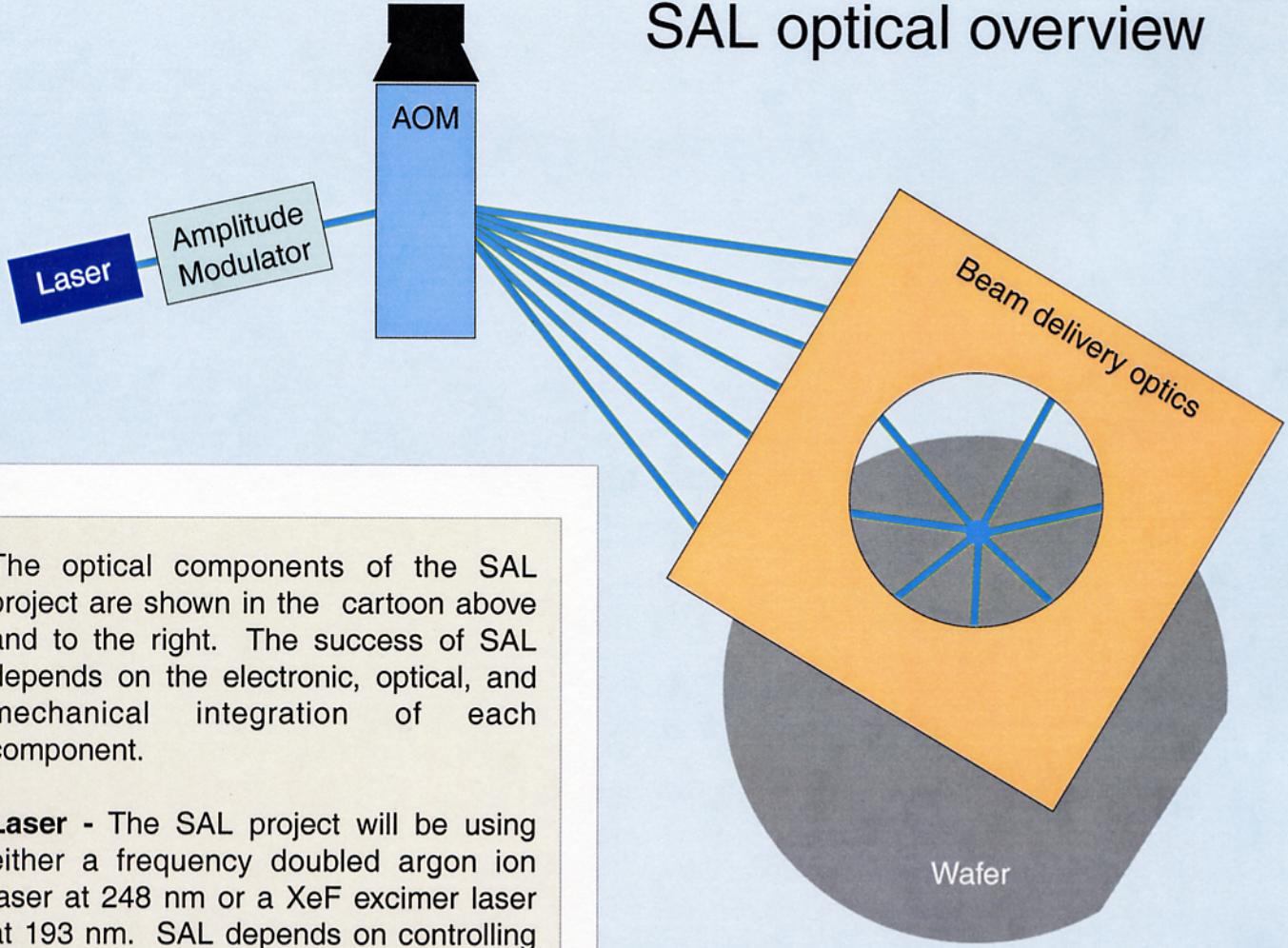
SAL optical overview

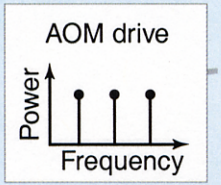


The optical components of the SAL project are shown in the cartoon above and to the right. The success of SAL depends on the electronic, optical, and mechanical integration of each component.

