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T10/00-274r0

Ultra320 SCSI Eye Diagram Data for a System with a Backplane and a Short Cable Assembly

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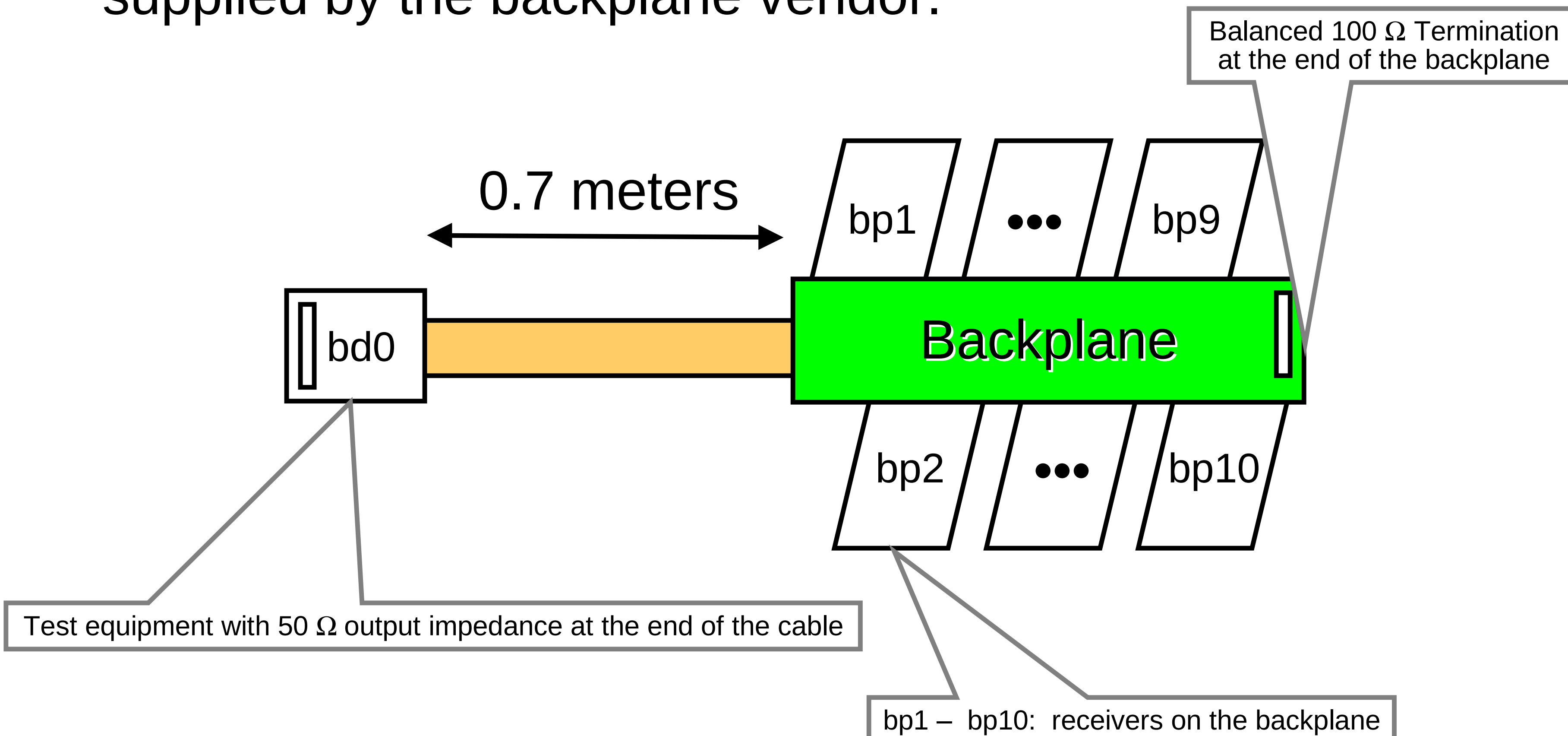
Introduction

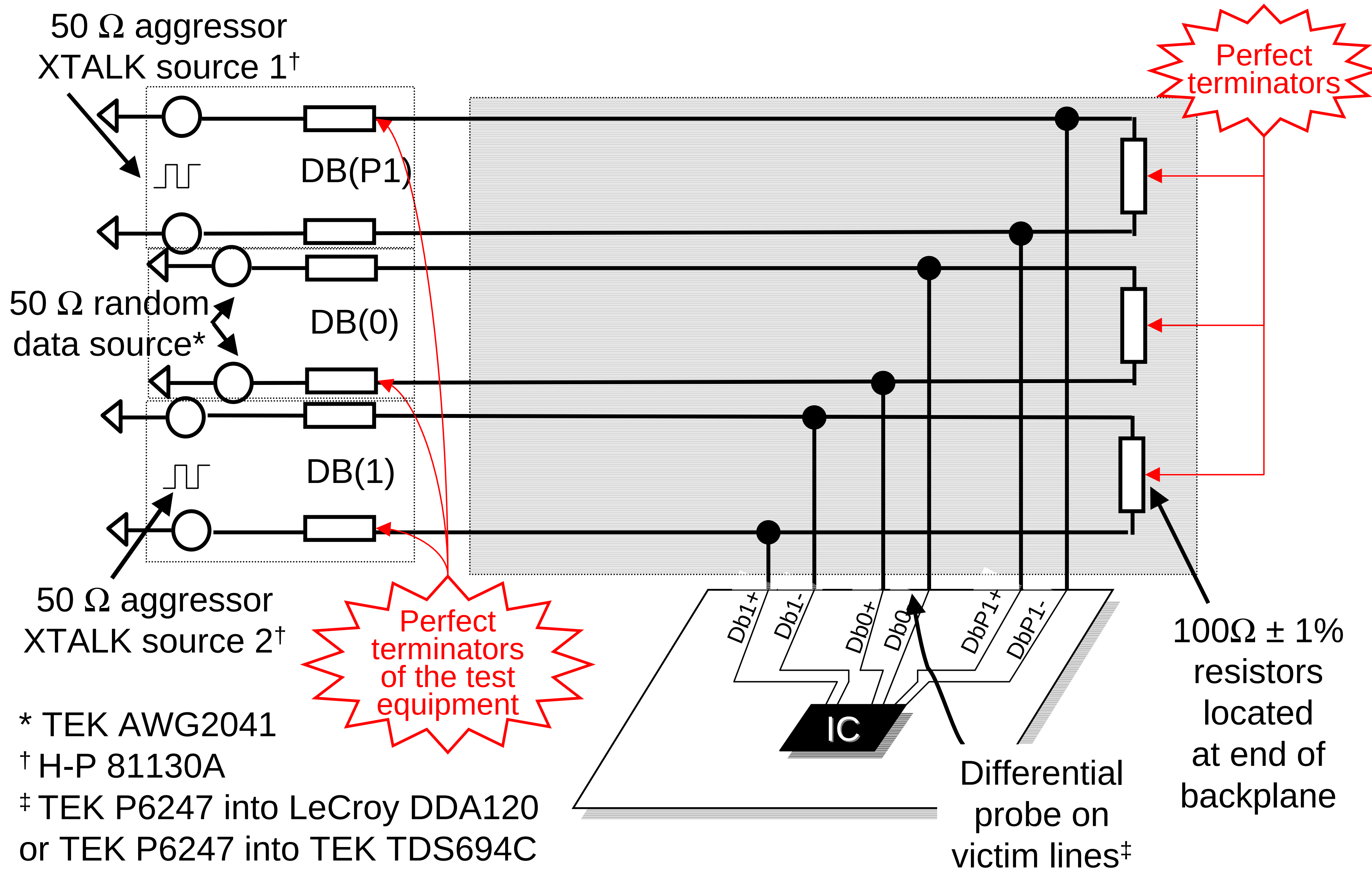
- This presentation is for data gathered with a 10-slot backplane and a 0.7 meter cable in order to evaluate the effect of the short cable (see the next three slides for test set-up details; also see T10/00-214 for additional details).
- Four slides are shown for each of three slots (1, 6, and 9):
  - At the receiver without crosstalk, without transmitter precompensation (TxPC), and without receiver equalization (AAF),
  - At the receiver with crosstalk and without TxPC and AAF,
  - At the receiver with crosstalk using TxPC with 33% cutback, and
  - The signal at the receiver with crosstalk after processing by the AAF.
- The driver amplitudes used were:
  - 500 mV for data without precompensation or AAF,
  - 500 mV for data with AAF,
  - 500 mV maximum and 330 mV cutback (33%) for data with transmitter precompensation, and
  - 500 mV for crosstalk (since this is a "1010..." pattern, there would be no cutback).

