NEWTON'S RING VIRTUAL LAB

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Aim

To determine the wavelength of light and its refractive index using Newton's Rings experiment.

Apparatus

Travelling microscope, plane glass plate, circular glass plate, monochromatic light source, plano-convex lens, convex lens.

Theory

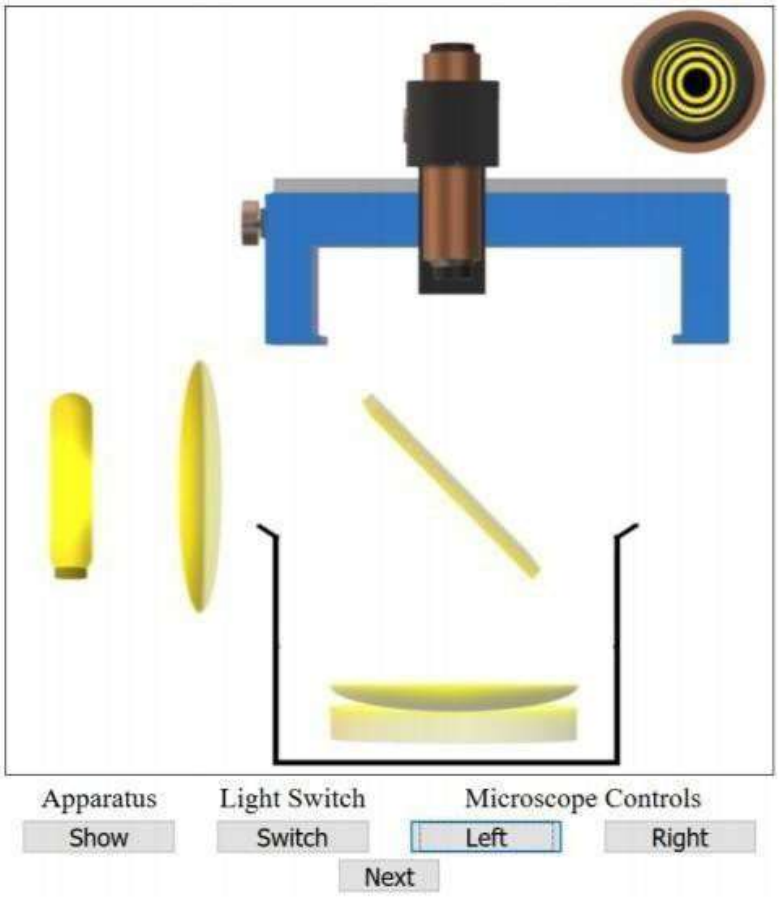
1. When two or more waves superimpose over each other, the resultant intensity is modified.
2. Interference fringes are alternately bright and dark patches of light obtained in the region of superposition.
3. There is no loss of energy in interference phenomenon, only redistribution of energy takes place. The energy absent in the dark regions is actually present in bright regions.
4. Alternate bright and dark rings formed due to the presence of air film when plano-convex lens is placed on glass are called Newton's Rings.
5. When a plano-convex surface is placed on a glass plate am air film of gradually increasing thickness is formed. The thickness of the air film is symmetrical and increases out wards from the point of contact.
6. When monochromatic light is allowed to fall normally on the air film and viewed in reflected light, alternate dark and bright rings are observed.
7. The rings are formed as a result of interference between light waves reflected from the upper and lower surfaces of the air film developed between the convex surface of plano-convex lens and plane glass plate.
8. This is so because the air film formed is wedge shaped and loci of points of equal thickness of air film are circles concentric with point of contact.

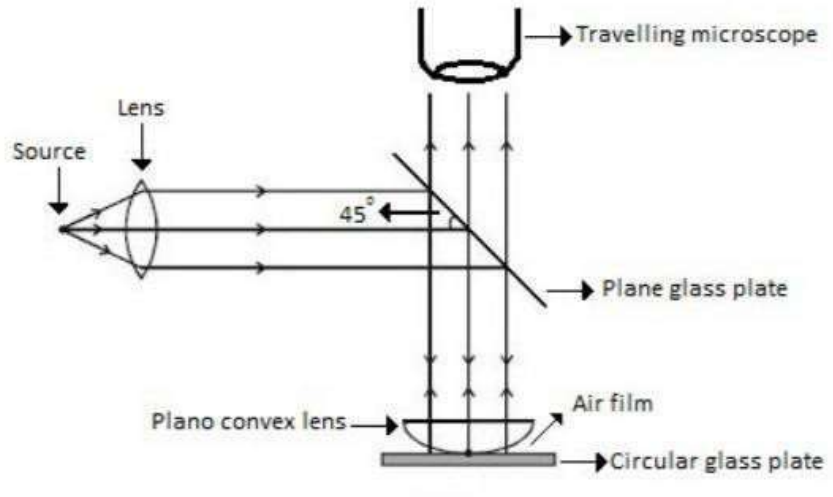
9. If ‘t’ is the thickness of the air film at a point on the film, the refracted wavelet from the lens has to travel a distance ‘t’ into the film, and after reflection from the top surface of the glass plate, it has to travel the same distance back to reach the point again.
10. Thus, it travels a total path ‘2t’. One of the two reflections takes place at the surface of the denser medium and hence it introduces an additional phase change of π or an equivalent path difference of λ/2 between two wavelets.
11. The Wavelength of the light can be calculated using the formula:

$$\boldsymbol{\lambda = \frac{D_n^2 - D_m^2}{4(n-m)R}}$$

Where: D_n & D_m = Diameters,
n & m = Ring Numbers,
R = Radium of plano-convex lens.

