Fermilab

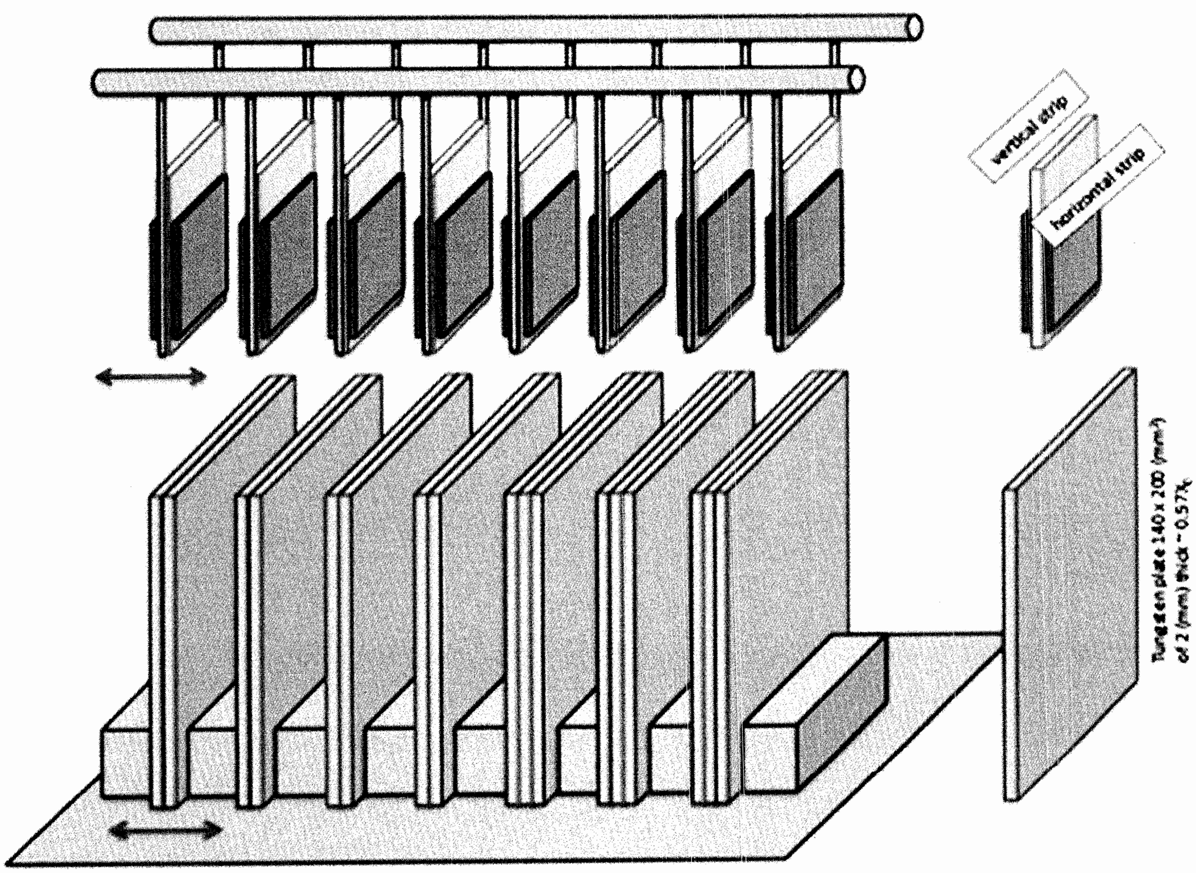
Directorate

TECHNICAL SCOPE OF WORK
FOR THE 2014 FERMILAB TEST BEAM FACILITY PROGRAM

T-1054

sPHENIX PreShower

January 24, 2014



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INTRODUCTION

This is a technical scope of work (TSW) between the Fermi National Accelerator Laboratory (Fermilab) and the experimenters of PHENX who have committed to participate in beam tests to be carried out during the 2014 Fermilab Test Beam Facility program.

The TSW is intended primarily for the purpose of recording expectations for budget estimates and work allocations for Fermilab, the funding agencies and the participating institutions. It reflects an arrangement that currently is satisfactory to the parties; however, it is recognized and anticipated that changing circumstances of the evolving research program will necessitate revisions. The parties agree to modify this scope of work to reflect such required adjustments. Actual contractual obligations will be set forth in separate documents.

