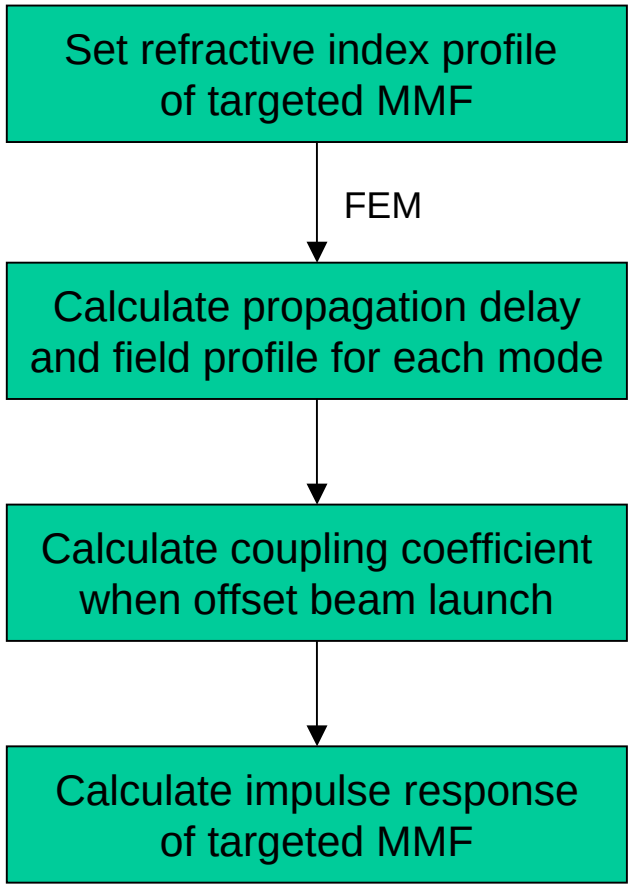
MMF impulse response modeling for designing 10G, MMF links

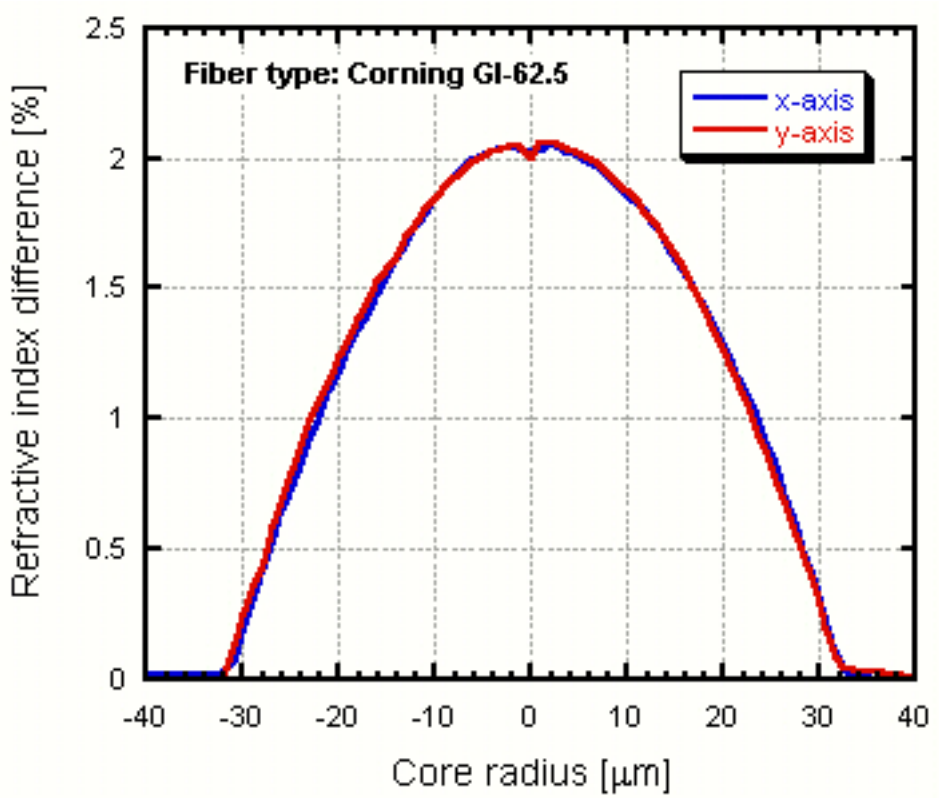
Jan. 7th, 2004

Fiber Optic Modules R&D Department,
Transmission Devices R&D Laboratories,
Sumitomo Electric Industries, LTD.

