


ONLINE PUBLIC DEMONSTRATION

17th November 2020, 10:00-12:00 CET



InteGrated and PHysically Optimised Battery System for Plug-in Vehicles Technologies

 This session is being recorded

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This project has received funding from the European Union's Horizon2020 Programme for research and innovation under grant agreement No.770019.



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Battery cooling

Rainer Sonnenberger, Roque Salazar-Alvear



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Cooling requirements



Fiat 500 PHEV

- 1 Basic Unit
- $Q' = 600 \text{ W}$
- water glycol



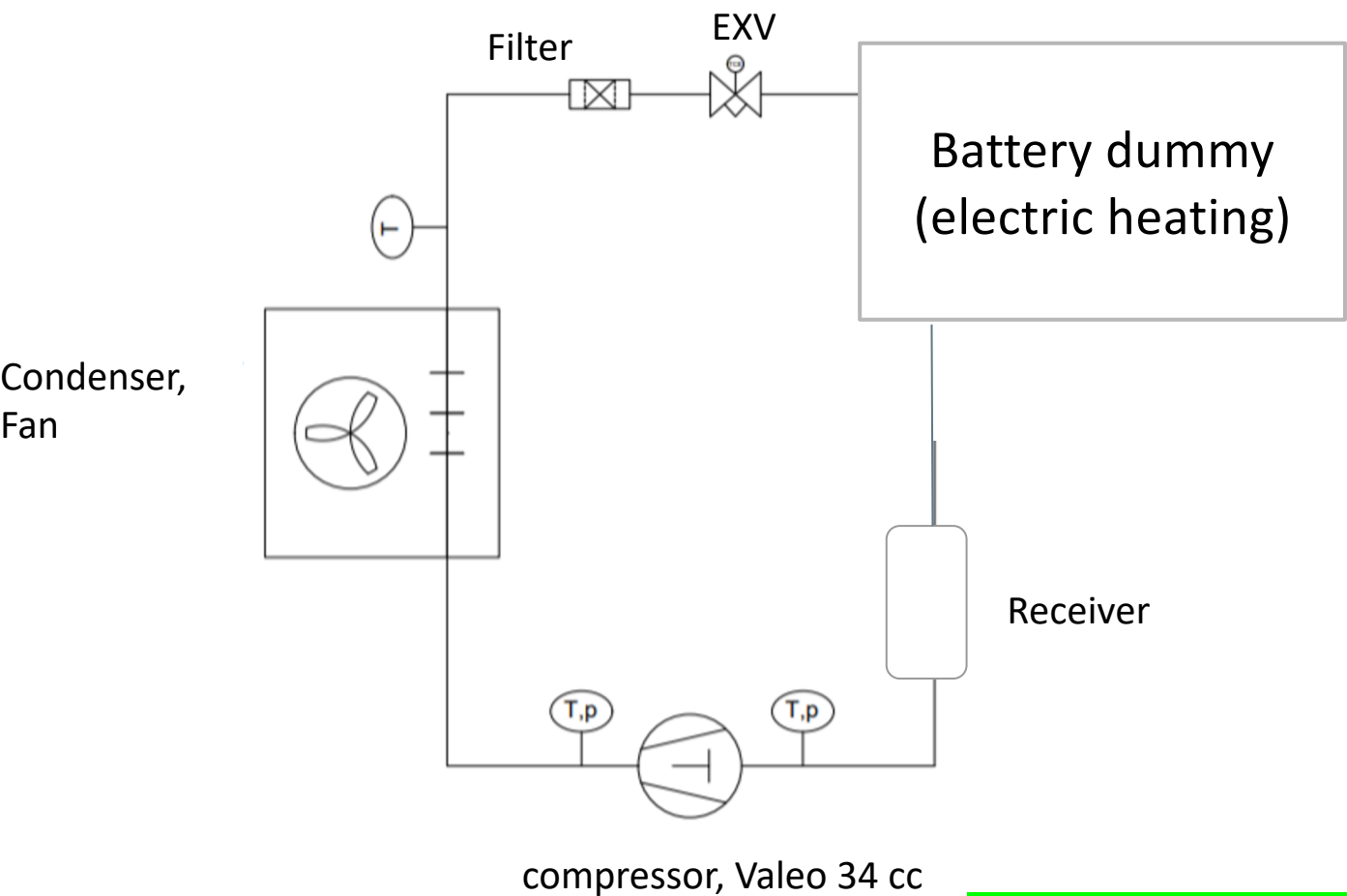
Iveco 12m city e-bus

- 6 Basic Units
- $Q' = 21\,600 \text{ W}$ (fast charging, $C = 5/h$)
- refrigerant 1234yf
- opportunity charging: $240 \text{ kW} / 6 \text{ mins}$

Temperature Homogeneity:

- $\Delta T_{\text{cell}} = 5 \text{ K}$
- $\Delta T_{\text{pack}} = 5 \text{ K}$
- $\Delta T_{\text{max}} = \Delta T_{\text{cell}} + \Delta T_{\text{pack}} = 10 \text{ K}$

