The RTPC Gas Supply System Layout

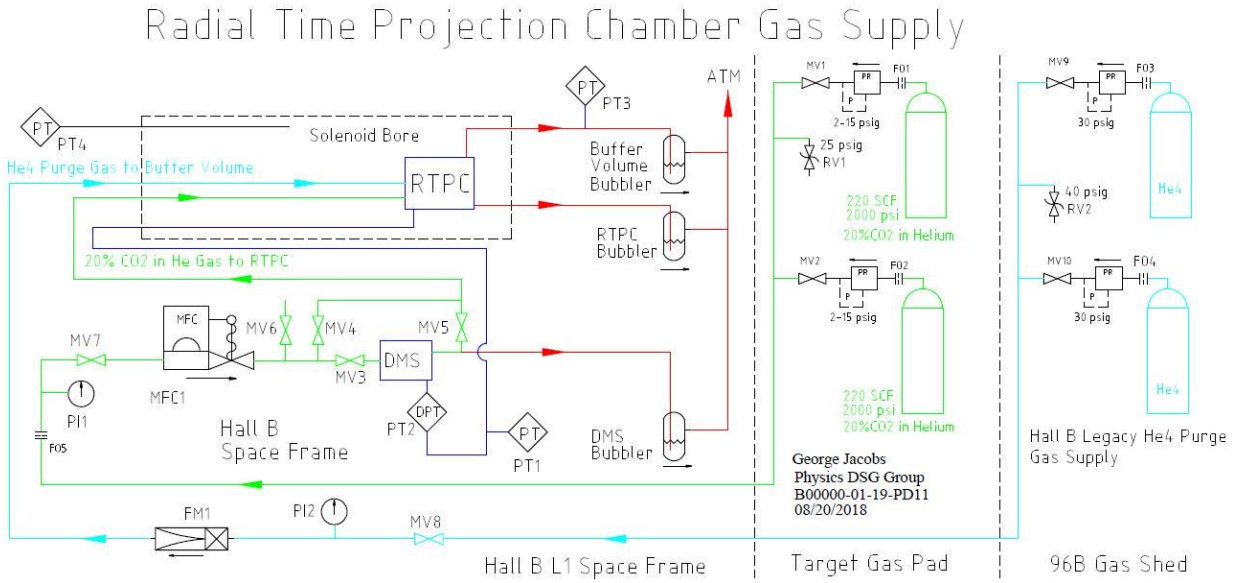
Introduction

The Radial Time Projection Chamber, RTPC, gas supply system delivers pre-mixed gas, 20% CO2 in He, to the RTPC detector and Drift Monitor System, DMS, gas volumes.

The pre-mix gas cylinders are located at the Hall B target gas pad behind the counting house. Gas is delivered via a stainless steel gas line that runs from the target gas pad to the Hall B space frame.

Gas flow to the RTPC and DMS gas volumes is metered by a mass flow controller. Gas flows first to the DMS, Drift Monitor System, which measures the electron drift speed in the gas mix. Gas then flows to the RTPC, Real Time Projection Chamber, which tracks particles emitted from the target. Gas exits the RTPC and is vented to atmosphere.

He4 gas is used to purge the Buffer volume between the CO2 target and RTPC ground plane. A manual flow meter is used to adjust flow. An oil filled bubbler is used to maintain pressure and prevent back flow of air into the Buffer volume.



Gas Line Runs and Connections

There are pre-existing lines running from the target gas pad into the hall that are available. These lines terminate at the downstream end of the space frame. These

lines can be diverted to the upstream location or new lines can be run that terminate at the upstream end of the space frame to connect to the RTPC gas panel which supports the mass flow controller, the pressure sensors, and system valves. This location must be outside of the magnetic field for proper MFC operation.

The pre-existing gas line runs for the He4 purge gas run from the Hall B Gas Shed, 96B, into the Hall. The line is split into 2, with one line to supply the space frame, upstream beam line and the other terminating in the downstream alcove..

