



Australian Government



SAXS/WAXS Beamline: In-Vacuum End-Station EPS/PSS

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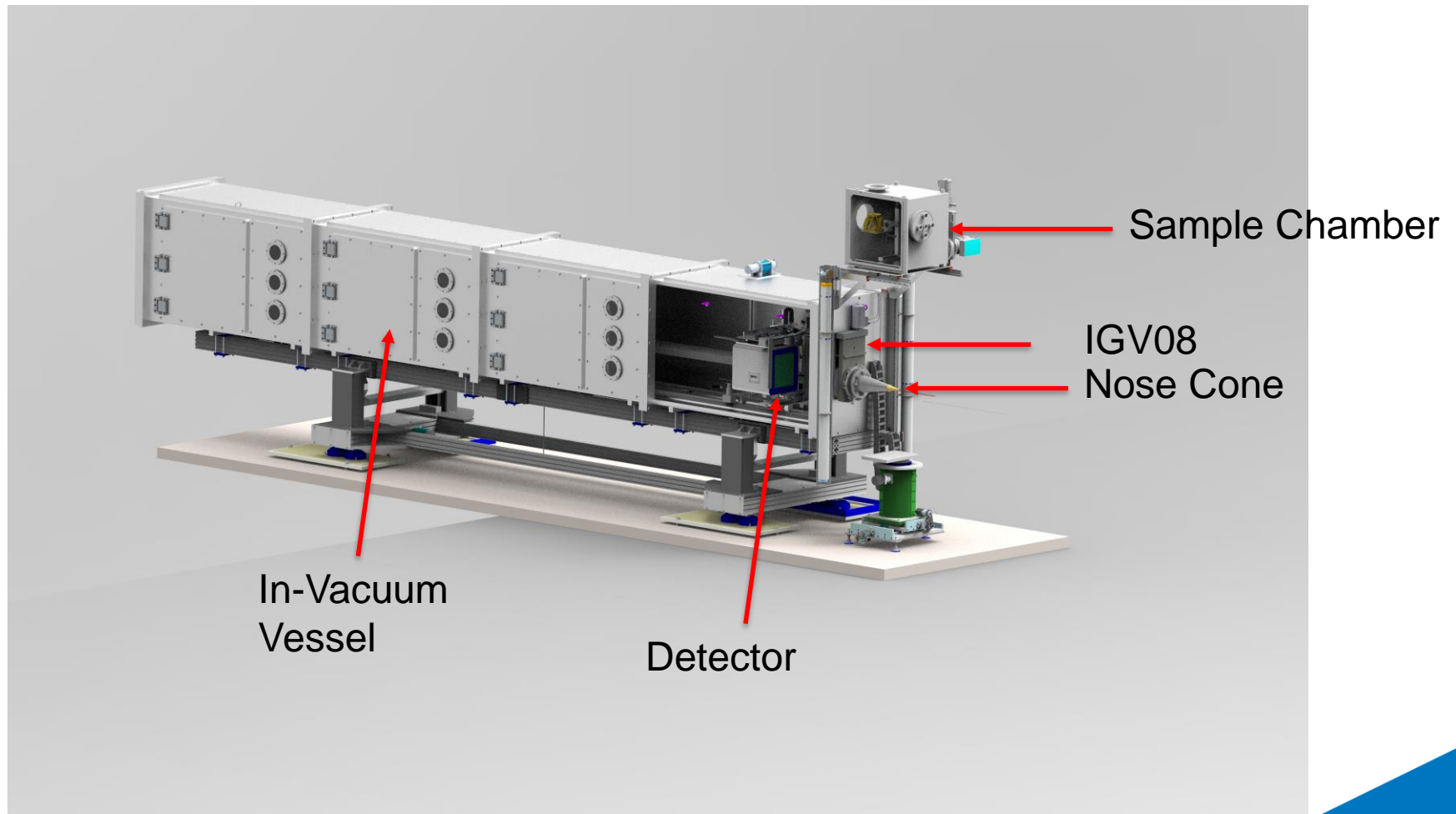
EPICS Collaboration Meeting

