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Novel calibration facility for water flow with large temperature span

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Introduction

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- EXISTING test rigs:
  - 5 L/h up to 500 m³/h (gravimetric and reference meters)
  - temperature range from 4 °C up to 85 °C.
- REVAMPED test rig:
  - flow down to 1 L/h
  - flow up to 1000 m³/h in DN400 pipes
  - 1 bar pressure difference across the test section at 1000 m³/h
  - Temperature range 4 °C up to 85 °C.
  - Dynamical flow rate patterns
- DIGITIZATION and DIGITALIZATION:
  - Revival of all electronics and cables
  - SCADA system
  - Digitisation of all data
  - Automatisation of the test rigs
  - Digitalisation of certificate generation

Calibration principle

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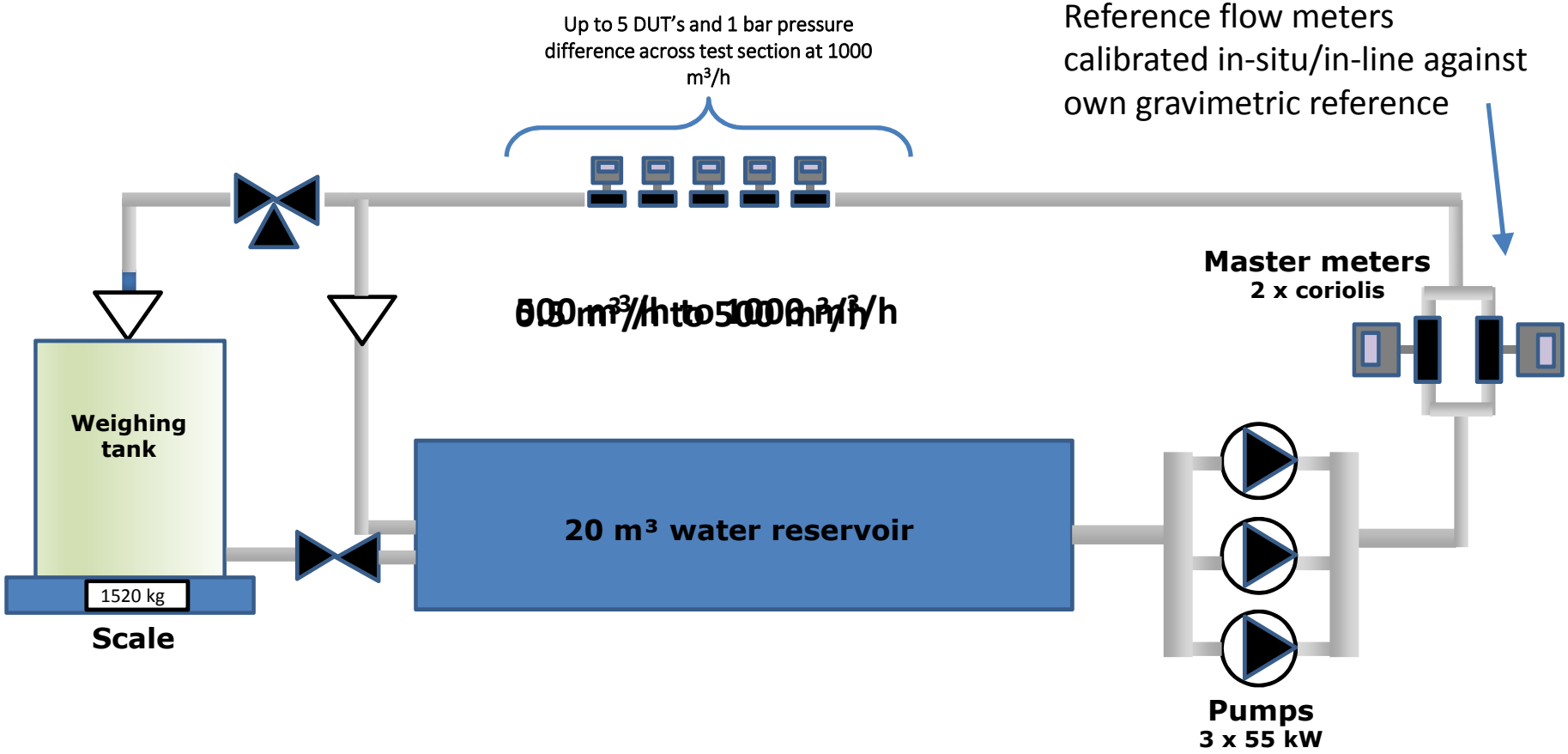

