



LUNDS UNIVERSITET
Lunds Tekniska Högskola

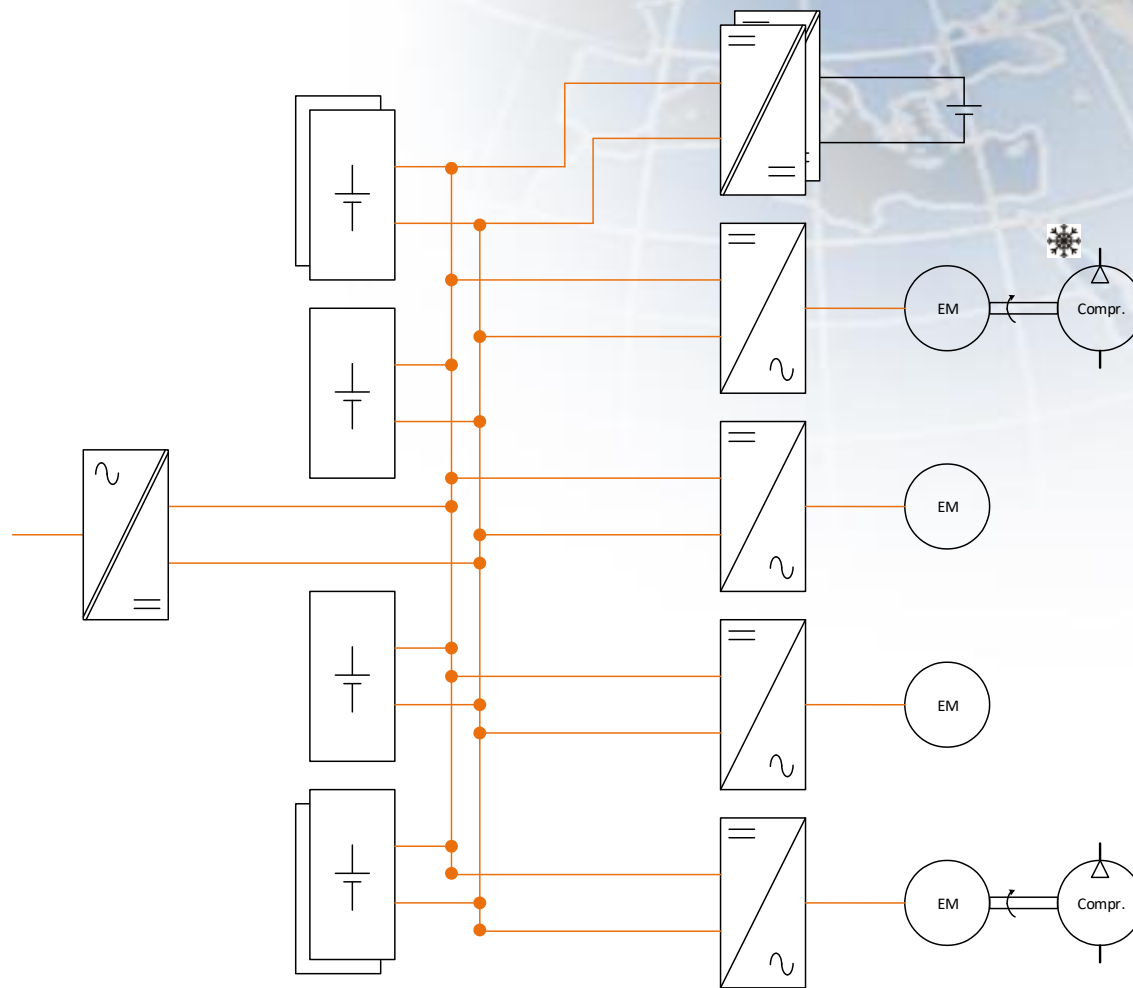
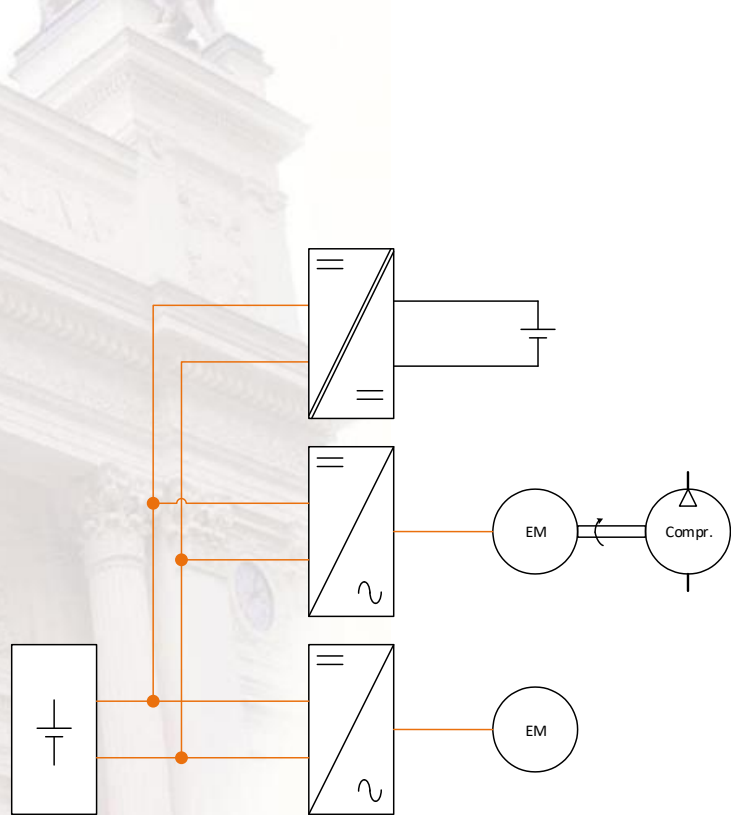
VOLVO

