



PHENIX MuTr OPS IN THE PEH

procedure name

PHENIX Procedure No. PP-2.5.2.12-07

Revision: C

Date: 10-21-04

Hand Processed Changes

HPC No.

Date

Page Nos.

Initials

Approvals

PHENIX S E & I Date

Cognizant Scientist/Engineer Date
/Activity Manager

PHENIX Safety Date

CA-D Safety/Liaison Scientist Date
/Liaison Engineer

REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	WRITTEN BY	APPROVED BY	TYPED BY
A	First Issue	3/15/2001	n/a	R. Towell, W. Lenz, A. Etkin	n/a
B	No record of changes	12/04/2002	n/a	n/a	n/a
C	No record of Changes	10/21/2004	n/a	n/a	n/a

1 Purpose

The purpose of this document is to specify the operation of the High Voltage and Low Voltage Systems for the PHENIX Muon Tracking System.

This document describes:

1.1 On start-up:

- 1.1.1 procedure for turning on and off high voltage
- 1.1.2 procedure for turning on and off low voltage

1.2 For normal running:

- 1.2.1 the standard procedure for turning on and off high voltage
- 1.2.2 the standard procedure for turning on and off the low voltage

2 Responsibilities

During any data taking period there will be at least four people on shift in the PHENIX counting house. Prior to data taking, there will be a period of chamber commissioning when the chambers are flushed with operating gas and tested at high voltage. High Voltage (HV) and Low Voltage (LV) power shall not be left operating unattended.

During commissioning, it will be the responsibility of the Gas Experts to establish the flow of operating gas, as described in [PHENIX Procedure No. PP-2.5.2.12-09](#). During this period there can be no high voltage on the Muon Tracking Chambers. It is the responsibility of the Muon Tracking Chamber Gas Experts to ensure that the HV is off during this period.

During commissioning, it is the responsibility of the Muon Tracking Chamber Experts to bring on the HV in a safe manner, as described in Sec. 6.1

During commissioning, it is the responsibility of the Muon Tracking Electronics Experts to bring on the LV in a safe manner, as described in Sec. 6.3

During data taking, it will be the responsibility of the PHENIX Shift Crew to:

- 2.1 *Monitor the status and alarms of the gas system according to a prescribed check off list [MuTr-Gas-CHECKLIST-V1.0](#) (Attachment 5) at least once a shift (eight hours).*
- 2.1 *Monitor the voltages, currents and status of the HV channels throughout the shift, according to a prescribed checklist (Attachment 1).*
- 2.2 *Monitor the status and alarms of the LV system throughout the shift, according to a prescribed checklist (Attachment 2).*
- 2.3 *In the event of an alarm or irregularity, contact an expert from the Expert Call List (Attachment 3).*

It is the responsibility of the Muon Tracking System Experts to:

- 2.4 *maintain the Chamber Gas System in a safe operating condition in accordance with [PHENIX Procedure No. PP-2.5.2.12-09](#).*
- 2.5 *maintain the Chamber HV System in a safe operating condition. This includes*
 - 2.5.1 verifying the readiness of the chamber for HV,
 - 2.5.2 turning on the HV according to the operating procedures described below,
 - 2.5.3 posting any special instructions or notifications as required, and
 - 2.5.4 carrying out any emergency actions, as prescribed in the Procedures section of this document.
- 2.6 *maintain the Muon Tracking Low Voltage System in a safe operating condition. This includes:*
 - 2.6.1 Verifying the readiness of the front-end electronics for low voltage power
 - 2.6.2 Turning on the LV according to the operating procedures described below,
 - 2.6.3 Posting any special instructions or notifications as required, and
 - 2.6.4 Carrying out any emergency actions, as prescribed in the Procedures section of this document.

3 Prerequisites

The Chamber Experts shall have read or have training in the following areas:

- 3.1 C-A Local Emergency Plan for the Collider-Accelerator Department, C-A_3.0,
- 3.2 The PHENIX High Voltage Control System manual
- 3.3 PHENIX Emergency Plan C-A_3.16
- 3.4 Geographical layout of the experimental area (routes of egress, location of emergency equipment, phones and controls)

4 Precautions

The PHENIX Safety Monitoring and Control System (SMCS) is interlocked with the power to the Gas Room of the Mixing House (MH). In the event of any Level 3 alarm, all power to the Gas Room of the MH is shut off. The Level 3 alarms include:

- Detection of flammable gas by the VESDA system in the Interaction Region (IR),
- Detection of smoke by the HSSD system in the IR.
- Flammable gas alarms in the MH.
- Heat sensor alarms in the MH.

