# PIXE – PAN 2008

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# OPTICS

Group B


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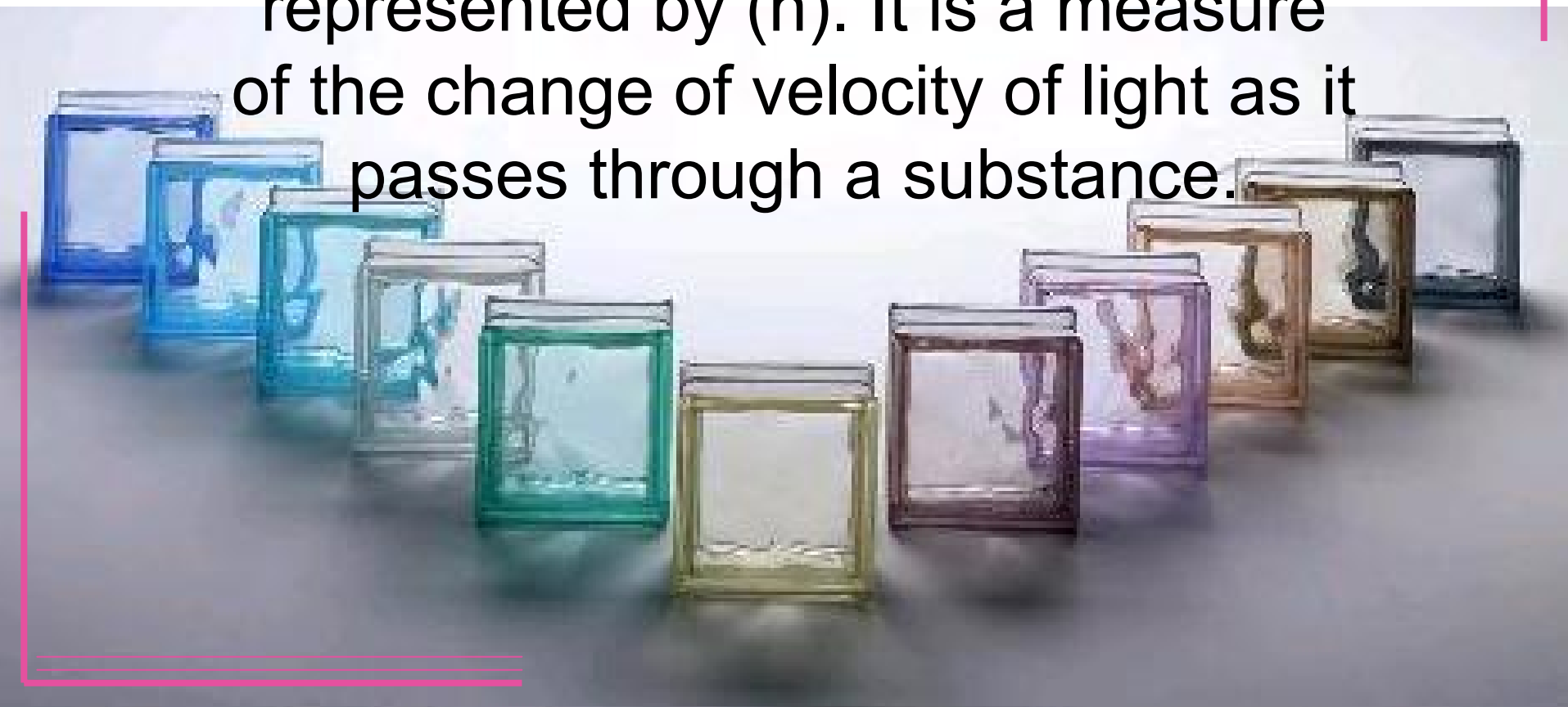
# Index of Refraction

- If you look at a straw in water, it appears to be bent.
- This is a result of the index of refraction.

# Refraction

- The ***Index Of Refraction*** is represented by (n). It is a measure of the change of velocity of light as it passes through a substance.



# Purpose of Experiment

- Purpose
  The goal of this experiment is to calculate the index of refraction for a piece of glass.
  This means that we are basically proving that light bends as it goes through different objects.

# Necessary Equations

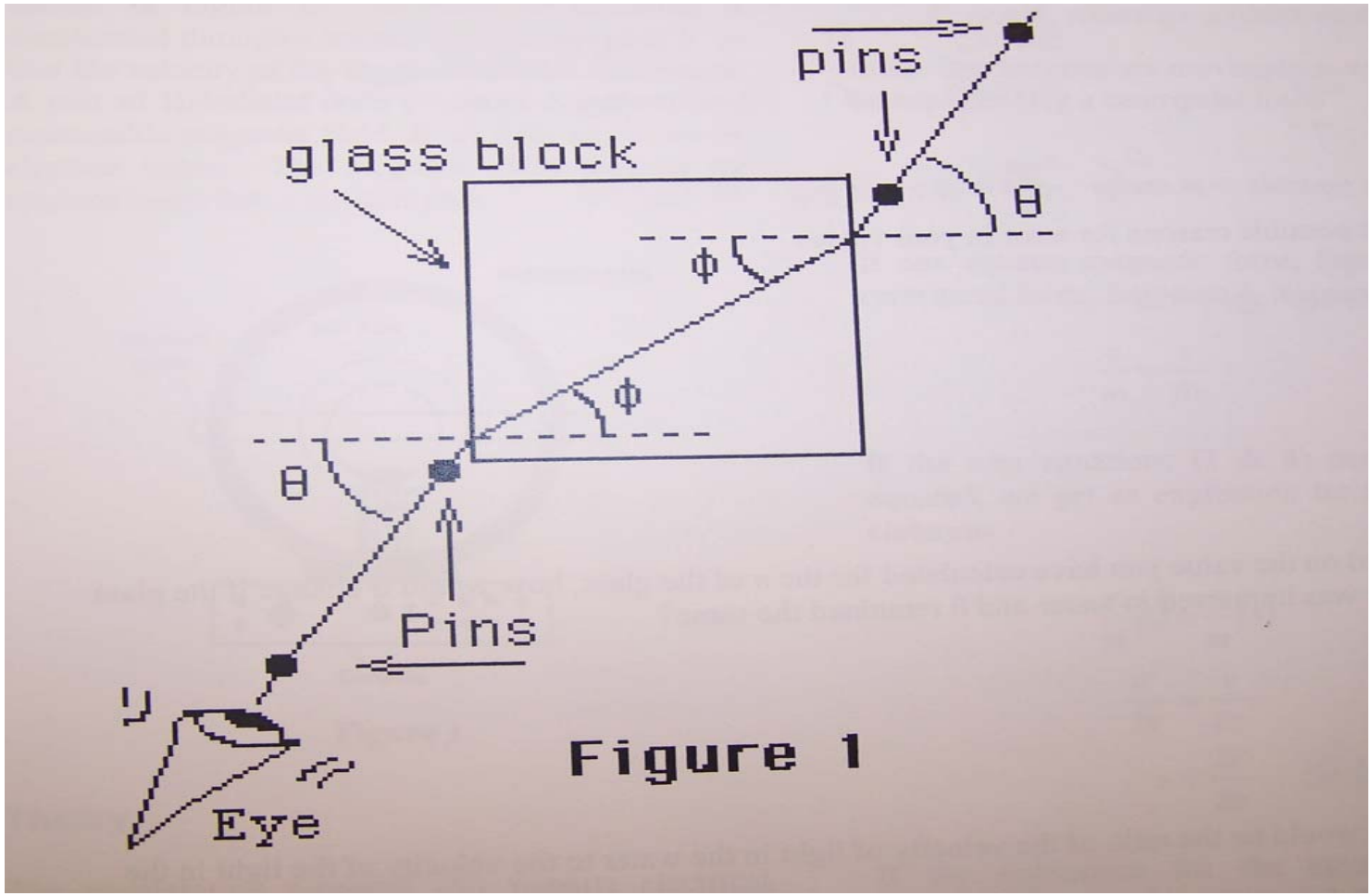
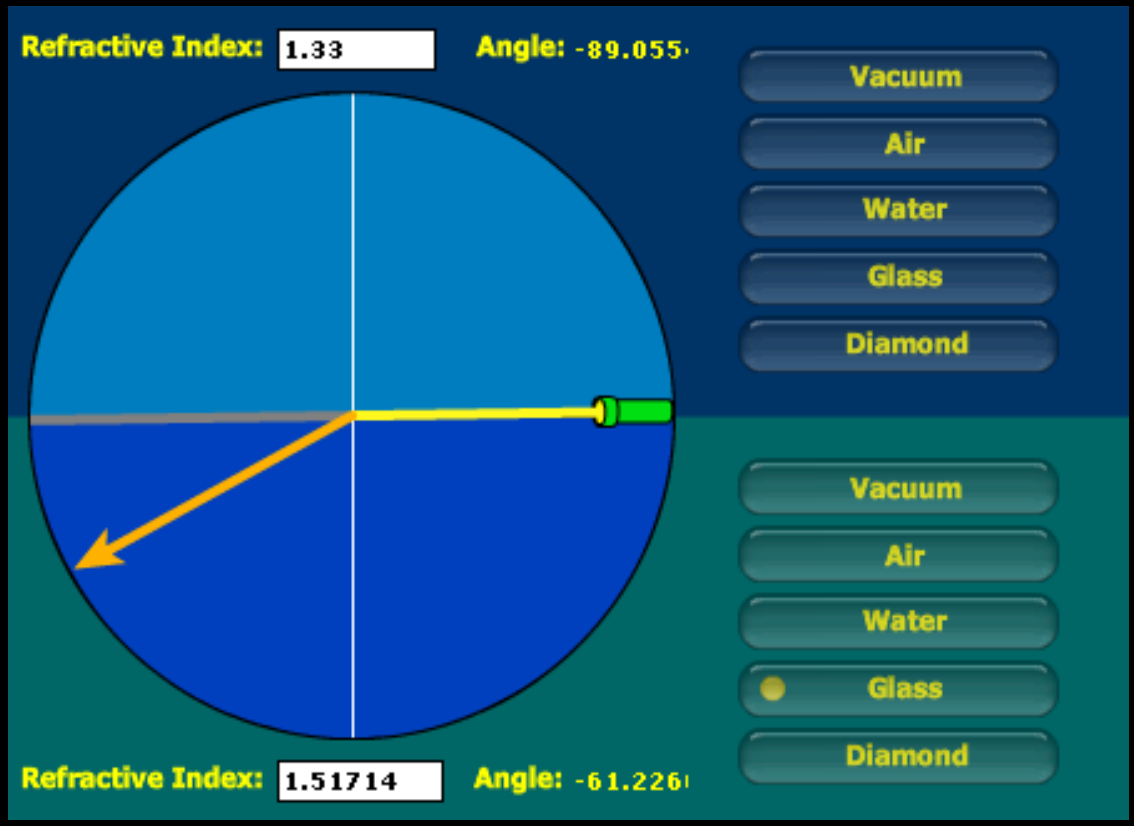
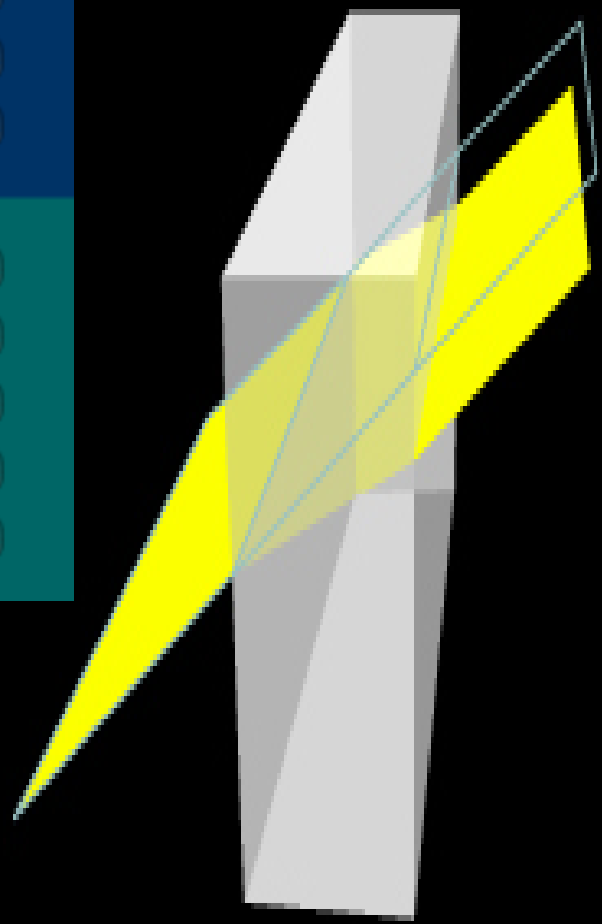


