LRM OM2 Monte Carlo modeling set 50um Beta 2.2 set for review/discussion.

John Abbott Corning Incorporated

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Summary

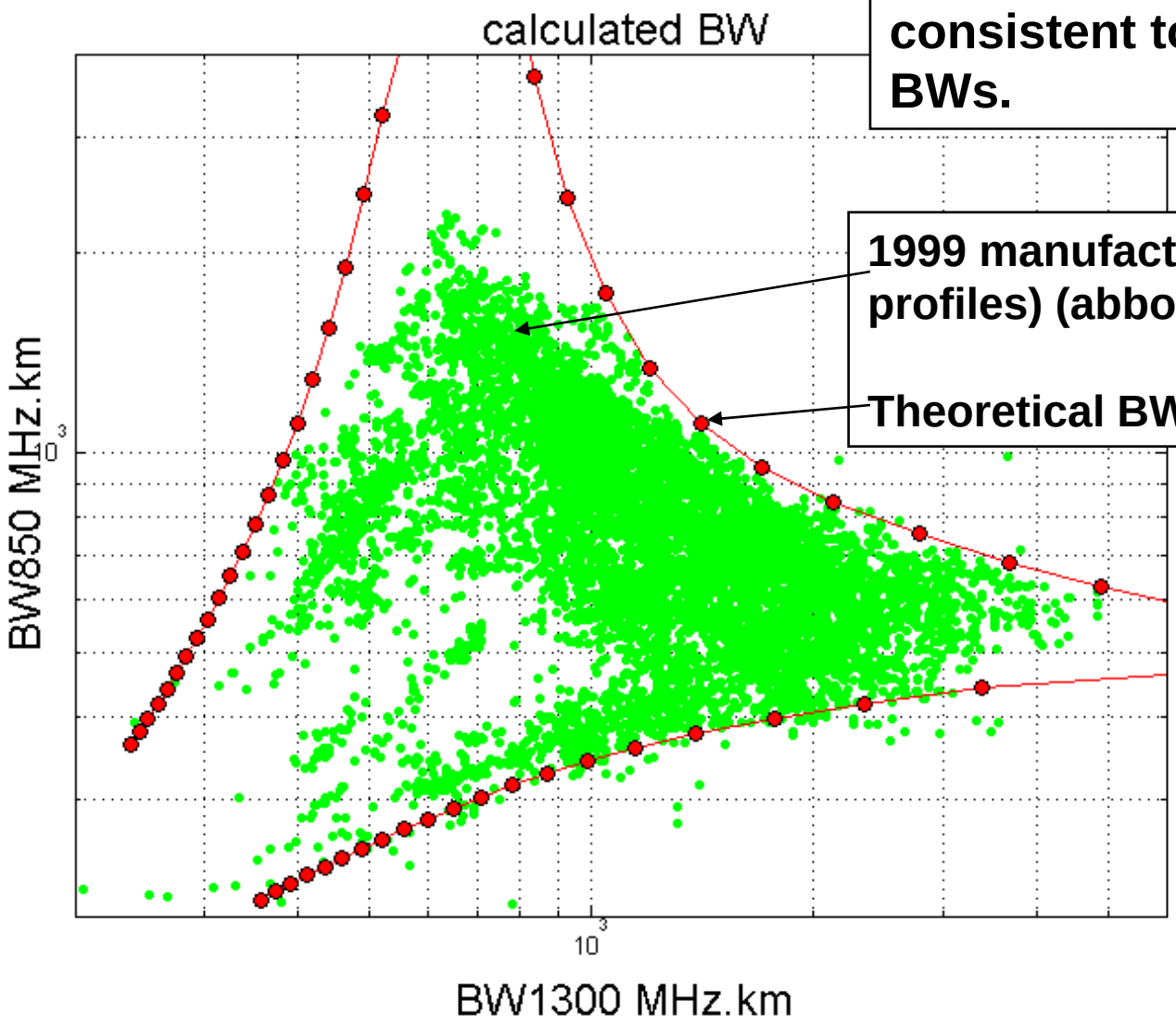
An OM2 Monte Carlo set is generated by creating mode delay files whose 850nm & 1300nm OFL BWs exactly match measured OFL BWs in a reference set from 1999. The resulting data set has the correct 850nm/1300nm statistics which is important because of the 500/500 spec.

A fallout of this work is an 850nm OM2 data set which can be used in Fibre Channel.

The procedure is outlined. BW distributions, PIE-D, and EMB vs. PIE-D are given for offset launches.

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

Step 2.

2.1 take 5000 mode delay sets for Gen67YY (62.5um 1300nm, 19 mode groups).

