Background

In the first meeting with Infinera Stockholm we discussed that one of the most pressing problems currently for them is estimating penalties for mixed channel links. They have a tool for estimating penalties across a network, that gives them OSNR penalties for the transmission, different amplifiers, ROADMs etc.. However they have a significant portion of legacy links with dispersion compensation and 10G OOK channels, they would like to be able to quickly estimate a worst case nonlinear penalty on added coherent channels. The difficulty is that split-step simulations are too slow (the tool should be "instantaneous"), and traditional GN-model estimations do not work.

Aim

To design and verify models that can estimate penalties in a mixed signal link with dispersion compensation and a number of legacy 10G OOK channels. Ideally with a "OSNR-equivalent" penalty output. Network optimisation is not needed at this point, but could be interesting at a later stage.

Approach

1. Split-step simulation of the model system.
   (a) single polarization
   (b) include fixed polarization
   (c) varying polarization/PMD across the link
2. Model-approaches
   (a) investigate 0-dispersion model as a "worst-case"
   (b) combine 0-dispersion model with GN-variety models for more accurate estimations
   (c) pertubation models

Model system

The model system to check simulations against has the following parameters:

- 4 spans of 82 km SSMF followed by DCF with 80 km SSMF-equivalent compensation, plus one span of 82 km SSFM followed by DCF with 90 km SSMF-equivalent compensation
- One amplifier after each span, links are transparent
- Total 11 channels
- channel spacing: 50 GHz
- channel under test (at center): 120 Gb/s, RRC with 0.2 roll-off (also compare to no shaping)

- CUT surrounded by 5 channels of 10G OOK on both sides.
- SSMF: D=17 ps/nm, S=0.06 ps/nm/km, $\alpha_{dB} = 0.2$ dB/km $\gamma = 1.4$ /W/km
- DCF: ideal FBG
- same launch power for all channels
- no filters except for 50 GHz WDM-DEMUX
- Target pre-FEC Q=7.3 dB
- amplifiers simulated as ideal noise-less and equivalent noise added at the end.

Action Items

JS

- Simulate system without pol-mux (by July)
- Simulate system with pol-mux, no PMD (August)

Other

- Simulate system with varying PMD
- Implement pertubation method
- 0-dispersion model
- Combine 0-dispersion with GN-model