

# Hall B Gas Controls Report

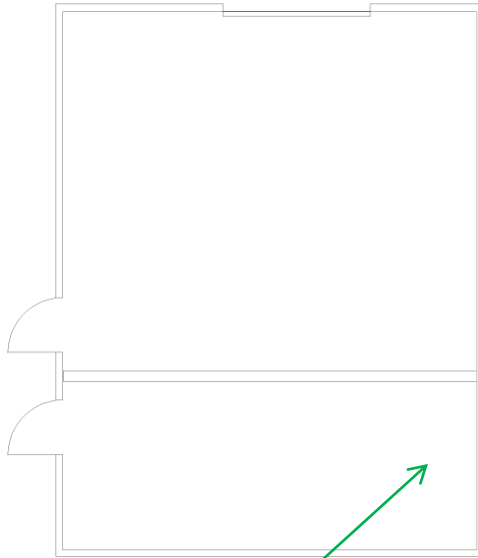
Marc McMullen  
Detector Support Group

# DSG Controlled Gas Systems

1. DC Supply and Mixing System(DC)
2. LTCC Sector 5 C4F10 Test(LTCC)
3. HTCC CO2/N2/Air Purge(HTCC)
4. SVT N2 Purge(SVT)
5. MVT Mixing System(MVT/FT)

# Hall B Gas Controls: System Locations

Hall B Gas Shed



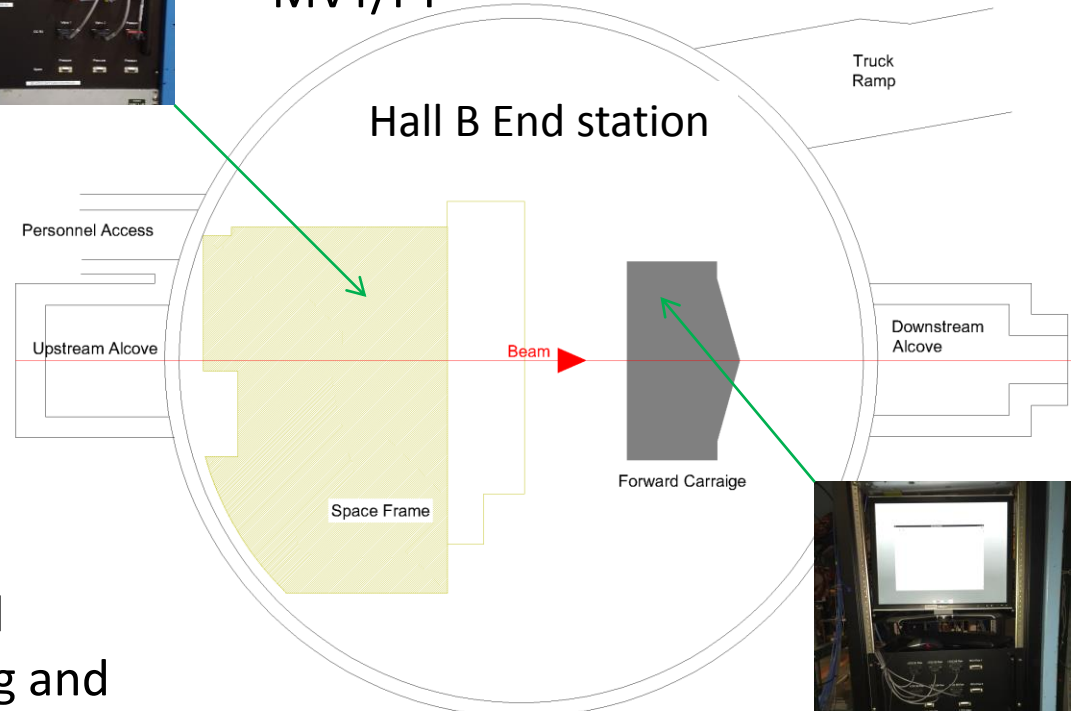
Hall B Gas Shed

- DC Gas Mixing and Regional Supply



Space Framee L3

- DC
- SVT
- HTCC
- MVT/FT



Forward Carriage

- LTCC



# Gas Controls Expert GUI

❖ Daily gas controls checks to verify operation of controls software.

