Automation of the accelerator vacuum system

Summer school (Phase 2)

Joint Institute for Nuclear Research (JINR)

Dubna, Moscow region, Russia

Presenters:

Fulufhelo Radzilani (University of Johannesburg)

Temnotfo L Fakude (University of South Africa)

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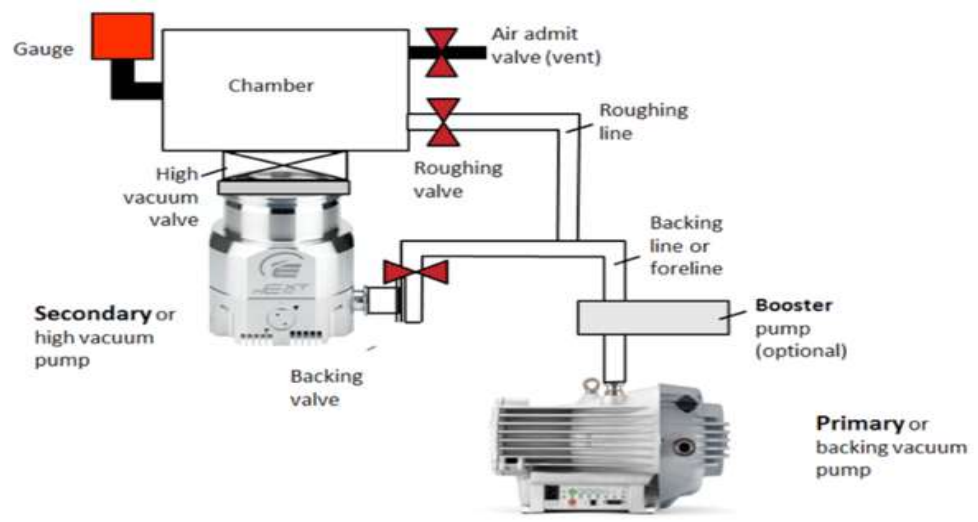
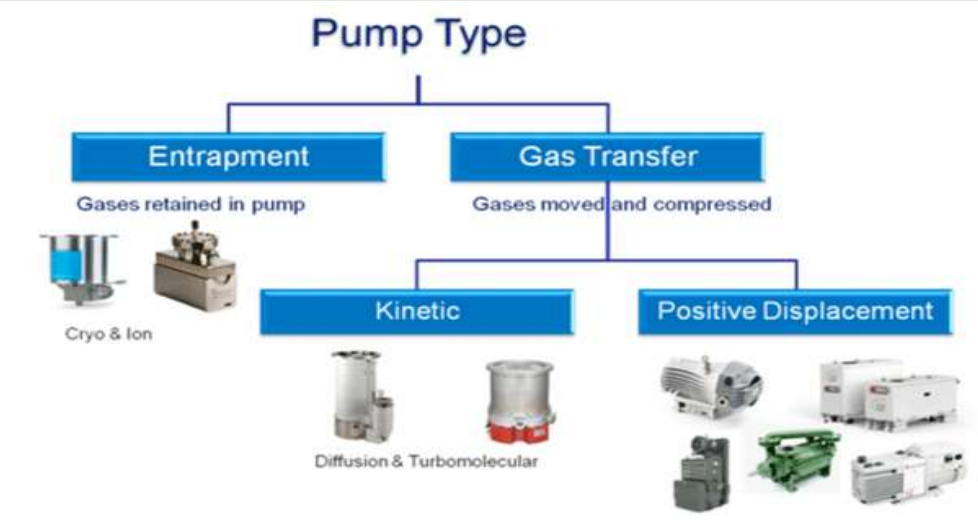
JINR University Centre

- Supervisors:

- Mikhail Nozdrin, acting leader of the Scientific-Engineering Group of the JINR University Centre.
- Dmitriy Zlydenny, engineer of the Scientific-Engineering Group of the JINR University Centre.

