Cryogenic System Documentation For CD1 4/6/2009 RLS

1. A Specifications document(s) will be prepared. Specifications will be written for all aspects of the experiment. Regarding cryogenics the specifications will address safety, physics detector requirements, operating costs, normal and abnormal operating conditions. These specifications will be posted, discussed and subject to general agreement among the collaboration.
2. A cooling system will be provided for the detector vessel and associated equipment. The capacity will be determined for steady state and tank filling conditions. The general plan at present is for two cooling systems, each with enough capacity for the steady state heat load. During normal operations one will serve as a backup. During filling both cooling systems will run. Alternatives considered will be purchased liquid nitrogen and refrigeration.
3. A fill procedure will be developed. About ten truck loads will be needed to fill the detector vessel. The procedure will include plans to test the truck load, connect it to the system piping, purify the liquid and transfer it to the detector vessel. Alternatives will include the possibility of a buffer volume, unloading time, purification scheme, and testing requirements.
4. An evaluation of the need for argon storage will be written. The initial space and cost for a full sized argon storage tank will be balanced against storage of the argon during detector maintenance periods.
5. A purification plan will be written to purify the detector vessel starting with it full of air. The vessel will be designed for full vacuum. It will also be equipped with nozzles to push air out without evacuation. This may be used to demonstrate the feasibility of a very large, non-evacuated detector tank. The purification system for the detector vessel will be designed to run continuously. The design will be based on experience at Icarus and Fermilab. Flow capacity be evaluated for purification time vs. initial equipment cost. Other alternatives will include the purification of gas as well as liquid, backup equipment, regeneration procedures, flow rate, valve type, etc.
6. A preliminary hazard analysis will be done for the experiment. It will include a list of relevant ES&H chapters, how they will be addressed. It will also include a discussion of secondary containment. Although there are no standards requiring secondary containment for argon storage there are good reasons for providing it.
7. A piping and instrument diagram per ANSI/ISA S5.1 will be drawn. This diagram will schematically show all valves, instruments and piping connections for the cryogenic and gas handling systems.
8. The cryogenic instrument and control system will be described. A modern, industrial control system will be described. The descriptions will include controllers, displays, possible web servers, interfaces with DAQ systems, backup power, and other features. Alternatives will be discussed.
9. Plans and procedures for commissioning, testing normal operations, abnormal operations, will be outlined at this time. Abnormal conditions will include equipment failure and repair, power outage, leaks, etc. These needs will be folded into the earlier topics.