The RTPC replaces the SVT on the beam line and moves with the solenoid cart. There are a total of five gas lines that run from the gas panel to the RTPC on the cart; the RTPC pre-mix gas supply line, the RTPC gas exhaust line, the RTPC pressure instrumentation line, the He4 purge gas supply line, and He4 purge gas exhaust line.

The gas lines that run to the cart from the gas panel must move with the cart along the track. The exhaust lines to atmosphere should run from the valve panel to either the target gas pad penetration outside the hall or to a location above the top level of the space frame.

Gas System Components

RTPC gas is supplied in high pressure, 2000 psi, pre-mix cylinders of 20% CO2 in He, each containing 220 SCF. Pressure regulators reduce the gas supply pressure to 15 psi for the mass flow controller. Flow limiting orifices limit gas flow in case of component failure.

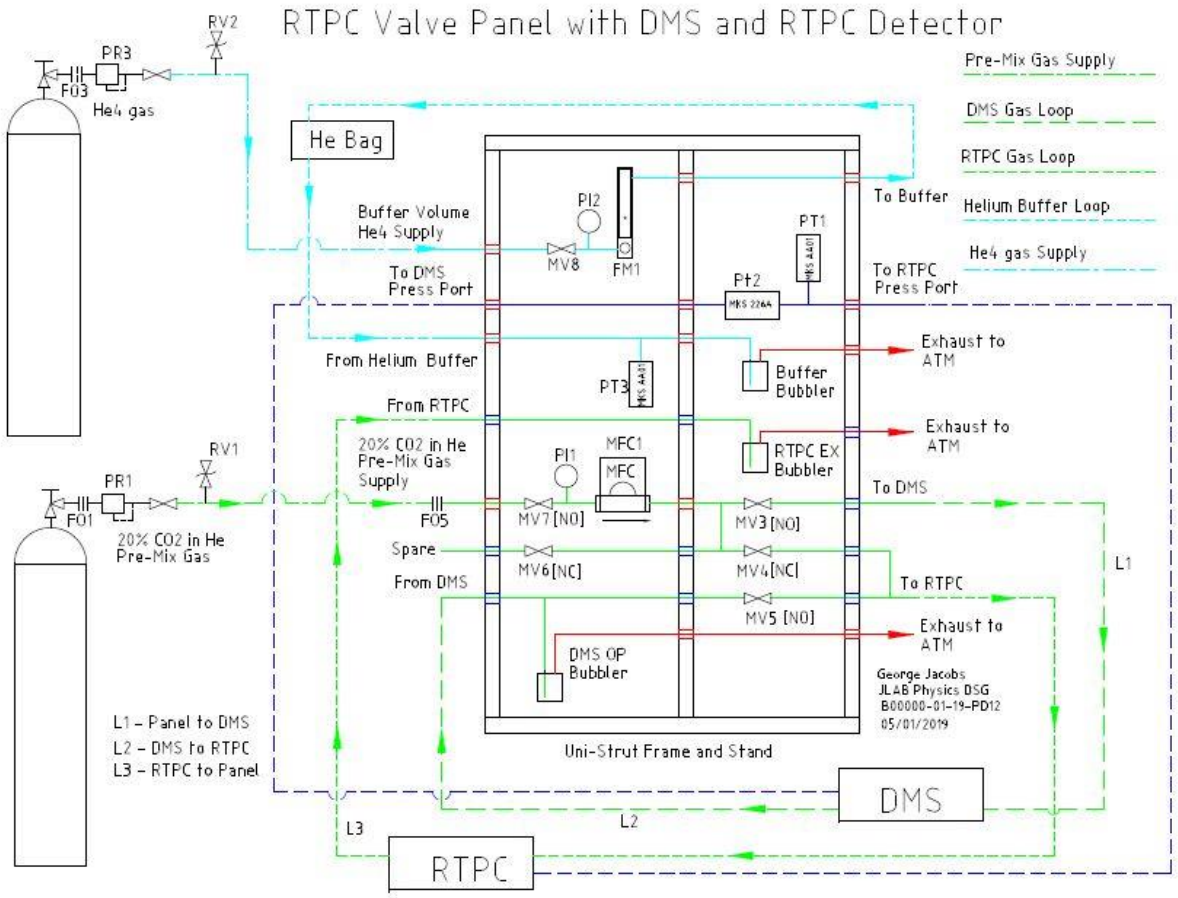
The He4 purge gas is supplied in high pressure, 3000 psi, cylinders each containing 220 SCF. Pressure regulators reduce the gas supply pressure to 15 psi for the manual flow meter with valve. Flow limiting orifices limit gas flow in case of component failure.

