DUNE Optical Test Stand
Setup and First Measurements
At Room Temperature

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Summary

The optical test stand described in earlier presentations has been (it was powered down when not in use over the summer to relieve the cooling system burden)

The tests to be carried out on the components of interest for DUNE cryogenic links (SFP+ modules to start with) have been verified.

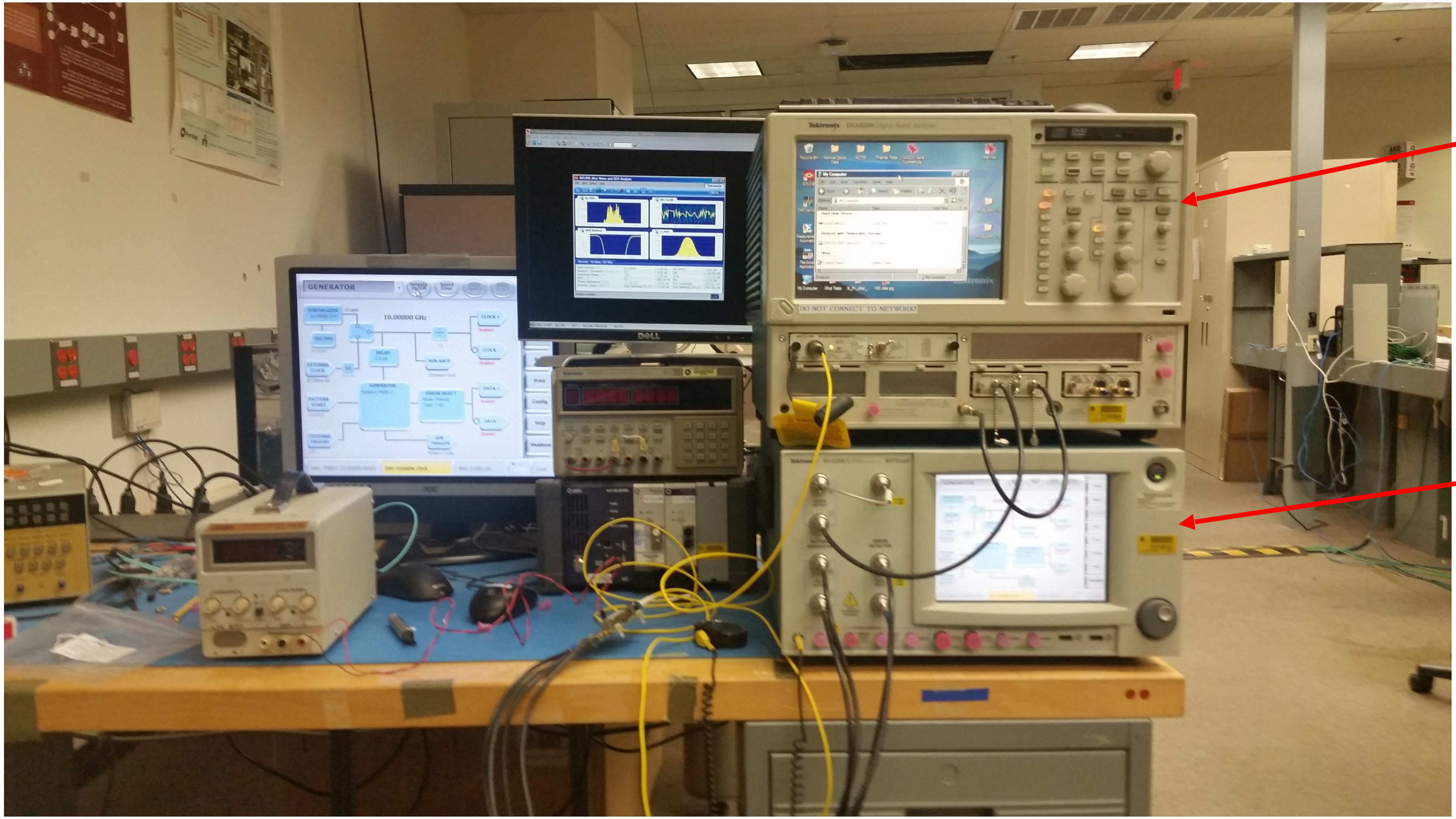
Presented here are initial room temperature test results including tests on two categories of devices:

SFP+ TRx devices with Fabry-Perot (F-P) Lasers as transmitters.
SFP+ TRx devices with Distributed FeedBack (DFB) Lasers as transmitters.

In the results presented here, the receiver channel (Rx) of each device was left unpowered and no optical signal was presented to its input. This was done to more accurately characterize the power consumption of the transmitter channel (Tx) only (a figure of merit of importance to DUNE). The SMA connectors on the Rx outputs were terminated with 50 Ohms to ground to help prevent any chatter that might occur.

The test configuration block diagrams have been presented in earlier presentations and are not repeated here.

Key Test Stand Components



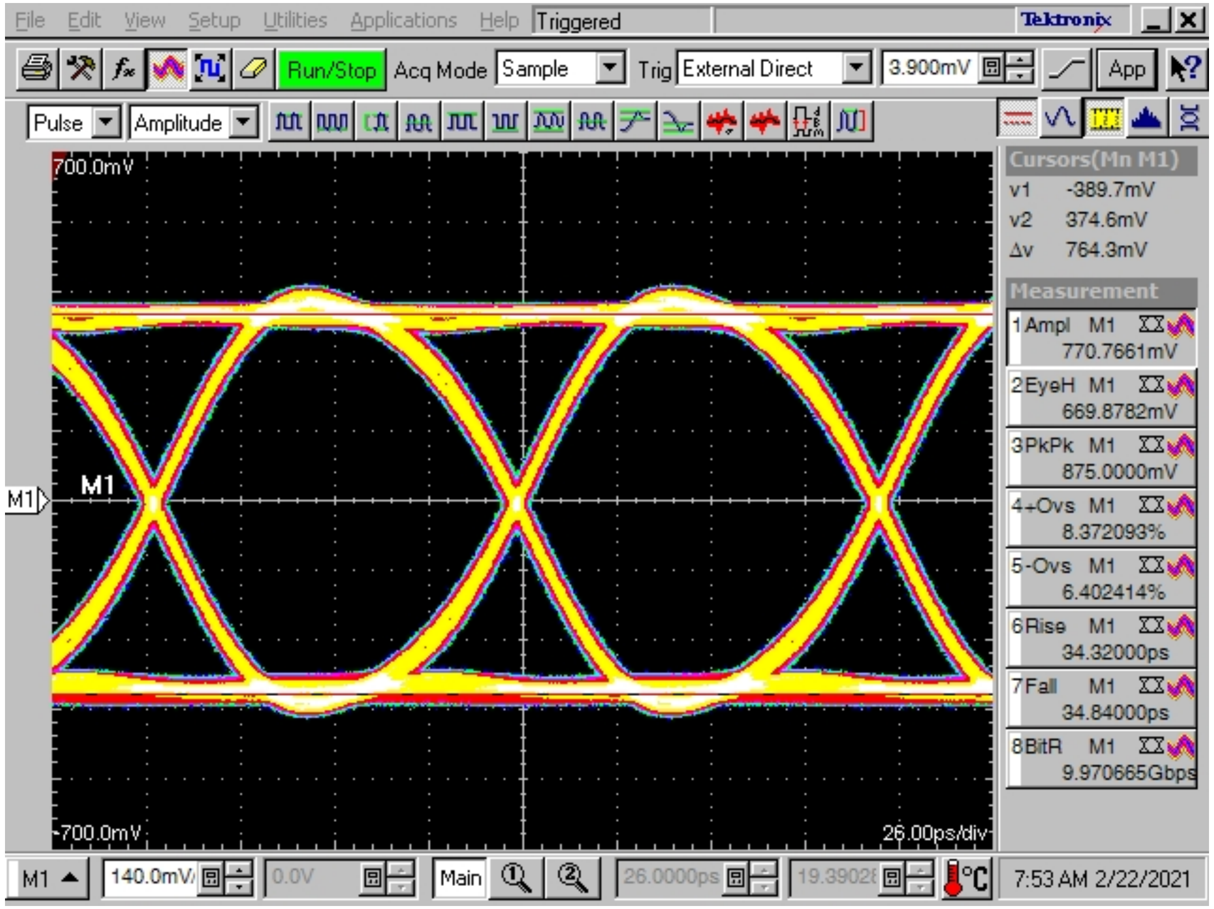
Tektronix DSA8200:

