What Is a High-Speed Eye Diagram?

TI Precision Labs - Signal Conditioning

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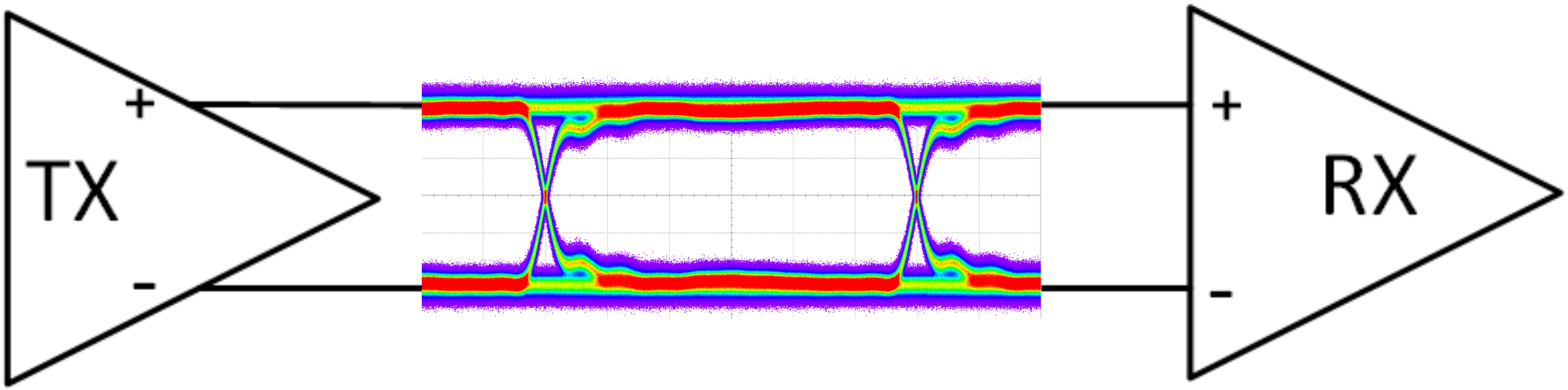
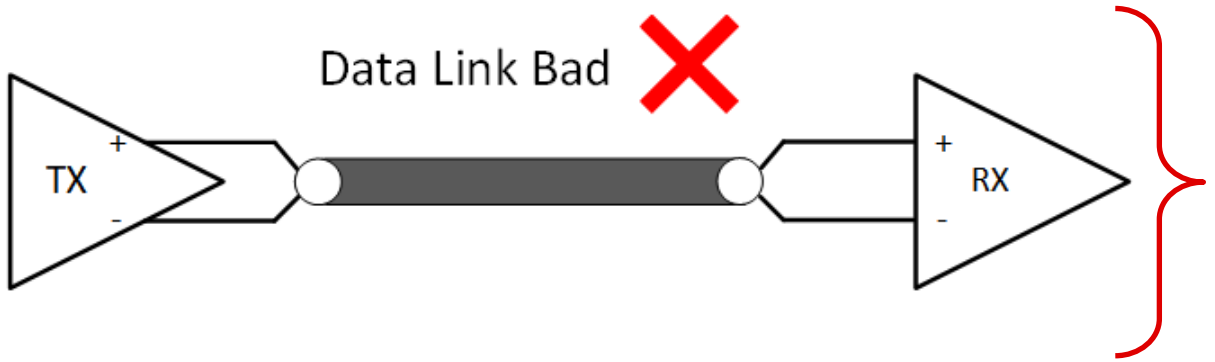
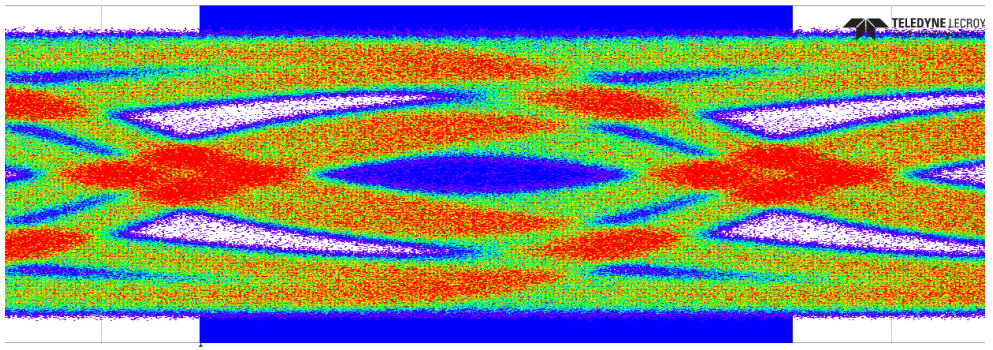
What is an eye diagram?

