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DOE/ER/12991-10

Final Report

"Data System for the
University of Texas Reactor"

DE-FG02-90ER12991

University Reactor Instrumentation Program

The University of Texas at Austin

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1. Background

Over the past 20 years, the number of nuclear reactors on university campuses in the U. S. has declined from more than 70 to less than 40. The number of research reactors located at DOE laboratories has also decreased dramatically. Contrary to this trend, The University of Texas at Austin constructed a new reactor facility at a cost of \$5.8 million. The new reactor facility houses a new TRIGA Mark II reactor which replaces an in-ground TRIGA Mark I reactor located in a 50-year old building. The new reactor facility was constructed to strengthen the instruction and research opportunities in nuclear science and engineering for both undergraduate and graduate students at The University of Texas.

On January 17, 1992, The University of Texas at Austin received a license for operation of the new reactor. Initial criticality was achieved on March 12, 1992, and full power operation, on March 25, 1992. We expect a greater than 10-fold increase in teaching, research, and service activities for the new reactor facility as compared to the old one. Funds from the University Reactor Instrumentation Program increase the usefulness of The University of Texas reactor facility to the scientific community.

The new reactor facility is located on the off-campus Balcones Research Center and contains 2 major laboratory experimental areas, a 3600-sq-ft bay for the above-ground TRIGA Mark II nuclear reactor and a 900-sq-ft bay (30 x 30 x 30 ft well-shielded room) for a neutron generator. The TRIGA reactor is licensed for 1.0-MW steady state power operation and 3.00-dollar power-pulse transients. The design of the reactor provides for a wide variety of in-core, out-of-core, and neutron-beam experiments. The neutron generator provides an intense source of DT or DD fusion neutrons; the design of the neutron generator room allows for shielding measurements as well as dosimetry and spectroscopy studies. In addition, the new reactor facility contains 8 support laboratories (2340 sq ft), 6 supplemental support areas (1430 sq ft), and 12 rooms of conference and office space (2570 sq ft).

2. Reactor Instrumentation and Proposed Use

A variety of neutron beam experiments is planned for the new reactor facility. Beam tube configurations include radial and tangential geometries, two diverging beam ports, and other features. A basic instrumentation system was proposed in 1990 to provide a data acquisition and analysis support system for the neutron beam experiments. The purpose is to decrease the equipment cost for individual experiments, provide a coordinated central point for control of experiments, and increase the productivity of data acquisition. Experiments of interest are neutron depth profiling, prompt gamma analysis, on-line neutron radiography, and experiments with neutron scattering and time of flight.

The equipment in our proposal included four phases. Awards for instrumentation, DOE Grants DE-FG0(7)2-90ER12991 and DE-F603-92ER79137, were received for the items of Phases I, II, and III. In support of these awards a building network system has been installed with supplemental funds that are not part of the DOE grants. This network provides an ethernet thinwire network for connections to PS/2 type computers, an Appletalk network for connection to Macintosh Type computers, and connections to a broadband cable that allows access to campus, state, national, and international networks. The network connections with the Phase I and II equipment acquisition will facilitate ready access to computer programs and data that relate to particular experiment projects.

The network-type arrangement has been developed with a powerful workstation as the central element. This system is supplemented with typical nuclear acquisition and analysis equipment such as multichannel analyzers, NIM acquisition systems, and test instruments to provide the interface to the individual experiment nodes of the network. The goal is to put in place the key elements of typical nuclear experiment systems (primarily digital components), so that each individual experimenter can concentrate experiment funds on detectors and special signal

processing equipment. This planned configuration of equipment for basic experiment support not only makes the use of funds for individual experiments more efficient, but also will encourage more experiments that are exploratory or unfunded.

Another consideration for the planned system is the availability of sufficient acquisition capability for either single or multiple experiments to accumulate as much data as possible within the available experiment time. This latter factor is an important asset as the costs of digital systems decrease, while the available computational power increases. In comparison, the cost of reactor time, beam time, and other operation factors are not expected to decrease, but will continue to increase with time. Thus, a premium will exist on experiment time and for some experiments, substantial gains will be available if all available data are processed. In some cases, this may require real time or on-line data processing for efficient experiment performance by rapid evaluation and adjustment of experiment conditions.

The planned project consists of 4 phases over a four year period. Phase I of the project (first year) has been completed to identify and acquire the best workstation for the primary system element. The choice made was a Digital Equipment Corporation (DEC) Vaxstation 3100 model 76 and 32 megabyte memory operating with VMS 5.x. This phase has included determination of the network or interface control software to operate the experiment nodes, and review of available software for support of the experiment applications. Examples of application software are spectroscopy analysis packages, multiparameter processing routines, spectrum fitting and unfolding, and multigroup spectrum calculations. Purchase of the workstation and acquisition of some application software are completed. Available licenses for DEC software will allow access to a wide range of utilities and compiler programs such as FORTRAN, Pascal, LISP, ADA, and OPS5. Development of data file control and command structures to coordinate use of software will be coordinated with the available system - user interfaces (window structures) or logic programming languages. (PROLOG).

Phase IV of the project will be to finish purchasing the basic elements of the experiment nodes. These components are multichannel analyzer/multiparameter systems, with nuclear instruments and computer control features. Equipment configuration will be sufficient to perform as a minimum gamma spectroscopy, multiparameter data acquisition, accumulation and control of multiple scalar-timer devices. One component of Phase I, the terminal server (RS232 equipment standard) will provide the connection to some systems. A GPIB (IEEE 488) bus is available (Phase II) for the connection to digital instruments such as the digital voltmeter, current voltage source, and NIM modules.

DATA ACQUISITION SYSTEM

PHASE I

Items in Phase I have been purchased. The subtotal 32,850 is the equipment award for DOE Grant DE-FG07-90ER12991 (9/90-8/91).

1.	Vax Station Model 3100 stand alone workstation with memory disk drive, floppy diskette, color monitor	\$18,500
2.	Terminal server	3,000
3.	Software & manuals	3,200
4.	Printer device	3,000
5.	Network components	2,410
6.	Other, cables, interfaces, etc.	<u>2,740</u>

Phase I Granted Funds Total	32,850
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PHASE II

Items in Phase II have been purchased. The subtotal 8,290 is the equipment award for renewal of DOE Grant DE-FG0(7)2-90ER12991 (9/91-8/93).

General Instrumentation

1.	Frequency measurement, Keithley 775A	1,769
2.	Electrometer, Keithley 617	3,649
3.	Digital multimeter, Keithley 196	1,443
4.	IEEE interfaces and cables	483
5.	Carry over to Phase III	<u>946</u>

Phase II Granted Funds Total	8,290
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