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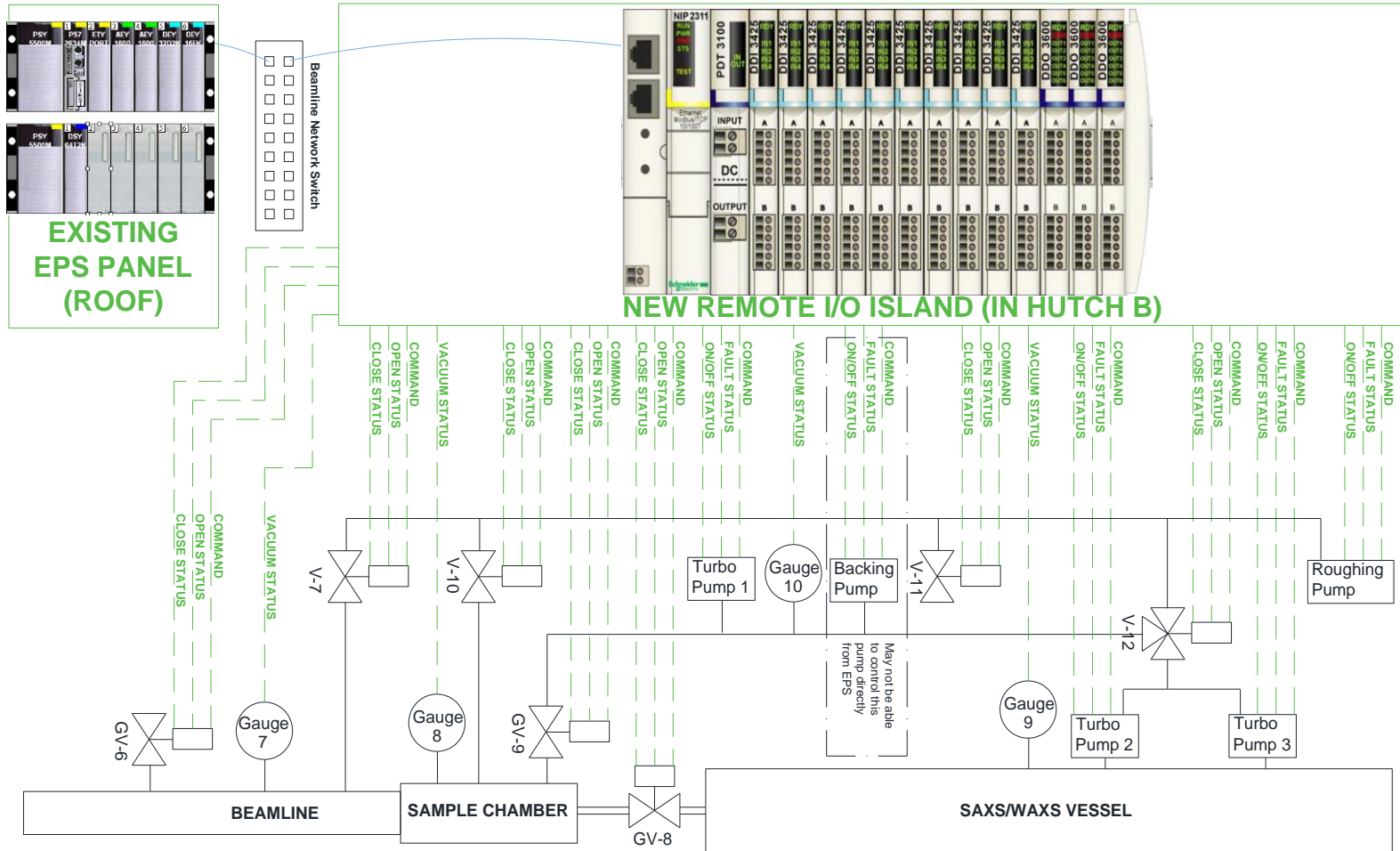
Background

- SAXS/WAXS beamline is currently using a Pilatus2-1M in-air detector and is fully optimised to support in-air detection.
- Its age and mechanical implosion of the vacuum window are two modes of potential failures that can bring the whole beamline down for several months.
- To maintain the highest level of availability for users and to overcome the inherent technical limitations of in-air detectors, a new Pilatus3 2M detector and dedicated in-vacuum end-station system will be used.
- That will increase the detection efficiency significantly.

