Implications of TIA modeling for EDC channel modeling development: lognormal distributions

John Abbott

Corning Incorporated

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Discovering Beyond Imagination

2-- Distribution of BWs

There is a question about estimating what % of the installed base has FDDI fibers with the OFL BW less than X, or the “DMD” less than X, etc.

These slides will emphasize that certain aspects of the fiber will in fact follow a lognormal distribution.

A lognormal distribution is inherently very broad. The ratio of the upper 20%tile value to the median equals the ratio of the median to the bottom 20%tile value.

For example if median = 1000, top 20% = 2000, then bottom 20% = 500.

Background

Data is on IEEE website at

http://www.ieee802.org/3/z/mbi/index.html

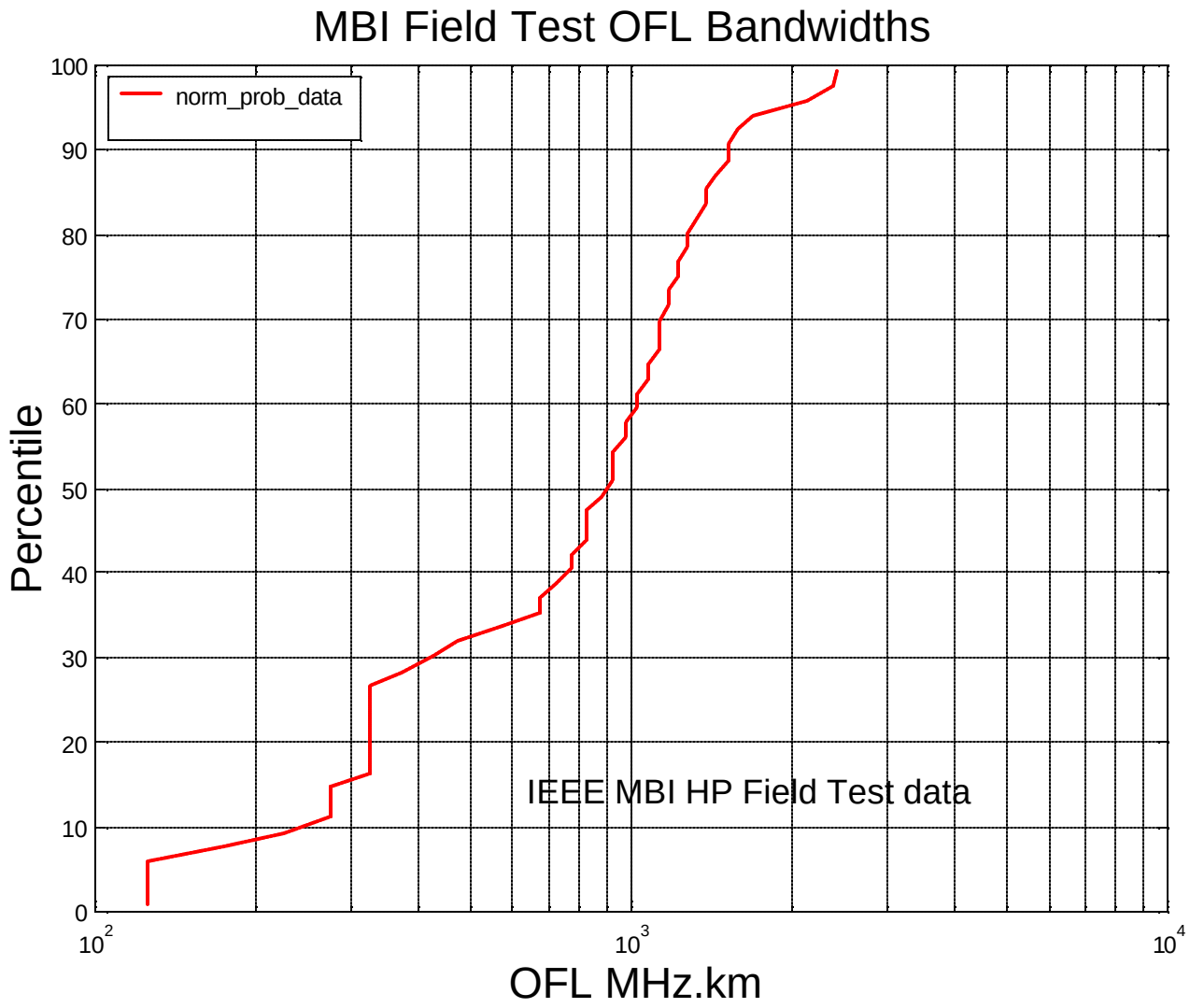
Excel spreadsheet

http://www.ieee802.org/3/z/mbi/fldbnd95.xls

Basic approach is expected to work with other data sets.

