Integration test performed on January 18, 2001.

Tsunefumi Mizuno
Department of Physics, Hiroshima University
mizuno@hirax6.hepl.hiroshima-u.ac.jp

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I tested an connection between ACD electronics and External Targets with the help of Dave and Jim. The test was performed on Jan. 17–18 at room #148 of a HEPL building (Stanford University). Here I briefly summarized the test results of the first day.

1 PMT output

First of all, I checked out whether External Targets (PMT, Plastic scintillator, and HV unit) I brought from Hiroshima are alive or not. I supplied +12 V to HV units, whose output can be adjusted by a potentiometer and monitored as HV $= 250 \times V_{mon}$. The HV outputs were at 500, 625, 750, 875, and 1000V. The PMT signal (anode output) was monitored by oscilloscope with 50 Ω termination. A trigger level was set relatively high, and the events observed were cosmic-ray (mostly MIP muon) origin. I checked out 4 External Targets and all of them looked work well. Among them, I show the PMT output of LA9807 in Figure 1.

2 Test of ACD electronics board–pulser input

Before integration test between the External Target and the ACD electronics board, I inputted BNC pulser signal into the board (the pulser is a BNC random pulser model DB-2, but was used in a repetition mode). The risetime was set at 100 ns, and the fall time was set at 5 us. In this test, the jumper was adjusted so that the pulser signal is not connected to the charge integrating preamp, but connected directly to the mid–amp. The pulser output and the mid–amp output are monitored by oscilloscope. As shown in Figure 2, the gain of the mid–amp is about 10. Jim also found that the mid-amp output is saturated at about 1 V, both in positive and negative.

3 Connection test between the External Target and the ACD electronics

It seems that the discriminator and the Peak Follower circuit expect that the polarity of the signal is positive. On the contrary, the output of the PMT of External Target are

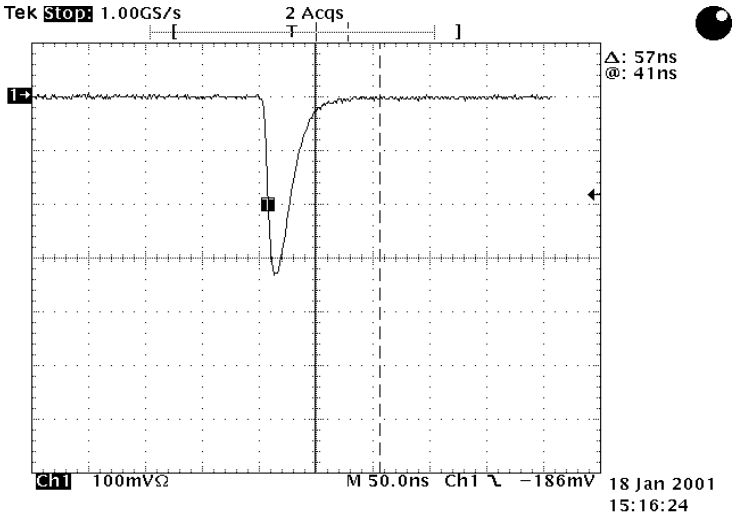

Figure 1: An anode output of LA9807 with 50 Ω termination. The PMT was operated at 750 V. This event is probably induced by cosmic-ray MIP muon, so I expect that an energy deposit is about $2\ \frac{\mathrm{MeV}}{\mathrm{cm}} \times 5\ \mathrm{cm} = 10\ \mathrm{MeV}$.