Rationale and Motivation





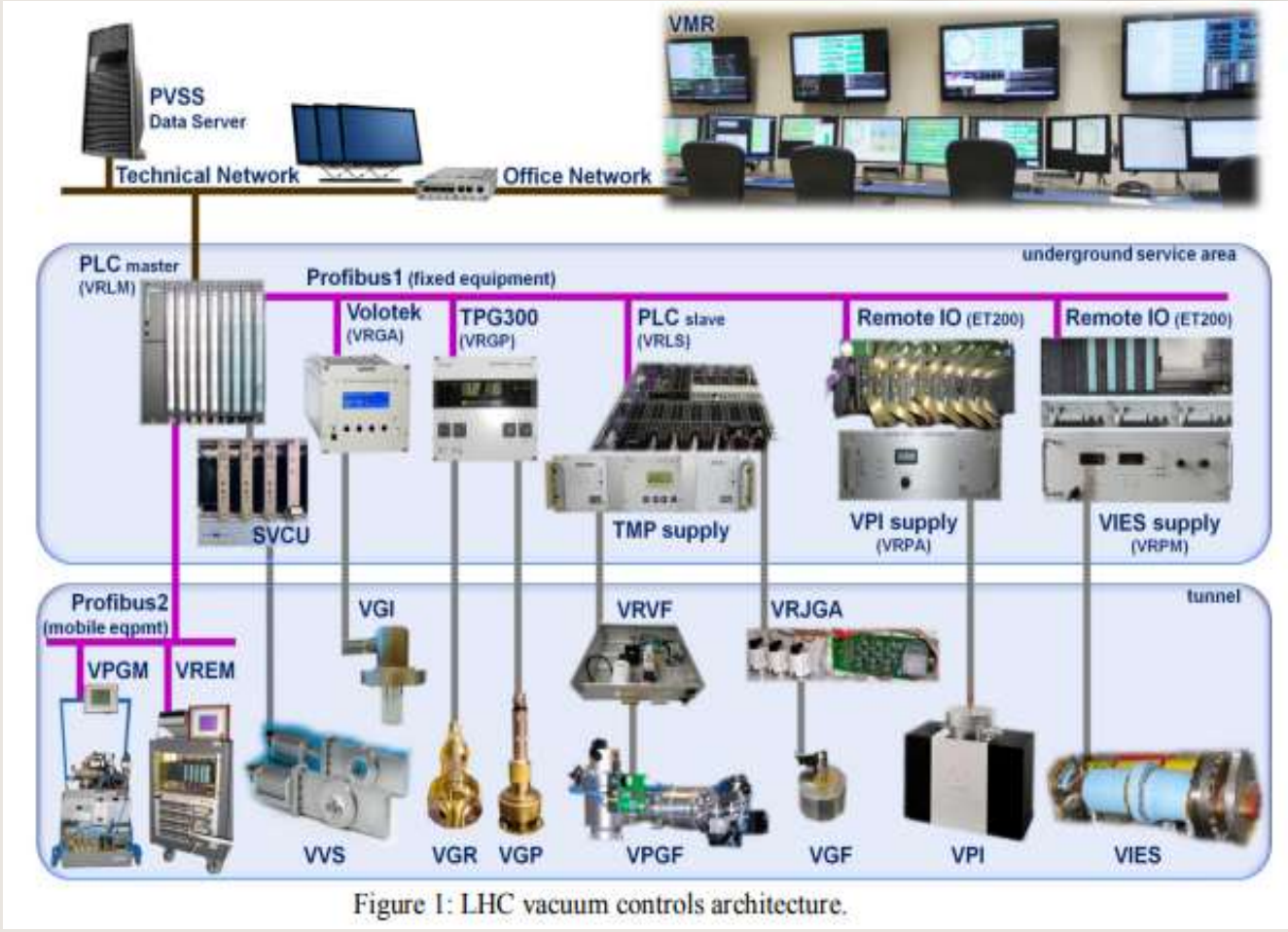


Figure 1: LHC vacuum controls architecture.

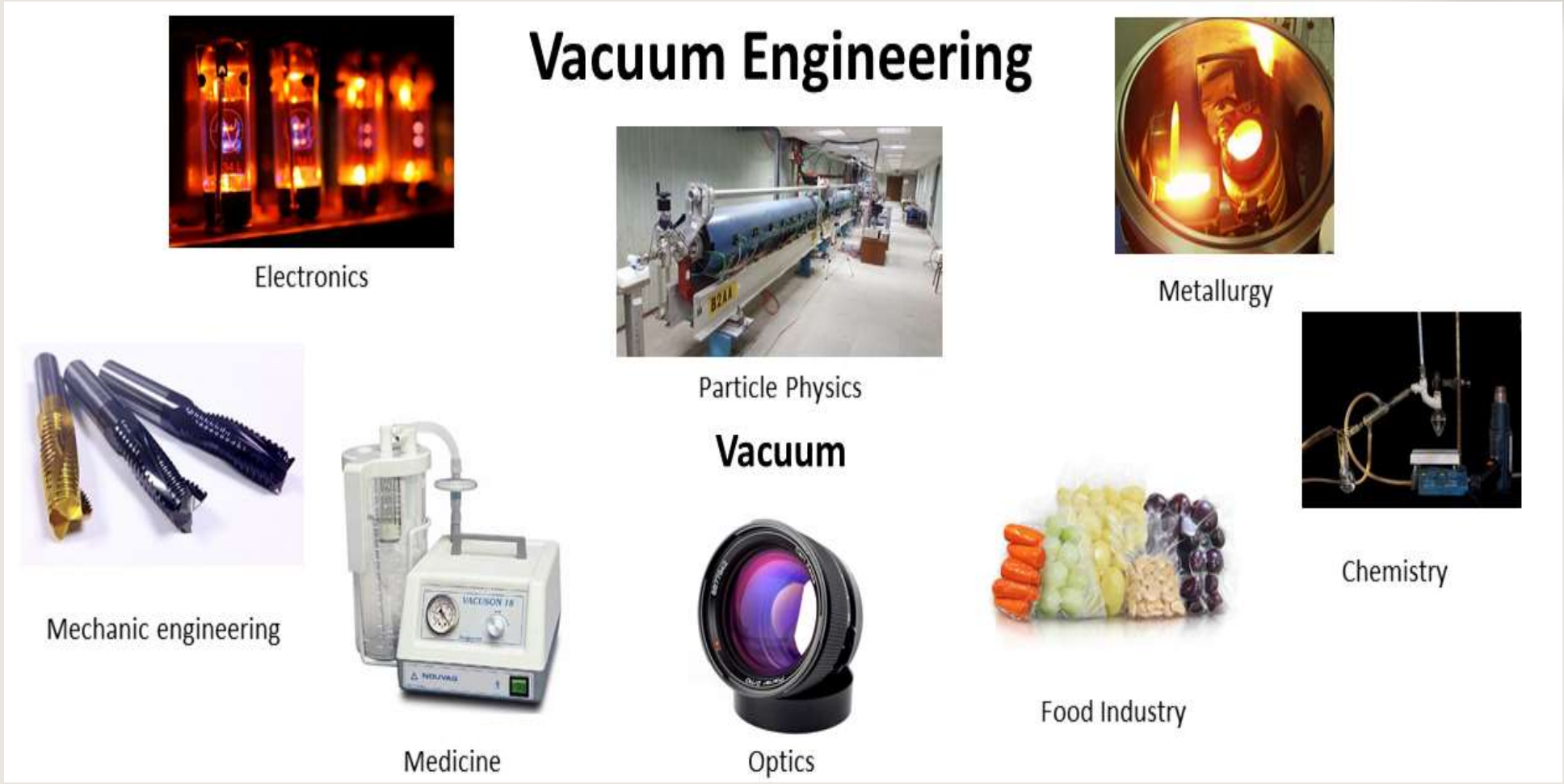
P. Gomes *et al.* "The control system of CERN accelerators vacuum [current status & recent improvements]", ICALEPCS, 2011, Grenoble, France

