

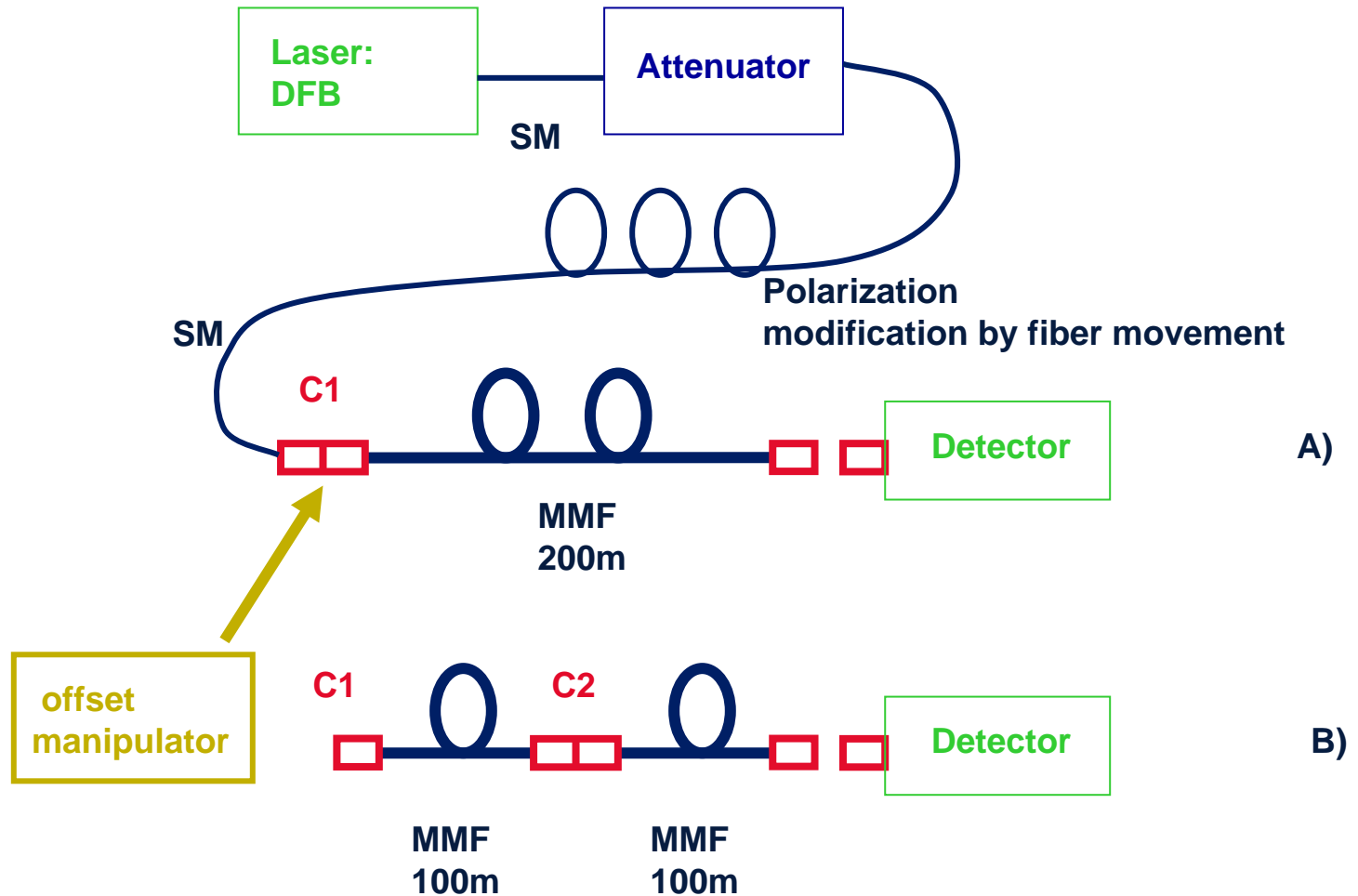
Polarization Effects in Multimode Fiber Transmission