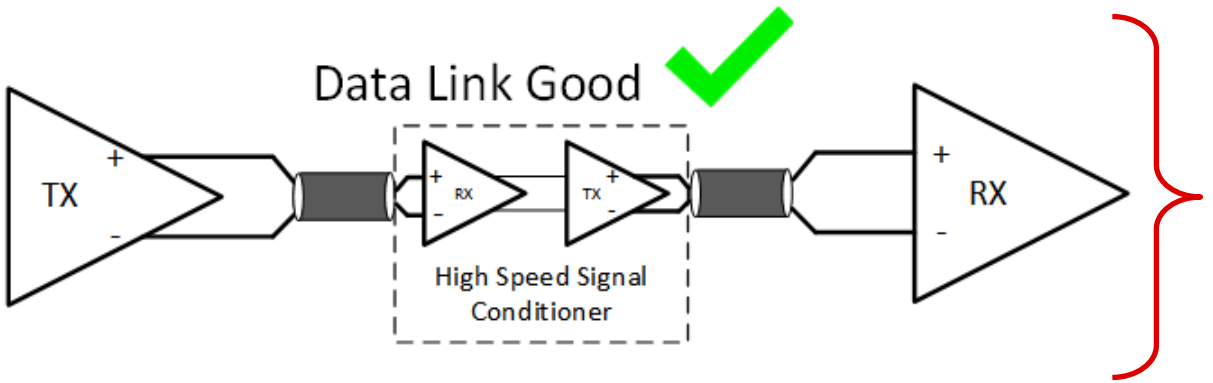


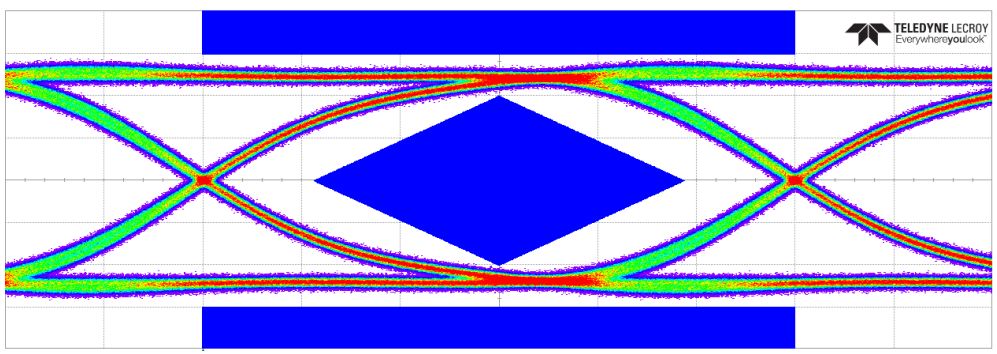
Data-dependent electrical measurement used to evaluate high-speed data quality and high-speed transmitter/receiver performance.

Why use an eye diagram?

