

Analysis of 1998-99 FDDI fibers for PIE-D and “DMD BW”

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Discovering Beyond Imagination

Introduction/Summary

Analysis of historical DMD pulse data from 1998-1999.

This data represents 1806 reels of 8.8km fiber for which we have (OFL850, OFL1300, Length) and the DMD pulse information as well.

OFL1300>500MHz.km for all reels.

The intent is to calculate PIE-D's for all offsets to complement the OFS/Georgia Tech study presented in Vancouver as balemarchy_1_0105.pdf

We present offset BWs and PIE-D distributions as well as coverage curves.

Dual launch PIE-D ~5.1dB without connectors.

CAVEAT – relation to “installed base”

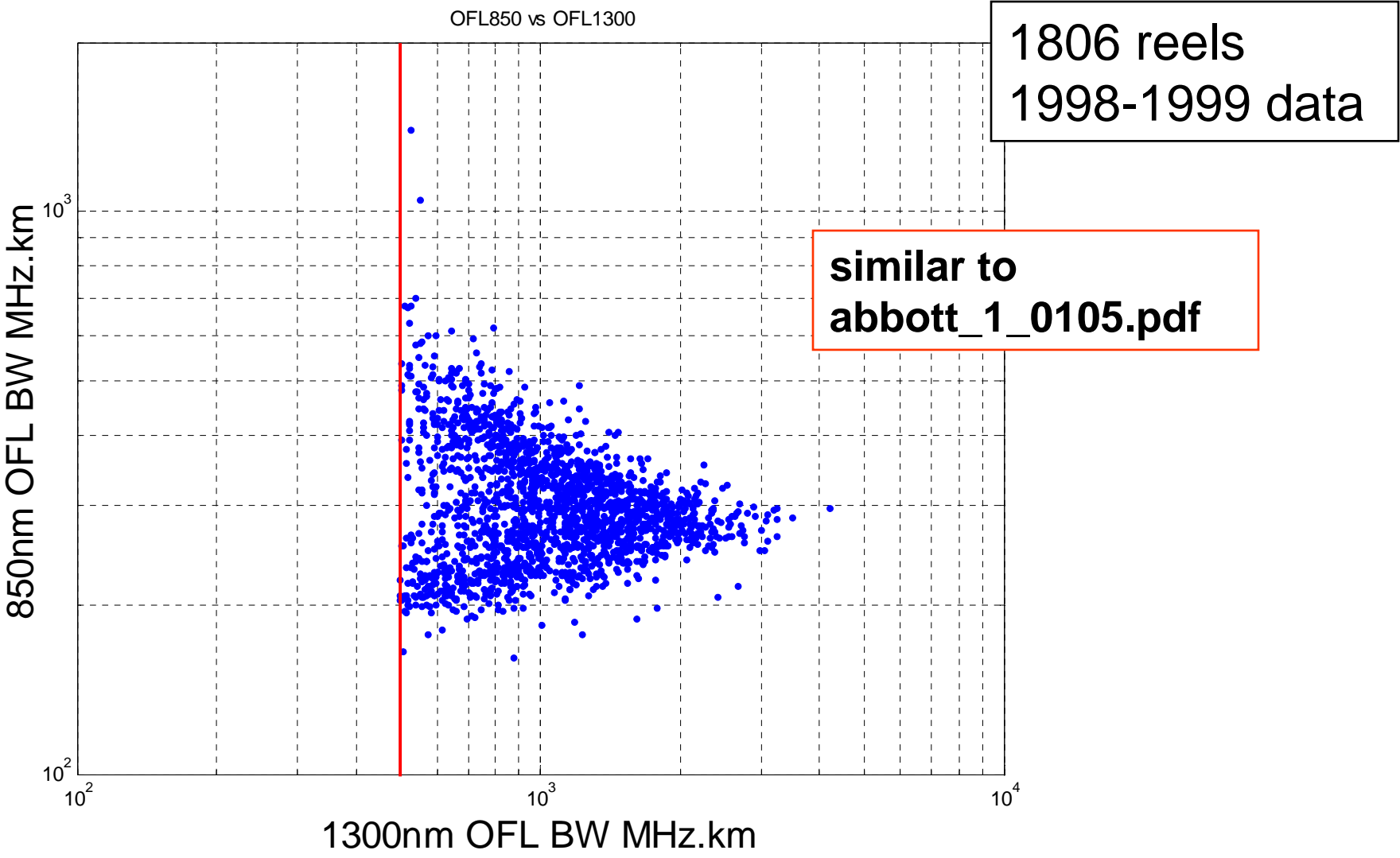
This historical data is not synonymous with the installed base.

1. Earlier FDDI fibers from all manufacturers have more significant profile perturbations near the center, as seen in 1GbE MBI work.
2. FDDI fiber samples from some manufacturers continue to show center perturbations through 2004.
3. These fibers and the OFS sample can be checked against the Gen67 Monte Carlo set – the Gen67 set approximates the OFLBW distribution of the Corning/OFS 98-99 data as well as the distribution of offset BW (see [abbott_1_1104.pdf](#))

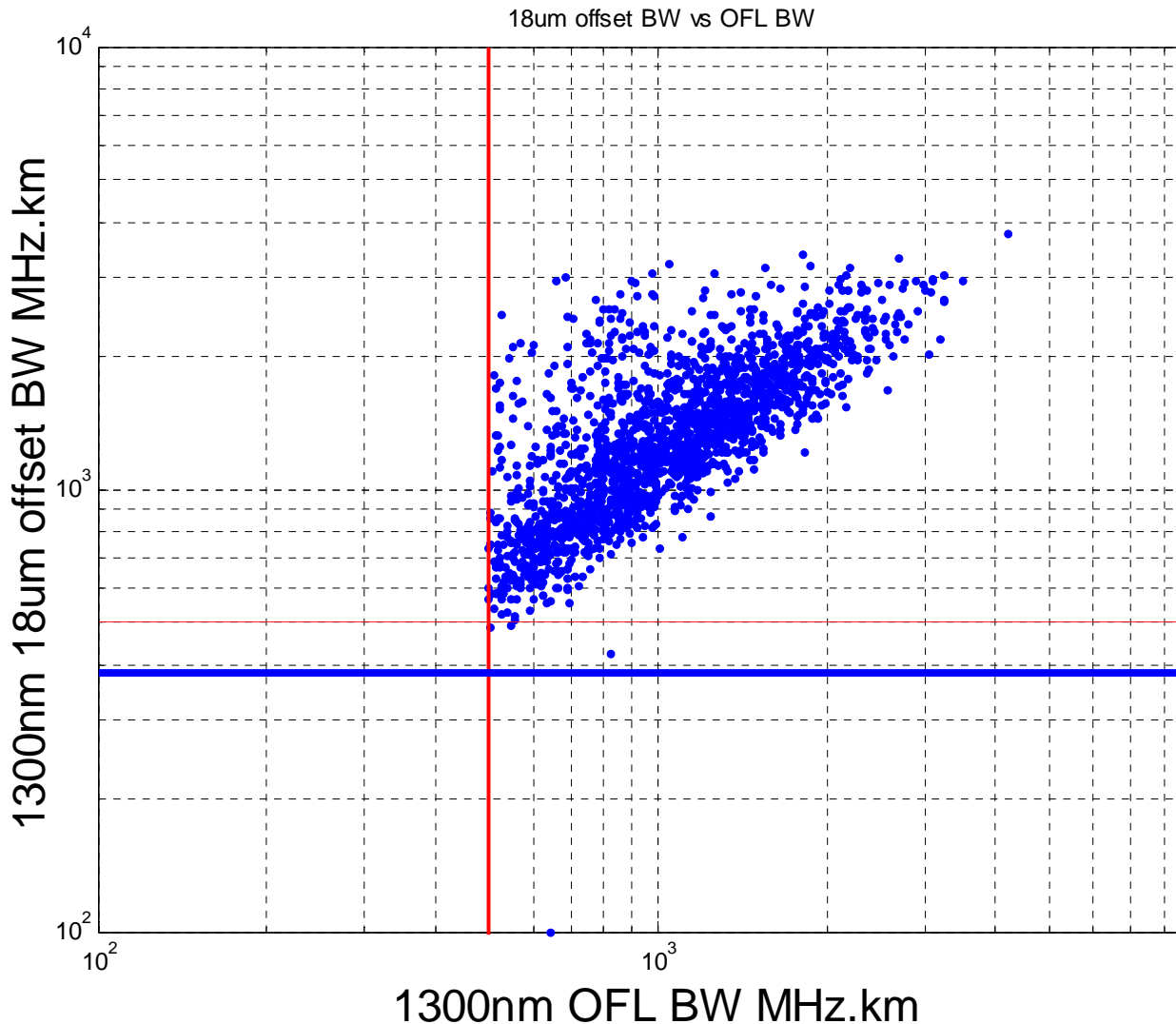
Outline

- (A) Characterize data with OFL BW, offset BWs
- (B) PIE-D results; comparison to OFS data in [balemarthy_1_05.pdf](#)
- (C) PIE-D coverage curves, dual launch results of 99% coverage in range 5.1-5.7dB; estimated dual launch failure rate at 5.0dB with connectors = 4%.
- (D) Additional data for (A), (B), (C)

