
Polarization Effect in 10GbE Transmission over Multimode GI-Fiber

Application to 10GBASE-LRM

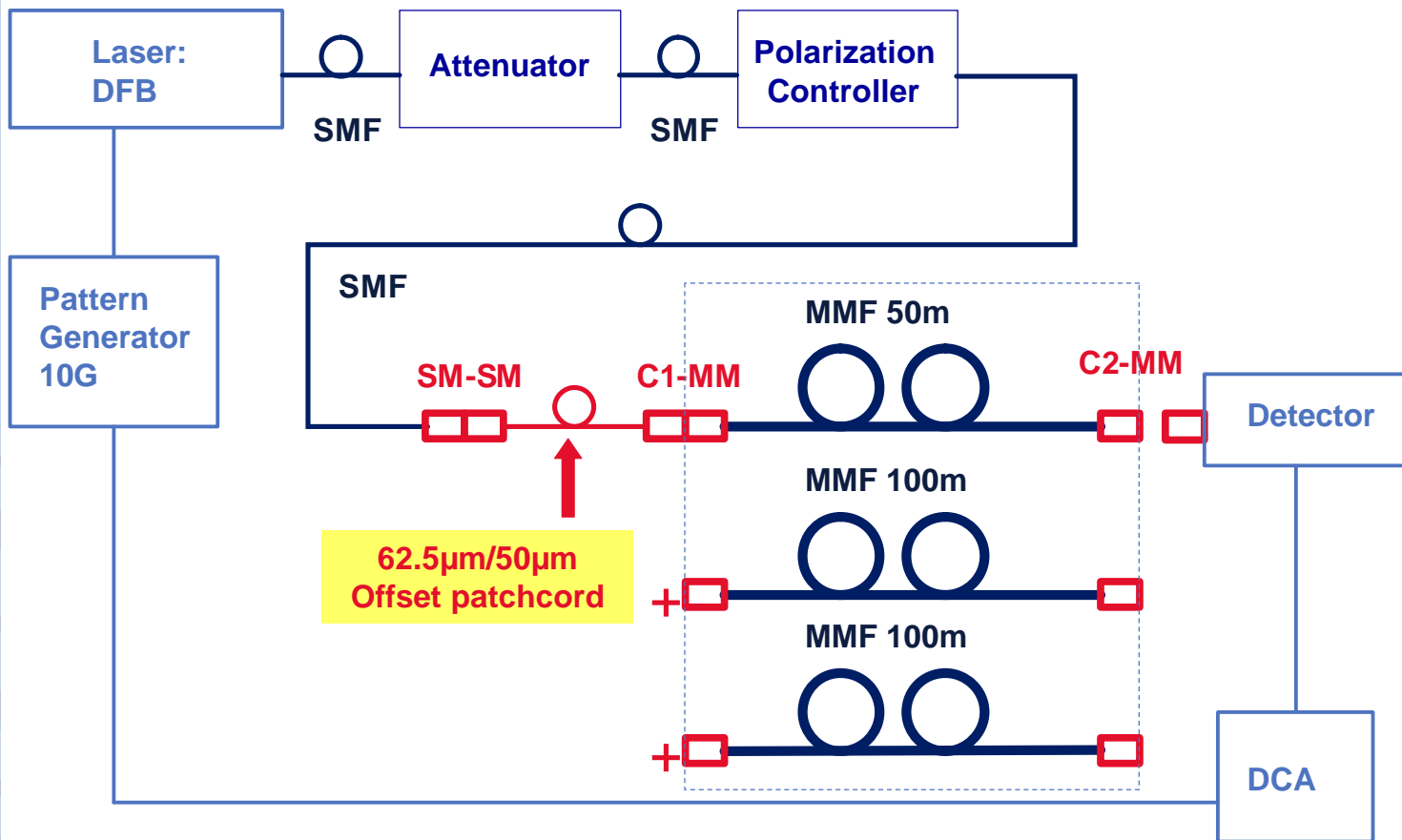
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S. Bottacchi,
J. Fiedler
IFFO MOD CE

Sept. 2004
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Background and Motivation

- All transmission experiments done at 10GbE over MMF at Infineon labs showed strong dependency upon fiber layout, manipulation and twisting.
- The same experiment setup using EDC samples over 200m gave controversial performances just after close measurement repetitions.
- Polarization effects have been addressed since last few months in order to explain those phenomena and to find quantitative conclusions on the performance fluctuation encountered during experiments.

