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Status of the Gas Test Line

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Overview

- Requirements for the gas system
- Working principle of the gas system
- Detailed description of the functional blocks
- Outlook/Next Steps

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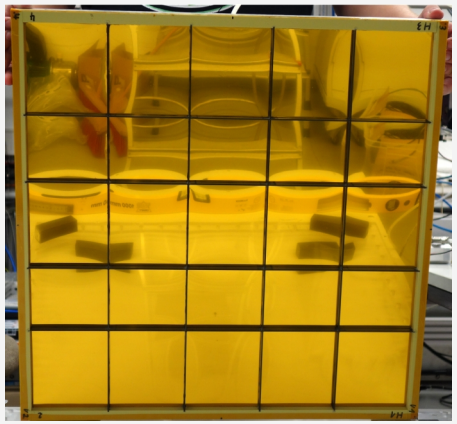
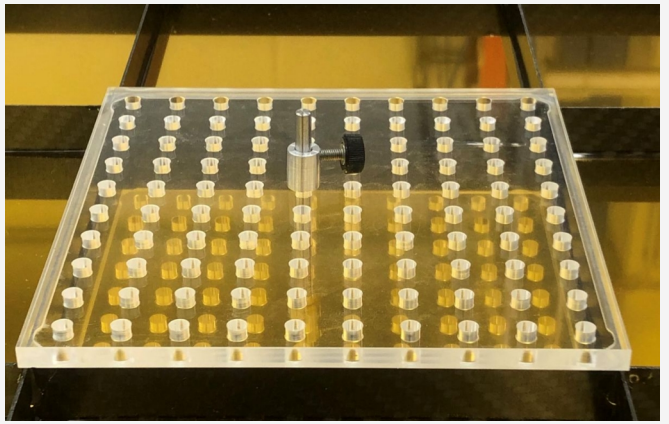
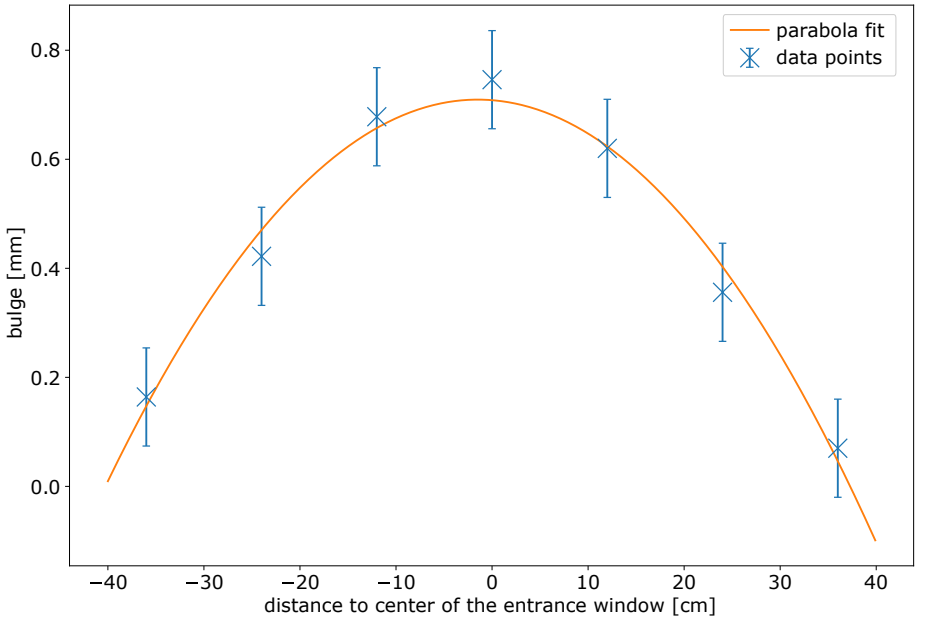
Pressure range





- Large chamber has a volume of 11l
- Over pressure causes bulging
  → Change in field which must be avoided
  → Over pressure below 0.7mbar relative
- Over pressure increases the volume by 0.86l

