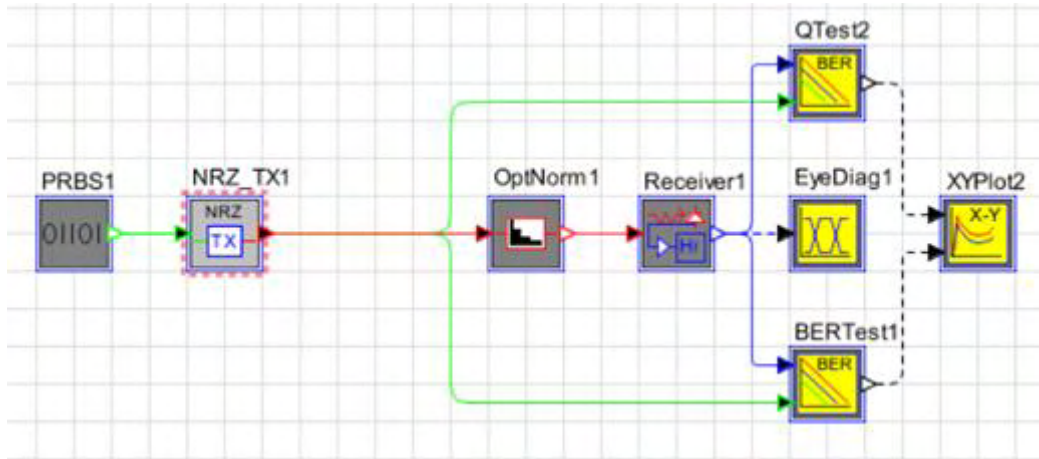


## Receiver Sensitivity

Tools Used: OptSim

The purpose of this example is to study the effect of optical receiver characteristics on a system performance.

The figure below depicts the layout of such a system consisting of: Bit Pattern Generator, NRZ Transmitter, Optical Power Normalizer, Optical Receiver, BER Tester, Eye Diagram Analyzer, and XY-Plotter.

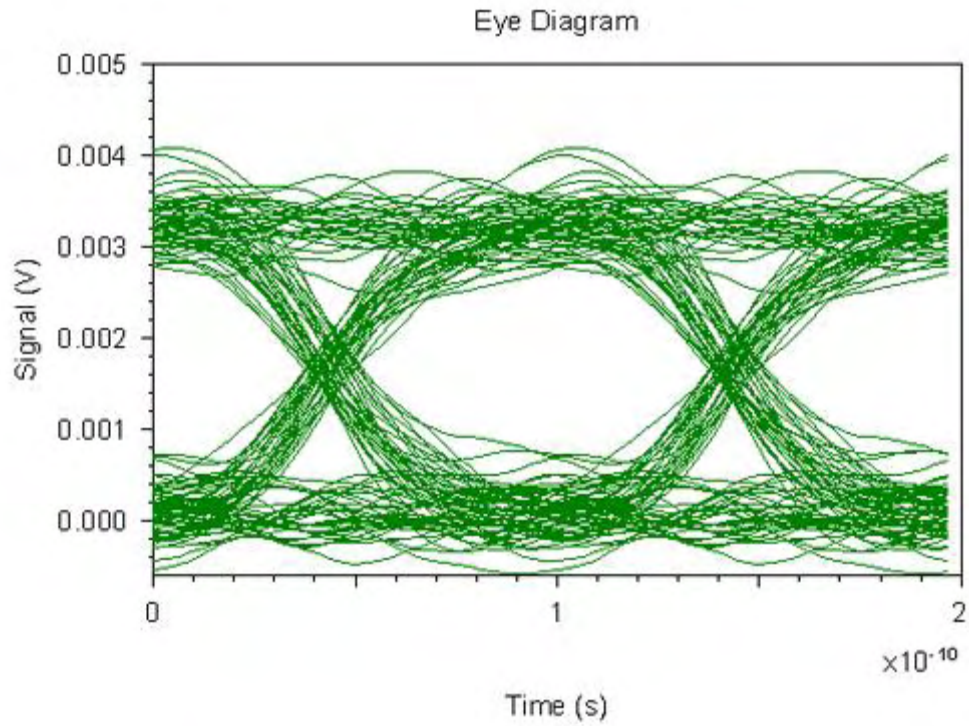


This sensitivity was achieved by adjusting the receiver parameters. Let us describe in details the receiver setting. Optical Receiver Model is a combination of a few components: PIN Photodiode, Electrical Filter, and electrical transimpedance amplifier (TIA). Photodiode is characterized by Responsivity, which is defined by quantum efficiency. Current at photodiode is derived as:

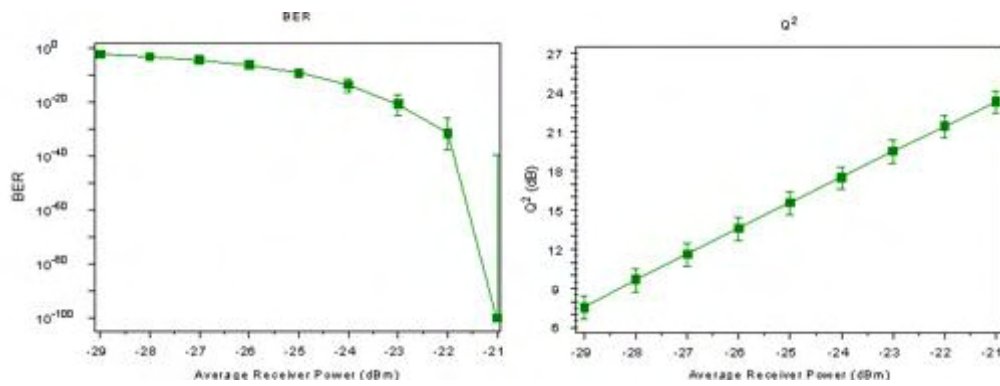
$I(t) = R P(t) + N(t)$ , where  $R$  is Responsivity,  $P(t)$  is the input optical signal, and  $N(t)$  is the noise generated at receiver. The current passed to TIA, converted to voltage, and sent passes through electrical filter. For electrical filter we used low- pass 4-th order Bessel with bandwidth 7.5 GHz.

Total noise is a combination of different noise contribution mechanisms: thermal noise from TIA, signal and dark current shot noise, RIN noise (depends of RIN value of optical sources such as lasers), signal-spontaneous and spontaneous-spontaneous beat noise. The receiver model allows to turn ON/OFF each of these noise contributions separately.

The figure below shows corresponding eye diagram at receiver for input power -25 dBm.



Next we want to observe the effect of changing of receiver input power on BER. The parameter sweep for input power is from -29 to -21 dBm, i.e. within  $\pm 4$  dB range from original input power.



The plot of BER vs. Q-factor is shown below:

BER vs. Q-factor

