25% Precomp Cutback Level Proposal

SCSI Parallel Working Group

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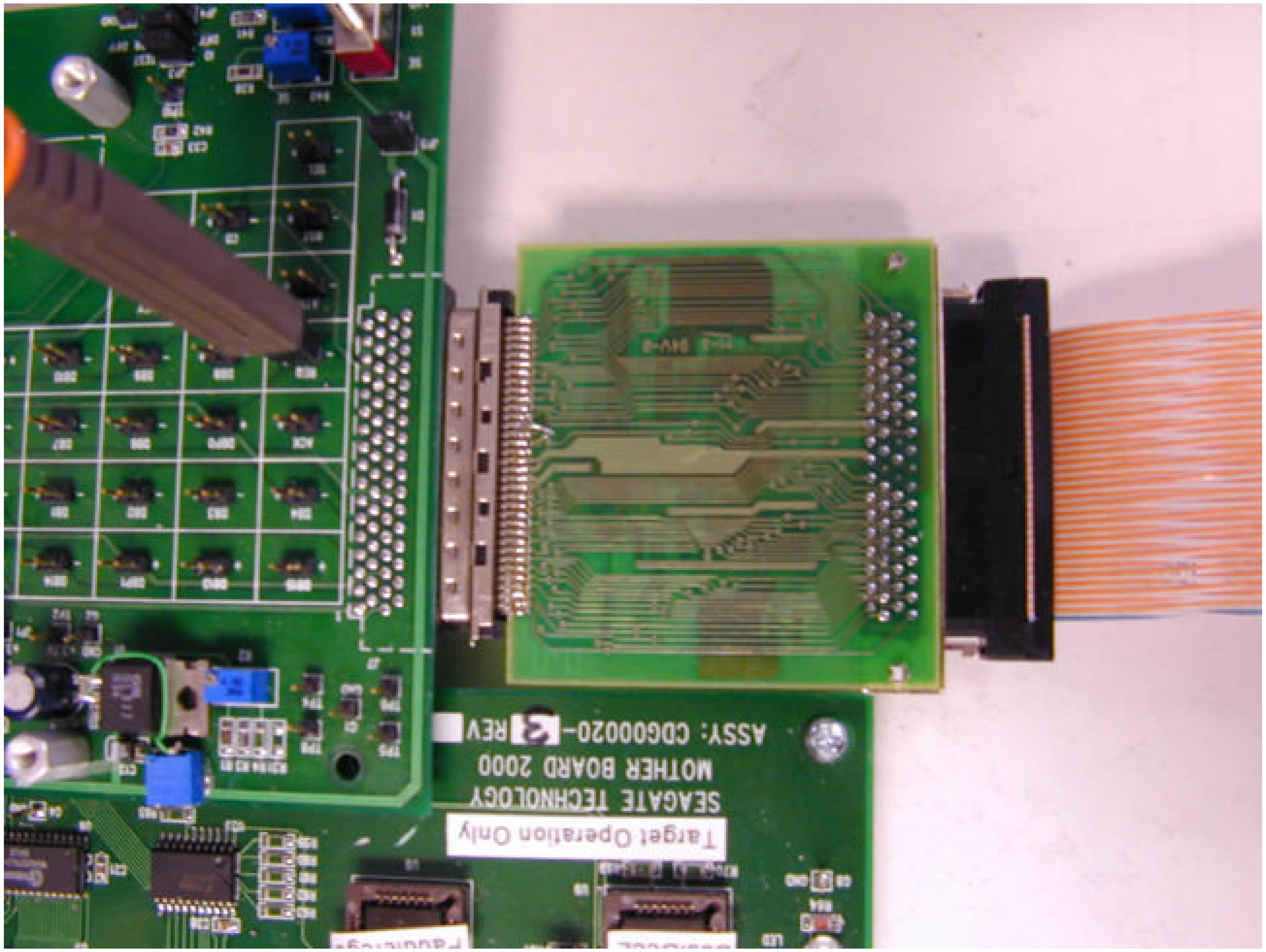
Seagate Technology

