PMT Testing at UTA

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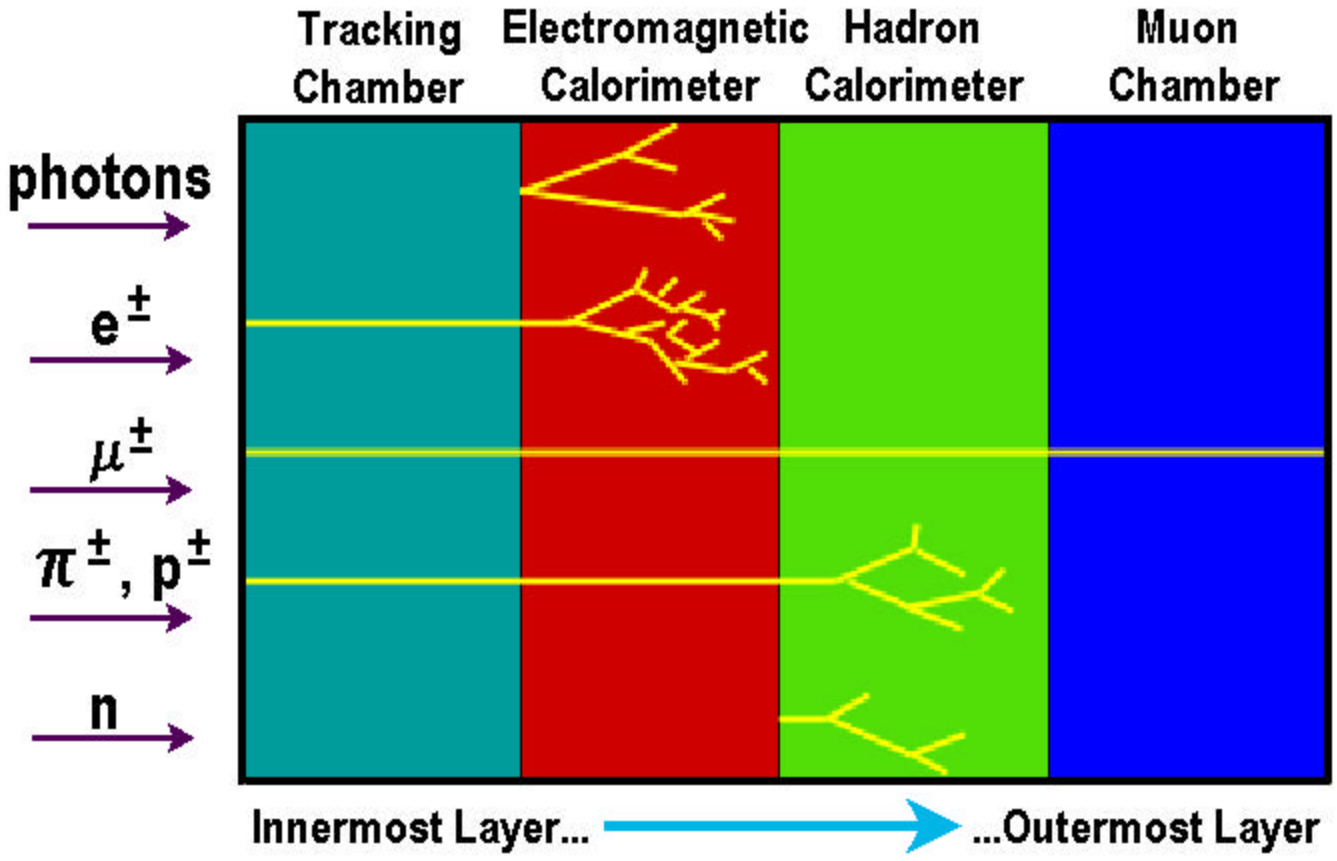
OUTLINE

