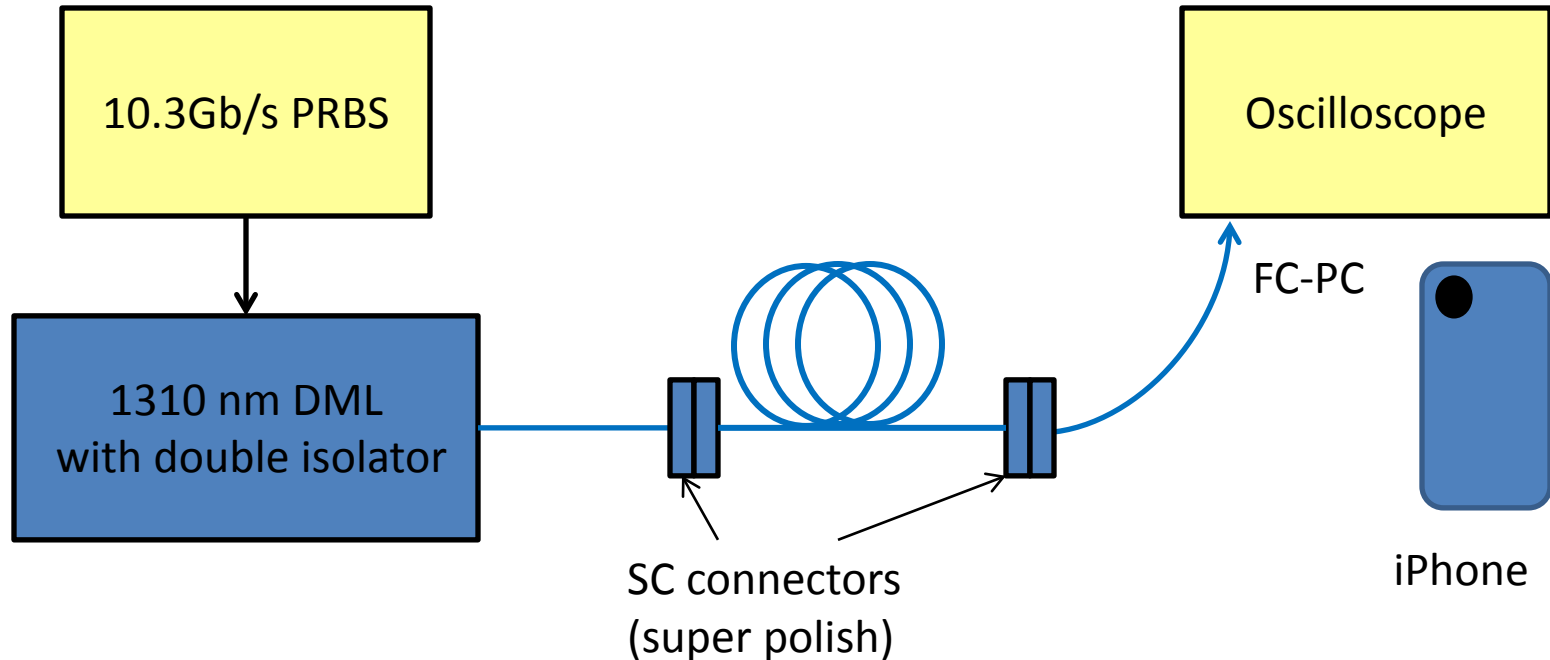


Multi path interference in optics - experiment

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MPI Experiment

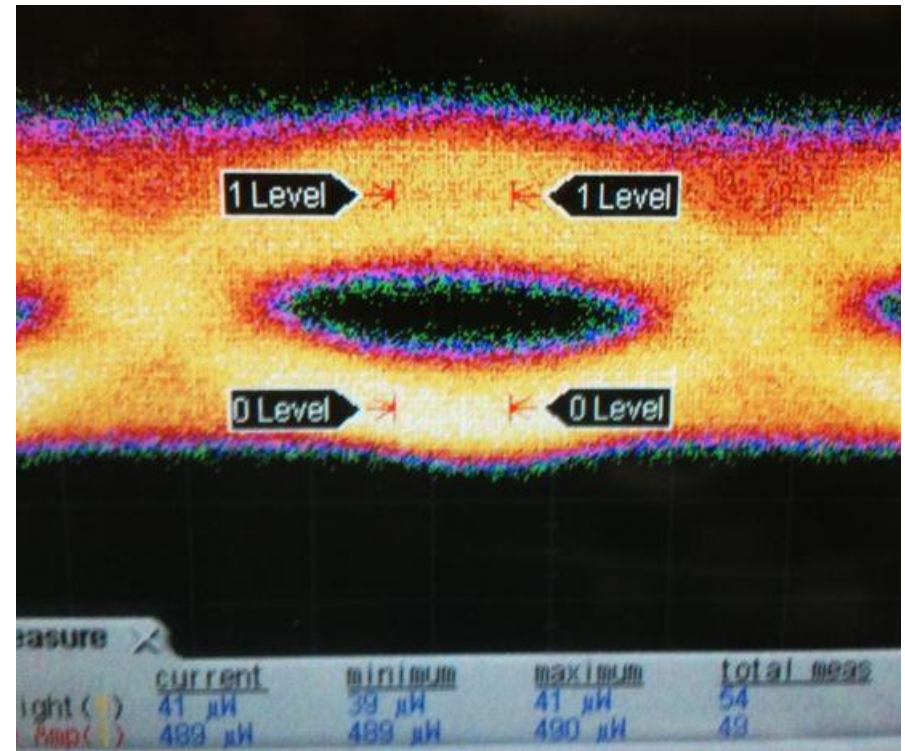
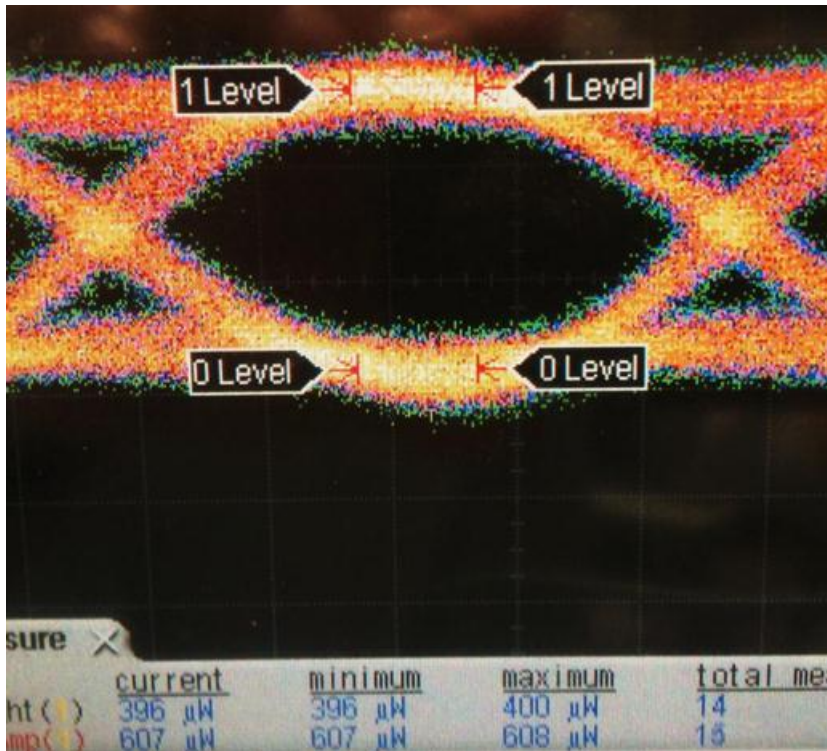


- 1 – connectors fully mated
- 2 – SC connectors not fully mated to introduce reflections in the link
 - 4 air-glass interfaces @ ~ 14.4 dB (e.g. SMF, $n=1.467$)
 - ~ 1 dB additional loss through link

1310 nm single mode isolated DML 10Gb/s eyes:

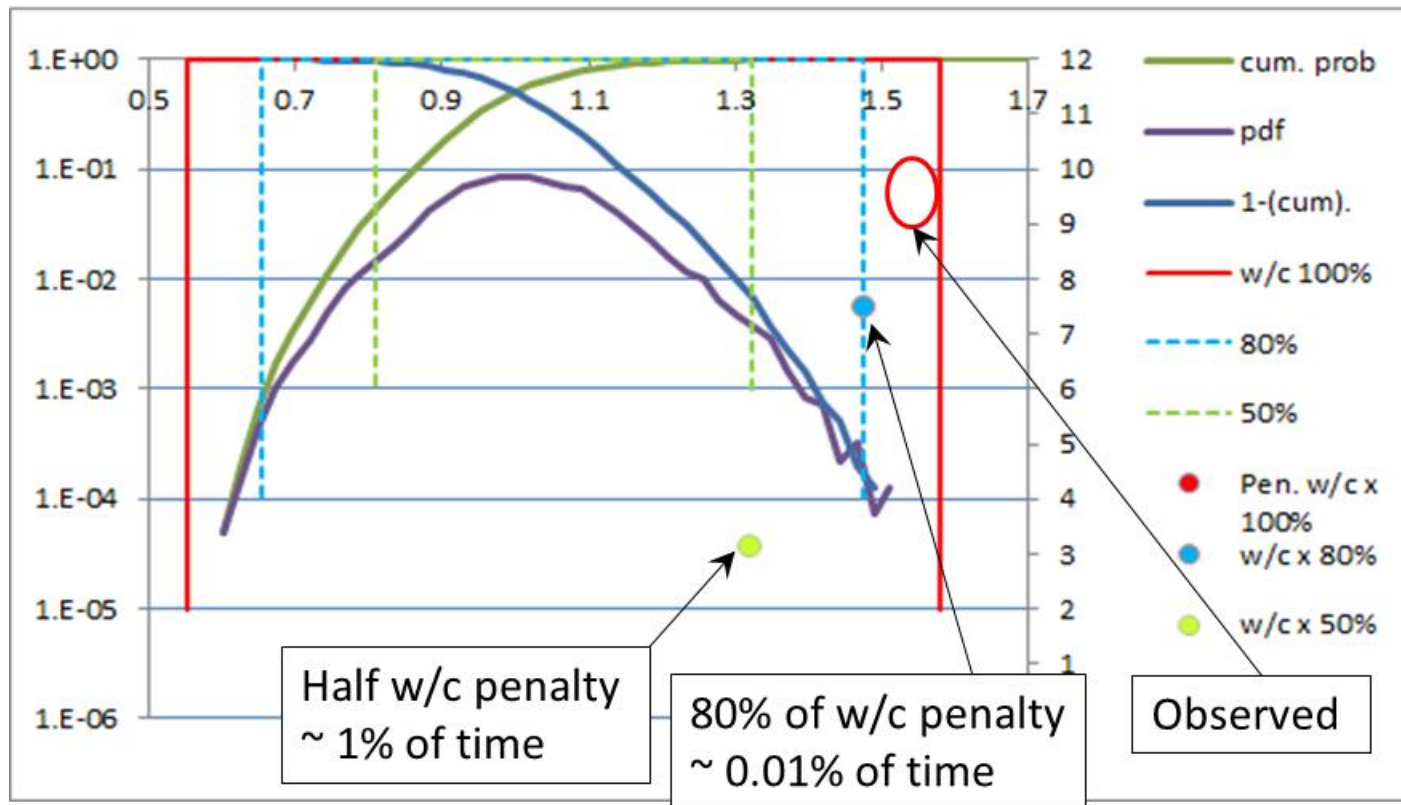
Connectors mated

Two connectors not fully mated: $\Delta IL \sim 0.94$ dB



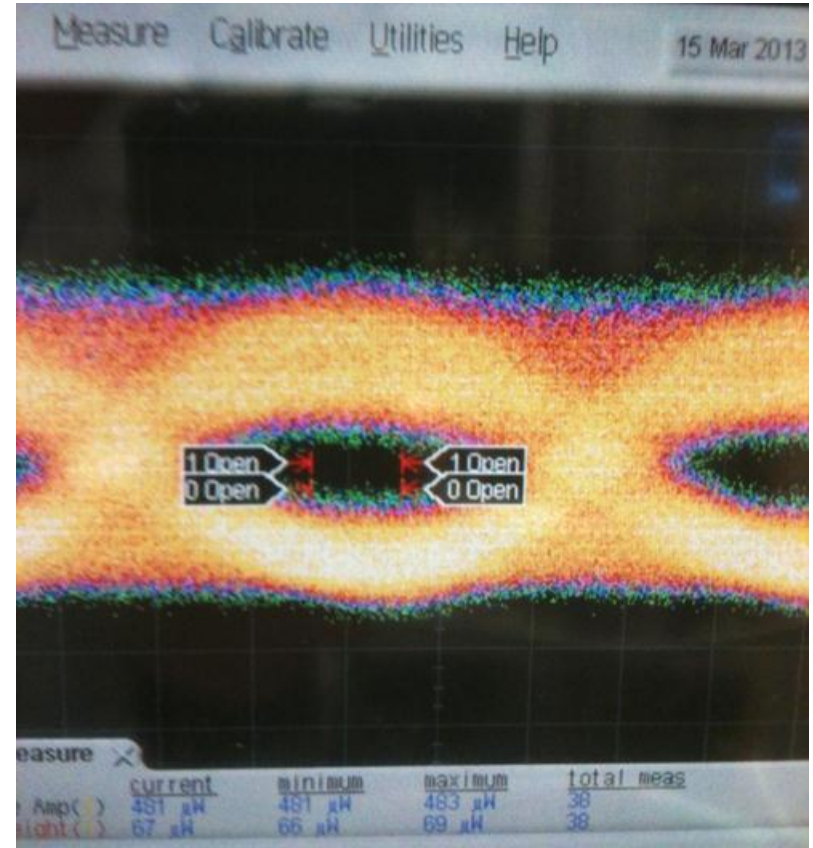
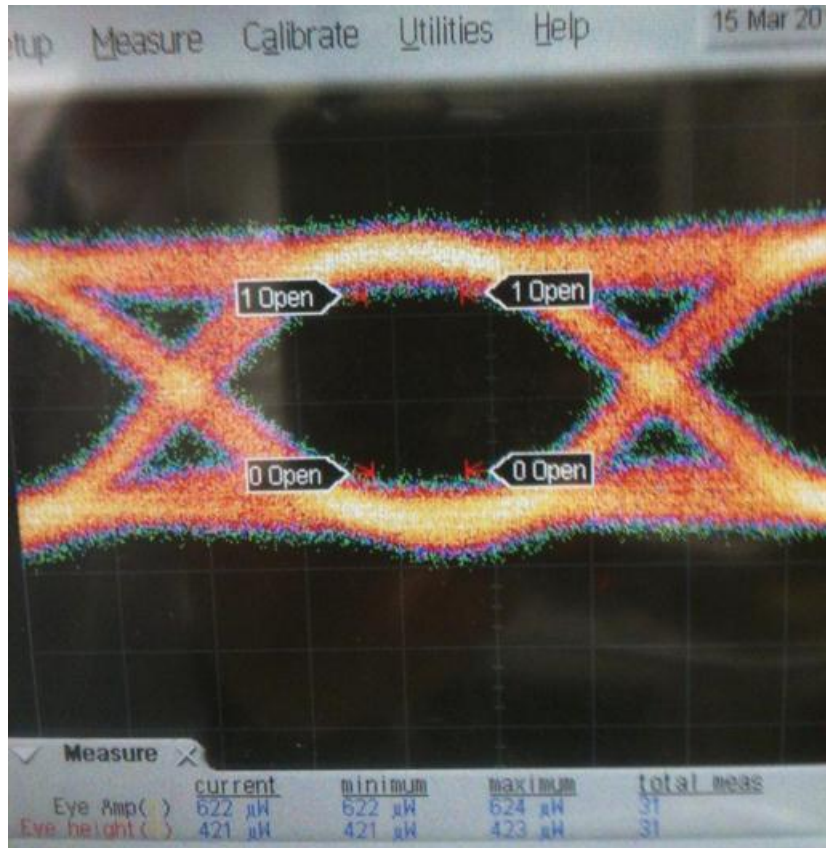
- Vertical eye closure penalty ~ 10 dB

Expected penalty for this experiment: modeled penalty and probability



- Sum (MPI + main signal) vs probability, random phase between reflectors
- 4 glass air interfaces, no other reflections
 - 2 reflections at -14.4 dB, 2 reflections at -15.4 dB (accounts for coupling loss)
 - Average reflection level is -13.4 at each connector
- NRZ source, ER = 6dB

Temporal



- ~5 minutes later, still bad

Conclusions

- Coherent Multi-path Interference penalty is real.
- Near worst case penalties are observed in practice, despite reassuringly low probability of occurrence.
- Very slowly varying phenomena (minutes).
 - FEC can't fix it.
 - EQ can't fix it.
- Need to budget for worst case.