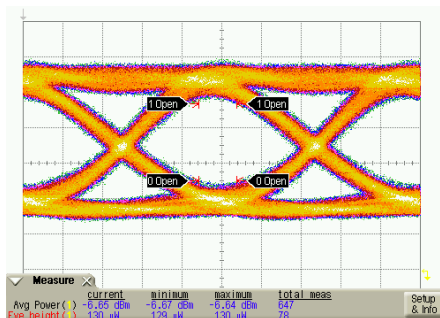
3. Experimental Setup with Standard Offset Patchcord



3. Standard Offset Patchcord – Fiber #1 several length

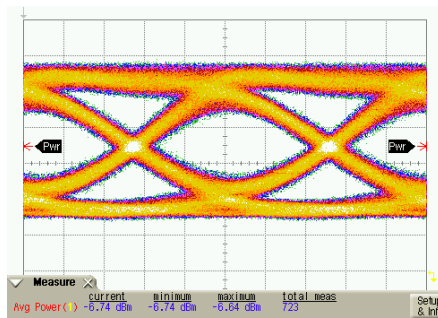
Siecor 62.5 μ m benchmark MMF (BW~500MHz*km at 1310nm)

50m



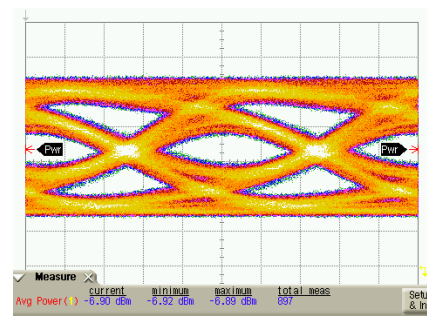
Polarization \perp

100m

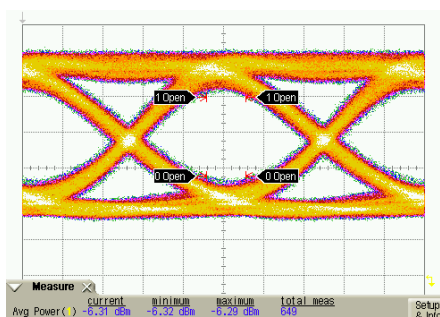


Polarization \perp