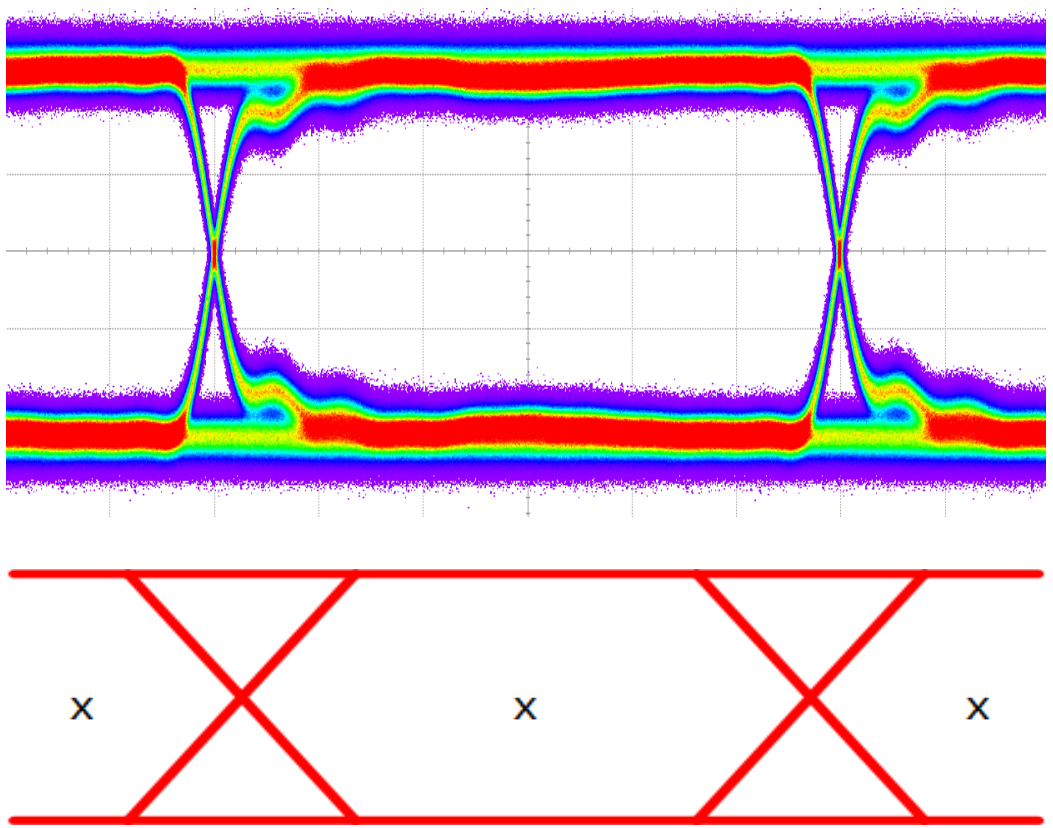




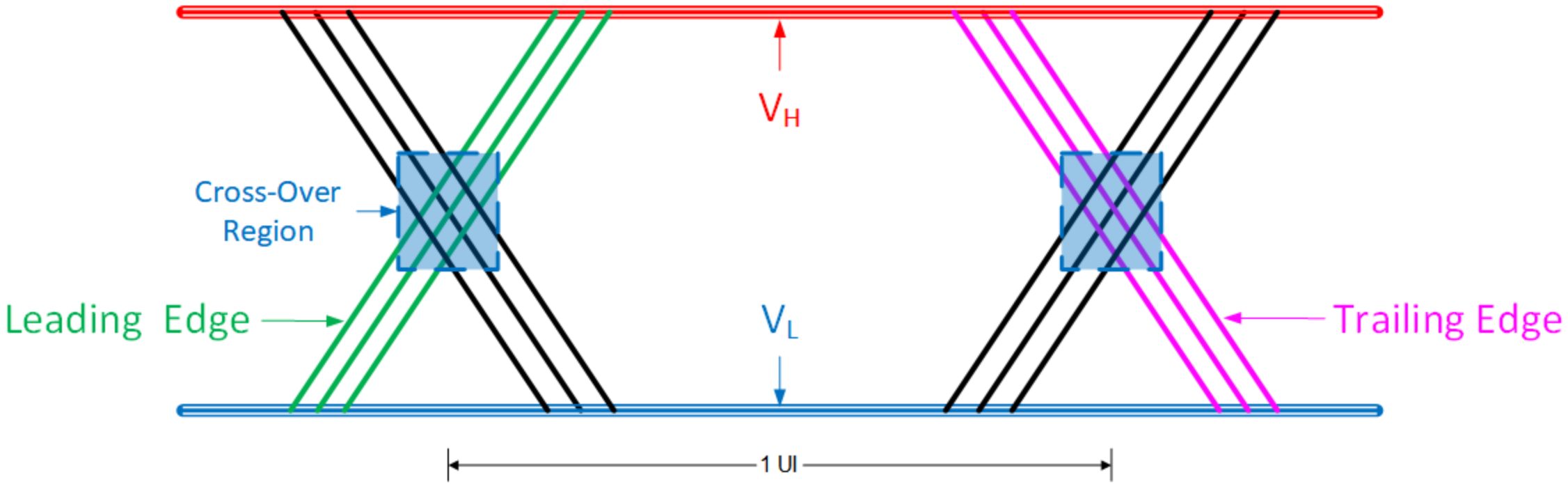




