

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 $>3.0\text{ K}$ \rightarrow 60kW heating power
 - If difference between actual value and setpoint is $<0.5\text{ K}$ \rightarrow 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
 \rightarrow 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 $\pm 0.03\text{ K}$
 - In future (PITZ bought): read out system from National Instruments with 24 bit and a precision $\pm 0.001\text{ K}$ (**theoretically**)
- PITZ uses same construction of controllers as in Hamburg

Actual settings for controller circuits

Conditioning mode

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

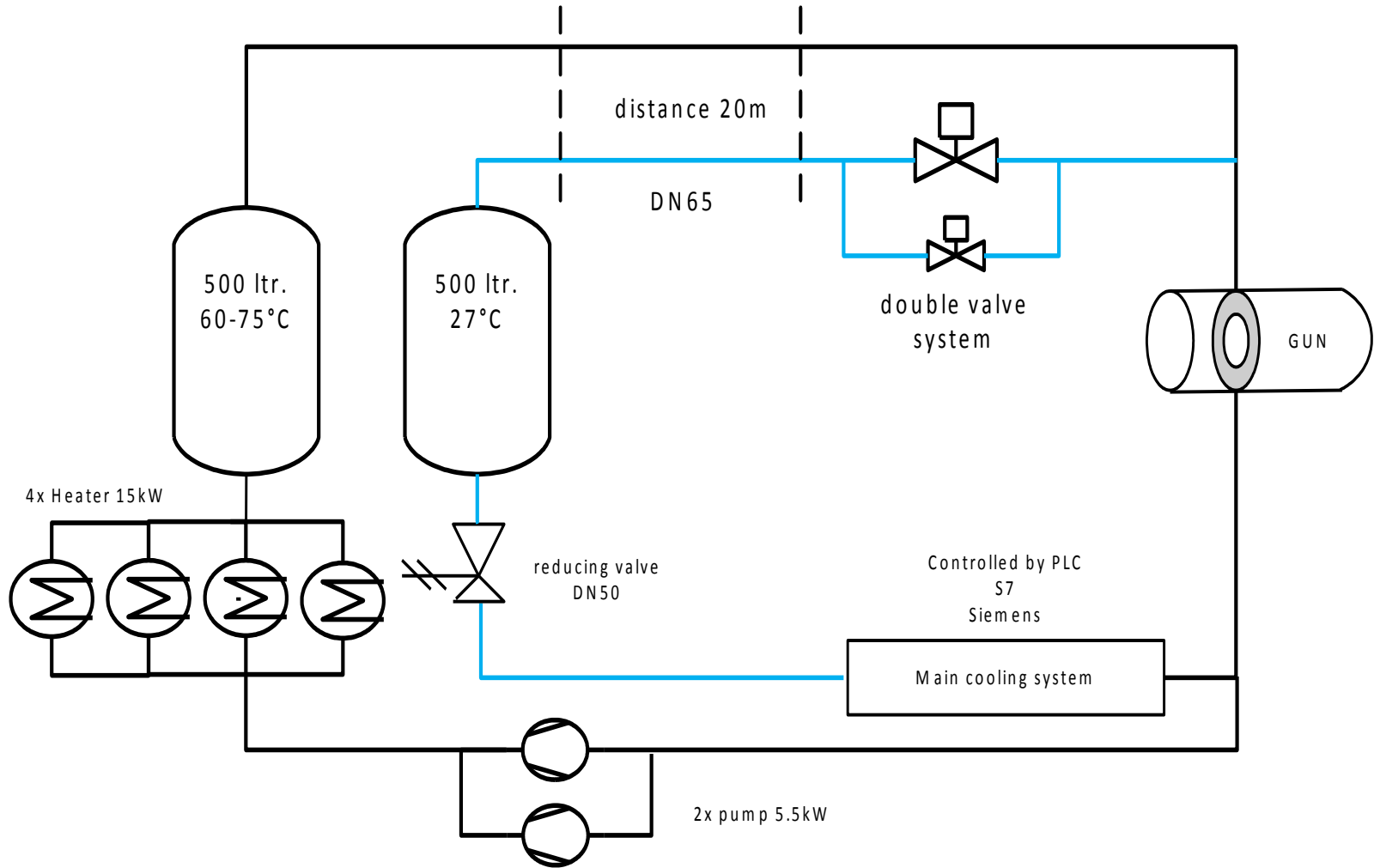
Operation mode

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

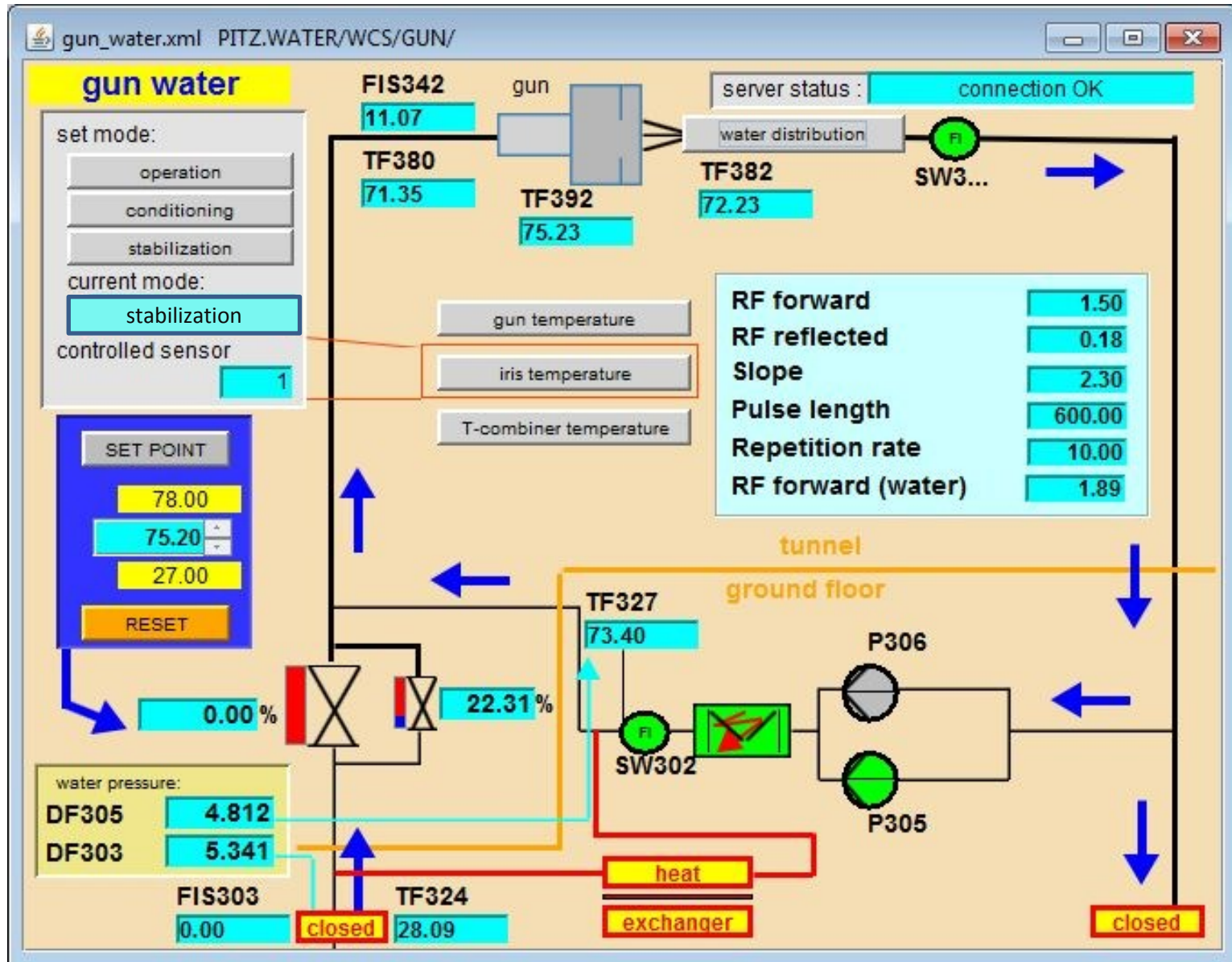
Stabilisation mode

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

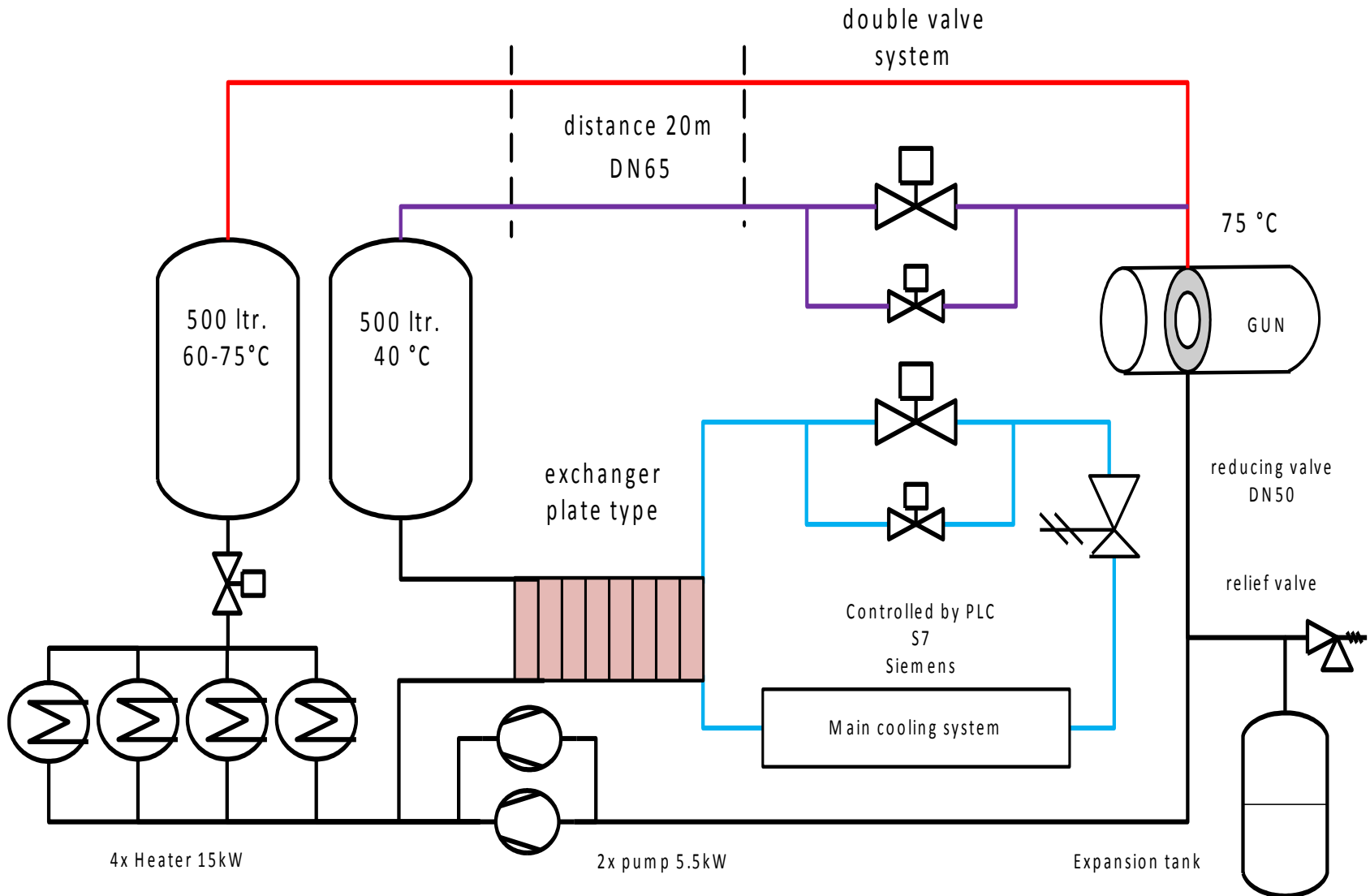
Normal operation: conditioning or operation mode



