

10SPE

Automotive PHY channel consideration - time domain simulation

Contributors:

Christoph Wechsler, Audi

Carsten Schanze, VW

Olaf Krieger, VW

Supporter:

Kirsten Matheus, BMW

Tony Adamson, NXP

Helge Zinner, Continental

Motivation

To show the gap between existing transceiver technologies and our ambitions for 10SPE @15m.

Aspects:

- Choice of topologies (Based on Stefan Buntz presentation in the 10SPE adhoc on 29 March 2017)
- Transceiver technology:
FlexRay (10MBit/s)

General information: FlexRay

	FlexRay
Control mode	Time triggered
Time response	Deterministic
Bus access	TDMA
Error detection	CRC
Bus level	<u>Data 0:</u> $U_{\text{Bus_p}} = 1.5\text{V}$ $U_{\text{Bus_m}} = 3.5\text{V}$ $U_{\text{diff}} = -2.0\text{V}$ <u>Data 1:</u> $U_{\text{Bus_p}} = 3.5\text{V}$ $U_{\text{Bus_m}} = 1.5\text{V}$ $U_{\text{diff}} = 2.0\text{V}$
Medium	Twisted pair
Topology	Linear (daisy-chain)

Methodic: Time domain simulation

Simulation environment

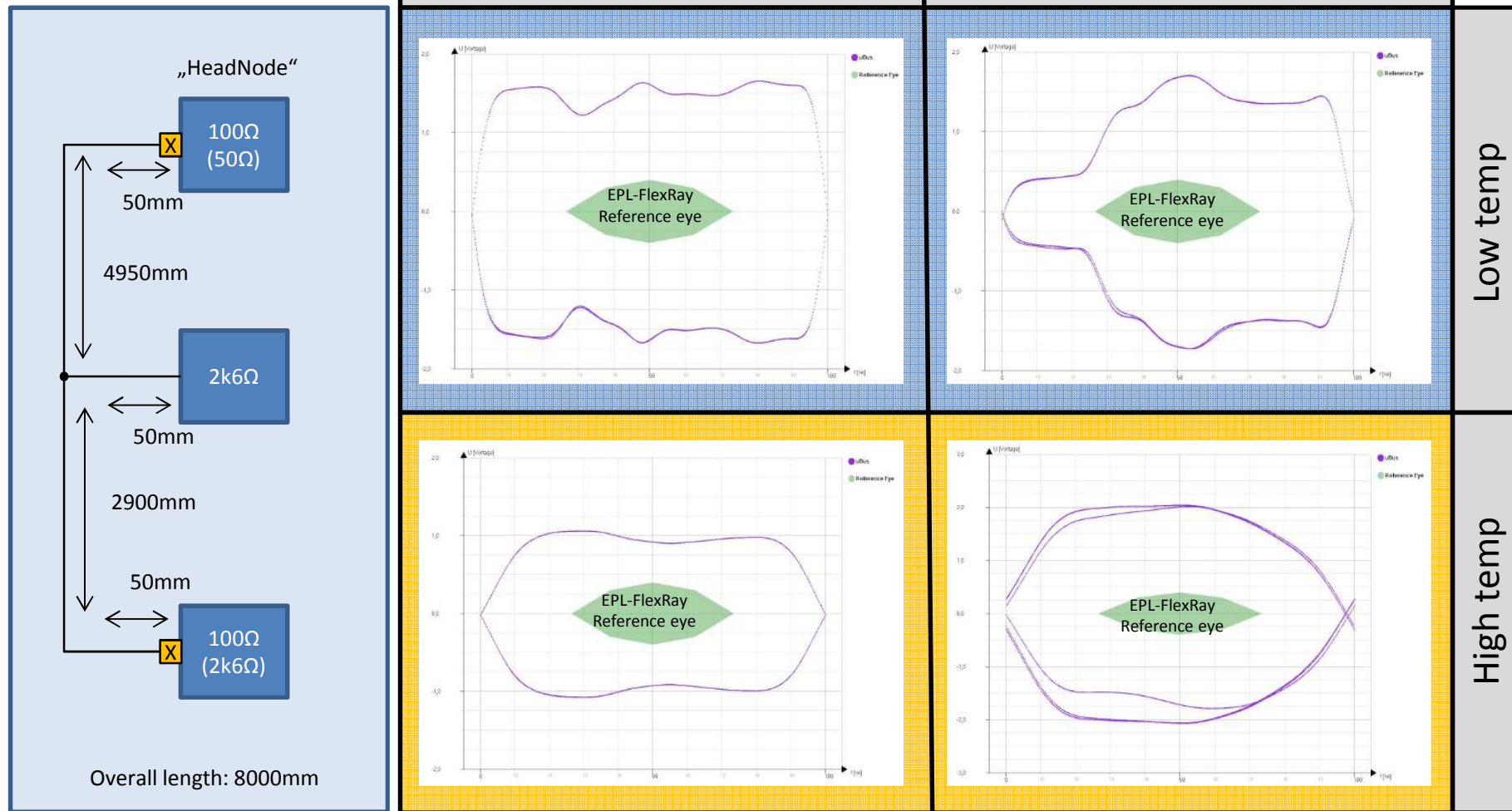
- VHDL-AMS Simulator
- Transceiver
 - FlexRay: TJA1081 (NXP)
- Cable model
 - FlexRay: FLR9Y (Coroplast)
- Temperature range
 - FlexRay: Low / Max