Diagram





Procedure

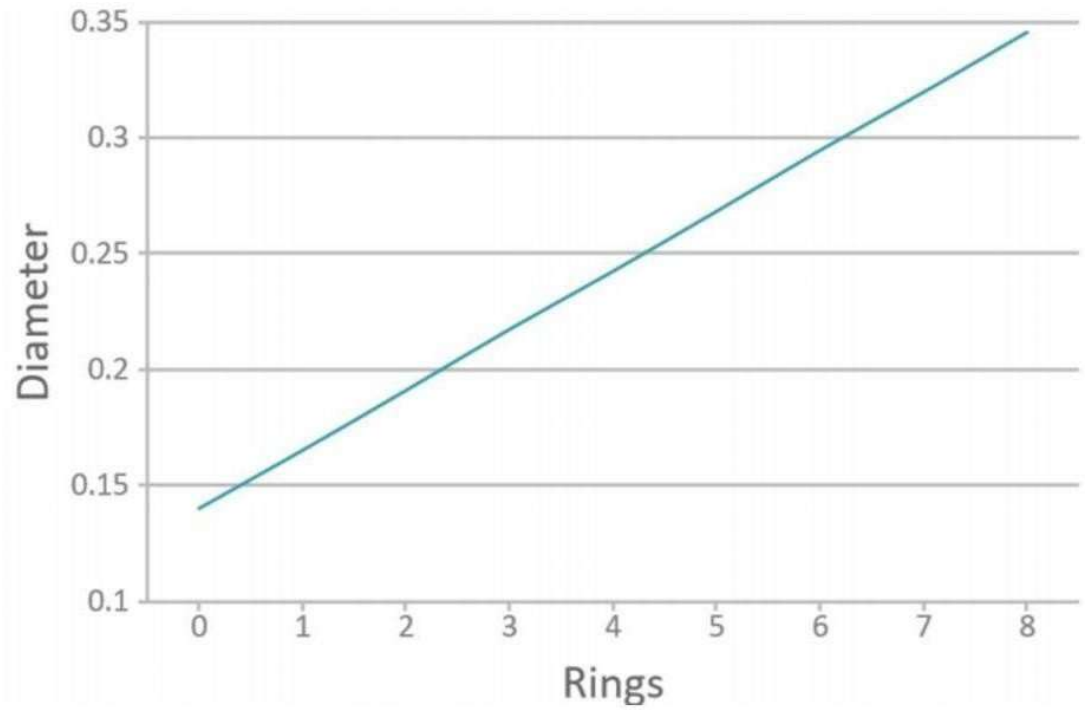
1. Select a medium by clicking on the container symbol.
2. Click on the “show” button, this will reveal the apparatus.
3. Click on the “switch” button, this will turn the light source on. Note the ring patterns appearing in the field of view of the telescope seen at the top right corner of the screen.
4. Use the microscope controls to observe the motion of the travelling microscope.
5. Click on the “show travelling microscope” button, this will reveal the experimental setup.
6. Use microscope movement and lens movement buttons to get resolved ring pattern and set the vertical cross wore at appropriate position.
7. To note the readings, click on “add to table” button.
8. To show the graph, click on “generate graph” button.
9. Click on “conclusion” button. Note the conclusions from the experiment performed.

Observational Table

Ring	Left MSR	Left VSR	Left TR	Right MSR	Right VSR	Right TR	Diameter	Diameter Square
1	9.9	39	9.939	10.05	12	10.062	0.123	0.015
2	9.9	0	9.900	10.05	50	10.100	0.200	0.040
3	9.85	25	9.875	10.1	26	10.126	0.251	0.063
4	9.85	3	9.853	10.1	48	10.148	0.295	0.087
5	9.8	33	9.833	10.15	18	10.168	0.335	0.112
6	9.8	16	9.816	10.15	35	10.185	0.369	0.136
7	9.8	1	9.801	10.2	13	10.213	0.412	0.170
8	9.75	38	9.788	10.2	27	10.227	0.439	0.193
9	9.75	24	9.774	10.2	39	10.239	0.465	0.216

