Voltage drop simulation at Volvo cars

Topics

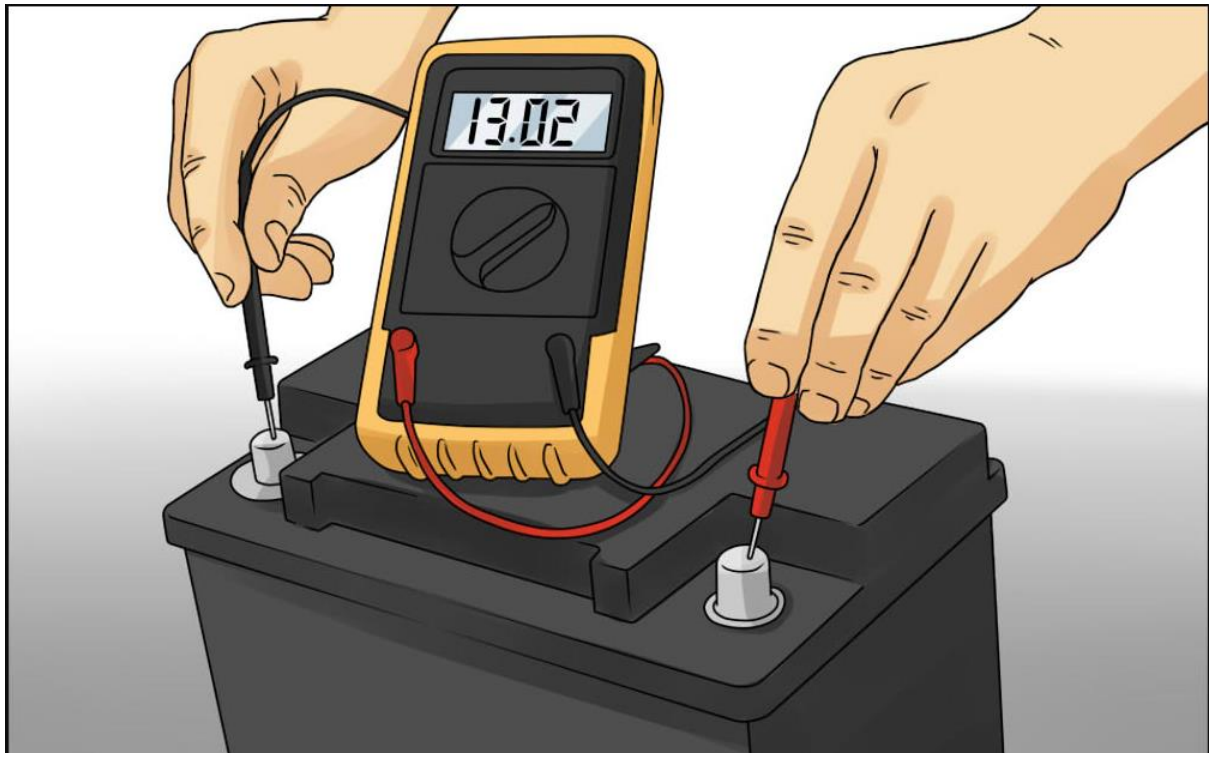
- Why voltage drop
- Old methods
- Why change
- Simulation in SaberESD
- What is the benefits?
- Future simulations

Why voltage drop

- To ensure that minimum voltage level at component is fulfilled.
- To optimize the wiring design in regards to wire sizes
- Reduce the need for physical testing
- We also use wire resistance to calculate fuse braking capacity

Old methods

- Measuring in car
  - Time consuming
  - Not able to measure all cables



Old methods

- Calculating in excel sheet
  - Time consuming
  - A lot of documents
  - Everything is manual work, easy to make mistakes.

