

Supplementary

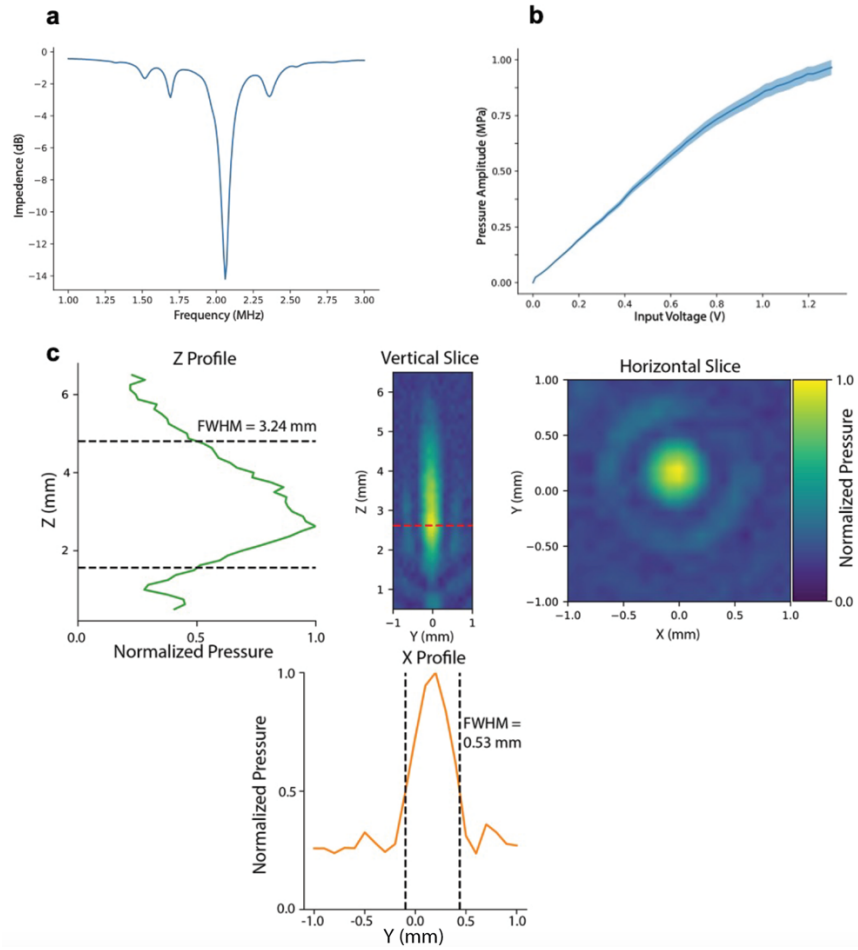


Fig. S1: Transducer characterization. **a**, Transducer high-mode resonant frequency at 2.1 MHz. **b**, Calibration of function generator driving voltage to pressure amplitude. **c**, 3D mapping of the transducer pressure profiles. The red dashed line in the vertical slice image denotes where in the focus the horizontal slice image was taken from and the location of the two-photon focal plane.

