Conditioned Launch for 50um and 62.5um Fibers

Modeling of Vortex Launch Performance and Implications for TP2 Compliance Test

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Condition Launch Goals

- **Launch Should Guarantee a Minimum Channel Response Which Enables a Workable EDC Penalty**
  - **Channel Response Characterized by an Agreed on Figure of Merit Correlated to EDC Penalty**
    - **3 dB bandwidth, IFR, Other?**
  - **In Addition to Performance over Agreed on Range of Fibers, Minimum Performance Must Be Met With Worst Case Combination of Connector Concentricity Offsets**

- **Launch Should be Compatible With Practical Integration Into Transceivers**
  - **A Single Launch Must Work for Both 50 and 62.5um Fiber**
  - **It is Highly Desirable That Launch Tolerate Practical Implementation Tolerances**

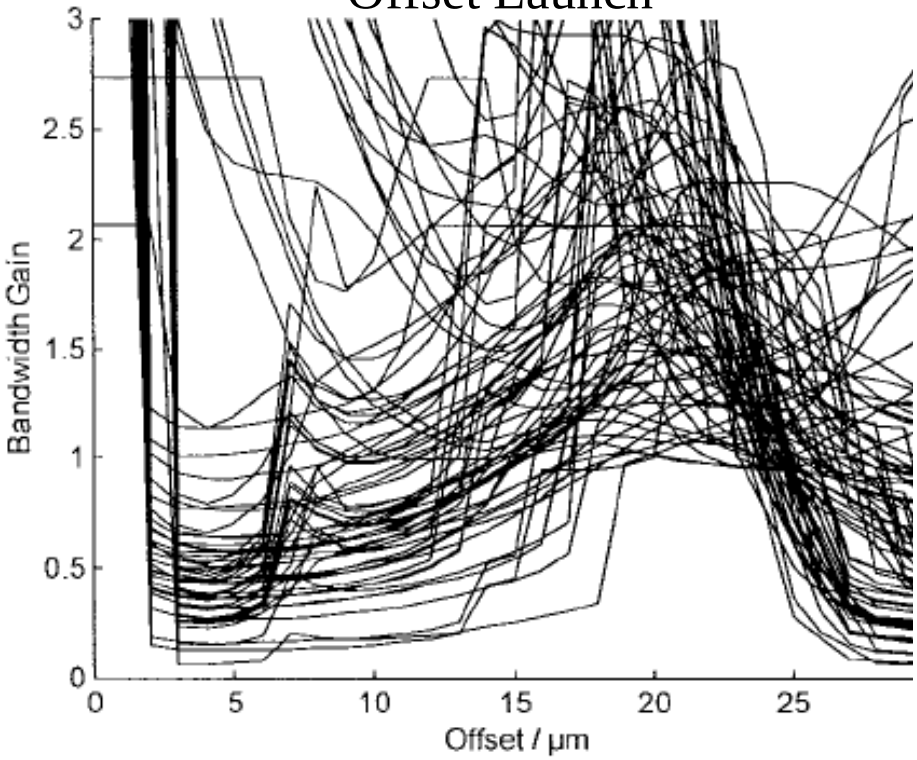
Offset Launch for 50 and 62.5um

- Current Spec for 500Mhz km 3 dB Bandwidth
  - 62.5um : 20um +/- 3um
  - 50um: 14um +/-3um
- Both: 17um +/- 0um
- No tolerance allowed for Offsets in an Integrated Launch.