4.1 High Voltage System Precautions:

- 4.1.1 The SMCS is interlocked with the High Voltage (HV) power supplies. Activation of the alarms automatically shuts down the power to all HV supplies,
- 4.1.2 The total stored electrical energy in the high voltage systems is low. The HV power supplies are current limited to less than 1 uA per channel unless otherwise stated with an absolute limit of 100 uA.
- 4.1.3 For the safety of the chambers, HV will not be turned on, except for low voltage testing, until operating gas has filled the chamber. Voltages less than 1000 volts may be applied to the chambers for short periods of time provided the operation is monitored at all times by a Chamber expert. In order to raise the HV to operating voltage, the chamber must be filled with operating gas. This means that operating gas must have been flowing for at least 48 hours prior to increasing the HV above 1000 volts.
- 4.1.4 All HV controls associated with the MuTr HV system are to be operated by designated MuTr HV experts only, or by the PHENIX shift leader following specific instructions from MUON TRACKING SYSTEM experts (see Attachment 1).

4.2 Low Voltage System Precautions:

- 4.2.1 The SMCS is interlocked with all power to the PHENIX hall including the Low Voltage (LV) power supplies. Thus, activation of the alarms automatically shuts down the power to all LV supplies. The LV system is used to provide power to the Chamber Front End Modules (FEMs) that are monitored by Dallas chips through Arcnet slow control system. Over temperature indication on selected probes will NOT shut off power to the entire muon LV system.
- 4.2.2 Any reconfiguration of the MuTr LV beyond turning the power on/off is to be performed by MuTr LV experts only, or by the PHENIX shift leader following specific instructions from Muon Tracking System experts (see Attachment 2).

5 Emergency Procedures

In the event of an emergency, follow the procedures outlined in PHENIX Emergency Procedure 3.16 detailed below.

5.1 *In the event of a fire or fire alarm in Building 1008, members of the PHENIX Shift Crew shall (in order of priority)*

- 5.1.1 the nearest fire alarm if the alarm is not already sounding (Attachment 8.1 of PHENIX Emergency Procedure 3.16 gives the layout of the building 1008 showing the location of the gas system area and the fire alarm pull stations in the area),
 - 5.1.2 Go to a safe location and call 911 or 2222.
 - 5.1.3 Pull Await the arrival of the Fire/Rescue Group. If the fire is small, the Shift Crewmember may return to the area and attempt to extinguish the fire using a fire extinguisher.
 - 5.1.4 The Shift Leader shall report to the Fire/Rescue Captain upon arrival at the Command Post.
- 5.2 *In the event of an emergency related specifically to the Muon Tracking Chamber electronics,*
- 5.2.1 The SMCS is interlocked with the Gas, HV and LV power supplies. Activation of the alarm automatically shuts down the flammable gas flow and all power to HV and LV supplies. No further action is needed for this.
 - 5.2.2 Notify the MuTr Chamber Expert On Call that an emergency affecting the MuTr Chambers has occurred