Background



EPS: Existing PLC and new RIO



EPS: Remote I/O Island



ESP: Standard Code

we are deploying standard EPS code and related PLC GUIs across all beamlines.


Unity Pro will be installed on a beamline OPI and scientists and users can monitor and control EPS elements via PLC GUIs.

SAXS/WAXS EPS Operator Screens Menu

F7 - Toggle To Enable Buttons & Input Data
Ctl+J - Animate Screens
Ctl+K - Connect To PLC

General System Monitor							
Flow WTrCond Temperature							
Vacuum FESH FIScreen							
Vacuum Control							
Vacuum Interlocks							
Flow Interlocks							
Temperature Interlocks							
Conductivity Interlocks							
Flow Trends							
Temperature Trends Water							
Temperature Trends Ln2							
Filters							
Cryocooler							

INTERLOCKS	VACS	VALVES	FLOWS	TEMPS	WTRCOND	CRYOCOOLER	PERMITTED
FRONT END SHUTTER	✔	✔	✔	✔	✔	✔	✔
STORAGE RING RF	✔	✔					✔

STATUS	FEP SH	RIO COMMS	PLC
FRONT END SHUTTER		✔	✔

EPS: Vacuum Control

- A new vacuum system including pumps (roughing, backing and 2 turbo pumps), new combined micro Pirani/Piezo vacuum gauges and vacuum control valves will take care of the vacuum in the end-station, sample chamber and nose cone.
- Existing EPS PLC will control this vacuum system via the new remote I/O island.
- Related IOC database and EPICS GUIs will be updated and a new GUI will be developed for vacuum system.
- As part of our plan for beamline EPSs, we will develop a standard EPICS GUI and it will replace the current EPS related GUIs in the future.

EPS: Truth Table

PLC cold or warm start	boSR13ID01Prcd1PwrFault	39	1	
Cryocooler mute key activated	boSR13ID01Crcd1MuteKeySwitch	41	0	
Cryocooler level low	boSR13ID01Crcd1LLMin	40	1	
Cryocooler alarm	boSR13ID01Crcd1Alm	39	1	
Cryocooler not ready	boSR13ID01Crcd1RdyAlm	38	1	
FSC01 (High Temperature)	boSR13ID01Fscd1T.es01Sis	37	0	
DCM01BST01 (High Temperature)	boSR13ID01Dcm01Bsd01.es01Sis	36	0	
DCM01XTL02 (High Temperature)	boSR13ID01Dcm01Xld02.es1Sis	35	0	
DCM01XTL02 (High Temperature)	boSR13ID01Dcm01Xld02.es1Sis	34	0	
DCM01XTL01 (High Temperature)	boSR13ID01Dcm01Xld01.es1Sis	33	0	
DCM01XTL01 (High Temperature)	boSR13ID01Dcm01Xld01.es1Sis	32	0	
WBS02 (High Temperature)	boSR13ID01Wbsd02.es01Sis	31	0	
WBS01 (High Temperature)	boSR13ID01Wbsd01.es01Sis	30	0	
MSK01 (High Temperature)	boSR13ID01Mskd01.es01Sis	29	0	
HEX01 (High Temperature)	boSR13ID01Hexd01.es01Sis	28	0	
DCM01BST01 (Low Flow)	boSR13ID01Dcm01Bsd01F.in01Sis	27	0	
DCM01XTL01 (Low Flow)	boSR13ID01Dcm01Xld01F.in01Sis	26	0	
BEW01 (Low Flow)	boSR13ID01Bekd01F.in01Sis	25	0	
FSC01 (Low Flow)	boSR13ID01Fscd1F.in01Sis	24	0	
BPM01 (Low Flow)	boSR13ID01Bpm01F.in01Sis	23	0	
WBS02 (Low Flow)	boSR13ID01Wbsd02F.in01Sis	22	0	
WBS01 (Low Flow)	boSR13ID01Wbsd01F.in01Sis	21	0	
Mskd01 (Low Flow)	boSR13ID01Mskd01F.in01Sis	20	0	
HEX01 (Low Flow)	boSR13ID01Hexd01F.in01Sis	19	0	
HEX01 (Low/High Conductivity)	boSR13ID01Hexd01V.ecd01Sis	18	0	
IGV01 (Move Fail)	boSR13ID01Igd01MoveF.AlsSis	17	1	
IGV01 (not open)	nsSR13ID01GVd1Pos	16	Not 3	
IMG10 (Backing Pump bad var)		15	0	
IMG09 (Detector Vessel bad var)		14	0	
IMG08 (Sample Chamber bad var)		13	0	
IMG07 (Section 5 bad var)		12	0	
PRG06 (Section 5 bad var)		11	0	
IMG06 (Section 5 bad var)		10	0	
PRG05 (Section 4 bad var)		9	0	
IMG05 (Section 4 bad var)		8	0	
PRG04 (Section 3 bad var)		7	0	
IMG04 (Section 3 bad var)		6	0	
PRG03 (Section 2 bad var)		5	0	
IMG03 (Section 2 bad var)		4	0	
PRG02 (Section 1 bad var)		3	0	
IMG02 (Section 1 bad var)		2	0	
PRG01 (Section 1 bad var)		1	0	
IMG01 (Section 1 bad var)		0	0	
Fault Source	Signal name	#	Value	
	#			
	Valve/Shutter/RF			
	SR13ID01IGV01	0	1	
	SR13ID01IGV02	1	1	
	SR13ID01IGV03	2	1	
	SR13ID01IGV04	3	1	
	SR13ID01IGV05	4	1	
	SR13ID01IGV06	5	1	
	SR13ID01VLV07	6	1	
	SR13ID01IGV08	7	1	
	SR13ID01IGV09	8	1	
	SR13ID01VLV10	9	1	
	SR13ID01VLV11	10	1	
	SR13ID01VLV12	12	3	
	FEPSh	13	2	
	Storage Ring RF	14	2	