Evaluation

- FlexRay: Eye diagram (Selection criteria: Shortest distance between signal and reference eye (Worst Case))

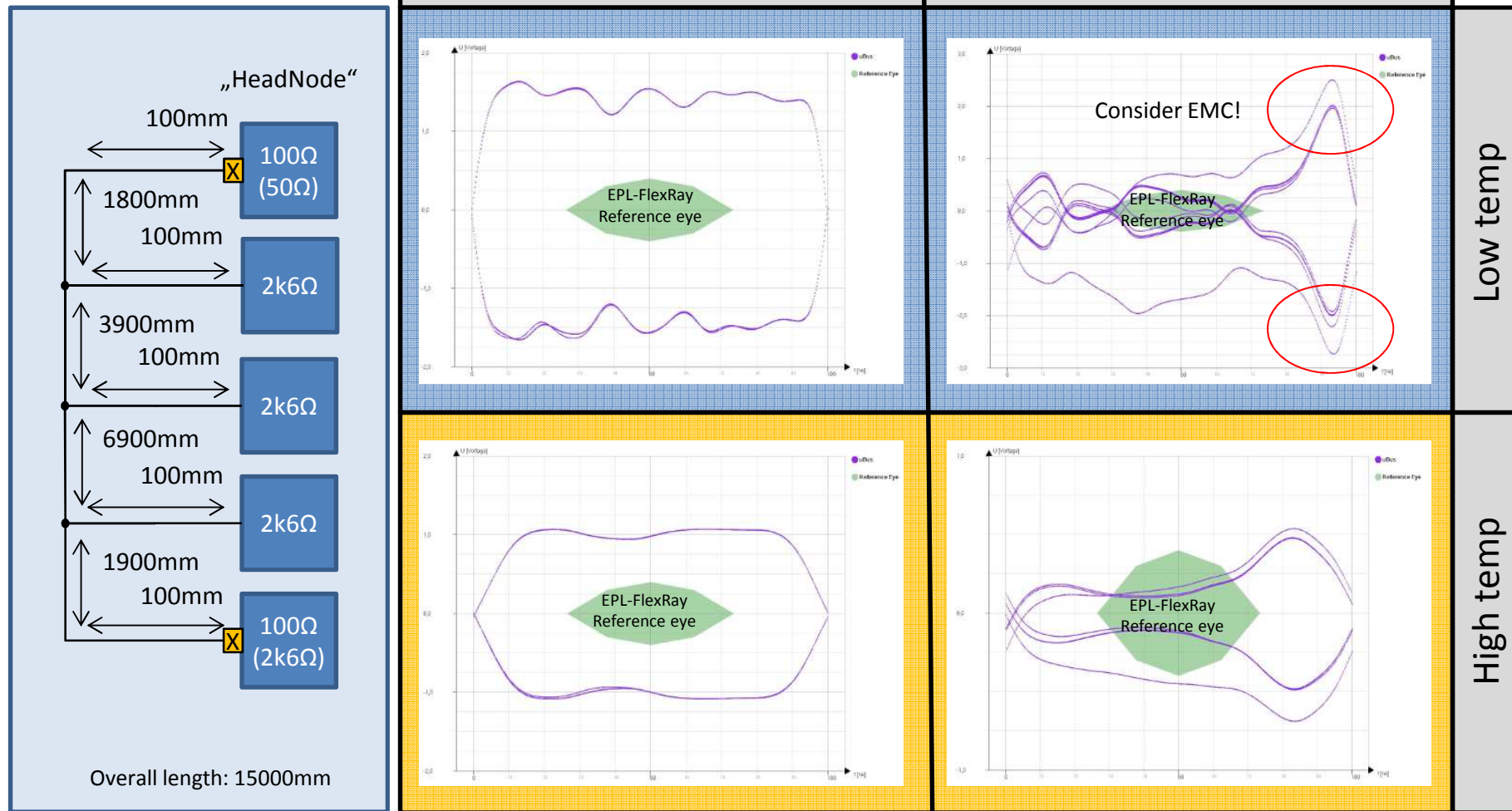
-FlexRay-

Passive linear topology – min. dimension



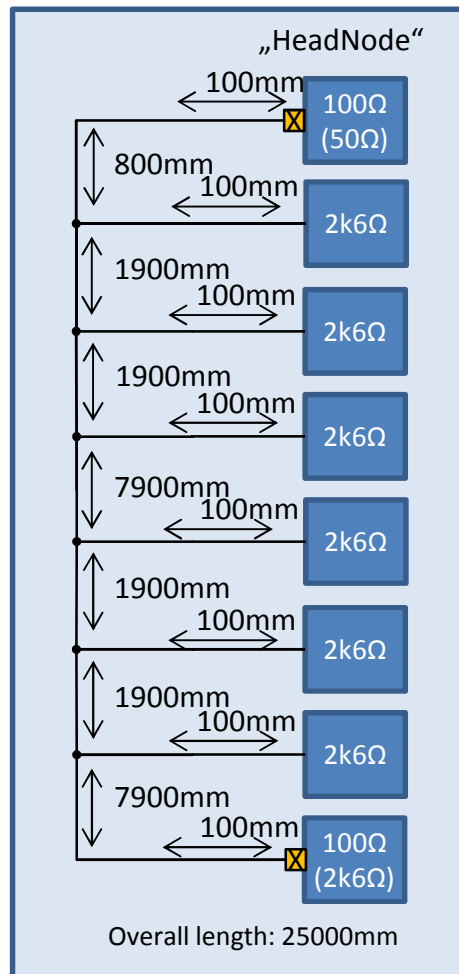
