

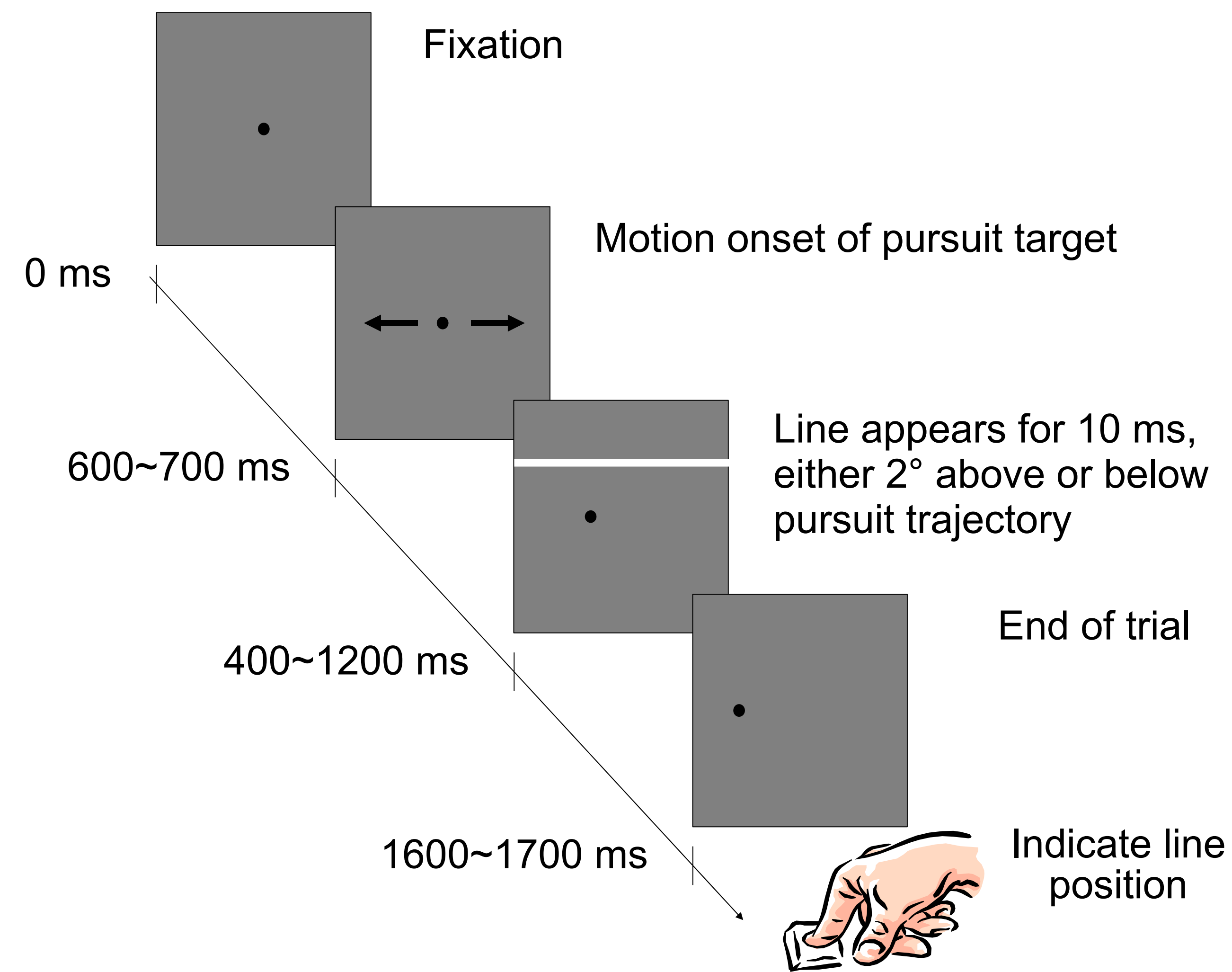
Contrast sensitivity during the initiation of smooth pursuit eye movements

