

<http://fusedweb.pppl.gov/CPEP/chart.html>

Fig. 1.1 Plasma regimes

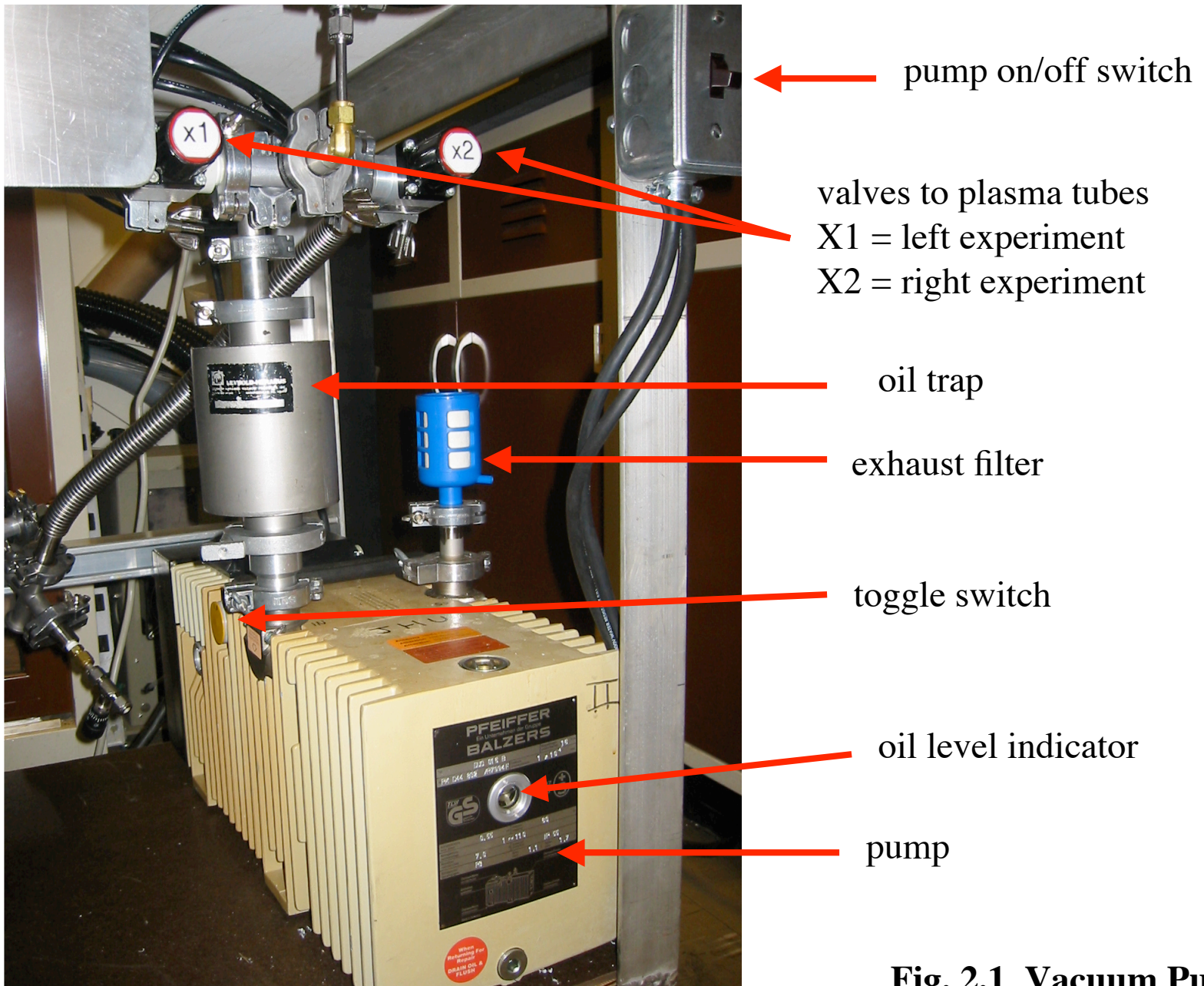


Fig. 2.1 Vacuum Pump

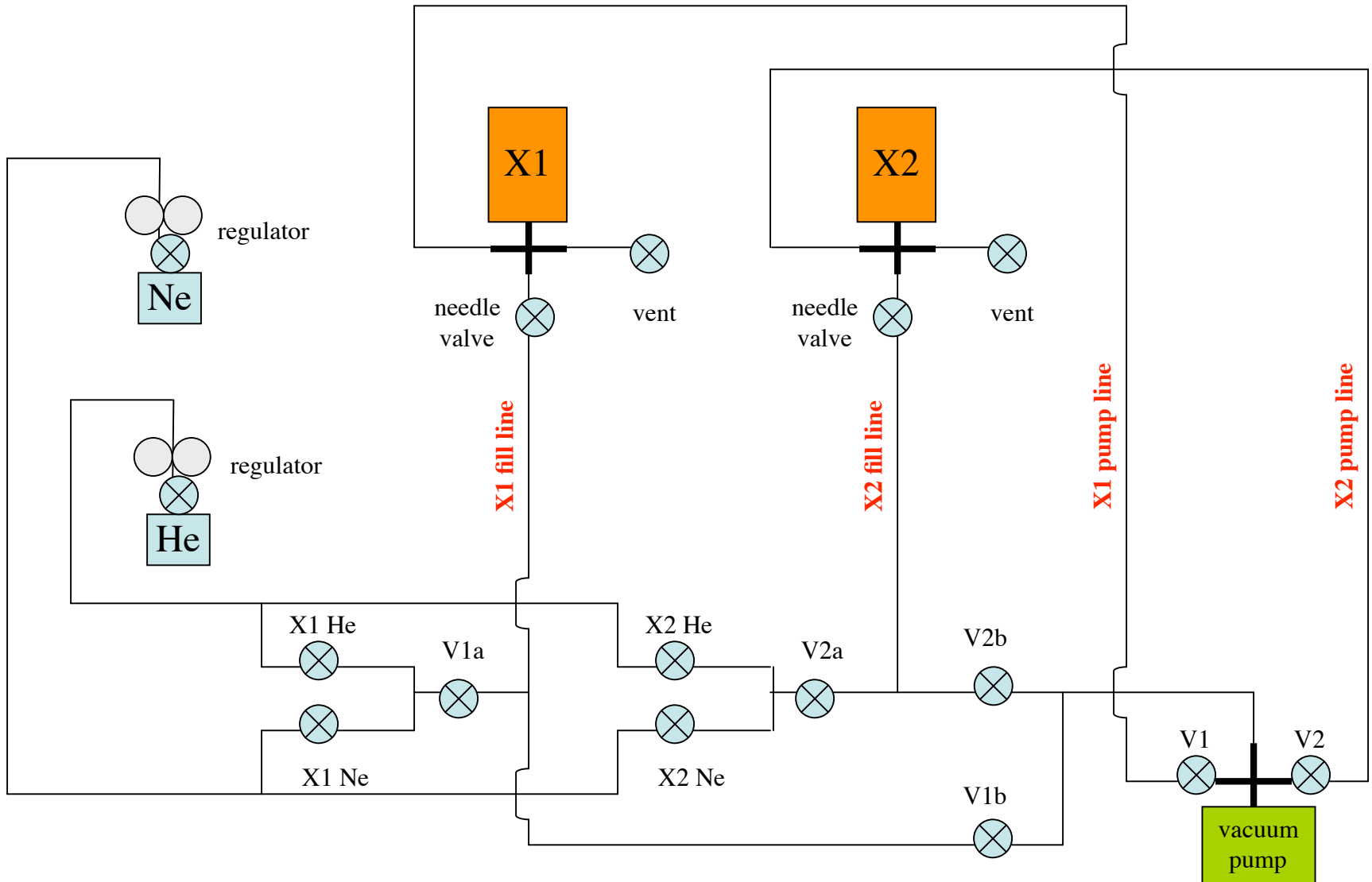


Fig. 2.2 Vacuum and gas delivery diagram

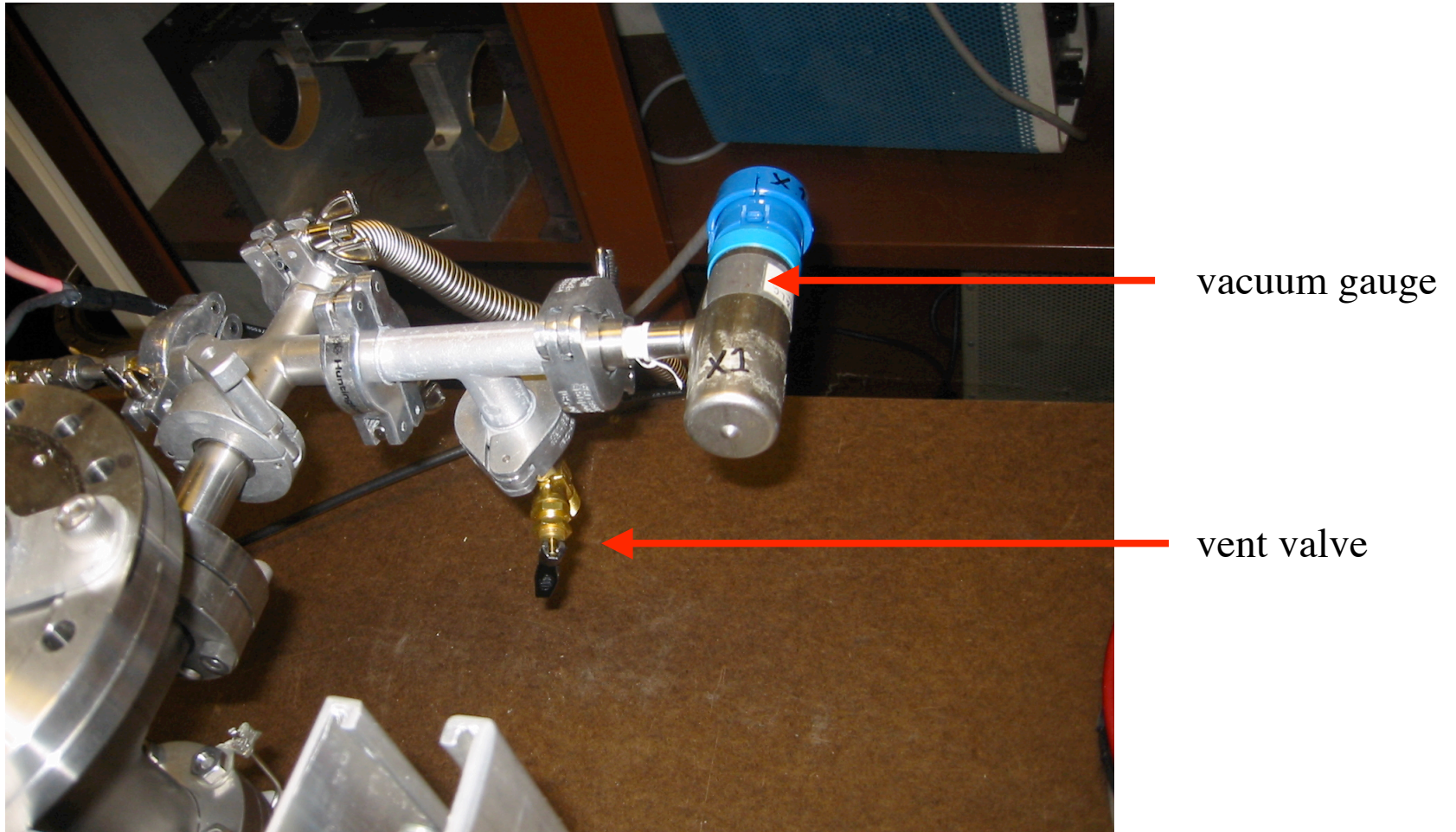
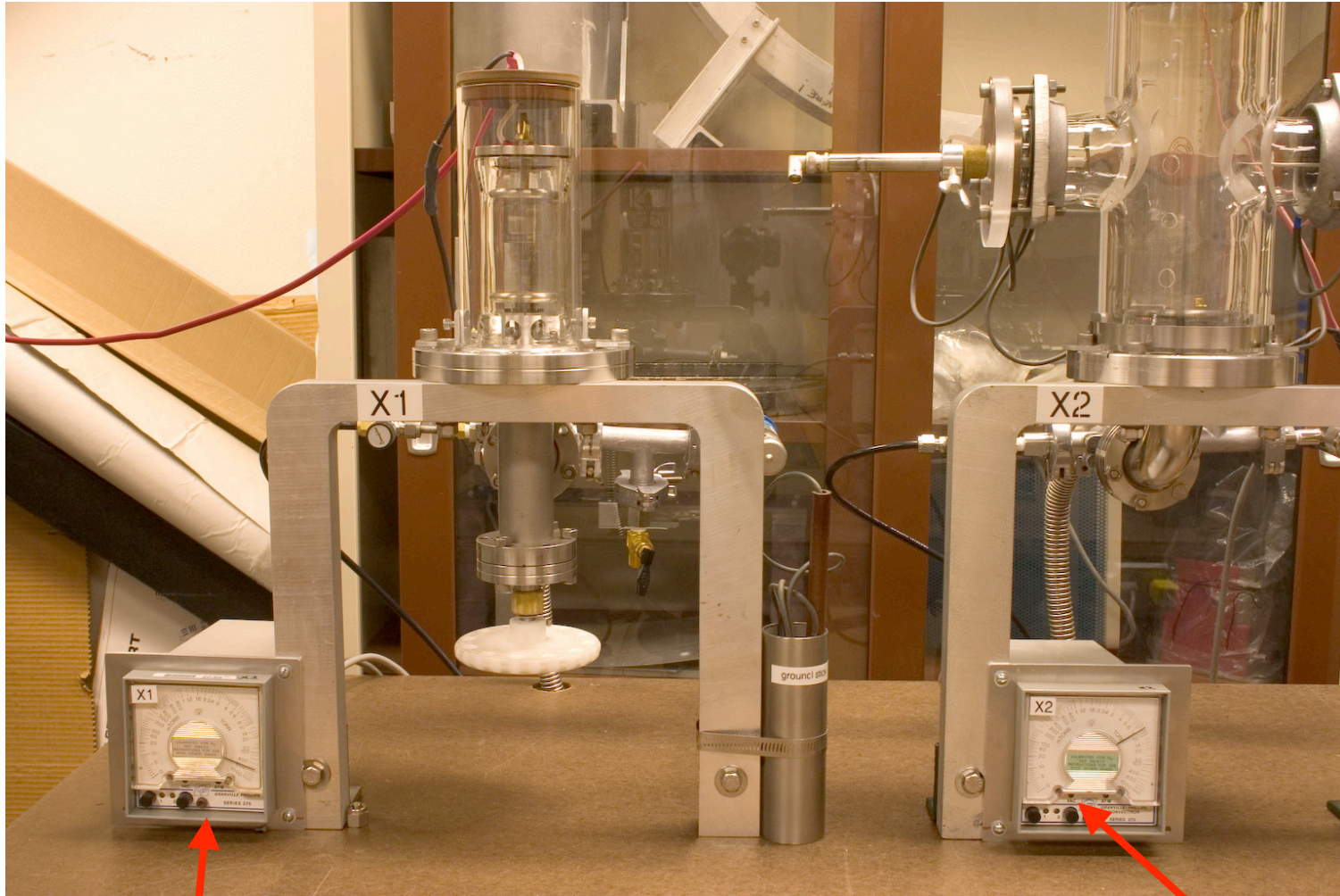