OFL850 vs OFL1300



18um offset BW vs OFL1300



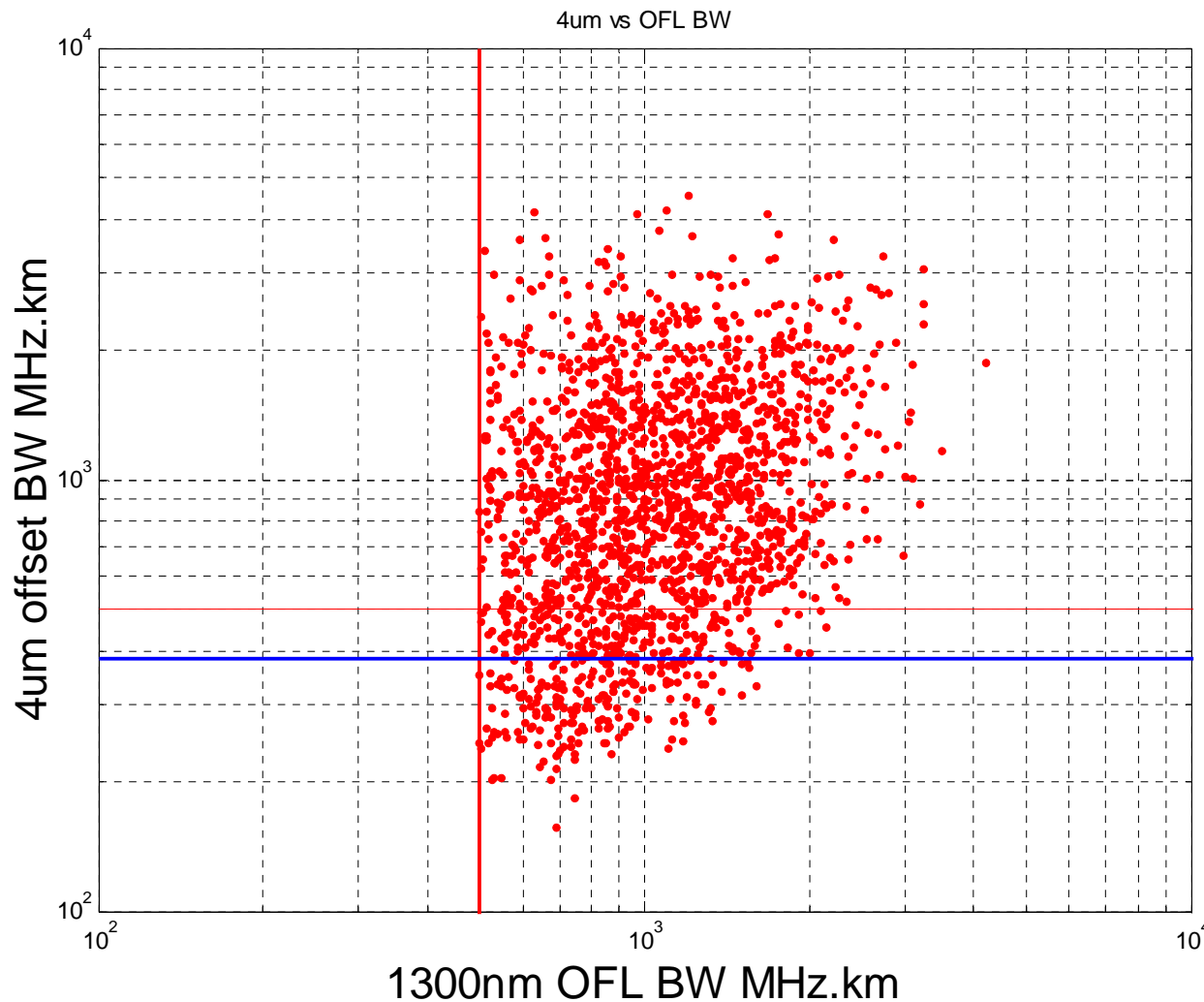
1806 reels
1998-1999 data

**1GbE 300m
requires offset
BW ~385MHz.km
which is easily
met with 18um
launch (OFS uses
18,21,24 offsets)**

**Reference pulse
has not been
deconvolved
which limits max
offset BW.**

**Correlation with
OFL BW**

4um offset BW vs OFL1300



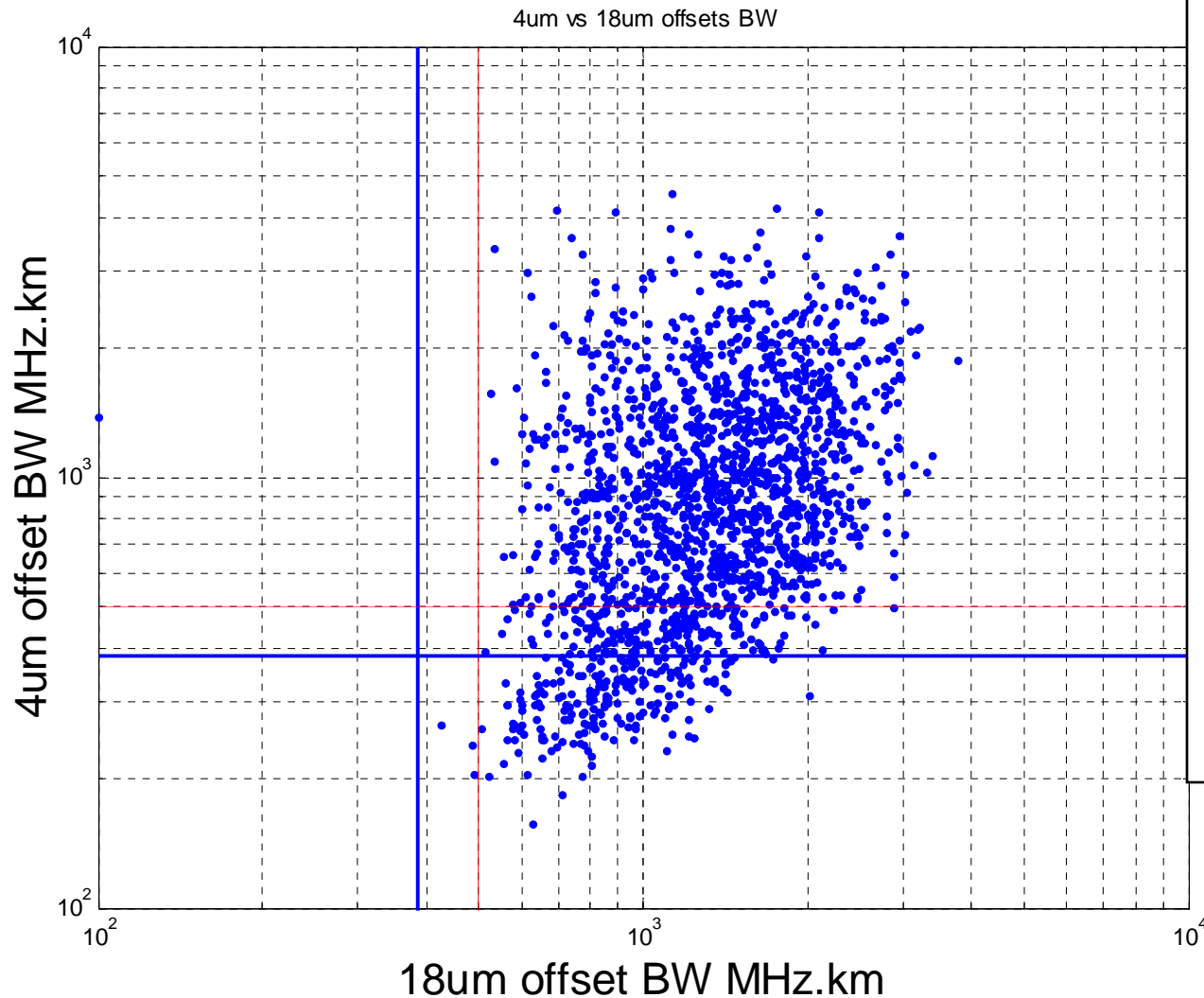
1806 reels
1998-1999 data

**1GbE 300m
requires offset
BW ~385MHz.km**

**4um offset BW
frequently fails
this requirement
(hence offset
patchcord
needed)**

**Less correlation
with OFL BW.**

4um offset BW vs 18um offset BW



1806 reels
1998-1999 data

**1GbE 300m
requires offset
