# Split-symmetric stressor and power - update

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*New slides and material added, unchanged slides and material from dawe_1_1005.pdf removed or greyed out – corrections in black*

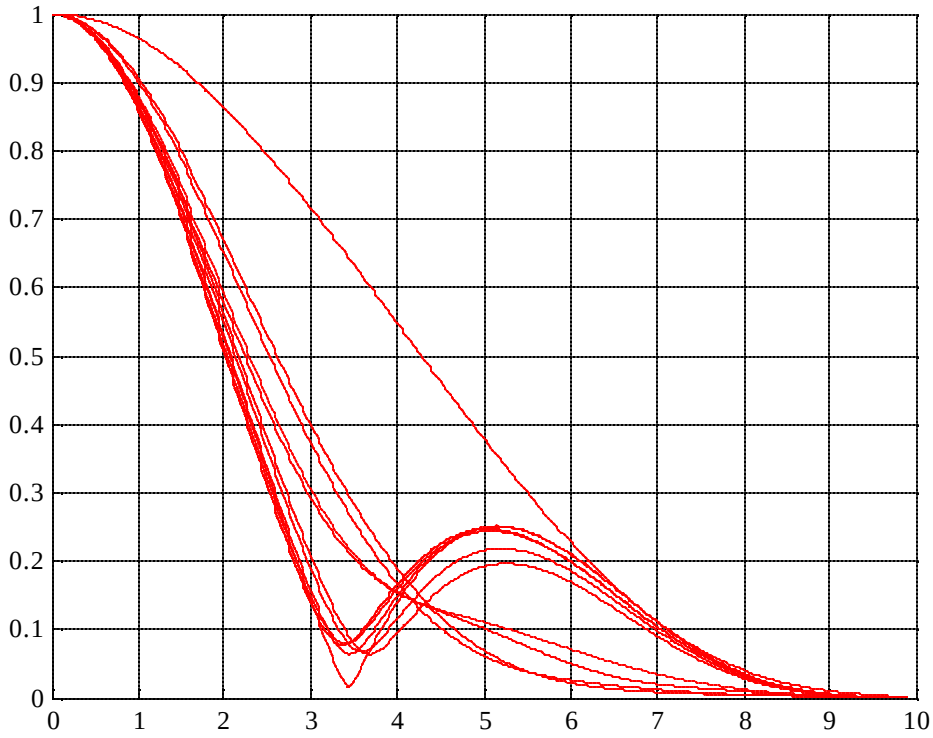
# D2.3 and candidate stressors

| | | | A1 | A2 | A3 | A4 | PIE-D | Noise loaded TWDP(14,5) | TWDP(8,3) no Tx noise | Fiber-length -3dBo BW | Freq notch depth 0 to 5 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D2.3 pre | Red | | | | | 4.01 | 5.08 | 5.69 | 2.70 | 0.0 |
| | D2.3 sym | Green | 0 | 0.513 | 0 | 0.487 | 3.80 | 5.29 | 4.32 | 5.23 | 17.7 |
| | D2.3 post | Blue | | | | | 4.17 | 5.07 | 4.38 | 2.62 | 0.0 |
| A | PD Sept | Black | 0.545 | 0 | 0.425 | 0 | 3.84 | 4.98 | 4.09 | 6.34 | 11.1 |
| B | PD Sept | Magenta | 0 | 0.55 | 0 | 0.45 | 3.72 | 4.94 | 4.04 | 6.75 | 11.9 |
| C | PD Sept | Cyan | 0.03 | 0.545 | 0 | 0.425 | 3.81 | 4.96 | 4.06 | 4.12 | 11.0 |
| D | PD Sept/Oct | Yellow | 0.545 | 0 | 0.425 | 0.03 | 3.84 | 4.98 | 4.09 | 6.34 | 11.1 |
| E | Ewen 0.8 Oct | Yellow | 0 | 0.526 | 0.056 | 0.417 | 3.83 | 4.99 | 4.13 | 7.38 | 11.7 |
| F | Ewen 0.8 Oct | Black | 0 | 0.507 | 0.093 | 0.4 | 3.92 | 5.06 | 4.22 | 4.90 | 11.9 |
| G | Ewen smooth s | Cyan | 0.101 | 0.389 | 0.437 | 0.073 | 3.82 | 4.90 | 4.48 | 3.26 | 0.0 |
| H | Ewen smooth s | Cyan | 0.11 | 0.349 | 0.445 | 0.095 | 4.06 | 5.24 | 4.91 | 3.09 | 0.0 |
| | b2b | Black | | | | | 1.22 | 1.82 | 1.29 | 10.31 | 0.0 |

