SM282 Long Range Experiment

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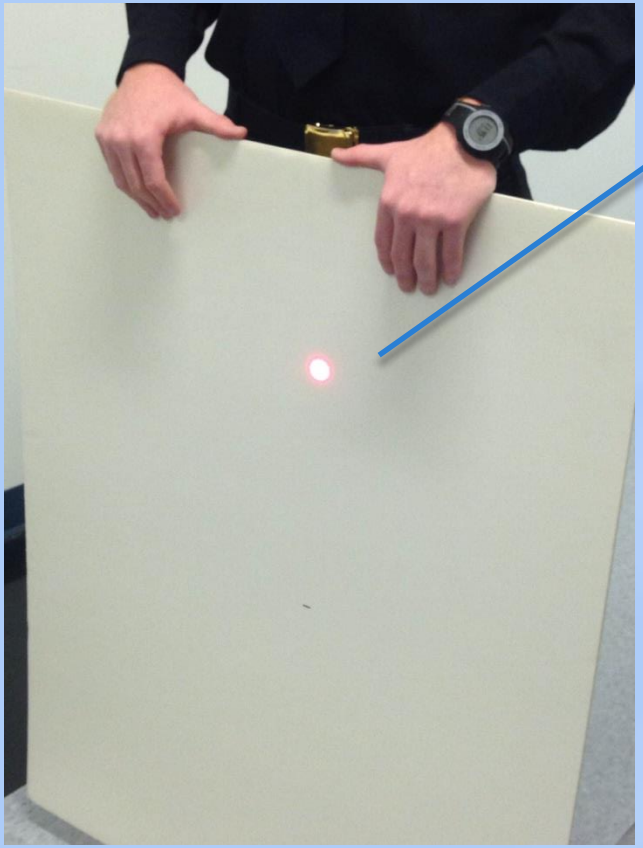
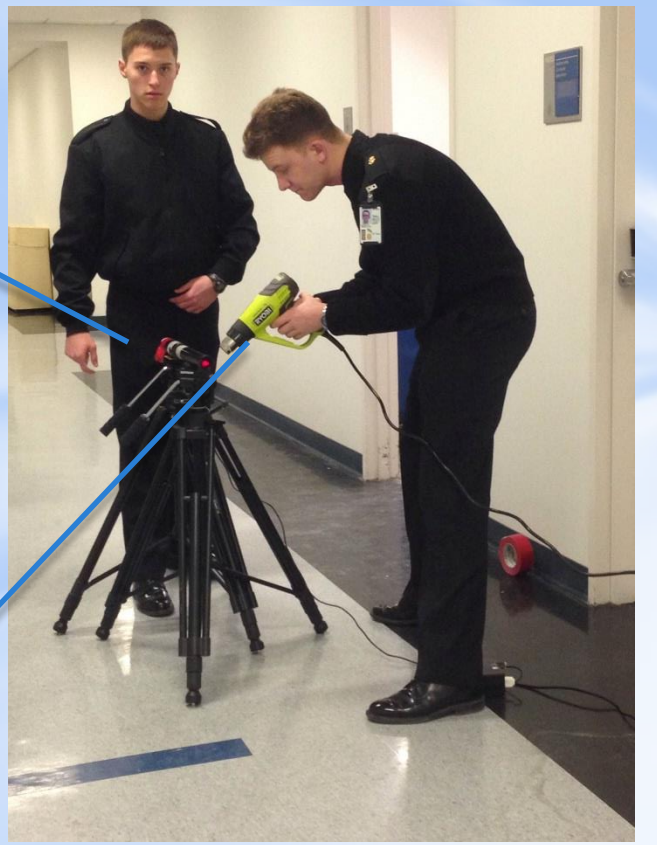
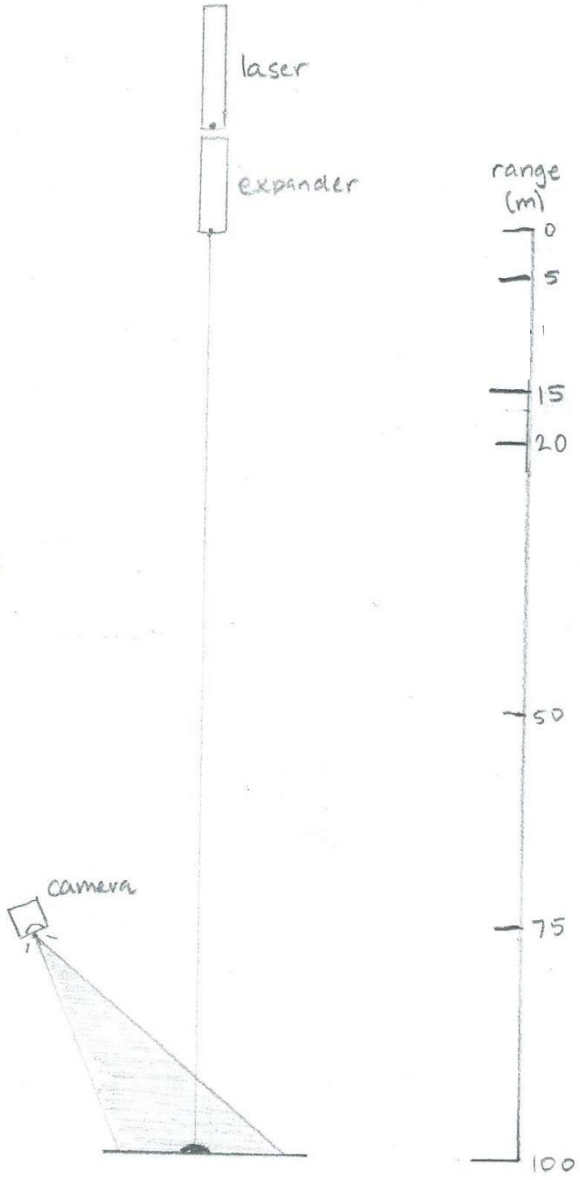
Set-Up