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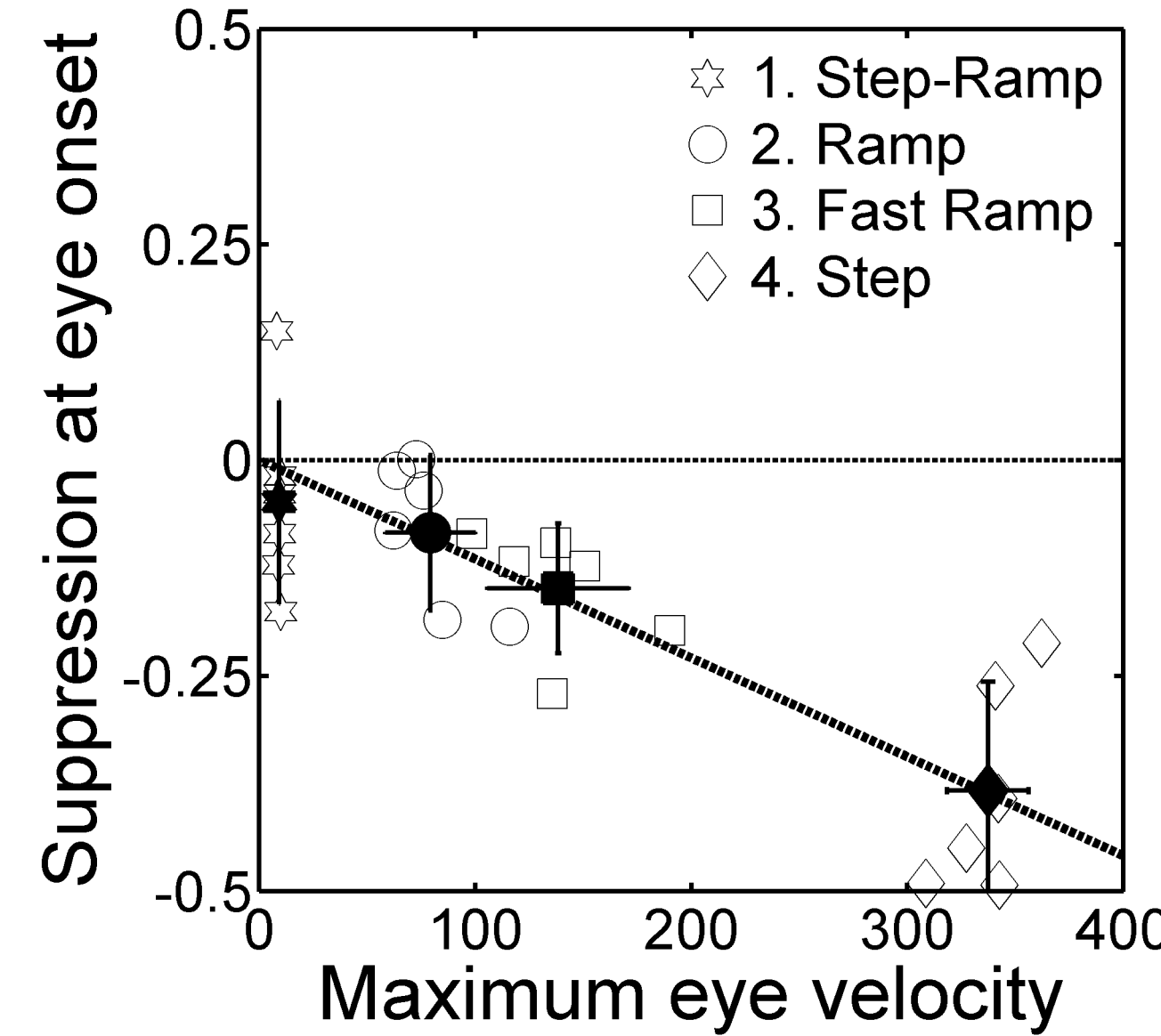
Introduction

Eye movements challenge the perception of a stable world by inducing strong retinal image motion, resulting from different kinds of acceleration of the eyes. For saccades there is strong evidence that this perceptual stability is accomplished by saccadic suppression¹. Here we explore whether such a suppression also occurs during smooth pursuit initiation.



Summary

The results do not show any suppression at the onset of pursuit, if the pursuit is elicited by a step-ramp target (Exp. 1). If the pursuit is elicited by a ramp target (Exp. 2 & 3), the initiation of smooth pursuit is accompanied by initial saccades for which saccadic suppression can be observed (only for large saccades of 4.5° in Exp. 3). One possibility would be that the maximum velocity during the initiation of smooth pursuit is simply too low, to cause a suppression effect³.