Fig. 2.3 Vacuum gauge and vacuum vent valve



X1 meter

X2 meter

2.4 X1 and X2 vacuum pressure meters

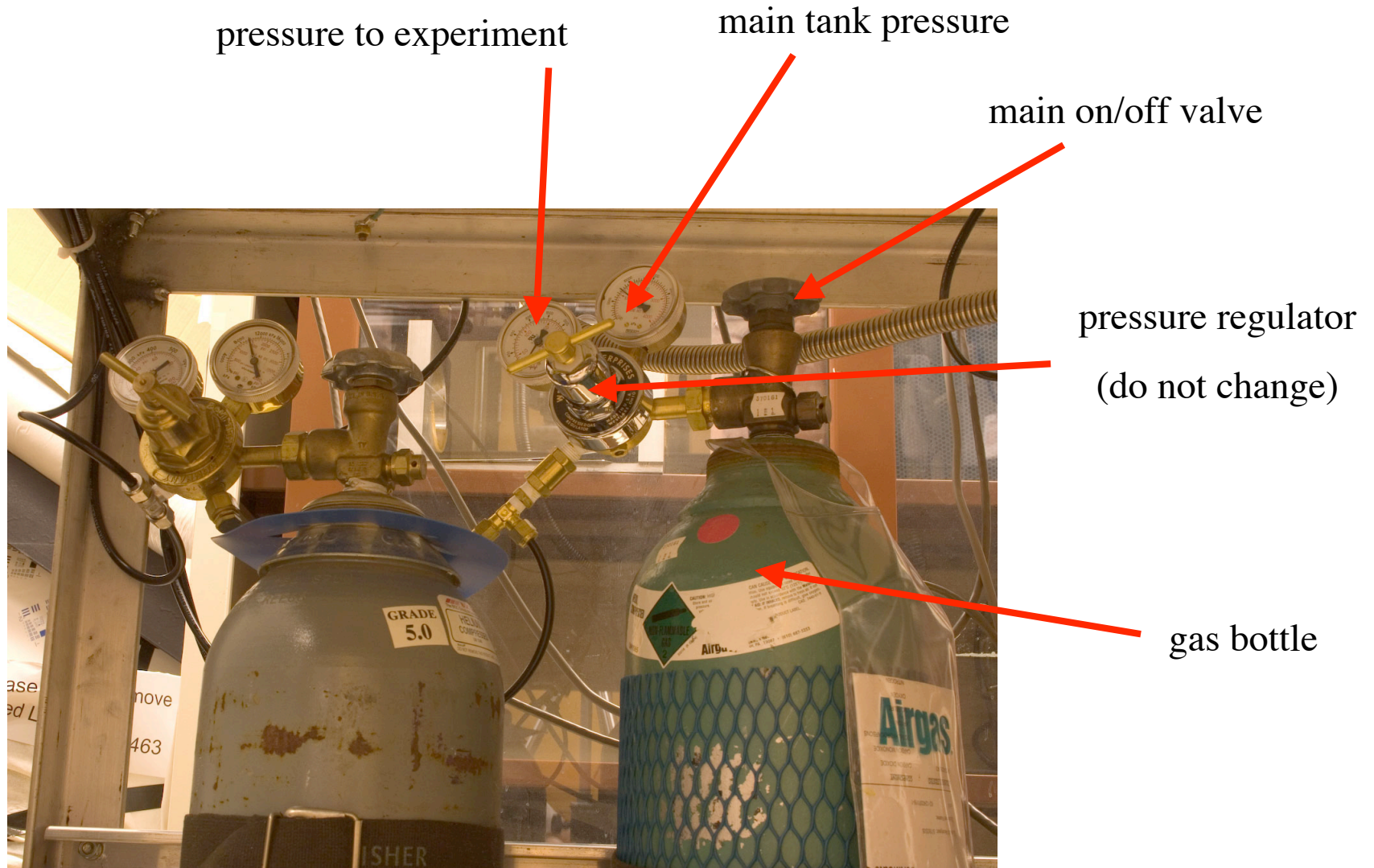


Fig. 2.5 Helium and Neon gas bottles

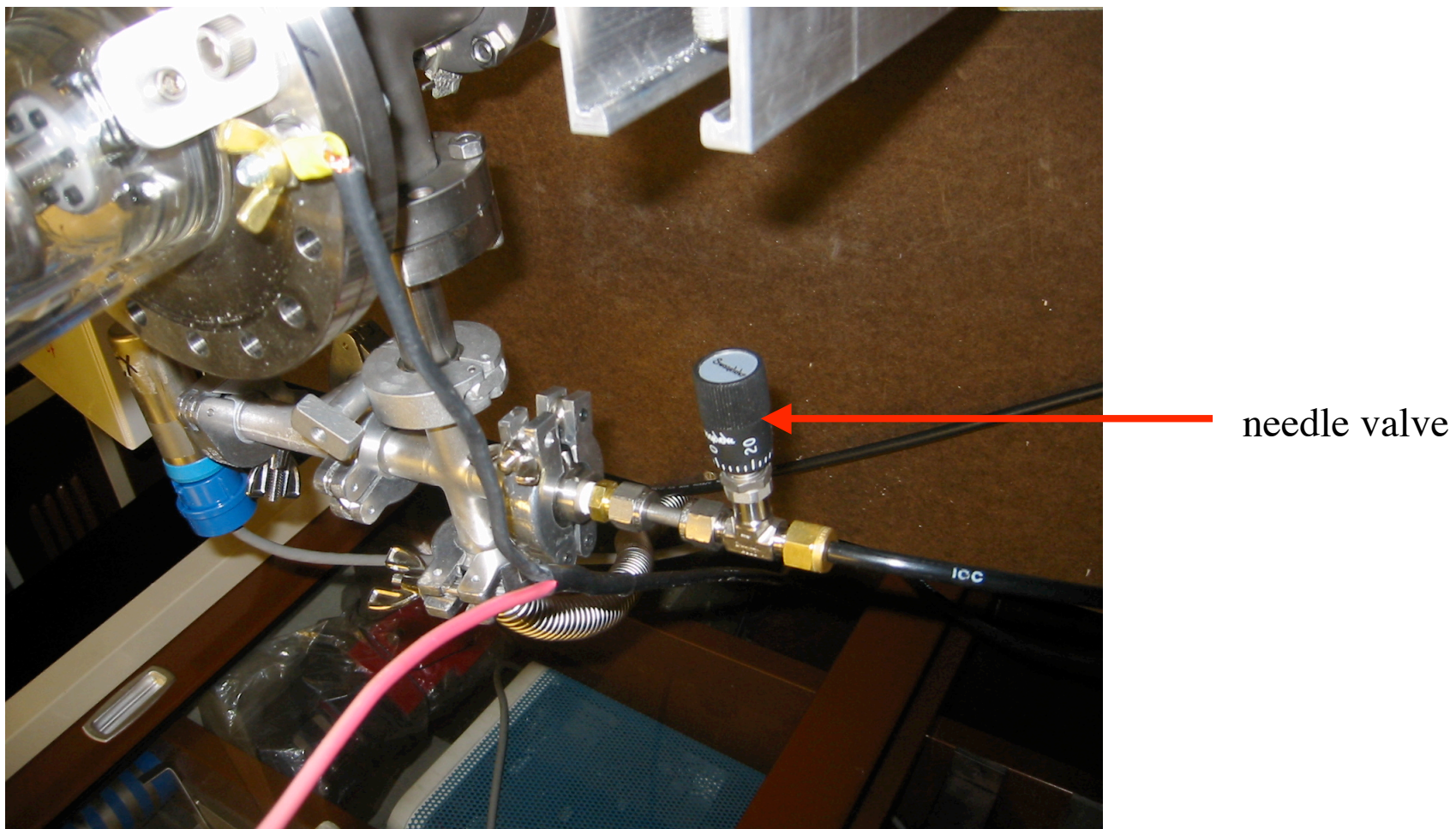


Fig. 2.6 Gas pressure (needle) valve

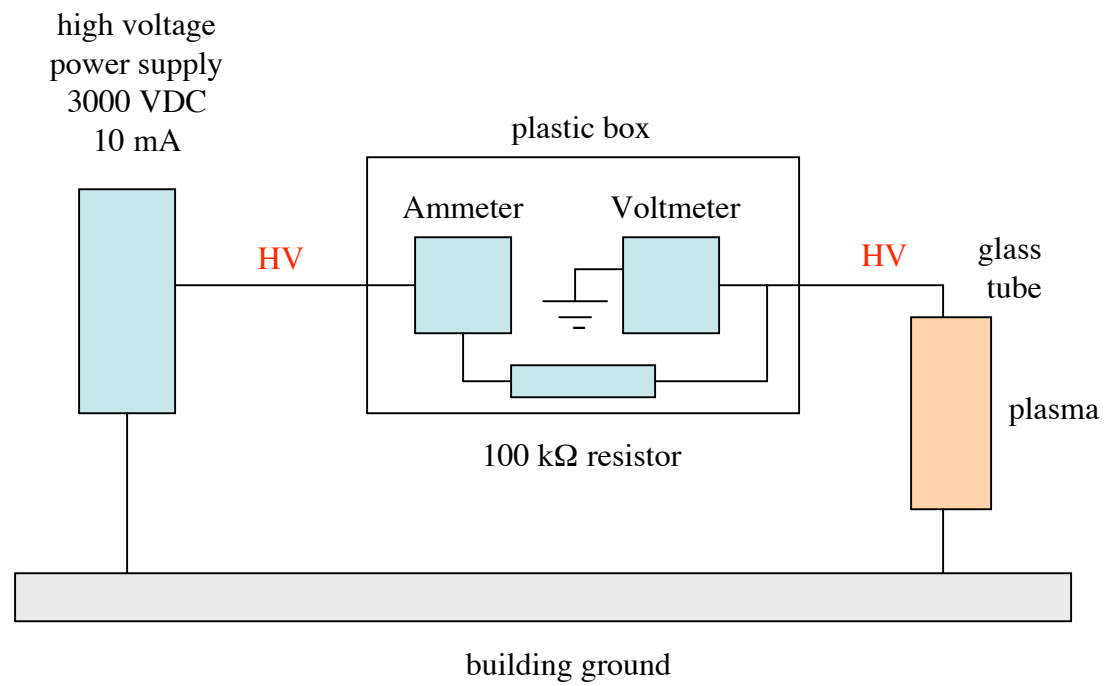
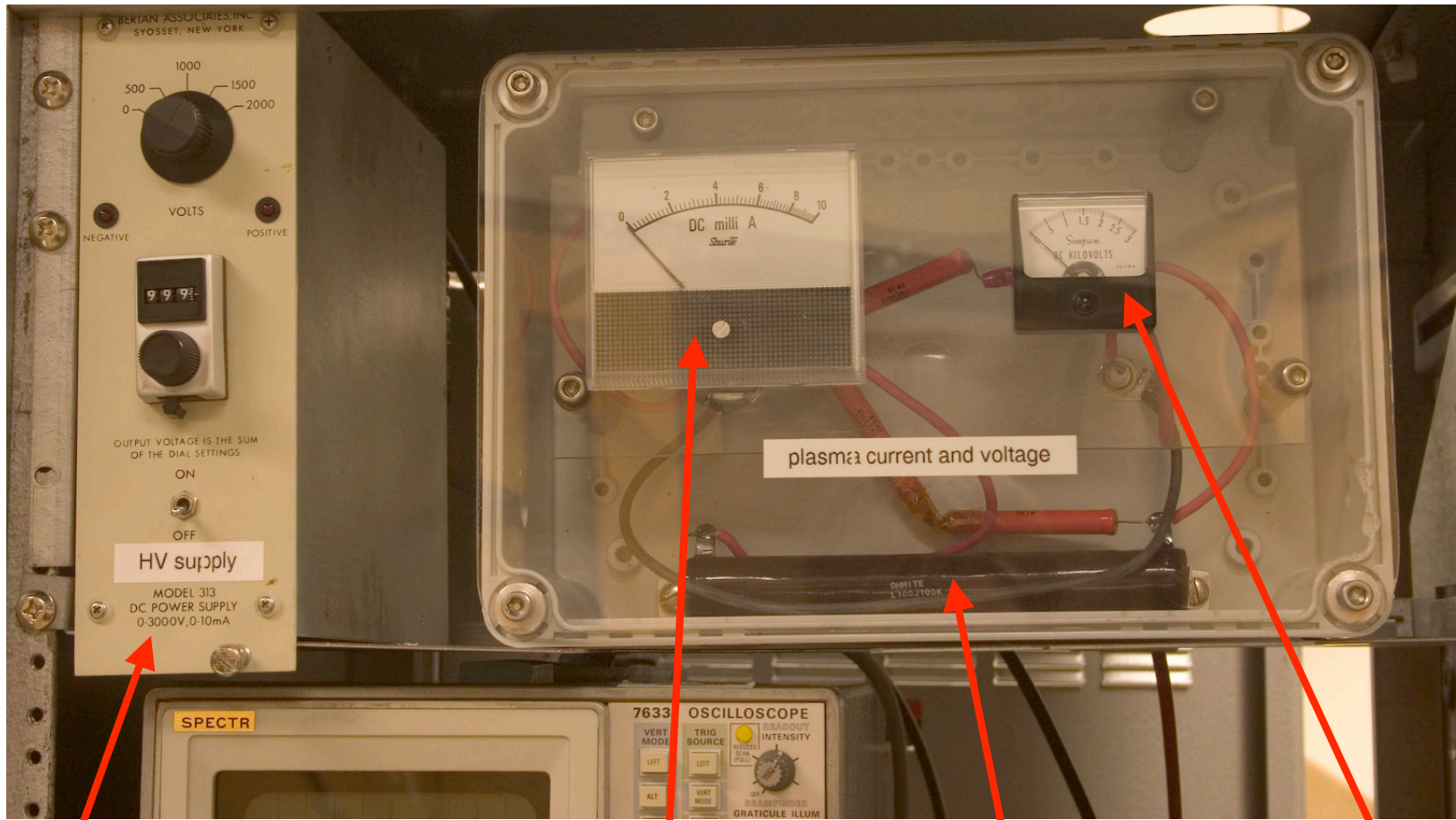