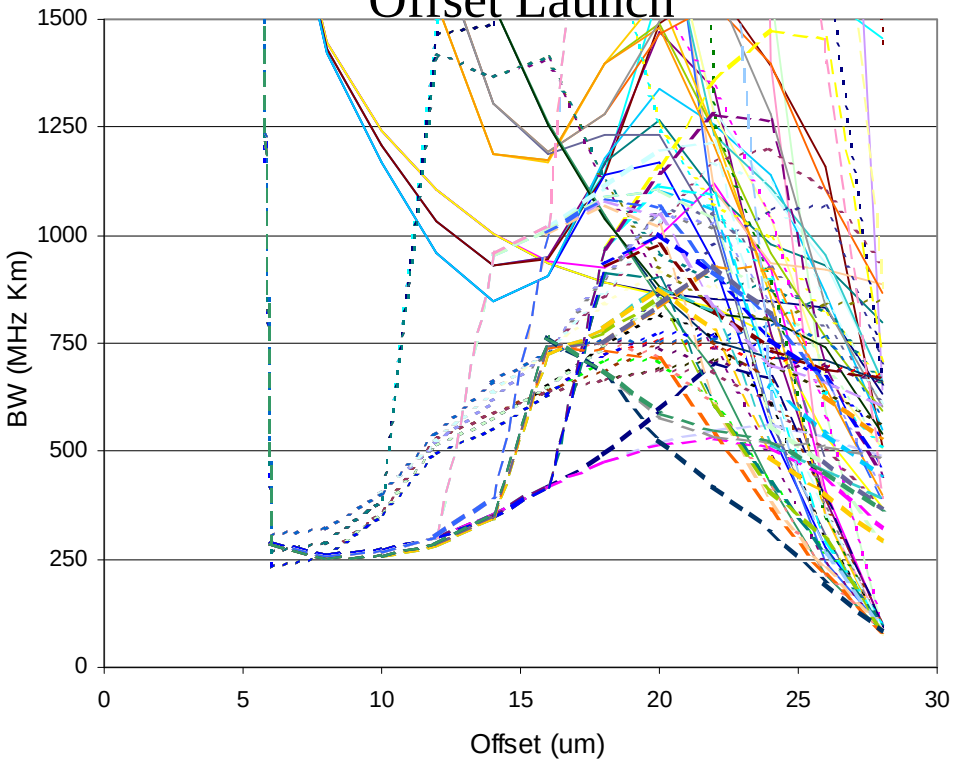
- Should be Characterized Further
  - Using More Appropriate Figure of Merit
  - Tolerance for Connector Offsets in Integrated Launch Implementation