BW ~385MHz.km**

**Note that the OFS
analysis includes
both 18,21,24um
offsets, and uses
0,3um offsets at
the center.**

PIE-D Results

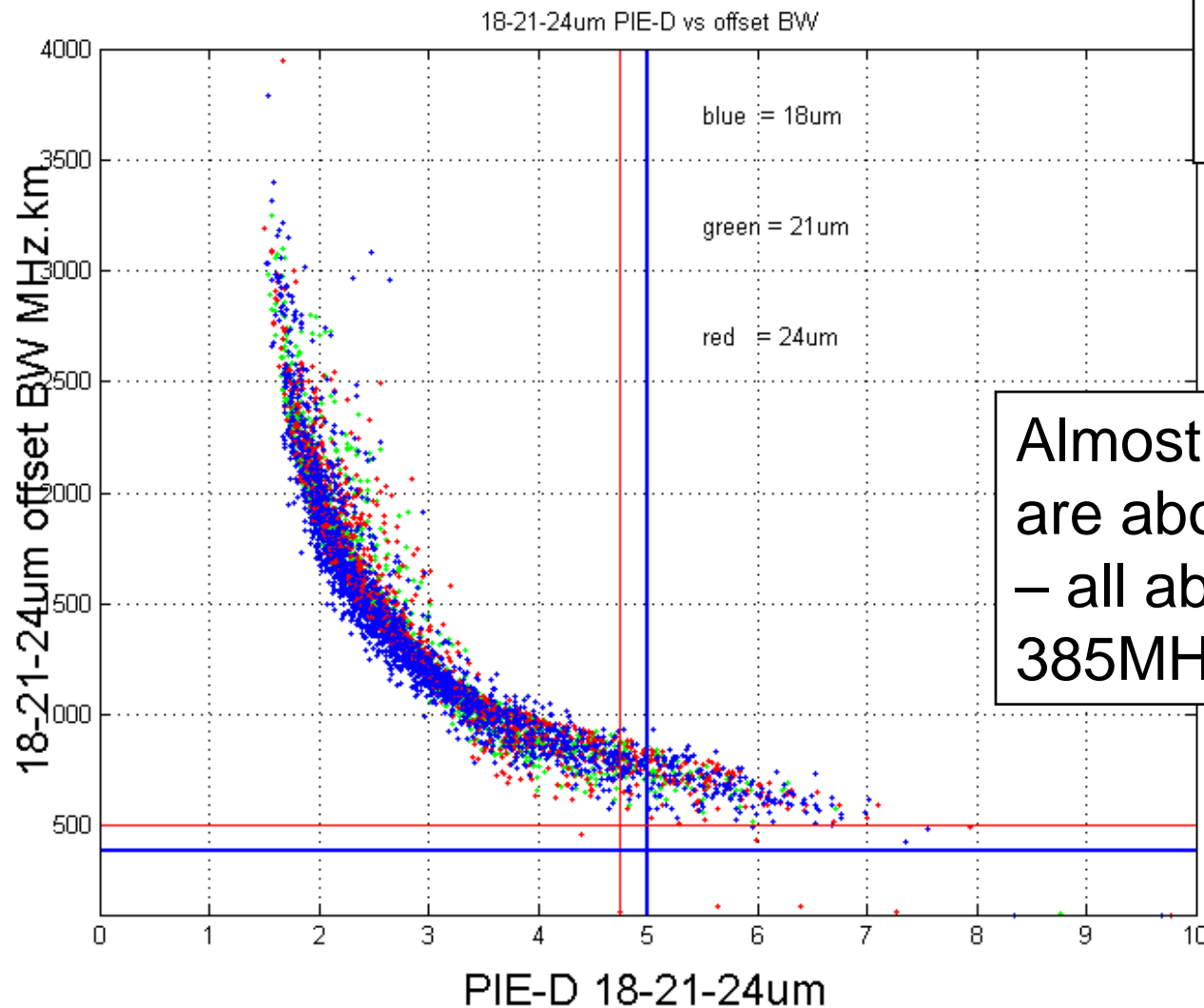
Results agree with Georgia Tech / OFS presentation
balemarthy_1_0105.pdf (Vancouver 1/2005).

Use of mode conditioning patchcords for 1GbE 300m is ROBUST.
Required offset BW = 385MHz.km is met by all 1806 reels.

However, for 10GbE 300m, numerous reels exceed a PIE-D of
5.0 dB with the offset launch.

Coverage curves will show 4um and a 18um launch have frequent
PIE-D failures so that the probability of failing 5.0dB on both is
approximately 4% (estimate of effect of connectors).

