

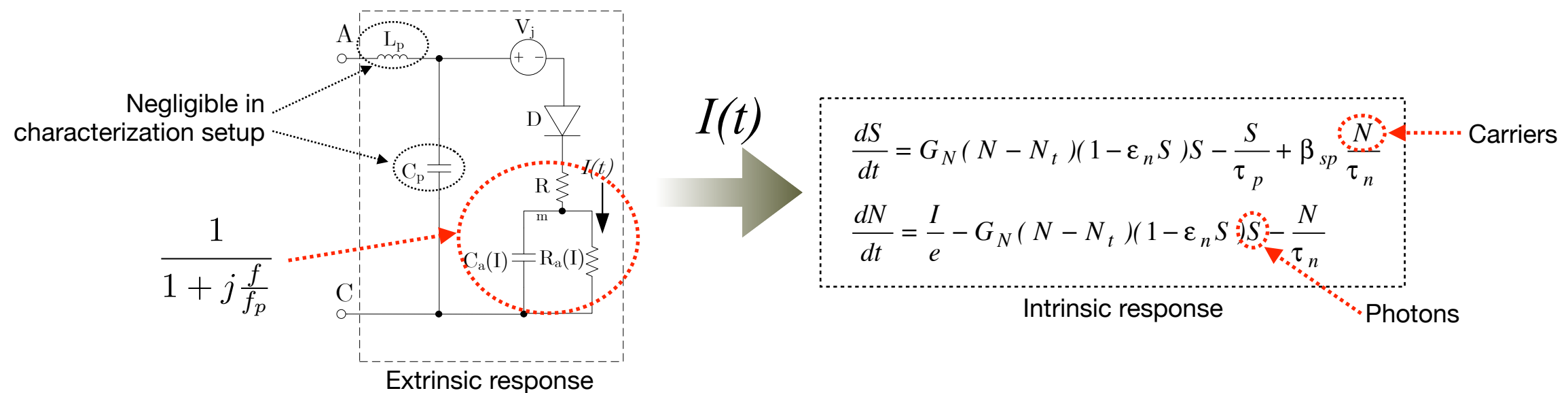
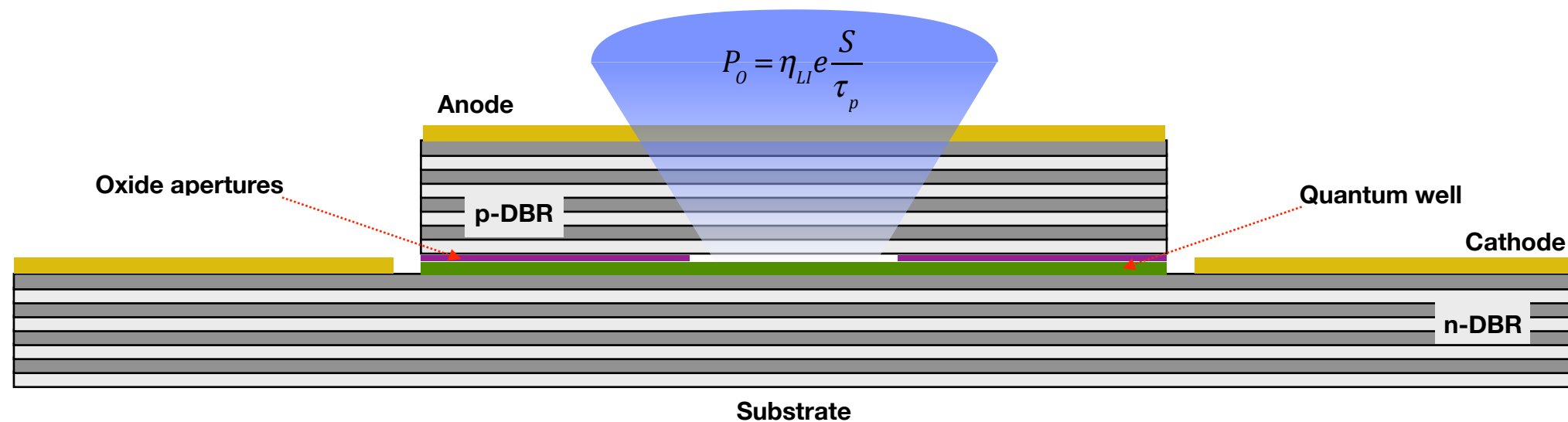