2.2 take first 18 groups and use for OM2 50um 850nm delays (TIA OM3 uses 17 groups for OFLBW)

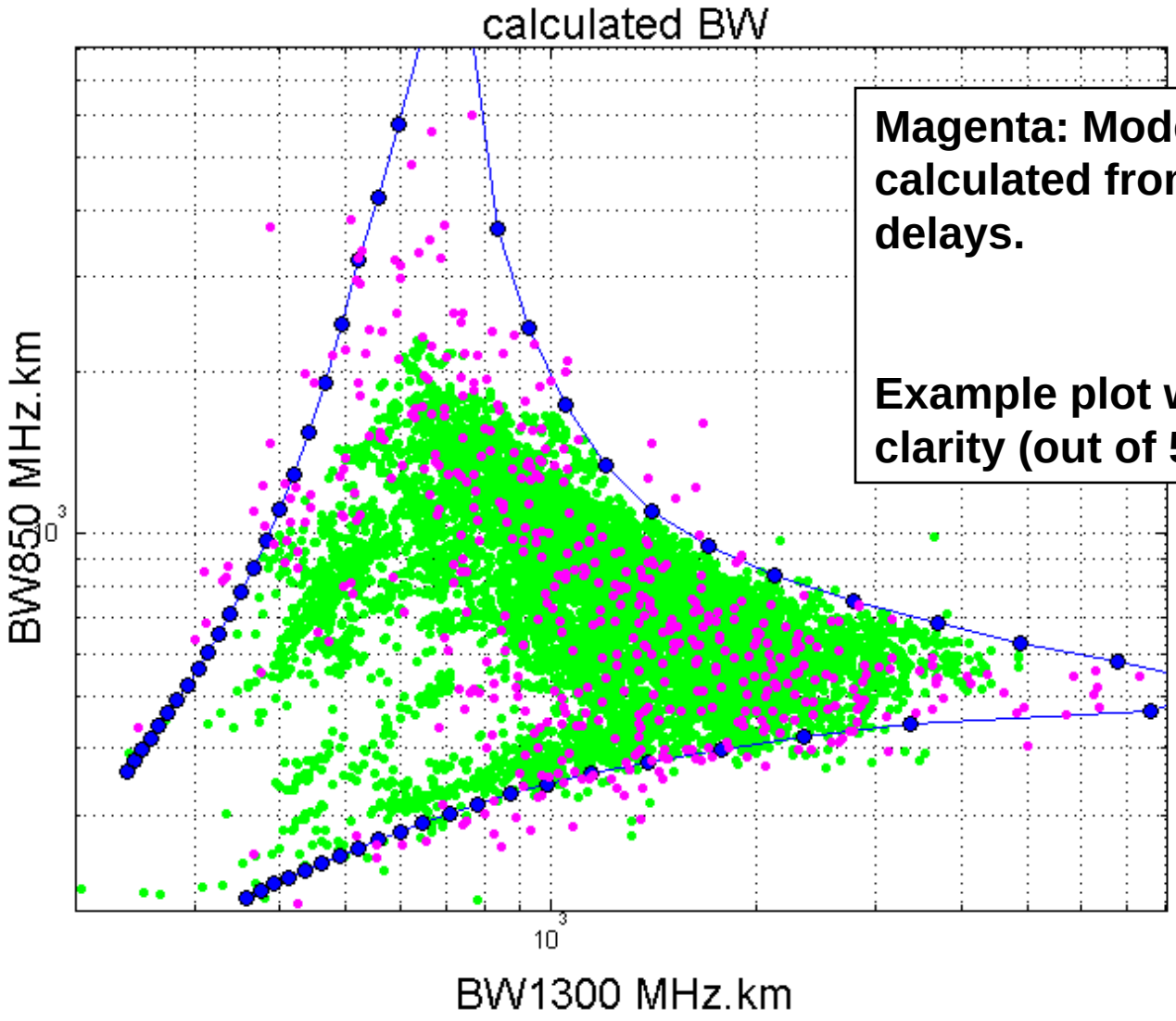
2.3 solve for index error $\delta n(r)$ corresponding to 850nm delays.

2.4 Calculate base index profile n(r) and hence $\delta n(r)$ at 850nm and at 1300nm. Add an "α–error" to shift n(r) to be optimized nearer to 1300nm

2.5 Recalculate taus at 850, 1300 and BWs at 850, 1300.

Plot BWs

Step 2: add BWs from Model Fiber Set



Magenta: Model BWs calculated from Gen67YY mode delays.

Example plot with 500 fibers for clarity (out of 5000)