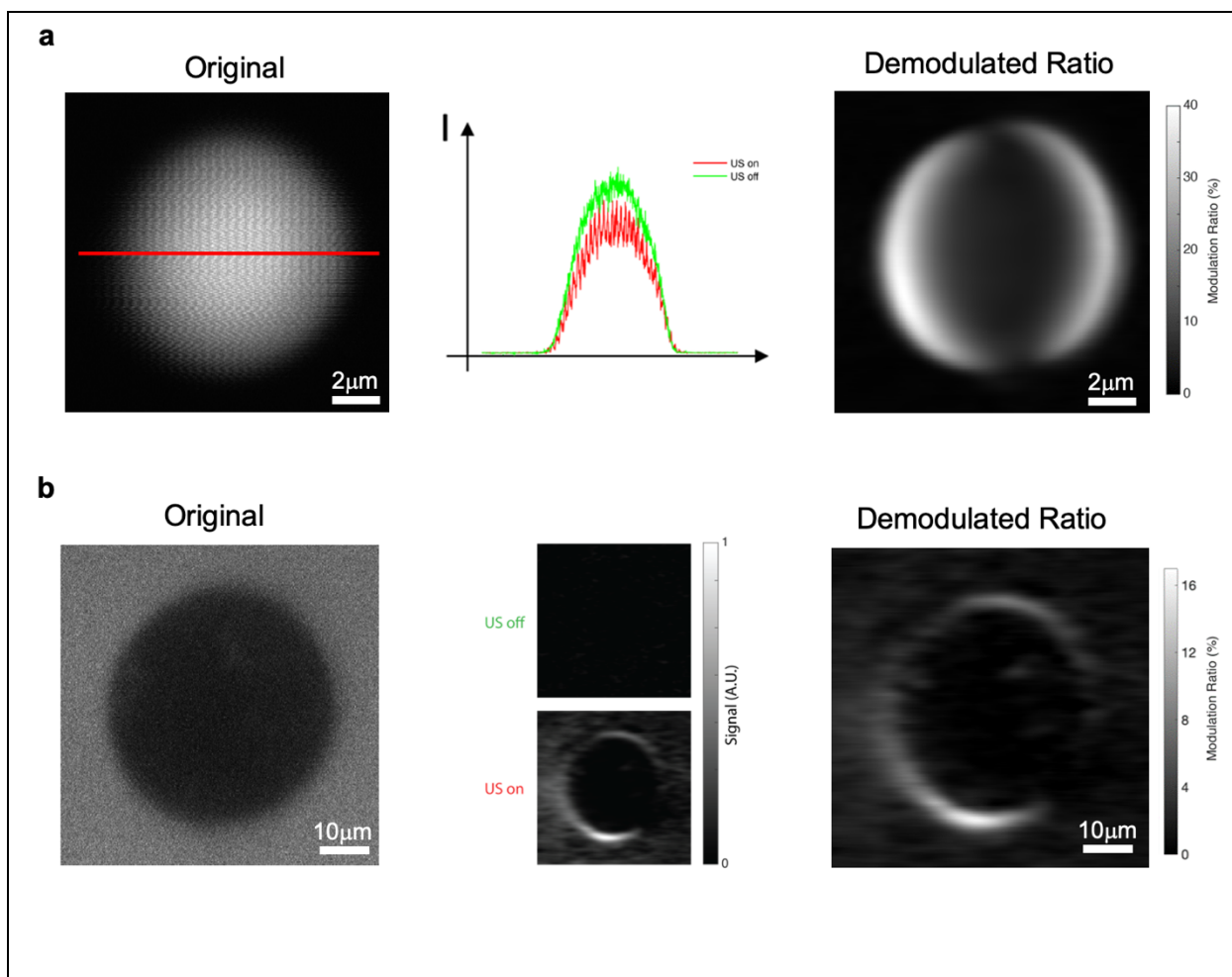
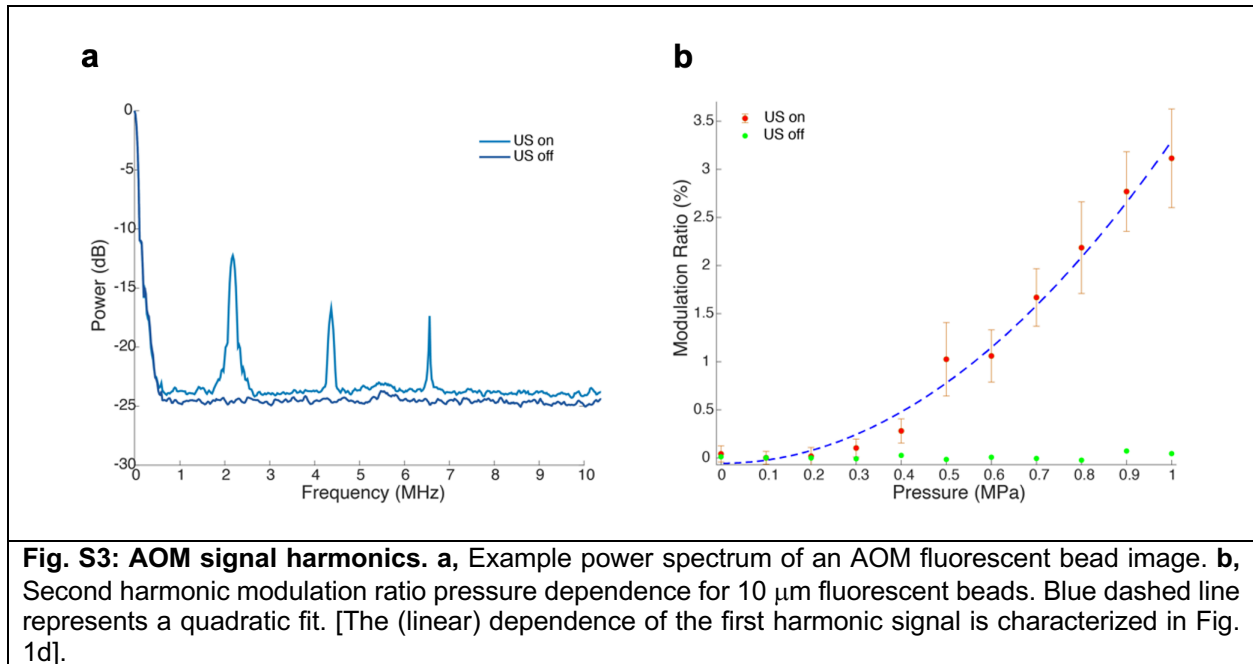
