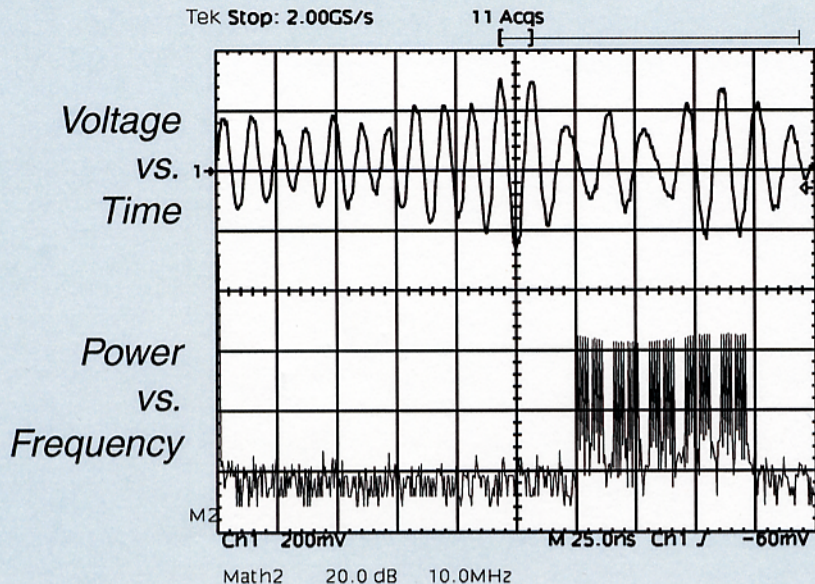
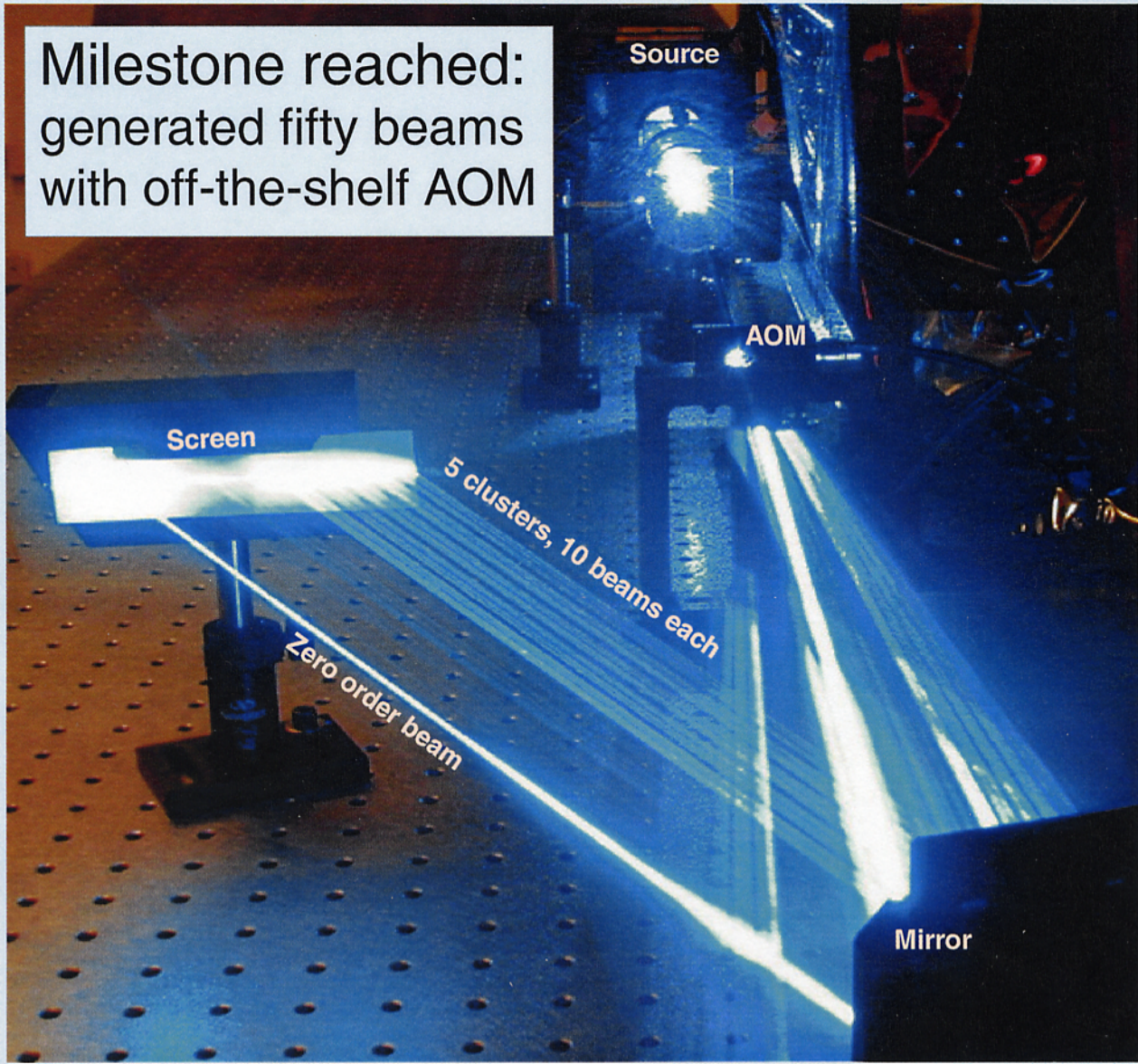


