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Development of a two photon microscope for tracking Drosophila larvae[1] DOYCHO KARAGYOZOV, MIRNA MIHOVILOVIC SKANATA, MARC GERSHOW, New York University — Current in vivo methods for measuring neural activity in Drosophila larva require immobilization of the animal. Although we can record neural signals while stimulating the sensory organs, we cannot read the behavioral output because we have prevented the animal from moving. Many research questions cannot be answered without observation of neural activity in behaving (freely-moving) animals. We incorporated a Tunable Acoustic Gradient (TAG) lens into a two-photon microscope to achieve a 70kHz axial scan rate, enabling volumetric imaging at tens of hertz. We then implemented a tracking algorithm based on a Kalman filter to maintain the neurons of interest in the field of view and in focus during the rapid three dimensional motion of a free larva. Preliminary results show successful tracking of a neuron moving at speeds reaching 500μm/s.

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Doycho Karagyozov
New York University

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