❖ Expert Screen checks to ensure all mass flow controller loops are running.

❖ Check controls tabs.

- DC Supply and Mixing flows and pressures.
- SVT flow.
- HTCC flow, pressure, and moisture.
- LTCC flow set point, valve position, flow, differential pressure.
- MVT flow.

The screenshot displays the 'Gas System GUI.vi' interface. The top menu bar includes 'File', 'Edit', 'View', 'Project', 'Operate', 'Tools', 'Window', and 'Help'. Below the menu is a tabbed interface with tabs for 'cRIO', 'DC', 'HTCC', 'LTCC', 'MVT', 'SVT', and 'Expert'. The 'Expert' tab is active, showing two main sections: 'Drift Chamber - PID Control' and 'Drift Chamber - Mix Calibration'.

**Drift Chamber - PID Control**

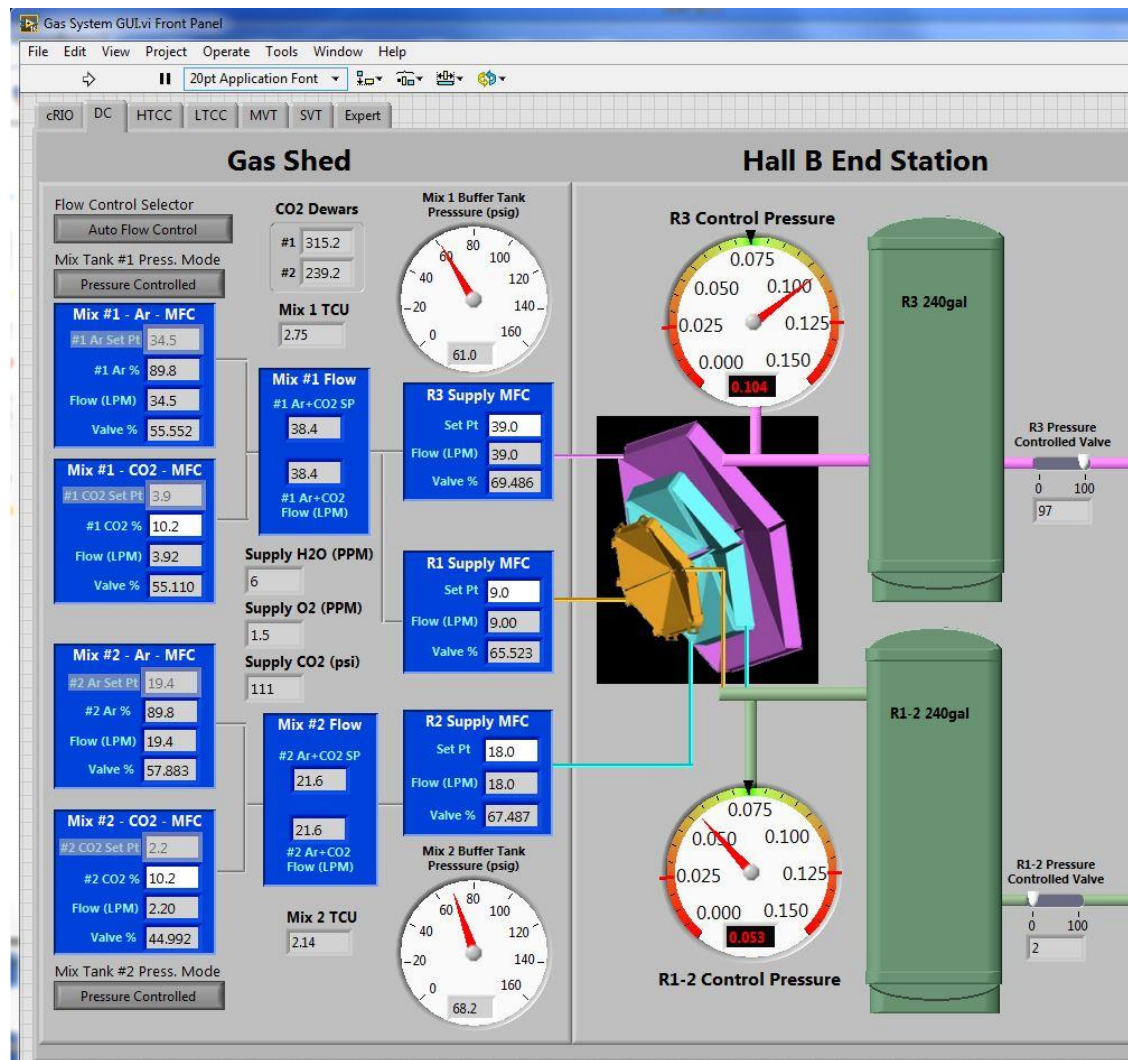
This section contains two PID gain configuration panels. The first panel, 'R1-2 PID Gains', has a 'Proportional Gain (Kc)' of 2.5, 'Integral Time (Ti, min)' of 0.05, and 'Derivative Time (Td, min)' of 0.001. It is linked to a 'Plant Output' of 0.042300. The second panel, 'R3 PID Gains', has the same gain settings and is linked to a 'Plant Output' of 0.035057. A 'DC - PID Set Pt' of 0.075 is also shown. A 'Diff. Pressure' graph is visible on the right, showing a grid from -1 to 1. A 'GUI Polling Delay' of 250 is set in the top right. A 'Reinitialize MFCs' section on the right has three buttons: 'Gas Shed', 'Space Frame', and 'Forward Carriage', all of which are highlighted with a red box. Below this is a 'Stop cRIO Stops' section with an 'Enable cRIO Stops' button.

