Ultrasonic Diffraction of Laser

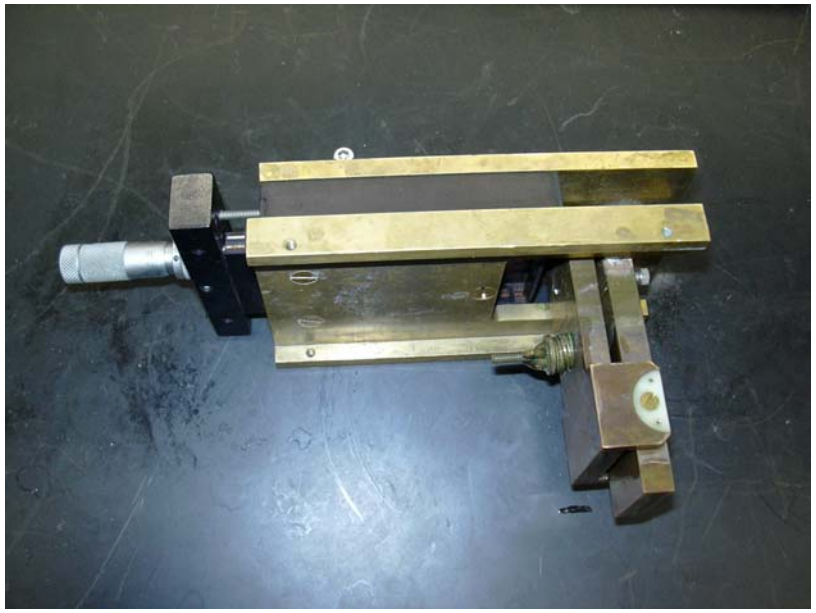
- Determination of periodic variation of density in liquid by ultrasonic transducer
- Determination of velocity of sound in liquid at different temperatures using Debye and Sears method
- Determination of velocity of sound in liquid at different temperatures using reflected wave method
- Determination of velocity of sound in liquid at different temperatures using Striation method
- Students are expected to do more innovative investigation

Photograph of the experiment

List of Instruments and components

- Optical bench
- He-Ne Laser
- Ultrasonic tank with glass windows
- Wave reflector
- Lenses: f=3.5 cm (eyepiece), 27 cm, 15 cm, 500 cm
- Mirrors
- Signal generator (100 KHz - 70 MHz)
- RF power amplifier
- Frequency Counter
- Collapsible optical base
- Oscilloscope
- Cables with BNC connectors
- Transparent liquid: Distilled water, Canola oil etc.