								Voltage Drop from Battery			
Tailgate_L	High Mounted brake lamp			Tailgate_L			GND				
V8113H	10/19.A-1	Device	10/19.A-2	G1107C	93/270_138	G1107B	31/107				Decision
Wire_0.5	0.64 Tmnl		0.64 Tmnl	Wire_0.5	Splice<35mm2	Wire_0.5	M6 Ring				
0,044m	1		1	0,068m	1	0,062m	1				
39	7,5		7,5	39	0,2	39	0,4	+Voltage (A)	-Voltage (B)	Voltage Drop at component (A-B)	
0,00172	0,00750		0,00750	0,00265	0,00020	0,00242	0,00040				
0,00172	0,00750		0,00750	0,00265	0,00020	0,00242	0,00040				Maximum Voltage Drop 1.5V
0,3A	0,3A		0,3A	0,3A	0,3A	0,3A	0,3A				
0,0A	0,0A		0,0A	0,0A	0,3A	0,3A	0,3A				
0,3A	0,3A		0,3A	0,3A	0,7A	0,7A	0,7A				
0,001	0,003		0,003	0,001	0,000	0,002	0,000	0,400V	0,028V	**0,427V**	**PASS**

Why change

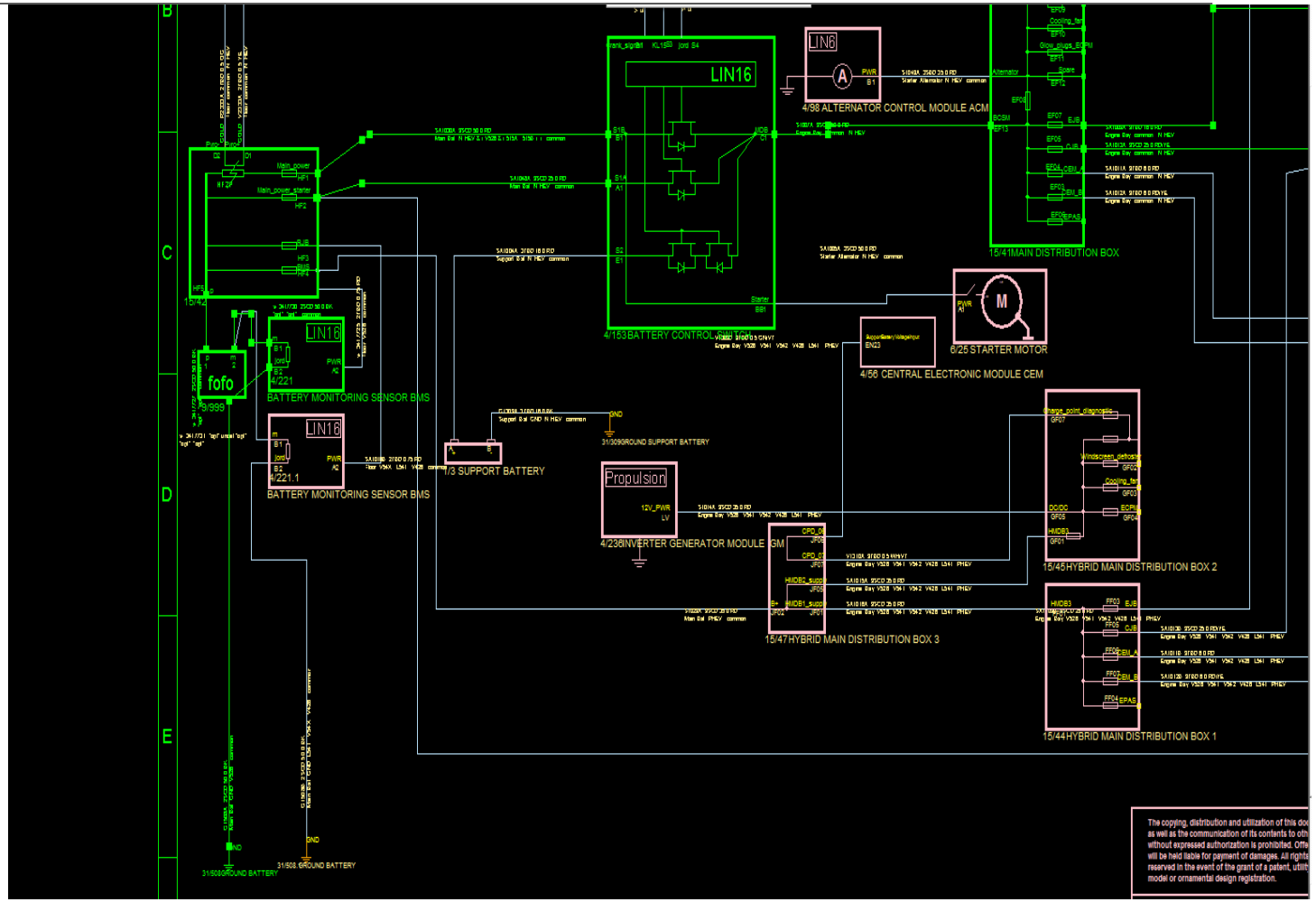
- Not effective enough
- Only one case is possible to simulate with old methods
- A better flow from design to verification
- More exact simulations/calculations
- A lot more flexibility