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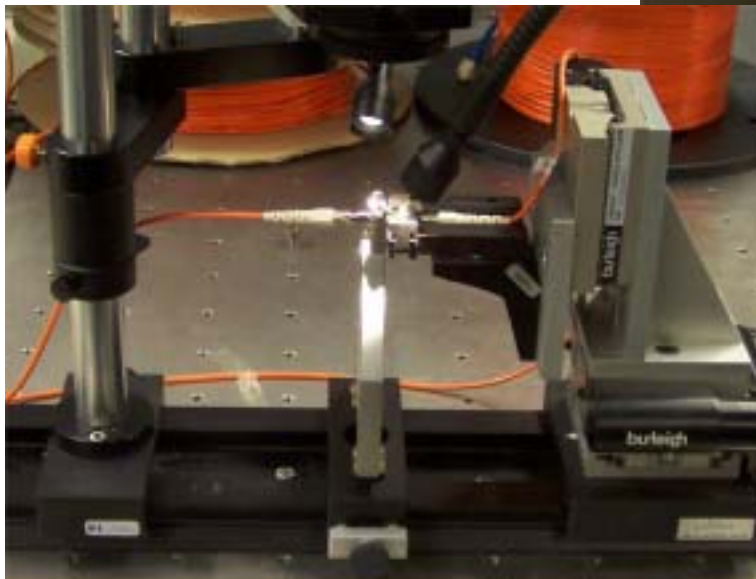
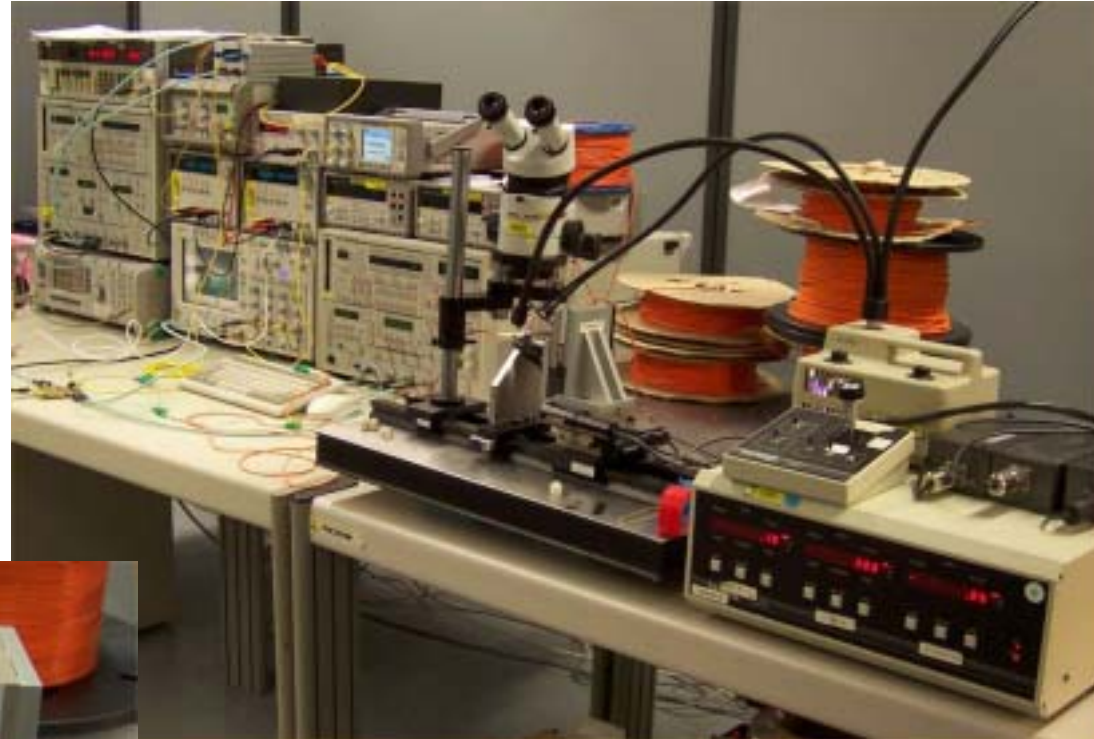
- Influence of connectors on polarization sensitivity
- Comparison of central launch with offset launch
- Observation of signal variations at the end of the transmission line caused by polarization orientation

