Water cooling system of the gun

Three modes are implemented:

-operation mode
-conditioning mode

difference: velocity of the controller is faster in conditioning mode than in operation mode.

-stabilization mode

different hydraulic circuits that are independent of the main cooling system, low speed of the controller (PI-ratio)

Function of the water cooling system

- Controller for heater and for cold water valves
- Heating up to working temperature uses a hysteresis:
  - If difference between actual value and setpoint is >3.0 K → 60kW heating power
  - If difference between actual value and setpoint is <0.5 K→ max. 15kW heating power

- After switching on of RF, water temperature is increasing and the cooling is in operation using a double valve system, i.e. one big and one small valve
- Small valve is controlled to up to 50% regulation, corresponding to the big valve

- Faster heating up by using a bypass at the warm water tank
- At the same time the flow through the tank is reduced by a valve
→hardware is installed, behavior is still under investigation

- Read-out system:
  - Sensor: 8x Iris sensors PT 100
  - At the moment: Siemens RTD 100 Ohm with 15 bit and a precision of ±0.03 K
  - In future (PITZ bought): read out system from National Instruments with 24 bit and a of precision ±0.001 K (**theoretically)**

- PITZ uses same construction of controllers as in Hamburg

Actual settings for controller cicuits

Conditioning mode

	P-factor	I-factor
Small valve	-0.5	500ms
Big valve	-0.5	2s

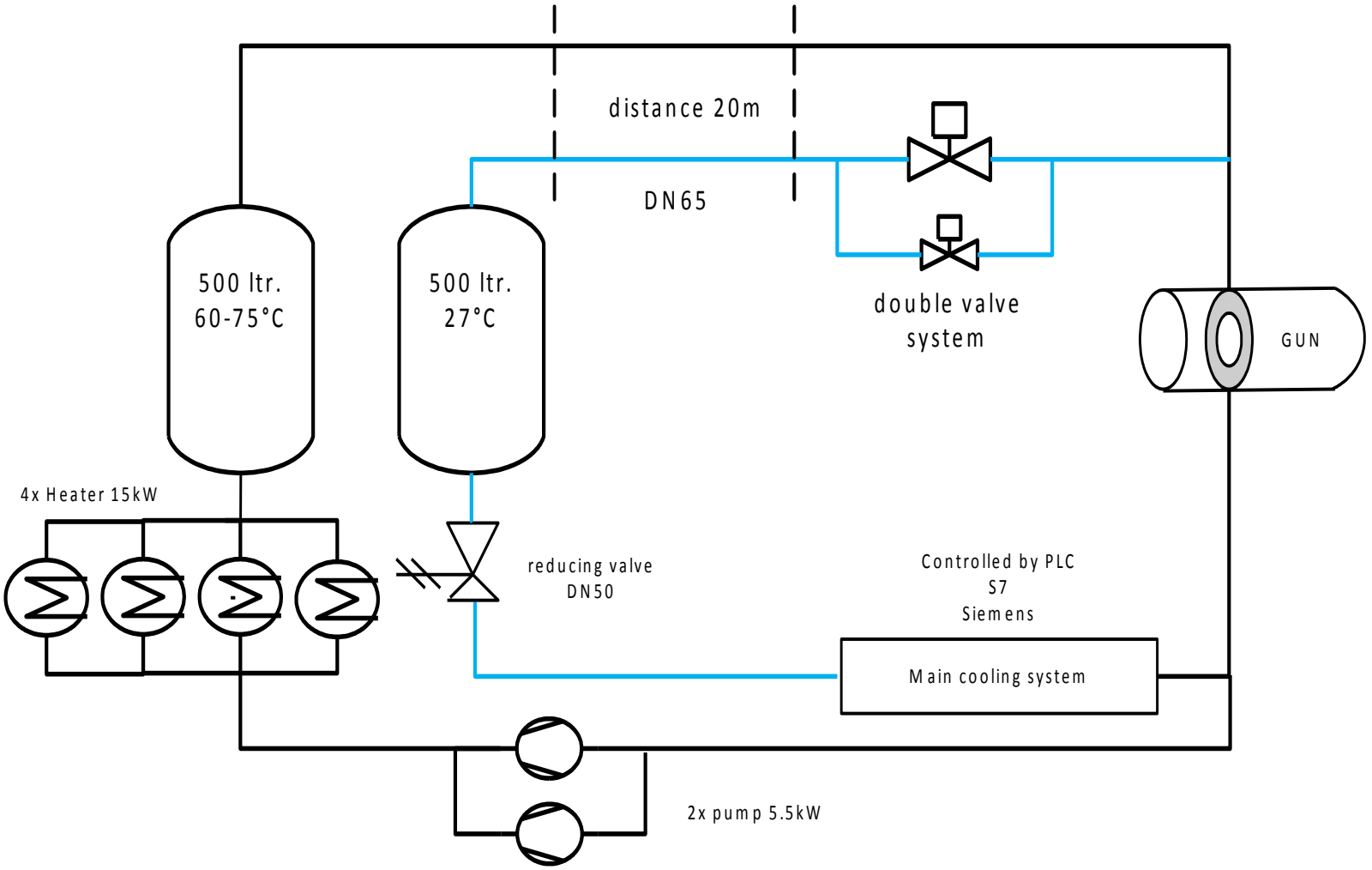
Operation mode

	P-factor	I-factor
Small valve	-0.5	1s
Big valve	-0.5	4s

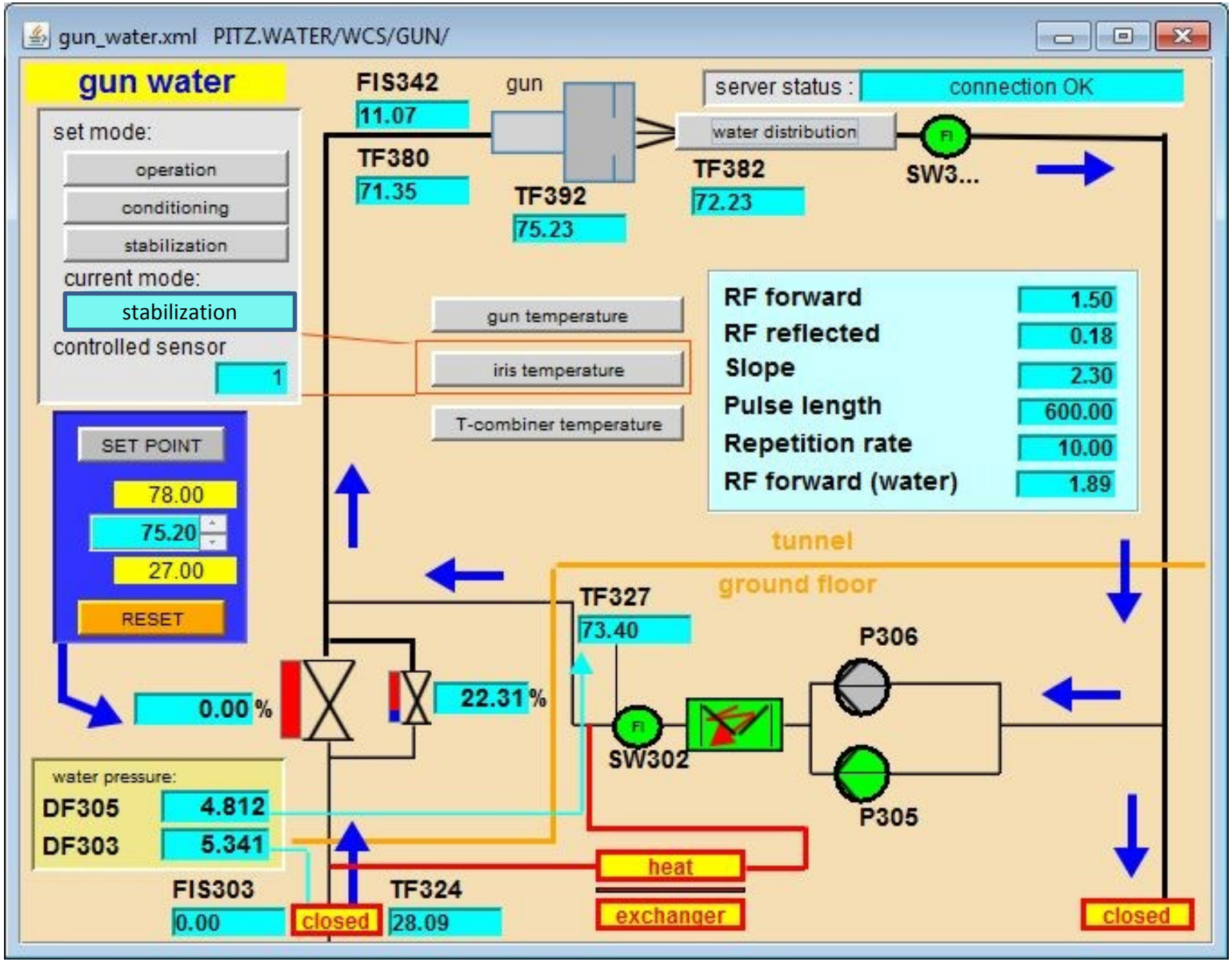
Stabilisation mode

	P-factor	I-factor
Small valve	-0.5	1s
Big valve	-0.5	2s

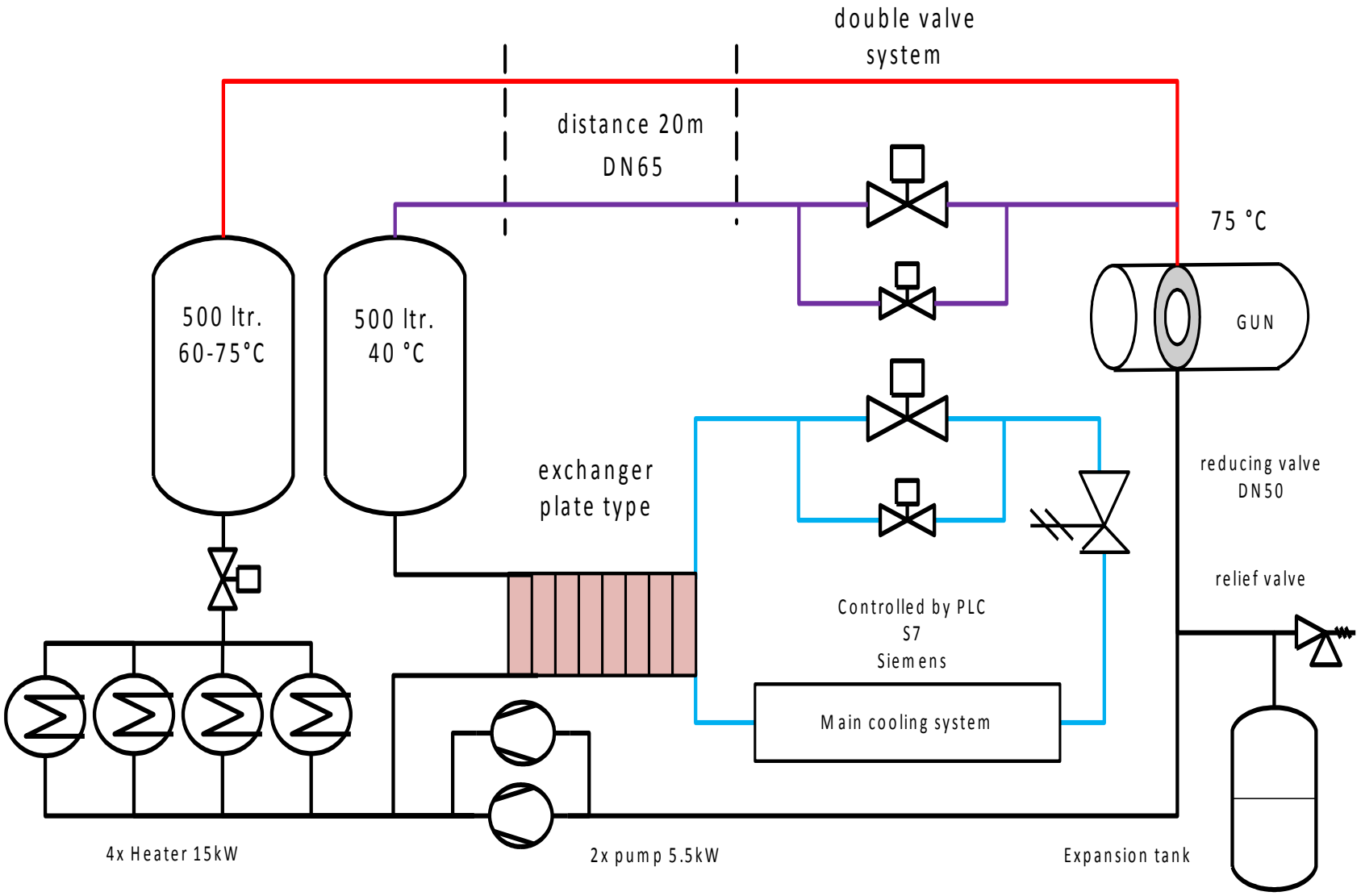
Normal operation: conditioning or operation mode