IEEE MBI Field Test OFL BW distribution

Measured OFL BW in field test



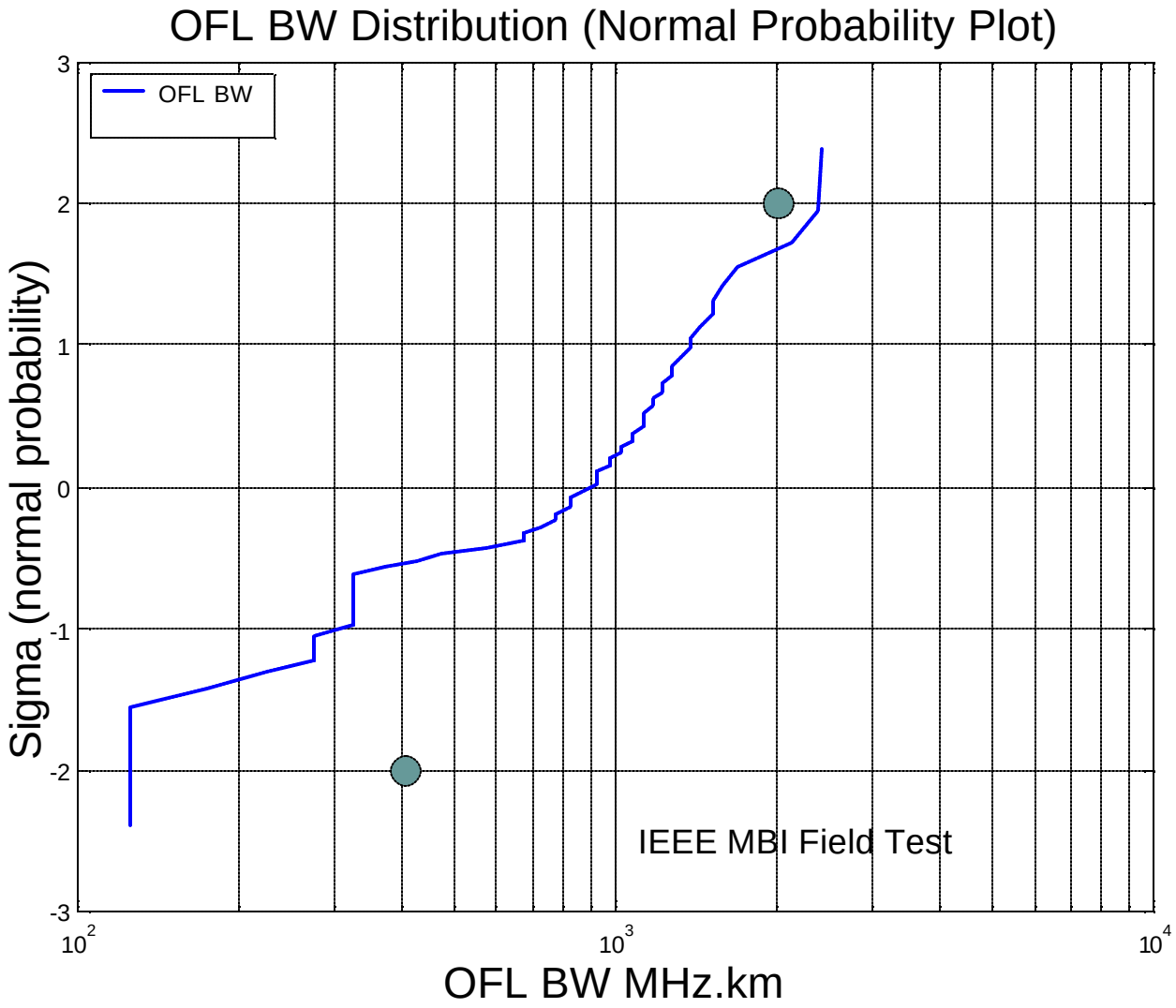
MBI OFL BW on Normal Probability Scale

BW distribution is lognormal – an inherently broad distribution at both the high end and low end.