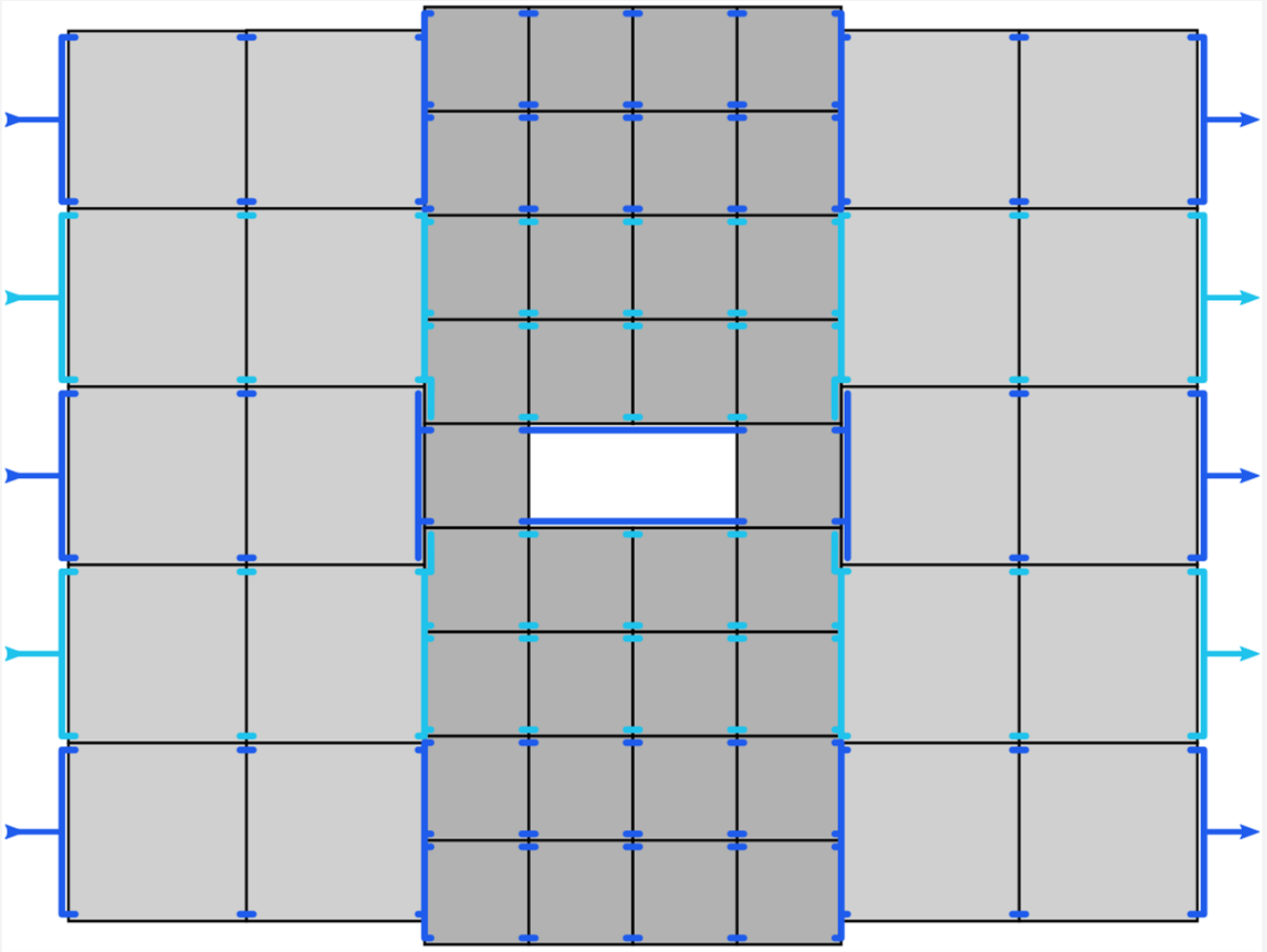


Work by Luisa Faber

Detector Connection

- Separation of a detector layer into 5 lines
- Serial connections to minimize material budget
- 1m of height difference increases the hydrostatic pressure about 0.4 mbar

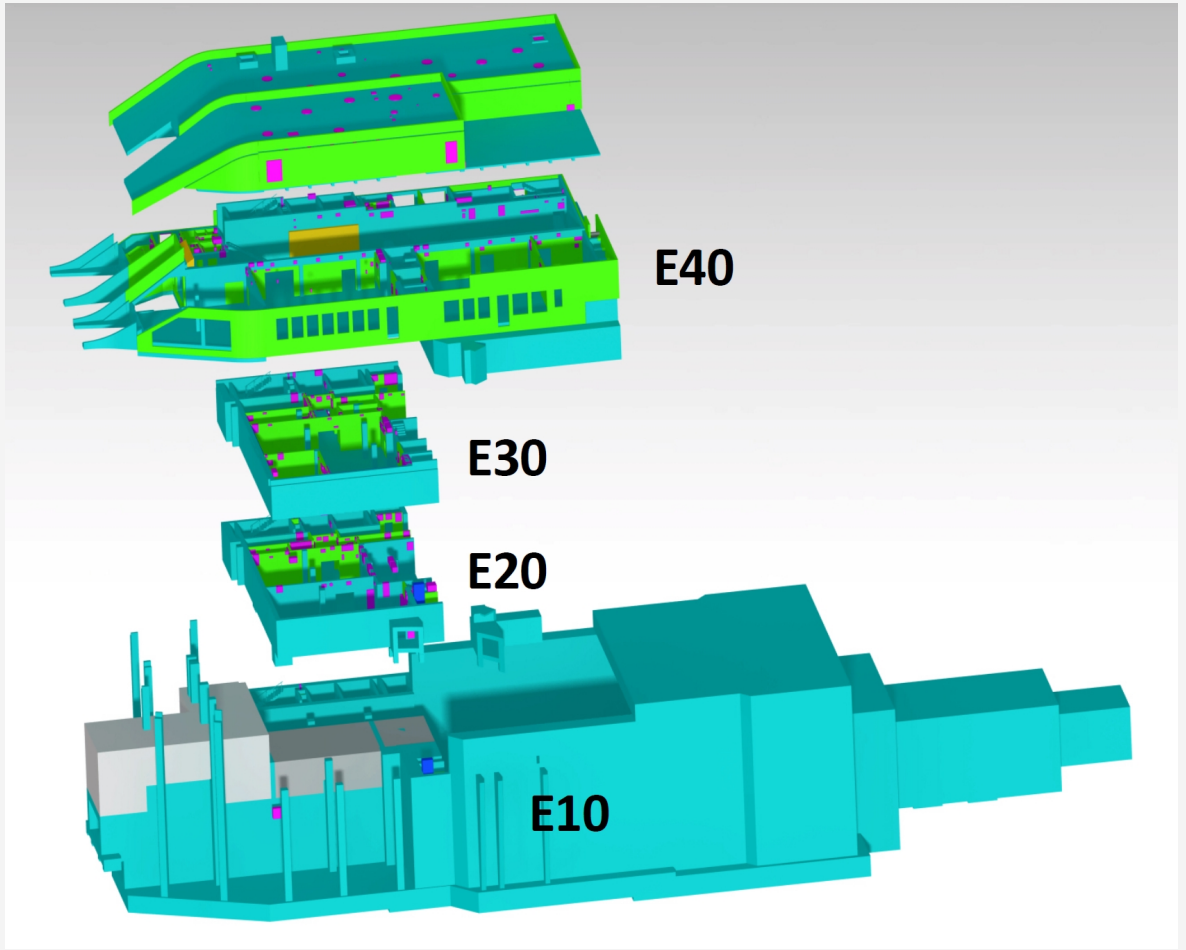
  → each line needs a separate gas supply



