Comparison of vortex launch condition

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Outline

- Model assumptions
- Compare to other published models
- Vortex comparison
- References

Model Assumptions

- OM1
  - 54YY monte carlo data set provided by John Abbott
  - Only fibers with >500Mhz km included (list provided by John Abbott)
- OM3
  - 850nm TIA OM3 monte carlo delay set converted to 1300nm by P. Pepeliugoski
  - 5000 fibers in the delay set
  - Subset of these fibers were used in the simulations
    - Passed 850nm EMB (list provided by John Abbott)
  - 10 mode groups were used in the simulations
- Launch to Fiber offset
  - PIE-D calculated for the range of +/-3um in 1um increments
- Connectors
  - 2 Connectors w/ random offset
    - Rayleigh distribution, mean 3.58µm, truncated at 7µm
    - Snapped to 0.5um increments (transfer matrix from Richard Penty email)
  - Include only MPD diffusion effects using transform matrix approach
- PIE metrics
  - 47.1ps risetime Gaussian Tx filter
  - 7.5GHz, 4th-order BT Rx filter
- Vortex

  m = 7, radius of ring=12.7 um, width of ring=5.95 um (FWHM)

Comparison to other models

- Use model from ewen_1_041215.pdf as a benchmark
- Pick 2 different launches for 54YY and OM3 as a comparison point

	54YY		OM3	
	DOC	Ewen	DOC	Ewen
CL	5.6	5.9	5.1	4.8
OSL 17um	5.5	5.6	6.5	6.6

- DOC values within 0.3dB of Ewen numbers

Comparison of CL, OSL, and Vortex

PIE D for 2 connectors, 300mm		
Launch	**54YY**	**OM3**
Vortex	**5.3dB**	**5.4dB**
CL	**5.9dB**	**4.8dB**
OSL	**5.7dB**	**6.7dB**
+/- 3um launch tolerance		

CL and OSL taken from ewen_1_041215.

Note OSL is actually two different launch conditions:

54YY=20um +/- 3um

OM3=13um +/- 3um

- CL best for OM3
- Vortex best for OM1
- Vortex has the lowest “worst case” penalty for a common launch (5.4dB)
- This penalty is still better than the best proposed launch for OM1 (5.7dB)

References

- Calculation of PIE-D for CL and OSL: ewen_1_041215.pdf
  - http://www.ieee802.org/3/10GMMFSG/email/msg00583.html
- Previous vortex presentations
  - http://www.ieee802.org/3/10GMMFSG/public/mar04/morris_1_0304.pdf
  - http://www.ieee802.org/3/aq/public/may04/morris_1_0504.pdf

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Vortex Mode Couping Coefficients for 62MMF

$$phase(q) = e^{-jMq}$$

$$M = 7$$

$$\text{int}(r) = e^{-2\left(\frac{r-r_0}{w}\right)^2}$$

$$r_0 = 12.7um$$

$$w = 5.95um$$

Vortex		For 62.5um fiber				
M=7						
Ring Width	7um FWHM (intensity)					
Ring Radius	12.7um	(radius to peak intensity)				
	Misalignment (um)					
Mode Group #	0um	1um	2um	3um	4um	5um
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
6	0.0000	0.0000	0.0000	0.0001	0.0008	0.0036
7	0.0000	0.0000	0.0004	0.0038	0.0158	0.0406
8	0.0000	0.0012	0.0158	0.0597	0.1248	0.1780
9	0.0000	0.0688	0.2114	0.3032	0.2800	0.1825
10	0.9776	0.8208	0.4704	0.1644	0.0404	0.0571
11	0.0000	0.0816	0.2346	0.2983	0.2291	0.1192
12	0.0019	0.0073	0.0457	0.1288	0.2009	0.1978
13	0.0000	0.0006	0.0031	0.0218	0.0761	0.1446
14	0.0123	0.0092	0.0046	0.0037	0.0133	0.0484
15	0.0000	0.0030	0.0065	0.0057	0.0046	0.0103
16	0.0032	0.0017	0.0015	0.0045	0.0059	0.0054
17	0.0000	0.0011	0.0014	0.0010	0.0032	0.0056
18	0.0017	0.0009	0.0006	0.0011	0.0008	0.0024
19	0.0000	0.0006	0.0008	0.0005	0.0008	0.0007
20	0.0010	0.0005	0.0004	0.0007	0.0004	0.0005
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000