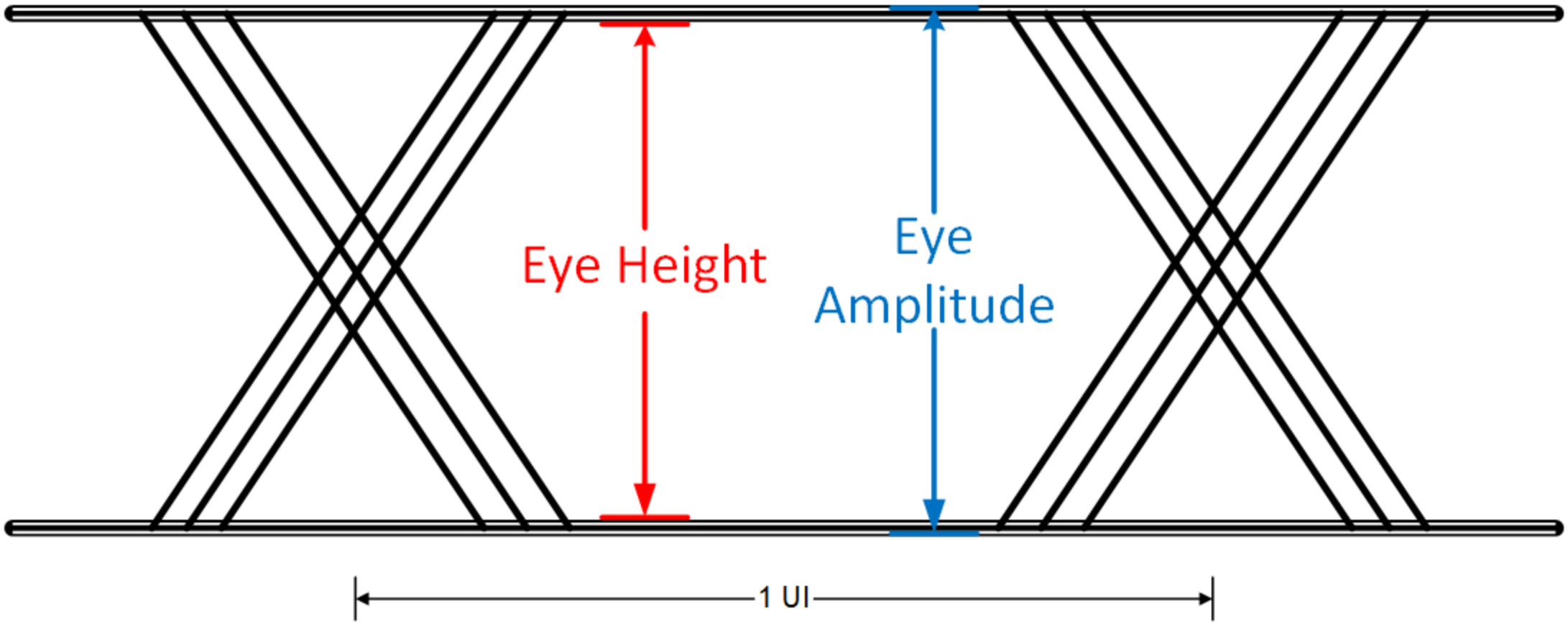
Constructing an eye diagram



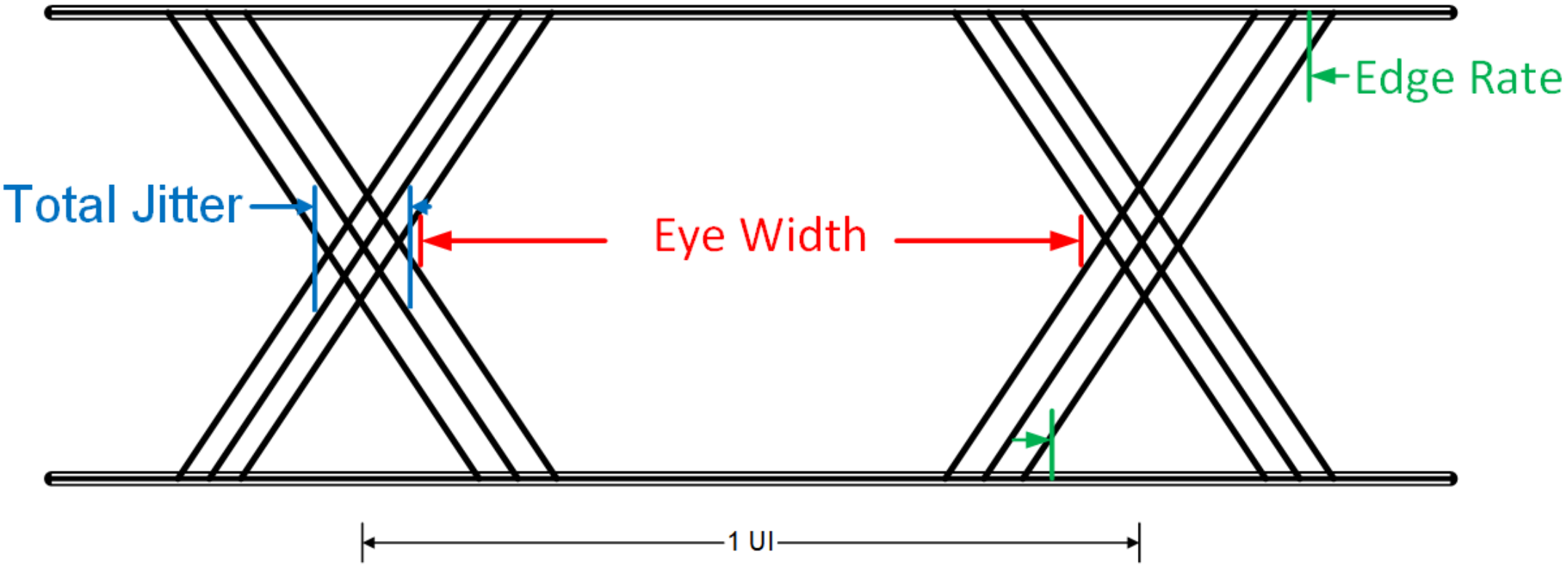
