Budget Justification

The proposed budget will support the creation of a digital instrumentation lab for educating students and a high neutron fluence end station for both research and training. A list of all the equipment and costs is given in Table EquipmentCosts. Five digital instrumentation stations will be established to control and perform digital measurements of the instruments described in the narrative. The VME crates and single board computers are available for five of these stations but each station requires a input/output module for interrupting the VME backplane, a VME based module for digitizing analog signals (ADC, TDC, ...) , a host computer for data storage and control, several coaxial signal cables, and NIM modules. A high neutron fluence end station will also be configured which duplicates the components used for the class room instrumentation stations and is specialized for the end station. A target system for the production of neutrons using an electron linac will contain several items which collectively amount to $73,000 but individually are less the threshold of $25,000 quote requirement. While most of the detectors to be used in the proposed digital instrumentation lab are in house, we would like to acquire a fission chamber from General Electric at a cost of $30,000.

The cost of creating 5 digital instrumentation stations for a classroom based training facility and an end station for practical training in an environment exposed to high neutron fluences will be approximately $227,000. Each of the 6 total stations will need a host computer, a IO module for VME interrupts, discriminators to discriminate an instruments analog output, dual timers to provide digital signal delays, and digital signal level translators. These modules represent a basic VME based data acquisition system. The coincidence units will be used to determine if the analog output of two detectors occurs within the same time interval. Two fast amplifiers are needed for the HpGe detector and ionization chamber stations. Three stations will require time to digital converters (TDCs) and three will require analog to digital converters (ADCs). A flash ADC will be used for the pulse shape discrimination station. Although we currently have enough VME crates and single board computers for the classroom stations, we will need to purchase a crate and computer for the end station. We have allocated a coaxial cable budget of $6,000 to transport analog and digital signals for all the stations. We also need two additional NIM bins to power the NIM modules for two of the labs while we expect to use 4 NIM crates currently in hand for the remaining stations. We would also like to purchase an EPICS embedded digitizer for $18,000 for the students to share and use to evaluate the time evolution of signals that they will be measuring at each digital instrumentation station.

Costs for the high neutron fluence target system are based on a design which has been in development for several months. The target is designed to withstand the power deposited by a 10 kW electron beam. The Tungsten converter will be acquired at a cost of $11,000. A Stainless steel chassis will be used to hold the cylindrical converter at a cost of $12,000. Shielding the high power target carries most of the cost for the system. High density concrete has been estimated to cost $20,000 by the radiation safety group. Borated Polyethylene is also required and will cost $21,000. A heat exchanged to cool the tungsten target is estimated to cost $9,000.

Cost	Description
$18,000	6 SIS3610 I/O modules
$12,000	6 Host computers for DAQ control and storage
$20,000	6 CAEN dual timers N93B
$12,000	3 CAEN quad coincidence units N455
$6,000	2 Four channel CAEN fast amplifiers N978
$24,000	6 CAEN discriminators (N840, N 842, N844)
$18,000	6 Level Translators
$18,000	3 CAEN TDC V775
$18,000	3 CAEN ADCs V792
$9,000	1 Flash ADC 250 MHz Struct
$6,000	1 VME crate 64x
$4,000	1 Single board computer (GE XVB601)
$6,000	coaxial cables
$18,000	EPICS compatible digital scoilloscope
$8,000	2 NIM bins
$11,000	Tungsten target for neutron production
$12,000	Stainless Steel Target holder
$20,000	high density concrete shielding
$21,000	Borated polyethylene shielding
$30,000	GE fast and slow neutron detectors

Table 1: Equipment Budget