

Dolores – Direct Driven Hydraulic (DDH) Test Bench

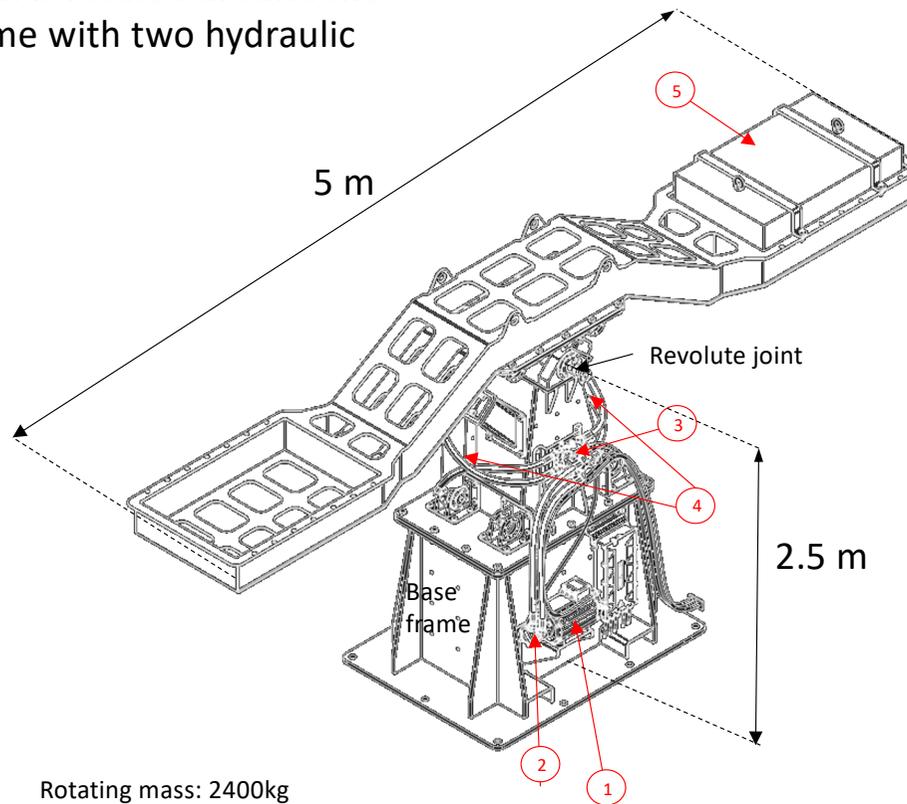
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Dolores test bench

Working principle

The boom is rotated around the base frame with two hydraulic cylinders



Rotating mass: 2400kg
Total mass: 4300kg

Test bench's history

- Test bench designed to study the DDH technology in frame steering application of a mining loader
- Test bench to Aalto for test purposes in 2019
- Currently first empirical research going on

Main components

1. E-motor
 - Parker GVM 210 150 ZP W
 - Power: 80kW
2. Hydraulic pump-motor
 - Parker F11-019-MB-SV-S
3. Parker DDH valve block
4. Hydraulic cylinders
 - Parker 100/50-450 2pcs
5. Additional load
 - 0...1700kg
6. Motor controller
 - ABB ACS 880 industrial frequency converter

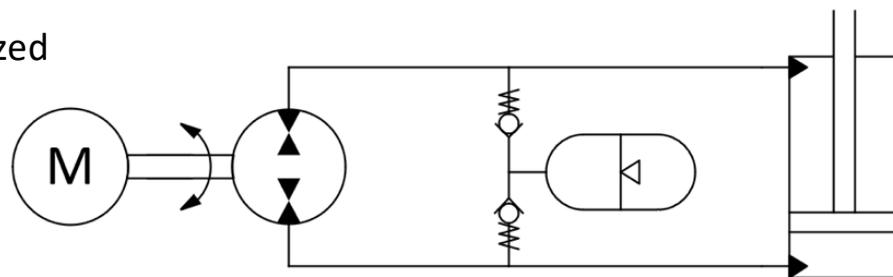
DDH = Direct Drive Hydraulic

Working principle

- Hydraulic pump-motor controlled with electric servomotor
- Pump ports connected to cylinder ports
 - Cylinder movement is controlled with servomotor movement
- Possible to operate vice versa: Cylinder as prime mover, pump as motor, servomotor as a generator
 - Energy regeneration