Optical Sampling
Electrical Sampling
Optical Jitter
Electrical Jitter

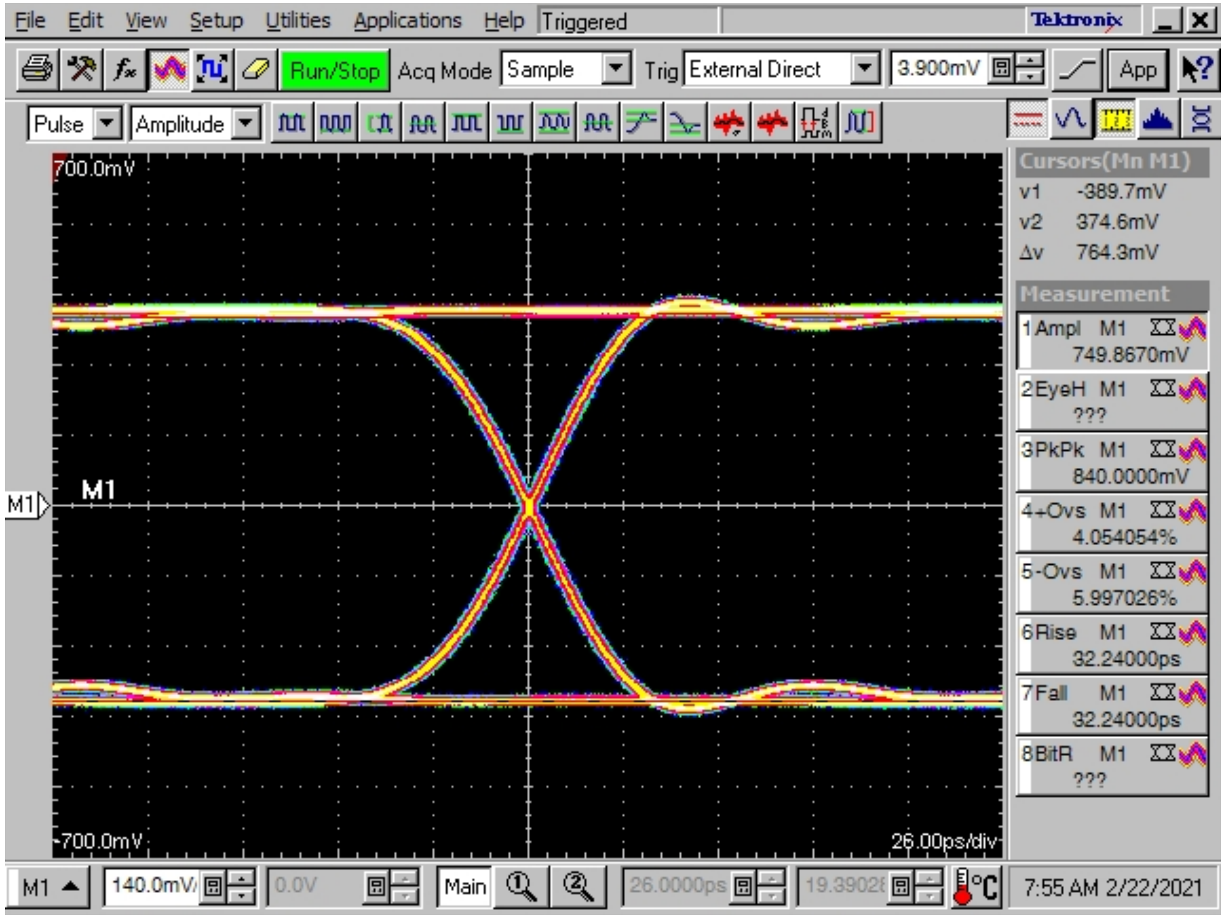
Tektronix BSA286CL BER Tester:

Electrical Pattern Generator
Electrical Error Checker

BSA286CL Pattern Generator Electrical Eyes
10 Gbps PRBS7 (127 bits); LVDS Levels; AC Coupled



Data Rate: 10 Gbps



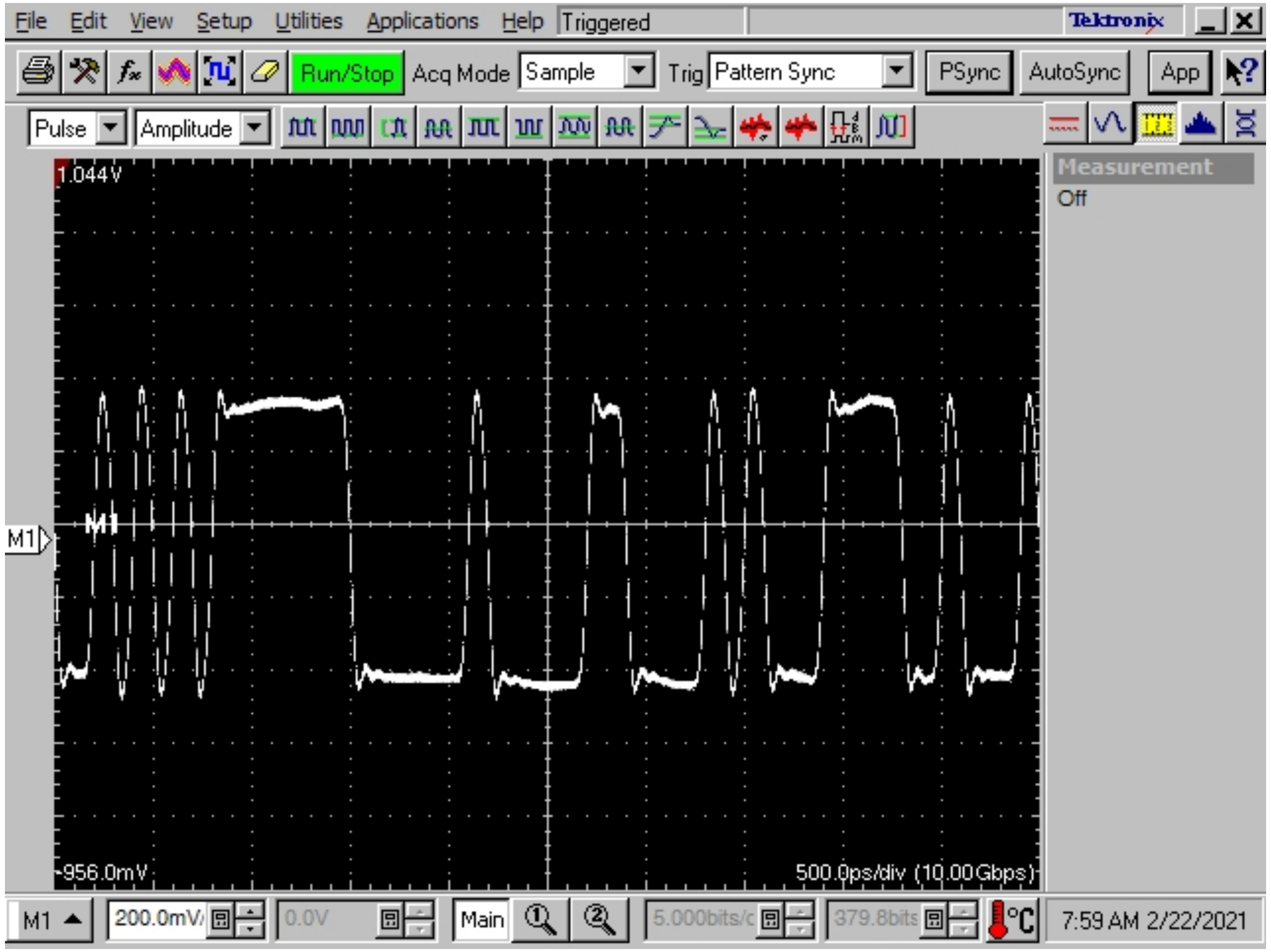
Source Rise Time (t_{src}(rise)): 32.2 ps