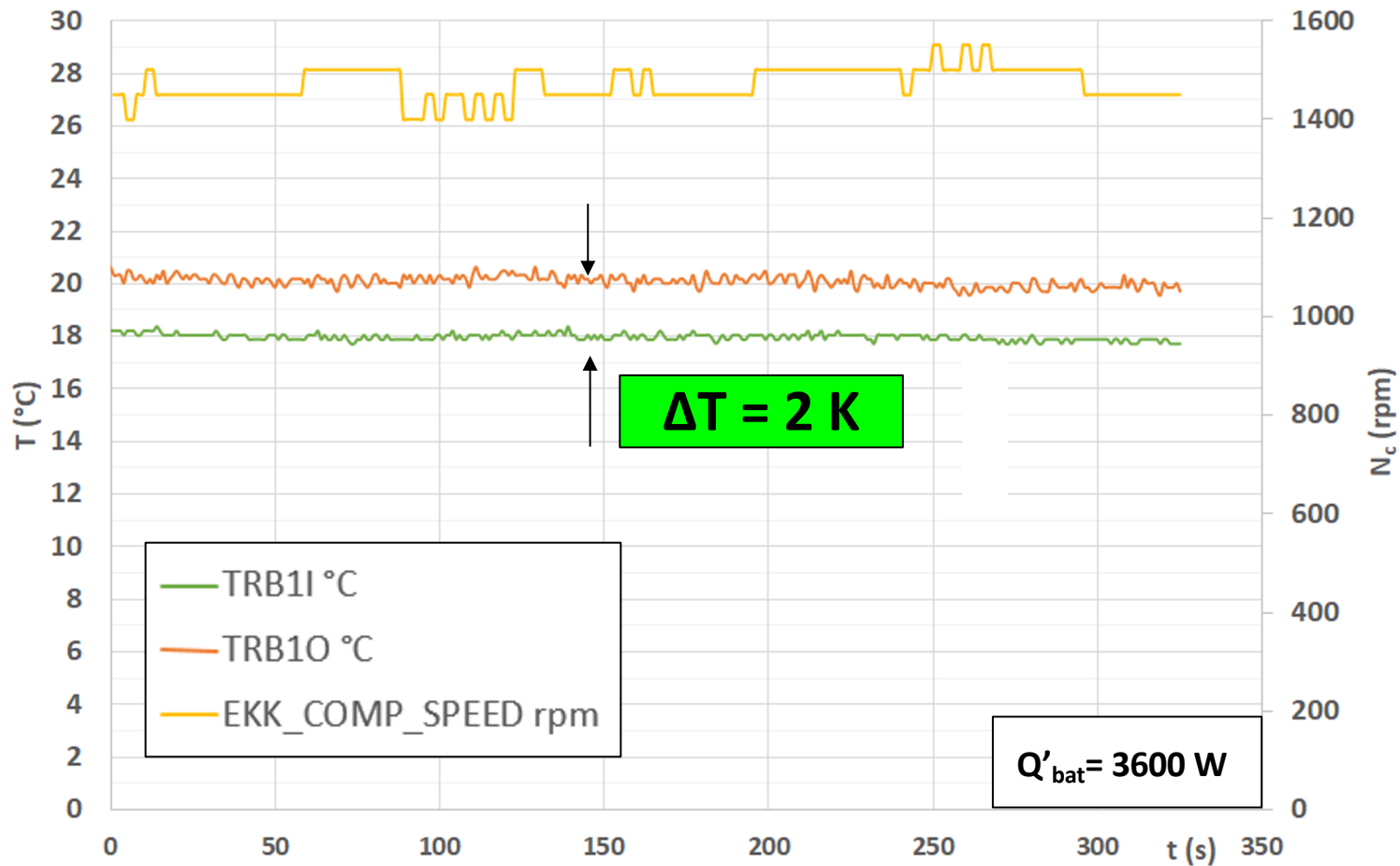
Mini-GHOST refrigerant loop



test case	battery heat load Q'_{bat} [W]	C-Rate [1/h]
1	600	0,8
2	1200	1,7
3	1900	2,6
4	2750	3,8
5	3600	5,0

fast charging