VCSEL simulation model

Parameters extraction and verification

Rubén Pérez-Aranda
rubenpda@kdpof.com

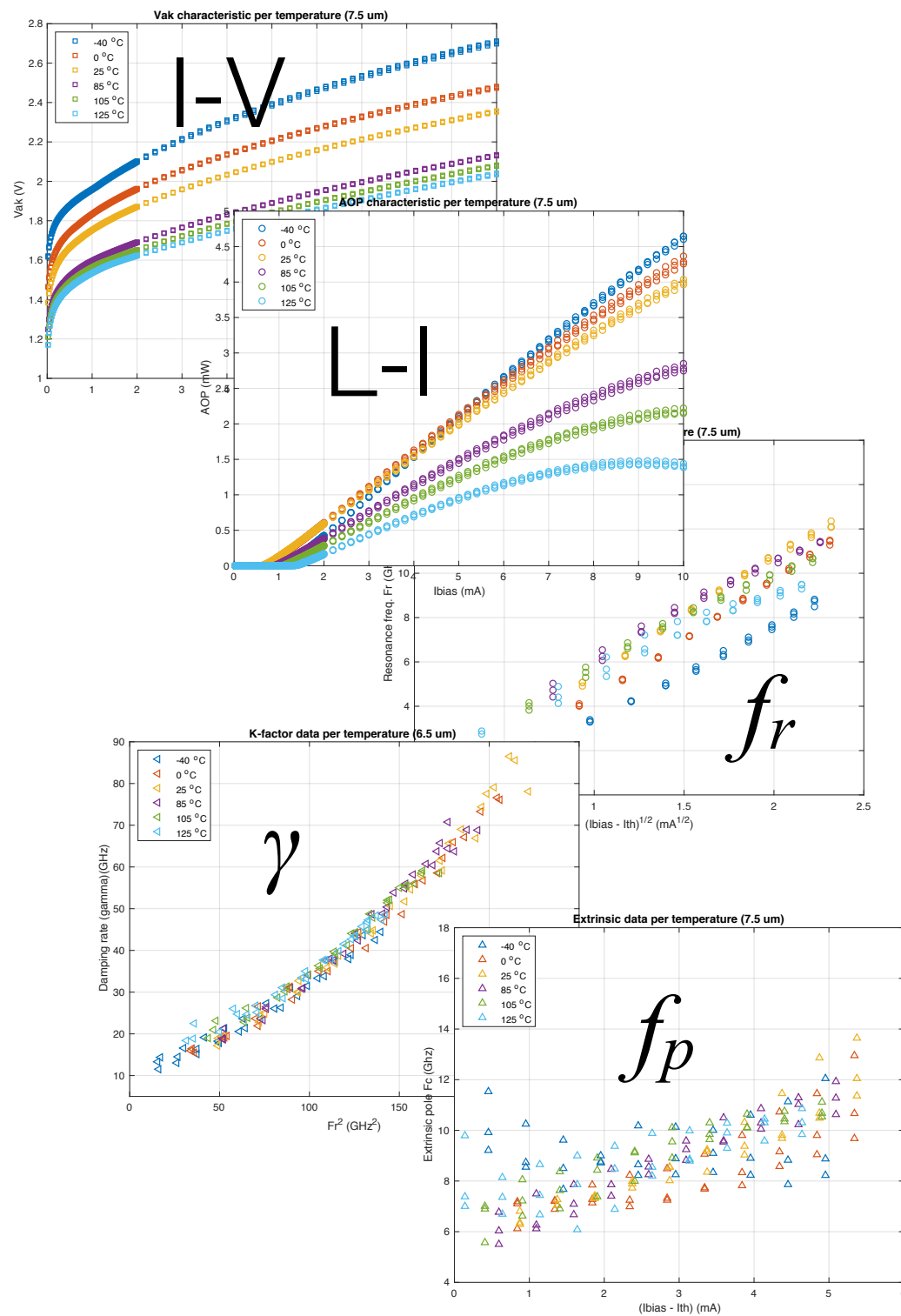
VCSEL simple modeling



$$H(f) = C \cdot \frac{f_r^2}{f_r^2 - f^2 + j \frac{f}{2\pi} \gamma} \cdot \frac{1}{1 + j \frac{f}{f_p}}$$

