

# MMF Optimized Launch Condition

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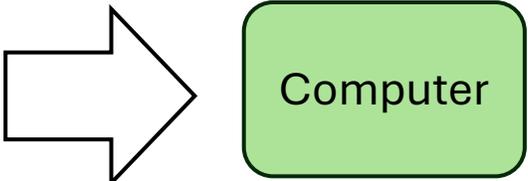
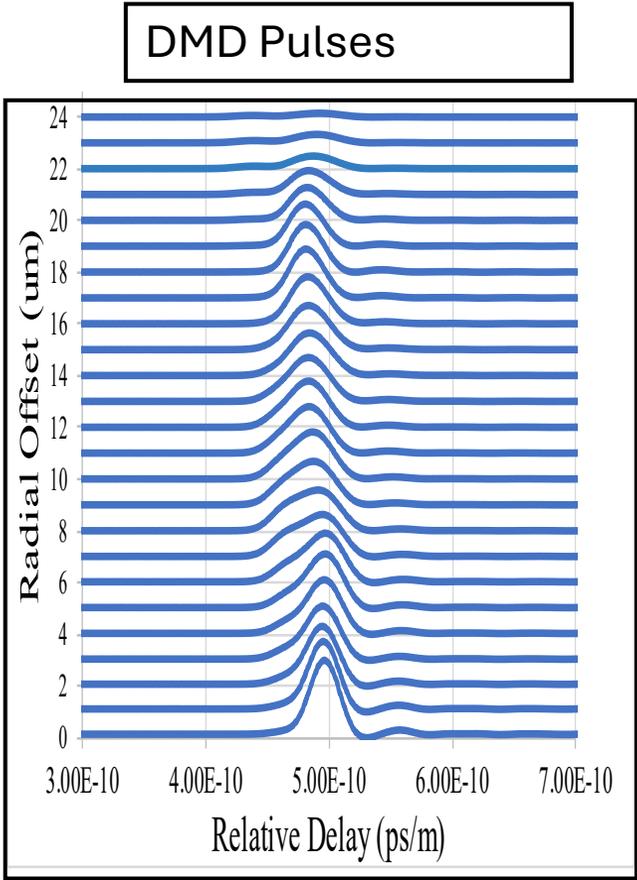
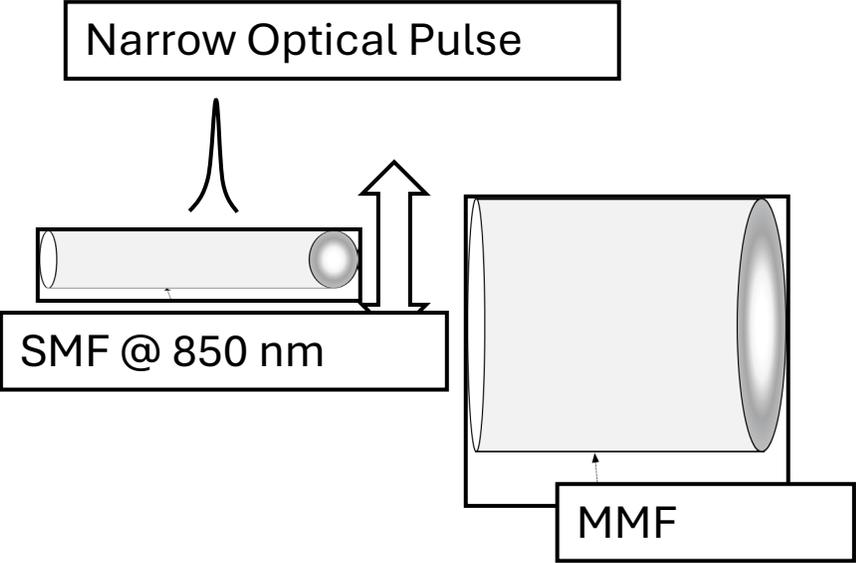
# Supporters