Operable by GUI: stabilization mode



Current condition of stabilisation mode



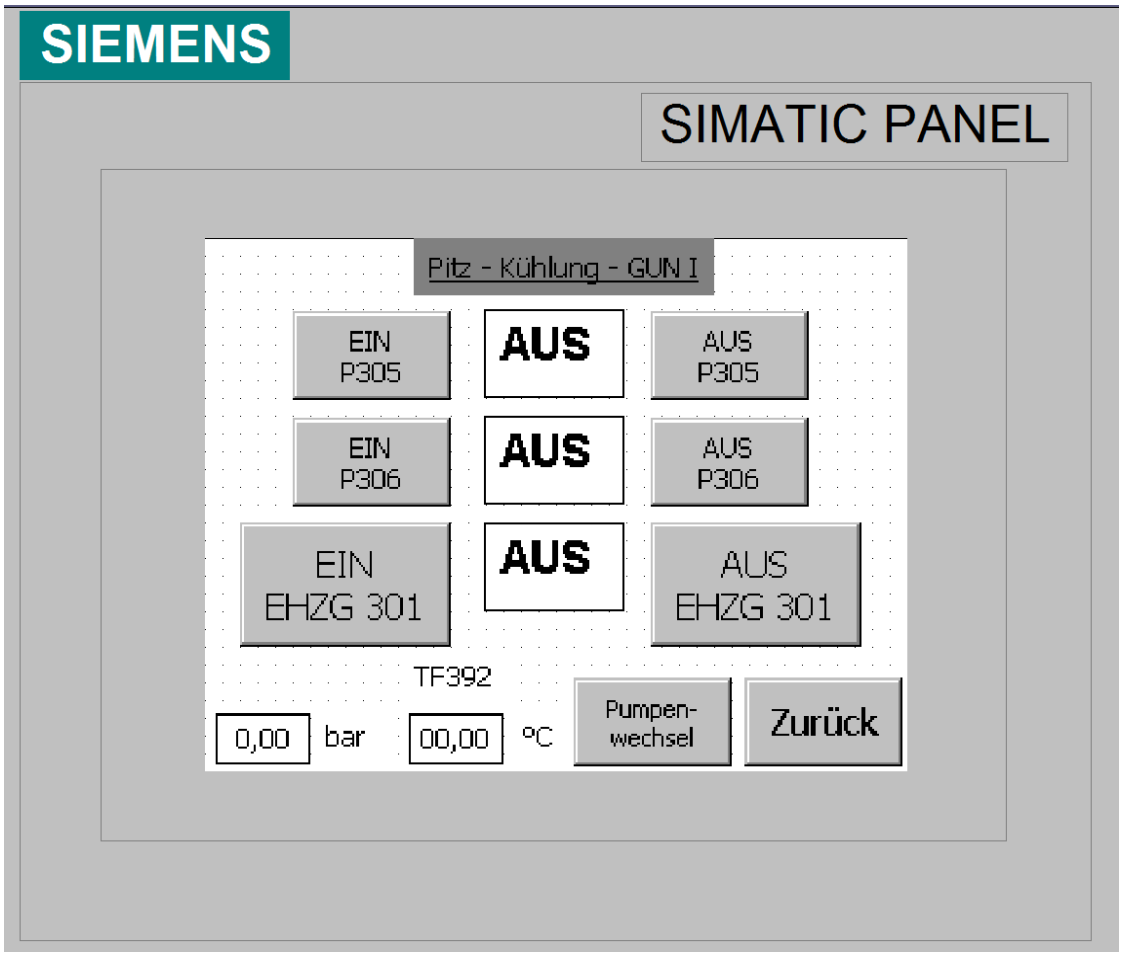
Heat exchanger and double valve system

Buffer tanks with volume of 500 litres

Pump and standby pump for gun and TDS structure

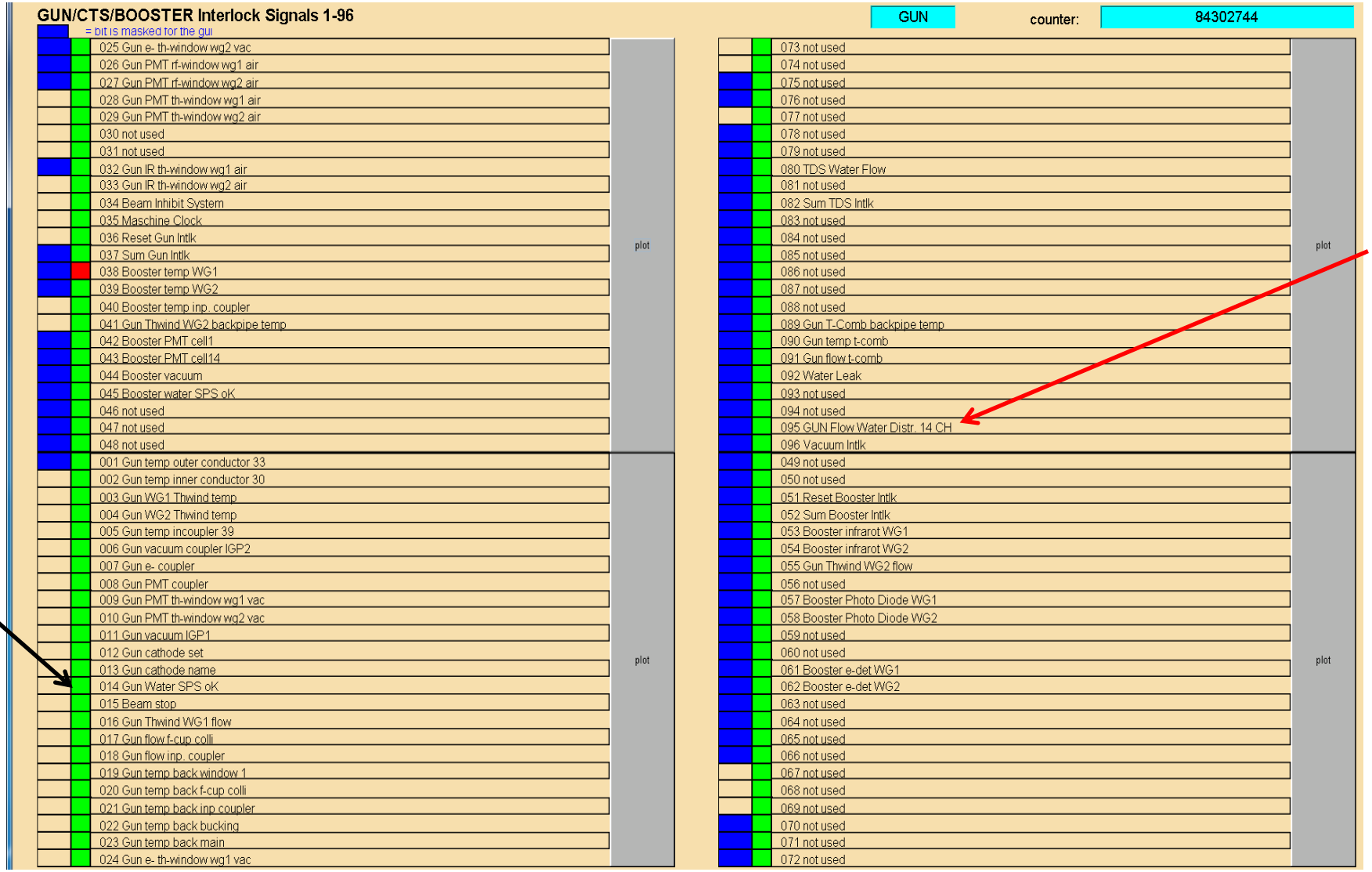
Cabinet with display for gun control (basement)

