Analysis of the accumulation measurement on the x arm at LLO March 16-20, 2015

R. Weiss March 25, 2015

Summary The results of the accumulation are: a nitrogen accumulation rate of 3.2 x 10^{-6} torr liters/sec which becomes an air leak rate of 3.9 x 10^{-6} torr liters/sec, a hydrogen accumulation rate of 8.4 x 10^{-6} torr liters/sec at 25.6C which corresponds to a hydrogen outgassing rate at 23C of 5.0x10^{-14} torr liters/sec/cm^2. The state of the large gate valves during the accumulation was GV12, GV5 and GV6 all were hard closed while GV8 and GV11 were open. The accumulation rate under similar conditions (DCC LIGO T1300757 : GV6 closed but with GV8, GV11 and GV12 open) made in August 28-31, 2013 gave an air leak rate of 1.6 x 10^{-6} torr liters/sec and a hydrogen outgassing rate normalized to 23C of 5.7 x 10^{-14} torr liters/sec/cm^2 . At the time of the accumulation in 2013 we thought the air leak came from an unpumped annulus space between "O" rings on one of the large flanges on the test mass chamber. Subsequently, we have learned by direct qualitative leak hunting that GV11 has a similar leak as the GV7 at the mid point of the y arm but with a 10^{-6} torr liter/sec size rather than a 5 x 10^{-5} torr liter/sec size. If we attribute the air leak in the 2013 accumulation to the GV11 leak it implies that the leak has grown by a factor of 2.4 between 2013 and 2015. The hydrogen outgassing is the same in the two accumulations and consistent with 5.4 x 10^{-14} torr liters/sec/cm^2 measured in 2000.

DATA:

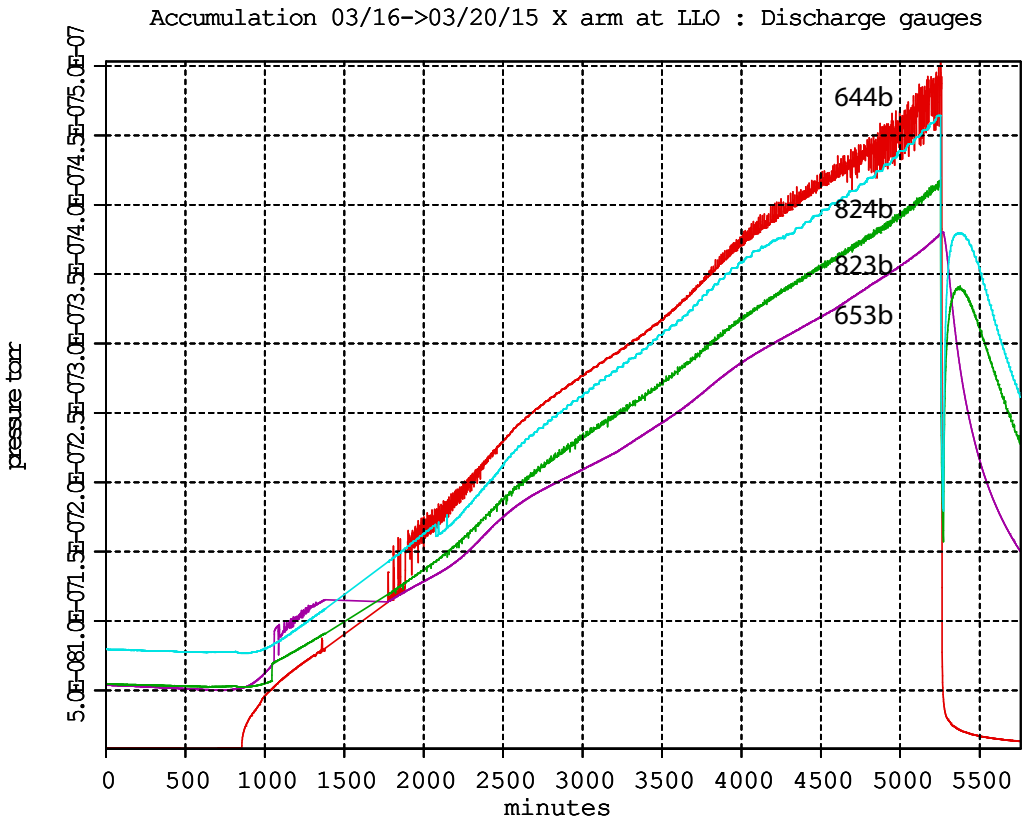

Figure 1: Total pressure measured on four discharge gauges on the x arm during the accumulation. The average rate of rise is dp/dt = 1.45 x 10^{-12} torr/sec. The gauge factor for hydrogen used in the analysis is P(H2, measured)/P(H2, actual) = 0.46 .

