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Fermilab

Directorate

MEMORANDUM OF UNDERSTANDING FOR THE 2006 MESON TEST BEAM PROGRAM

T957

Northern Illinois University Tail-catcher/Muon Tracker Test

January, 2006

INTRODUCTION

This Memorandum of Understanding requests beam time at the Meson Test Beam Facility in Jan-Feb 2006 for tests with a few layers of the CALICE Tail-catcher/Muon Tracker prototype. The memorandum is intended solely for the purpose of providing a work allocation for Fermi National Accelerator Laboratory and the Northern Illinois University. It reflects an arrangement that is currently satisfactory to the parties involved. It is recognized, however, that changing circumstances of the evolving research program may necessitate revisions. The parties agree to negotiate amendments to this memorandum to reflect such revisions.

The CALICE Collaboration is pursuing the construction of a cubic meter sized scintillator-steel device which will serve as both a tail-catcher and muon tracker (TCMT). The prototype being constructed under the leadership of Northern Illinois University (NIU) with assistance from DESY and Fermilab has been designed with this dual purpose in mind. The TCMT will have a fine and coarse section distinguished by the thickness of the steel absorbers (2cm and 10 cm respectively). The fine section sitting directly behind the hadron calorimeter will provide a reasonable snapshot of the tail end of the hadron showers which is germane to the validation of hadronic generator Monte Carlos. The following coarse section will be a high quality muon tracker and will facilitate studies of muon reconstruction and identification within the particle flow framework. There will be a total of 16 layers (8 fine and 8 coarse) in the TCMT. Extruded scintillator strips with wavelength shifting fiber mated to Silicon Photomultiplier readout will serve as the active medium. The strips are 1m long, 5 cm wide and 5 mm thick. The choice of these dimensions have been driven by Monte Carlo studies focused on both calorimetric and muon reconstruction issues. The strips will be oriented perpendicular to each other in successive layers. The TCMT will use the same electronics as the scintillator-steel hadron calorimeter.

The tests involve a set of TCMT layers or 'cassettes' which have been built at NIU. Data collected from the tests will be used to characterize the TCMT response, its stability and uniformity under beam conditions. The data taking will also result in the setup of a commissioned test-stand running the full CALICE electronics chain which would be of much interest to other US CALICE institutions. The tests are expected to start in Feb. of 2006 and should be considered as a precursor to the larger ones planned by CALICE and the American Linear Collider Calorimetry groups.

I. PERSONNEL AND INSTITUTIONS:

Spokesman and Physicist-in-charge: V. Zutshi

Fermilab Liaison: E. Ramberg

The NIU group members interested in the testbeam:

1.1 G. Blazey, D. Chakraborty, A. Dyshkant, K. Francis, G. Lima, R. Mcintosh, M. Smith, V. Rykalin, V. Zutshi

Other commitments:

DØ: G. Blazey, D. Chakraborty, A. Dyshkant, G. Lima, V. Zutshi
Minerva: V. Rykalin
ILC: All

II. EXPERIMENTAL AREA, BEAMS AND SCHEDULE CONSIDERATIONS:

2.1 LOCATION

2.1.1 The experiment is to take place in the MTEST beamline and will be situated in the MT6 enclosure. The experimenters' first choice for location in the enclosure is MT6-B3 on the existing motion table. Space for a 9U VME crate and power supplies will be needed inside the enclosure. In addition, the main control room to the west of the MTest beamline will be used to house a data acquisition computer and provide a limited amount of work space for three people.

2.2 BEAM

2.2.1 The tests will use slow resonantly-extracted, Main Injector proton beam focused onto the MTest target. The tests require muon and pion beams.

2.2.2 A mixed beam of momentum selected muons and pions in the 5-15 GeV/c range will be needed for stability runs and scans, both transverse and longitudinal. Triggered beam spot sizes (i.e. using a finger counter) of about 10 mm^2 for transverse and not greater than 1 cm^2 for longitudinal scans are desired. The experimenters request a week of dedicated running for these tests.

2.2.3 Momentum unselected muons, as generated by the MT6 secondary beam stop will be needed to study the feasibility of using them as a calibration tool for the CALICE beam tests in 2007. Additionally the multi-particle environment so generated will be used to do some preliminary pattern recognition studies. These tests will proceed concurrently with the ones described in 2.2.2.

2.2.4 For the above a rate of approximately 100 Hz is assumed.

2.2.5 The TCMT test can run parasitically downstream of some other test during most of the setup and debugging. Also, because of limited manpower the experimenters cannot run continuously. They can alternate with other users.

2.3 SETUP

2.3.1 The detector consists of one to two 'cassettes' of scintillator strips with WLS fibers and Silicon-photomultiplier photodetection. Each cassette is roughly 1.2 m x 1.2 m x 2 cm and weighs 30 kgs. The experimenters request that the cassettes be placed on the movable table with vertical and horizontal motion.