Median is 900MHz.km

Top 2-s value is about 2000MHz.km

Bottom 2-s value is approximately (900/2000)*900 = 405MHz.km

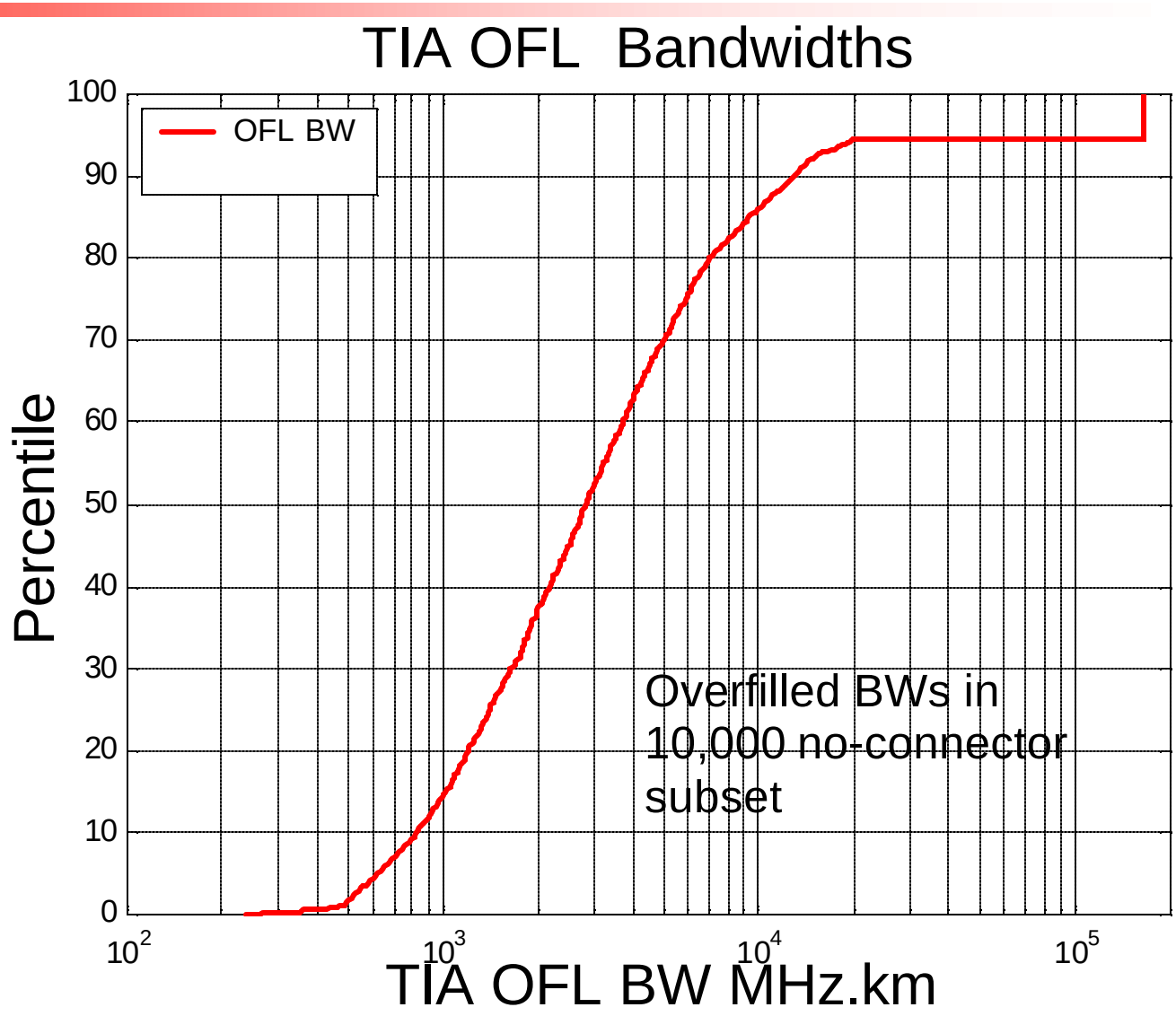


Background --- TIA modeling

In the development of the TIA OM3 spec for 300m 10GbE, a set of 5000 mode delays was constructed as well as a set of 2000 laser source MPDs. The following slides using results of the modeling show how the BW metric tends to become lognormal. Examples include modeled OFL BW, the minEMB over 10 specific sources, -1.5 and -3.0dB BWs, and the Effective Modal Bandwidth (EMB) seen on 40,000 links with fibers and lasers chosen randomly from the distribution.