Fig. 2.7 Electrical circuit diagram



high voltage power supply

ammeter

100 kΩ series resistor

voltmeter

Fig. 2.8 High voltage power supply and meters



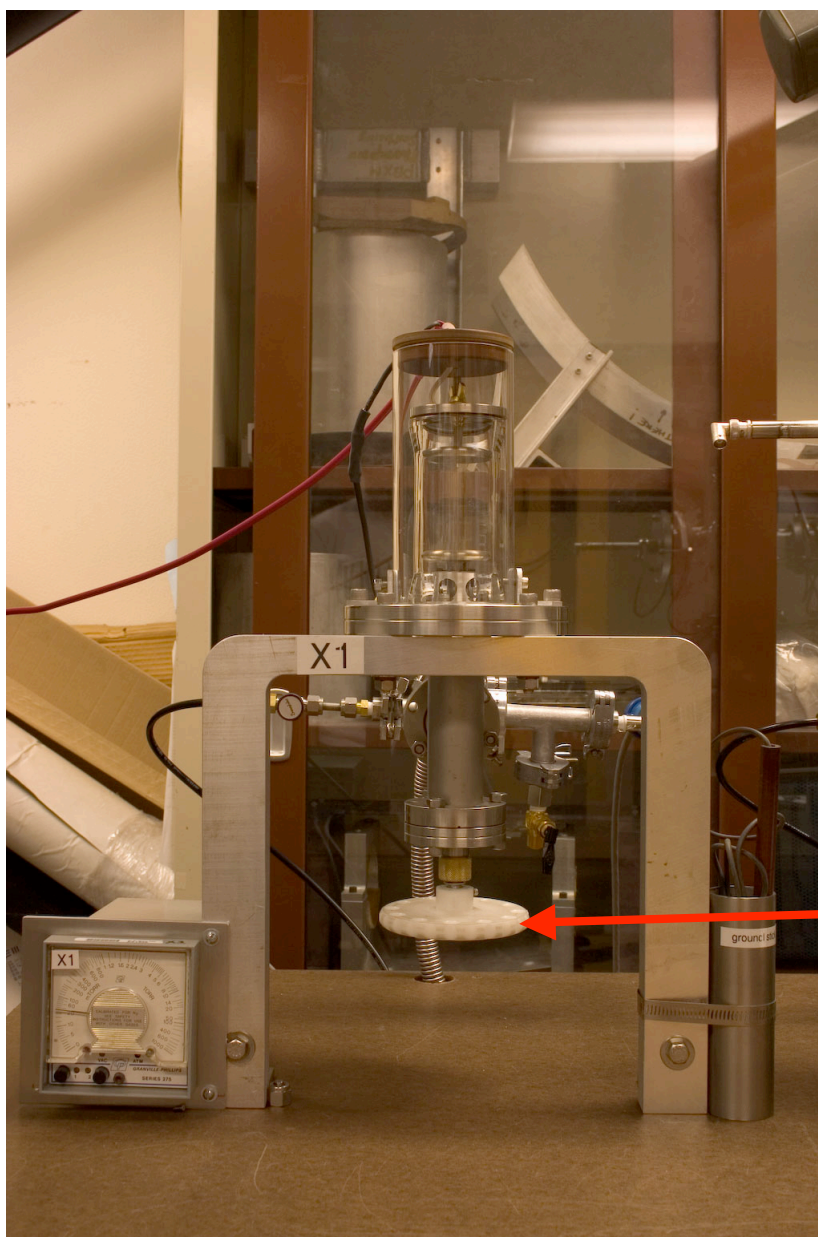
high voltage
cable entering
plasma tube

Note: red part is
the insulation
covering the
ground wire; the
high voltage is a
small copper
wire inside the
white interior
insulator