T10/01 – 136r0

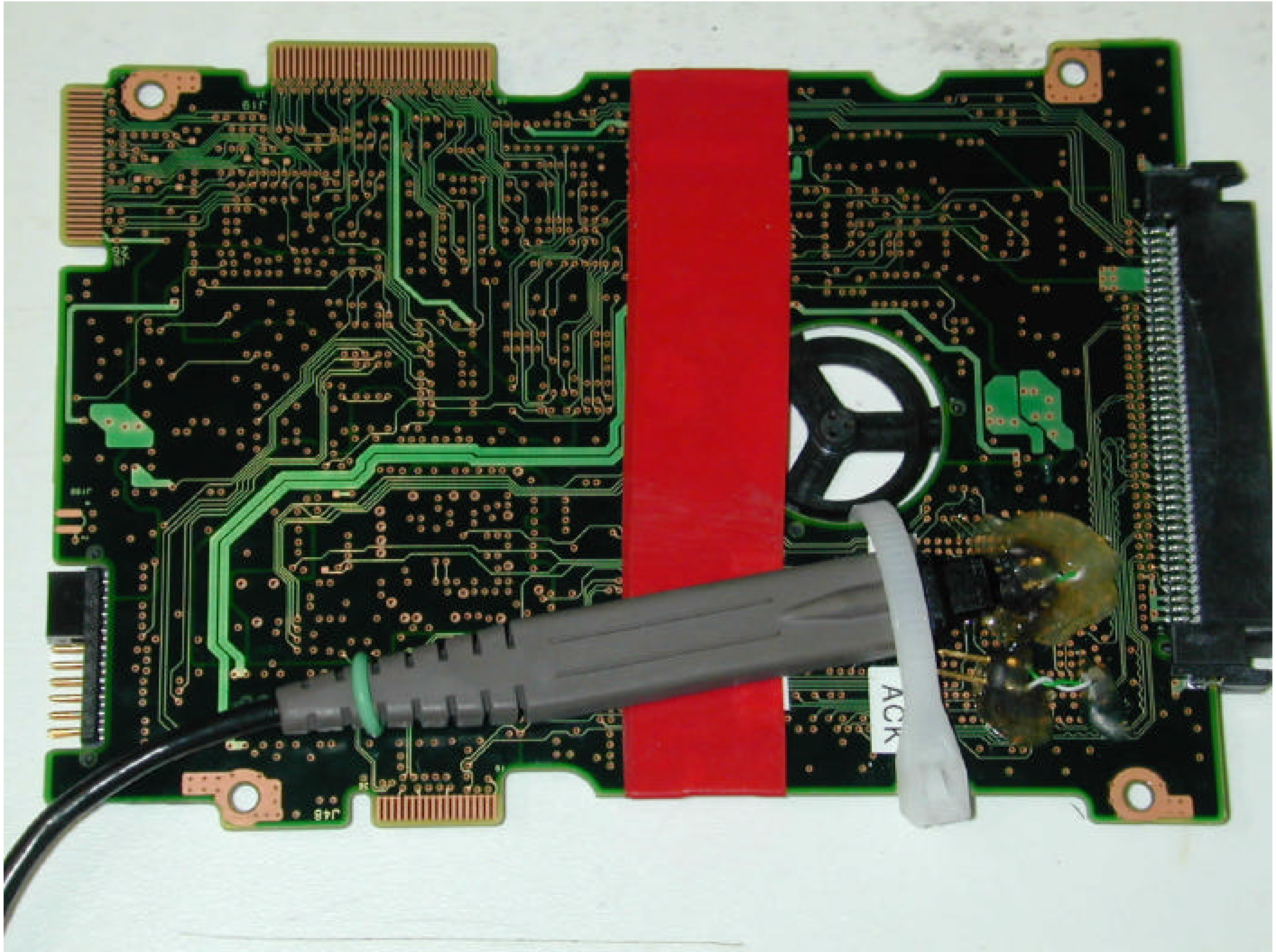
Data Collected

- Test Setup
- First Pulse
- Eye Pattern
- Statistical Data Collection
- Proposed Changes
- Conclusions