Figure 1

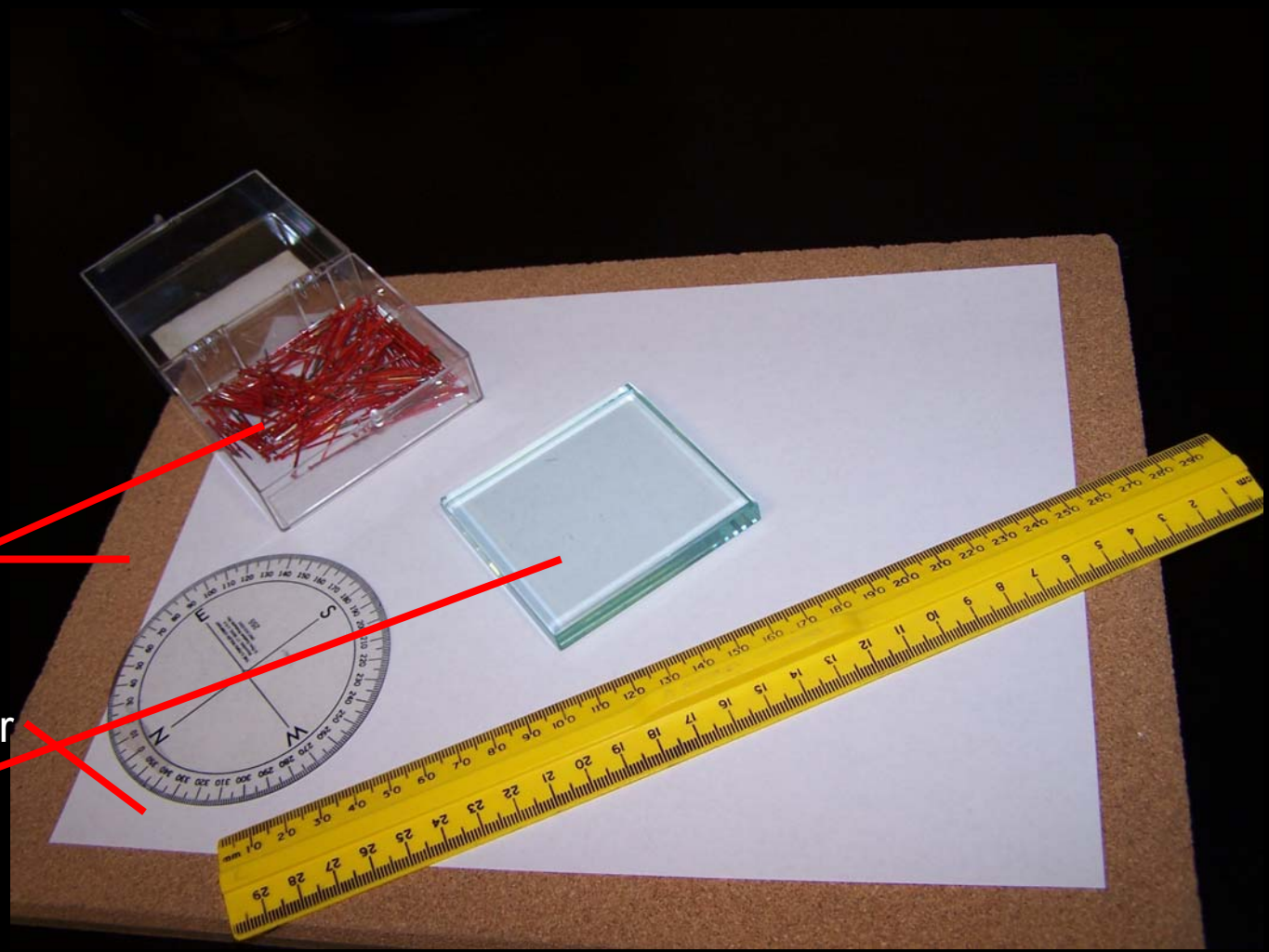
$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