Small signal AC response

VCSEL model parameters extraction



$$\tau_p$$

photon lifetime

$$\epsilon_n$$

normalized gain compression factor

$$N_t$$

transparency carrier number

$$G_N$$

differential gain

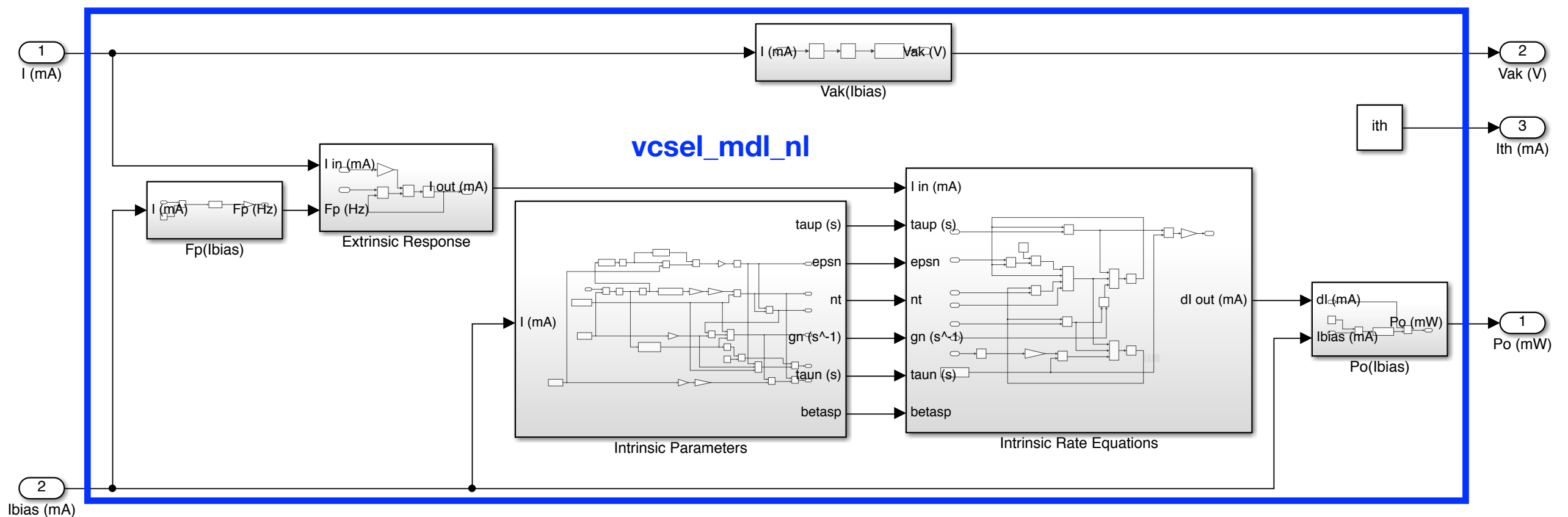
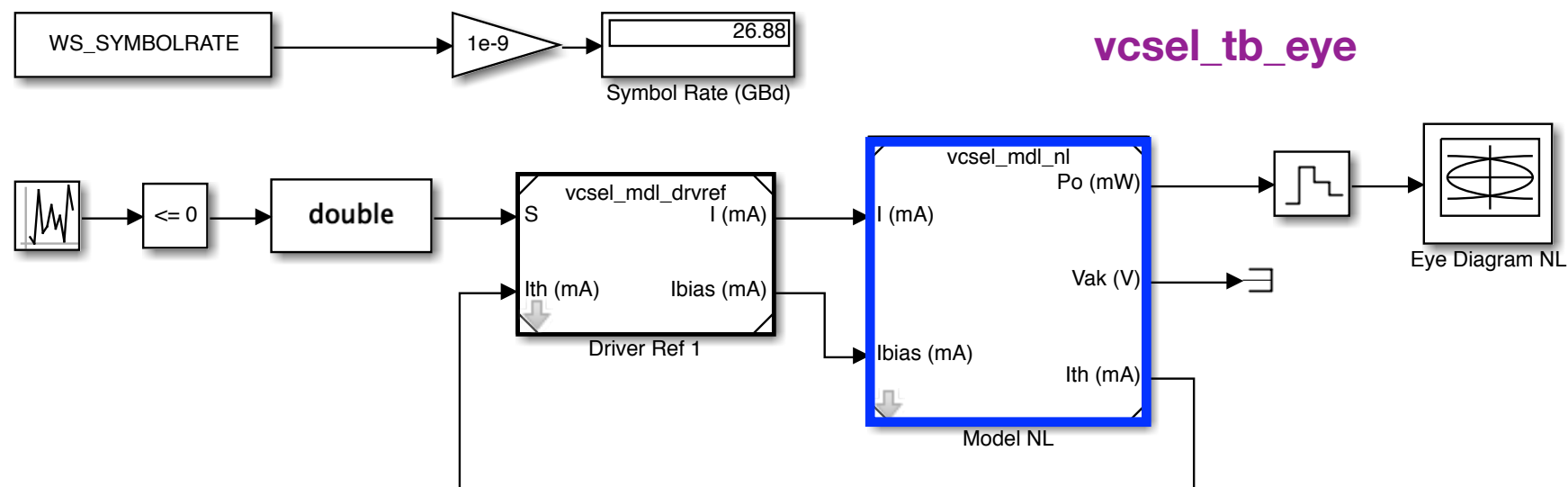
$$\tau_n$$

carrier lifetime

$$\beta_{sp}$$

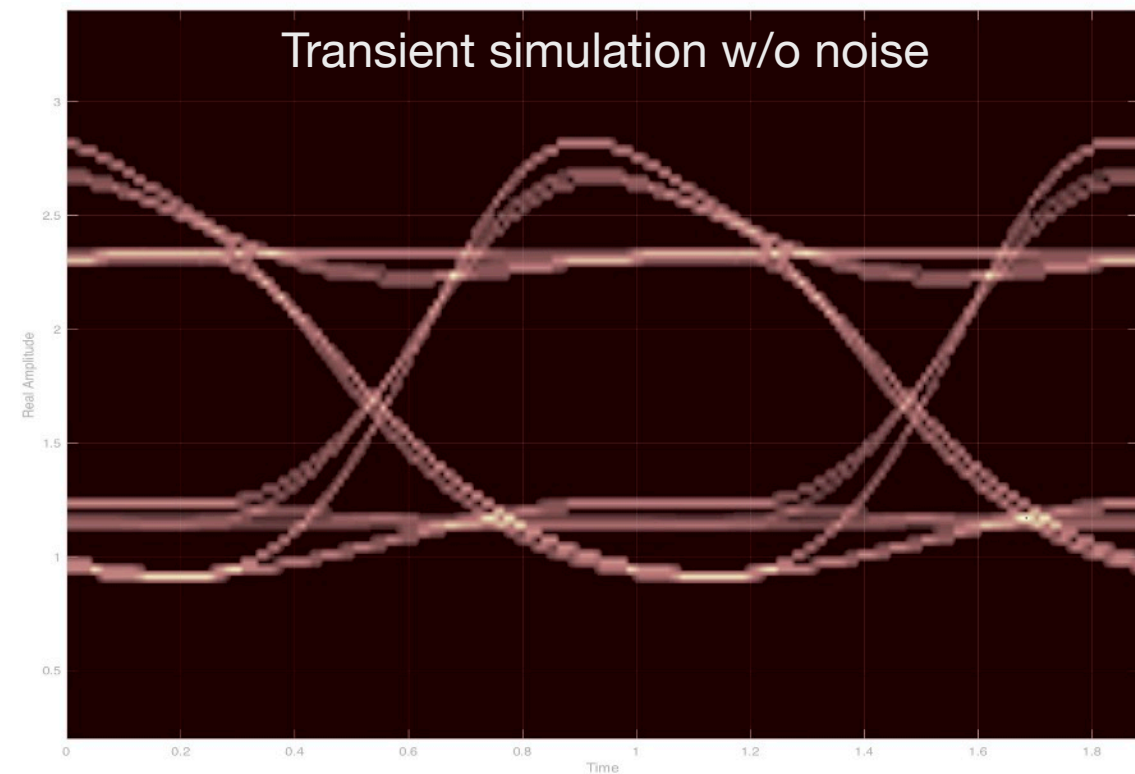
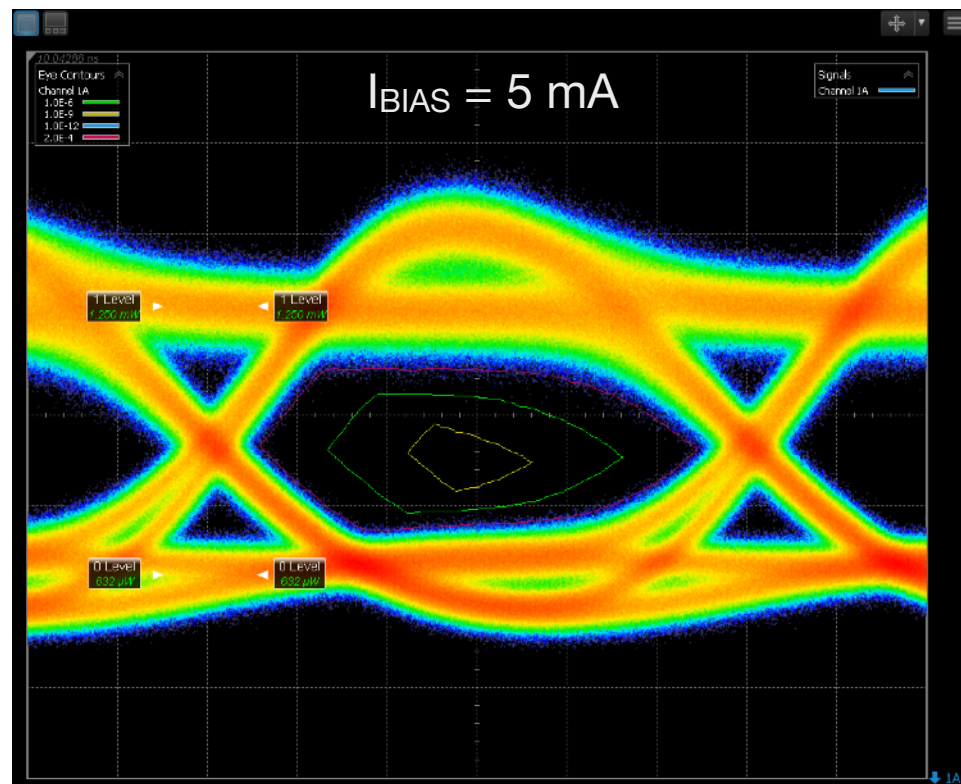
spontaneous emission fraction

