SNAP
Supernova/Acceleration Probe

REU Summer Project 2003

Nate Barron

SNAP SuperNova Acceleration Probe
at the University of Michigan

What is SNAP?

SNAP is a space-based telescope designed to measure the dark energy of the universe.

It will use 36 CCDs and 36 HgCdTe NIR detectors to survey the sky with detail never before achieved.

Will look at over 2000 type IA SNe from redshift z=0.1 to 1.7, using them as standard candles to measure both the amount and nature of the dark energy.

Undergraduate Task

SNAP SuperNova Acceleration Probe
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- **Spot-o-matic**
- **SNAP utilizes 36 HgCdTe NIR detectors, each with 4 million pixels**
- **To image the universe in the detail that SNAP seeks, each pixel on these detectors must be tested and characterized.**
- **Must shine a sub-pixel sized spot onto the detector, and be able to move it around VERY precisely**

Spot-o-matic

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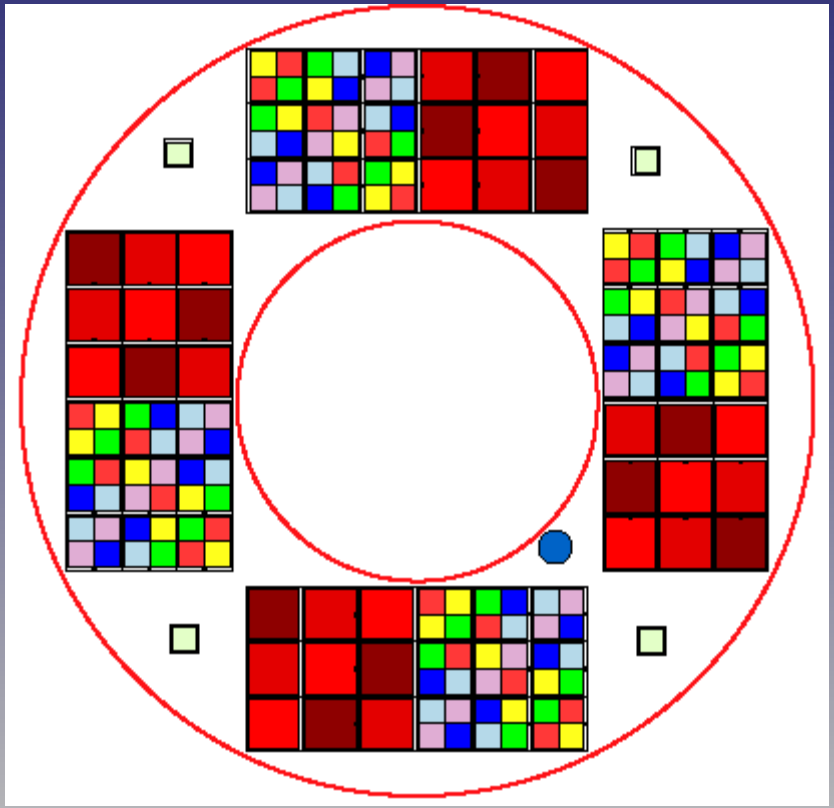
SNAP Detector Design



Each HgCdTe detector has 4 million pixels, each of which must be tested!