Anatomy of an eye diagram



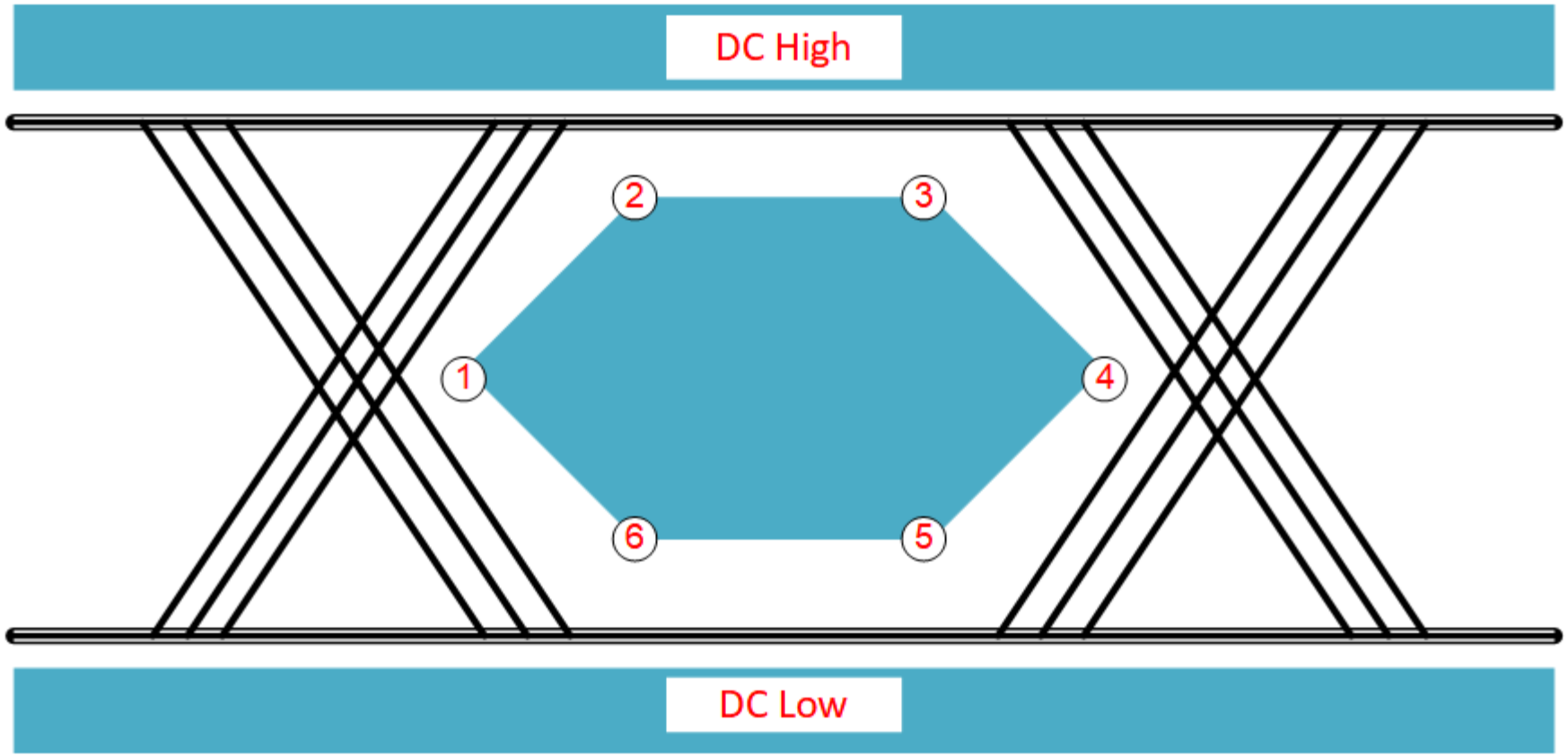
Measuring an eye diagram