VCSEL simulation model

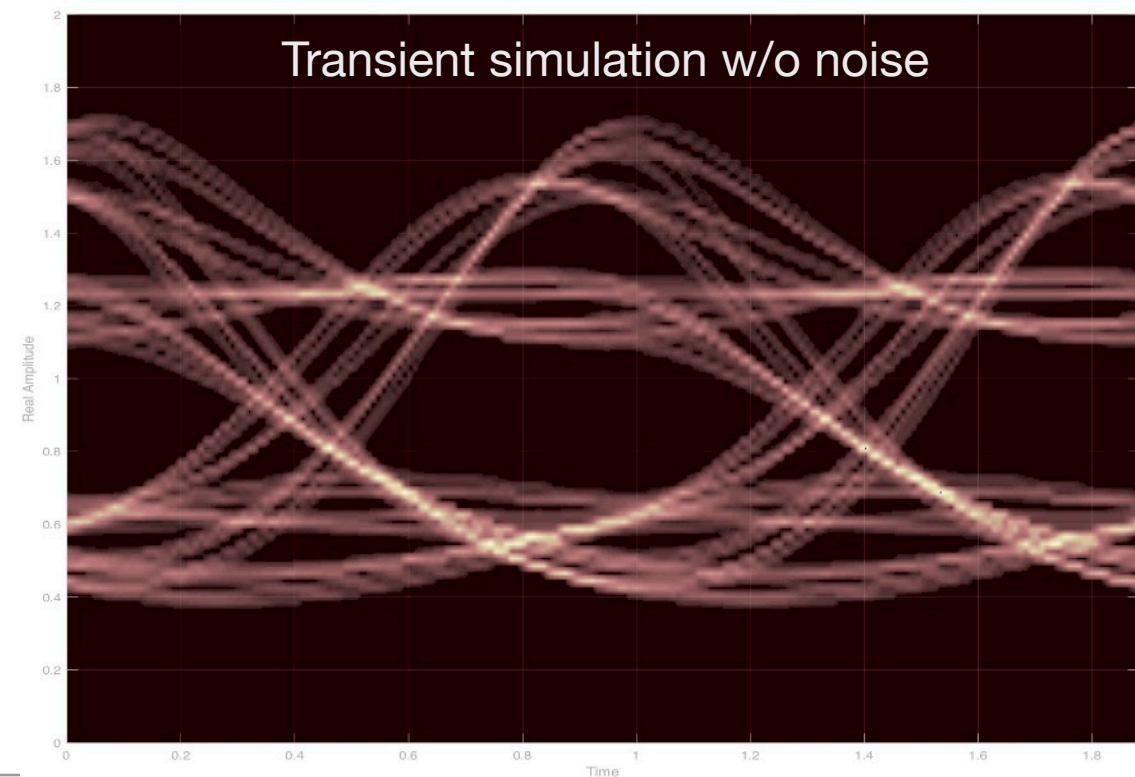
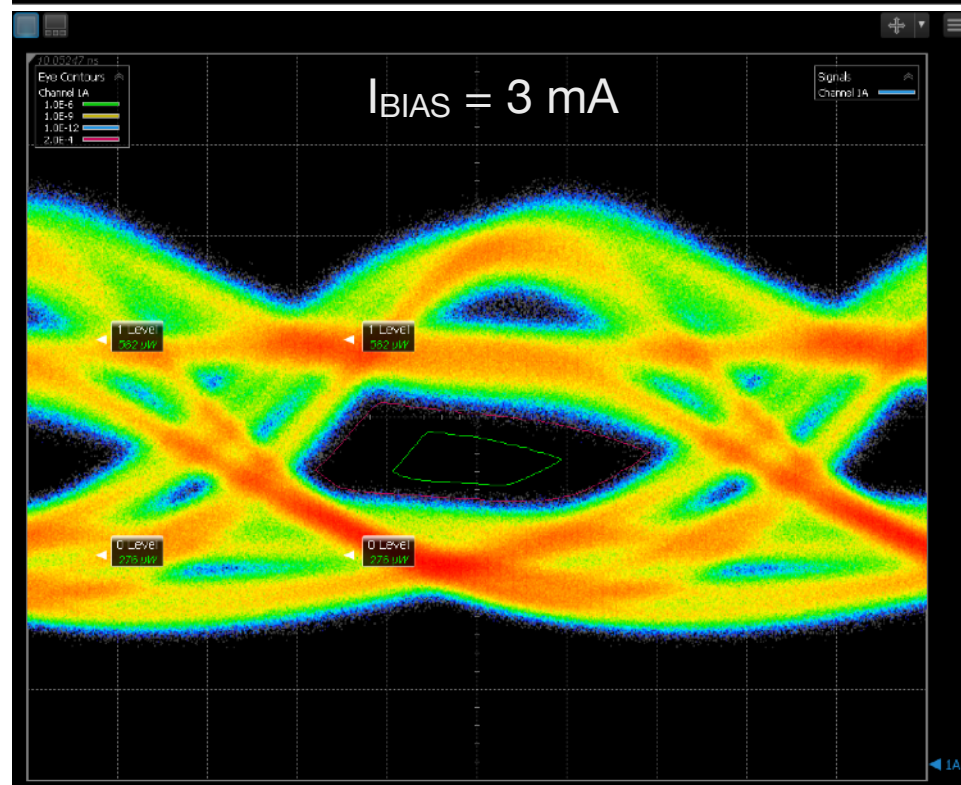