Simulation in SaberESD

- Filter
- Component setup
- Importing cable lengths
- Experiment
- Transient simulation

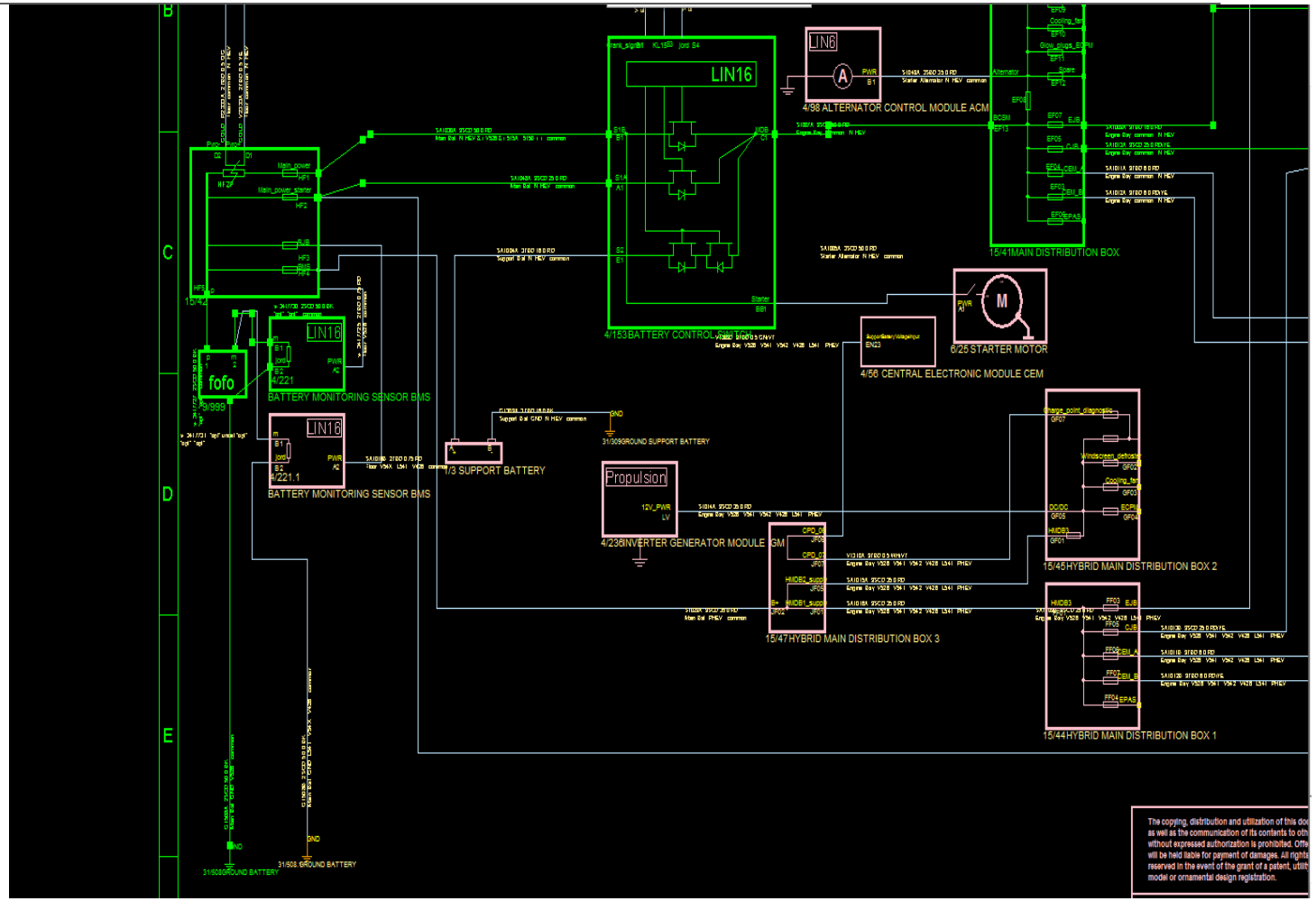
Simulation in SaberESD

- Either creating a filter by using existing properties, or by creating new.
- This needs to be done on all wires/components so that complete circuit is made.
