Experimental Safety Assesment Document for g6c

July 30, 2001

1 General Safety and New Equipment

The Hall B, g6c runing period from August 17, 2001 to September 12, 2001 consists of experiment 01-017. This experiment studies meson spectroscopy of photo-produced few-body final states on a liquid hydrogen target. There are no new elements installed as part of the CLAS endeavor. However, compared to a standard CLAS photon run, E01-017 will run with the target one meter moved in the upstream direction. The start counter will be moved together with the scattering chambera distance of about 13 cm relative to the new target position. E01-017 will be using the PRIMEX pair spectrometer consisting of a power supply and an 18D36 dipole magnet. During g6c, the PRIMEX collaboration will be performing parasitic PWO calorimetry tests. This test will be done using electrons produced by a thin radiator(10^{-5}) upstream of the target and deflected by the pair spectrometer magnet.

The operation of 01-017 present the same safety risk and operational guideline that are specified in the CLAS conduct of operations. The operation of the cryogenic target has been reviewed and is covered by the existing documentation present in the Hall B counting house.

This document outlines the hazards and operating guidelines for the dipole magnet during the g6c period and is considered as a supplement to the base ESAD for Hall B. The beam pipe inside the magnet ends with a flange containing a vacuum window. The vacuum window is a $2.5in^2$ x $127\mu m$ Kapton foil aluminized on one side that has been presure tested to 18.4 psid.

2 Hazard Analysis

The hazards associated with the magnet and power supply are electrical, magnetic, fire, and implosion of the downstream vacuum window.

- **Electrical:** The power supply has a maximum output current of 3500 A at a voltage of 110 V and thus presents a potentially lethal hazard.
- **Magnetic:** The magnet produces a maximum central field of 22 kG. As the magnet has a return yoke, the external field is much smaller than the central field. Although the magnetic field is primarily confined to the magnet gap, fringe fields are strong enough to accelerate unsecured metal objects in the vicinity of the magnet. In addition these fields may present a hazard to individuals using a pacemaker. Fields may also corrupt magnetic recording media or interfere with the operation of mechanical devices with metallic parts.
- **Fire:** There exists a potential fire hazard associated with high current power supplies. A failure of the coil cooling system may lead to a fire in the coils.
- **Window Implosion** The vacuum window may rupture due to a mechanical failure or from a puncture due to contact with a foreign object. The resulting pressure wave from

a rupture of the beam pipe window inside the magnet presents a hazard to personnel in the vicinity of the magnet during the rupture event.

3 Hazard Mitigation

- **Electrical:** Access to the power supply or magnet can only be made after following "Lock and Tag Procedures" as described in Chapter 6110 of the Jefferson Lab EH&S Manual for the power supply. When working on the power supply, the responsible people will follow the guidelines in the electrical safety chapter of the EH&S manual.

- **Magnetic:** Signs must be posted which indicate the possible presence of high magnetic fields (these are standard Jefferson Lab safety signage). The area surrounding the magnet will be roped off whenever it is possible that the magnet will be energized. The ropes will be at a distance from the magnet such that the fringe fields are less than 500 T (5 G) at full current (3000 A). This is roughly one meter.1 Personnel with ferromagnetic implants and those wearing electronic medical devices are not allowed inside the roped off area. Due to the large magnet gap size (8"), personnel working inside the roped-off area should be aware of the possible presence of a magnetic fringe field, as well as a high field in the magnet gap.

- **Fire:** The magnet coils are protected from over-heating (and hence fire) by the cooling water system in the Hall. There are Klixon devices installed on the magnet and interlocked to the power supply that will shut off the power supply in case of the coil over-heating.

- **Window Implosion** Safe work practice will reduce the chances of accident. Noise and pressure wave hazards are mitigated by ear protection and distance.

  1. All work in the vicinity of the magnet must follow official Lock and Tag procedures as described in Chapter 6110 of the Jefferson Lab EH&S Manual. This will reduce the possibility of stray material caught in the magnetic field from impacting the window.
  2. Ear plugs must be worn during work that takes place within the vicinity of the magnet.
  3. Signs must be posted indicating the vacuum window presence and the use of ear plugs in the vicinity of the magnet when vacuum is present.

4 Guidelines for Operation

Applying Power to Power Supply

1. Rope off the area around the magnet.

2. Sweep the area inside the ropes for magnetic material. Make sure that the area is clean, and that no foreign objects are in or near the aperture of the magnet or the inside of the stay-clear zone. All such material must be removed and placed outside of the ropes.
3. Make sure all protective barricades, signs, etc. are in place to warn of possible exposure to magnetic,electrical, and vacuum hazards.
4. Verify all covers on energized conductors on the magnet are securely in place.
5. Verify all power supply doors and cabinets are closed and locked.
6. Check that the cooling water is turned on. Valves on the magnet and on individual cooling paths must all be open.
7. Verify that water flow is present–feel the hoses.
8. Turn on the flashing beacons.
9. Remove the administrative lock on the power supply disconnect switch. Make sure that Jefferson Lab's Lock and Tag procedures, as described in Chapter 6110 of the Jefferson Lab EH&S Manual, are followed throughout the following procedures:
   (a) Up-to-date Lock and Tag training.
   (b) Training on the operation of the power supply and magnet.
   (c) Authorization by A. Freyberger
10. Enable main power on the power supply and ramp output current according to standard procedures.