Wavelength = 6284 * 10^{-8} cm OR 6285 Å

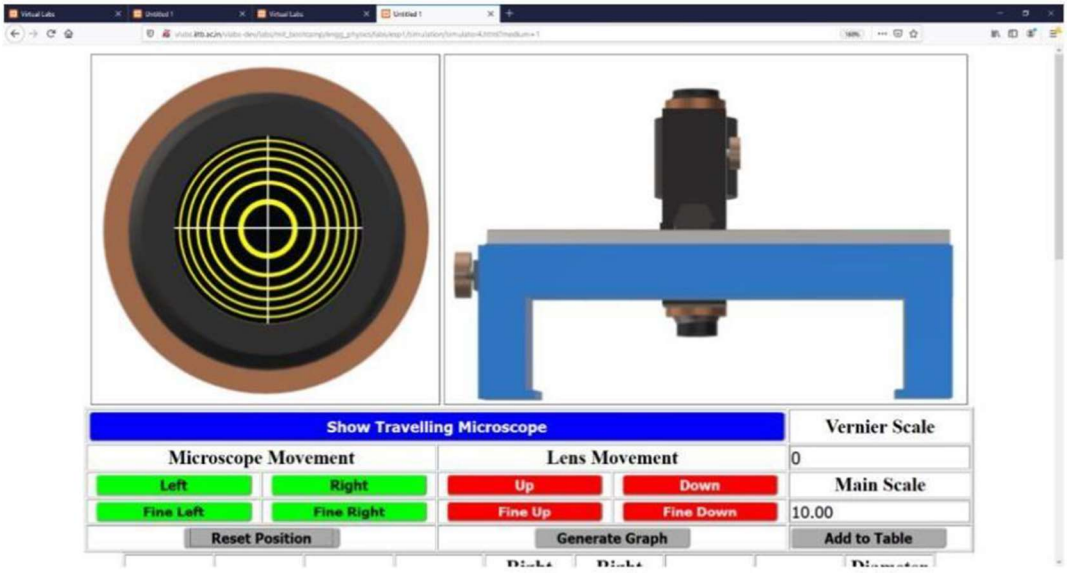
Graph

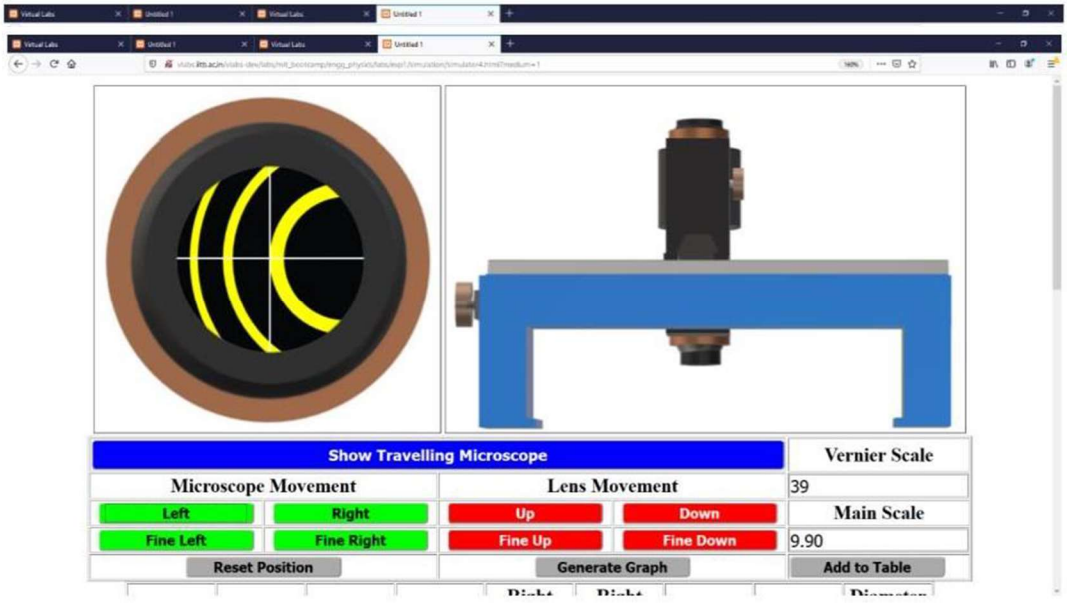


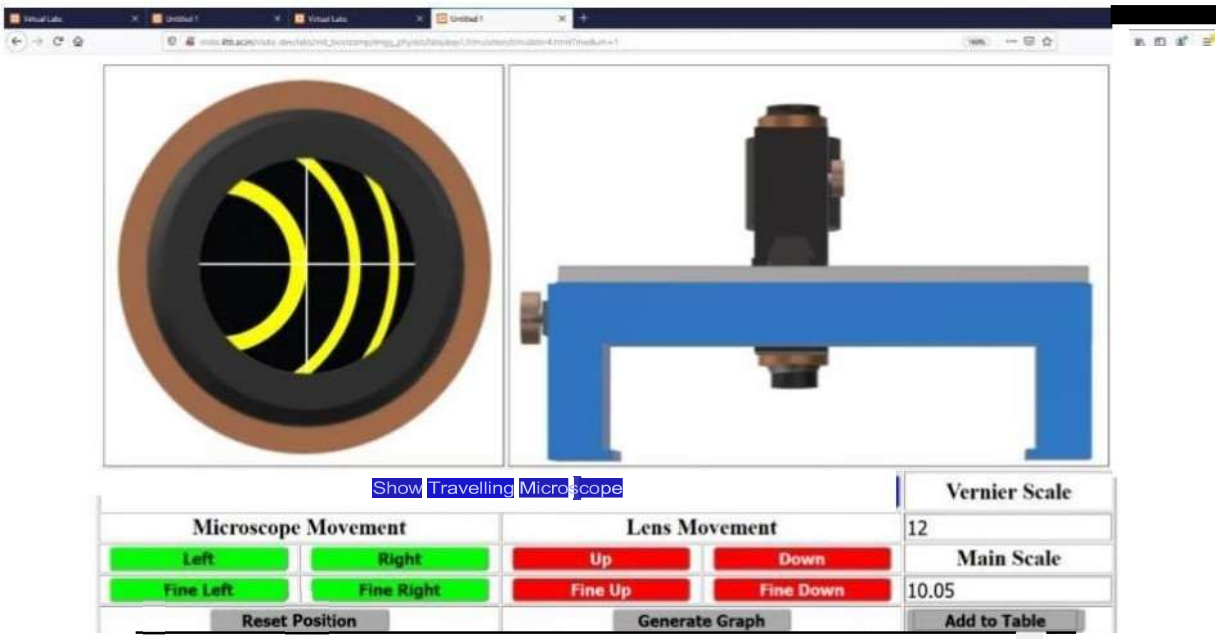
Conclusion

- The standard value of wavelength of sodium light in air is 5893 * 10^{-8} cm.
- The experimental value calculated is 6284 * 10^{-8} cm.
- The percentage error in value of wavelength is 6.63 %.
- The refractive index of air is 1.