**Drift Chamber - Mix Calibration**

This section shows a four-step calibration process. Step 1 is 'Configure TCU to Sample Standard'. Step 2 is 'Start Standard Measurement' with a 'Std Sample Time (min)' of 10. Step 3 is 'Stop Standard Measurement' and 'Reconfigure TCU to Sample Mix'. Step 4 is 'Start Mix Measurement' with a 'Mix Sample Time (min)' of 10. A 'Current Step' indicator shows '1' and a 'Progress' bar is at 0. On the right, there are two offset fields: 'DC - Mix 1 - Offset' and 'DC - Mix 2 - Offset', both set to 0.

Gas controls expert screen

# DC Gas Mixing and Regional Supply Controls



DC Gas Controls Tab

# DC Supply and Mixing System

- ❖ Regional Supply (Flow set by Hall B Mech)
  - R1 flow (9Lpm) (low alarm at 1Lpm)
  - R2 flow (18Lpm)(low alarm at 5Lpm)
  - R3 flow (39Lpm)(low alarm at 9Lpm)
- ❖ Differential pressure
  - R1/2 (~0.06 iwc)
  - R3 (~0.100-0.120 iwc)
  - High alarms at 0.17iwc.
- ❖ Low CO2 alarm is 90psi.
- ❖ Mixing system tank pressure controls
  - Pressure (60-80psi)
  - Flow (120% or 80% times demand)

