

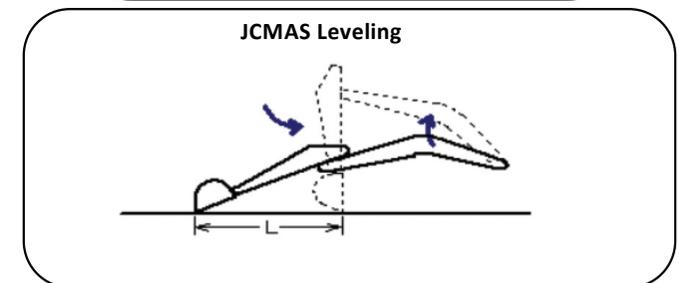
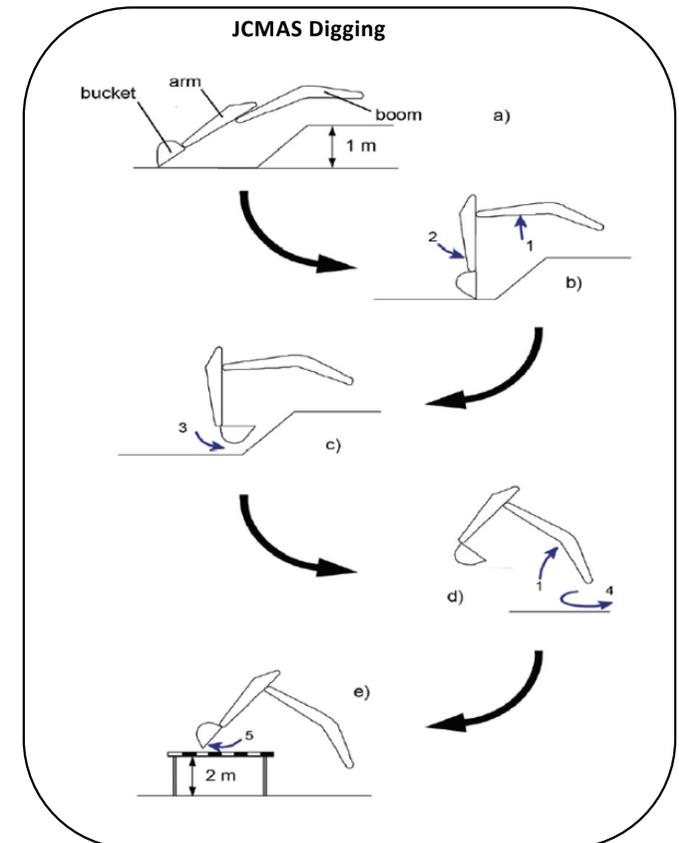
Micro Excavator with Direct Driven Hydraulic (DDH) actuators

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Research

- **On going: Energy consumption measurements**
 - The JCMAS duty cycles will be used to measure energy consumption
 - Same cycles with direct driven hydraulics and conventional hydraulics
- **Future: System durability, controllability and safety features evaluation. Intelligent functions...**