GaAs 14G VCSEL, 10.625 GBd, -40°C

8.7 μm , sample ID #4

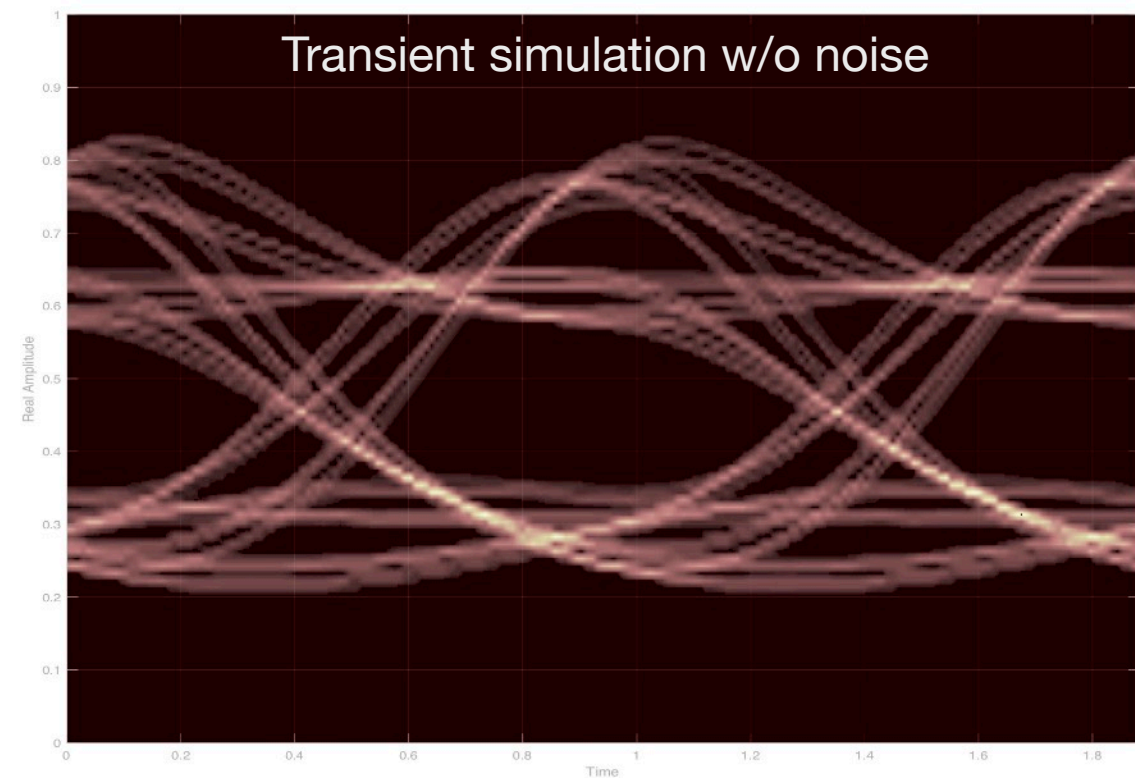
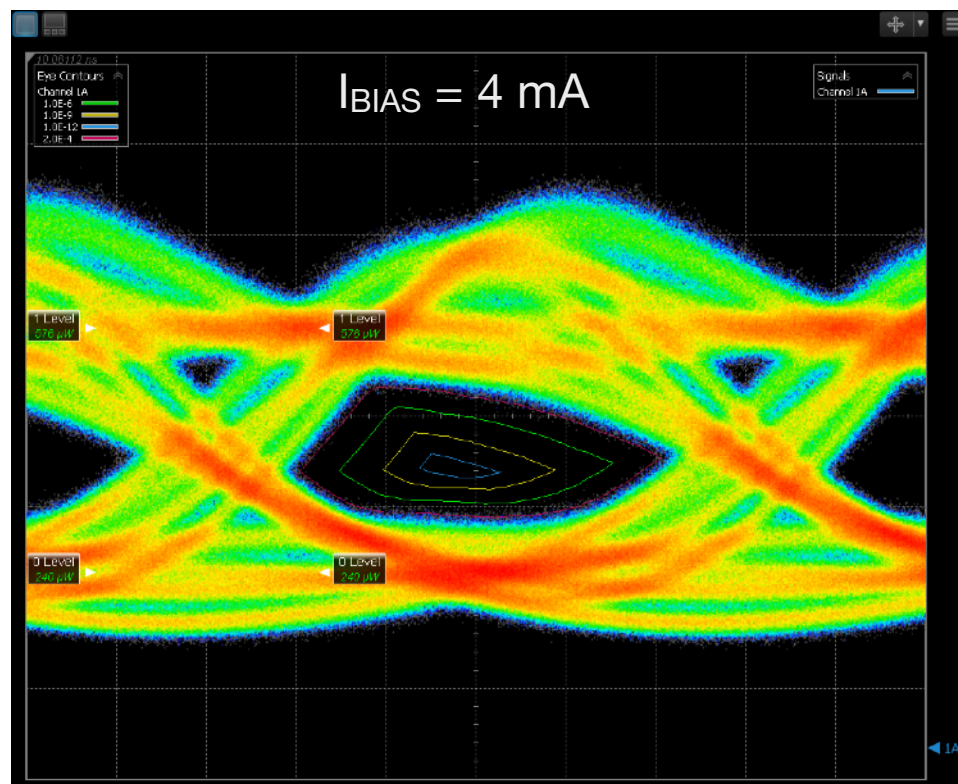