Modeling of electric power system in electric vehicles

NI Automotive Forum Sweden
7 November 2019
Per Widek

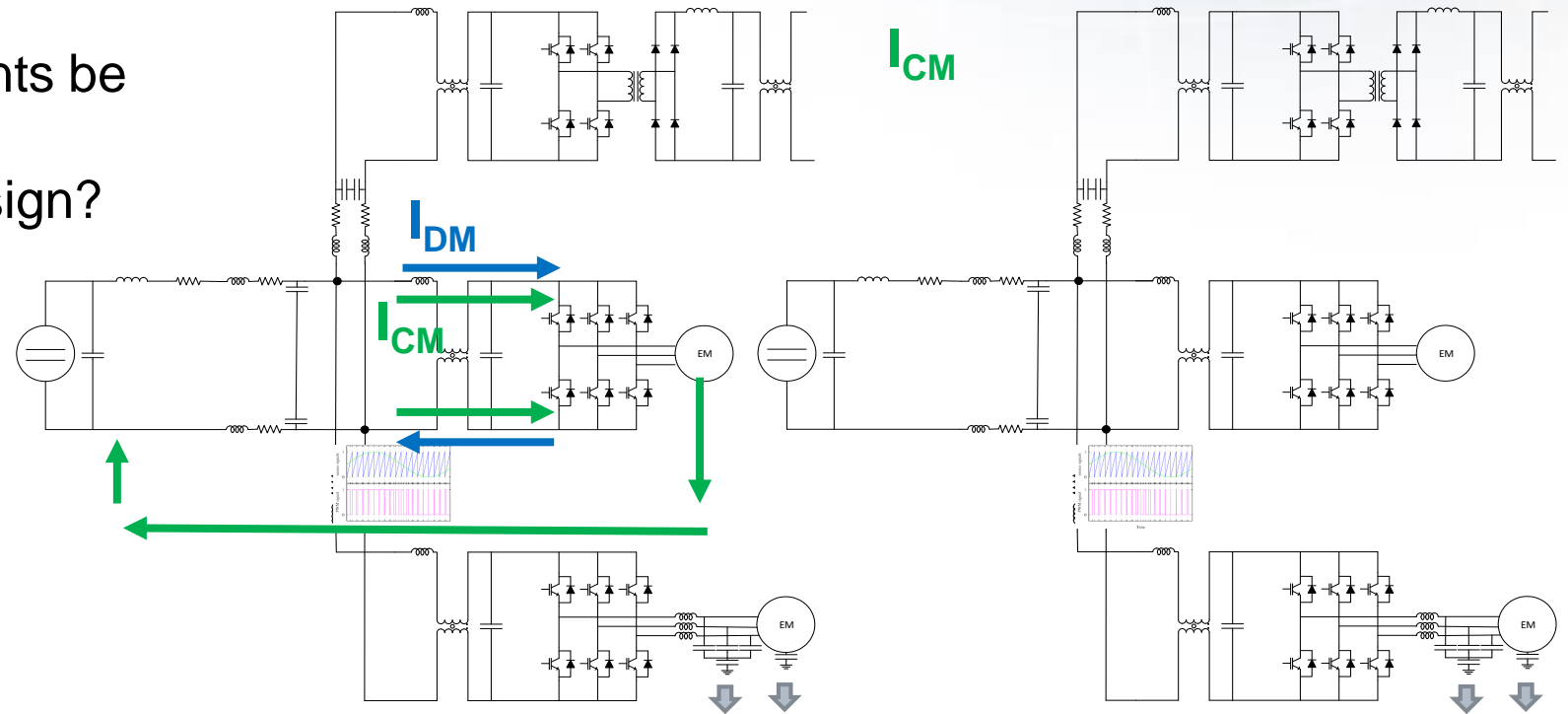
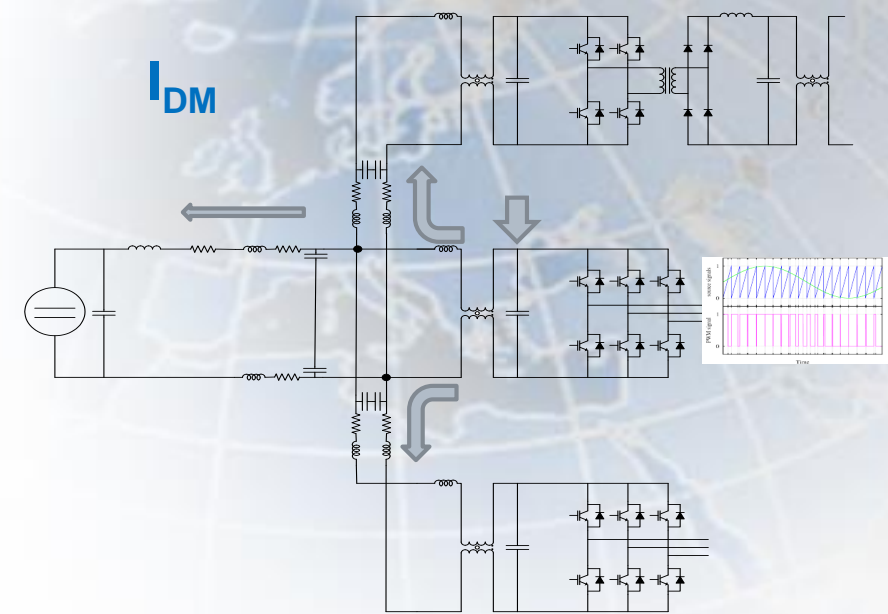