Laser - The SAL project will be using either a frequency doubled argon ion laser at 248 nm or a XeF excimer laser at 193 nm. SAL depends on controlling aspects of the light such as phase, amplitude, and polarization.

Doppler shift compensation

1. Multiple frequency AOM drive



Laser

Amplitude Modulator

AOM

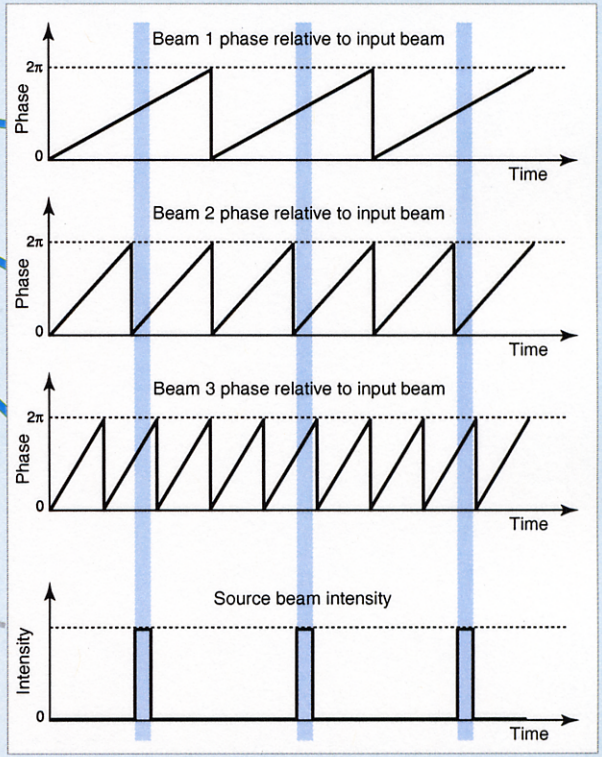
2. Each output beam Doppler shifted by drive frequency

