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5/28/08

MEMORANDUM OF UNDERSTANDING FOR THE 2008 MESON TEST BEAM PROGRAM

T978

CALICE TEST BEAM

March 14th, 2008

INTRODUCTION:

This is a Memorandum of Understanding (MoU) between the Fermi National Accelerator Laboratory and the experimenters of the CALICE Collaboration who have committed to participate in beam tests to be carried out during the 2008 MTest program.

This memorandum is intended solely for the purpose of providing a work allocation for Fermi National Accelerator Laboratory and the participating universities and institutions. 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.

Description of Detector and Tests:

The CALICE Collaboration has been carrying out a major R&D effort on calorimetry for the International Linear Collider Detector. The major focus of this research has been the development of particle-flow calorimetry for achieving the unprecedented jet energy resolutions required to fully exploit the physics potential of an e^+e^- collider. As such, the prototyping efforts have concentrated on the development of calorimeter technologies with a high degree of longitudinal and transverse segmentation. The collaboration is studying various options for electromagnetic (Si-W and Scint-W) and hadronic (Scint-Steel, RPC-Steel and GEM/Micromegas-Steel) calorimeters with the aim of comparing their performance with respect to the ILC physics requirements.

This memorandum covers the experimental activities of the CALICE collaboration foreseen for the year 2008. In 2008, two electromagnetic calorimeters (Si-W and Scint-W), a Scint-Steel hadron calorimeter and a Scint-Steel tail-catcher/muon tracker will participate in the data taking. It is expected that in 2009, these tests will be followed by similar data collection periods with gas (RPC-Steel, GEM/Micromegas-Steel) hadron calorimeters. At that stage this MoU will be extended or amended appropriately. These running periods with different technologies in the same setting and environment are key to providing fair comparisons of the performances of the different calorimeter options and their suitability for a Linear Collider Detector. To this end, it is intended to integrate the gas hadron calorimeter(s) into the CALICE installation, DAQ and reconstruction software. The integration is foreseen to start with individual RPC layers and prototype electronics in dedicated test runs as part of the 2008 program.

I. PERSONNEL and INSTITUTIONS:

CALICE Spokesperson:	Jean-Claude Brient
Fermilab Liaison:	Erik Ramberg
CALICE Liaisons:	Roman Poeschl, Vishnu Zutshi
CALICE Run Coordinators:	George Mavromanolakis, Roman Poeschl, Vishnu Zutshi (preliminary)
CALICE Mechanical Installation:	Karsten Gadow
CALICE Remote Control:	Sven Karstensen
CALICE DAQ:	Paul Dauncey
CALICE Software and Computing:	Roman Poeschl, Neils Meyer
CALICE Si-W ECAL Team Leader:	Roman Poeschl
CALICE Si-W ECAL Experts:	Hegne Li, Marcel Reinhard
CALICE Sci-W ECAL Team Leader:	Tohru Takeshita
CALICE Sci-W Experts:	Kiyotomo Kawagoe, Saturo Uozumi
CALICE Sci-Steel HCAL Team Leader:	Felix Sefkow
CALICE Sci-Steel HCAL Experts:	Erika Garutti, Alexander Kaplan
CALICE Sci-Steel TCMT Team Leader:	Vishnu Zutshi
CALICE Sci-Steel TCMT Experts:	Alexander Dyshkant, Kurt Francis

These and other members of the group interested in the test beam are listed in Appendix A.

II. EXPERIMENTAL AREA, BEAMS & SCHEDULE CONSIDERATIONS:

2.1 Location

2.1.1 The tests will be carried out in beamline MT6, section 2C and 2D, contiguously, with some tracking and trigger elements installed in section 2B.

2.1.2 The setup will consist of the HCAL and TCMT mounted on their motion frames, drift chambers, scintillator counters, power supplies and a power transformer. The ECAL will be mounted on the HCAL motion frame.

2.1.3 Optical fiber connections will communicate data between the electronics crates and the data acquisition computers.

2.1.4 Office space in MTest will be provided for 4-5 CALICE Collaboration members.

2.2 Beam

2.2.1 The tests will use slow resonantly-extracted proton beam focused on to the MTest target. The tests require secondary electron, pion, proton and muon beams.