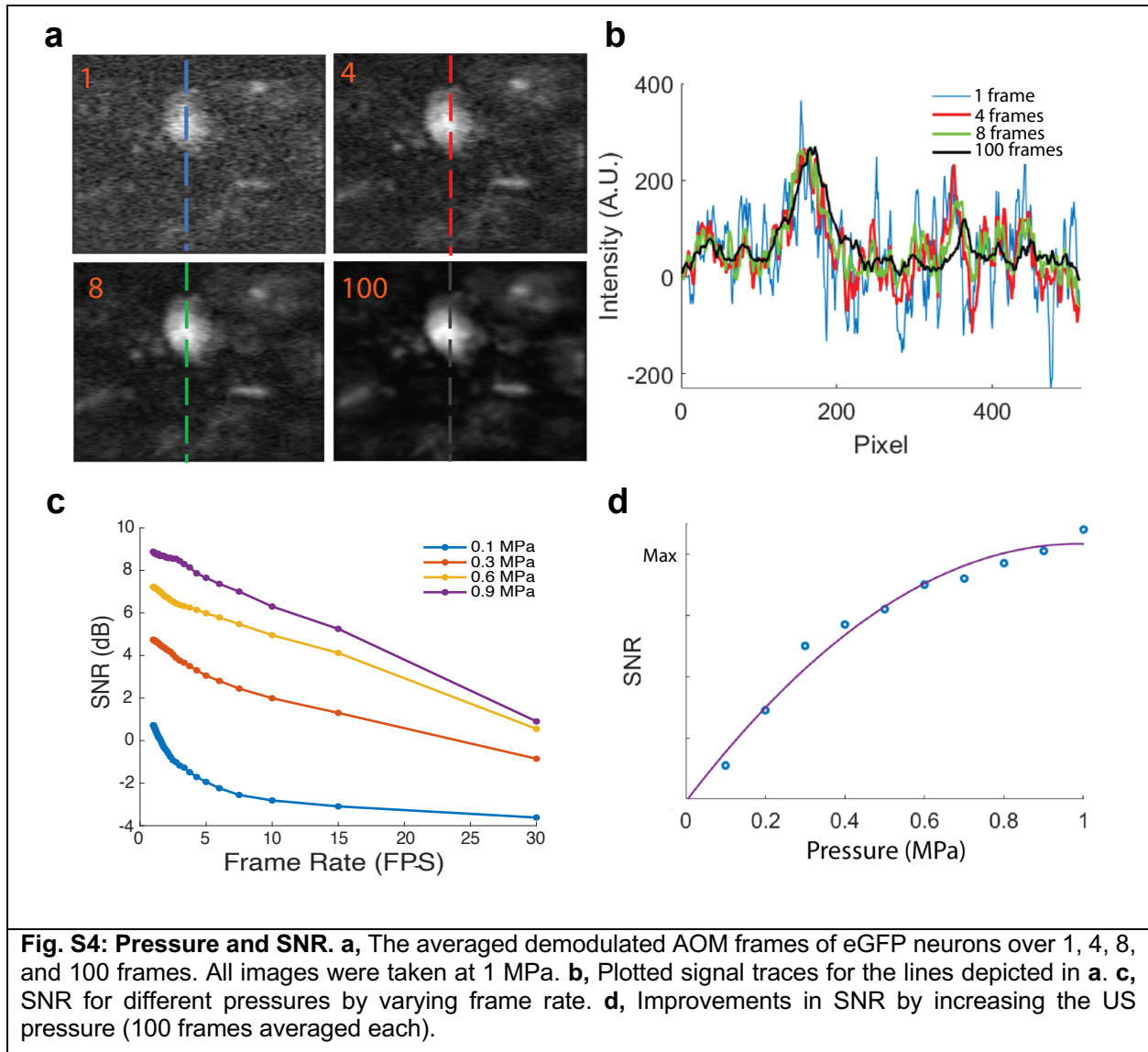
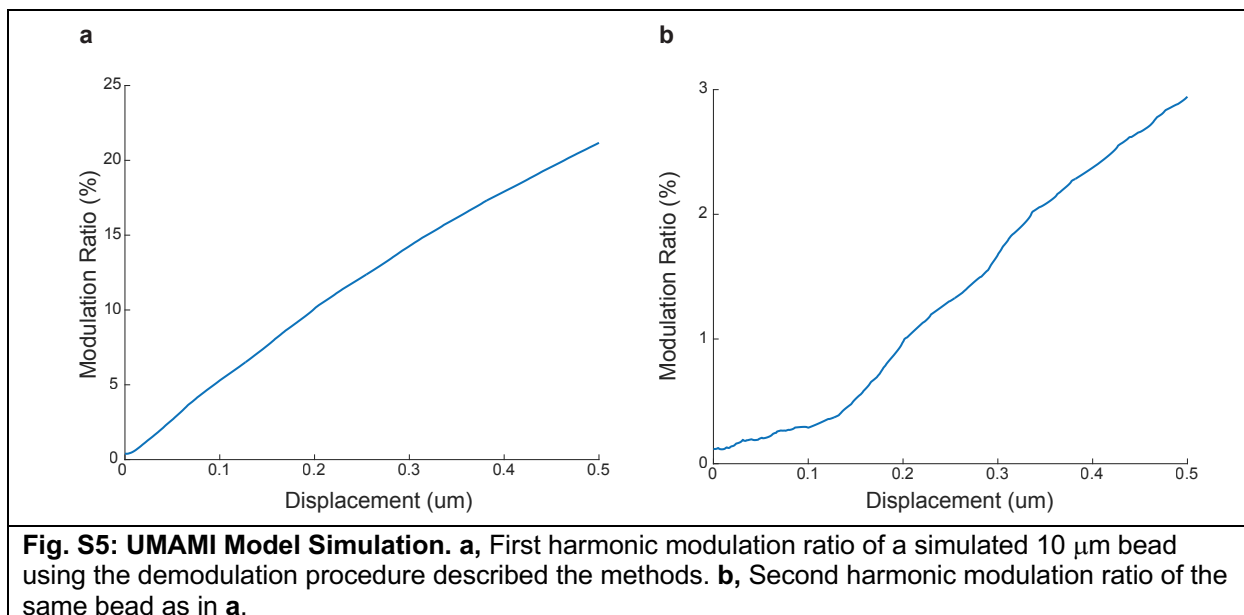