Simulation Images






Show Travelling Microscope
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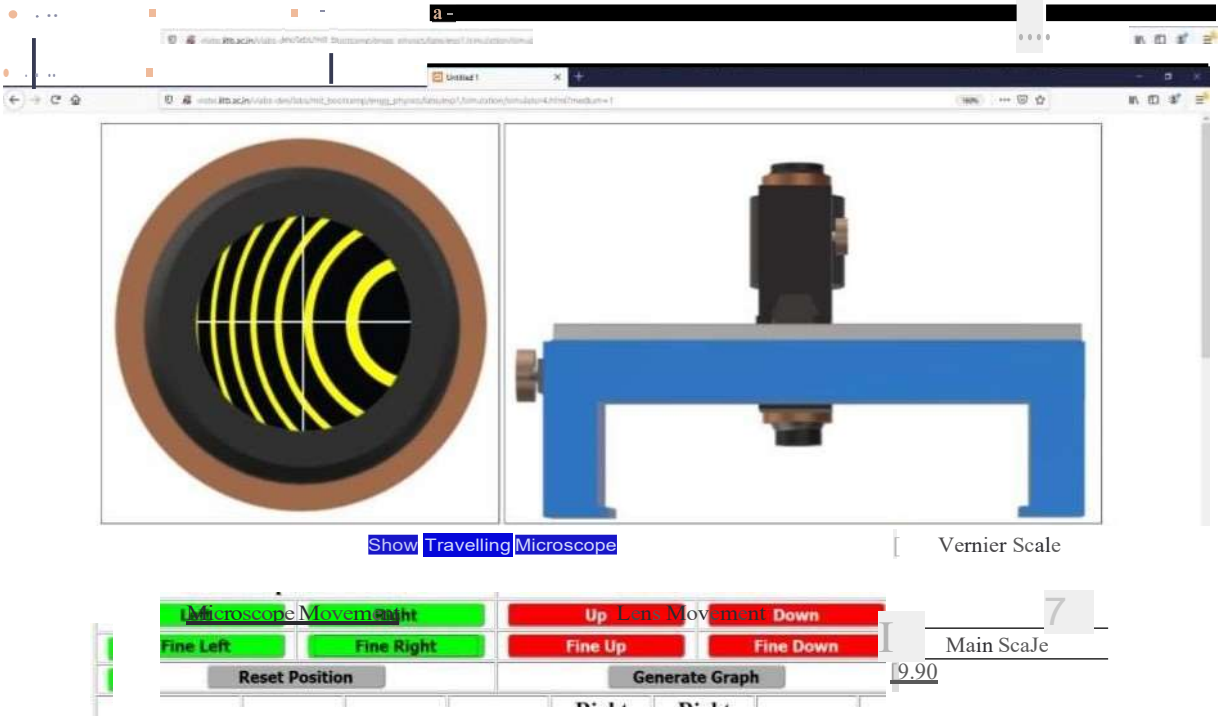
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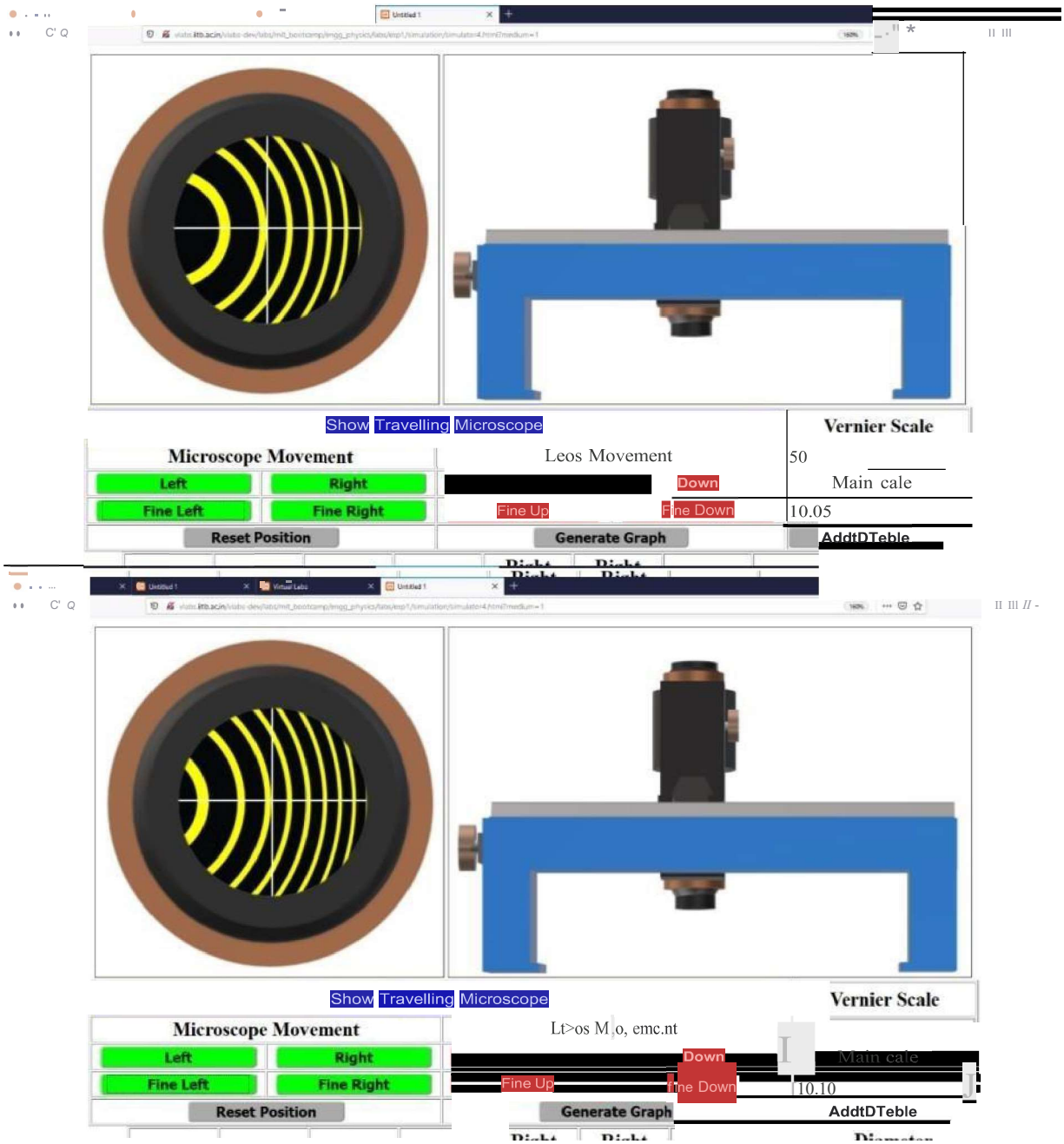