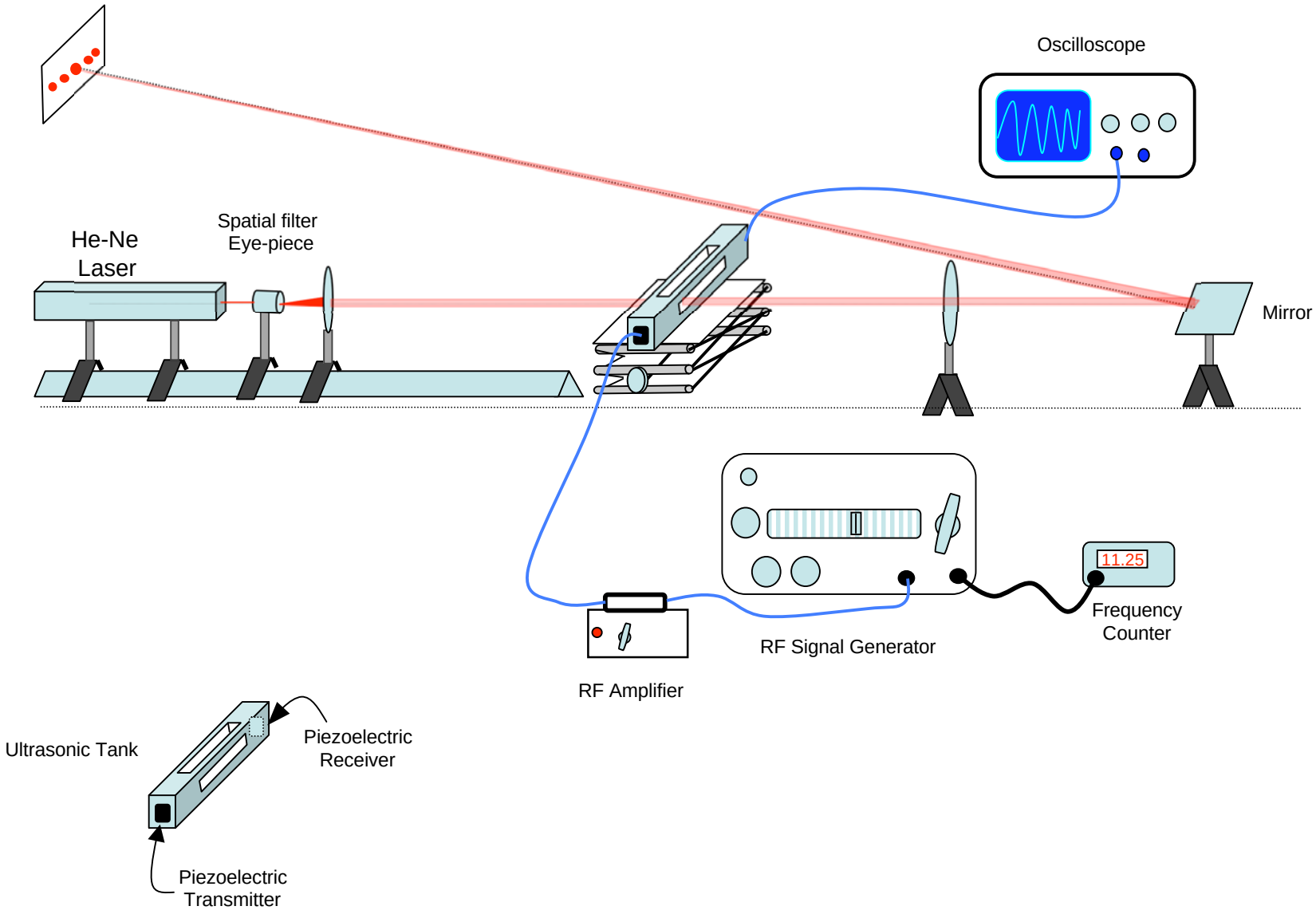
Components: Photo



He-Ne laser and RF generator