Use and Operation of PMTs

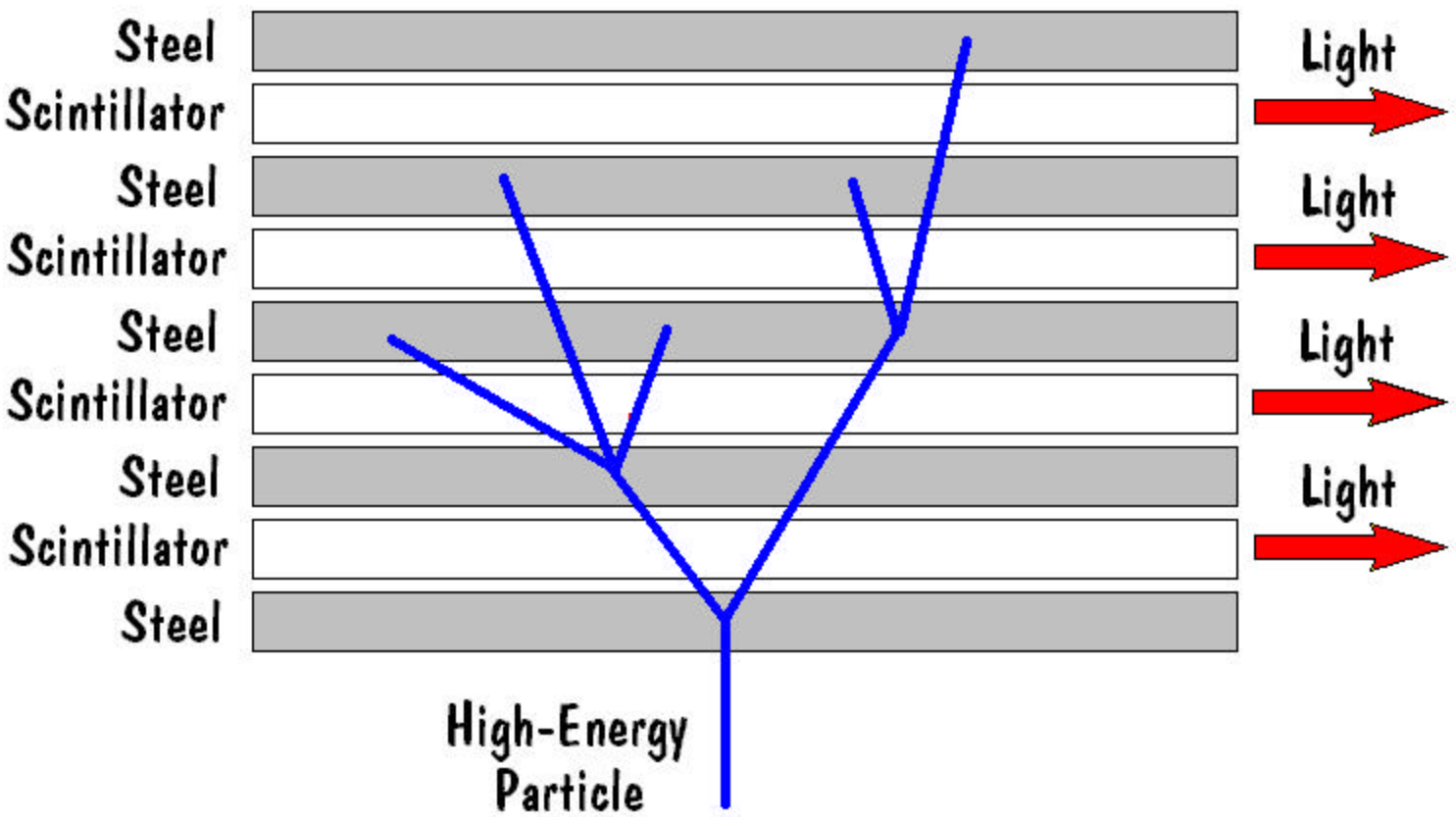
Testing PMTs

PMT Testing Equipment at UTA