Challenges

- Wishes are unlimited – budgets are not!
- Traceability: Reference flow meter system vs. gravimetric system
  - Price
  - Space
  - Accuracy, repeatability, and stability
- Storage tank and pumping system
  - Size of tank
  - Pump power needed
  - Electrical power supply
- Data handling – How to
  - Acquisition
  - Management
  - Storage

Reference flow metering - consideration

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- Two meters in parallel => 500 m³/h in each section => calibration on own gravimetric system.
- MAG-meters
  - Price: Low
  - Accuracy: ”Low”
  - Pressure loss: Low
- Coriolis-meters
  - Price: High
  - Accuracy: High
  - Pressure loss: High

Reference flowmetering system

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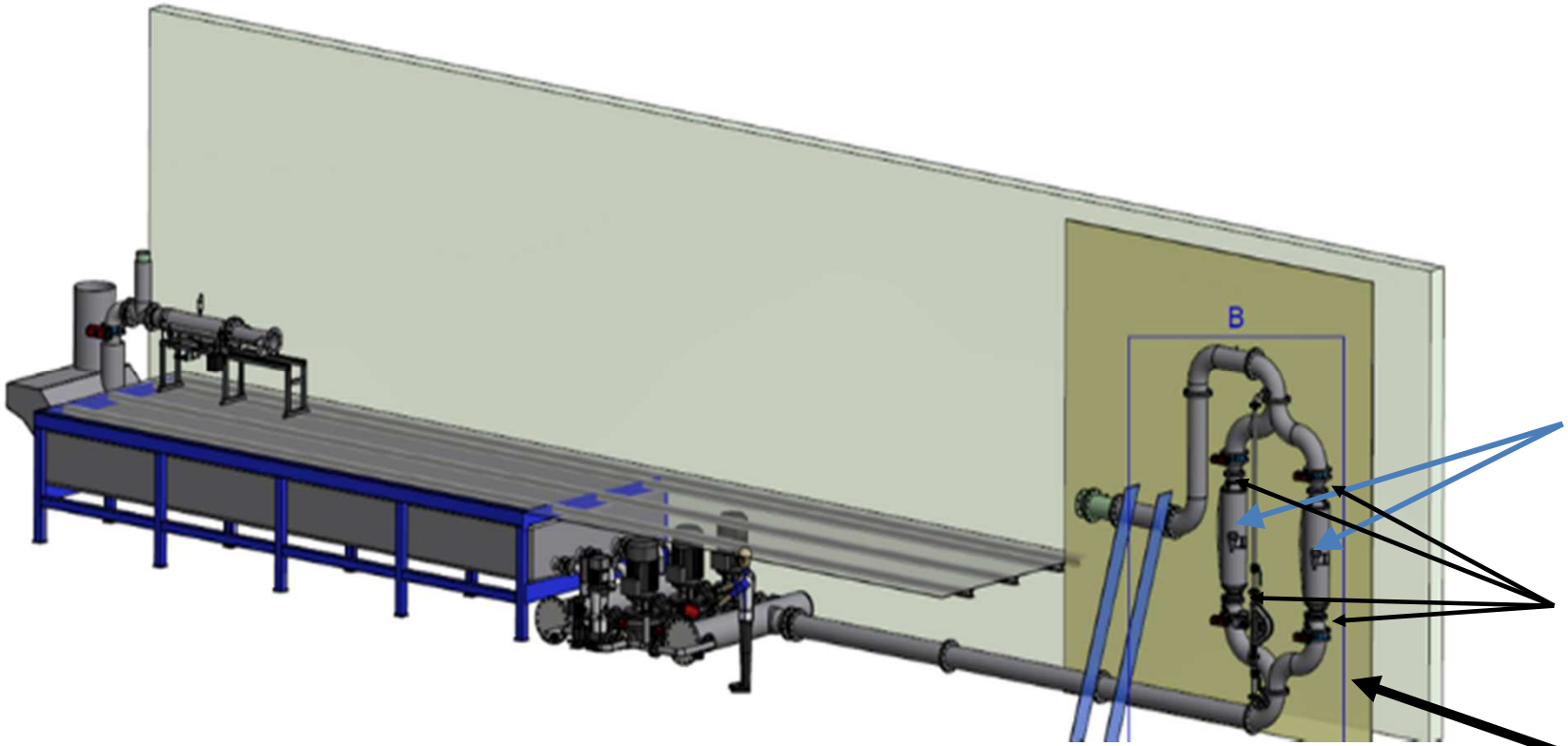