Frequency counter and RF amplifier

Experimental setup - 1



Schematic

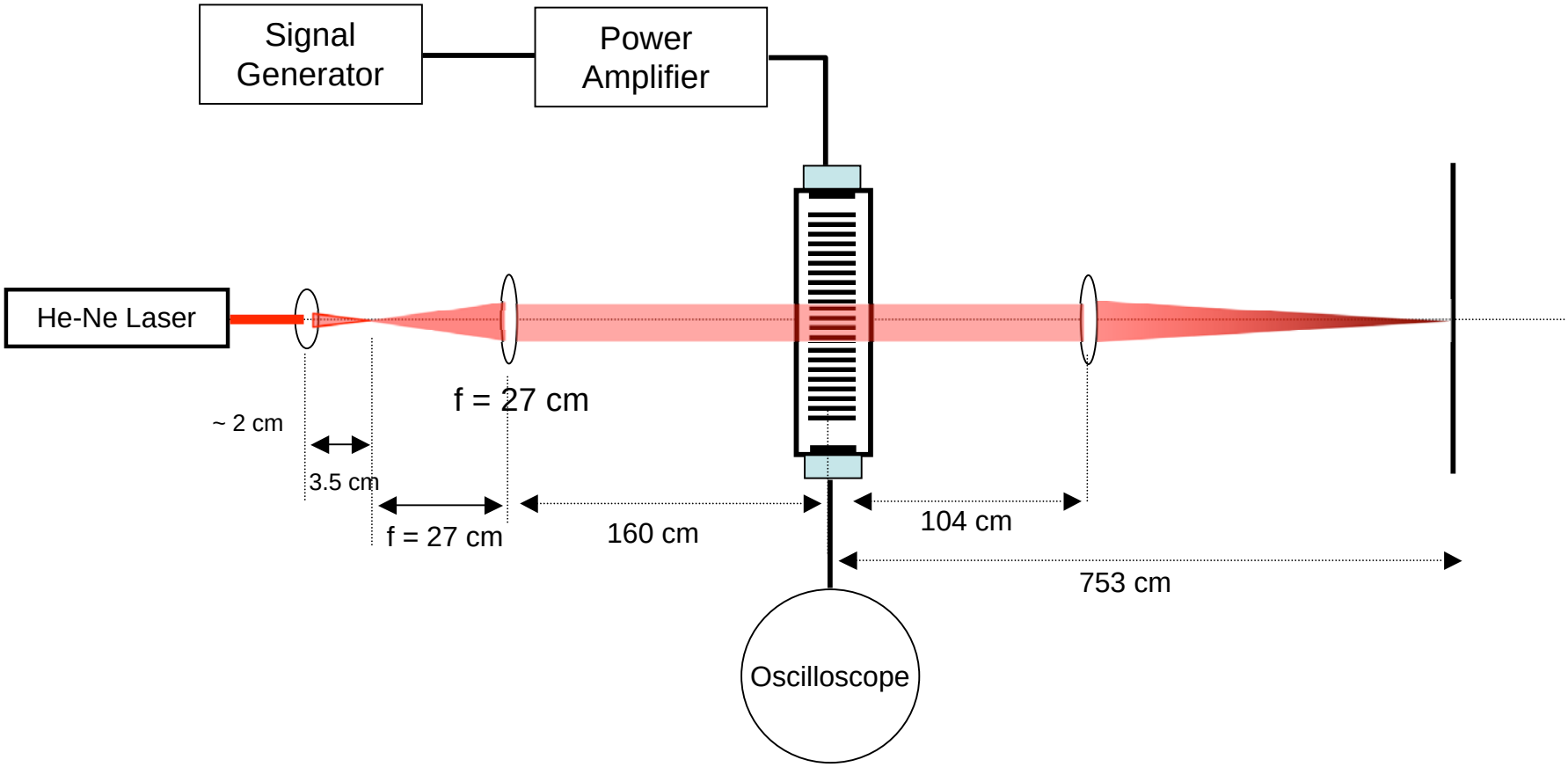
