Cryostat/Cryogenics/Purification Parameters: 6/11/09

Parameter	Value	Comments	Review Status
	Argon		
Quantity Ordered	250 tons	Need 230 tons in vessel?	
Supply Argon O2 Contamination Spec	1 ppm	Depends on cost and affects filter sizing. lartpc-docdb documents 430 and 280	
Supply Argon H20 Contamination Spec	1 ppm -	Industry standard.	
Supply Argon N2 Contamination Spec	5 ppm	Depends on cost and affects light output.	
Supply Argon hydrocarbons Contamination Spec	1 ppm	Industry standard	
Required Delivery rate	40,000lbs/day	1 truck/day	
Time to validate received argon	6 Hours	allows for truck turn-around	
Argon Buffer storage volume	1150 ft^3	2 trucks	
Argon Long-Term Storage Dewar Volume	6,300 ft^3 47,200 gallons	Total amount ordered plus ullage	
	Cryostat		
Material	SS304	ASME approved material, cleanable	
Wall Thickness	1 inch	Defined by ASME Coded U stamped Vessel.	
Straight Section Length	39 ft 5 in 12.01 m	Set by transportation	
End Cap Depth (each)	2 ft 4 in 0.71 m		
Total Length	44 ft 1 in 13.44 m	Set by transportation	
Outer Diameter	12 ft 8 in. 3.86 m	Set by transportation	
Height as received	13 ft 8 in 4.16 m	Without full chimneys	
Height from support surface with final flanges	16 ft 4 in 4.98 m	Surrounded by insulation and with 1 ft below bottom of insulation – note no allowance for cables here	
Distance from floor to bottom of insulation	1 ft	To allow insulation to be installed	
Inner Volume	5,213 ft^3 147.6 m^3	without chimneys,	
Weight as received	73,700 lbs 33.5 tonnes	without chimneys, mounting brackets	
Number of TPC signal chimneys	12		
Number of TPC HV Chimneys	1		
Number of PMT Signal Chimneys	1		
Number of PMT HV Chimneys	1		
Number of PrM chimneys	2		
Total inner surface area	1860 ft^2 172.5 m^2	Not including chimneys,	
Surface finish	As rolled		
Cleanliness Spec	Clean per procedure	Cleaning procedures uBdocdb 460, lartpcdocdb 438	
	Cryogenics		
Control System	Commercial		
Ullage Fraction	9%	No value specified in ASME	
Mass of Argon	413,000 lbs 185 tonnes		

Permissable heat load	5kWatts	Nitrogen system capacity
Calculated heat leak	13 Watts/m^2 2250 Watts total	
Heat load from electronics	140 Watts/channel 1300 Watts total	uB docdb document 459
Total Heat Load from Cryostat	3550 Watts	
Insulation thickness	16 in 0.41 m	
Insulation weight	??	
Heat load from Argon Storage Dewar	??	
Nitrogen Usage	75,000 SCF/day	Includes cryostat and storage dewar
Loss rate if cooling fails	1.35 tons/day	
Maximum Allowable pressure	30 psig	To reduce relief piping size
Operating Pressure	2 psig 16.4 psia	Allows positive pressure at all times
Operating pressure range	+/- 1 psig	Affects temperature and therefore drift-velocity, and depth of liquid.
Operating Temperature	88.4K	Set by operating pressure
Temperature Stability	+/- 0.5K	Set by operating pressure range
Temperature variation in active volume	+/- 0.5K	see docdb document 15
Level stability	+/- 0.3 in +/- 7.5 mm	Without any level control, corresponds to +/- 1 psig variation in pressure
Cool-down rate	??	Acceptable ΔT between TPC frame and the wires
Number of Temperature Probes	8	May need more to monitor cool-down rate
Resolution of Temperature Probes	0.1K	
Number of Level Probes	4	Two full range, two short range
Resolution of Level Probes	0.2 in/0.1 in 5 mm/2.5 mm	
Nitrogen storage dewar volume	6,000 gallon	This will maintain the cryostat for a week.
ODH status of building	??	Needs calculation

Purification

Time to fill (cold)	1 day/Delivery truck	
Recirculation rate (liquid)	1 volume/day	
Recirculation rate (gas volume)	1 volume/ 4 hours	See below
Gas purge rate	1 volume/ 4 hours	See lartpc-docdb document 88
Volume of liquid purification system	?? ^{3}	A small volume
Mass of Oxygen filter material (per filter)	??	See lartpc-docdb document 430 on capacity before break-through
Mass of Zeolite (per filter)	??	
Number of Lifetime Monitors	5	4 in cryostat, 1 in receiving circuit
Oxygen Concentration	<100 ppt	Measured directly
Electron drift-lifetime	> 3 milliseconds	
Evacuation time	10^{-5} torr in 7 days	Need to size pumping system