MMF impulse response calculation algorithm

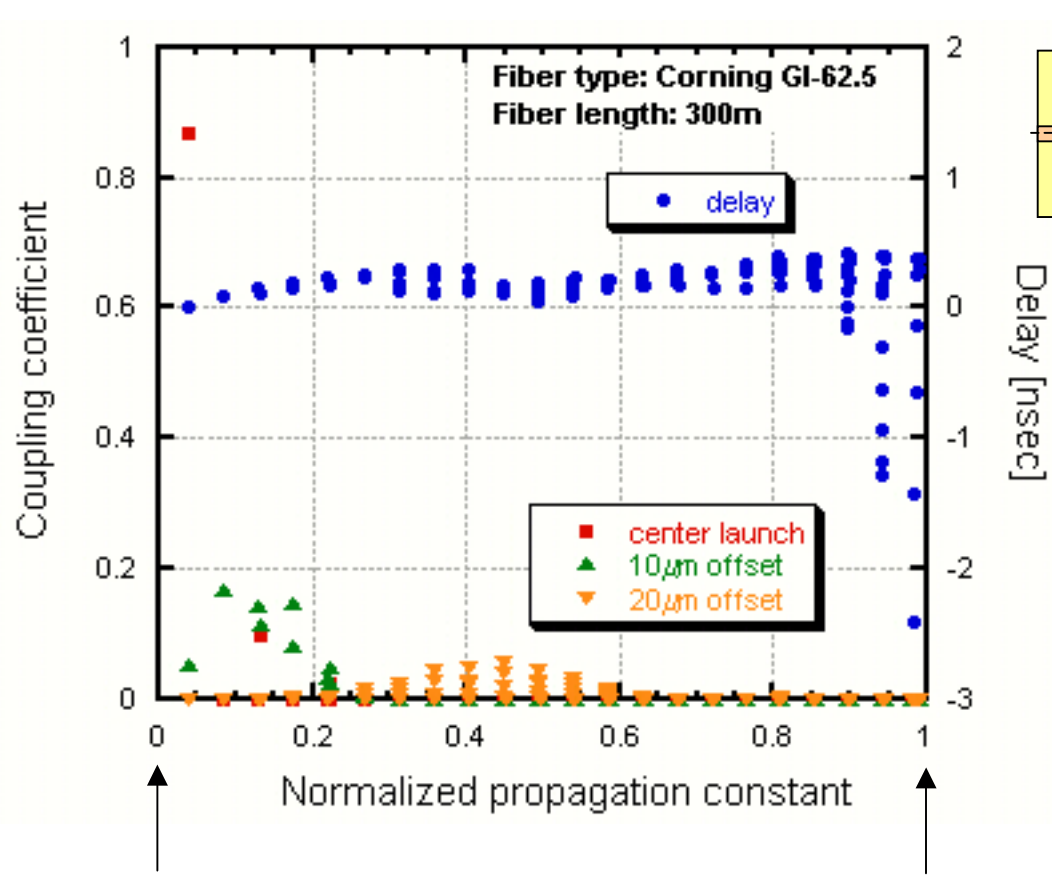


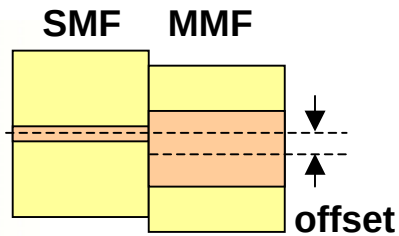
MMF refractive index profile used in this simulation - Corning GI-62.5 fiber -