Step 3. Expand Model Fiber Set

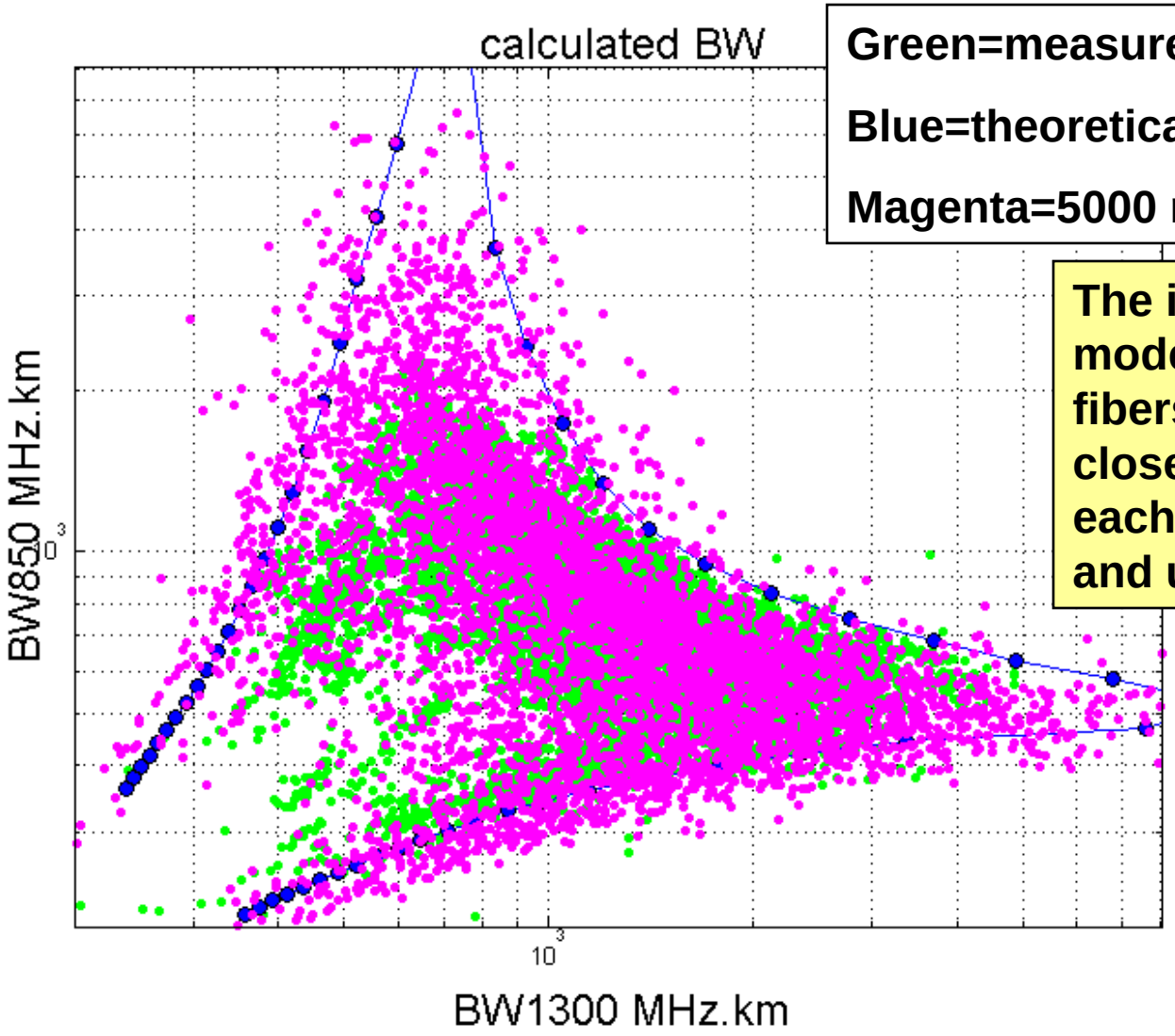
From the 5000 ‘fibers’ generate a larger set of 25,000 ‘fibers’:

3.1 scale the 1300nm mode delays by a factor of 1.2, 1.4, 1.6, 1.8, 2.0x. (5 sets of 5,000)

3.2 Each time re-calculate 1300nm index error dn_1300(r), convert to n(r), re-calculate 850nm index error dn_850(r), and then recalculate 1300nm and 850nm mode delays and OFL BWs.

