Test results from a LBL Base for the Hamamatsu R5946 Photomultiplier Tube for use in the Central Trigger Barrel for STAR.

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Leo Greiner, Ismael Flores

We have tested an LBL designed and fabricated base for the Hamamatsu R5946 Photomultiplier Tube that will be used in the Central Trigger Barrel for the STAR experiment. We find that, with an output pulse-height of 600 mV, the PMT/base combination will sustain pulse rates of greater than 1 MHz making is suitable for use in the CTB.

The Hamamatsu R5946 Photomultiplier tube is a 1-1/2 inch 16 stage planar mesh dynode type of photomultiplier tube selected for use in the STAR Central Trigger Barrel. We have constructed a prototype standard resistor-voltage divider type base, shown schematically in figure 1. The base is of simple mechanical construction, consisting of a small 1.30" diameter circuit board with attached LEMO signal cable and RG-59 SHV cable high voltage cable soldered to the PMT socket and all fitted into a machined standard Sch. 80 PVC pipe cap. The socket is glued into the pipe cap and the cable egress at the back of the cap is sealed with black silicon sealant. See picture in figure 2.

This base was tested using an R5496 PMT in a light box with a Hamamatsu PLP-01 picosecond light pulser. The PMT waveforms observed do not differ significantly when the PMT views this pulser or a Bicron BC-408 scintillator with a source. The measurement setup is shown in figure 3. Two of the observed waveforms are shown in figures 4 and 5. Figure 4 shows the waveform viewed through 10 feet of RG-174 LEMO cable. The waveform in figure 5 is viewed after 10 feet of RG-174 LEMO cable and ~100 feet of RG-58 BNC cable.

The pulse height output of the PMT-base combination as a function of pulser frequency for three high voltage settings is shown in figure 6. For pulse heights up to 600mV the PMT-base combination appears to work well for pulser frequencies up to and above 1MHz. We expect to run the tubes in the gain region where a single MIP gives a PMT-base pulse height of 100mV or less.