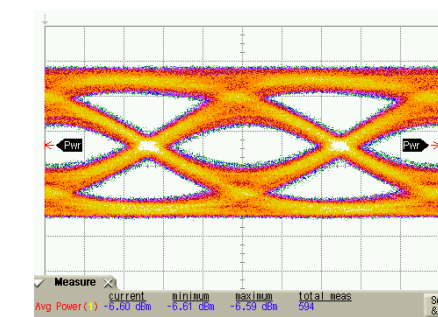
150m



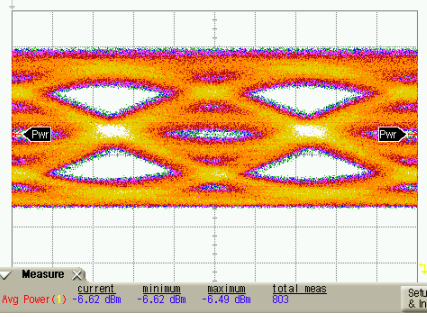
Polarization \perp



Polarization \parallel



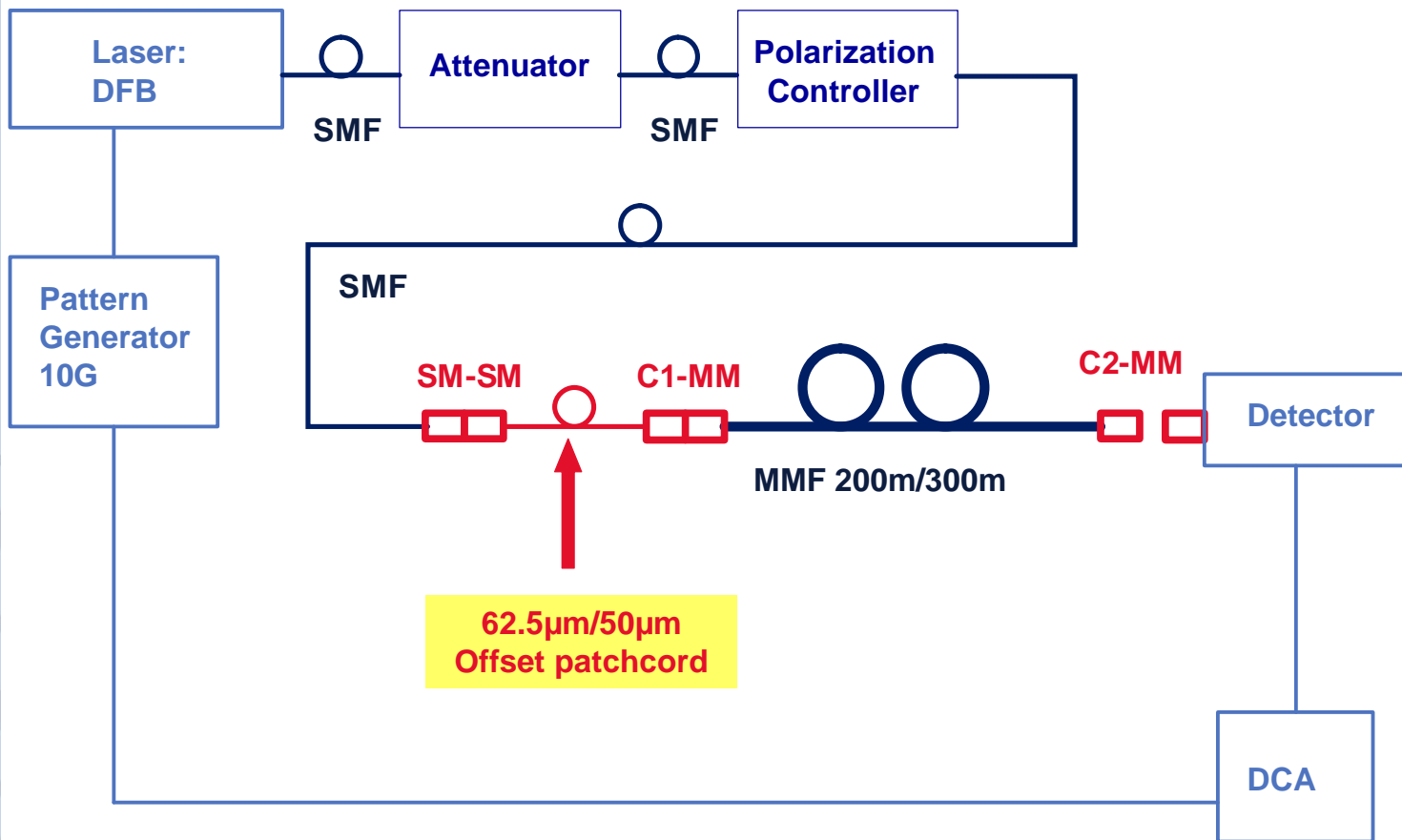
Polarization \parallel



Polarization \parallel

Result: Polarization sensitivity is strongly dependent on the fiber length

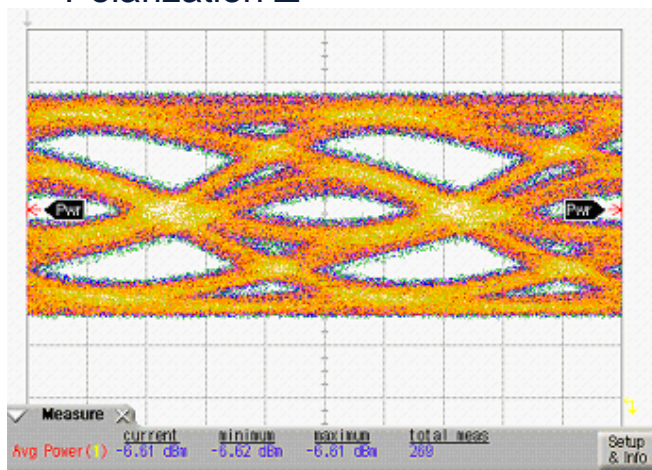
2. Experimental Setup with Standard Offset Patchcord