Gun display in the engineering room (basement)

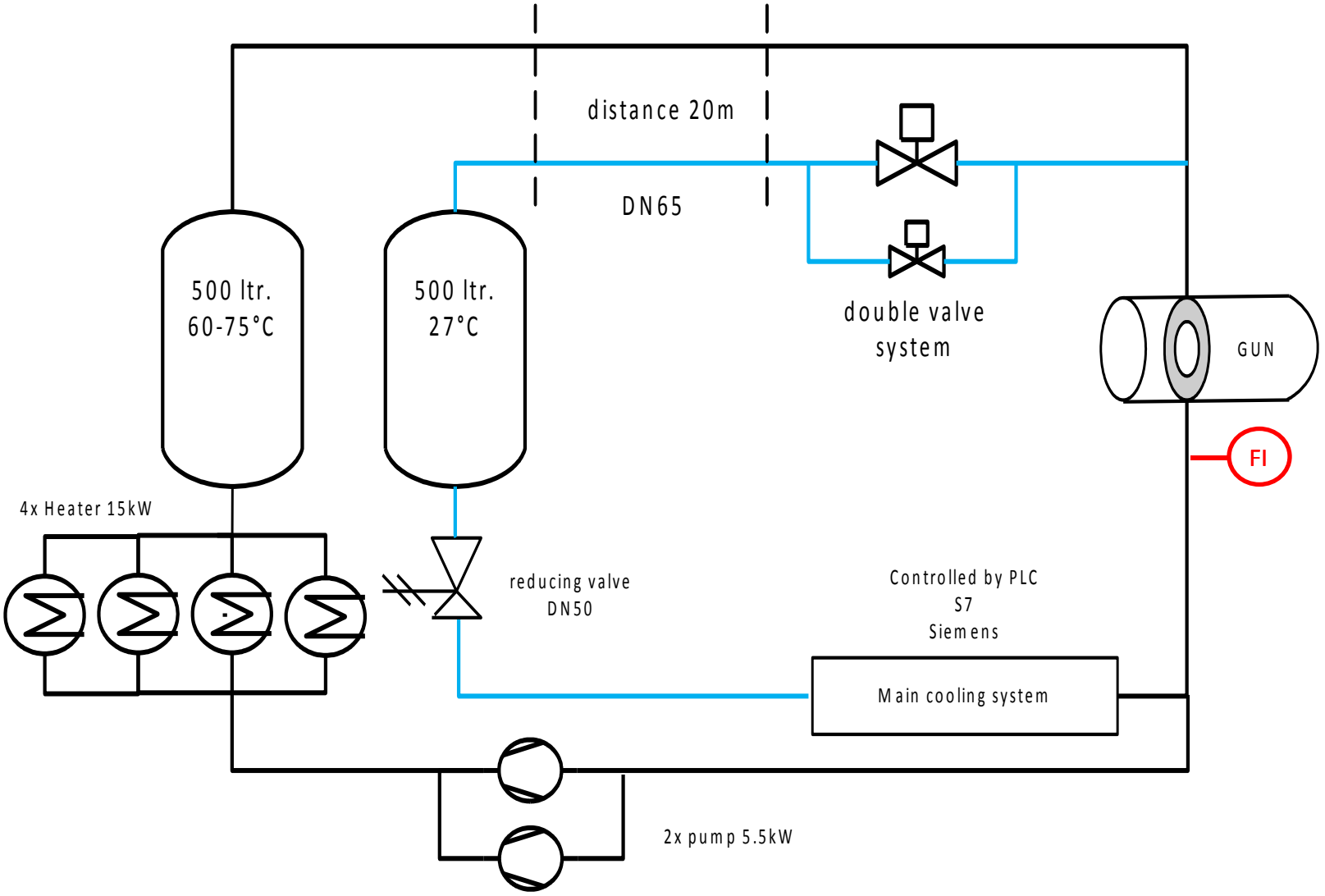


-pumps and heater are switchable
-pump change is done very smoothly in ongoing operation

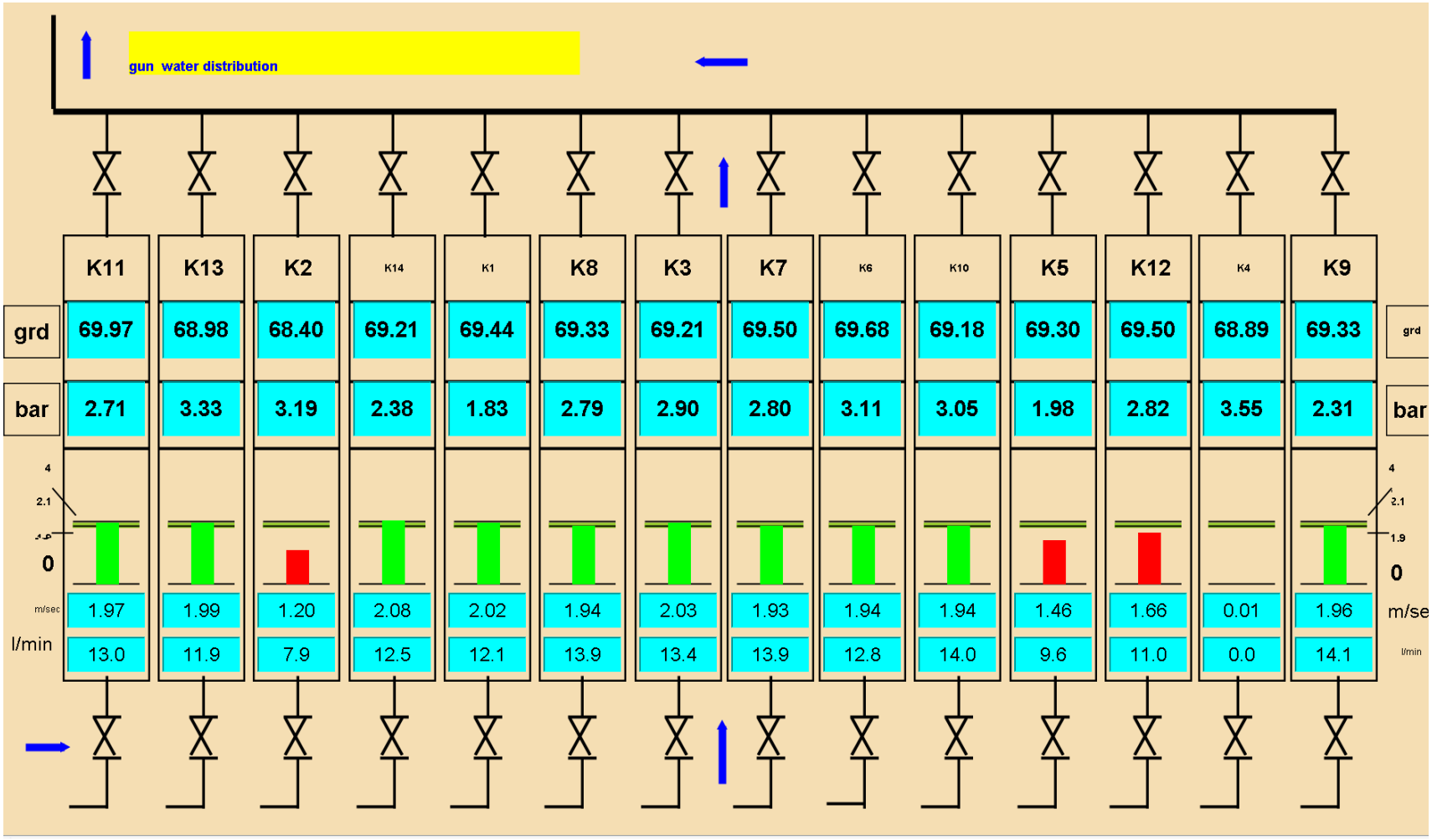
Interlock signals for Interlocksystem 3 (H.Leich)