0: Bypassed in the logic

1: Unconditional

2: Latched alarm is used in the logic (instead of status)

3: To Backing Pump

4: It will be considered in vacuum control system. It should always be closed unless we are venting.

*. IGV07 and IGV10 shall always be closed unless we are roughing.

Newly added device

To be checked

Logic changed/added/deleted

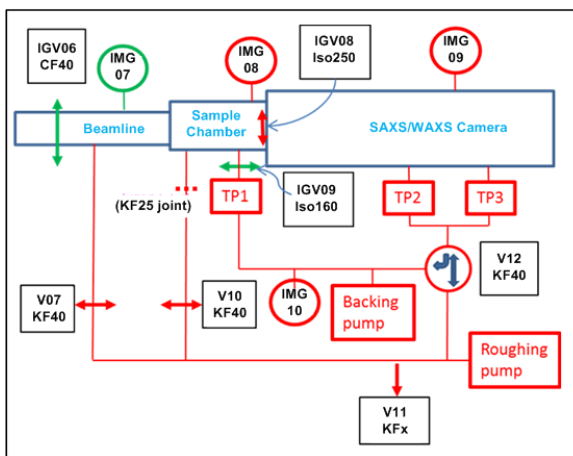
Changed in Meeting 26/04/2018

New Cryocooler logic

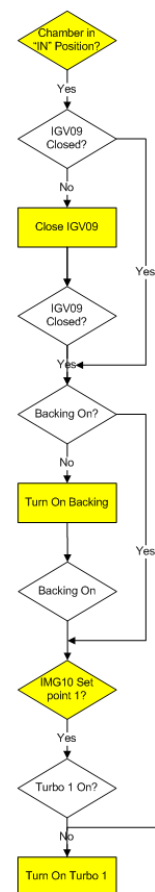
EPS: Vacuum Control Sequences

IMG 07, IMG 08 and IMG09 Set Points:

- 0: Vented = 900 mbar
- 1: Start Turbo = 1 mbar
- 2: Vacuum Good = 0.01 mbar

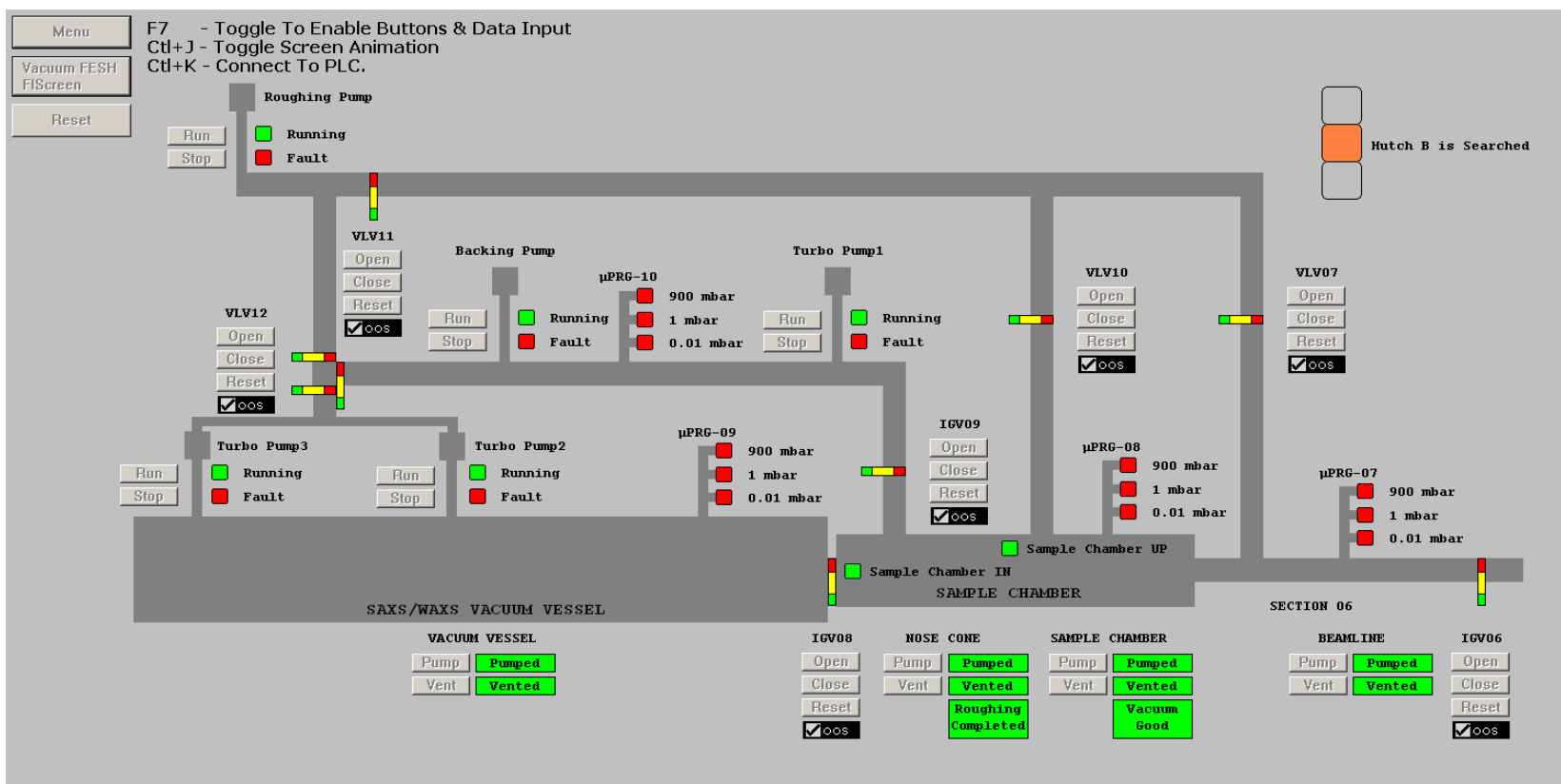


Pumping Sample Chamber