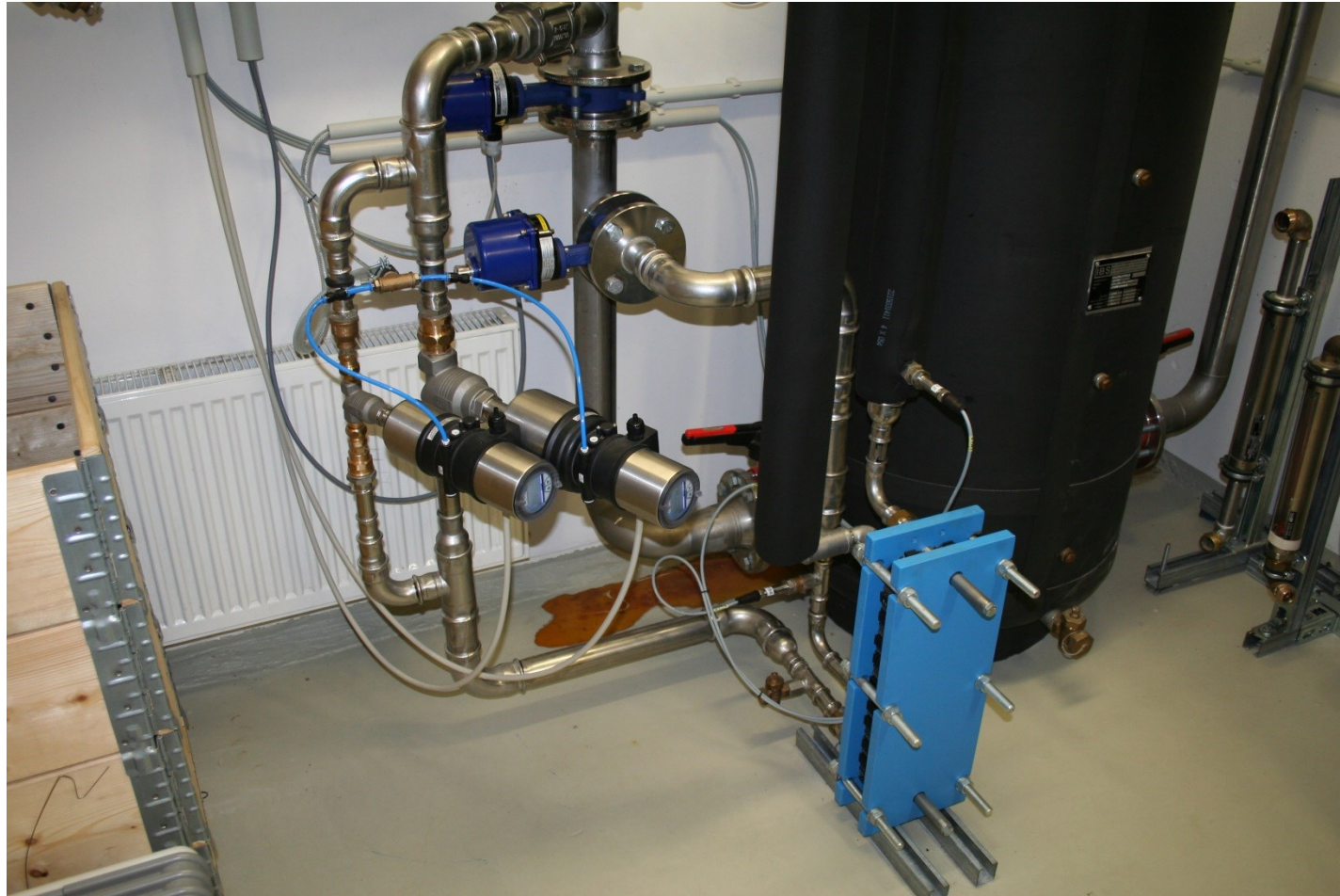
Operable by GUI: stabilization mode



Current condition of stabilisation mode



Heat exchanger and double valve system



Buffer tanks with volume of 500 litres



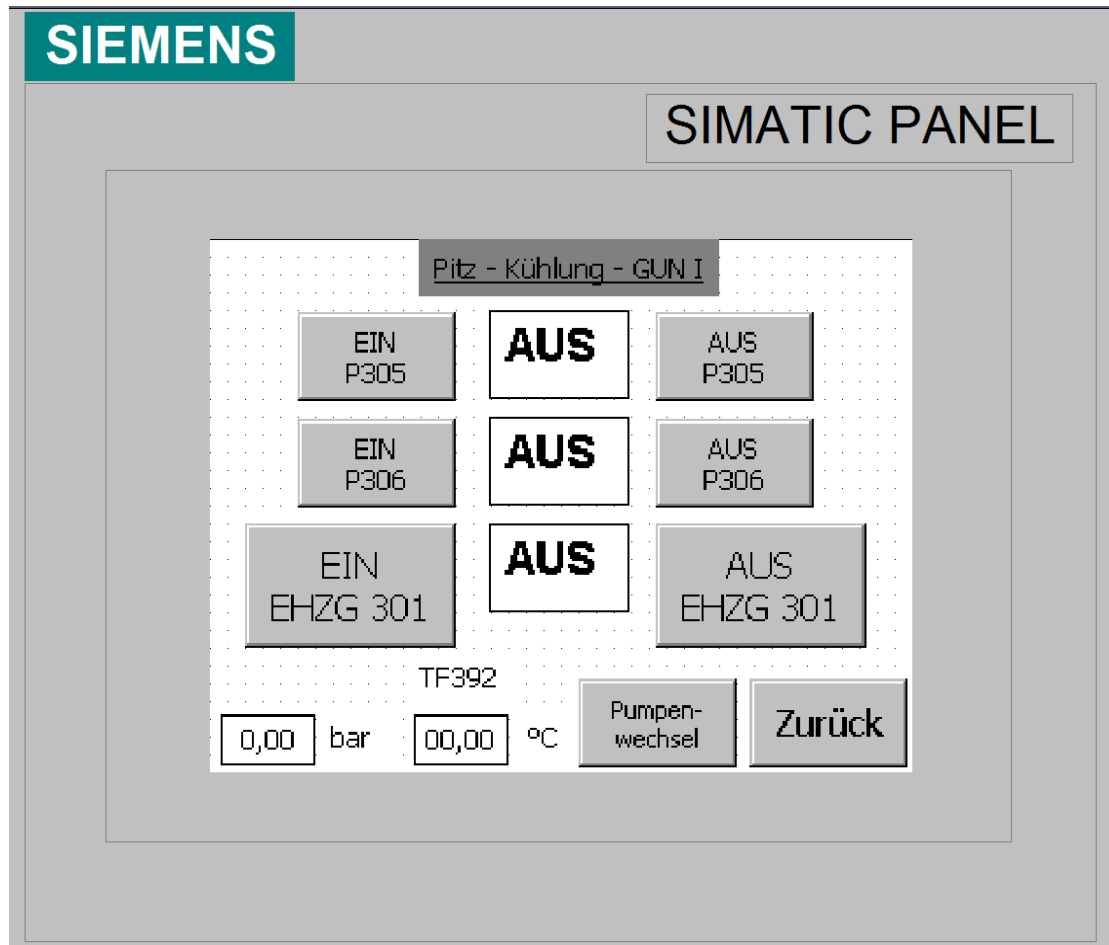
Pump and standby pump for gun and TDS structure