Test System Configuration

- 10-slot, commercially available backplane fully populated with Quantum Ultra160 drives; 0.7 meter flat cable supplied by the backplane vendor.



Test Schematic



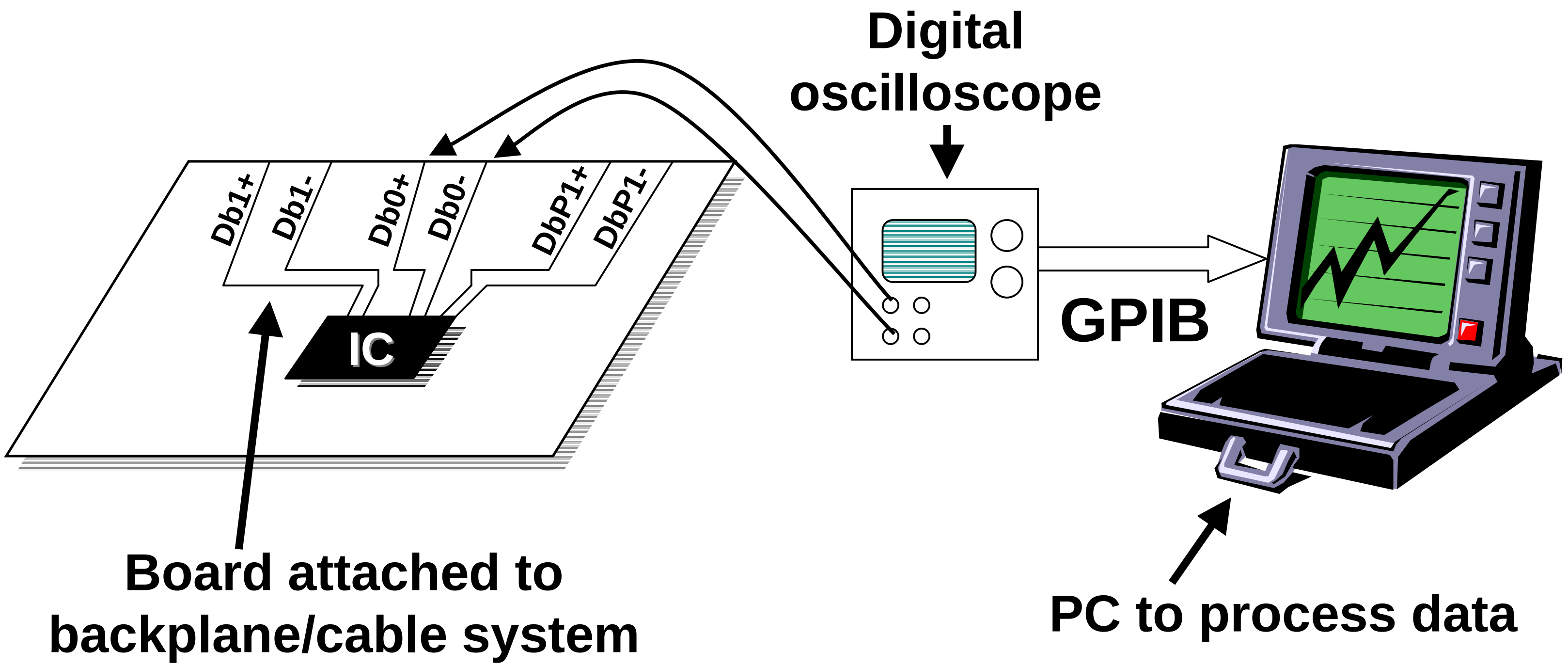
* TEK AWG2041

† H-P 81130A

‡ TEK P6247 into LeCroy DDA120 or TEK P6247 into TEK TDS694C

Creating the Eye Diagram

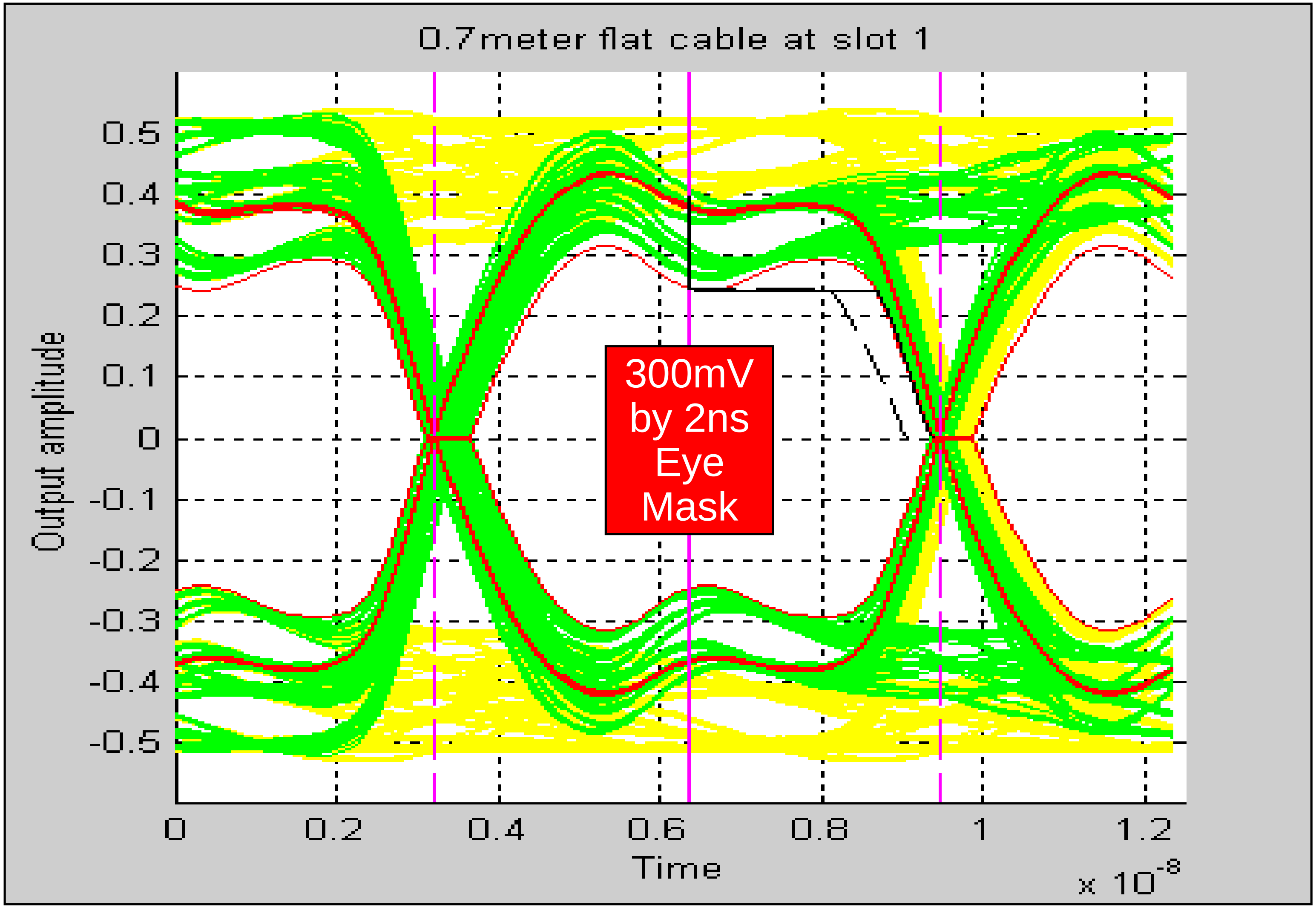
- Differential data was captured at the receiver.
- For signals without AAF: raw data was sent to a PC and processed to create the eye diagrams.
- For signals with AAF: The "no TxPC/no AAF" data was processed by transistor level simulation of the AAF to create the eye diagrams.