- Note candidates E and F

# Filtered frequency responses of D2.3 and candidate stressors, and back-to-back link

Filtered frequency response (linear)



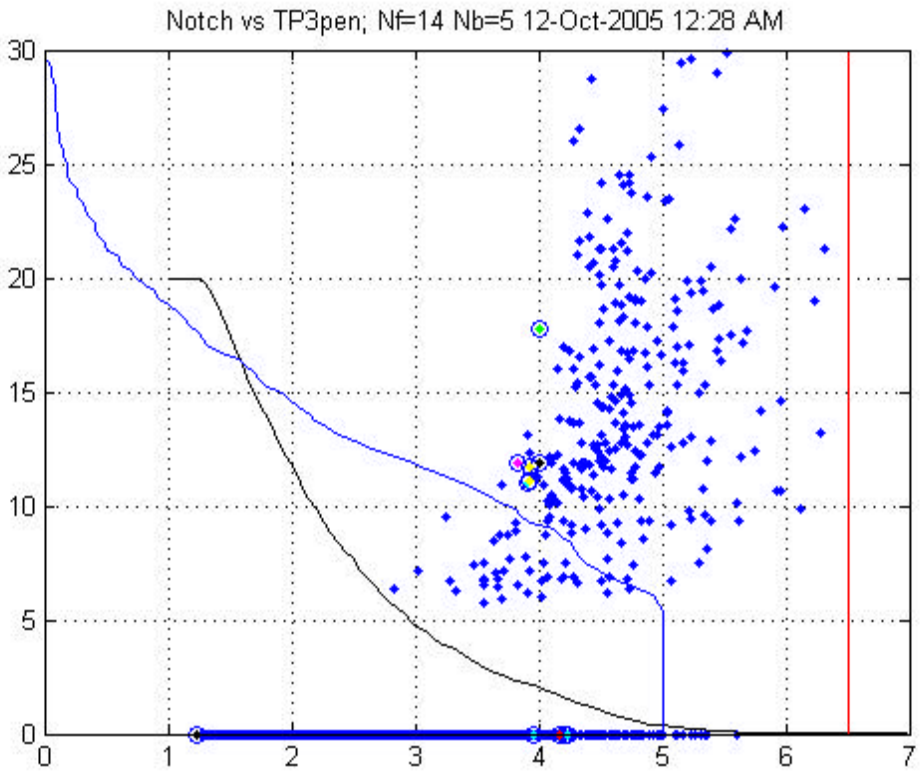

Frequency (GHz)

# Correlation of notch depth vs. PIE(14,5)

D2.3 split sym (circled green dot) falls outside the range of 5000 simulations (FDDI grade, dual launch, 1-1-220) *Candidate stressors added*

Depth of notch (dBo)

Histograms (scaled to 5, 20) do not agree with Ewen model but this does not invalidate conclusions about correlation




PIE(14,5) (dBo)