Measured data

Mode distribution in MMF when offset launching

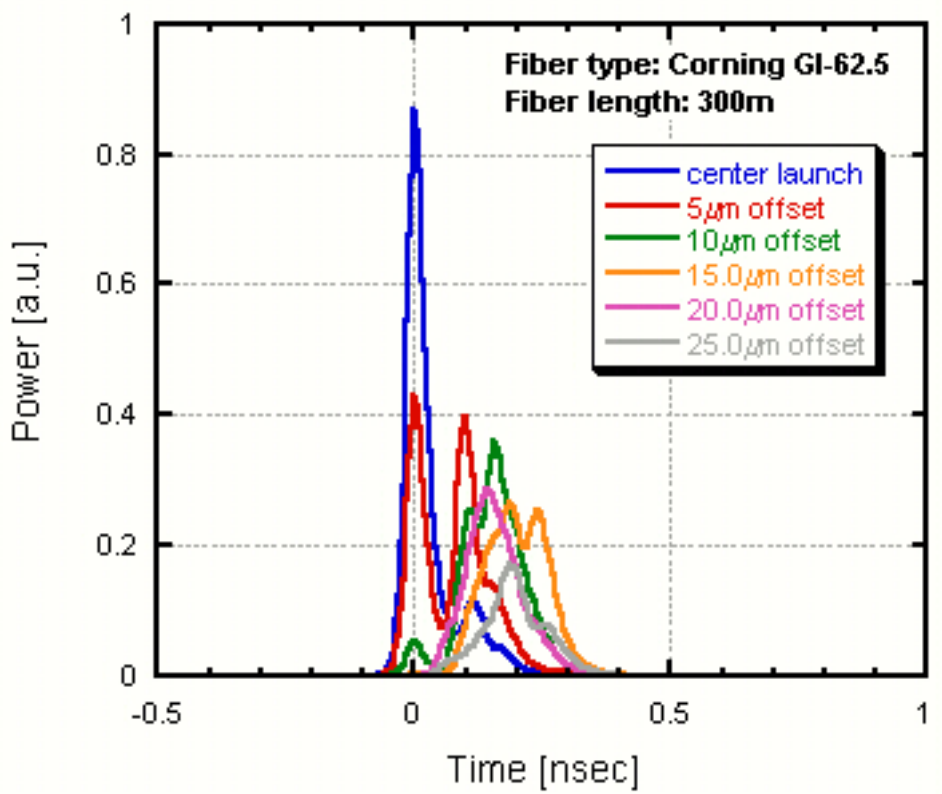




corresponds to $2\pi n_1/\lambda$,
where n_1 is the refractive index of core.

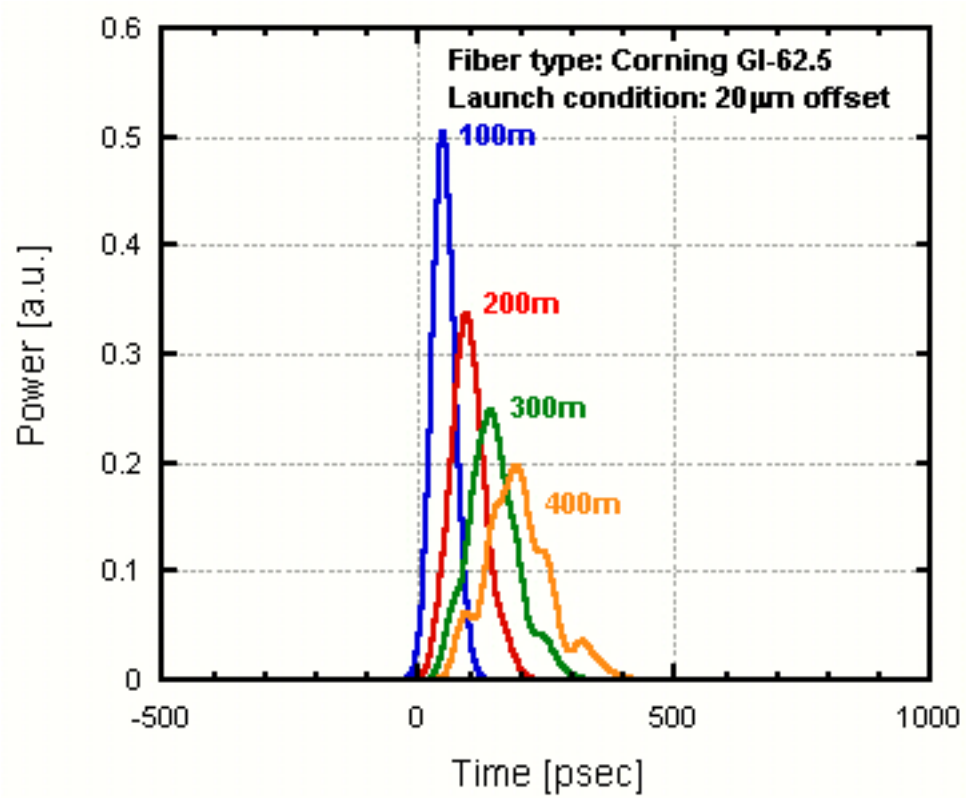
corresponds to $2\pi n_2/\lambda$,
where n_2 is the refractive index of clad.