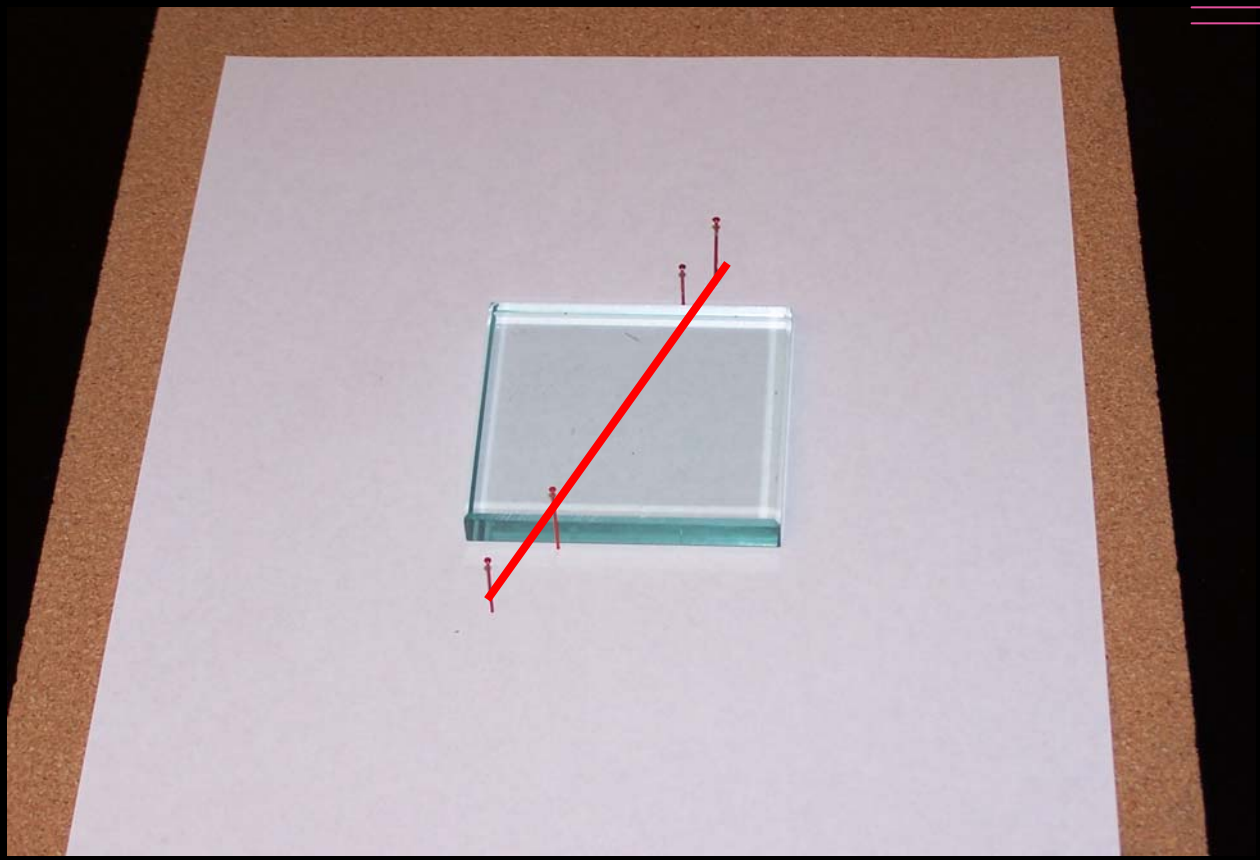

Refractive Index: 1.33
Angle: -89.055
Vacuum
Air
Water
Glass
Diamond
Vacuum
Air
Water
Glass
Diamond
Refractive Index: 1.51714
Angle: -61.226



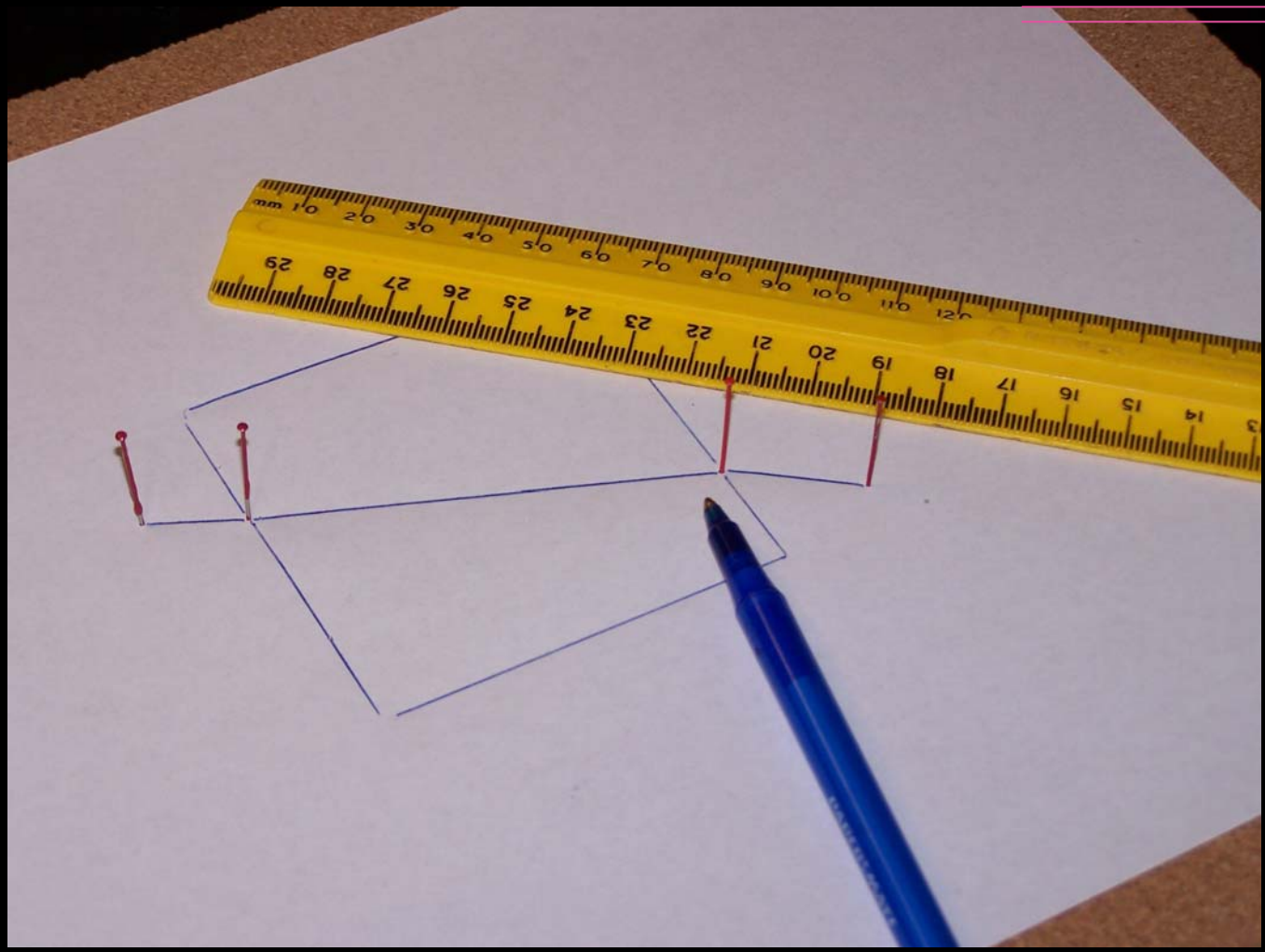
# Necessary Supplies

1. Cork Board
2. 4 pins
3. Blank sheet of paper
4. Glass square

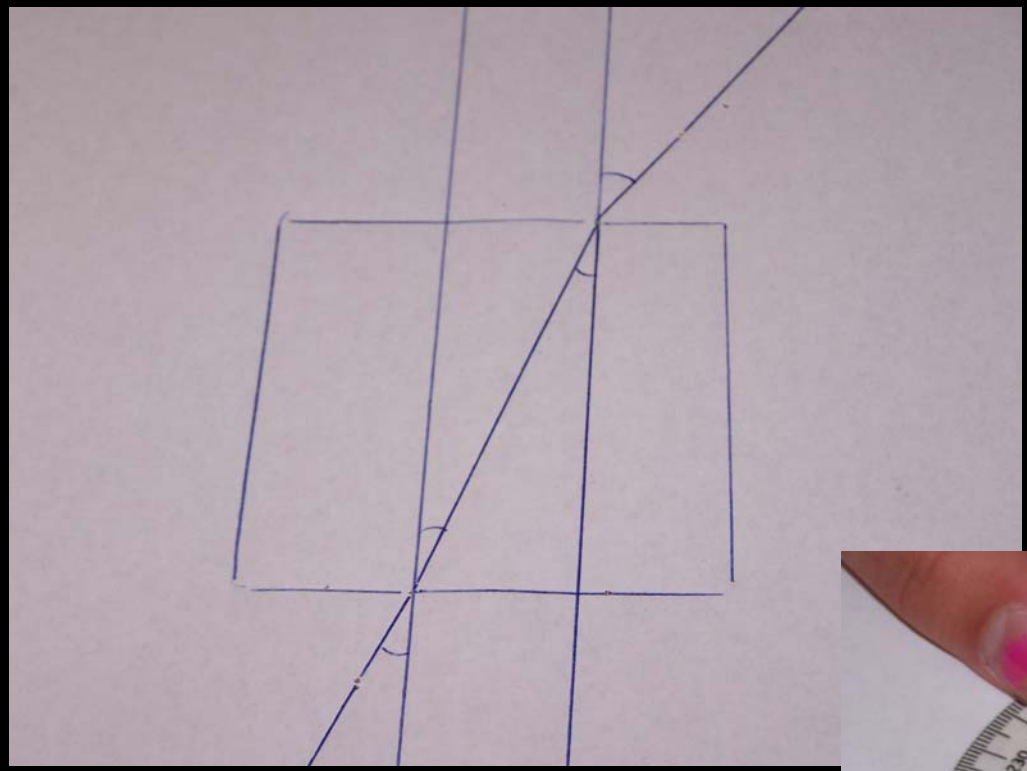




- Place the glass plate on the sheet of paper which is on the cork board.
- Place 2 pins on opposite sides of the glass, so that they appear to be in a diagonal line.

