THE K600 FOCAL PLANE POLARIMETER

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Construction has begun on a high–efficiency polarimeter for intermediate–energy charged particles. This device, which will initially be located downstream from the medium-dispersion focal plane of the K600 spectrometer system, has now been fully designed. All components of the dedicated electronics have been ordered, materials for wire chamber and scintillator fabrication are in–house, and an adjustable mounting/shielding platform for alignment and integration into the existing K600 system is under construction.

The polarimeter consists of a thick carbon block, followed by two sets of paired x–y multiwire proportional chambers, and two planes of plastic scintillator. The high–density (1.74 g/cm^2) carbon target serves as the polarization analyzer, and can be varied in thickness from 1.27 cm to 5.08 cm in 1.27 cm increments. For incident proton energies between 120 and 200 MeV, the p–^{12}C analyzing powers are large in magnitude, and have been carefully studied for both elastic and inelastic scattering processes.[1] The needed carbon blocks are now complete, and associated mounting structures have been designed and submitted for fabrication.

The MWPC designs were finished by mid–1987, and all necessary materials have been procurred. The printed circuit boards used to transmit signals from the actual wires to the pre–amplifier cards were designed and etched, and several sections of the required G–10 have been machined. Readout of the wire chamber information will occur via the LeCroy PCOS III system, which offers several advantages over either direct coincidence register or highly multiplexed configurations. A crucial feature is the rapid encoding time ($<$ 500 ns), with presentation of the encoded output at an ECLport. This information will be used as input to a second–level trigger processor for on–line rejection of events in which the particle underwent no significant scattering in the analyzer target. We estimate that this should increase our data–taking speed by approximately a factor of twenty. Other features include programmable chamber card thresholds, computer control of latch delays, clusterization of adjacent wire hits, and minimal word transfer over the (slow) CAMAC dataway. By the end of 1987, all the MWPC cards and most of the PCOS electronics were in–house, with all remaining modules expected by the end of February 1988.

The scintillator planes will be 0.64 cm and 7.62 cm thick NE102 stock. Depending on the incident particle type and energy, these will serve as either a ΔE–E pair or as a ΔE–high-resolution–ΔE combination. The 0.64 cm scintillator will be a single sheet, viewed by four low–gain 2" photomultiplier tubes (Hamamatsu R329), while the 7.62 cm thick plastic will be segmented into six vertical non–overlapping sections, each viewed by two similar 2" tubes. This segmentation was considered necessary in light of the high background rates that arise under certain spectrometer running conditions and the large volumes of scintillator involved. The sixteen anode signals will be discriminated and fed into another second–level trigger processor which allows for user–selectable logic levels to be generated for all possible 16–bit inputs. Thus, the high–voltage bias applied to the photomultiplier tubes, the discriminator thresholds, and even the 16–fold scintillator coincidence logic will

all be under remote computer control. All the PMT bases are transistor–stabilized, and have been built and tested. A prototype E detector has been constructed, and preliminary measurements suggest that pulse–height resolutions of 2–3% should be readily attainable, with a uniformity over the entire active surface of better than 1%. More extensive tests are planned, and will be compared to Monte Carlo calculations for the particular light–guide geometry chosen.

With the above polarimeter, our goal is to calibrate and measure the normal component of outgoing proton polarizations by mid–1988, and to complete measurements of the induced polarization P and the polarization–transfer coefficient $D_{NN'}$ for experiment E306 by the end of the year. During this time, we will also be involved in the commissioning of additional equipment that will be required for full polarization transfer capabilities at IUCF. This includes installation of two spin–precession solenoids in the high–energy beamlines, development and calibration of associated in–beam transmission polarimeters, and the addition of two horizontal drift chambers to the K600 focal plane system for complete vertical trajectory information. Most of these tasks are part of general laboratory development, and will benefit many other users beyond the spin–transfer group. Operation of the focal plane detectors at locations other than the medium–dispersion mode may also be required before complete sets of all polarization–transfer observables can be obtained.

1. see, for example, IUCF Scientific and Technical Report 1982, p. 182–188.

TARGET LAB TECHNICAL STATUS

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A new design for an electrolysis cell was used to produce ^{66,67}Zn foils of very high purity with 94.7% material efficiency. The cell was constructed of teflon machined so that a retangular bar of mirror-polished tungsten carbide (the cathode) could be compression-sealed in the side. In this way the Zn could deposit only on one vertical surface of the WC bar. A Pt screen was used for the anode. Argon gas was bubbled through the plating solution of ZnO dissolved in 3 ml of acetic acid. The argon helped to achieve a more uniform Zn deposit. The Zn peeled easily in one piece from the cathode. With this method, followed by rolling between stainless steel packs, targets of 7.3, 5.0, and 1.7 mg/cm^2 were produced.

Large area (1/2" × 1 1/2") pressed powder targets of ^{10,11}B (150-200 mg/cm^2), ^{32,34}S (16 mg/cm^2) and Si (16 mg/cm^2) were developed. For the B and Si, the binder was partially decomposed styrene. The new binding technique involved preparation of a solution of styrene in sylene to which enough ETOH was added to precipitate styrene powder fine enough to be suspended in the liquid i.e., the solution became cloudy. After the concentration was determined, 1-2% by weight was mixed (wet) with the target powder and allowed to dry.