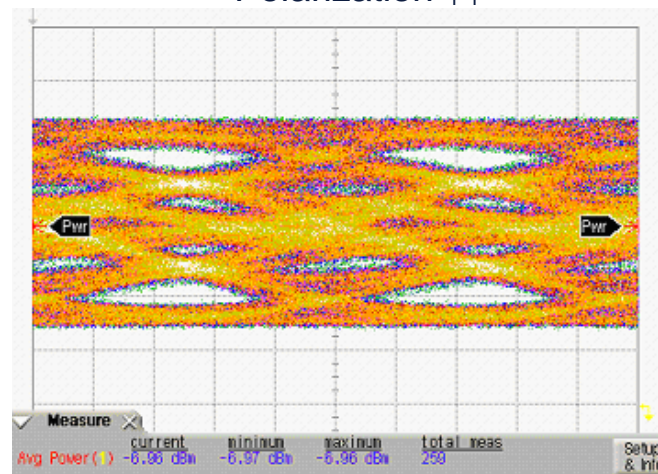
2. Standard Offset Patchcord – Fiber #1

Siecor 62.5 μ m benchmark MMF (BW~500MHz*km at 1310nm) ? 200m

Polarization \perp



Polarization \parallel

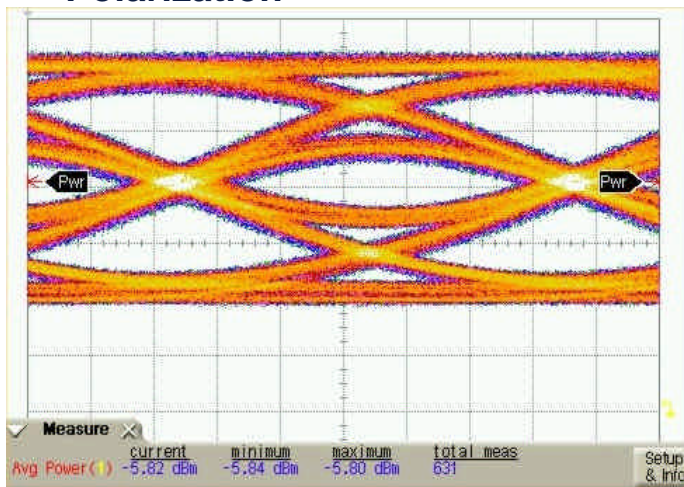


Result: Strong influence of polarization on transmission performance

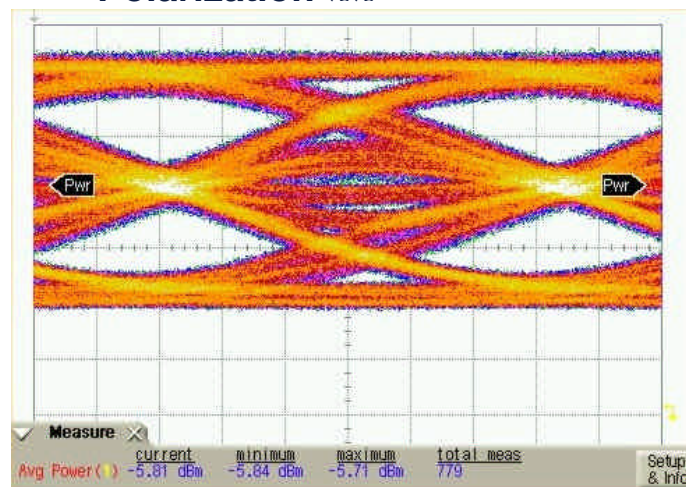
