



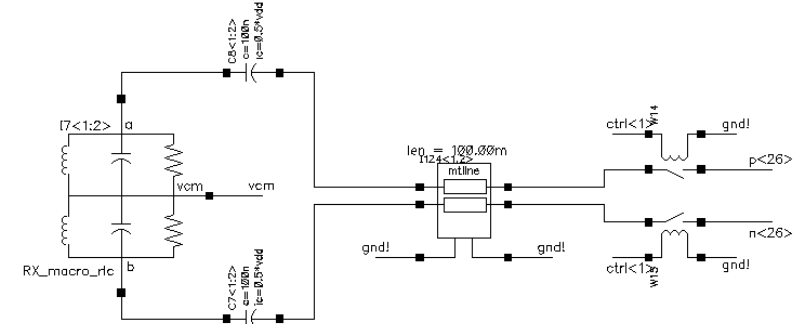
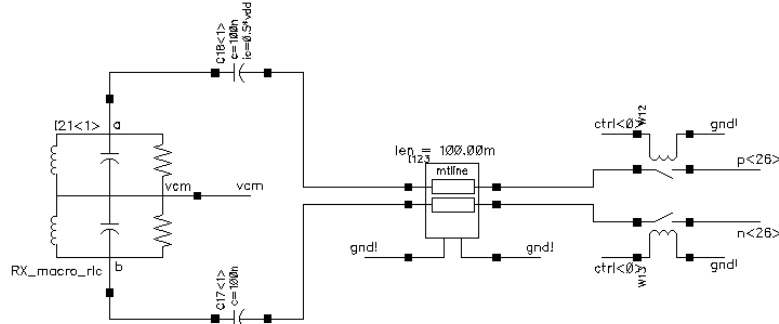
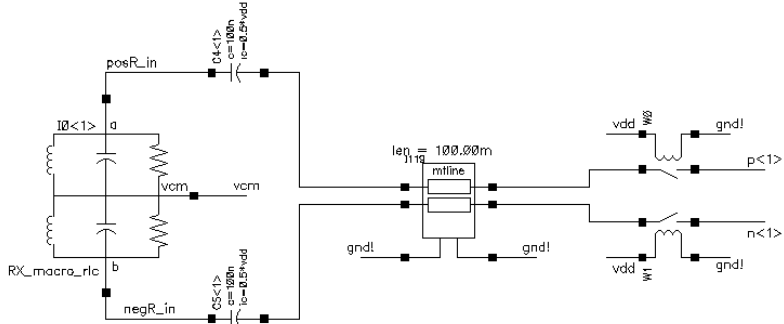
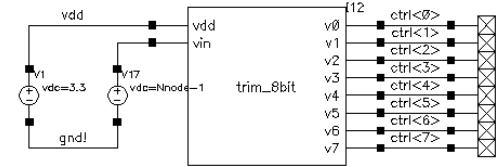
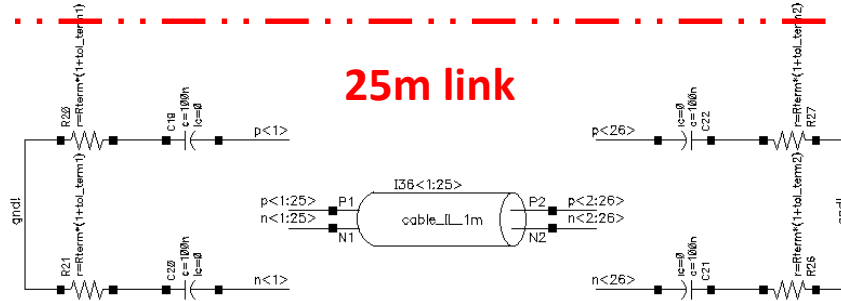
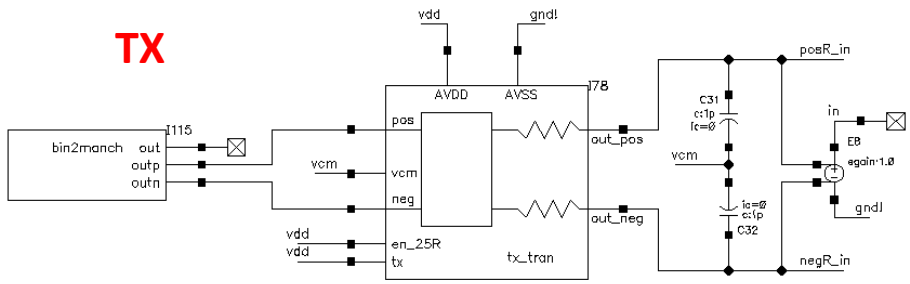
Gian Marco Bo
Piergiorgio Beruto