Fig. 2.9 HV connection to plasma



Fig. 3.1 Front panel gas and vacuum controls



knob

Fig. 3.2 Electrode height adjustment knob



Fig. 3.3: Helium plasma in X1

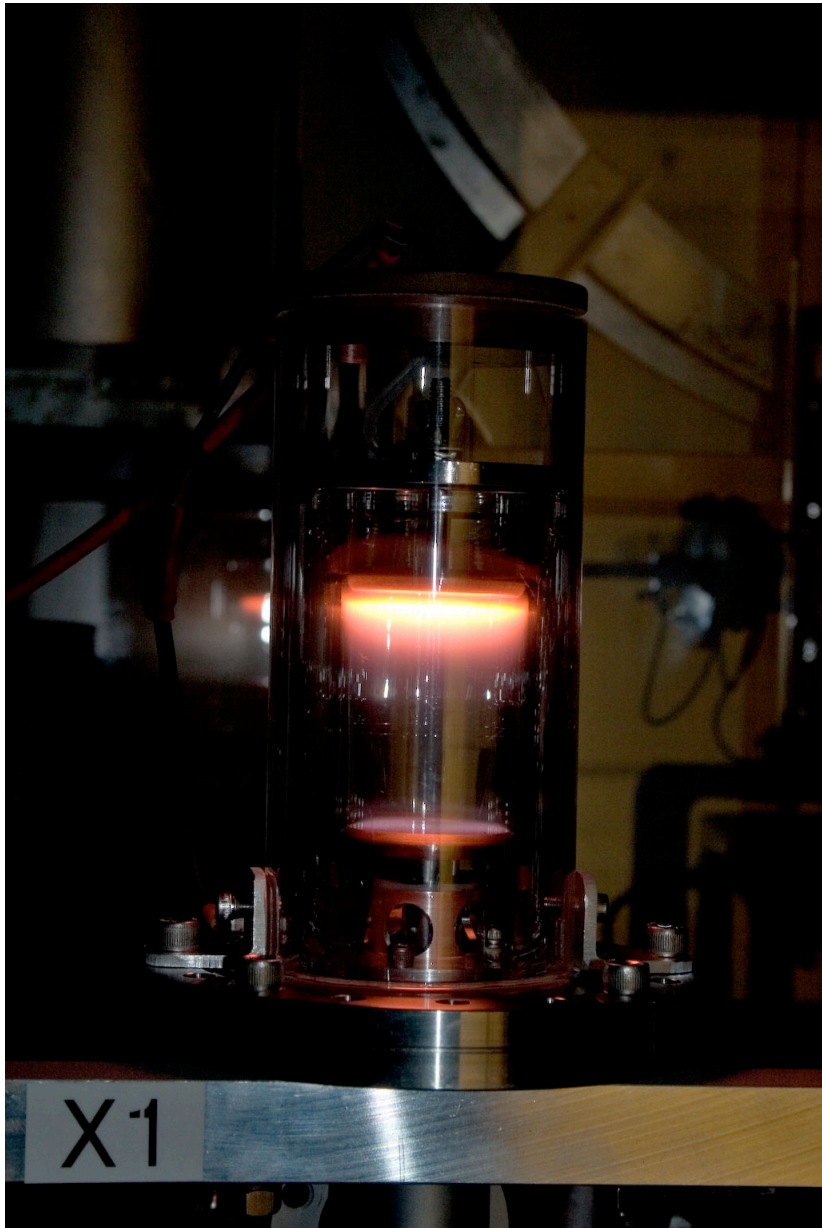


Fig. 3.4: Neon plasma in X1

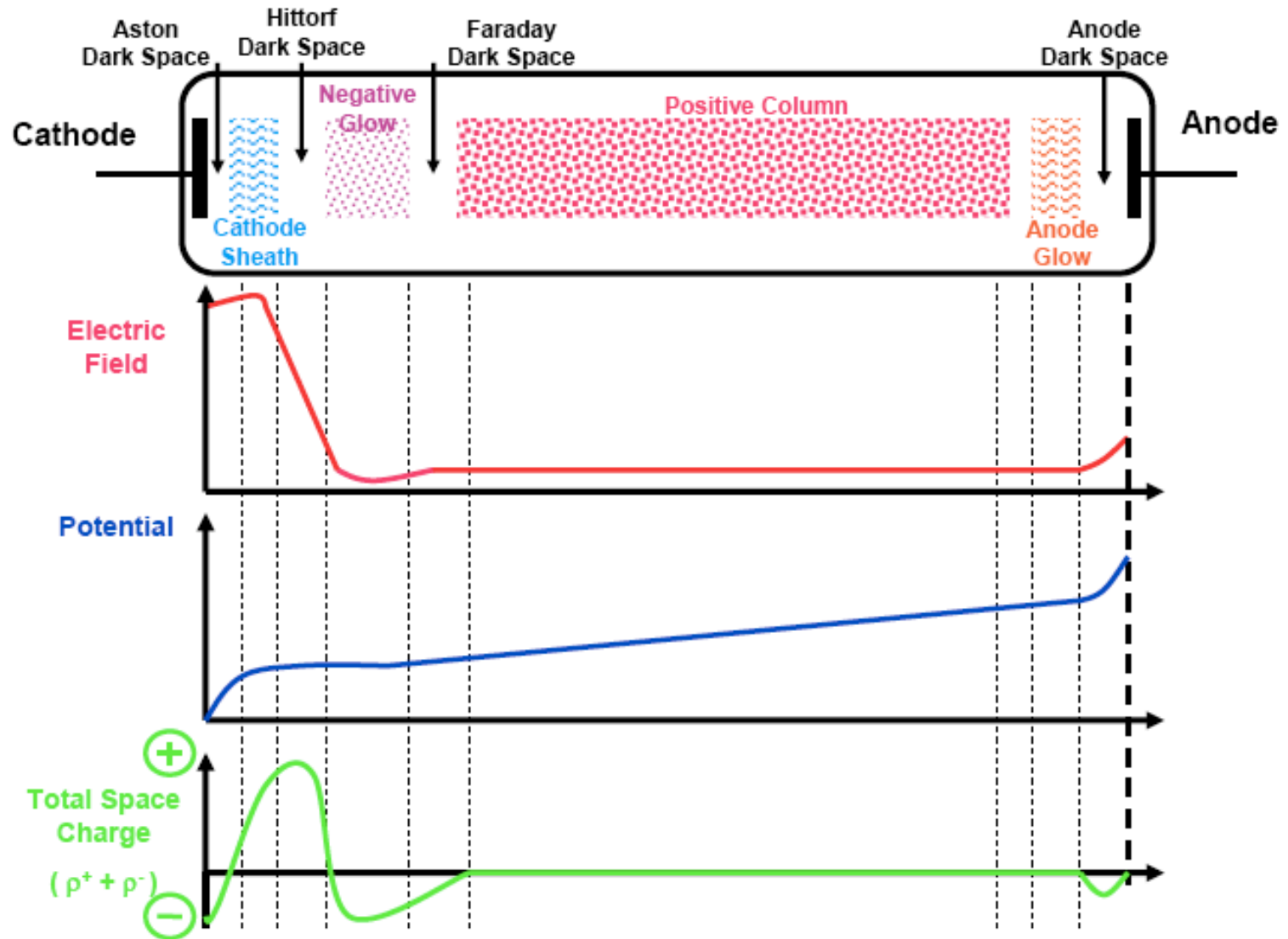


Fig. 5.1 Glow Discharge Structure

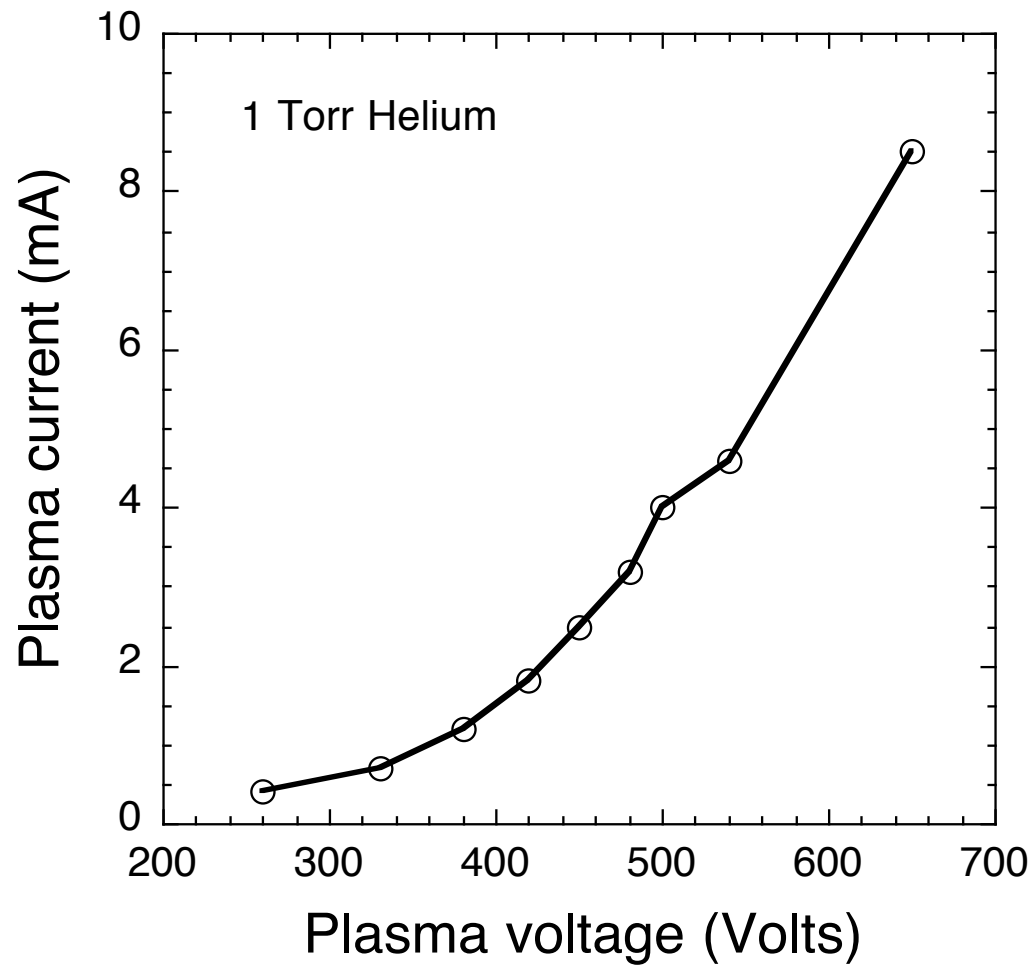


Fig. 5.2 Typical plasma current vs. voltage

<u>Glow discharge parameter</u>	<u>Range of values</u>	<u>X1 Value</u>
Discharge tube radius	$a = 0.3 - 3 \text{ cm}$	2 cm
Discharge tube length	$L = 10 - 100 \text{ cm}$	5 cm
Plasma volume	$V \approx 100 \text{ cm}^3$	50 cm ³
Gas pressure	$p = 0.03 - 30 \text{ Torr}$	1 Torr
Gas density	$n = 10^{15} - 10^{18} \text{ cm}^{-3}$	$3 \times 10^{16} \text{ cm}^{-3}$
Voltage between electrodes	$V = 100 - 1000 \text{ V.}$	500 V.
Current between electrodes	$I = 10^{-4} - 0.5 \text{ A.}$	5 mA.
Power level	$P \approx 100 \text{ W.}$	2.5 W.
Electron temperature	$T_e \approx 1-3 \text{ eV}$	1 eV
Ion temperature	$T_i \ll 1 \text{ eV}$	0.1 eV
Electron density	$n = 10^9 - 10^{11} \text{ cm}^{-3}$	10^{10} cm^{-3}