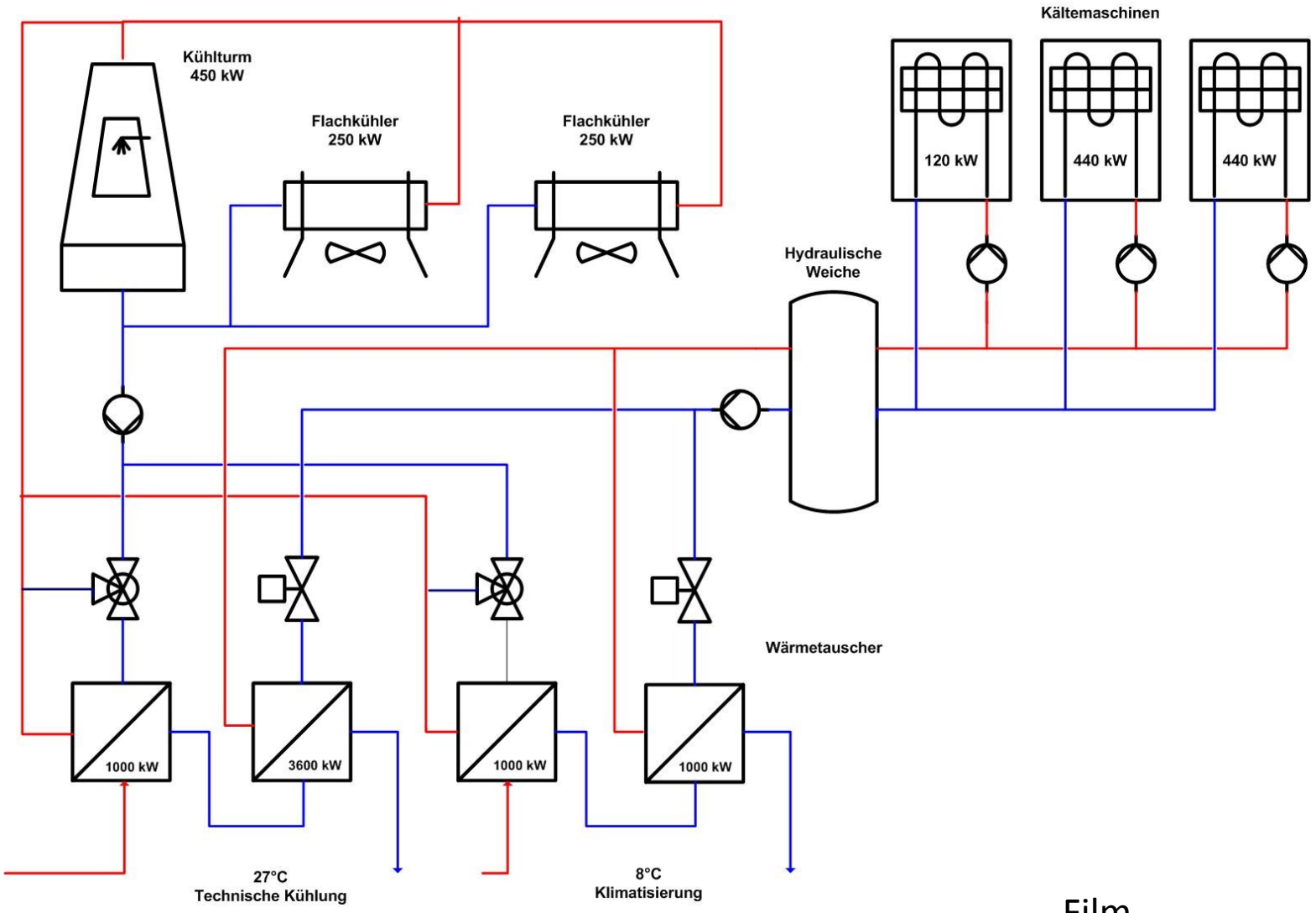
Flow sensor for interlock in the backpipe