Rationale and Motivation

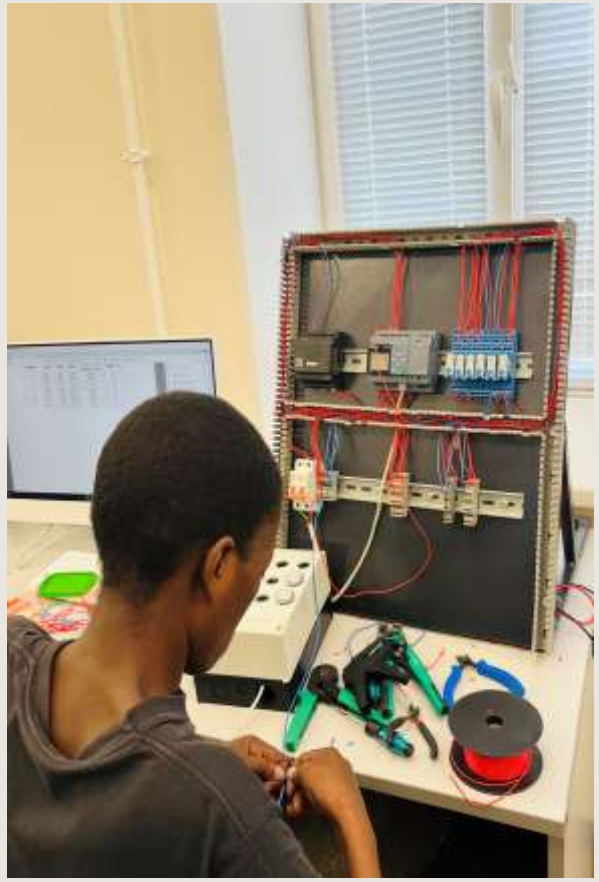
Vacuum classification and applications	
Low vacuum from 1.10^{+5} to 1.10^{+1} Pa	Medicine, holding and lifting cargo, pneumatic drives of transport vehicles, filtration.
Medium vacuum from 1.10^{+1} to 1.10^{-3} Pa	Manufacturing of incandescent, fluorescent, and electric discharge lamps, melting, sintering, packaging, dehydration, and degassing.
High vacuum from 1.10^{-3} to 1.10^{-6} Pa	Electronics and cathode-ray tubes, photomultipliers, X-ray tubes, mass spectrometers, electron microscopes, electron beam welding, coating.
Ultra-high vacuum from 1.10^{-6} to 1.10^{-10} Pa	Charged particle accelerators, modelling and testing of materials for the space industry

http://uc.jinr.ru/en/vacuum

Rationale and Motivation



Aims



Objectives

Equipment description

Pfeiffer Pascal 2010 SD: oil rotary vane pump

Edwards nXDS6i: scroll pump

Pfeiffer HiPace 300
Turbopump

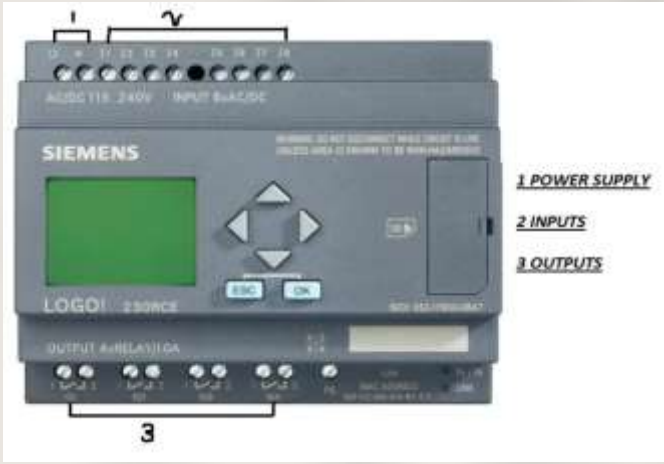
Angle valves:
VAT Series 24
24428-KE01 CBVAC GD-J25

Gate valve: VAT Series 08

Edwards AGP 100

Edwards WRG

Equipment description



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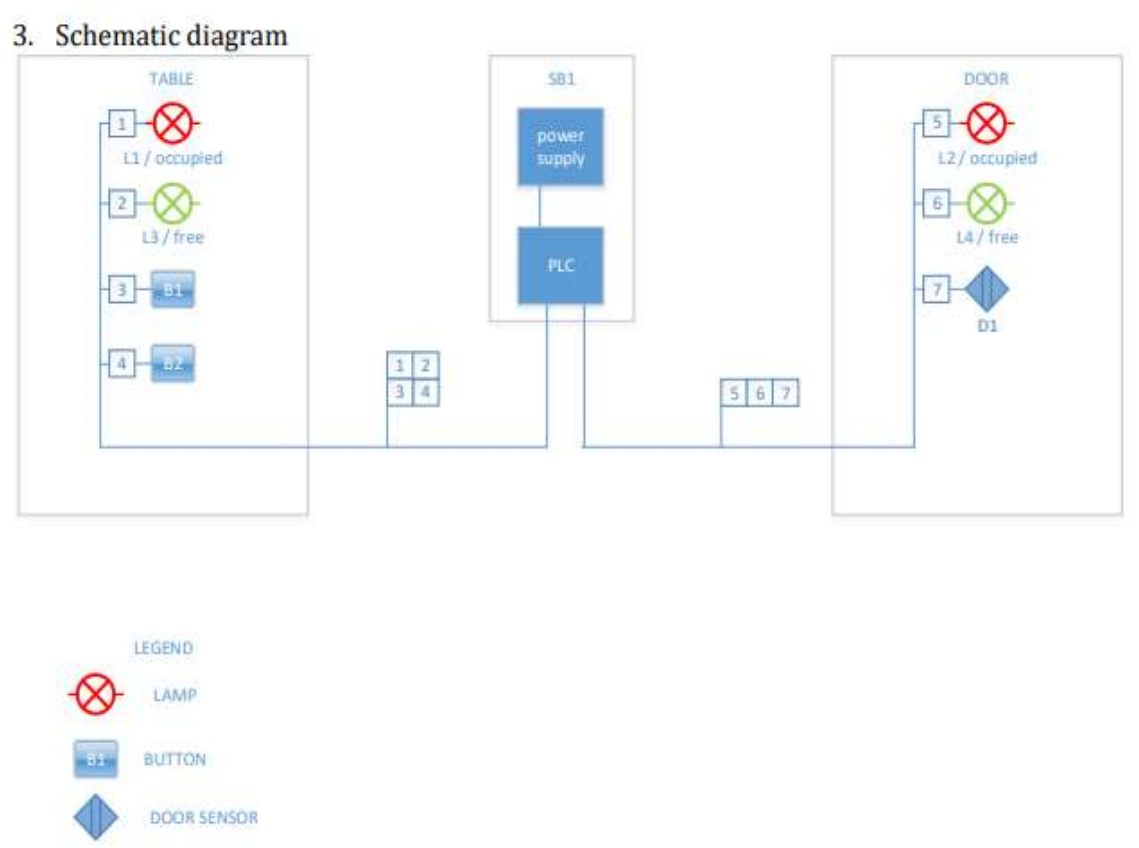
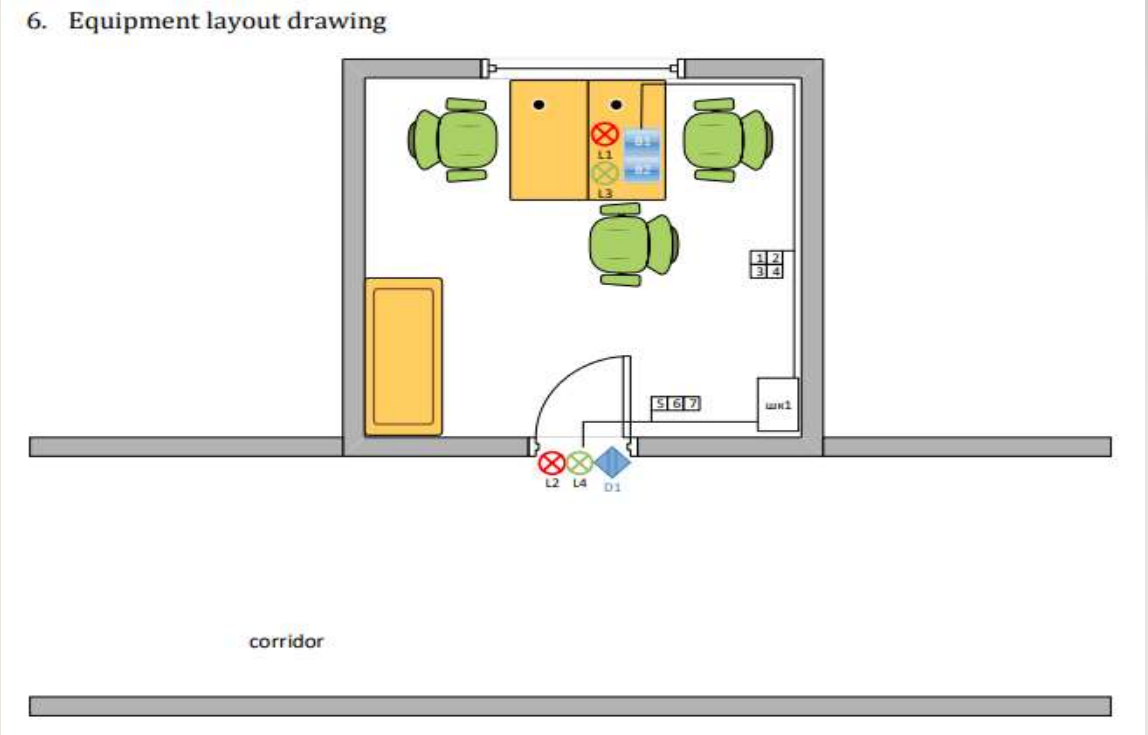
Experimental description