- Work ongoing with new way to filter out a complete buildable car.



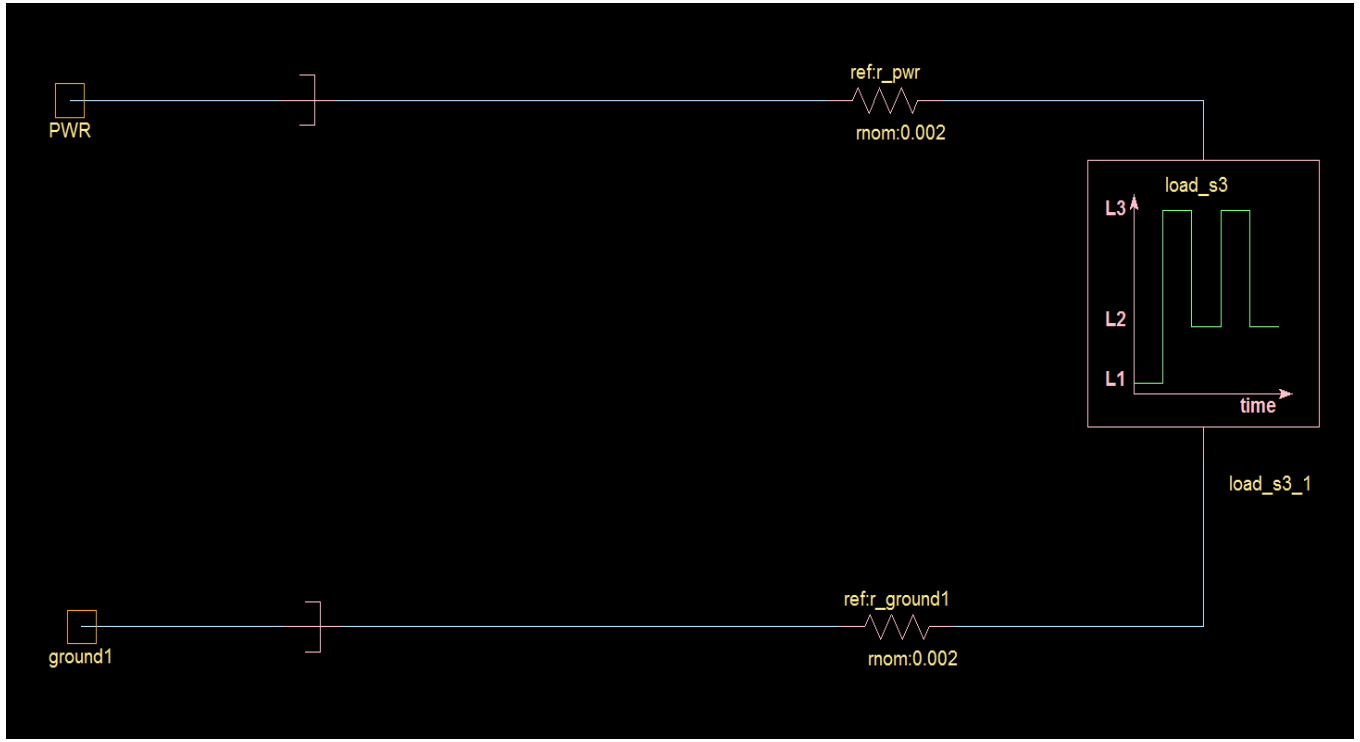
Simulation in SaberESD

- By using filter saber is understanding which circuit to simulate. This is done by adding the filters in the netlister.