Installation at GSI

- The gas system is placed in E30 18m above the detector
- Total distance between the cave and the system is approx 50m
- Due to high radiation, no complex electronics can be mounted close to the detector

  → only pressure sensors close to the detector



Requirements

- Provide a gas mixture of Xe/CO_2 85/15; 15 l/h
- Differential pressure below 0.7 mbar!
- Long tubing
- Parts and devices in proximity to detector must be radiation hard
- Flushing the system when taken into operation
- Adjustment of gas mixture
- Recuperation of Xenon
- Safety concerns (Power shut down, Leakage...)

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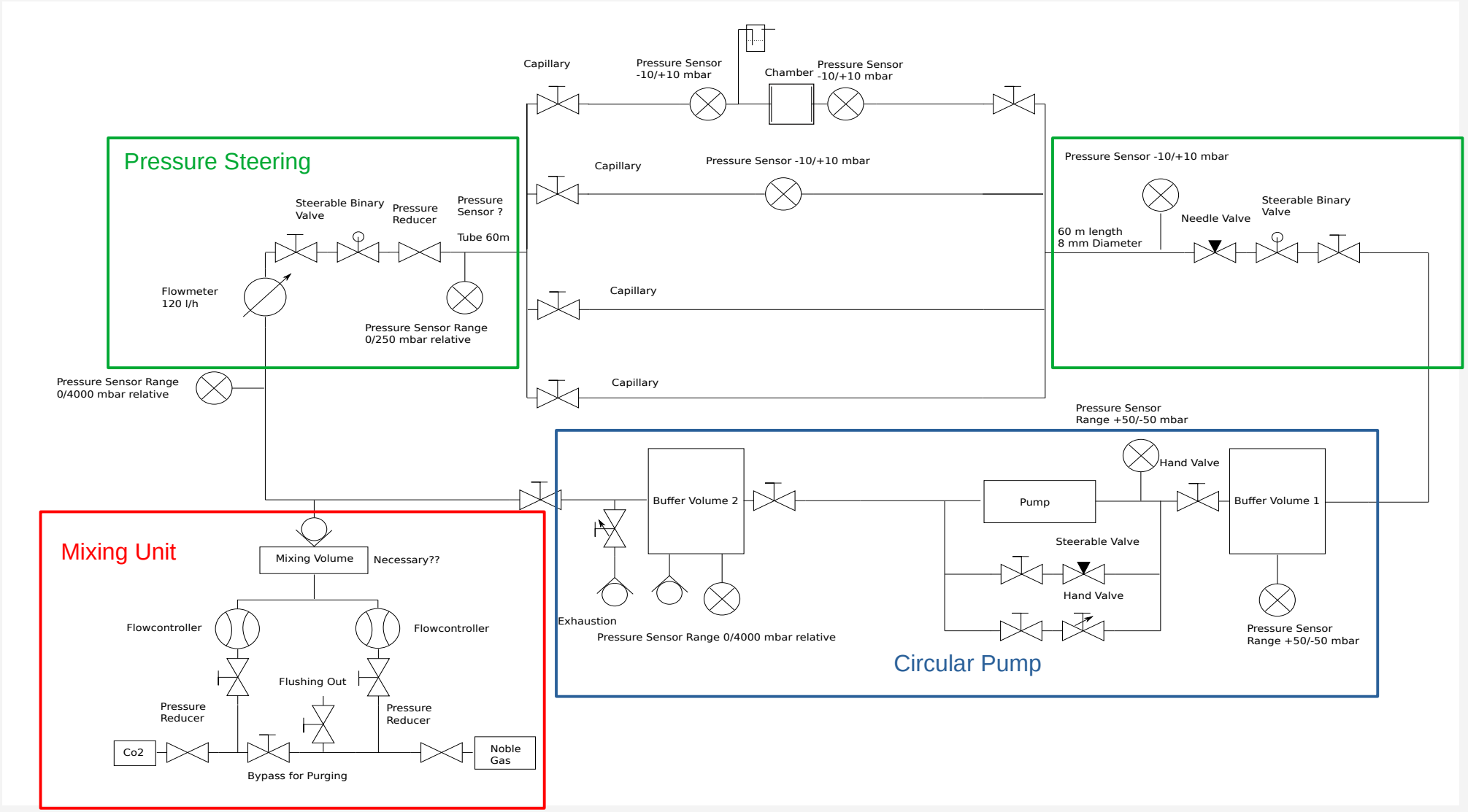
Functional Blocks of the System