2.2.2 Specifically the experimenters request the following momentum selected beams: electrons (1-25 GeV/c), hadrons (1-66 GeV/c) and protons (120 GeV/c). Special emphasis will be put on the low energy pion (1-10 GeV/c) running.

2.2.3 Momentum unselected beam dump muons will be needed for commissioning and calibration purposes.

2.2.4 Triggered beam spots of a few cm^2 are desired over the entire momentum range.

2.2.5 The experimenters request a $\Delta p/p = 5\%$ or better for beam energies in the 1-5 GeV/c range and 2% or better for higher energies.

2.2.6 For the above, a triggered beam rate of approximately 500-700 Hz is assumed. Running at momenta below 2 GeV/c may result in a lower rate due to safety envelope considerations.

2.3 Schedule

2.3.1 In 2008, the CALICE collaboration requests three running periods of 3 weeks each. It is desirable that two of the running periods be before the 2008 shutdown and one after it.

2.3.2 Specifically, the following schedule is proposed for consideration:

Installation and Commissioning	:	April 2008
1st three week running period	:	May 2008
2nd three week running period	:	July 2008
3rd three week running period	:	to be negotiated as discussed below

2.3.3 Nominally a Si-W ECAL and Scint-Steel, HCAL and TCMT will take beam in the first two periods. For the third period the Si-W ECAL will be replaced by a Scint-W ECAL.

2.3.4 During these running periods a 4 second flat top spill structure is desired given the performance parameters of the CALICE DAQ (buffer ~ 2000 events, rate ~ 700 Hz). It is requested that one such spill be delivered every minute for typically 12 hrs a day. The experimenters seek to schedule the runs in the most efficient manner in order to fulfill their physics needs within the Fermilab guideline of less than 5% impact from test beam operation to the overall program. For running conditions which are beam-flux limited the experimenters may opt for two one second spills instead of a single 4-sec flat-top.

2.3.5 The different running and setup phases will be coordinated with the activities of other MTest users. In particular it would be of interest to find out if the CALICE setup can usefully take data in the parasitic mode.

2.3.6 In the event of concurrent running by another experiment during the CALICE installation period, the CALICE experimenters request use of the 6am-6pm shift. The experimenters require control of the beam during their commissioning period. It is expected that the installation and commissioning periods will last approximately 2 weeks each.

2.3.7 It is understood that the exact scheduling of the third running period cannot be finalized at the moment due to the uncertainties in the shutdown schedule. However, the CALICE Collaboration strongly urges the Lab to find a time slot for this period in 2008 itself. August and mid-Nov. are possible suggestions should the 10-week shutdown occur.

2.4 Setup

2.4.1 The Si-W ECAL and the Scint-Steel HCAL will be shipped from DESY towards the end of February and are expected to arrive approximately 4 weeks later. The TCMT will ship from CERN towards the end of January and is expected to arrive approximately 6 weeks after that. Storage/staging space for the detectors will be required prior to their installation in the experimental hall in April. The Scint-W ECAL will be shipped later in the year from Japan. Crane facilities will be needed for both the extraction of the detectors from their shipping containers and during the installation process.

2.4.2 Crane facilities will be needed at the final location of the experiment and also intermittently during the running period(s).

2.4.3 The experimental setup will consist of two motion frames. The HCAL motion frame which houses the ECAL and electronics crates has a footprint of ~ 5m x 2.5m. The total weight of the HCAL frame along with the detector modules is ~ 15 tonnes. The TCMT frame sitting directly behind the HCAL frame rides on rails and occupies an area that is approx. 3m long and 3m wide. Total weight for the TCMT is ~ 12 tonnes. Fixation for the rails will be needed in the experimental hall.

2.4.4 The movement and installation of the CALICE detectors in the experimental area will require the assistance of Fermilab equipment, technicians and safety experts. An agreement on the installation procedure and its impact on this and any other experiments should be worked out between FERMILAB and CALICE as soon as possible.

2.4.5 In addition to the building crane, the experimenters will provide a gantry for installing detector elements into the setup.

2.4.6 It is planned that the experimenters will bring drift chambers for their tracking needs. Fermilab help will be needed in providing movable supports for the chambers. Survey measurements for installation and alignment will also be required. An Argon-Ethane gas mixture for the operation of the drift chambers will be needed. The Fermilab MWPC's available in the test beam area are to be considered as a backup option. Running of other experiments may require moving parts of the CALICE tracking and triggering setup.

