LRM OM2 Monte Carlo modeling set. Comparison of "Step3" & "Step2" data sets

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Discussion for

IEEE P802.3aq 10GBASE-LRM Task Force & T11.2 optical

Based on presentation abbott_1_0705

at IEEE San Francisco meeting   July 18-21, 2005

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Summary

At the 7/2005 LRM meeting in San Francisco an OM2 model data set was presented. 5000 mode delay sets suitable for OM2 were 'shifted' from the MC67YY data set and the modes calculated at both 850nm & 1300nm. This data set was called "Step 2" and it was expanded to 30,000 sets in "Step 3". 5000 'fibers' from the Step 3 set were select to best-fit historical OFL BW data and this was the 850&13000 mode delay sets recommended to 802.3aq LRM(1300) & T11.2(850)

As an alternative we took the Step 2 data, and fit it to 5000 random fibers chosen from the the historical data, and compared to Step3. Step 2 and Step 3 agree in the 1300nm OFL BW distribution and 16um offset BW distribution, but the Step 2 distribution has smaller perturbations near the center. Its 4um-5um BW distribution is similar to that of MC67YY.

We suggest using the Step 2 data as an alternative, 'upper bound' to the Step 3 in initial LRM & T11.2 modeling, but feel that a modified Step 3 process is probably the best approach.

