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Laser- based Insect Tracker (LIT) LEONARDO MESQUITA, SHIVA SINHA, ROB DE RUYTER VAN STEVENINCK, Indiana University Bloomington, Dep. of Physics — Insects are excellent model systems for studying learning and behavior, and the potential for genetic manipulation makes the fruitfly especially attractive. Many aspects of fruitfly behavior have been studied through video based tracking methods. However, to our knowledge no current system incorporates signals for behavioral conditioning in freely moving flies. We introduce a non-video based method that enables tracking of single insects over large volumes ($>8000\text{cm}^3$) at high spatial ($<1\text{mm}$) and temporal ($<1\text{ms}$) resolution for extended periods (>1 hour). The system uses a set of moveable mirrors that steer a tracking laser beam. Tracking is based on feedback from a four-quadrant sensor, sampling the beam after it bounces back from a retro reflector. Through the same mirrors we couple a high speed camera for flight dynamics analysis and an IR laser for aversive heat conditioning. Such heat shocks, combined with visual stimuli projected on a screen surrounding the flight arena, enable studies of learning and memory. By sampling the long term statistics of behavior, the system augments quantitative studies of behavioral phenotypes. Preliminary results of such studies will be presented.

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