beam 1

beam 2

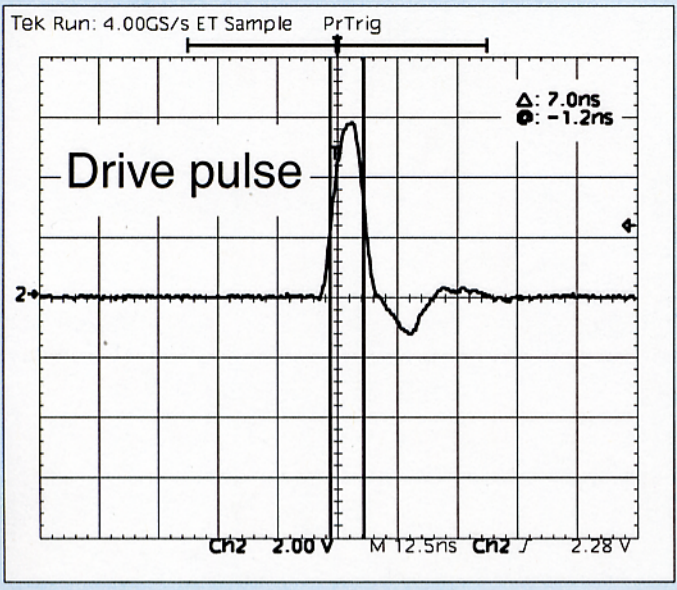
beam 3

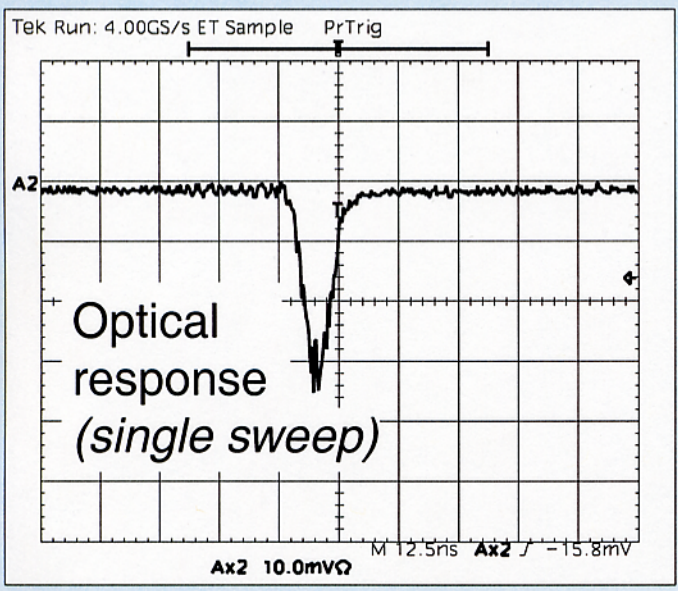
3. Phase relationship repeats periodically