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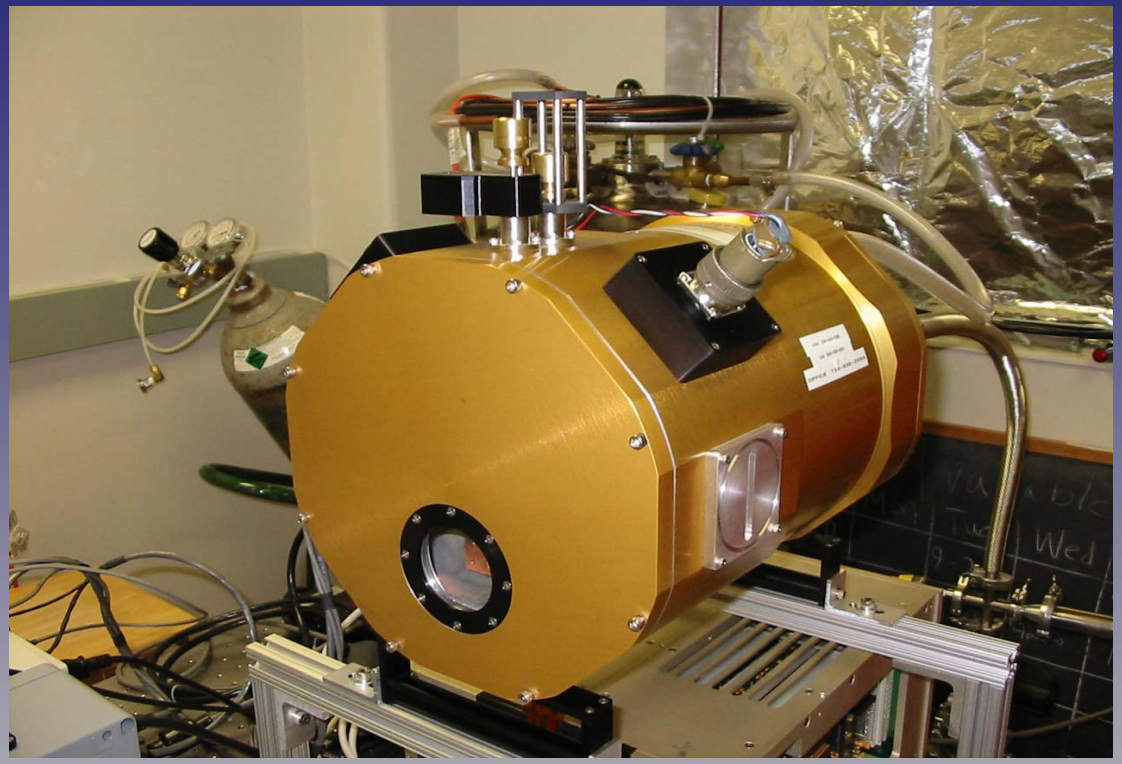
Detector Design



Detector to be tested is mounted inside a dewar to keep it at 140K.

Dewar necessitates a long working distance!

Spot-o-matic

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Testing the detector

We need to test:

- Lateral Charge Diffusion
- Intrapixel variation in sensitivity
- Pixel to Pixel uniformity
- Absolute pixel size