Simulation model comparison

Cambridge Calculation
Offset Launch



DOC Calculation
Offset Launch

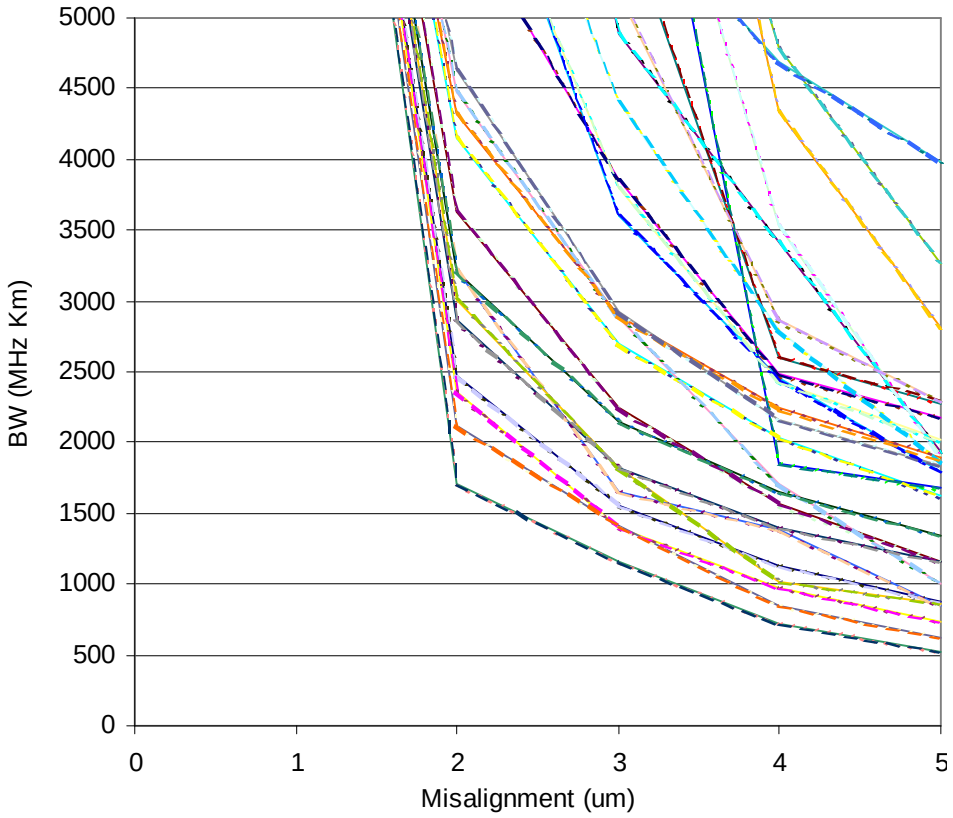


–Good agreement between the two models

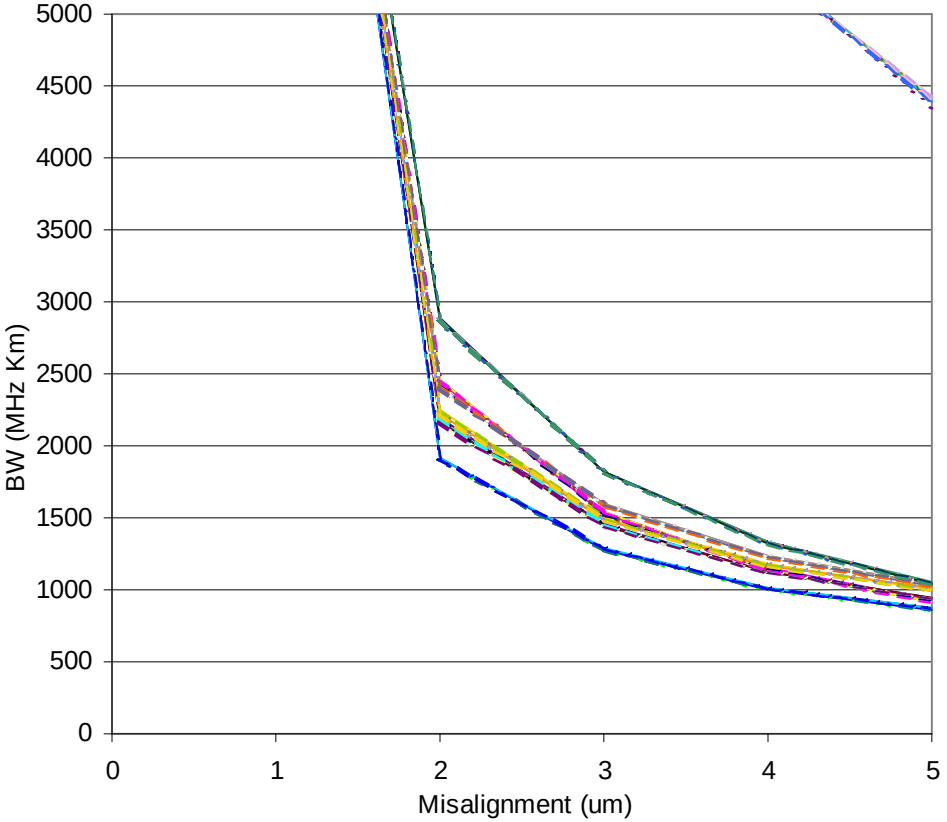
No DMD scaling in DOC calculation
All fibers included (none removed) in DOC calculation