Calculated MMF impulse response for various offset condition

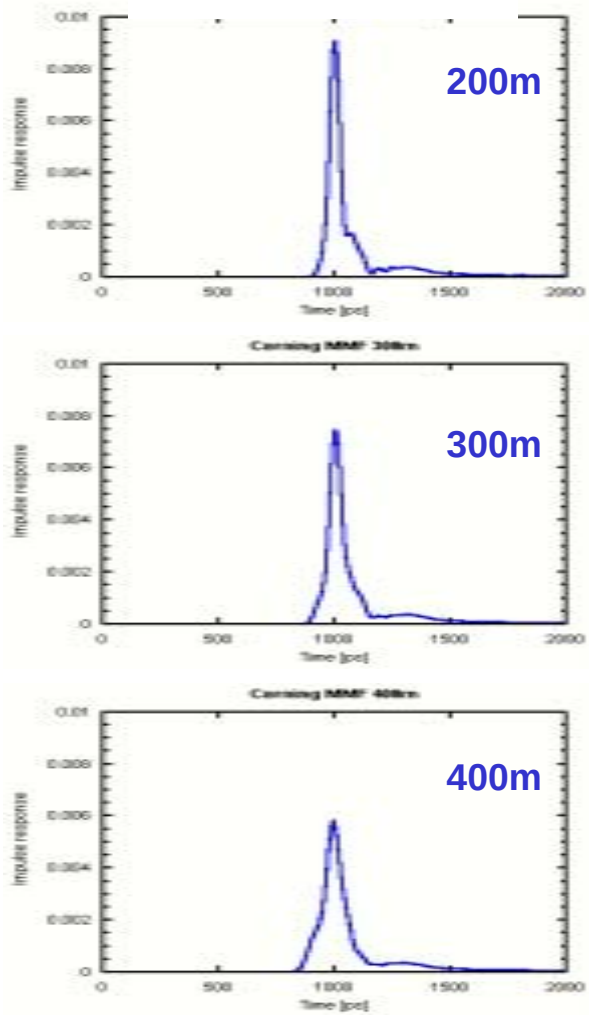


Offset for mode conditioning patch code: 17 to 23 μm

MMF impulse response dependency on fiber length
- 20μm offset launch condition -