What does “the future” mean from an electrical layout?

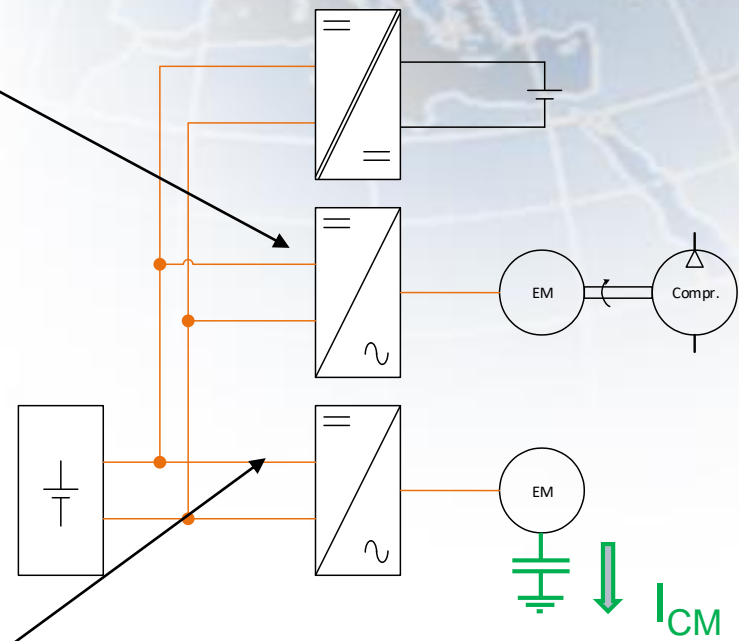
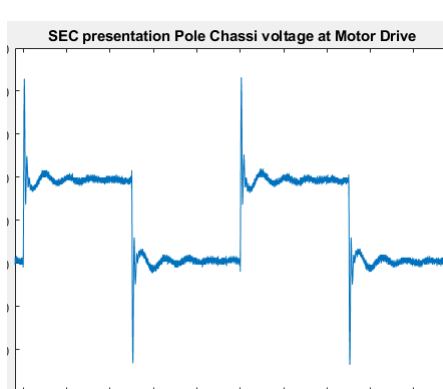
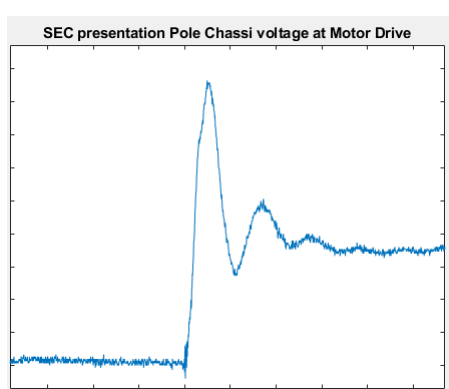
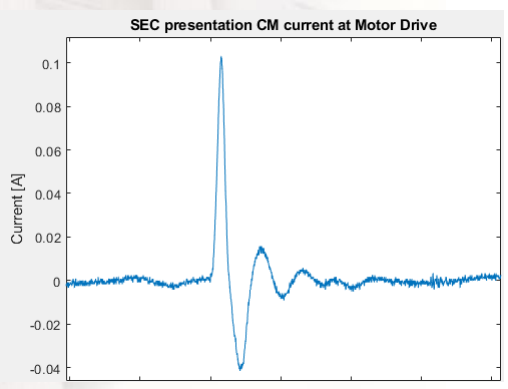
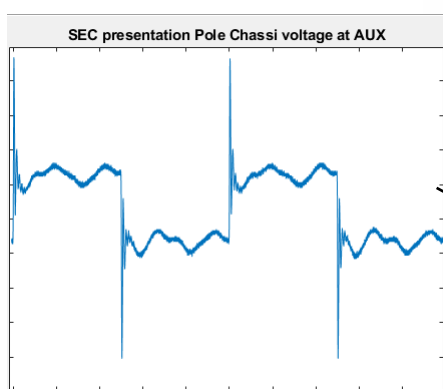
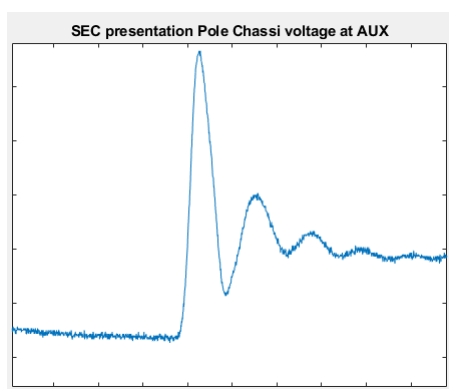
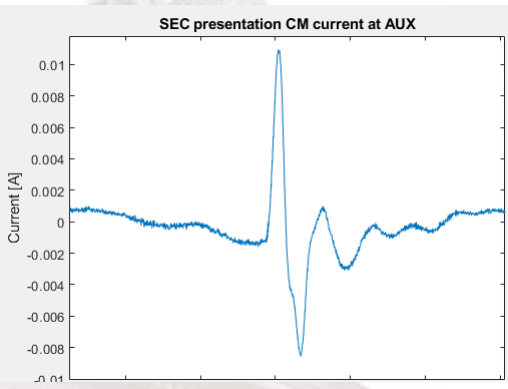