Comment 478 - MDI electrical specification
IEEE802.3cg TF

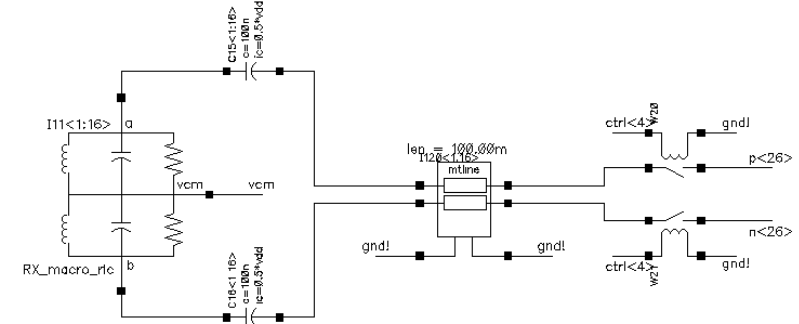
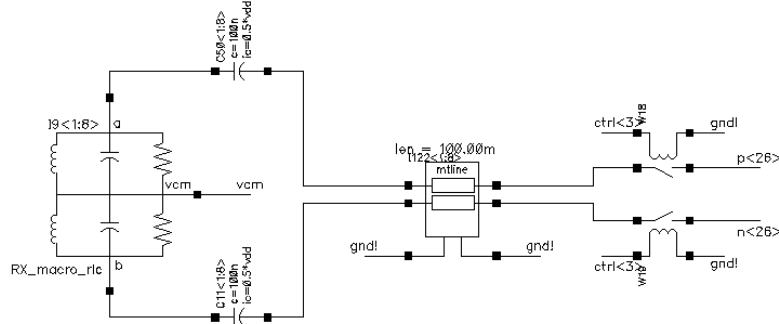
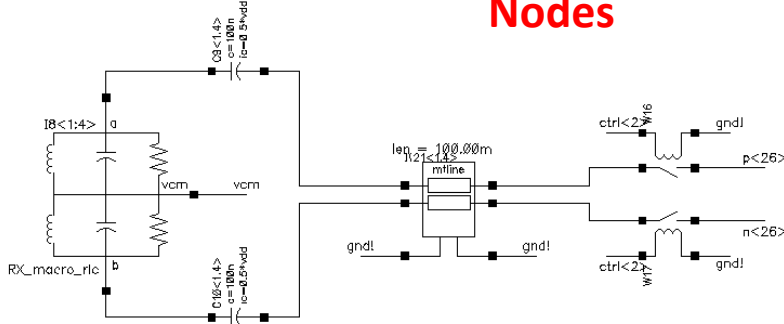
- Follow-up in detail for mixing segment node loading
 - http://www.ieee802.org/3/cg/public/Mar2018/brandt_cg_01a_0318.pdf
 - Comment #478
 - http://www.ieee802.org/3/cg/comments/802.3cg_draft1p2_Received_Comment%20ID.pdf
- Investigate the loading effect for different node count
- Propose a max total capacitance load across all nodes and a max node capacitance load

- 25m length link considered
- 8 to 40 nodes considered
- Lumped configuration considered since it represents worst case (in particular for the differential node capacitance value)
- Eye opening have been investigated versus differential node resistance, inductance and capacitance values.
- RLC from http://www.ieee802.org/3/cg/public/Mar2018/brandt_cg_01a_0318.pdf and comment #478
 - $R > 5K\Omega$
 - $440\mu H < L < 1mH$
 - $C < 4.5pF$
- Node capacitance has been determined considering a large node count (40)
- It is expected that a smaller node count allow to tolerate larger capacitance value