Simulation in SaberESD

- Component setup
- The load characteristics is set in the hierarchical schematics
- We are using a current type load to simulate voltage drop.
- We add signal names on both the supply pin and the ground pin, these signal names are later on used in an experiment that calculates the voltage drop.



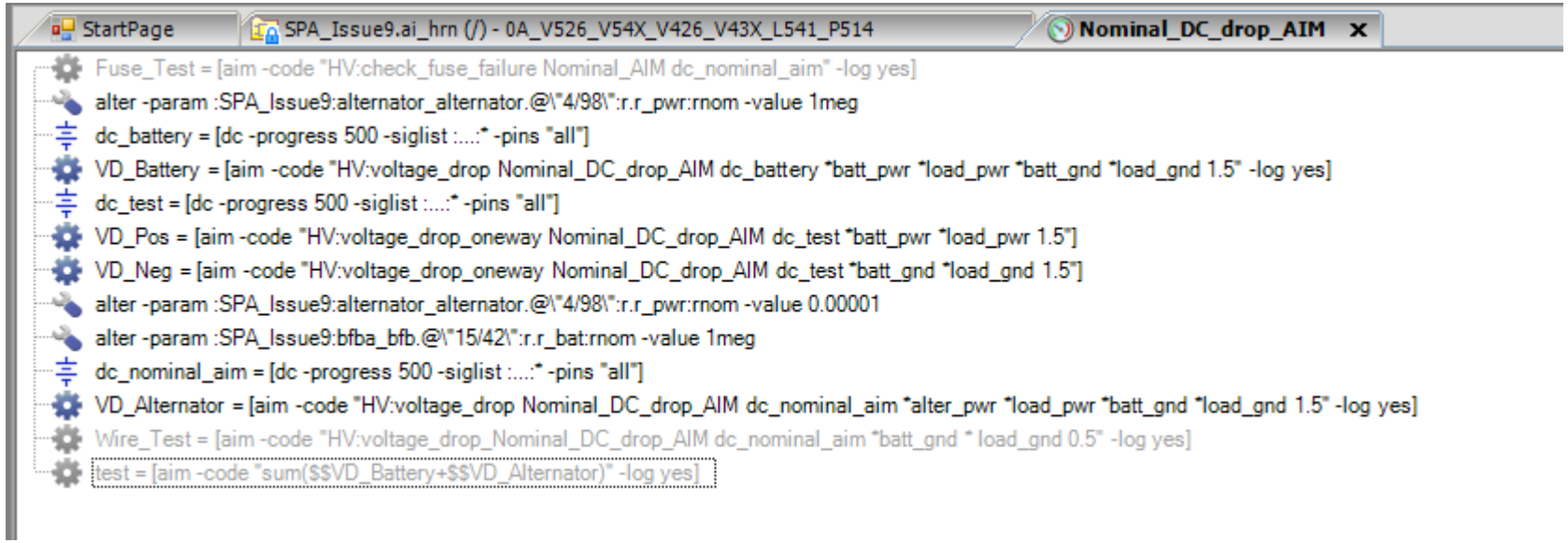
Simulation in SaberESD

- Importing of cable lengths is done by linking a excel document in the start script which contains all wires with ID and length for a specific car.
- These are then used by the netlister to do all calculations

	A	B	C	D
1996	VS3161C	1089		
1997	VS3172A	1680		
1998	VS3178D	1093		
1999	VS5013D	1012		
2000	S1049A	1141		
2001	SA1005A	987		
2002	G1309A	255		
2003	SA1004A	125		
2004	CM1202BR	191		
2005	CP1201BR	191		
2006	G1010AC	180		
2007	L1007L	180		
2008	SA1031G	180		
2009	SG1017AB	180		
2010	V1319B	180		
2011	V3015P	180		
2012	V3016C	180		
2013	V3017B	191		
2014	V3018B	191		