Moreover a slight attenuation of contrast sensitivity occurs at target onset (Exp. 1, 2 & 4). This attenuation can be interpreted as inattentive blink, caused by the generation of the following eye movement.

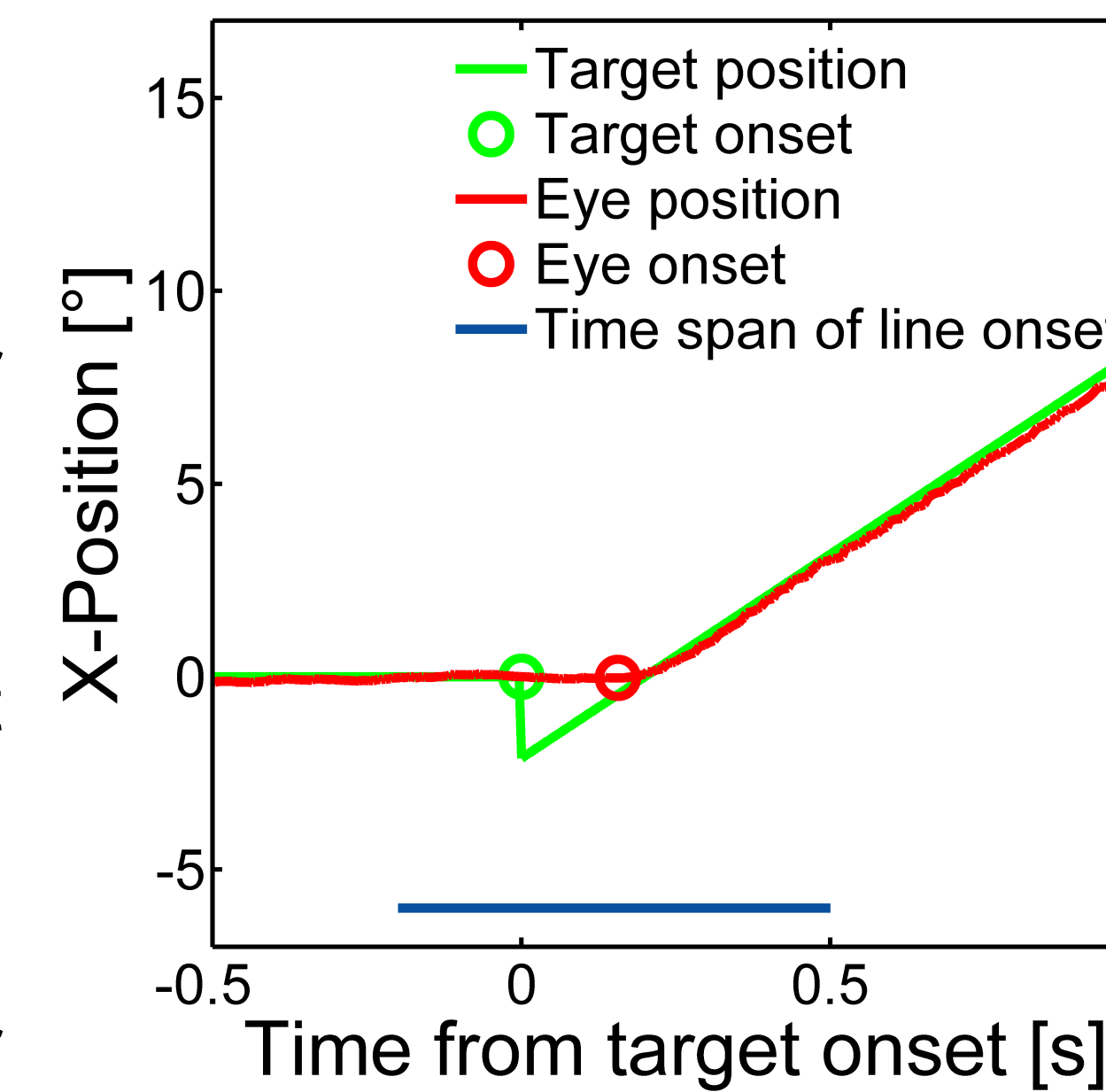
- References:**
 [1] Ross, J. Morrone, M.C., Goldberg, M.E., & Burr, D.C. (2001). Changes in visual perception at the time of saccades. *Trends in Neuroscience*, 24(2), 113-121.
 [2] Rashbass, C. (1961). The relationship between saccadic and smooth tracking eye movements. *Journal of Physiology*, 159, 326-338.
 [3] Mitrani, L., Yakimoff, N. & Mateeff, St. (1970). Dependence of visual suppression on the angular size of voluntary saccadic eye movements. *Vision Research* 10, 411-416.