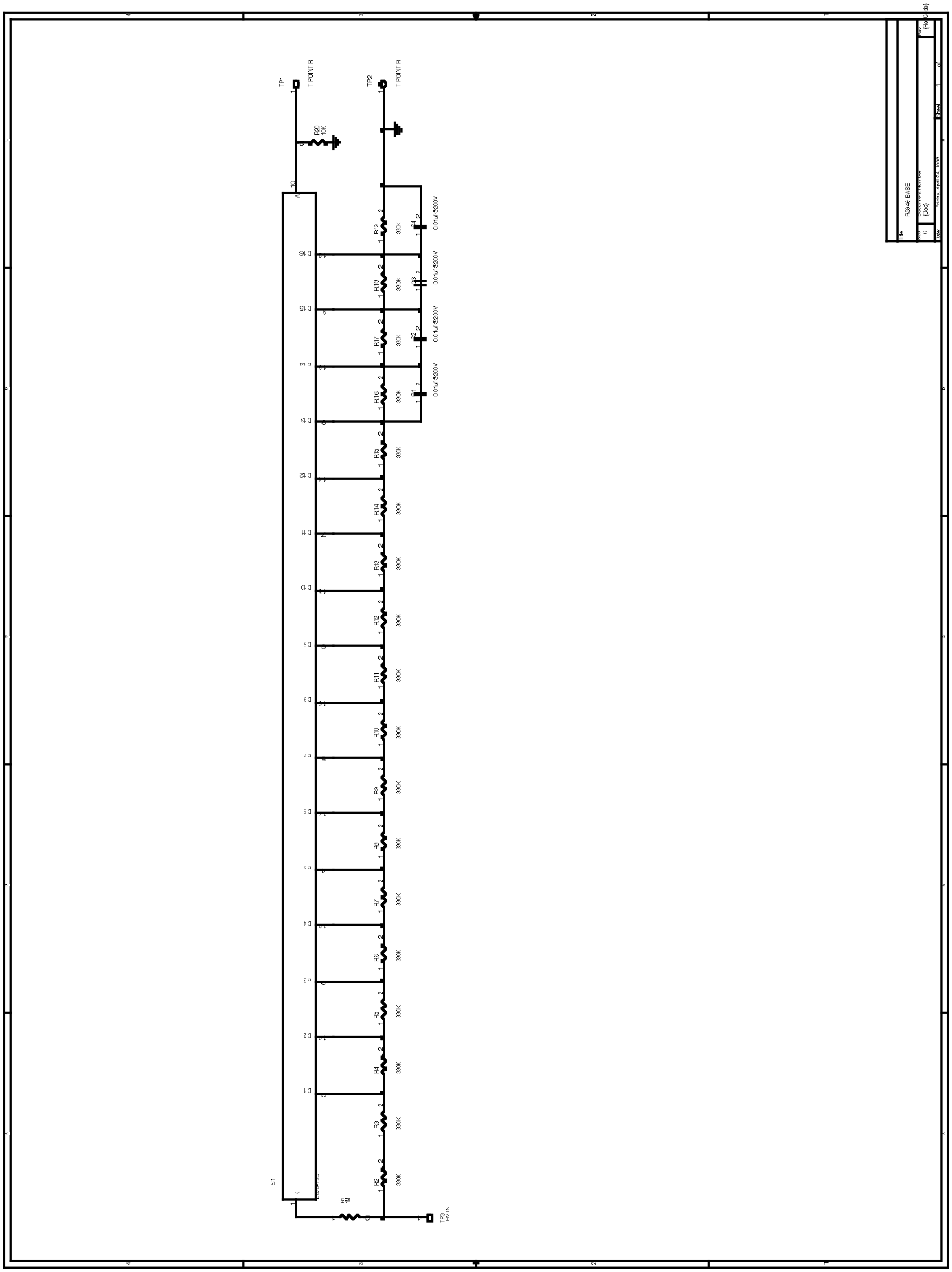

Figure 1: Electrical schematic for base.

Figure 2: Picture of disassembled base showing printed circuit board soldered to PMT socket and PVC pipe cap housing

