

# DRAFT

**Memorandum of Understanding  
between  
University of California, Los Angeles  
and  
Pierre Auger Collaboration  
date signed**

## 1. Introduction

This Memorandum of Understanding describes the commitment by members of UCLA to the Pierre Auger Project. The purpose of this project is the design, fabrication and operation of the Pierre Auger Cosmic Ray Observatory. The Pierre Auger Observatory consists of sites in Mendoza Province, Argentina and Millard County, USA. The construction of the southern site will begin in 1999 and is expected to be complete in five years. Construction of the northern site is expected to begin in 2002 and will require about three years to complete. The Pierre Auger Project is described in the Pierre Auger Project Design Report of November 1996 and subsequent technical documents elaborating that design. The organization, leadership, operating procedures and present membership of the Pierre Auger Project collaboration are described in the Pierre Auger Project Management Plan.

This Memorandum of Understanding describes the long-term contributions of UCLA to design, construction and operation of the Pierre Auger Cosmic Ray Observatory. Contributions to the southern site only are included at this time. It is understood that the anticipated contributions of UCLA may be modified or that additional responsibilities may be added to those described here.

Annual amendments to this Memorandum of Understanding will detail the contributions of UCLA as the detector construction proceeds and will contain the specific activities, deliverables and funding required for the coming year.

This Memorandum of Understanding is made between UCLA and Pierre Auger Project Management. It does not constitute a legal contractual obligation for either of the parties. It reflects an arrangement that is currently satisfactory to the parties involved. The parties agree to negotiate additional amendments to this memorandum as required to meet the evolving requirements of the Pierre Auger Project.

## 2. Personnel

### 2.1. List of Scientific Personnel

Participating scientists including postdocs and students committed to the Pierre Auger Project during the full project period are shown in table 1. Katsushi Arisaka will serve as Principal Investigator.

Table 1: Scientific Personnel Commitments

Name	Position	Pierre Auger Project Fraction	Other Research Commitment
Katsushi Arisaka	Professor	50%	TA, EUSO/OWL, CMS
William Slater	Professor	50%	KTeV, KAMI
Arun Tripathi	Postdoc	80%	KTeV
Chris Jillings	Postdoc	100%	
Predrag Ranin	Grad student	100%	
Christian Howard	Grad student	100%	
David Barnhill	Grad student	100%	

## 2.2. Collaboration Board Representative

Katsushi Arisaka is the present representative of UCLA on the Pierre Auger Project Collaboration Board.

## 2.3. List of Technical Personnel

Technical staff members foreseen to participate during the full project period and the fraction of their time dedicated to the project.

Table 2: Technical Personnel Commitments

Profession	Name	Pierre Auger Project Fraction	Source of Support
Technician	To be hired	100%	Construction funds
Machinist	Shop staff	As needed	Construction funds
Programmer	Shimul Akhanjee (undergrad student)	10h/week; full time in summer	Construction funds
Undergrad students	Several - To be hired	10 h/week; full time in summer	Construction funds
Elec. eng.	UCLA staff	As needed	Construction funds

## 2.4. Other Key Personnel

The person responsible for environment, safety and health policies associated with Pierre Auger Project participation by this institution is currently Katsushi Arisaka. The person responsible for quality assurance in the tasks performed by this institution is currently Christopher Jillings.

## 3. Design, Fabrication and Installation Responsibilities

### 3.1. Design and Fabrication Responsibilities - Construction Period

The Pierre Auger Project Work Breakdown Structure (WBS) contains a detailed cost estimate for all the components, materials and labor required to complete the construction of the project. UCLA in coordination with the country representative agrees on a best efforts basis to provide the following components, materials and services based on the cost estimate contained the WBS. The WBS costs include contingency.

### 3.1.1. Description of Items Provided

Table 3: Items to be provided. Note that WBS numbers here are the “revised WBS” from the March 18, 2000 revision of the Pierre Auger Project Cost Estimate – Southern Detector. Items labeled A and B do not have a WBS entry.

WBS Item	Description	Number/Fraction
A	Test modified PMT from 3 companies	5
2.2.1.1.1.6	Review for final phototube design...	n/a
2.2.1.2.3	Phototube test stand for production	One 48-tube stand
2.2.1.2.2.3	Test production run PMTs	10% for southern site
2.2.2.2.2.5	Assemble bases to PMT	10% for southern site
2.2.2.2.2.6	Test tube bases-PMT assembly	10% for southern site
2.2.2.2.2.7	Ship tube base-PMT assembly to site	10% for southern site
B	Test PMTs from MACRO experiment	40% PMTs known not to be contaminated with He.

Details of our proposal for testing PMTs are available in GAP note 2000-038 and in a revision currently being written that will be submitted as early as possible to the GAP-note database.

