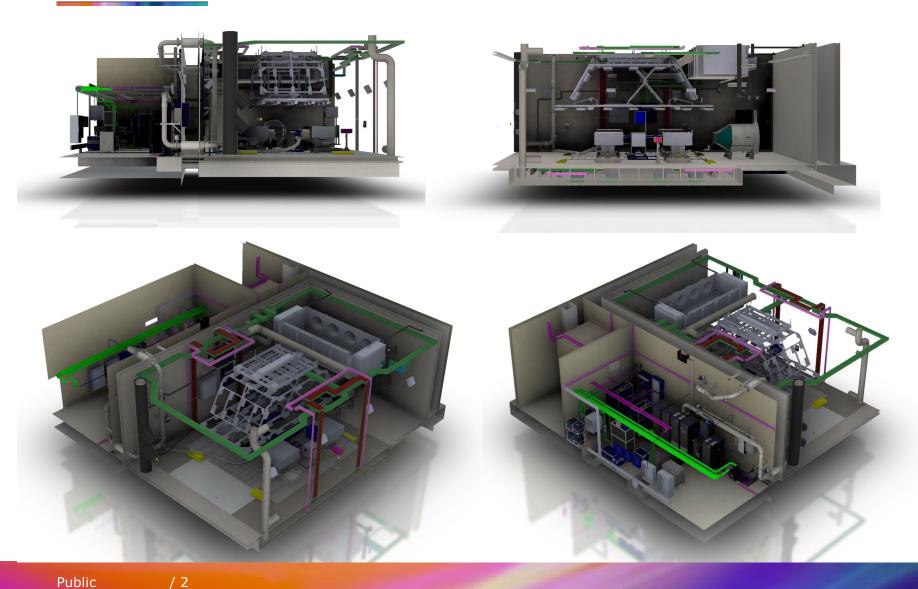


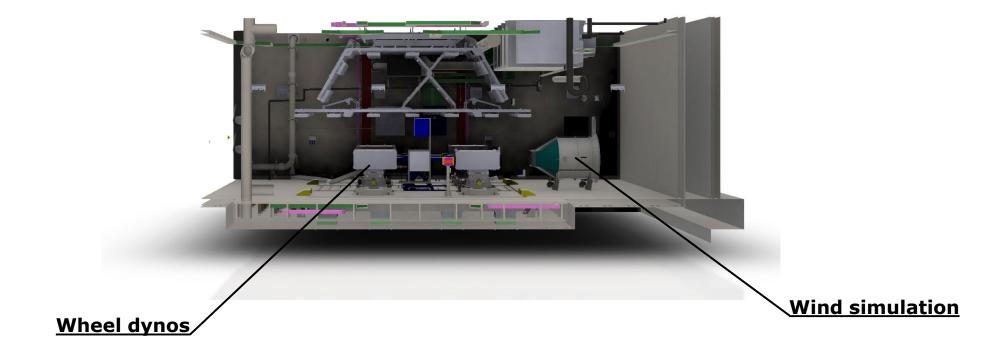
Energy Flow Testbed

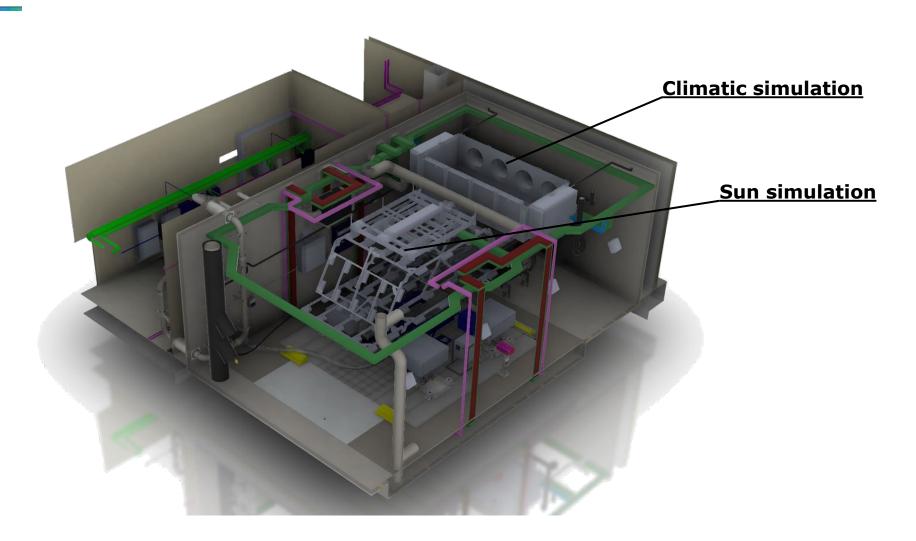
Testbed Overview, Installation Setup, Vehicle Instrumentation, Data Acquisition System