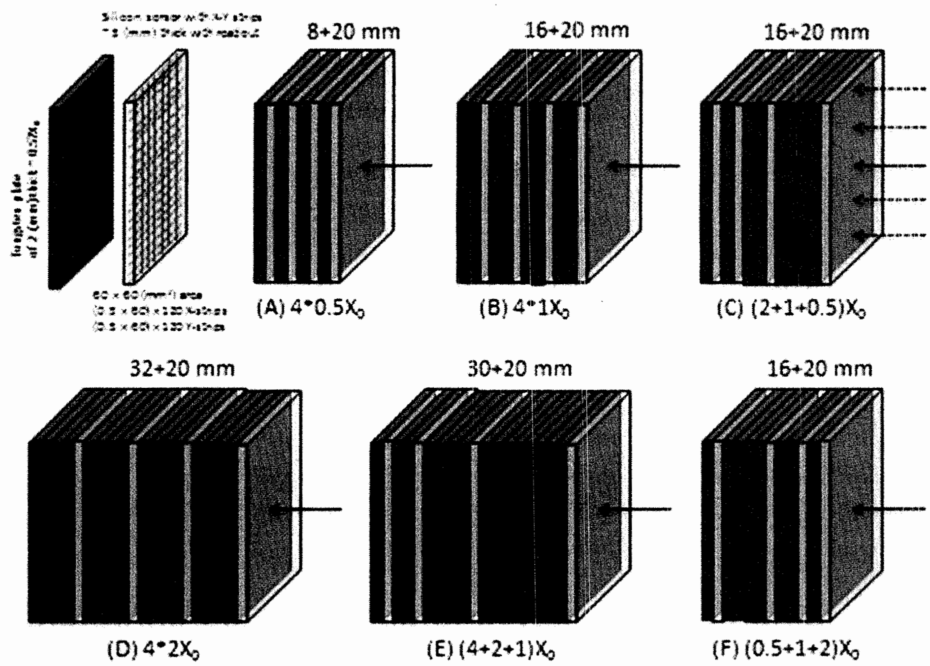
This TSW fulfills Article 1 (facilities and scope of work) of the User Agreements signed (or still to be signed) by an authorized representative of each institution collaborating on this experiment.

Description of Detector and Tests:

The experimenters propose to install and test in the particle beams at FNAL a small (6x6 cm^2 sensitive area) prototype of High resolving power preshower detector for the calorimetry system of the future sPHENIX detector at BNL. The design of the prototype is based upon recent developments in "no collateral damage" high density and high resolution (position and energy) Si-W calorimetry which has already resulted in approval and independent funding of preshower detectors for the very forward calorimeters in PHENIX.

During this test the experimenters are planning to measure in great details the development of electromagnetic showers in the first four radiation length of tungsten. The absorber will be structured in layers of ½ X_0 thickness, interleaved with X and Y silicon strip detectors.

A comparison will be made between "thin plate configurations" (2mm absorbers) and "fat plate configurations" (4/6/8 mm absorbers) to study the effect of massless gaps on spreading particles in the electromagnetic and hadronic showers (see Figure 1)



The detector is built of eight 2mm thick W plates 12x12 cm^2 in size. The readout gap between individual plates is 7mm and allows for simultaneous readout with 0.5 mm wide strips oriented in X and Y directions. Mechanically the detector is built to allow for an easy reconfiguration: varying the total number of plates (total thickness of absorber), number of readout gaps and thickness of individual plates, spacing between plates. The total size of assembled detector is 12x12x12 cm^3. All communications between detecting elements (dual sensor micromodules) and readout FEM and power distribution board are along the upper side of the detector. Readout elements are positioned in the gaps free standing and located by plastic spacers.

The experimenters plan to run parasitic to T-1044 with the preshower detector located in front of the T-1044 EMCal on the 2C lift table. No additional support structure except mini-table (frame) to rise the prototype to a common height above the FNAL moving table used to handle the EMC prototype is required.