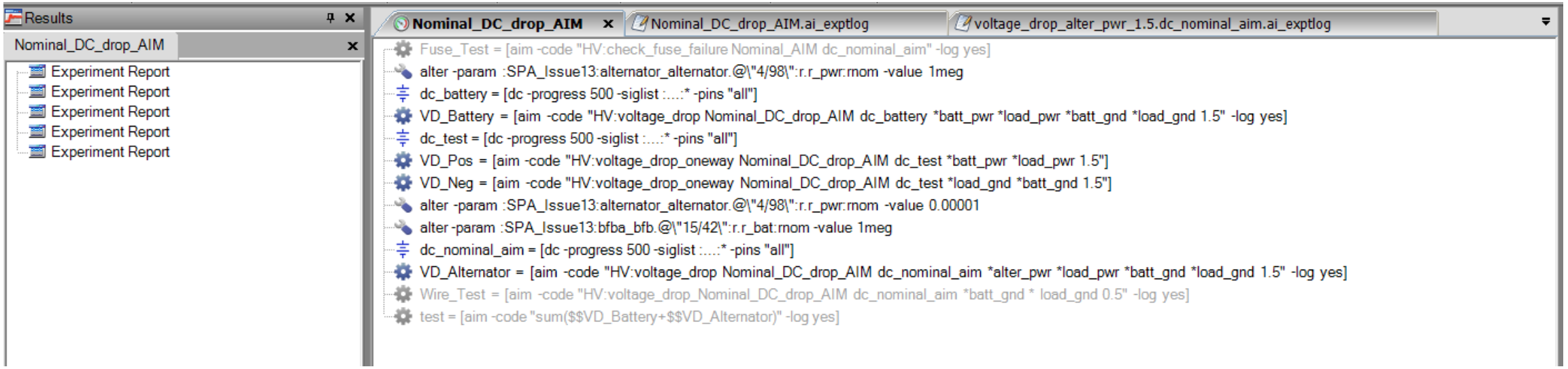
Simulation in SaberESD

- By using a predefined experiment a voltage drop calculation is done that calculates both the voltage drop of the positive side of the component as well as the negative side.



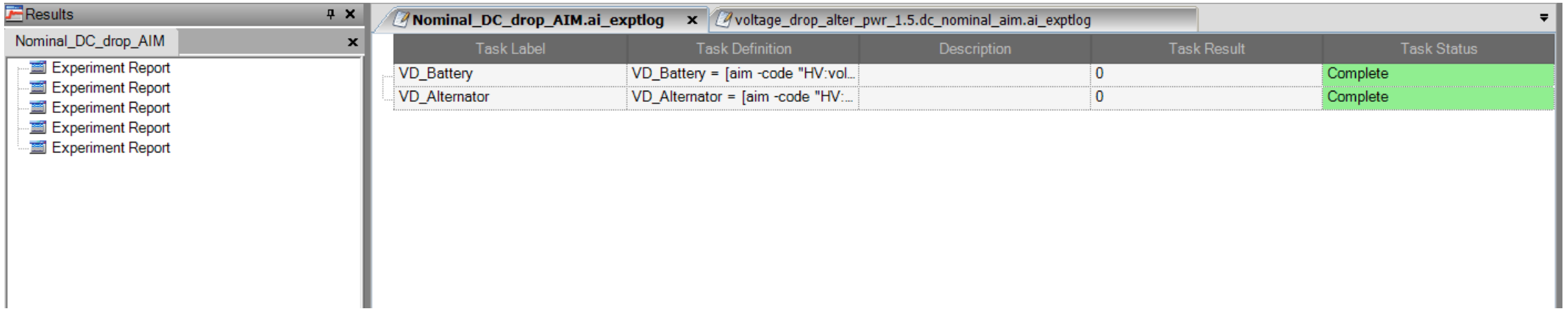
Simulation in SaberESD

- With this experiment it is also possible to simulate from either the alternator or the battery.
- The signal names that are assigned in the hierarchical model are used in the experiment as reference points.



