Modification of the PIBETA Signal Splitters for the PEN Experiment

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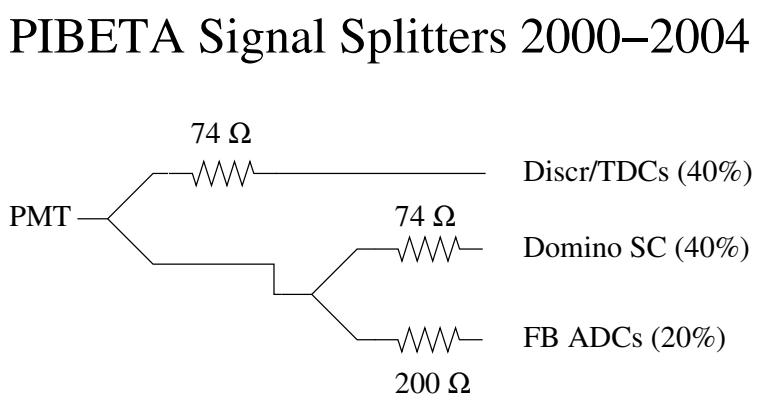
One major change in the data acquisition electronics for the PEN experiment will be the elimination of the Domino Sampling Chip (DSC) waveform digitizing system, used in PIBETA runs since 2000 for all CsI calorimeter, plastic veto hodoscope, and beam counter signals. The beam counter waveforms will be digitized in the PEN experiment using a new, faster system. Eliminating the DSC for the CsI and other non-beam counters will enable us to double the signal amplitude going to the discriminator/TDC branch, and thus to achieve increased discriminator efficiency.

Signal splits in the PIBETA experiment were implemented by using two splitters, models UVA-122 (74 Ω to Discr./TDC and a short to UVA-139), and UVA-139 (74 Ω to DSC-wfd, and 200 Ω to Fastbus ADCs), in series, as shown in Fig. 1 (top panel). The splitter units were designed and built by Bill Stephens at UVa. Both devices were designed to use interchangeable resistors, so that the voltage ratios of signal splitting can be changed according to need. In addition, they were configured with connectors appropriate for the use. UVA-122 is rack-mounted, while UVA-139 sits on a board plugged into a header connector. Originally, precision metal-film resistors were used. A quick inspection of Fig. 1 shows that the effective resistance presented to the signal delay line is $\sim 50\,\Omega$ for the splitter combination, preventing (excessive) signal reflections.

The required changes in DAQ signal splitting as we go from the PIBETA 2000 configuration to the PEN 2006 configuration are:

1. Altogether remove the second signal split, i.e., the UVA-139 units.
2. Change the resistors in the UVA-122 splitters to values: 12.5 Ω for the discriminator/TDC branch, and 200 Ω for the Fastbus ADC branch.

The new configuration of the UVA-122 splitters for the PEN experiment is also shown in Fig. 1. Again, the photomultiplier signal delay line "sees" an effective impedance of $\sim 50\,\Omega$, minimizing reflections. Calorimeter signal splitting in the trigger branch will remain unchanged.



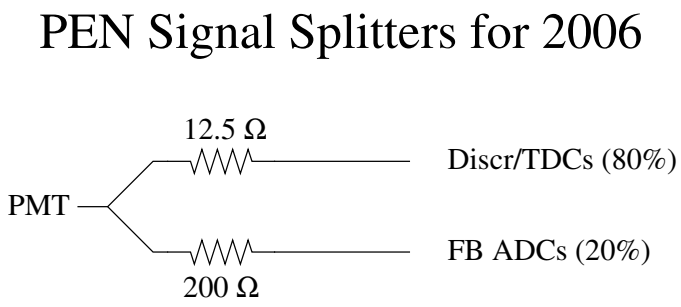


Figure 1: Schematic diagrams of the DAQ branch signal splitting in the 2000–2004 PIBETA runs (top), and that required in the 2006 PEN run. The first split in the PIBETA circuit (74/0 Ω) is accomplished in a UVA-122 module, while the second split (74/200 Ω) is done in a UVA-139 module. The PEN experiment will use only the UVA-122 units for DAQ branch signal splitting.