2. Standard Offset Patchcord – Fiber #2

Corning OM3 grade 50 μ m multimode fiber (BW~900MHz*km at 1310nm) ? 300m

Polarization \wedge

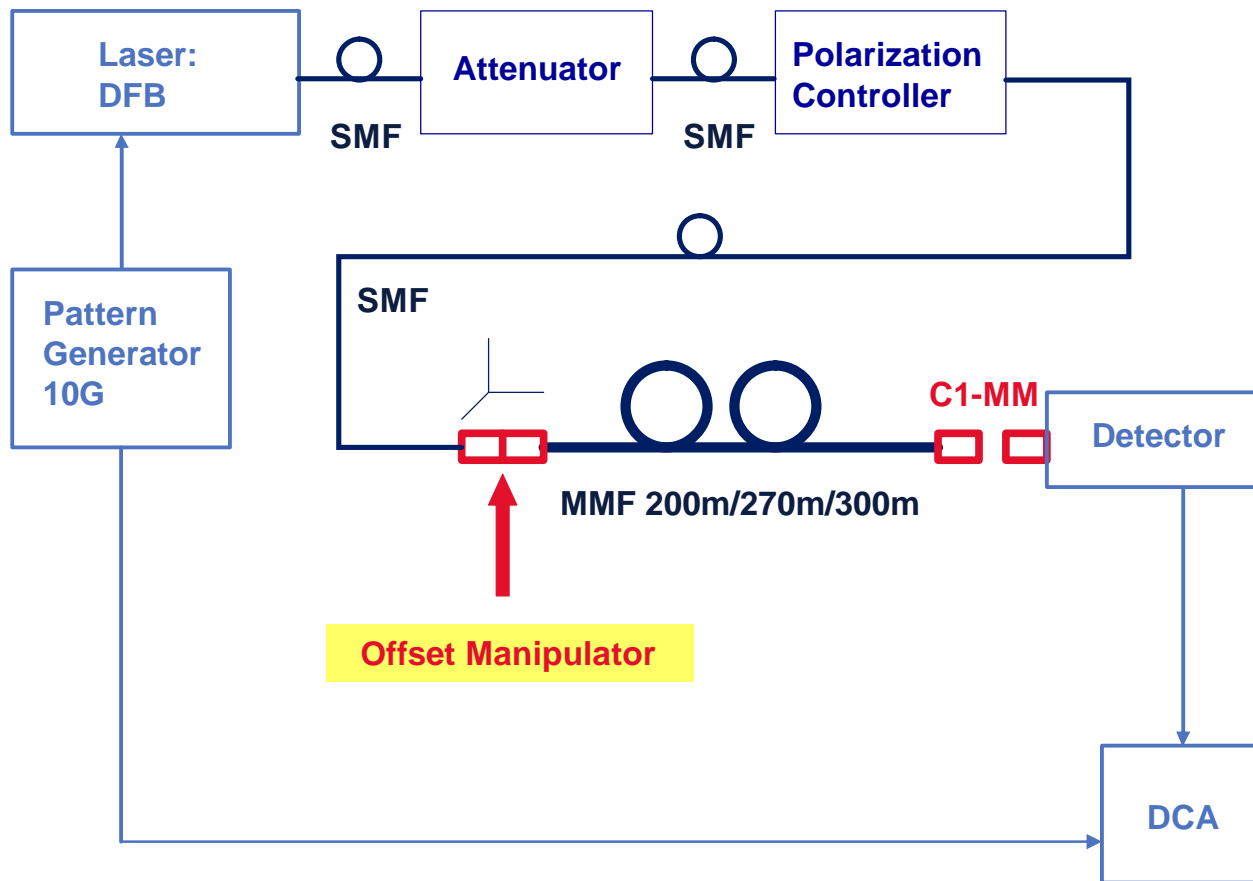


Polarization $\frac{1}{2}\frac{1}{2}$



Result: Strong influence of polarization on transmission performance

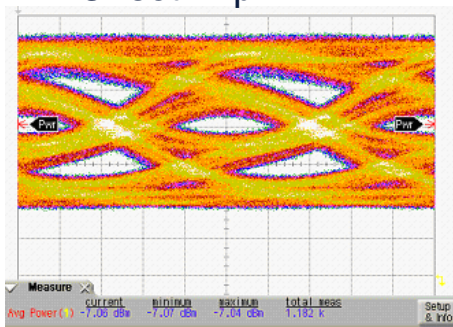
1. Experimental Setup with Controlled Offset Launch