Test 5: refrigerant temperature battery in/out



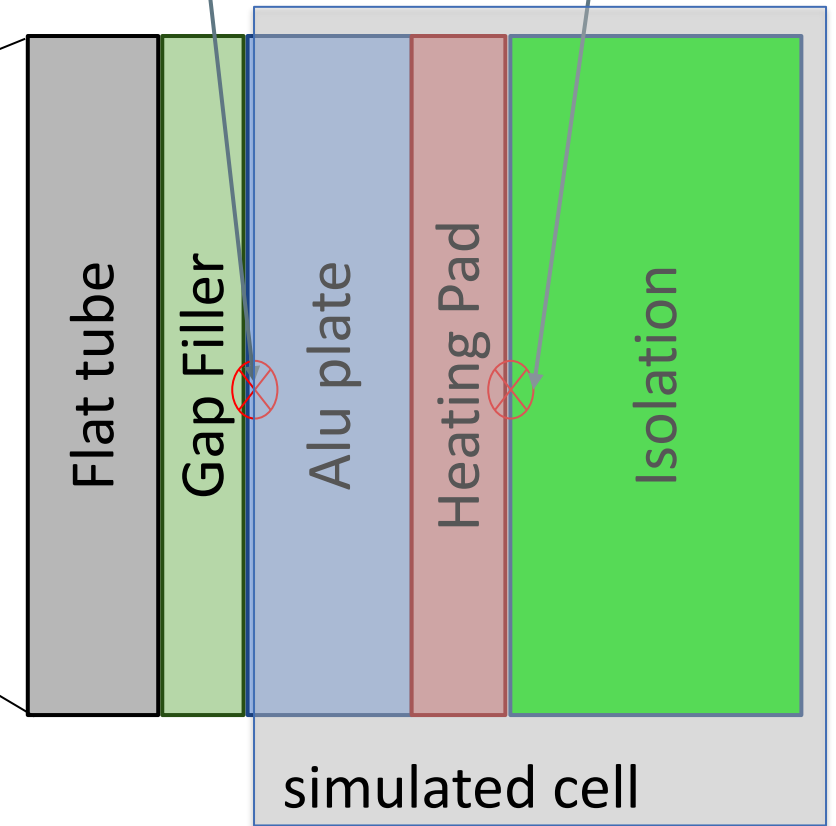
Measurement setup battery dummy



4 cooling plates

$T_{\text{heating_pad},i}$
(THB_i)

$T_{\text{Alu_plate},i}$
(TAB_i)