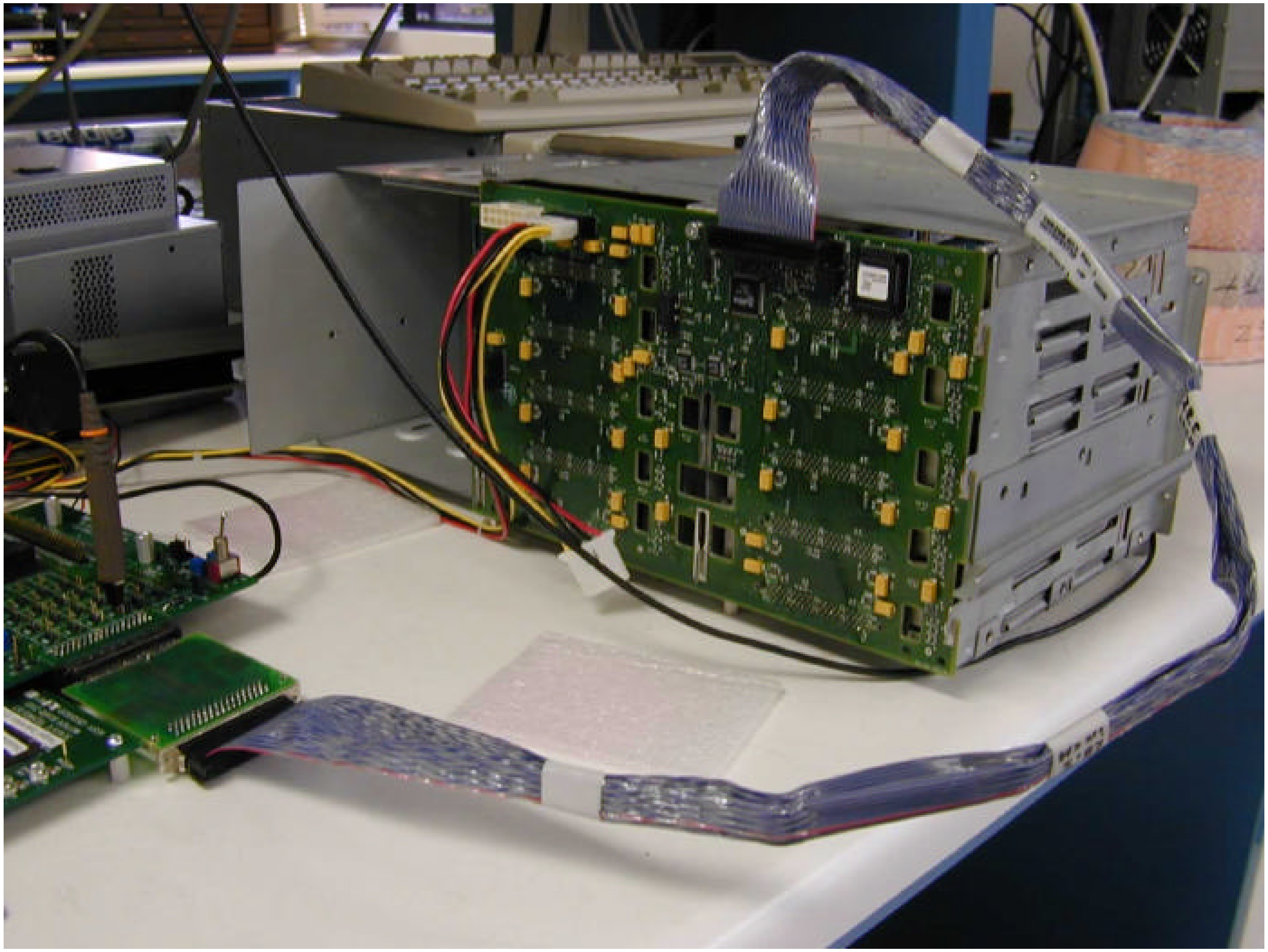
Test Setup


ASSY: CDG00020-
MOTHER BOARD 2000
SEAGATE TECHNOLOGY
Target Operation Only

Test Setup



Test Setup



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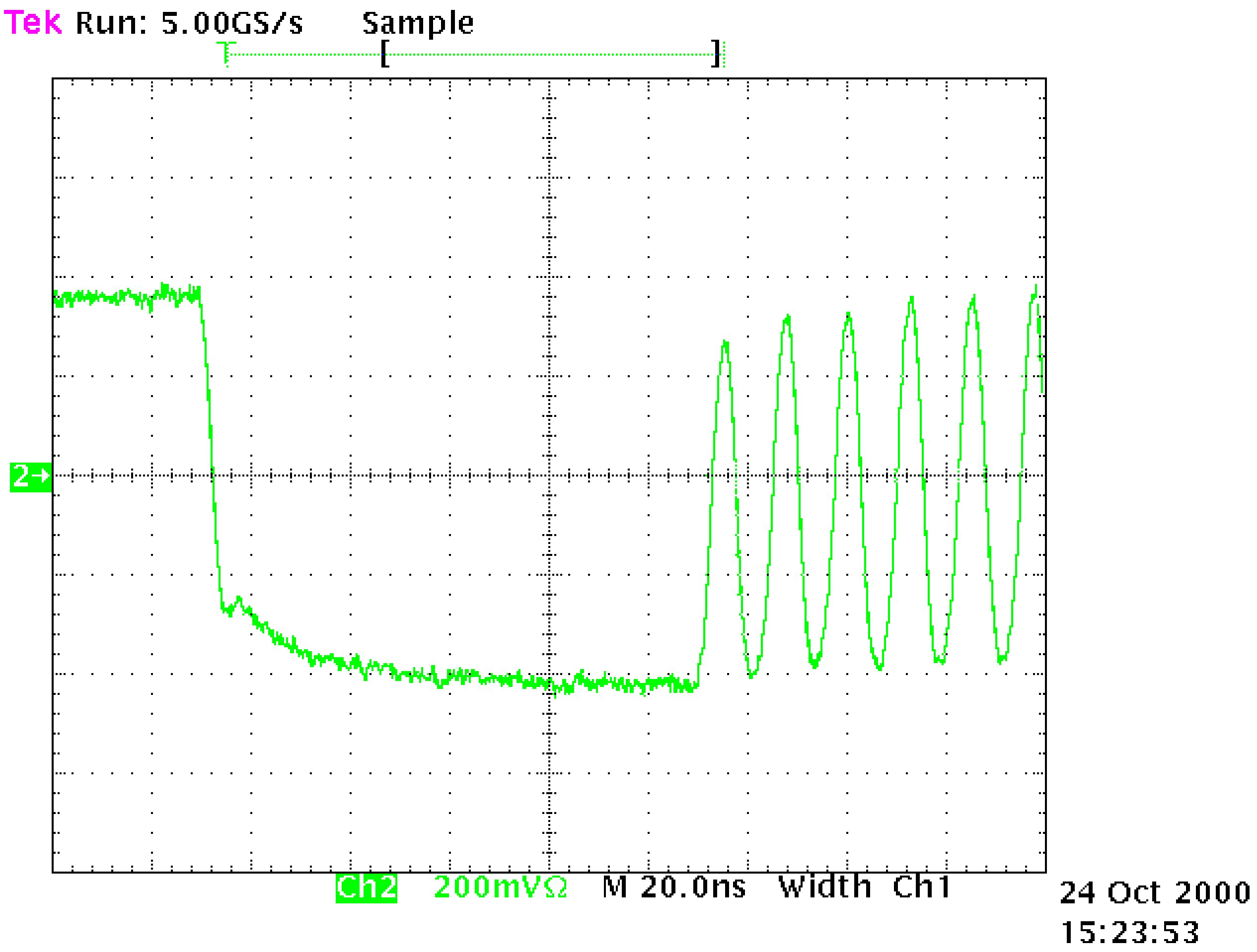
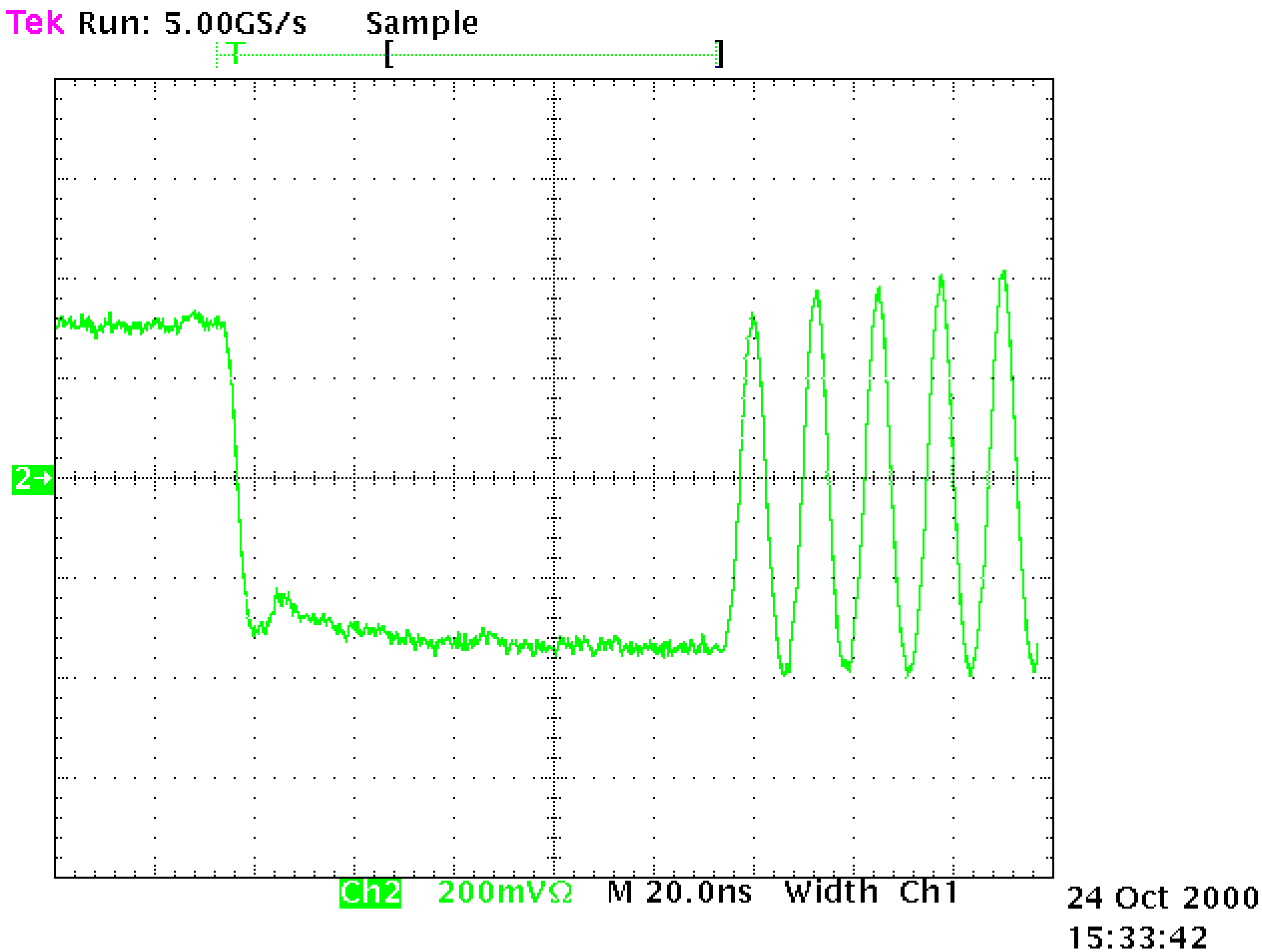
Data

