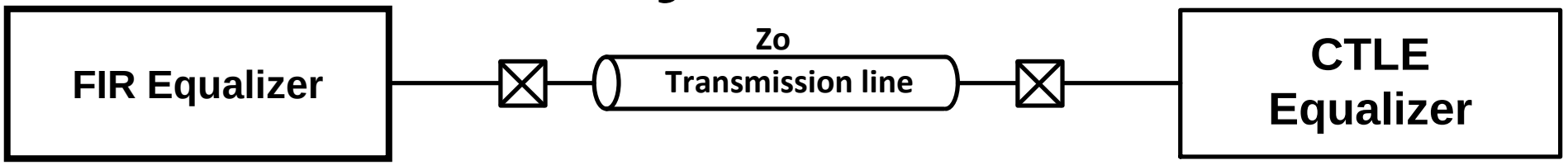
High-Speed Serial Interface Circuits and Systems

Project 2 –

Equalizers

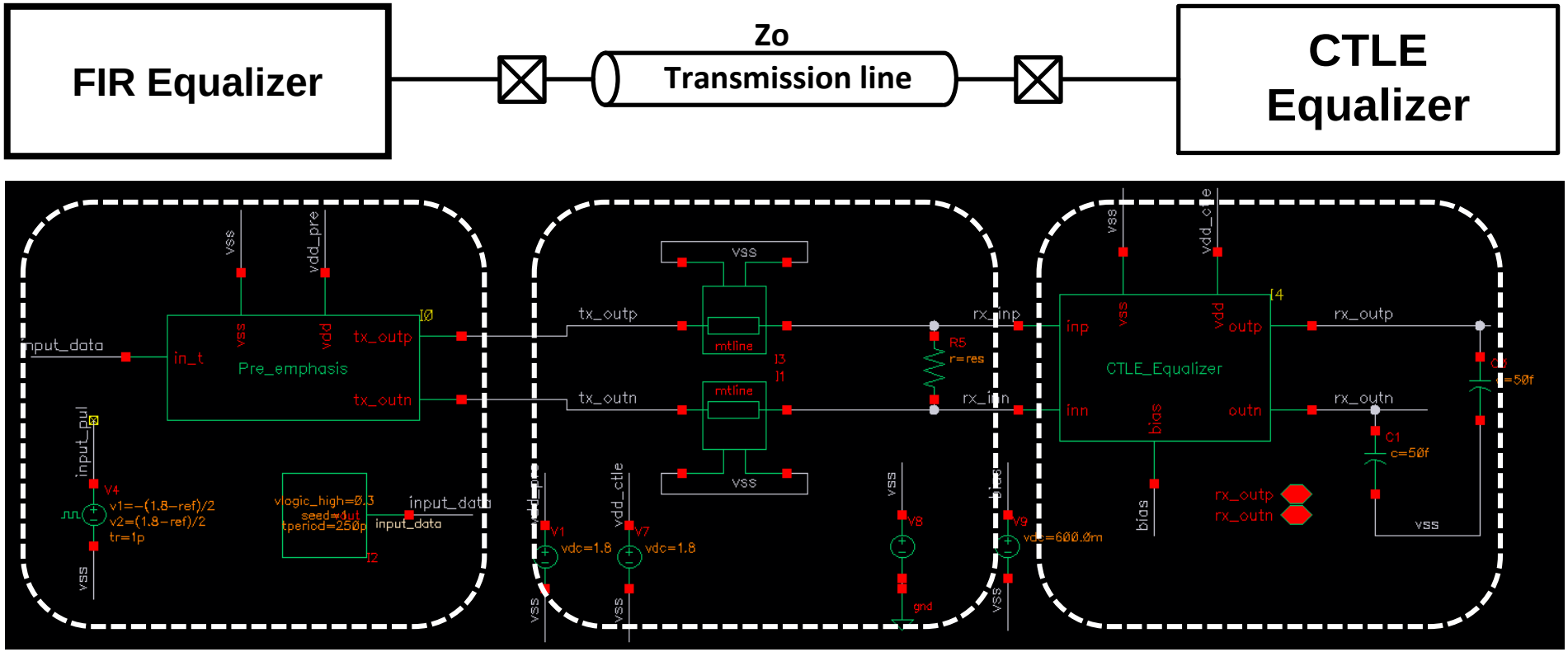
Project Goals



- 4Gb/s FIR and CTLE equalizers design
  - Transmission line
    - Analyze transmission line impedance and loss
    - Need impedance matching
  - CTLE equalizer
    - R_{load} : 1Kohm & C_{load} : 50fF and Current limit : 600uA
  - FIR Equalizer
    - Make sure to use pre-cursor(s)
  - Input data condition
    - Swing voltage 600mV and rising & falling time 10ps
- The report must contain:

  1. Show schematic(size), transmission line characteristic(Z_0, loss), output eye diagram (including simulation time), current for each circuit (FIR and CTLE).
  2. Explain how you come up with your circuit design.
  3. Evaluation standard
     - EYE diagram height and width (Differential output): Simulate at least 10us for eye-diagram
     - Total Current consumption
- Due date : 18 Dec. AM 10:00 @ B629 Hardcopy

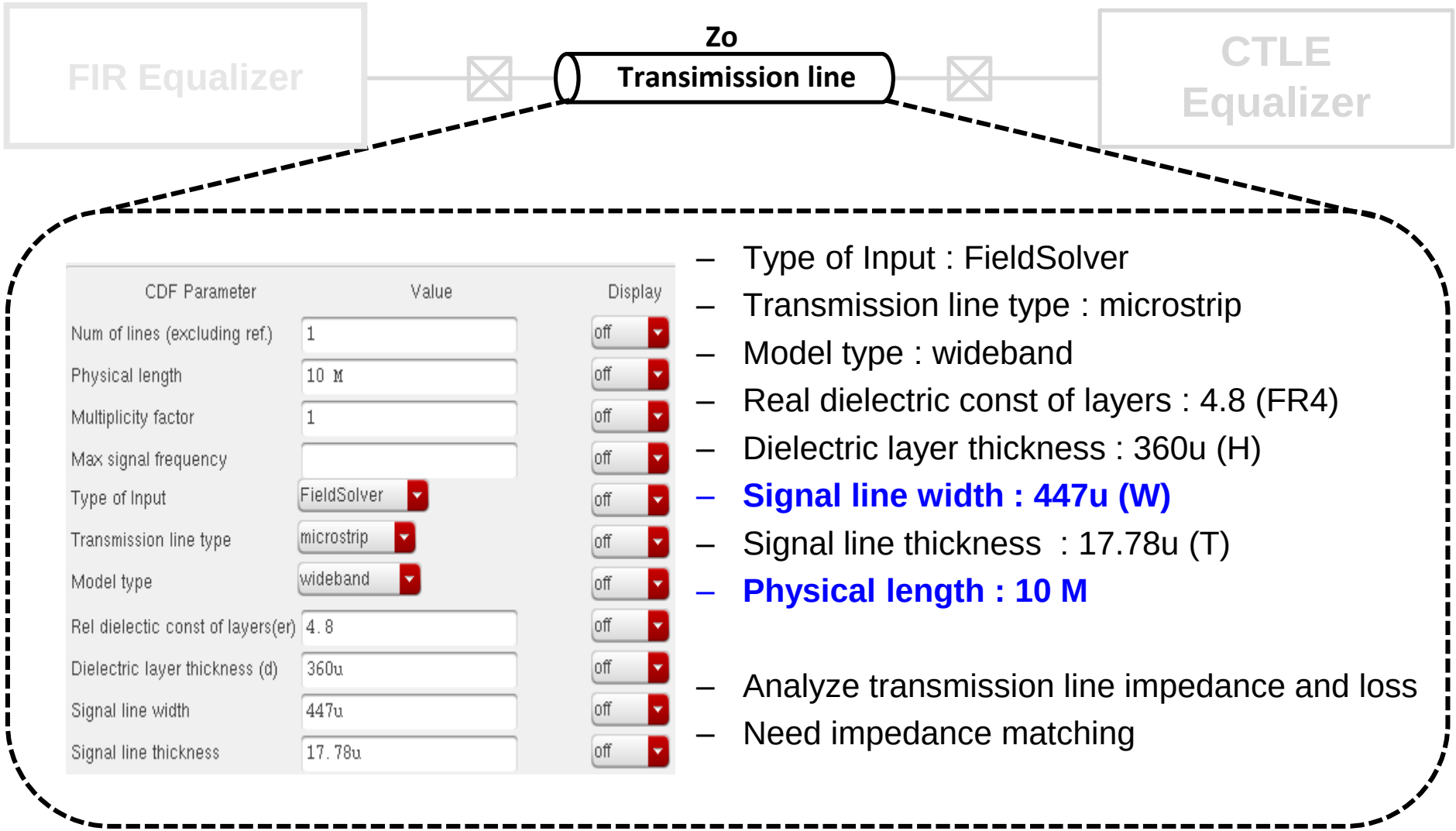
Schematic



< Pre-emphasis > < Transmission-line > < CTLE Equalizer>

- Design 4Gb/s FIR and CTLE equalizers.
- Analyze transmission line impedance and loss.