The UCLA group will be responsible for evaluating the phototubes used by the MACRO project to determine whether they will be satisfactory for use in the southern Pierre-Auger. This item is listed last in table above and does not have a WBS number. Arun Tripathi has agreed to act as the contact person with the MACRO collaboration and work with Stéphane Coudu of Penn State University on this task.

### 3.1.2. Transportation

Unless specifically indicated otherwise here, items produced by UCLA for use in the Pierre Auger Project shall be transported by the providing institution to the agreed upon point of delivery. UCLA shall be responsible for safe transport of all items to these delivery points.

### 3.1.3. Installation and Commissioning

UCLA will participate in the installation and commissioning of its contributed items and will have personnel at the site as required, subject to adequate travel funding through their operating grant.

## 3.2. Coordination

The Pierre Auger Project Task Leader for the SA PMT/electronics subsystem is James Beatty at Penn State University (PSU). The institution contact person for the SA PMT activities at UCLA is Christopher Jillings.

Given the intimate link between the PMTs, the bases and the front-end electronics, it is imperative that regular contact be maintained with the Penn State University group and the UCLA group, and James Beatty and Stéphane Coutu in particular

### 3.3. Collaboration with Other Task Groups and Institutions

Design, construction and installation related to the SD PMT/electronics subsystem will be carried out in close communication and collaboration with other groups working on this and related subsystems.

For items 2.2.2.2.2.5 and 2.2.2.2.2.6 below the interaction with PSU will be important for two reasons. First, while UCLA will do the work, input from PSU in the design of a jig to assemble the PMTs and bases will be helpful. Second, the results of the testing must be supplied promptly to PSU, the institution responsible for the bases, so corrective action in manufacturing can be taken if necessary. Also the Institut de Physique Nucléaire d’Orsay is responsible for making the bases and we will need to be in close contact with them.

Table 4: Collaborating Institutions. PSU refers to Penn State University; IPNO, Institut de Physique Nucléaire – Orsay; FNAL, Fermi National Accelerator Laboratory. Items labeled A and B do not have a WBS number.

WBS/Task	Description	Collaborating Institution
2.2.1.1.1.6	Review for final phototube design...	PSU, IPNO, FNAL
A	Test modified PMT from 3 companies	PSU, IPNO
2.2.2.2.2.5	Assemble bases to PMT	PSU, IPNO
2.2.2.2.2.6	Test tube bases-PMT assembly	PSU, IPNO
B	Test PMTs from MACRO experiment	PSU

## 4. Contribution of Effort, Services and Facilities

### 4.1. Effort

Subject to adequate funding, UCLA will provide support personnel for the scientific and technical personnel as indicated in Section 2.

### 4.2. Services

The services of the UCLA Purchasing Departments and the Administrative Staff will be available to the Pierre Auger Project to the degree required to carry out the procurement responsibilities of UCLA.

### **4.3. Facilities and Equipment**

The following UCLA facilities and equipment will be made available to the Pierre Auger Project to the degree necessary to carry out the design and fabrication responsibilities of the group:

- 2000 sqft Laboratory space in the Physics department
- 2000 sqft Laboratory space in the STRB (Science and Technology Research Building)
- PMT test facility in the Lab

### **4.4. Operating Costs**

UCLA will support the normal research operating expenses (such as physicists' salaries, travel expenses, miscellaneous supplies, administrative support, etc.) of the UCLA group working on the Pierre Auger Project. These normal operating expenses are not considered as part of the Pierre Auger Project cost estimate.

## **5. Administration**

### **5.1. Procurement Authorization**

Pierre-Auger Project procurement authorization procedures are described in the Auger Project Management Plan.

### **5.2. Reporting**

UCLA will report all Pierre-Auger Project related expenditures and associated technical progress in each item of work by Work Breakdown Structure (WBS) category level 4 on a monthly basis through the appropriate Task Leader(s) to the Pierre Auger Project Manager. The progress reports will be based on percent complete and earned value for each WBS category.

Technical progress will be reported by WBS element to the Task Leader, Project Manager and the Spokesperson on a monthly basis and will cover all activities covered in this Memorandum of Understanding regardless of the specific nature of the funding support. All status reports will be assembled and made public to the Pierre Auger Project collaboration.

### **5.3. Component Ownership**

See the Pierre Auger International Agreement.

## **6. General Considerations**

### **6.1. Safety and Engineering Practices**

### **6.2. Maintenance**

For each subsystem contributed to the project UCLA shall undertake to provide a comprehensive subsystem maintenance package as described in the Auger Project Management Plan. This

provision is intended to ensure that sufficient maintenance capabilities are available for every subsystem over the planned 20year project life cycle.