Ramana Murty, Broadcom

# Background

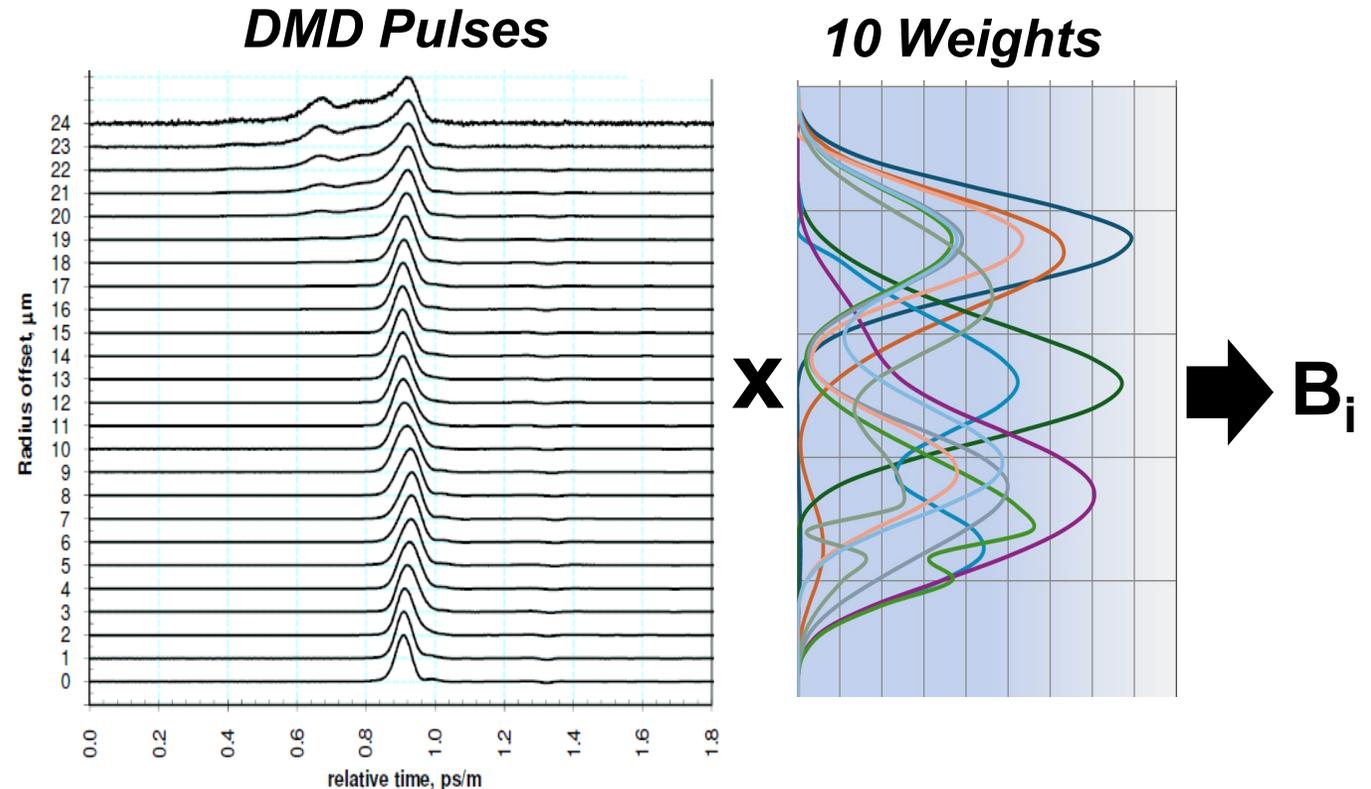
- MMF channels, which provide lower power consumption and greater resilience to contamination and misalignment than SMF ones.
- In AI networks, MMF reaches are usually below 30 m, but there is still interest in achieving 50 m reach at 200G/lane over MMF, as standard OM4/OM5 cannot support that distance.
- A fiber optimized for 1060 nm and used with a 1060 nm VCSEL can overcome that constraint, but it requires time to develop.
- Options to achieve 50m reach with 850nm VCSELs have been proposed [murty\\_200gmmf\\_adhoc\\_01\\_250904.pdf](#) and [murty\\_3ds\\_adhoc\\_01\\_260303](#) requiring an MMF with an EMB of 5200 MHz·km in the 852–868 nm range.
- Here, we propose means to achieve the required modal bandwidth while improving production yield.