6.5 μm , sample ID #12

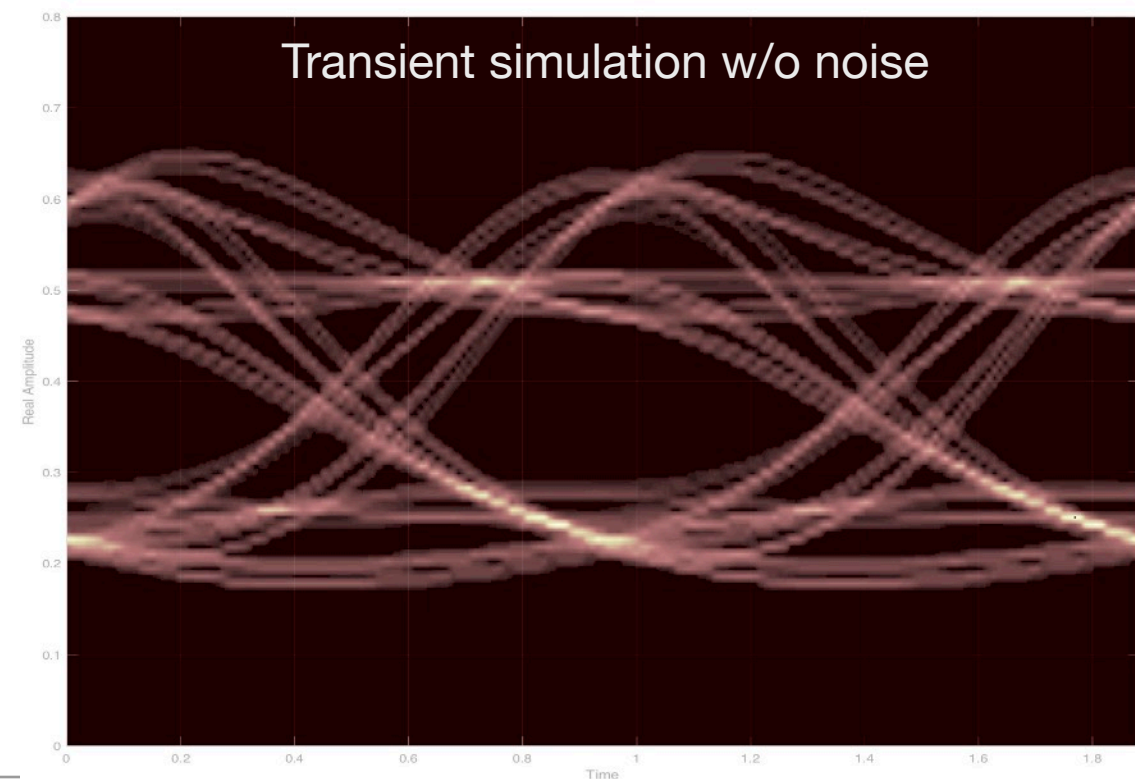
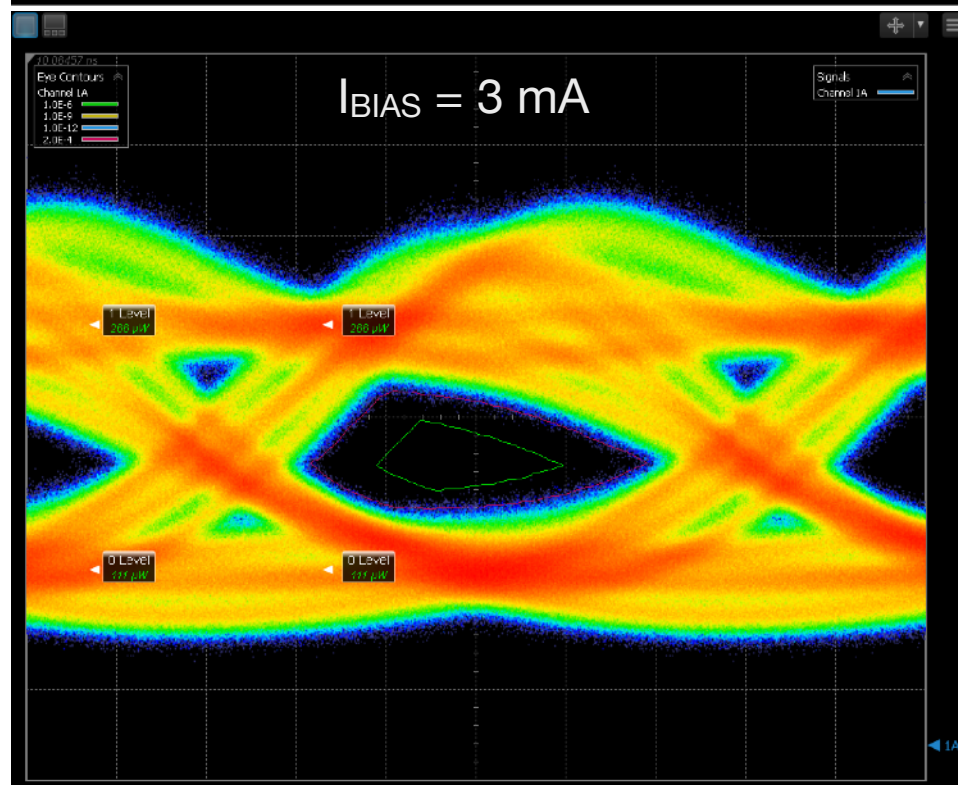