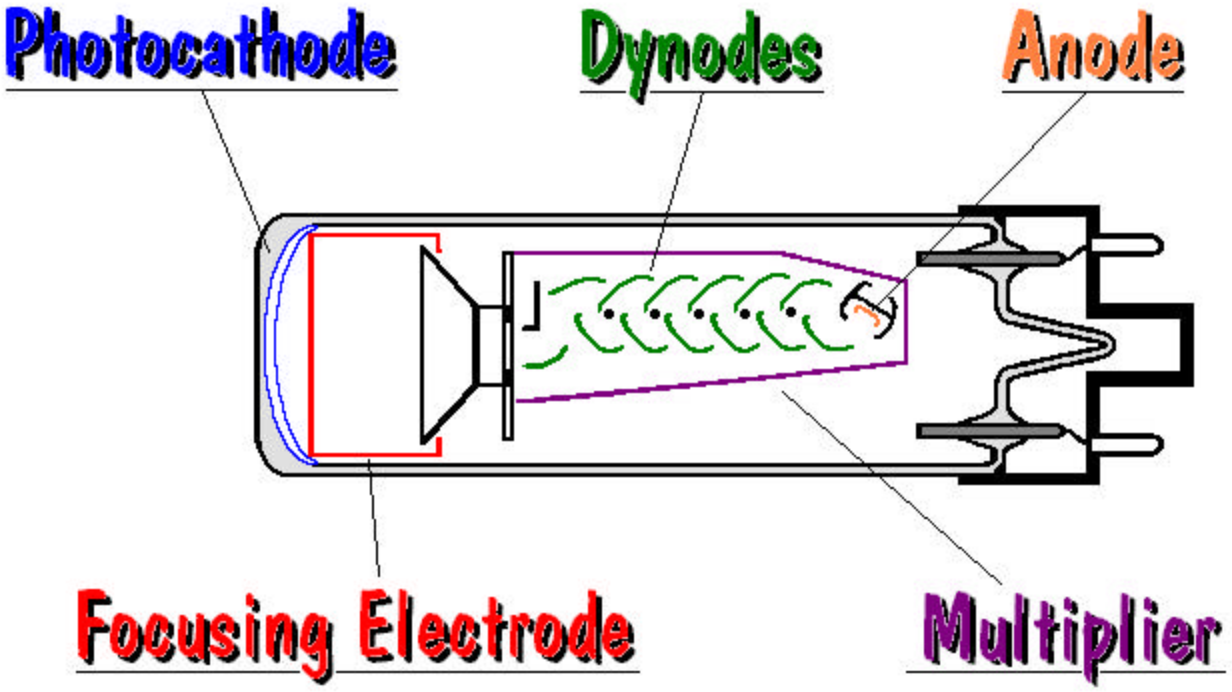
Detector Components



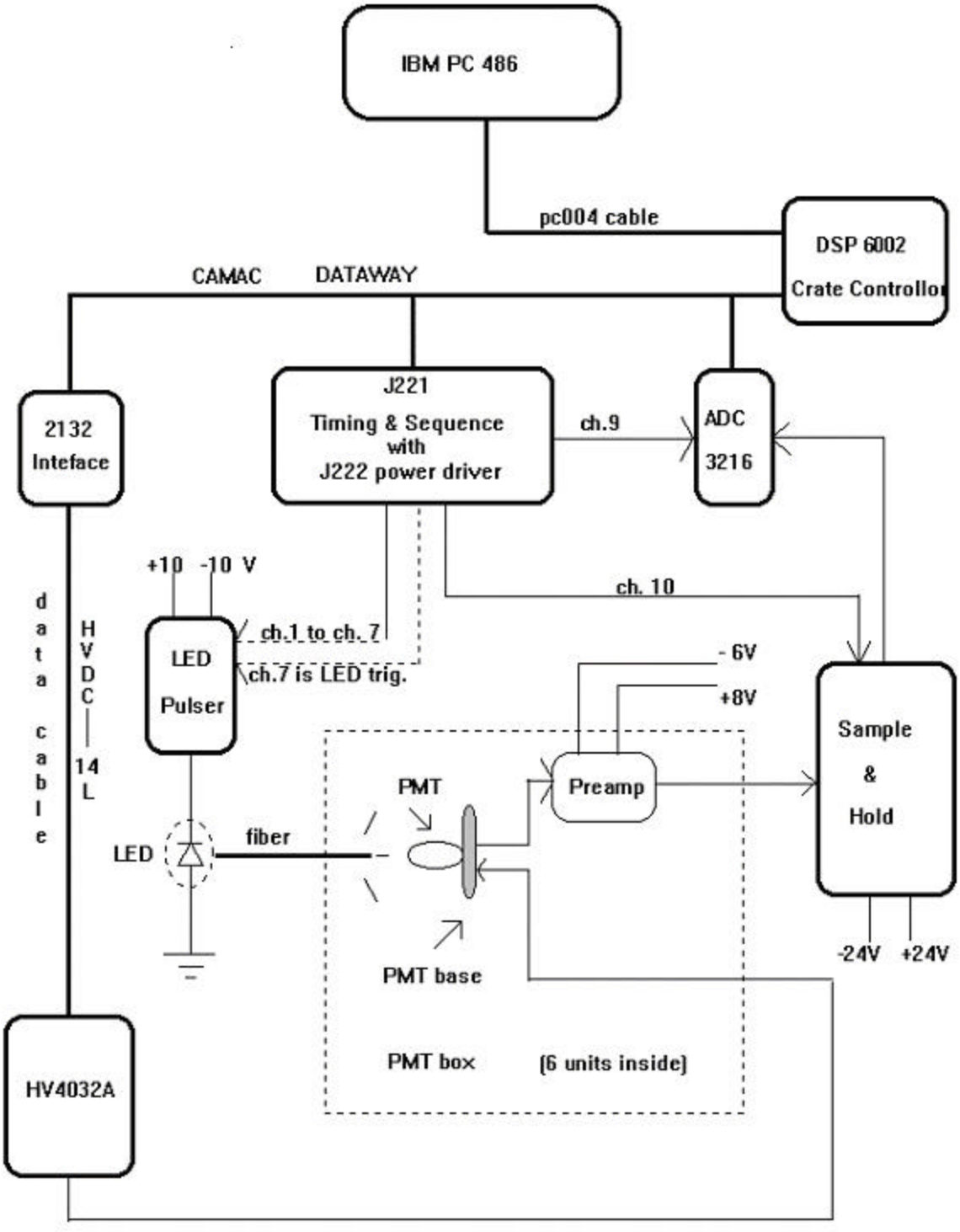