-FlexRay-

Passive linear topology – mid. dimension

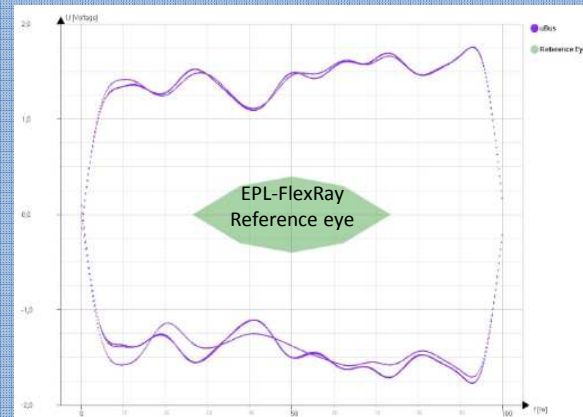


-FlexRay-

Passive linear topology – max. dimension



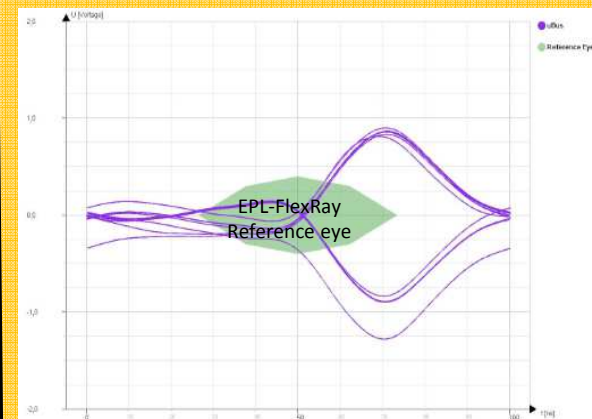
Decentral termination



Central termination (Head Node)

Simulation error!