DDH implementation



JCB Mirco mini excavator

Weight: 1100 kg



Main valve

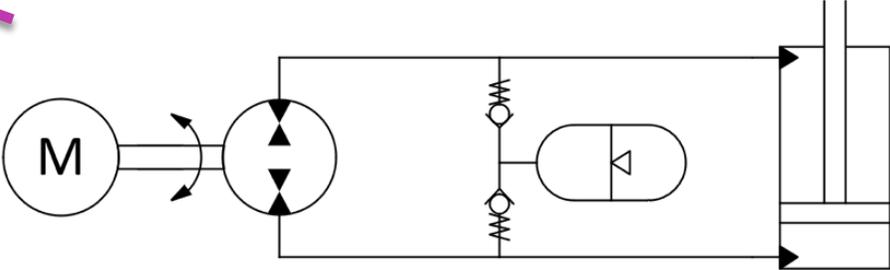


Diesel engine + pump

removed

installed

3 x DDH pump packets for boom, arm and bucket cylinders



DDH System overview

3 x DDH pumps

Rexroth Indra Drive M
HMS02 motor controllers



BOSCH Rexroth
MST130C motors,
water cooled,
540VAC, 5,2 kW

+



Rexroth External
gear motor/pump,
8.0 cm³/rev

3 x DDH valves

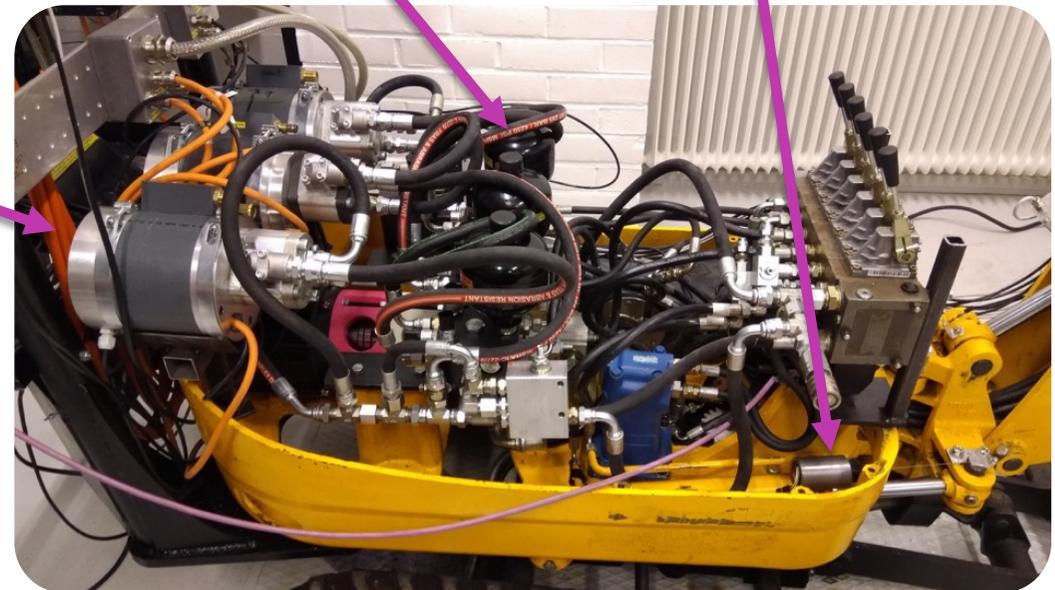
Parker DDH valve block, 10 bar
accumulator



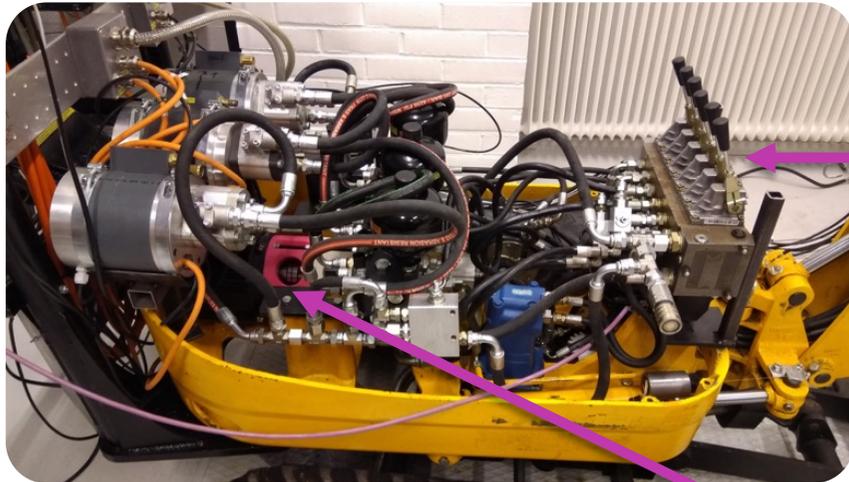
Sensors



Uppercase swing and all boom cylinders
equipped with position sensors



Conventional & pre-charge hydraulics



Flow control

Danfoss PVG-32 proportional CAN-valve



Power source



Altair-Nano battery pack 96V 60Ah

Conventional hydraulics pump and DDH pre-charge pump



Motenergy ME1302, water cooled, 24-96VDC, 12kW

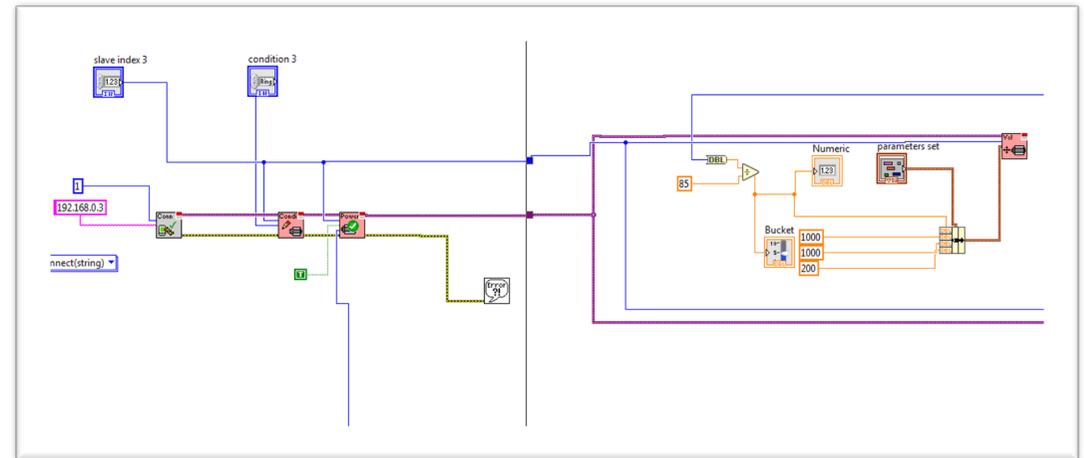
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Genuine Parker/JCB Twin hydraulic pump

Control

- Excavator control and measurement data collection with LabVIEW
- Data processing with MATLAB



Energy consumption

- Original diesel powered 1,6 l/h \approx 16,2 kWh/h
- Electrified excavator 3 kWh/h
- DDH goal 1 kWh/h



Thank you!