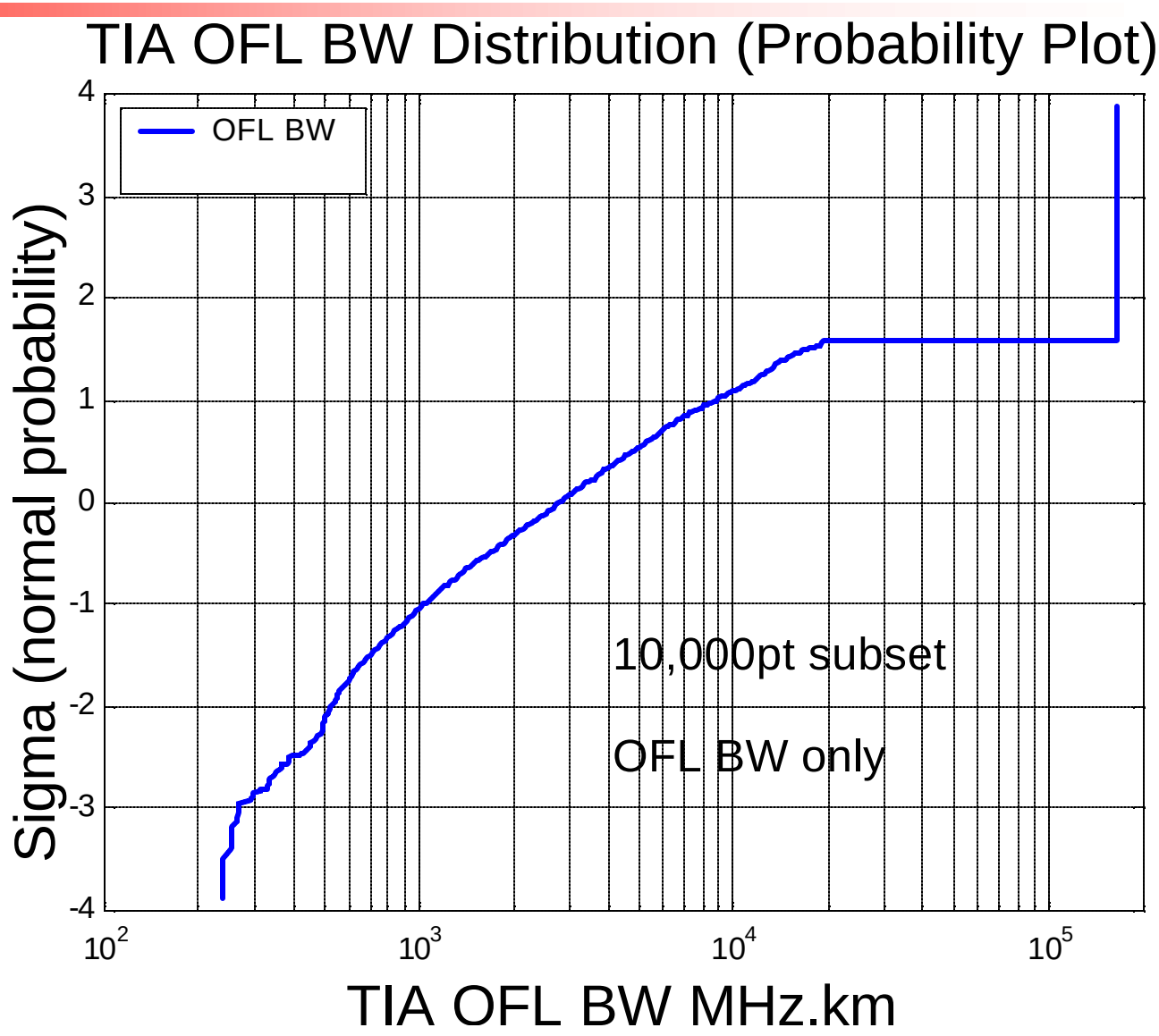
TIA OM3 modeling OFL BW distribution

OFL BW for TIA model fiber



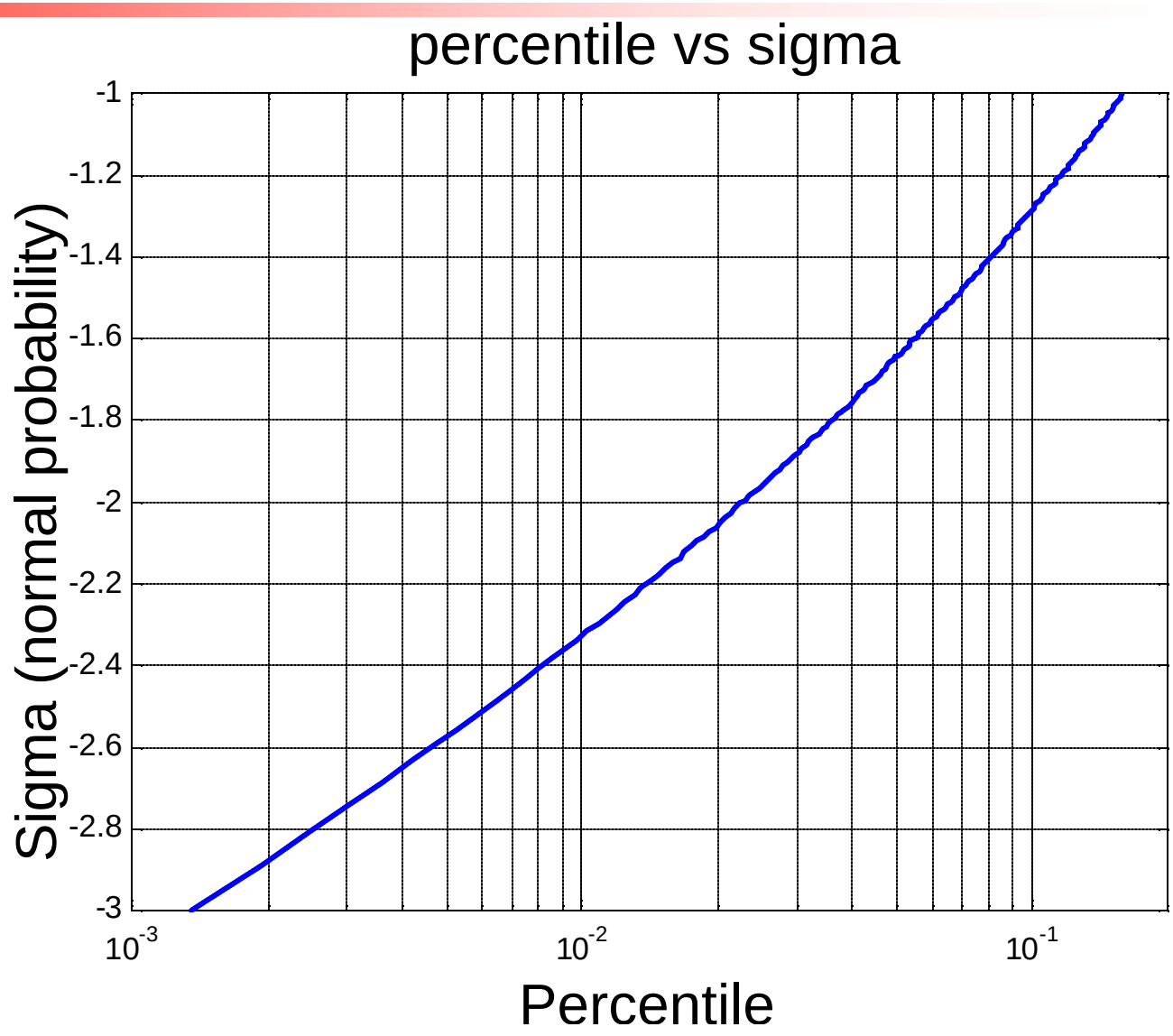
TIA OM3 OFL BW on Normal Probability Scale

OFL BW for TIA model fiber We are interested in estimating approximately the bottom 2sigmal level of the installed base.