PERSONNEL AND INSTITUTIONS:

Spokespersons and Lead Experimenters in charge of beam tests: Edouard Kistenev

Fermilab Experiment Liaison Officer: Aria Soha

The group members at present are:

	Institution	Country	Collaborator	Rank/Position	Other Commitments
1.1	Brookhaven National Laboratory	USA	Edouard Kistenev	Scientist	PHENIX
			Mickey Chiu	Scientist	PHENIX
			Andrei Sukhanov	Scientist	PHENIX
1.2	Hiroshima University	Japan	Kenta Shigaki	Associate Professor	PHENIX
			Yusuke Oya	Graduate student	PHENIX
			Kazuya Nagashima	Graduate student	PHENIX
1.3	University of Tsukuba	Japan	Tatsuya Chujo	Assistant Professor	PHENIX
			Motoi Inaba	Associate Professor	PHENIX
			ShinIchi Esumi	Associate Professor	PHENIX
			Yasuo Miake	Professor	PHENIX
			Toshihiro Nonaka	Student	PHENIX
			Wataru Sato	Student	PHENIX
			Masahiro Hirano	Student	PHENIX
			Ikumi Sakatani	Student	PHENIX
			Sanshiro Mizuno	Student	PHENIX
			Hiroshi Nakagomi	Student	PHENIX
			Takafumi Niida	Student	PHENIX

II. EXPERIMENTAL AREA, BEAMS AND SCHEDULE CONSIDERATIONS:

2.1 LOCATION

2.1.1 The beam test(s) will take place in MT6.2C, as shown in Appendix I.

2.2 BEAM

2.2.1 BEAM TYPES AND INTENSITIES

Energy of beam: 1 GeV – 60 GeV
Particles: pions/muons/electrons
Intensity: 10k – 100k in units of particles/ 4 sec spill
Beam spot size: about 1cm^2

2.2.2 BEAM SHARING

The experiment will run parasitic to T-1044 and T-1048.

The preshower detector will be configured with a total radiation length ranging from 0.5 to 4 X_0.

2.2.3 RUNNING TIME

The mechanical aspects of the preshower detector and its electronics will be installed with the T-1044 calorimeters on February 16, 2014. The detector will be ready for an ORC review on February 17th.

2.3 EXPERIMENTAL CONDITIONS

2.3.1 AREA INFRASTRUCTURE

The experimental setup includes the preshower detector (12x12x12 cm^3 in size), four layers of double side silicon carrier cards (two sensors on both sides of carrier board), one data collection card, flat ribbon data cables, and multiwire power cables.

No special equipment except that already approved for T-1044 is required.

Detector is not using any gases.

2.3.2 ELECTRONICS AND COMPUTING NEEDS

Detector electronic is split between silicon micromodules (SVX4 readout chips and passive supporting components), slow control components on carrier boards and FPGA based data collection, compaction and transmission on a single readout FEM which must be located within 2 m distance from detector (Al box 4x8x24 cm^3).

Running the detector requires +3V low voltage power, which is generated locally (total current below 3amp at +3V), and positive bias for silicon sensors (below 120V, total current less than 0.1ma).

No PREP electronics are requested.

No new network equipment is required.

2.3.3 Description of Tests

- preinstallation testing – counting house;
- leakage current measurements, detector general evaluation;
- software and firmware stability under FNAL test beam conditions;
- data collection in a stand alone and sPHENIX integrated modes in beams of electrons and hadrons.

2.4 Schedule

The experiment as proposed will use strip detectors with strips of 62 mm length which is non-optimal for preshower installed in from of tower structured EMC. A version using minipad patterned sensors (15x2 mm^2 mini pads) will soon be available. It will be used as part of the next sPHENIX test beam run whenever it will happen.

Experimental Planning Milestones:

2/16/2014 - Installation

2/17/2014 – ORC Review

2/18/2014-2/25/2014 – Data collection

III. Responsibilities by Institution – Non Fermilab

3.1 BNL :

Detector construction

3.2 Tsukuba:

- detector testing, data analysis.

IV. RESPONSIBILITIES BY INSTITUTION – FERMILAB

4.1 FERMILAB ACCELERATOR DIVISION:

4.1.1 Use of MTest beamline as outlined in Section II. [0.25 FTE/week]
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 Scalers and beam counter readouts will be made available via ACNET in the MTest control room.
4.1.4 Reasonable access to the equipment in the MTest beamline.
4.1.5 Connection to ACNET console and remote logging should be made available.
4.1.6 The test beam energy and beam line elements will be under the control of the AD Operations Department Main Control Room (MCR). [0.25 FTE/week]
4.1.7 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.
4.1.8 The integrated effect of running this and other SY120 beams will not reduce the neutrino flux by more than an amount set by the office of Program Planning, 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 TSW will make use of the Fermilab Test Beam Facility. Requirements for the beam and user facilities are given in Section II. The Fermilab Particle Physics Division will be responsible for coordinating overall activities in the MTest beam-line, including use of the user beam-line controls, readout of the beam-line detectors, and FTBF computers. [6.5 FTE/week]
4.2.2 Table 2.C, parasitic to T-1044
4.2.3 No forklift or crane required
4.2.4 Conduct a NEPA review of the experiment.
4.2.5 Provide day-to-day ESH&Q support/oversight/review of work and documents as necessary.
4.2.6 Provide safety training as necessary, with assistance from the ESH&Q Section.
4.2.7 Update/create ITNA's for users on the experiment.
4.2.8 Initiate the ESH&Q Operational Readiness Clearance Review and any other required safety reviews.

