

## Usage of Perfluorobutane in the Hall B Low Threshold Cerenkov Counter

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Hall B’s Low Threshold Cerenkov Counter (LTCC) uses perfluorobutane ( $C_4F_{10}$ ). At \$130/kg, limited availability, and long lead time (~6 months) for procurement, accounting gas usage is imperative. This note describes the LabVIEW controls and monitoring program developed to provide a daily account of the flow measured by the mass flow controllers, and graphical data displays.

To fill and operate the LTCC’s sectors 3 and 5 (S3, S5), 500 kg of  $C_4F_{10}$  was procured. Filling of S3 started on 1/23/19, with supply tank scale reading 120 kg; filling stopped on 1/30/19 when the sector pressure was 1.75 wc. The supply tank scale reading was 34 kg, 86 kg of  $C_4F_{10}$  used. Filling of S5 started on 1/30/19 and ended on 2/4/19, also when sector pressure was 1.75 wc; 83 kg of  $C_4F_{10}$  was used. In all, ~170 kg of  $C_4F_{10}$  was used. Figure 1 shows flow rates, sector pressures, and supply tank scale readings.

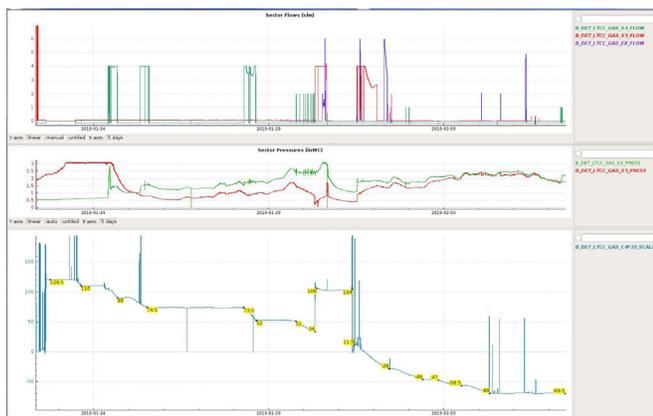


FIG. 1. Top: recorded flow [L/m]. S3 green, S5 red, return flow violet. Middle: pressure [wc]. S3 green, S5 red. Bottom:  $C_4F_{10}$  supply weight [kg].

Since some 42 kg of  $C_4F_{10}$  was available from the previous run for the filling, of the procured 500 kg of  $C_4F_{10}$ , ~372 kg remains. This remaining gas is stored in three tanks containing ~180 kg, ~148 kg, and ~44 kg; the gas is stored in three tanks rather than in one for risk mitigation of relief valve failure.

If sector pressure is greater than 2.5 wc, gas exhausts from the sectors into two 240-gallon buffer tanks, which hold ~40 kg of  $C_4F_{10}$  at 18 psig, 21° C. The stored buffer gas is used when a sector’s pressure drops below 1.7 wc. Controls stop flow to the buffer tanks when buffer tank pressure reaches 18 psi.

Gas is supplied to the sectors from the buffer tanks until the buffer tank pressure (9 psi as of 2/8) falls below the supply tank’s regulator set point of 4 psi. At this point, the supply tank becomes the source. Figure 2 shows the supply and recovery controls diagram for S5.

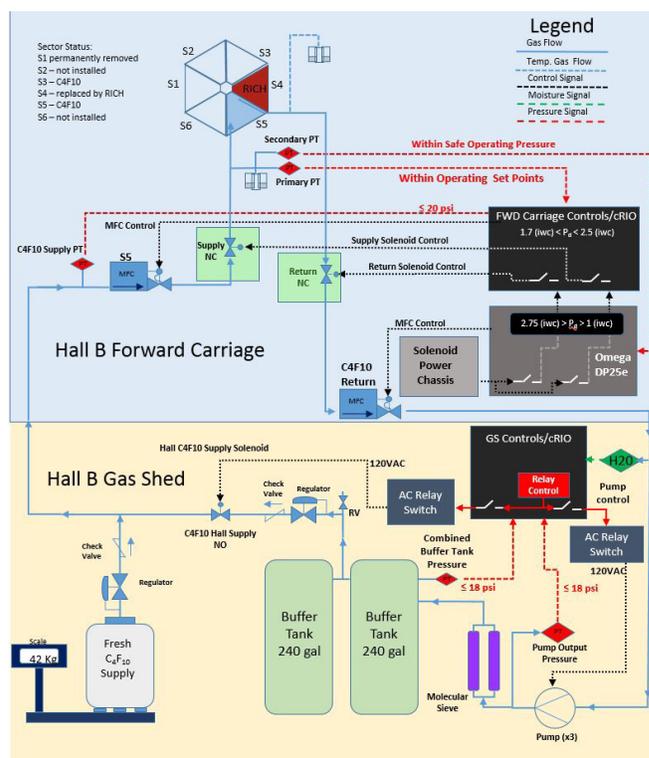


FIG. 2. LTCC gas controls diagram. S5 circuit displayed.

Since the filling of the sectors, the daily flow rate for S3 averages ~19 L/d, while S5 averages ~27 L/d, in all ~53 L/d (~ 0.5 kg).