Single vortex launch for 50 and 62.5 fiber

- **81 fiber "Cambridge" model**
  - **No mode mixing within mode group**



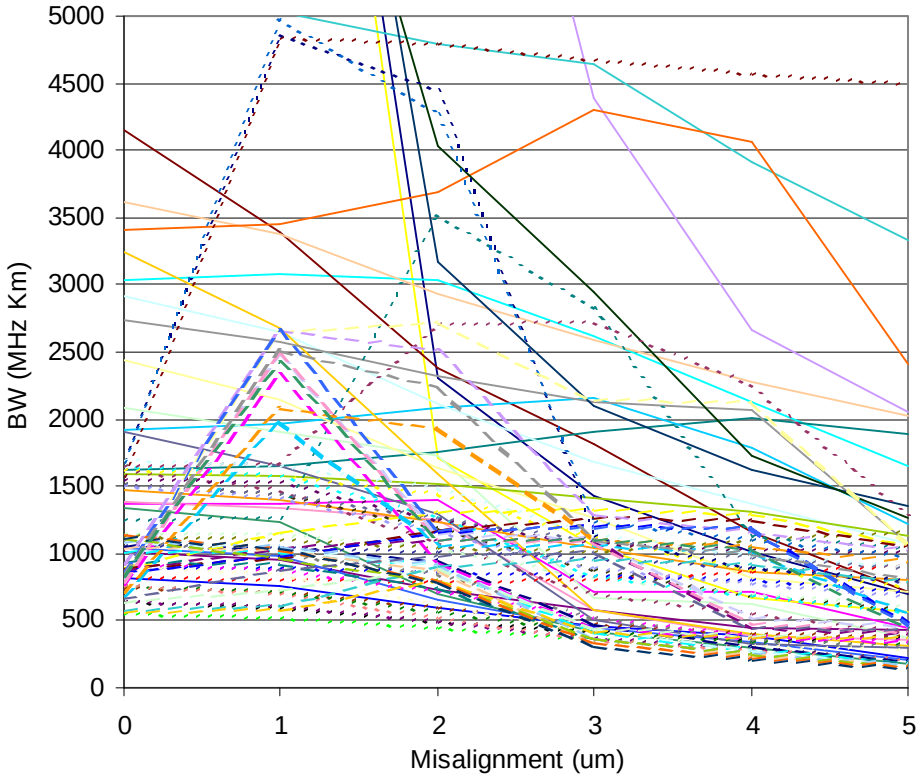
50um Fiber vortex launch



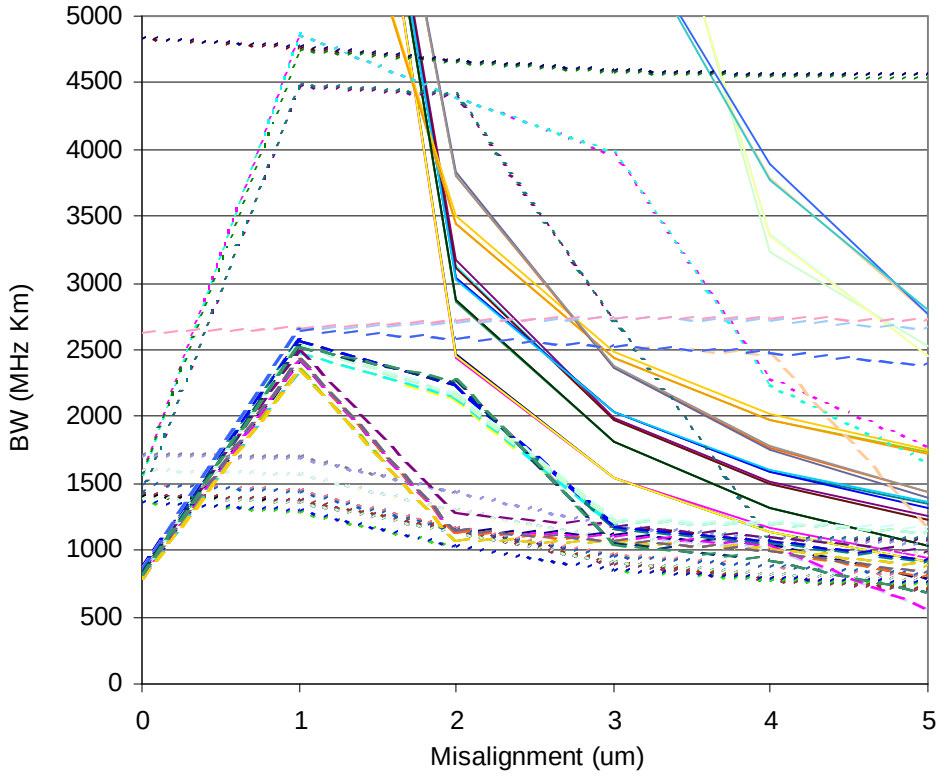
62.5um Fiber vortex launch

Single vortex launch for 50 and 62.5 fiber

- **81 fiber "Cambridge" model**
  - **100% mode mixing within mode group**



50um Fiber vortex launch



62.5um Fiber vortex launch

Summary of vortex launch for 50 and 62.5um fiber

	Max Radial mis-alignment which maintains 500Mhz Km	
Fiber	50	62.5
100% Mixing	+/- 1.25um	> +/- 5um
No Mixing	+/- 5um	> +/- 5um

- **Realistic performance probably somewhere in between "100% Mixing" and "No Mixing"**
- **Should remove "bad" fiber models**
- **Is 50um fiber model too conservative?**
- **Vortex conditions:**
  - **M=7, Radius=12.7um, FWHM=7um**

TP2 Compliance Test Implications

- TP2 Compliance Test Should Guarantee Minimum Figure of Merit) on 50 and 62.5 um Fiber with Allowed Offsets
  - May Be Different Criteria for Each Fiber Type
  - Integrated Launches Should Meet Both Criteria
- Should Clearly Exclude Known Poor Launches
  - Center Launch (High Sensitivity to Offsets/Mode Mixing)
  - ROFL type Launches
- Should Clearly Allow Specific Known Good Launches (as demonstrated against agreed on metrics)
  - Offset Single Mode Launch (perhaps not integrated)
  - Vortex Launches ?
  - Others TBD
- Should be Straightforward and Practical to Implement

- Will an Encircled Flux Type Test Suffice?
- Will Test Need to Measure Phase or “Helical” Content of Launch?
- Can a test which measures specific coupled mode powers be generated?

Summary

- Vortex/spiral type launches can provide wider tolerance for a common launch into 50 and 62.5um fiber
- Experiments underway to verify simulations
  - Launch Integrated into Transceiver to be Tested
  - Need Experiments to Resolve Degree of Mode Mixing
- Simulations indicate the phase is more important than the intensity
- Compliance test should not ignore the phase (angle) of the conditioned launch
- Simulation issues to be resolved
  - Need agreed on Figure of Merit
  - Level of mode mixing
  - 50um fiber defects (may not be as severe as 62.5um)
  - High order mode cutoff / attenuation