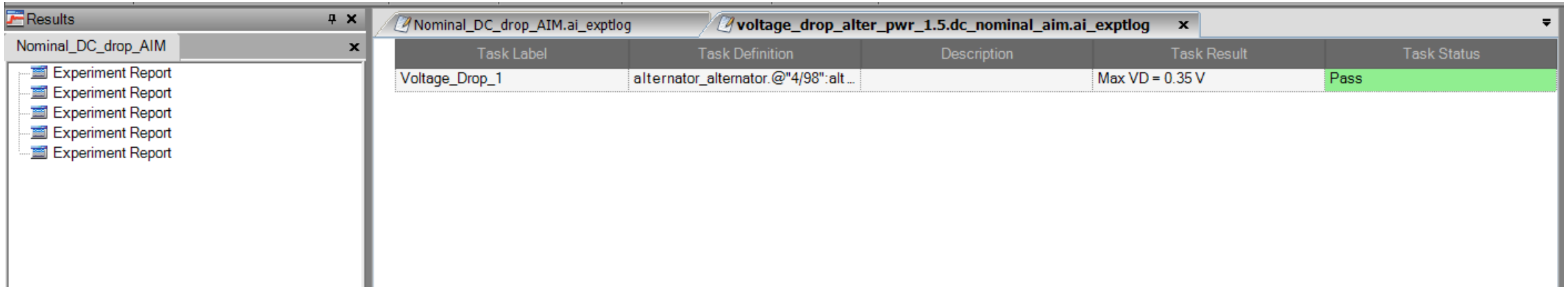
Simulation in SaberESD

- How to report results and what threshold values we want are set in the experiment



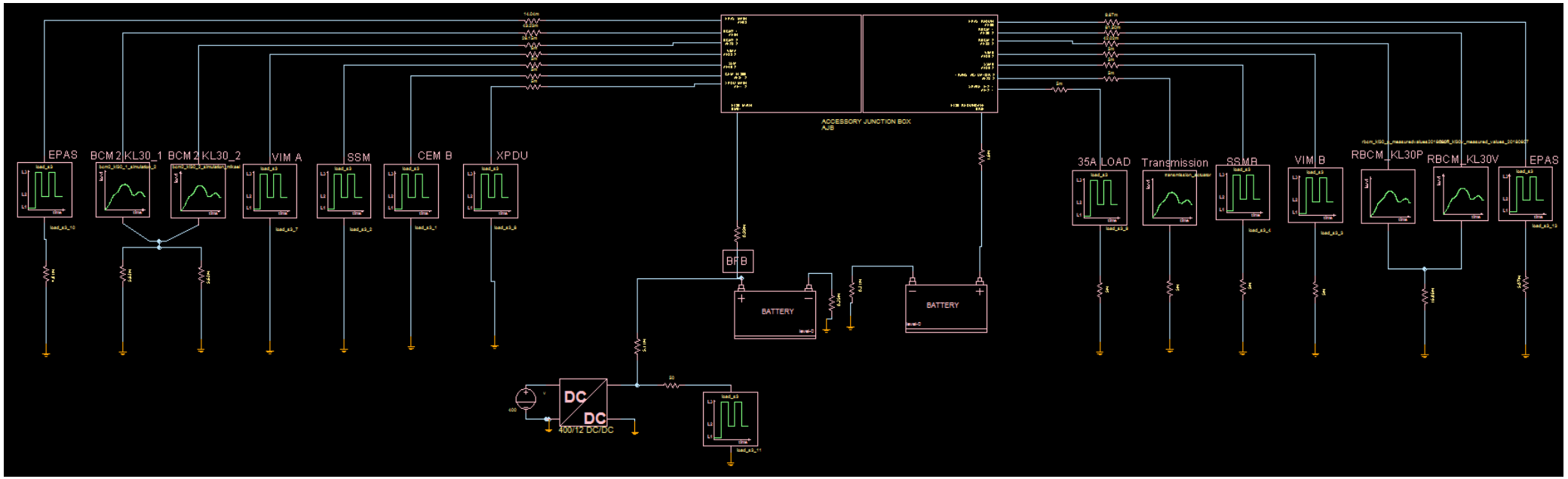
Simulation in SaberESD

- For each component one line in the report shows the pass or fail and actual voltage drop. For large simulations report can be exported to Excel.