Differential and common mode

- What is Common mode and differential mode?
- What is the effect from the motor drive in the other components?
- How shall the requirements be written towards suppliers to get a good system design?

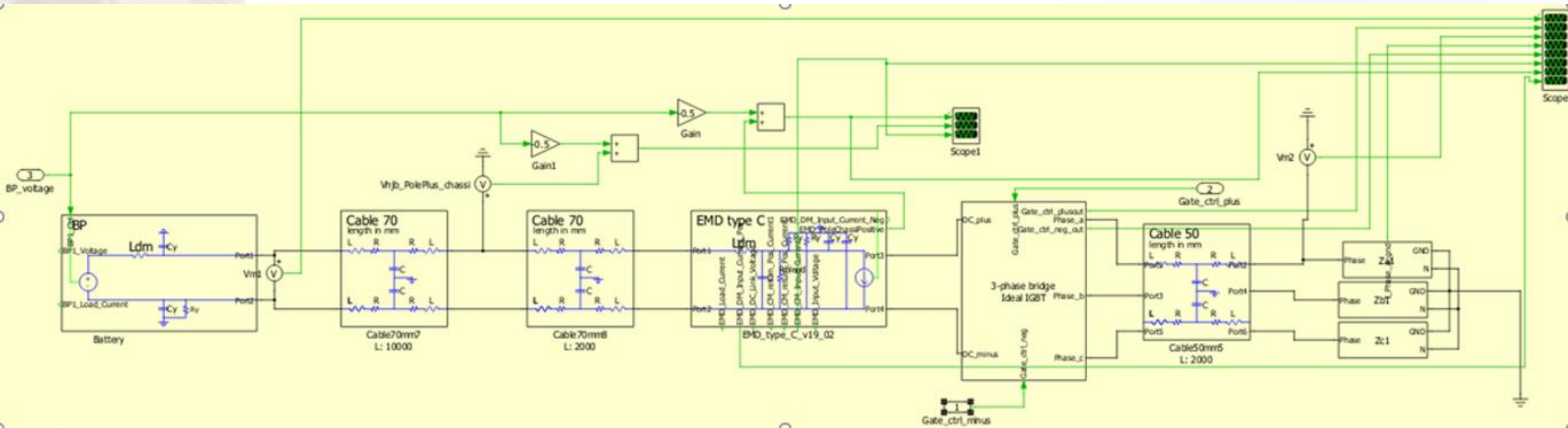


Common mode currents and voltages

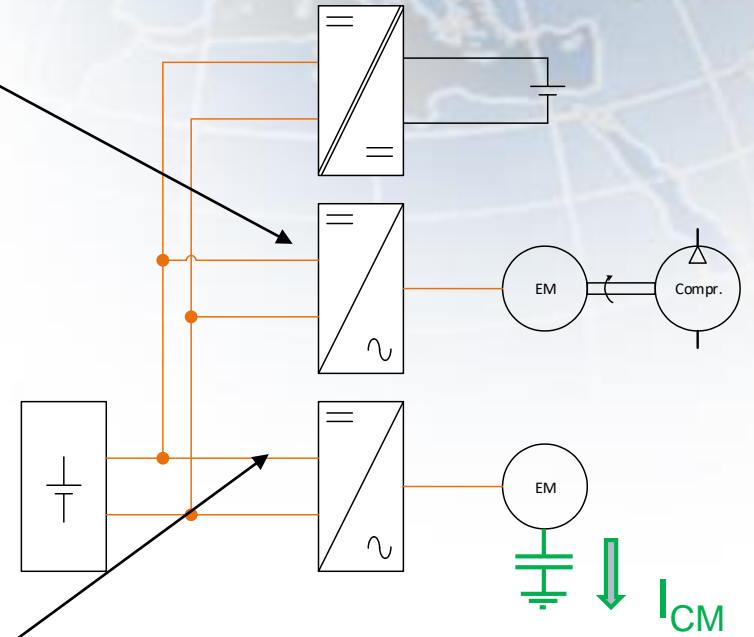
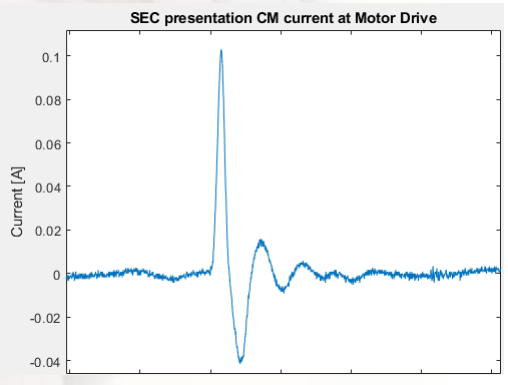
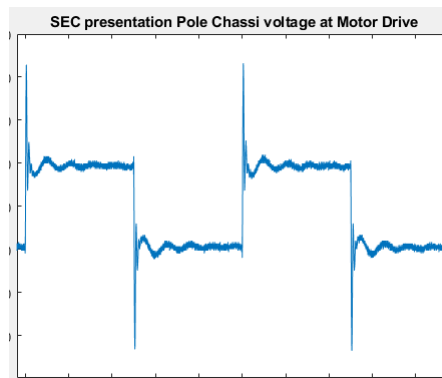