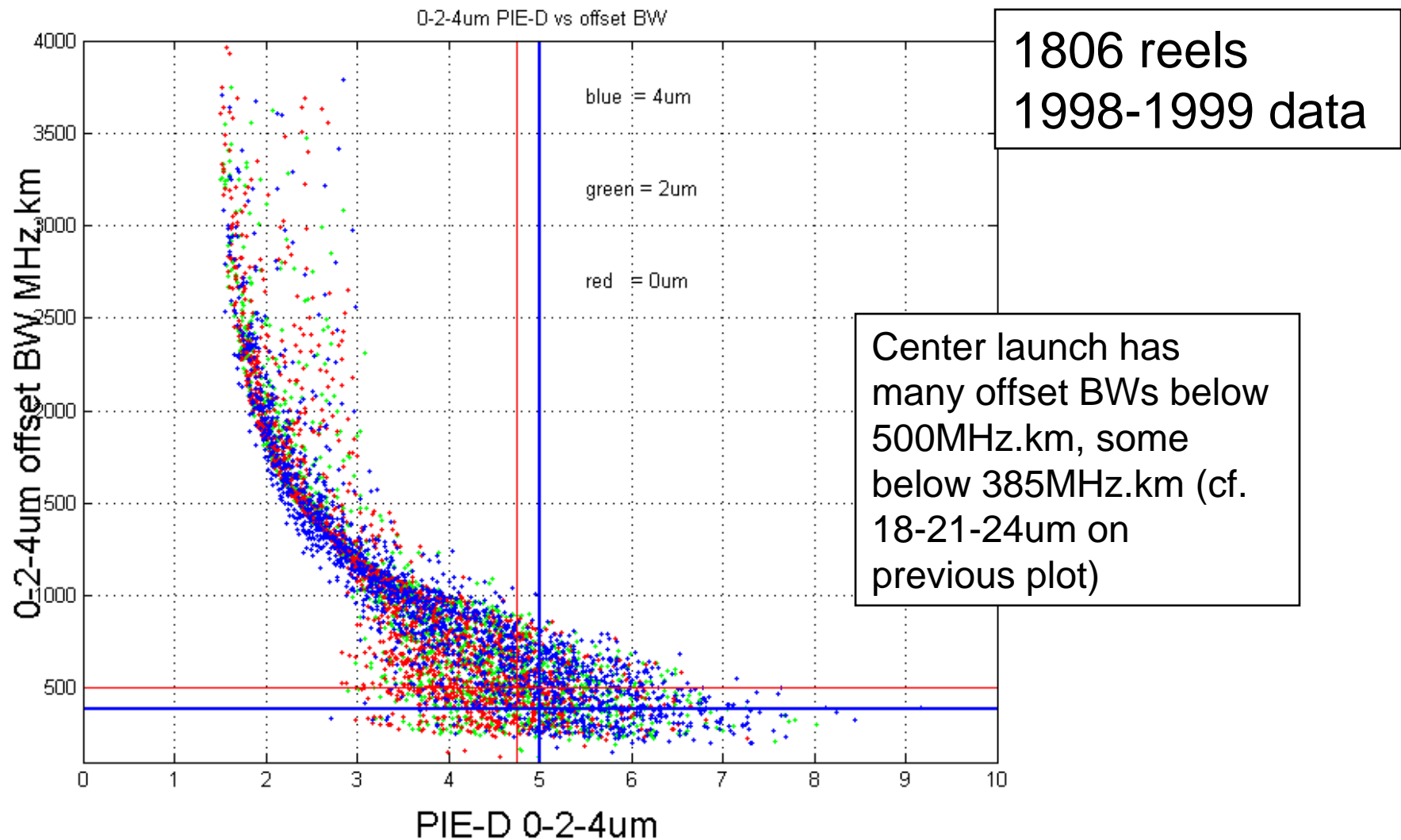
Offset Launch BW vs PIE-D



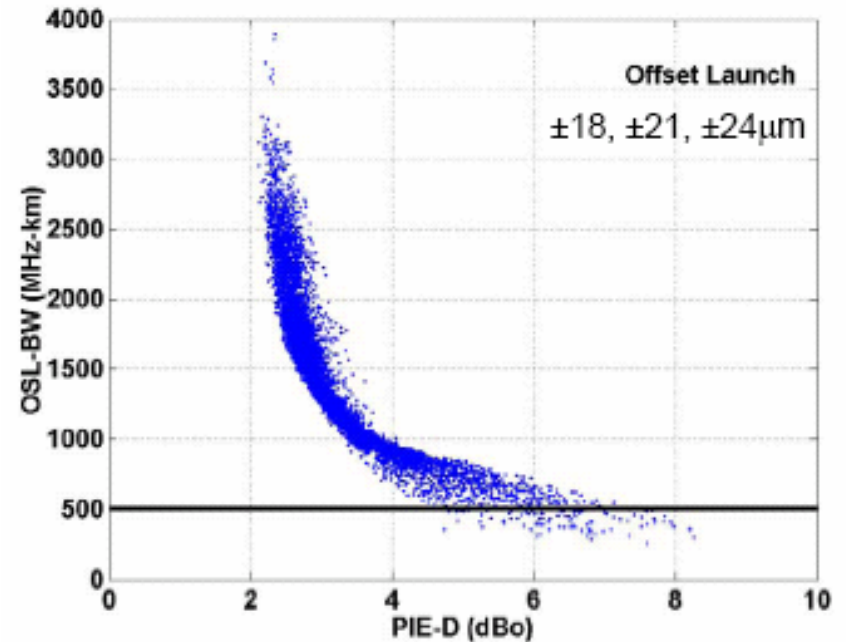
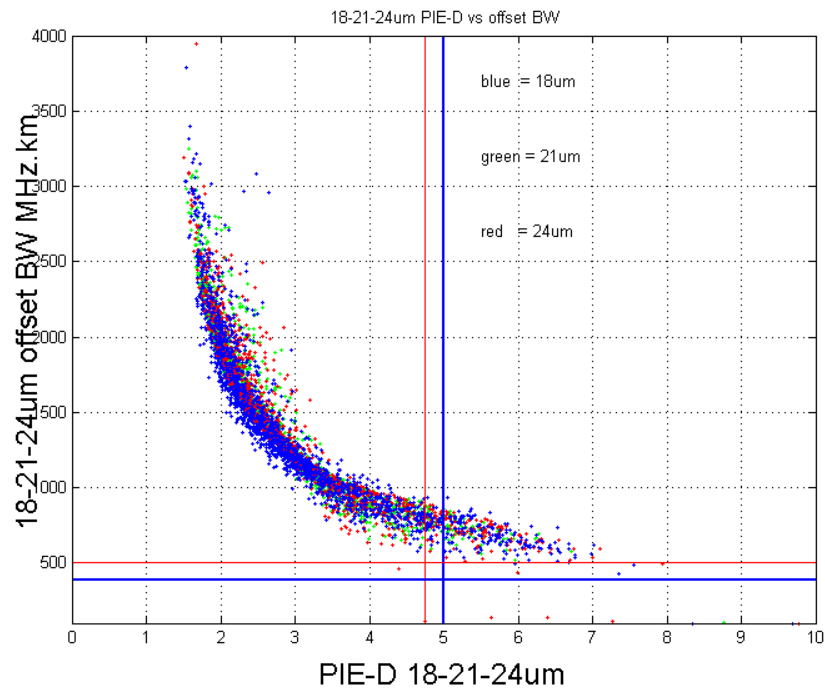
1806 reels
1998-1999 data

Almost all offset BWs
are above 500MHz.km
– all above
385MHz.km...

Center Launch BW vs PIE-D



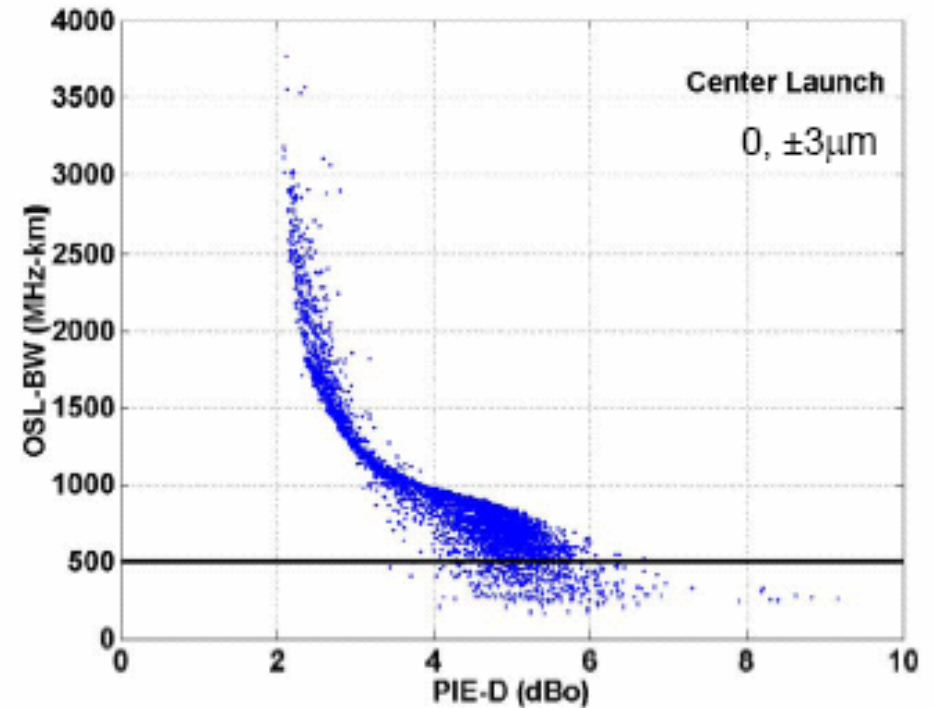
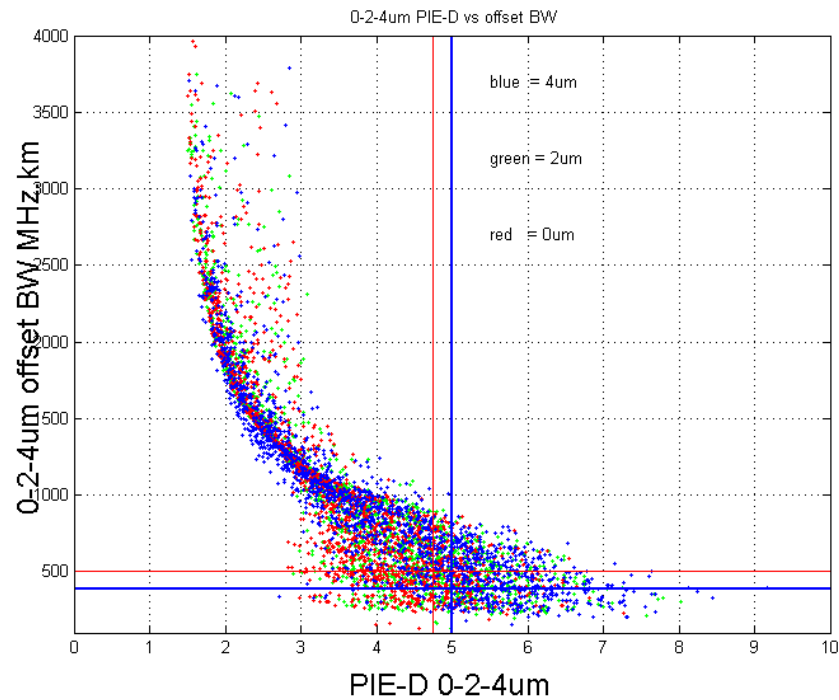
Offset BW vs PIE-D agrees with GT-OFS