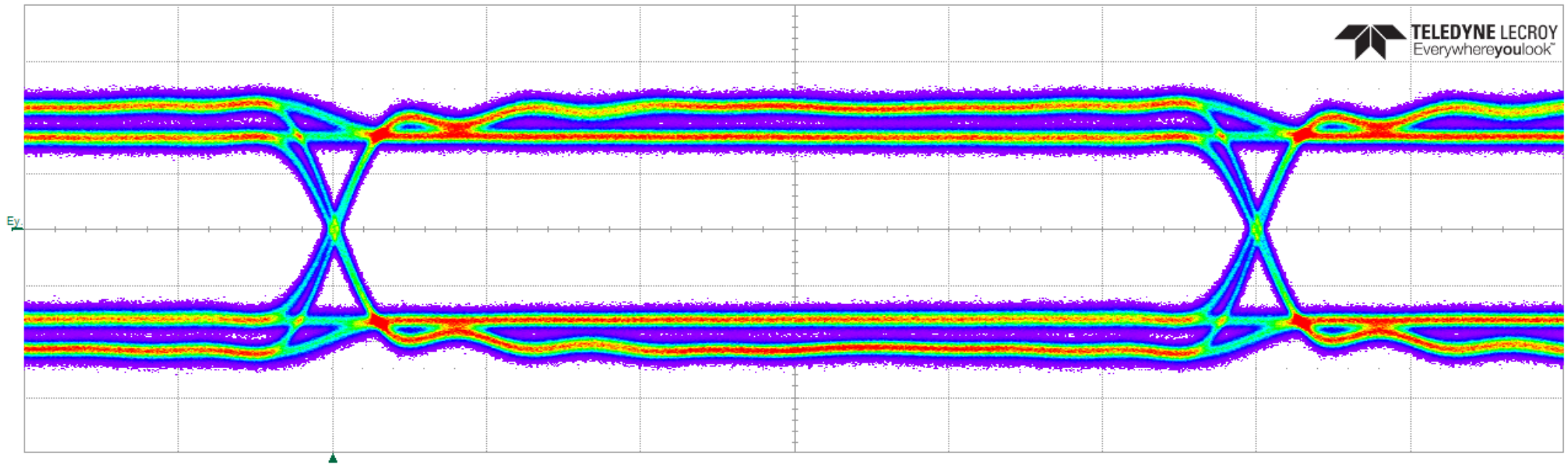
Measuring an eye diagram



What is an eye mask?