Mats Ivarson

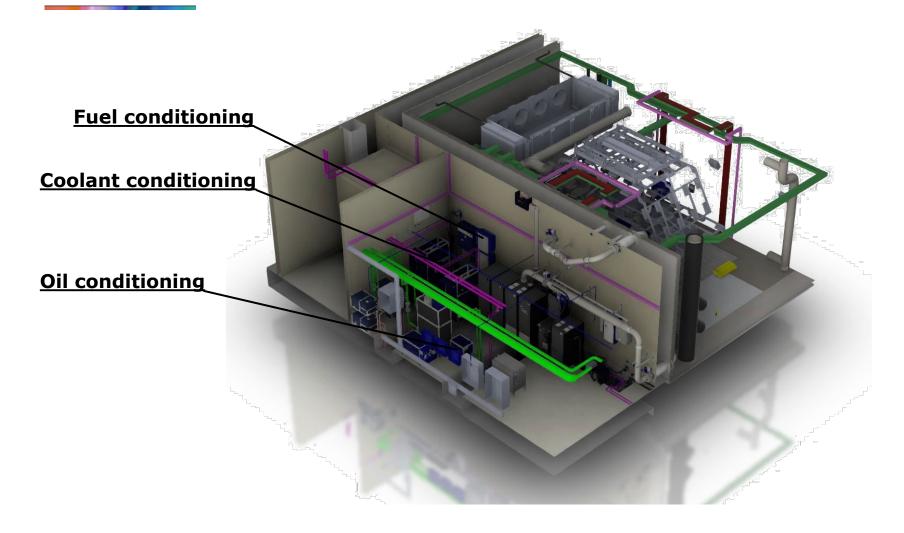
AVL List GmbH (Headquarters)