Source Fall Time (t_{src}(fall)): 32.2 ps

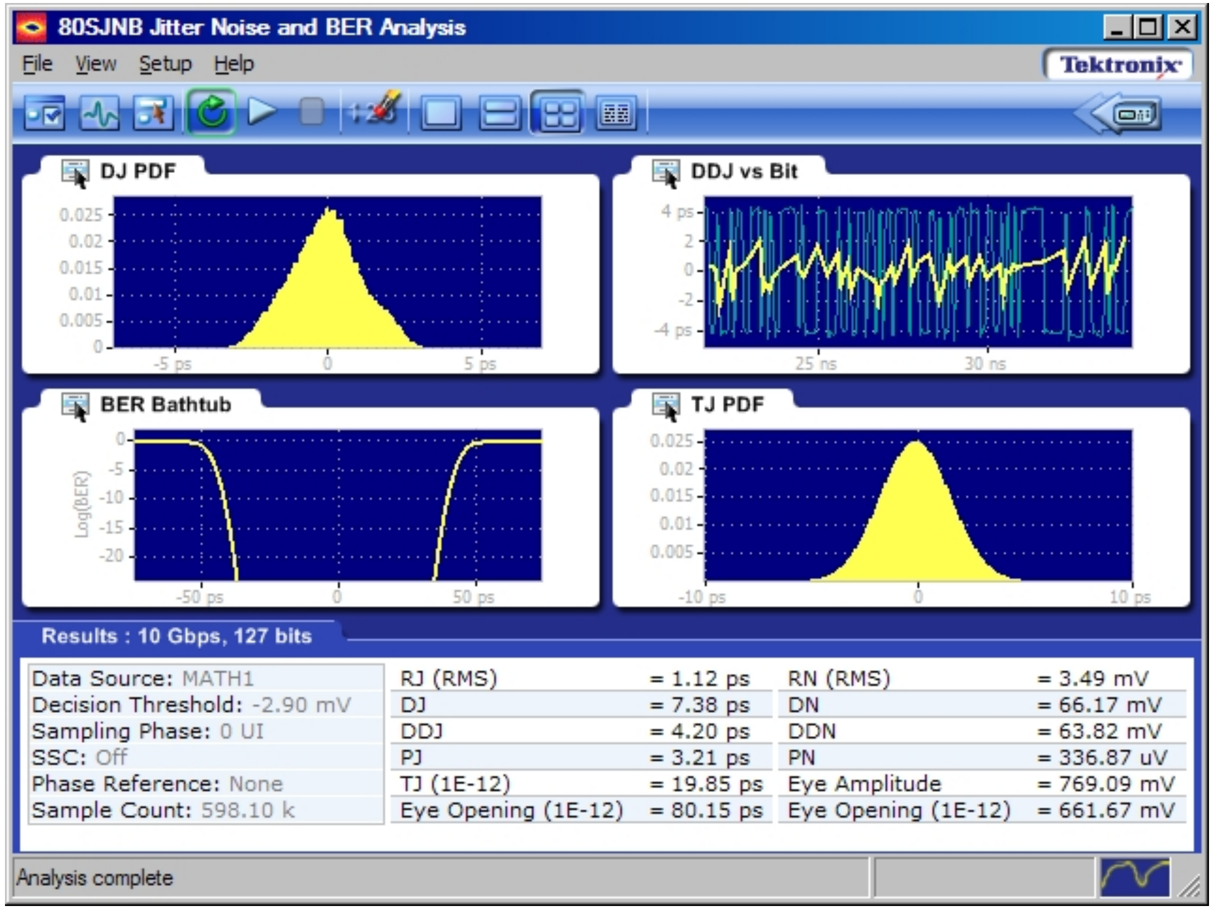
These are the measurements obtained on the source which are needed for compensation to characterize the rise/fall times of the DUT itself.

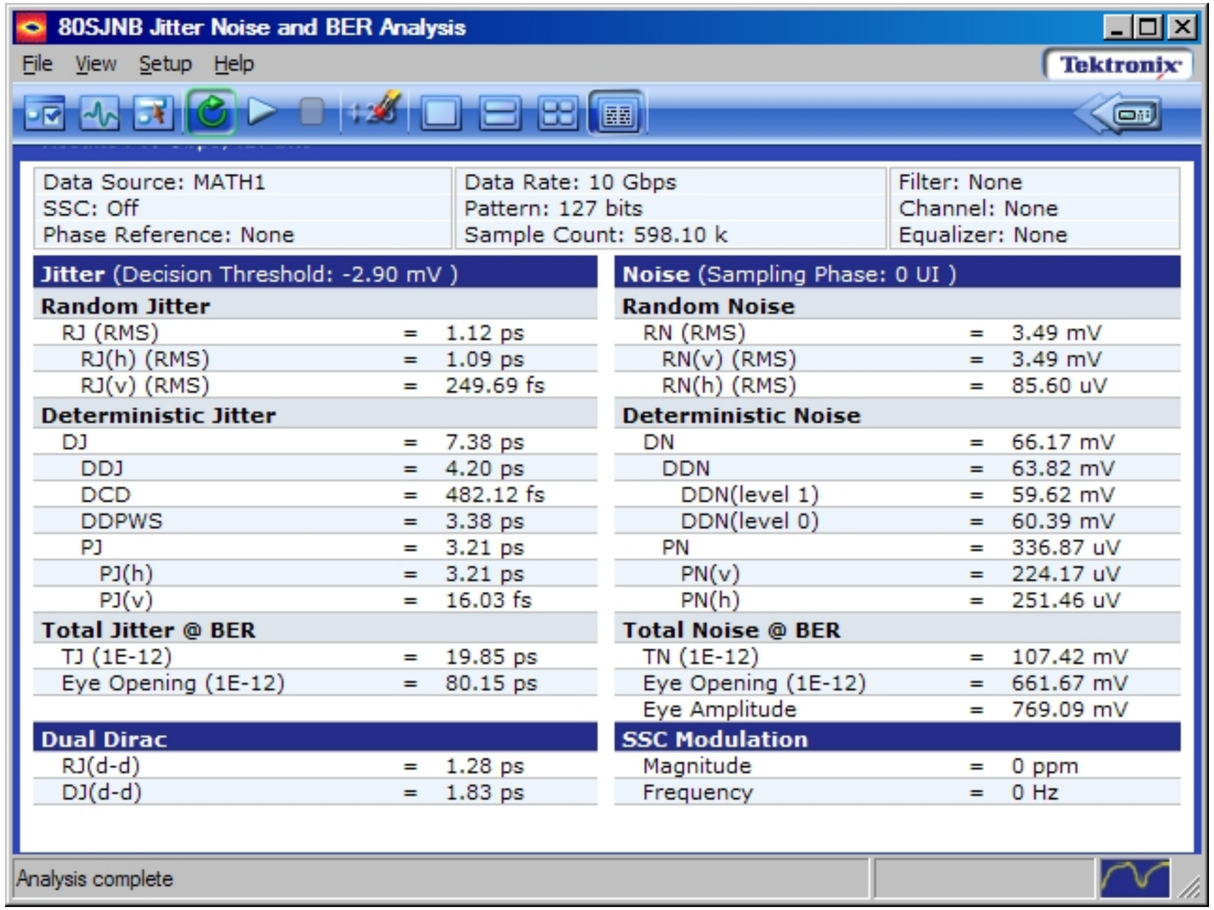
BSA286CL Pattern Generator 10 Gbps PRBS7 Synchronized Electrical Pattern