Fig. 5.3: Typical Discharge Parameters

Neutral Helium Total Ionization Cross-Section

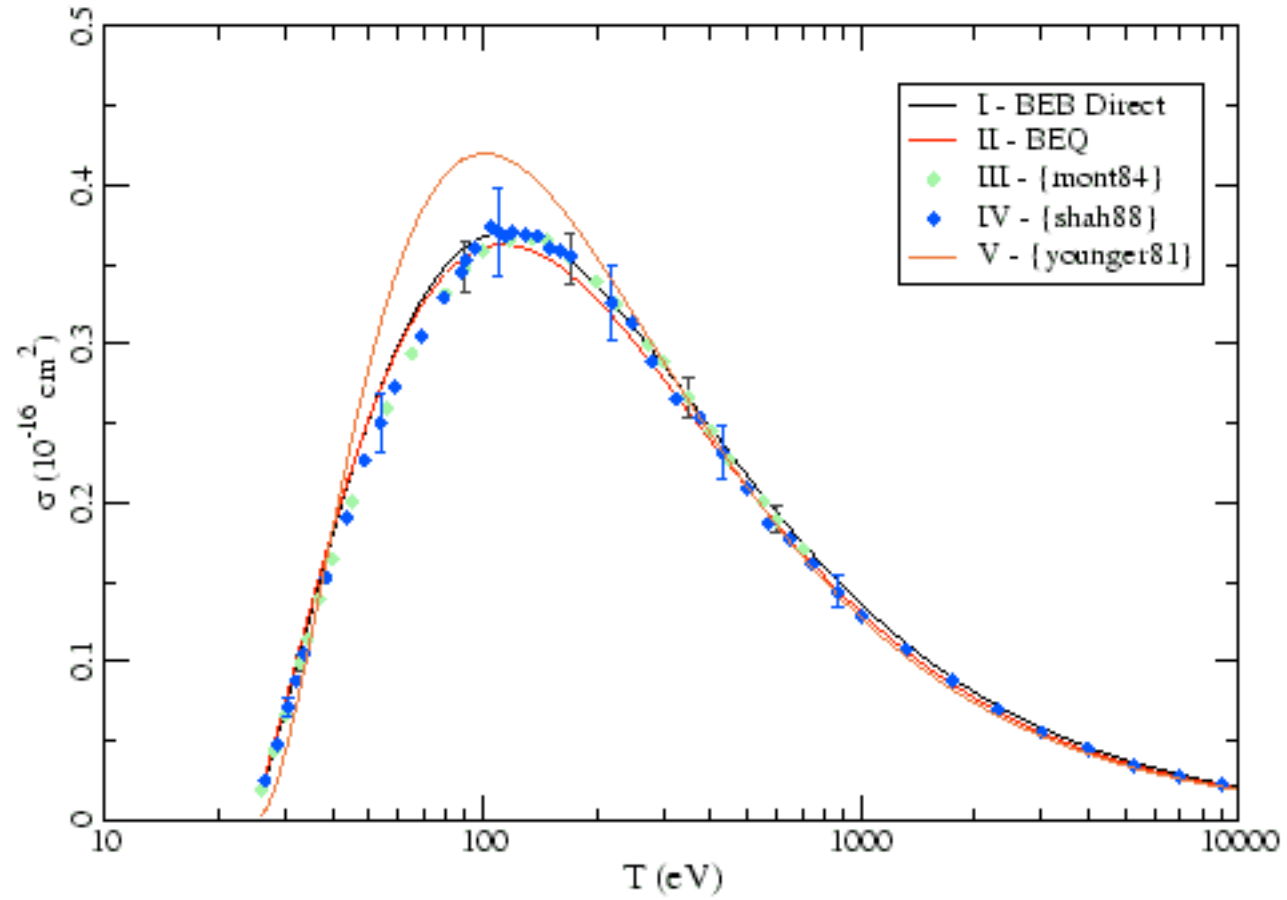


Fig. 5.4: Ionization rate of Helium

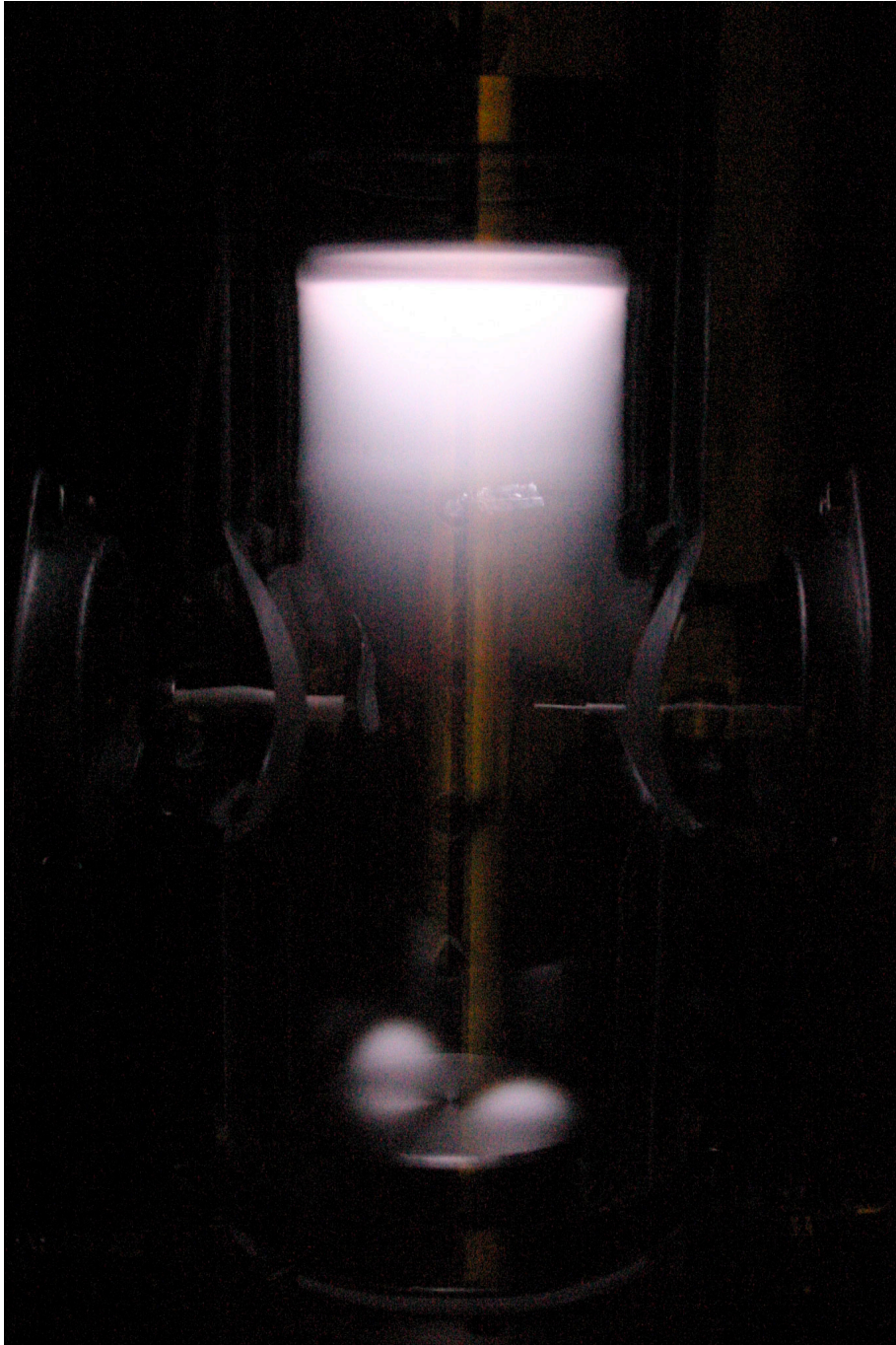


Fig. 5.5: Anode spots

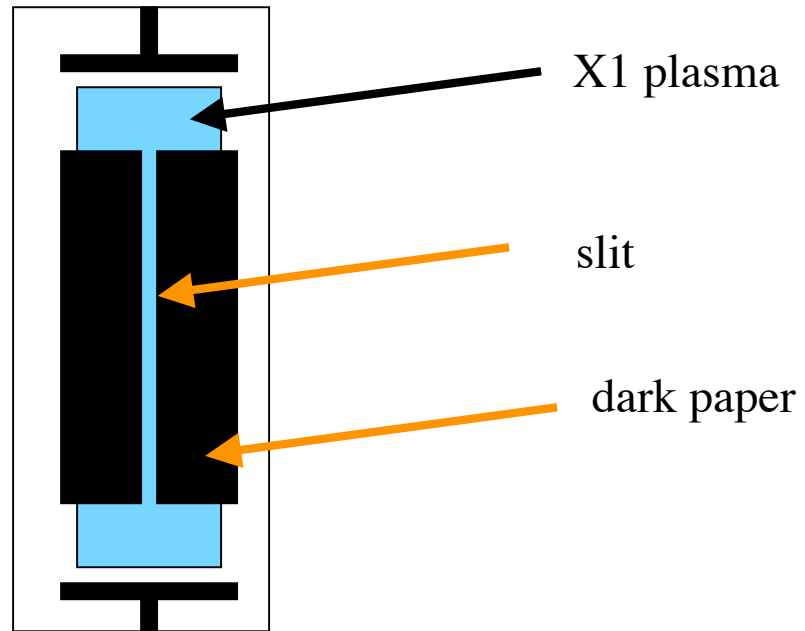
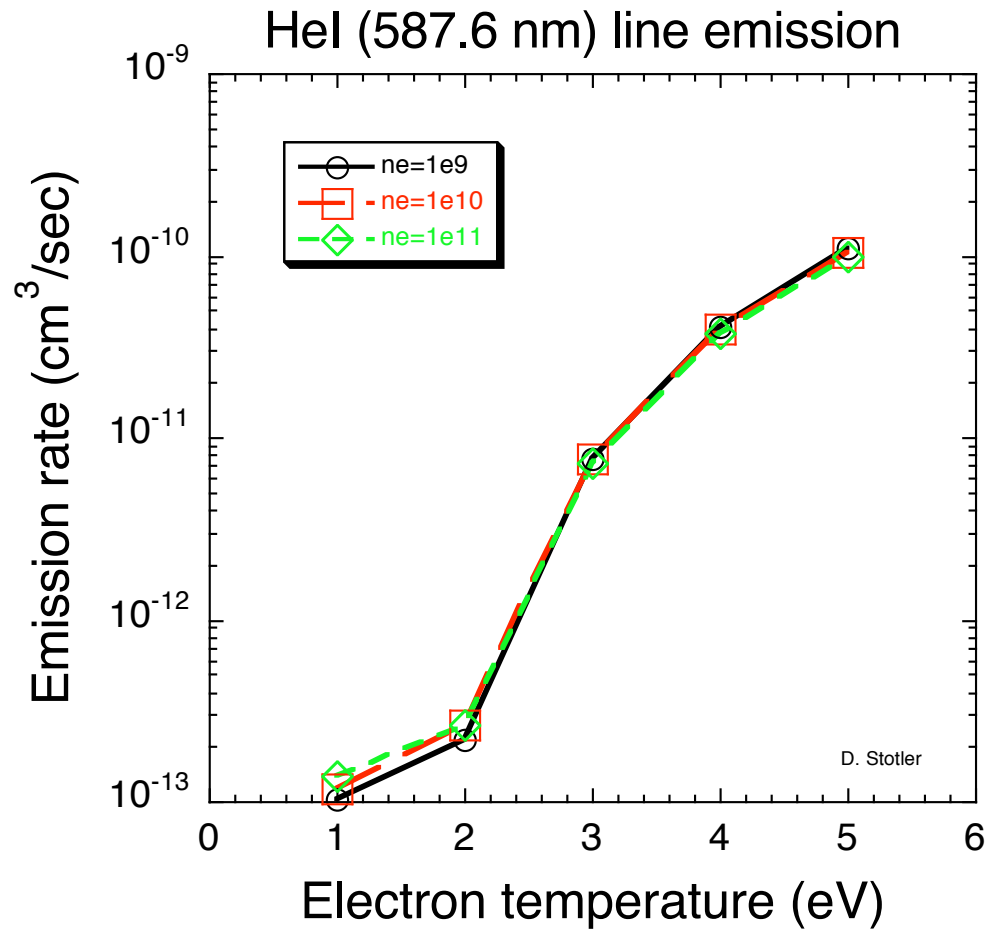
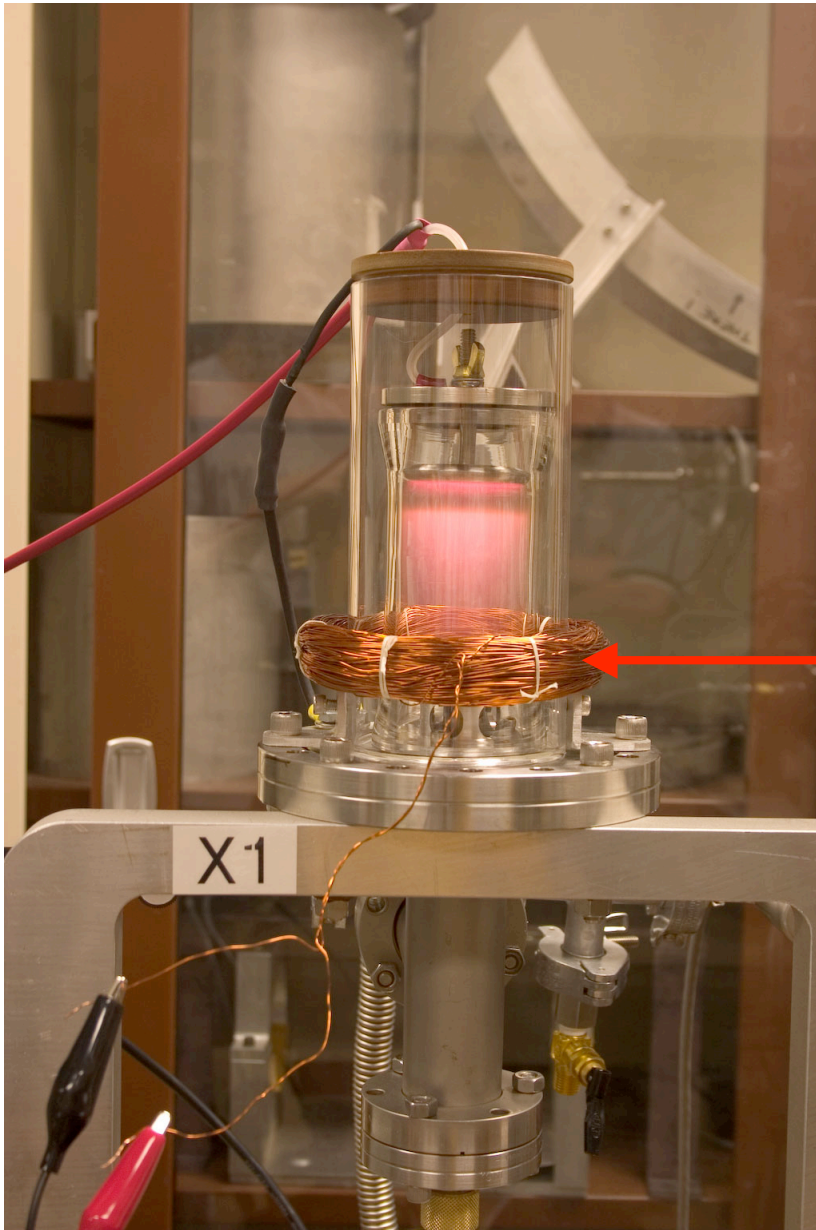