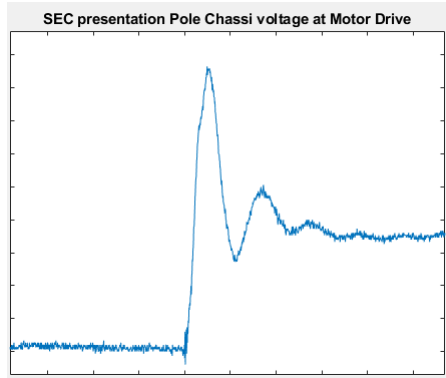
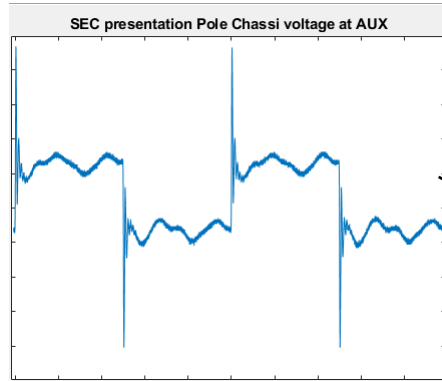
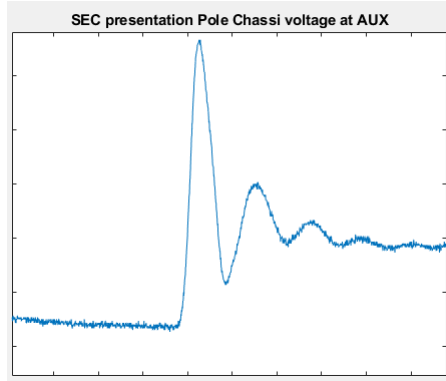
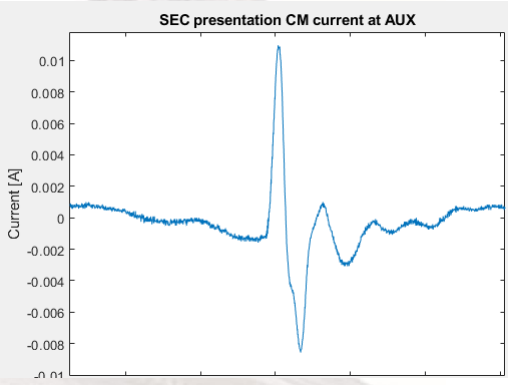


Simulation in PLECS

- The model of the system described earlier has partly been built.
- The system is “stiff” is hard to solve. More challenges 😊
- First results this week shows good correlation with simulations and measurements.

