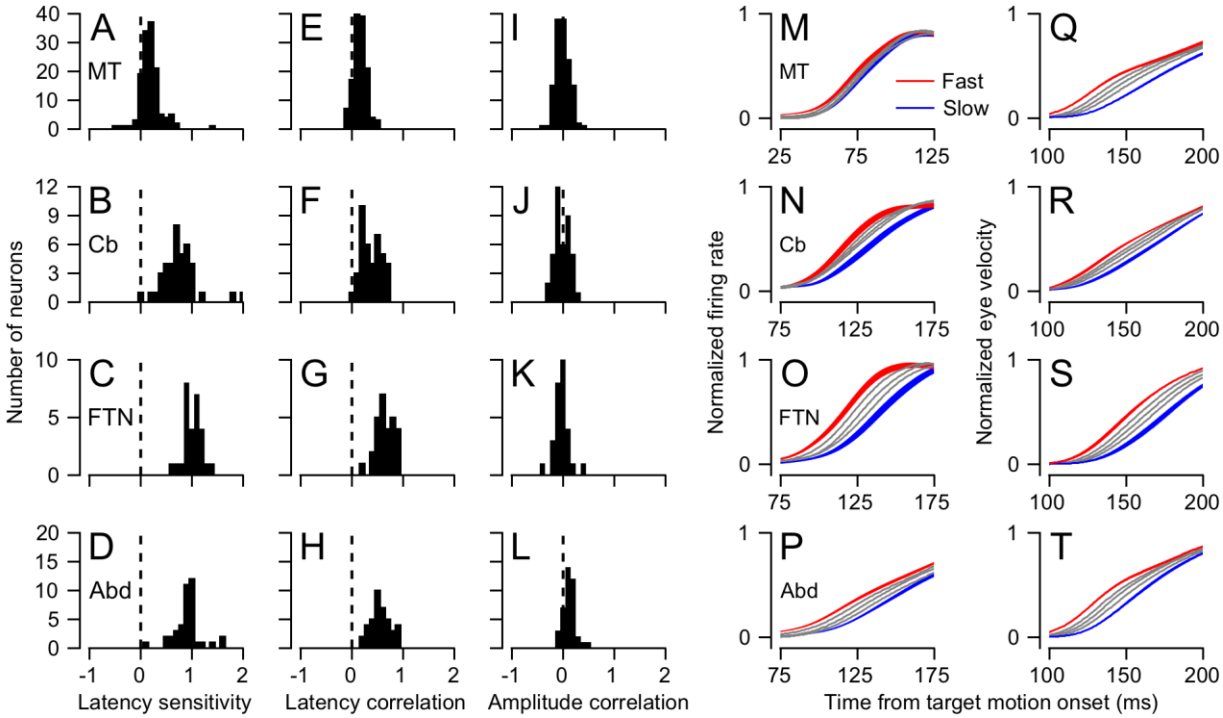
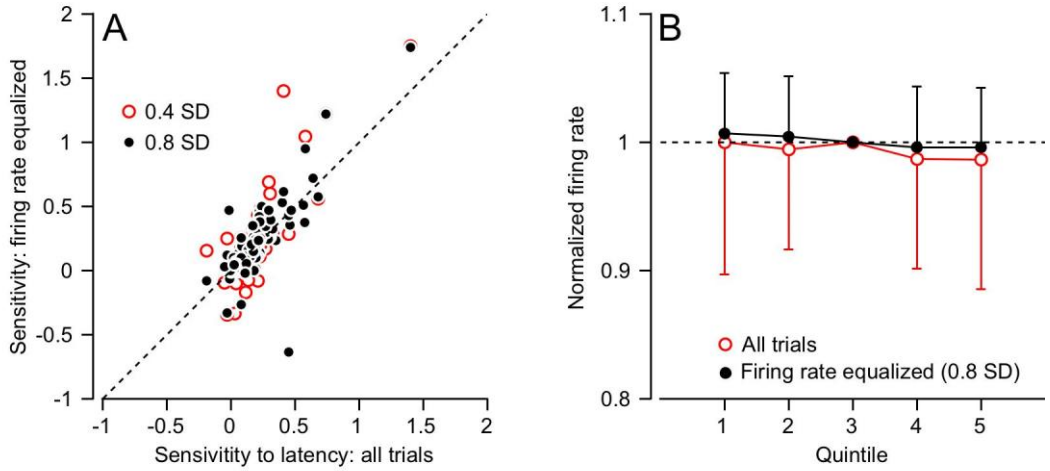


Supplementary Figure 1 [related to Figures 2 and 3]. Population distributions for latency sensitivity, latency correlation, and amplitude correlation, and behavioral latency sorted quintiles of normalized neural/behavioral responses. A-D: latency sensitivities for area MT, cerebellar Purkinje neurons, floccular target neurons, and abducens neurons. **E-F**: latency correlations between neurons in four areas and behavior. **I-L**: correlations between response amplitude and behavioral latency for the neurons in four areas. **M-P**: normalized quintile of average neural responses (Gaussian smoothed peristimulus time histogram), sorted by pursuit latency. **Q-T**: normalized quintile of average smooth pursuit velocity, sorted by pursuit latency.



Supplementary Figure 2 [related to Figure 4]. Demonstration that neural response amplitude does not affect measures of neural latency. We reanalyzed the data used in Figure 2 to show the neural and behavioral latencies were strongly related in MT neurons. We measured response amplitude in each trial as the firing rate in the 100-ms interval from 31 to 130 ms after the onset of stimulus motion. We computed the mean and standard deviation of response amplitude for each neuron and then selected trials that had response amplitude within a specified bound relative to the mean for that neuron. For 108 and 70 neurons, we obtained more than 50 trials within $\pm$0.8 or $\pm$0.4 standard deviations of the mean. For those trials with a limited range of response amplitudes, we then repeated the analysis of the sensitivity of neural latency to behavioral latency (Figure 2). In panel **A**, each symbols plots the results from an individual neuron. Across the population, sensitivity was the same for the full set of trials as it was for the trials with neural response amplitudes restricted to $\pm$0.8 (black symbols) or $\pm$0.4 (red symbols) standard deviations of the mean. In these data, the mean of the standard deviation of response amplitude was 21.2 spikes/s. After restriction to trials within $\pm$0.8 or $\pm$0.4 standard deviations of the mean, the means of the standard deviation of responses amplitude of the remaining trials was 3.8 or 8.9 spikes/s. Thus, the relationship between neural and behavior latency remained even when there was quite restricted variation in neural response amplitude. In panel **B**, we show that the response amplitude did not vary across the quintiles of trials divided by pursuit latency. The same absence of a relationship appeared when we analyzed the absolute firing rates, but here we shown firing rates normalized to those for the trials in the middle quintile. This allows the standard deviations, shown by error bars, to reflect the difference between the analysis for all trials (red) and that for those with firing rate equalized by restricting the database to trials with neural response amplitudes within $\pm$0.8 standard deviations of the mean (black).