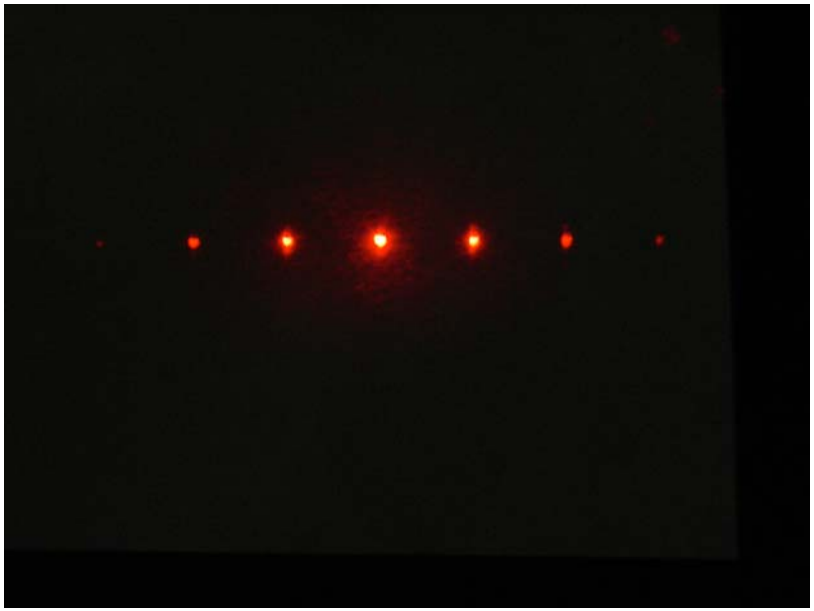
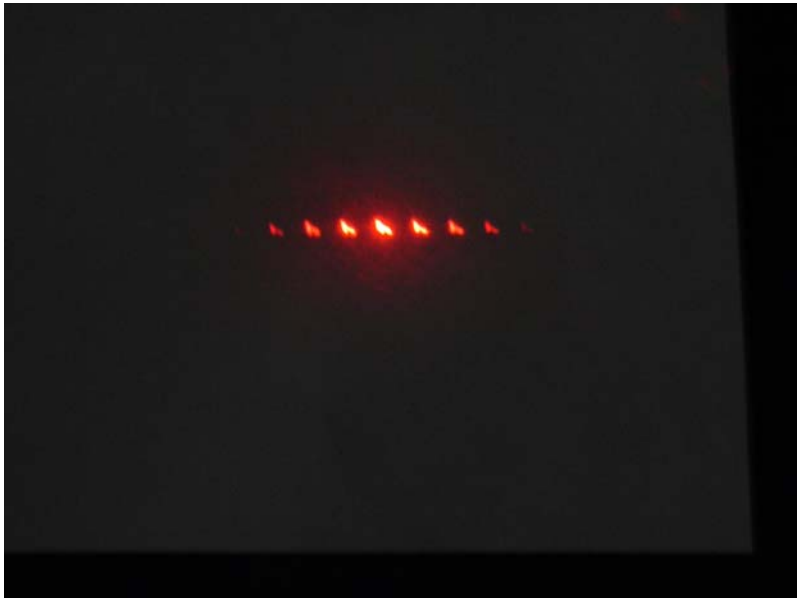

