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P. Smith

Minutes of GlueX tracking mini-workshop - Ohio University - October 4, 2005

Present:

IU: Paul Smith, Ryan Mitchell, Gerard Visser (IUCF); OU: Dan Carman, Simon Taylor

By phone:

FIU: Werner Boeglin; CMU: Curtis Meyer, Zebulan Krahn

Ryan Mitchell showed some GEANT plots of track path length and energy deposition in the CDC and FDC. These plots are available as GlueX-doc-533. This information was used to estimate the number of electrons produced by ionization in the tracking chambers and to estimate the range of expected signals which is a factor of 30 for the CDC, a factor of 10 for the FDC anodes, and a factor of 100 for the FDC cathodes. This information has been used to update GlueX-doc-412, the GlueX detector summary table.

Ryan's earlier PID simulations also show that the FDC provides unique particle ID information in either the DIRC or gas Cerenkov versions of the GlueX detector. The conclusion is that we definitely want dE/dX information from the CDC. We still don't know whether the FDC cathodes can provide this information; there is anecdotal evidence from Bill Dunwoodie that this may be problematic. In the interests of commonality with the CDC and with the uncertainty of getting dE/dX from the FDC cathodes, the feeling was that the safest thing to do is instrument the FDC anodes with flash ADCs instead of the currently proposed TDCs. This isn't a definite decision at this time, but will continue to be studied. Hopefully a beam test can provide a definitive answer. It is also unclear whether there is any cost advantage to the anode TDC system.

Gerard Visser showed a preliminary design for a 65 Msps ADC. It should be possible to fit 96 channels in a 6U VME64X module.

There were discussions of simulations. We would like a simulation that starts from a track through the CDC and FDC gas volumes and generates a current waveform at the anodes and cathodes. This especially needs to take into account the "clumped" ionization and the drift trajectories. GARFIELD should be able to simulate these processes. Once this simulation is in place it could be used to optimize the preamp shaping time and the fADC sampling rate and bit depth.

The feeling is that enough information is in hand to allow preamp and fADC prototyping to proceed. It seems likely that a faster (125 Msps) ADC will be needed to achieve the necessary 2 ns timing resolution required for the anodes; a slower (65 Msps) ADC is probably adequate for the FDC cathodes. It may be possible to compromise and a pick a sampling rate appropriate for both anodes and cathodes. Current fADC chips have densities of up to 8 channels at 65 Msps, but at 100 Msps or faster the density is only 1 or 2 channels/chip. This may well change on a year or two time scale.

Regardless of simulations, it is important to continue with a program of measurements on CDC and FDC prototypes. Simon Taylor has a Struck SIS3300 8 channel, 100 Msps fADC VME board which JLab owns connected to the FDC prototype. Struck has just announced a 200 Msps version of this module (SIS3320). Instrumenting the anodes with this module will be very important for near term tests before prototype GlueX developed modules are ready. The proposal is to use FY06 R&D funds to purchase 2 of the 200 Msps boards (at $7K each) so that the FDC and CDC can each have 8 channels instrumented and one additional 100 Msps ($5K) board so that 16 FDC cathodes can be instrumented. The chamber prototypes should be operated in a magnetic field as soon as practical, and beam tests should be scheduled in the next 2 or 3 years.

The current FDC prototype will be rebuilt on a month or so time scale. Simon Taylor showed data collected with the Struck fADC. In the near future he will attempt to increase the gain of the “post-amplifier” and the Struck board. Currently his cathode signals only use a small (~20 counts) part of the potential 12 bit range. Even so, he is able to achieve about a 5 ns time resolution by fitting to the leading edge of the pulse waveform; this is quite encouraging.

Curtis Meyer has extensive experience with algorithms which fit to the leading edge of drift chamber fADC data; he has forwarded his code to Simon.

Some thought has gone into the design of a full scale FDC prototype. The biggest question is how to make and support the cathodes planes which need to be low mass and as flat as possible. The JLab detector group is helping with this effort.