6 Standard Operating Procedures

6.1 HV System procedures

- 6.1.2.1. Initial Startup
- 6.1.2.2. Only Muon chamber experts will turn on and turn off the north and south muon chambers in preparation for the run
- 6.1.2.3. The muon chamber experts will establish the normal operating conditions and notify the operators when the chambers can be operated normally. Appropriate settings and limits will be posted and added to the operations procedure as an attachment.
- 6.1.3. Normal running procedure
 - 6.1.3.1. The shift operator will turn on the HV to stand by during tuneup via the MuTr GUI.
 - 6.1.3.2. Upon stable beam the shift operator will turn up the HV by the MuTr GUI.
 - 6.1.3.3. During a beam fill the HV will be returned to standby.
 - 6.1.3.4. The shift operator can turn off the HV via the GUI when deemed necessary.
 - 6.1.3.5. Trips are automatically reset by the MuTr HV program.
 - 6.1.3.6. If any uncertainty exists as to the correct operation of the MuTr HV than contact the Muon chamber expert on call.
- 6.2. *HV System Procedures: Turning on HV:*
 - 6.2.2. If the HV is being turned on for the first time, verify by checking with a MuTr Chamber Gas Expert that operating gas has been flowing to the Muon Tracking Chambers for at least 48 hours before attempting to bring on the HV.
 - 6.2.3. Check that the appropriate current limits are in place for the power supply. These limits are given in Attachment 1. The Muon Chamber Experts shall maintain a HV logbook where the operating parameters of the HV settings are recorded. This shall include the current limits, target voltages, ramp rates, operating voltages and currents, and trip tolerances.
 - 6.2.4. As a check, the chamber is to be turned on at very low voltage to identify any broken wires. Set the target voltage for each HV output channel to 100 volts.
 - 6.2.5. Check that the ramp up rate for each HV channel is appropriate (25 volts per second).
 - 6.2.6. Ramp up the HV.
 - 6.2.7. If any of the HV channels trips, disable that and the neighboring HV channels until the reason for the trip is understood. Then begin the procedure again from 6.1.4
 - 6.2.8. If there are no HV trips, verify that the operating currents are appropriate.
 - 6.2.9. Change the target voltage to the correct operating voltage for each chamber, as given in Attachment 1.
 - 6.2.10. Continue ramping up the HV.
 - 6.2.11. When ramping is complete, verify that the operating currents are appropriate, as given in Attachment 1. If any channel draws more than 0.5 uA of current it should be disabled and a
 - 6.2.12. note made of it in the logbook.
 - 6.2.13. HV is ready for chamber testing.
- 6.3. *HV System Procedures: Turning off High Voltage to a chamber:*
 - 6.3.2. Begin ramping down the HV.
 - 6.3.3. Verify by the read back that the HV is off the system.
 - 6.3.4. In the event of irregularities, call a Muon Chamber Expert.
- 6.4. *LV System Procedures: Turning on Low Voltage:*
 - 6.4.2. Verify that the AC is on to the LV crate.
 - 6.4.3. Click on the appropriate button to turn LV power on to the channel required.
 - 6.4.4. Verify that the button changes color to indicate power is on (RED). This may take ten to twenty seconds. If not, call a Muon Tracking Electronics Expert.
 - 6.4.5. Open Muon Tracking System LV Distribution Control GUI. Click on the appropriate button to turn on LV of a given channel. Verify that the button changes color from Green to Red (power is on). In normal operation mode, operator only needs to click "ALL ON" button to turn on all LV channels.
- 6.5. *LV System Procedures: Turning off Low Voltage:*
 - 6.5.2. Click on the appropriate button on the LV Distribution GUI to turn LV power off to the channel required. In the case need to turn off all channels, hit "ALL OFF" button.
 - 6.5.3. Verify that the button changes color to indicate power is off (Green). This may take ten to twenty seconds. If not, call a Muon Tracking Expert.

7 Documentation

All irregular HV readings and trips should be noted in the PHENIX Online Logbook

8 References

- 8.1 C-A_3.0, "Local Emergency Plan for the Collider-Accelerator Department."
- 8.2 A copy of The PHENIX High Voltage Control System manual, which contains explicit instructions for operating the system, is kept in 1008 next to the phones0 console. It is also available at http://www.phenix.bnl.gov/phenix/WWW/publish/djkim/HV/mutrHV_instruction.html.
- 8.3 Detailed documentation of the MUON TRACKING Low Voltage Power System is available at <http://www.phenix.bnl.gov/phenix/WWW/muon/PowerControl/>

9 Appendix

- 9.1 Attachment 1: - Check list for the Muon Chamber High Voltage System
- 9.2 Attachment 2: - Check list for the Muon Chamber Low Voltage System
- 9.3 Attachment 3: - Call list for the Muon Chamber Gas, HV, and LV Experts.
- 9.4 Attachment 4: - PHENIX MuTr Gas System Checklist

Attachment 1:**MUON TRACKING SYSTEM HV Settings**

The MUON TRACKING SYSTEM chambers have the following nominal operating voltages and trip currents:

Anode Voltage	1850 V (station-1), 1875 (station-2), 1900 (station-3)
Individual Trip Current	1 uA
Bulk Supply Trip Current	10 uA

The SA1 is responsible for making sure all voltages are at their setpoints, making sure that all currents are $< 0.5 \text{ uA}$ and to reset all channels which trip. If a channel trips more than 3 times during a data taking run it should be disabled a note made in the PHENIX Online Logbook as with any other irregularity.

NB: These voltages are subject to change as we learn about the chamber operation. Also some channels may be allowed to exceed the 1 uA trip limit. Please refer to the MUON TRACKING SYSTEM HV Logbook for additional information on the HV and trip current settings.

