

# IEEE 802.3aq Channel model ad hoc Launch study

Summary of progress 19 Jan 2005  
revision 2

# Launch Study Participants

- David Cunningham
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- Joerg Kropp
- Jonathan King
- John Jaeger
- Sudeep Bhoja
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# Launch study goals

- Specific inputs to task force on launch conditions and launch testing
  - in time for January meeting

## Activities

- OM1 link simulations and experiments
- OM2 model development prompted (in task1)
- OM3 link simulations and experiments
  - Simulation and experimental results for centre launch and range of OSL (offset single mode) launches, and a universal launch candidate ('Vortex' launch)

# List of contributions to Launch Study

## In 'task force material' area (2005)

- 1) Simulation results confirming that explicit modeling of dynamic impulse responses is not required: *'PIE-D statistics Comparison Between Averaged Mode and Individual Mode Computation Method'*, Yu Sun.
- 2) Vortex launch experimental results: *'IPR / PIE Measurements on OM1 and OM3 Center, Offset and Vortex Launches'*, Yuri Vandyshev et al.

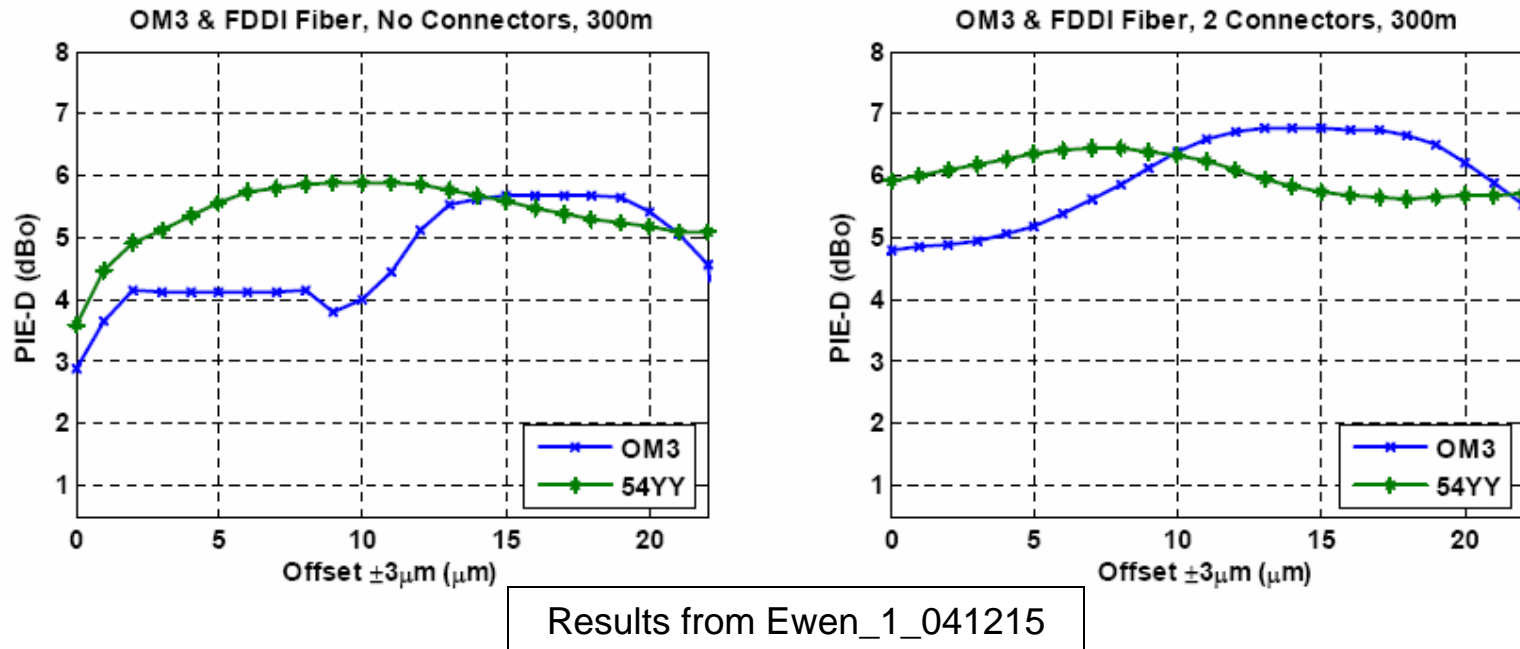
## On reflector

- 3) Experimental support for lowest PIE-D on OM3 with single-mode centre launch: *'PIE-D Measurements, 10Gb/s ,OM3 fibre'*, David Cunningham & Simon Meadowcroft (filename: *PIE-D Measurements OM3.pdf*)
- 4) OM3 PIE-D vs Launch measurements on TIA 2.2 demo set showing lowest PIE-D for centre launch: *'OM3 PIE-D vs Launch'* F Sugihwo & J King (filename: *OM3-PIEvLaunch.ppt*)
- 5) Calculations of ideal OM3 IPRs; shows best bandwidth with centre launch, and plots of cumulative encircled flux: *'Pulse Response of OM3 Fiber with 1300nm Transmission'*, J-R Kropp & S Botacchi (filename: *OM3 Fiber EFD PIED11.pdf*)
- 6) Calculated Encircled Flux Distribution for 62.5 $\mu$ m Fiber with Single Mode Launch and Offset Launches, and proposed EF test criteria: *'Calculated PIE-D for the various Transmissions'*, J-R Kropp & S Botacchi (filename: *OM3 EFD PIED2.pdf*)
- 7) Calculated and measured OM3 response vs offset showing centre launch required for non-single-mode launches: *'Coupling Conditions and 10G-Transmission on OM3 Fiber'*, J-R Kropp (filename: *OM3 Fiber Pulse Response3.pdf*)
- 8) Calculates best fit alpha of ideal OM3 model to experimental results: *'Optimum Exponent of 850nm OM3 Fibers Comparison and Experiments'*, J-R Kropp (filename: *Optimum alpha for OM3 Fiber*)
- 9) Monte Carlo fibre model simulations showing OSL best for OM1, centre launch best for OM3 in presence of connector offsets: *'OM3 PIE Metrics with Connectors'*, J Ewen & P Pepeljugoski (filename: *Ewen\_1\_041215.pdf*)
- 10) PIE-D calculations with Vortex launch on OM1 and OM3, showing PIE-D values comparable to OSL on OM1: *'Vortex PIE Calculations'*, J Morris & Adam Fedor (filenames: *morris\_050112\_1-4.pdf, morris\_050112\_5.pdf, morris\_050112\_6-7.pdf*)