Fig. S2: Bead Demodulation Results. **a**, Left, a single original, raw frame of fluorescent bead under CW US modulation. The fringe pattern is noticeable across the bead surface. Middle, single modulated and unmodulated line profiles of the representative line in the original image. Right, an example demodulated ratio image, as calculated by dividing the filtered demodulated image by the original image (24 frames averaged). The enhancement of bead edges is evident in the image representation. **b**, Left, single frame of a $45\mu\text{m}$ non-fluorescent polystyrene bead in fluorescein-laden agar undergoing AOM. Middle, the AOM signals are observed in demodulated images when the US is on. Right, a similar demodulated ratio image as in **a**. The edge enhancement effects are readily observed here as well.







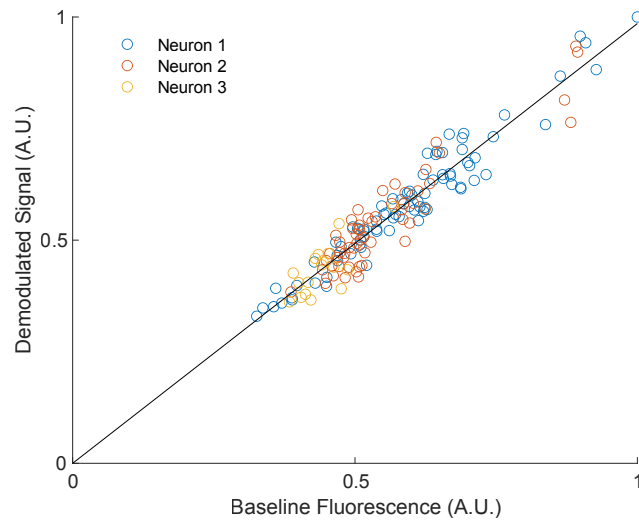


Fig. S6: Baseline and Demodulated GCaMP Signal Correlation. The fluorescent signals across three neurons showed strong correlation between the unmodulated baseline signals with demodulated signals. Pearson correlation coefficient, $r = 0.96$.