2   IEEE 802.3aq   **CORNING**
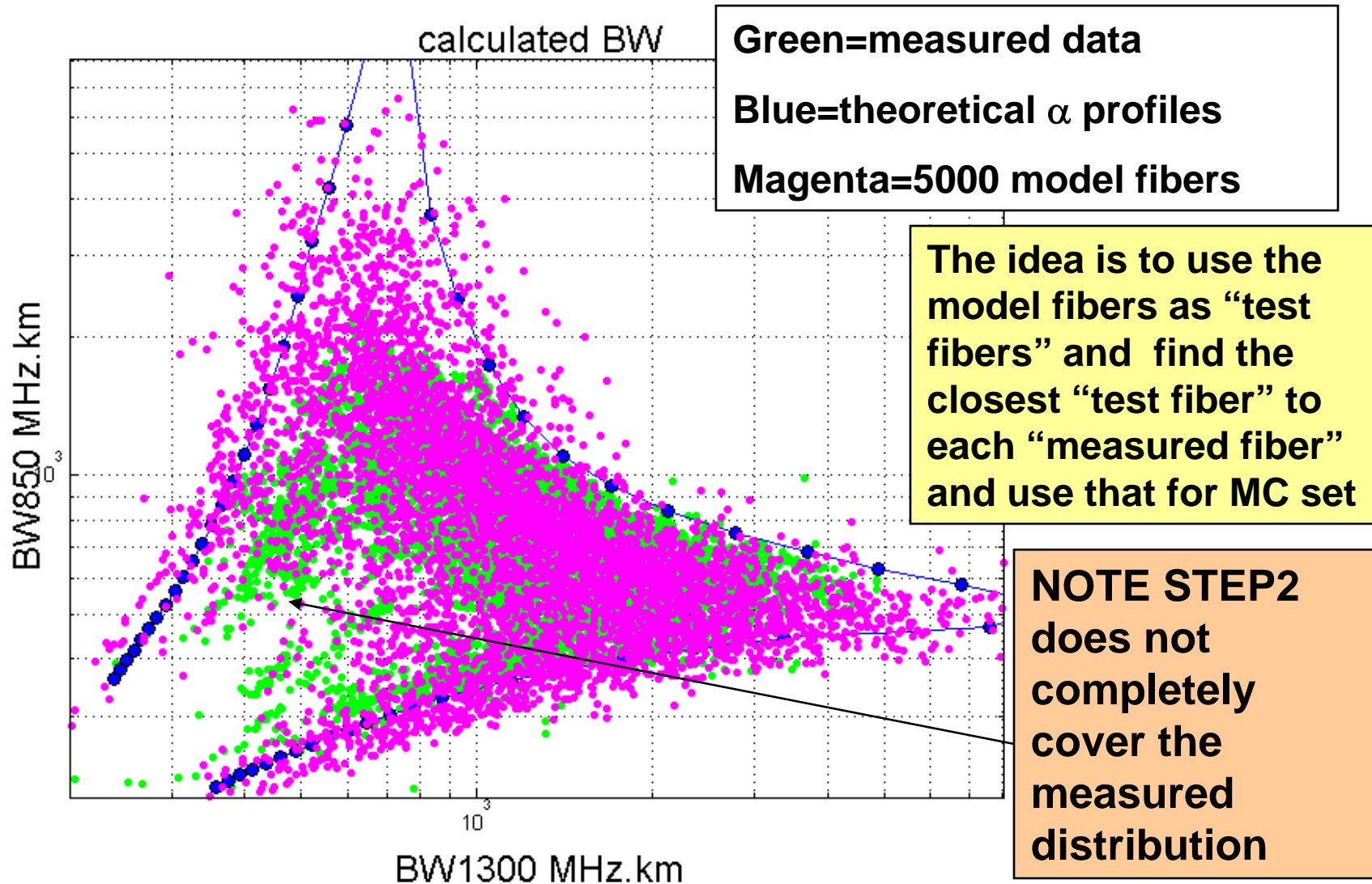
Step 1: reference data