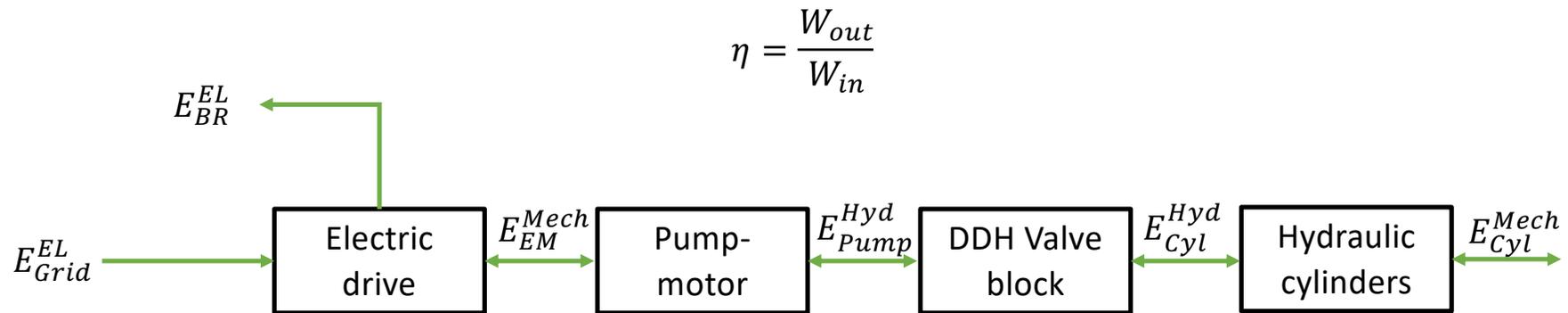
DDH benefits

- Energy efficiency (no throttling, energy regeneration)
- Controllability
- Compact design and flexible design, decentralized hydraulics



Research

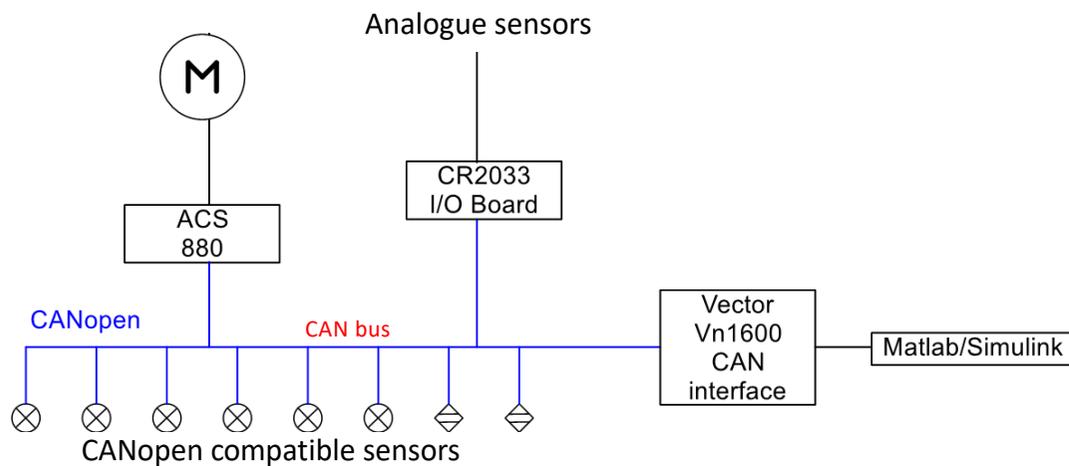
- Energy efficiency of the system



Next:

- Measurements (CANopen)
- Control

CANopen based data logging and control



All the data goes through singular CAN bus.