This waveform is viewed as a check that the instrument is synchronized with the repeating PRBS pattern (necessary for accurate jitter composition measurements)



BSA286CL Pattern Generator 10 Gbps PRBS7 Electrical Jitter





RJ_{src} = 1.12 ps (RMS)

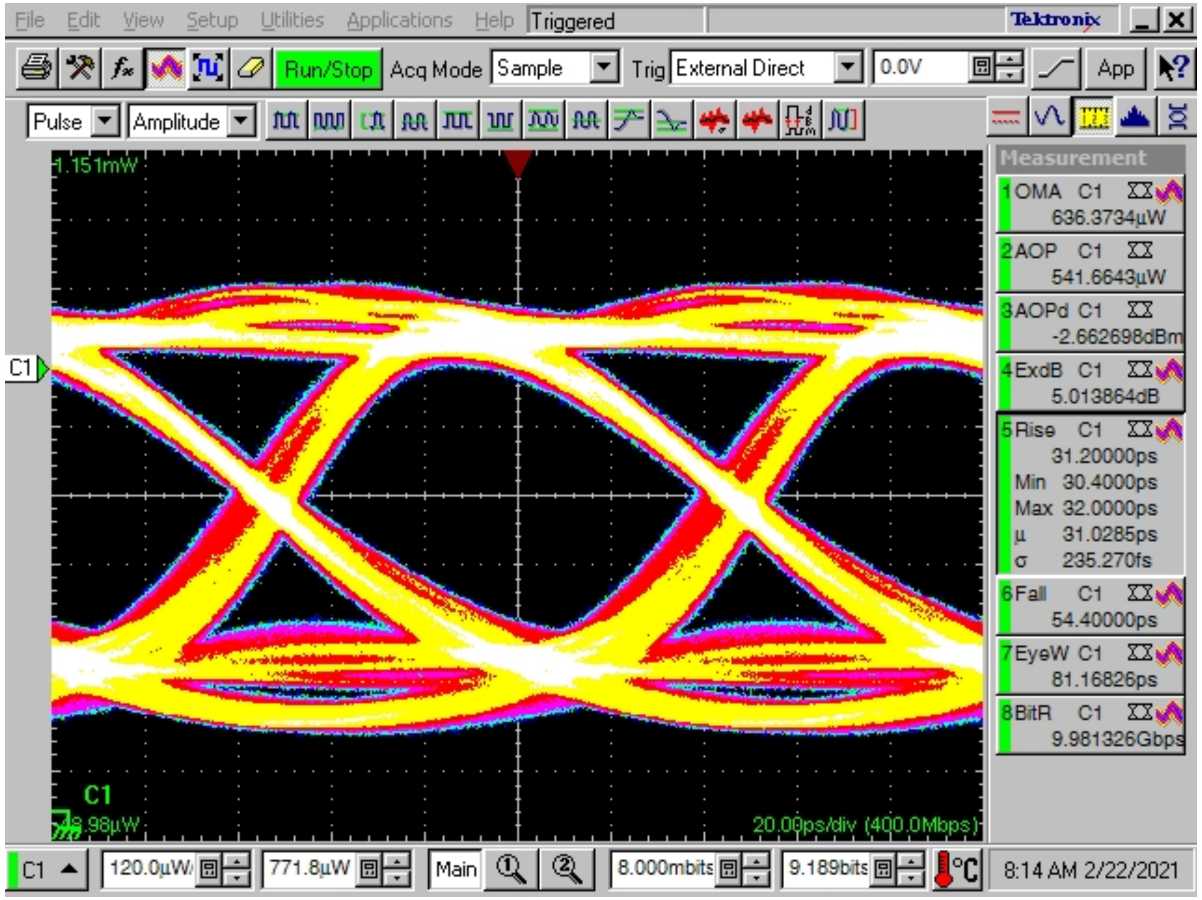
TJ_{src} = 19.85 ps

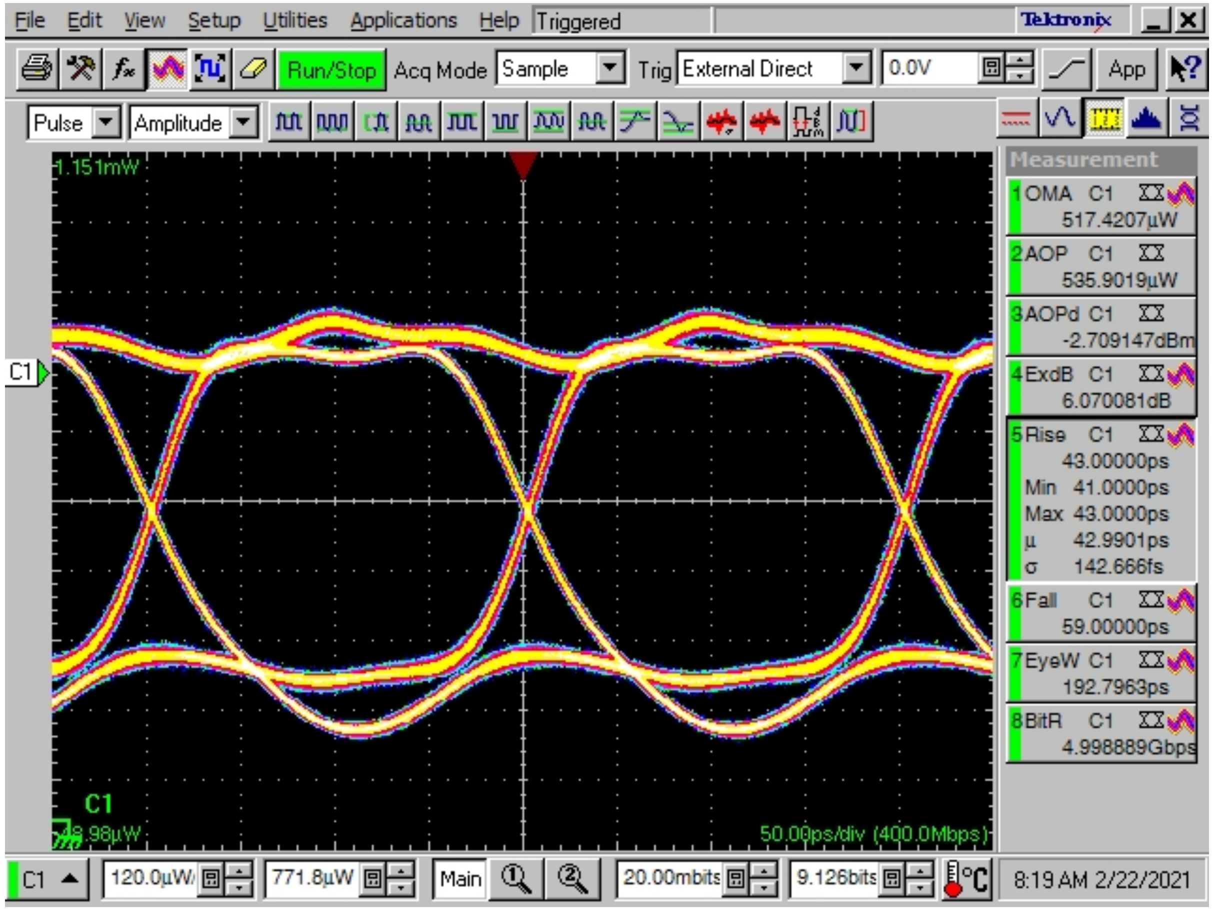
These are the jitter statistics obtained on the source which are needed for compensation to characterize the jitter contribution of the DUT itself.

Fabry-Perot (F-P) Device 1 Optical Eyes
10 Gbps PRBS7 (127 bits)