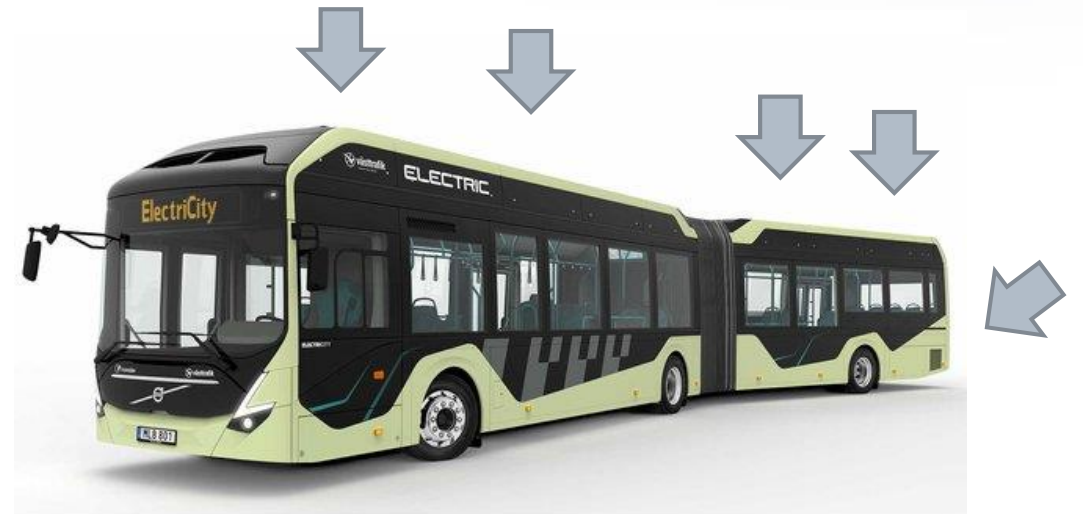


Measurement vs. simulation

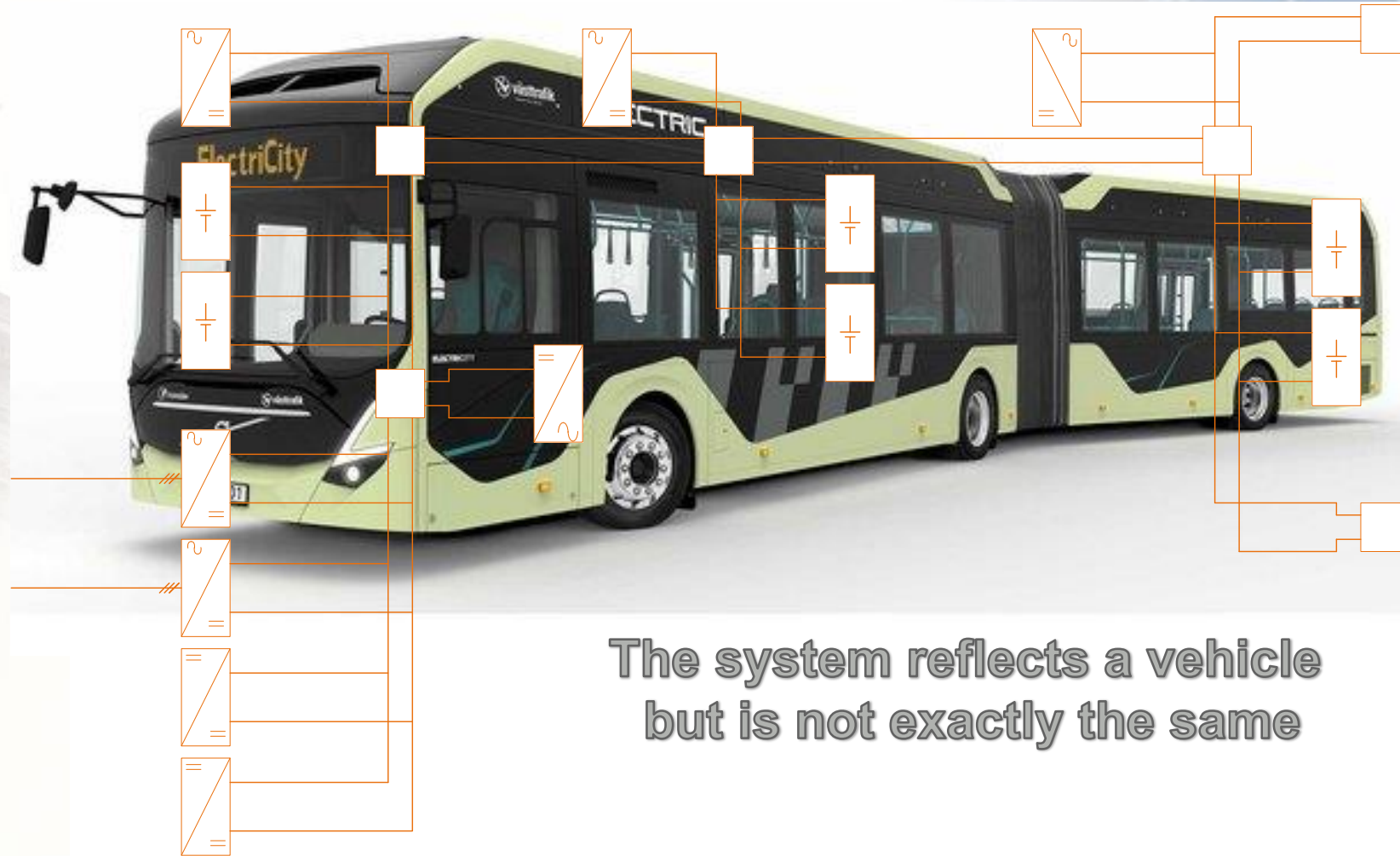


Vehicle to measure on - Bus

- Bus is 24 m long
- Some equipment is on the roof
- Some equipment in the engine compartment