- Sensor signals
- Motor control signal

Benefits:

- Simple cable management (everything connected sequentially)
- Digital data is less prone to interference

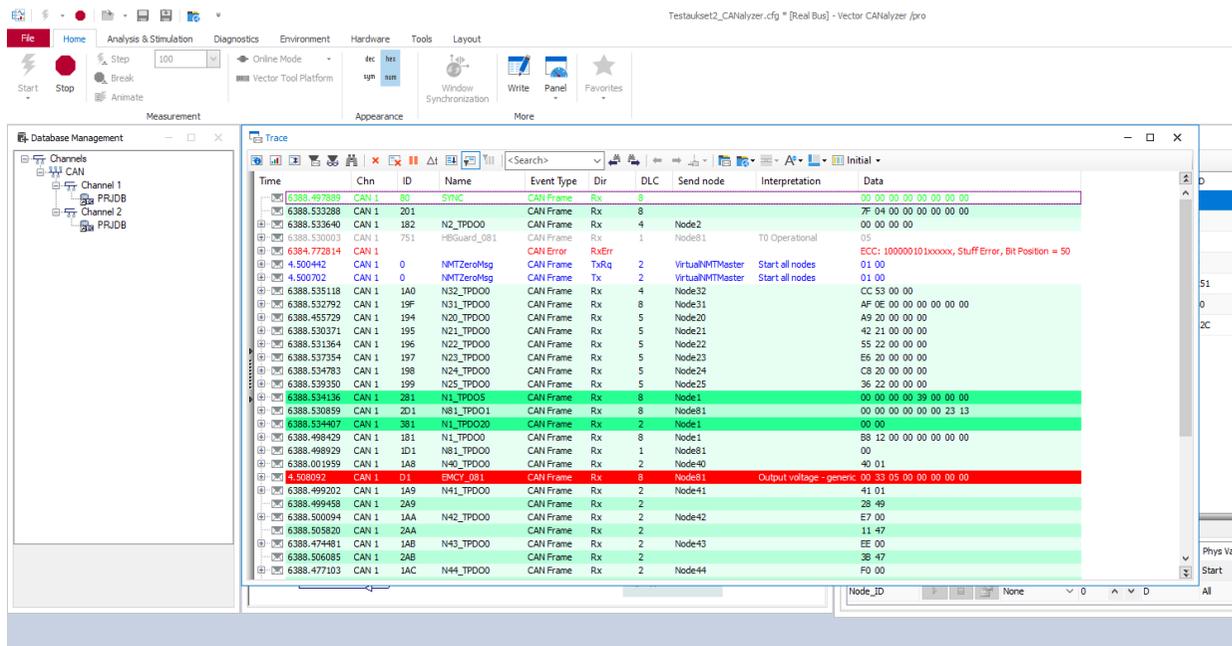
Most of our sensors are CANopen compatible, requiring no analogue to digital data conversion.

Few analogue sensors are used, analogue to digital conversion done via CR2033 I/O board.

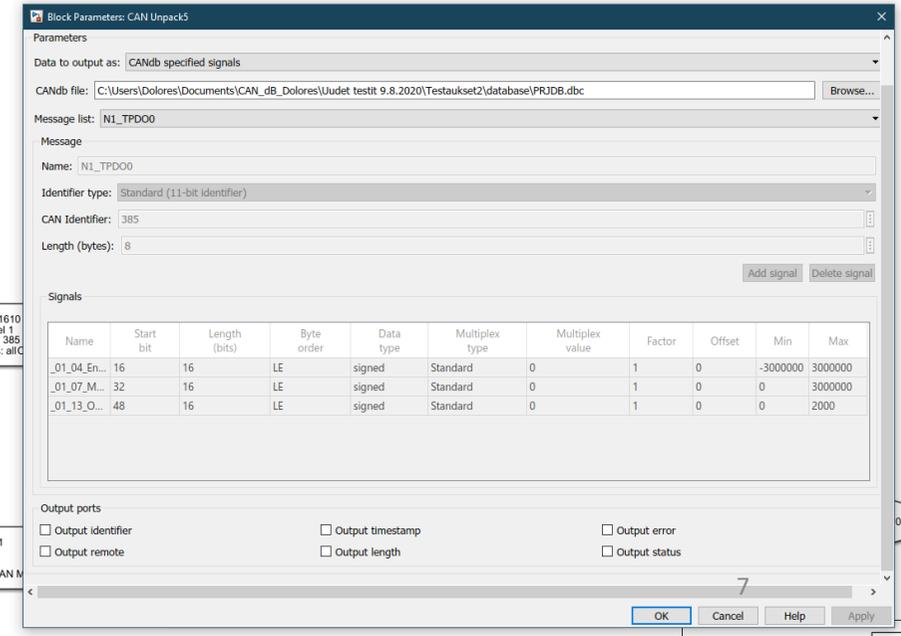
Easy signal management via database.