- Beam at target
- Laser and expander
- Heating element



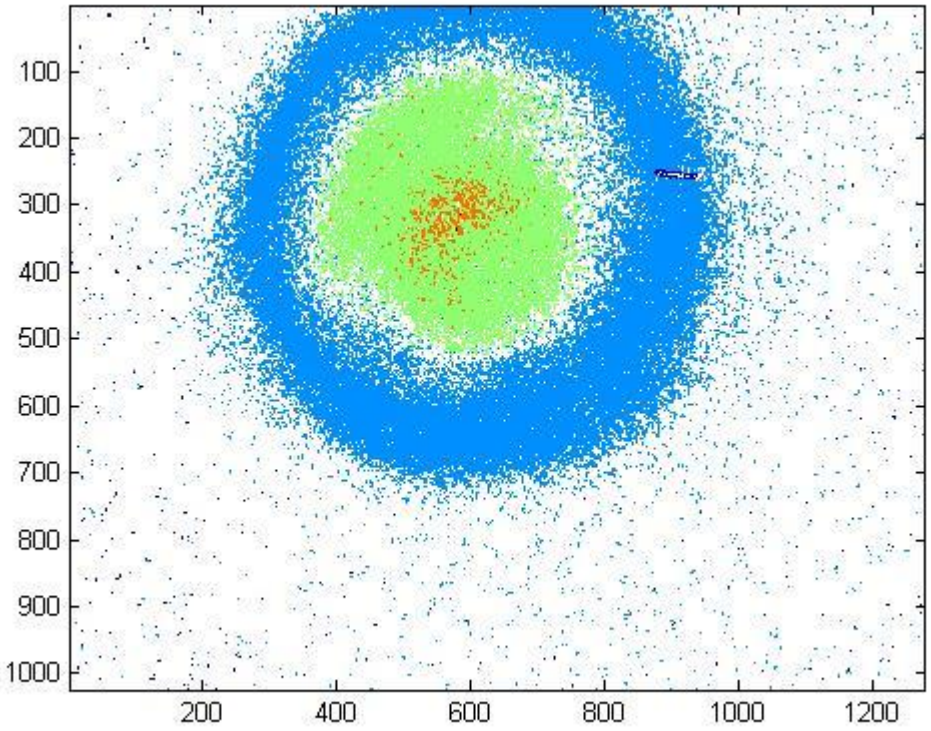

laser
expander
range (m)
0
5
15
20
50
75
100
camera

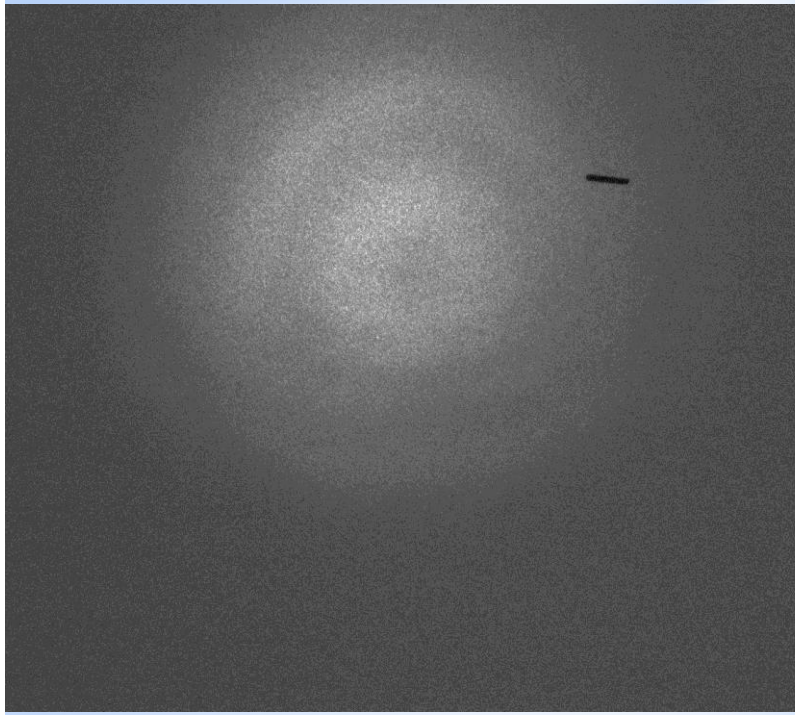
Results…

75m

Diameter =

10.115cm, filter = 1.1

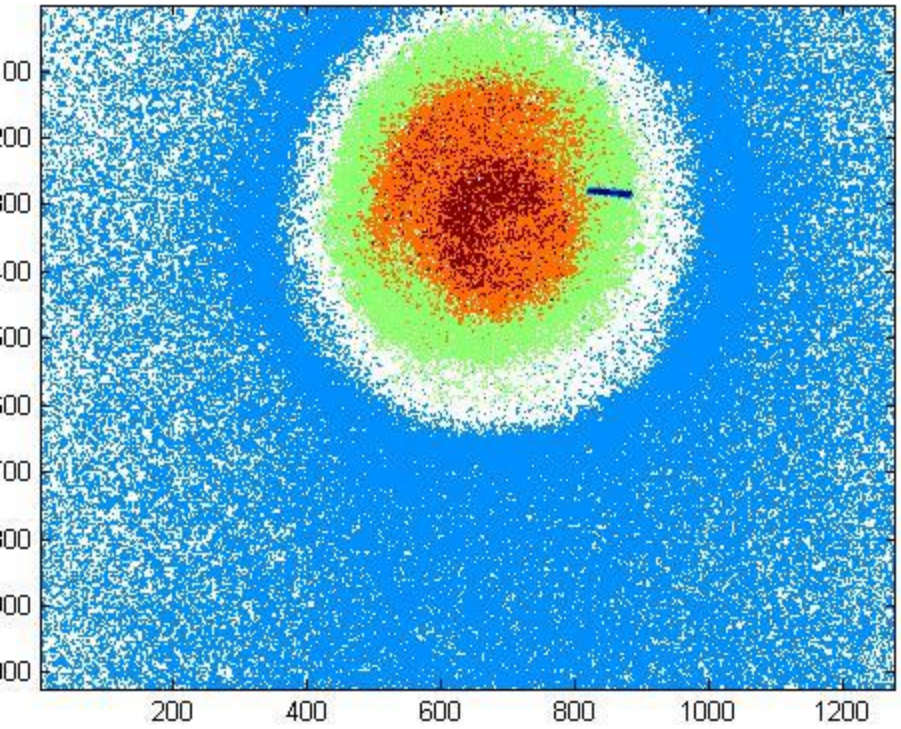