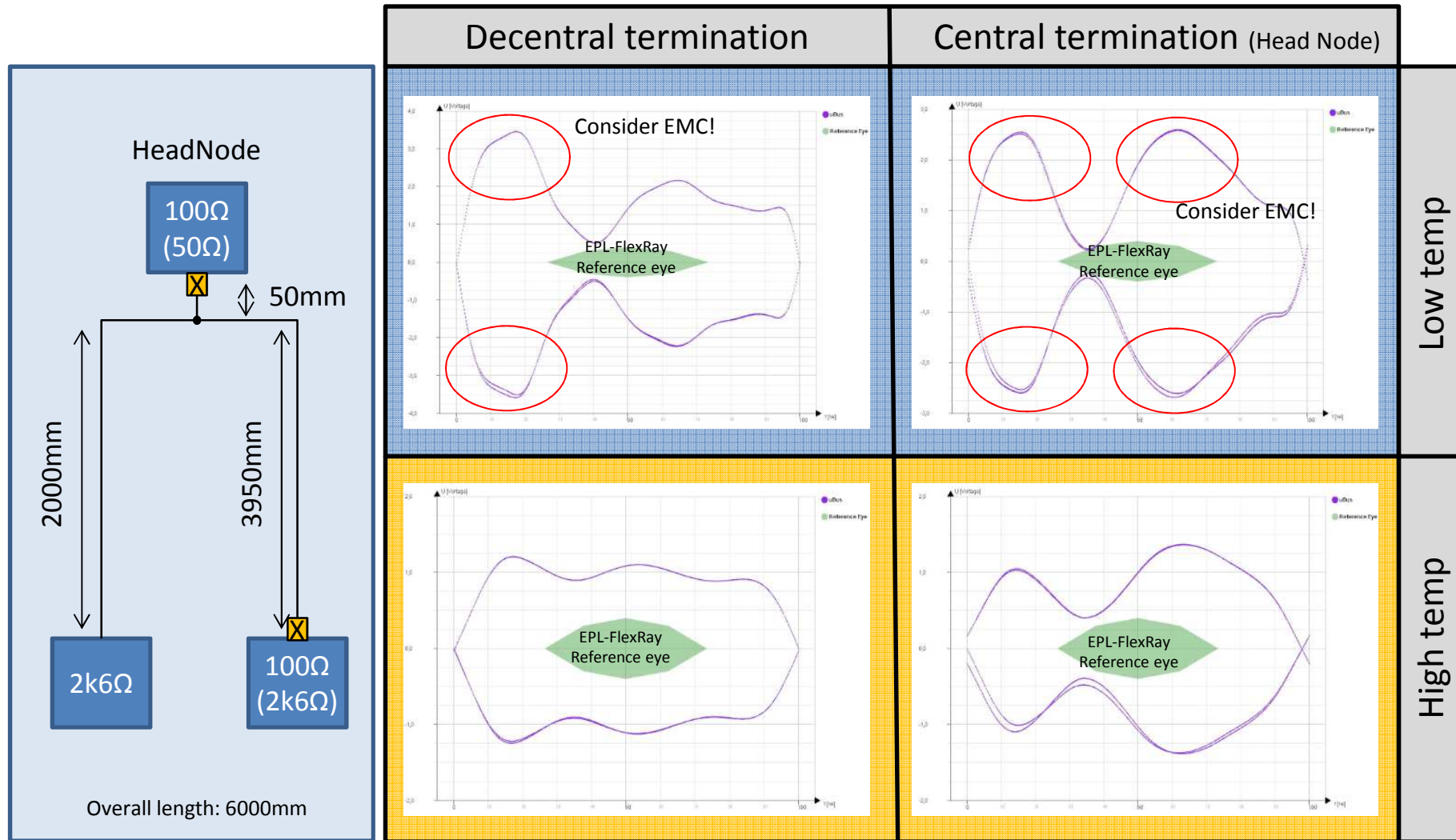
Low temp



High temp

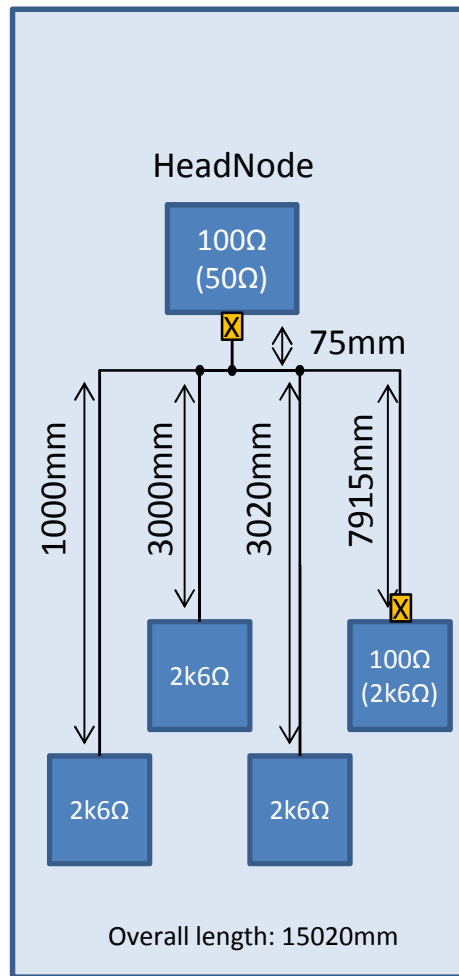
-FlexRay-

Passive star topology – min. dimension

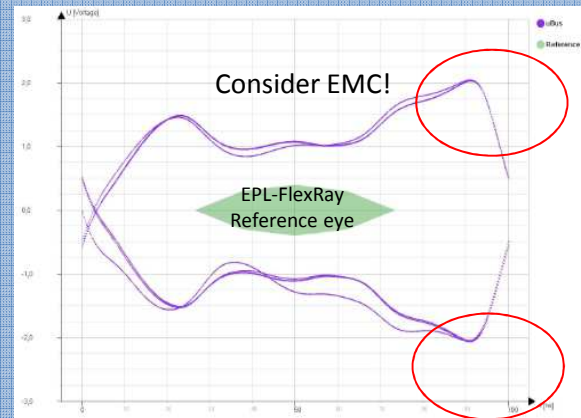


-FlexRay-