Average Optical Power: 542 µW

Optical Modulation Amplitude: 636 µW





Measured Rise Time (t_{meas}(rise)): 43 ps

Extinction Ratio: 5.0 dB

Data Rate: 10 Gbps

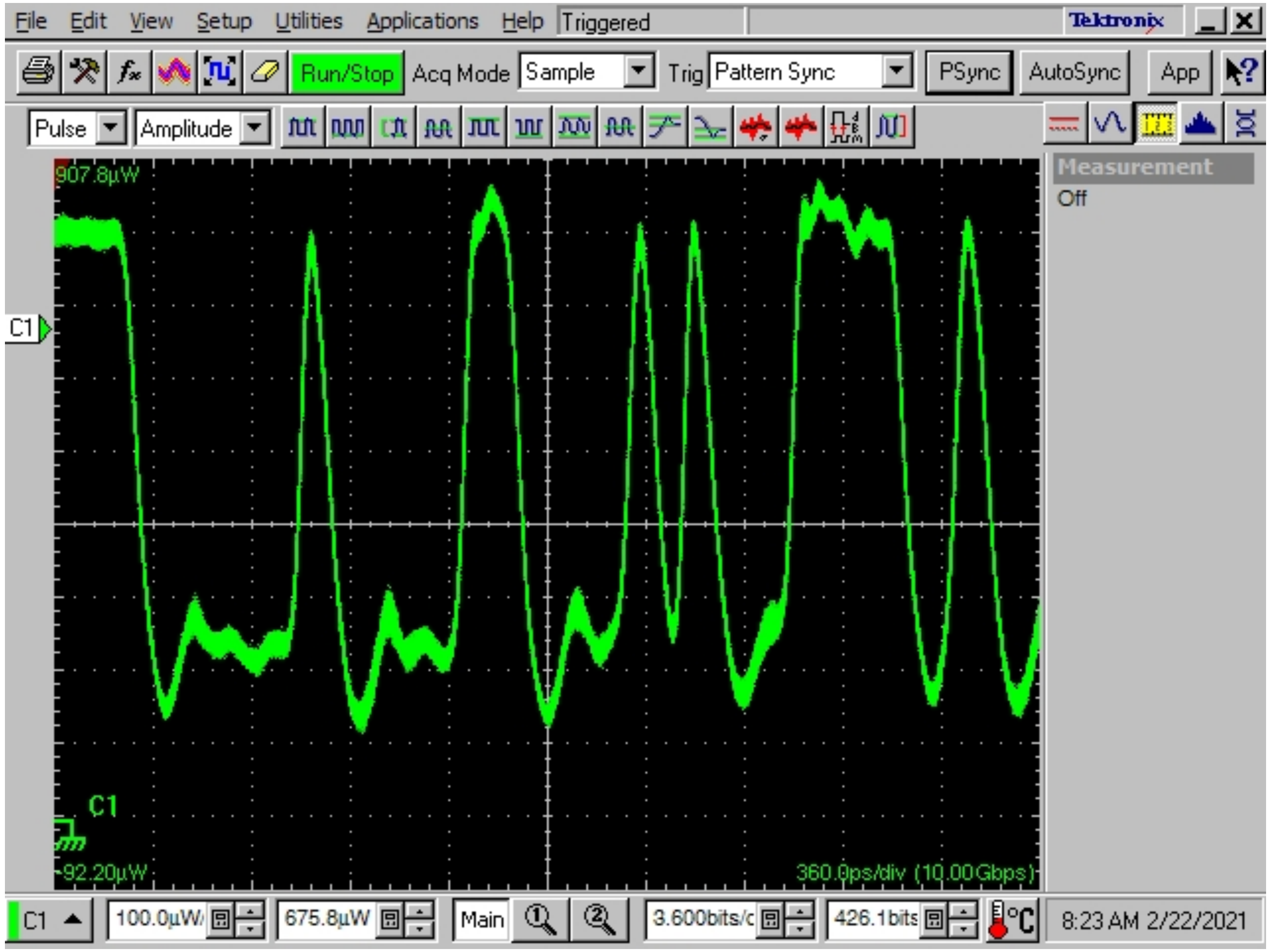
Measured Fall Time(t_{meas}(fall)): 59 ps

Power Consumption: 204 mA @ 3.3 V

S/N F2020249554

Fabry-Perot (F-P) Device 1 Optical Pattern Sync Check
10 Gbps PRBS7 (127 bits)

This waveform is also viewed as a check that the instrument is synchronized with the repeating PRBS pattern (necessary for accurate jitter composition measurements)