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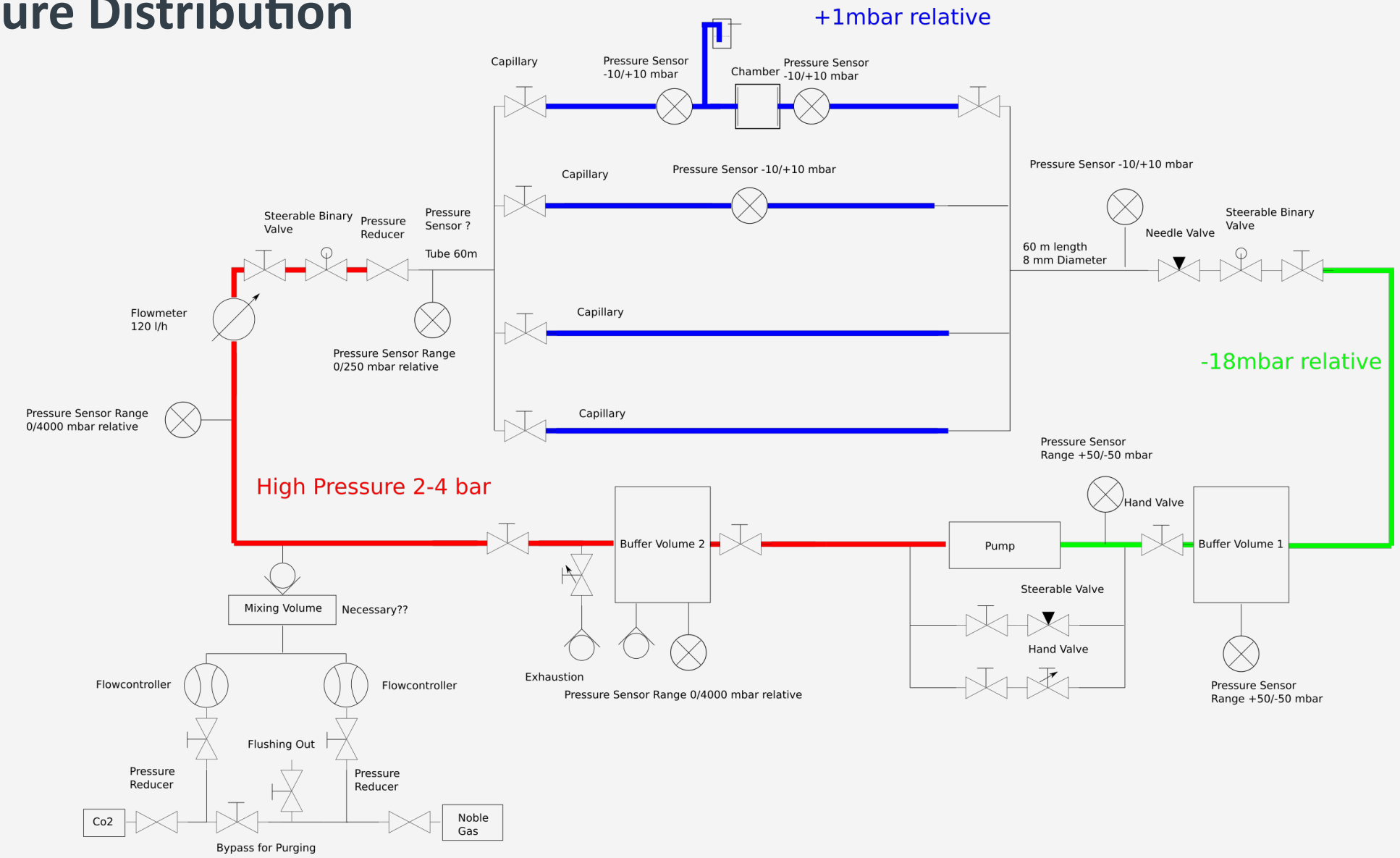
Pressure Distribution



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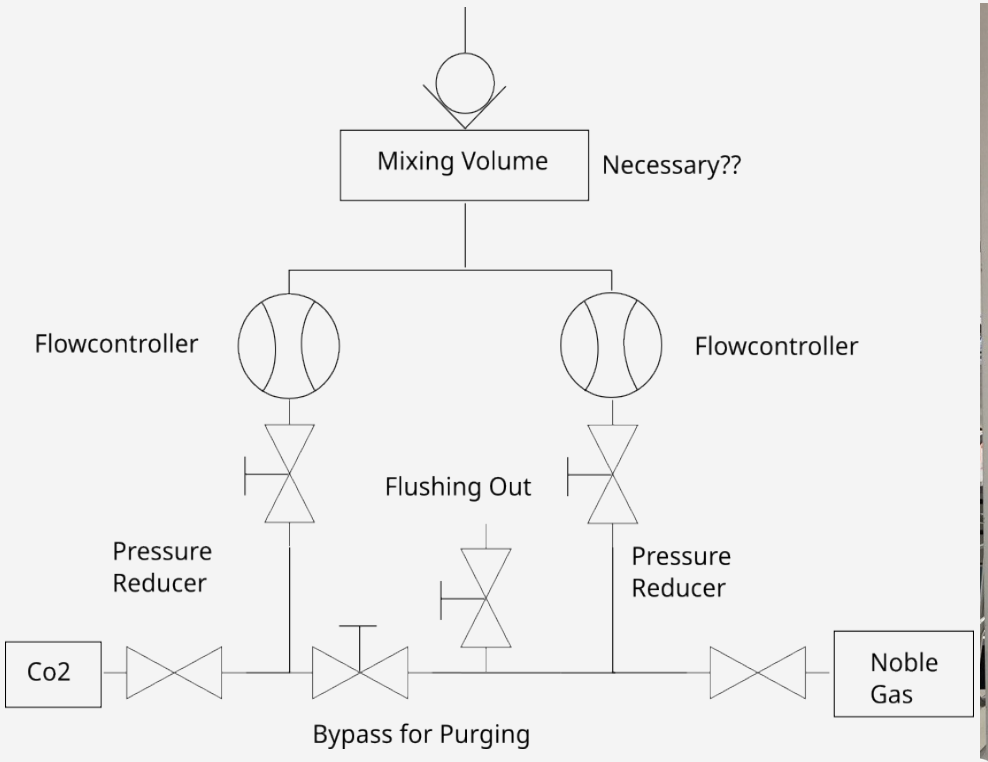
Mixing Unit