Color Key

- The following is the color key for the "eye diagram" slides:
  - The solid purple vertical line is the center of the bit cell being measured.
  - The dashed purple vertical lines are the outer limits of the bit cell.
  - The reddish-purple line inside the eye are the worst-case signals.
  - The red lines are the 1010... training pattern before the random data.
  - The green lines are transitions that changed state at the start of the cell being measured.
  - The yellow lines are transitions that did not change state at the start of the cell being measured.

Slot 1, No TxPC, No AAF, No Xtalk



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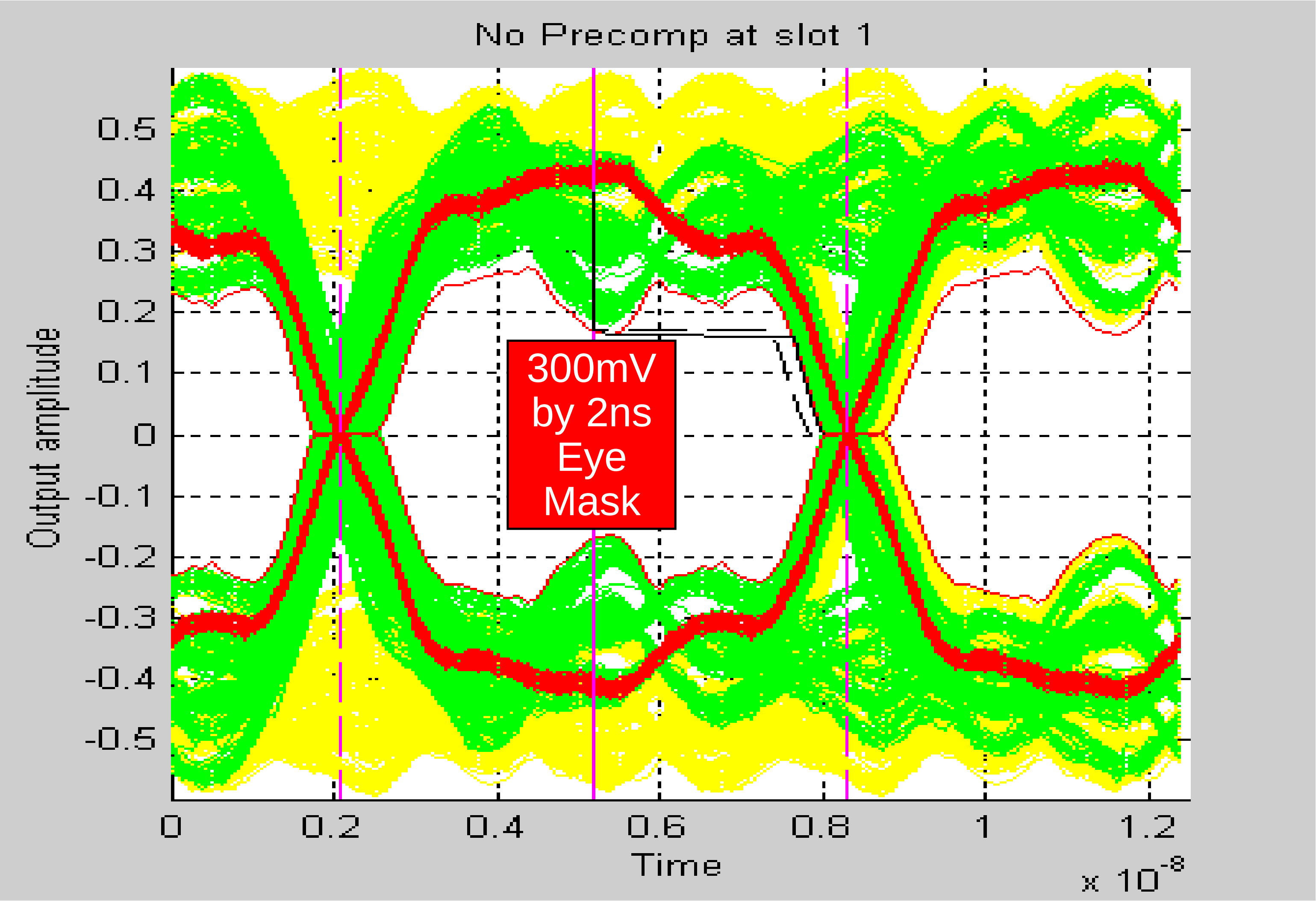
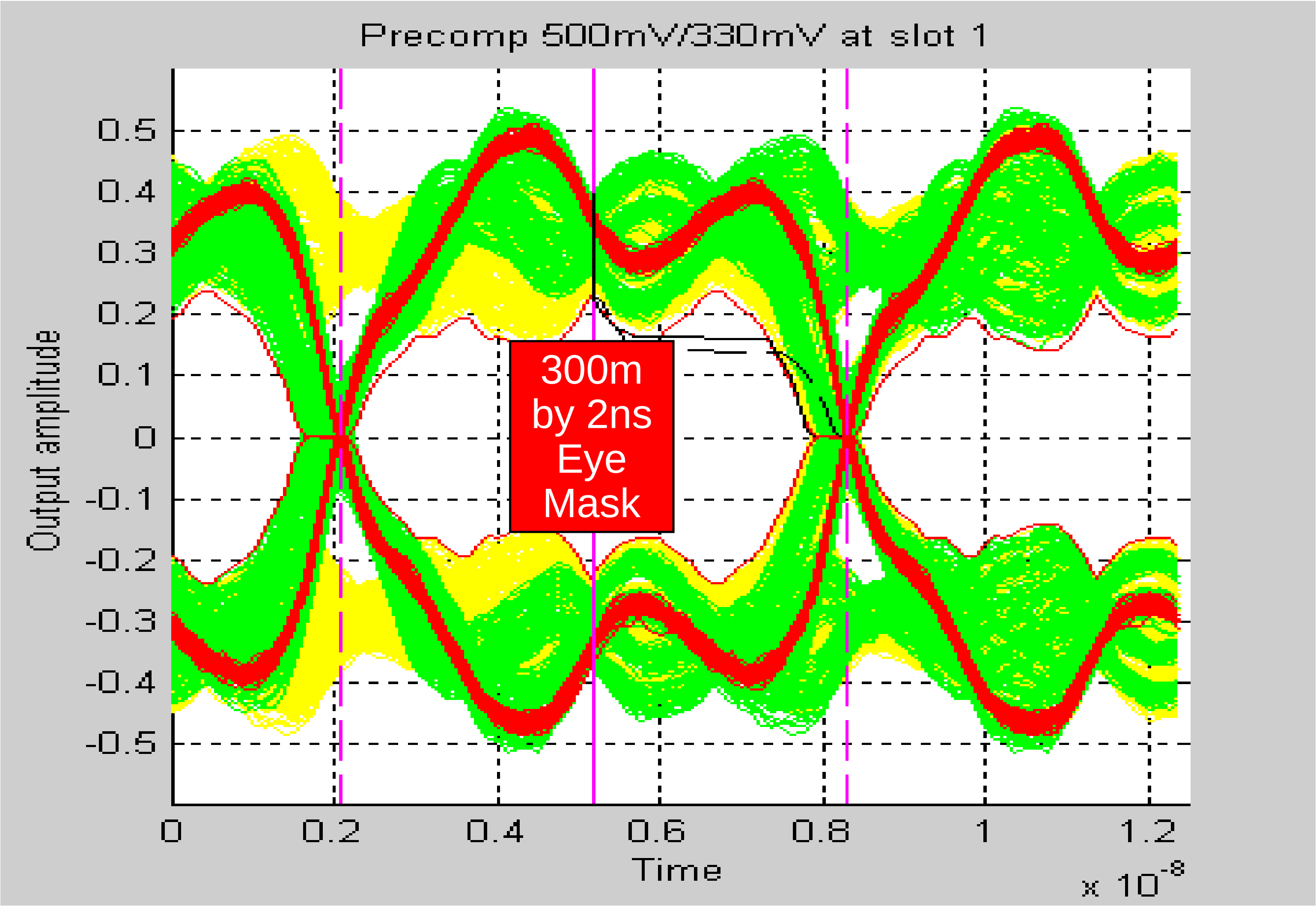
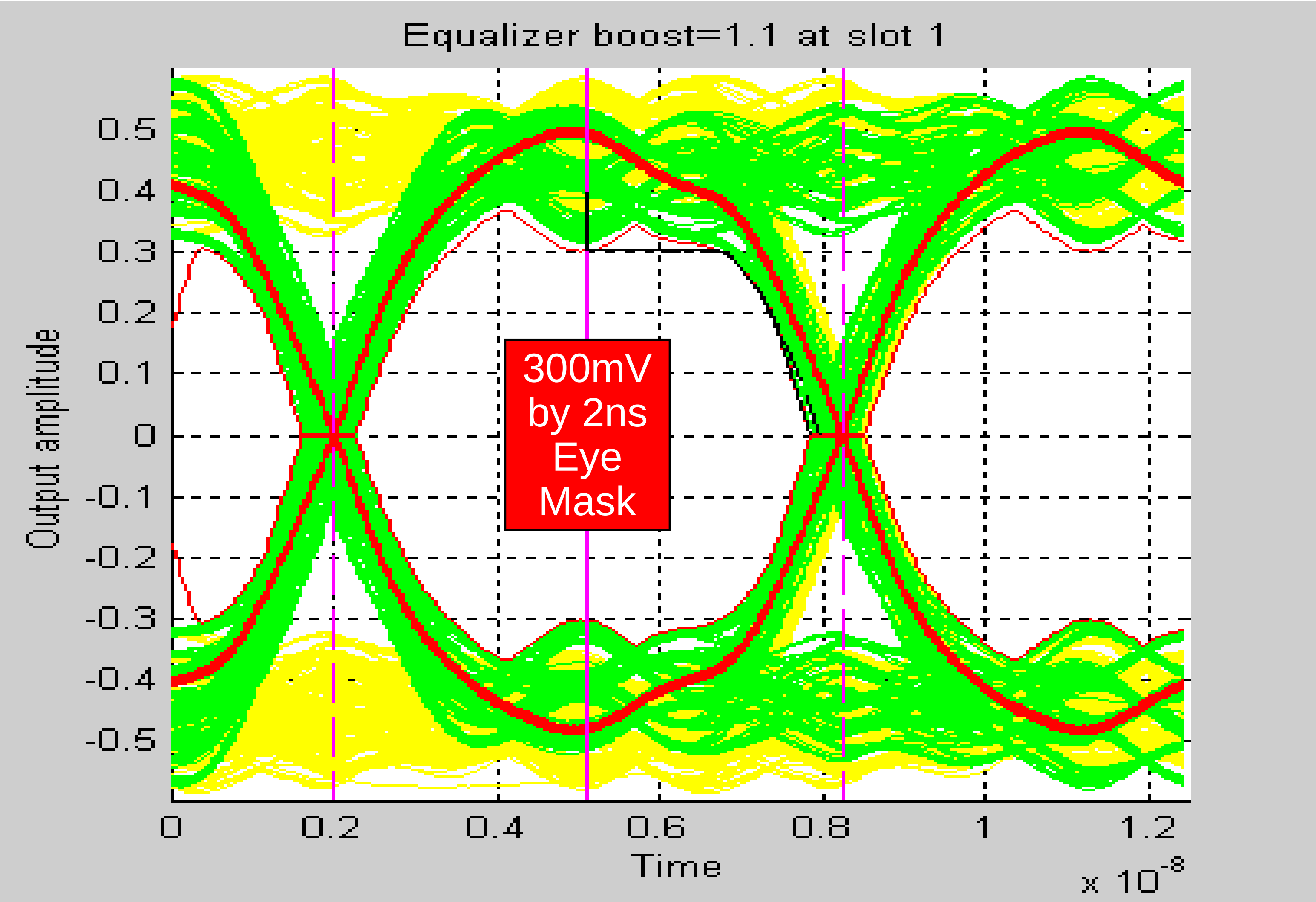
Slot 1, No TxPC, No AAF, With Xtalk