Signal Generator
Power Amplifier
He-Ne Laser
~ 2 cm
3.5 cm
f = 27 cm
f = 27 cm
160 cm
104 cm
753 cm
Oscilloscope

Image of the diffraction

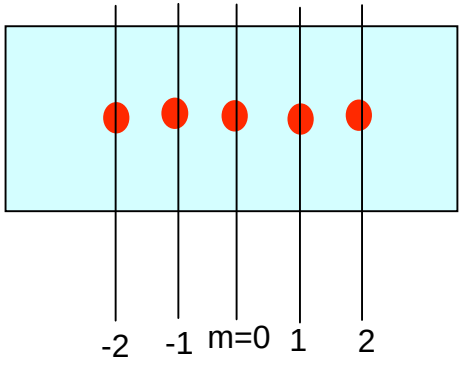


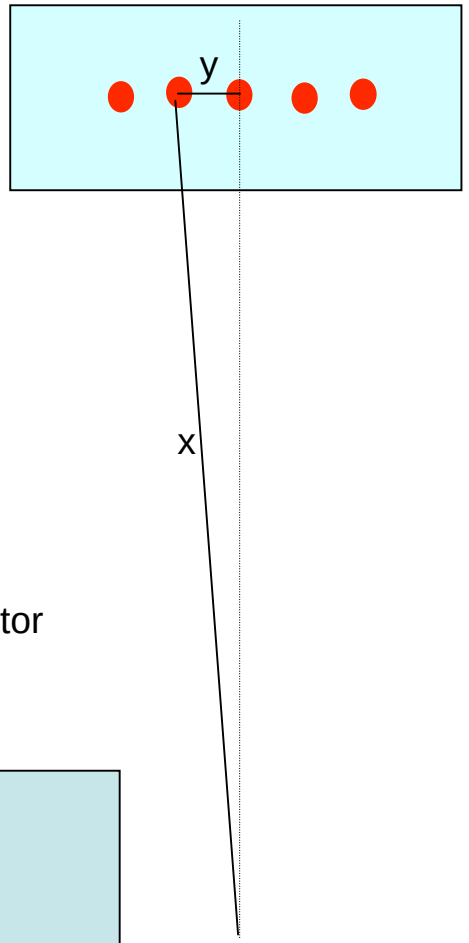
For oscillator frequency:
11.3 MHz



For oscillator frequency:
4.3 MHz

Determination of periodic density variation





$$v = f \Lambda$$

$$m\lambda = \Lambda \sin\theta$$

m = 0, 1, 2, 3, …

$$\sin\theta \sim y/x$$

V: velocity of sound in liquid used

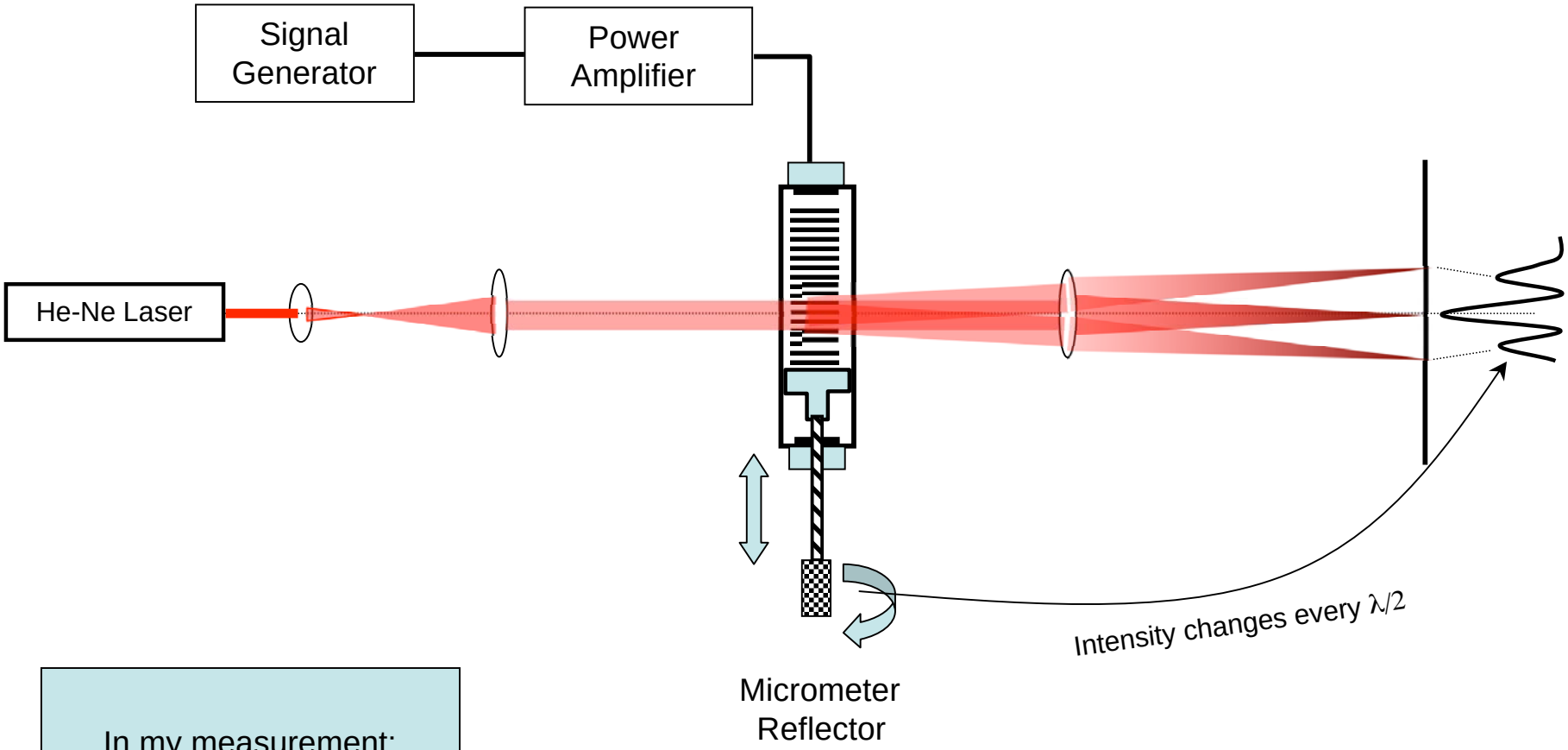
F: frequency of the signal generator
4.2 MHz, 11.2 MHz