GaAs 14G VCSEL, 10.625 GBd, 125°C

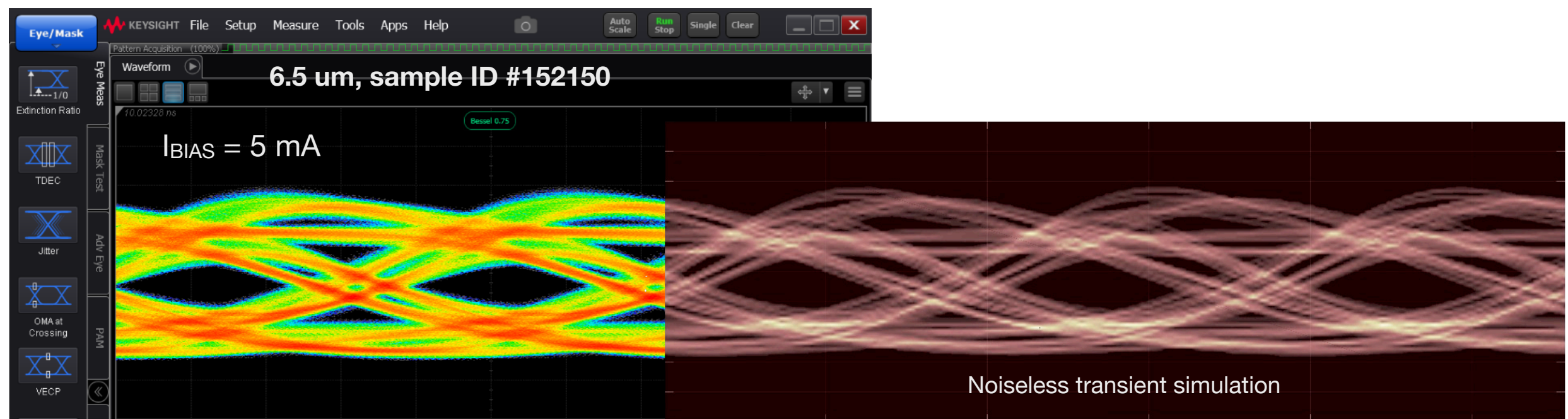
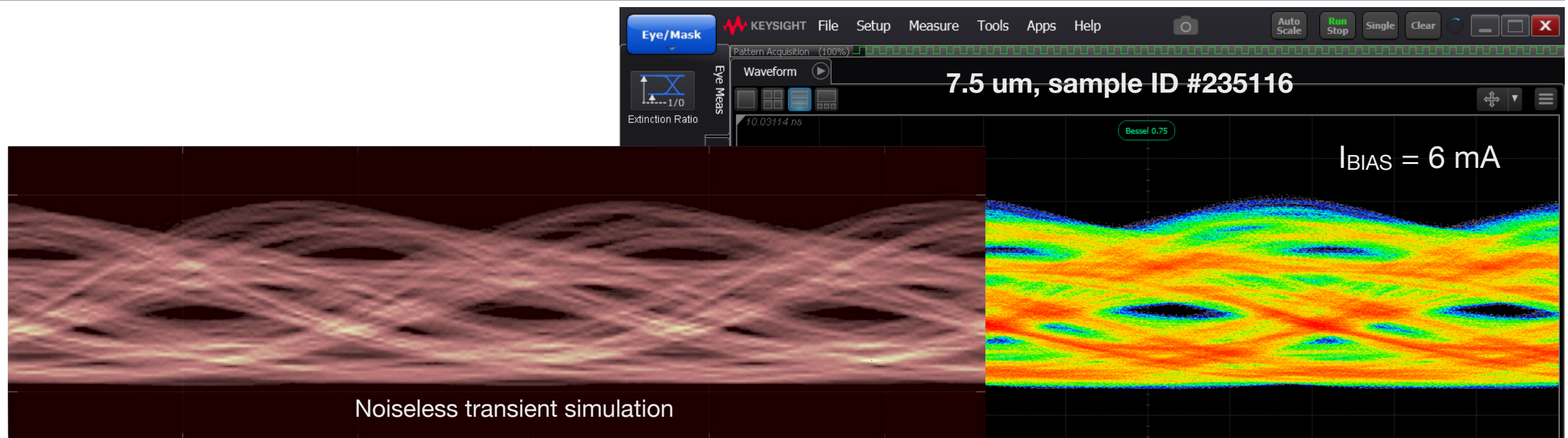
8.7 μm , sample ID #4