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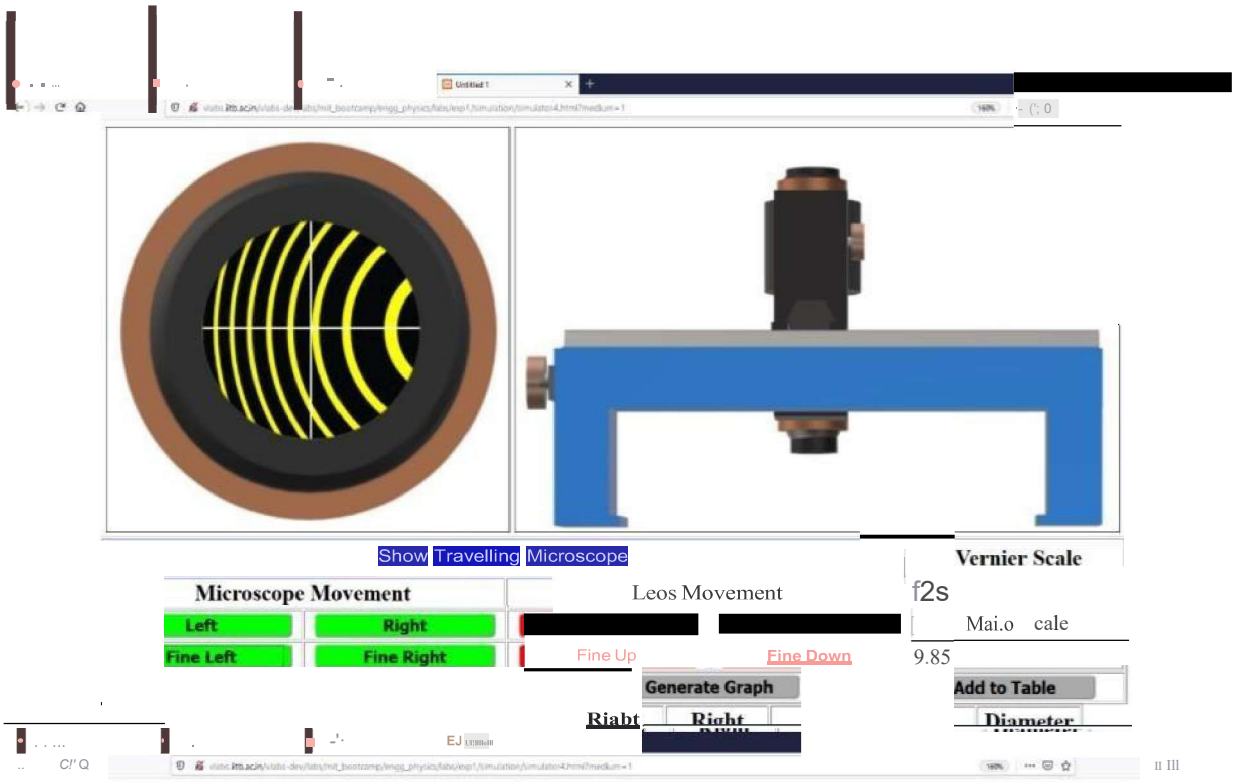
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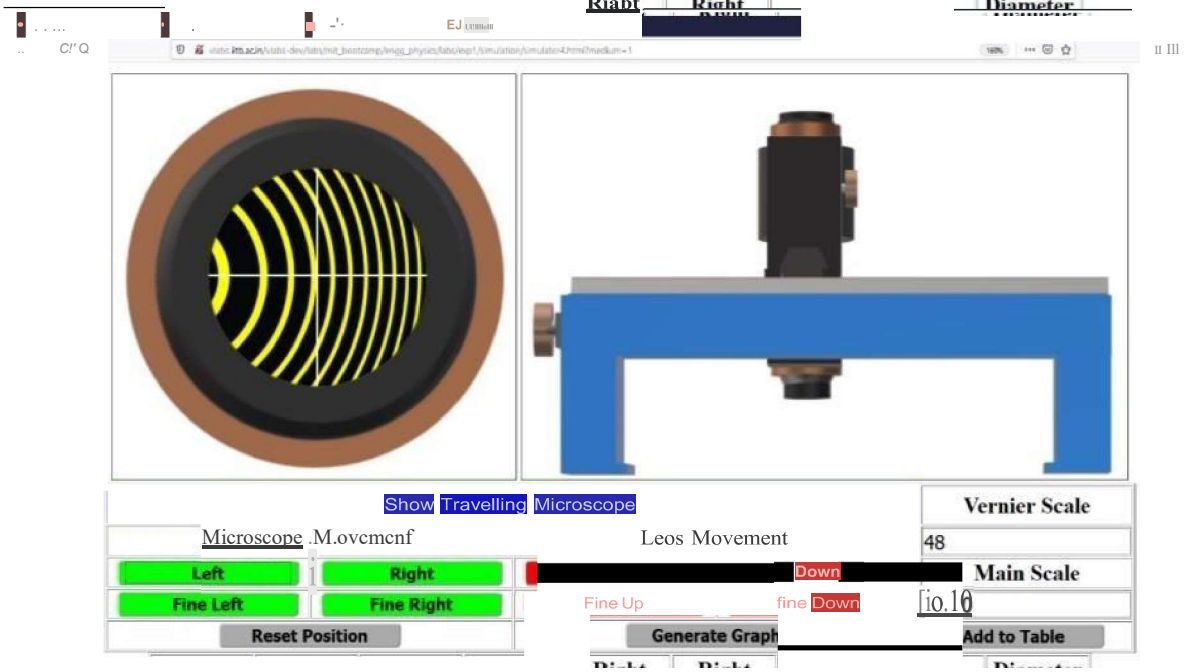
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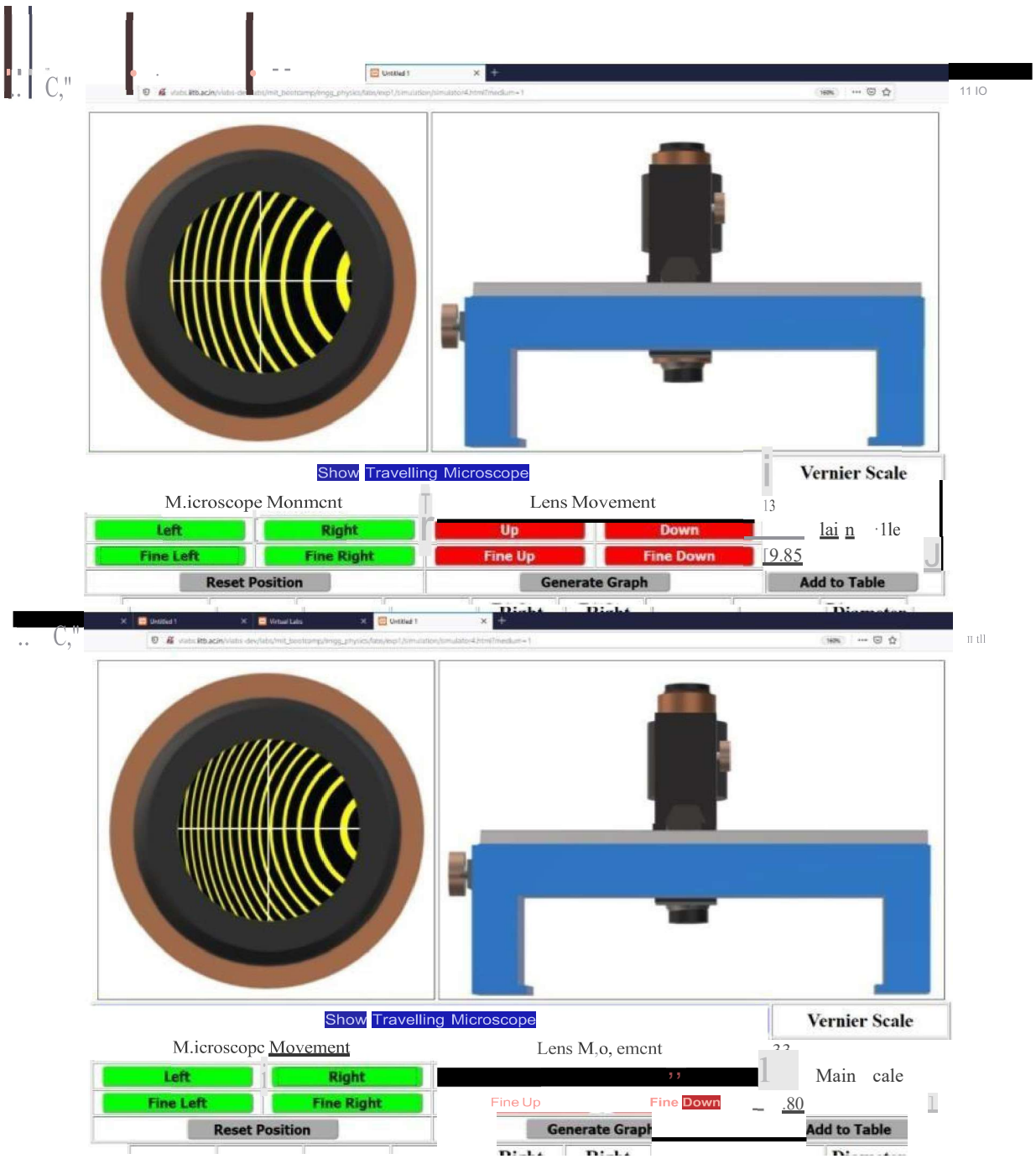