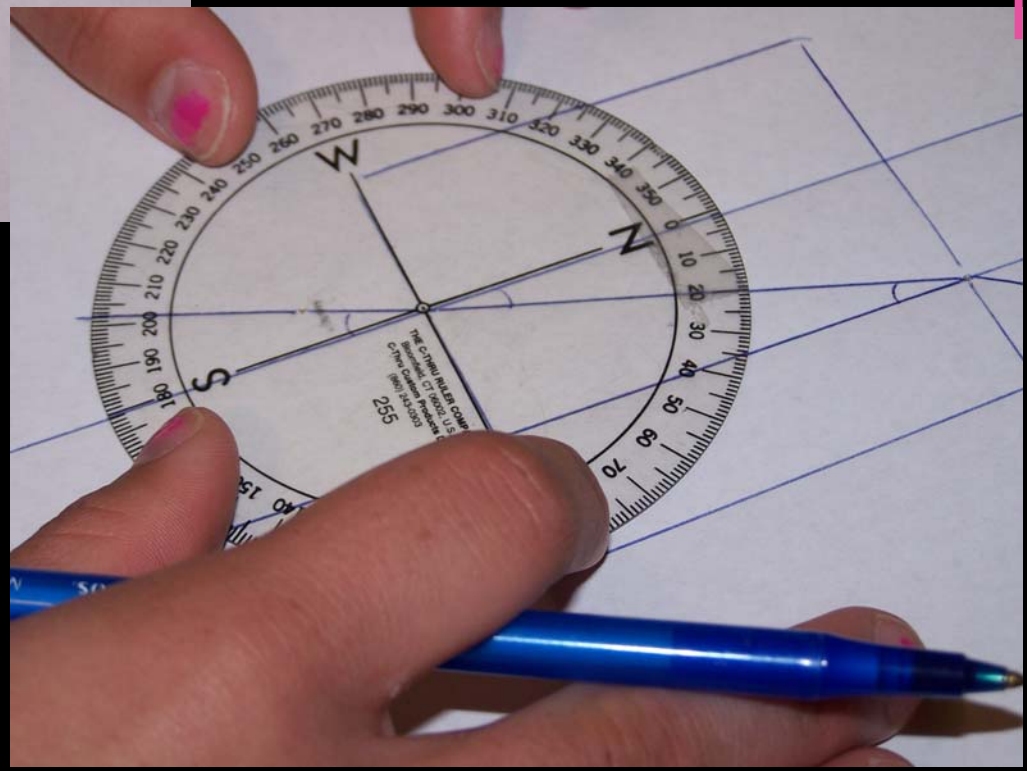


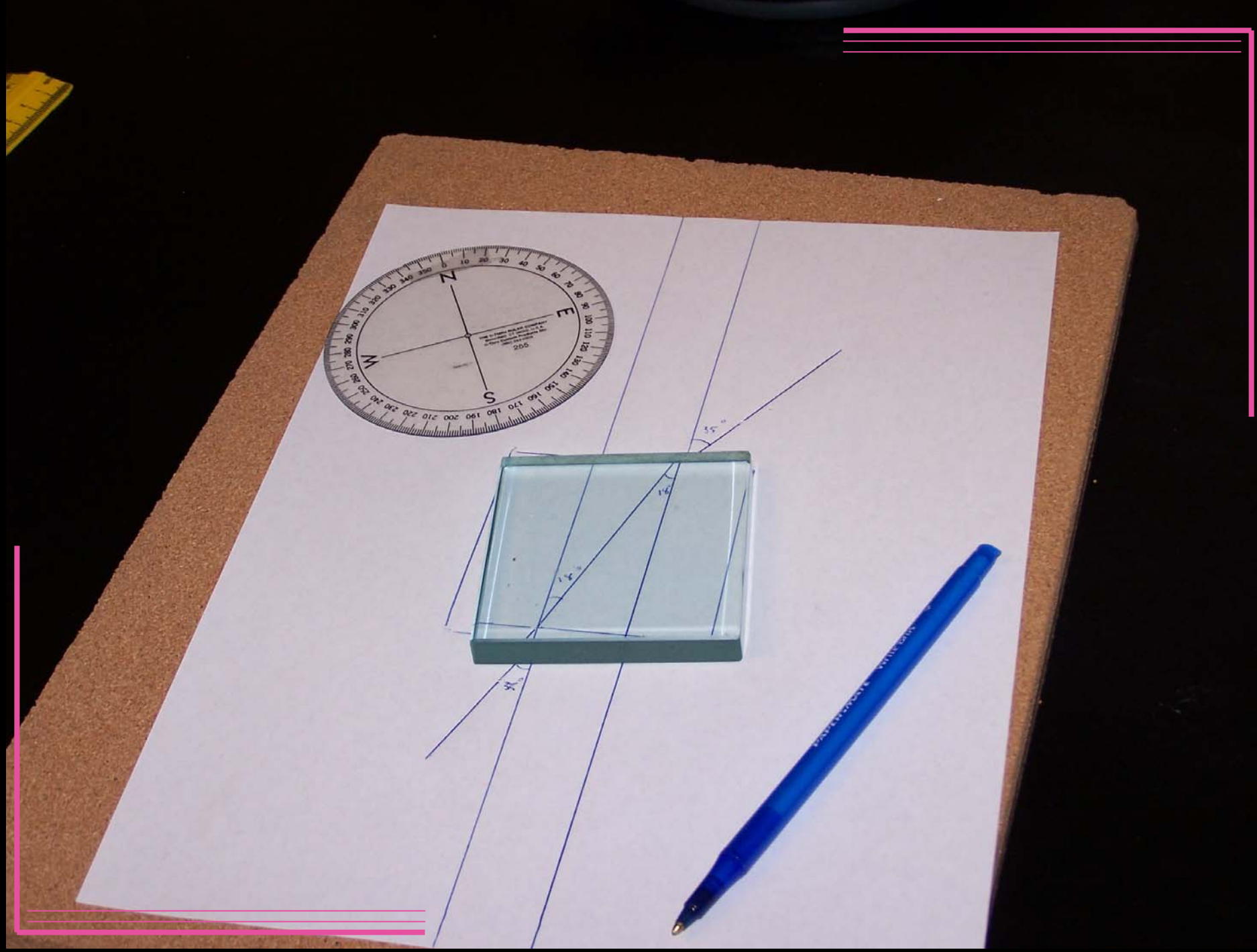
•Trace the glass plate and connect the individual pins so that they form a line.



•Use a ruler to draw parallel transversals through the vertices of the lines.

•Measure the four angles formed with a compass.




N
E
S
W

# Summary

- If the light traveled in a straight line, then all four angles would have the same degree measure.
- But as we see, light bends as it travels through different substances.