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)

GUN/CTS/BOOSTER Interlock Signals 1-96

GUN

counter:

84302744

= bit is masked for the gui

025	Gun e- th-window wg2 vac	
026	Gun PMT rf-window wg1 air	
027	Gun PMT rf-window wg2 air	
028	Gun PMT th-window wg1 air	
029	Gun PMT th-window wg2 air	
030	not used	
031	not used	
032	Gun IR th-window wg1 air	
033	Gun IR th-window wg2 air	
034	Beam Inhibit System	
035	Maschine Clock	
036	Reset Gun Intlk	
037	Sum Gun Intlk	
038	Booster temp WG1	
039	Booster temp WG2	
040	Booster temp inp_coupler	
041	Gun Thwind WG2 backpipe temp	
042	Booster PMT cell1	
043	Booster PMT cell14	
044	Booster vacuum	
045	Booster water SPS ok	
046	not used	
047	not used	
048	not used	
001	Gun temp outer conductor 33	
002	Gun temp inner conductor 30	
003	Gun WG1 Thwind temp	
004	Gun WG2 Thwind temp	
005	Gun temp incoupler 39	
006	Gun vacuum coupler IGP2	
007	Gun e- coupler	
008	Gun PMT coupler	
009	Gun PMT th-window wg1 vac	
010	Gun PMT th-window wg2 vac	
011	Gun vacuum IGP1	
012	Gun cathode set	
013	Gun cathode name	
014	Gun Water SPS ok	
015	Beam stop	
016	Gun Thwind WG1 flow	
017	Gun flow f-cup colli	
018	Gun flow inp_coupler	
019	Gun temp back window 1	
020	Gun temp back f-cup colli	
021	Gun temp back inp_coupler	
022	Gun temp back bucking	
023	Gun temp back main	
024	Gun e- th-window wg1 vac	

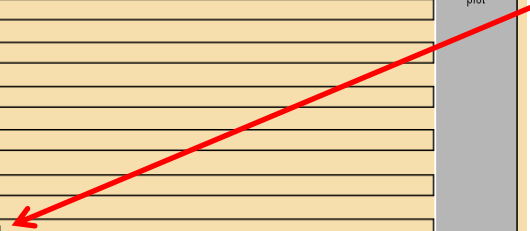
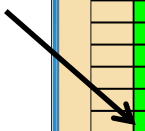
plot

plot

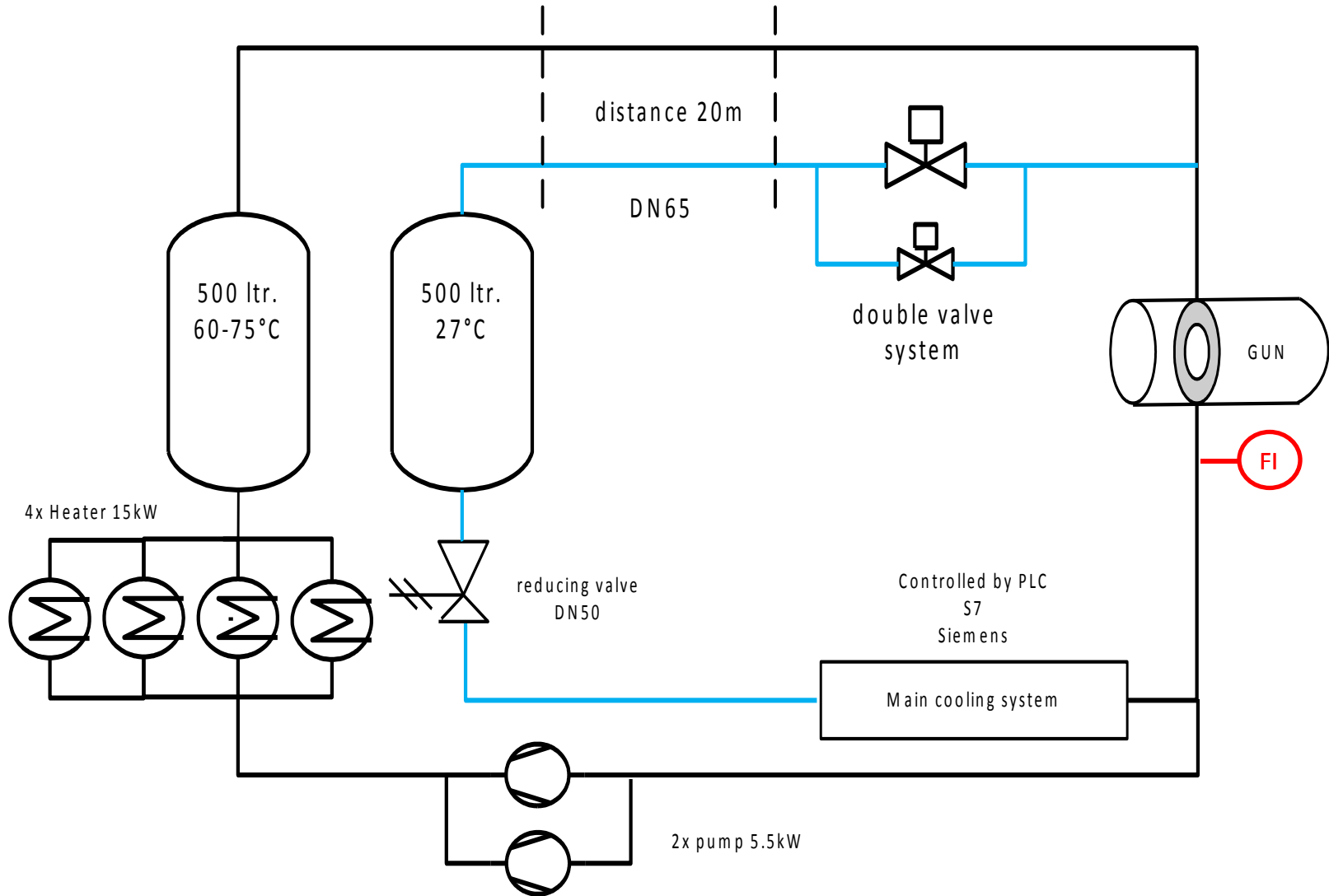
073	not used	
074	not used	
075	not used	
076	not used	
077	not used	
078	not used	
079	not used	
080	TDS Water Flow	
081	not used	
082	Sum TDS Intlk	
083	not used	
084	not used	
085	not used	
086	not used	
087	not used	
088	not used	
089	Gun T-Comb backpipe temp	
090	Gun temp t-comb	
091	Gun flow t-comb	
092	Water Leak	
093	not used	
094	not used	
095	GUN Flow Water Distr. 14 CH	
096	Vacuum Intlk	
049	not used	
050	not used	
051	Reset Booster Intlk	
052	Sum Booster Intlk	
053	Booster infrarot WG1	
054	Booster infrarot WG2	
055	Gun Thwind WG2 flow	
056	not used	
057	Booster Photo Diode WG1	
058	Booster Photo Diode WG2	
059	not used	
060	not used	
061	Booster e-det WG1	
062	Booster e-det WG2	
063	not used	
064	not used	
065	not used	
066	not used	
067	not used	
068	not used	
069	not used	
070	not used	
071	not used	
072	not used	