- Many environments
  - 87 Cases of Backplanes with various supplied cables
    - 100 % required no precomp or AAF
    - 4% had increased margin with 25% cutback
    - 0% had increased margin with 50% cutback
  - First Pulse data – Graph showing histogram of amount of precomp required
  - Statistical data – Graphs showing # of standard deviations from threshold

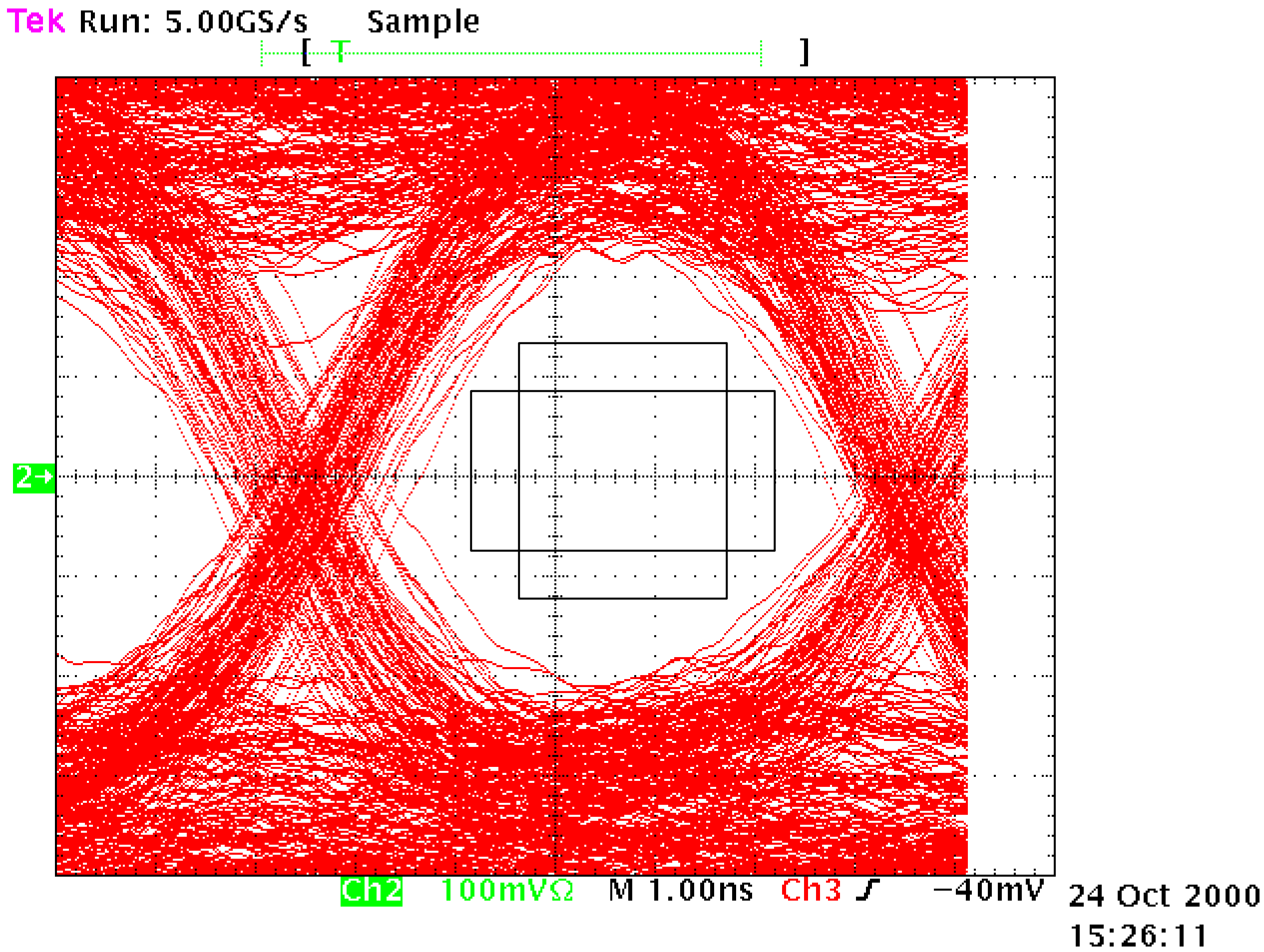
1st Pulse- Point to Point, 25m Round cable w/o Precomp



