TOSP to test FMWPC (wire chambers) in EEL 126

1 Introduction

The purpose of this TOSP is to provide an overview of the test and setup for the Forward Multi Wire Proportional Chamber (FMWPC) in EEL 126. This document describes the detector and associated hazards and mitigation, and outlines the operational procedures. A list of personnel who are authorized to operate the chamber and associated equipment is given at the end of this document.

2 Description of the Test Setup

There are in total 8 identical FMWPC chambers each with a dimension of roughly 60 inches by 60 inches and a thickness of 1 inch. The weight of one chamber is roughly 150 lb. Only one chamber is operated and tested at any given time.

The test setup covered by this TOSP includes in addition to the wire chamber a set of two plastic scintillator paddles that will trigger on cosmic rays passing though the wire chamber that is laying horizontally on a table. Since these wire chambers are build to detect muons they are build very sturdy and are fully self supporting with strong frames.

The purpose of the test is to study the performance of each wire chamber and determine its operating parameters.

To operate the wire chamber two high voltage (HV) connections are required to supply the chamber with a maximum of +1800V. This is provided by a standard HV power supply using certified cables and connectors (SHV) according to JLAB requirements. To power the electronics two +5V and two -5V connections are required. The power supply as well as the cables and connectors are defined by the electronics group at JLAB (F. Barbosa). In addition, the chamber also requires an operating gas. This will be an Argon, CO2 gas mixture provided by a high pressure gas cylinder with a pre-mixed gas of 90% Argon and 10% CO2. The gas pressure and flow is controlled with a regulater with some additional hardware (see below in Hazard section).

The cosmic ray trigger is provided by the two scintillator paddles and will require four channels of about -1600V HV. This voltagees are provided by standard HV power supplies used for regular operation in HallD. The electronics for digitization requires one standard VXS crate and a standard NIM crate with standard NIM electronics to be used to trigger the data acquisition system that is controlled by a standard desktop computer. This equipment will use standard 110V AC power provided by standard electric outlets.

3 Goal of the TEST

The purpose of the test is to determine the performance of the chamber, its operating parameters and its detection efficiency, all as a function of chamber HV. For this purpose

cosmic data will be taken for different chamber HV settings up to about +1800V to determine the "plateau" curve. Once the optimal operating HV is determined from the data of the "plateau" curve, drift time spectra can be recorded to determine the time to distance relation and characterize the detector response, its efficiency and the noise levels.

4 Hazards

The following hazards for this test setup can be readily identified:

1. HV power for chamber operation and scintillator paddle operation.
2. LV power for operating the preamplifier electronics on the wire chamber
3. High pressure gas cylinder and gas supply to the wire chamber
4. AC power to operate the VXS and NIM crate as well as the DAQ computer

The following measures are taken to mitigate all these risks:

1. All cables adhere to the CL2 standard.
2. HV
    - Use standard HV power supplies used at the lab that are designed with protective connectors (SHV) to prevent exposure of HV. These systems are in regular operation in HallD.
    - Use of JLAB standard HV cables rated for the appropriate HV with the approved SHV connectors.
    - The PCB boards with the HV capacitors, resistors and preamplifier electronics are encased in a protective cover made from metal. This shield is heavily grounded to the detector frame and servees as a faraday cage to reduce detector noise. This shield also serves as a guard against direct exposure of any HV or LV. Only the connectors for signal cables and LV and HV cables are directly accessible by the operator.
3. LV
    - Use of standard comercial LV power supplies (Wiener) that are also used in HallD.
    - D-sub type connectors will be use to connect the LV cables to the detector. The cables will be the same type as what is used in HallD.
4. High pressure gas
    - Use of regulator with limiting orifice on the high pressure side and a relive valve on the low pressure side to limit the maximum gas pressure and flow.
    - Use of manual rota-meter with a needle valve to limit the gas flow.
    - Maximum gas flow is 500 sccm (standard cubic centimeters per minute)

5 List of Personnel Working on the Project

The individuals whose signatures appear below are authorized to operate this test setup. The detector and associated equipment are located in EEL 126. The signatures indicate that each person has read and understood the contents of this document and agrees to strictly follow the established operational procedures. A name can be added to the list below only by Benedikt Zihlmann and only after the person has read and understood the contents of this document and has had the hazards and operational procedures explained to them by the existing authorized personnel.

Personnel	Read and Understood
Beni Zihlmann	
Elton Smith	
Alexander Austregesilo	
Fernando Barbosa	
Mark Stevens	