Polarization Experiments with MM-Fiber

Effect of Connectors



Setup for the Experiment



**High precision manipulator
with 0,05 μ m step size**

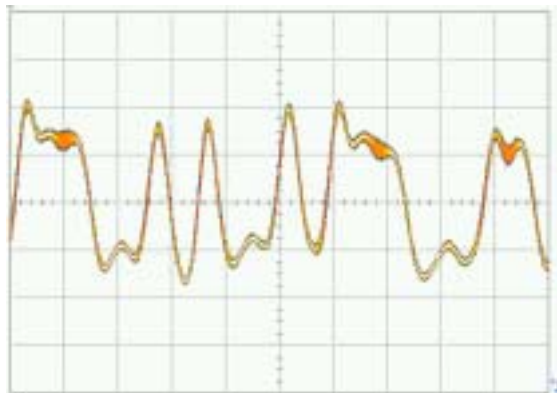
Polarisation Experiments with MM-Fiber

Polarisation Sensitivity 200m Fiber, without / with Connector

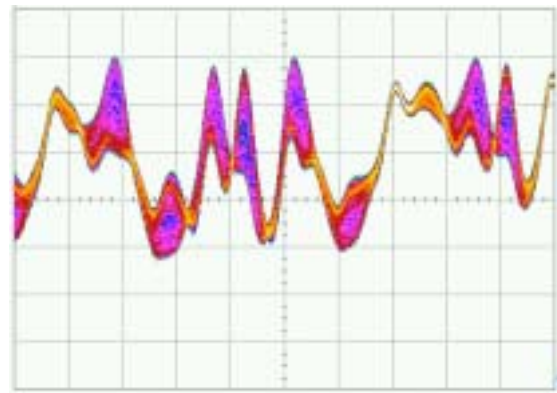
200m, one fiber

100m + 100m fiber

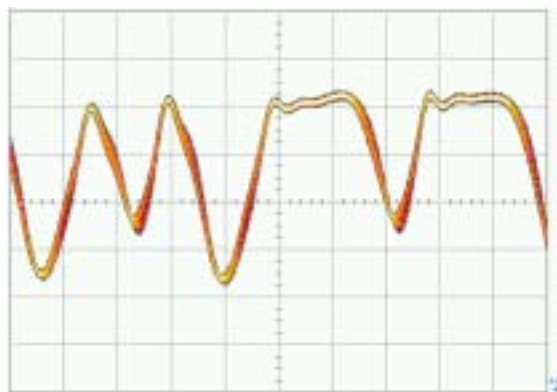
0 μm offset



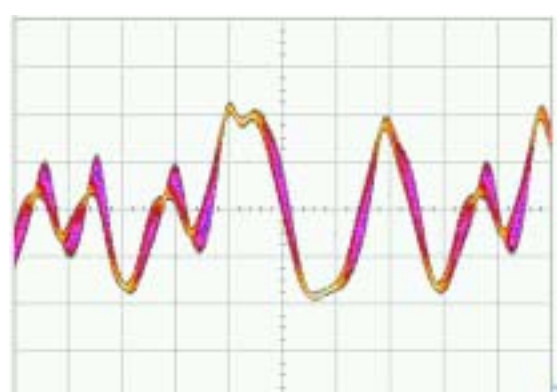
0 μm offset



20 μm offset



20 μm offset



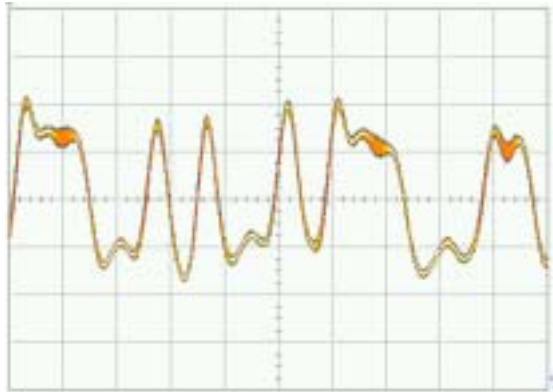
Polarization induced noise

Polarisation Experiments with MM-Fiber

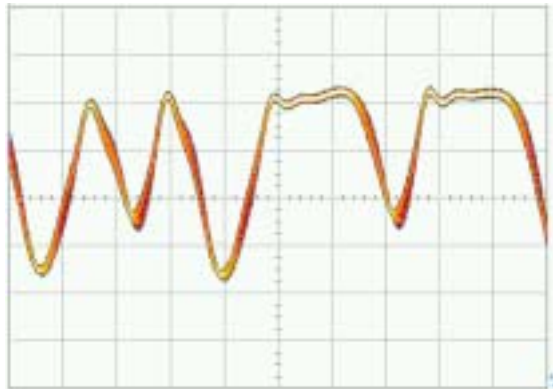
Polarisation Sensitivity 200m Fiber, without / with Connector