Corning 18,21,24um
This presentation
1806 reels
1998-1999 data

OFS -24,-21,-18,+18,+21,+24 um
balemorthy_1_0105.pdf 9/19
1423 reels
1998 data

Center BW vs PIE-D agrees with GT-OFS



Corning 0-2-4um

This presentation
1806 reels
1998-1999 data

OFS -3, 0, +3 um

balemorthy_1_0105.pdf 9/19
1423 reels
1998 data

PIE-D Coverage Curves

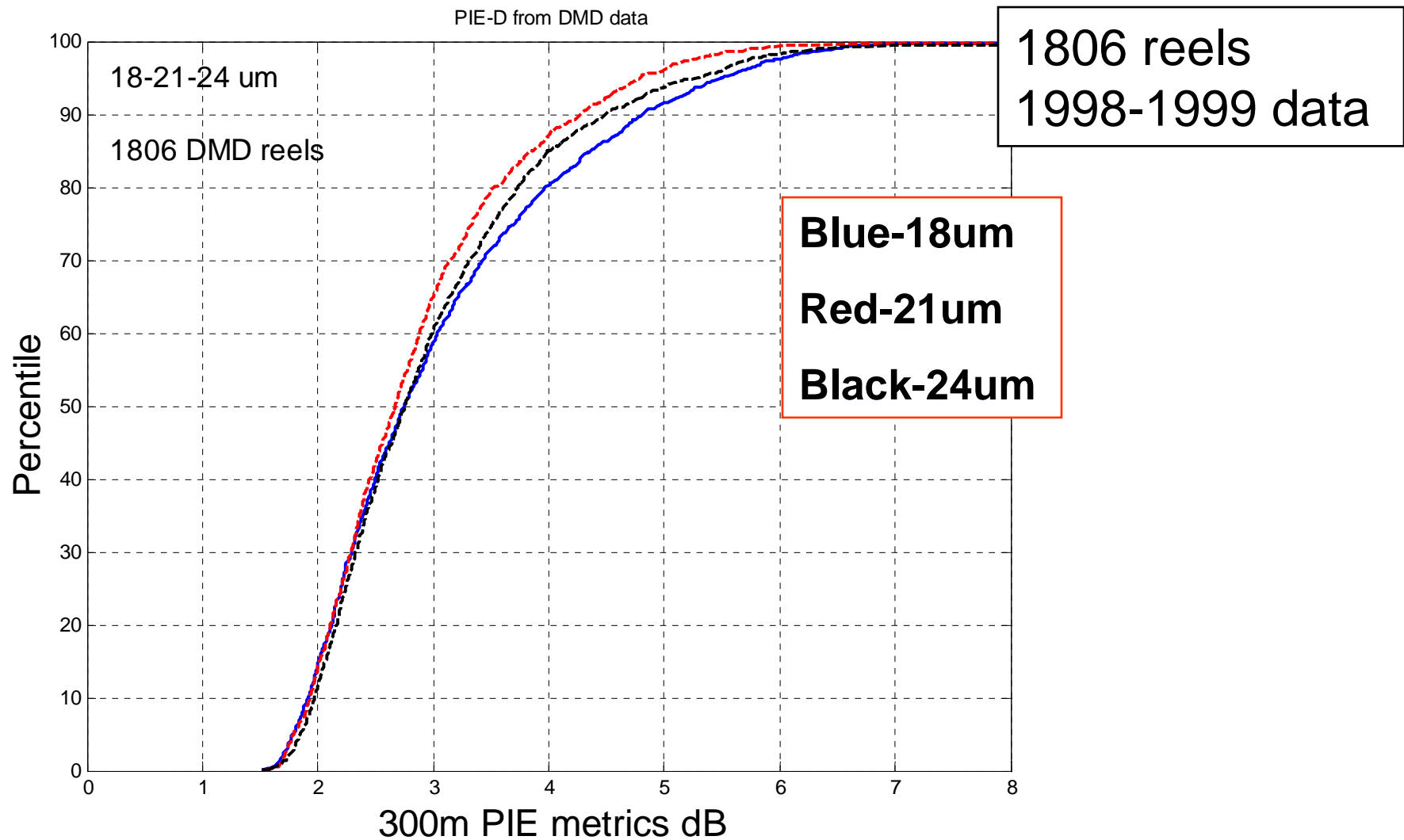
Coverage plots for joint distribution also look similar to [balemarthy_1_0105.pdf](#)

99%tile for dual launch 0-2-4 and 18-21-24 is 5.1dB

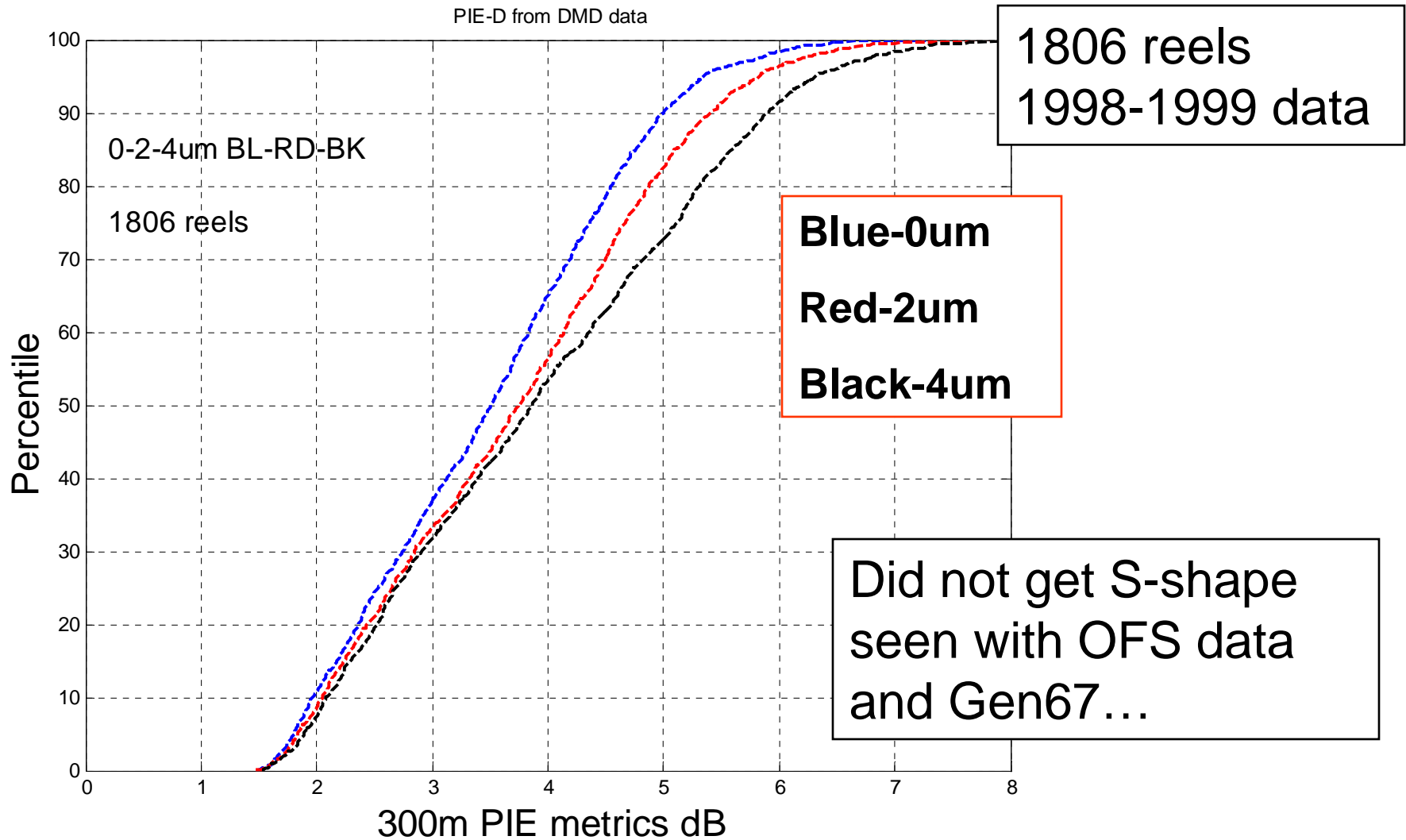
99%tile for dual launch 4um and 18um is 5.7dB (closer to expectations with connectors); 5dB corresponds to 96%.

Recalling that this distribution is an optimistic estimate of the total installed base, 802.3aq should budget at least 5.1-5.7dB for PIE-D penalty.