Attachment 2:**MUON TRACKING SYSTEM LV Settings**

MUON TRACKING FEE has 20 separate channels of Low Voltage (LV) per arm and 5(7) additional channels for the Glink/Clink crate LV in the South(North) arm. During data taking, PHENIX shift crews can turn on or off the LV system, but **Any change of LV settings must be preformed by Mutr experts only.**

Check list:**LV power supply:**

- Check PHENIX LV GUI control buttons, should be in RED color (Red =ON; Green = OFF).

LV power distribution GUI:

- Check Mutr LV Distribution GUI control buttons, should be in RED (Red = ON; Green = OFF).

Water cooling:

- If PHENIX water cooling flow fails, LV for the muon tracking FEE should be turned off to prevent overheating.

Attachment 3.1: Muon Tracking Gas System Experts

The following people have been trained to operate the PHENIX Muon Tracking gas system. They have completed the prerequisite BNL training courses (see 3.1).

Carter Biggs	x7515
David Lee	505-667-8888
Walter Sondheim	

Additional qualified users are to be listed below and posted in the gas mixing house:

Attachment 3.2: Muon Tracking High Voltage System Experts

The following people have been trained to operate the PHENIX MUON TRACKING HV system. They have completed the prerequisite BNL training courses (see 3.1).

Dong-Jo Kim	x7336, x4803
David Lee	505-667-8888
Steve Pate	505-646-2135
Mikhael Stepanov	x7421
Ahmed Al-Jamel	x7421

Additional qualified users are to be listed below and posted in the counting house:

Attachment 3.3: Muon Tracking Low Voltage System Experts

The following people have been trained to operate the PHENIX Muon LV system. They have completed the prerequisite BNL training courses (see 3.1).

Olivier Drapier	x3919, 33 1 69 33 31 48
Doug Fields	505-277-1466
Frederic Fleuret	x3919, 33 1 69 33 31 03
Jean Gosset	x3919, 33 1 69 08 73 05
Raphael Granier de Cassagnac	x3919, 33 1 69 33 31 51
Mike Leitch	x6277, 505-667-5481
Ming Liu	x6277, 505-667-7125
Steve Pate	505-646-2135

Additional qualified users are to be listed below and posted in the counting house:

Attachment 4 : MuTr-Gas-CHECKLIST-Version 2.16 May12, 2004

PHENIX MuTr GAS SYSTEM CHECK LIST

(To be filled out once per shift by the shift assistant)

Item	Check Point	Nominal	Min.	Max.
1	ArRegulator Pressure,PIT1	20 psi	13 psi	30 psi
2	CO2 Regulator Pressure,PIT2	25 psi	13 psi	30 psi
3	CF4 Regulator Pressure,PIT3	12 psi	10 psi	20 psi
4	Tank Output Pressure,PIT 4	60 " WC	30 " WC	75 " WC
5	Supply Pressure,PI4	4" WC	1" WC	10" WC"
6	Return Pressure, PIS1	0.3" WC	0.0" WC	+1.0" WC"
7	Total Supply Flow, FM5	8 LPM	2 LPM	12 LPM
8	Flow to South FM6	4 Lpm	1 Lpm	8 Lpm
9	Flow toNorth, FM7	4 Lpm	1Lpm	8 Lpm
10	Flow to Vent, FM 4	1.0 LPM	0 LPM	12 LPM

Sensor	Function	Range
FM1	Argon Flow	0.1 - 6 LPM
FM2	Co2 Flow	0.15 - 4 LPM
FM3	Cf4 Flow	0.25 - 4 LPM
SPIT5	South Input Pressure	.25" - 2" (nom 0.85")
SPT6	South Output pressure	.05" - 1" (nom 0.2")
NPIT5	North Input Pressure	.25"- 3" (nom 3.0")
NPT6	North Output Pressure	.05"-1" (nom .25")
C02_FM	Co2 mix	28%-32% (nom 30%)
CF4_FM	CF4 Mix	18%-22% (Nom 20%)
Program	Current time on Monitor screen	Should be within 10mn of PC clock
Alarms	Alarm system	Should be Enabled

In emergencies, contact Carter Biggs (BNL pager 344-3456 then 8535 then 7821) office x7515)

or

Robert Pisani (BNL pager 344-3456 then 8539 then 7821) office x5301 , Cell: 631-553-0252

(dont leave voice mail on the Cell)

USE PAGER NUMBERS FIRST. Page one person at a time.

IF one person does not reply in 10mn try the other person