# E/M

# Background Information

J.J Thomson was the first person to measure the mass of an electron
This experiment is a variation of Thomson's experiment but is also based on the interaction of a magnetic field with a moving electric charge

1. **A beam of electrons is accelerated through a known electric potential**
2. **A pair of Helmholz coils produces a uniform and measuable magnetic field**
3. **The magnetic field deflects the electron beam into a circular path**

Video from:
http://phoenix.phys.clmson.edu/labs/cupo/eoverm

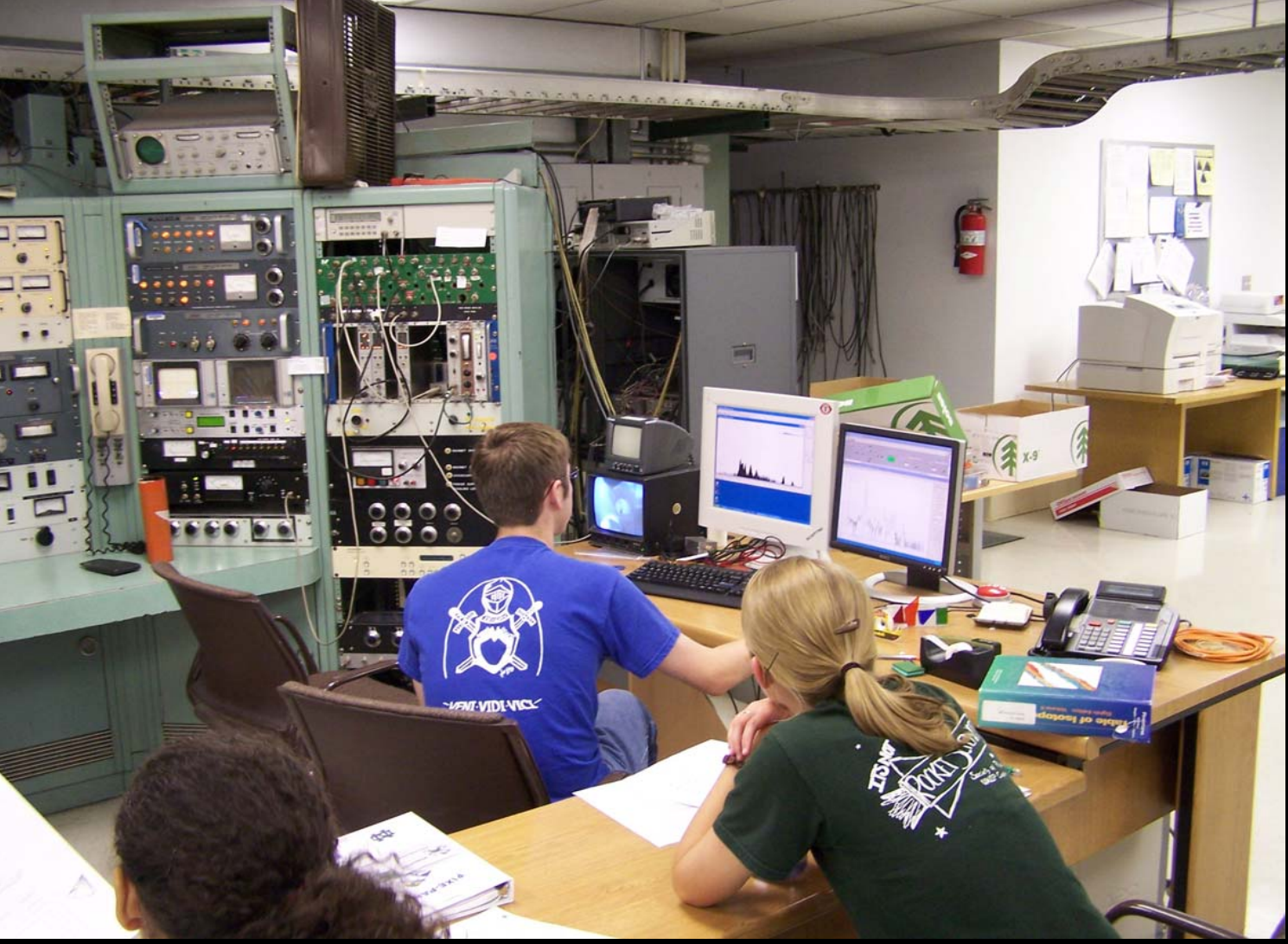
# Summary

- This experiment can be used to calculate the speed of electrons.
- It can also measure the ratio of the electron charge to the electron mass, or $^{e}/_{m}$