Tile Calorimeters



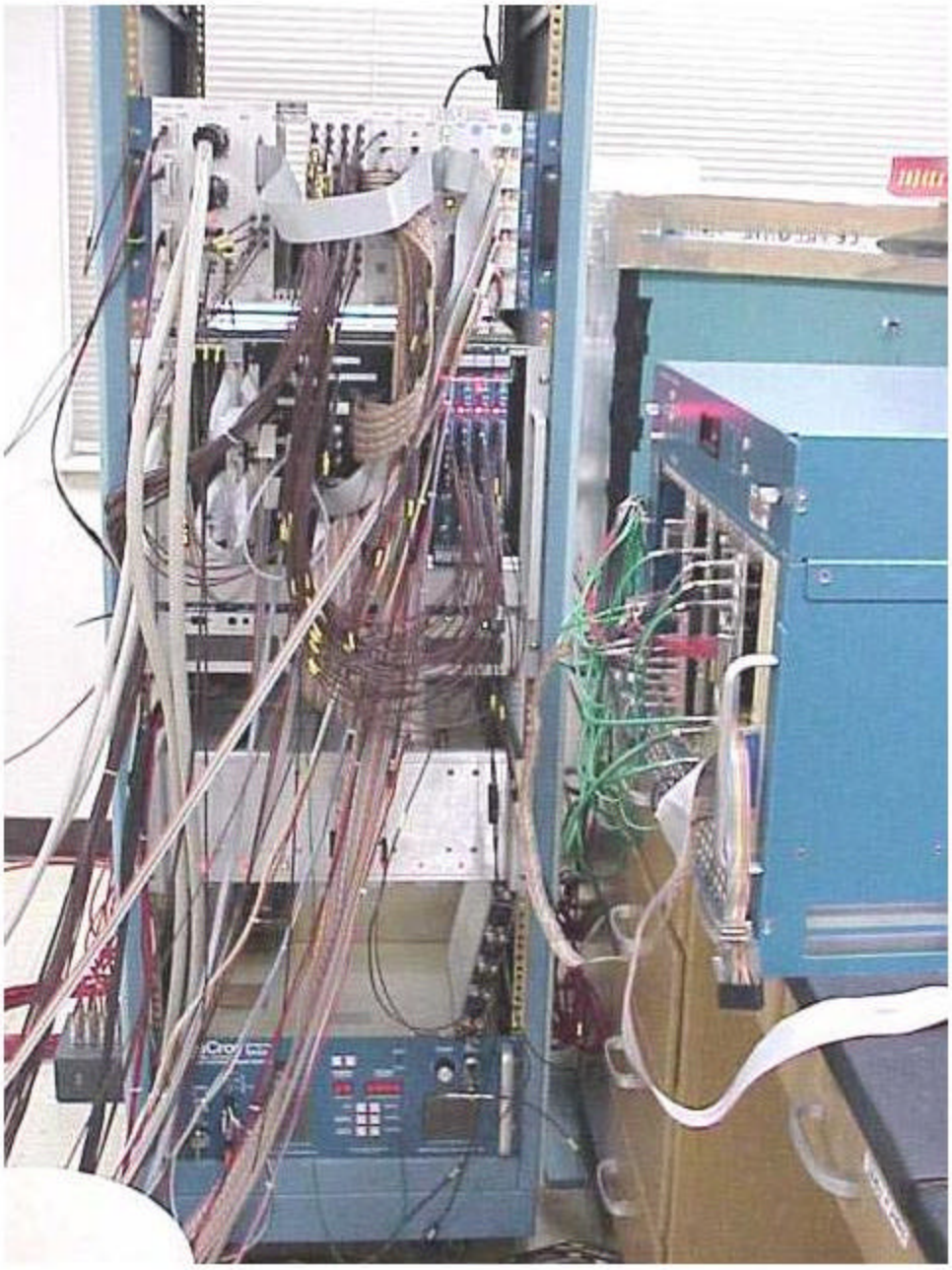
Photomultiplier Tubes (PMTs)