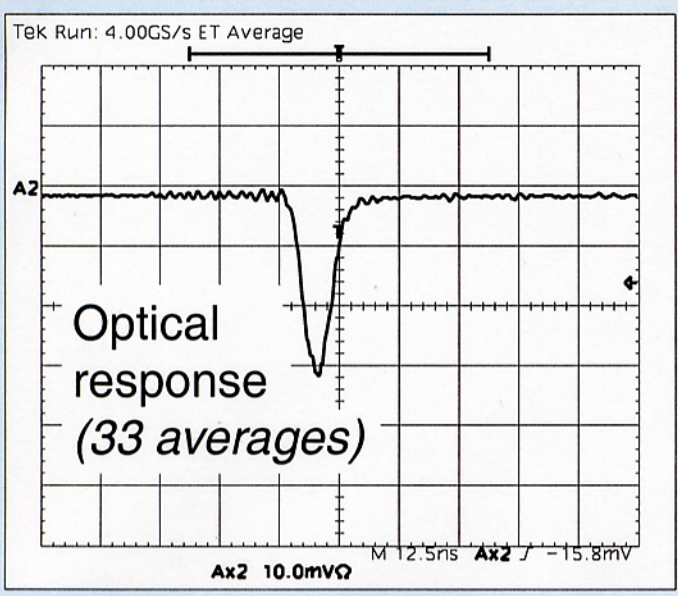


4. Laser strobed to "freeze" phase relationship during exposure

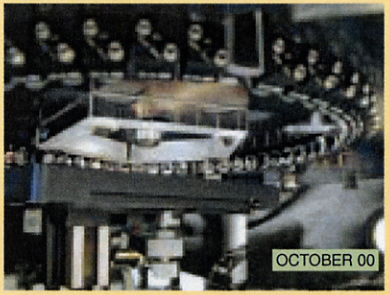
Strobe measurement

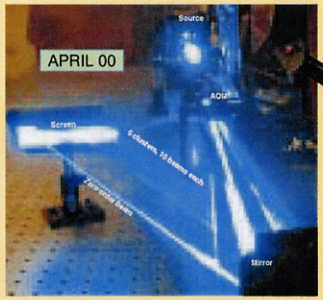


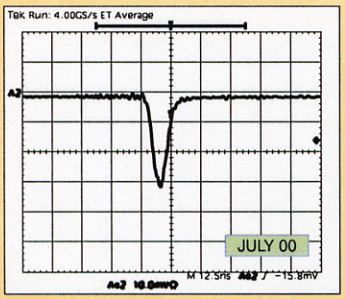


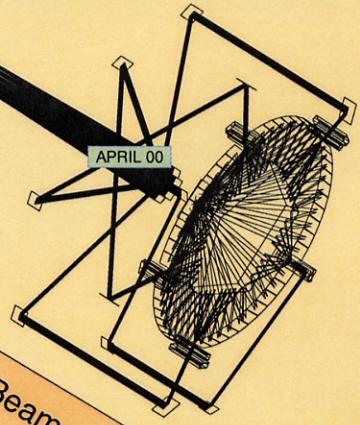


SAL system components working together









Laser

Amplitude Modulator

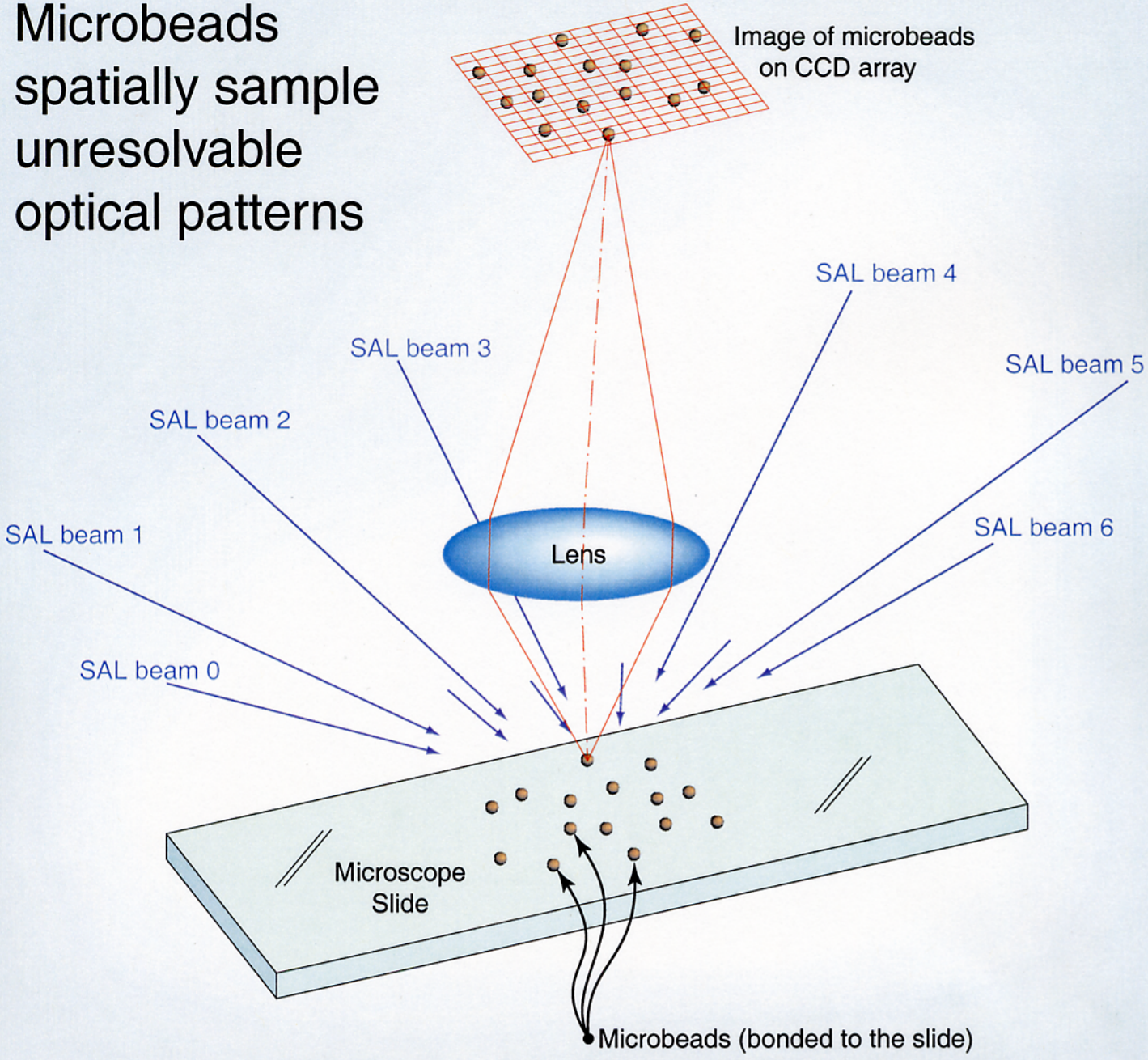
AOM

Beam delivery optics

SAL optical overview

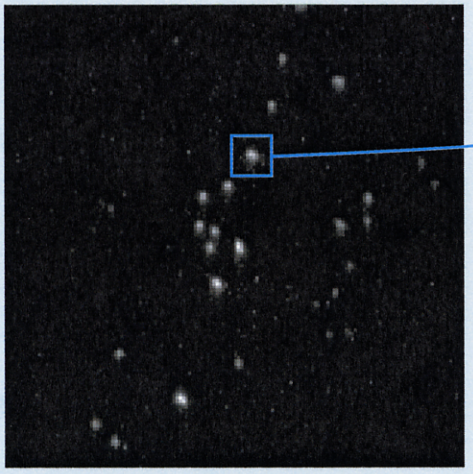
The optical components of the SAL project are shown in cartoon above in the blue box, and in physical terms in the gold region above that. The success of SAL depends on the electronic, optical, and mechanical integration of each component, as demonstrated by this quarter's progress.

Microbeads spatially sample unresolvable optical patterns

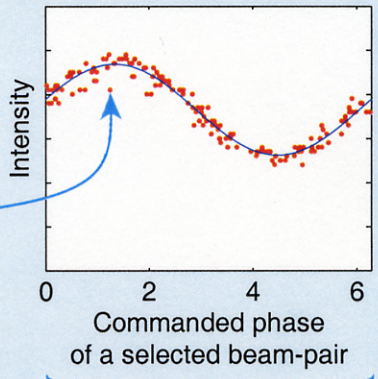


Pattern calibration enables SAL

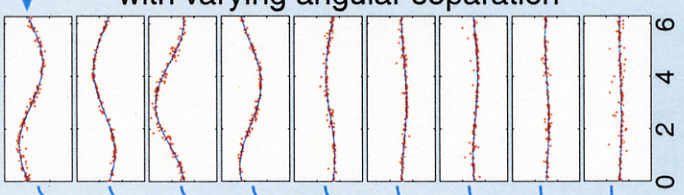
Example CCD image of microbeads

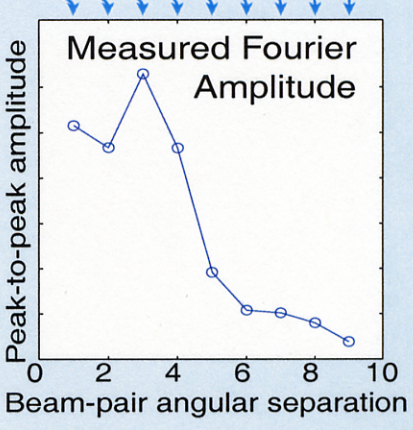


Response of a single microbead to many projected patterns



Responses for beam-pairs with varying angular separation





Stationary interference patterns generated by the SAL testbed contain features that are not resolved by conventional optics. In the optical micrograph above, microbeads sample these fine patterns. Even though the image of the beads appears blurry, the measured intensity is truly sampled at highly localized regions of space. Notice how some beads are brighter than others in this image. The next image in a sequence might have a different pattern of bead brightness, depending on the sub-microscopic projected pattern.

The curve in the upper right shows the intensity variation of the indicated microbead for many projected patterns (and correspondingly many CCD images). The pattern's intensity (y-axis) at the bead is plotted against the commanded phase difference (x-axis) of a selected pair of SAL source beams. The intensity varies as a cosine with a measurable amplitude, bias, and phase offset.