14 channel read out for backpipes

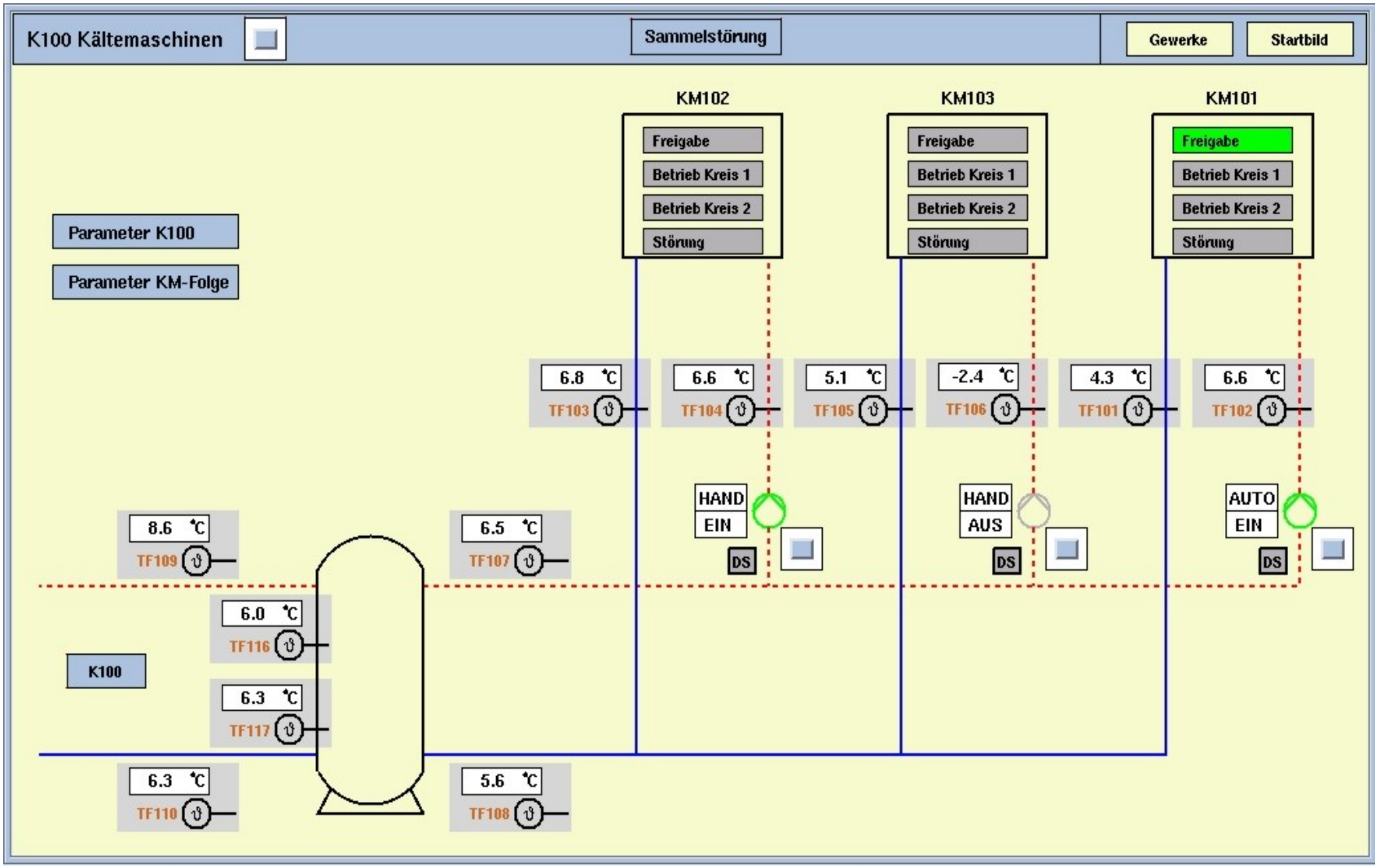


Overview: main cooling system