3.3 Save a total of 30,000 mode delay sets and OFL BW pairs.

Step2: all 5000 model fibers



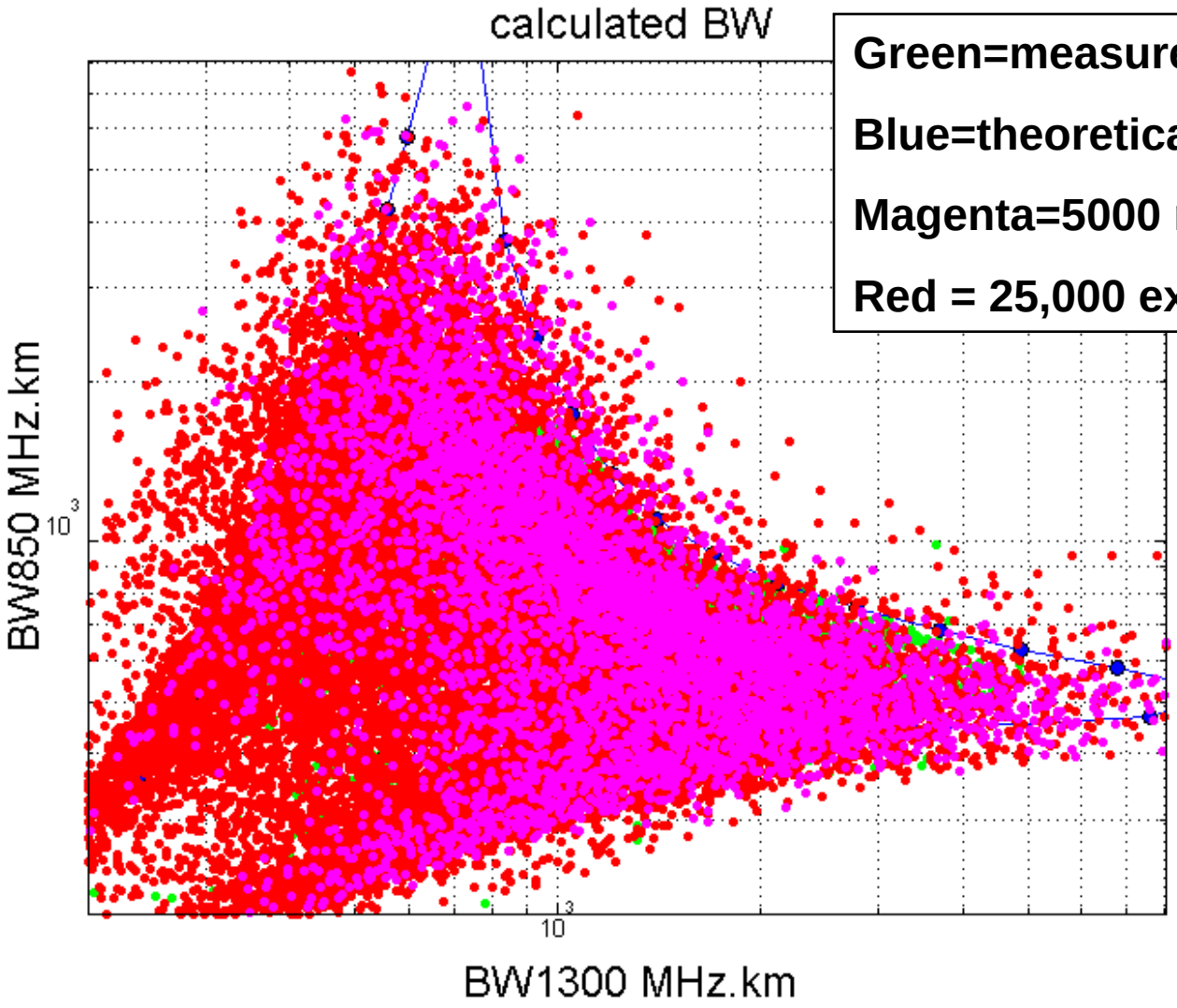
Green=measured data

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

Step3: all 30000 extended model fibers



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

Step 4. Choose MC fibers

4.1 loop through N_meas measured fibers. For each measured fiber, compare to 30,000 test fibers (model fibers). Choose fiber which minimizes

χ **= (OFL850_meas-OFL850_test)^2 + (OFL1300_meas-OFL1300_test)^2**

fiber goes into set of N_meas MC "feedstock".

4.2 Sort N_meas MC "feedstock" into random order and take 1st 5000 as the OM2 MC set. Save mode delays at 850nm and 1300nm, OFL850, OFL1300.