The gas system components are all mounted on a compact panel to afford portability for testing at W&M and the EEL prior to hall installation.

The valve panel will be located on level one of the space frame in Hall B. The pressure gauge, PI1, indicates the gas pressure at the inlet of the mass flow controller. The valve panel isolation valve, MV7, is used to isolate the gas supply from the gas panel for maintenance.

The mass flow controller, MFC1, meters flow to the DMS and RTPC volumes. An absolute pressure transducer, PT1, monitors the absolute pressure inside the RTPC

detector volume. A differential pressure transducer, PT2 monitors the differential pressure between the DMS and RTPS gas volumes.



The DMS location must be outside of any magnetic field for proper operation. The DMS can be isolated and bypassed using the manual valves, MV3, MV4, and MV5.

The option of a second or alternate gas supply is provided by a tee connection and isolation valve, MV6.

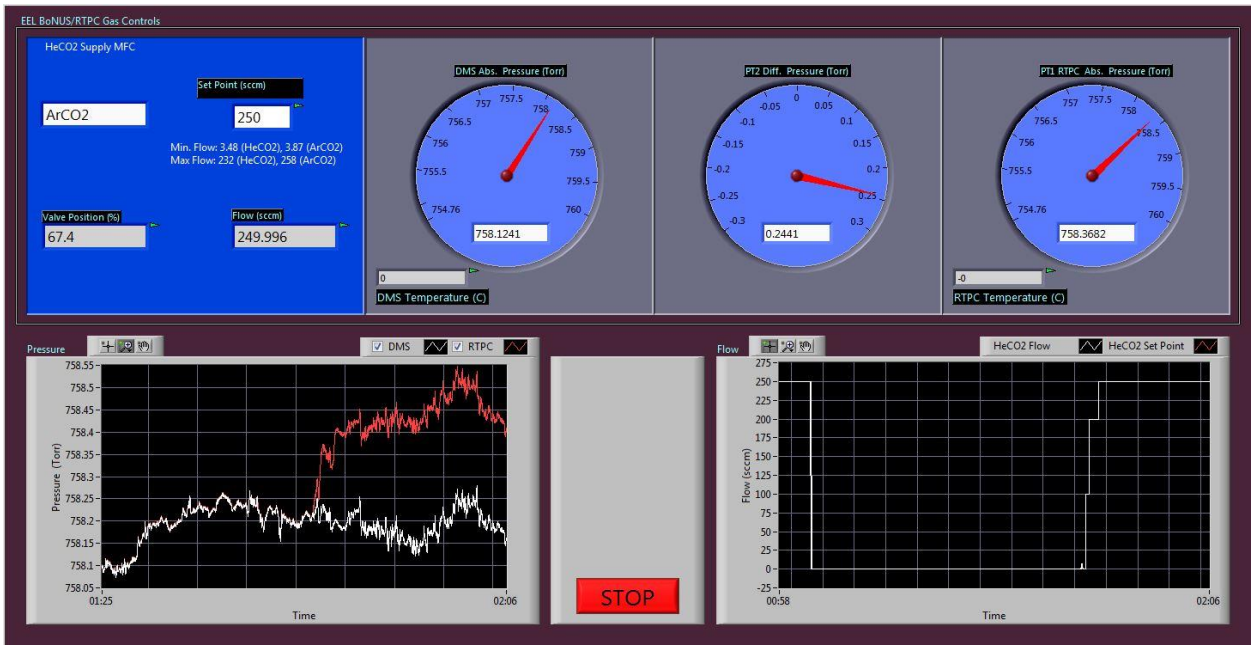
Gas for the He4 Buffer purge is supplied from the Hall B He gas distribution system. The He4 gas cylinders are located at the Hall B Gas Shed, Bldg. 96B. Manual flow meter, FM1, is used to adjust He4 gas flow to the Buffer volume. Pressure gauge PI2 indicates the He gas supply pressure and manual valve MV8 is used to isolate the He4 supply.