Layout of Test Bench



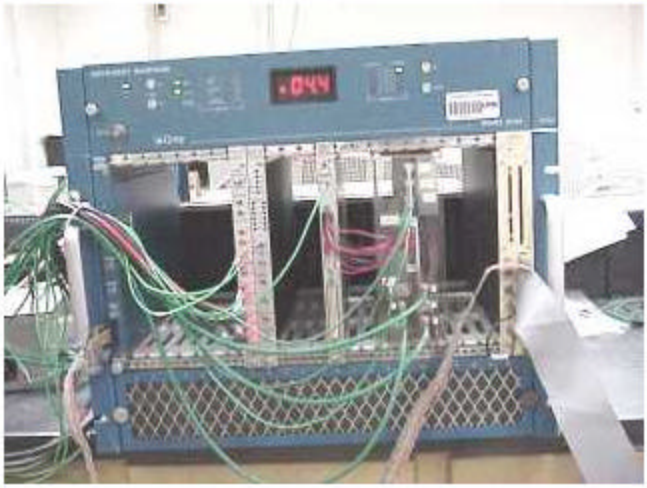
PMT Test Bench Set-up



Test Bench Components

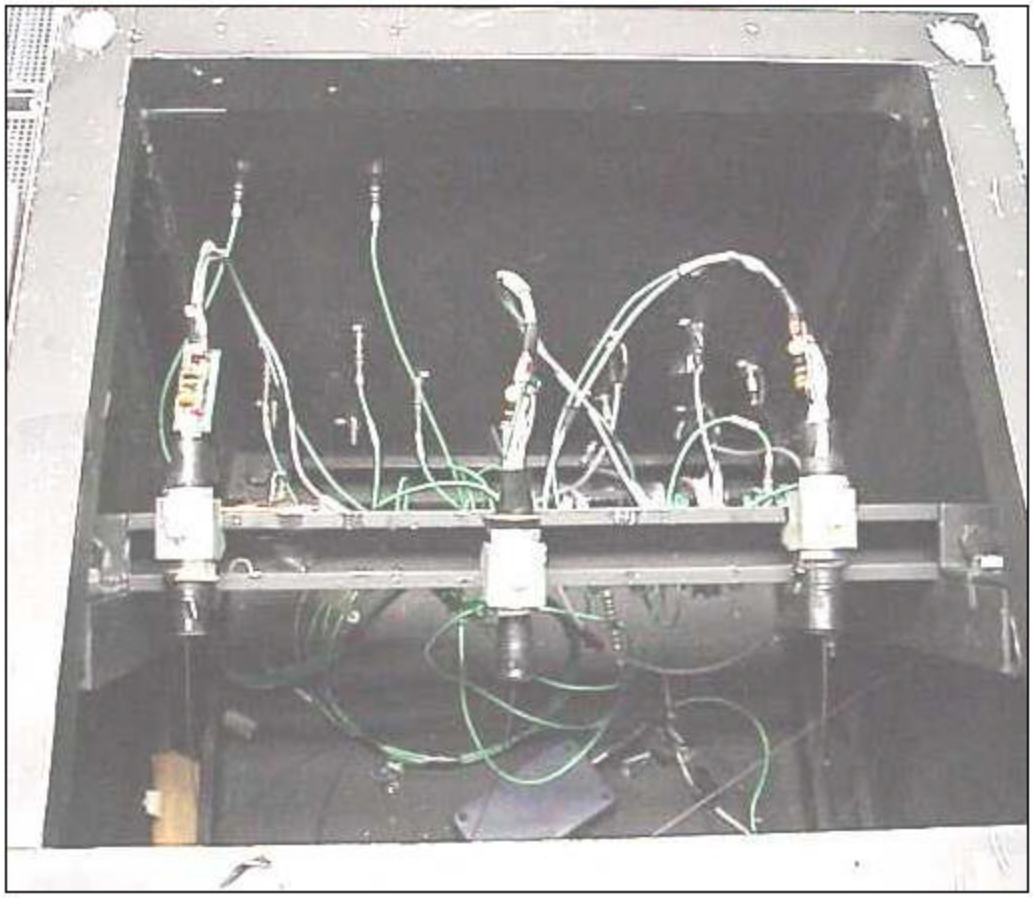
High Voltage Source

VME Crate

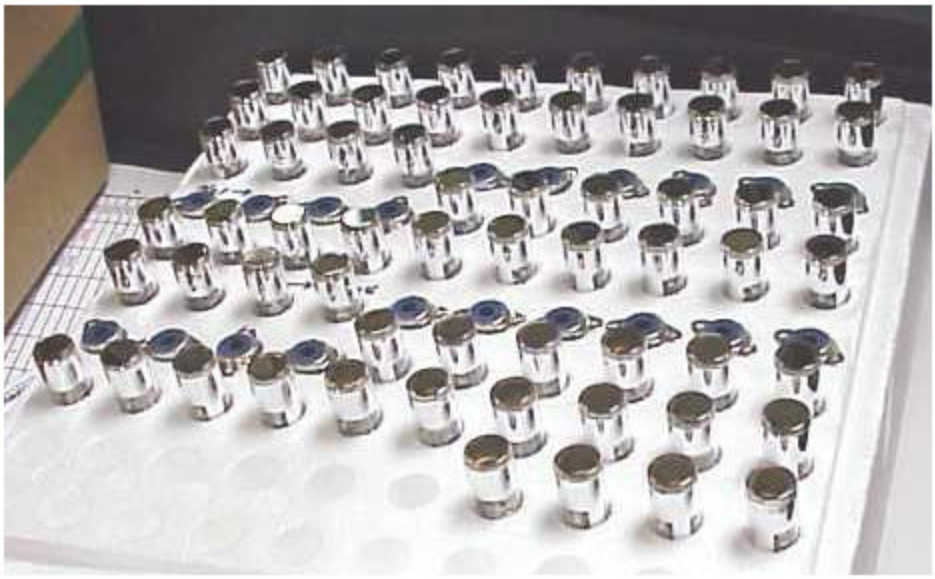


Light Tight Box

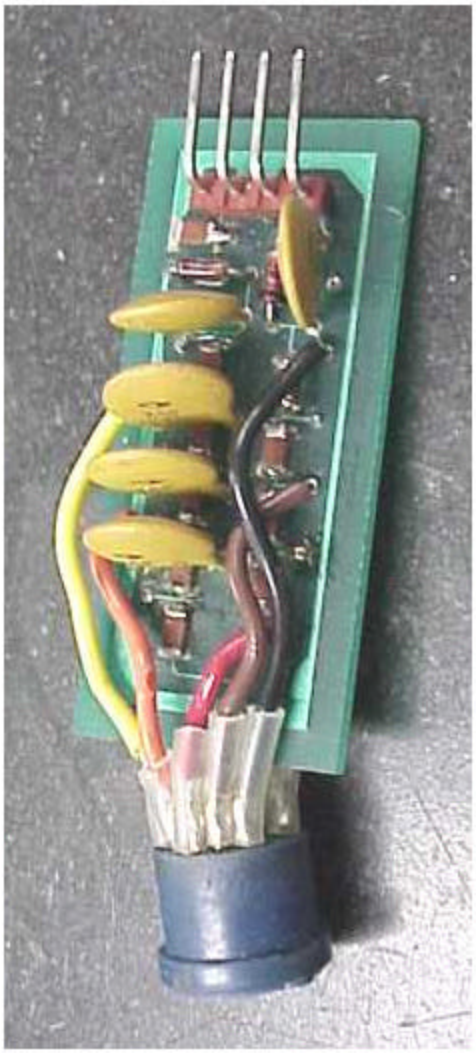
Light Tight Box

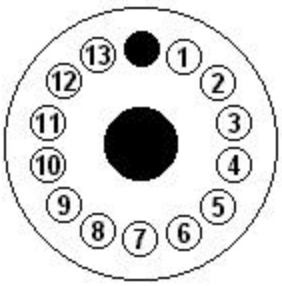


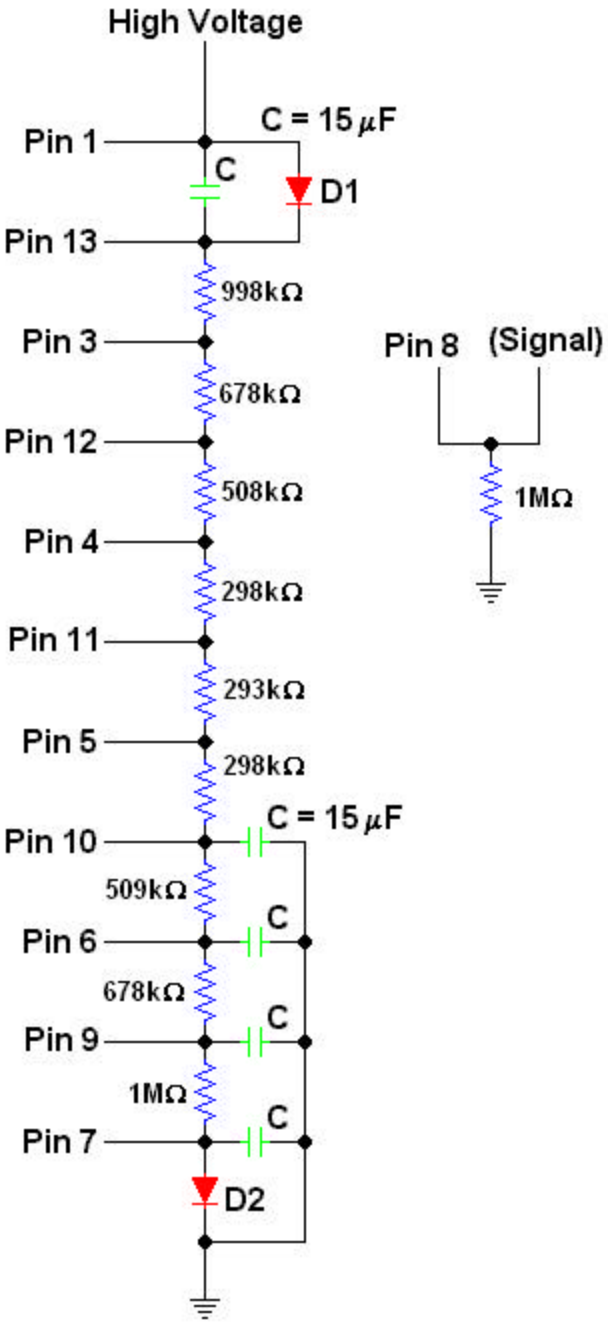
PMTs



Voltage Dividers



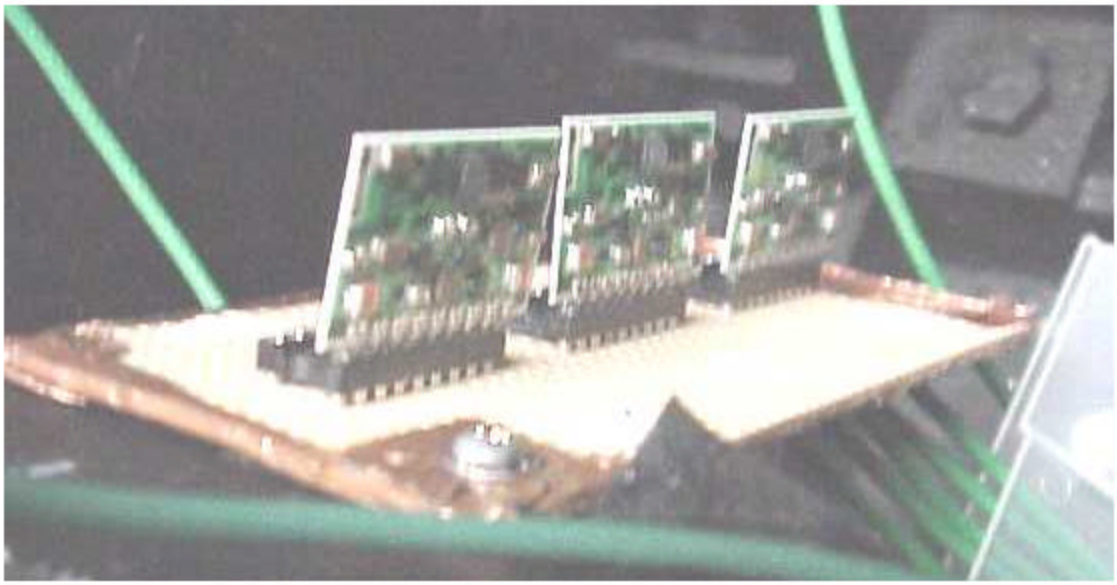


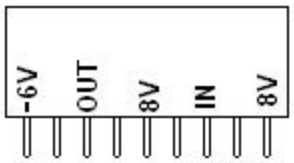


Note: diodes have reverse breakdown voltage of 150V

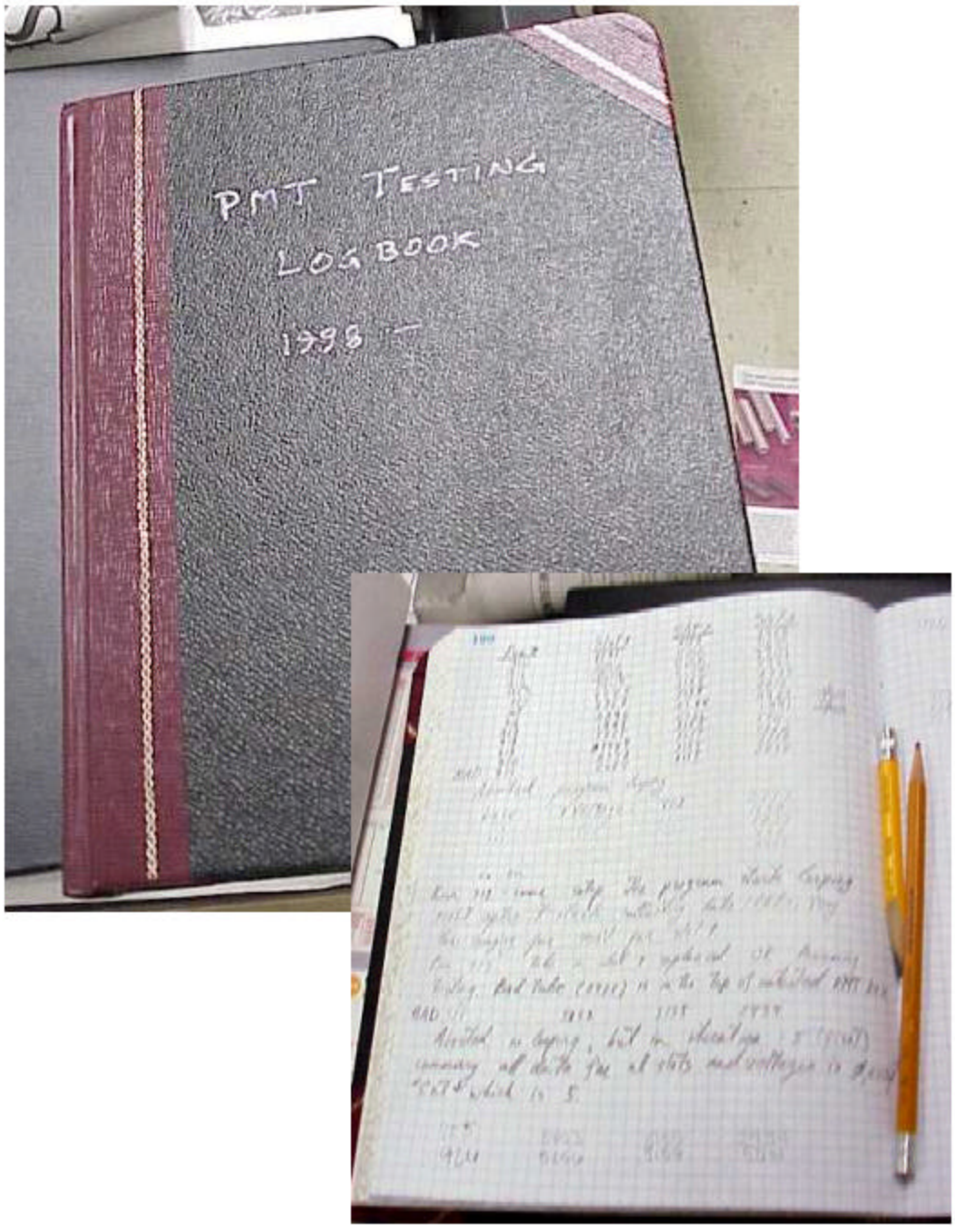
LED Source

Amplifier Cards

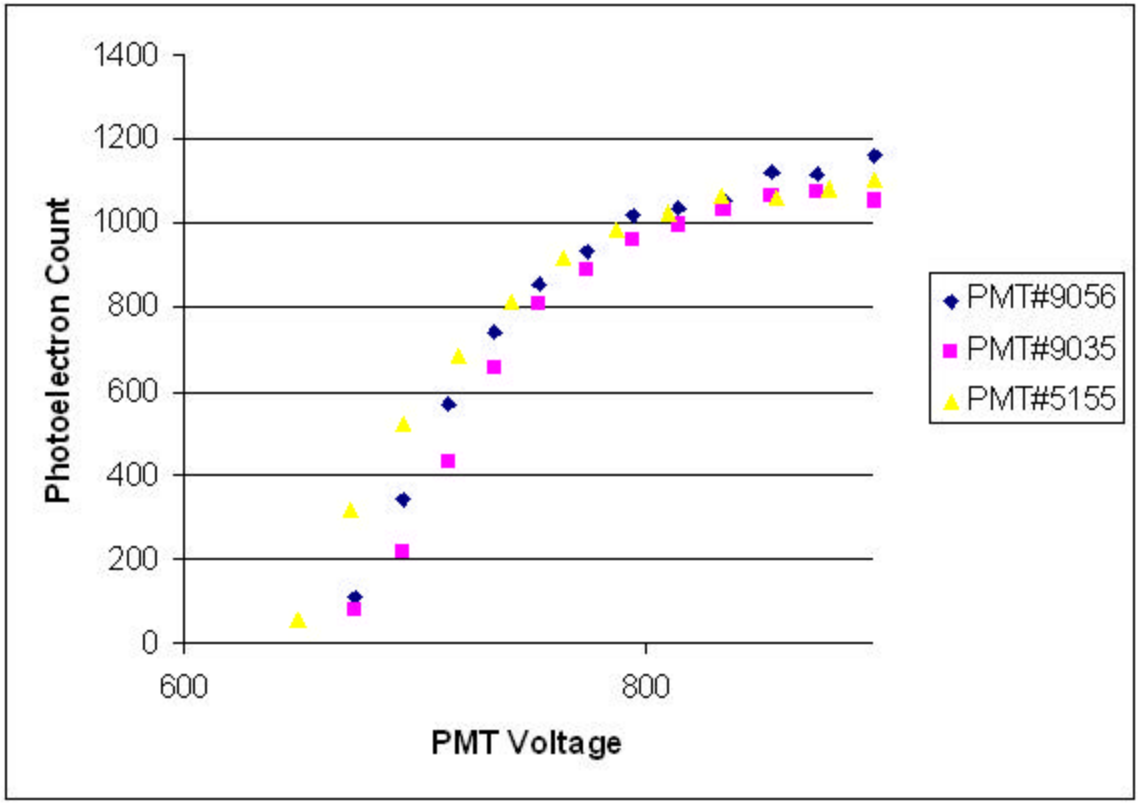




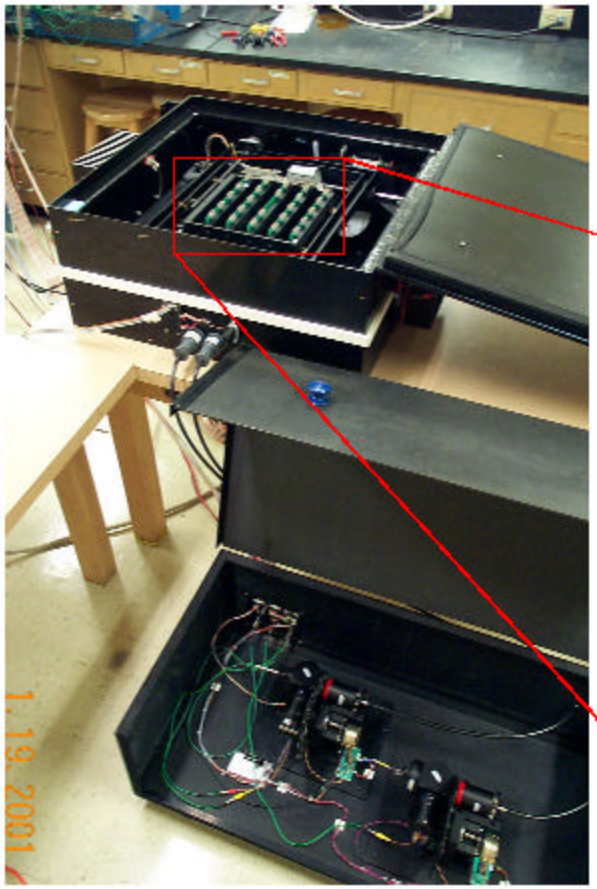
Log Book



Example Data Graph



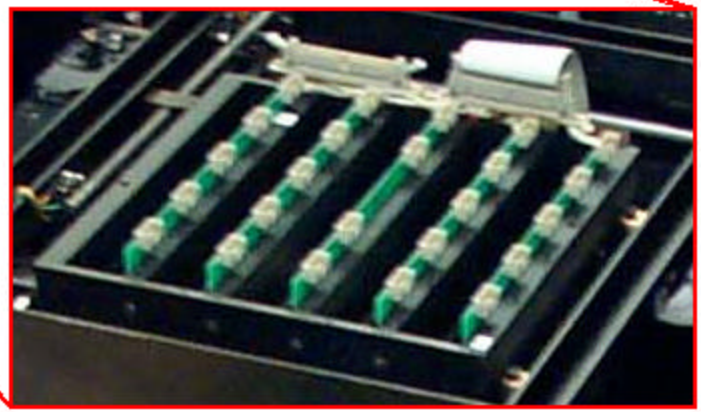
PMT Testing for ATLAS



24 photomultiplier tubes are tested at the same time.

An LED is used as a source with the beam split to each PMT.

Testing a batch of 24 PMTs takes two days time.



Troubleshooting the D0 PMT Test Bench