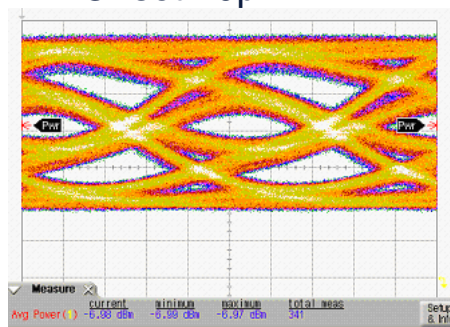
1. Controlled Offset Launch – Fiber #1: Offset launch

Siecor 62.5 μ m benchmark MMF (BW~500MHz*km at 1310nm) ? 200m

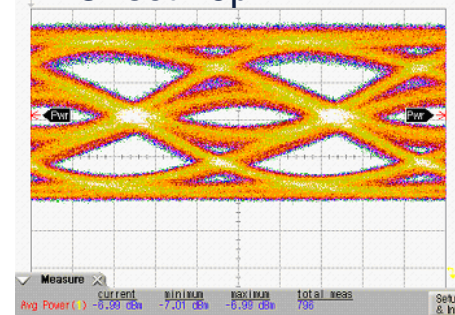
Offset 17 μ m \perp



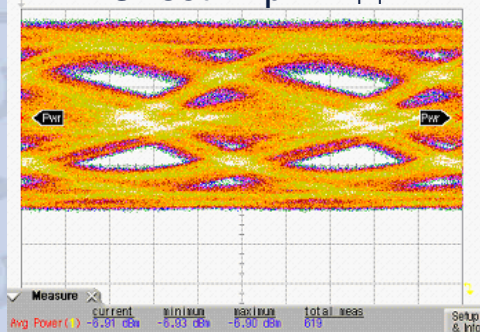
Offset 20 μ m \perp



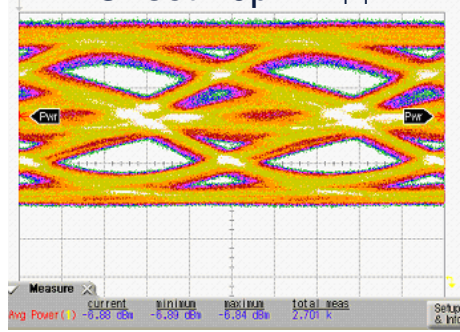
Offset 23 μ m \perp



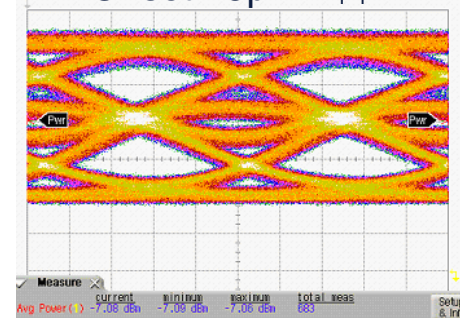
Offset 17 μ m \parallel



Offset 20 μ m \parallel



Offset 23 μ m \parallel

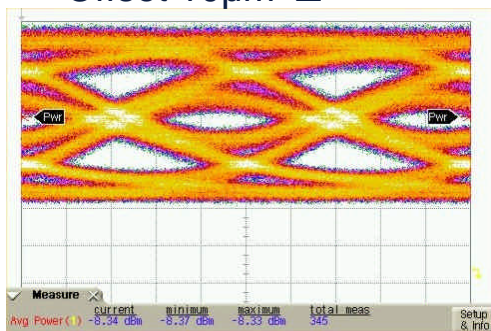


Result: Strong influence of polarization on transmission performance without any mode selective loss