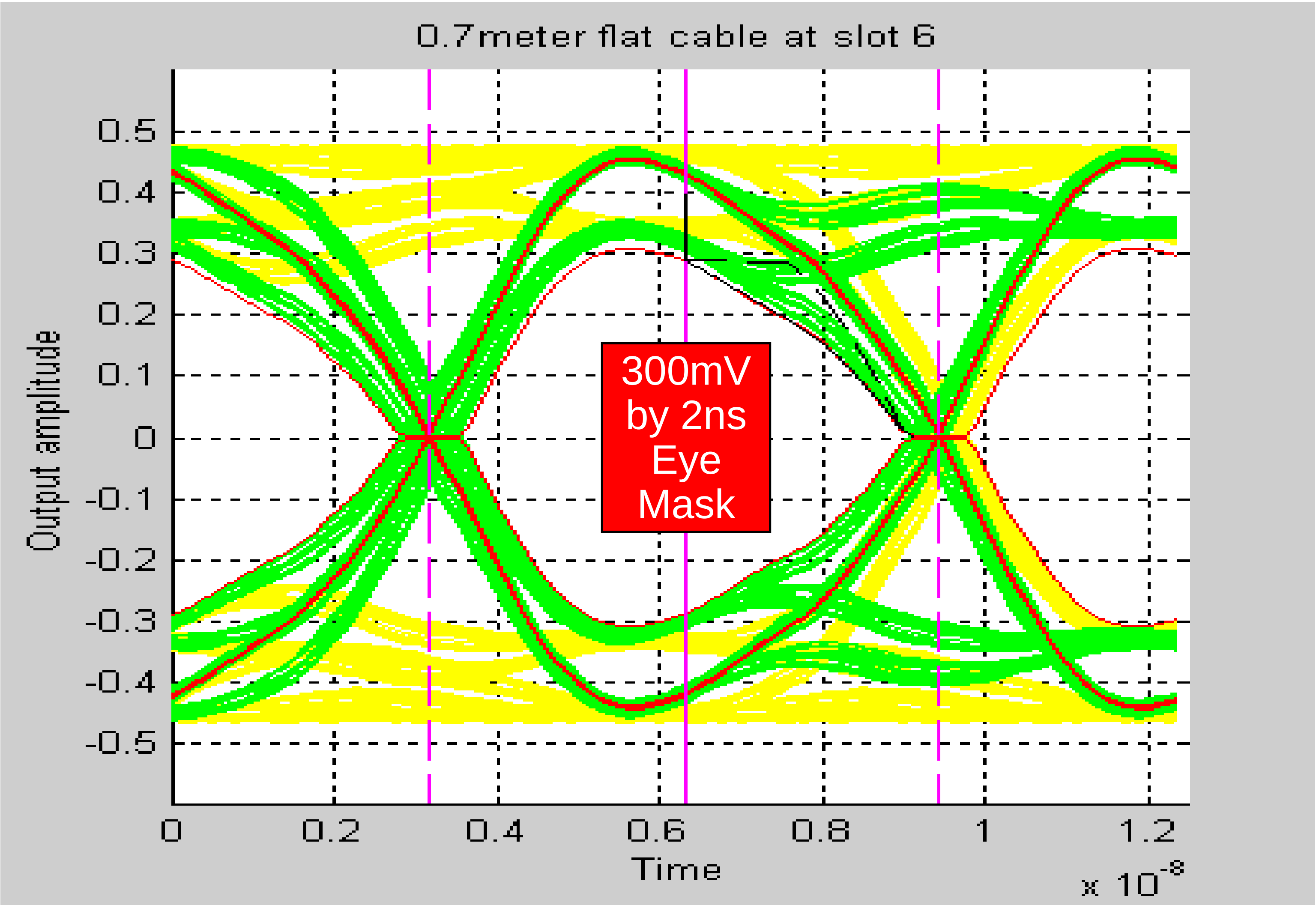
Quantum™ Slot 1, TxPC cutback = 33%, W/Xtalk



