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SAXS/WAXS beamline In-Vacuum End-Station EPS/PSS

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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.

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 a new remote I/O island. Related IOC database and EPICS GUIs will be updated and a new GUI will be developed for the new vacuum system.

We conducted a complete risk analysis on this project and found following safety risks that should be mitigated using safety PLCs.

A 250mm custom-made gate valve can be exposed in several cases and likely lead to serious injuries. To mitigate that risk, the existing Beamline PSS, interlocked to the hutch search state, will control gate valve actuation. Safety vacuum switches on upstream and downstream sides of the valve will ensure that the valve is closed. In addition, a safety valve on the compressed air path will isolate the gate valve whenever someone is in the hutch to make sure that the valve will not move.

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. Since the motion controller does not have Safe Torque Off capability, we will modify that to be able to remove the power from motion drive amplifier via safety rated relays. Existing beamline PSS will cut the power when there is a safety risk.

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