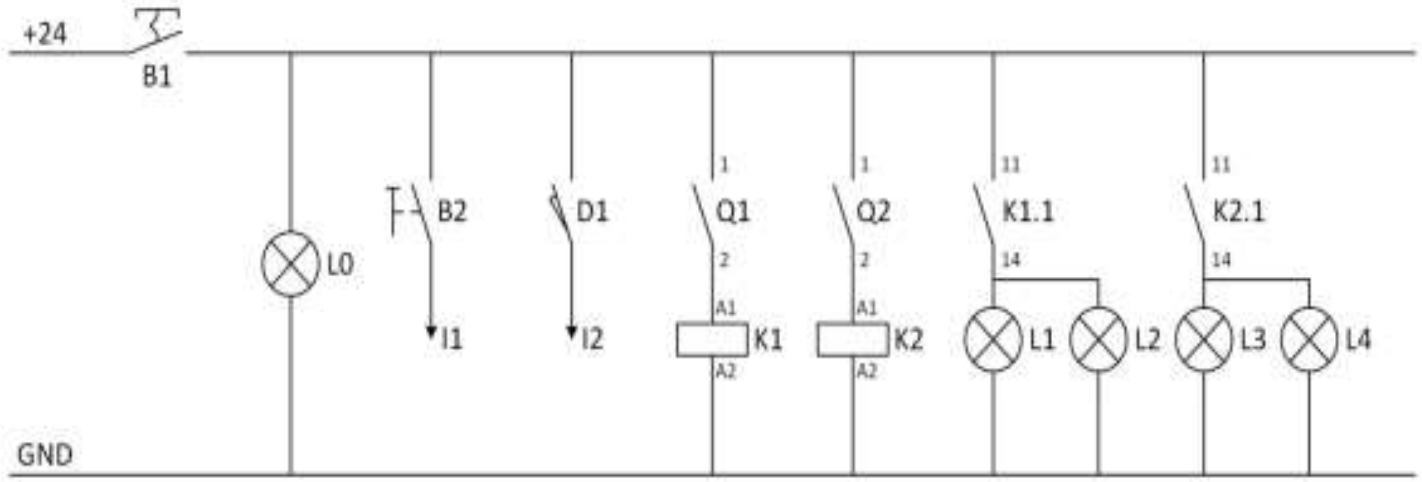
- First project: Clinic receives large patient amount (more than 30 per room) every day
- It was decided to implement a visual notification system order maintaining and performance optimization





