

A Proposal

To Design and Construct

PHOTO-DETECTORS FOR READOUT OF CLAS ECAL UPGRADE

Submitted to

Thomas Jefferson National Accelerator Facility
(Jefferson Lab)

by

Dr. Kevin Giovanetti
Physics Department
James Madison University

INTRODUCTION

This is a proposal for funding for Dr. Kevin Giovanetti and a team of James Madison University undergraduates for the spring and summer of 2000. Dr Giovanetti has been approved for a full year's sabbatical leave starting in the fall of 1999 and continuing until the start of the 2000-2001 academic year. This proposal outlines the work that Dr. Giovanetti will perform during this period and the associated costs that need to be covered. Jefferson Lab has agreed to provide the bulk of the procurement. This proposal only requests salaries, and a small supply budget.

PROJECT DESCRIPTION

The CLAS detector of Hall B at Jefferson Lab has proved to be a valuable tool for studying both particle and nuclear physics. The detector's capabilities coupled with the electron accelerator CEBAF have afforded experimentalists the opportunity to study fundamental aspects of several theories. These successes as well as improvements and upgrades to the accelerator have prompted the investigation of upgrades for the CLAS detector. These issues were addressed in considerable detail at the conference *Physics and Instrumentation with 6-12 GeV Beams*, Jefferson Lab, June 1998. The CLAS collaboration has agreed to proceed with developing prototype detectors to examine in detail some candidate detector improvements.

Starting in the fall of 1999 a group of physicists from The Institute of Theoretical and Experimental Physics (ITEP) in Moscow, Russia will construct three prototype detectors. These detectors will be designed for installation in front of the coils of the CLAS torus. The detectors will be able to extend the geometrical coverage of the CLAS detector and increase the detector's sensitivity to neutrons. The prototypes will all be calorimeters. Two will be based on lead/tungstate crystals and one will be based on a radiator/scintillator sandwich (Shashlik detector). All three convert the initial incident particle energy into a light signal. The collection and measurement of the light produced is performed by the readout system.

During the spring semester Dr. Giovanetti will work closely with the physicists from ITEP to design a readout system for the three prototypes. This will involve the testing of the candidate photo-detectors. The three most likely photo-detectors are avalanche photodiodes, vacuum photodiodes and photomultiplier tubes. Dr Giovanetti will also investigate methods for maintaining the calibration of these detectors. These developments will be carried out both at Jefferson Lab and in Dr. Giovanetti's research laboratory at James Madison University.

BUDGET

A budget summary can be found in Table I. Shown is Dr. Giovanetti's salary for the period from January 1, 2000 to May 31, 2000. There is a summer salary for one undergraduate student. Testing will be performed in Dr. Giovanetti's research lab. Laboratory space will be provided at Jefferson Lab should there be a need. Most of the equipment necessary for the testing will be supplied on loan from Jefferson Lab. The candidate photo-detectors required for testing will also be procured by Jefferson Lab. Dr. Giovanetti is requesting a small supply budget to allow for the purchase of laboratory essentials like cleaning chemicals and cables.

In order to allow Dr. Giovanetti and his students this unique research opportunity and to support Dr. Giovanetti's long-standing research program. JMU will utilize the unrecovered indirect cost for the University's in-kind contribution (item D). This will provide the proposal a competitive edge by bringing costs within acceptable values. It will guarantee Dr. Giovanetti's involvement in an important development for the CLAS detector, which will strongly enhance future opportunities for funding. It will also allow continued scholarly development for Dr. Giovanetti and his students.

Table 1 Budget Summary

James Madison University
800 South Main Street
Harrisonburg, VA 22807

SPONSOR: Thomas Jefferson National Accelerator Facility

		Sponsor Request	UNIVERSITY CONTRIBUTION	TOTAL
A. PERSONNEL	FTE			
1. Faculty-Academic Year				
Kevin Giovanetti	0.50	27567		27567
FY99-52,012*.06=55133				
2. Student	No.			
Undergraduate	1	3500		3500
TOTAL PERSONNEL		31067		31067
B. FRINGE BENEFITS				
@ 7.65%		2377		2377
TOTAL FRINGE		2377		2377
C. SUPPLIES				
1. Technical and Laboratory		1300		1300
TOTAL SUPPLIES		1300		1300
TOTAL DIRECT COSTS		34743	0	34743
D. INDIRECT COSTS		1568	12350	13918
TOTAL COSTS		36311	12350	48661
TOTAL DIRECT COSTS REQUESTED FROM SPONSOR			34743	
TOTAL INDIRECT COSTS REQUESTED FROM SPONSOR			1568	
TOTAL COSTS REQUESTED FROM SPONSOR			36311	
University In-Kind Contribution			12350	
TOTAL PROGRAM COSTS			48661	