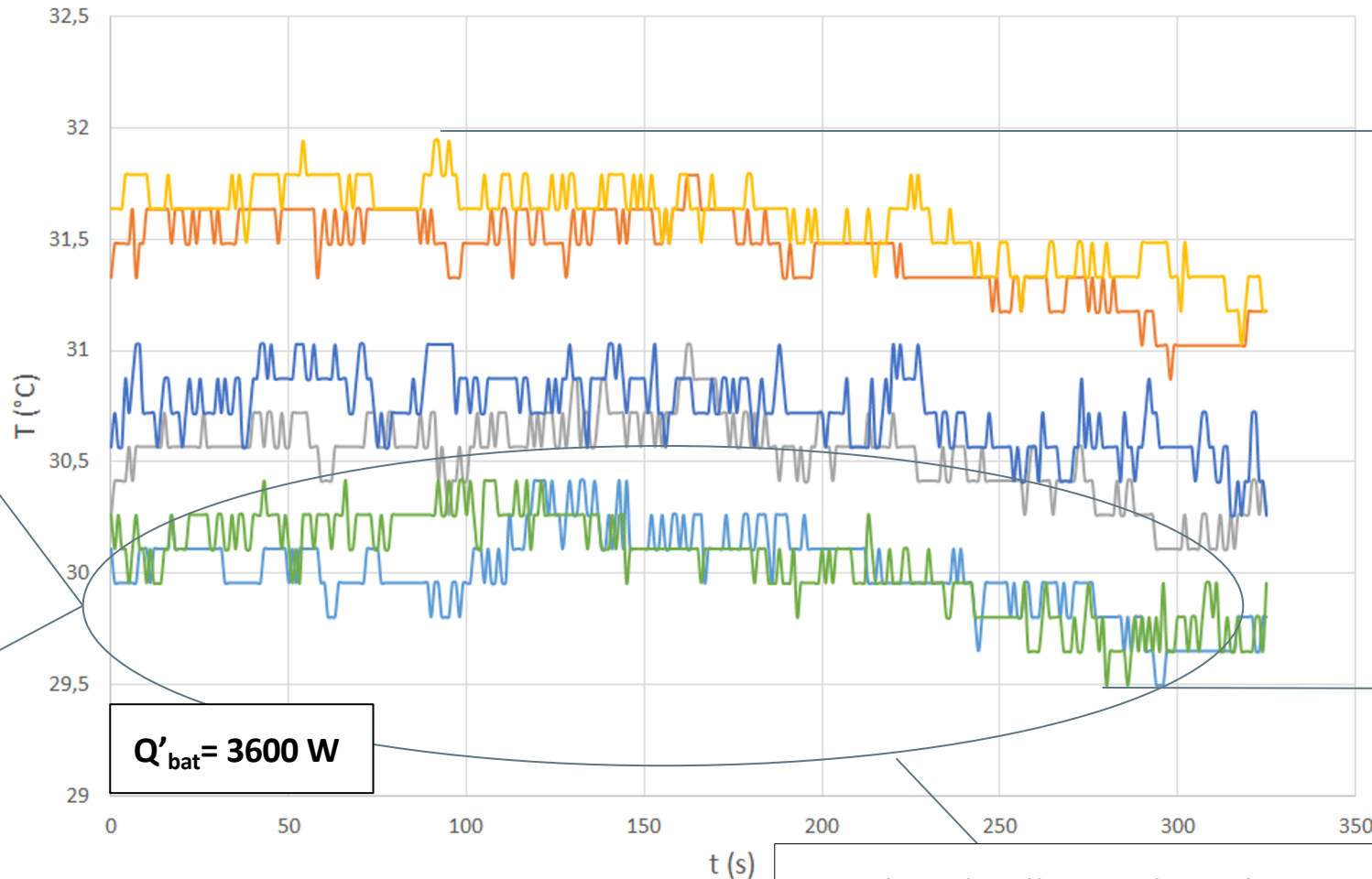


Temperature homogeneity: upper part of Basic Unit

requirement:
 $\Delta T = 5 \text{ K}$



— TAB-1 °C
— TAB-2 °C
— TAB-3 °C
— TAB-4 °C
— TAB-5 °C
— TAB-6 °C