plot

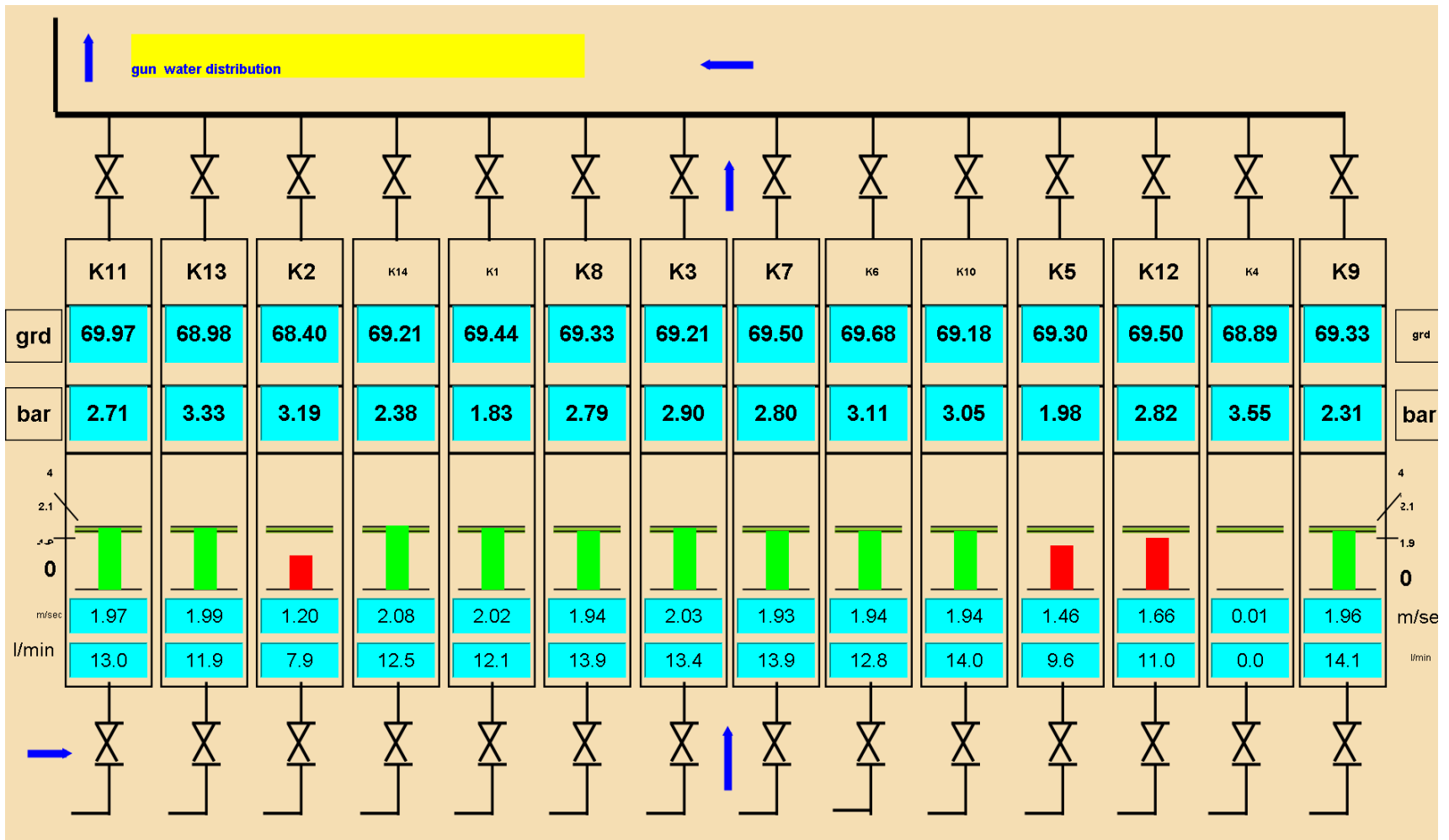
plot



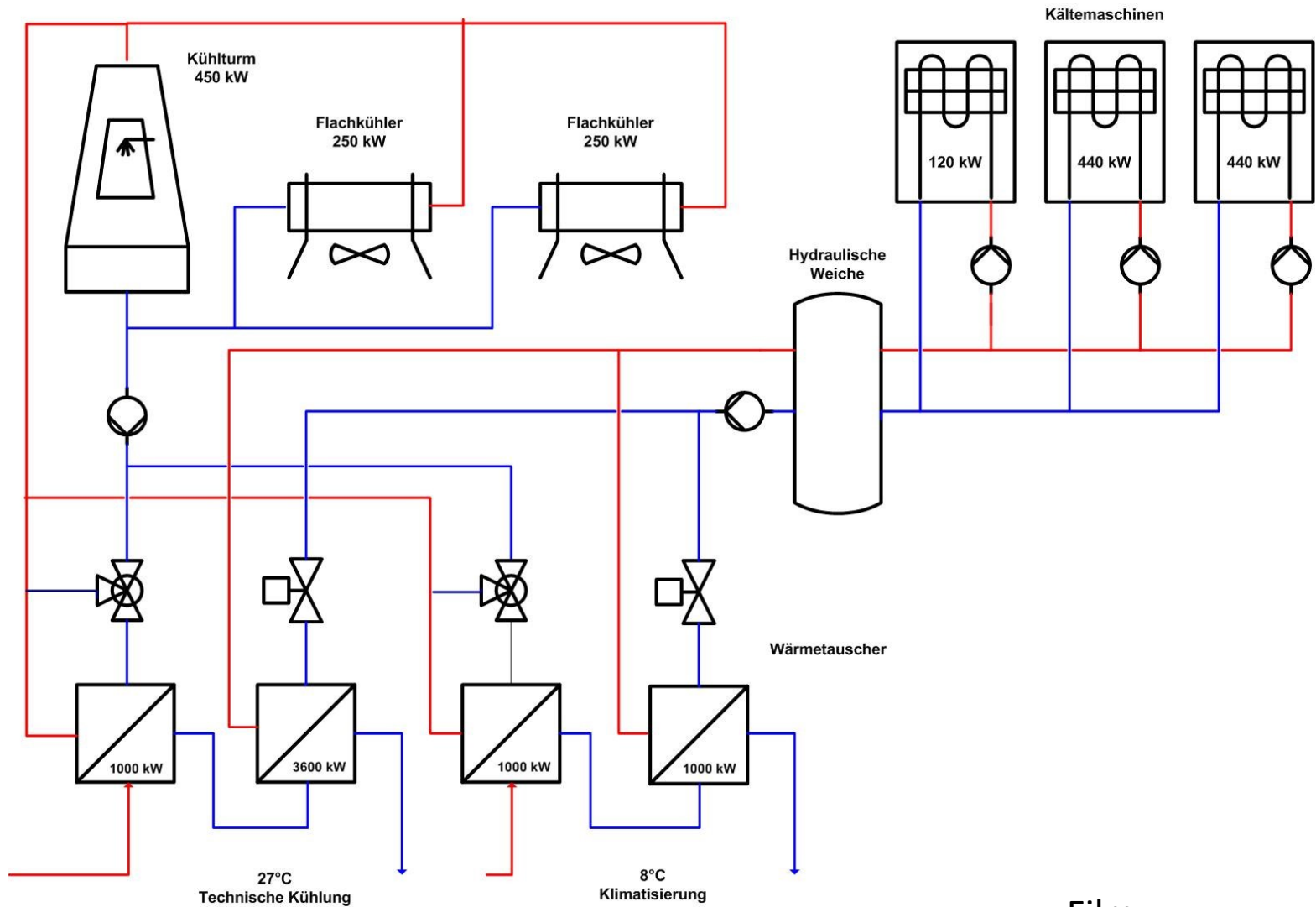
Flow sensor for interlock in the backpipe