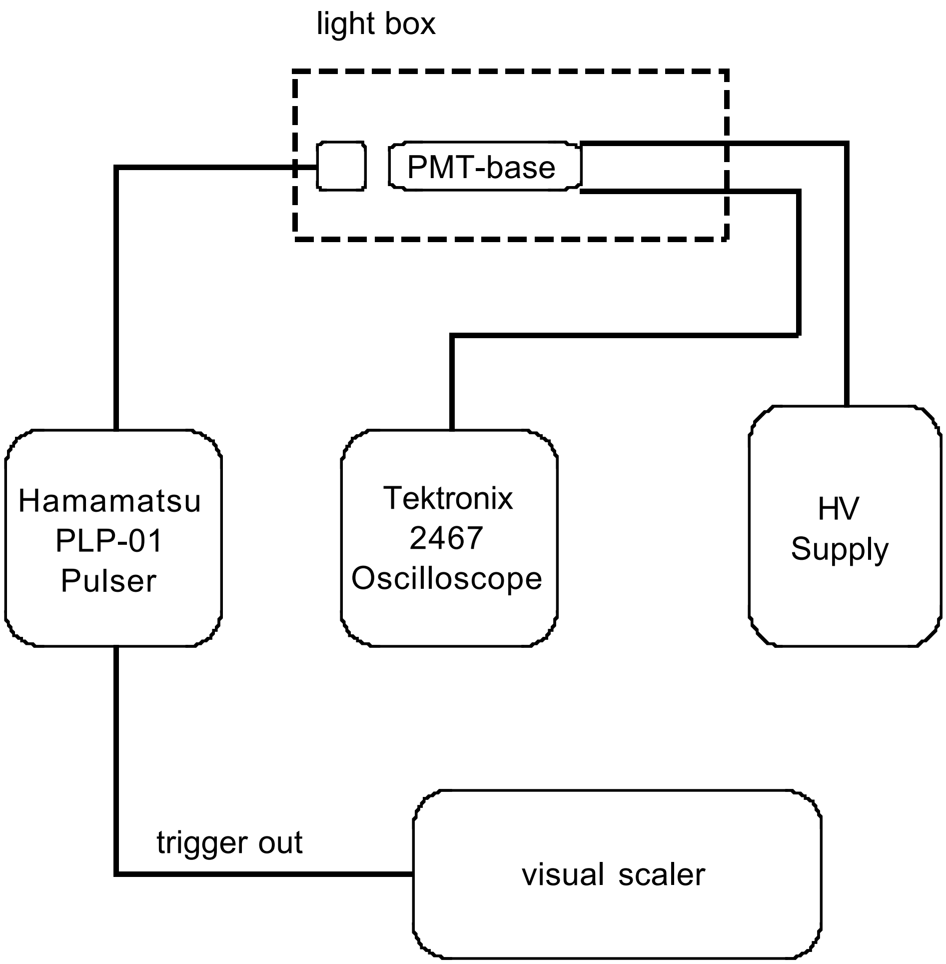

Figure 3: Measurement setup

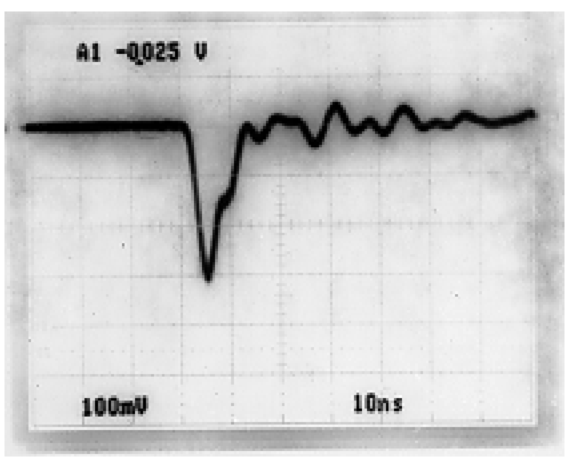

Figure 4: PMT-base waveform viewed through 10 feet of RG-174 LEMO cable

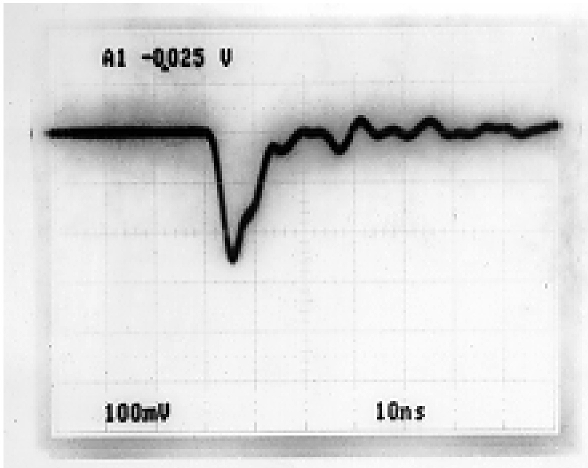

Figure 5: Same signal as figure 4 but viewed through an additional ~100 feet of RG58 BNC cable

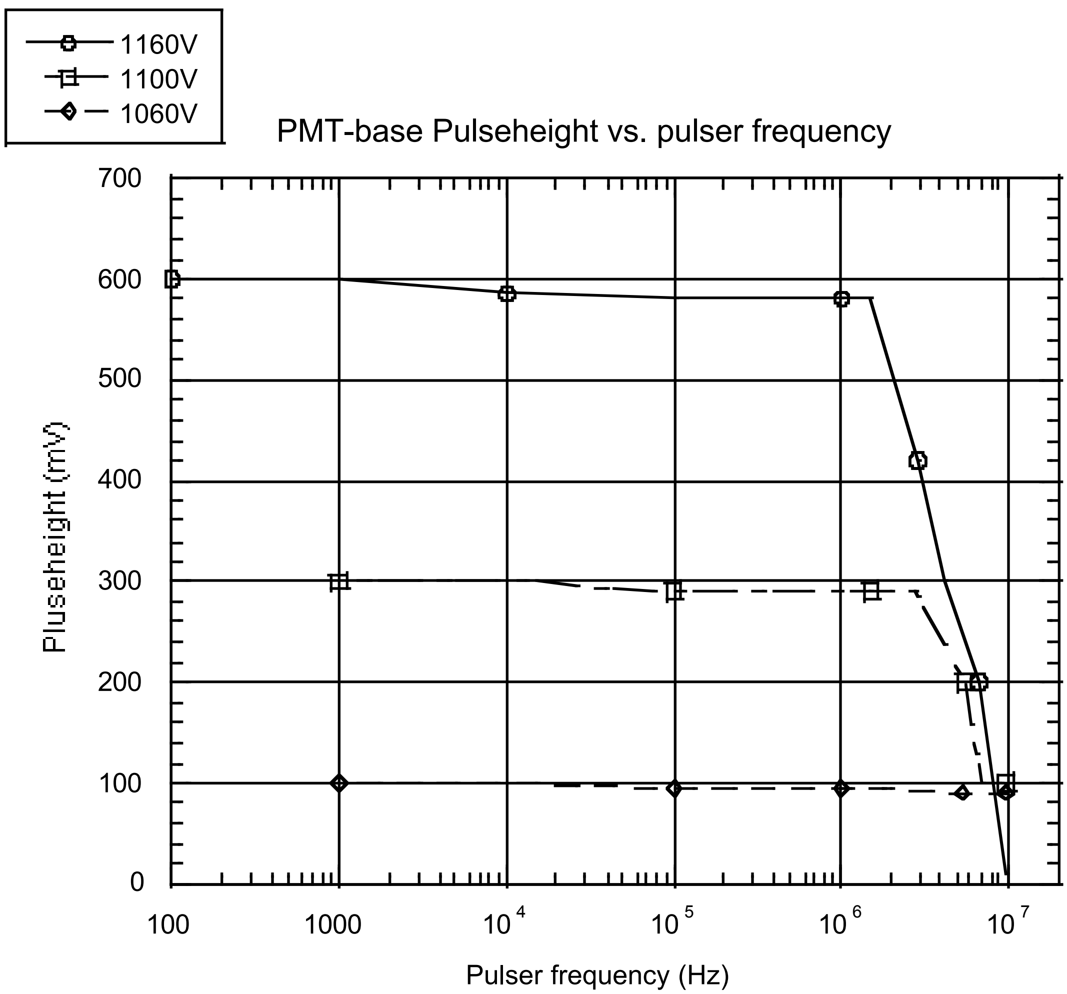

Figure 6: PMT-base pulseheight versus pulser frequency for three high voltage settings; 1060 V, 1100 V and 1160 V.