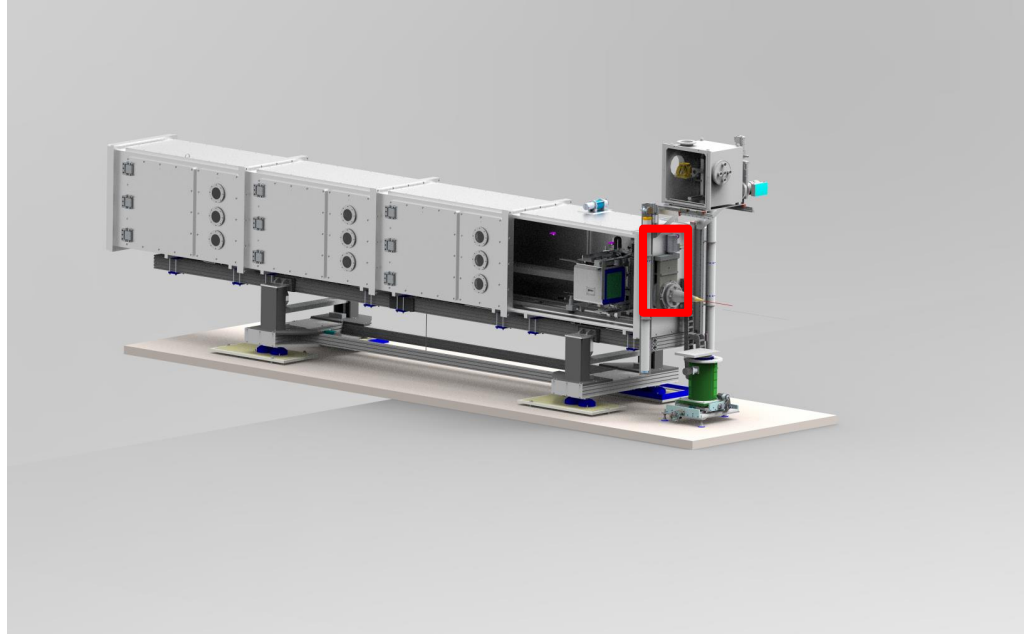
EPS: Vacuum Control

This is the PLC GUI for vacuum control and EPICS GUI will be similar to this.