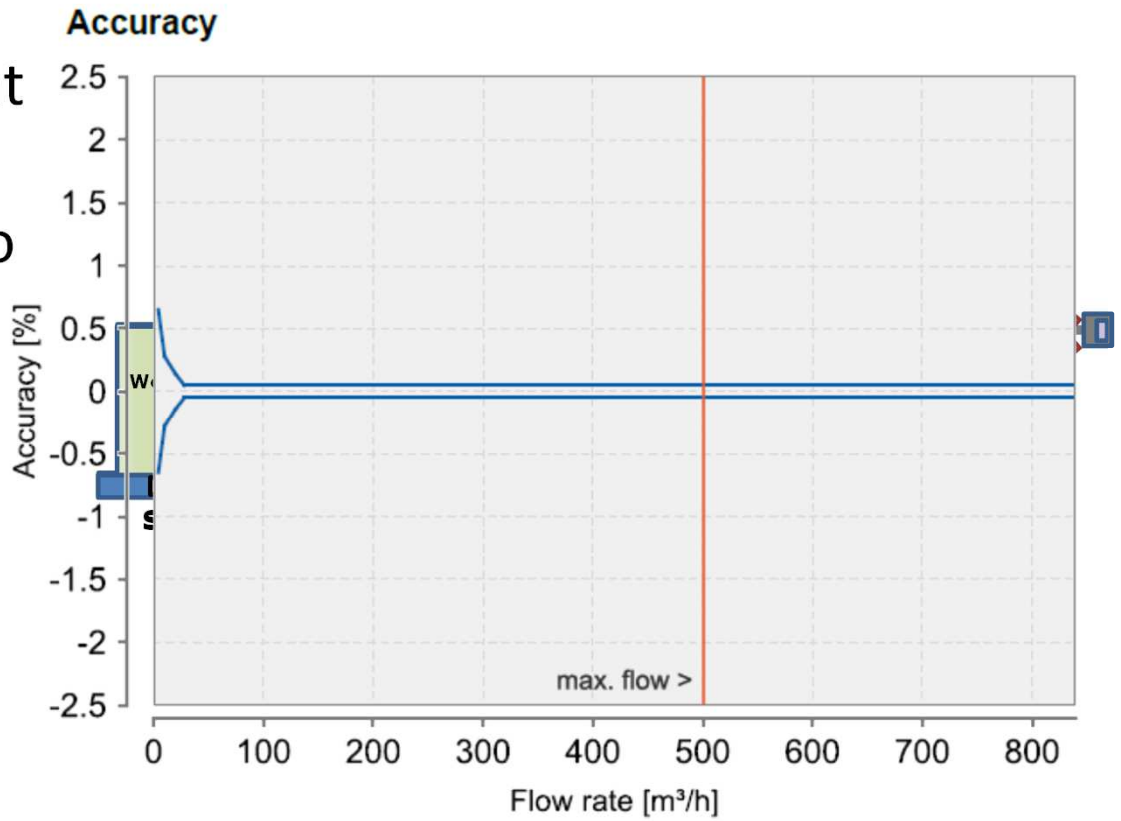
2 coriolis flowmeters in parallel

4 Butterfly valves

Block and bleed system

Reference flow metering

- Calibration in-situ: each meter at a time
- Stated accuracy: 0.05 % down to 28 m³/h
- Stated repeatability: 0.05 %
- CMC of existing gravimetric system is 0.05 %
- Expected uncertainty for flows above 500 m³/h is 0.2 % with reference meter system