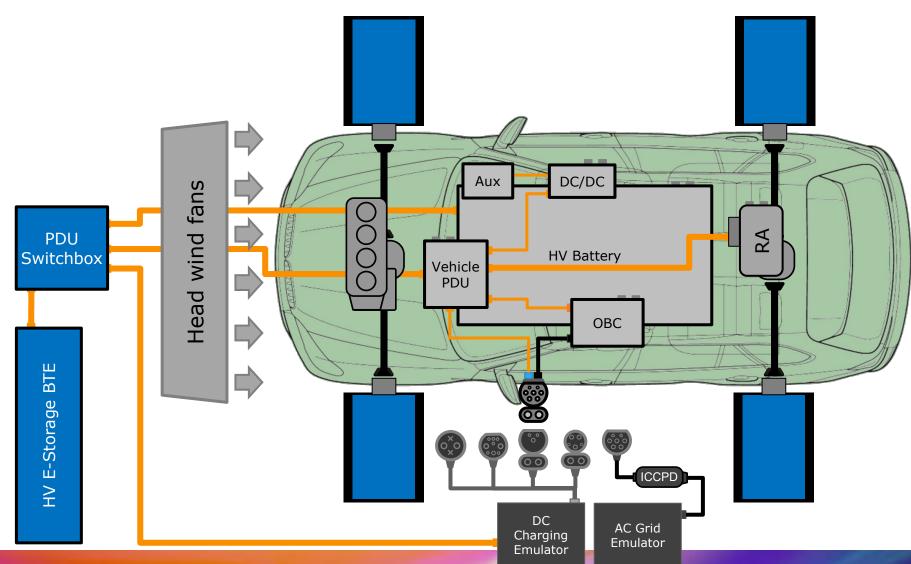
Installation Setup

Installation Setup: Examplary Installations

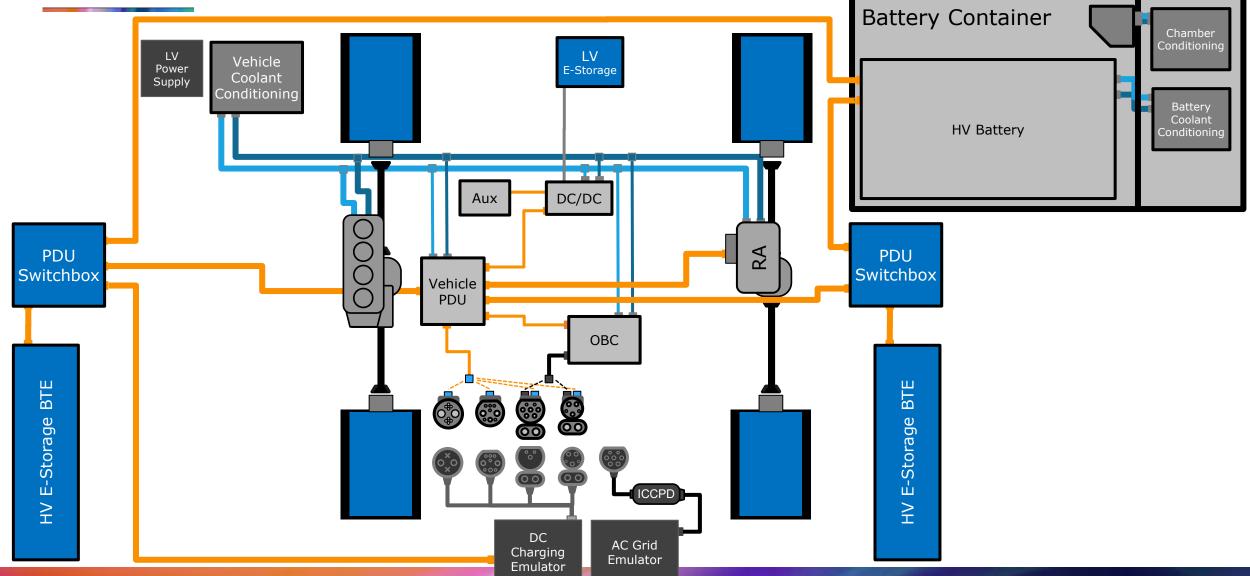




Exemplary Installation Setup Vehicle-in-the-Loop (ViL)



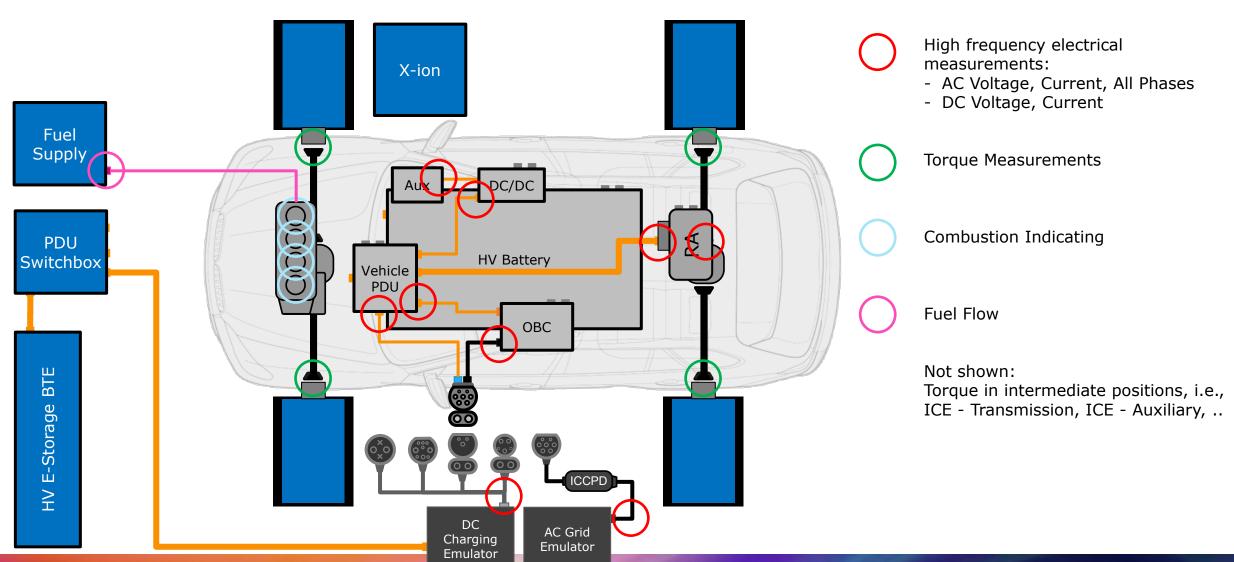
Exemplary Installation Setup Powertrain-in-the-Loop (PiL)