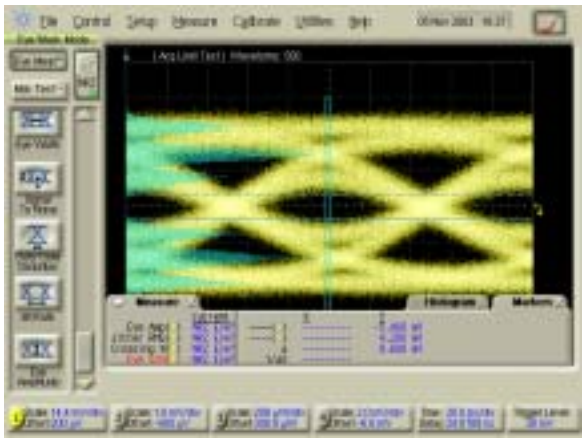
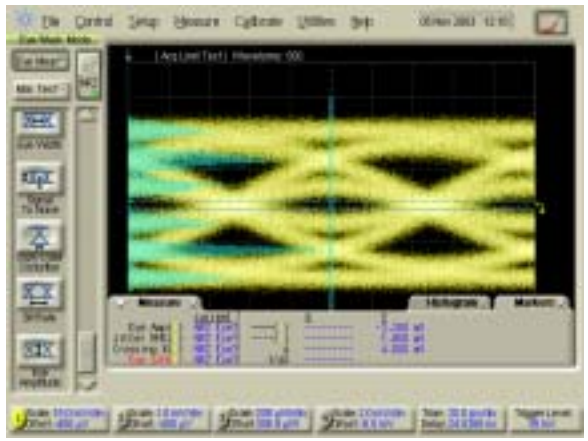
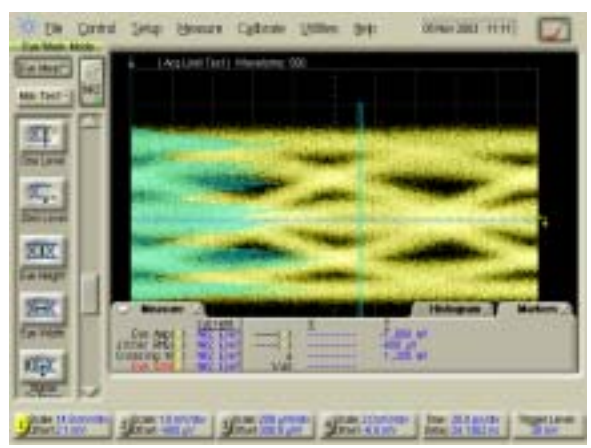
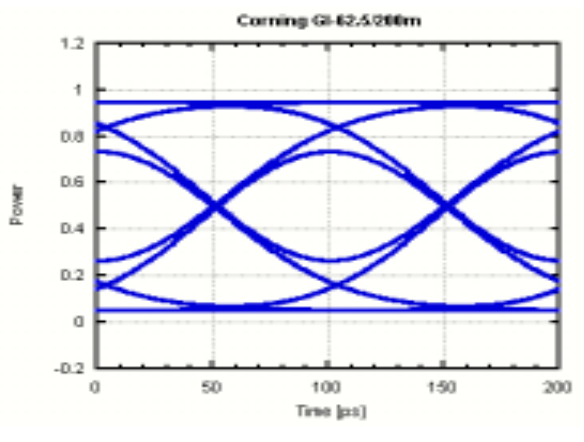
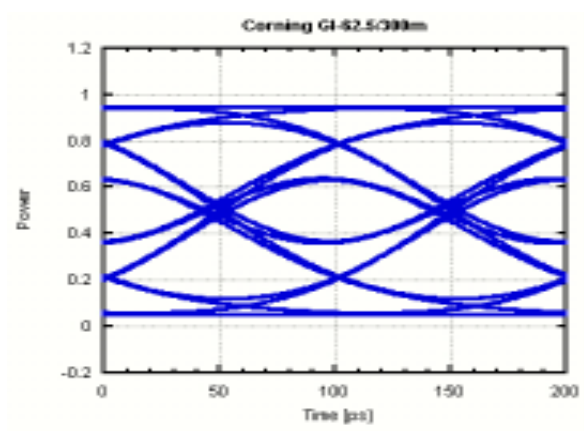
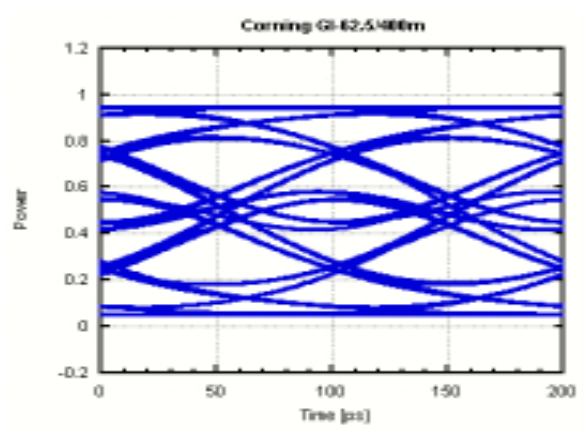