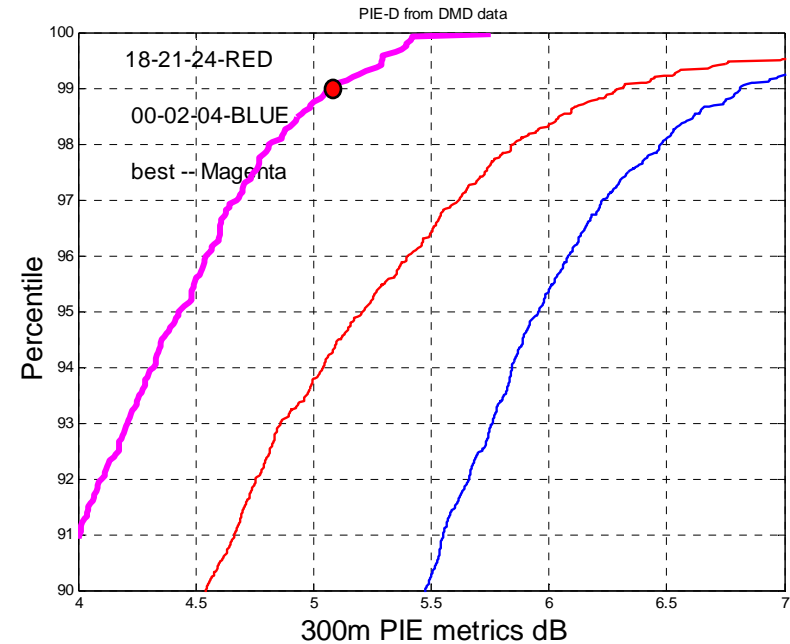
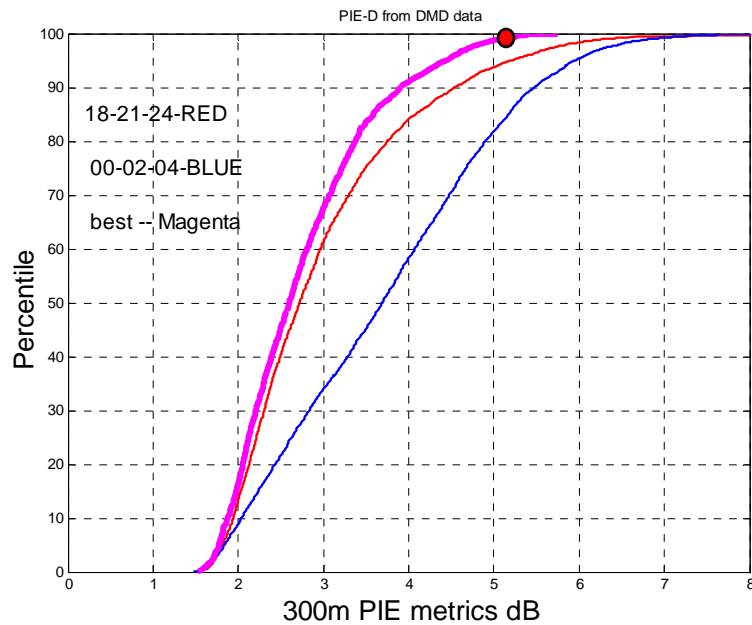
PIE-D Coverage Curves



PIE-D Coverage Curves



PIE-D Coverage Curves--combined



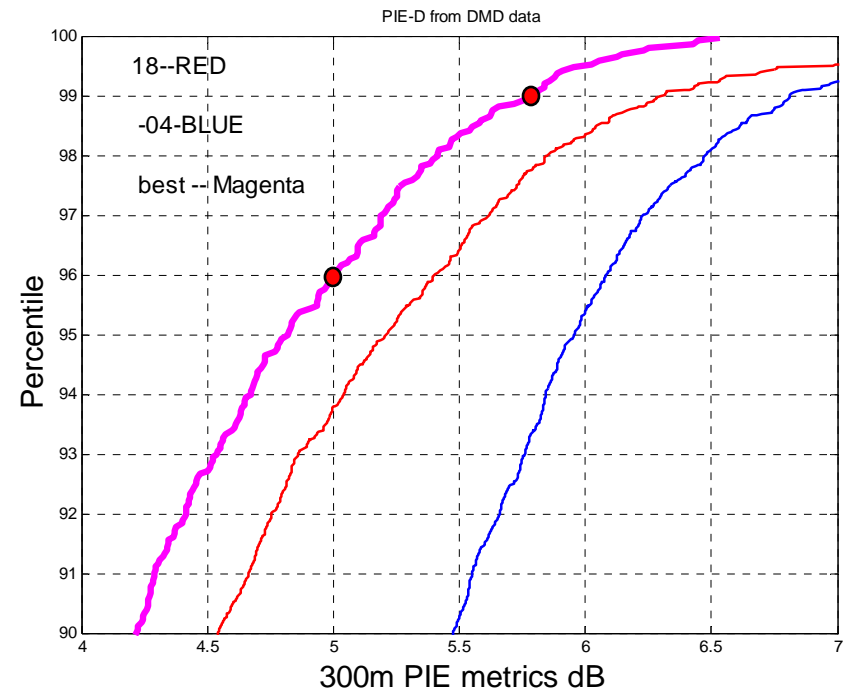
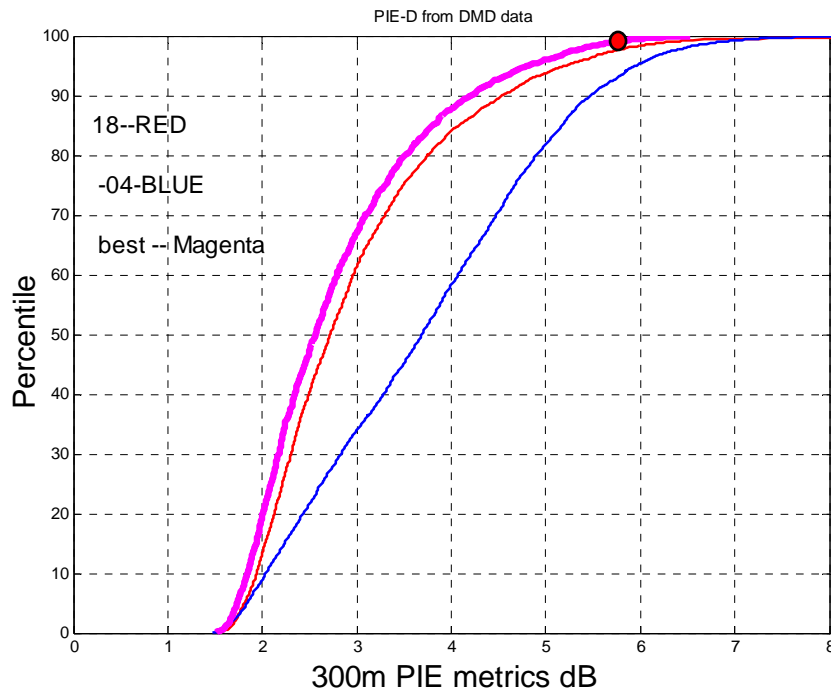
Method:

- (a) $PIE_outer = (P18+P21+P24)/3$
- (b) $PIE_inner = (P00+2*P02+2*P04)/5$
- (c) $PIE_best = \min(PIE_out, PIE_in)$

All 1806 reels have OFLBW>500MHz.km

99%tile dual launch = 5.1dB

PIE-D Coverage Curves—4um-18um only



ONLY 4um & 18um offsets
Dual PIE-D at 99% = 5.7dB
Dual PIE-D at 5.0dB = 96%
(approximates connectors)

Additional Slides.