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Valeo

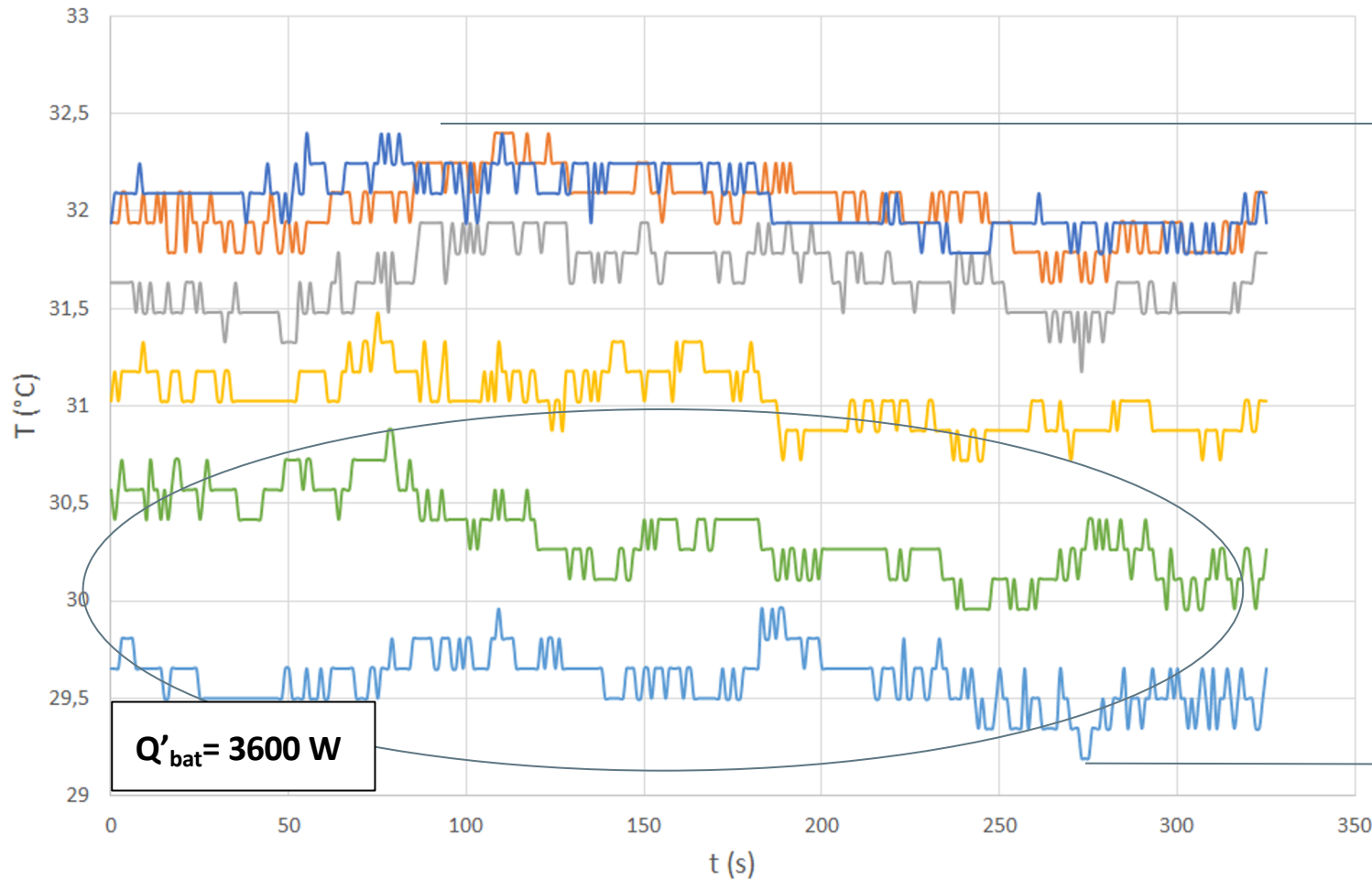
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Temperature homogeneity: lower part of Basic Unit