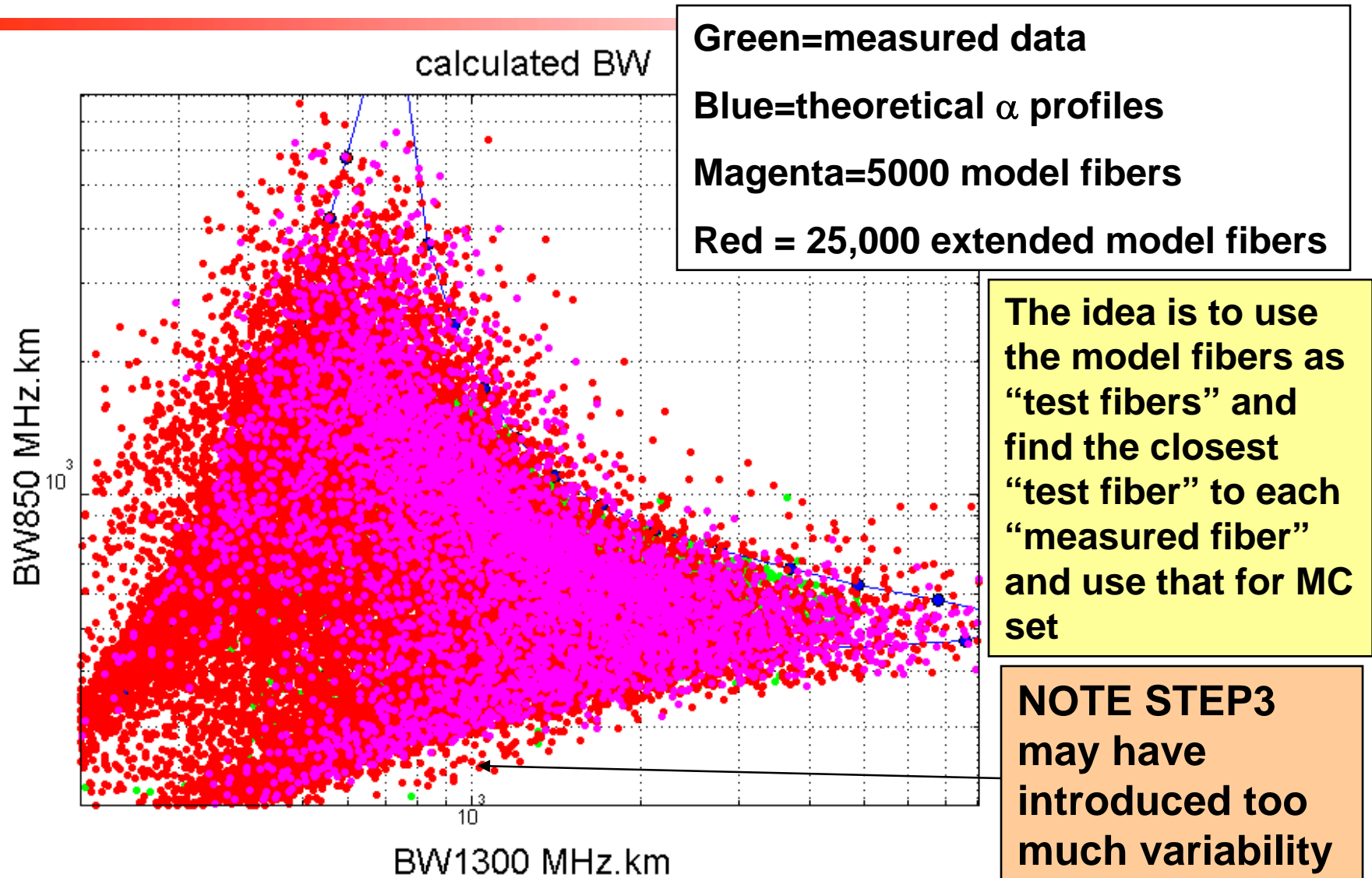**Idea is to force Monte Carlo mode delays to be consistent to measured BWs.**