# LTCC Sector 5

## ❖ Flow (set by DSG at 0.1 Lpm)

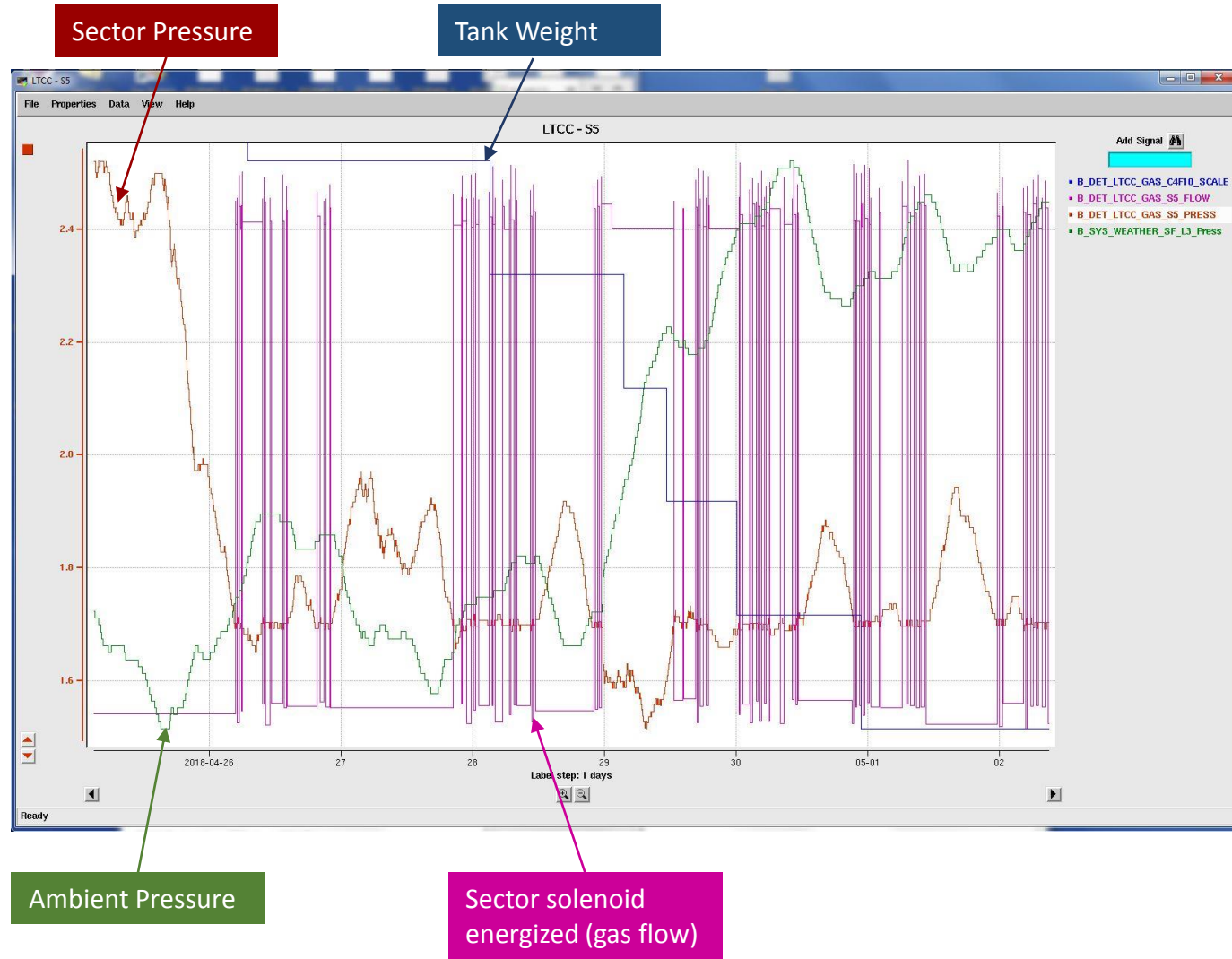
- Ensure gas is flowing
  - if mfc valve is less than 100%, solenoid valve open.
- Flow starts below pressure set point (currently 1.74iwc)
- Flow stops at deadband of set point + 0.02iwc.

## ❖ Differential pressure vs. Ambient

- Observe behavior.

## ❖ C4F10 Tank level

- Daily usage ~0.5Kg/day
  - Usage varies with detector response to ambient pressure.
- Total usage 115kg (75kg to fill, 40kg used)
- 35kg remaining in tank.



S5 Diff. Pressure vs. Amb. Pressure with flow and C4F10 level.

# LTCC Daily Gas Usage

LTCC Sectors	daily avg. flow (L) since 11/08/17	Gas
2	37.41	N2
5	33.03	C4F10
6	614.46	N2

\*Sectors 1,3,and 4 have been removed or bypassed.