λ=632.8 nm

Find Λ

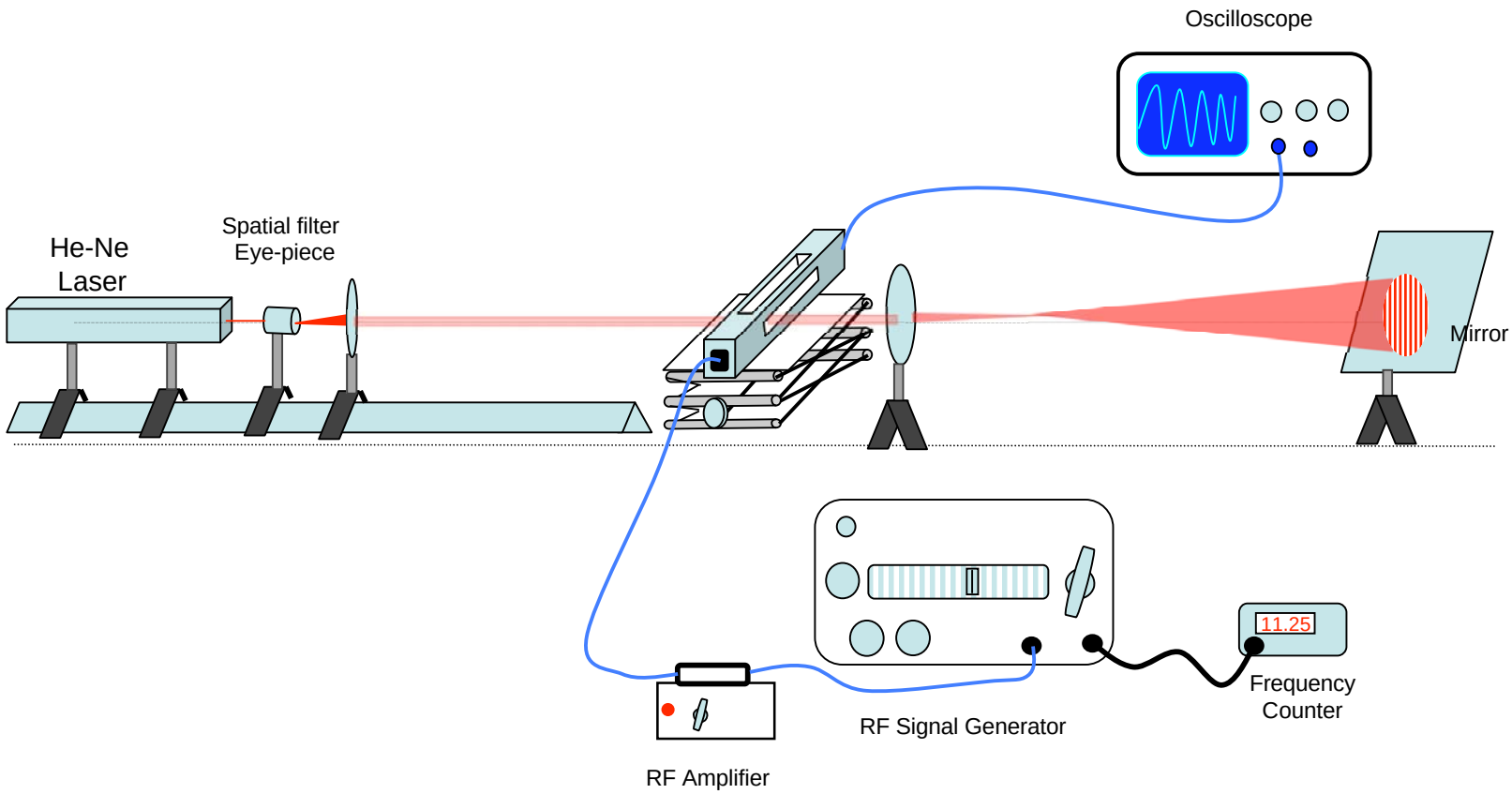
In my expt:
Y=3.4 cm, x = 753 cm
F=11.37 MHz
Λ ~ 0.14 mm