Reference Plot – convert from % to σ

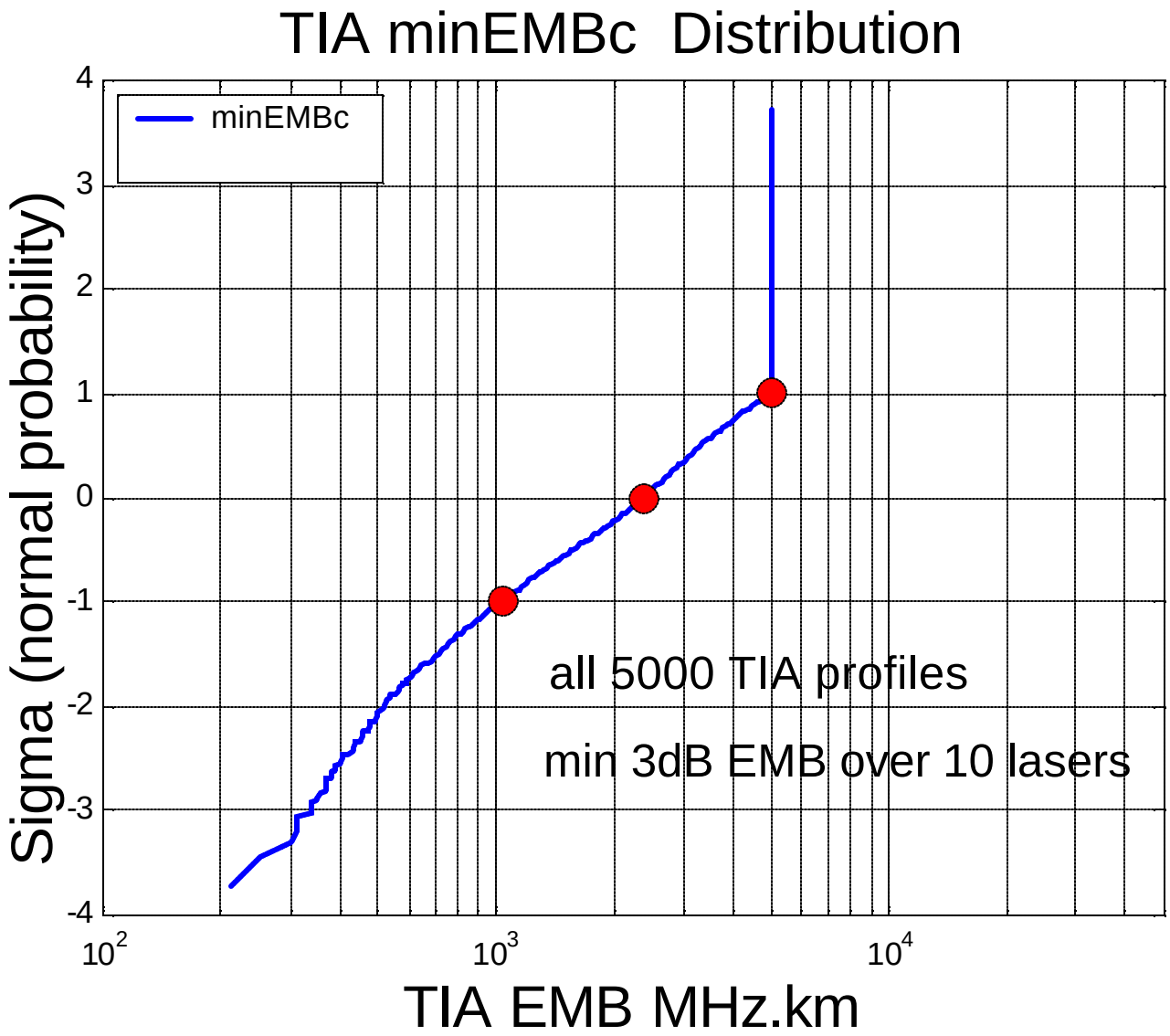
1 sigma corresponds to about 16%,
2 sigma corresponds to about 2.5%.



TIA OM3 minEMBc on Normal Probability Scale

Min -3dB EMB for the 10 TIA lasers closest to the EF parameters for the 10 EMBc lasers.