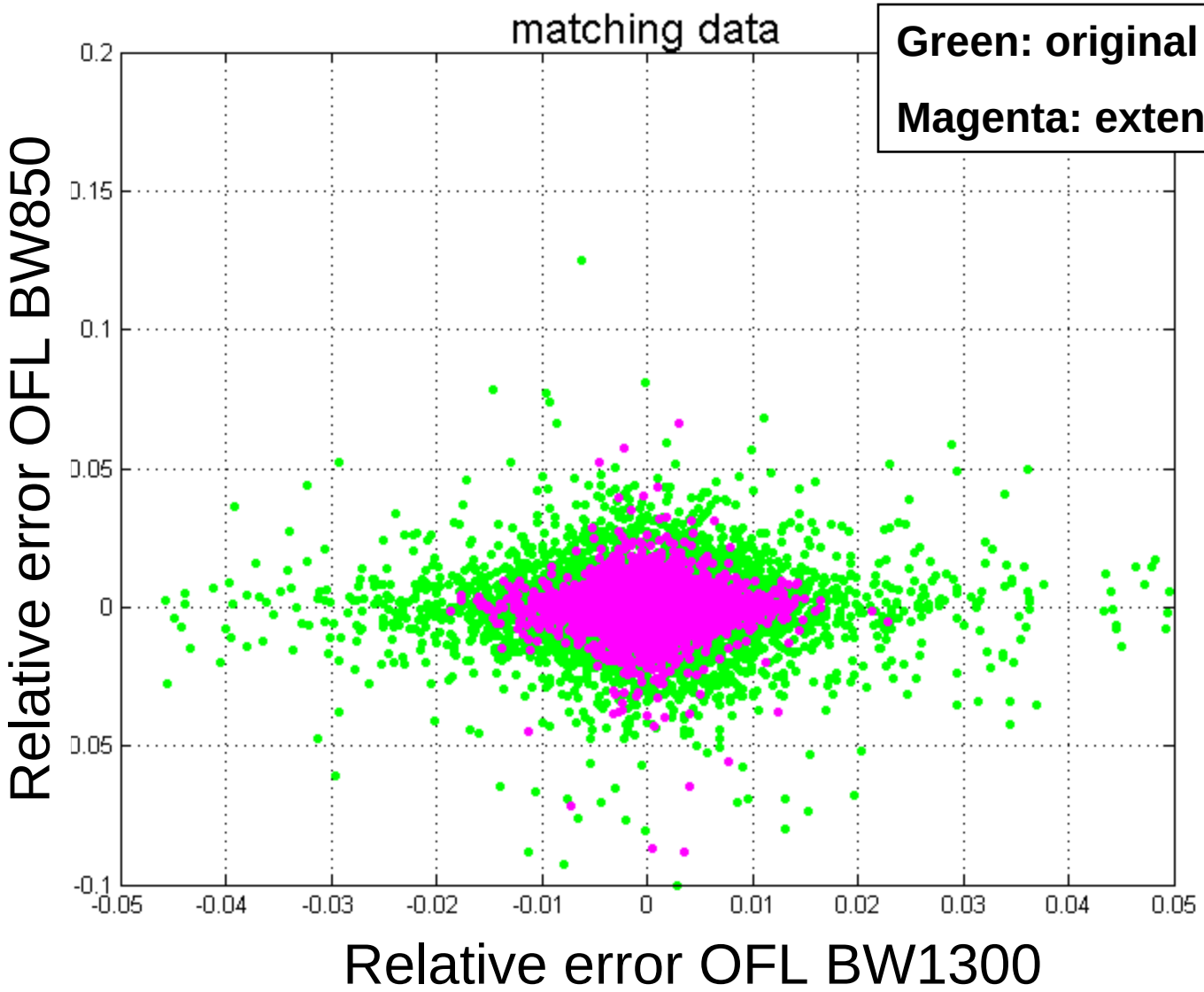
NOTES

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

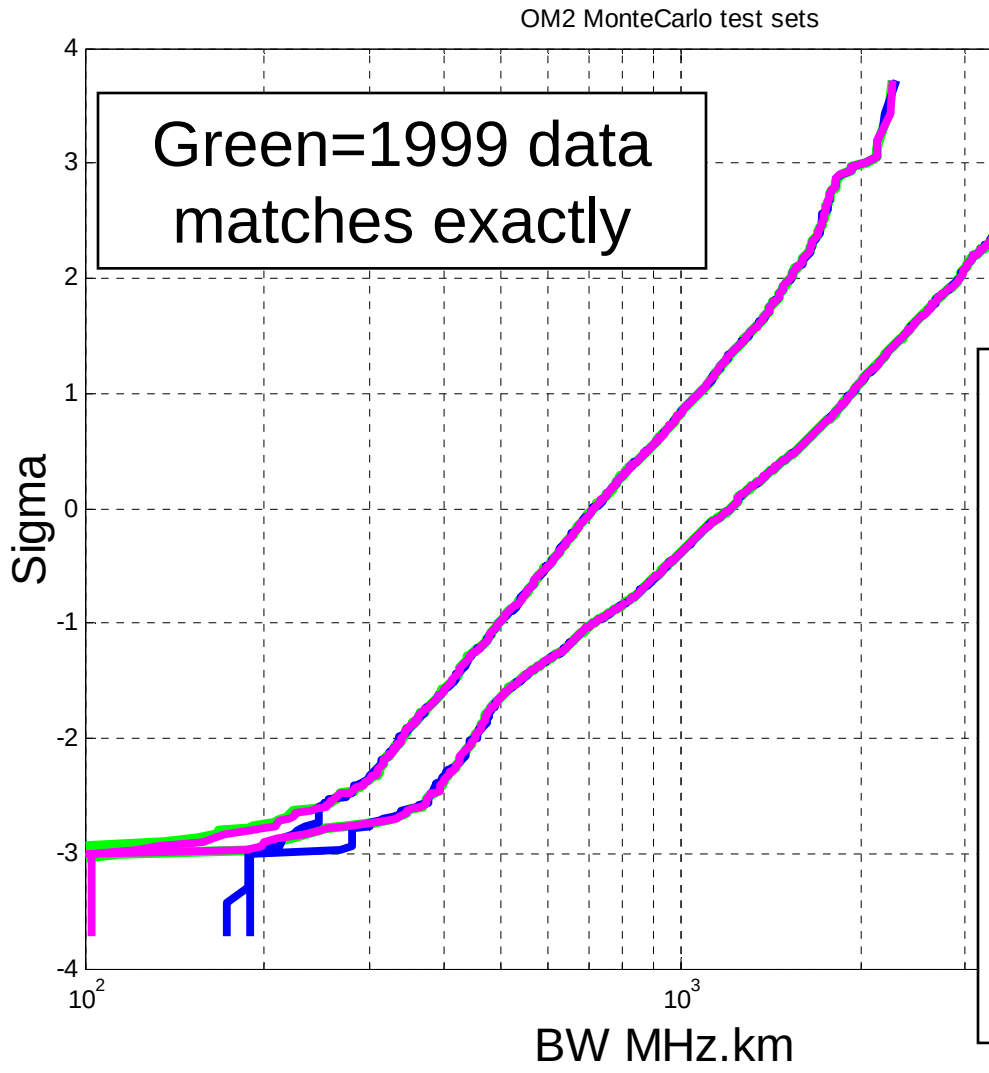
OM2 850: 18-19 groups, use 17 (file has 18 groups)

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

Best-Fit Theoretical BWs compared to data



Cumulative Probability Plots



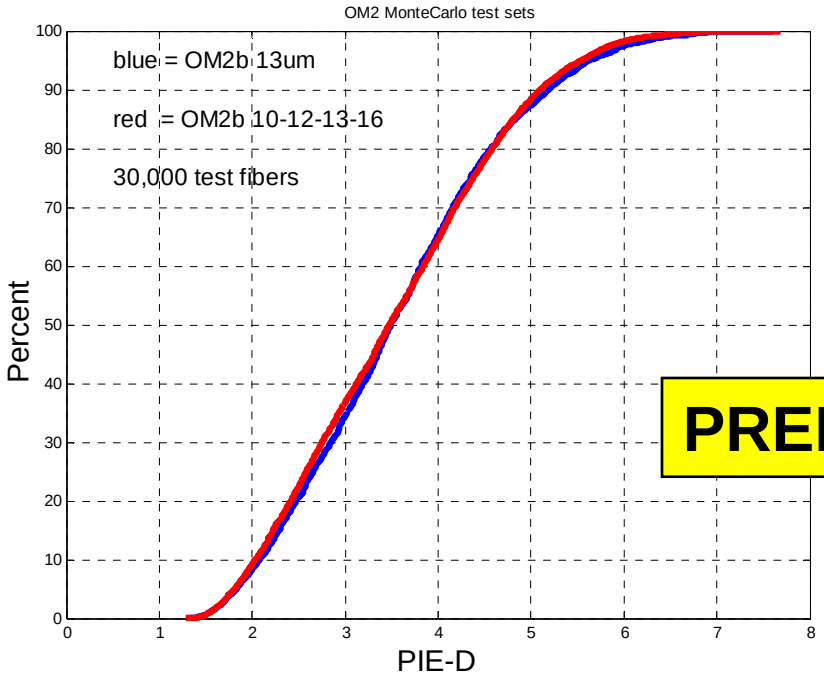
The two model distributions overlay the actual data almost exactly.