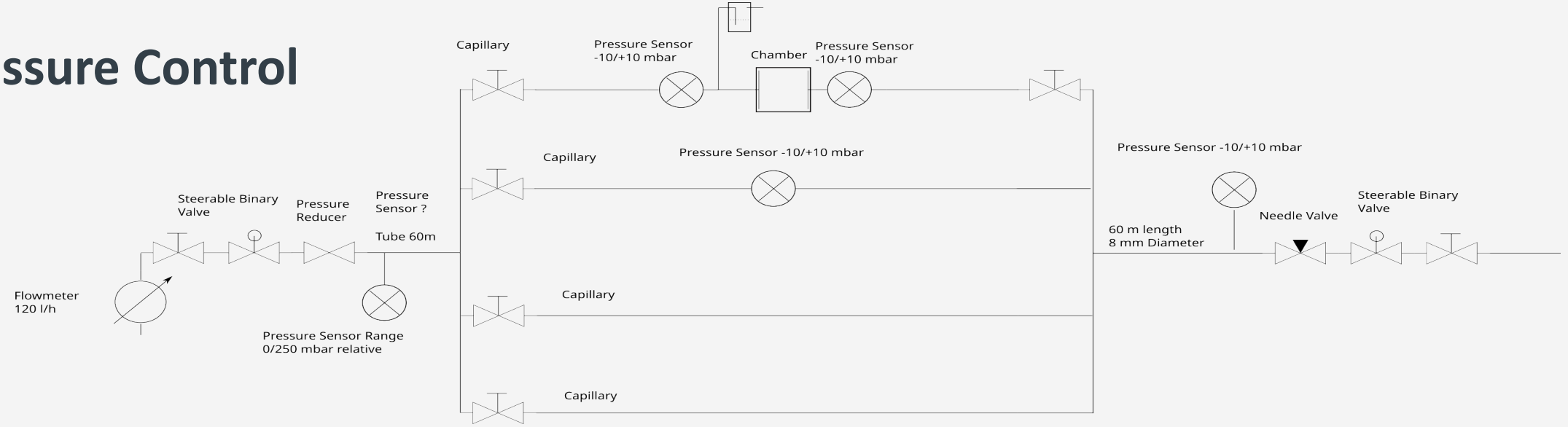
- Flow controllers from Brooks
  - **Xe,CO2 Calibrated,**

    0-100l/h
- Flushing Procedure:
  - **Flushing with 60 l/h CO2 (15 l/h per line)**
  - **Removing CO2, adding Xe**

    → CO2 separation needed for tests
- Tests at the moment with 82%/18% Ar/CO2 (SAGOX)



Pressure Control



Inlet:

- Flow meter, Hand valve, steerable binary valve, static pressure reducer, pressure sensor, 60 m tubes 4 mm diameter

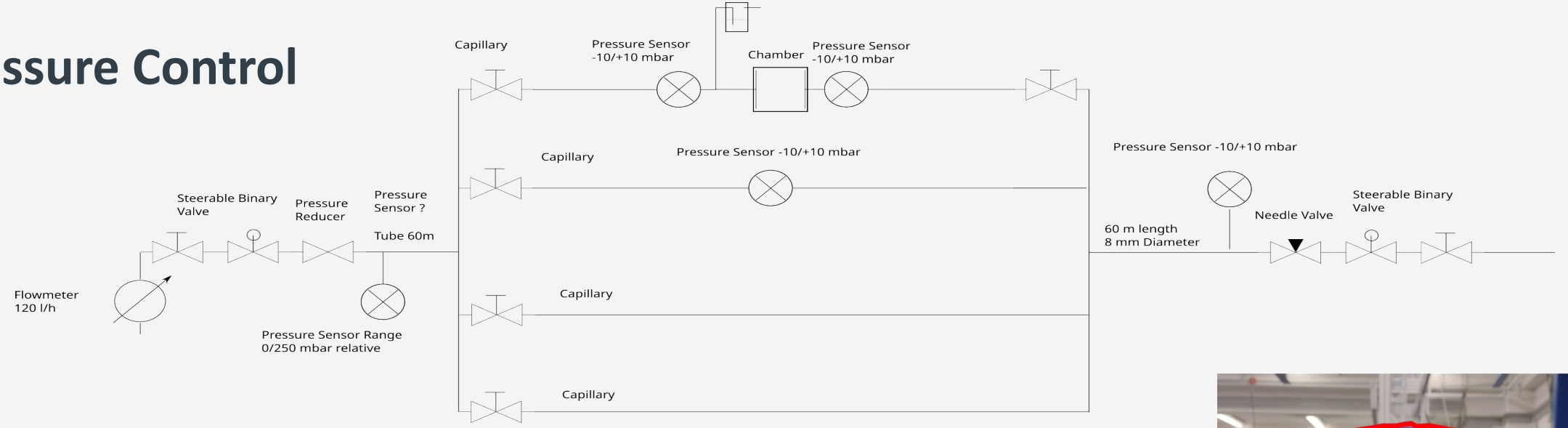
Detector Line:

- Hand valve, capillary, pressure sensor, bubbler (over pressure fuse), detector, 3 parallel lines

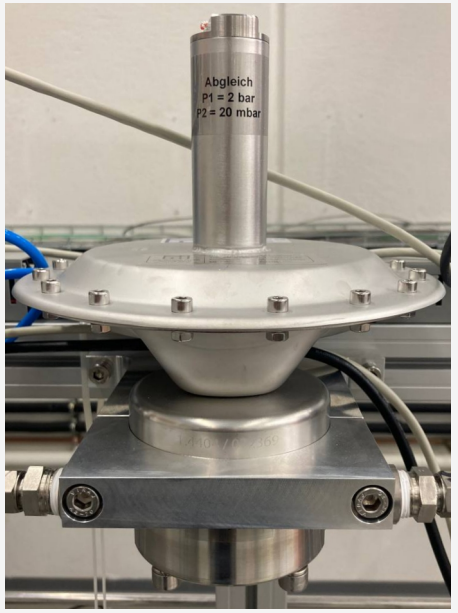
Outlet:

- 60 m tubes 8 mm diameter, pressure sensor, steerable needle valve, steerable binary valve, hand valve

Pressure Control

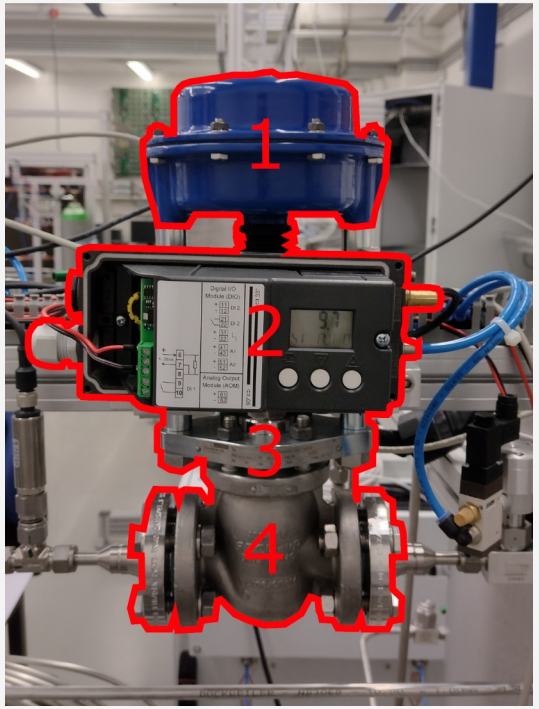


Inlet:

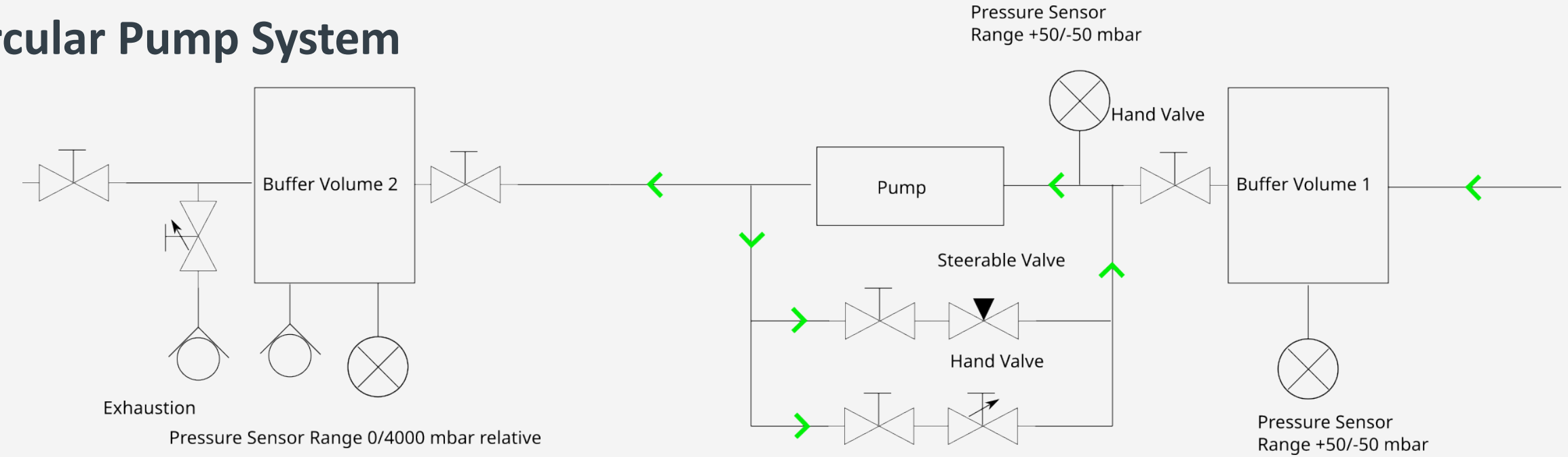


Detector Line:

Outlet:



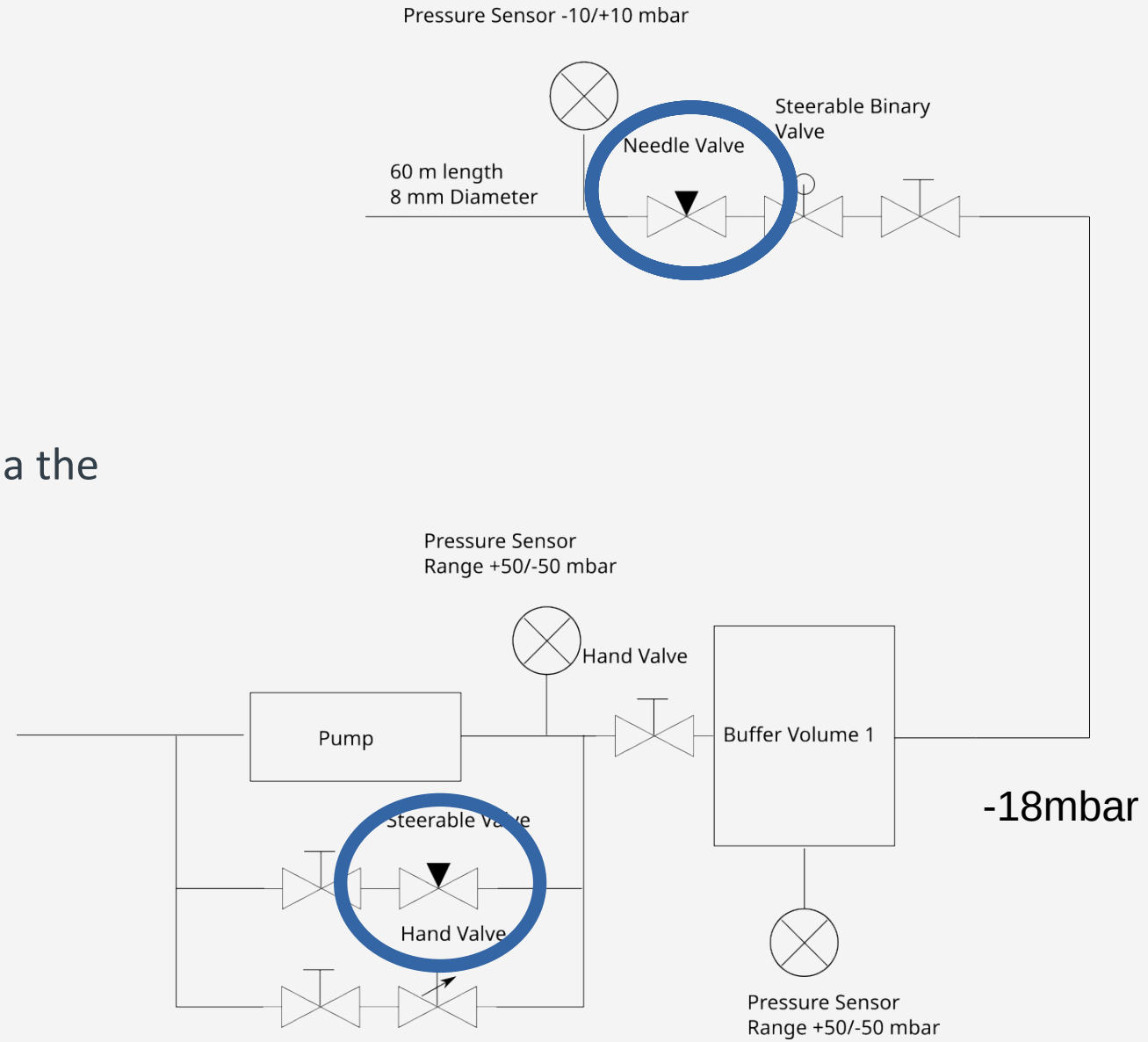
Circular Pump System



- Pump runs at full power
- Bypass system controls the gas flow (pressure)
- Hand valve sets working point
- Buffer volume 2 stores gas for ambient pressure change compensation
- Buffer volume 1 decouples the control mechanisms

Buffer Volume 1

- Pump valve and pressure valve coupled via pressure in tube
- Decoupling of the two control mechanisms via the buffer volume
- Size of the buffer volume determines the dampening of potential pressure oscillations



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Buffer Volume 2

- Compensates changes in ambient pressure
- Dimensions are chosen to store excess gas volume in a pressure range of 2 bar to 4 bar total pressure
- Barometric data from Darmstadt needed
- First approximation: 256 l buffer volume would be able to compensate for pressure changes between 962 hPa and 1063 hPa