Transmission Line

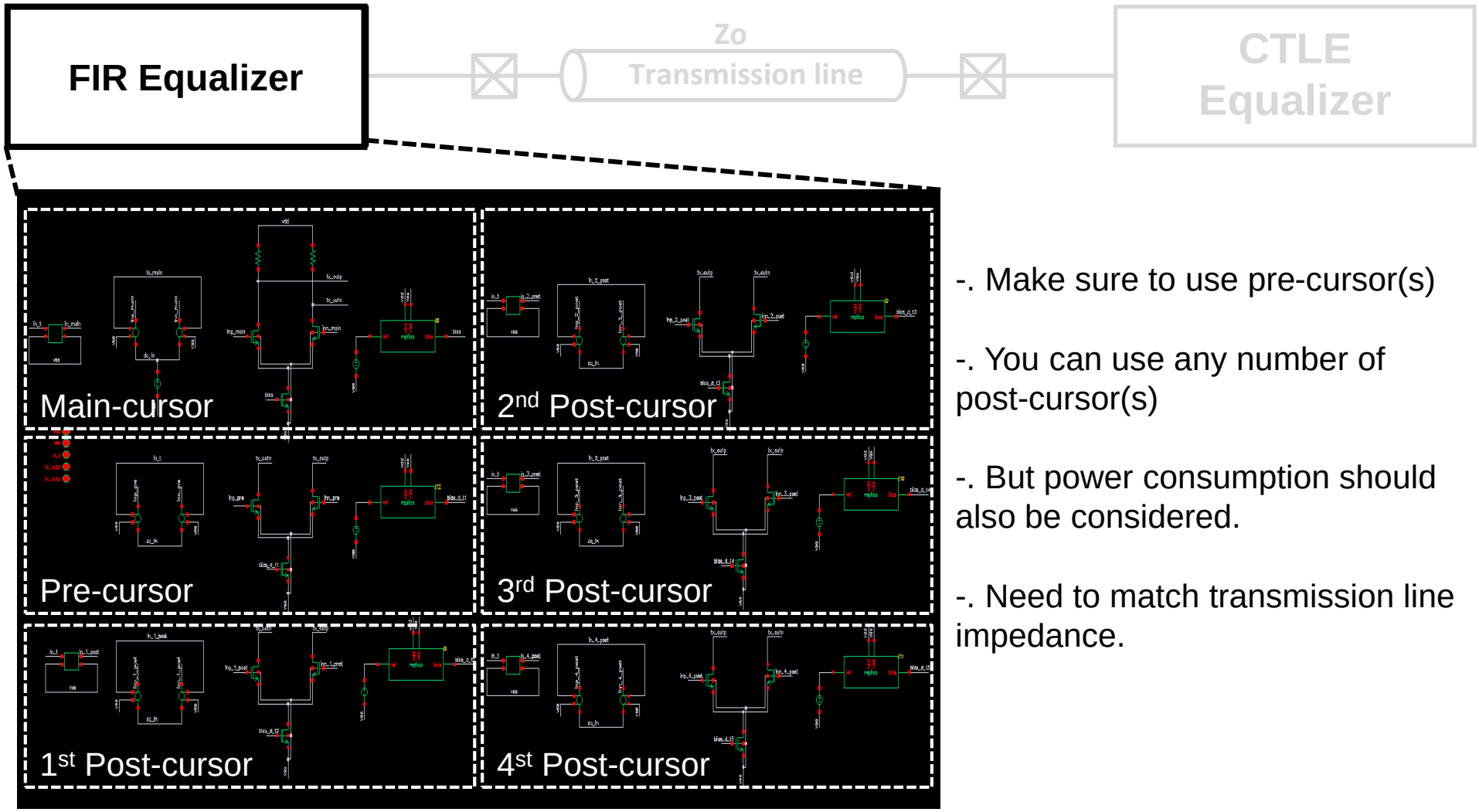


CDF Parameter	Value	Display
Num of lines (excluding ref.)	1	off
Physical length	10 M	off
Multiplicity factor	1	off
Max signal frequency		off
Type of Input	FieldSolver	off
Transmission line type	microstrip	off
Model type	wideband	off
Rel dielectic const of layers(er)	4.8	off
Dielectric layer thickness (d)	360u	off
Signal line width	447u	off
Signal line thickness	17.78u	off