Fig. 6.1 Making a slit

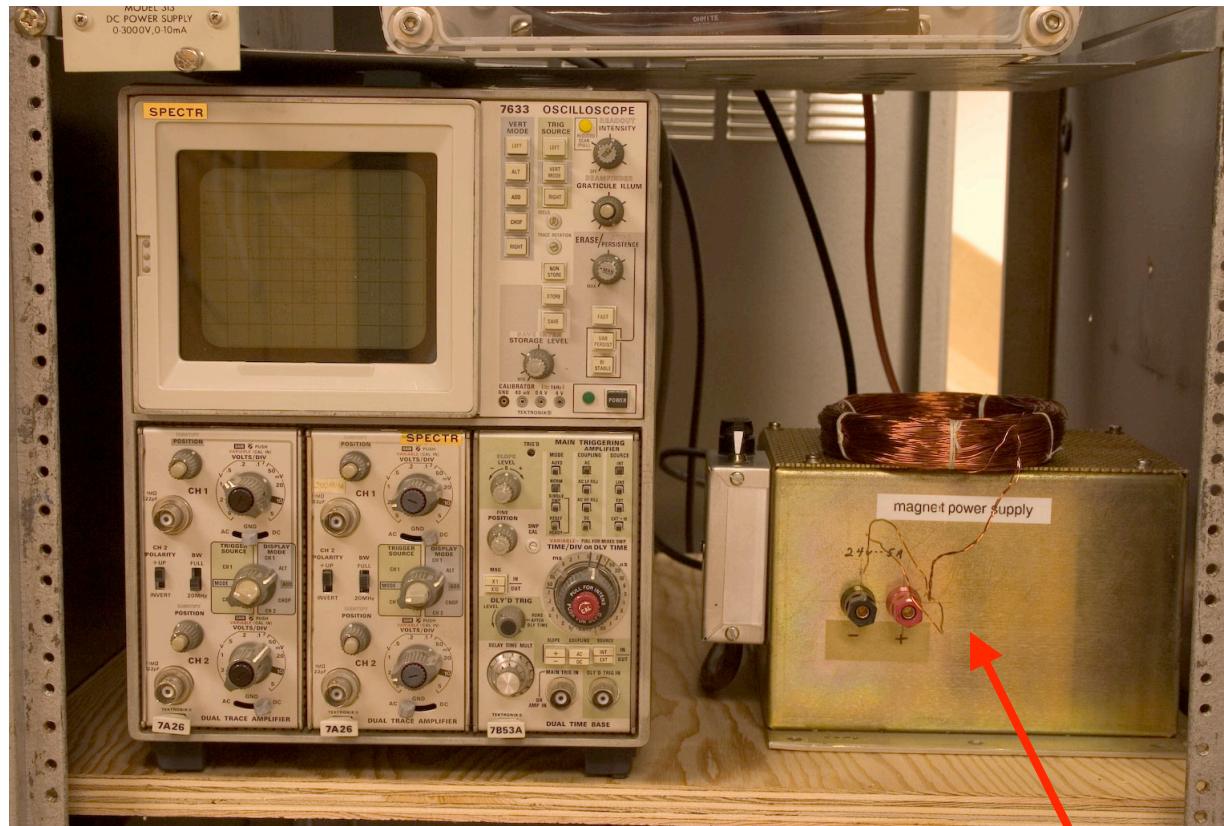


6.2 Helium I (587.6 nm) line brightness



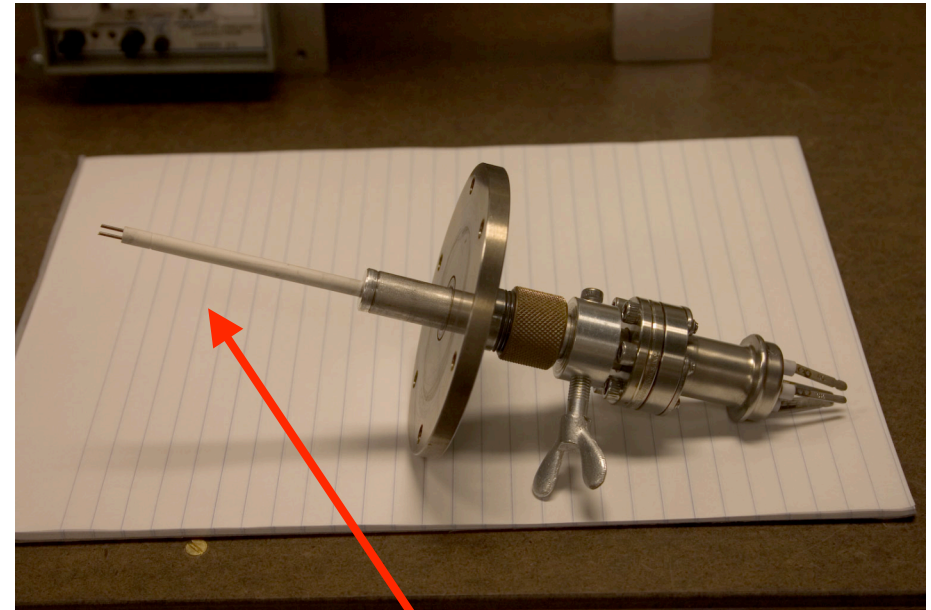
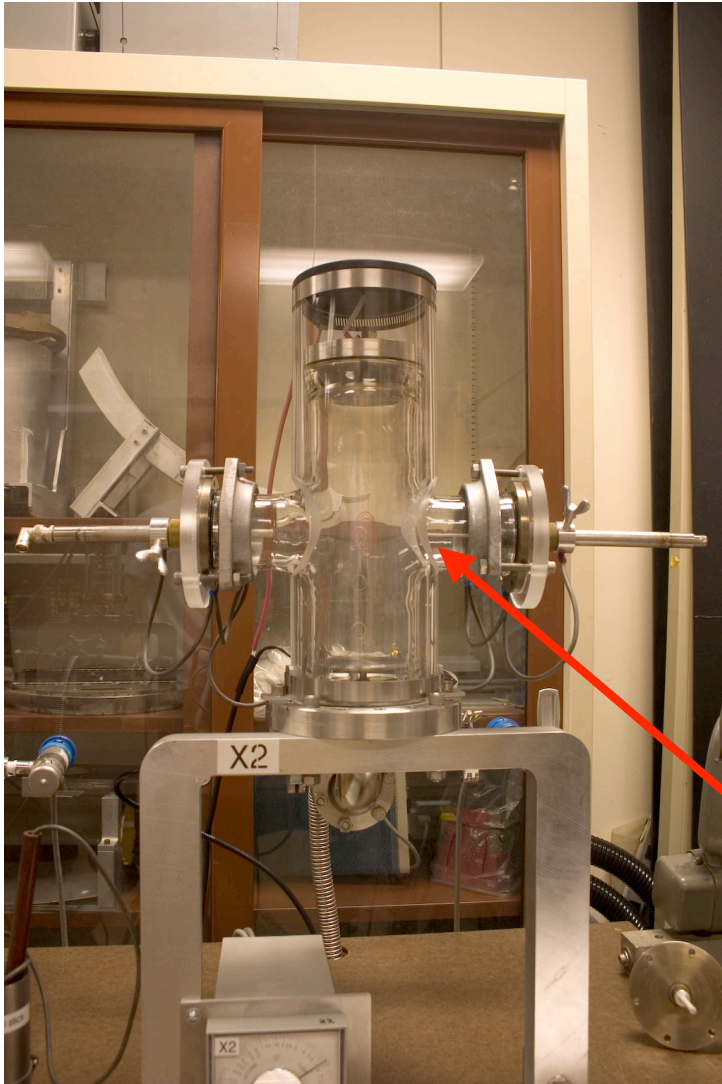
Electromagnet