Standing wave by a reflector

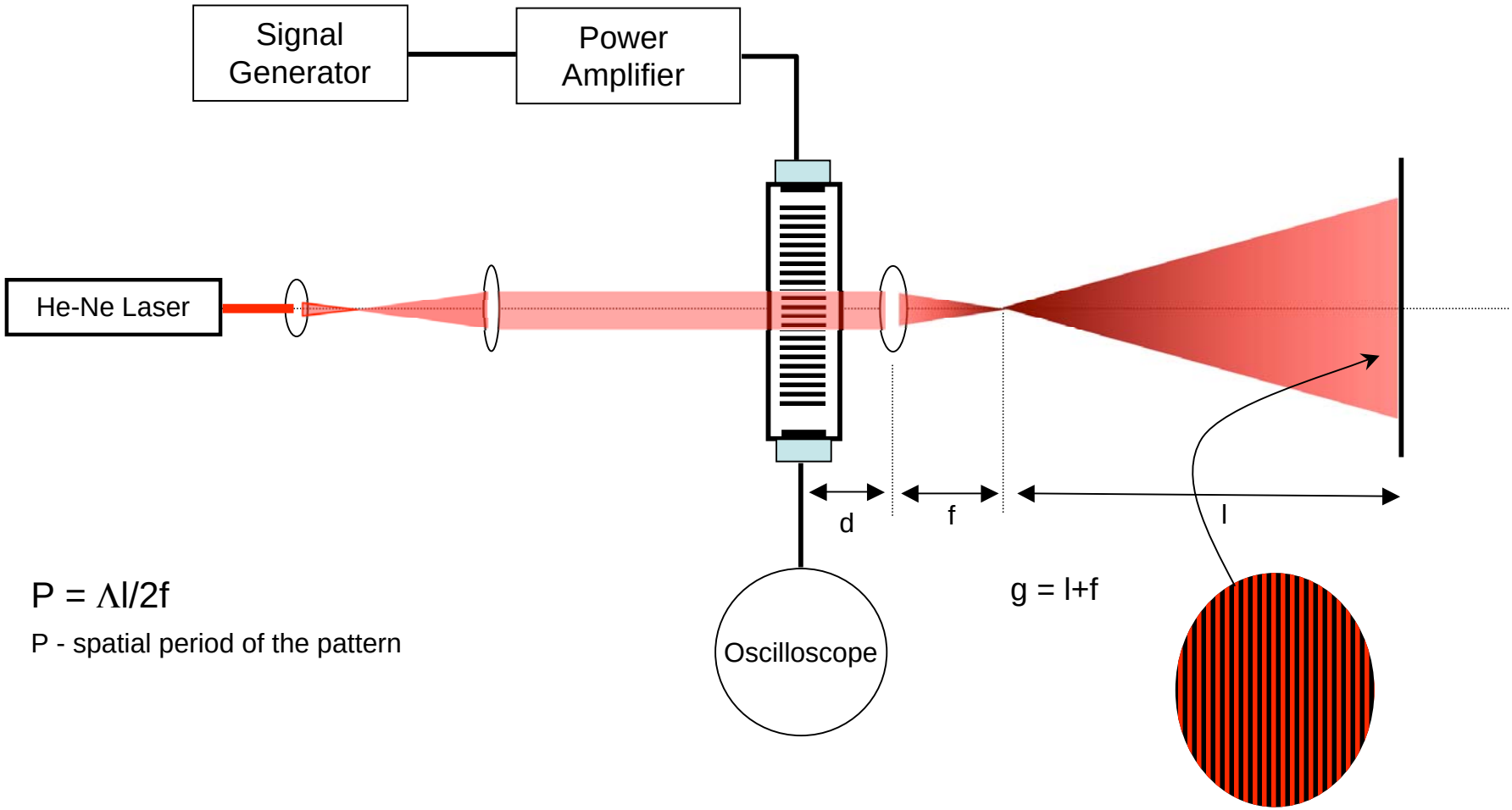


In my measurement:
22 peaks for 1.5 mm
Λ=1.5/11 = 0.136 mm

Setup for Striation Method



Striation Method