Storage tank and pumping system

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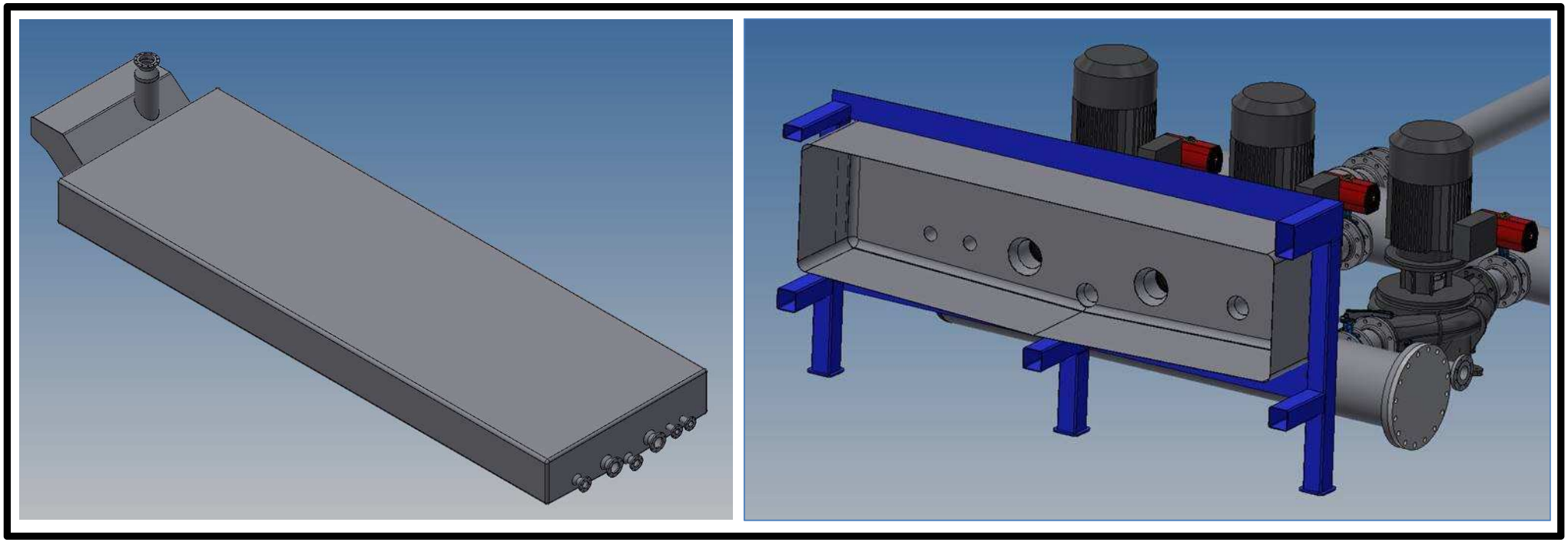
- 20 m³ storage tank (existing)
- At 1000 m³/h the water is changed every 72 sec. (approx.)



Storage tank and pumping system

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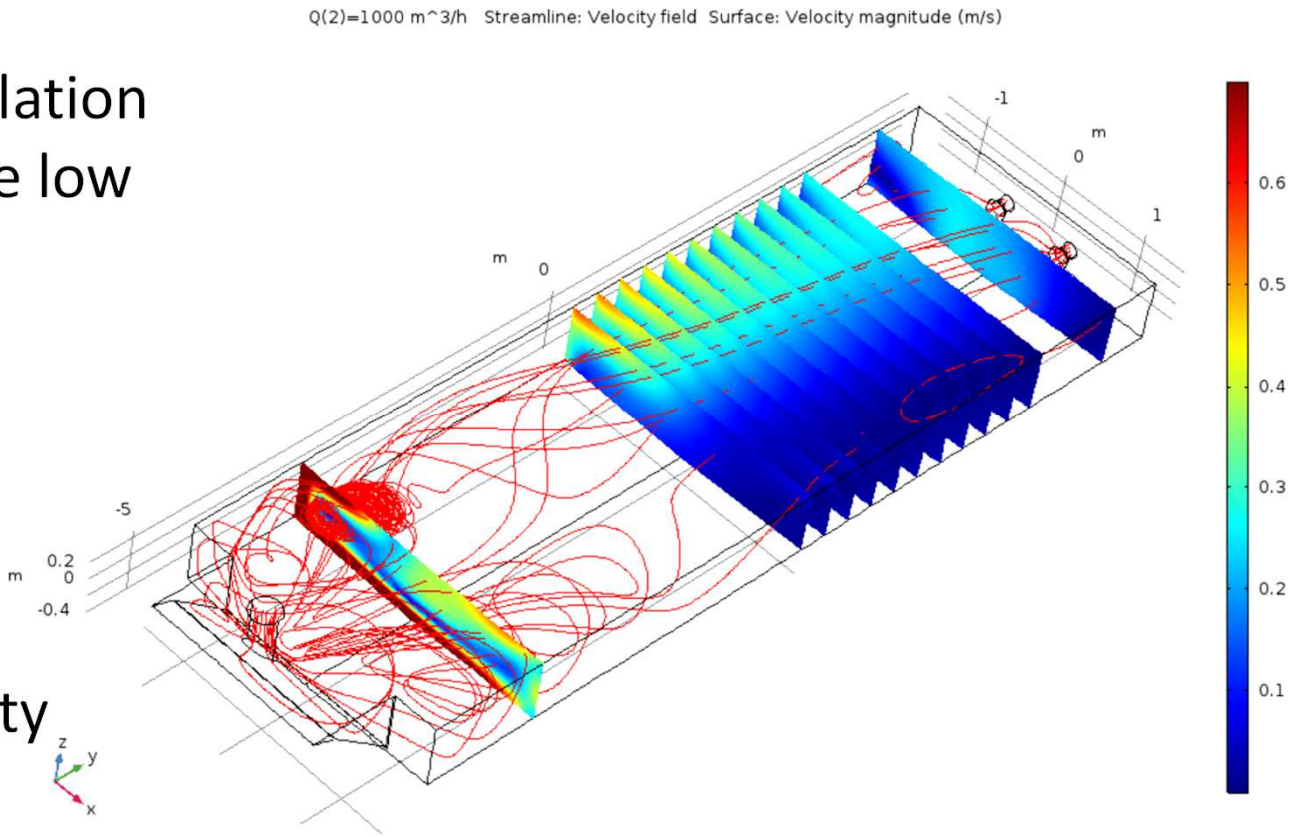
- The velocities in the recirculation zone close to the outlets are low (≤0.15m/s)
- Avg. fluid velocity in the simulations approx. 8 m/s
- Using all outlets fluid velocity reduces to approx. 4.6 m/s



