Setting the MTC for a Grow-In/Decay cycle.

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In a number of cases with LeRIBSS we would like to observe both the growth in activity while the beam is being deposited at the center of the CARDS array as well as the decay of the activity while the beam is being deflected by something upstream. To deflect the beam, we will send a TTL signal to the beam-line control system. At the same time I want to insure that the MTC stays in synchronization with the beam being turned off. To do this, I will use the remote control features of the tape system even though they were considered somewhat an unusual situation. To control the timing, I will use a Philips 794 Quad Gate and Delay Generator as describe here. A schematic diagram of the wiring of the Philips 794 module is shown in Fig. 1 while the timing diagram for this process is shown in Fig. 2.

Each channel of the Philips 794 module contains a trigger input, a width adjustment potentiometer, a TTL output, a gate output (NIM), and a complimentary gate output (anti-NIM) which will be used. These are indicated in Fig. 1. The module can be triggered by the falling edge of any convenient signal. Within a few microseconds of the trigger, the three output signals will be produced. The module has been set so that the TTL output matches the timing of the gate and not the delayed signal. The width of these signals can be set by adjusting the potentiometer. Since the complimentary gate signal has its falling edge at the end of the gate time, I will use this to trigger the next gate in a sequence of Beam On/Beam Off/Tape Move. This sequence requires three gate channels while the fourth is used to send a signal to the MTC control unit to enable it. In the following paragraphs I will go into the gory details of how this all works.

Before going into specifics of how the system works, I want to go over a few details of how the MTC control box works. There are two modes of operation available. The more common mode is "Local" where the one just selects the appropriate tape cycle program, enables the system using the toggle switch, and pushes the start button. However, Ed, in his wisdom, included a mode with the ability to enable the tape remotely and then send a signal to tell the system to start running the selected program. Now I am going to use this second mode to force the tape to move when I want it to, independently of the "dwell" time programmed into the system. Now when enabled remotely, the MTC control will sit and wait to receive the External Start signal before launching the program. As long as the system remains enabled, this program will continue to run without further external support. But this is a problem since I want the Philips module to dictate when the tape moves. To get around this I simple use the fact that the tape will not move if it is not enabled. Hence, I can send a tape enable signal, move the tape, and then immediately disable the tape. I only need to be sure that the tape move is completed before I disable the tape. This works because the first step in the MTC cycle, as far as the controller is concerned, is to move the tape.

An MTC timing cycle is started by triggering the "Beam On" gate (Fig. 2). At the end of this time, the complimentary gate signal is used to trigger the "Beam Off" gate. At the same time, I want to enable the tape. I do this using the gate signal from the "Beam Off" channel so that within a few microseconds they are synchronized. The TTL output from the "Tape Enable" channel is then sent to the MTC control unit. The width of the tape enable gate is set to extend into the beginning of the beam-on gate for the next cycle to insure that the tape move is completed before the tape is disabled. It is important that this gate go to the base line before it is triggered again or the system will go out of synchronization and stop. At the end of the beam-off gate, the complimentary gate signal is used to trigger the "Tape Move" gate. The TTL output from this channel is sent to the MTC control unit to initiate the program. About 3ms later, the tape will move, so the tape move gate is used to insure that the tape has time to complete its motion before the next cycle begins. This seems to work fine if the gate remains open for just a few milliseconds after the end of the "Tape in Motion" signal as shown in Fig. 2.

It should be easy to adjust the timing cycle by adjusting the widths of the gates using an oscilloscope. If a faster or slower tape speed/acceleration is used, the width of the tape move gate should be adjusted accordingly. Just be sure to change the tape enable gate width to make sure it occurs after the start of the beam-on gate but before the end of this gate. You can also reduce the gate times quickly with the rotary switch, but be sure to check the tape enable gate which will cause major problems if it doesn’t occur at least a few milliseconds before the tape move signal is sent.
Figure 1: Schematic layout of the wiring for the Philips 794 module as described in the text.
Figure 2: Timing diagram for the Grow-In/Decay MTC timing cycle.