# Correlation of fiber bandwidth vs PIE(14,5)

5000 MC sims (FDDI grade, dual launch, 1-1-220)

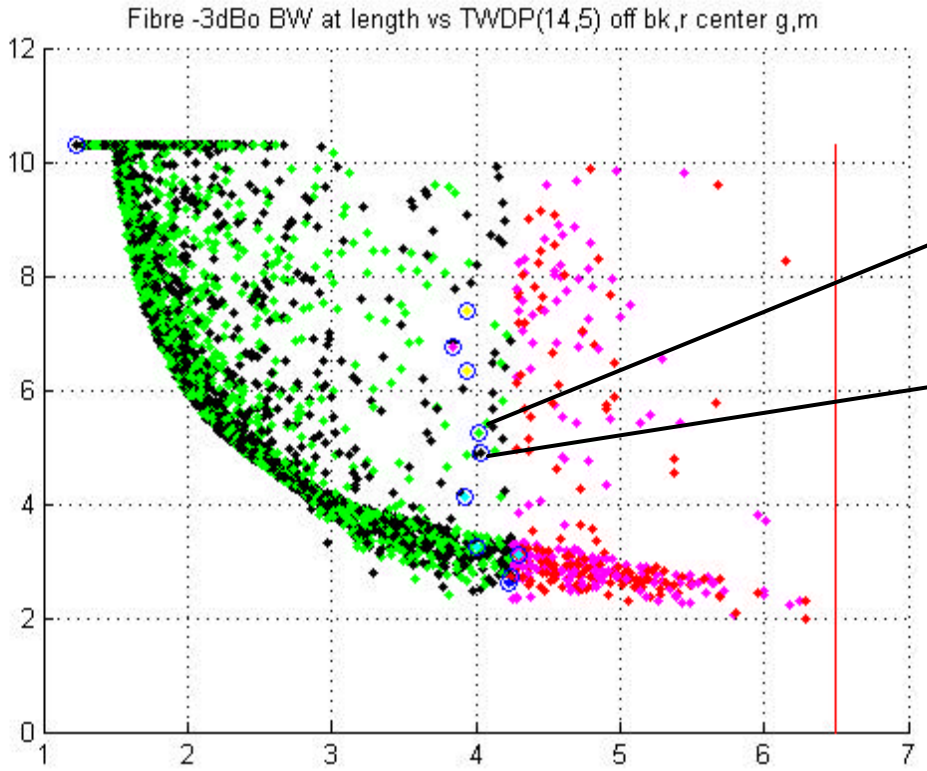
Red, green, blue D2.3 precursor split-sym postcursor

Black magenta cyan yellow Moderated split-sym

Yellow, black Split-sym chosen for “fairness”

Cyan (2) Single-peaked near sym chosen for “fairness”

Fiber –3dBo bandwidth for 220 m (GHz)




D2.3 split-sym

“Fair” split-sym F

TWDP(14,5) (dBo)

# Correlation of fiber bandwidth vs noise-loaded TWDP(14,5)

500 MC sims (FDDI grade, dual launch, 1-1-220)

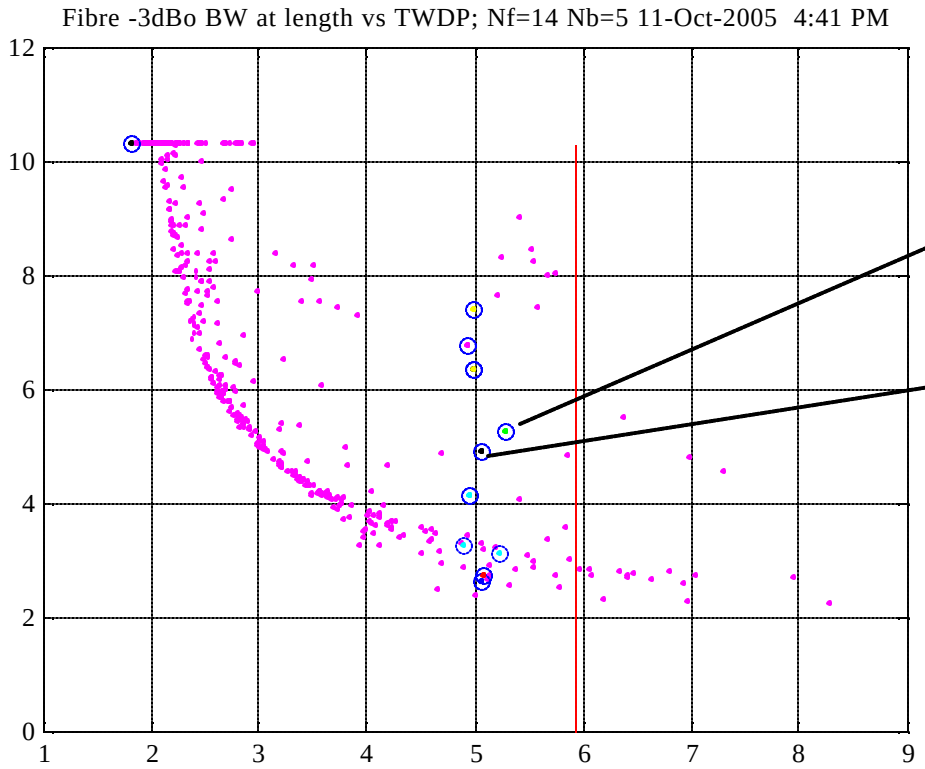
Red, green, blue D2.3 precursor split-sym postcursor

