PRELIMINARY RESULTS ON THE EFFECT OF DIGITIZER LEAST COUNT ON POINTING ERROR

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I have put digitizer least count (LCNT) into DUMC as a parameter. Now, after the OM hit times are generated and Gaussian–wiggled with a sigma defined by the parameter TRES (currently 2.5 ns), I round them off by LCNT. In the track fit, the chisq term containing the square of the difference of the measured and expected times is weighted by the reciprocal of TRES^2 + LCNT^2. That is, the errors are rms'ed. Thus the rms time error for LCNT = 1 ns is then 2.7 ns, negligible compared to 2.5 ns, while for LCNT = 2 ns it is 3.2 ns.

So, if the PMT time resolutions are as good as 2.5 ns, then going from LCNT of 1 to 2 ns makes an appreciable dent in the time resolution. Thus there are two questions:

(1) What is TRES for the two tubes?
(2) What is the effect on the physics?

In answer to the first question, the OM–builders present time jitter distributions expressed in terms of FWHM. Taking FWHM = 2.3*sigma, the Phillips tube has sigma = 2.3 ns for 1 p.e., 1.7 ns for 2 p.e., and even lower for more p.e. (see C. Wiebusch report, Bern meeting). The last report I have on Hamamatsu tube jitter is in the June, 1989 Collaboration Meeting Minutes: FWHM = 5.6 ns or sigma = 2.4 ns, presumably at 1 p.e. So TRES = 2.5 ns seems a reasonable, conservative choice.

As to the physics, everyone agrees that the pointing error is an important parameter – particularly for background–reduction in searching for signals. We have advertised a median error of 1 deg., but the MC's give a median more like 1.3 – 1.5 deg. in the presence of noise, depending sensitively on the minimum number of tubes and strings required for the fit. Further, the distributions have a long tail, so the average is more like 5 deg. It is hoped that improved track fitting algorithms can reduce this tail and a number of ideas are being pursed by the Monte Carloers.

So any results on absolute pointing errors are at this time only preliminary. Taking my existing program, which is currently undergoing extensive development, and my current favorite algorithms and parameters, and with SIGMA = 2.5 ns, I find that LCNT = 1 ns has no significant impact on the experiment. That is, I get the same results for LCNT = 1 as for LCNT = 0. This is consistent with the argument about rms errors given above. LCNT = 2, however, degrades the pointing error by about 1/4 deg.

Now 1/4 deg. is less than the current uncertainty in the absolute pointing error for the experiment. But it does add to the other errors and I am not prepared to dismiss it as negligible.

A tentative decision was made at last week's Seattle meeting to go to LCNT = 2 ns. This is probably OK, but the hardware people should take one more look to see if it is absolutely essential before freezing the decision.