All nodes (sensor) are sorted by ID with their signals → Database imported to Simulink where each signal easily available.

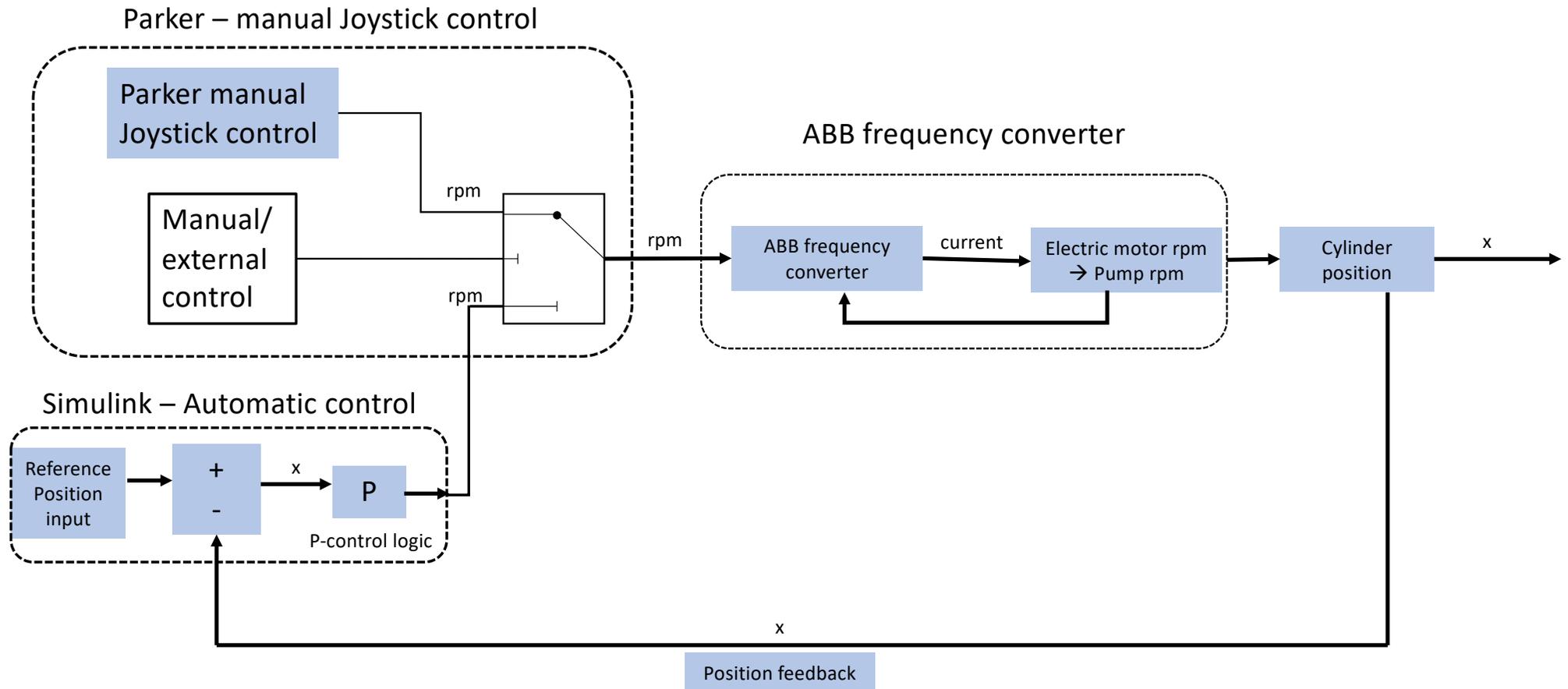
Database creation in CANalyzer.