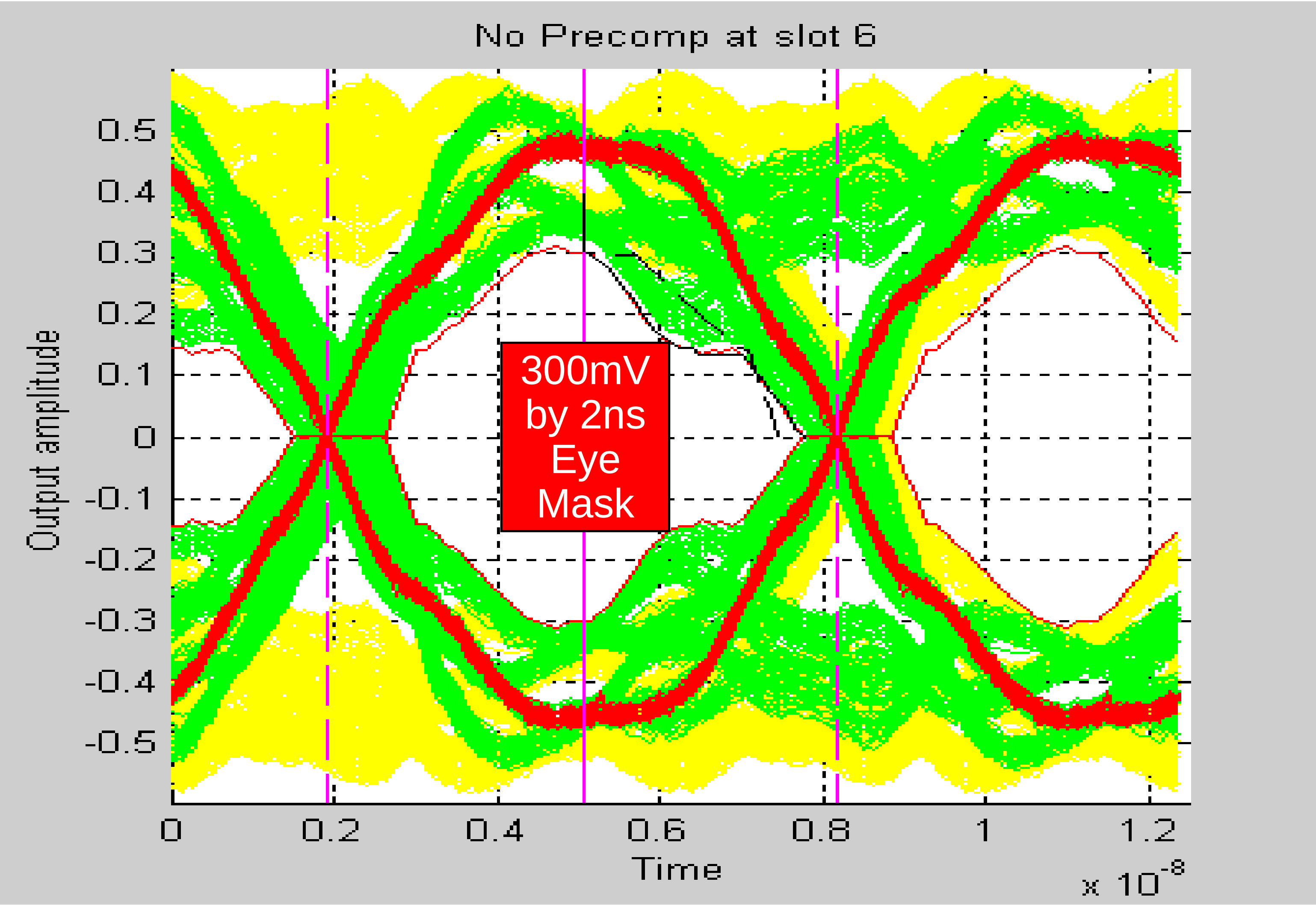
Slot 1, AAF w/boost = 1.1x, W/Xtalk



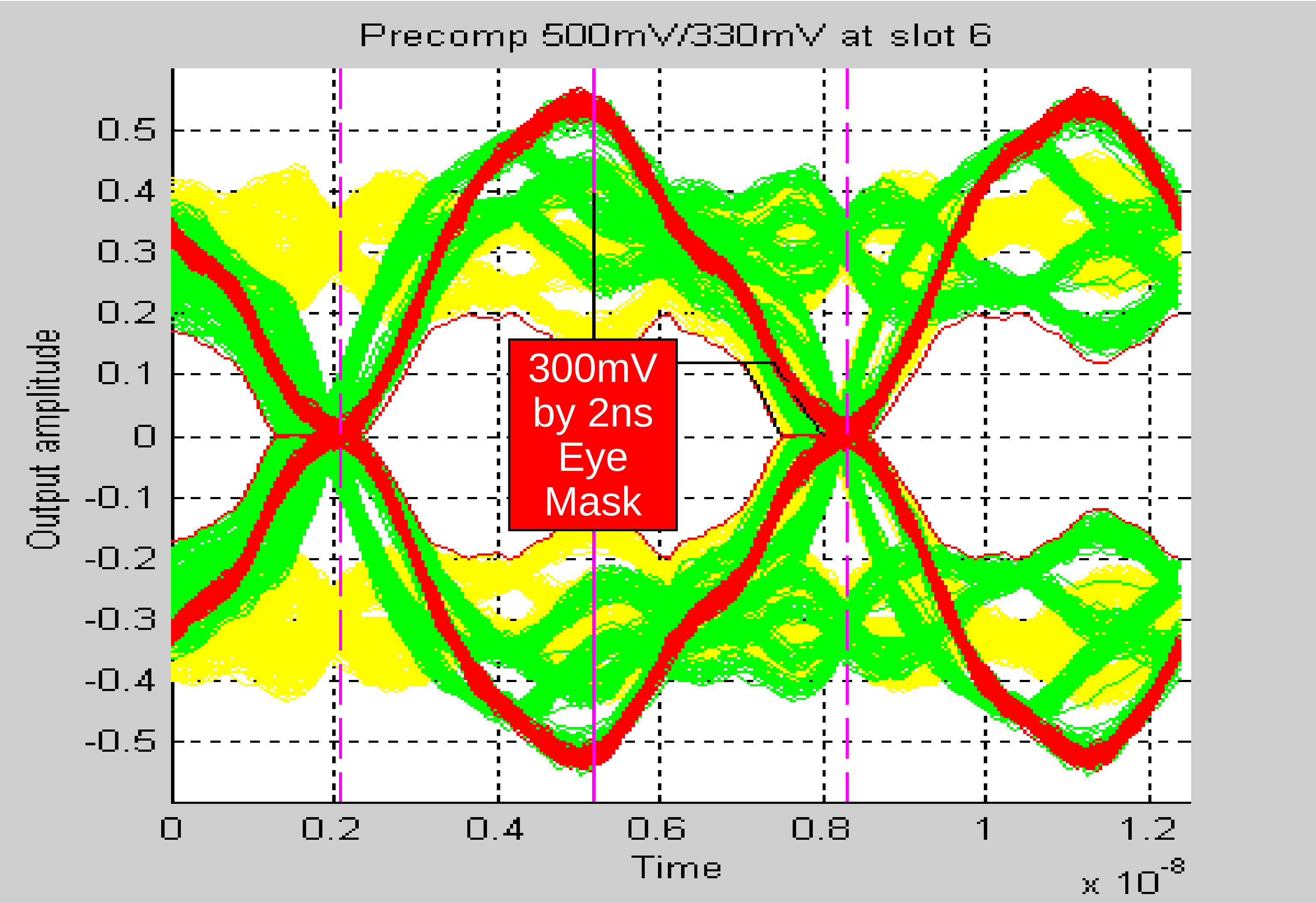
Slot 6, No TxPC, No AAF, No Xtalk