2.4.7 Survey measurements for installation and alignment of the CALICE setup will also be required.

2.4.8 The availability of an efficient particle identification system will be key to these tests. Help will be needed in integrating Cerenkov signals in the experimenters data stream.

2.4.9 Operation of some of the CALICE equipment requires ~ 400 V. The experimenters will be using the 70kW, 380V transformer provided by Fermilab. Specifications of the wiring for the emergency switches and the power outlets have been furnished to Fermilab.

2.4.10 The experimenters request cooling inside the experimental enclosure that would keep the ambient temperature inside the tent below 25^0 C. It is expected that average power dissipated will be ~10kW. Additionally, for the pressurized air cooling of the detector electronics, a heat exchanger in the form of water with a temperature below 18^0 C will be needed.

2.5 Run Plan

2.5.1 The running conditions will be permutation and combinations of the following parameters:

Energy	Particle Type	Angle of Incidence	Configuration
1-66, 120 GeV/c	e, pi, p	0, 10, 20, 30 deg.	w/ and w/o ECAL

2.5.2 Of order 100 running conditions are planned per running period.

2.5.3 The experimenters wish to collect 250-500K events per running condition per running period. In addition a large data sample of beam dump muons for calibration purposes will be collected.

2.5 Computing

2.6.1 The computing system brought in by the experimenters will comprise 10 computers (called CALICE Computers hereafter), 1 disk array for on-site storage, 1 Gigabit Ethernet switch and 2 web cameras for remote control purposes.

2.6.2 The computers will be dedicated to the following tasks:

- 3 computers will serve as DAQ Computers
- 1 computer will serve for online monitoring and data transfer
- 2 computers will serve for remote control of the experiment
- 3 computers will be used for the slow control of the experimental apparatus
- 1 General purpose computer.

2.6.3 CALICE will try to replicate its data processing scheme established during the CERN 2006/07 test beam campaign. This includes local caching on a storage device provided by CALICE. The data will then be copied by means of grid, i.e. glite tools, over the wide area network to the DESY mass storage with subsequent processing 'on the grid'. The necessary software tools for the data transfer and submission of the processing jobs will be installed on a dedicated server provided by the CALICE collaboration. The running of the glite tools on that server does not constitute a concern for the Fermilab computing environment.

2.6.4 Fermilab will provide assistance in establishing a sustained transfer rate of ~20 MByte/s for the data transfer from the MTest control room to the DESY mass storage. This includes on-site connectivity, i.e. between the MTest control room and the general Fermilab network as well as the connectivity to the wide area network. If necessary, dedicated tests of the network performance when connecting to the DESY site will be conducted. Experts for this purpose, on both sides, will be named at a later stage. For on-site tests of the network, Fermilab will provide tools which can be operated by the experts of the CALICE collaboration. The relevant CALICE experts will be introduced to these tools by the corresponding experts on the Fermilab side.

2.6.5 The primary data storage location will be the DESY dCache system. If, however, the transfer to DESY is interrupted by whatever reason, the data will be staged to tape backed storage via the Fermilab public dCache system. The public dCache provides about 7 Tbytes of write and 4 Tbytes of read disk used to temporarily stage files to/from tape and is shared amongst a number of users, of which CALICE will be one.

2.6.5.1 Fermilab is ready to provide a total of up to 40 Tbytes of tape storage for the CALICE dataset, including data taken in the past at CERN and DESY as well as simulated data. This total includes tape storage used to buffer data in the event of interruption of transfers to DESY. Should the needs arise, financial contributions by the experimenters to purchase disk space beyond the 40 TByte mentioned above and corresponding peripheral systems is subject to further negotiations between Fermilab and CALICE.

2.6.5.2 In addition, Fermilab can provide cpu resources for the general processing of the CALICE data. Fermilab will provide assistance in interfacing the glite tools as developed within the European grid efforts and the OSG which is in use in the US and North America.

2.6.5.3 Fermilab is ready to act as a co-host of the 'vo calice' which is currently hosted by DESY solely. Details of the co-hosting are to determined between Fermilab, DESY and CALICE experts at a later stage.