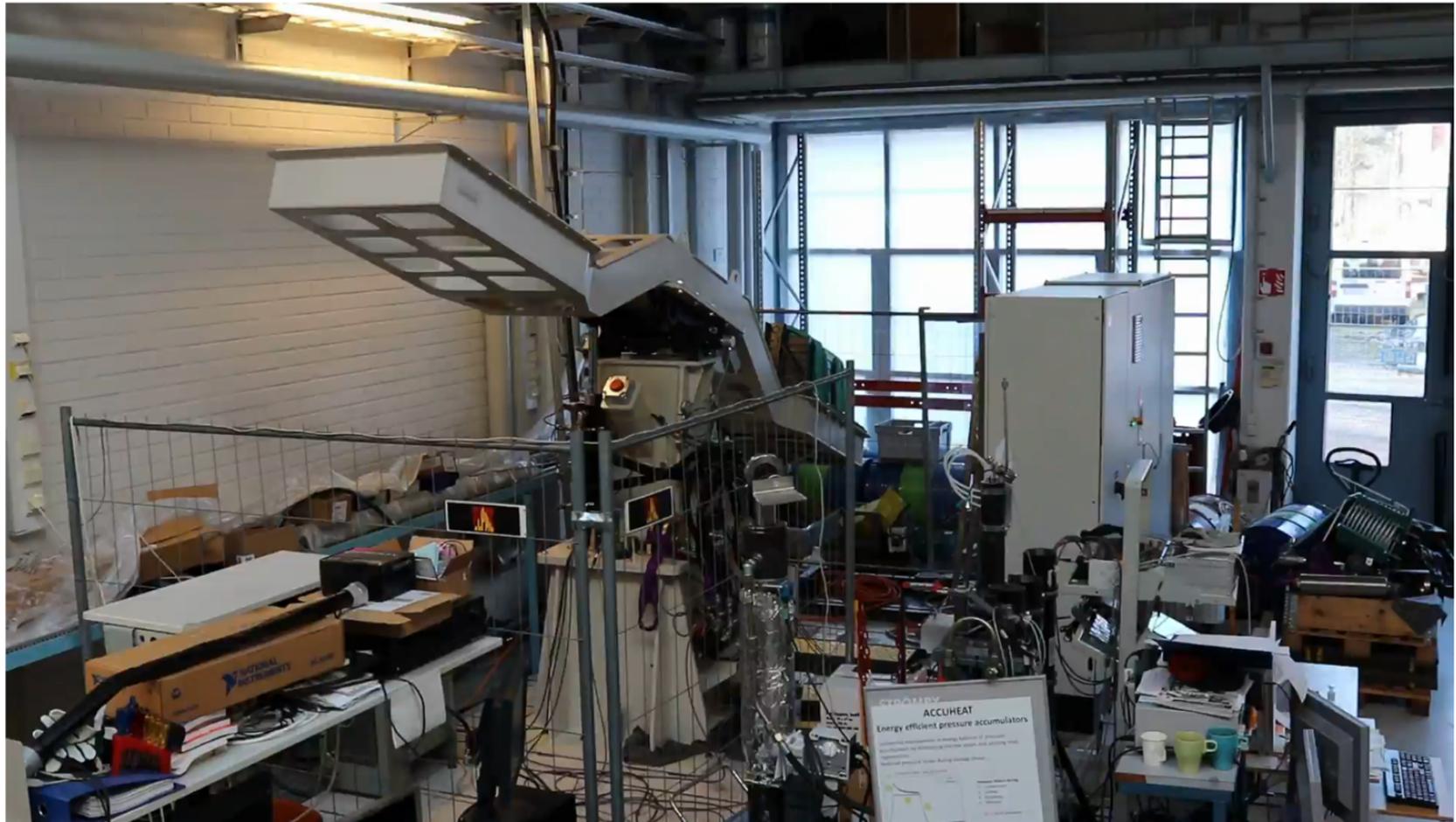
Imported database allows simple signal selection in Simulink.



Control



Dolores test bench in action



Thank you!