Salaries and wages are estimates only based on current rate and pay.
Actual salaries and wages will be paid accordingly.

Budget Preparation: Patricia D. Buennemeyer
Date: August 11, 1999
Budget Administrator: Kevin Giovanetti

Progress and Milestones

The progress of the project will be followed using the following statement of work and timetable.

STATEMENT OF WORK
PHOTO-DETECTORS FOR READOUT OF CLAS ECAL UPGRADE

by
James Madison University

There are three prototype designs being fabricated^a by the Institute of Theoretical and Experimental Physics (ITEP) in order to determine the best method for upgrading the CLAS detector for higher beam energies. These prototypes are candidate designs for a forward calorimeter that could be placed in front of the CLAS magnetic field coils. The detectors would extend coverage and greatly increase the CLAS detector's sensitivity to neutral particles. Dr. Giovanetti and students from James Madison University will study the light readout and detection method for these prototypes. Two of the prototypes will be fabricated from lead/tungstate crystals. The third, a shashlik calorimeter, will be a sandwich design with alternating layers of radiator and scintillator. The light generated in the scintillator will be transported to the photo-detector using embedded wave shifting fibers.

Successful readout methods for these types of detectors include photomultiplier tubes, avalanche photodiodes, and vacuum photodiodes. The JMU group plans to explore the use of these photo-detectors with the above three prototypes, determine the appropriate readout method for each and develop the specifications for the procurement. In addition, the JMU group will design and build a calibration system that will monitor the gains of the readout photo-detectors.

Required funds:

Salary January 1 - May 31:	\$29,675
Student salary:	\$ 3,768
Facilities/Administrative:	\$ 1,568
Supplies:	\$ 1,300
 TOTAL	 \$36,311

Jefferson Lab, under the coordination of Dr. Burkert, will purchase the detectors for testing, components for the calibration system and will loan special testing equipment to JMU when necessary.

Milestones:

1) Project start	January 1, 2000	\$ 5,000
2) Mid term report	April 1, 2000	\$20,000
3) Final design for readout chosen	July 1, 2000	
4) Completion of calibration system	Aug 1, 2000	\$11,311

^a This work is being done under an agreement between Jefferson Laboratory and ITEP.

SOLE SOURCE STATEMENT

PHOTO-DETECTORS FOR READOUT OF CLAS ECAL UPGRADE

This project requires a thorough knowledge of the current status of the CLAS detector and an understanding of its operation in Hall B. Dr. Giovanetti has been involved in the design and construction of the forward calorimeter and has built a calibration system for this detector. His expertise in photomultiplier tubes and other readout devices is critical for the timely completion of the readout design for the prototypes. His experience with CLAS gives him unique insight into the challenges and limitations that will be placed on the physical layout of the detectors and the important environmental factors which will affect operation. Dr. Giovanetti has worked with all levels of the detector readout and control for CLAS. This will be essential in integrating new CLAS detectors and support systems into the current CLAS environment.

Dr. Giovanetti has worked with Jefferson Lab for over 10 years. He has a good working relationship with scientists and engineers at the lab and has worked closely with the support staff for the CLAS system. He has demonstrated that he can work effectively and independently at the lab. This project will be a natural extension of his past efforts.

Dr. Giovanetti's sustained interest in the CLAS detector and Hall B experiments demonstrates his commitment to this project. Successful detector upgrades will require the continued involvement of the scientists that understand the new systems.

James Madison University has the expertise and experience to successfully complete this project and a proven track record at Jefferson Lab. We recommend JMU as a sole source vendor for this endeavor.