- Type of Input : FieldSolver
- Transmission line type : microstrip
- Model type : wideband
- Real dielectric const of layers : 4.8 (FR4)
- Dielectric layer thickness : 360u (H)
- **Signal line width : 447u (W)**
- Signal line thickness : 17.78u (T)
- **Physical length : 10 M**

- Analyze transmission line impedance and loss
- Need impedance matching

FIR Equalizer



-. Make sure to use pre-cursor(s)

-. You can use any number of post-cursor(s)

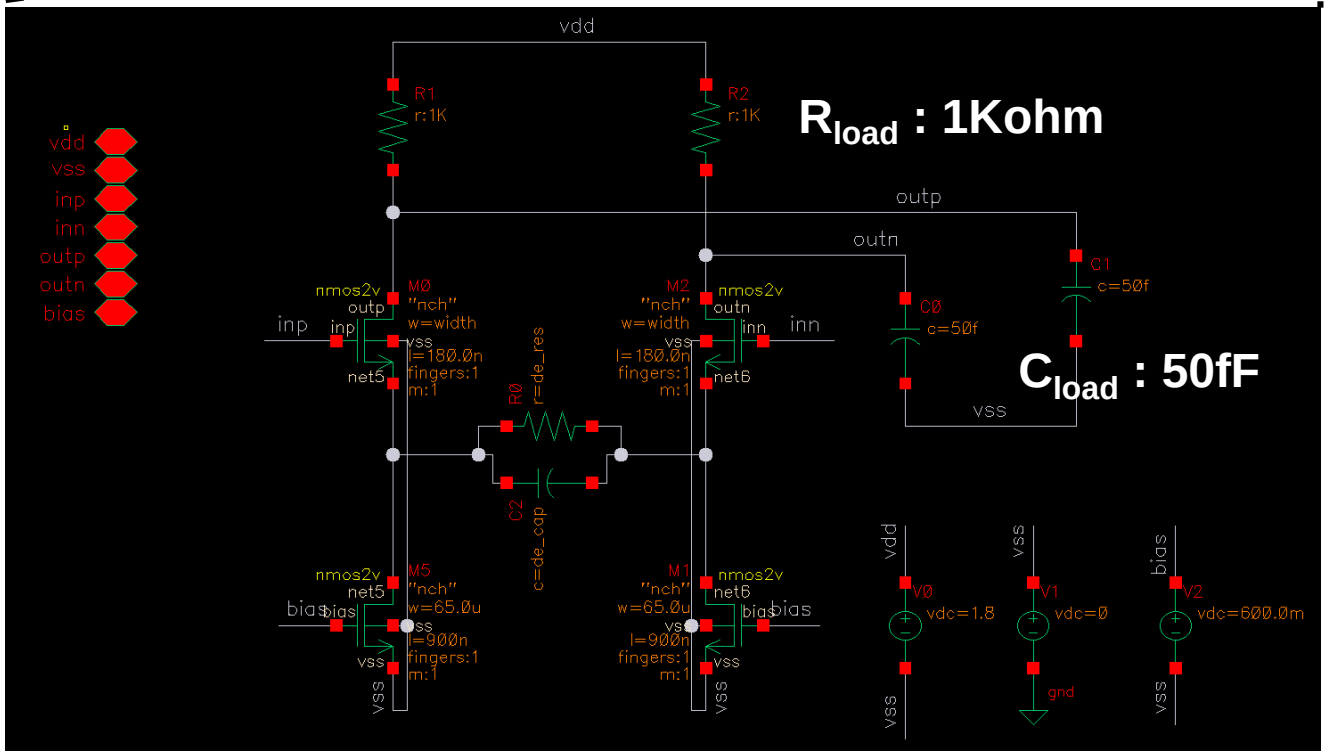
-. But power consumption should also be considered.

-. Need to match transmission line impedance.

