

Instruction Manual

for

CP-06 Mass of the Electron Apparatus

Introduction

This apparatus is designed to carry out the determination of the mass of the electron as described in the *PSSC Physics Laboratory Guide, Fifth Edition*. In this experiment, the cathode ray tube, (CRT), is surrounded by an axial solenoid which creates a magnetic field along the axis of the tube. The electron beam is given a small transverse velocity and spirals down the length of the tube. The accelerating voltage in the tube establishes the velocity of the electrons. Movement of the spot on the screen measures how much the beam has rotated. With this information, the ratio of the charge to the mass of the electron can be determined. The solenoid, which is required to establish the magnetic field, is available separately and is not supplied with the apparatus.

The CRT stand has banana jacks to connect to the heater, the cathode, and the anode of the tube as well as the "X-X" and "Y-Y" deflection plates. It is designed to operate with the CV-02 PSSC Universal Power Supply. Other power supplies are satisfactory as long as their outputs are not connected to ground, since the CRT stand makes the required connections internally. If other power supplies are used, care should be taken not to exceed the filament voltage of 6.3 Vac. Excessive filament voltage will burn out the filament of the cathode ray tube.

Apparatus Setup

This description assumes that the CV-01 or EV-02 Universal Power Supply is used to power the apparatus. If alternatives are used, some interpretation will be required.

This apparatus uses 500 Vdc and such a high voltage can inflict a painful shock. Always turn off the power supply before changing the banana plugs. Remove the patch cords from the power supply before removing them from the apparatus.

1. Connect the Universal Power Supply to a bench outlet and make sure that it is turned off.
2. Connect the green filament jacks on the tube stand to the green banana jacks on the Universal Power Supply using banana plug terminated patch cords.
3. Connect a patch cord from the blue banana jack marked "Cathode" on the CRT stand to the black jack of the High Voltage supply.
4. Connect a patch cord from the red jack marked "Anode" to the red jack on the High Voltage Supply.



5. Place the grid over the screen of the CRT by slipping it into the end of the CRT enclosure. The small hole in the grid is to insert a pencil point to rotate it.

CAUTION

When the patch cords are connected to the Power Supply, their plug ends will have 500 Vdc between them when the Power Supply is turned on. This is a hazardous voltage. Be sure the plug ends are inserted into the CRT stand jacks before the power is turned on.

6. Turn on the Power Supply. The CRT takes about a minute to warm up. A green spot will appear on the screen.
7. The beam is focussed using the knob on the side panel of the CRT stand. Adjust it until there is a fine spot on the screen.
8. Connect a patch cord to one of the X deflection jacks. Touch the bare plug on the end of the cord,; stray pick up from your body will cause the spot to become a short (1 - 3 mm) line on the screen. Rotate the grid until the X axis is parallel to the line on the screen.
9. This procedure orients the grid correctly relative to the deflecting electrodes in the tube and is important for the subsequent measurements of the beam deflection by the magnetic field.

The undeflected spot may not be exactly at the center of the screen. This is not important since it is deflected during the experiment so that it rotates in the axial magnetic field. Normally, a dc potential is applied to the deflection plates to center the beam, when the tube is used as an oscilloscope.

The experiments are described in the PSSC Laboratory Manual and will not be repeated here.

When the experimental session is ended, the apparatus should be disconnected as follows:

1. Turn off the Power Supply. Wait a minute until the internal capacitors have had time to discharge.
2. Disconnect the patch cords from the Power Supply.
3. Disconnect the patch cords from the CRT stand.

Storage

When storing the apparatus, make sure that the tube enclosure is secure on the stand; it is not packed to withstand a fall. To prevent it falling, tape the enclosure to the stand or hold it in place with a large elastic band when storing the equipment.