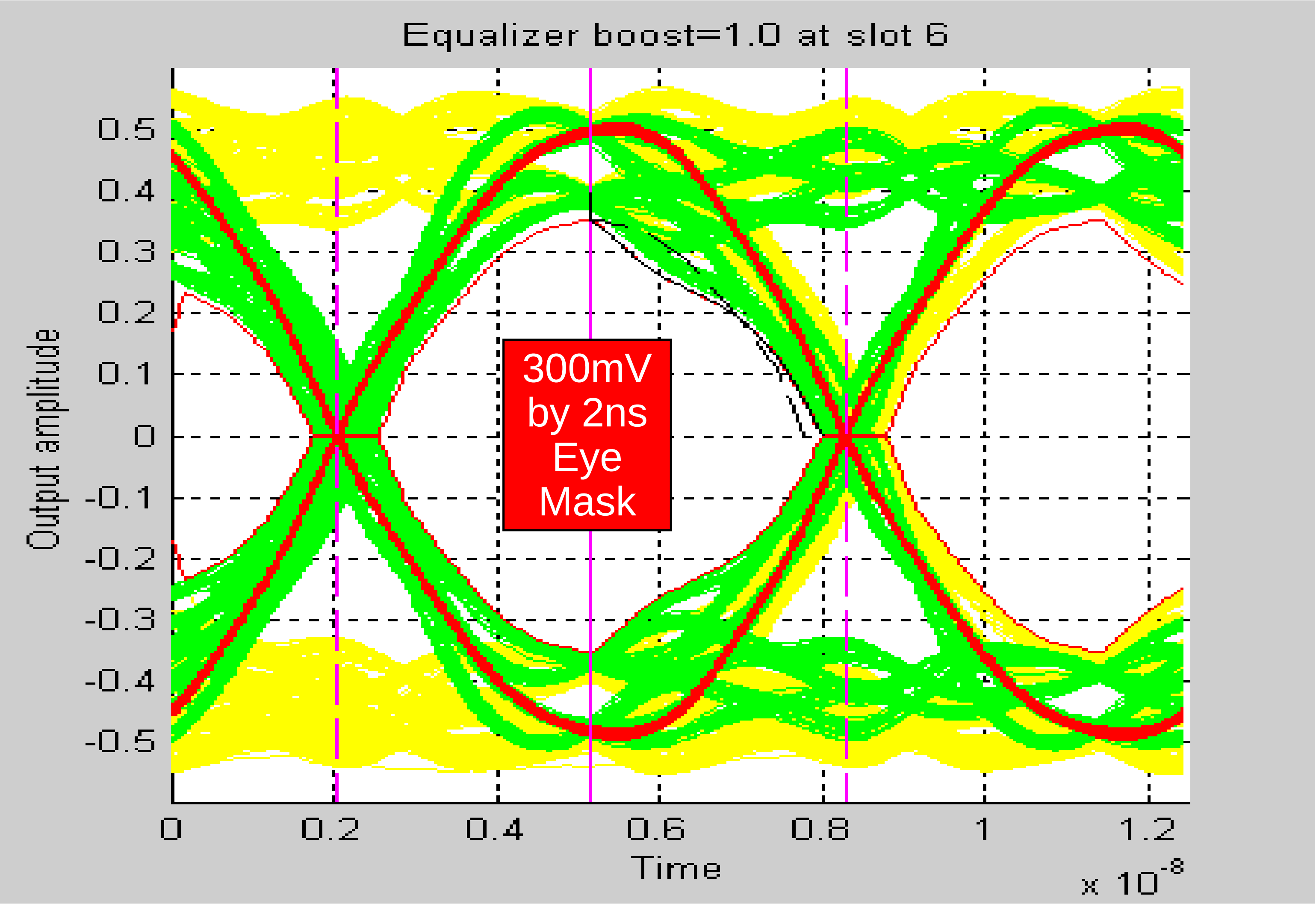
Slot 6, No TxPC, No AAF, With Xtalk



Slot 6, TxPC cutback = 33%, W/Xtalk



Slot 6, AAF w/boost = 1.0x, W/Xtalk



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