



Figure 1. Experimental design and measurements. **A.** Experimental setting. Awake behaving mice were allowed to run on a ball. Sounds were presented randomly interleaved with LED trials. Pupil size was measured on the contra-lateral side from neural recording site (recordings in left auditory cortex and right pupil). **B.** Stimulus presentation. Laser pulses were presented with and without 80 dB WN bursts, the conditions were randomly interleaved, with a one second ISI. When presented, LED pulse began 50 ms before the start of the sound and ended 150 ms after sound offset. Animal's behavioral state varied spontaneously. **C.** Example traces of neuronal FR (25 ms time bins with Gaussian convolution smoothing with sigma = 50 ms), pupil size, and running speed during interleaved WN stimulus presentation. Animals frequently oscillated between low and high arousal states with short bursts of running.