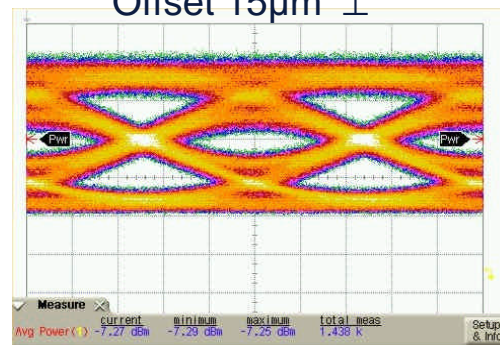
1. Controlled Offset Launch – Fiber #2: Offset launch

Corning OM3 grade 50 μ m multimode fiber (BW~900MHz*km at 1310nm) ? 300m

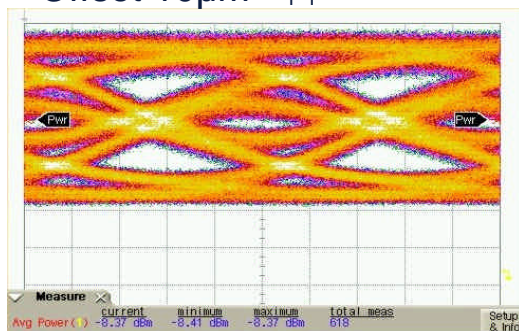
Offset 10 μ m \perp



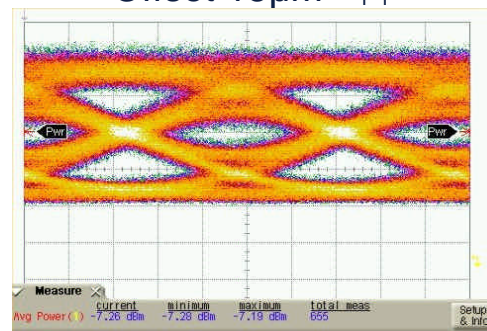
Offset 15 μ m \perp



Offset 10 μ m \parallel



Offset 15 μ m \parallel

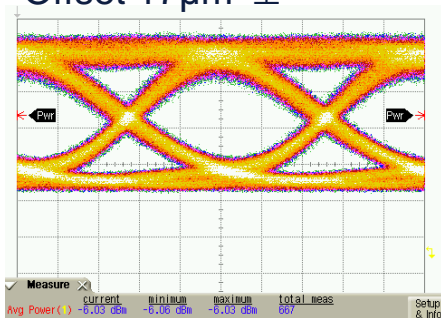


Result: Very low Influence of polarization on transmission performance

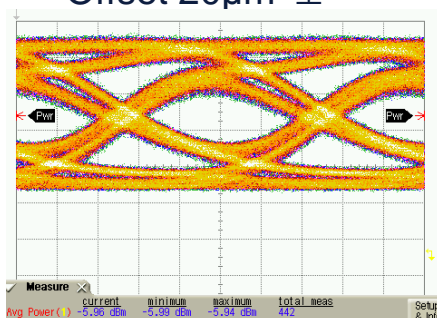
1. Controlled Offset Launch – Fiber #3: Offset launch