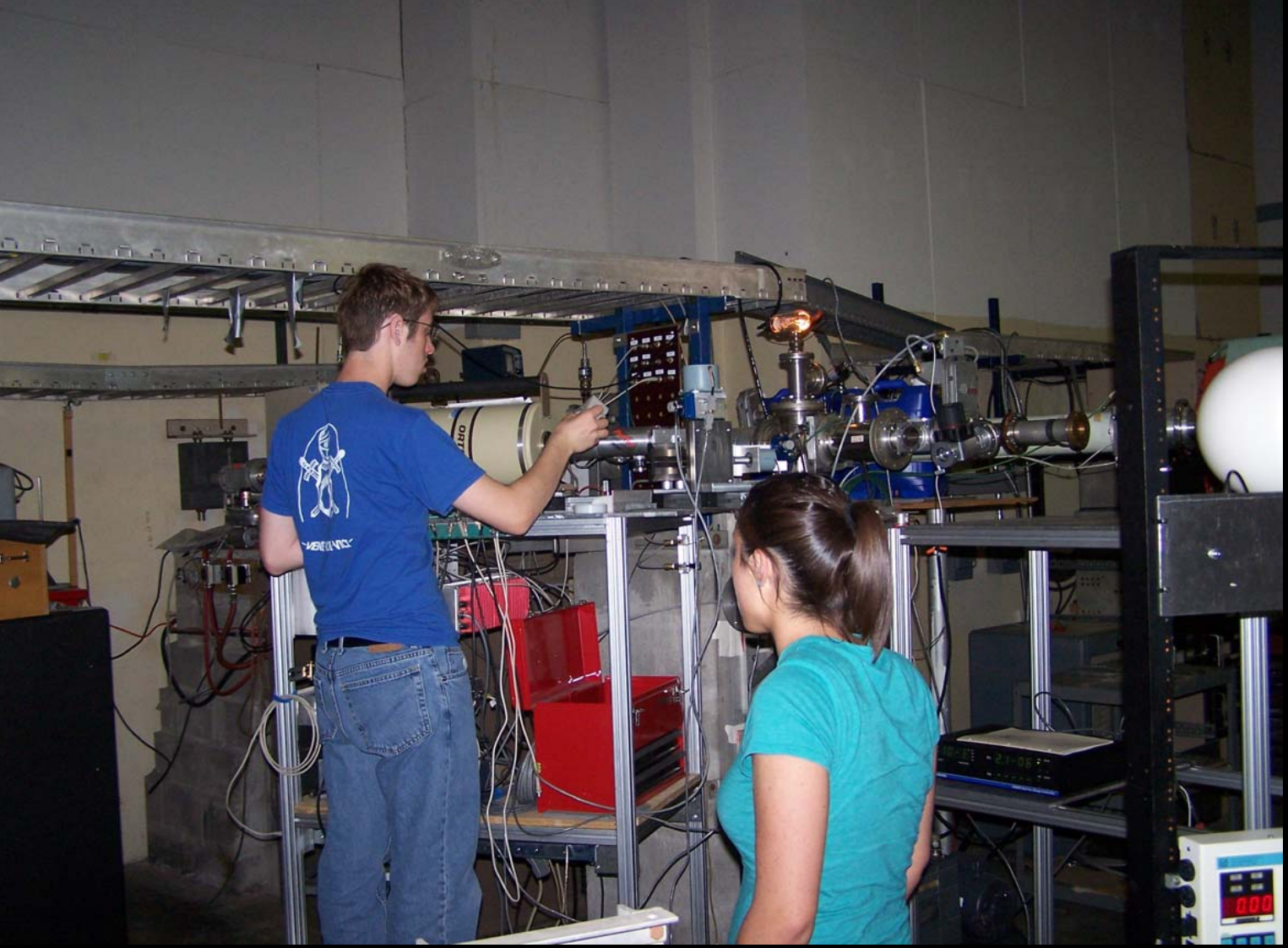
# PIXE

# Proton Induced X-Ray Emissions

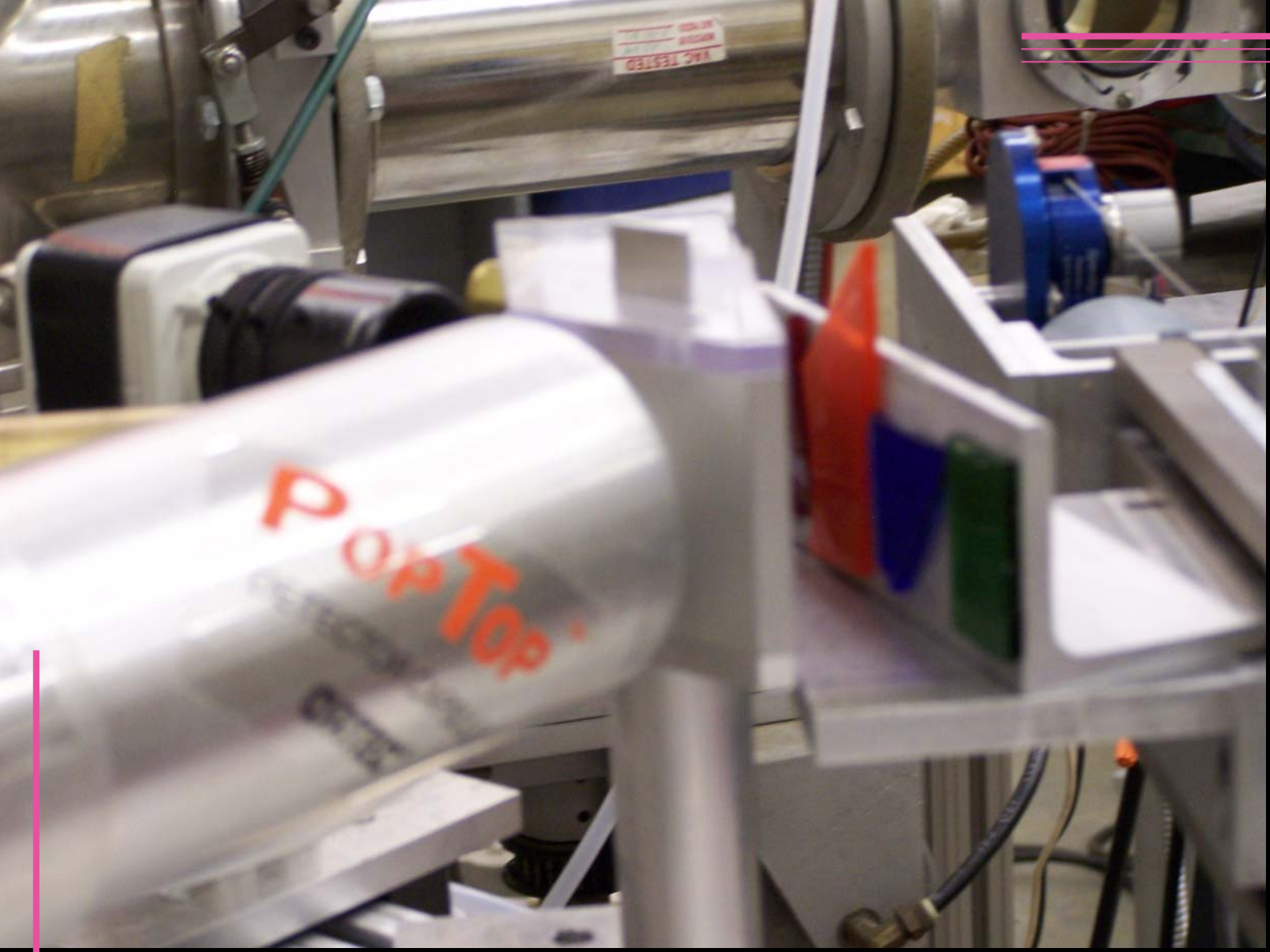
# Proton Beam



Inside the control room for the PIXE accelerator, the proton beam and its intensity can be manipulated and the sample can be moved so that the beam is focused on different parts of a substance.

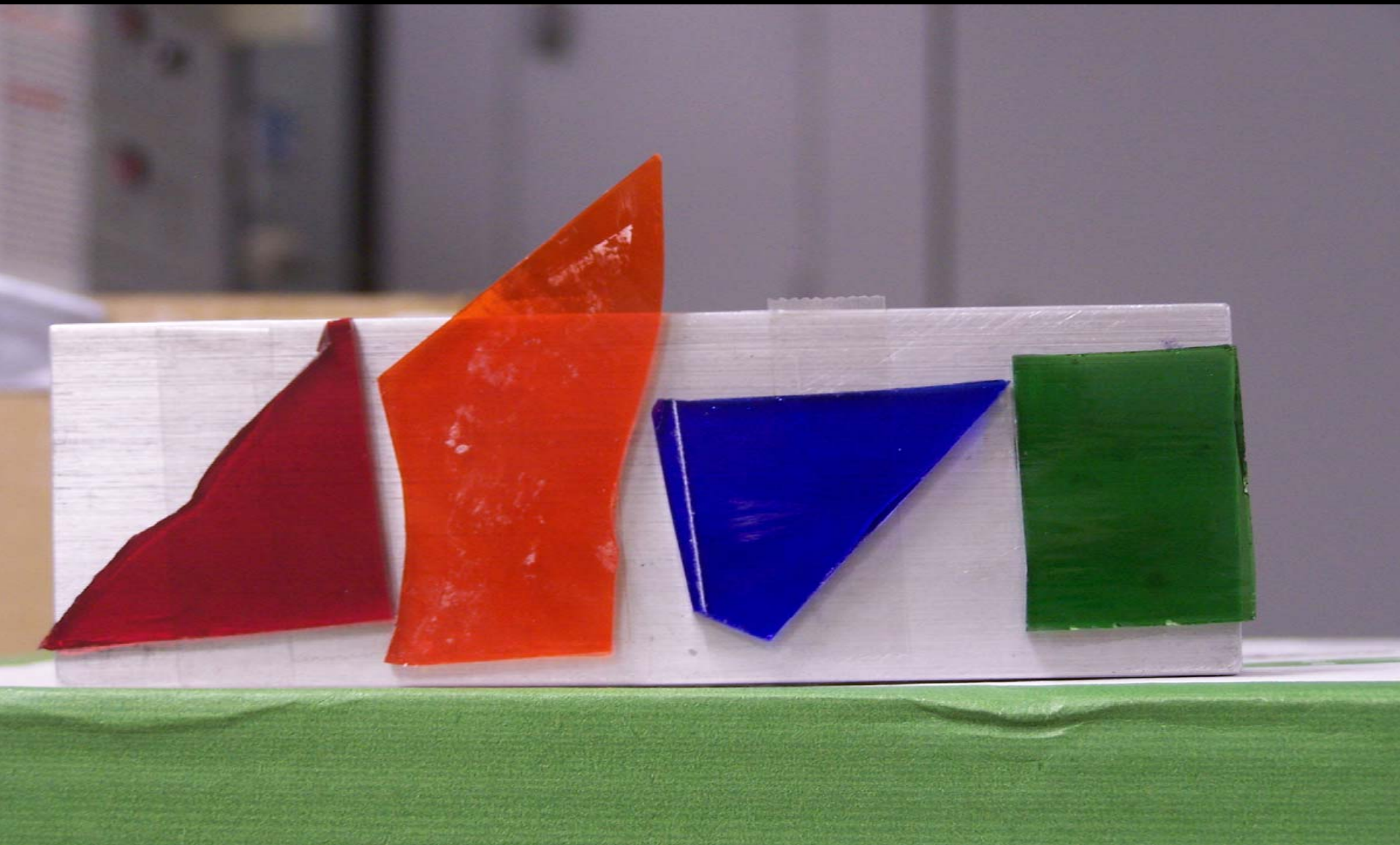


Changing the sample to be tested is relatively easy, although there should be somewhat of a seal between the substance and the beam chamber so that the argon gas in the air does not appear in the results.