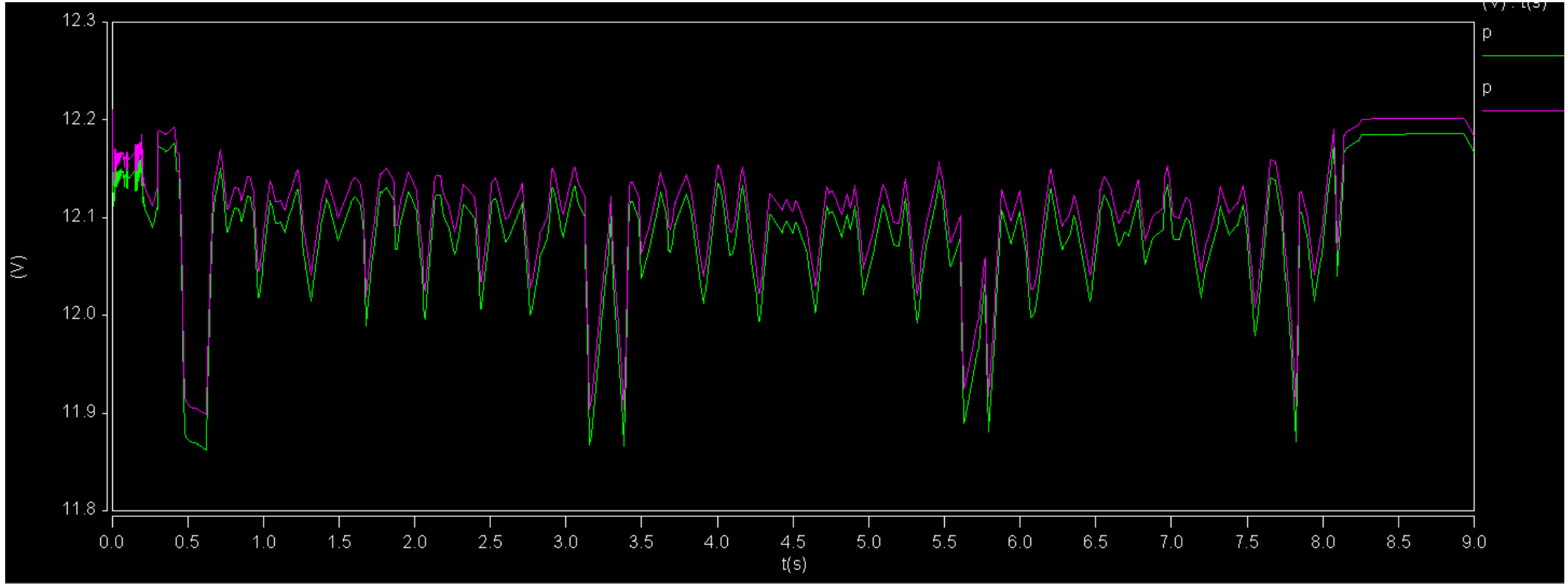
Dynamic Simulation in SaberESD

- Transient simulation



Dynamic Simulations in SaberESD

- Output, voltage levels for certain components.



Dynamic Simulation in SaberESD

- Was previously done in Math Lab
- Strategy decision
- Transferred to SaberESD
- Benefit to reuse the wiring harness design
- Use SaberRD for even more advanced simulations

What’s the benefits?

- Using of the same tool for verification and desig
- Verification when making changes in schematics
- Less time consuming
- More possibilities within simulation
- Reduce physical testing

Future simulations

- Simulate different cycles
  ex, cold and hot climate.
- Simulate systems instead of components.
- Simulate a complete buildable car
- See the effects of variant complexity

Questions?

Thank you!