The section below explains how to troubleshoot a channel of the PMT test bench when there is at least one functioning channel. If there are no functioning channels… you're on your own.

1. Swap the HV lines (on the back of the light tight box) between the functioning channel and the malfunctioning channel. At the same time swap the corresponding signal lines (also on the back of the light tight box). Retest. If the malfunction shifts to a different channel, then the problem(s) are within the light tight box (go to step 2). If the malfunction stays on the same channel, then the problem(s) is outside the light tight box. Return the lines to their original position.

2. Swap the PMTs (inside the light tight box) between the malfunctioning slot and the functioning slot. Move the voltage divider cards and the wires that connect to them along with the PMTs. Retest. If the functioning channel stops working, then there is no light coming from the optical fibers. If the faulty channel still does not work, then there is a problem with the PMT or the electrical components of that channel. Return the PMTs to their original slot.

3. Swap only the PMTs, excluding the voltage dividers and electrical system, between the malfunctioning slot and the functioning slot. Retest. If the functioning channel stops working, then the PMT is faulty. If the malfunctioning channel still does not work, then there is a problem in the electrical system. Return the PMTs to their original slot.

4. Swap only the voltage divider cards between the functioning and the malfunctioning slots. Retest. If the functioning channel stops working, then the voltage divider is faulty. If the malfunctioning channel still does not work, then there is a problem in the electrical system outside of the voltage divider. Return the voltage dividers to their original positions.

5. Check the lines of the voltage divider's connector (for the faulty channel).
    a. Check for continuity between the high voltage pin of the voltage divider's connector and the connector where the high volt line enters the box.
    b. Check for continuity between the ground pin of the voltage divider's connector and the walls of the light tight box. Make sure that this connection is made where the metal shows through the paint.
    c. Check for continuity between the signal pin of the voltage divider's connector and the input pin of the corresponding amplifier card.
    d. Check that there is no continuity between the signal pin of the voltage divider's connector and ground.

6. Check the lines connecting to the amplifier card of the faulty channel.\
    a. Check that there is 8V and –6V at the appropriate pins of the amplifier card.
    b. Check for continuity between the connection for the signal line on the outside of the light tight box and the appropriate pin on the amplifier card.
    c. Check that there is no continuity between the outpin pin of the amplifier card and ground.

7. Disconnect the 8V and –6V lines where the connection is made on the inside wall of the light tight box. Then swap the amplifier cards between the function channel and the malfunctioning channel. If the functioning channel stops working, then the amplifier card is faulty. If the malfunctioning channel still doesn't work, then there is still an error somewhere else. Return the cards to their original positions.