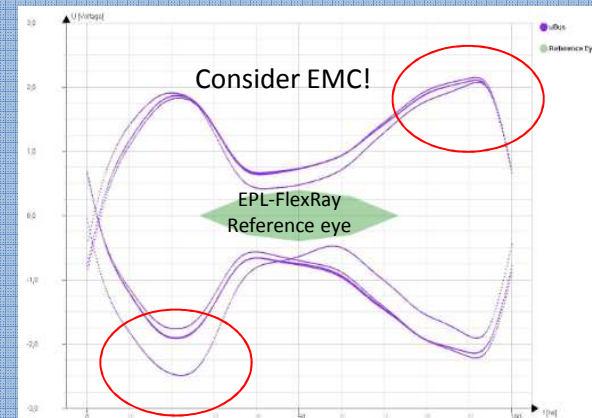
Passive star topology – mid. dimension



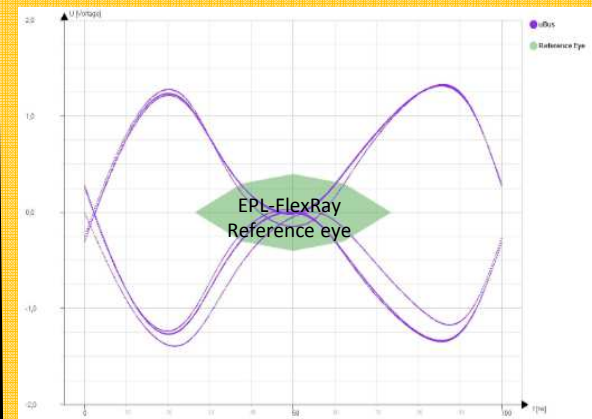
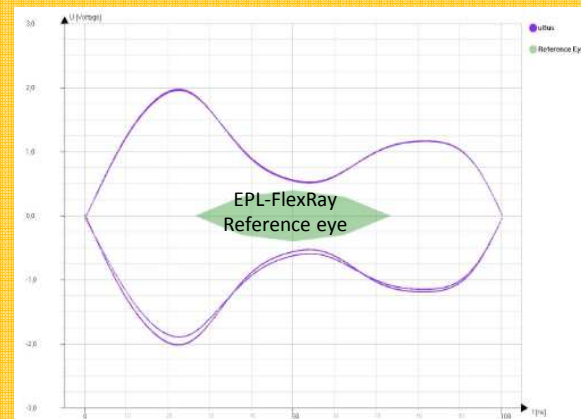
Decentral termination



Central termination (Head Node)



