4.5 MANUAL CONTROL DEFLECTION UNIT (MCDU)

Deflection, also called centering deflection, allows the beam to be guided by the operator to the target. The Manual Control Deflection Unit (MCDU) is a modular power supply system in the main power supply unit that provides output voltages for deflection.

The Deflection assembly in the gun consists of two pairs (X and Y) of deflection plates located near the beam-exit end of the gun. Potentials applied to these plates produce a deflecting force in a plane perpendicular to the direction of beam travel. The movement of the spot in the target plane is generally linearly related to these potentials.

As shown in the graph below, the position of the spot varies directly with the deflection voltages applied. However the amount of movement also depends on beam parameters such as the electron acceleration energy. At low energies, a given deflecting voltage produces a much larger shift in position. The maximum possible deflection may be less at a higher energies than at low energy.

Depending on the gun model, non-uniformities in the deflecting electric field may cause the spot to become distorted if the beam is deflected too close to the deflection plates. Better spot shapes will be achieved if the amount of deflection is kept to a minimum.

For initial set-up and positioning, the spot can best be observed using a phosphor screen in the target area.
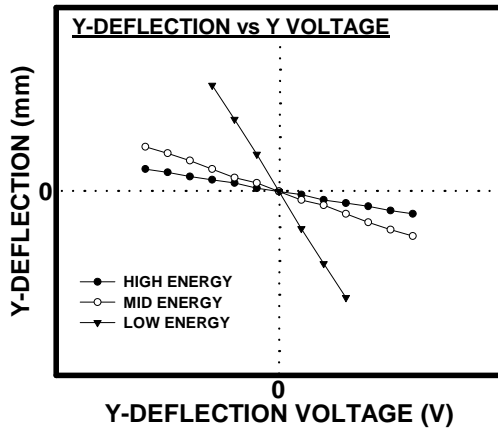
DESCRIPTION OF CONTROLS

Deflection Switch: An amber rocker switch labeled **DEF ON/OFF (I / O)** that enables or disenables the power supplies in the deflection unit. The **O** position is OFF, and the **I** position is ON. (When off, outputs are grounded, so the deflection plates are grounded).

X Deflection Control/ Meter: A FlexPanel control labeled **X DEFLECT**. When selected, the encoder wheel voltage programs the X power supply for deflection in the X direction, operable only if the DEF rocker switch is on. The value displayed is the voltage applied to the X pair of deflection plates in the gun.

Y Deflection Control/ Meter: A FlexPanel control labeled **Y DEFLECT**. When selected, the encoder wheel voltage programs the Y power supply for deflection in the Y direction, operable only if the DEF rocker switch is on. The value displayed is the voltage applied to the Y pair of deflection plates in the gun.

Set proportional outputs A FlexPanel program menu item that sets the output of one supply to vary proportionally with the output of another supply, so that the first will be changed automatically when the second is adjusted.

Fig. 4.5-1 The effect of Deflection Voltage on the position of the spot, at three different Energies (Data from a typical gun)

4.5 MANUAL CONTROL DEFLECTION UNIT (MCDU) cont.

DEFLECTION OPERATION

1. For initial set-up and positioning, the spot can best be observed using a phosphor screen in the target area.

2. On the power supply after initial startup, switch the amber **DEF ON/OFF** rocker switch on (**I** position) to enable the supplies in the Deflection unit (MCDU); the switch should light.
    a. With a LabVIEW^{TM} computer program, set the **Deflection ON/ OFF** toggle switch in the **ON** position.

3. Adjusting the Deflection plate voltages:
    a. On the LabVIEW^{TM} computer panel only, set the desired range with the **Deflection Scale Range** switch in the **User Controllable Options** section below the main panel.
    b. Using the **X DEFLECT** and **Y DEFLECT** controls (encoder wheel or computer control), adjust the Deflection plate voltages as needed to center or position the beam in the X and Y directions within the target plane. With the LabVIEW^{TM} computer panel, the red arrow thumb slide controls can be used for easier adjustment.
    c. Monitor on the **X DEFLECT** and **Y DEFLECT** meters. The display shows the X and Y output voltages which are generally linearly related to the movement of the spot in the target plane.
    d. With the FlexPanel Controls, push **STORE** when the spot is in the desired position.

4. To maintain a constant position when Energy is varied:
    a. The deflection voltage can be set to be proportional to the beam energy as energy is changed. This enables *approximately* constant positioning of the spot as the beam energy is changed.
        i. For example: If Energy = 1000 V initially and X Deflection = 50 V, when Energy is turned down to 500 V, the X Deflection voltage automatically "tracks" down to 25 V.
    b. If desired, set the Deflection outputs to be proportional to Energy.
        i. Push the **MENU** button and select **set proportional outputs** with its selector button. Then select **change proportional sources**.
        ii. Select **SLAVE OUTPUT** and turn the encoder wheel to choose **X DEFLECT**. Then select **SOURCE OUTPUT** and choose **ENERGY**. Push **Done.**
        iii. Repeat for **Y DEFLECT**.
        iv. Press **Done** until the screen returns to the control / meter display.
        v. To cancel the proportional relationship, repeat the process choosing **SOURCE OUTPUT : FULL RANGE**.
    c. When using computer/ remote control, this program option is not available. However, appropriate deflection voltages for different Energy levels can be saved with the Saved Settings files.
    d. If not set as proportional, the deflection voltage remains constant as the beam energy is varied. Deflection can then be adjusted manually.

5. To turn off the MCDU: Switch the amber **DEF ON/OFF** rocker switch off (**O** position). When off, outputs are grounded, so the deflection plates are grounded.

This completes the Manual Control Deflection Unit Instruction