Black magenta cyan yellow Moderated split-sym

Yellow, black Split-sym chosen for “fairness”

Cyan (2) Single-peaked near sym chosen for “fairness”

Fiber –3dBo bandwidth for 220 m (GHz)




D2.3 split-sym

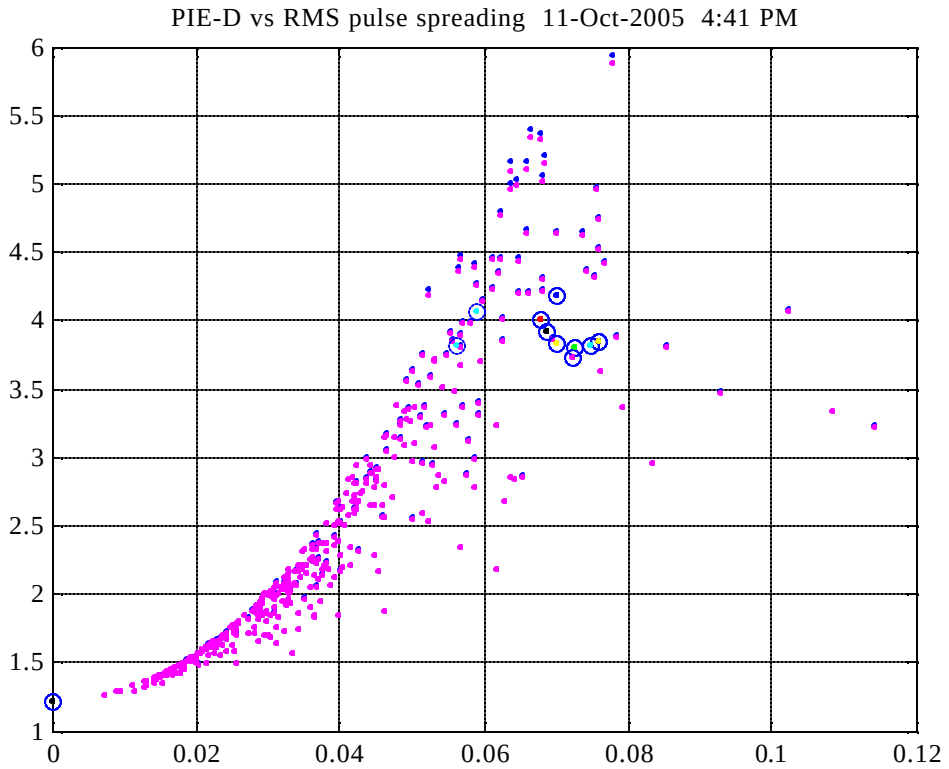
“Fair” split-sym F

Noise-loaded TWDP(14,5) (dBo)

# Correlation of PIE(14,5) vs RMS impulse spreading

500 MC sims (FDDI grade, dual launch, 1-1-220)

| | |
|---|---|
| Red, green, blue | D2.3 precursor split-sym postcursor |
| Black magenta cyan yellow | Moderated split-sym |
| Yellow, black | Split-sym chosen for “fairness” |
| Cyan (2) | Single-peaked near sym chosen for “fairness” |