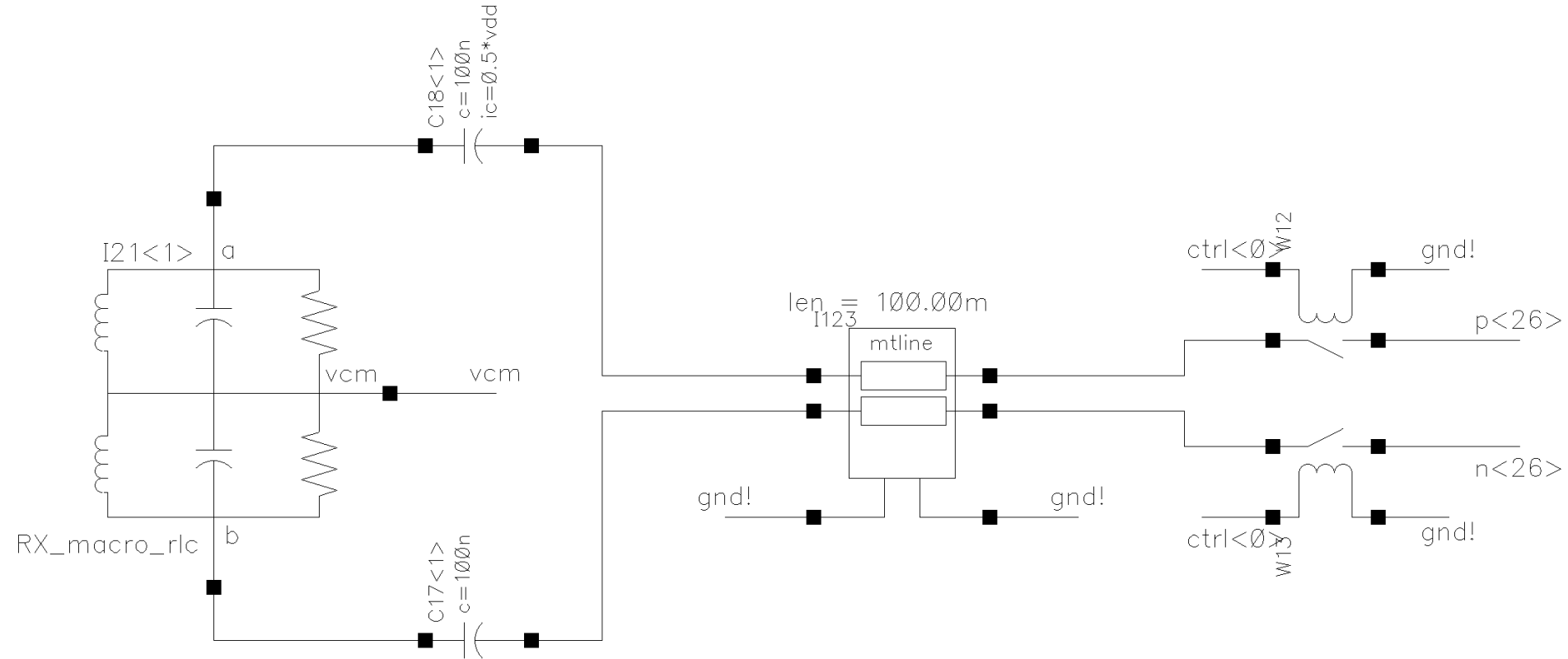
Modeling



Nodes

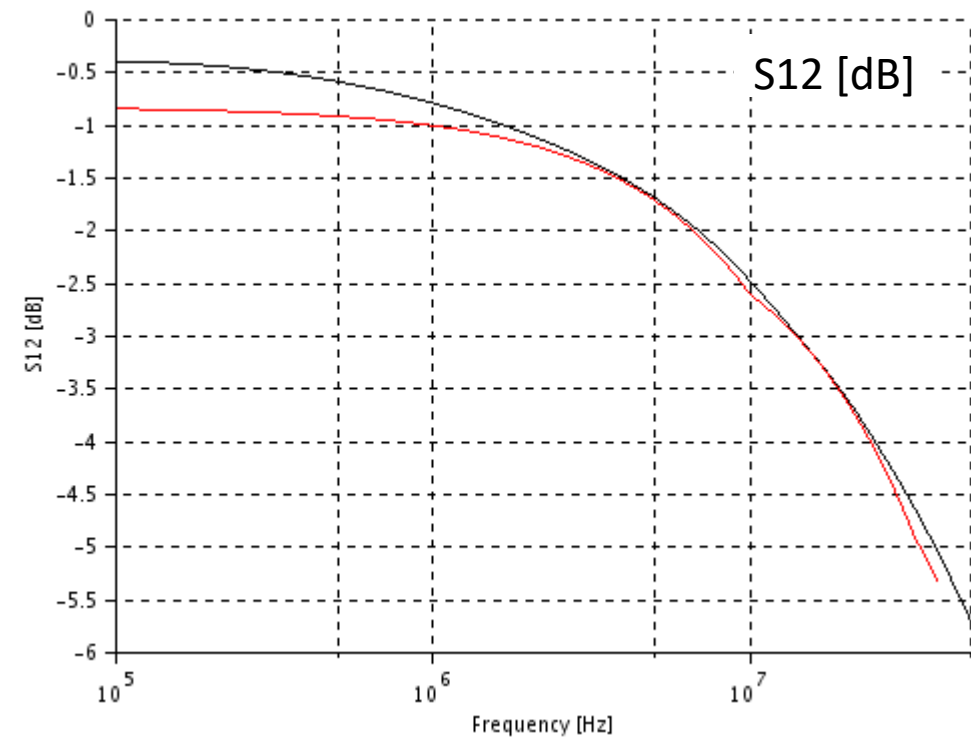