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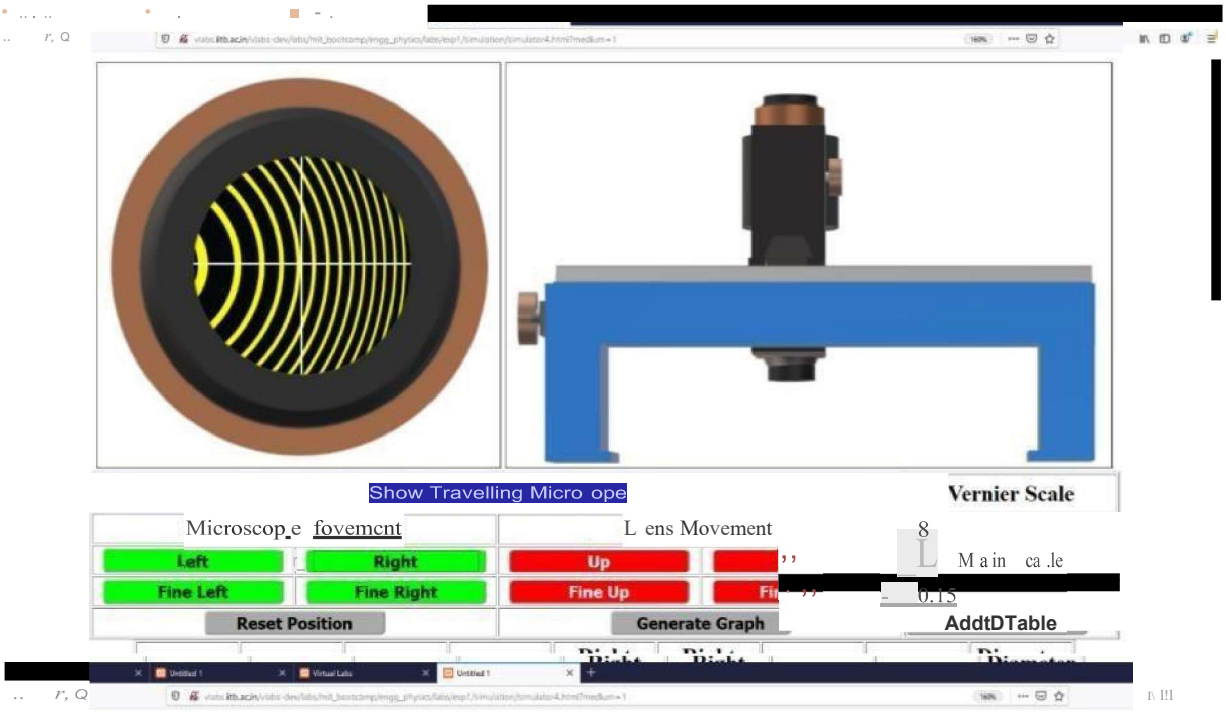
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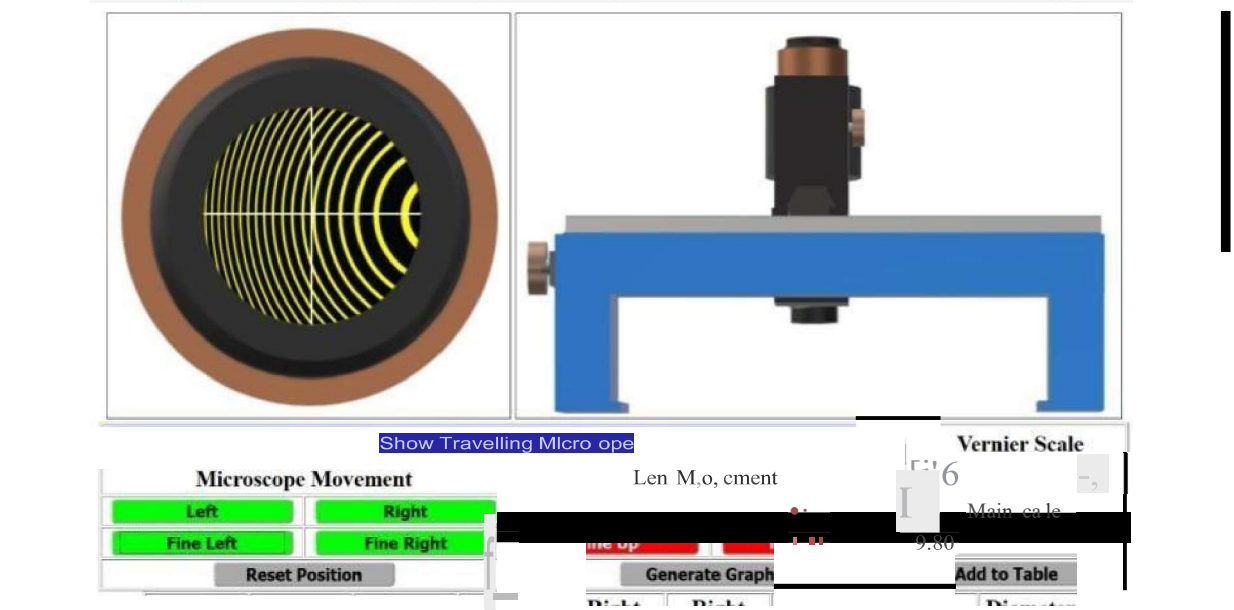
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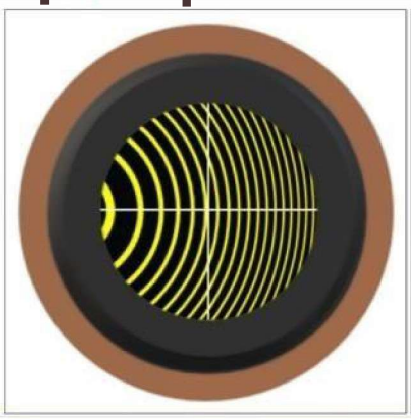