# Modal Bandwidth Measurement



# EMB Calculation

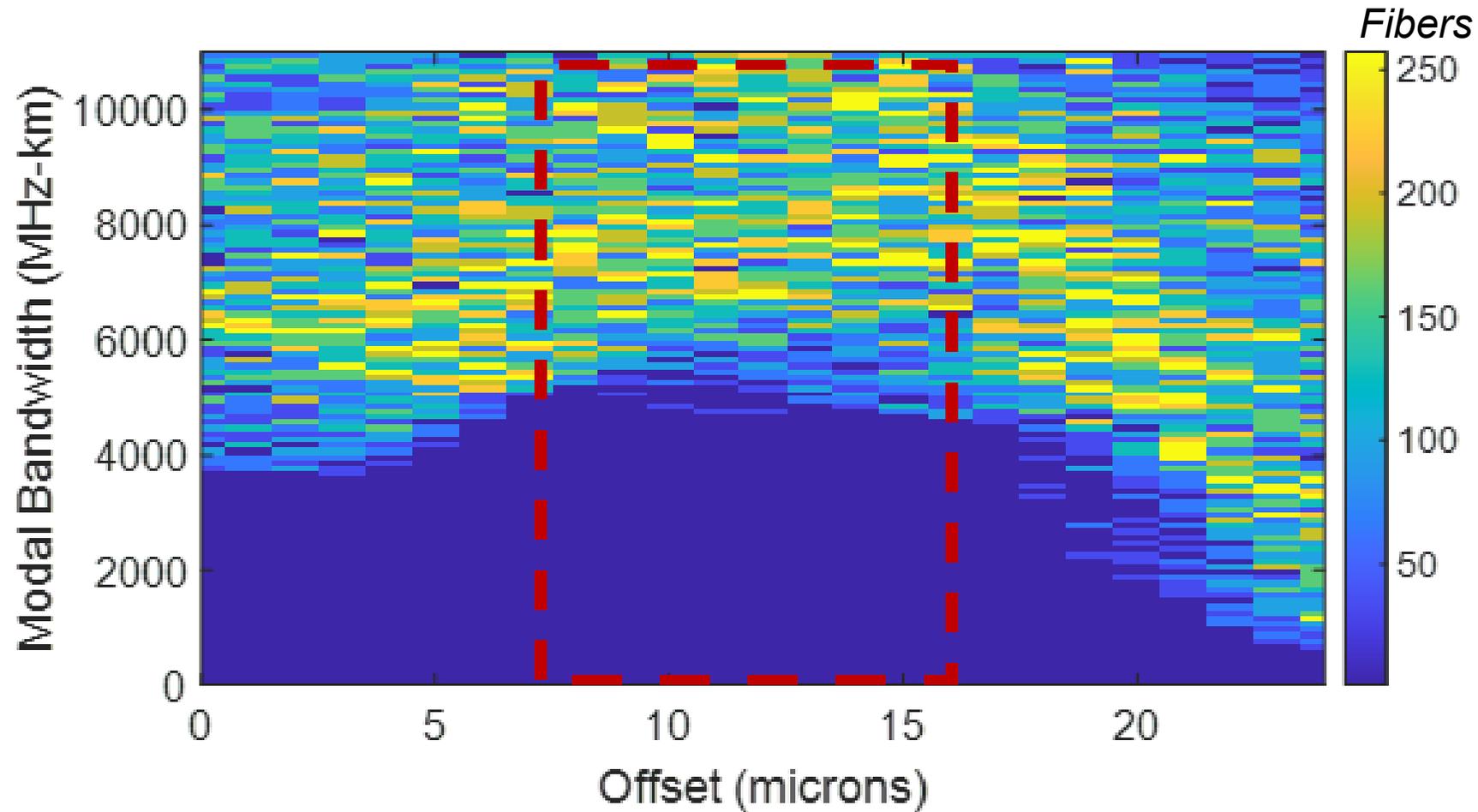
- Ten impulse responses are computed using ten selected power distributions, corresponding to ten VCSEL launches.
- Each weighted impulse response is transformed into the Fourier domain, and the 3 dB optical bandwidth is computed using a Gaussian fit.
- The EMB is proportional to the worst modal bandwidth among the ten weighting sets.
- Under this method, for OM4 fiber, the worst case among the ten VCSEL launches has a modal bandwidth greater than 4700 MHz·km.
- ***This value may be higher if a selected launch is enforced.***



$$\text{EMB} = 1.13 \min(B_i)$$

i: Index from 1 to 10  
B: modal bandwidth  
EMB: Effective Modal Bandwidth

# Modal Bandwidth per offset for 400 MMF



*There is a trend to have higher modal bandwidth at selected offset launches*

# Discussion

- An EMB of at least 5200 MHz·km over the 852–868 nm range is required to support 50 m reaches at 200 Gb/s per lane using VCSELs operating at a nominal wavelength of 850 nm.
- This requirement reduces fiber production yield, thereby increasing cost relative to OM3/OM4.
- If VCSEL experts agree that the higher EMB requirement (5200 MHz·km) is applicable only to a limited set of launch conditions, the yield of OM4/OM5 fiber meeting the higher bandwidth requirement can be improved.
- Verification would not require additional measurements, but only the inclusion of specific weighting set(s) representing the restricted launch conditions and the computation of their corresponding bandwidths.