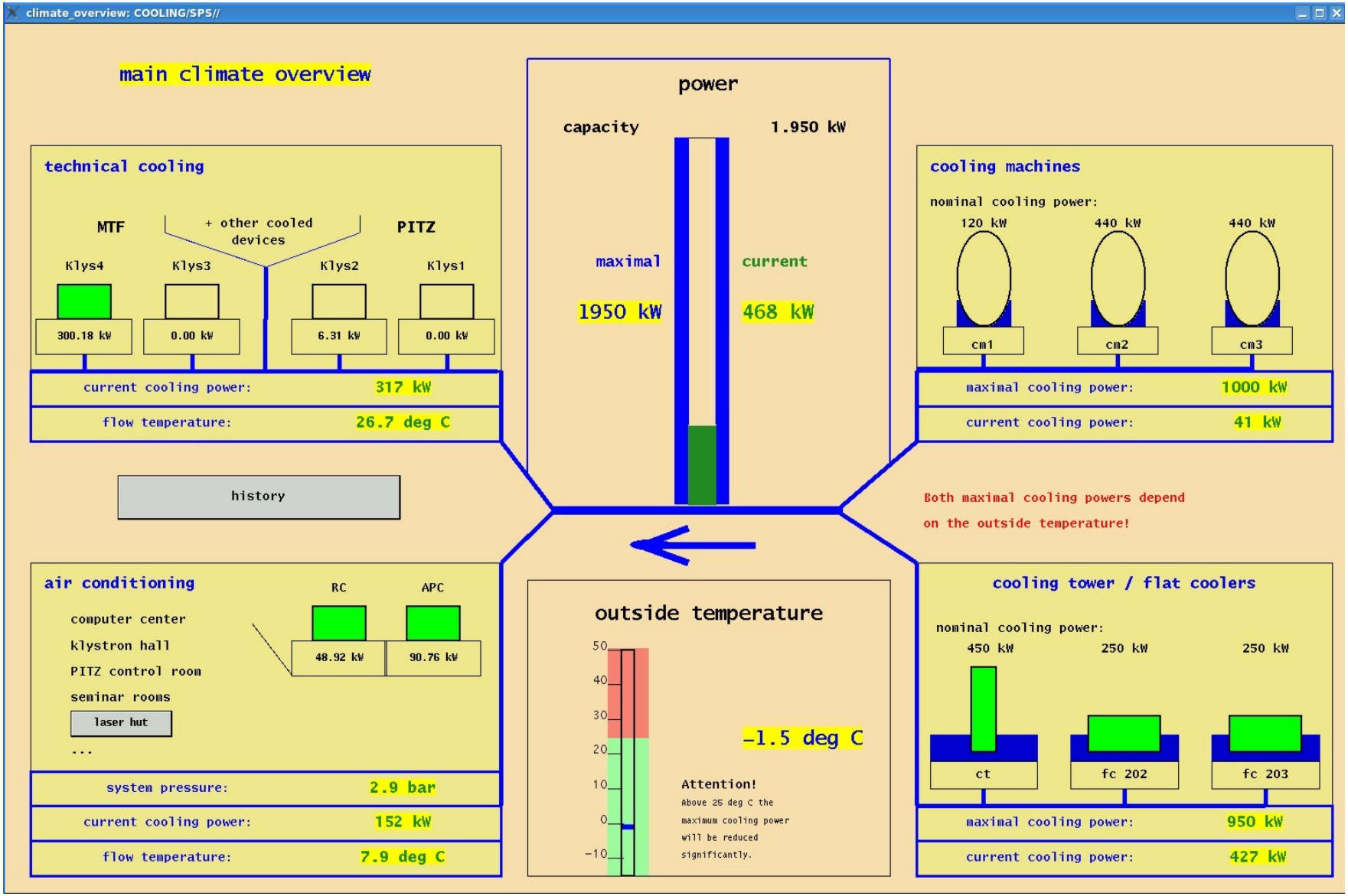


Film

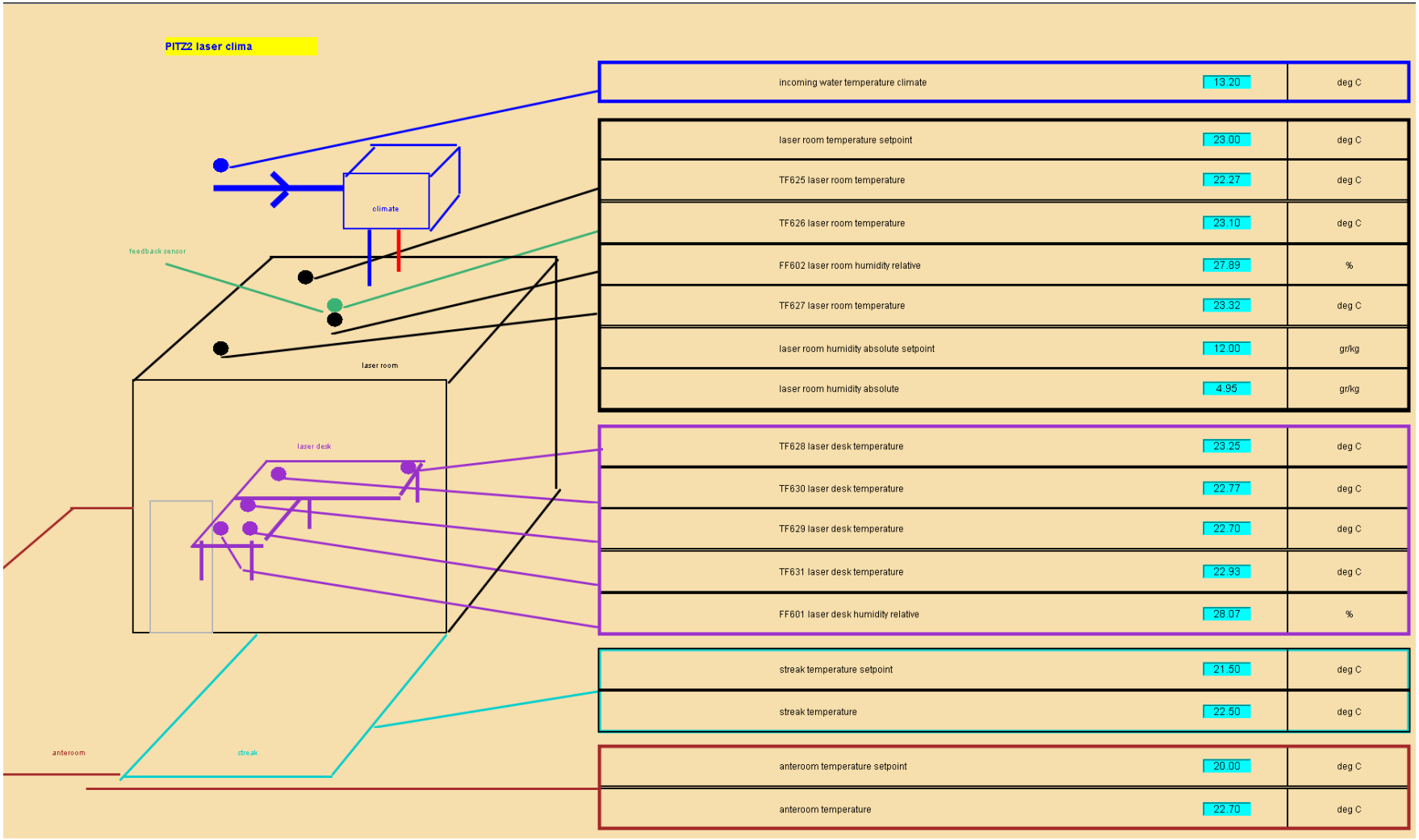
Control system: SICLIMAT X (Siemens)