4.3 FERMILAB SCIENTIFIC COMPUTING DIVISION

4.3.1 Internet access should be continuously available in the MTest control room.
4.3.2 Si Tracking system not required
4.3.3 See Appendix II for summary of PREP equipment pool needs.
4.3.4 No additional networking required.

4.4 Fermilab ESH&Q Section

4.4.1 Assistance with safety reviews.
4.4.2 No sources are being used.
4.4.3 Provide safety training, with assistance from PPD, as necessary for experimenters. [0.2 FTE]

V. SUMMARY OF COSTS

Source of Funds [$K]	Materials & Services	Labor (FTE/week)
Accelerator Division	0	0.5
Particle Physics Division	0.0	6.5
Scientific Computing Division	0	0
ESH&Q Section	0	0.2
Totals Fermilab	$0.0K	7
Totals Non-Fermilab	50K	2 person-years

VI. General Considerations

6.1 The responsibilities of the Spokespersons and the procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Researchers": (http://www.fnal.gov/directorate/PFX/PFX.pdf). The Spokespersons agrees to those responsibilities and to ensure that the experimenters all follow the described procedures.

6.2 To carry out the experiment a number of Environmental, Safety and Health (ESH&Q) reviews are necessary. This includes creating an Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee. The Spokespersons 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 Spokespersons will ensure at least one person is present at the Fermilab 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 ESH&Q 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 Spokespersons 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 Scientific Computing Division management. The Spokespersons also undertakes to ensure no modifications of PREP equipment take place without the knowledge and written consent of the Computing Sector management.

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

At the completion of the experiment:

6.8 The Spokespersons 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 Spokesperson will be required to furnish, in writing, an explanation for any non-return.

6.9 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 ESH&Q requirements, including those related to transportation. All the expenses and personnel for the removal will be borne by the experimenters unless removal requires facilities and personnel not able to be supplied by them, such a rigging, crane operation, etc.

6.10 The experimenters will assist Fermilab with the disposition of any articles left in the offices they occupied.

6.11 An experimenter will be available to report on the test beam effort at a Fermilab All Experimenters' Meeting.

SIGNATURES:

The spokespersons are the official contact and are responsible for forwarding all pertinent information to the rest of the group, arranging for their training, and requesting ORC or any other necessary approvals for the experiment to run.
The spokespersons should also make sure the appropriate people (which might be everyone on the experiment) sign up for the test beam emailing list.