1st Pulse - Point to Point, 25m Round cable, with Precomp



Eye Diagram - Point to Point, 25m Round Cable w/o Precomp



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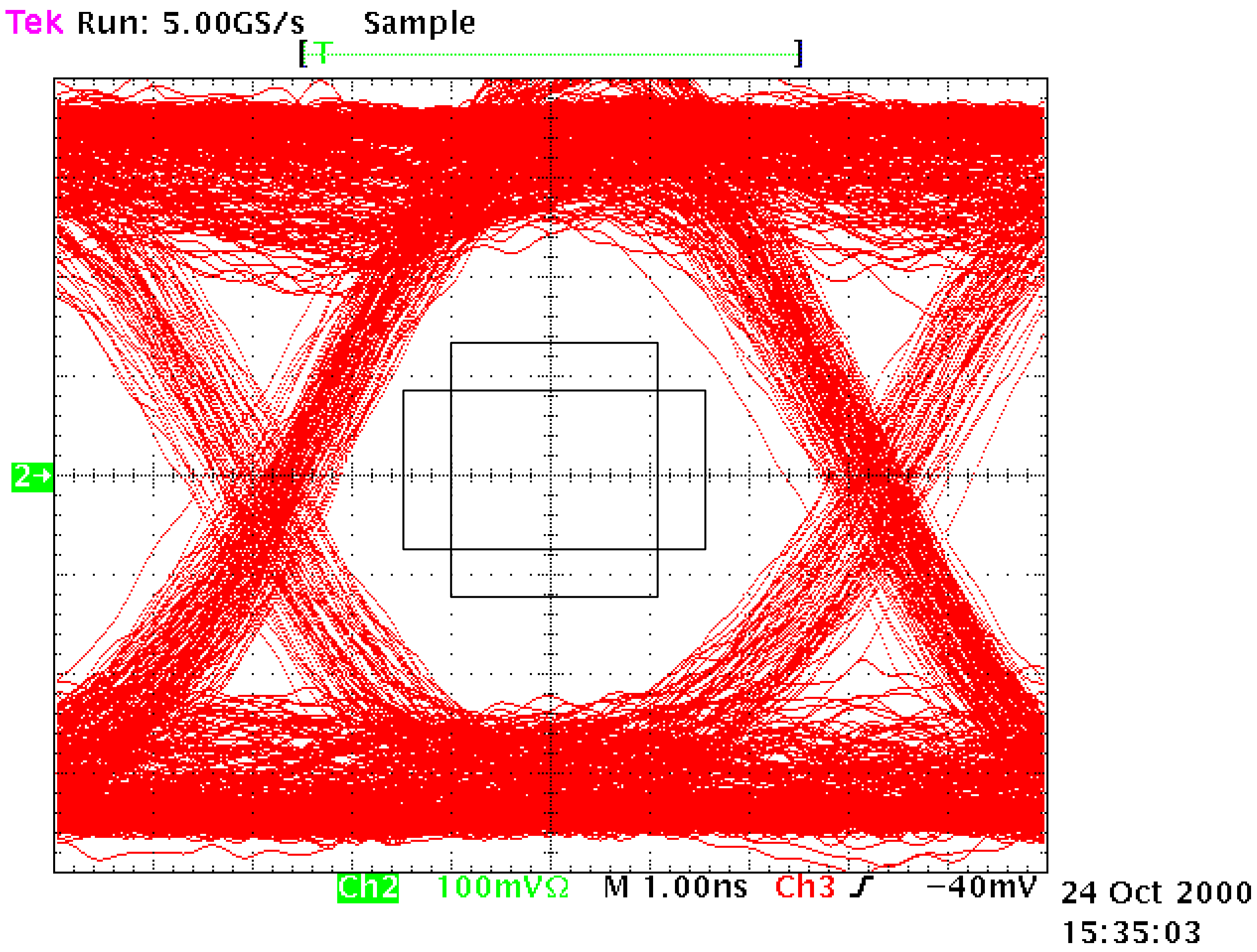
Eye Diagram - Point to Point, 25m Round Cable with Precomp



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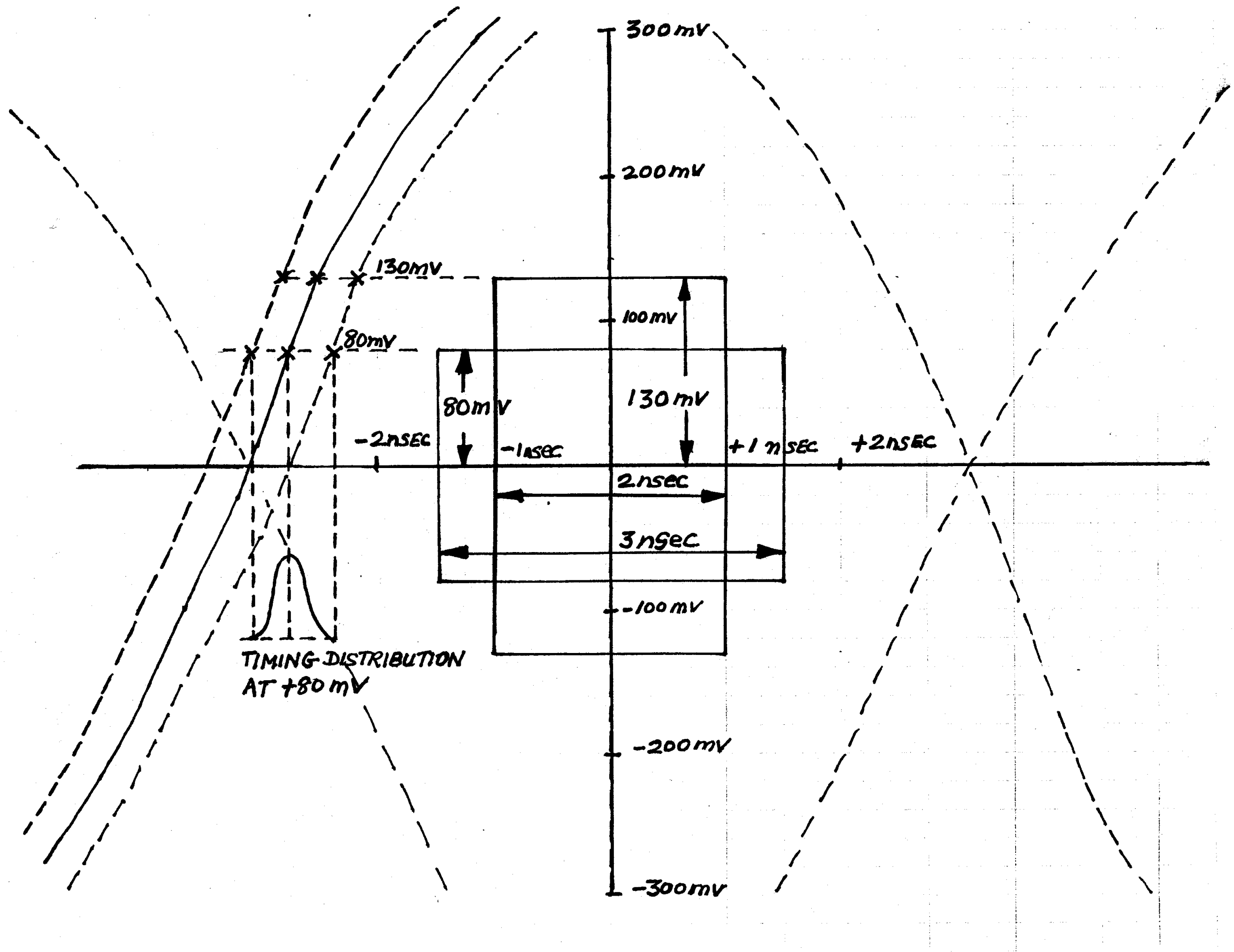
Statistical Data Collection