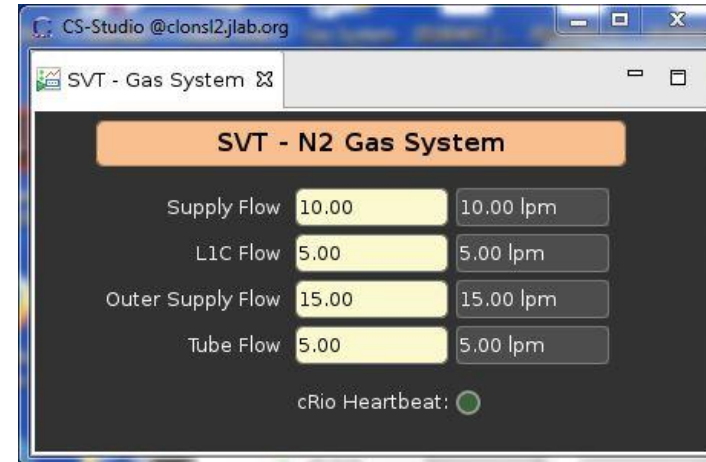
# SVT and HTCC Purge Systems

## ❖ SVT Flow

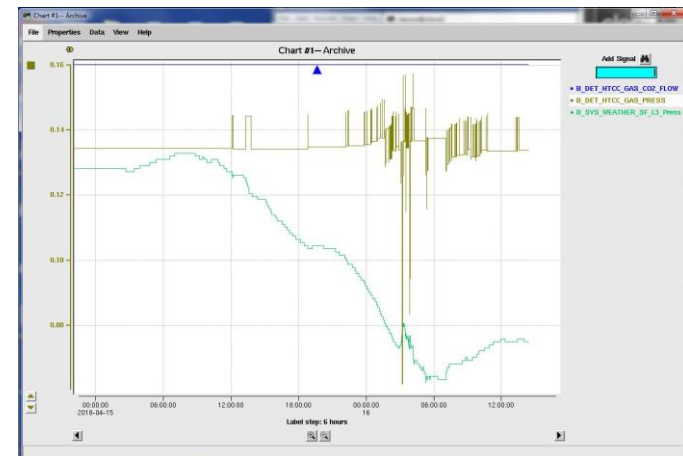
- ❖ Flow should match demand on controls GUI.

## ❖ HTCC

- ❖ Flow should match demand on controls GUI.
- ❖ Differential Pressure ( $\sim 0.1$ iwcc)
- ❖ Moisture ( $< 100$ ppm)



SVT N2 flow in all areas



HTCC Diff. Pressure vs. Amb. Pressure during transient

# MVT/FT Mixing System

## ❖ Mixing system mode

### ❖ Automatic

#### ❖ Mixture (Ar/C<sub>4</sub>H<sub>10</sub>/CF<sub>4</sub> and Ar/C<sub>4</sub>H<sub>10</sub>)

- ❖ Bounces between high (150%) and low(50%) multipliers of the demand flow.
- ❖ Demand flow is set automatically by MVT supply software (75sccm and 150sccm are typical).

#### ❖ Tank pressure (5 to 15 psi)

### ❖ Manual

- ❖ Flow is set by manually by MVT staff.

# Issue: 3/14 Space Frame Gas Outage

- ❖ Hall B Mech. Group disconnected SVT MFCs after consulting with SVT manager.
- ❖ DSG was not notified.
- ❖ Sub VI controlling all space frame MFCs timed out.
- ❖ Affected systems: SVT, MVT mixing, DC regional supply, HTCC MFCs were offline  
**No gas from 8:15am to 11am.**
- ❖ DSG notified by SVT detector manager, that SVT had no gas flow.
- ❖ DSG reinitialized the space frame cRIO.
- ❖ Gas was restored to all systems.

# Issues: Lessons Learned and Preventative Measures

- ❖ Instructions on proper procedure to shutdown any portion of gas control was passed to the Hall B gas community.
- ❖ Controls for the DC MFCs moved to the Gas Shed cRIO.
- ❖ MFC control will be broken down on the three cRIOs by detector, thus minimalizing the effect of a future unplanned outage.
- ❖ DSG recommends that system managers purchase individual cRIOs to provide independent control of their systems.

# Conclusion

- Gas system training for Hall B Mech. conducted
- DSG reviews status daily to ensure the system is functioning properly.
- **Gas system controls functioning very well.**



# The End