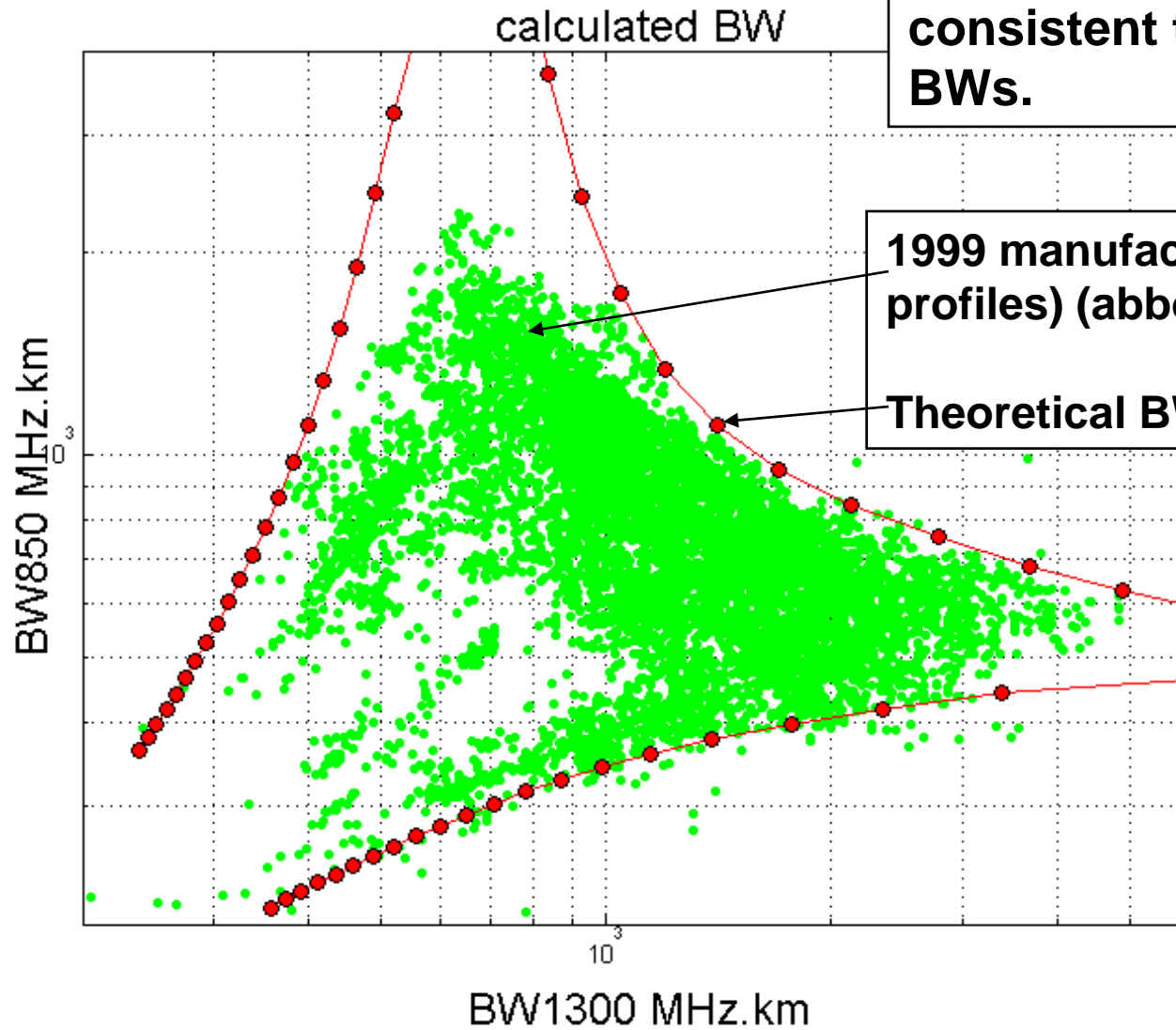
1999 manufacturing data (9000 profiles) (abbott_1_0105.pdf)