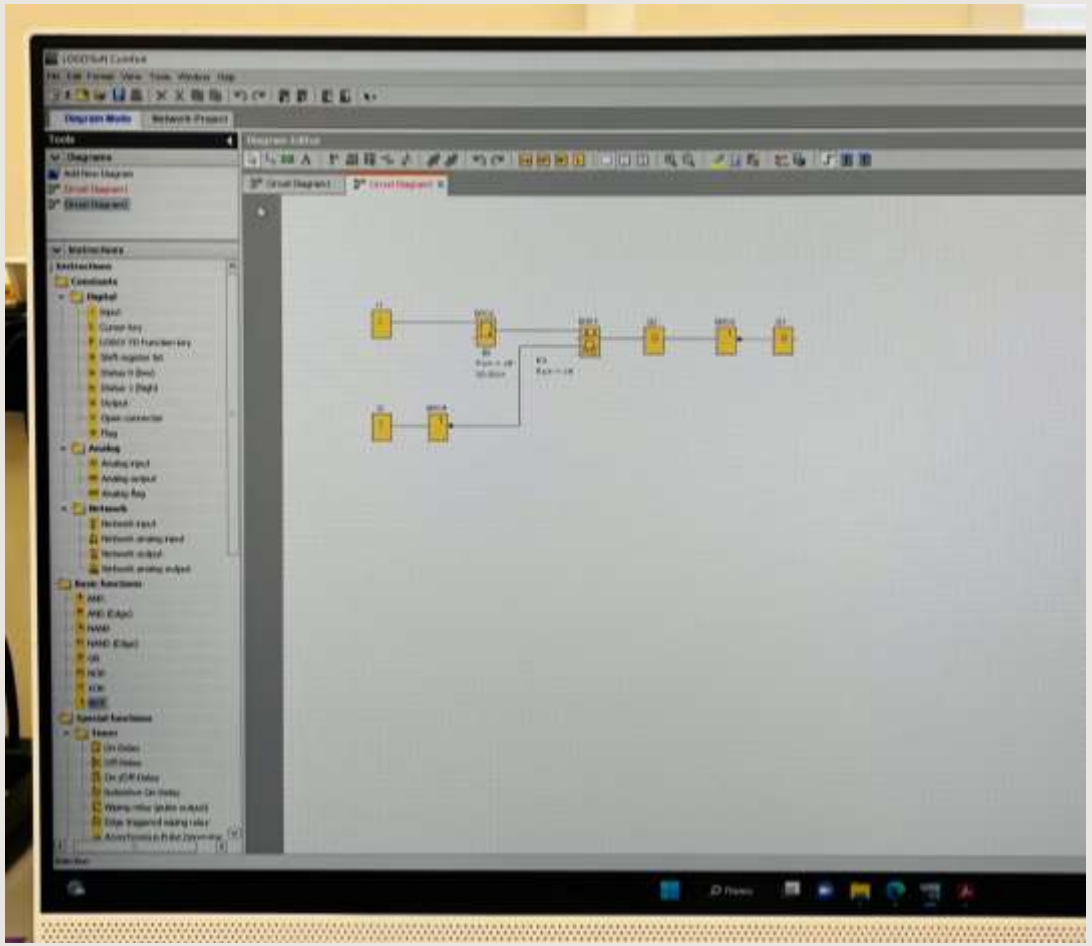
Experimental description

4. Electrical drawing

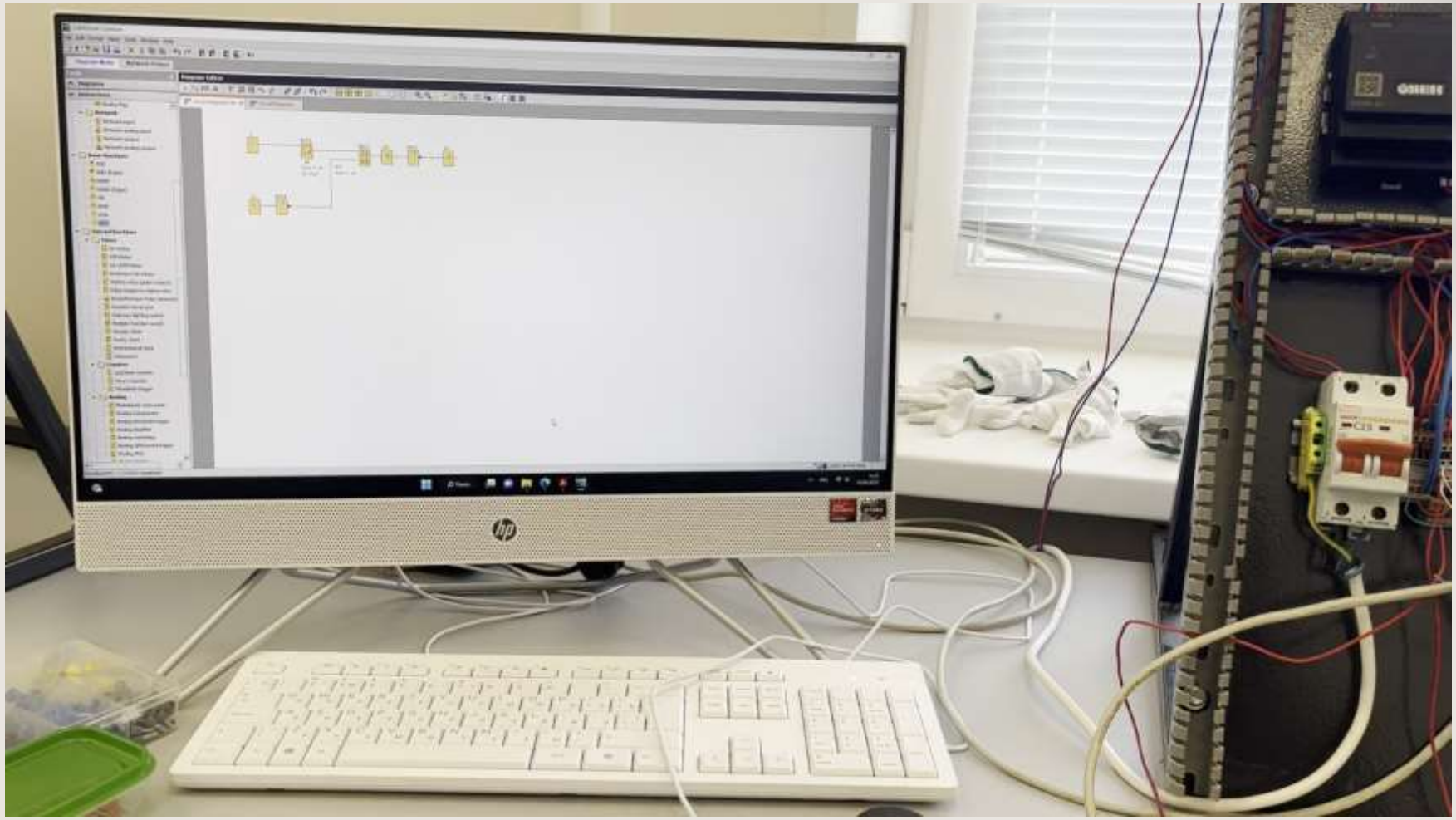


B1 — power button
B2 — state triggering button
D1 — door position sensor
L0 — power button illumination
L1, L2 — red lamps
L3, L4 — green lamps