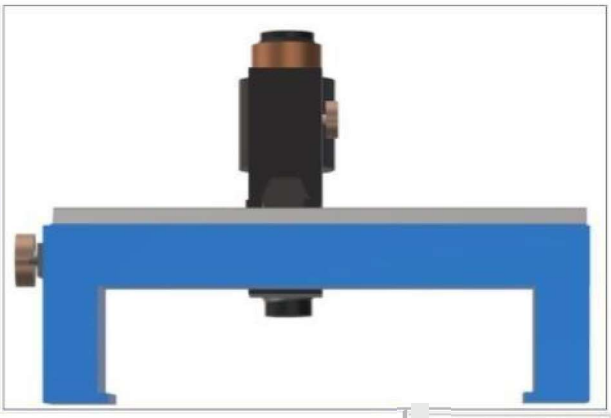

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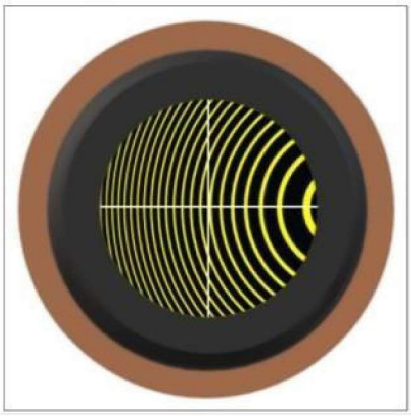