Theoretical BWs for α-profiles

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Step2: all 5000 model fibers (abbott_1_0705.pdf)

calculated BW

BW850 MHz.km

BW1300 MHz.km

Green=measured data

Blue=theoretical α profiles

Magenta=5000 model fibers

The idea is to use the model fibers as "test fibers" and find the closest "test fiber" to each "measured fiber" and use that for MC set

NOTE STEP2 does not completely cover the measured distribution

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Step3: 30000 fibers (abbott_1_0705.pdf)

Green=measured data

Blue=theoretical α profiles

Magenta=5000 model fibers

Red = 25,000 extended model fibers

The idea is to use the model fibers as "test fibers" and find the closest "test fiber" to each "measured fiber" and use that for MC set

NOTE STEP3 may have introduced too much variability
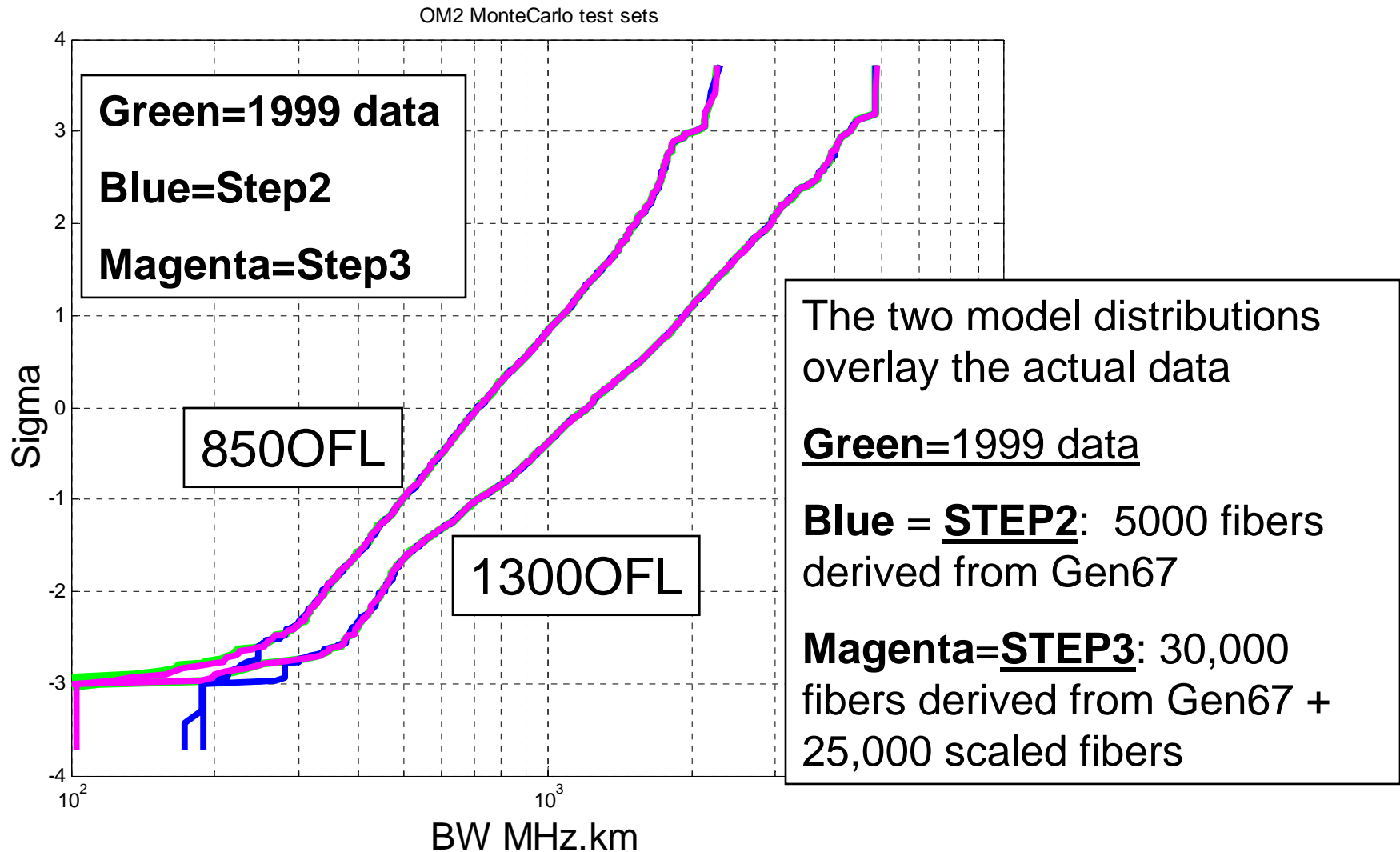
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NOTES

