2 dB link loss due to connectors
- shortest links have only 3.2 dB (0 dB loss) ~1.5 dB (2dB loss) worst case penalty (polarization aligned)
- excellent agreement between measurements and analytical model



Interferometric Noise Penalty - 3.7 dB ER

- IN penalty 2.5 dB with maximum polarization alignment - leaves even more positive margin
- No IN penalty with minimum polarization alignment

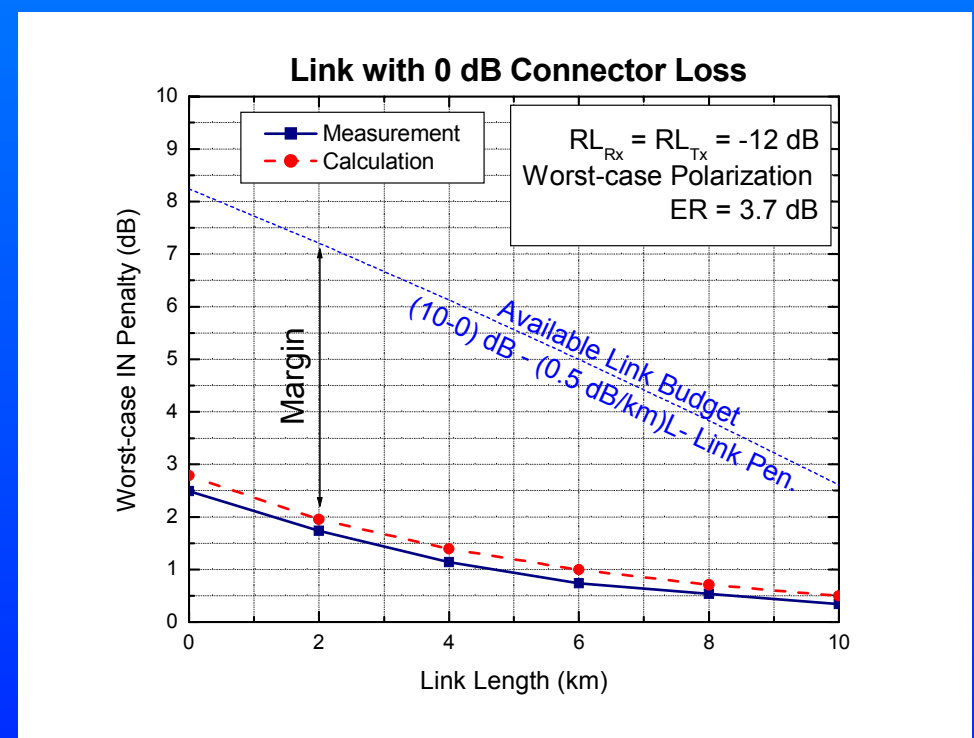
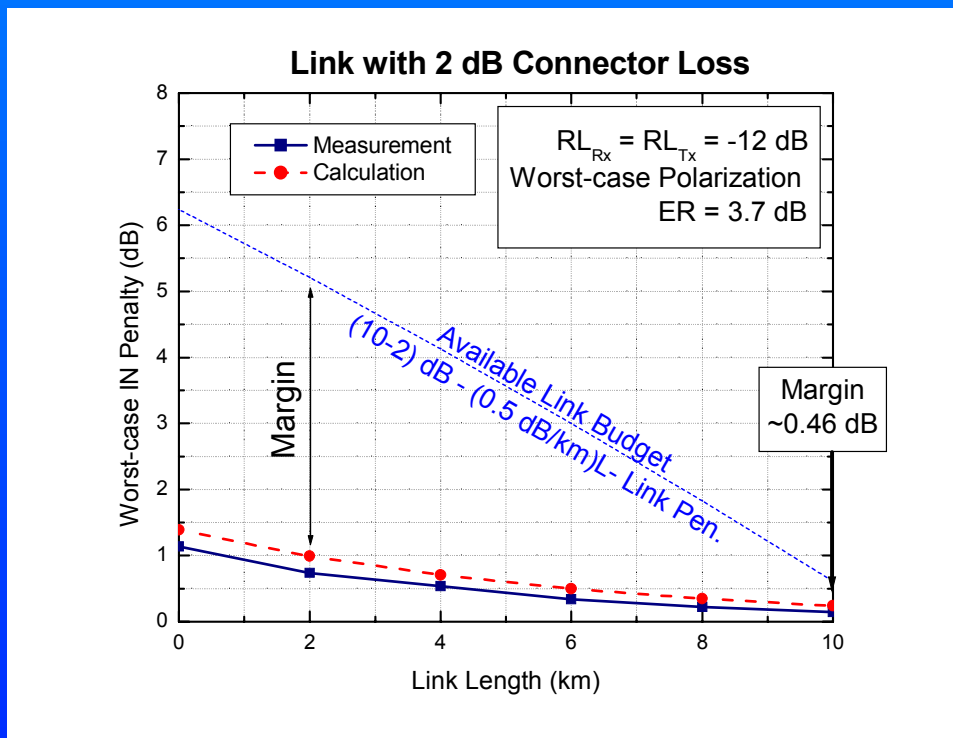


4 dB ER will be even more robust!