2.3.2 Each cassette is connected to a base-board carrying the preamplifier cards with 1.5 m long multi-coax cables. The base-board in turn is connected to the DAQ card sitting in a 9U VME crate with a SCSI cable. Space and electric power will be needed for the base-board, 9U VME crate, power supplies and cables inside the experimental enclosure.

2.3.3 The DAQ card will communicate with the computer located inside the counting room with a fiber-optic cable.

2.3.4 Access to the beam area will be needed periodically for installation and cabling.

2.4 SCHEDULE

2.4.1 The experimenters will initiate these tests in February of 2006 and propose to continue them after the shutdown.

III. RESPONSIBILITIES BY INSTITUTION-NON FERMILAB:

[] denotes the replacement cost of existing hardware in USD.

3.1 The detectors and electronics will be brought by NIU.

3.1.1	1.3 m x 1.3 m x 2cm TCMT layers or cassettes	[3K]
3.1.2	Electronics cards	[15K]
3.1.3	9U VME crate with controller	[15K]
3.1.4	Scope	[10K]
3.1.5	Pulser	[3K]
3.1.6	Power supplies	[3K]
3.1.7	Cables	[1K]
3.1.8	PC and monitor	[2K]

IV. RESPONSIBILITIES BY INSTITUTION-FERMILAB:

4.1 FERMILAB ACCELERATOR DIVISION:

4.1.1 Use of MTest beam as outlined in section 2 above.

4.1.2 Maintenance of all existing standard beam line elements (SWICs, loss monitors, etc) instrumentation, controls, clock distribution, and power supplies.

4.1.3 A scaler or beam counter signal should be made available in the counting house.

4.1.4 Reasonable access to our equipment in the test beam.

4.1.5 The test beam energy and beam line elements will be under the control of the AD Operations Department Main Control Room (MCR).

4.1.6 Position and focus of the beam on the experimental devices under test will be under control of MCR. Control of secondary devices that provide these functions may be delegated to the experimenters as long as it does not violate the Shielding Assessment or provide potential for significant equipment damage.

4.1.7 The integrated effect of running this and other SY120 beams will not reduce the anti-proton stacking rate or protons on target for neutrino production by more than 5% globally, with the details of scheduling to be worked out between the experimenters and the Office of Program Planning.

4.2 FERMILAB PARTICLE PHYSICS DIVISION:

4.2.1 The test beam efforts in this MoU will make use of the Meson Test Beam Facility. Requirements for the beam and user facilities are given in Section 2. The Fermilab Particle Physics Division will be responsible for coordinating overall activities in the MTest beamline, including use of the user beam-line controls, readout of the beam-line detectors and the MTest gateway computer.

4.2.2 The experimenters will need help in setting up a fast beam trigger counter, using components already in existence at MTBF or NIU. [0.5 person-weeks]

4.2.3 The experimenters will require use of the remote controlled motion table, with movement in both vertical and horizontal directions. [0.5 person-weeks]

4.3 FERMILAB COMPUTING DIVISION:

4.3.1 Ethernet and printers should be available in the counting house.

4.3.2 Connection to beams control console and remote logging (ACNET) should be made available in the counting house.

4.4 FERMILAB ES&H SECTION:

4.4.1 Assistance with safety reviews.

V. SUMMARY OF COSTS:

Source of Funds	Equipment	Operating	Personnel
Accelerator Div.			
Particle Physics Div.			1.0 person-weeks
Computing Div.			
Totals (Fermilab)			1.0 person-weeks
Totals (non-Fermi)	$52K		

VI. SPECIAL CONSIDERATIONS:

6.1 The responsibilities of the spokesman of the Northern Illinois University (NIU) group and the procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Experimenters" (http://www.fnal.gov/directorate/documents/index.html). The Physicist in charge agrees to those responsibilities and to follow the described procedures.

6.2 To carry out the experiment a number of Environmental, Safety and Health (ES&H) reviews are necessary. This includes creating a Partial Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee. The spokesman of the NIU group will follow those procedures in a timely manner, as well as any other requirements put forth by the division's safety officer.

6.3 The spokesman of the NIU group will ensure that at least one person is present at the Meson Test Beam Facility whenever beam is delivered and that this person is knowledgeable about the experiment's hazards.

6.4 All regulations concerning radioactive sources will be followed. No radioactive sources will be carried onto the site or moved without the approval of the Fermilab ES&H section.

6.5 All items in the Fermilab Policy on Computing will be followed by the experimenters (http://computing.fnal.gov/cd/policy/cpolicy.pdf).

6.6 The spokesman of the NIU group will undertake to ensure that no PREP or computing equipment be transferred from the experiment to another use except with the approval of and through the mechanism provided by the Computing Division management. They also undertake to ensure that no modifications of PREP equipment take place without the knowledge and consent of the Computing Division management.