# Correlation of frequency notch to connector loss

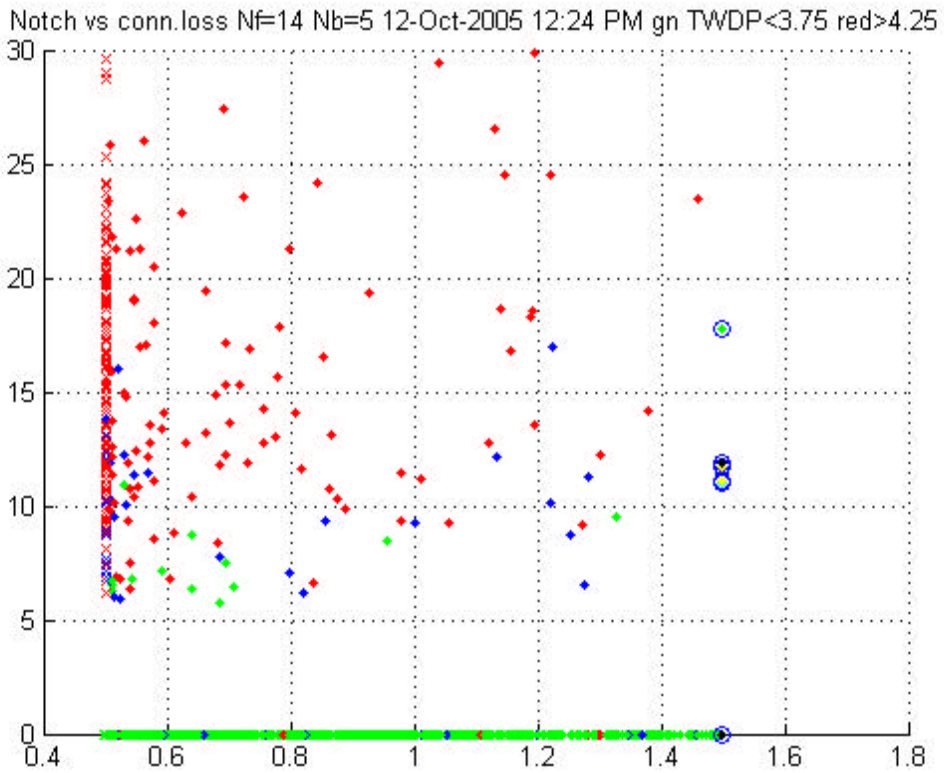
From 5000 MC sims, FDDI, 1-1-220, dual launch

Green dots: “easy”, blue: near spec limit: red: too high TWDP, out of spec
Most responses are monotonic

Also note blue and green dots do not show high connector loss and deep notch simultaneously

Circled colored dots are frequency notch of stressors. D2.3 split-sym (green circled black) is not representative of challenging simulated links (blue dots)

Depth of notch (dBo)




Dots: offset launch

Crosses: center launch

Connector loss (dBo)

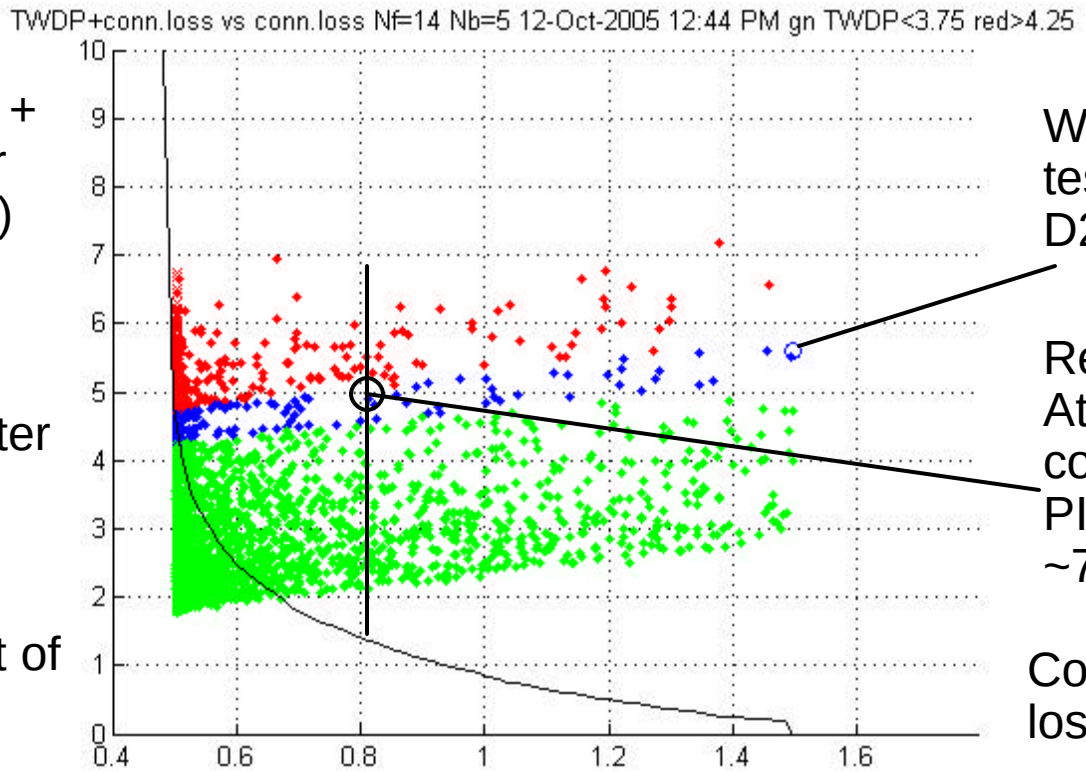
# Correlation of (PIE(14,5) + connector loss) to connector loss