AOM Drive: the sum of 50 Sines



Milestone reached:
generated fifty beams
with off-the-shelf AOM

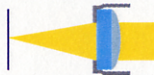


WHY A NEW LIGHT MICROSCOPY?

Limitations of Lenses



High Resolution
Small Field of View
Short Working Distance

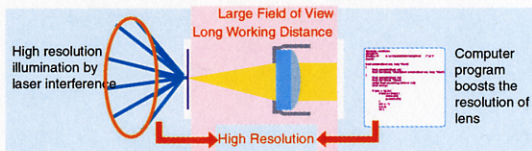


Low Resolution
Large Field of View
Long Working Distance

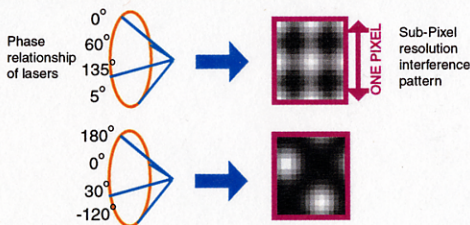
- Lens link resolution, field of view, working distance
- Lens cannot image wide region (**brainstem nuclei**) with high resolution (**synapse**)

SYNTHETIC APERTURE MICROSCOPY (SAM)

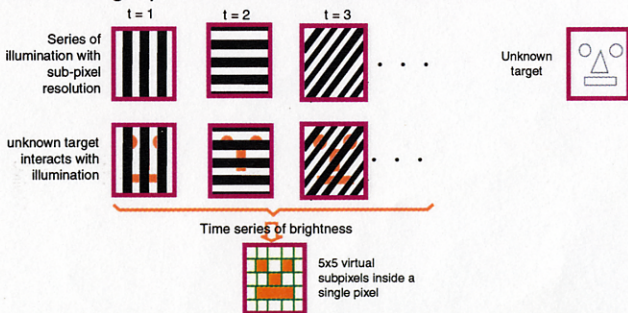
- Add laser illumination and computer program to a lens



- Phases of lasers determine high resolution illumination



- Inside a single pixel: How resolution is boosted



PHASE RELATION BETWEEN BEAMS MUST BE CALIBRATED

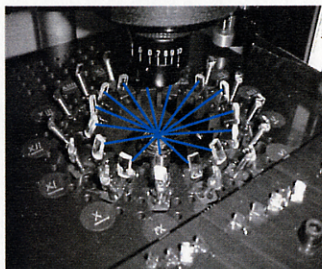
unknown actual phase known command phase unknown phase offset

$$\phi_j = c_j + \Delta_j$$

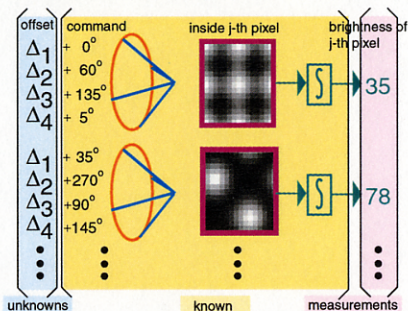
thermal drift of mirrors
unknown path length
etc.

ESTIMATING PHASE RELATIONS BETWEEN 15 BEAMS

- 15 evenly spaced beams arranged in a ring



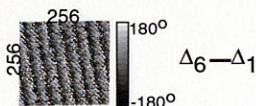
- For a single pixel



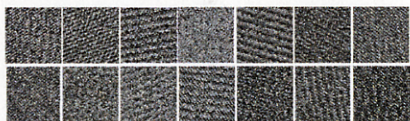
solve a set of linear equations

INDEPENDENT RESULTS FOR ALL PIXELS SHOWN AS AN IMAGE

- independent results for 256×256 pixels
- Collectively shown as a grayscale image



- Results for 15 beams



$$\Delta_2 - \Delta_1 \quad \dots \quad \Delta_8 - \Delta_1$$

$$\Delta_9 - \Delta_1 \quad \dots \quad \Delta_{15} - \Delta_1$$

DISCUSSION

- Estimated phase progresses linearly and periodically over CCD region
- Periodicity agrees with beam angle and wavelength
- Direction of phase progression agrees with beam direction