Practical implications – transmitter perspective



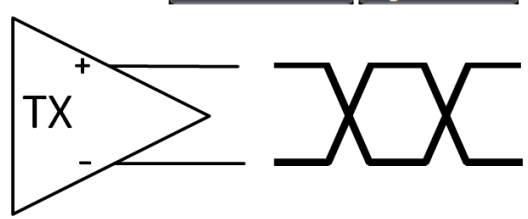
Eye
500 mV/div
67 ps/div
327.314 k#

Timebase 0.0 ns
20.0 ns/div
8.00 kS 40 GS/s

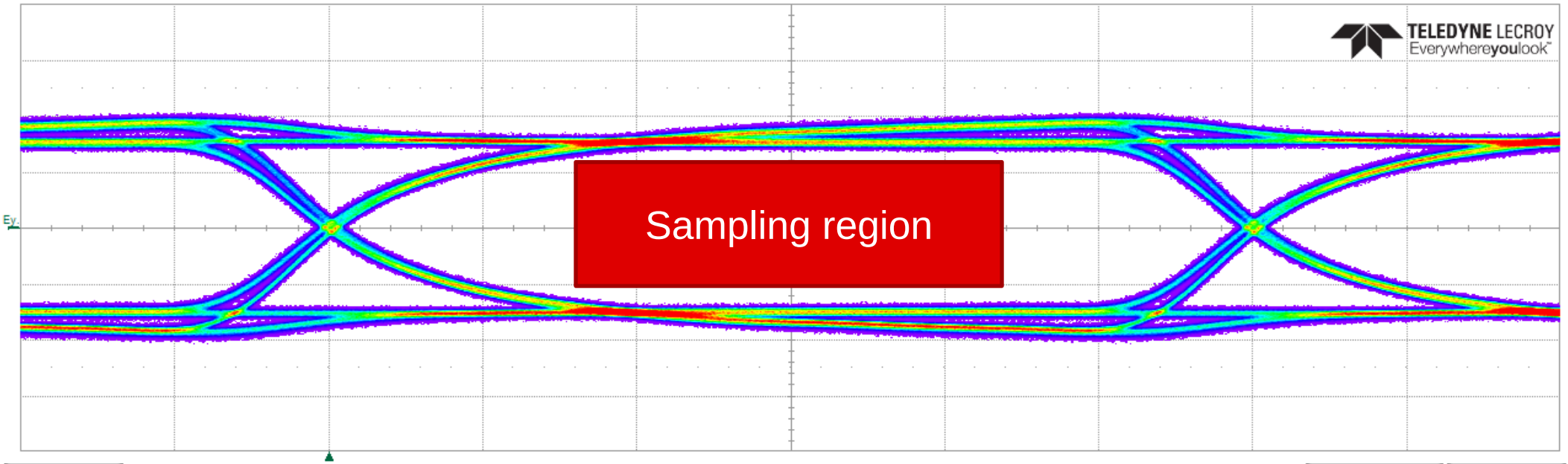
Trigger C1 DC
Auto 10 mV
Edge Either

SDA Eye	EyeHeight	EyeOne	EyeZero	EyeAmpl	EyeWidth
Lane1	1.054 V	950 mV	-944 mV	1.894 V	389.2 ps

SDA Jitter	Tj(1e-12.0)	Rj(sp)	Dj(sp)	Pj	ISI	DCD	DDj	BitRate
Lane1	14.866 ps	733 fs	4.548 ps	80e-15	4.751 ps	72 fs	4.751 ps	2.5017 Gbit/s