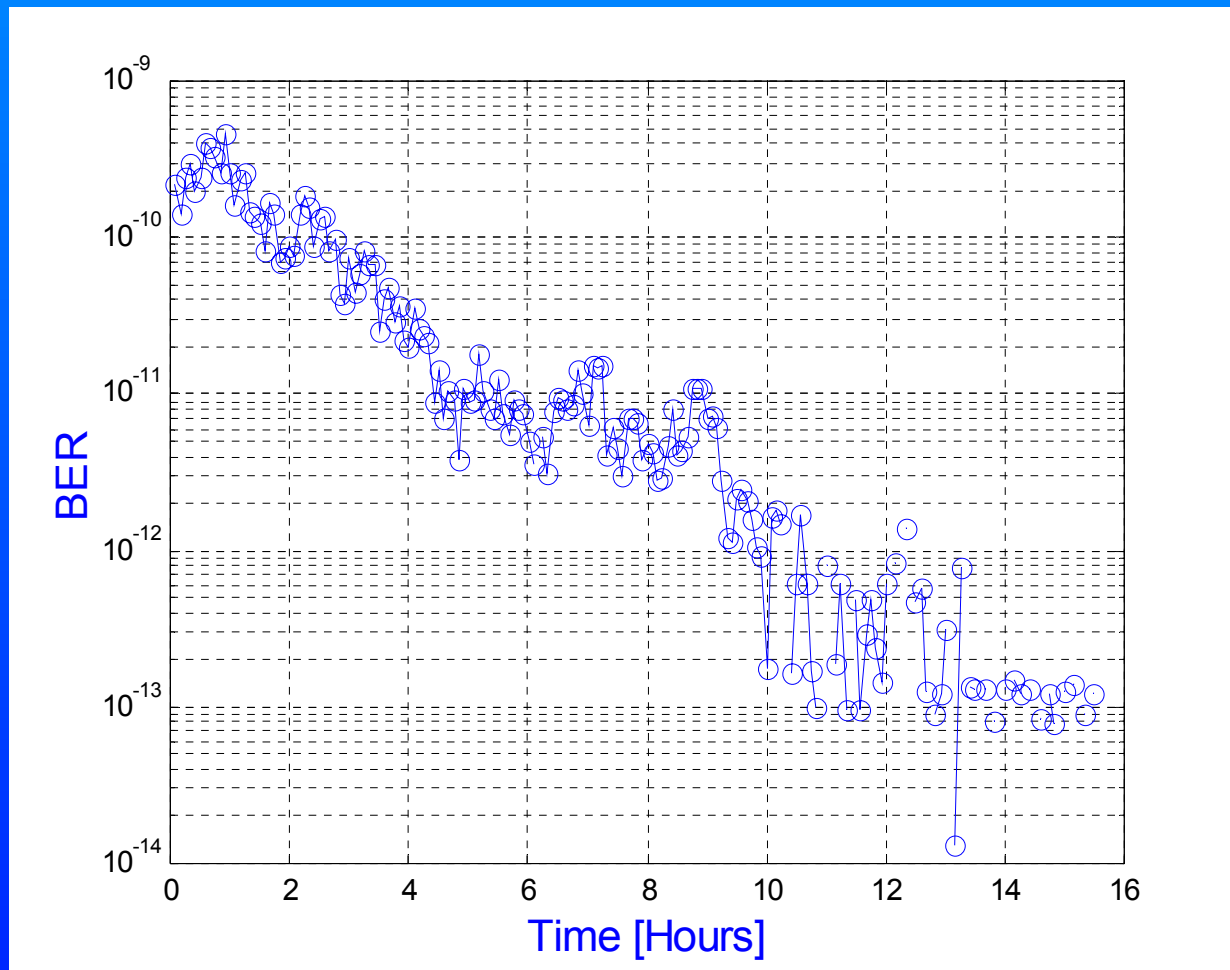
Comparison of Measured and Calculated Interferometric Noise Penalty 3.7 dB ER

- 0 or 2 dB link loss due to connectors
- shortest links have 2.5 (0 dB loss) or 1.1 dB (2dB loss) worst case penalty (polarization aligned)
- very good agreement with analytical model



Dependence of BER on Time

- BER drifts from maximum polarization
- initial link settings for BER = $0.5e-9$



Conclusions

- Interferometric noise penalty is real and can be large
- Measurements and calculations in excellent agreement
- 1300 nm serial links still have positive margin after allocating IN penalty
 - ▶ we have 0.4 dB margin left

Proposed Solution

- **Include interferometric noise penalty in the link budget**
- **Set minimum Extinction Ratio to 4 dB**
- **Proposed solution does not require any component redesign, does not cause pain to anybody**