18um offset BW vs. 18um PIE-D

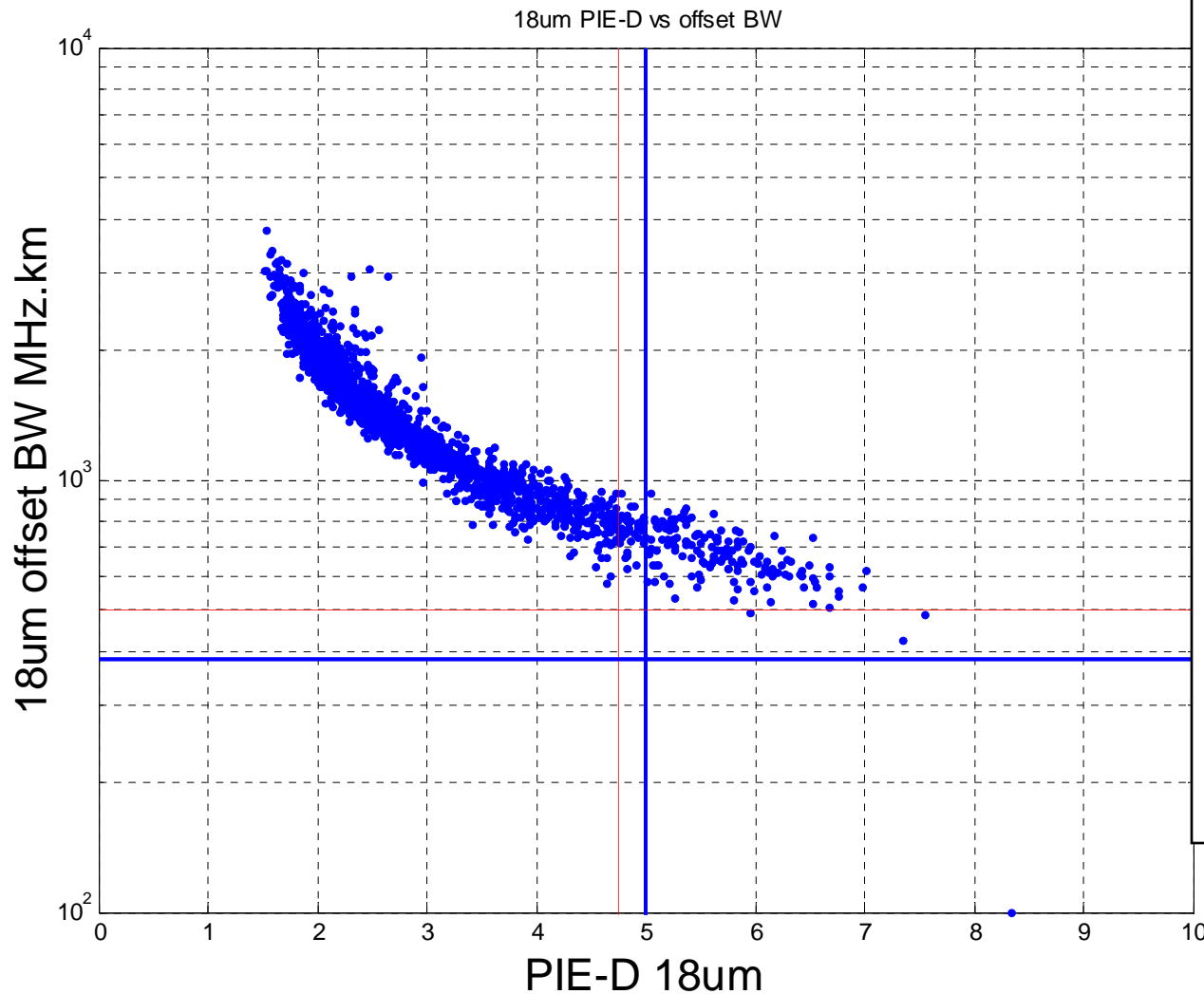
4um offset BW vs. 4um PIE-D

1300nm OFL BW vs. 18um PIE-D

1300nm OFL BW vs. 4um PIE-D

4um PIE-D vs. 18um PIE-D

18um offset BW vs 18um PIE-D



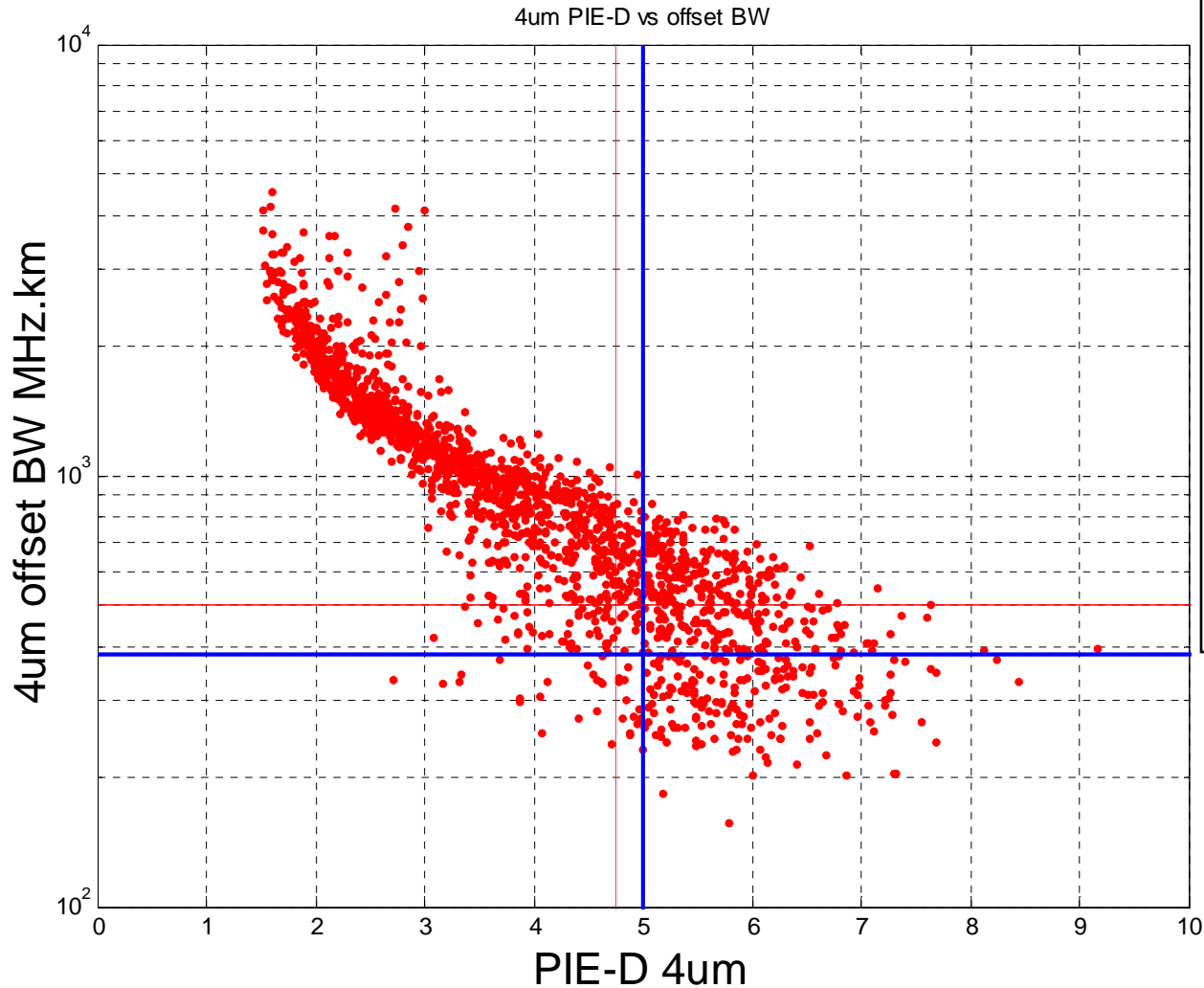
1806 reels
1998-1999 data

**1GbE requires
offset BW
>385MHz.km**

**NOTE NO 1GbE
FAILURES**

**Note that the OFS
analysis includes
18,21,24um
offsets,**

4um offset BW vs 4um PIE-D