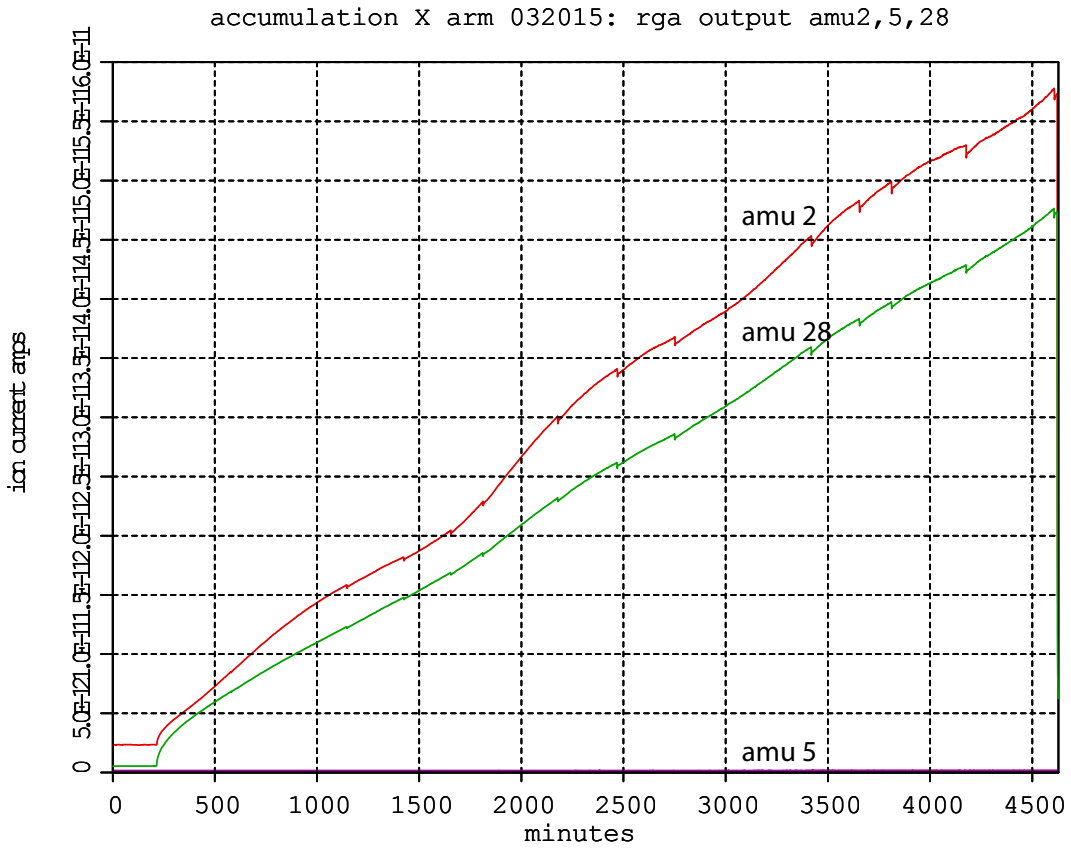

Figure 2 RGA ion current. The average rate for hydrogen is di(2)/dt = 2.096×10^{-16} amps/sec and for nitrogen di(28)/dt = 1.709×10^{-16} amps/sec. The RGA sensitivity for nitrogen 3.82×10^{3} torr/amp derived from the average of the discharge gauges correcting for the difference in hydrogen and nitrogen sensitivity. The tube temperature was varying by 10C peak to peak with an average over the time of the accumulation of 25.6 C. (Do not worry about the difference in origin of the time axes between **Figure 1** and **Figure 2**)