How we test for all these

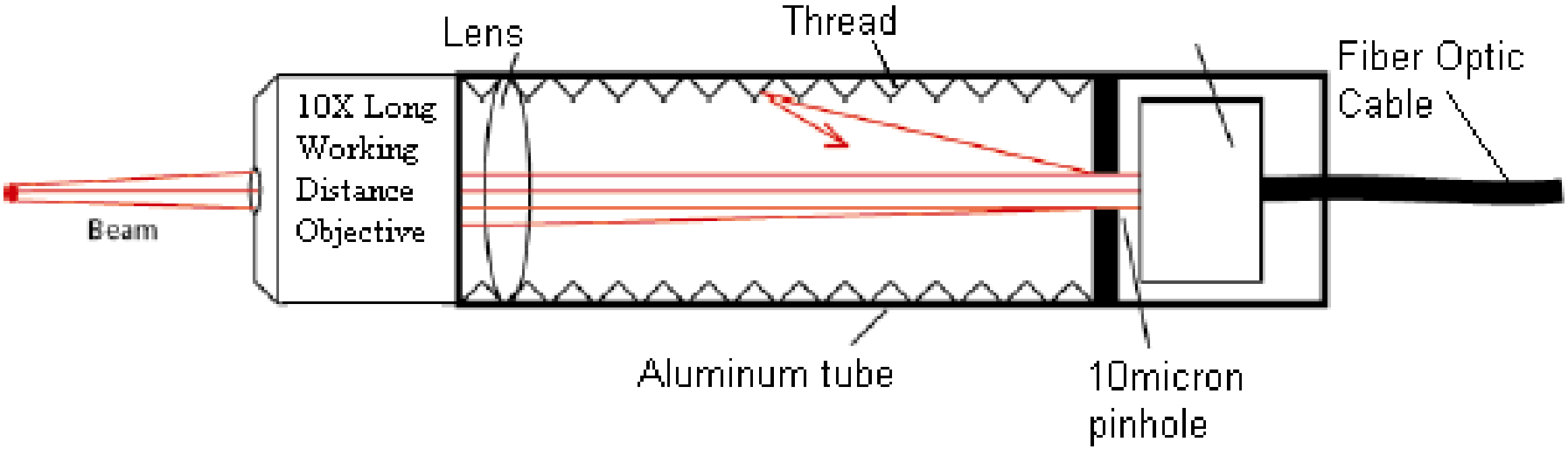
Pixels are approx 18micron across

We need to focus a very small (approx 3micron diameter) uniform spot of light into the dewar and onto an individual pixel.

It needs to be small enough and with motion control accurate enough to move about inside a single pixel.

How we did it

Idea borrowed from an LBL design, adapted for NIR light.

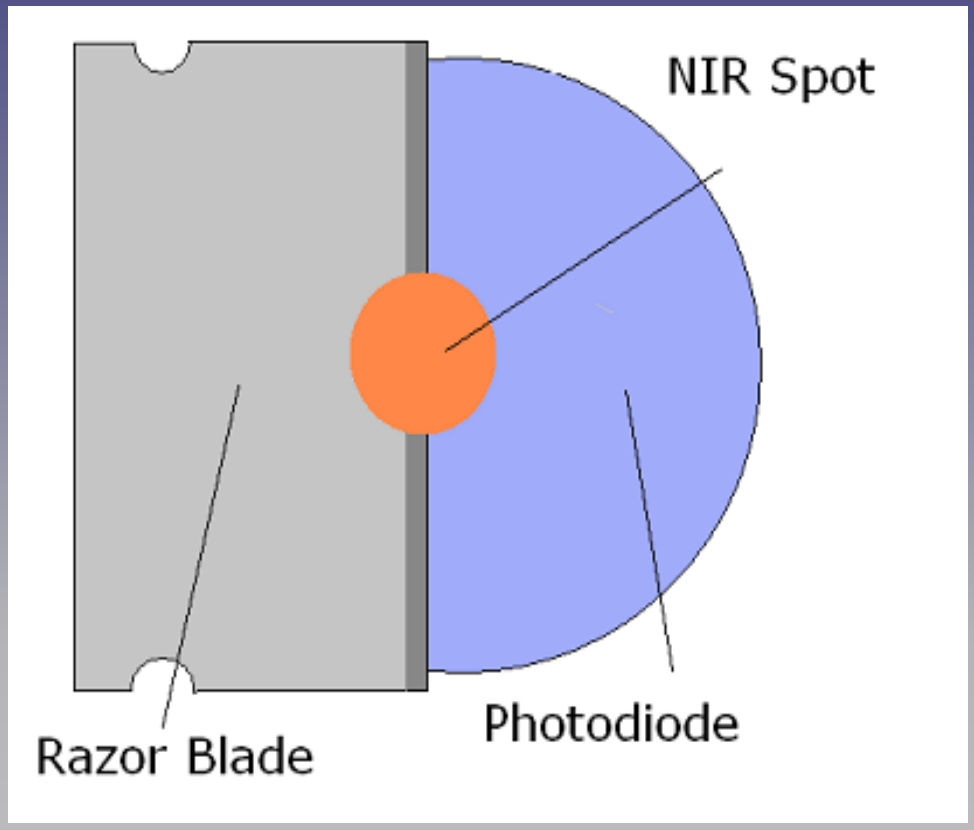


Spot-o-matic

How do you actually measure how big the spot really is?