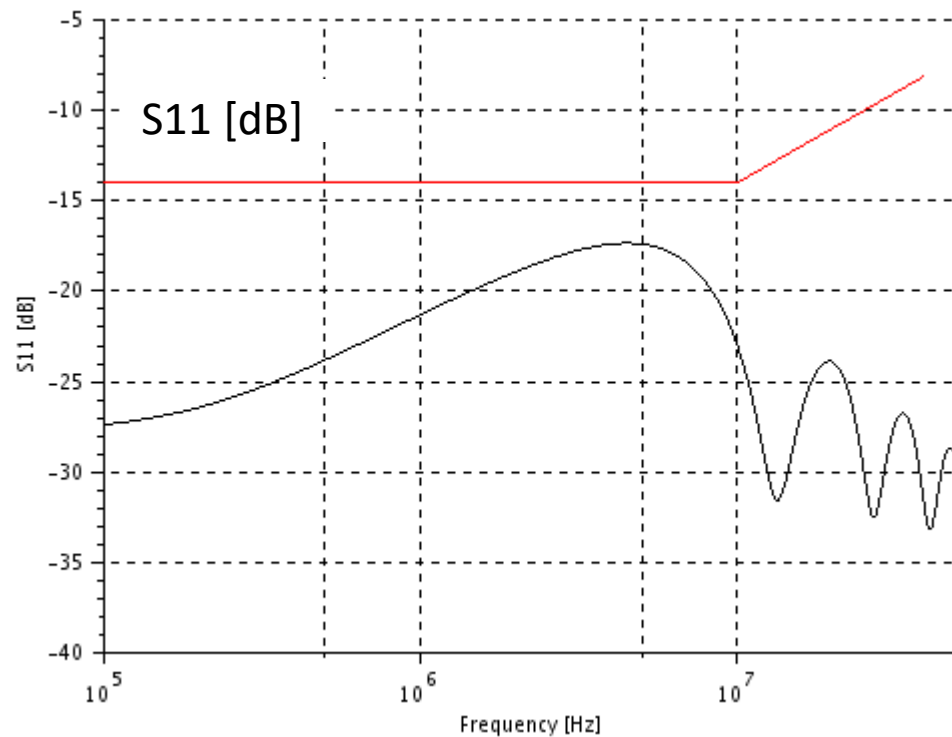
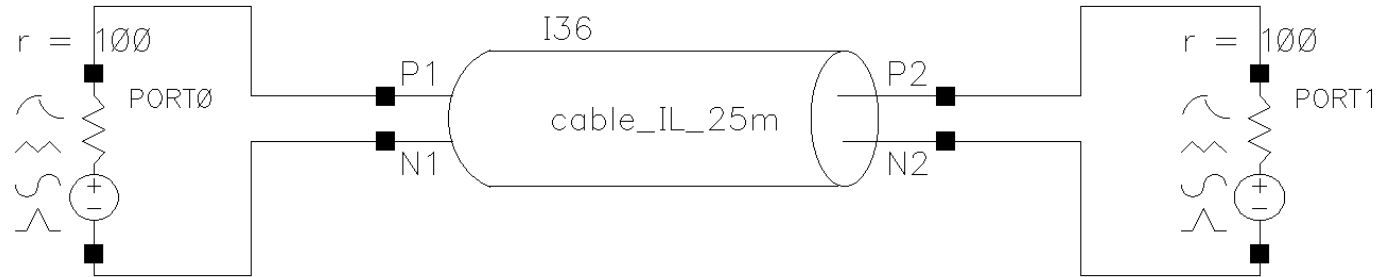