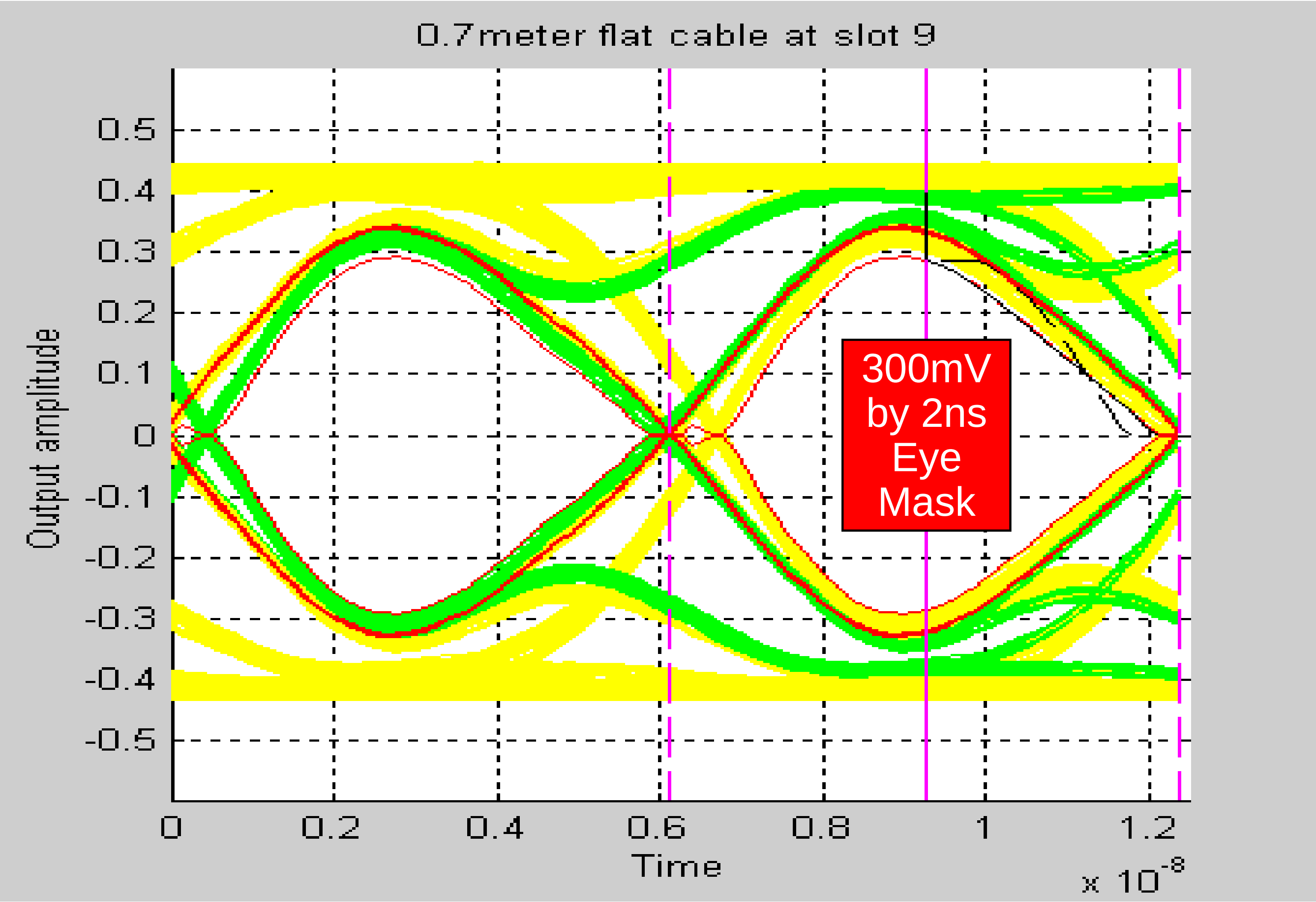
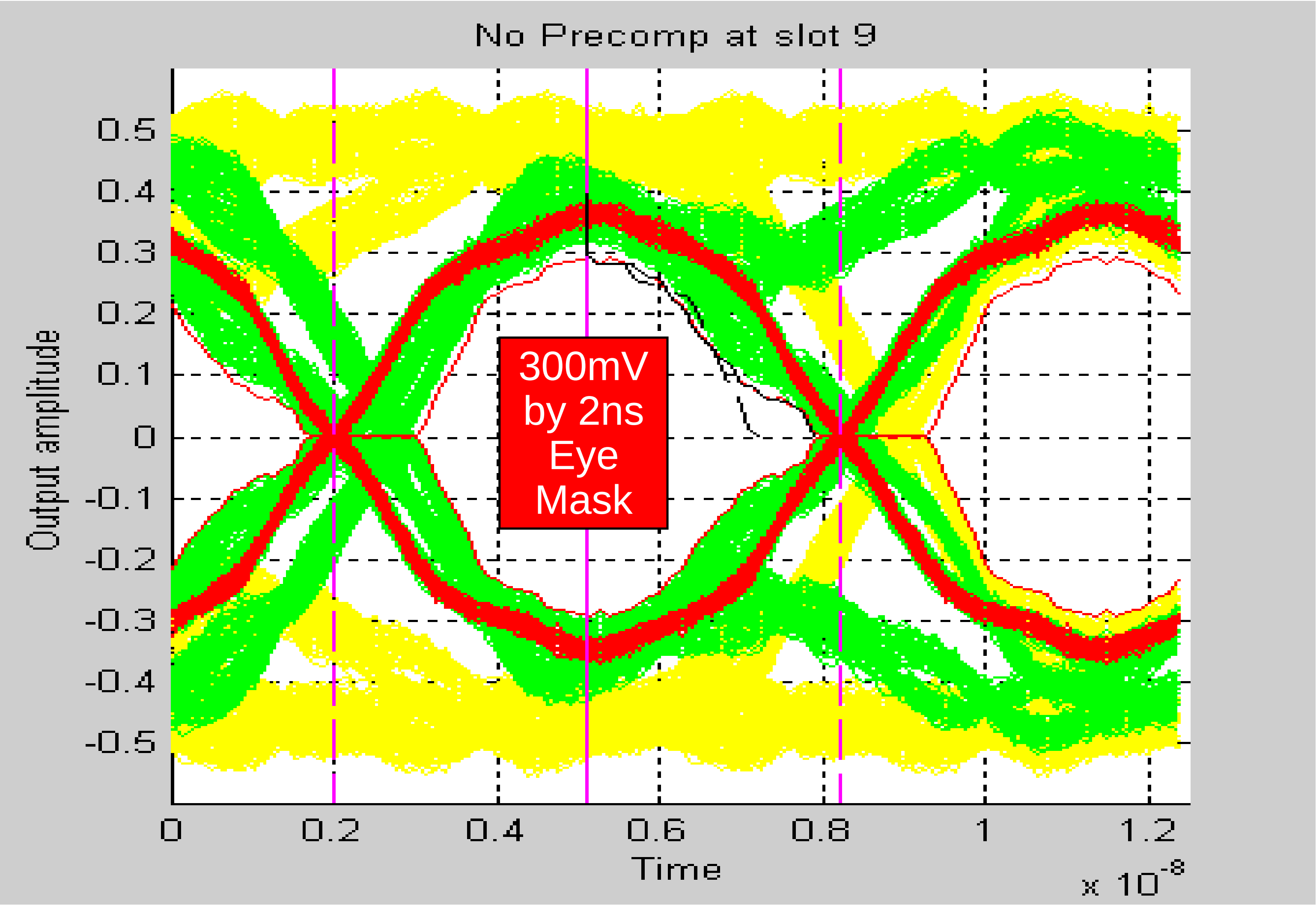
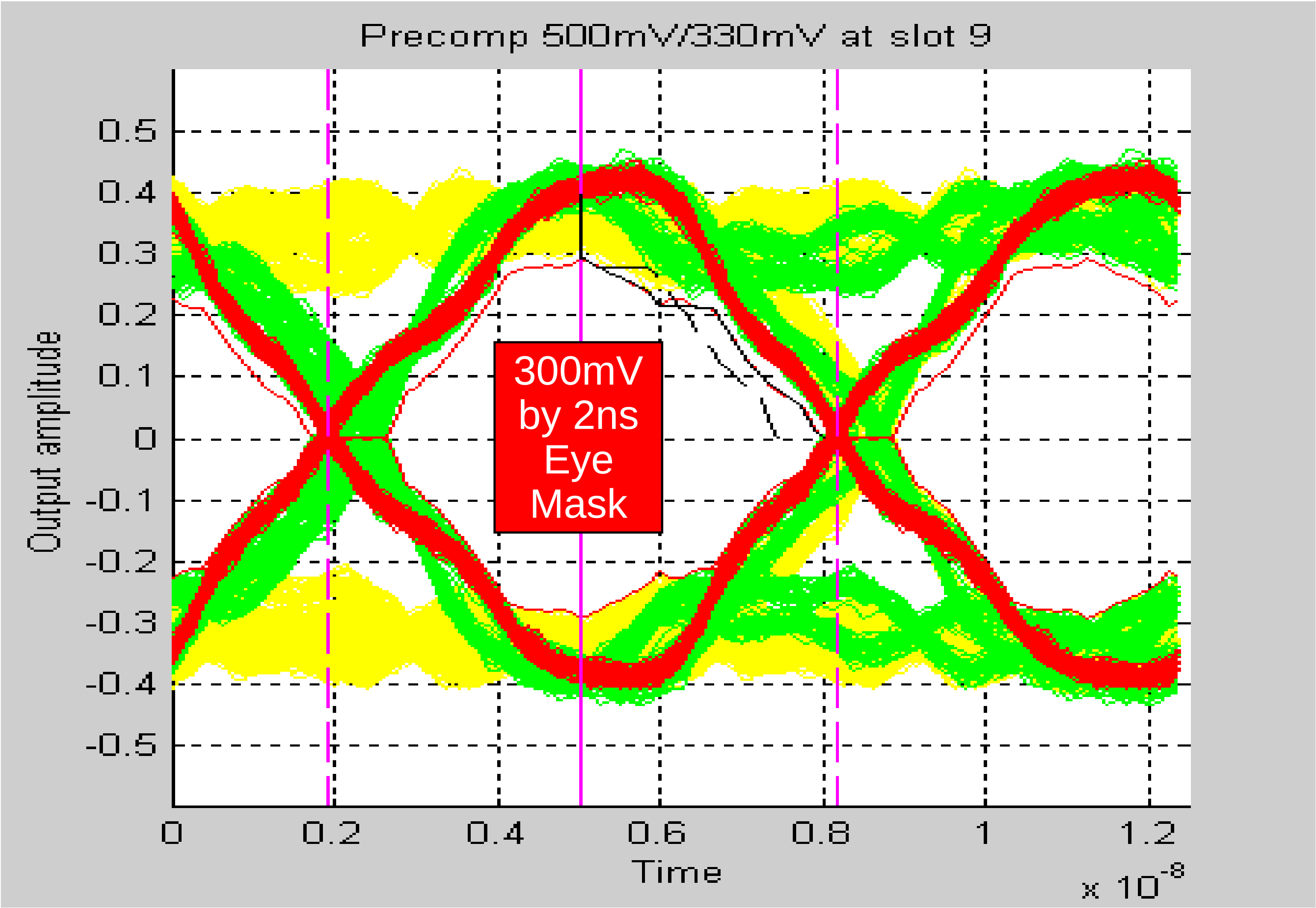
Slot 9, No TxPC, No AAF, No Xtalk