Use the knife-edge experiment to find the integral of intensity vs. distance.

Then take derivative to find the beam profile.



Spot-o-matic

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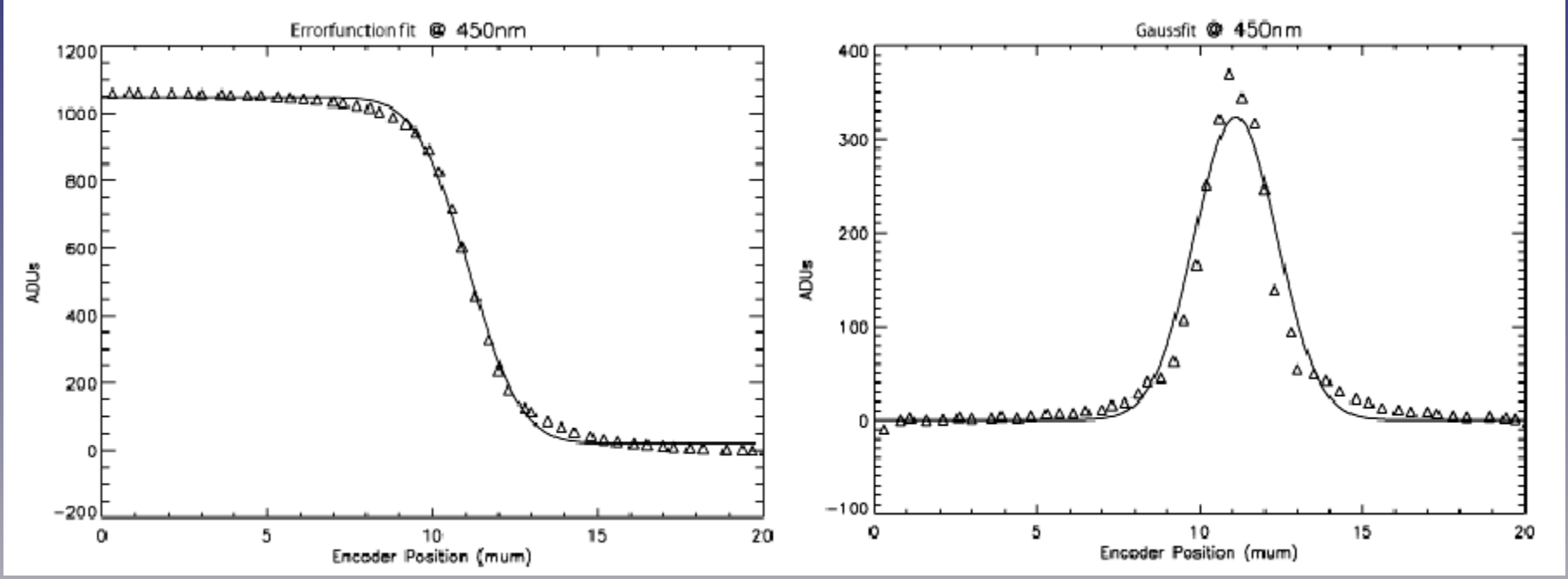
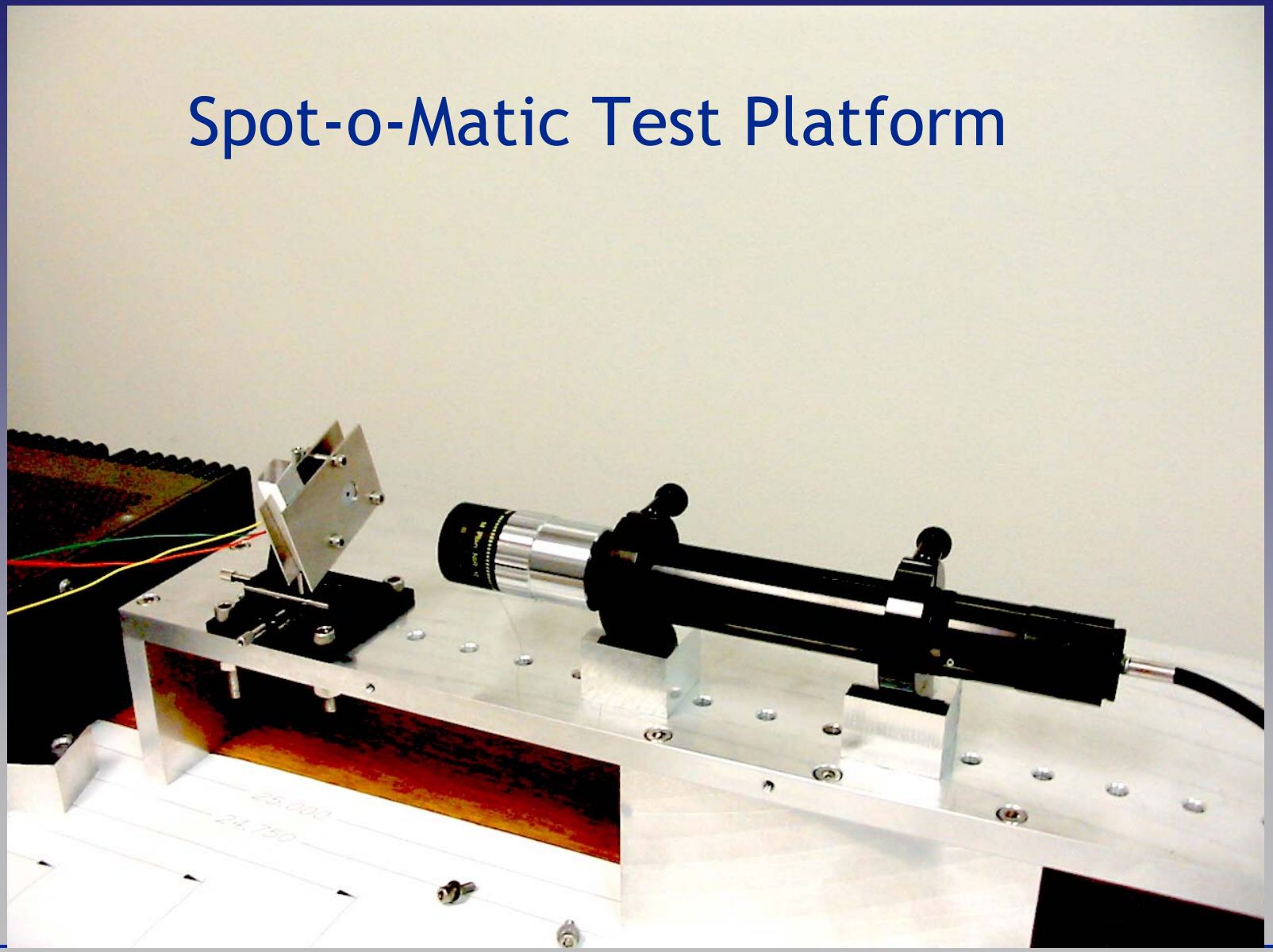
Anticipated Results