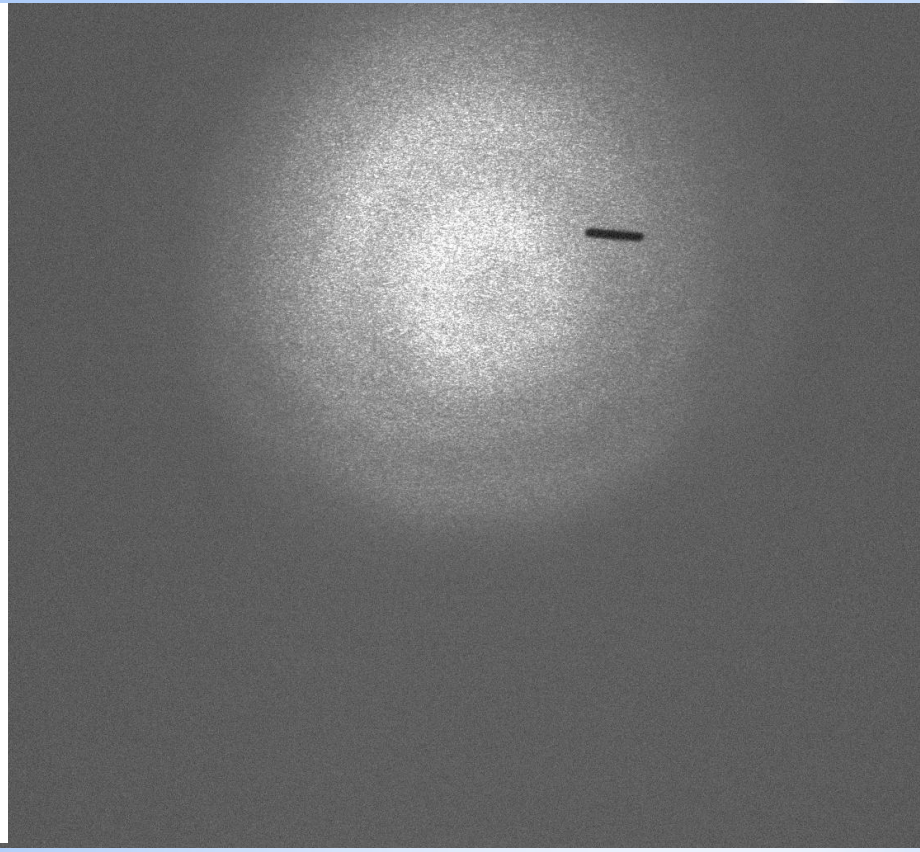


50m

Diameter =

9.086cm, filter = 1.1

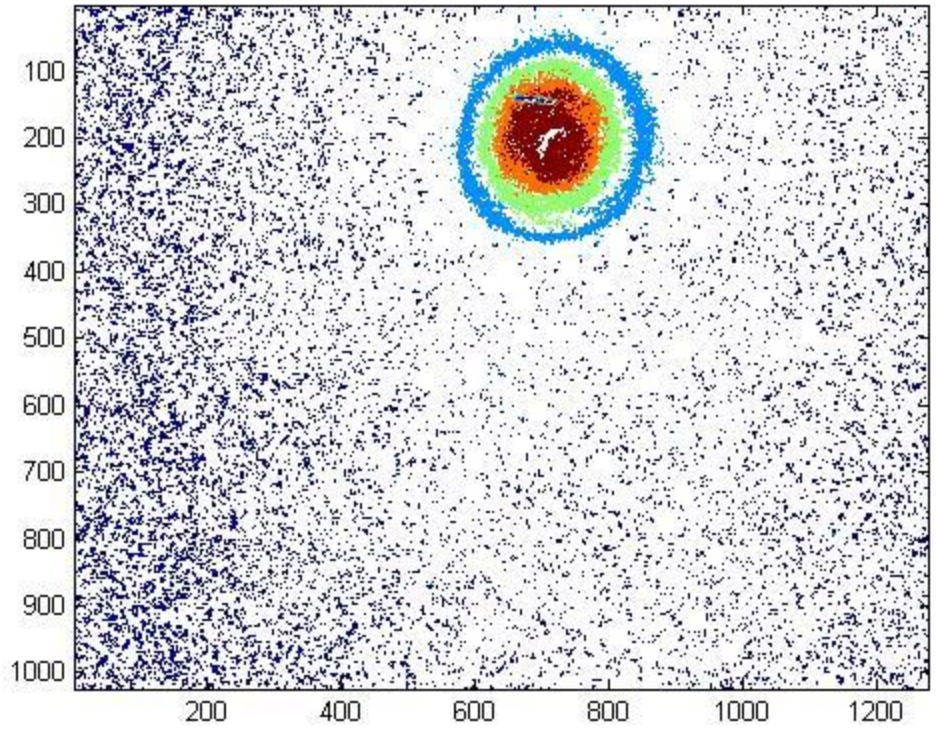


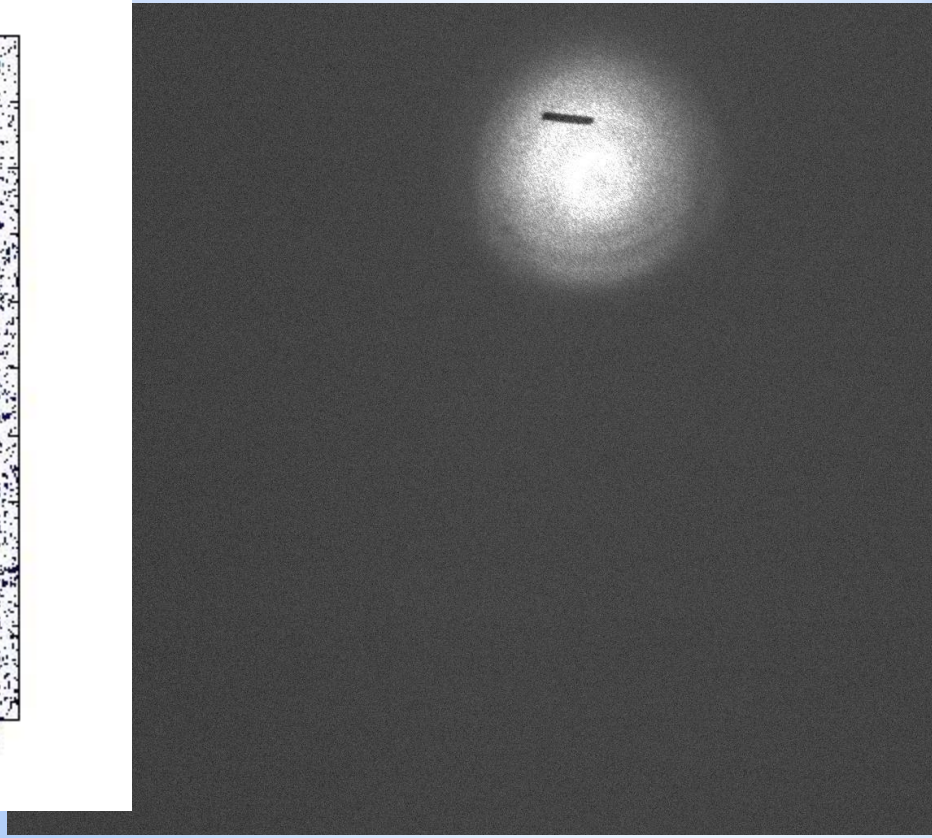


20m

Diameter =

4.441cm, filter = 1.8

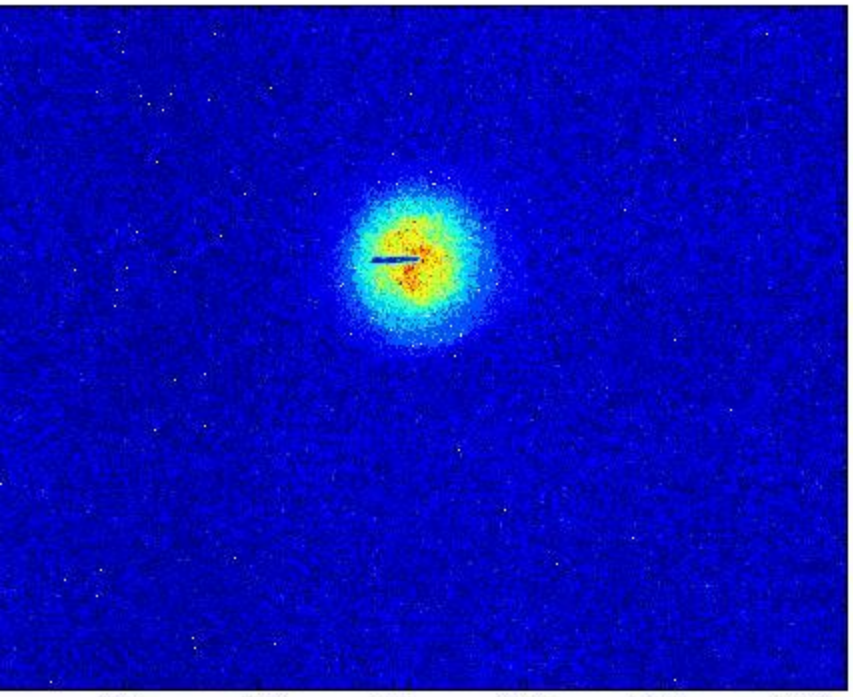


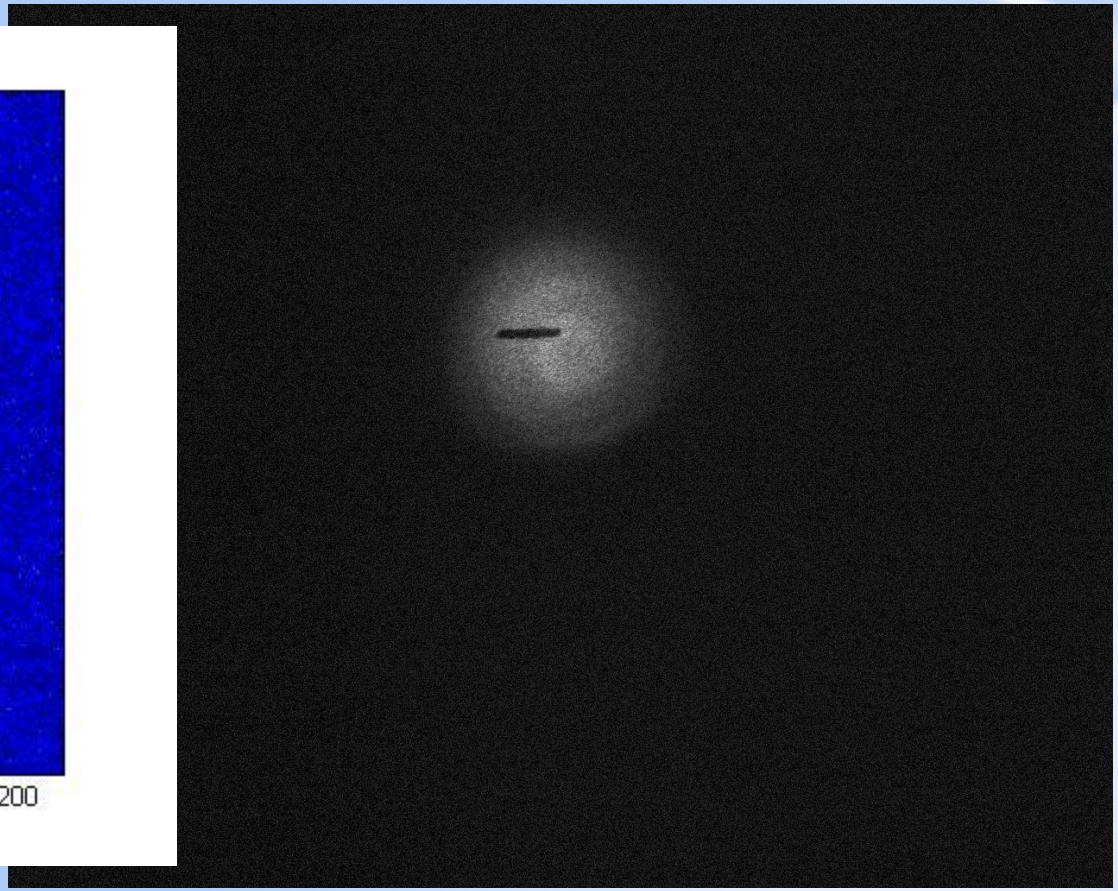