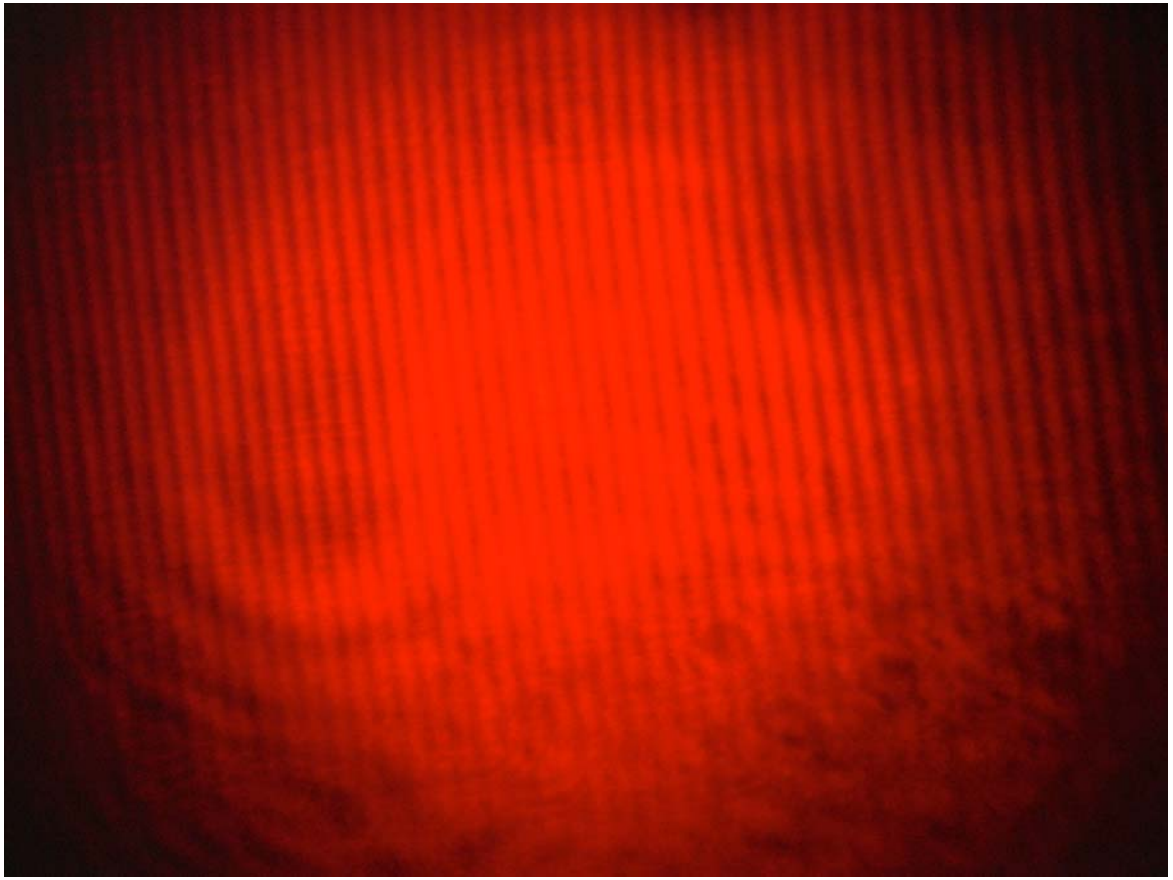


$P = \Lambda l/2f$

P - spatial period of the pattern

$g = l+f$

Image obtained by striation method



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