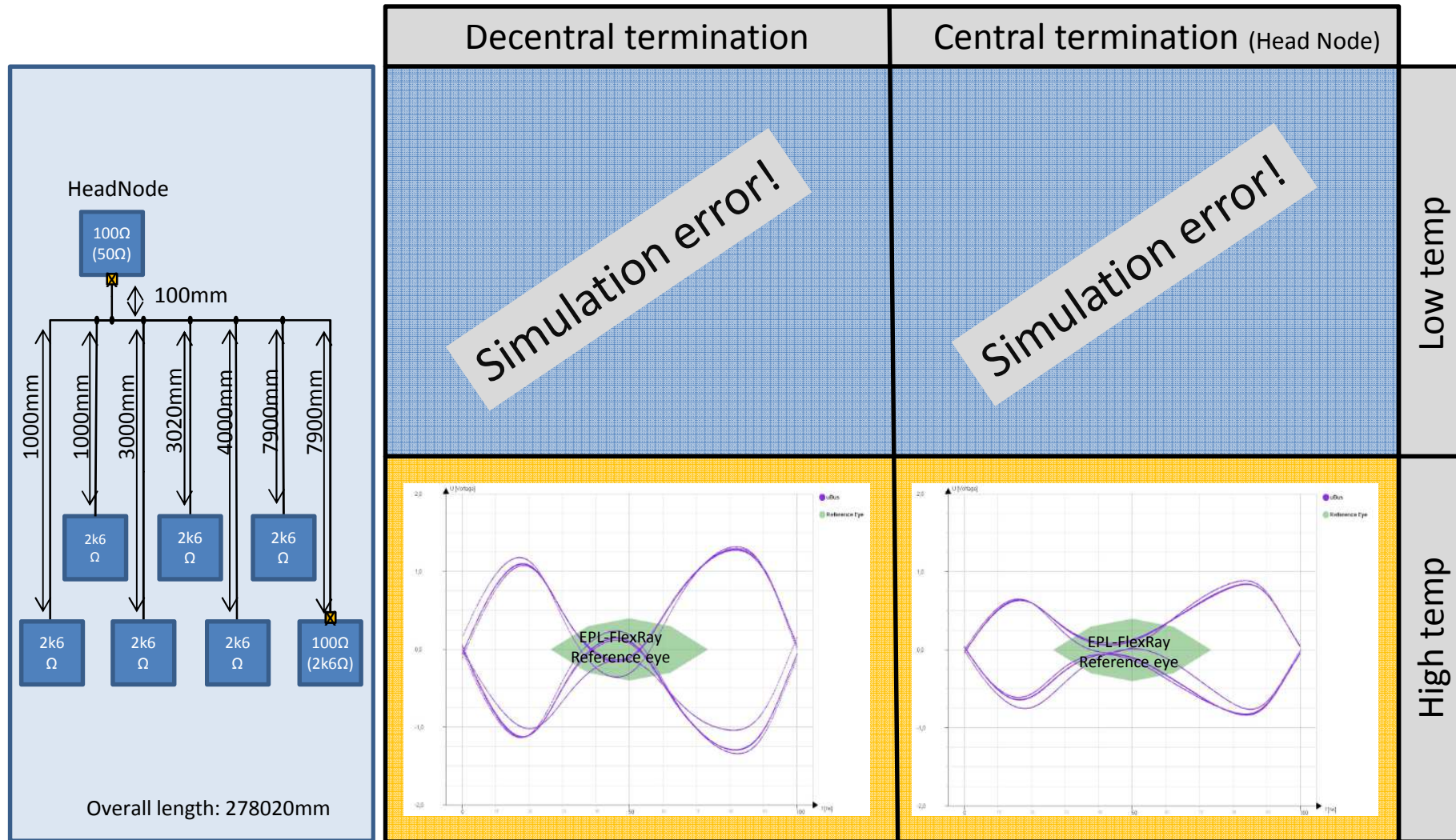
Low temp



High temp

-FlexRay-

Passive star topology – max. dimension



Conclusion:

With the existing transceiver technology (FlexRay), it seems to be possible to meet the minimum requirements (passive linear topologies / decentral termination) for 10SPE@15m. However, they are not suitable for use in passive star topologies and/or central termination.

Question to manufacturers:

Is it possible to develop a cost effective 10SPE@15m ETHERNET PHY that can handle the signal integrity in those cases?

Ambition:

Passive topologies with:

- central termination
- total length: min. 15000mm
- amount of ECUs: min. 5
- passive star topology