## 7. Schedules and Milestones

UCLA will make every effort to carry out their institutional responsibilities consistent with the schedule for the construction of the Pierre Auger Cosmic Ray Observatory. These schedules may have to be changed as the project progresses. Changes that affect UCLA will be noted in Amendments to this Memorandum. The milestones for R&D are to be included even if this work is not covered in the WBS.

### 7.1. Design, Fabrication and Installation Milestones

The key milestones relevant to UCLA are listed here:

Table 5: Key Milestones

Description	Baseline Date	Current Date
Design/specifications for production PMTs	Completed	
Test 5 revised PMTs from each company	2 mo. after receiving	
PMT test stand in working order (12 channels)	March 15, 2001	
Test stand fully automated (48 channels)	June 30, 2001	
Test stand automatically generating reports	July 31, 2001	
Start testing of MACRO PMTs	Spring 2001	

### A. Appendix 1: Table to Tasks, WBS Numbers and Costs

The following table is from our revised PMT test-system design, "Proposal to test the PMTs and Production Bases for the Southern Auger Detector" which will be submitted as a GAP note in November or December 2000.

		Required Items Before October 2001			
WBS	Purpose	Description	No.	Cost/Unit	Cost (USD)
2.2.1.2.3	Elec: Afterpulsing	TDC with 10 $\mu$ s full scale	48+ chan		
2.2.1.2.3	Elec: Dark noise	Leading-Edge Discriminator	48+ chan		
2.2.1.2.3	Elec: Dark Noise	CAMAC scalar	48+ chan		
2.2.1.2.3	Elec: Gain/linearity	Charge-sensitive ADC (with 5 $\mu$ s gate)	96+ chan		
2.2.1.2.3	Elec: Pulse shape	CAMAC Octal MUX	15		
2.2.1.2.3	Elec: misc	Quad Gate/delay generator (Phillips NIM 794)	1		
2.2.1.2.3	Elec: Hardware	1 rack, CAMAC Crate, NIM bin	1		
2.2.1.2.3	Elec: Shipping	Shipping from FNAL	1		2000
			<b>Sub</b>	<b>Total</b>	<b>2,000</b>
2.2.1.2.3	DAQ	Computer	1	3500	3500
2.2.1.2.3	DAQ	CAMAC Crate Controller	1	0	0

2.2.1.1.2	DAQ	PCI card for light source (Nat. Inst. 6025E)	1	700	700
2.2.1.2.3	DAQ	PCI card for HV control (Nat. Inst. 6704)	2	1100	2200
2.2.1.2.3	DAQ	PCI card for waveform digitization	2	3500	7000
			<b>Sub</b>	<b>Total</b>	<b>12,500</b>
2.2.1.2.3	Cables	50 $\Omega$ signal cable RG-58 (1000-foot roll)	2	150	300
2.2.1.2.3	Cables	Connectors at base	100	10	1000
2.2.1.2.3	Cables	BNC connectors	100	5	500
2.2.1.2.3	Cables	Patch panel connectors (1 BNC, 4 LEMO bulkhead)	50	25	1250
2.2.1.2.3	Cables	Patch panel to MUX: length = 4 ns	100	10	1000
2.2.1.2.3	Cables	Patch panel to ADCs: length = 4 ns	100	10	1000
2.2.1.2.3	Cables	Patch panel to Amp: length = 4ns	50	10	500
2.2.1.2.3	Cables	Amp to Disc: length = 4ns	50	10	500
2.2.1.2.3	Cables	Discriminators to TDCs: length = 4 ns	50	10	500
2.2.1.2.3	Cables	Discriminators to Scalars: length = 4 ns	50	10	500
2.2.1.2.3	Cables	Ribbon cables for light source and connectors			500
			<b>Sub</b>	<b>Total</b>	<b>5750</b>
2.2.1.2.3	Light source	Development and testing			2000
2.2.1.2.3	Light Source	PCI to light source interface (custom electronics)	1	2000	2000
2.2.1.2.3	Light Source	Purchase of parts for LED circuits			5000
2.2.1.2.3	Light source	Machining and construction			1000
			<b>Sub</b>	<b>Total</b>	<b>10,000</b>
2.2.1.2.3	Dark room	Construction			8,000
2.2.1.2.3	Dark room	Hardware for dark room development.			2,000
			<b>Sub</b>	<b>Total</b>	<b>10,000</b>
2.2.1.2.2.6	Human Resources	Shakedown of test stand			20000
	MACRO PMTs	Early measurements			10000
			<b>Sub</b>	<b>Total</b>	<b>30,000</b>
			<b>Grand</b>	<b>Total</b>	<b>70,250</b>

This table does not include expenses beyond October, 2001.