Green=1999 data

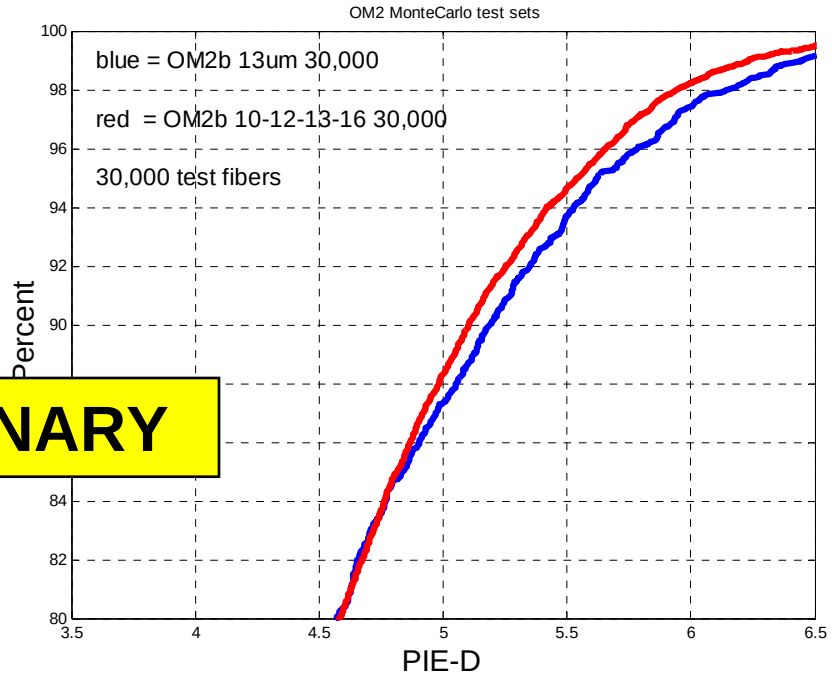
Blue = 5000 fibers derived from Gen67

Magenta=5000 fibers derived from Gen67 + 25,000 scaled fibers

PIE-D Coverage Plots: **PRELIMINARY**



PRELIMINARY

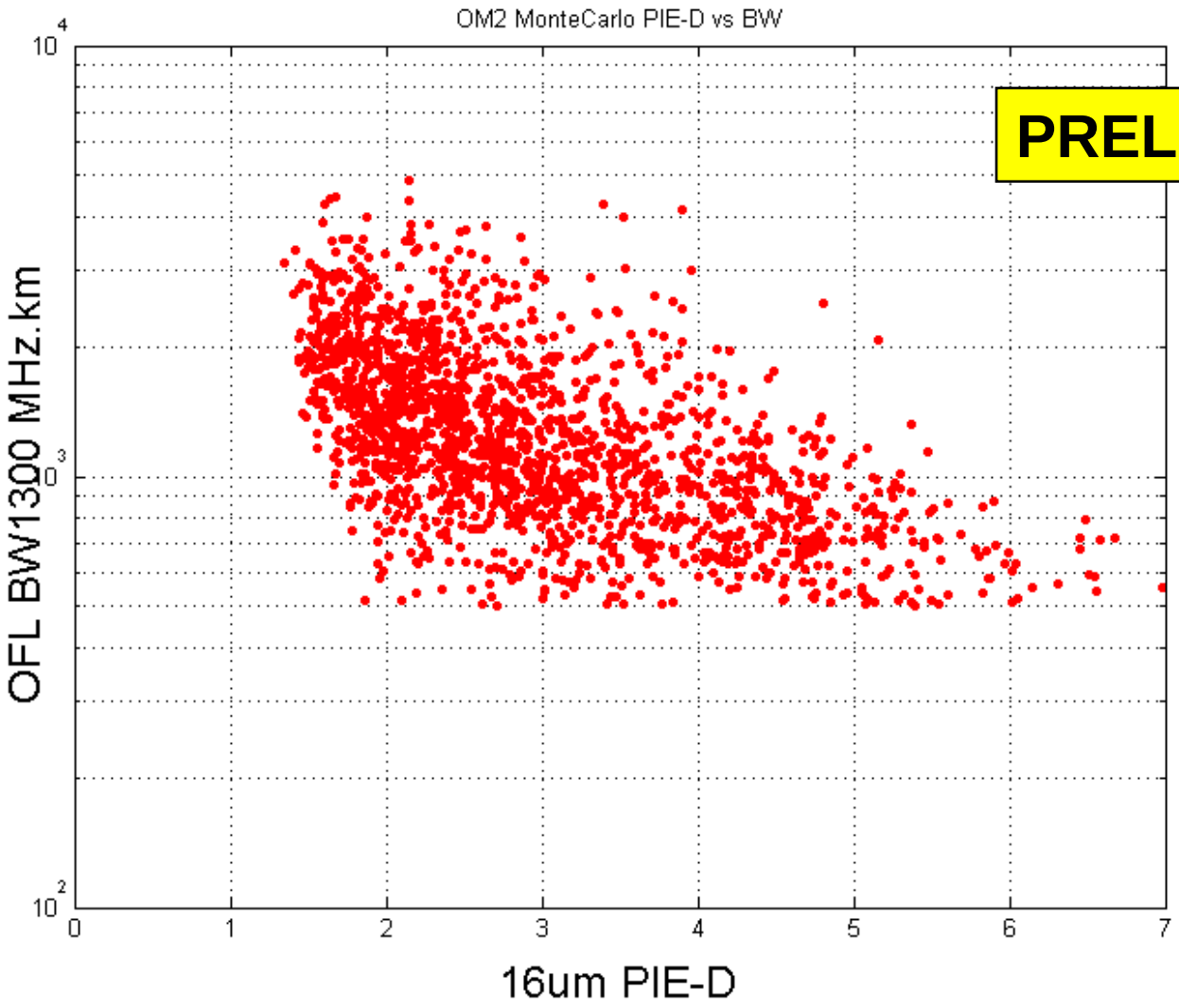