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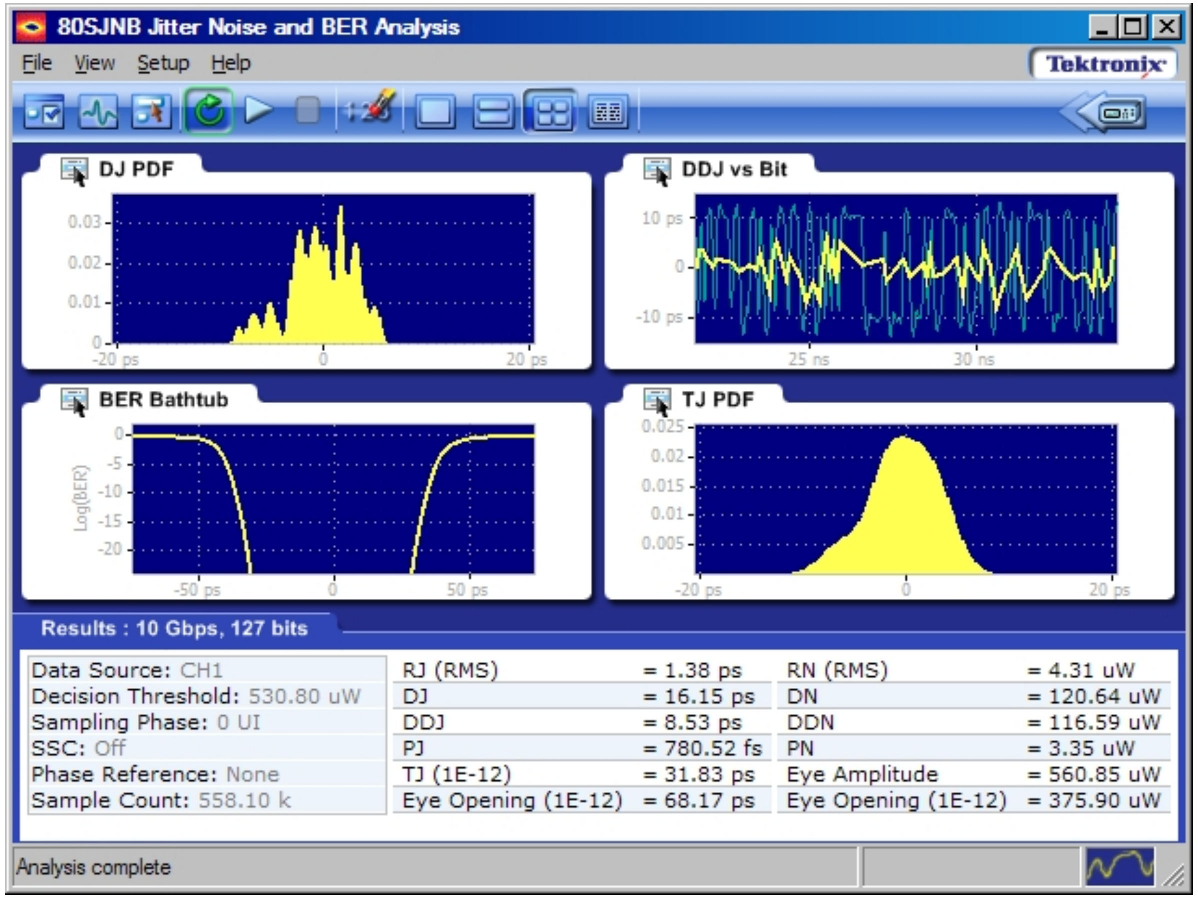
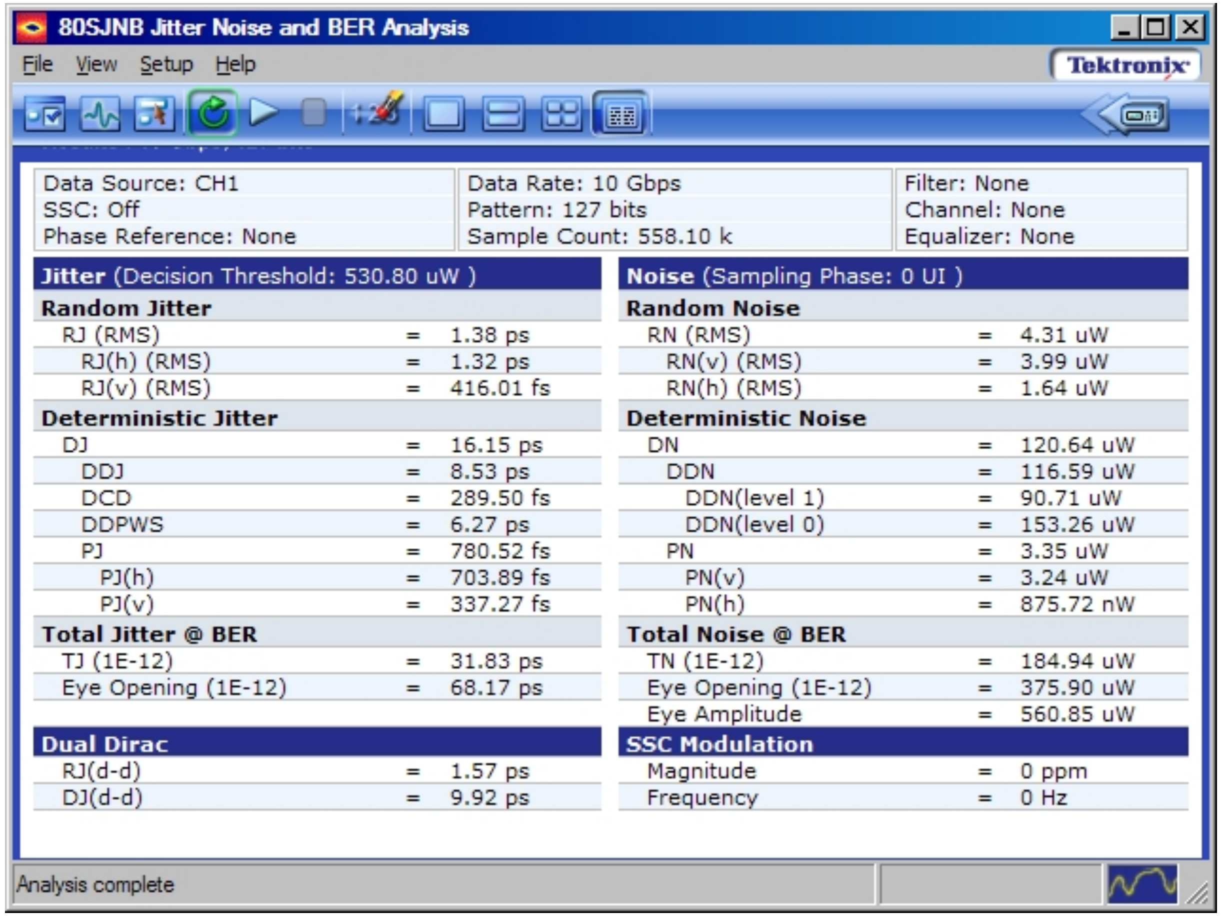
Fabry-Perot (F-P) Device 1 Optical Jitter
10 Gbps PRBS7 (127 bits)





RJ_{meas} = 1.38 ps (RMS)