Measured results



SUMITOMO ELECTRIC

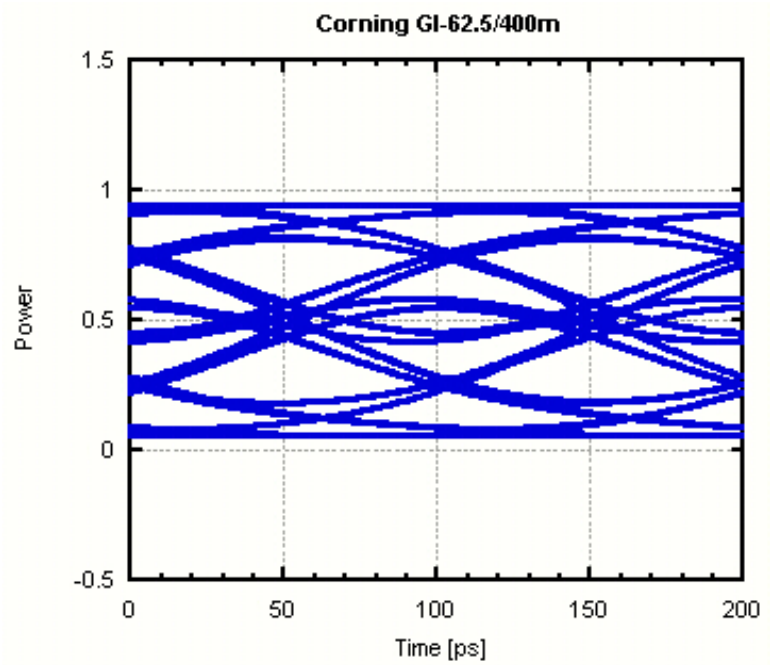
MMF transmitted waveforms

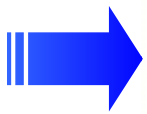
	MMF 200m	MMF 300m	MMF 400m
Experiment			
Simulation			

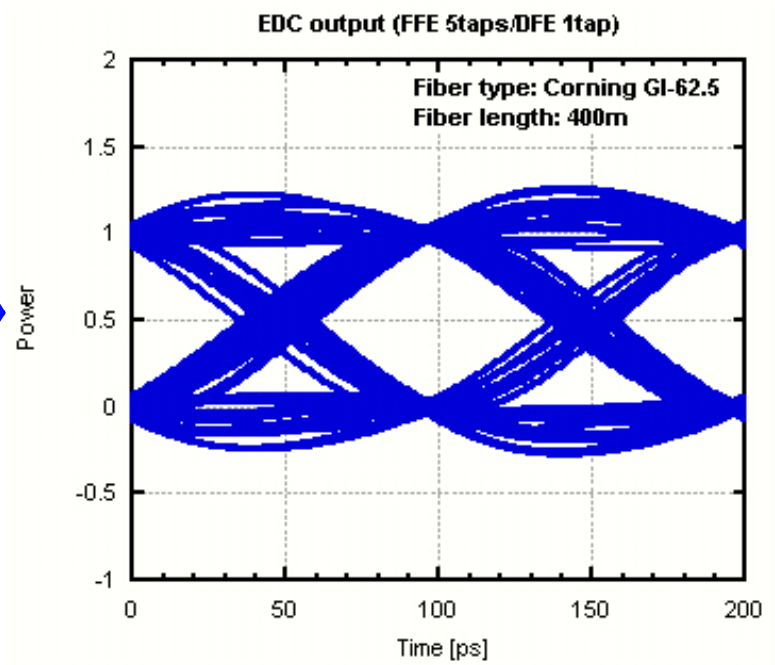
Measurement condition: 10.3125Gb/s, PRBS2^{31}-1

SUMITOMO ELECTRIC

EDC simulation results







MMF transmitted waveform (Corning GI-62.5/400m)

EDC output waveform (EDC type: FFE/DFE)

Summary

- MMF impulse response has been modeled by taking into account the variation of refractive index profile of actual MMF;

  - ✓ Simulation results of eye-diagram after MMF transmission using calculated MMF impulse response show good agreement with experimental results.

  - ✓ Calculated MMF impulse response can be used for the validation of EDC performance.

  ⇒ Can model “worst case” MMF impulse response for designing 10G, MMF link.