Experimental description

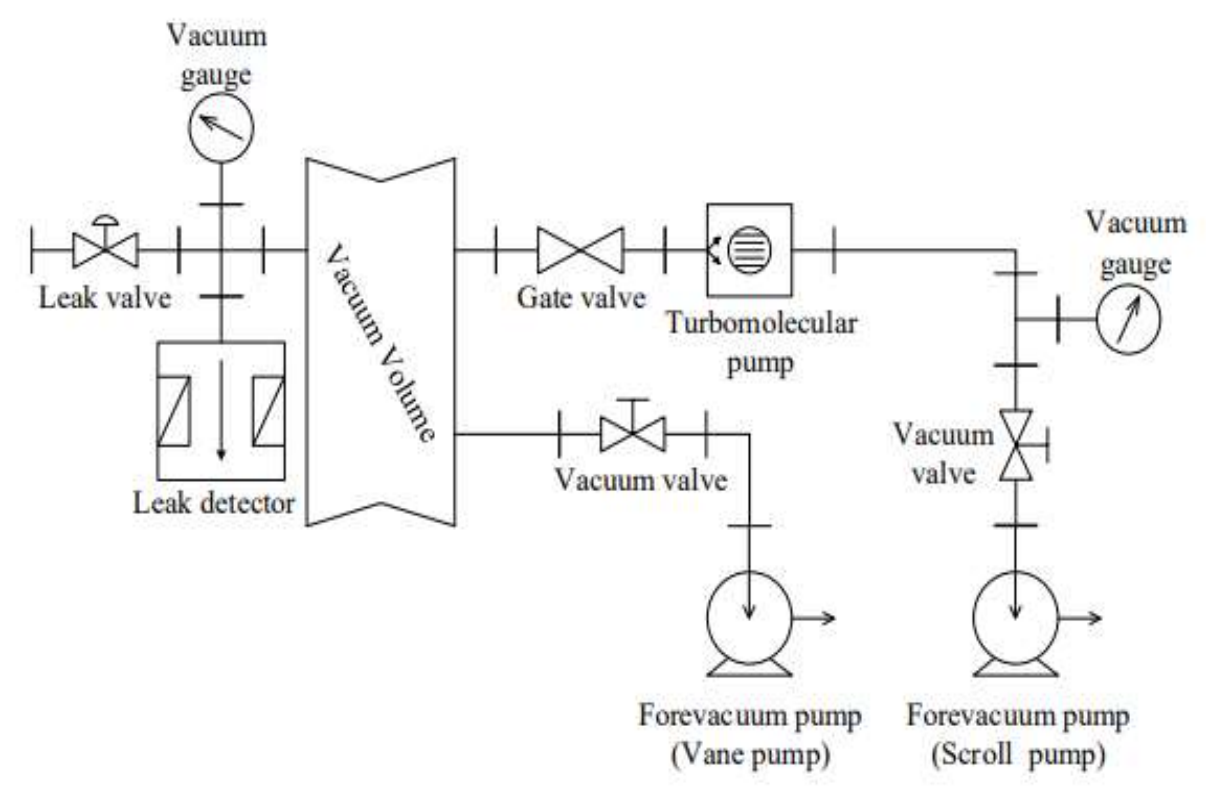


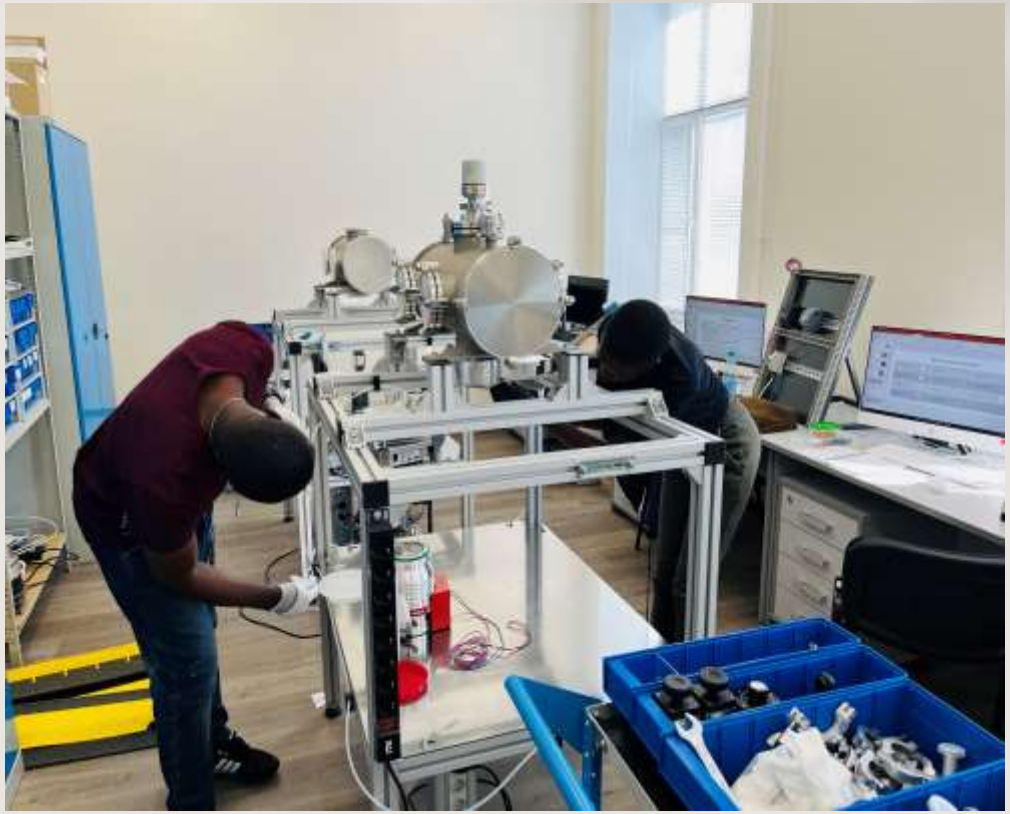
Testing the program



Main project

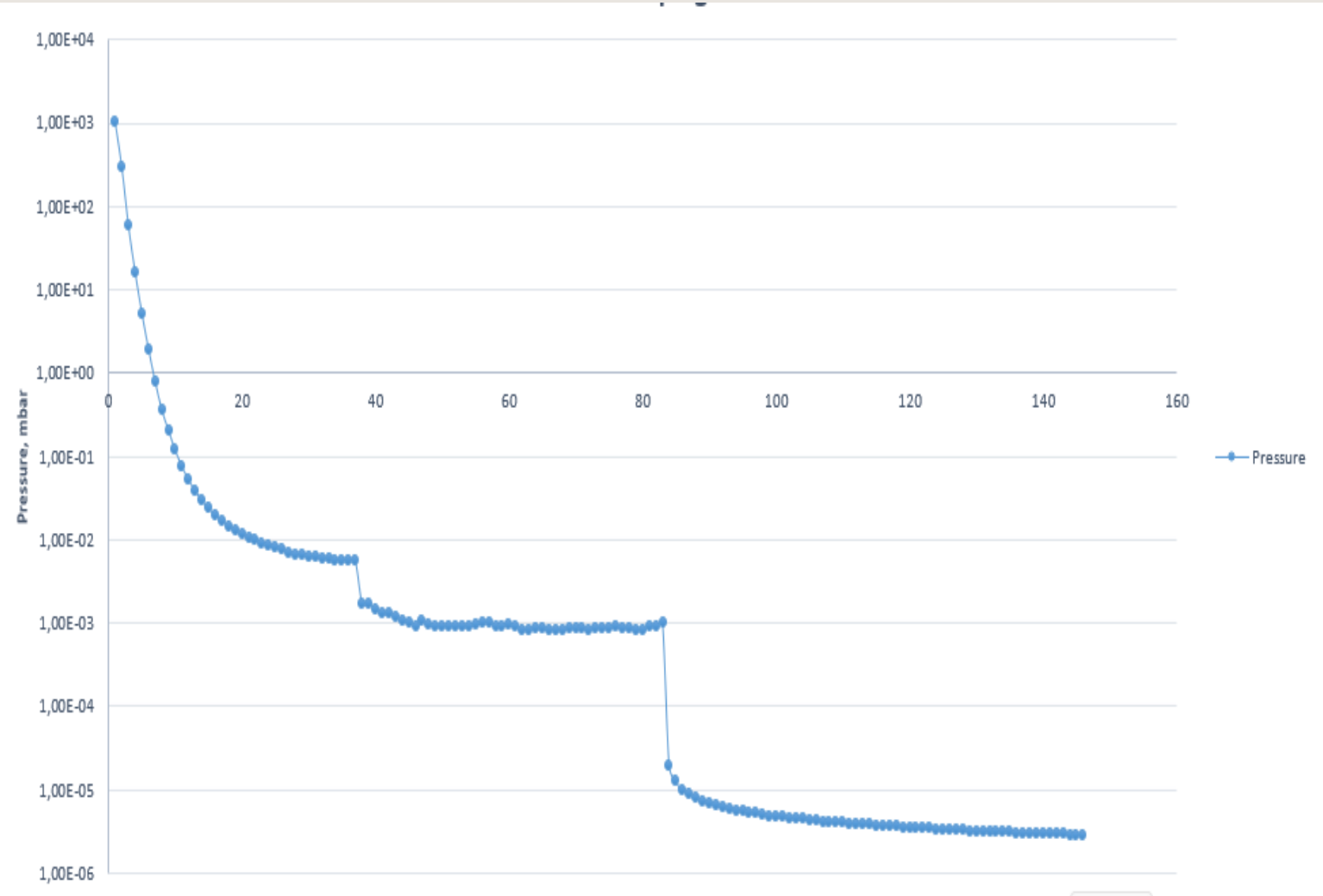
- Assemble manual vacuum system





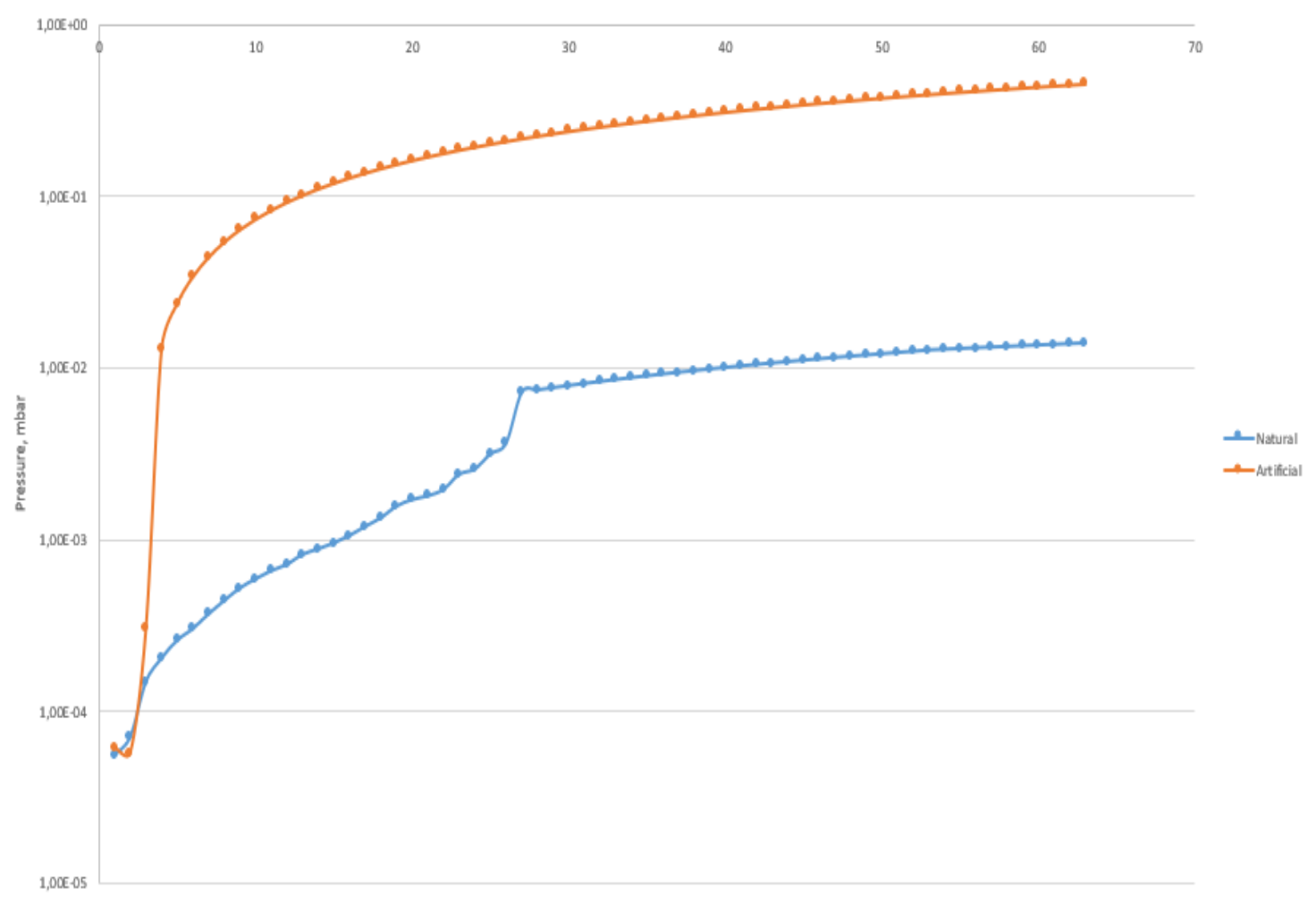