14 channel read out for backpipes

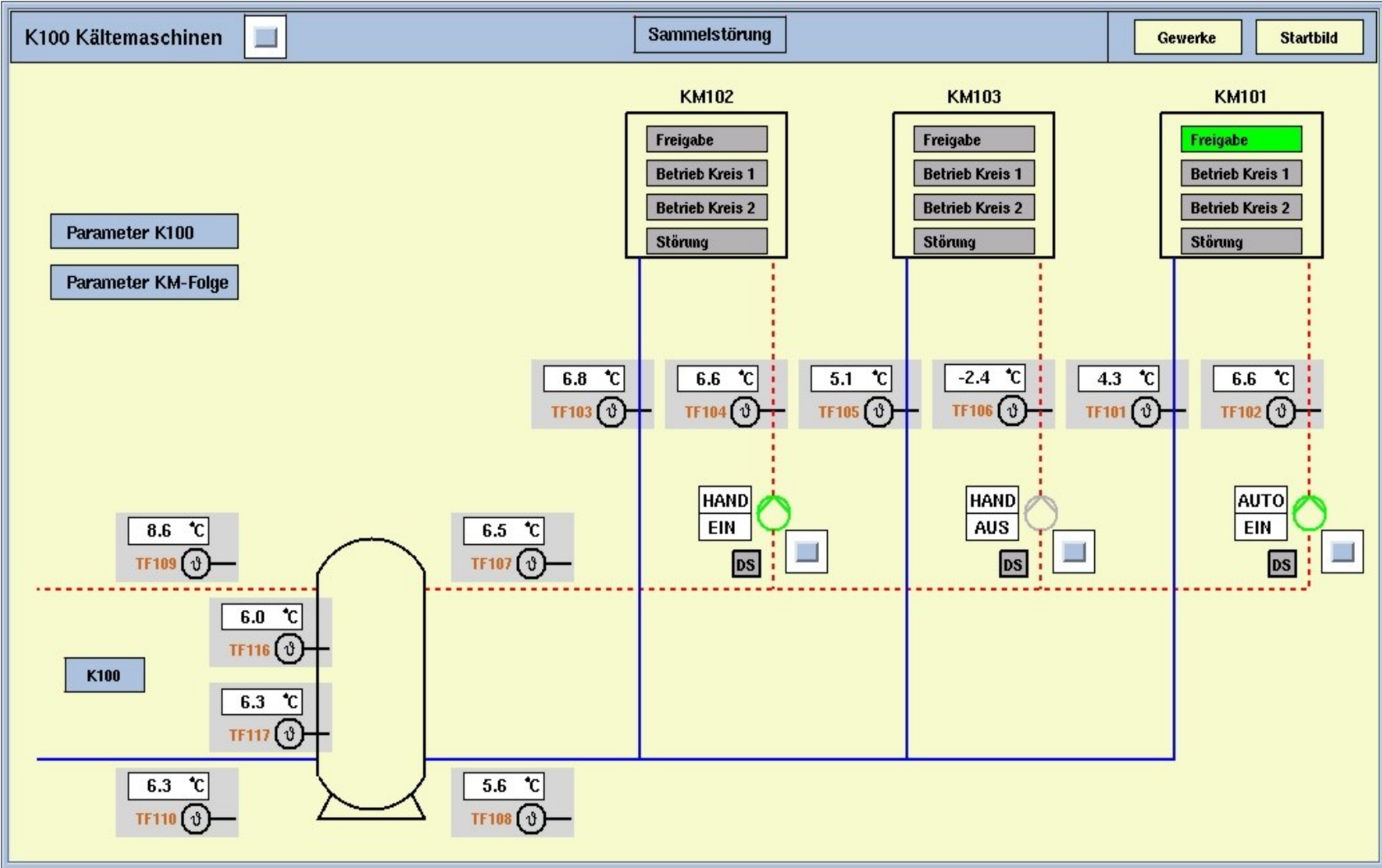


Overview: main cooling system

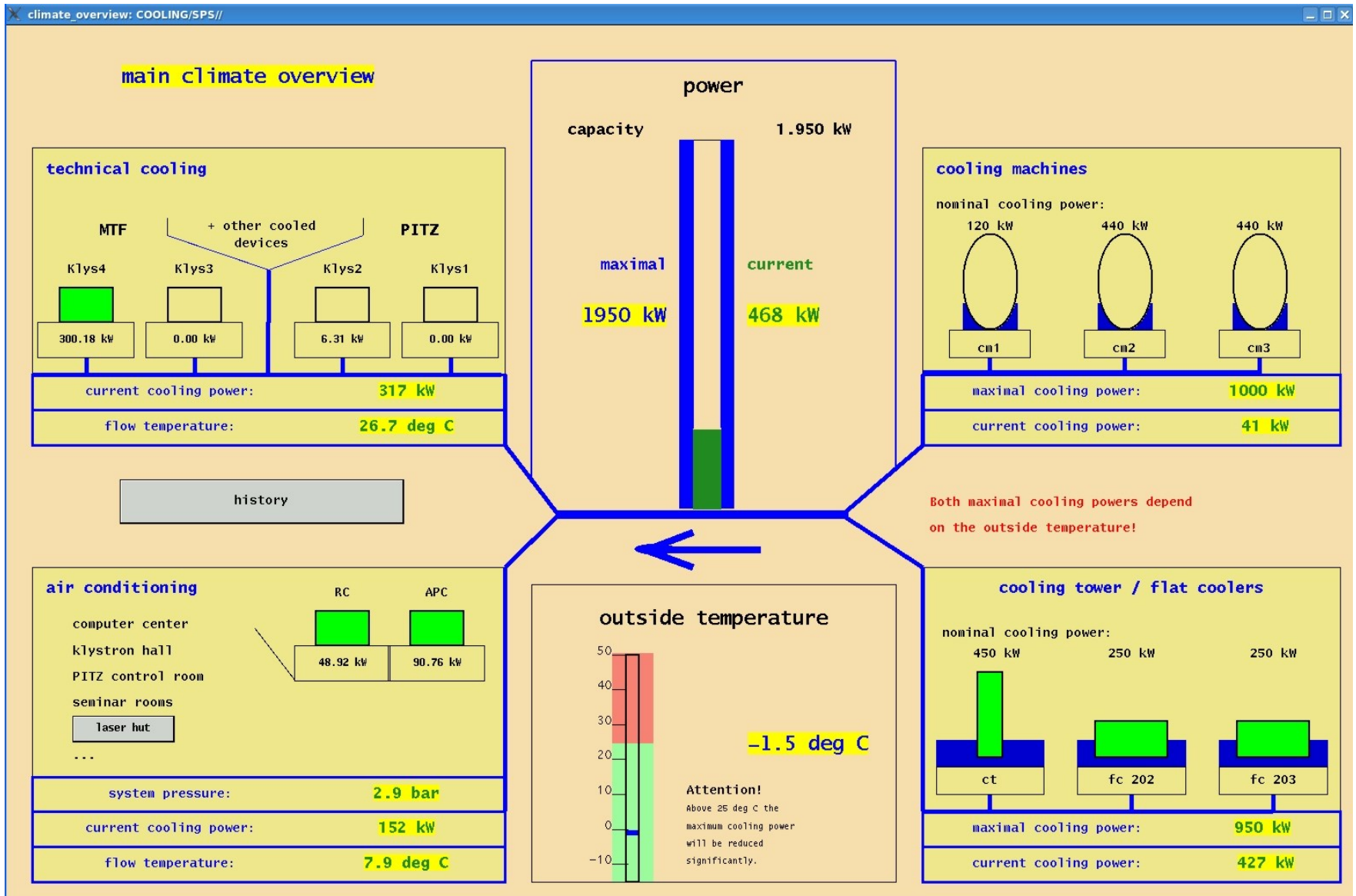


Film

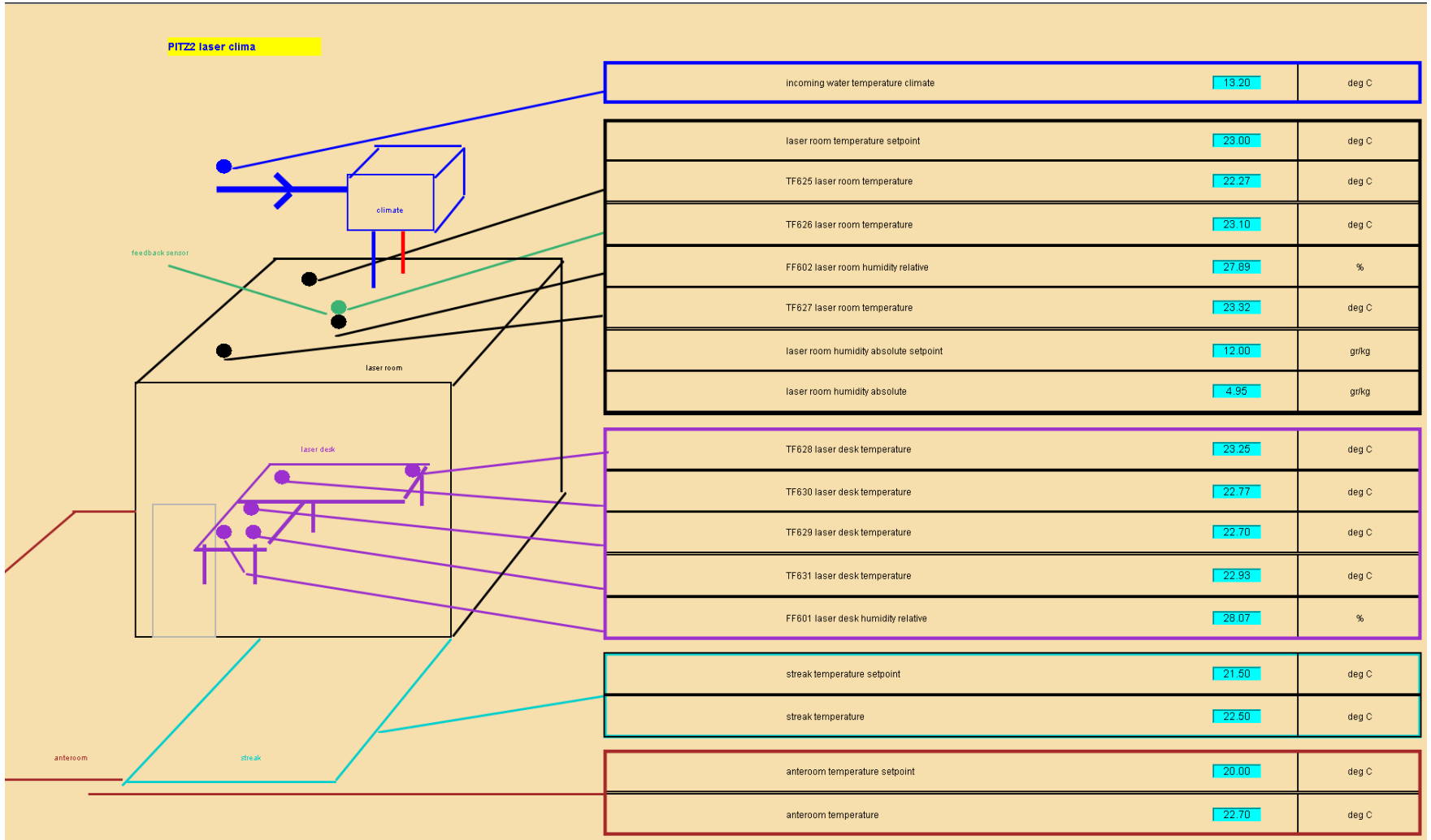
Control system: SICLIMAT X (Siemens)