The oil filled bubblers act as check valves to prevent backflow of air into the system while maintaining the desired detector pressure and providing a visual indication of gas flow.

The exhaust line directs the exhausted gas to atmosphere outside of the hall or into the hall above the space frame.

The valve panel and DMS location on L1 space frame must be determined prior to running the new gas lines.

Controls and Instrumentation

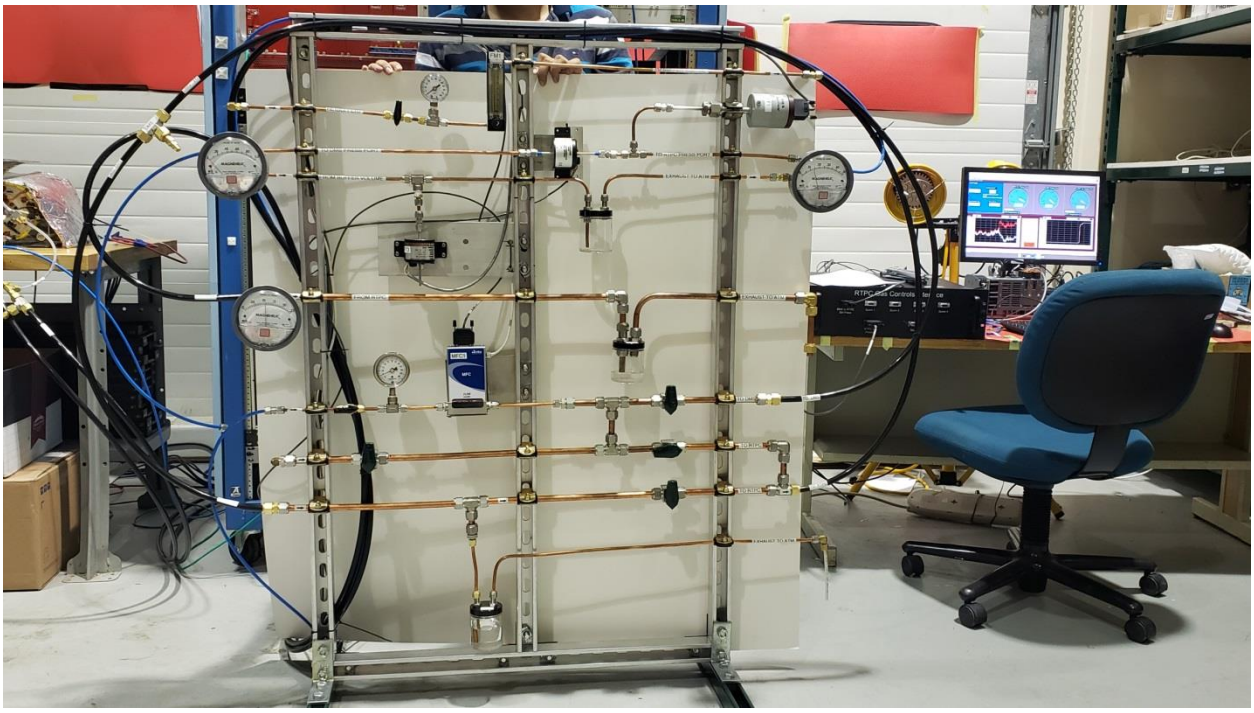


RTPC gas system GUI

A National Instruments cRio is used to control the MFC and read back the gas system flow and pressure signals.

These signals are available on EPICS.
- RTPC Gas Flow
- RTPC Absolute Pressure
- DMS-RTPC Differential Pressure
- Buffer Absolute Pressure

Conclusion



The RTPC gas system has completed JLAB pressure system requirements and is currently under testing in the JLAB EEL rm 125.The gas system will be moved to Hall B in Jan 2020.