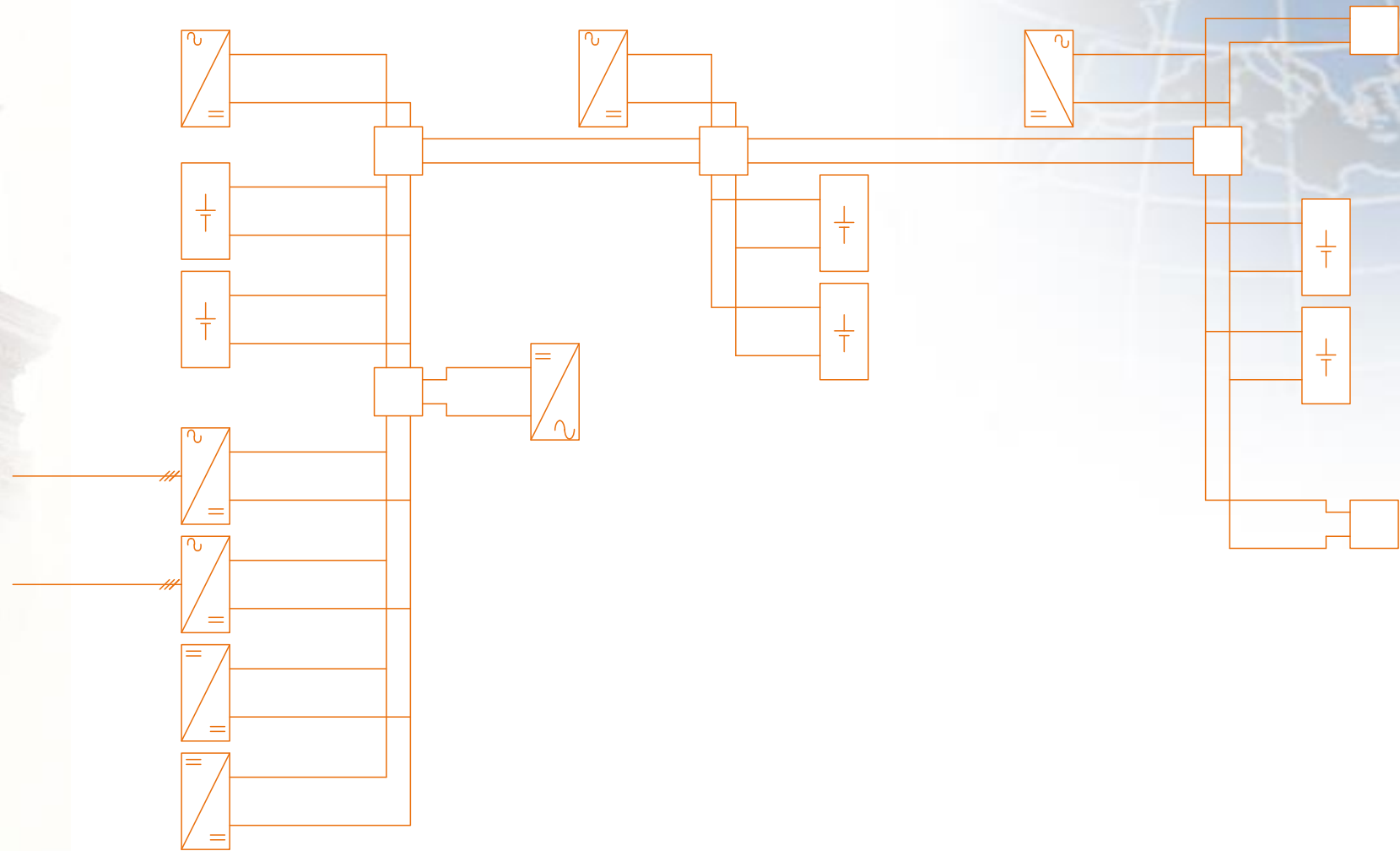


Devices under test are distributed in the vehicle

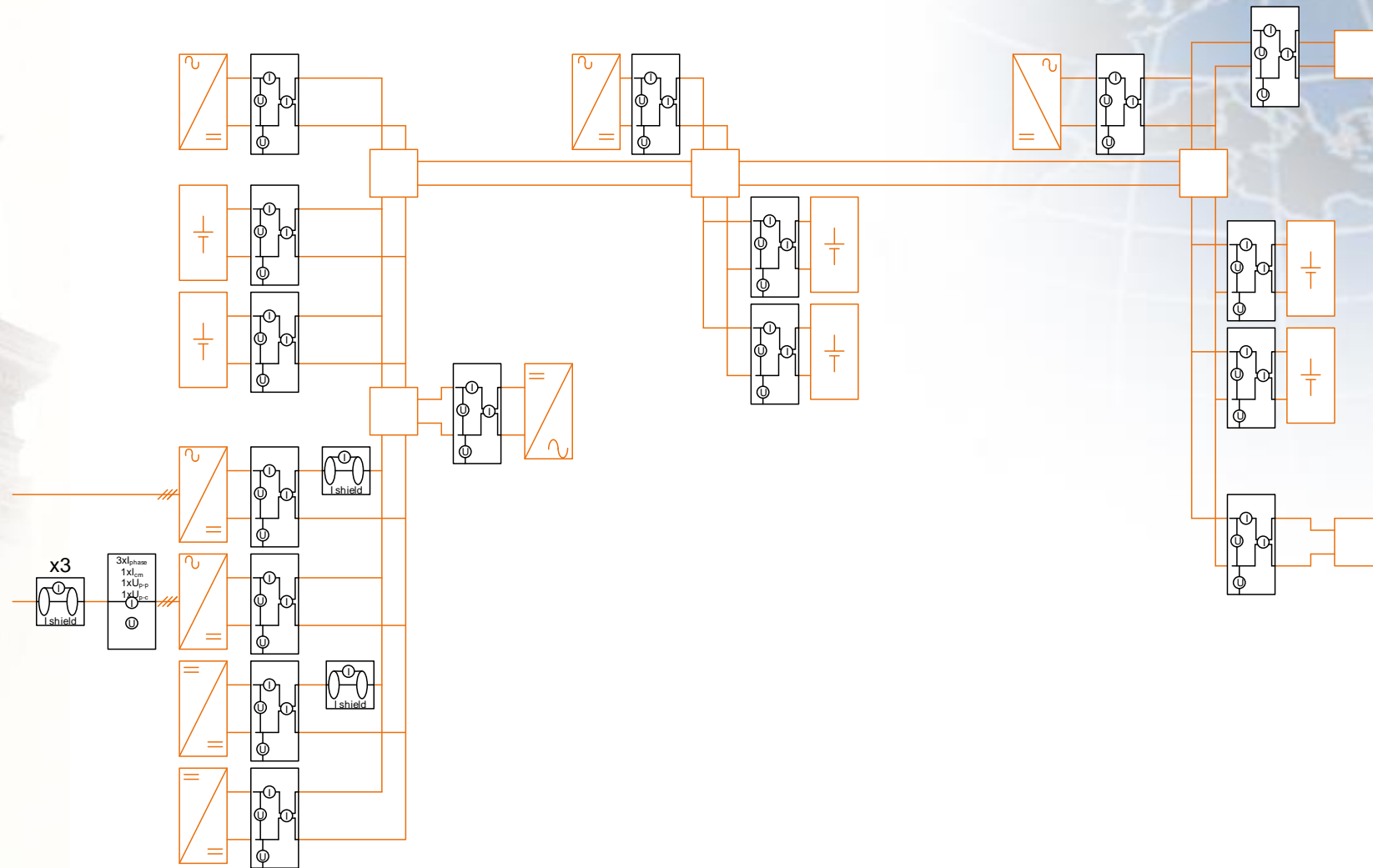


The system reflects a vehicle
but is not exactly the same

System



System and measurement boxes



Requirements on the new measurement system

- Synchronized measurements in the complete system
- Distance from sensor to oscilloscope is up to 10m.
- Be able to log and synchronize voltage, current and CAN signals. (CAN low sample rate)
- Must store more than 10 minutes of measurements
- Range as follows:
 - Current measurement 0-750A
 - Voltage measurement 0-1000V
 - Calculate the phase for U vs. I
 - Frequencies from DC to 30 MHz