Offset PIE-Ds (no connector). 30000 test fibers, 9000 data fibers 5000MC fibers with 4032 meeting OFLBW850&OFLBW1300>500MHz.km

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

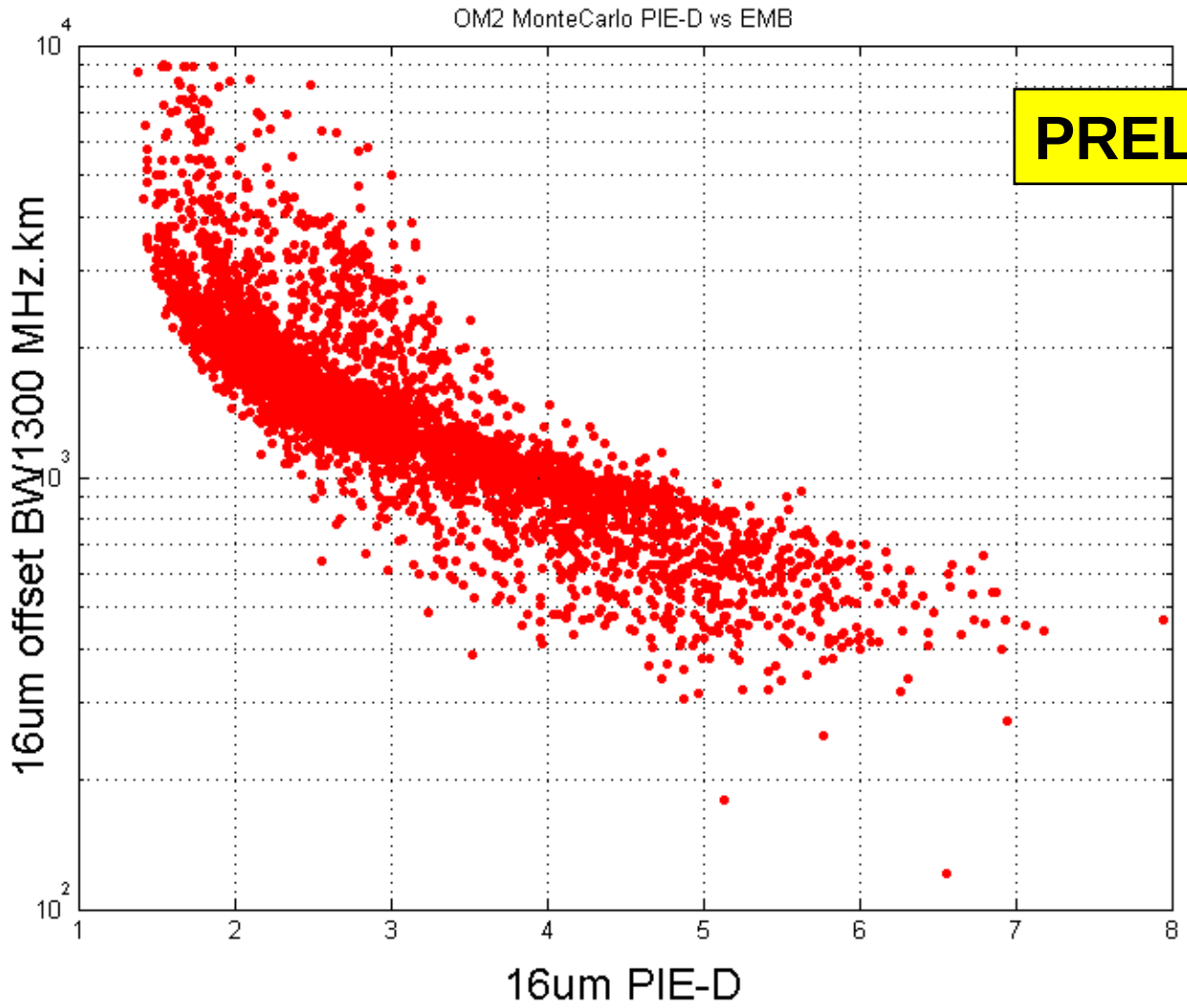
Blue = 13um offset

Scatter plot PIE-D vs OFL (OM2 MC model)