Pump power at 1000 m³/h

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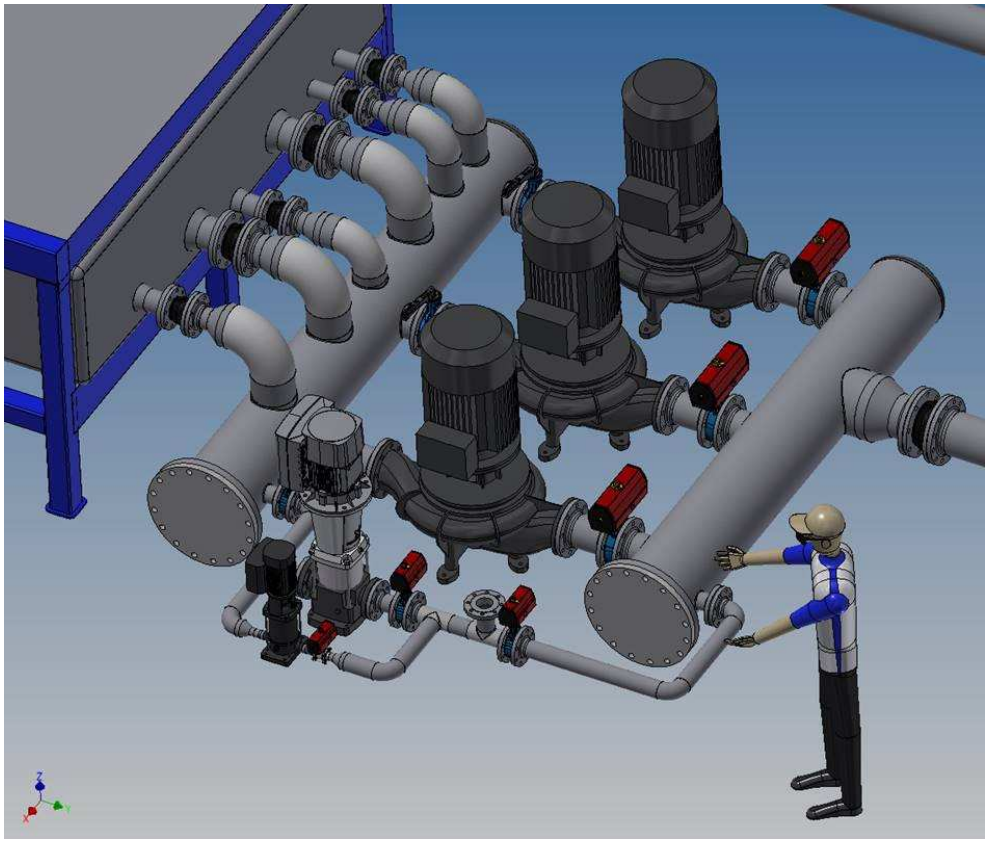
- Pressure loss across reference meters at 500 m³/h: **1 bar**
- Potential pressure loss across DUT section: **1 bar**
- Pressure loss in the piping system: **2 bar** (estimate based on calculation)
- **165 kW** pump power is necessary to pump 1000 m³/h with a total pressure loss of **4.5** bar in circuit.