Results from LBL

Our results should look much like this.

Spot-o-matic



Spot-o-matic

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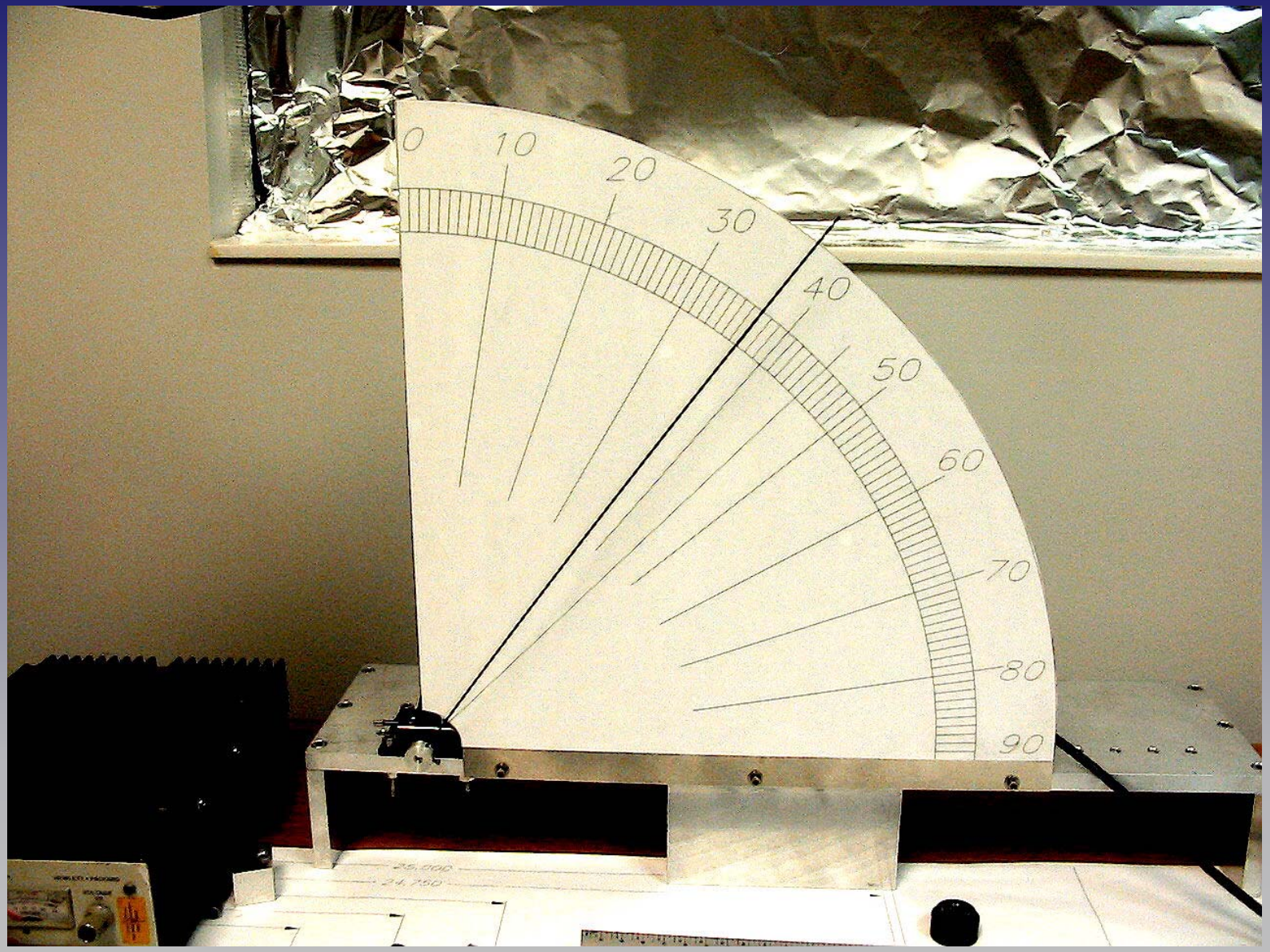

Spot-o-matic

Current Progress

Setup is completely ready except for the tube lens that we are still waiting on.

Upon arrival of the lens, measurement of spot size can be conducted.

Once spot size is confirmed, the spot-o-matic will be mounted on a motorized stage, and characterization of the detector can begin. Hope to have results in November 2003.

Automation

The Spot-O-Matic will eventually be mounted on a motorized, computer controlled X-Y-Z stage.

Control of the motion will be completely integrated into the detector read-out software.