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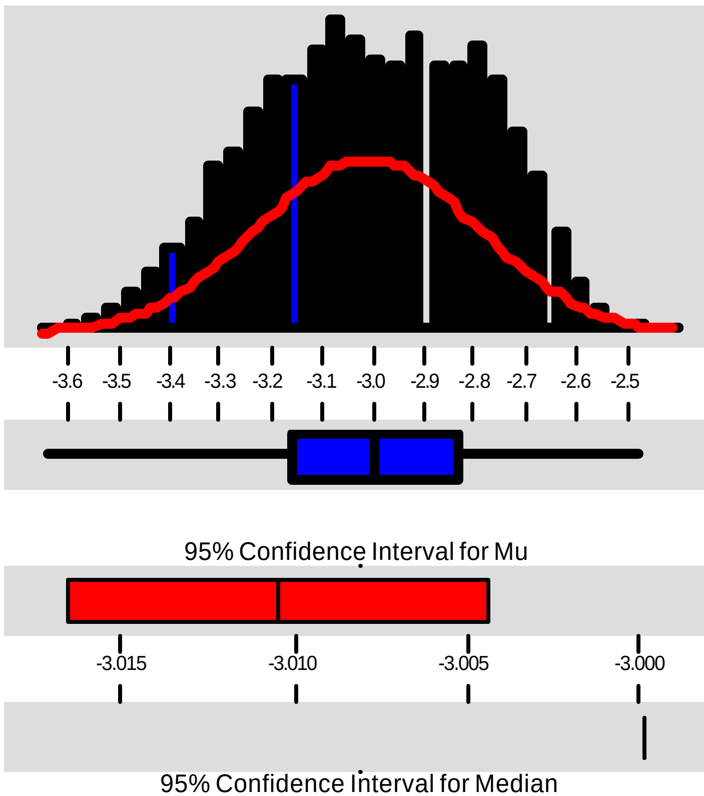
Timing Distribution - 80mv

Descriptive Statistics



Variable: -2.76

Anderson-Darling Normality Test

A-Squared:	22.049
P-Value:	0.000
Mean	-3.01047
StDev	0.21738
Variance	4.73E-02
Skewness	-1.4E-01
Kurtosis	-6.9E-01
N	4989
Minimum	-3.64000
1st Quartile	-3.16000
Median	-3.00000
3rd Quartile	-2.84000
Maximum	-2.48000

95% Confidence Interval for Mu

-3.01650 -3.00444

95% Confidence Interval for Sigma

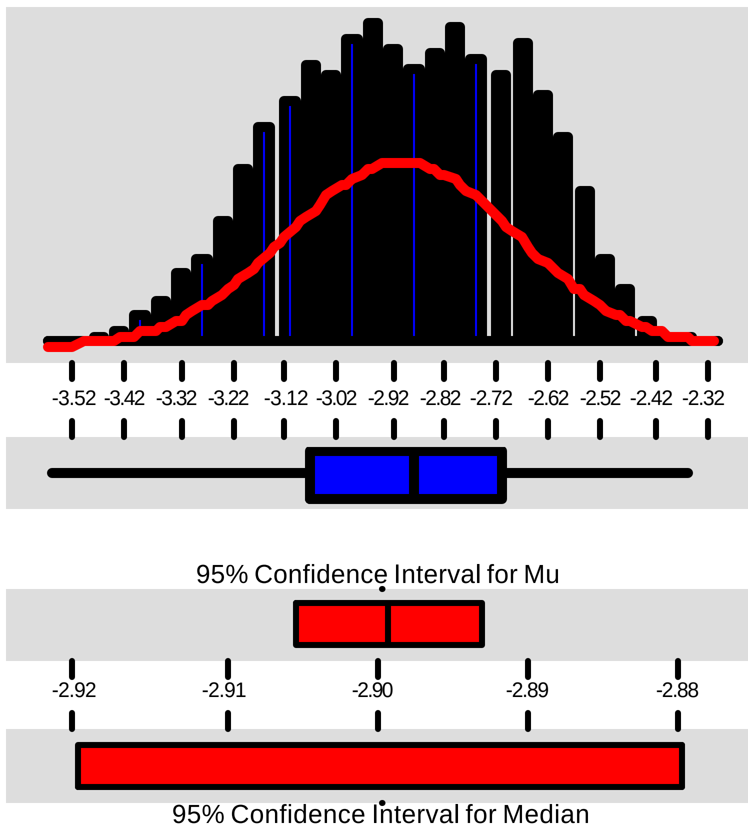
0.21320 0.22173

95% Confidence Interval for Median

-3.00000 -3.00000

Timing Distribution - 130mv

Descriptive Statistics



Variable: -2.68

Anderson-Darling Normality Test

A-Squared:	22.161
P-Value:	0.000
Mean	-2.89924
StDev	0.21751
Variance	4.73E-02
Skewness	-1.2E-01
Kurtosis	-7.1E-01
N	4989
Minimum	-3.56000
1st Quartile	-3.08000
Median	-2.88000
3rd Quartile	-2.72000
Maximum	-2.36000