TJ_{meas} = 31.83 ps

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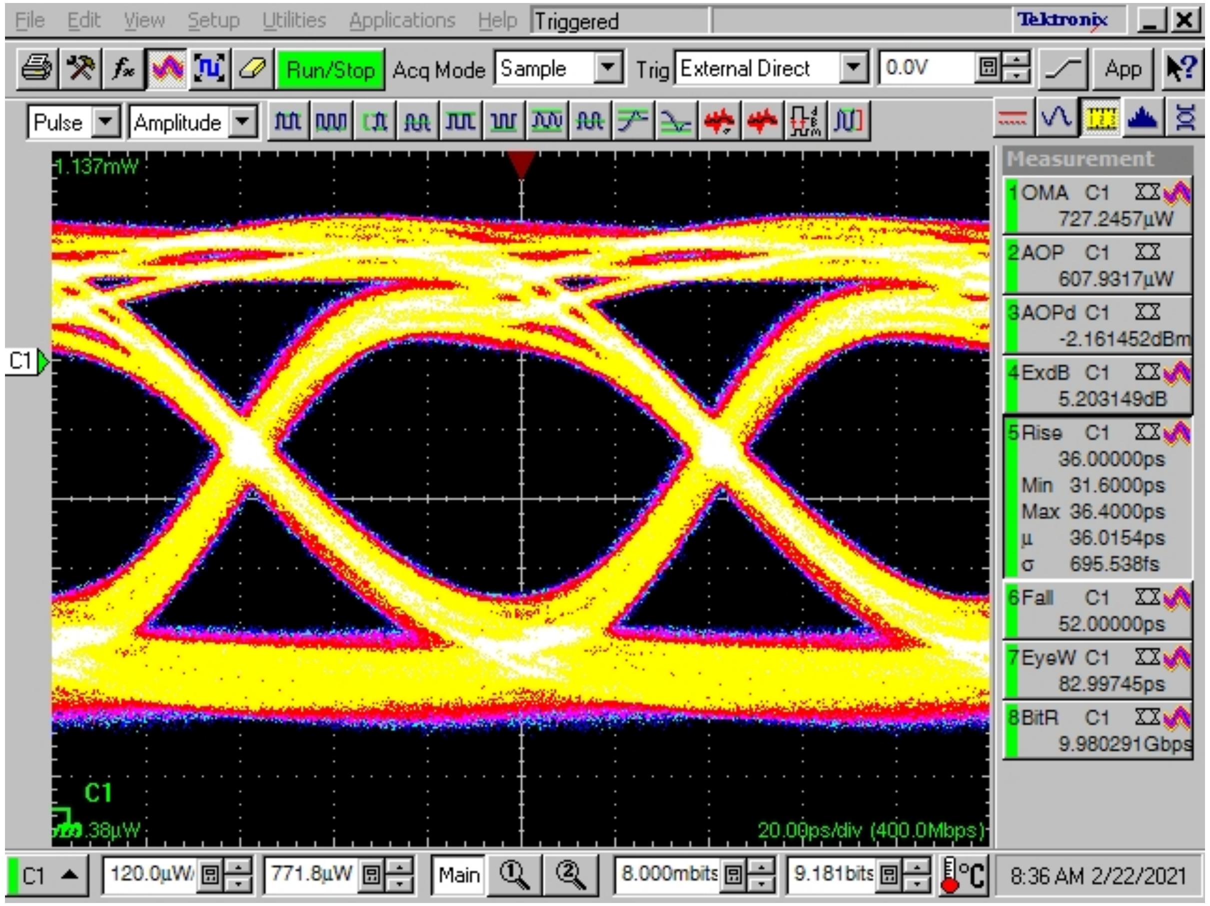
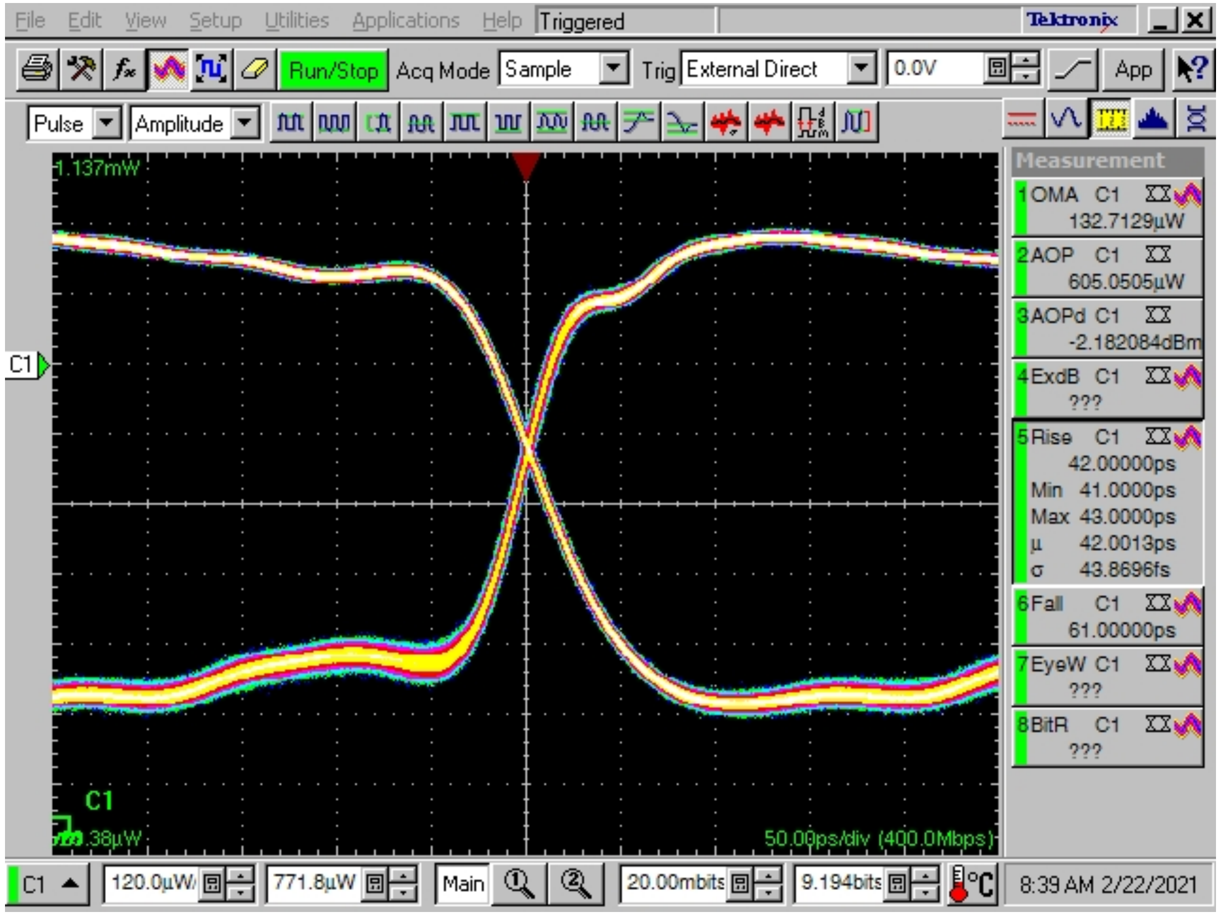
Distributed FeedBack (DFB) Device 1 Optical Eyes
10 Gbps PRBS7 (127 bits)

