

LAPD is a 30 ton liquid argon tank which cannot be evacuated. The tank air is removed by a purge of room temperature argon gas. The 1st run was during winter 2011-2012 and was instrumented with 4 ICARUS style purity monitors. A 3+ ms electron lifetime was demonstrated during this run which validated the room temperature argon gas purge concept. The 2nd run started during winter 2012-2013 and includes a TPC with a 2 meter drift. A 3+ ms electron lifetime has again been achieved. The room temperature argon gas purge exchanged 7.5 volumes and achieved contamination levels below 6 ppm oxygen, 18 ppm nitrogen, and 1.2 ppm water in about 24 hours. The room temperature argon gas in the tank was then re-circulated through the filters for 77 volume changes which took about 1 week. The oxygen dropped to 20 ppb and the H₂O to about 0.6 ppm. Nitrogen is not filtered but due to the mass ratio between argon vapor and argon liquid, 18 ppm nitrogen in the vapor will only add 21 ppb nitrogen to the argon liquid. The tank was filled through the filters with source liquid argon that contained 200 ppb oxygen and 8 ppm nitrogen. After filling the liquid argon in the tank contained 30 ppb oxygen. An electron lifetime of 1 ms was achieved after 6.6 volume changes of liquid recirculation through the filters and the volume exchange rate was 2.42 volumes changes per day. The lifetime stabilized at an indicated 4 ms after 60 volume changes. The pump flow rate was reduced from 2.45 to 1.22 and then from 1.22 down to 0.69 volume exchanges per day. The electron lifetime remained constant despite the reduced filtration rate indicating that the boil off gas intercepts the contamination outgassing from the cables and other warm surfaces in the ullage space before it can diffuse into the liquid argon. The boil off gas is condensed by a liquid nitrogen powered condenser which then feeds the condensate to the liquid pump suction where it is sent to the filters before returning to the tank. The contamination in the ullage argon gas in the vicinity of the TPC signal feed thru is quite high at 600 ppb oxygen and 2.4 ppm water while the liquid argon a few feet below maintains a 3+ ms lifetime. LAPD has an 80 liter molecular sieve filter and 80 liter oxygen filter (compared to a 22,000 liter liquid argon tank). During the 1st 4 months of run 2 these filters have not saturated. Virgin oxygen filter material must be very carefully regenerated to avoid damaging self heating. This involves slowly increasing the hydrogen fraction of the regeneration gas from 0% to 0.35% during the heated regeneration. At 0.35% hydrogen the filter exhibited 10 K/hr self heating. During run 2 a 4 inch diameter aperture in the tank vapor space was opened to remove a component from the tank and this removal did not introduce significant contamination into the tank. Entry into the tank between run 1 and run 2 revealed a surprising amount of particulate matter inside of the tank despite a 15 micron filter tank return filter. Careful measurements of the bulk liquid temperature reveal it to be isothermal within 0.1 K except within a few inches of the liquid vapor interface where evaporation takes place. Measurements of the temperature gradient in the vapor space in a half full tank show large temperature gradients on the order of 60 K over the 1st 20 inches of vapor above the liquid.