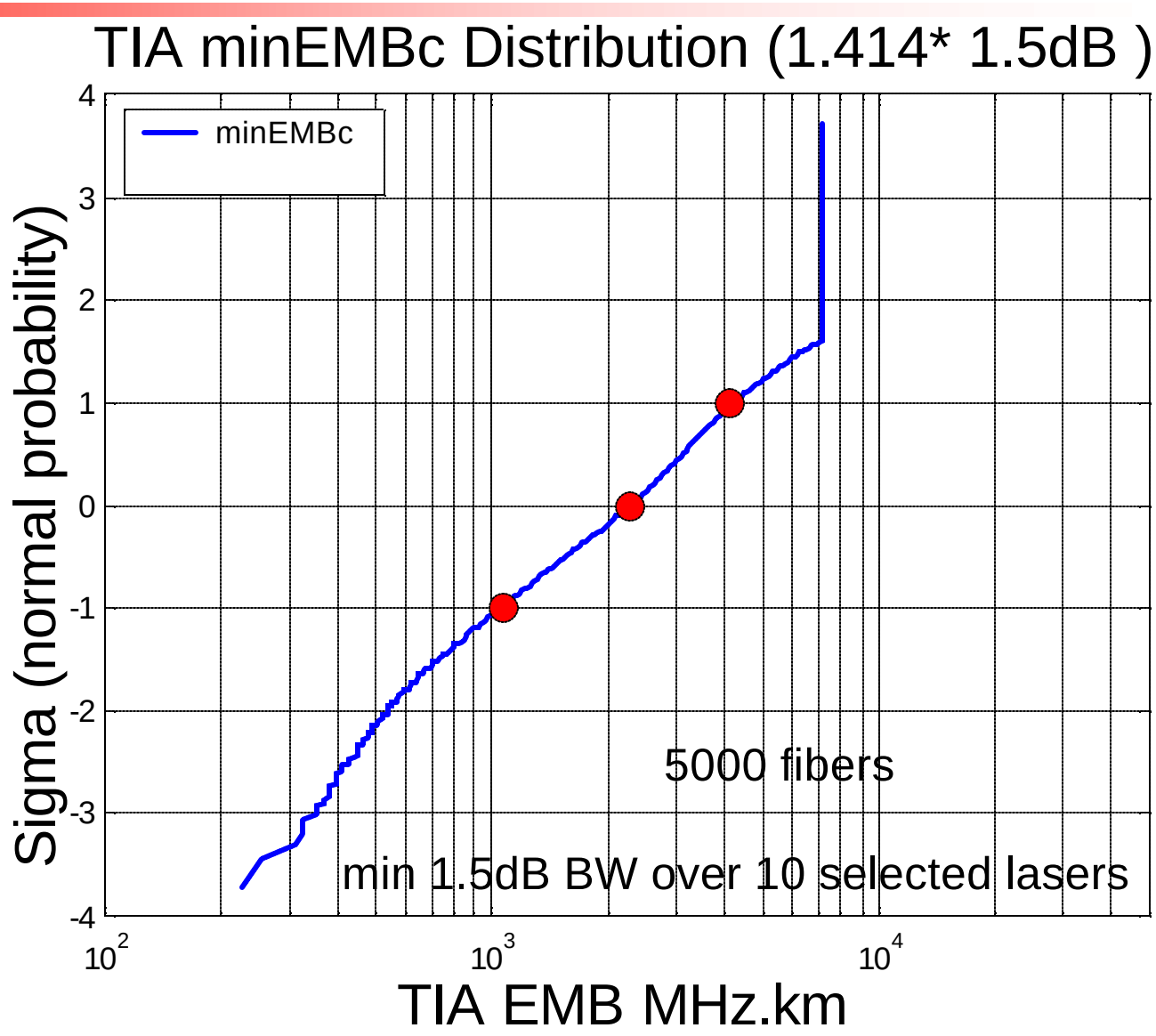
All 5000 TIA model fibers.



TIA OM3 minEMBc (1.5dB BW)

Min -3dB EMB for the 10 TIA lasers closest to the EF parameters for the 10 TIA EMBc lasers.

All 5000 TIA model fibers.



TIA OM3 EMB distribution (all lasers)

10,000 pairs were chosen at random from 5000 fibers and 2000 lasers.

This plot includes "noncompliant" lasers

These are the 10,000 no-connector links in the 40,000 link simulation.