Modeling: single node



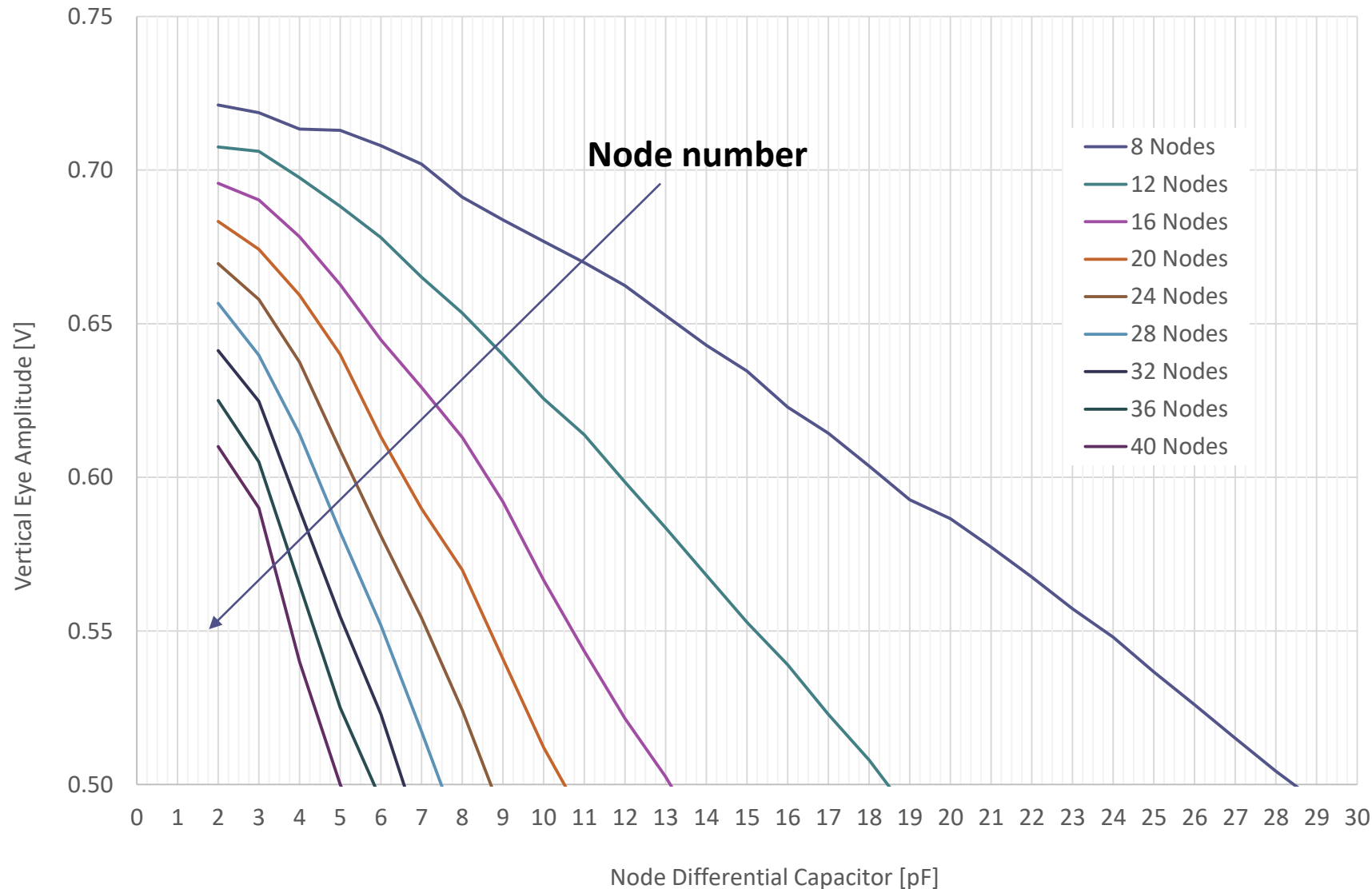
Modeling: 25m lossy transmission line S11 and S12