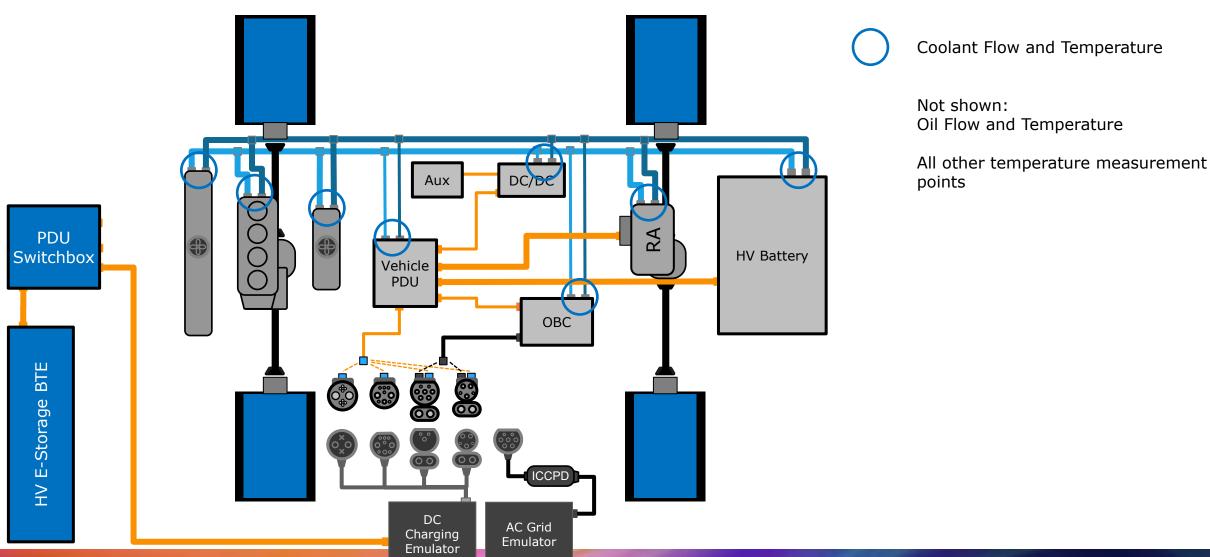


Vehicle Instrumentation

Exemplary Measurement Layout: Chemical, Electrical and Mechanical Energy Flow



Exemplary Measurement Layout: Thermal Energy Flow



Exemplary Instrumentation Setup: Battery Electric Vehicle

Cooling

Temperature/Pressure/Flow

Radiator
Battery
Front/Rear Motor
Air Compressor
Condenser
Evaporator
Chiller

Comfort

Temperature/Humidity/Speed/Shutter

HVAC Cabin fan Radiator Grill

Lubrication

Temperature/Pressure/Flow

Front/Rear Motor Oil Pump Oil Reservoir

~250 Sensors