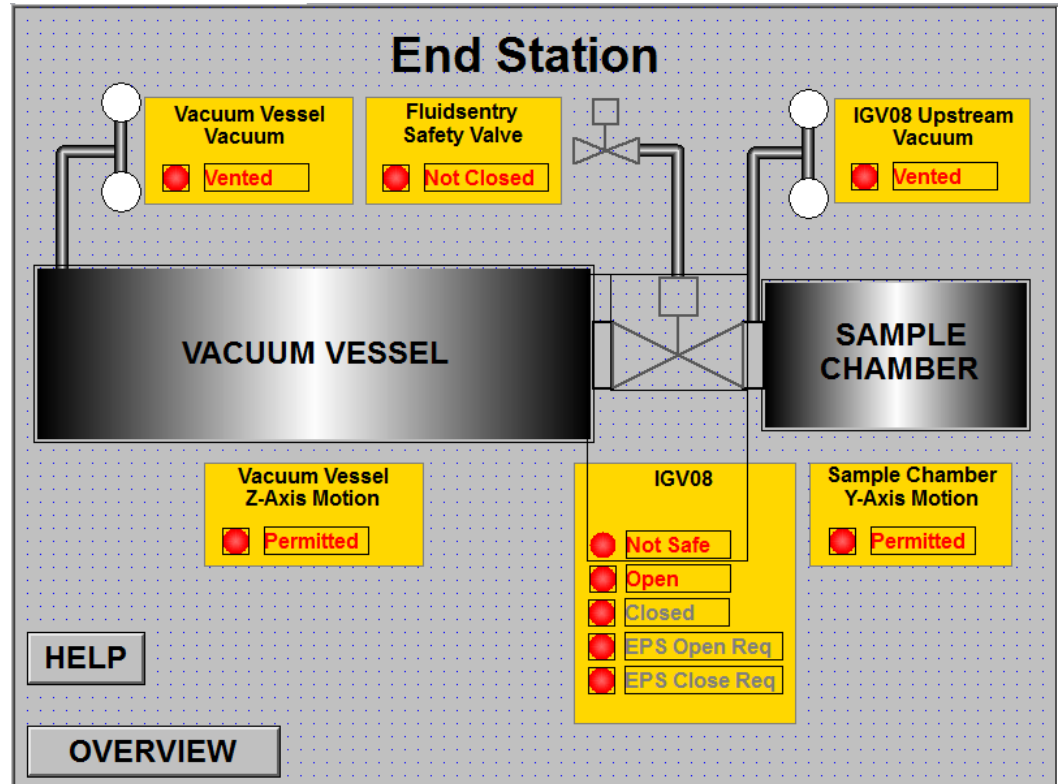
PSS: Gate Valve Safety

- A 250mm custom-made gate valve that can be exposed and lead to serious injuries
- The only case that IGV-8 can cause injury to users is when both sample chamber and SAXSX/WAXS vessel are not under vacuum and users can be in touch with the valve
- From safety point of view, the most important thing about the gate valve is that we need to know the valve is closed before we let people put their hands in the sample chamber or detector vessel



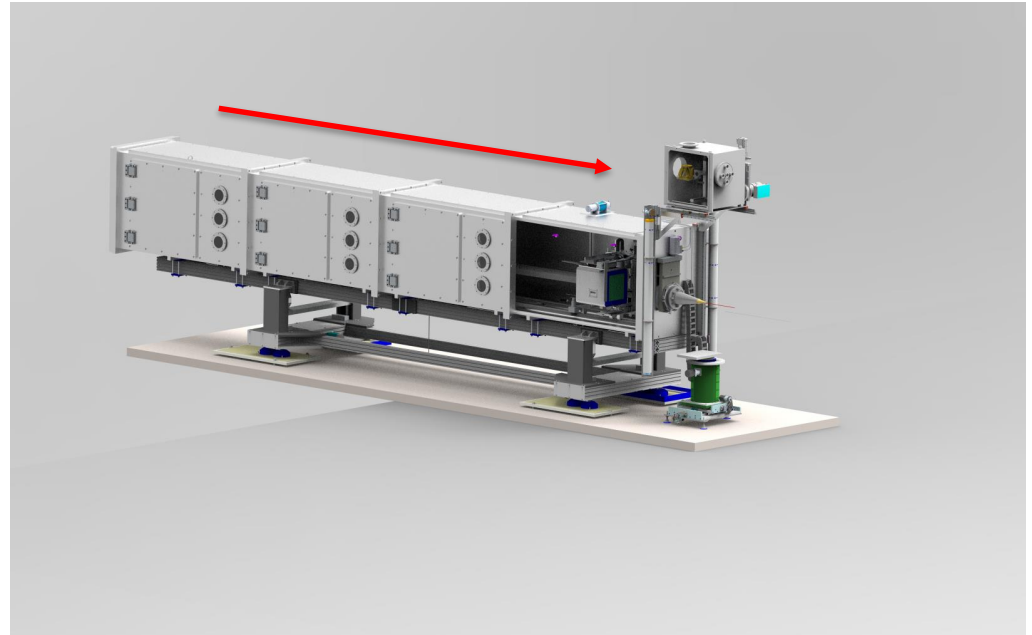
PSS: Gate Valve Safety

- Because the valve is not a safety valve, we have used safety vacuum switches on the upstream and downstream side of the valve that together with the position of the valve will tell us that the valve is closed.
- To make sure that the valve will not move, a safety valve will cut the compressed air path of IGV08 whenever someone wants to go in the hutch.
- PSS will keep the doors locked until IGV08 and safety valves are closed.