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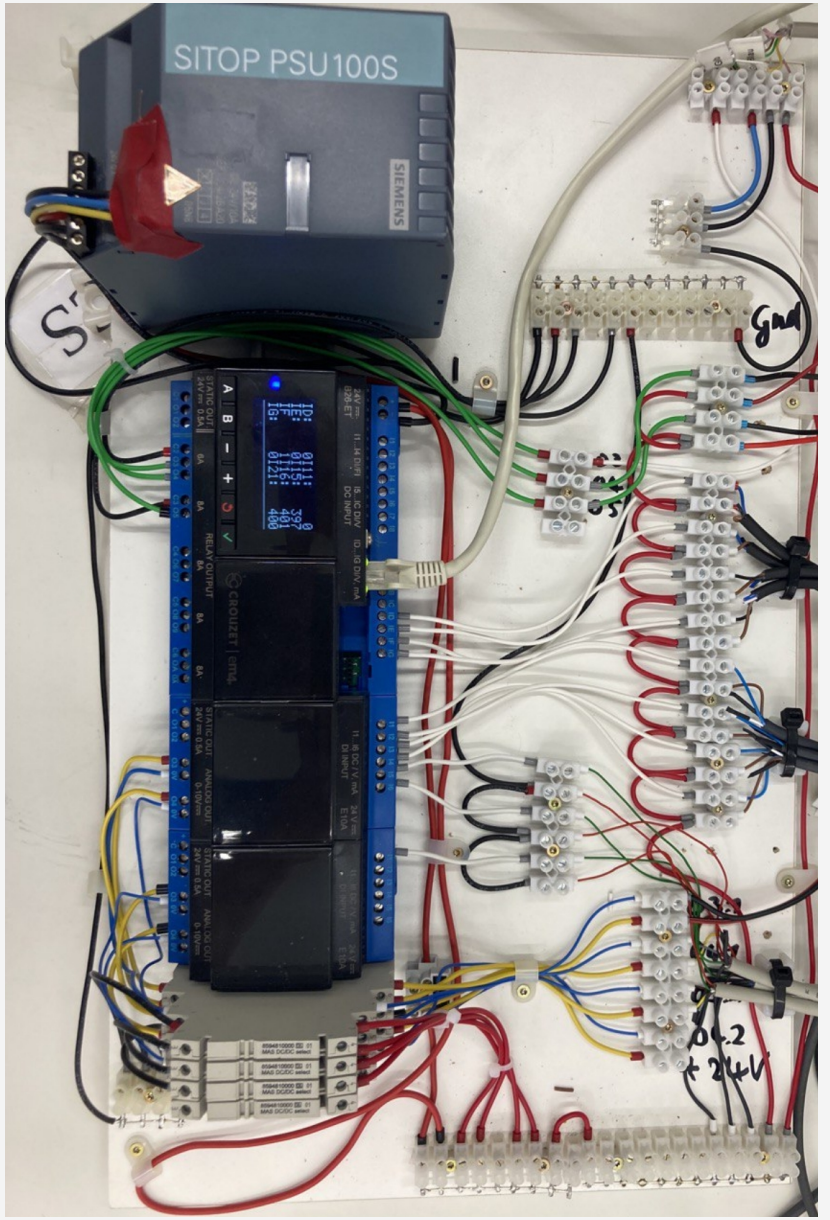
Steering, PLC, Connections

- Tested PLC Crouzet em4 works fine with the test system, not usable for the whole system
  - **Not enough ins/out**
  - **No good communication interface**
- All sensors read/controlled via 4-20 mA connection for stable communication
- PID controller foreseen for controlling

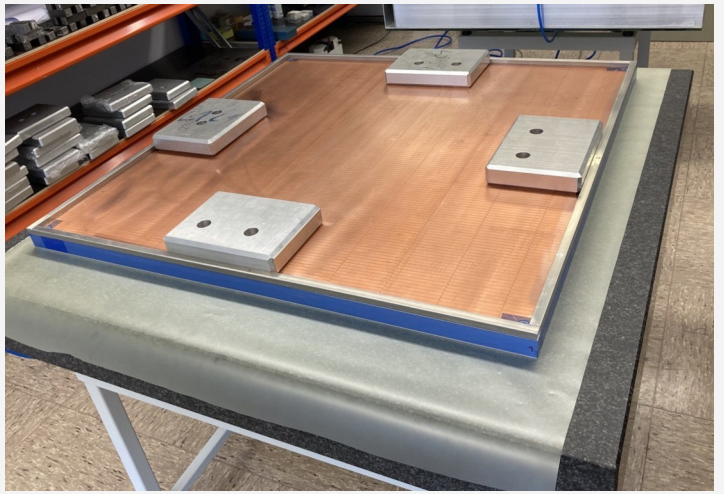


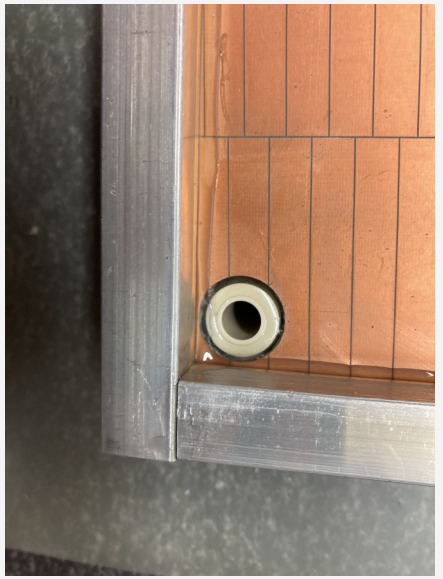
Upcoming Measurements

- Determination of the control parameters
  - **Valve-Pump system has to be tested**
  - **Pressure control and pump system has to be tested**
- Filling procedure for the system
  - **Pure CO2 → Pump works differently with different gases**
  - **No pressure spikes at the detectors**
  - **Filling a noble gas not possible, CO2 separation would be needed**

Upcoming Measurements

- Gas flow in the pressure driven system has to be determined with detector chambers
- Safety tests (Power cut off, Leakage…) will be performed
  - **Test chambers have been build for first measurements**
- Long term measurements will be done





Backup