2.6.5.4 Note, that the items 2.6.5.1-2.6.5.3 go partially beyond the needs for the actual data taking at Fermilab.

2.6.6 An attempt will be made to enable a remote control of the experiment for monitoring, diagnostics and trouble-shooting by experts. For this, part of the CALICE computing equipment has to be directly accessible from a couple of remote sites. Specifically, two standard Linux Computers and the two web cameras have to be directly accessible. At all times when such remote control is proceeding, there will be at least one experimenter present in the MTest Facility.

2.6.7 The CALICE computers will need a cooled area in or near the control room. Peripheral devices (Mouse, Keyboards, Screens) to operate these computers will be placed in the control room. Dedicated cabling and the set up of the computing system will be provided by the experimenters.

2.6.8 In addition, internet access will be needed for the laptops of the experimenters.

III. RESPONSIBILITIES BY INSTITUTION (NON-FERMILAB):

([ ] denotes cost of replacement for existing hardware)

3.1	*Si-W ECAL*		
3.1.1	Detector Slabs	$	[200K]
3.1.2	Alveolar Structures		[150K]
3.1.3	Motion Table		[15K]
3.1.4	Power Supplies		[15K]
3.1.5	Miscellaneous		[15K]
3.2	*Scint-W ECAL*		
3.2.1	Absorber Structure		[15K]
3.2.2	Scintillator Detectors		[20K]
3.2.3	Photosensors		[50K]
3.2.4	Cables		[10K]
3.2.5	Miscellaneous		[10K]
3.3	*Scint-Steel HCAL*		
3.3.1	Absorber Stack and Movable Stage		[200K]
3.3.2	Photosensors		[80K]
3.3.3	Electronics		[200K]
3.3.4	Miscellaneous		[30K]
3.4	*Scint-Steel TCMT*		
3.4.1	Absorber Stack and Frame		[25K]
3.4.2	Scintillator Detectors		[50K]
3.4.3	Electronics and Cables		[30K]
3.4.4	Miscellaneous		[10K]
3.5	*Computing*		
3.5.1	Computers		[10K]
3.5.2	Disk Arrays		[15K]
3.5.3	Miscellaneous		[5K]

IV. RESPONSIBILITIES BY INSTITUTION (FERMILAB):

4.1 FERMILAB ACCELERATOR DIVISION:

4.1.1 Use of MTest beam as outlined in Section 2.

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 Reasonable access to the experimenters' equipment in the test beam.

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

4.1.5 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 will be delegated to the experimenters as long as it does not violate the Shielding Assessment or provide potential for significant equipment damage.

4.1.6 An effort will be made to minimize double occupancy in the same bucket.

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 beam-line, including use of the user beam-line controls, readout of the beam-line detectors, and MTest gateway computer.

4.2.2 Scintillator/Cerenkov counters provided by facility for trigger, particle id and start time.

4.2.3 If needed, two of the MWPC stations will be moved into place in front of the calorimeters. Assistance will be provided in integrating this chamber into the experimenters' DAQ system.

4.2.4 PPD will generate engineering notes, job hazard analyses and lift plans, as required for installation and operation.

4.2.5 PPD will be responsible for all installations in the MTest facility.

4.2.6 Will provide surveying of detectors as needed.

4.2.7 Office space for 5 people in the MTest facility will be provided.

4.2.8 A water chiller will be provided to support cooling of CALICE electronics.

4.2.9 During installation, storage space will be provided in the Meson Detector Building to house all components.

4.2.10 Connection to a 380 V transformer will be provided to the experimenters to power their electronics.

4.2.11 Estimated costs for PPD support of CALICE will be under $10K M&S.

4.3 FERMILAB COMPUTING DIVISION:

4.3.1 Ethernet and printer 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. Help will also be required for integrating this data stream into the experimenter's DAQ.

4.3.3 Test beam facility DAQ computing support as needed during normal working hours.

4.3.4 Assistance in providing the high speed data connection to DESY and if possible also to CC IN2P3 (see Sec. 2.6.3).

4.3.5 Enabling of the remote access to the devices employed in the remote control of the CALICE Experiment (see Sec. 2.6.6). In detail two computers have to be accessible via port 443 (https) and the two cameras will be operated on port 80 (http). It is understood that the access to these ports does not violate any Fermilab computing security standards. If CALICE requires any exemptions (such as unkerberized login access or web server exemptions), they can be applied for through the usual process located at http://security.fnal.gov via the Request Forms link.