From 5000 MC sims, FDDI, 1-1-220, dual launch

Green dots: “easy”; blue: near spec limit; red: too high PIE(14,5), out of spec

Loss distribution is very strongly skewed to low losses

Blue circle is D2.3 (OMA,TWDP) point. It’s not representative of simulated links



# MC cumulative histograms

From 500 MC sims, FDDI, 1-1-220, dual launch. 14+5 equalizer

Blue cumulative histogram: without transmitter noise

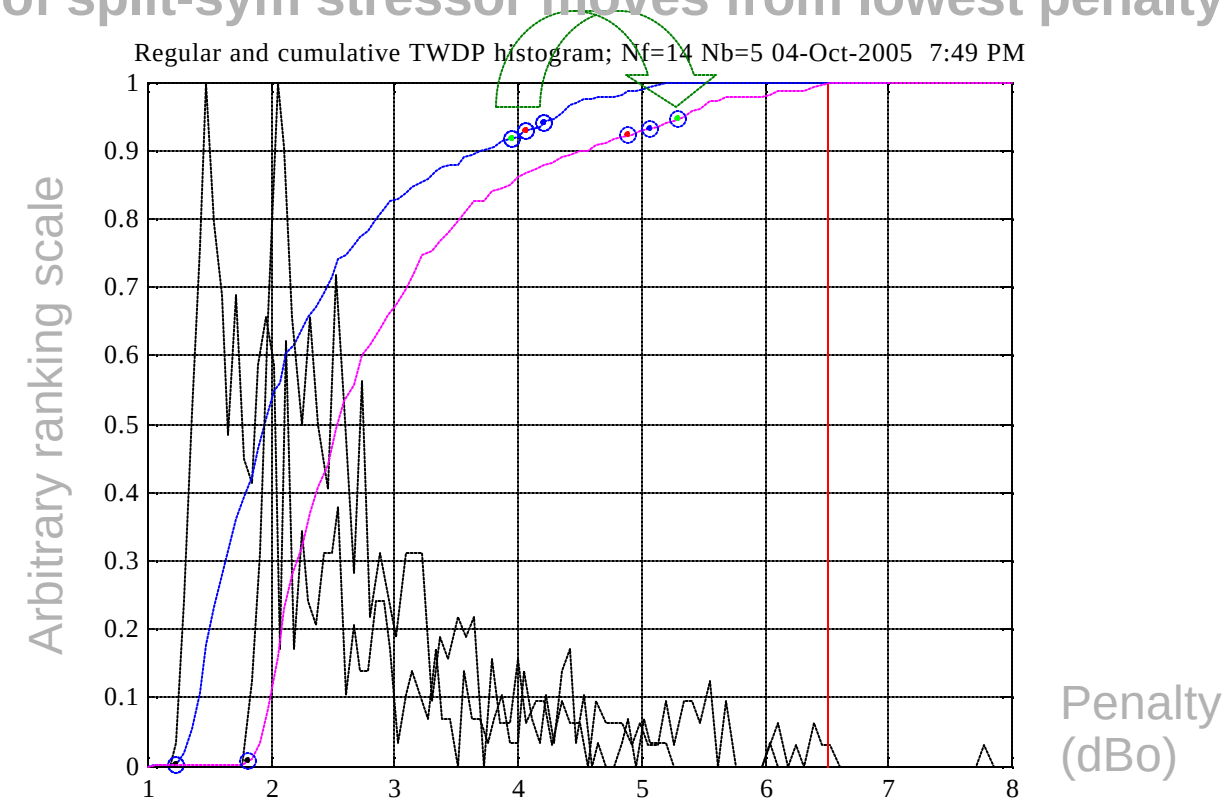
Magenta cumulative histogram: with Qsq ~22.5