Average Optical Power: 607 µW

Optical Modulation Amplitude: 727 µW





Measured Rise Time (t_{meas}(rise)): 42 ps

Extinction Ratio: 5.2 dB

Measured Fall Time: 61 ps

Power Consumption: 239 mA @ 3.3 V

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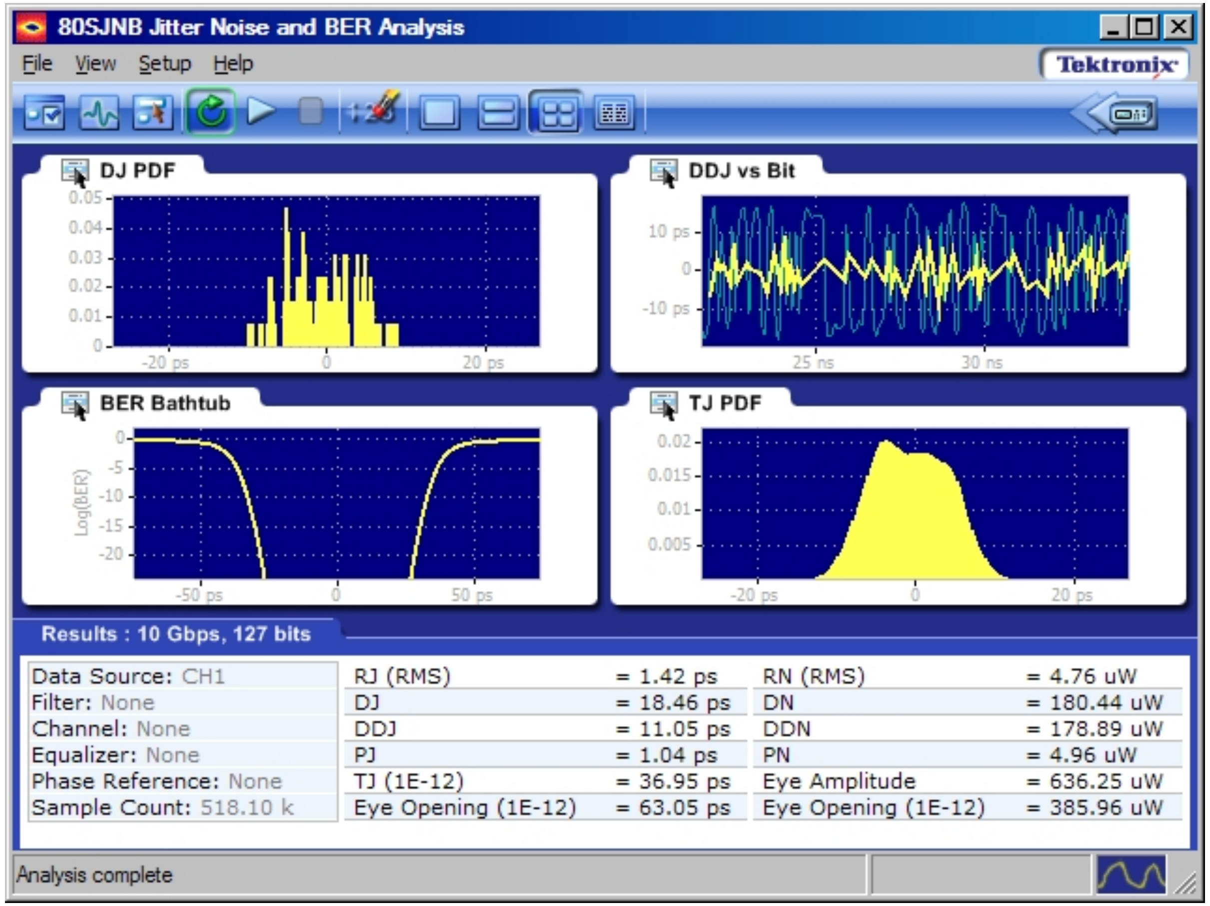
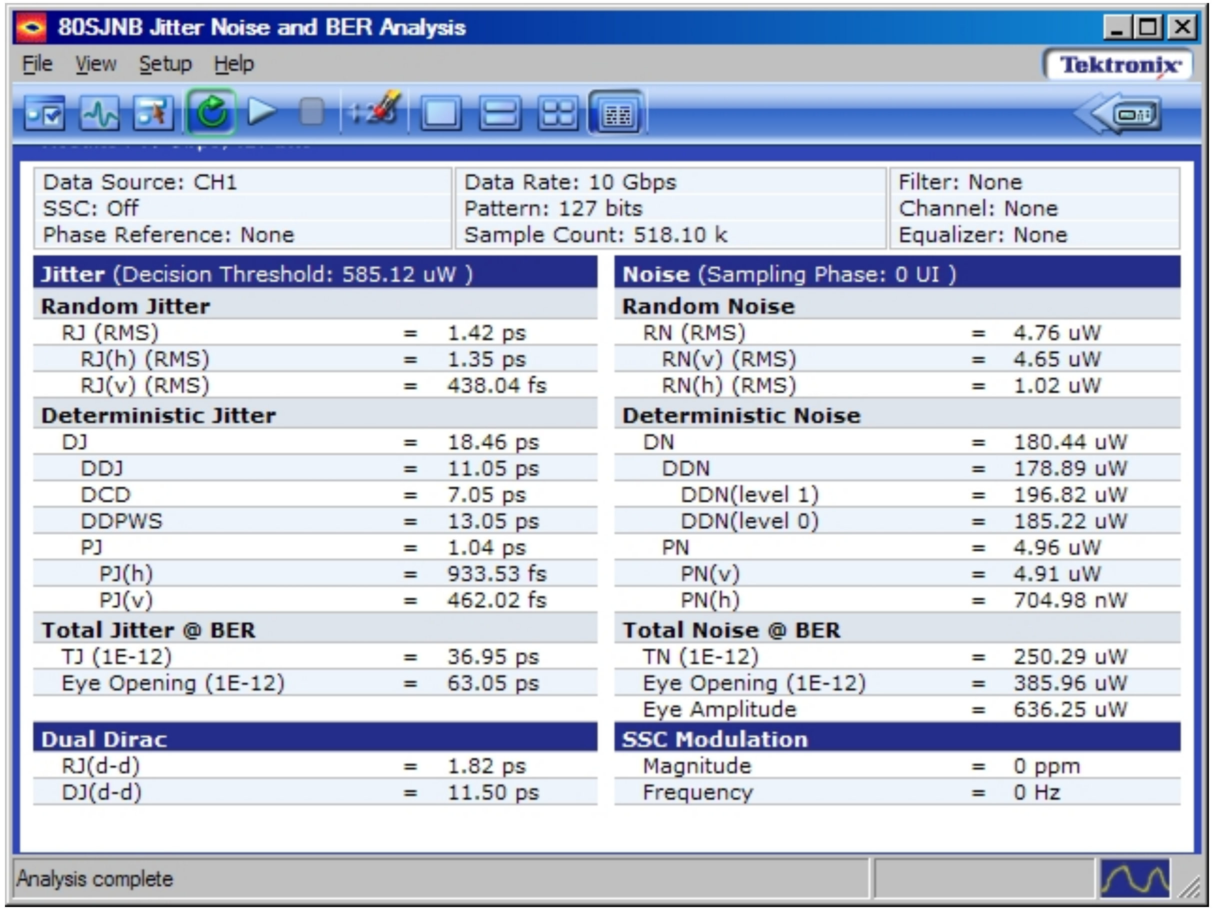
Distributed (DFB) Device 1 Optical Jitter

10 Gbps PRBS7 (127 bits)





RJ_{meas} = 1.42 ps (RMS)

TJ_{meas} = 36.95 ps

S/N F2011628622

Next Steps

As of Feb. 23, a total of 7 such devices have been characterized. We have more on hand and will continue with measurements of this type at room temperature until we have approval for LiN2 testing at the test stand.

We have obtained an optical spectrum analyzer so we will attempt to measure the spectra of the devices in order to make comparisons with LiN2-tested devices.

A spreadsheet with the cumulative results of the testing will be maintained and all of the images from which the data have been drawn have been archived.

We are continuing to pursue the approvals for testing at the Feynman Computing Center.