200m, one fiber

0 μm
offset

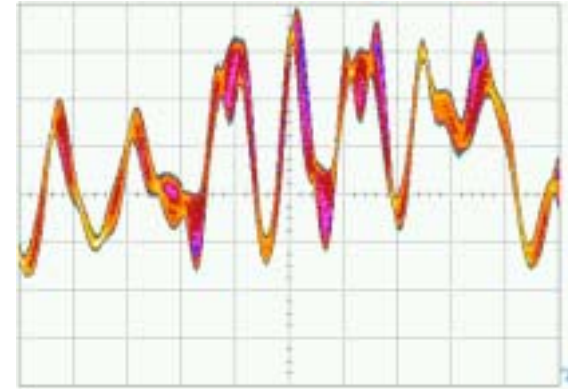


20 μm
offset

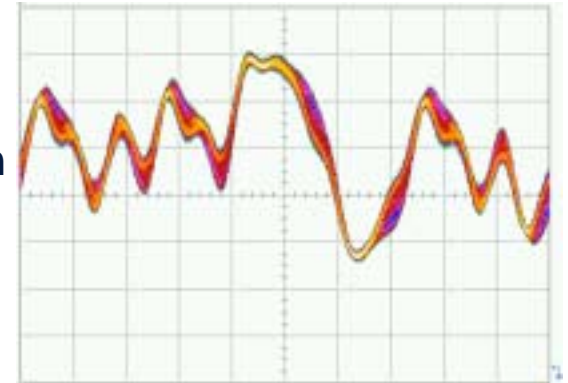


200m + 100m fiber

0 μm
offset



20 μm
offset



Polarization induced noise



Polarization Effect on Multimode Fiber Transmission Observations

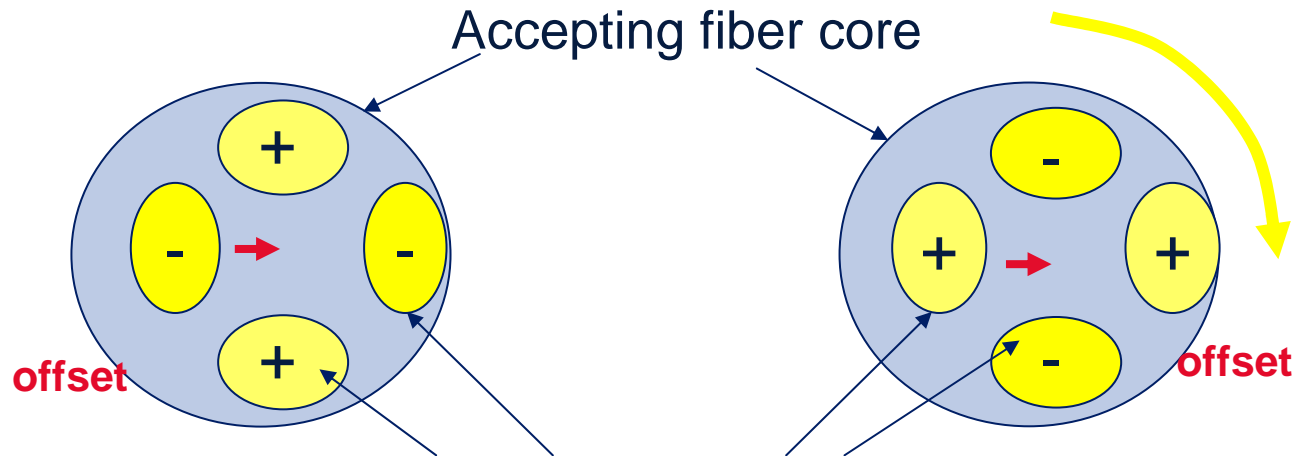
- Signal distortion is observed in MM-fiber links with connectors due to variation of polarization orientation of source
- No distortion on MM-fiber links without connectors

→ Combined effect of offsets and polarization orientation

- Can be observed even after longer fiber length of 100m or 200m
- Launch with offset patchcord is less sensitive to the effect

Polarisation-Induced Noise (PN) Explanation

- Turning of orientation of modes relative to radial offset excites different subset of modes
 - Turning induced by fiber movement, twist and source (e.g. VCSEL)
 - Random variation of polarization state leads to random pulse response after long run (100 - 200m) due to modal dispersion of fiber
 - Variation of pulse response with time leads to intensity noise



Same mode ($LP_{2,1}$) but different orientation relative to offset (turn by 90°)

Polarization-Induced Noise

Conclusion

- Size of the effect:

- Large for fibers with large modal dispersion and longer length
- Large for small fiber offsets and center launch due to low number of modes and large size of mode structures
- Small for offset patchcord due to coupling to larger number of modes with smaller size mode structures
- Small for coupling with large mode volume due to statistic behavior of large number of modes

- Not included in current model

- Power penalty must be evaluated !