Circled points per D2.3:

red: precursor, green: split-symmetric, blue: post-cursor

Cumulative histograms show near constant offset as expected

**BUT ranking of split-sym stressor moves from lowest penalty to highest**



# MC cumulative histograms - update

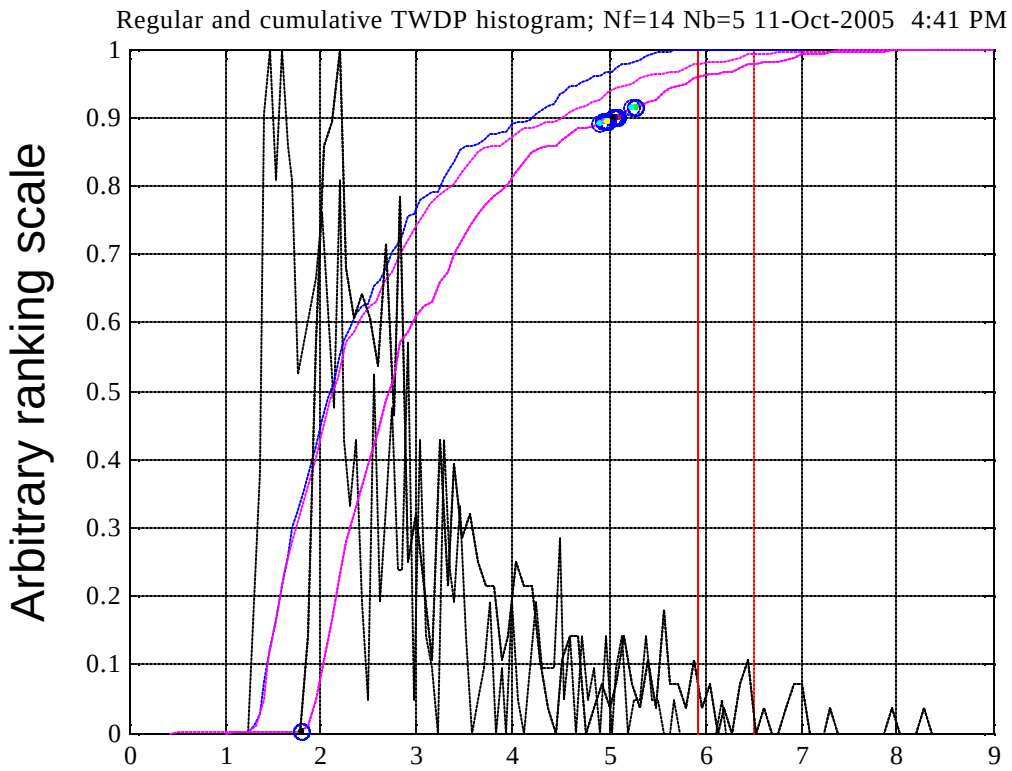
From 500 MC sims, FDDI, 1-1-220, dual launch. 14+5 equalizer

Blue cumulative histogram: without transmitter noise

One magenta cumulative histogram: with Qsq ~22.5

Other magenta cumulative histogram: with Qsq ~22.5 and Rx noise reduced to compensate

Cumulative histograms show that, typically, noise loading is more important for difficult channels