Data flow – Digitization and digitalization

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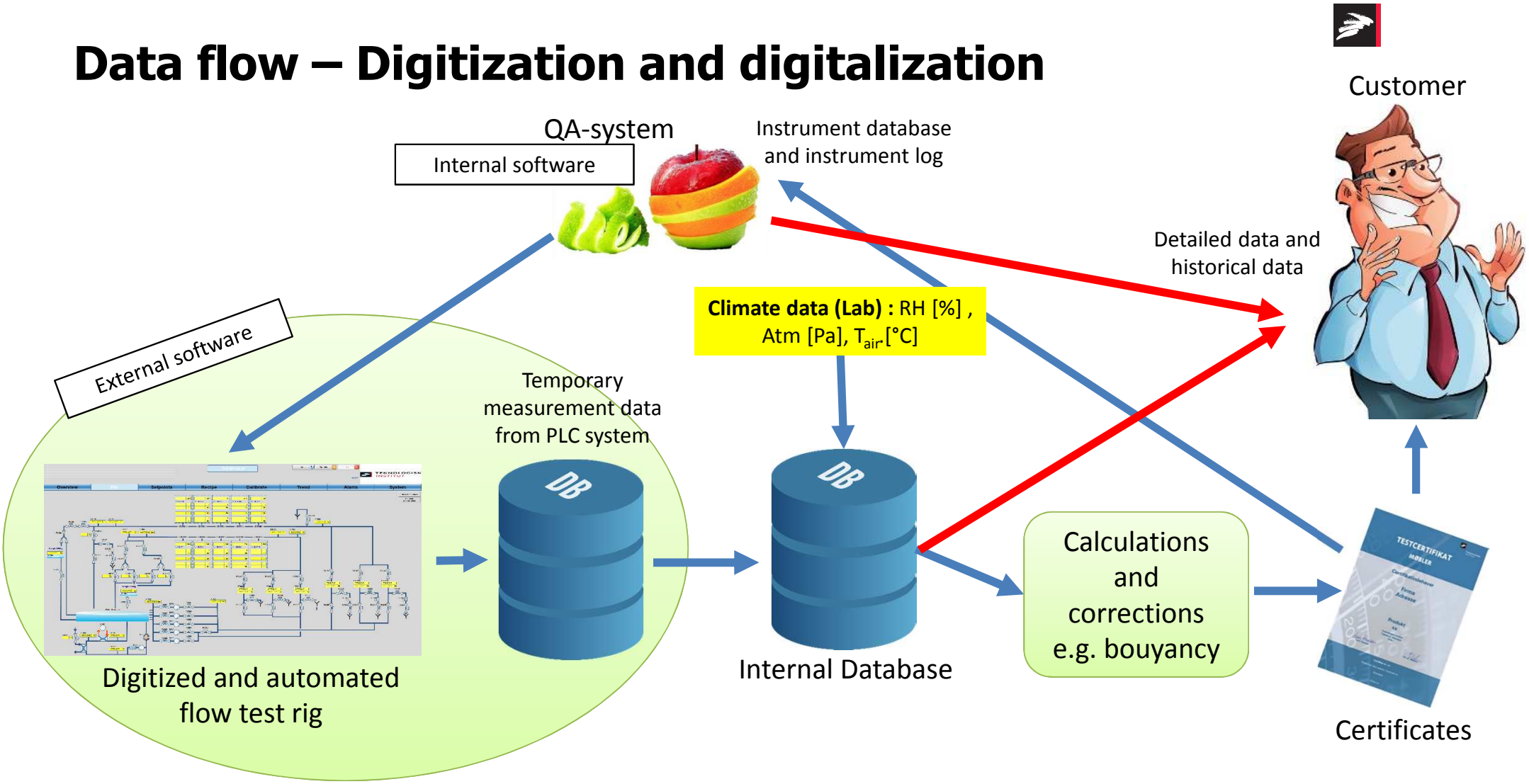
- Data acquisition
  - How much data or information is needed?
  - Should data be logged every millisecond, second or minut?
- Data management
  - Data flow and how to secure traceability of data
- Data storage
  - Where to store data and how to secure backups, permissions and access

Data flow – Digitization and digitalization



Thank you for your attention