7.1 Electromagnet on X1



electromagnet power supply

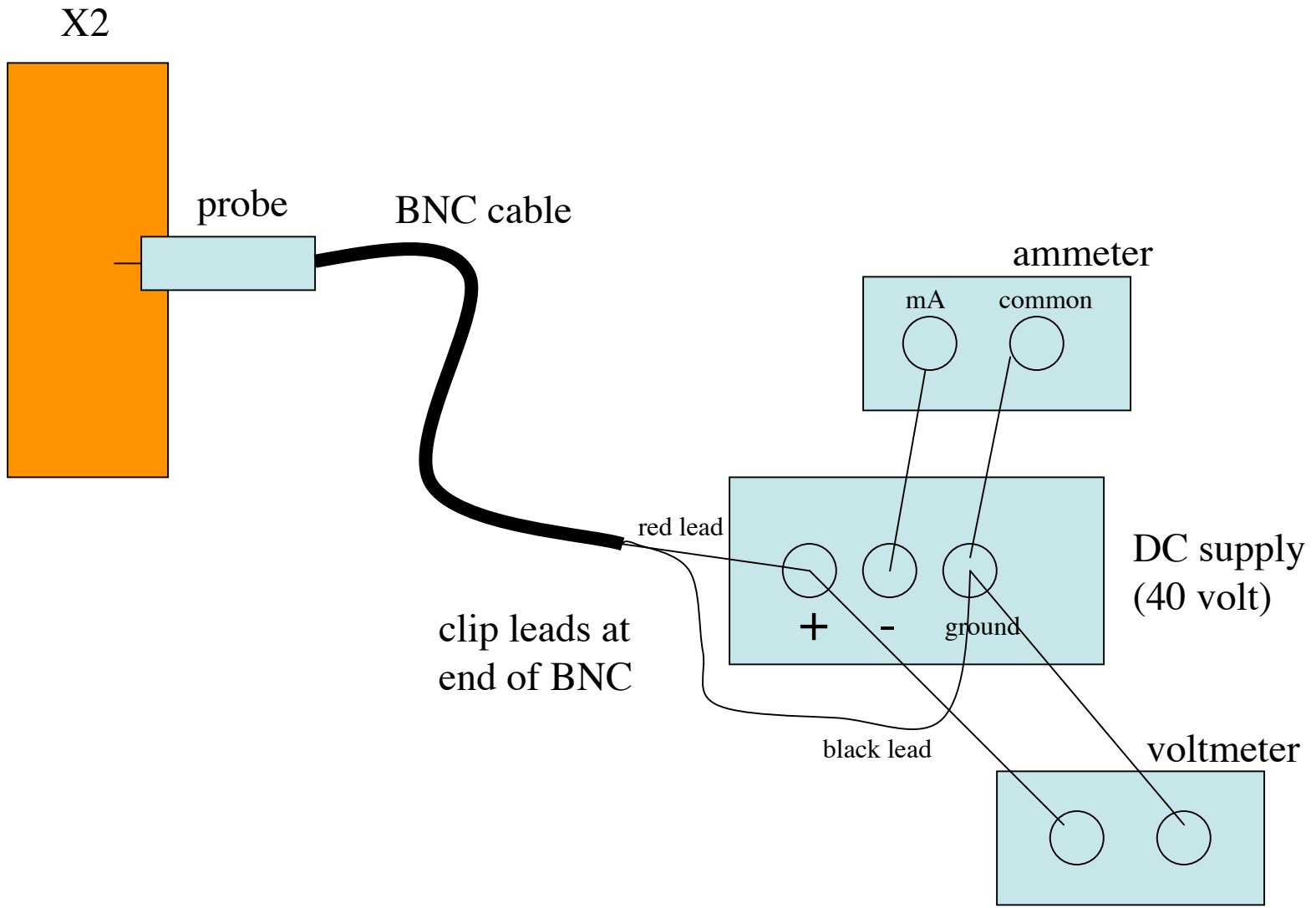
7.2 Electromagnet power supply



double Langmuir probe

single Langmuir probe in X2

8.1 Langmuir probes



8.2 Langmuir probe current measurement

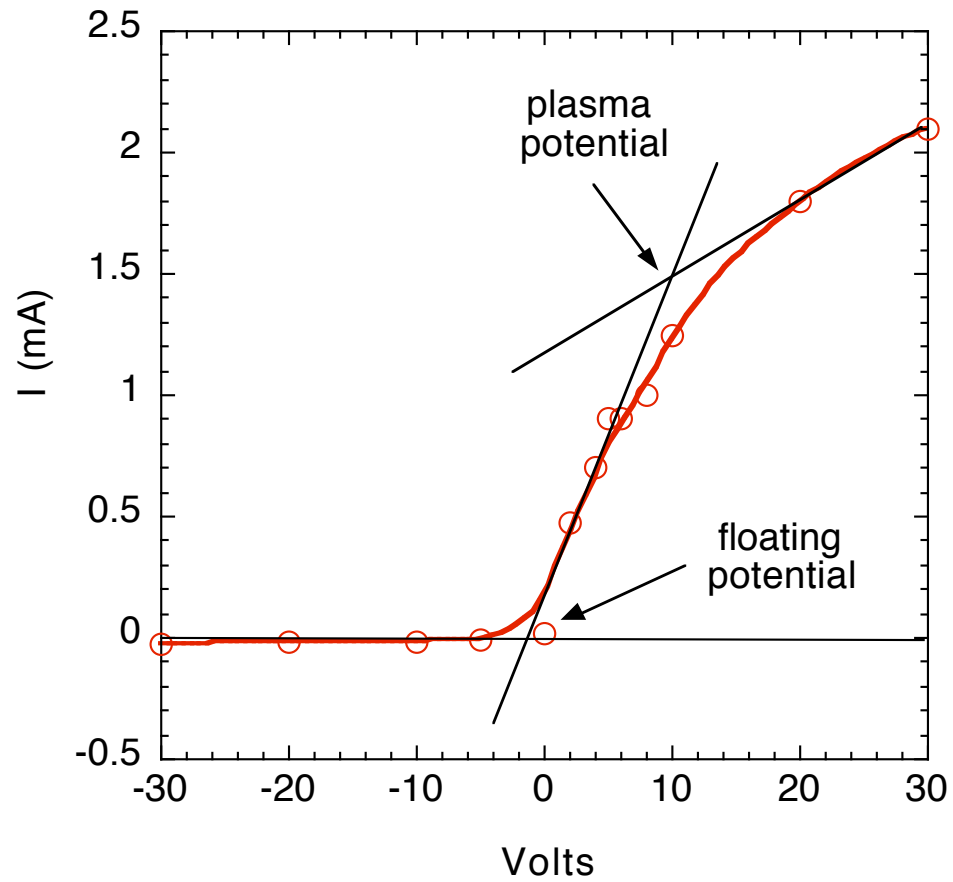
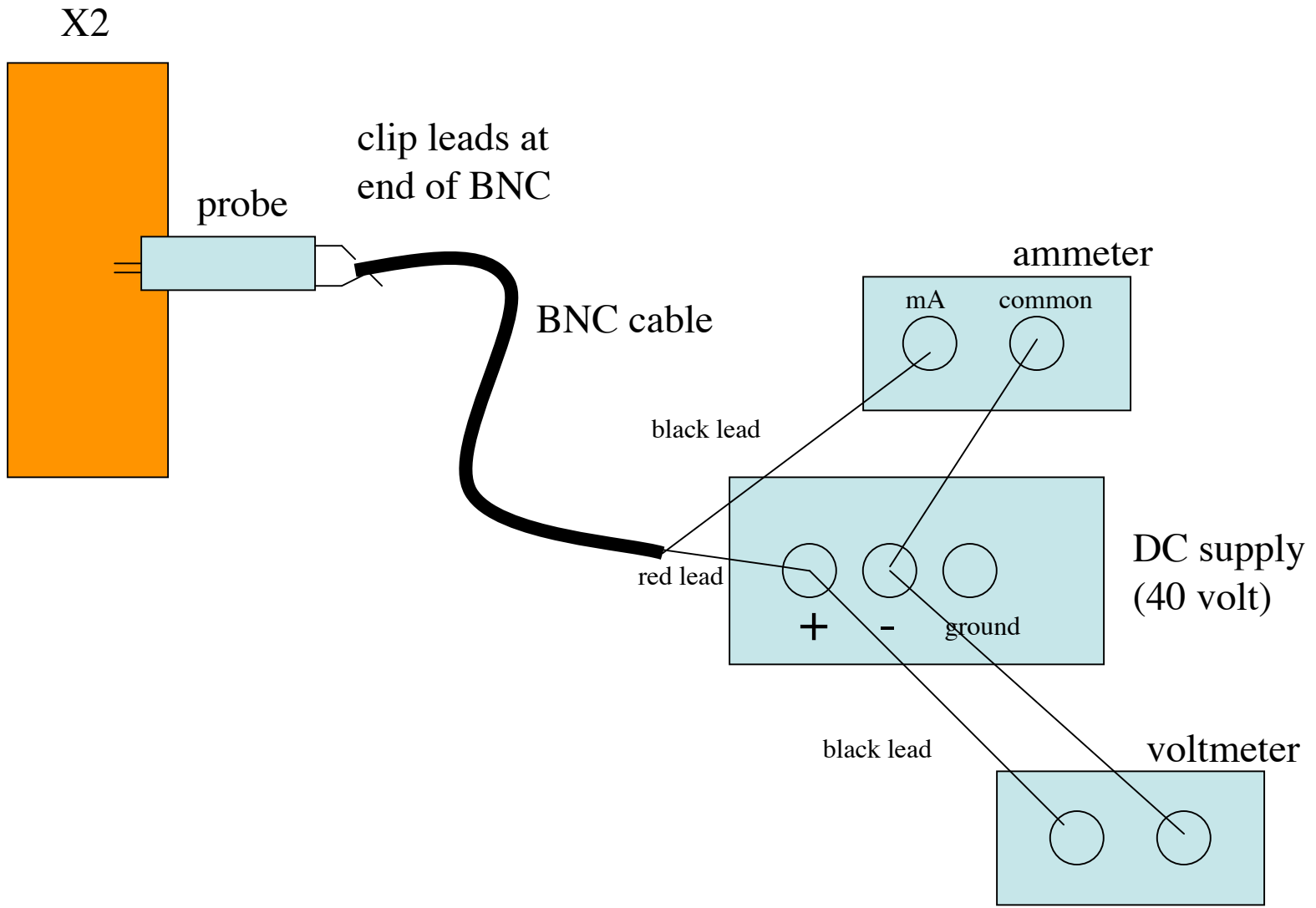


Fig. 8.3 Typical Langmuir probe curve



8.4 Double probe current measurement

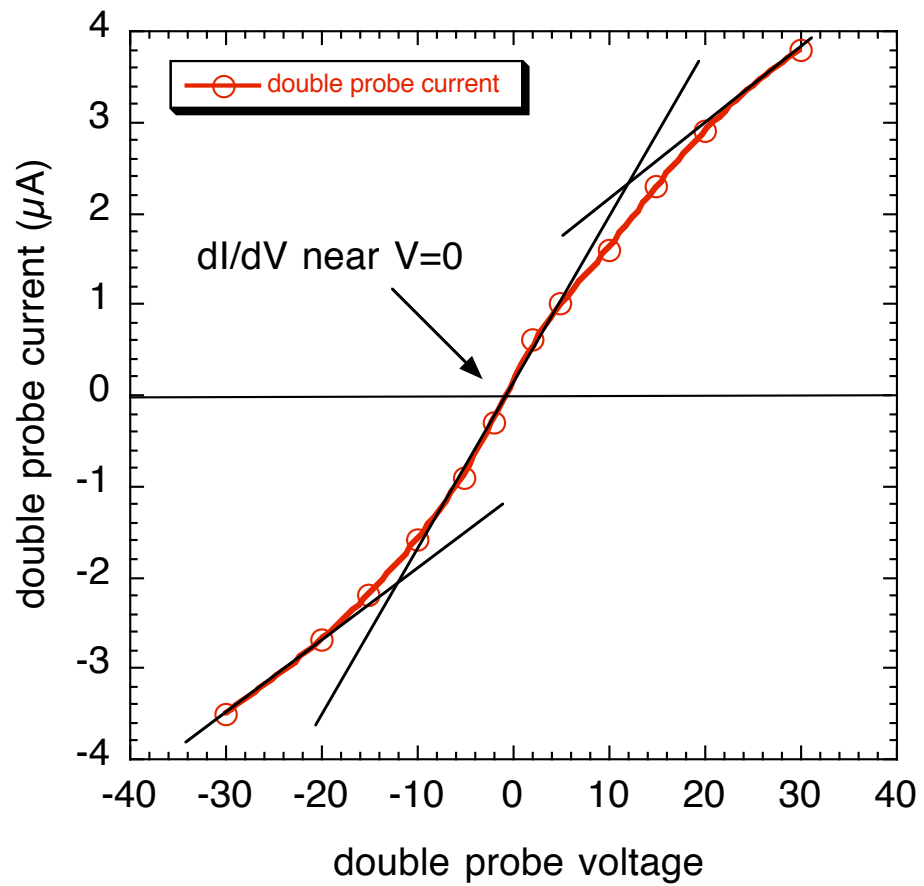
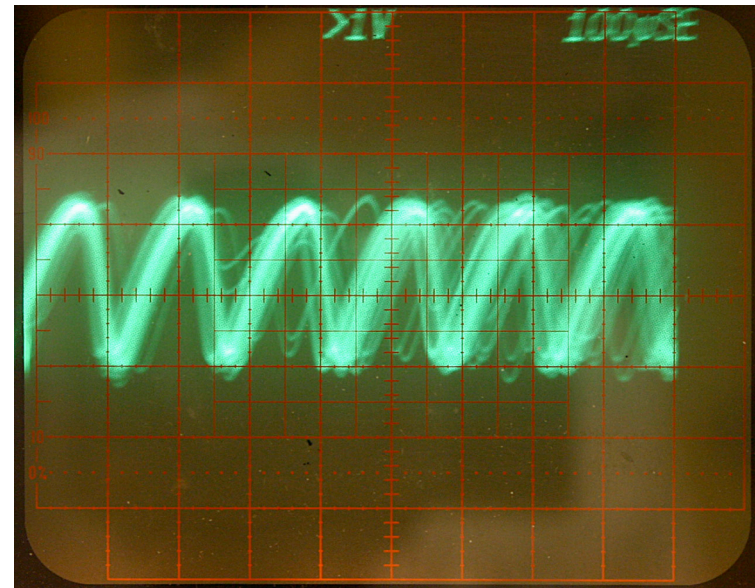
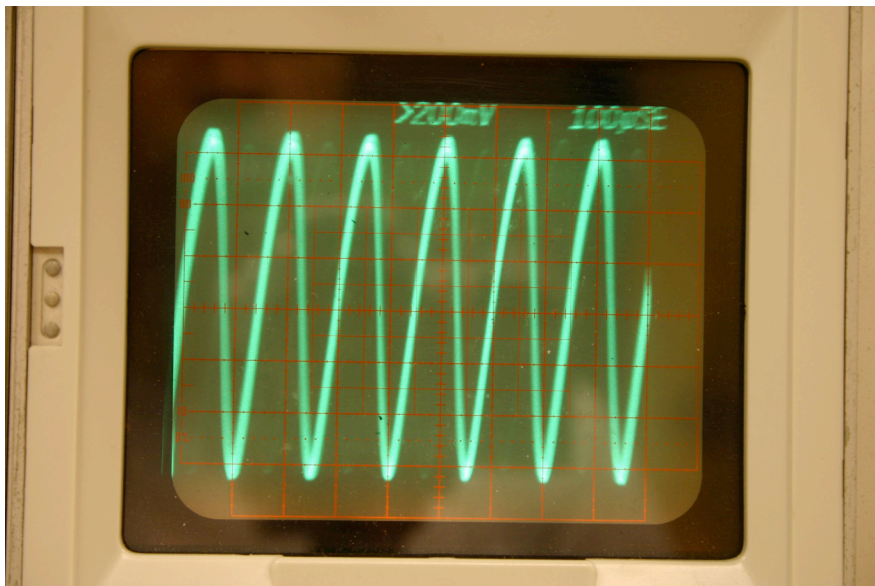