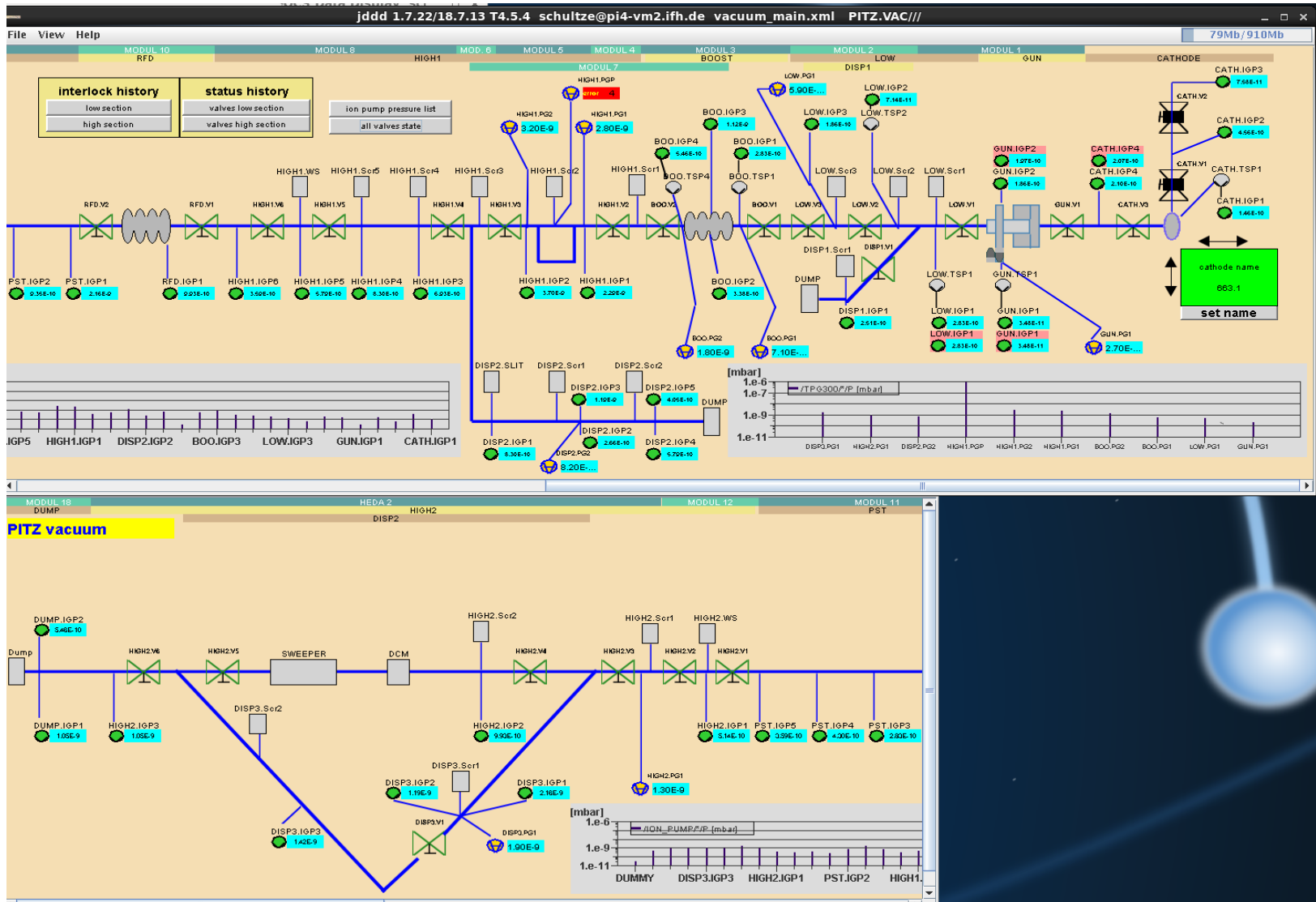
Control system in DOOCS



Control system in DOOCS: Laser room



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	open
IGP	1×10^{-6}	1×10^{-7}
PG	1×10^{-5}	1×10^{-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, lithium) valves in the neighborhood and HIGH1.V3, HIGH1.V4 and LOW.V1 are closed
- If pressure is $>1 \times 10^{-7}$ 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)

