

The Micromegas Vertex Tracker Gas Mixing System

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The Micromegas Vertex Tracker (MVT) gas mixing system supplies mixed gas to the MVT and the Forward Tracker's (FT) micromegas tracker.

The MVT gas mixing system, which supplies gas to the detectors via the distribution system, performs three functions—mix the gas in the correct ratios, maintain the gas delivery pressure at 12–16 psi, and supply Ar gas for system purge.

There are two independent gas mixing systems to produce two gas mixtures. Mix 1 (Fig. 1) is 10% C_4H_{10} in Ar and Mix 2 (Fig. 2) is 10% CF_4 and 10% C_4H_{10} in Ar. These mixtures are sent to the two MVT and FT distribution chassis in Hall B. The MVT gas chassis is supplied with both mixtures. The FT chassis is supplied with Mix 1.

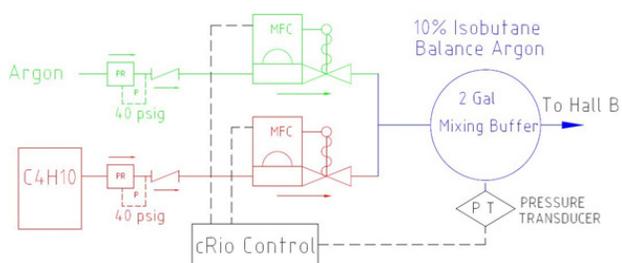


FIG. 1. Diagram of Mix 1.

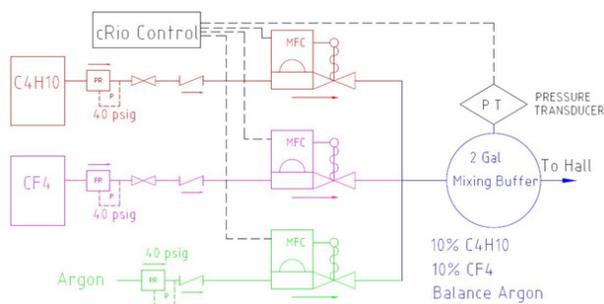


FIG. 2. Diagram of Mix 2.

Ar is supplied from the boil-off of the 1500-gallon liquid Ar dewar in the gas shed. A pressure regulator is used to reduce gas pressure to 40 psi to supply the mixing system.

C_4H_{10} is supplied from an FX type gas cylinder containing 116 lbs of gas at saturation temperature and pressure. C_4H_{10} is a flammable gas with an explosive range of 1.4%–8.3% in air. It has low vapor pressure, necessitating the use of a cylinder heater blanket to maintain cylinder temperature at 89°F, resulting in pressure of 55 psi. Pressure is reduced to 40 psi by a pressure regulator attached to the gas cylinder. Cylinder fill levels are monitored by weighing with a scale.

CF_4 is supplied from high pressure K size cylinders containing 65 lbs of gas at saturation temperature and pressure. Pressure is reduced to 40 psi by a pressure regulator attached to the gas cylinder. Cylinder fill levels are monitored by measuring the weight of the cylinder.

MKS mass flow controllers meter the gas at the programmed ratios and flow rates, Table I. The gas pressure in the mixing buffers is monitored by the control system.

	Gas	Rate [sccm]
Mix 1	Ar MFC	2820
	C_4H_{10} MFC	210
	10% C_4H_{10} in Ar	2000
Mix 2	Ar MFC	2820
	C_4H_{10} MFC	210
	10% C_4H_{10} and 10% CF_4 in Ar	2000

TABLE I. Maximum gas flow rates.

Mixed gas pressure is controlled by varying mixing flow rates to maintain pressure within 12–16 psi. A pressure transducer monitors pressure in the volume of the mixed gas buffer tanks. When pressure falls to the low level setpoint, the mixing gas flow rates are increased to raise pressure. When pressure increases to the high level setpoint, the mixing gas flow rates are decreased to reduce pressure. If the mixed gas pressure reaches the high high setpoint, the mass flow controllers close.

Normal operation of the gas mixing system is automatic, controlled by software running on a National Instruments CompactRIO. System startup and shutdown is controlled by the CompactRIO in the gas shed.

System operating parameters, mixed gas pressure, flow rates, and mix ratios are monitored by EPICS. EPICS system alarms for high and low pressure, high and low flow rates, and incorrect mix ratios alert personnel to mixing system errors.

To prevent air mixing with the flammable gas, a manual inert gas purge of the system must be performed at startup and shutdown.

The described system has been designed and is awaiting pressure system and fire safety approvals.