Siecor 62.5 μ m MMF (BW~875MHz*km at 1310nm) ? 270m

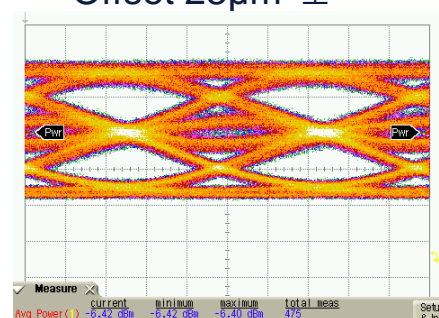
Offset 17 μ m \perp



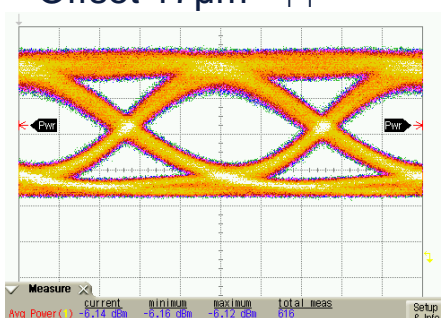
Offset 20 μ m \perp



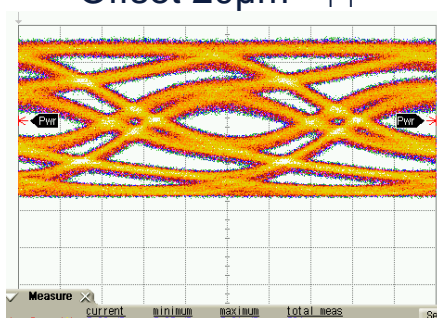
Offset 23 μ m \perp



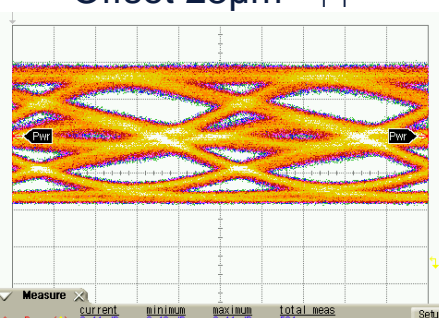
Offset 17 μ m \parallel



Offset 20 μ m \parallel



Offset 23 μ m \parallel

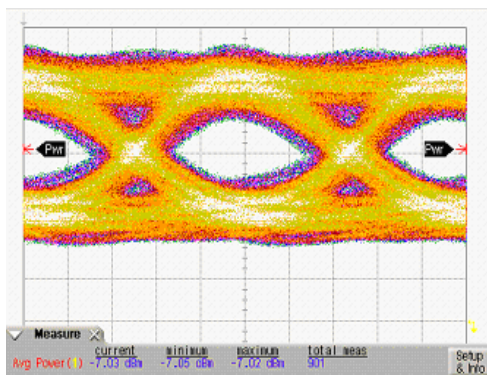


Result: Strong influence of offset position, polarization sensitivity of transmission performance for 20 μ m and 23 μ m offset.

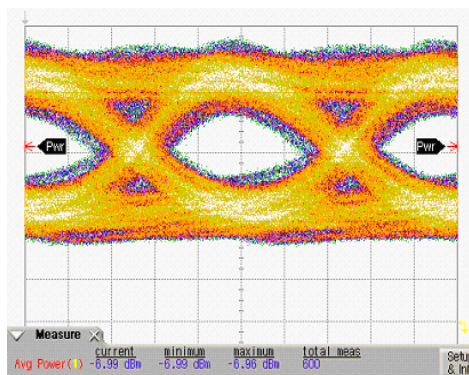
1. Controlled Offset Launch – Fiber #1: Central launch

Siecor 62.5 μ m benchmark MMF (BW~500MHz*km at 1310nm) ? 200m

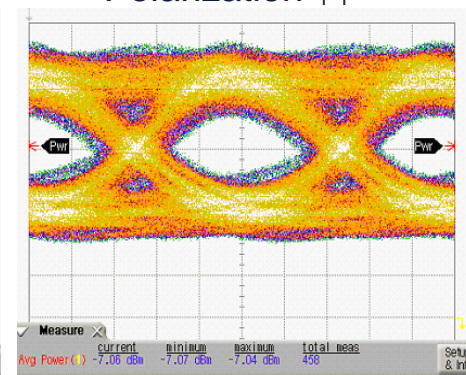
Polarization \perp



Polarization 45°



Polarization \parallel



Result: No influence of polarization on transmission performance

Summary of the Results

1. Polarization effect was not observed with center launch.
2. Polarization effect was observed with offset launch (both patchcord and controlled) using single link of Siecor 62.5 μ m benchmark MMF.
3. Polarization induced pulse distortion occurs in transmission without any mode selective loss due to connectors!
4. Polarization in multi-section Siecor 62.5 μ m benchmark MMF induced several dB of power penalty.
5. Polarization effect was very small in high grade fiber when controlled offset launch is applied.

Summary

1. More work to be done
2. In order to complete work faster:
 1. Include work on Polarization into channel ad hoc group
 2. Investigate and conclude on this topic towards the November meeting
3. Target
 1. Understand effect
 2. Identify related penalty to incorporate this into link budget if needed