

Low Gain PMTs

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Introduction

The main SNO tubes will have a dynamic range from approximately 0.05 photoelectrons to 1000 p.e. A 1 TeV event in the detector will create roughly 1000 p.e. per PMT. In view of the "peculiar events" observed in Kamiokande it was decided to increase the dynamic range of about 50 inward looking tubes to beyond 1000 p.e.

Design Criteria

There are several criteria which must be met for the low gain tubes :

- All low gain PMTs should be able to work at the 1 p.e. level. This maximizes the number of 'normal' PMTs and makes calibration of the low gain tubes easier.
- The number of modifications should be kept to an absolute minimum.
- Whenever possible use standard components.

- No active electronic components inside the base housing.
- Housing/cable assembly must not leak

Electronics

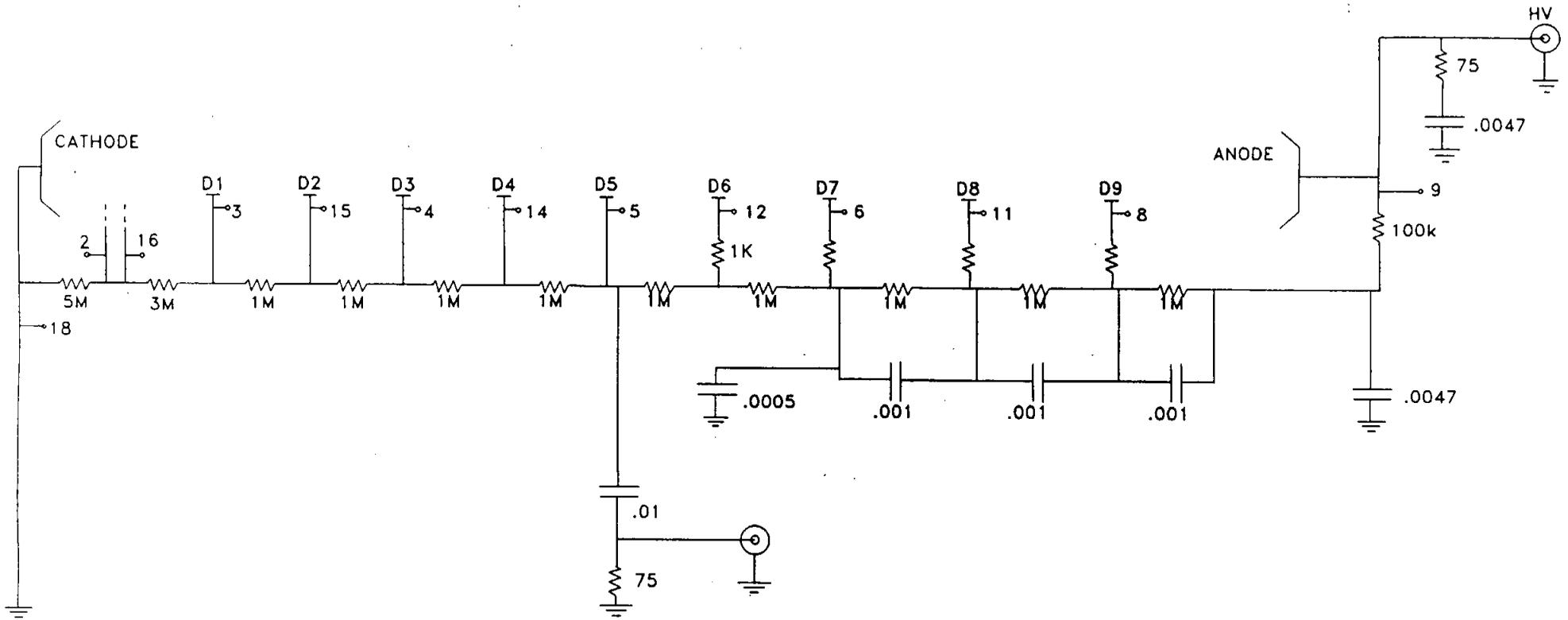
The first criteria means that we need two cables for the low gain tubes; one is the anode/high voltage and the other carries a signal from one of the dynodes.

Figure 1 shows the modified base circuit. An extra $1\text{K}\Omega$ blocking resistor (surface mounted) is added on dynode 6 and the 'low gain' end of the capacitor chain is A/C grounded to prevent cross-talk. A low gain signal is taken off dynode 5 through a high voltage capacitor. This signal is terminated with a $75\ \Omega$ resistor. Figure 2 shows the anode signal (top trace) and the (inverted) low gain signal (bottom trace). The measured charge gain relative to the anode signal (at an anode gain of 10^7) is roughly 0.01

The necessary modifications to a standard base are straightforward. Only one trace has to be cut (the $1\text{K}\Omega$ resistor). The signal capacitor is mounted between the base and the bulb where it cannot move. The other capacitor (physically much smaller) is mounted on the top of the base. A $1/4$ inch solder joint to a trace holds it in place. Two 26 gauge wires go to the extra connector. The $75\ \Omega$ terminating resistor is soldered directly to the connector.

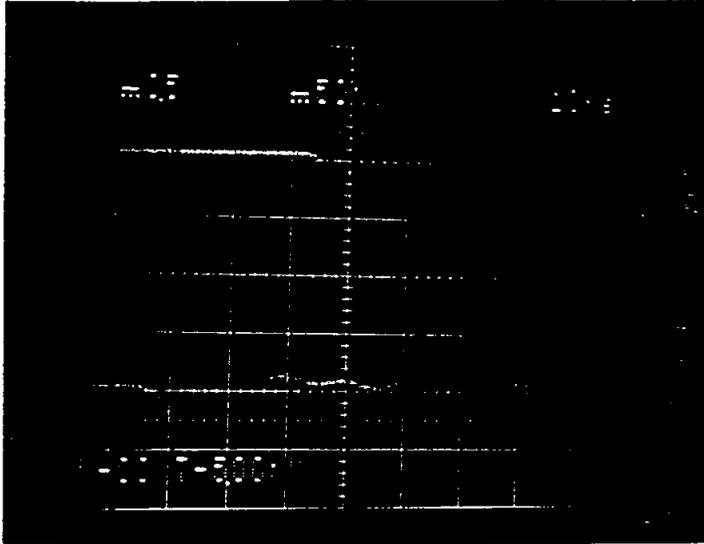
Water proofing

The low gain tubes use the same housing, endcap and heatshrink as the standard tubes. The only difference is that the plug inserted into the filling hole is replaced with a specially made up plug. This plug which is machined from high density polyethylene stock has a standard MA-COM connector in it. After the housing is filled with silicone gel in the usual manner, the two wires are soldered to the connector, the housing is topped up and the plug/connector is squeezed into place. The plug is then wrapped with heatshrink. Figure 3 shows the assembly.



TITLE:	
HAMAMATSU 1408 MODIFIED GAIN BASE	
DATE: SEPT 21/93	No.
DR by RLS	
FILE: 1408MOD.SKD	

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ASSEMBLED HAMAMATSU R1408 PMT