4.3.6 All CALICE computers will have kerberos login enabled as well as regular port scans will be performed using the tools as provided by Fermilab. Assistance in applying these tools might be needed.

4.3.7 Assistance in operation of the private laptops in compliance with the FERMILAB computing safety rules (see Sec. 2.5.6).

V. SPECIAL CONSIDERATIONS:

5.1 The responsibilities of the Run Coordinator of the CALICE Collaboration and procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Experimenters": (http://www.fnal.gov/directorate/documents/index.html). The Run Coordinator agrees to those responsibilities and to follow the described procedures.

5.2 To carry out the experiment a number of Environmental, Safety and Health (ES&H) reviews are necessary. This includes creating an Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee. The Run Coordinator of the CALICE Collaboration will follow those procedures in a timely manner, as well as any other requirements put forth by the division's safety officer and follow all procedures in the PPD Operating Manual.

5.3 The Run Coordinator of the CALICE Collaboration 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.

5.4 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.

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

5.6 The Run Coordinator of the CALICE Collaboration 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.

5.7 The CALICE Collaboration 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.

5.8 At the completion of the experiment:

5.8.1 The Run Coordinator of the CALICE Collaboration 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 group will be required to furnish, in writing, an explanation for any non-return.

5.8.2 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.

5.8.3 The experimenters will assist the Fermilab Divisions and Sections with the disposition of any articles left in the offices they occupied.

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

5.9 The experimenters' request the setting up of a budget code with their funds, that would allow purchases from the stock room and outside vendors.

VI. SIGNATURES

3/26/2008
Jean-Claude Brient, Laboratoire Leprince-Ringuet

3/14/2008
Greg Bock, Particle Physics Division

3/12/2008
Roger Dixon, Accelerator Division

3/12/2008
Victoria White, Computing Division

2/28/2008
William Griffing, ES&H Section

3/16/2008
Hugh Montgomery, Associate Director, Fermilab

3/18/2008
Stephen Holmes, Associate Director, Fermilab

APPENDIX I - List of CALICE members

Jose Repond, Lei Xia
Argonne National Laboratory
Trygve Buanes, Gerald Eigen
University of Bergen
Yoshinari Mikami
University of Birmingham
George Mavromanolakis, Wenbiao Yan
University of Cambridge
Eduardo Cortina, Mary-Cruz Fouz
CIEMAT/Madrid
Nicola D'Ascenzo, Riccardo Fabbri, Erika Garutti, Angela-Isabela Lucaci-Timoce,
Benjamin Lutz, Niels Meyer, Nanda Wattimena, Oliver Wendt
DESY/Hamburg
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Daniel Jeans
University of Kobe
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Imperial College London
Imad Laktineh, Robert Kieffer
INPL/Lyon
Eugeny Tarkovsky
ITEP Moscow
Hegne Li , Roman Poeschl, Manqui Ruan
LAL/Orsay
Jean-Claude Brient, Marcel Reinhard, Allister Levi Sanchez
LLR - Ecole Politechnique/Paris
Djamel Boumediene, Cristina Carloganu, Francois Morisseau
LPC/Clermont-Ferrand
Jean-Yves Hostachy, Laurent Morin
LPSC/Grenoble
Michele Faucci Giannelli, Fabrizio Salvatore, Tao Wu
Royal Holloway University of London
Valeria Bartsch , Matthew Wing
University College London
Alexander Dyshkant, Kurt Francis, Patrick Salcido, Vishnu Zutshi
Northern Illinois University
Miroslav Havranek, Michal Marcisovsky, Petr Mikes, Pavel Ruzicka, Jaroslav Zalesak
University Of Prague
Satoru Uozumi
Shinshu University
Andy White, Jaehoon Yu
University of Texas, Arlington

APPENDIX II - 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		
	Bubble chamber		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
	Calibration		Methane	**Mechanical Structures**	
	Alignment		TMAE		Lifting devices
type:			TEA	X	Motion controllers
Wattage:			photographic developers		scaffolding/elevated platforms
class:			Other: Activated Water?		Others