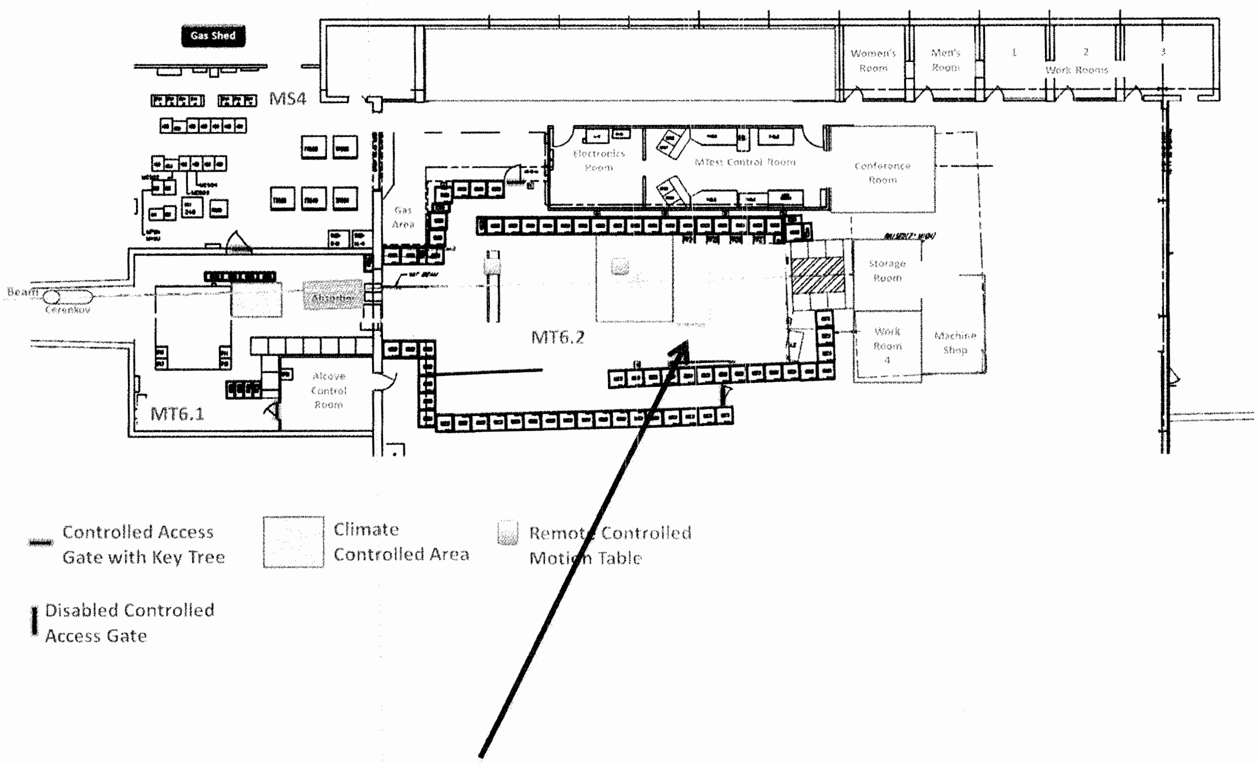
____ / / 2014
Edouard Kistinev, Experiment Spokesperson

APPENDIX I: MT6 AREA LAYOUT

APPENDIX I: MT6 AREA LAYOUT

The preshower will be located upstream of the sPHENIX EMC on a common table. Its bias power will come from the sPHENIX rack on a yellow table, it will need one extension cord with 4 outlets for low voltage power generators (commercial plug in units used for powering home electronics).

MTEST AREAS



Approximate location of the 2C lift table position. Will be used parasitic to T-1044.

APPENDIX II: - HAZARD IDENTIFICATION CHECKLIST

Items for which there is anticipated need have been checked.
See ORC Guidelines for detailed descriptions of categories.

Flammables (Gases or Liquids)		**Gasses**		**Hazardous Chemicals**		**Other Hazardous /Toxic Materials**
Type:		Type:			Cyanide plating materials	List hazardous/toxic materials planned for use in a beam line or an experimental enclosure:
Flow rate:		Flow rate:			Hydrofluoric Acid	
Capacity:		Capacity:			Methane	
Radioactive Sources		**Target Materials**			photographic developers	
	Permanent Installation		Beryllium (Be)		PolyChlorinatedBiphenyls	
	Temporary Use		Lithium (Li)		Scintillation Oil	
Type:			Mercury (Hg)		TEA	
Strength:			Lead (Pb)		TMAE	
Lasers			Tungsten (W)		Other: Activated Water?	
	Permanent installation		Uranium (U)			
	Temporary installation		Other:	**Nuclear Materials**		
	Calibration	**Electrical Equipment**		Name:		
	Alignment		Cryo/Electrical devices	Weight:		
Type:			Capacitor Banks	**Mechanical Structures**		
Wattage:			High Voltage (50V)		Lifting Devices	
MFR Class:			Exposed Equipment over 50 V		Motion Controllers	
		X	Non-commercial/Non-PREP		Scaffolding/ Elevated Platforms	
			Modified Commercial/PREP		Other:	
Vacuum Vessels		**Pressure Vessels**		**Cryogenics**		
Inside Diameter:		Inside Diameter:			Beam line magnets	
Operating Pressure:		Operating Pressure:			Analysis magnets	
Window Material:		Window Material:			Target	
Window Thickness:		Window Thickness:			Bubble chamber	

The following people have read this TSW:

____ 2 /10 / 2014

Michael Lindgren, Particle Physics Division, Fermilab

____ 02 / 05 / 2014

Sergei Nagaitsev, Accelerator Division, Fermilab

____ 2 / 11 / 2014

Robert Roser, Scientific Computing Division, Fermilab

____ 2 / 7 / 2014

Martha Michels, ESH&Q Section, Fermilab

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Greg Bock, Associate Director for Research, Fermilab

____ 2 / 16/2014

Stuart Henderson, Associate Director for Accelerators, Fermilab