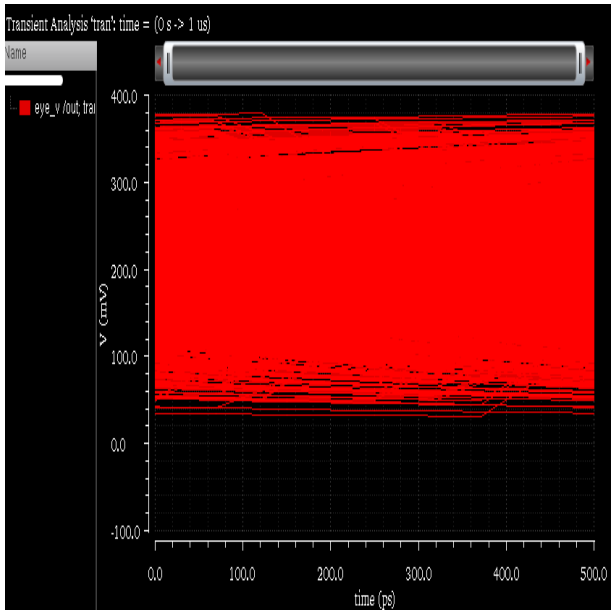
CTLE

FIR Equalizer — Zo Transmission line — **CTLE Equalizer**

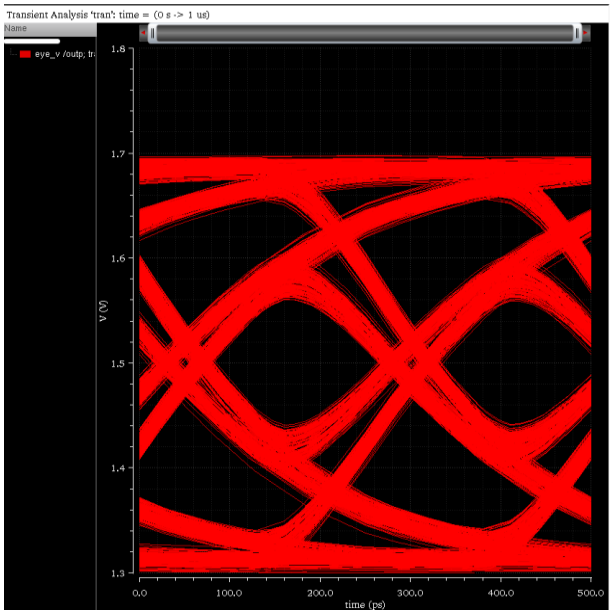
- R_{load} : 1Kohm
- C_{load} : 50fF
- Current limit : 600uA
- Tuning location of pole and zero
- Tuning DC gain



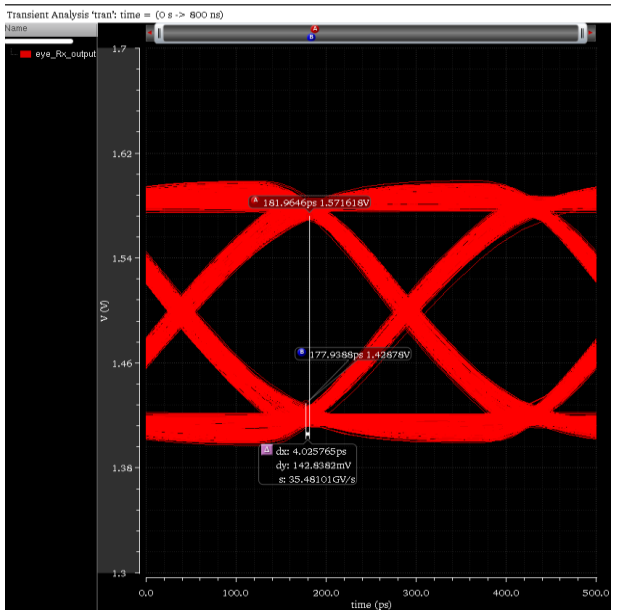
Simulation Result



< Transmission Line >



< CTLE >



< CTLE + FIR Equalizer >

EYE Diagram

- Pre-cursor and 3rd post-cursor FIR Equalizer
- CTLE Equalizer
- EYE Diagram
  - EYE width* : 219ps & height : 142mV
  - EYE Area* : 31210.58 (mV * ps)

*These results are single-ended

- Current consumption
  - Pre-emphasis : 28.222mA & CTLE Equalizer : 600uA
  - Total current : 28.822mA