# MC cumulative histograms – update and zoom in

From 500 MC sims, FDDI, 1-20 channel, 14+5 equalizer

Blue cumulative histogram: without transmitter noise

One magenta cumulative histogram: with Qsq ~22.5

Other magenta cumulative histogram: with Qsq ~22.5 and Rx noise reduced to compensate

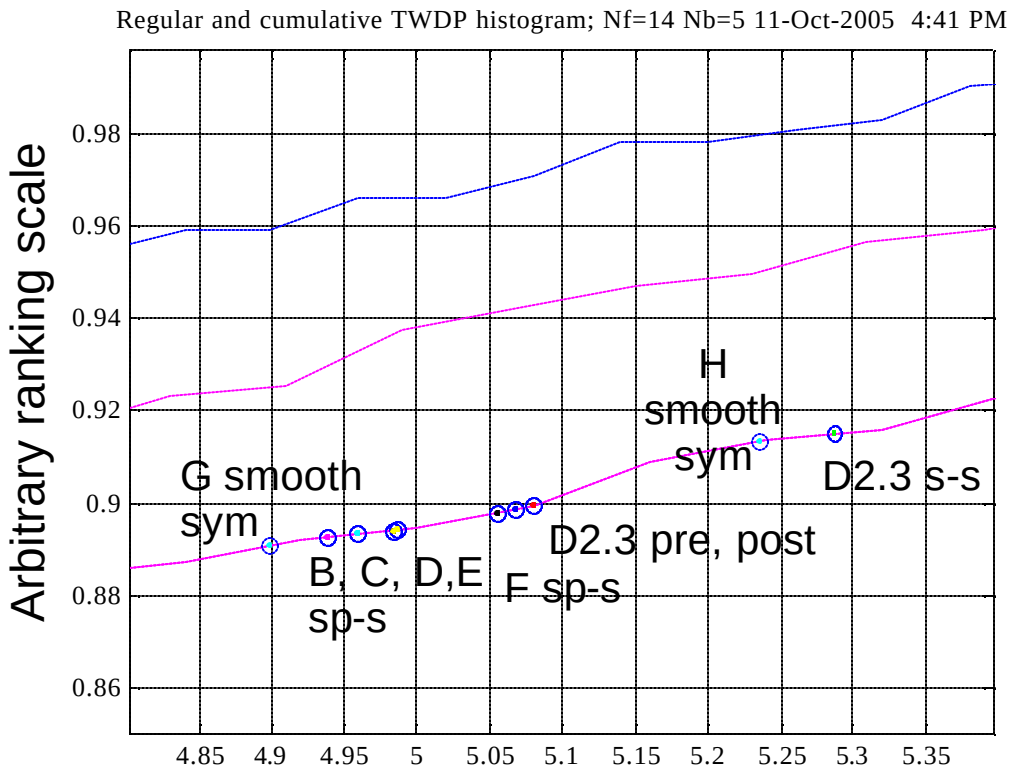
Cumulative histograms show that, typically, noise loading is more important for difficult channels

Red, green, blue D2.3 precursor split-sym postcursor

black magenta cyan yellow Moderated split-sym

Yellow, black Split-sym chosen for “fairness”

Cyan (2) Single-peaked near sym chosen for “fairness”




Penalty (dBo)

# D2.3 split-sym stressor is at wrong power level, is not a representative response, AND is more difficult than intended

- Correcting these things will leave coverage where we thought it was
- Still worst-casing transmitter RIN (and OMA, and Rx stressed sensitivity) – still conservative

# Proposed actions

1. Raise OMA by 1 dB for split-sym sensitivity to reflect strong correlation between notched response and connector loss
2. Find a new split-sym stressor with notch at 75$^{th}$ %ile of PIE-on-limit channels (no need to “worst case” the same cause twice)
   *Best candidates are E, F with notch ~12 dBo in freq domain*
   *In time domain, 1:0.8 peak ratio is in right %ile region*
3. *Confirmed: candidate stressors are fair to different equalizers per Ewen methodology*
4. Confirm new stressor is no more than 0.1 dB higher in %ile when noise loaded than any of three stressors without noise loading

*Confirmed: similar and easier than D2.3 precursor*