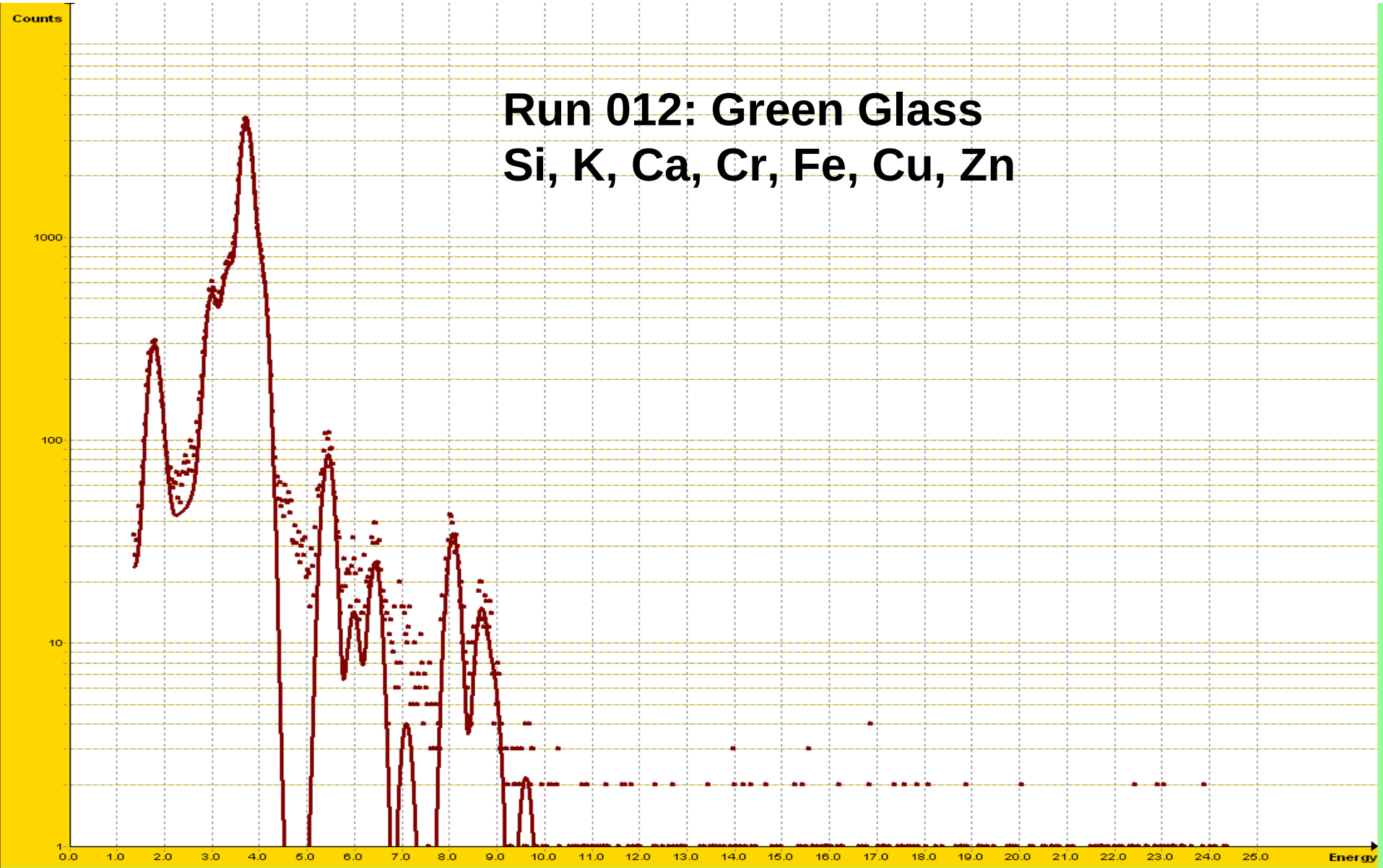



We tested several samples, though the colored glass appeared the most interesting.