Acknowledgments:
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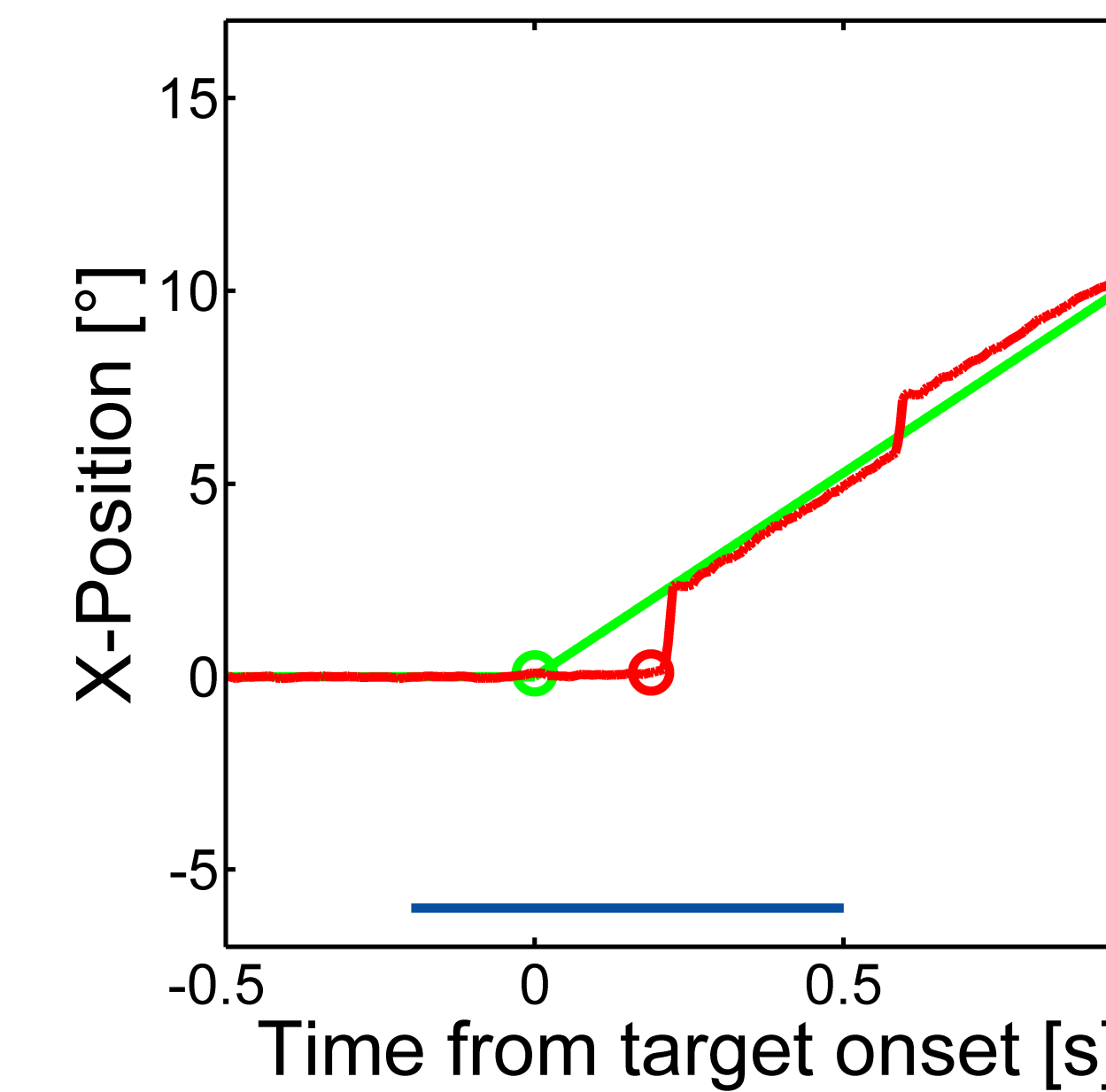
Methods

We tested pursuit initiation, saccades during pursuit and normal saccades. Eye movements were elicited by 4 different target conditions: 1. step-ramp², 2. ramp, 3. fast ramp and 4. step stimuli. At any time from 200 ms before target onset to 500 ms after target onset, a blurred 0.3 deg wide horizontal line appeared for 10 ms either 2 deg above or below the pursuit trajectory. The peak contrast of the line was adjusted to a level just above threshold for each subject. Subjects had to indicate whether the line appeared above or below the pursuit target.