15m

Diameter =

3.919cm, filter = 2.5

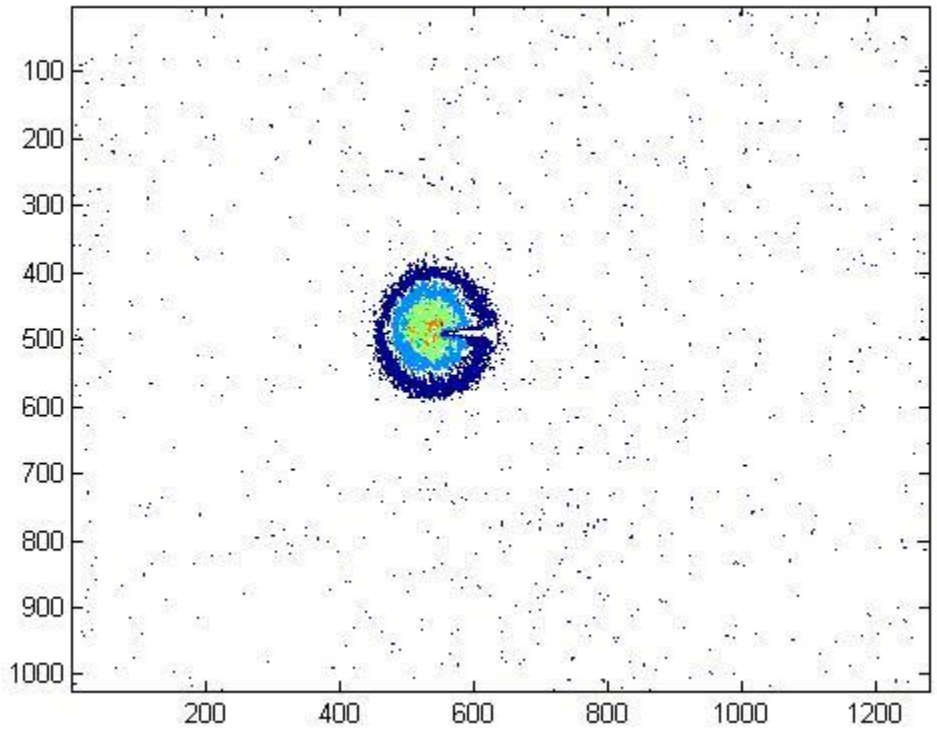


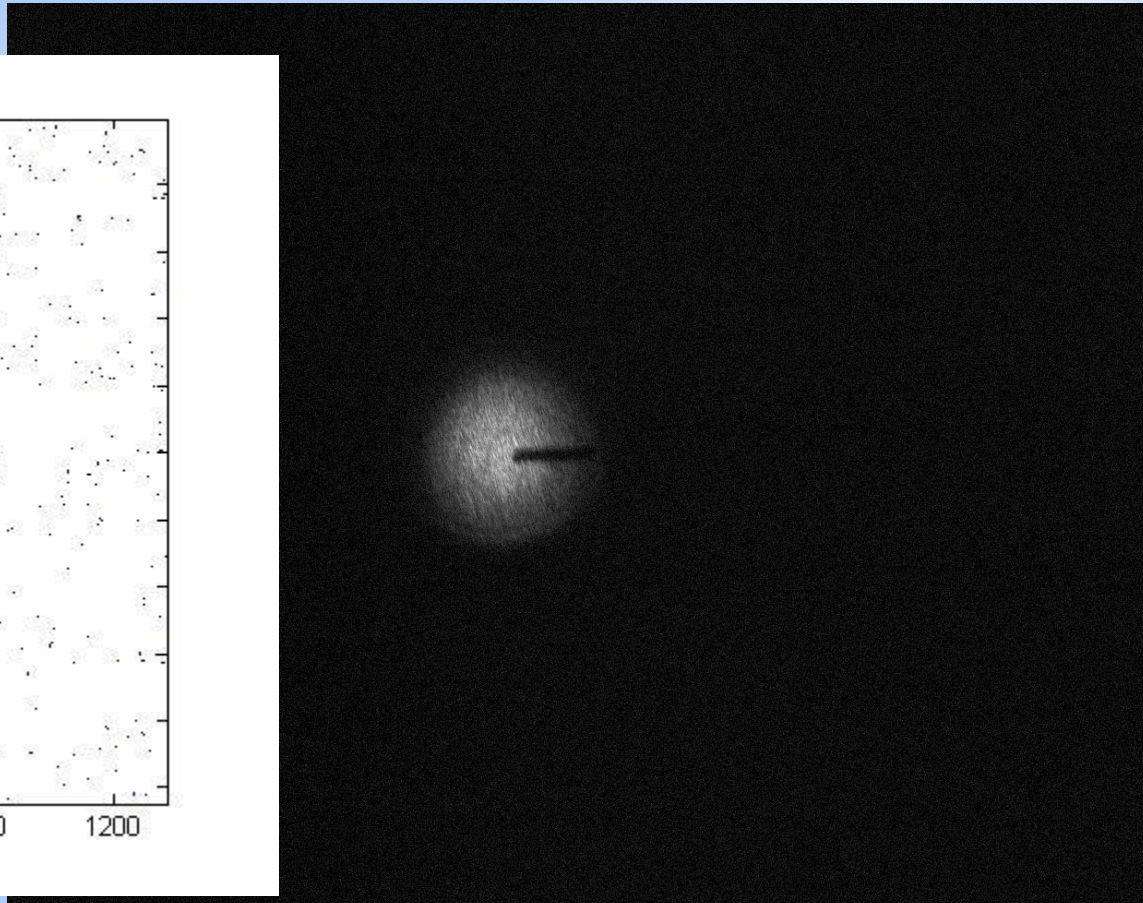


5m

Diameter =

2.455cm, filter = 2.5





Adding Heat to the Path of the Beam

- Used heat gun to apply 1200°F to laser, about 10cm away from the aperture of the expander
- At the target, the beam vibrated, about 0.5cm in all directions

Analysis – Heat

- Heat vibrates the air around it (and the medium the laser is propagating through)
- As a result, the image of the beam on the screen vibrates

Analysis - Contour

- One of our biggest findings was the drastic contour pattern of the laser
- The laser behaves like a Gaussian beam, with a strong contour at the center of the beam, with rings around it with gradually less power
- Could possibly be caused by constructive/destructive interference

Theoretical and Experimental Analysis of Beam Diameter vs Target Distance

(Theoretical laser converted to cm to give a better comparison of the findings)

Analysis – Beam Diameter

- Closer range, mistakes can be more pronounced
- Longer range, mistakes more likely to be "forgiven," and we achieve a "nicer" beam

Errors

- We took a photograph of the beam at 100m
- Image too saturated, came out too light
- Learned to use the correct filter and saturation to get a good image and to protect the camera!

Errors

- Theoretical diameters differed by a factor of 10 (found in mm, our experiment's values were in cm)