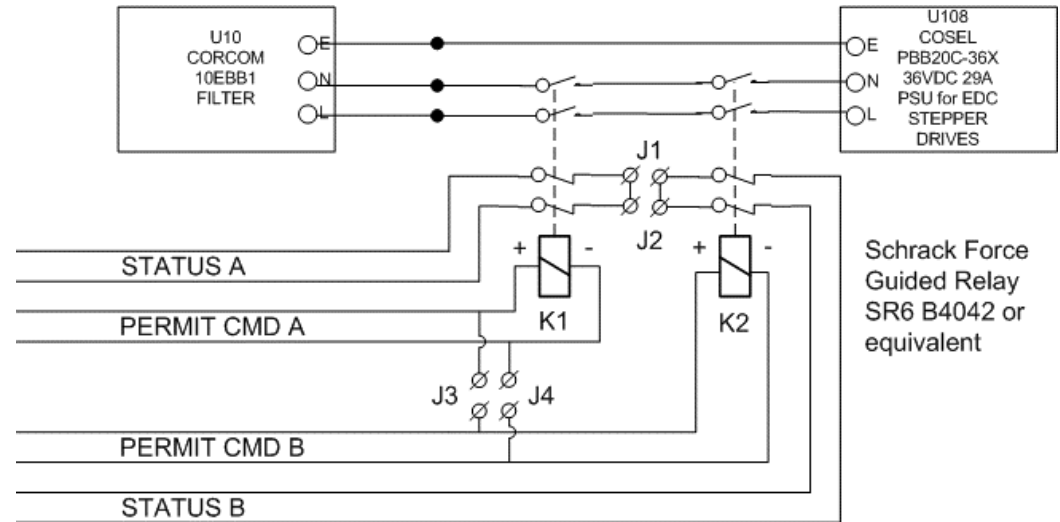
PSS: In-Vacuum Vessel Z-Axis Motion

- In-vacuum detector motion (in beam direction) at 80-100mm/s will be accessible if the vacuum vessel is open and it can cause permanent disability.
- When the vessel is not under vacuum or any E-Stop is pressed a safe stop command will be sent to the motion controller.



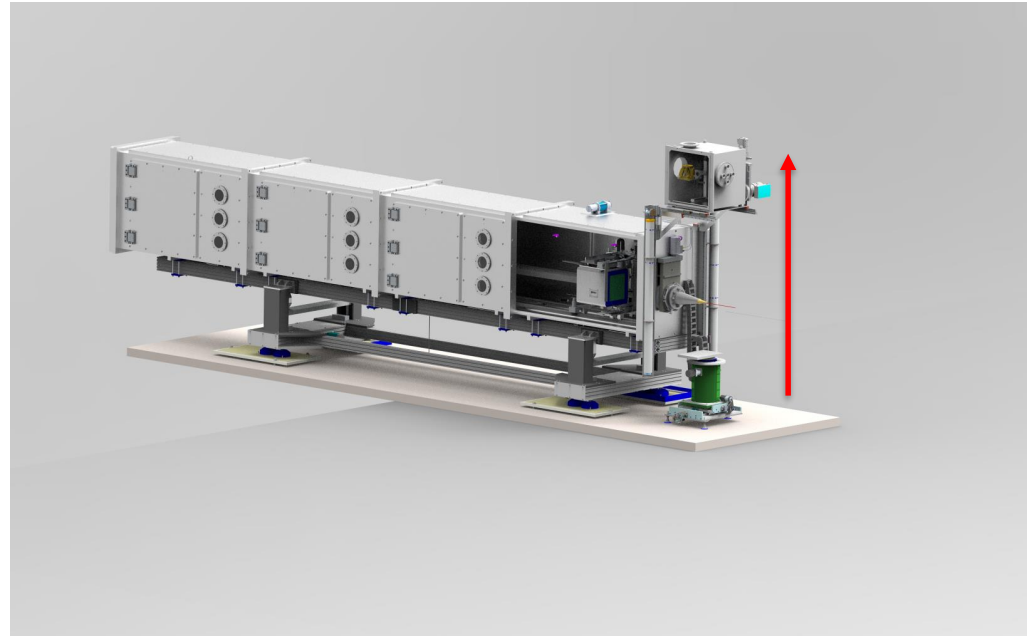
PSS: In-Vacuum Vessel Z-Axis Motion

- Since this motion controller does not have an STO input, we will change it a little bit and by using 2 force guided relays make it able to receive the safe stop command from PSS and cut the power to amplifier.



PSS: Sample Chamber Y-Axis Motion

- Since sample chamber can move in Y direction, PSS will enable the motion by sending a permit to the STO input of this motion controller only if sample chamber is not in vacuum and nobody has pressed an E-Stop.



THANK YOU