Brake

Pressure

Mechanical Brake

Low Voltage

Voltage/Current

DC/DC
Battery
Control units
Brake/Steering/Oil pump
Cabin fan/Coolant pump

High Voltage

Voltage/Current/Temperature

Onboard Charger Battery Front/Rear Motor Air Compressor Heater



Data Acquisition System

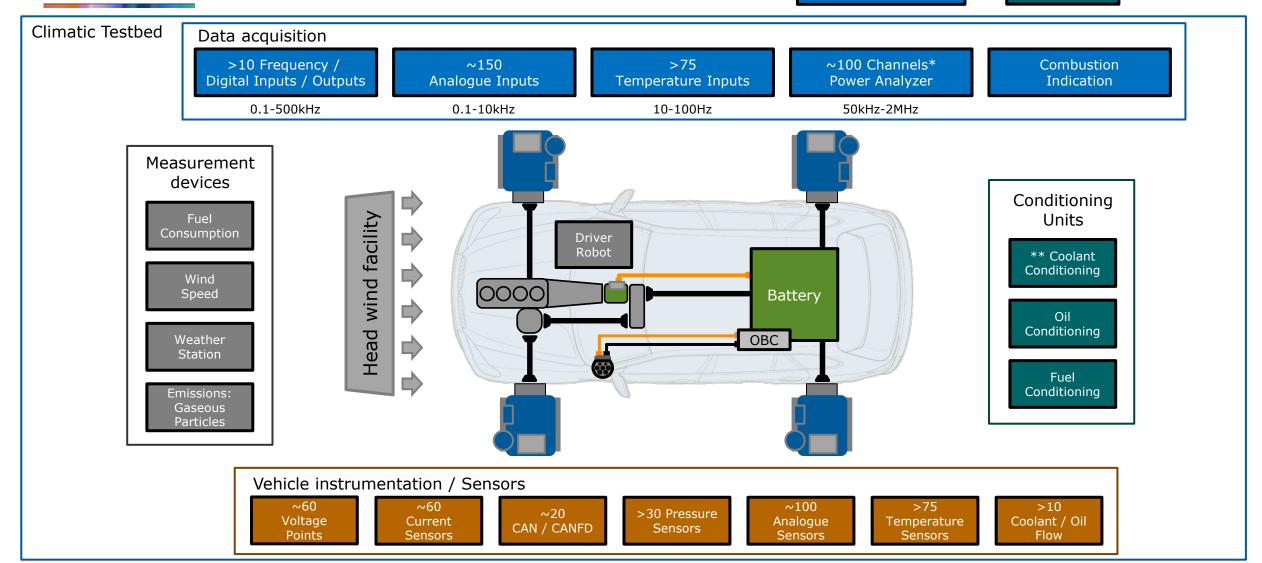


OEM Reference Energy Flow Setup: Measurement Equipment

* >15 AC High Voltage and Currents >30 channels

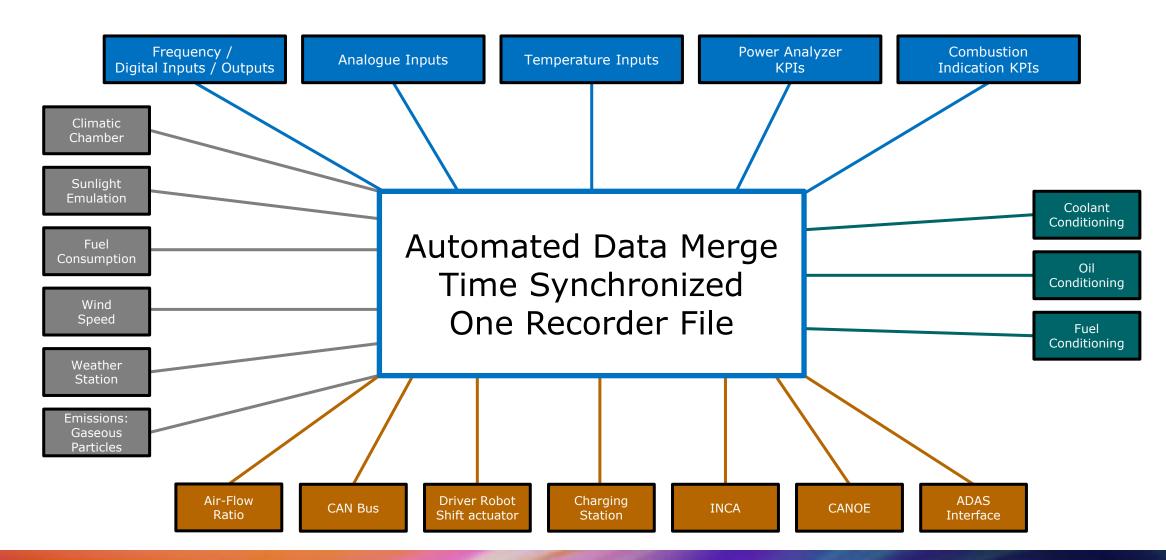
>30 DC High Voltage and Currents >60 channels ** ICE E-Motor(s) Inverter(s)