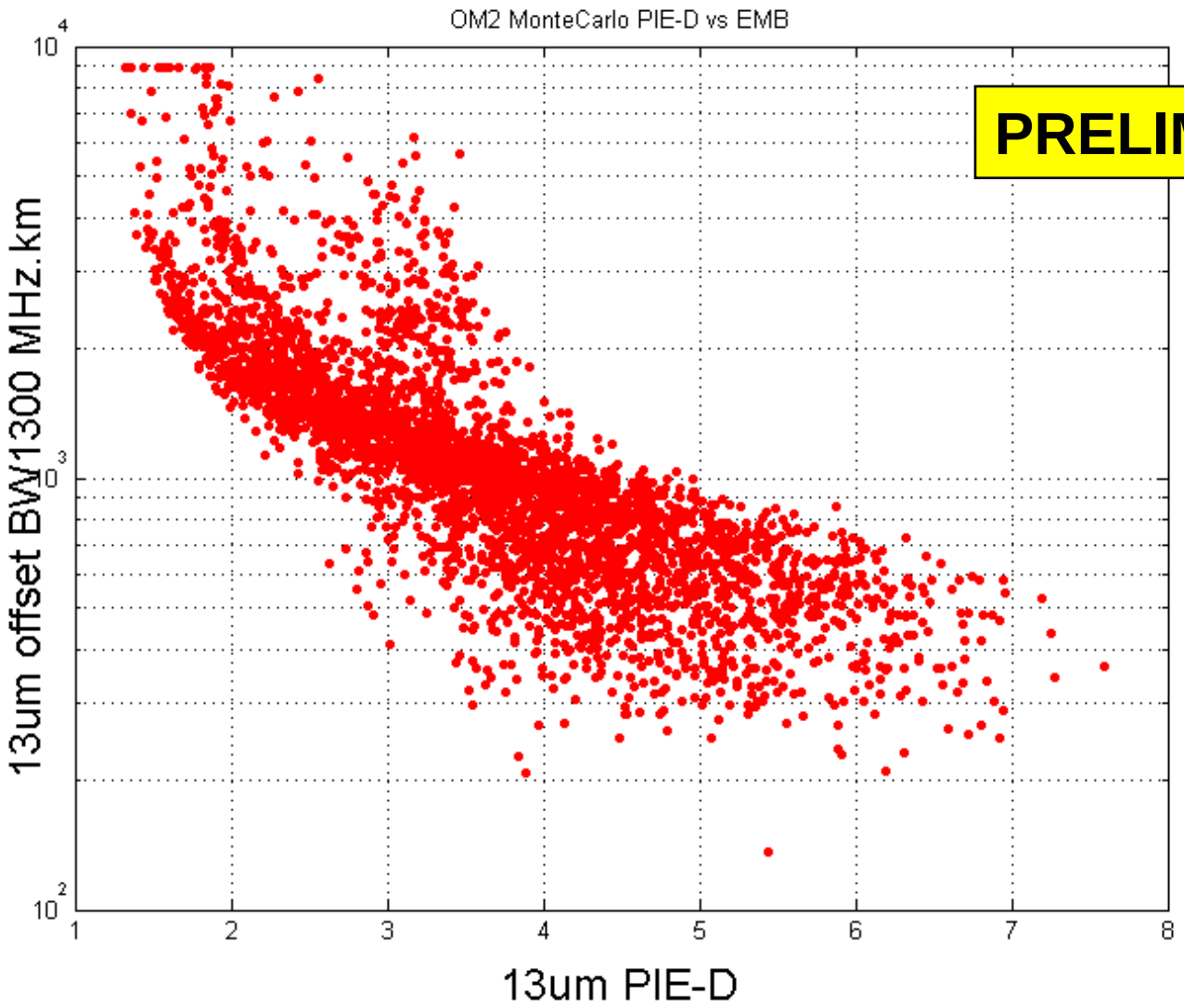
PRELIMINARY

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



PRELIMINARY

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



PRELIMINARY

Preliminary Results

The Preliminary results show offset PIE-D levels higher than OM1. This could be consistent with OM2 fibers having larger “alpha” deviations from 1300nm because fibers can be optimized for 850nm (similar result seen for OM3 – offset PIE-Ds are expected to be better than for OM3).

These results are preliminary and the mode delays, calculated DMDs, calculated index perturbations etc. need to be validated by comparing to typical curves.

PIE-D vs. offset BW is similar to OM1.

Summary

Methodology explained for generating OM2 MC set to agree with OM2 OFL BW850,BW1300 data.

Methodology is general:

(a) need data to be fitted (OFL BWs, DMD slopes, etc.)

(b) need method to generate “test fibers” (Gen67YY after morphing; another method would be to use mode delays calculated from measured index profiles)

(c) Usually need method to expand test fiber set to fully blanket the measured data.

Results presented here are preliminary, checking is in progress.

BACKUP

BACKUP1