6.7 The NIU group will be responsible for maintaining and repairing both the electronics and the computing hardware supplied by them for the experiment. Any items for which the experiment requests that Fermilab performs maintenance and repair should appear explicitly in this agreement.

6.8 At the completion of the experiment:

6.8.1 The spokesman of the NIU group is responsible for the return of all PREP equipment, computing equipment and non-PREP data acquisition electronics. If the return is not completed after a period of one year after the end of running the spokesman of the NIU group will be required to furnish, in writing, an explanation for any non-return.

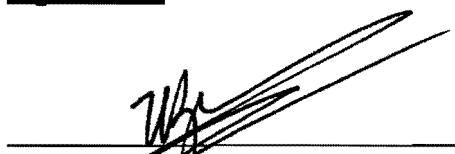
6.8.2 The experimenters agree to remove their experimental equipment as the Laboratory requests them to. They agree to remove it expeditiously and in compliance with all ES&H requirements, including those related to transportation. All the expenses and personnel for the removal will be borne by the experimenters.

6.8.3 The experimenters will assist the Fermilab Divisions and Sections with the disposition of any articles left in the offices they occupied, including computer printout and magnetic tapes.

6.8.4 An experimenter will be available to report on the test beam effort at a Fermilab All

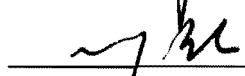
Experimenters Meeting.

Signatures:



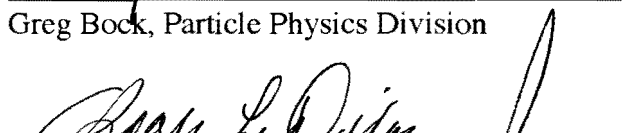
1/17/2006

Vishnu Zutshi, Northern Illinois University



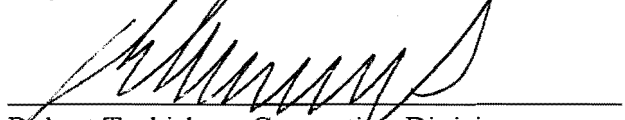
1/24/2006

Greg Bock, Particle Physics Division



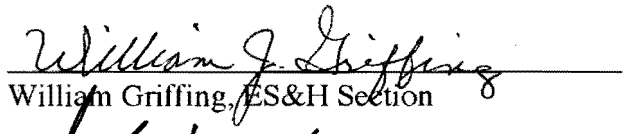
1/25/2006

Roger Dixon, Accelerator Division



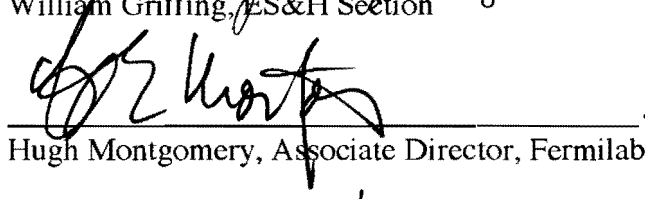
1/28/2006

Robert Tschirhart, Computing Division



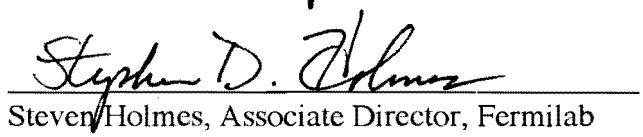
1/25/2006

William Griffing, ES&H Section



2/4/2006

Hugh Montgomery, Associate Director, Fermilab



1/30/2006

Steven Holmes, Associate Director, Fermilab

APPENDIX I - Hazard Identification Checklist

Items for which there is anticipated need have been checked

Cryogenics		Electrical Equipment		Hazardous/Toxic Materials	
	Beam line magnets		Cryo/Electrical devices		List hazardous/toxic materials
	Analysis magnets		Capacitor banks		planned for use in a beam line or experimental enclosure:
	Target	X	high voltage (100V at 1.0mA max) (for SiPMs)		
	Bubble chamber	X	exposed equipment over 50 V		
Pressure Vessels		**Flammable Gases or Liquids**			
	inside diameter	Type:			
	operating pressure	Flow rate:			
	window material	Capacity:			
	window thickness	**Radioactive Sources**			
Vacuum Vessels			permanent installation	**Target Materials**	
	inside diameter		temporary use		Beryllium (Be)
	operating pressure	Type:			Lithium (Li)
	window material	Strength:			Mercury (Hg)
	window thickness	**Hazardous Chemicals**			Lead (Pb)
Lasers			Cyanide plating materials		Tungsten (W)
	Permanent installation		Scintillation Oil		Uranium (U)
	Temporary installation		PCBs		Other : **Iron (Fe), Ta Cu**
	Calibration		Methane	**Mechanical Structures**	
	Alignment		TMAE		Lifting devices
type:			TEA	X	Motion controllers
Wattage:			photographic developers		scaffolding/elevated platforms
class:			Other: Activated Water?		Others