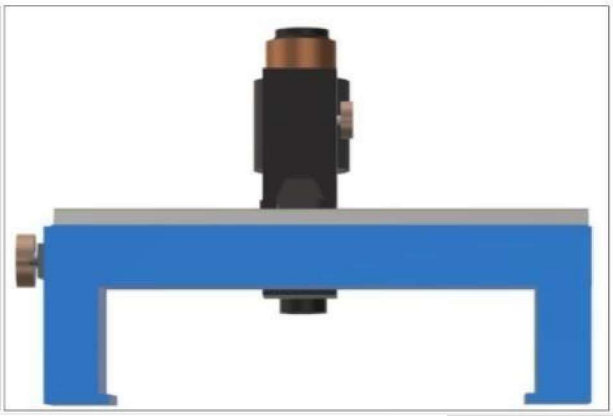

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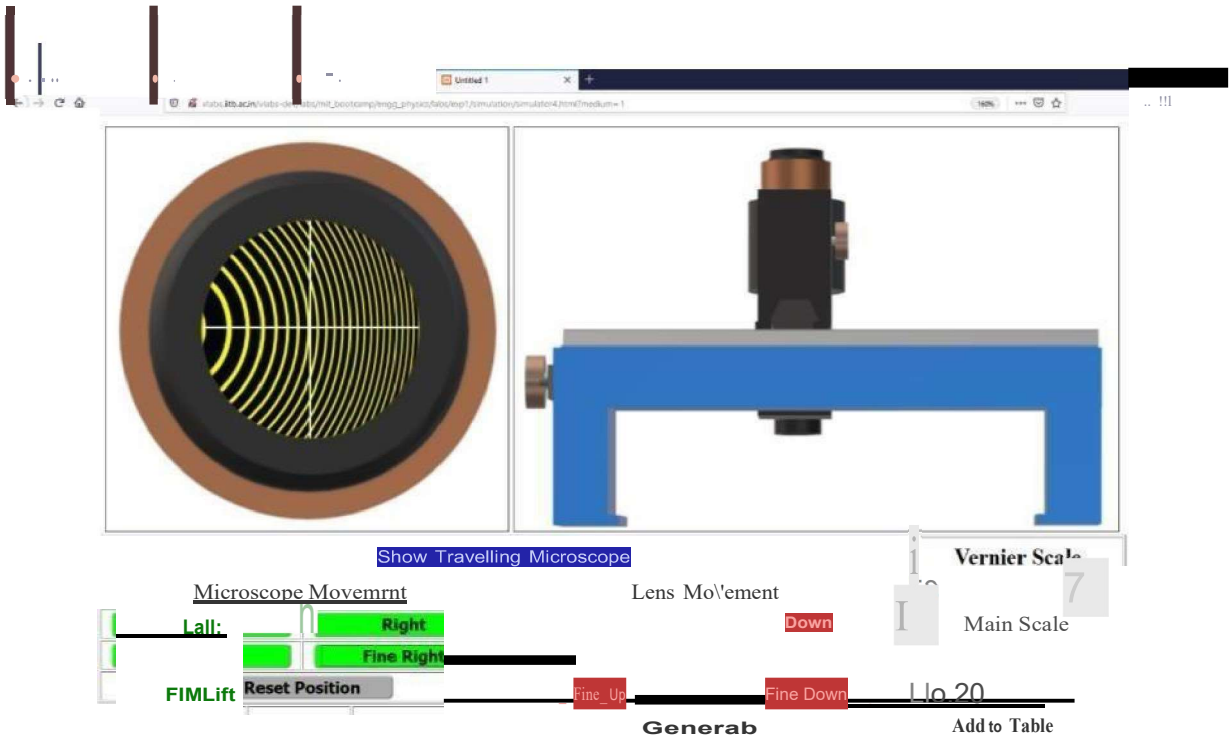
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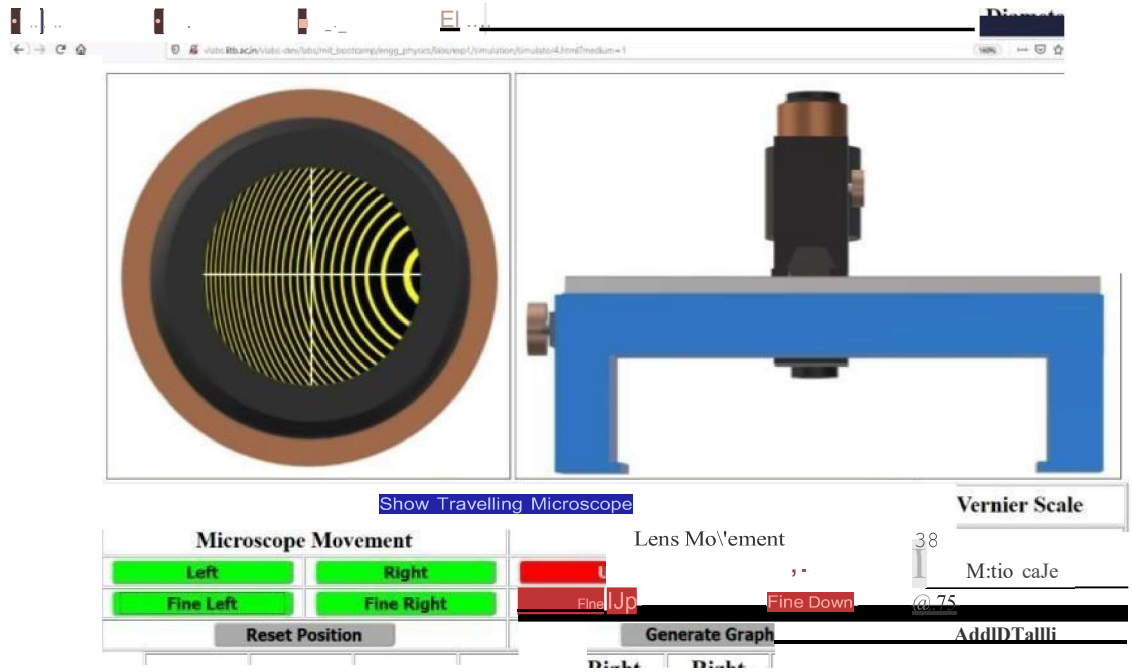
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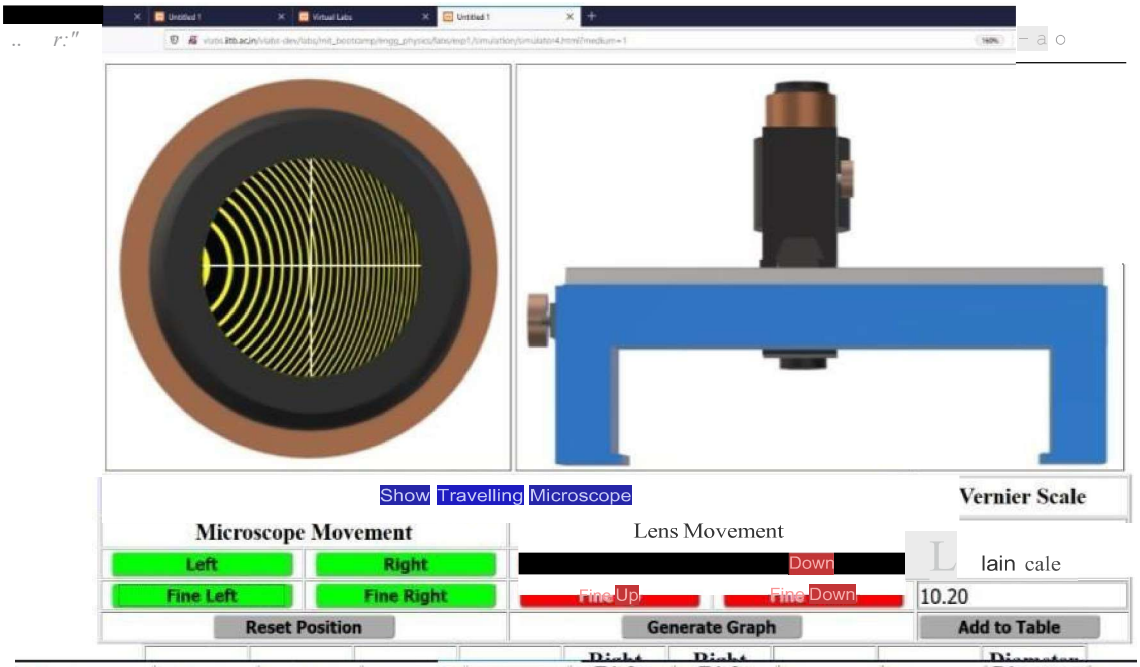
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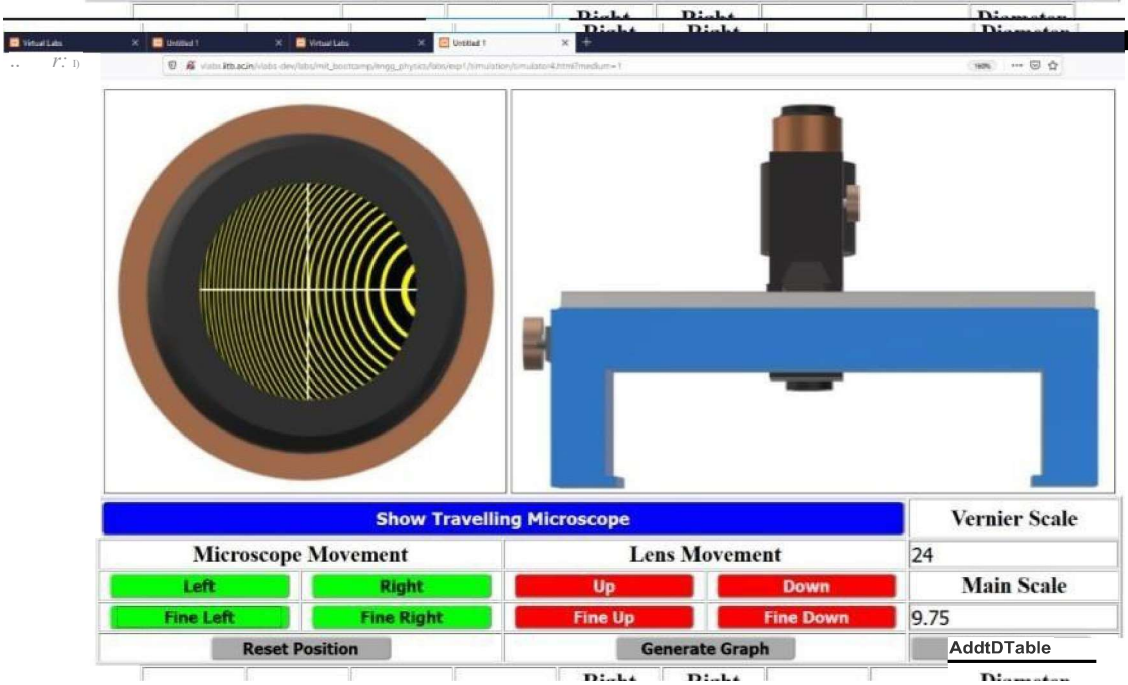
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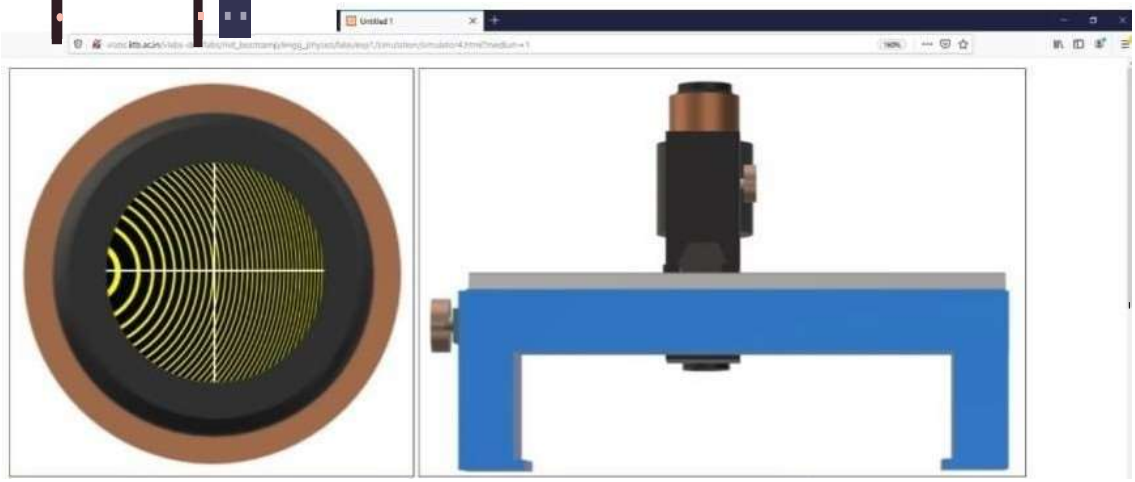

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