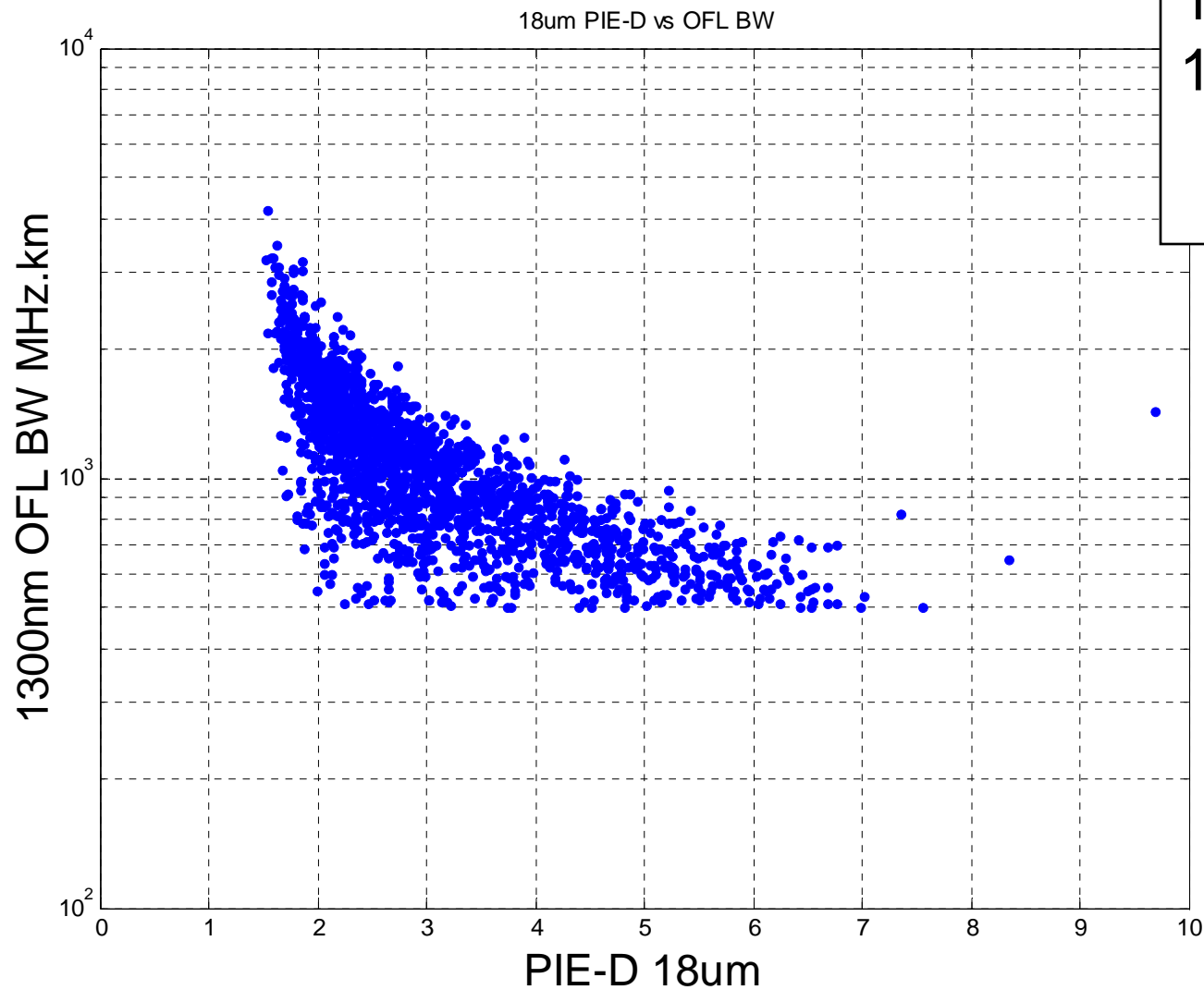


1806 reels
1998-1999 data

**1GbE requires
offset BW
>385MHz.km**

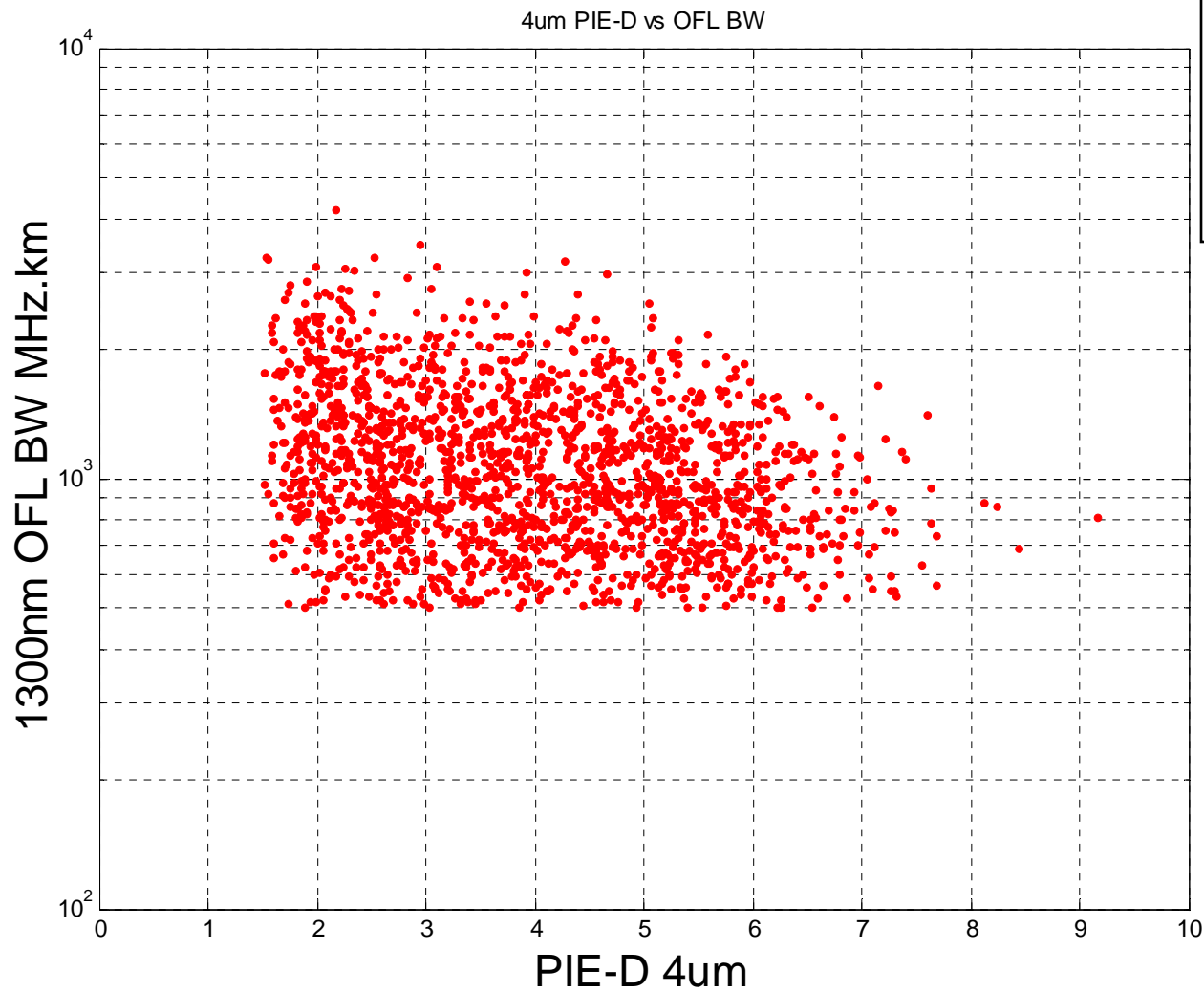
**Note that the OFS
analysis uses
0,3um offsets at
the center.**

PIE-D 18um vs 1300nm OFL BW



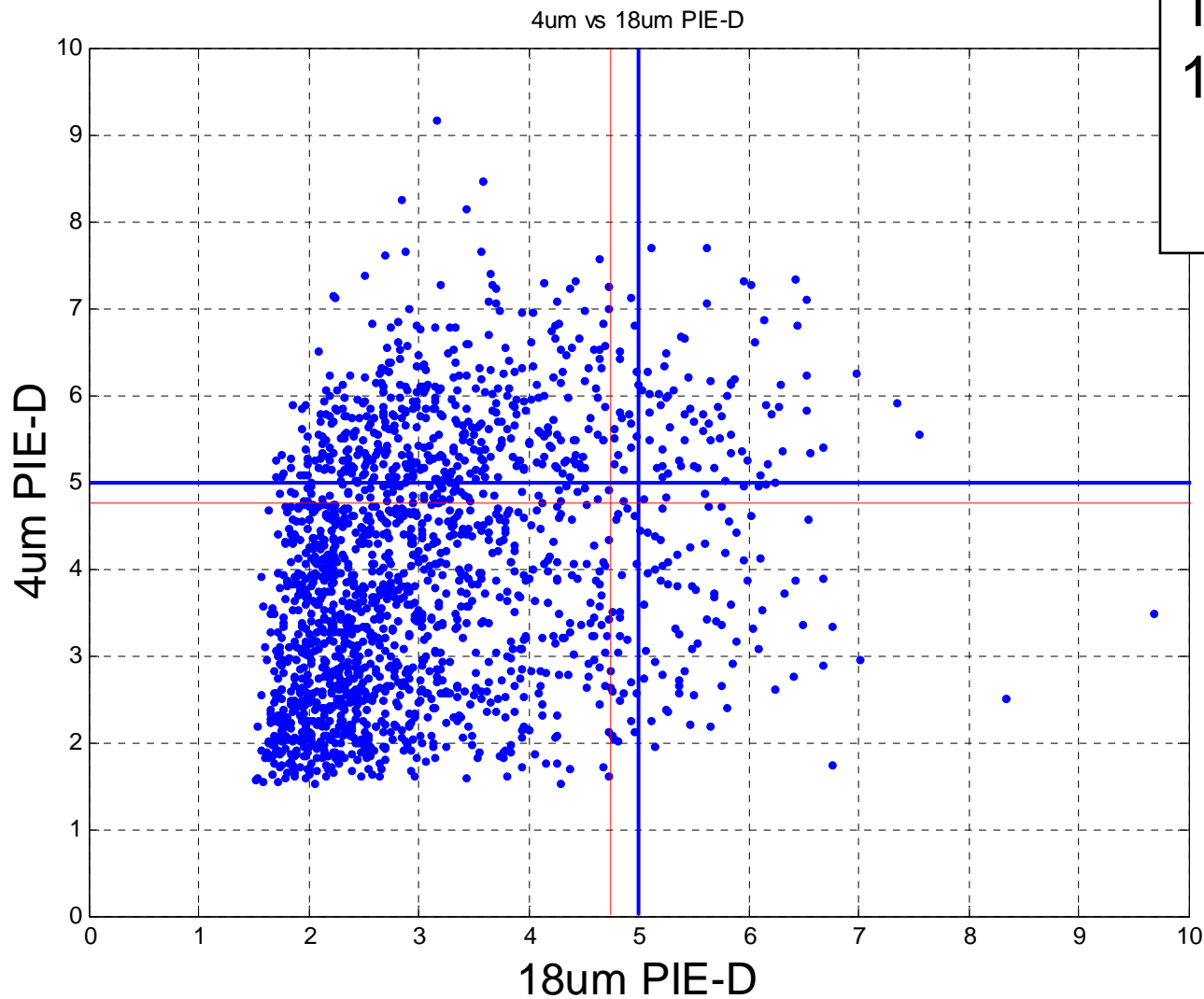
1806 reels
1998-1999 data

PIE-D 4um vs 1300nm OFL BW



1806 reels
1998-1999 data

PIE-D 4um vs PIE-D 18um



1806 reels
1998-1999 data