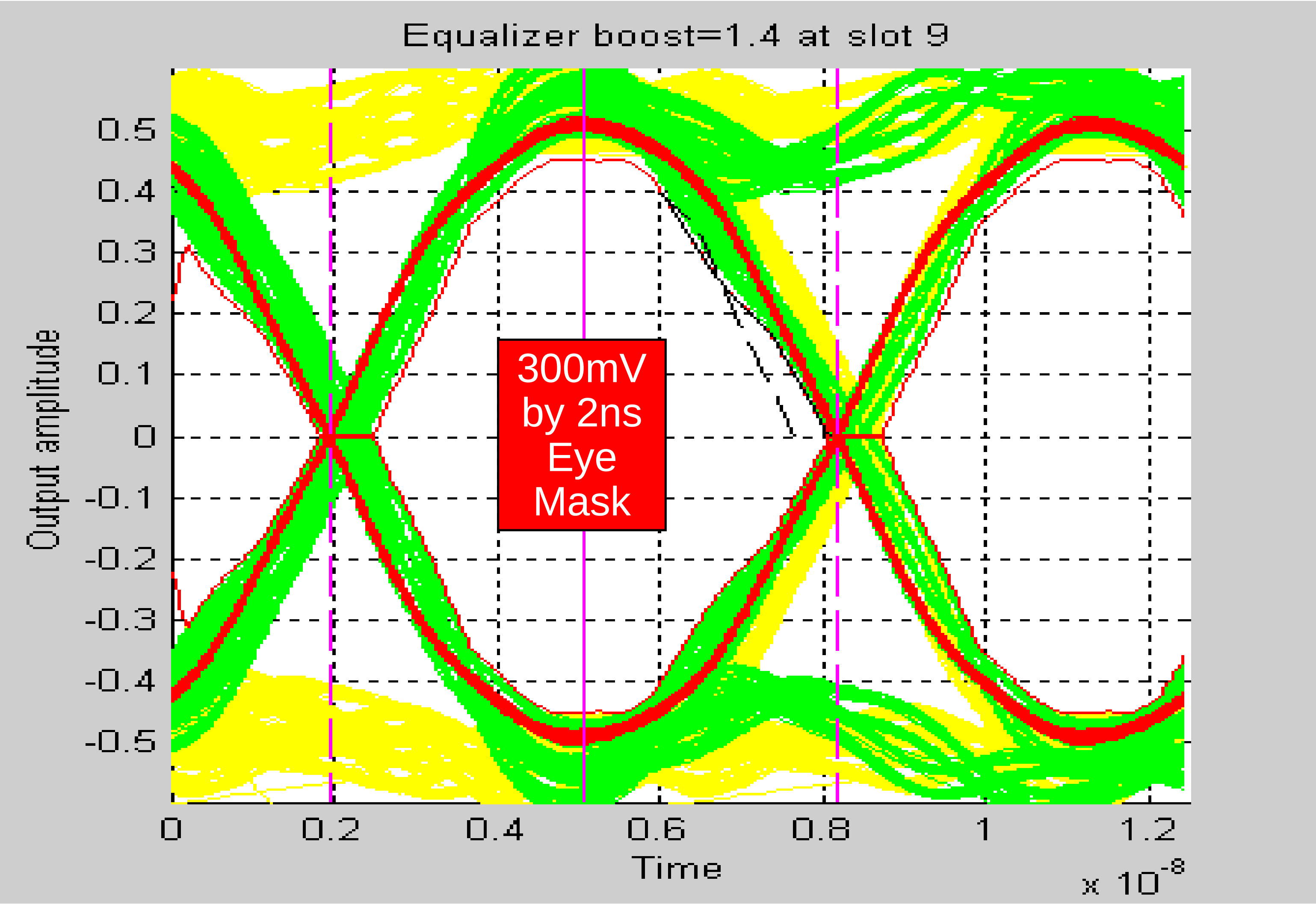
Slot 9, No TxPC, No AAF, With Xtalk



Slot 9, TxPC cutback = 33%, W/Xtalk



Slot 9, AAF w/boost = 1.4x, W/Xtalk



Observations

- As noted in T10/00-235r0, there is a significant difference in attenuation from slot to slot in this backplane.
  - The AAF boost that was determined for different slots in this backplane for this testing ranged from 1.0x to 1.4x.
  - A single transmitter precomp cutback level is not optimum for all of the drives in this system.
  - It is unwieldy to set different transmitter precomp levels for different drives.
- Reflections are more pronounced in this system using a relatively short cable assembly.
- The negative effect of these reflections is aggravated by the transmitter precomp drivers.
  - The driver amplitudes used for TxPC in this data were only 500 mV maximum and 330 mV cutback.
  - Using higher amplitudes would increase the negative effect of TxPC on reflections.

Conclusions

- Because each of the eye diagrams is generated from only 10 microseconds of data, any eye diagram that appears marginal might possibly fail in a real-world application.
- Transmitter precomp with cutback seems to makes things look worse and appears to exacerbate the effects of crosstalk and reflections in this configuration.
- There are some slots in this system where transmitter precomp with cutback doesn't appear as if it would work.
- Because of its adaptive capability (along with the advantages provided by its filter) AAF appears to provide excellent margin in all slots in this system.