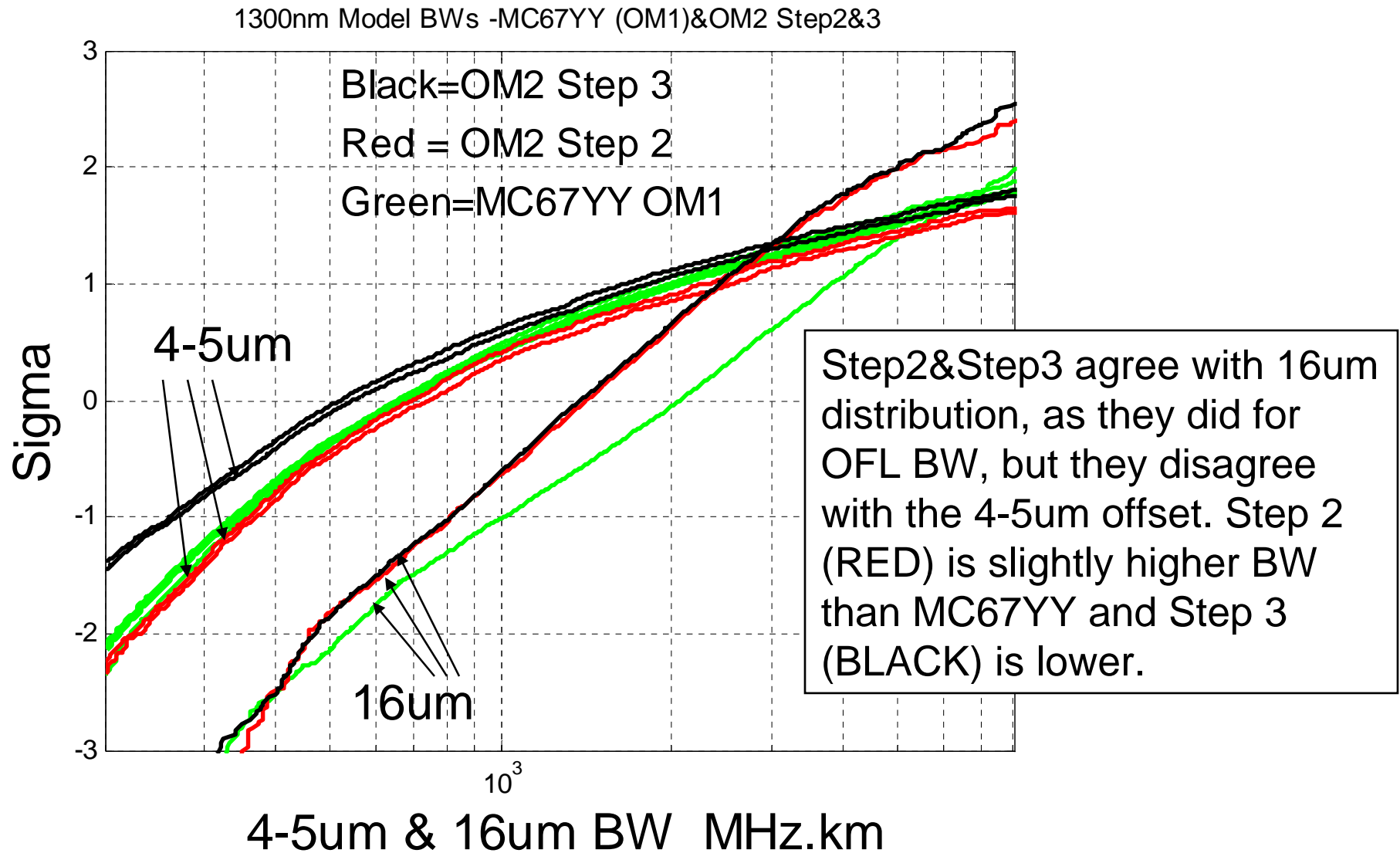OM1 1300: 20+ groups, use 19   (file has 19 groups)

OM2 850:   18-19 groups, use 17 (file has 18 groups)

OM2 1300: 12-13 groups, use 10 (file has 12 groups)

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Cumulative Probability Plots – OFL BW

OM2 MonteCarlo test sets

Green=1999 data

Blue=Step2

Magenta=Step3

850OFL

1300OFL

Sigma

BW MHz.km

The two model distributions overlay the actual data

Green=1999 data

Blue = **STEP2**: 5000 fibers derived from Gen67

Magenta=**STEP3**: 30,000 fibers derived from Gen67 + 25,000 scaled fibers

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Cumulative Probability Plots – offset BW

1300nm Model BWs -MC67YY (OM1)&OM2 Step2&3

Black=OM2 Step 3
Red = OM2 Step 2
Green=MC67YY OM1

4-5um

16um

Sigma

4-5um & 16um BW MHz.km

Step2&Step3 agree with 16um distribution, as they did for OFL BW, but they disagree with the 4-5um offset. Step 2 (RED) is slightly higher BW than MC67YY and Step 3 (BLACK) is lower.

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Cumulative Probability Plots – offset BW cont.

1300nm Model BWs -MC67YY (OM1)&OM2 Step2&3

Black=OM2 Step 3
Red = OM2 Step 2
Green=MC67YY OM1

4-5um

Sigma

10um

4-5um & 10um BW MHz.km

Comparing to previous slide, Step2 and Step3 agreed at 16um offset but not at 10um offset. At 10umStep2(RED) is definitely a higher BW than Step3(BLACK), but both are lower than the corresponding offset with MC67YY-OM1(GREEN).

