Hall B MVT/FT Gas System Controls and Monitoring Software

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This note presents the controls and monitoring software and hardware developed for the MicroMegas Vertex Tracker (MVT) and the Forward Tracker (FT) gas system.

The Hall B gas system comprises four custom designed chassis, which supply power to mass flow controllers (MFCs) and sensors, and interfaces signals between sensors and three National Instruments CompactRIOs (cRIO).

The cRIO located on Space Frame Level Three of Hall B monitors the MVT and FT and the cRIO in the gas shed provides the system interface GUI for changing gas flow, Fig. 1.

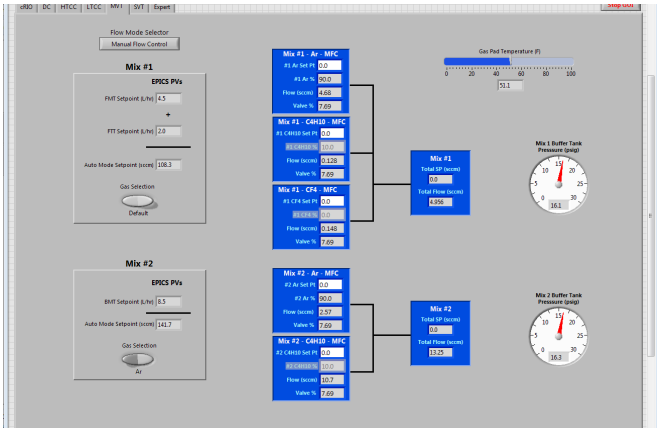

FIG. 1. MVT/FT LabVIEW GUI for changing gas flow.

The MVT/FT gas system provides two gas mixtures, using five GE50a MFCs, Fig. 2. Mix 1 tank is capable of providing a 10% C_4H_{10}/10% CF_4/80% Ar mixture; Mix 2 tank provides 10% C_4H_{10}/90% Ar.

In Automatic Flow Control mode, the Saclay MVT Gas Controls PLC, through EPICS, requests a flow value (typically <200 ccm) that is automatically loaded into the MFC controls software as base set points for the mixing MFCs.

To ensure the specified differential pressure (10 psi) between the inlet and outlet of the GE50a MFC, the buffer tank pressure is monitored by the controls software. The base flow setpoint F_{init}, provided by the Saclay PLC, is multiplied by 1.5, increasing the flow to the tank. Because the detector is only using the original base flow F_{init}, the tank pressure increases because the flow to the tank has been increased. This process continues until the pressure reaches 15 psi, at which point F_{init} is multiplied by 0.5; now the flow to the tank is reduced. However, the detector continues to use gas at the original base flow F_{init}. This decreases tank pressure until the pressure reaches 5 psi, which starts the cycle over. An interlock is embedded in the code to set the MFC flow value to 0 psi if the pressure exceeds 20 psi.

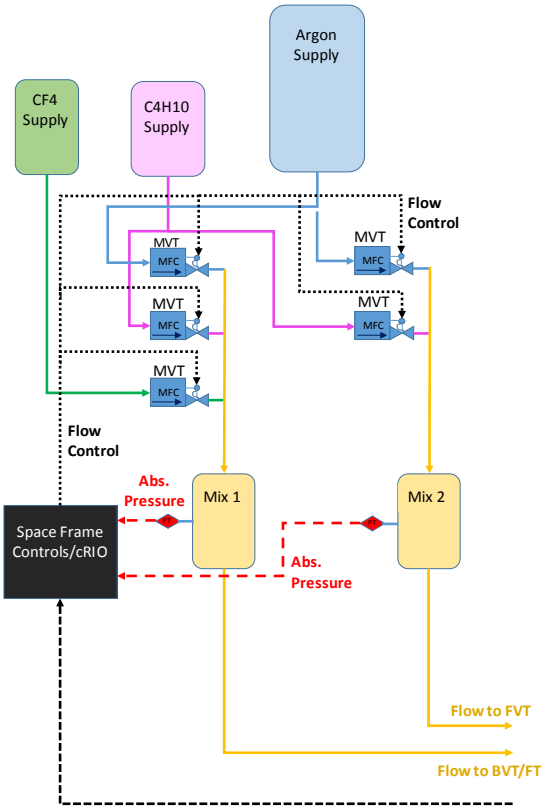

FIG. 2. MVT/FT gas system.

The Hall B Gas Controls system has been operational since late 2017 and has run without any major malfunction.