95% Confidence Interval for Mu

-2.90528 -2.89321

95% Confidence Interval for Sigma

0.21332 0.22186

95% Confidence Interval for Median

-2.92000 -2.88000

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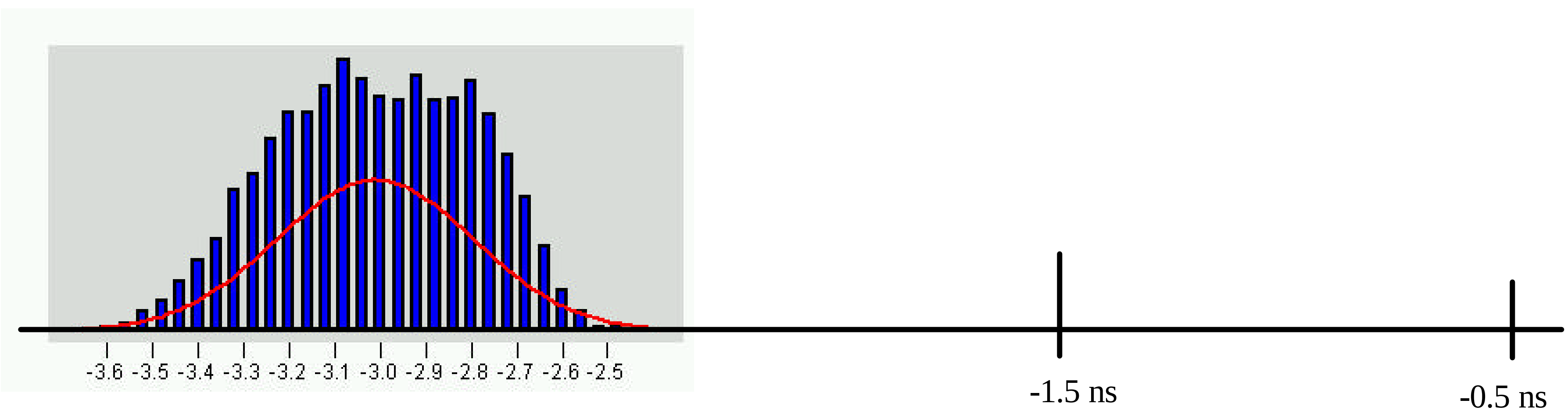
Goal is 6 sigma

- Sigma (standard deviation) is a measure of the 'narrowness' of the distribution
- 6 Sigma is 3+ failures in 1,000,000,000

Specification Limit and 80 mv Distribution

25% Cutback

Mean	-3.01047
StDev	0.21738
Variance	4.73E-02



Spec limit = -1.5 nsec

-3.01047 – (-1.5) = -1.51047

1.51047/.21738 = 6.95 sigma

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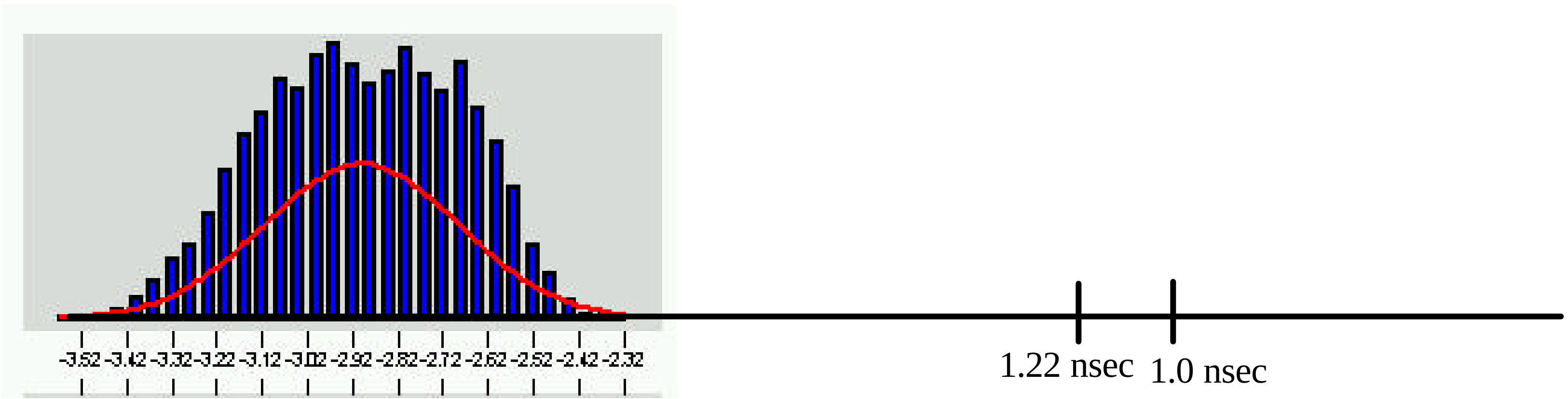
Specification Limit and 130 mv Distribution