Fig. 8.5 Typical Langmuir double probe curve



9.1 Typical plasma instability waveforms

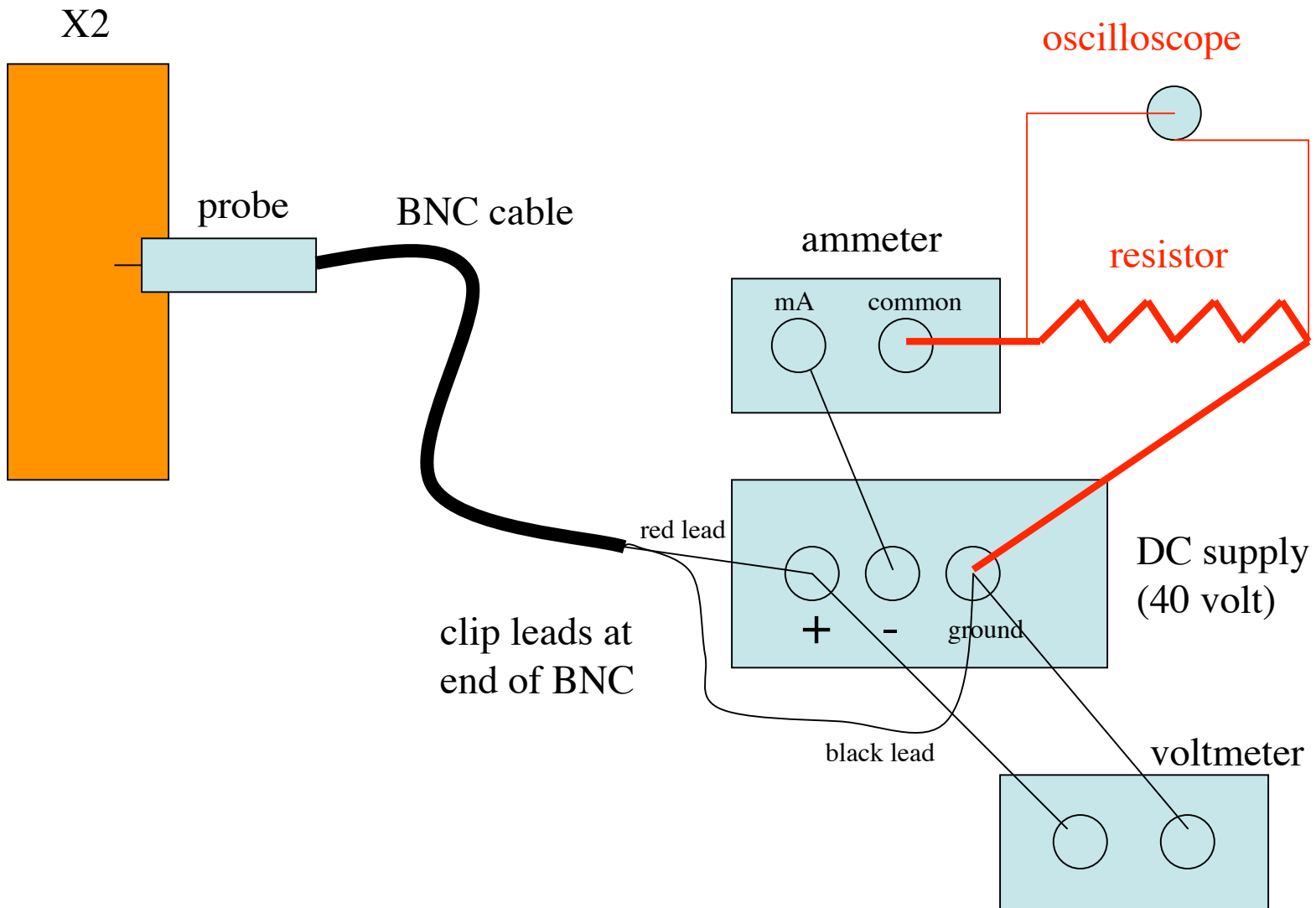


Fig. 9.2 Langmuir probe current fluctuation measurement



back side of X2

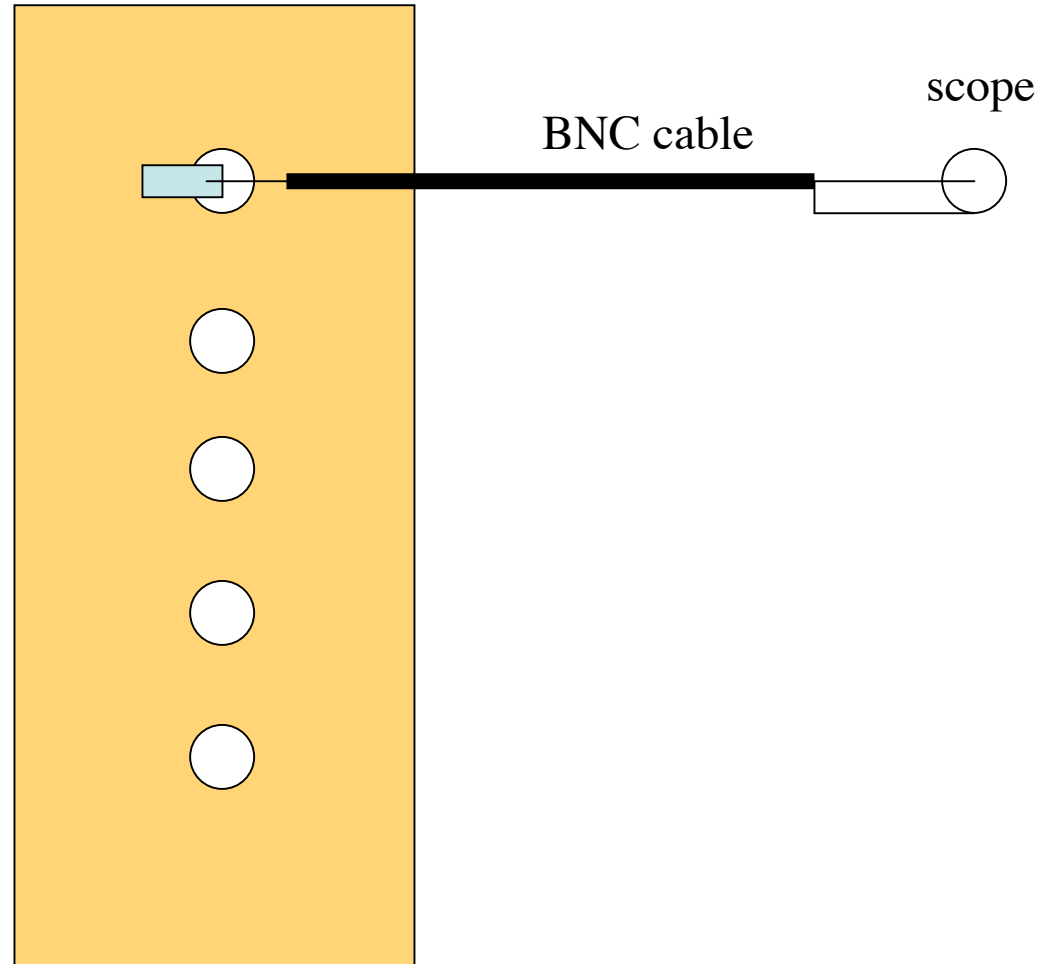
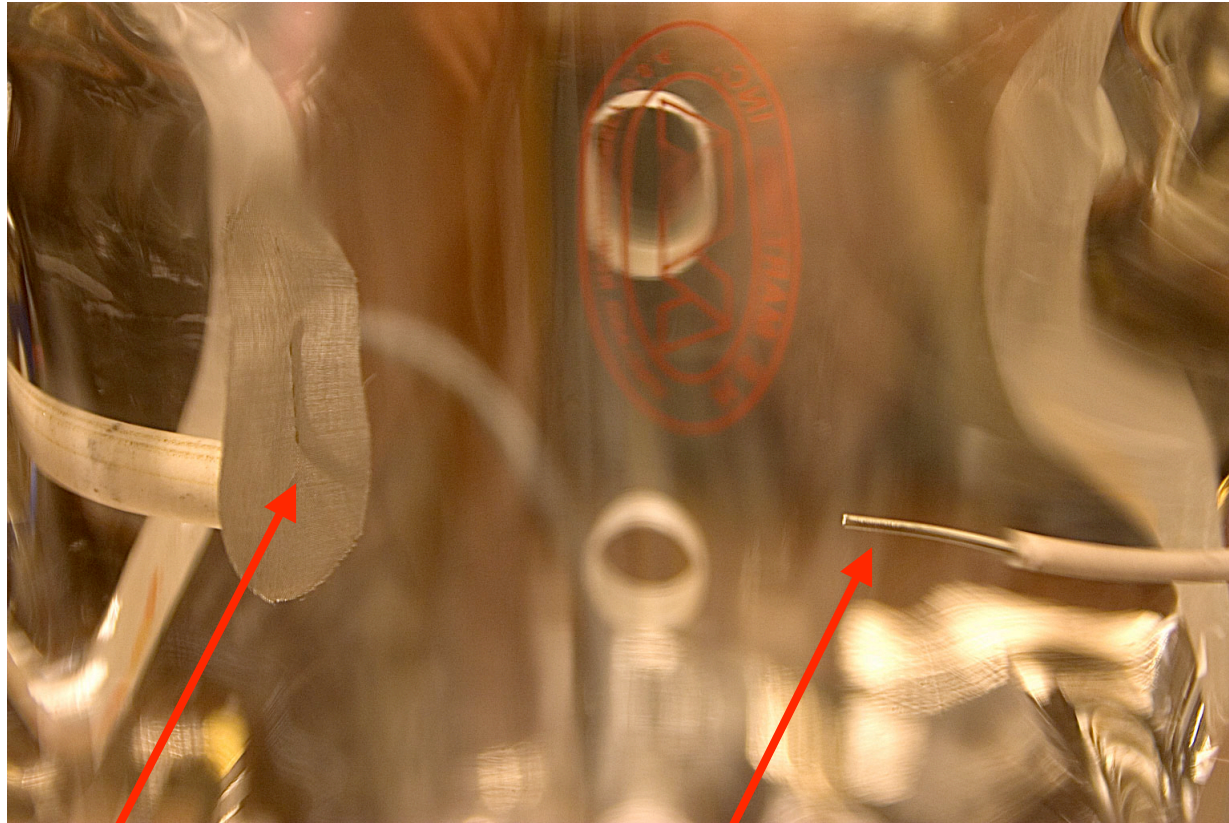


Fig. 9.3 - Capacitive probe



mesh probe
(through distorting glass)

single Langmuir probe tip
(through distorting glass)

Fig. 10.1 Mesh probe

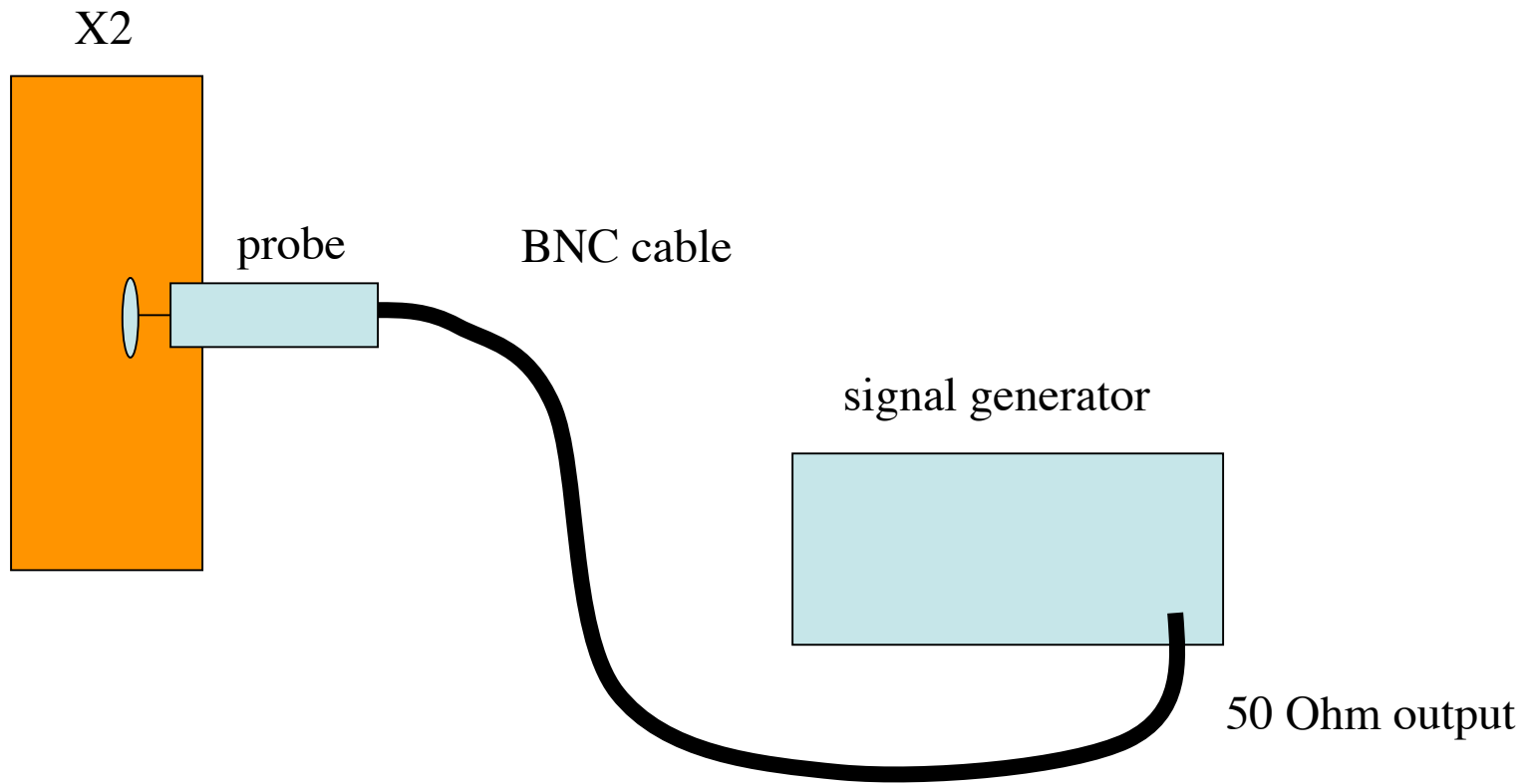


Fig. 10.2 Wave launching circuit