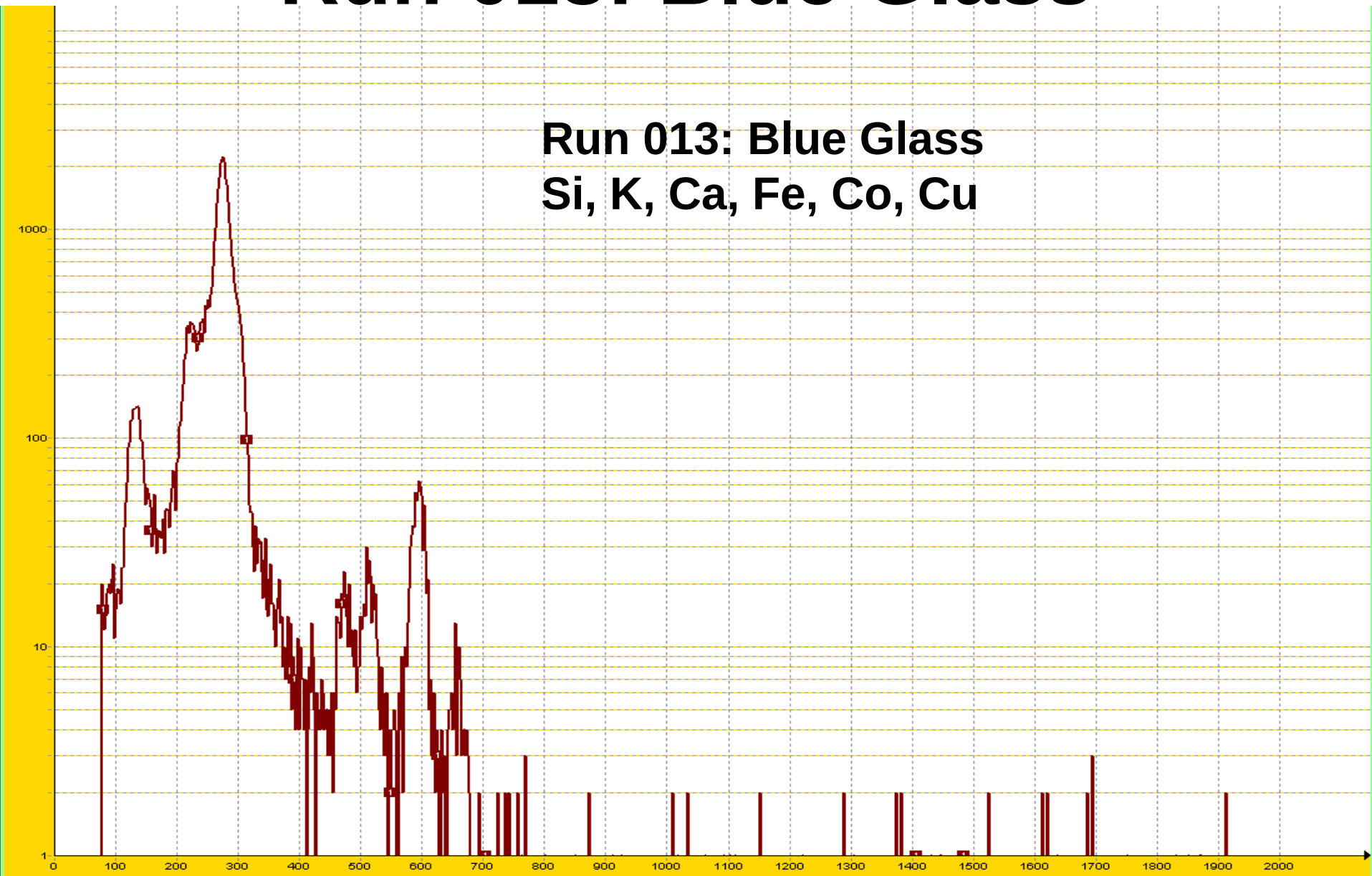
# Samples Tested



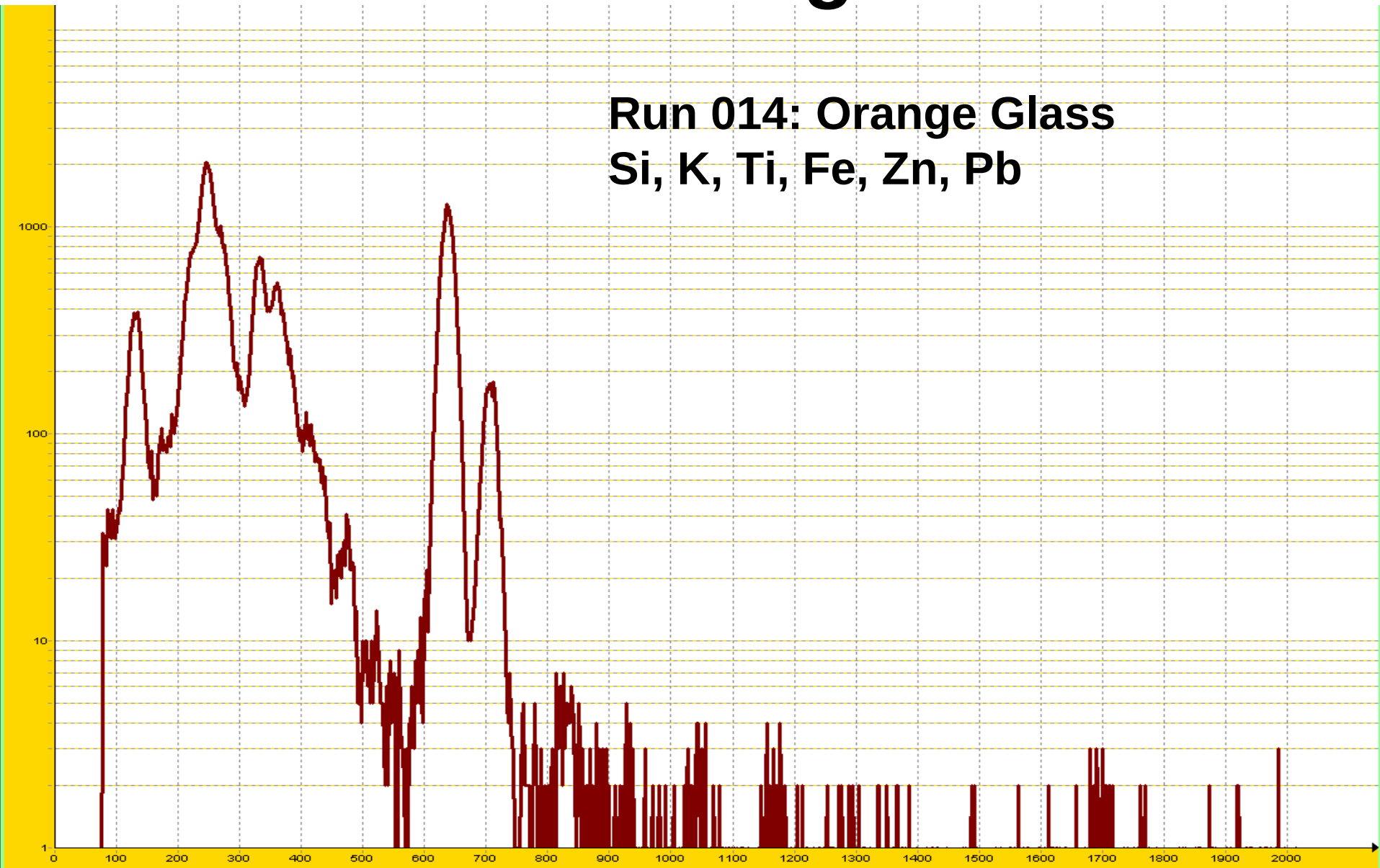
# Run 012: Green Glass



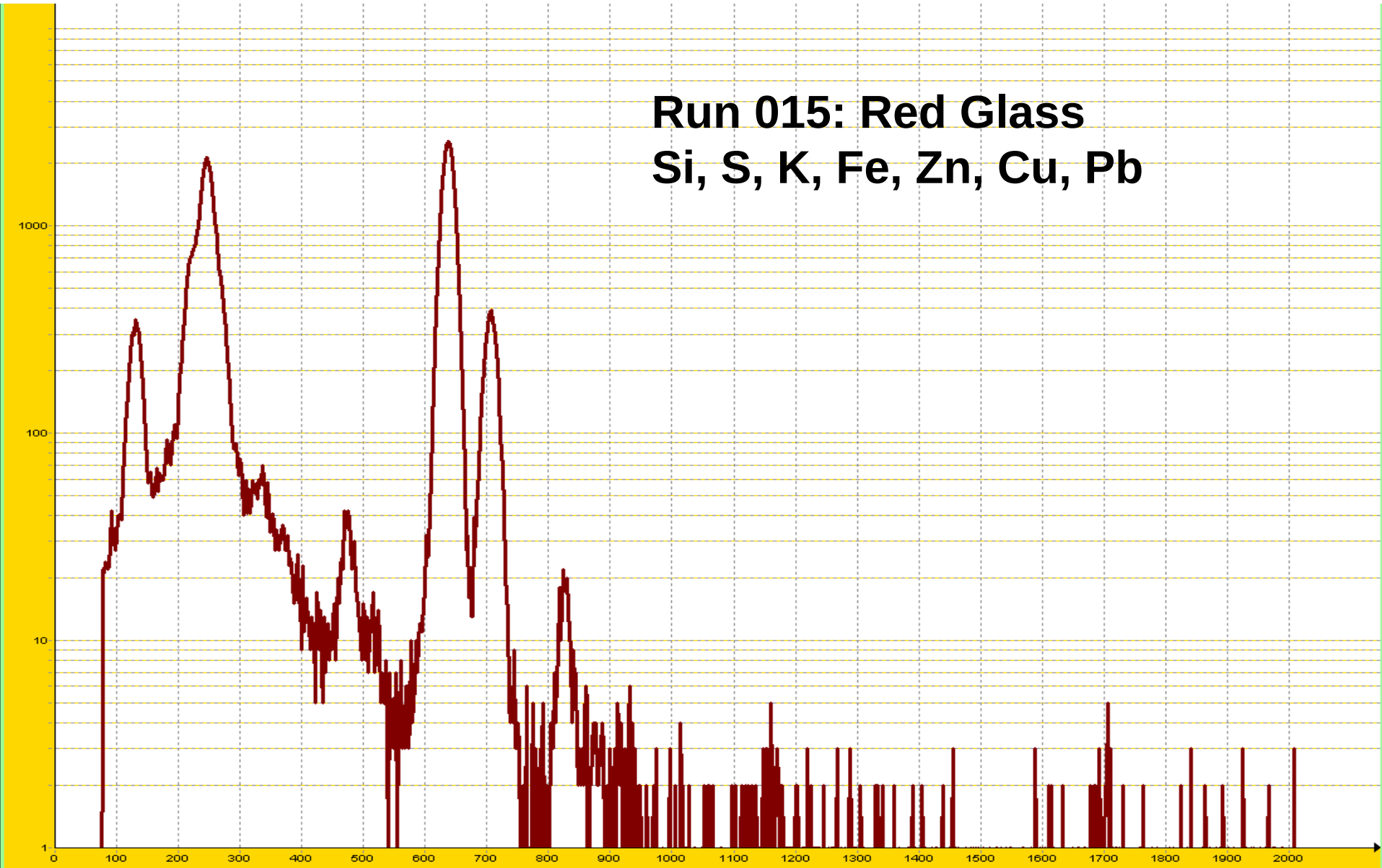
# Run 013: Blue Glass



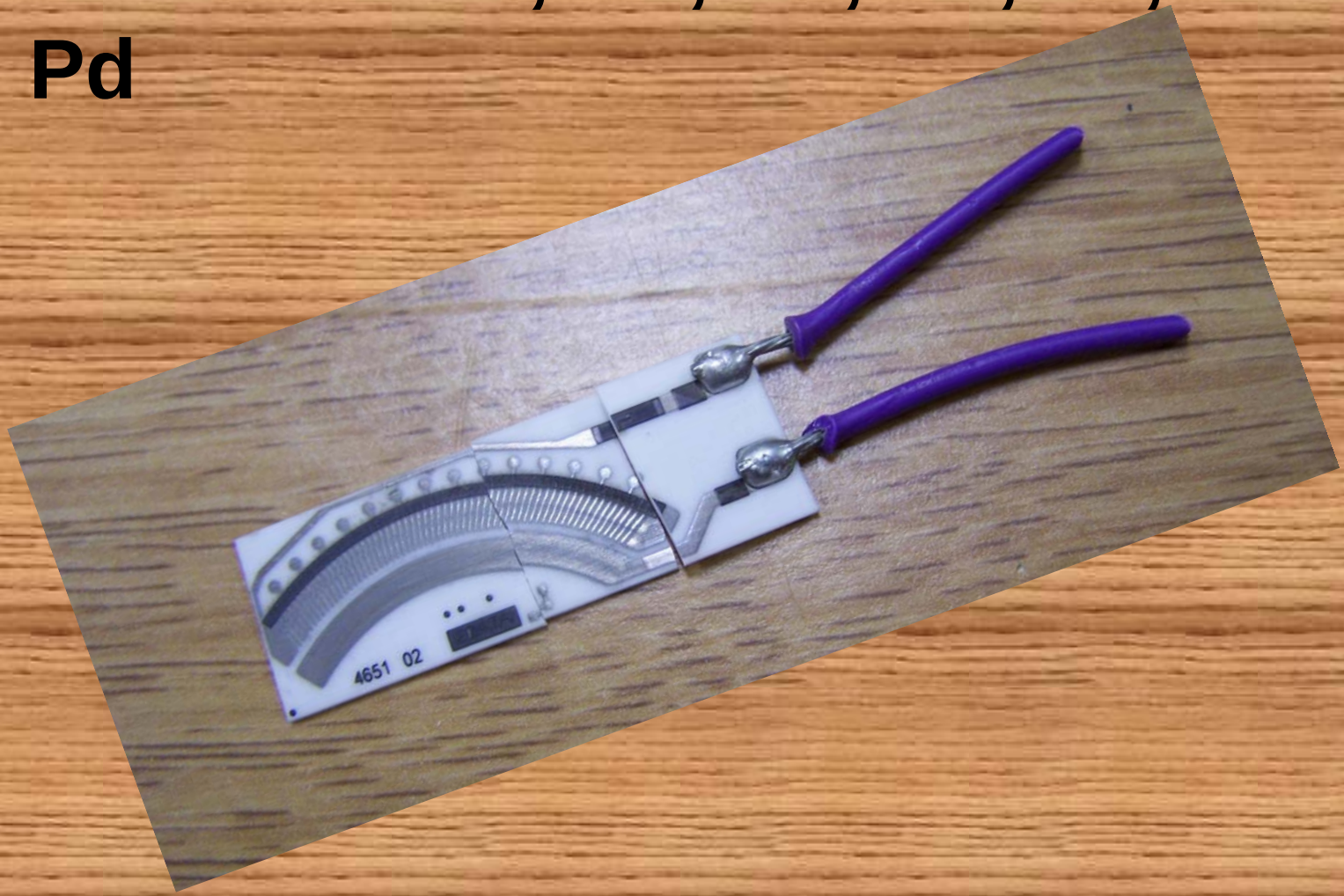
# Run 014: Orange Glass



# Run 015: Red Glass



# Resistor: Sn, Ru, Pb, Sb, Te, Pd



# Results

- The spectrum we obtained from the PIXE analysis seemed very accurate, as the elemental composition of the substances were reasonable.
- We were able to probe into the samples and see which specific elements were present in them.

# THE END