25% Cutback

Mean	-2.89924
St Dev	0.21751
Variance	4.73E-02



Spec limit = -1.0 nsec

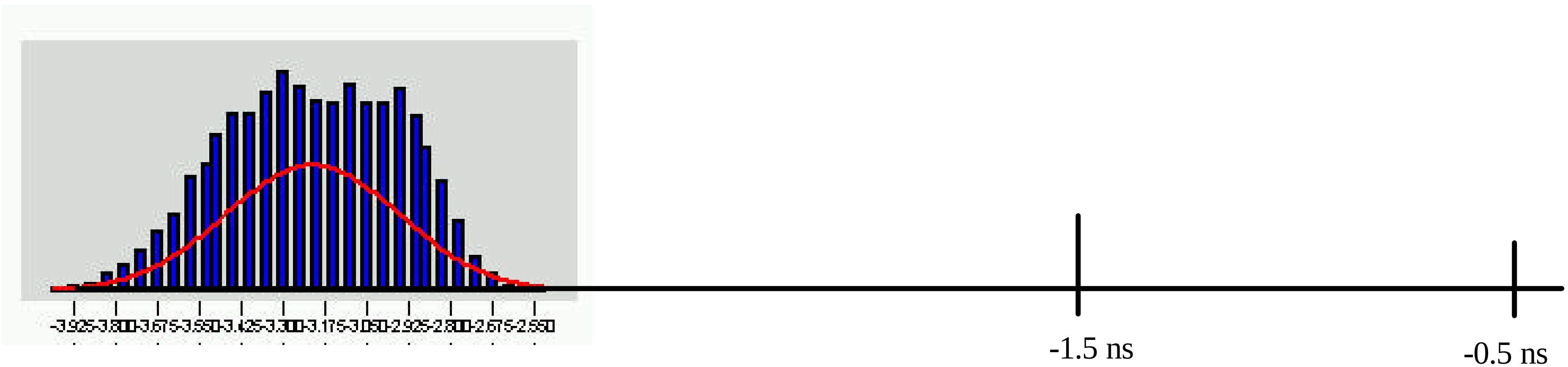
-2.89924 – (-1.0) = -1.89924

1.89924/.21751 = 8.73 sigma

Specification Limit and 80 mv Distribution

50% Cutback

Mean	-3.21257
StDev	0.26086
Variance	6.80E-02



Spec limit = -1.5 nsec

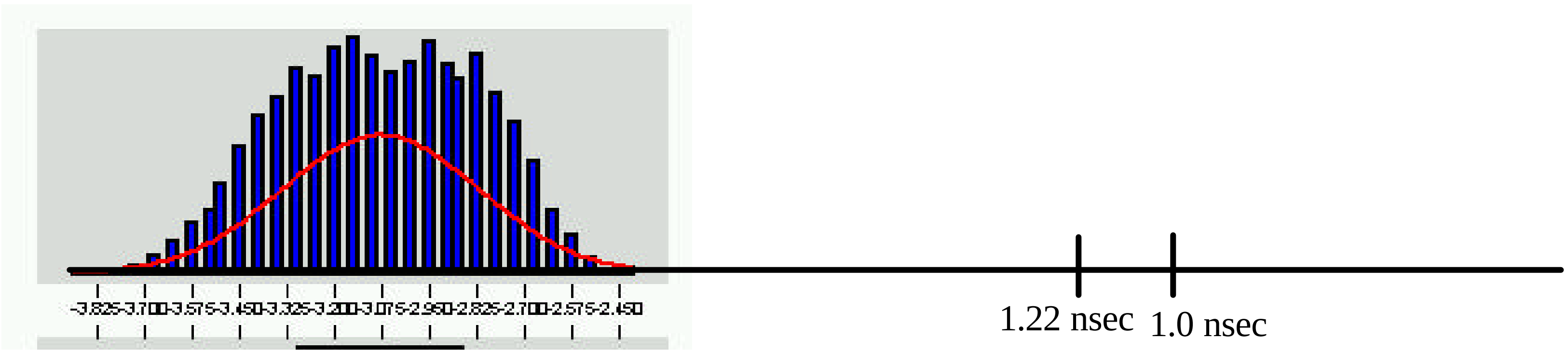
-3.21257 – (-1.5) = -1.71257

1.71257 /.26086 = 6.57 sigma (Vs. 6.95)

Specification Limit and 130 mv Distribution

50% Cutback

Mean	-3.07909
St Dev	0.26101
Variance	6.81E-02



Spec limit = -1.0 nsec

-3.07909 – (-1.0) = -2.07909

2.07909 /.26101 = 7.97 sigma (Vs. 8.73)

Engineering Judgment

- Given a distribution an engineer picks the value which best satisfies the broadest range of cases
- Of all the cases measured which are actual systems being shipped, none could be found that requires 50% cutback
- Let us not be myopic and set a level for all cases to that required by one which appears by supposition only, at the detriment of the 99+% of the cases.

Other Issues to Consider

- Power is an issue – Power (heat) relates to reliability
- With 50% cutback, the primary driver is at an extremely high level – even for minimum drive strength.
- Should we risk lowering reliability for the sake of covering a academic case? – NO!

How much ISI is compensated for?

- Table 37 - SCSI Fast-160 timing budget template states:

  "ISI Compensation | 2,0 ns | Assumes 50% of ISI is compensated"

- 50% cutback compensates for 100+% of the ISI

25% Cutback Proposal

- Change Paragraph **A.2.1 Driver requirements overview** in Annex A to read:

"If precompensation is enabled, the weak driver amplitude shall be a minimum of ~~50~~ 60% to a maximum of ~~66~~ 75% of the strong driver amplitude after the first bit of a series of adjacent ones or adjacent zeros."

Proposal (cont.)

- Change NOTE 49 to read:
- "If a weak driver is driving with the minimum amplitude specified in table A.2, then the 370 mV weak driver translates to a strong driver of ~~560~~ 493 mV for the ~~66~~ 75 % case ranging up to ~~740~~ 616 mV for the ~~50~~ 60 %case."

Conclusion

- 25% cutback gives superior performance to 50% cutback
- 50% cutback increases power
- One would be better off (if more power is acceptable) to use 25% cutback and increase average voltage. This increases the mean but keeps standard deviation the same (I.e. increases # of sigmas from mean to specification limit)