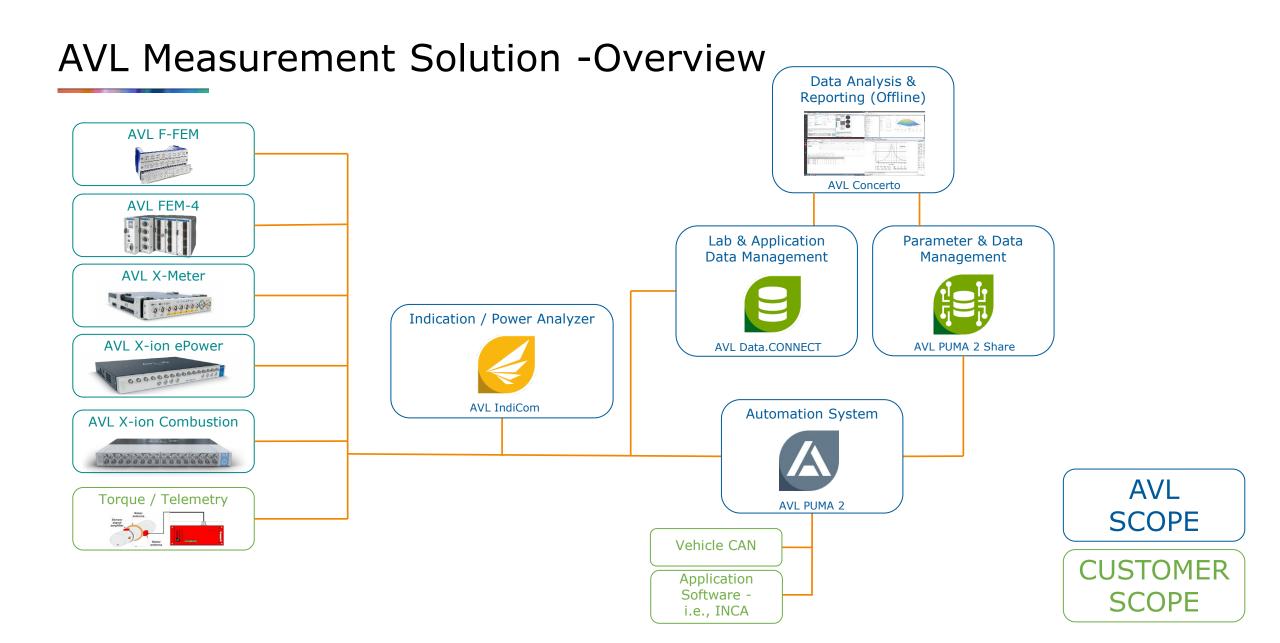
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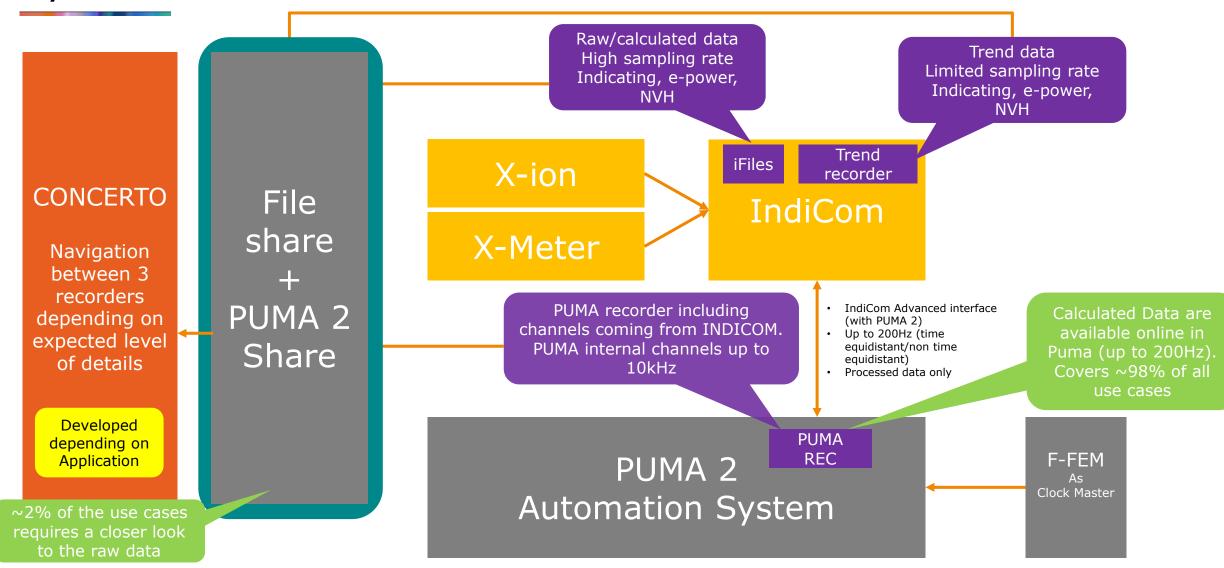
OEM Requirement on Data Acquisition System





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Synchronization recorders IndiCom/X-ion/PUMA



Thank you



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