Practical implications – receiver perspective



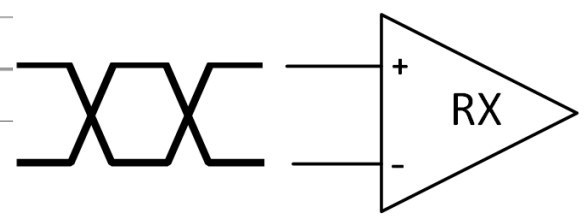
Eye
500 mV/div
67 ps/div
328.167 k#

Timebase 0.0 ns
20.0 ns/div
8.00 kS 40 GS/s

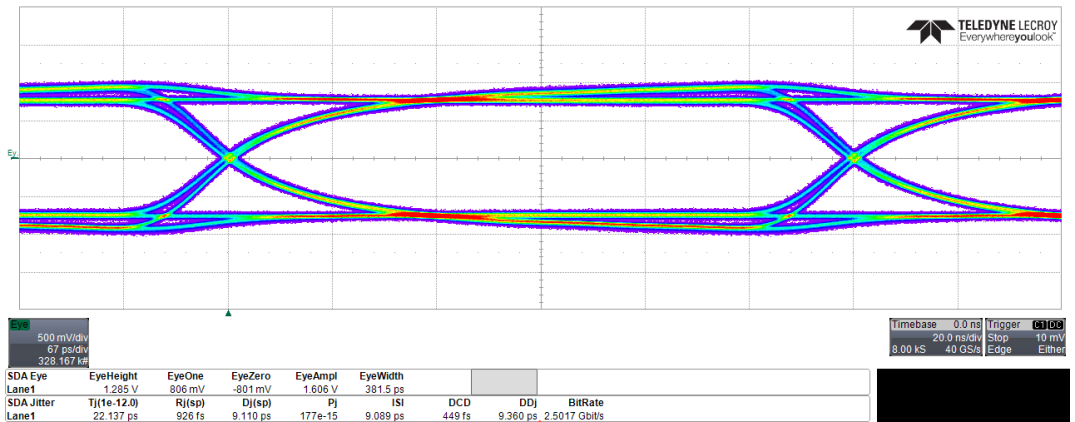
Trigger C1 DC
Stop 10 mV
Edge Either

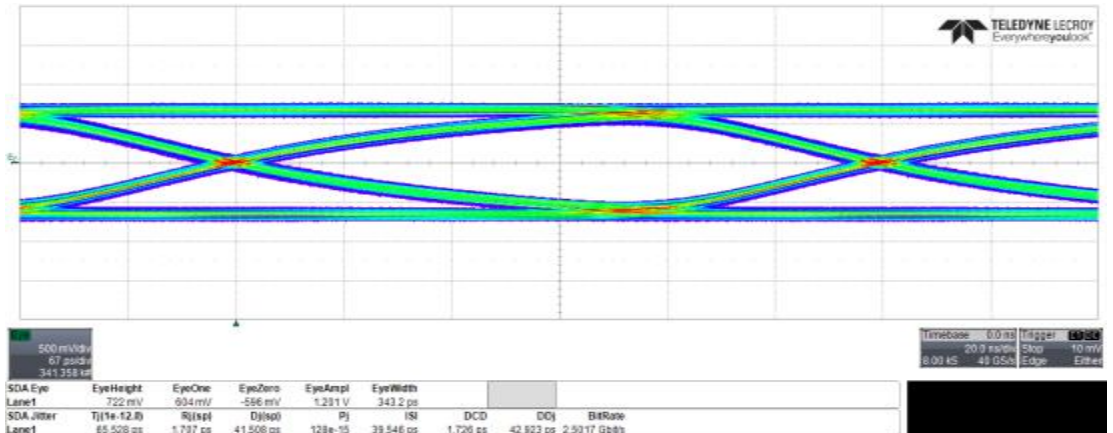
SDA Eye	EyeHeight	EyeOne	EyeZero	EyeAmpl	EyeWidth
Lane1	1.285 V	806 mV	-801 mV	1.606 V	381.5 ps

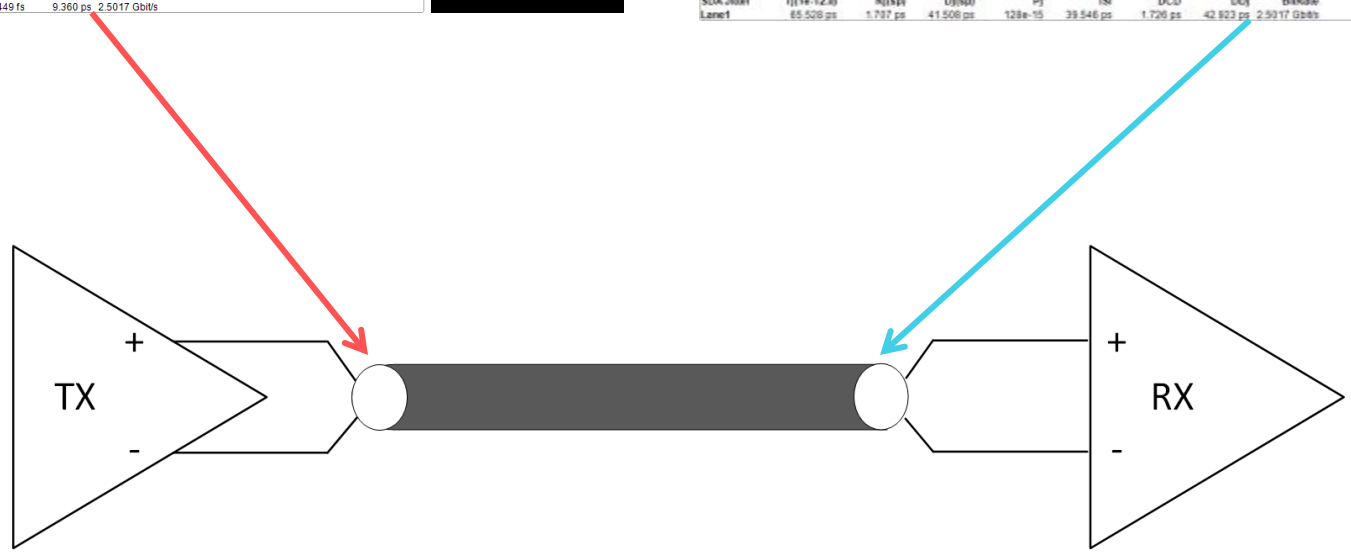
SDA Jitter	Tj(1e-12.0)	Rj(sp)	Dj(sp)	Pj	ISI	DCD	DDj	BitRate
Lane1	22.137 ps	926 fs	9.110 ps	177e-15	9.089 ps	449 fs	9.360 ps	2.5017 Gbit/s



Practical implications – system perspective







Short quiz

- Check all correct statements:
  A. Eye diagrams are an electrical measurement that is not data dependent.
  B. Adding high-speed signal conditioners can improve an eye diagram.
  C. Eye diagrams are constructed by overlaying different bit transitions over time.
  D. Eye diagrams only contain vertical measurements.
- Check all correct statements:
  A. Eye diagrams contain trailing and leading edges.
  B. Eye diagrams can be verified with an eye mask.
  C. Random jitter can be measured from an eye diagram.
  D. Edge rate can be measured from an eye diagram.
- True or False:
  A. Eye diagrams can only contain two discrete DC voltage levels.