- Support functionality as FFT, export of data,

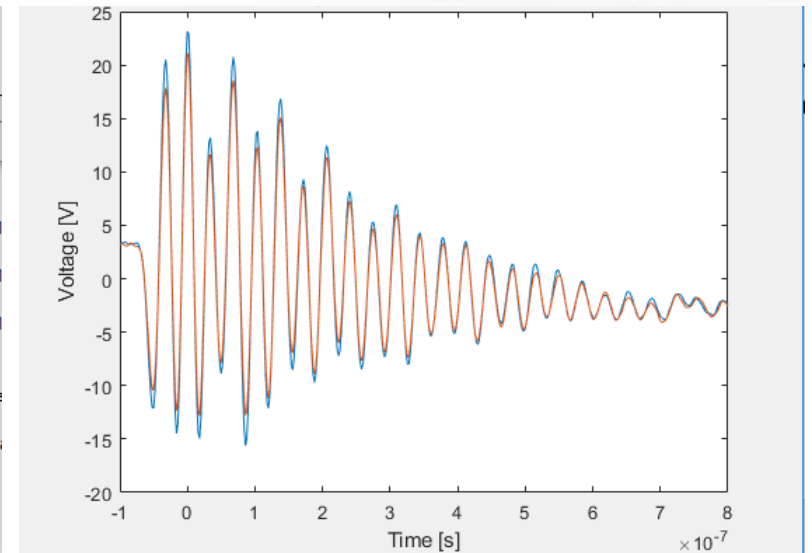
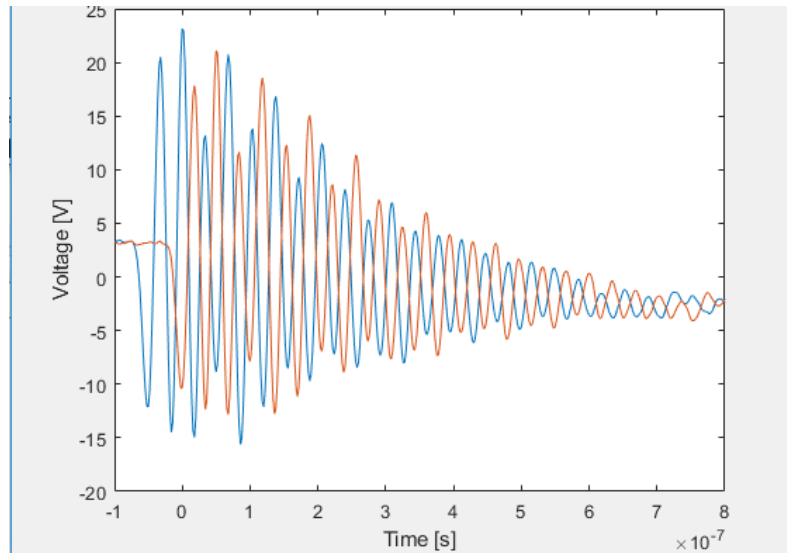
Measurement system

- A split “oscilloscope” system from NI with nx24 channels can solve the requirements for frequency range and storing data.
- Differential voltage probes
- DC and AC current probes



Requirements can be fulfilled for sensors

- I have not found any differential voltage probes with 10m long cables. Test has been performed at Volvo and Rise with extension coaxial cable and it works.
- For current sensors, Rogowski coils will be used. The supplier states that it works with extension coaxial cable when correction for cable delay is made.





Thank you!