- Red: limit
- Black: model



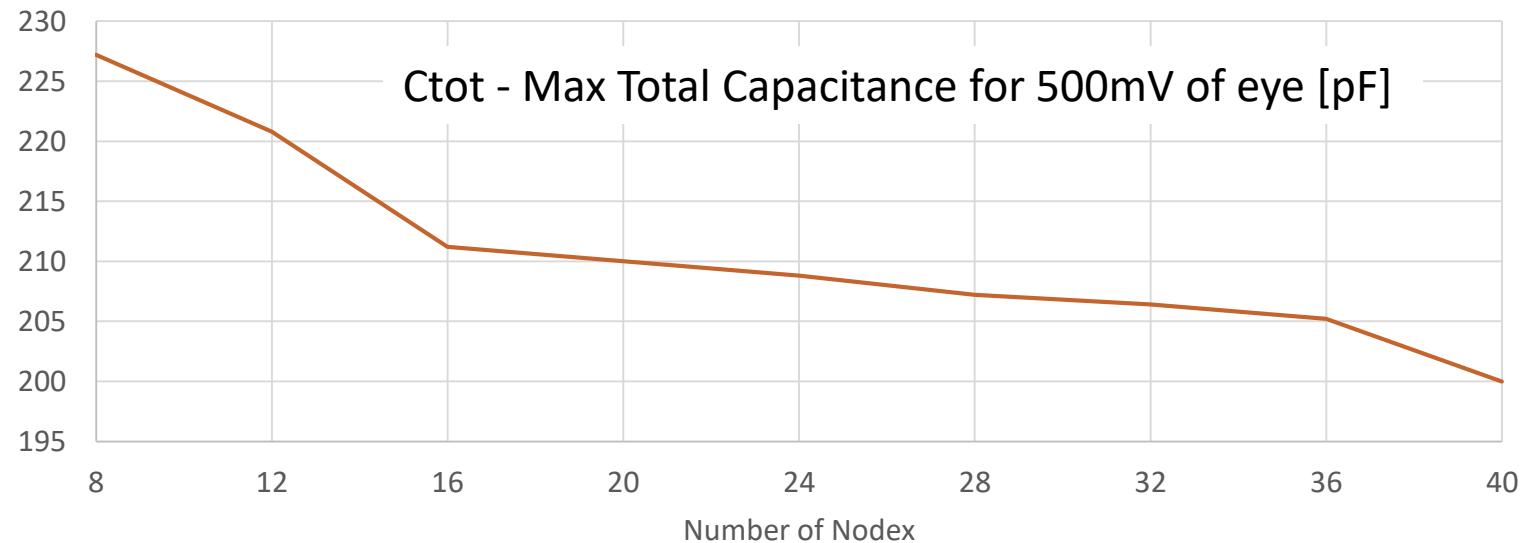
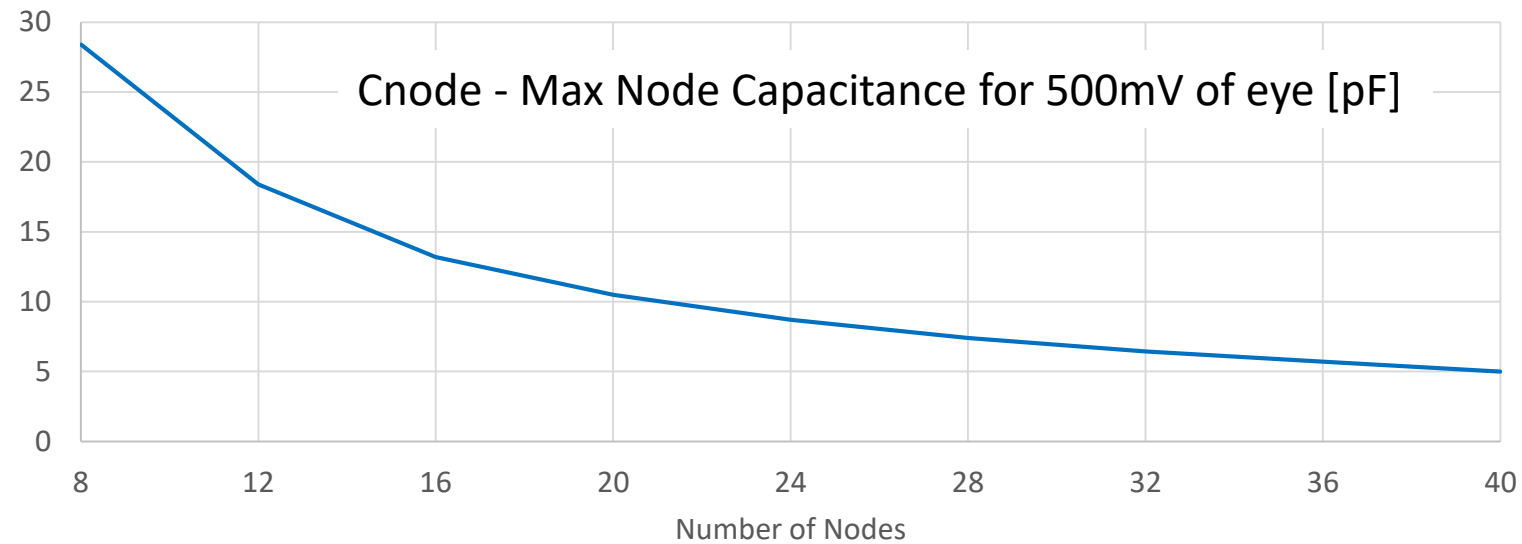
- Preliminary results show only a weak dependence on the differential resistance and inductance versus the number of nodes, but there is a strong dependence on the differential capacitance.
- Several runs have been then performed with the following configuration.
 - Differential node resistance set to $10\text{K}\Omega$
 - Differential node inductance set to $440\mu\text{H}$
 - Differential node capacitance varied between 2pF to 30pF
 - Node number varied between 8 and 40
 - Eye opening versus node number and differential node capacitance investigated