requirement:
 $\Delta T = 5 \text{ K}$

— TAB-7 °C
— TAB-8 °C
— TAB-9 °C
— TAB-10 °C
— TAB-11 °C
— TAB-12 °C



Gap Filler to provide electric isolation cells/cooling plate

Worst case failure: Simultaneous double isolation fault

→ short circuit, max 800 V

Voltage breakthrough falsification test

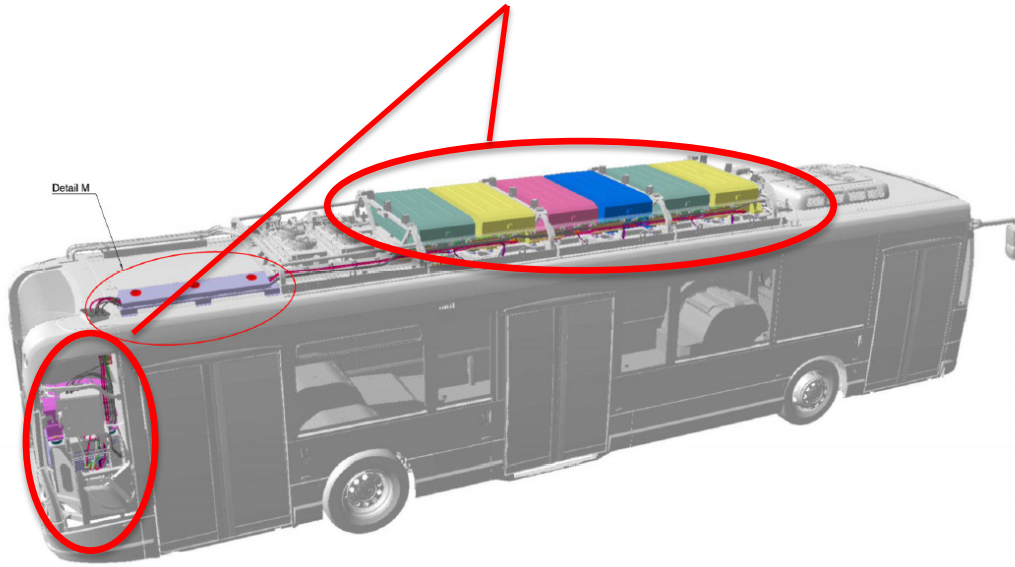


OK

Comparison between overnight- and opportunity charging

overnight charging (4-8 h):

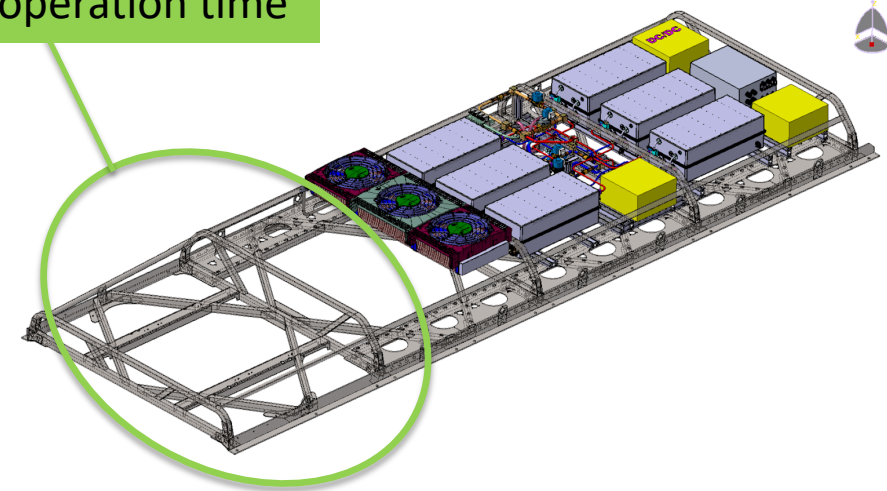
battery packs required for overnight charging



opportunity charging (6 minutes):

- weight
- volume
- invest in battery
- + longer operation time

- + invest for fast charger (pantograph)
- smaller autonomy



Next steps

- Assembly of BUs
- Development of control system for refrigerant loop (6 BUs)
- Test with 6 dummy BUs on rack
- Commissioning of full System

Thank you



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