Control system in DOOCS

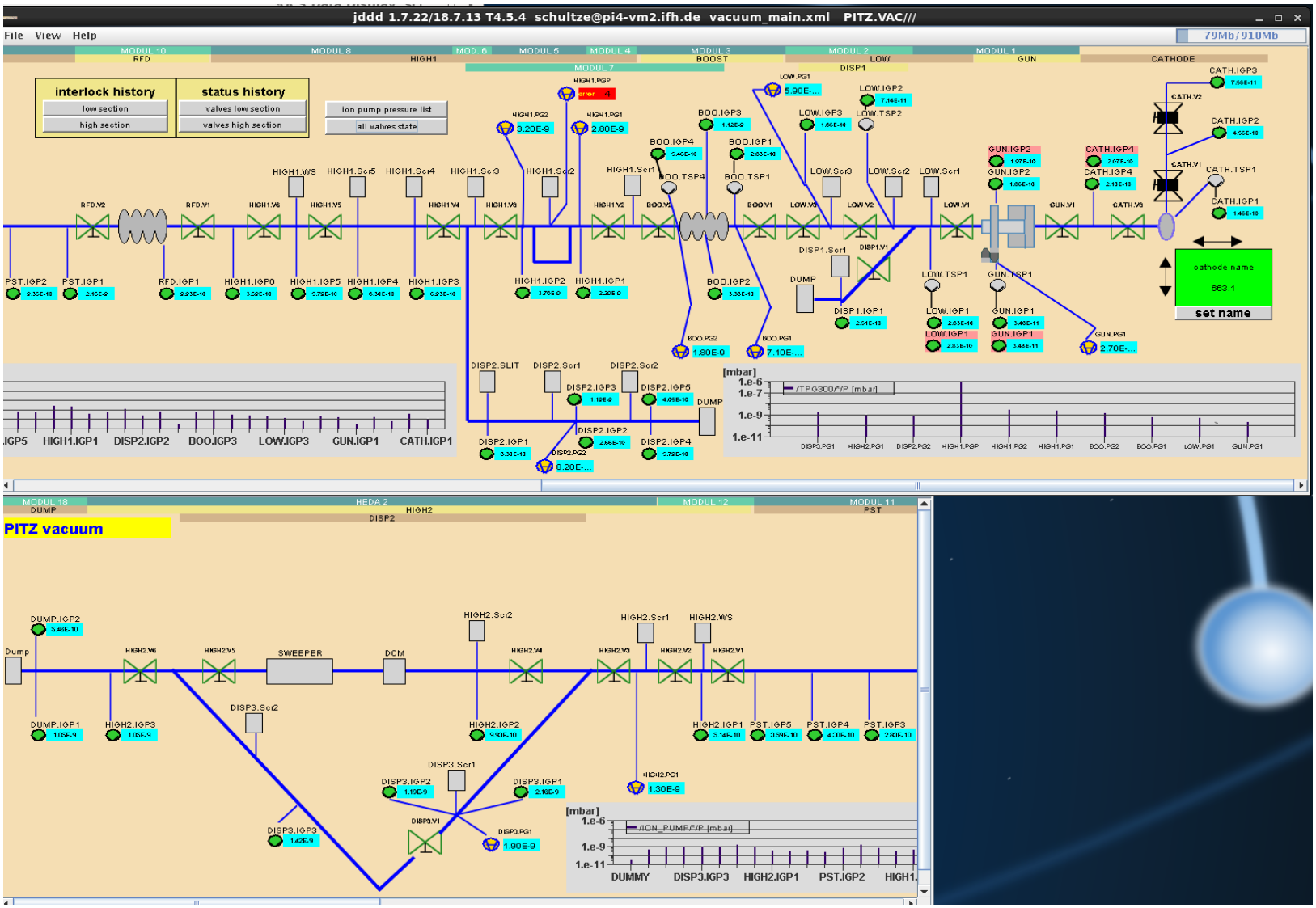


Control system in DOOCS: Laser room



incoming water temperature climate	13.20	deg C
laser room temperature setpoint	23.00	deg C
TF625 laser room temperature	22.27	deg C
TF626 laser room temperature	23.10	deg C
FF602 laser room humidity relative	27.89	%
TF627 laser room temperature	23.32	deg C
laser room humidity absolute setpoint	12.00	gr/kg
laser room humidity absolute	4.95	gr/kg
TF628 laser desk temperature	23.25	deg C
TF630 laser desk temperature	22.77	deg C
TF629 laser desk temperature	22.70	deg C
TF631 laser desk temperature	22.93	deg C
FF601 laser desk humidity relative	28.07	%
streak temperature setpoint	21.50	deg C
streak temperature	22.50	deg C
anteroom temperature setpoint	20.00	deg C
anteroom temperature	22.70	deg C

Vacuum interlock overview



Vacuum interlock - measurement systems used

-LIN_GUN_PG1
-LOW_IGP1
-LOW_IGP2
-LOW_IGP3
-BOO_IGP1
-BOO_IGP4
-HIGH1_PG1
-HIGH1_PG2
-HIGH1_IGP2
-HIGH1_IGP3
-DISP2_IGP1
-HIGH1_IGP4
-HIGH1_IGP5
-HIGH1_IGP6
-RFD_IGP1
-PST1_IGP1

-PST1_IGP5
-HIGH2_IGP1
-HIGH2_PG1
-HIGH2_IGP2
-DUMP_IGP1
-DUMP_IGP2
-DISP1_IGP1
-HIGH2_IGP3
-DISP3_IGP1
-DISP3_IGP2
-DISP3_IGP3

IGP= ion getter pump
PG= pressure gauge

	valves close	valves open
IGP	$1x\ 10^{-6}$	$1x\ 10^{-7}$
PG	$1x\ 10^{-5}$	$1x\ 10^{-7}$

(units in mbar)

Functions of the vacuum interlock

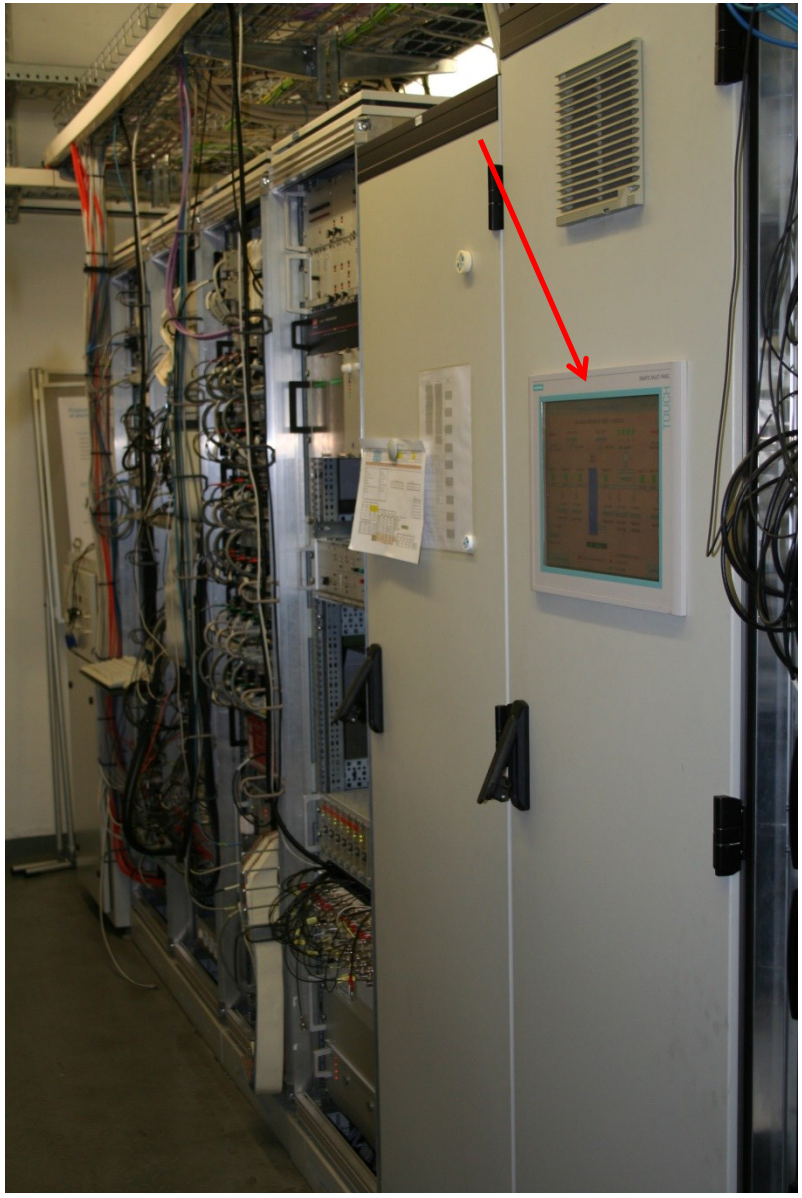
- In case of a rising pressure, valves in the neighborhood of the measurement system are closed
- In case of gas alarm (oxygen, nitrogen, argon, litium) valves in the neighborhood and HIGH1.V3, HIGH1.V4 and LOW.V1 are closed

- If pressure is >1x 10^{-7} mbar, valves are open

- All measurements generate a sum signal
- Sum signal is used for: release of RF and sending of a SMS

- All signals are maskable

Cabinet with display for vacuum interlock (rack room)



Overview vacuum interlock - *high1* section (rack room)