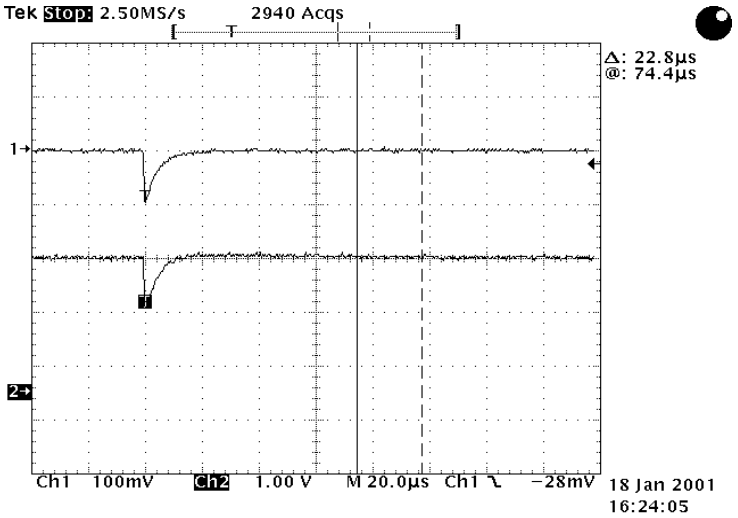

Figure 2: A pulser output (ch.1) and mid–amp output (ch.2). The gain of the mid–amp is about 10.

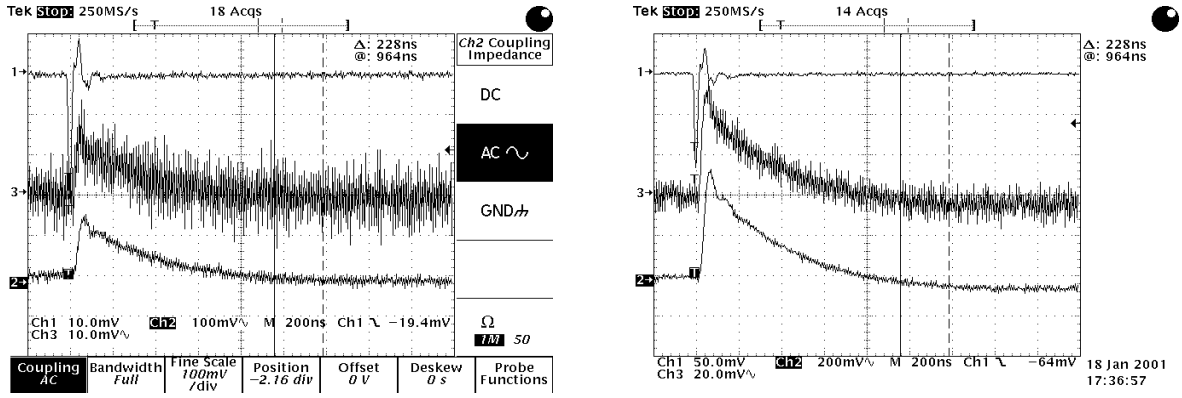

Figure 3: The waveforms obtained in the connection test between External Target and ACD electronics. Channel 1 (top) is the PMT output (with 50 Ω termination), Channel 3 (middle) represents the mid–amp input, and Channel 2 (bottom) shows the mid–amp output. The left figure is obtained when PMT was operated at 525 V, and the right one when 625 V.

anode output, so the polarity is negative. Therefore we adjusted jumpers so that PMT output is first fed by charge integrating preamplifier (where the signal polarity is inverted) and then connected to mid–amp. We used one of the 4 External Targets (serial number of the PMT is LA9807), set the high voltage at 500 V, 525 V, 550 V, 575 V, 600 V, and 625 V, and monitored PMT output (with 50 Ω termination), mid–amp input (charge amp output), and mid–amp output by an oscilloscope. The obtained waveforms are shown in Figure 3. The pulse-height ratio of PMT output and mid–amp input is about 0.5, so the effective gain of charge-integrating preamp plus mid–amp is about 5.

A typical pulse height of our PMT output is 300–400 mV and pulse width is about 50 ns for 10 MeV deposit when operated at 750 V, and typical HV index is about 7.9 (this means that PMT gain is proportional to $(\mathrm{HV})^{7.9}$). Therefore, if I set the threshold level of External Target at 50 MeV, and operated PMTs at HV=450 V, the level of the mid–amp output will be

$$400\ \mathrm{mV} \times 5 \times \frac{50\ \mathrm{MeV}}{10\ \mathrm{MeV}} \times (450\ \mathrm{V}/750\mathrm{V})^{7.9} \sim 180\ \mathrm{mV}.$$

This level seems to be appropriate, but I need to confirm.

4 Remaining issues

Today I performed connection test only by using oscilloscope. The test with DAQ will be done tomorrow. In addiiton, I think further investigation of charge integrating preamplifier (e.g., monitoring waveforms at several points by oscilloscope) is necessary to understand what determins the gain and pulse-shape of this amp.