RX Eye Amplitude vs. Node Differential Capacitor and Node Number



- From such data the maximum capacitance for each node C_{node} and the total capacitance across all nodes C_{tot} the maximum can be extrapolated (sum of all C_{node})
- 500mV RX eye target opening considered

Node and Total Capacitance vs Number of Nodes



Node and Total Capacitance vs Number of Nodes

- 180pF limit for the total capacitance can be considered (some margin have been taken into account)
- 40 nodes gives $180\text{pF} / 40 = 4.5\text{pF}$
- 8 nodes gives $180\text{pF} / 8 = 22.5\text{pF}$
- 15pF limit for the single node capacitor can be also considered to limit anyway the single node loading

- Changing the node number, the amount of tolerable differential capacitance values change.
- Maximum total capacitance across all nodes C_{tot} and the maximum capacitance for each node C_{node} can be defined.
- MDI minimum parallel impedance can be expressed as follow.
 - $Z = 1/\sqrt{(1/R)^2 + (1/(2*\pi*f*L) - 2*\pi*f*C_{node})^2}$
 - $R > 10 \text{ k}\Omega$
 - $440\mu\text{H} < L < 1 \text{ mH}$
 - $C_{tot} < 180 \text{ pF}$ and $C_{node} < 15 \text{ pF}$
 - $0.3 \text{ MHz} < f < 40 \text{ MHz}$