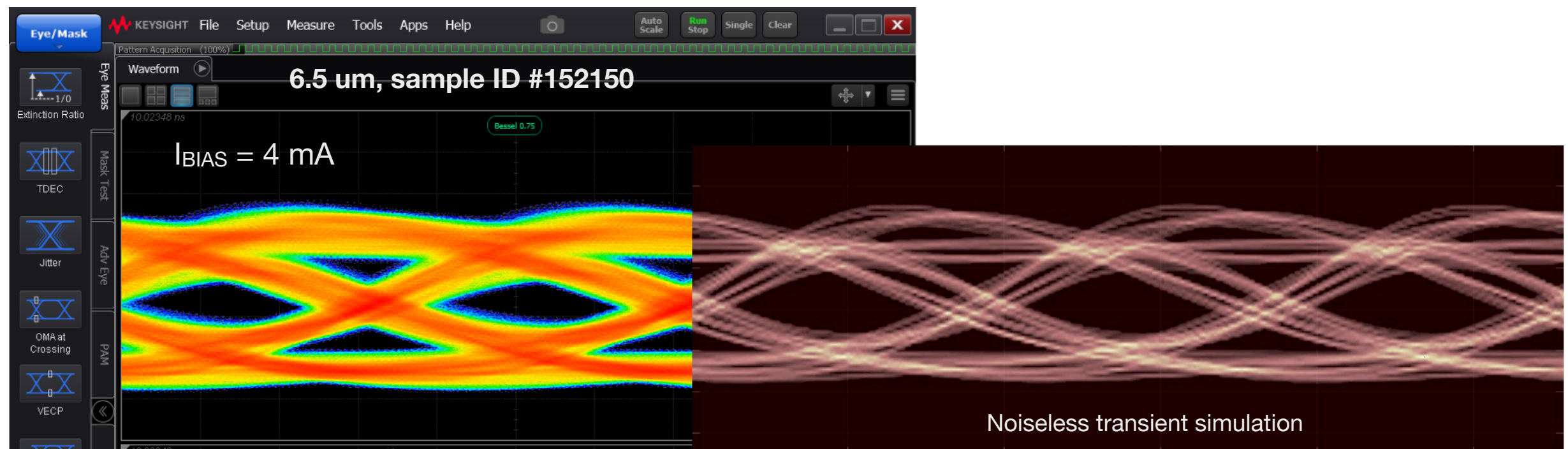
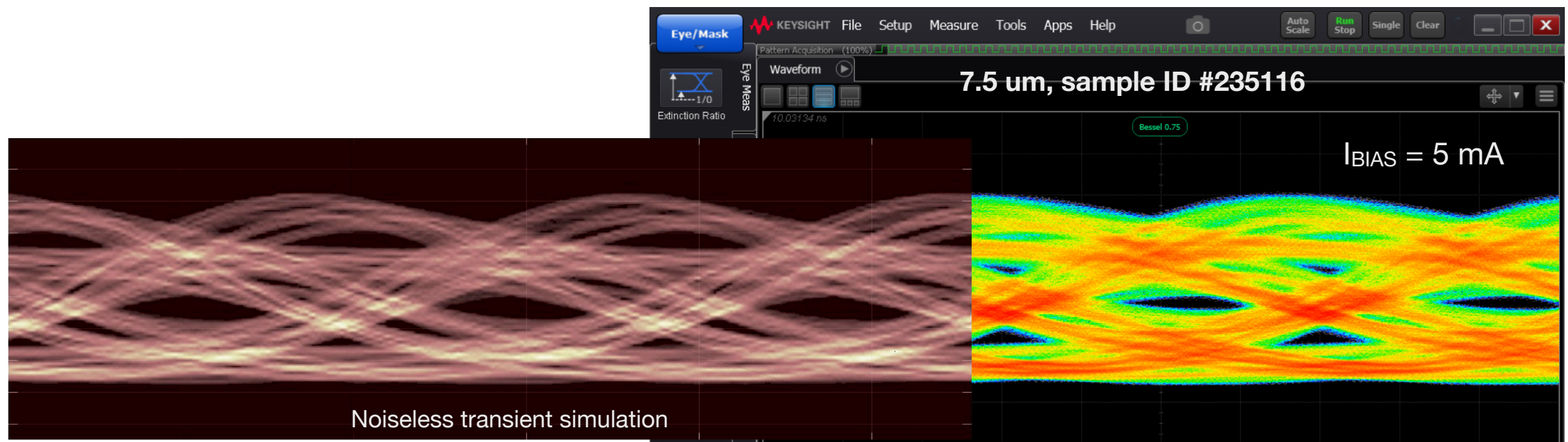
6.5 μm , sample ID #12



InGaAs 25G VCSEL, 26.88 GBd, -40°C



InGaAs 25G VCSEL, 26.88 GBd, 125°C



Conclusions



- VCSEL simulation model with parameters extracted from real L-I-V and AC measurements has been presented
- VCSEL simulation model has been verified against real transient large signal measurements
- The VCSEL simulation model is trustworthy to carry out time-domain communications system simulations, to obtain receiver sensitivity and make link budget assessment



Thank you