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Suggestions

1. Use Step2 distribution for test-modeling

2. Modify Step3 distribution: rather than using a multiplier in tau from 1.2 to 2.0 (1.2,1.4,1.6,1.8,2.0), use (1.04,1.08,1.12,1.16,1.20) for Step 3b. Check coverage plot and 1300nm offset results.

3. Generate a Step2 type distribution by re-generating the underlying OM1 distribution with a set of 10,000-40,000 data points, rather than using an augmentation procedure between steps 2 & 3. This ensures that the distribution of perturbations is consistent between the OM1 & OM2 data sets.

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BACKUP

BACKUP1

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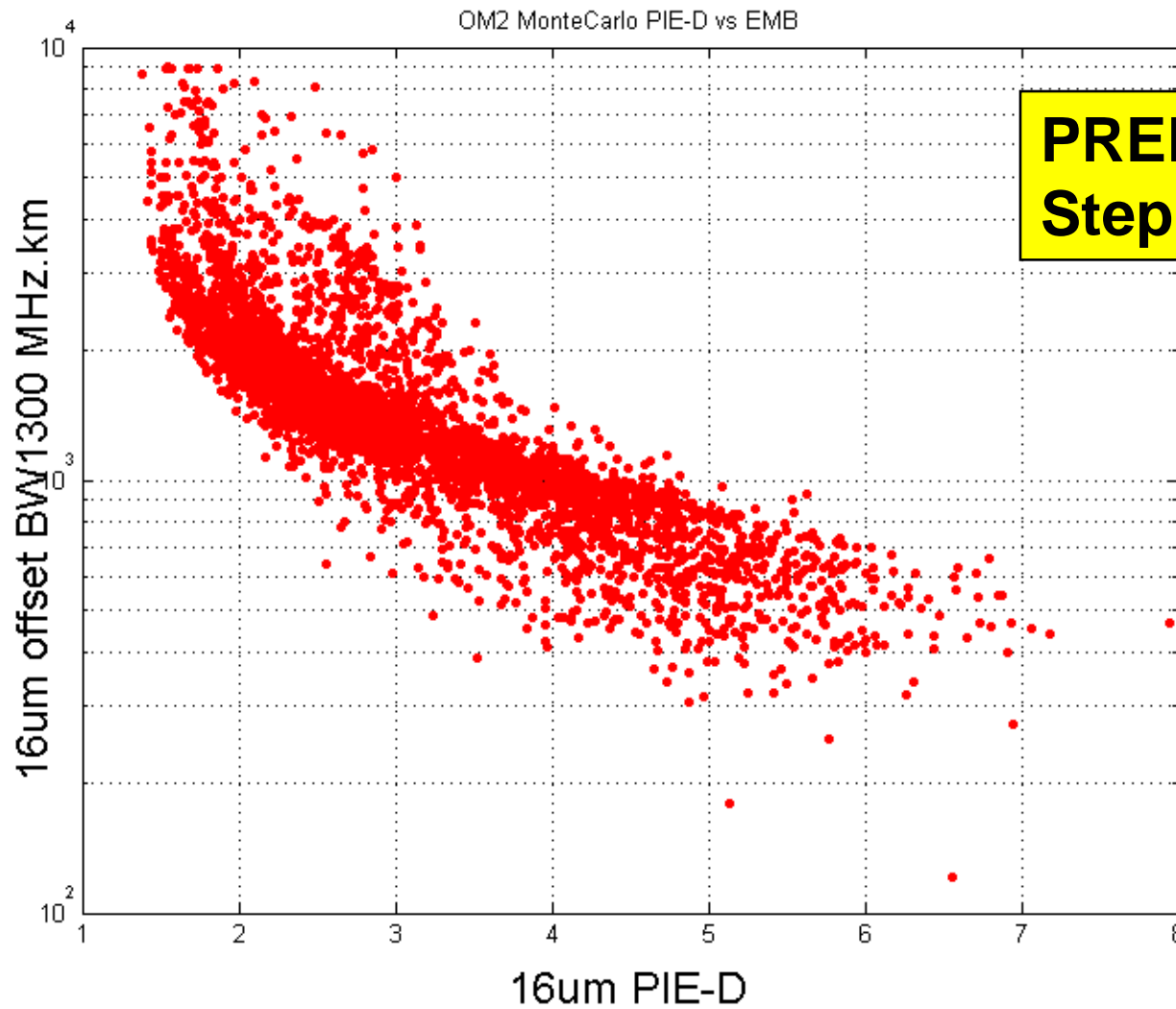
PIE-D Coverage Plots: **PRELIMINARY**
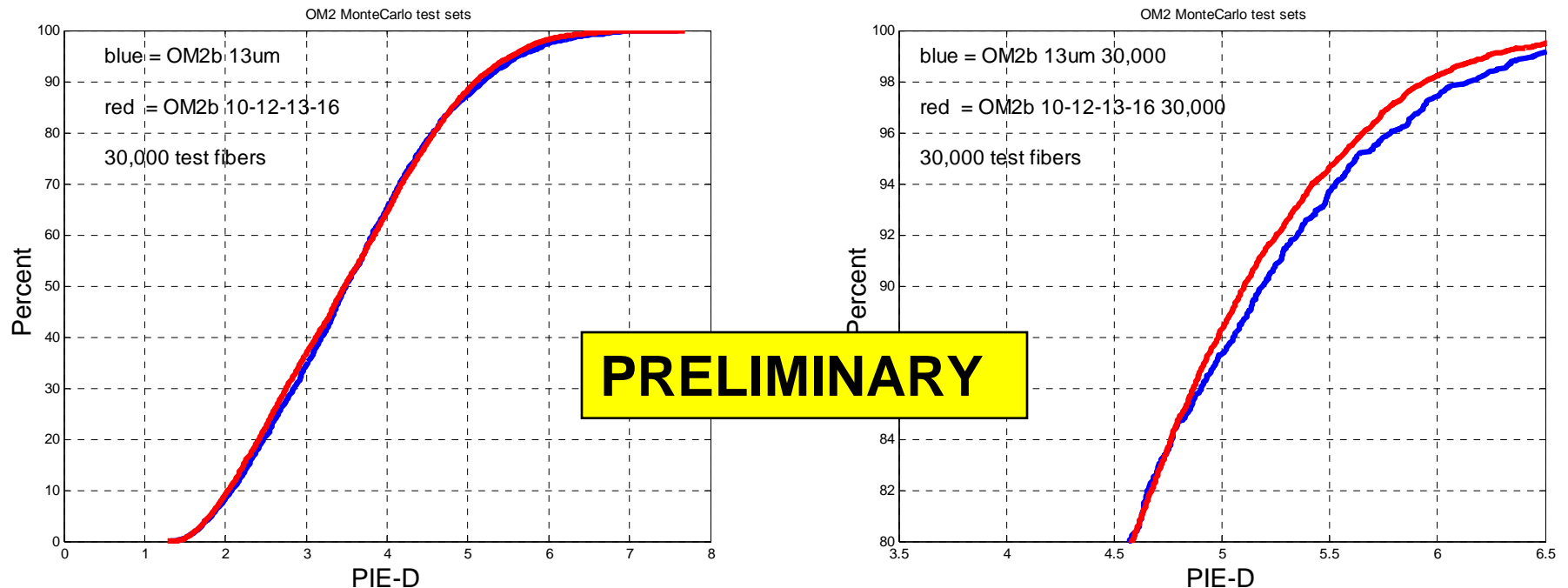
Offset PIE-Ds (no connector). 30000 test fibers, 9000 data fibers
5000MC fibers with 4032 meeting OFLBW850&OFLBW1300>500MHz.km

Red = pooling 10+12+13+16um offsets

Blue = 13um offset

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Scatter plot PIE-D vs 16um BW (OM2 MC model)

PRELIMINARY: Step 3

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Scatter plot PIE-D vs 13um BW (OM2 MC model)

OM2 MonteCarlo PIE-D vs EMB

PRELIMINARY: Step 3

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