- 11) PIE-D calculations with Vortex launch on OM1 and OM3 - update: *'Vortex PIE Calculations Updated 1-19-05'*, J Morris & Adam Fedor (filename: *Morris\_050119.pdf*)
- 12) Measurements of 4500 connectors and analysis of offset contribution tolerances - supports 7 $\mu$ m worst case value: *'Lateral offsets for multimode fiber (MMF) connectors'*, Al Brunsting & Rick Pimpinella (filenames: *Connector lateral offsets Rev3 - pt1.ppt, Connector lateral offsets Rev3 - pt2.ppt*)

## From previous interim and plenary meetings

- 13) Initial contribution describing Vortex lens concept as a candidate for a 'universal' launch: *March '04 meeting* (filename *Morris\_1\_0304*)

# Findings: OM3 and OM3



- With connectors - Center launch better for OM3, FDDI fiber slightly better with standard 62.5 $\mu\text{m}$  OSL (17 $\mu\text{m}$  – 23 $\mu\text{m}$ )
- No connectors - Center launch better for both OM3 and FDDI fiber
- Similar conclusions from simulation work from other groups (Joerg Kropp and S Botacchi)
- Supported by experimental data from many others (Joerg Kropp; F Sugihwo & J King; David Cunningham & Simon Meadowcroft; Yuri Vandyshev, Jim Mcvey, Hongyu Deng & Lew Aronson)
- Multiple launch options per fibre type may improve coverage

## Preliminary findings: OM2

- OM2 model is under development in task 1
  - 50 $\mu$ m OSL (10 $\mu$ m - 16 $\mu$ m offset) proposed for primary launch , centre launch as secondary launch, based on reported experience on TIA 12-96 round robin fibres
  - to be confirmed with further experiments and simulations pending OM2 model

## Preliminary findings: 'Vortex' launch

- 'Vortex' launch is being explored as a possible universal launch
  - initially described in Morris\_1\_0304
- Experiments compared Vortex with CL and OSL on OM1 and OM3:  
(Yuri Vandyshev et al)
  - Varies less with connector offsets than CL, comparable to OSL
  - Compares favourably to OSL for OM1
  - Worse than CL for OM3, but may be good enough
- Simulations of the Vortex launch are in progress and will be reported separately in this meeting (Morris\_1\_0105)

# Summary

- Simulation and experimental work on launch options for each fibre type has been carried out
  - Primary and secondary launch recommendations for each fibre type
    - OM1: OSL, CL
    - OM3: CL, OSL
    - OM2: OSL, CL - to be confirmed with further work
  - In addition, experimental and simulation work on a potential example of a universal launch has been carried out. An update of simulation results will be given this meeting (Morris\_1\_0105)
- Other points of note
  - Multiple launch options can increase coverage
    - need to understand how/if to specify dual launches in standard - seeking end customer input
  - Explicit modeling of IPR variation due to dynamic effects is not needed; details of this work will be presented in this meeting (Sun\_1\_0105)
- Three tables have been prepared to show the options for specifying launch in the Draft. Each table includes draft encircled flux launch test definitions (implementation non-specific) for primary and secondary launches, and for a 'universal' launch