Main project

- Pumping of the vacuum system



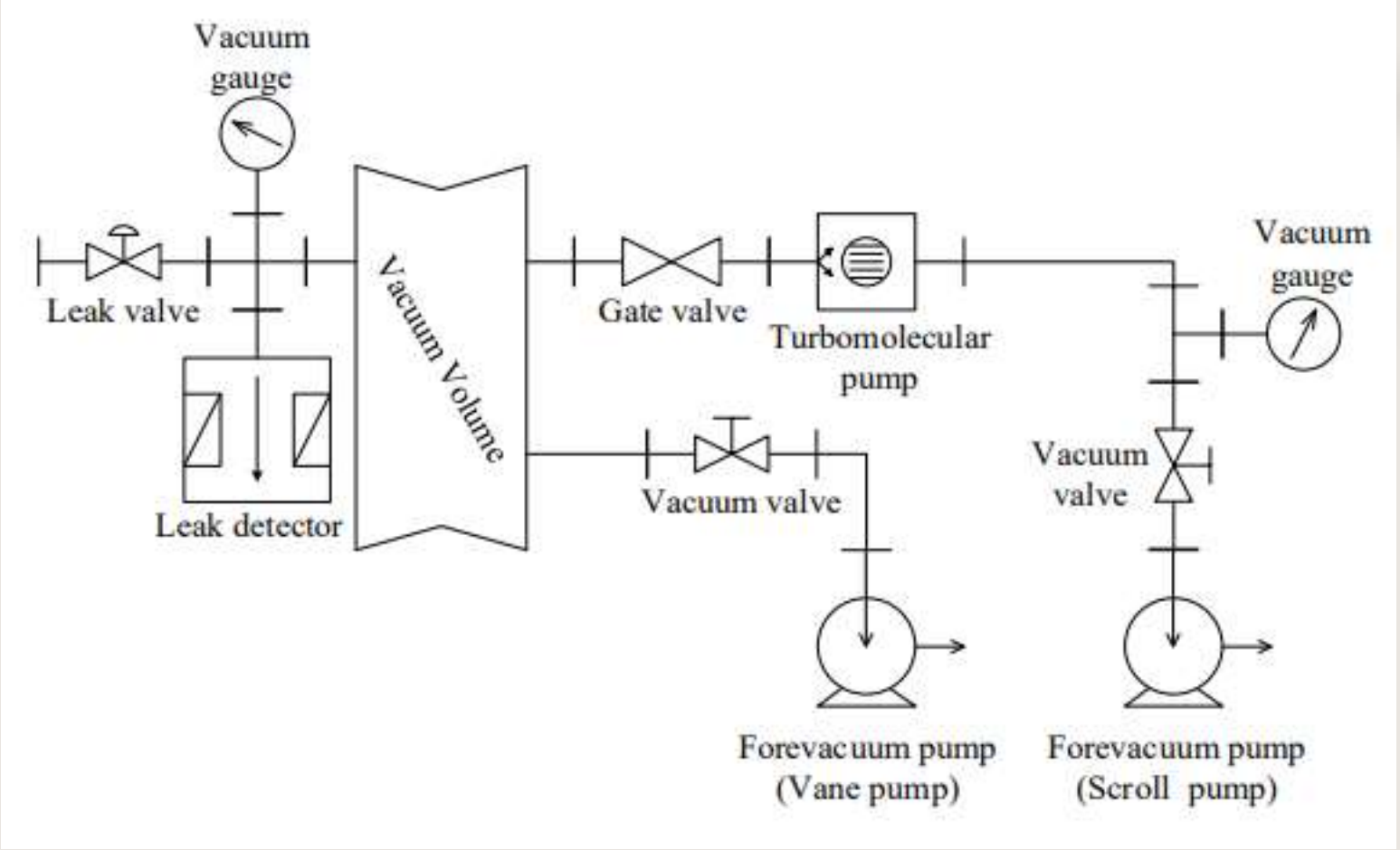
Main project

- Artificial and natural leak detection test



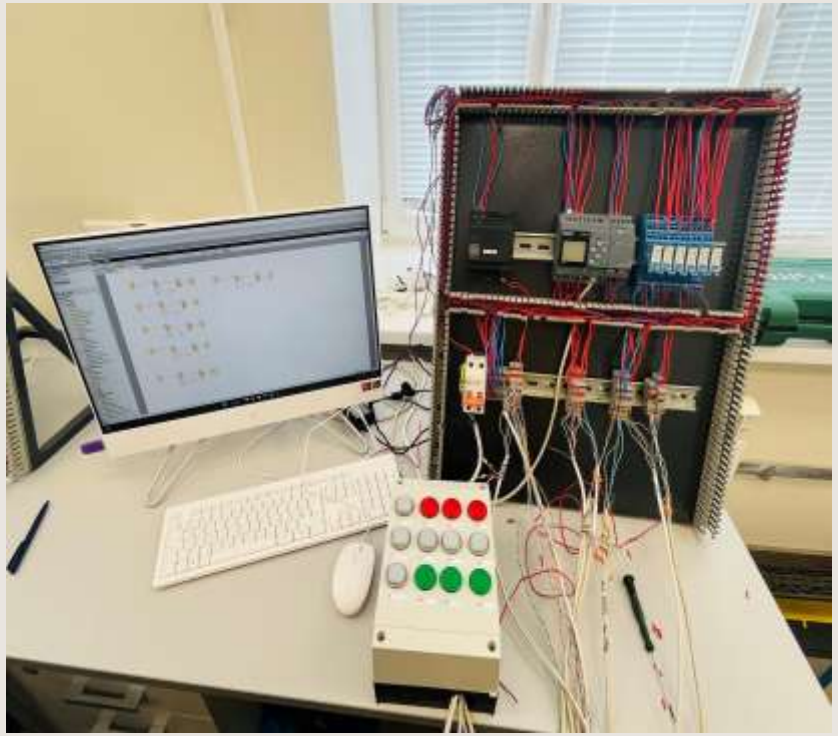
Main project

- Implementing an automatic control system for the vacuum system using the PLC, replaced manual valves with pneumatic valves.



Main project

- Implement an automatic control system for the vacuum system using the PLC



Main project

- Testing the main project

Acknowledgement