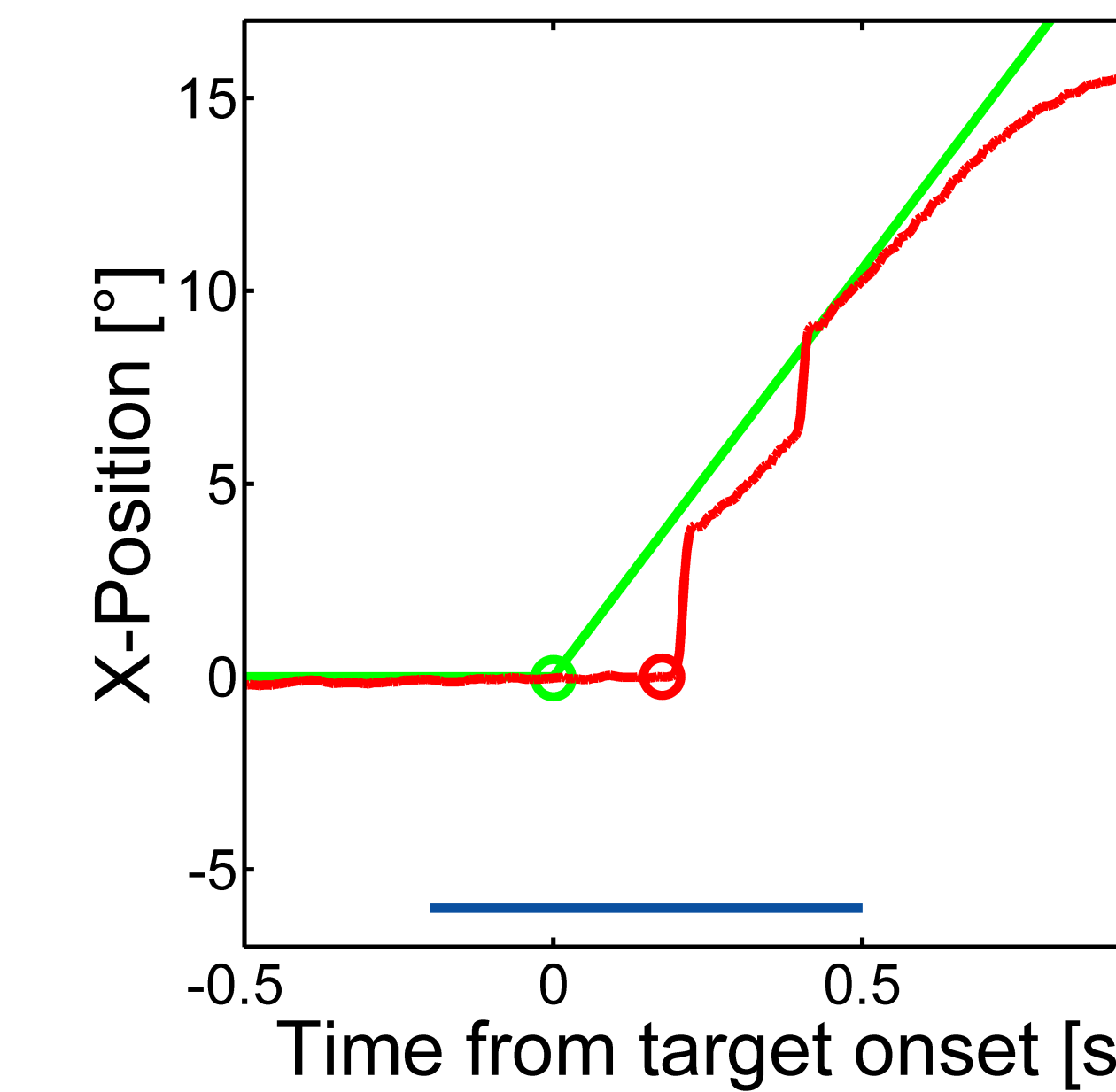
1. Step-Ramp



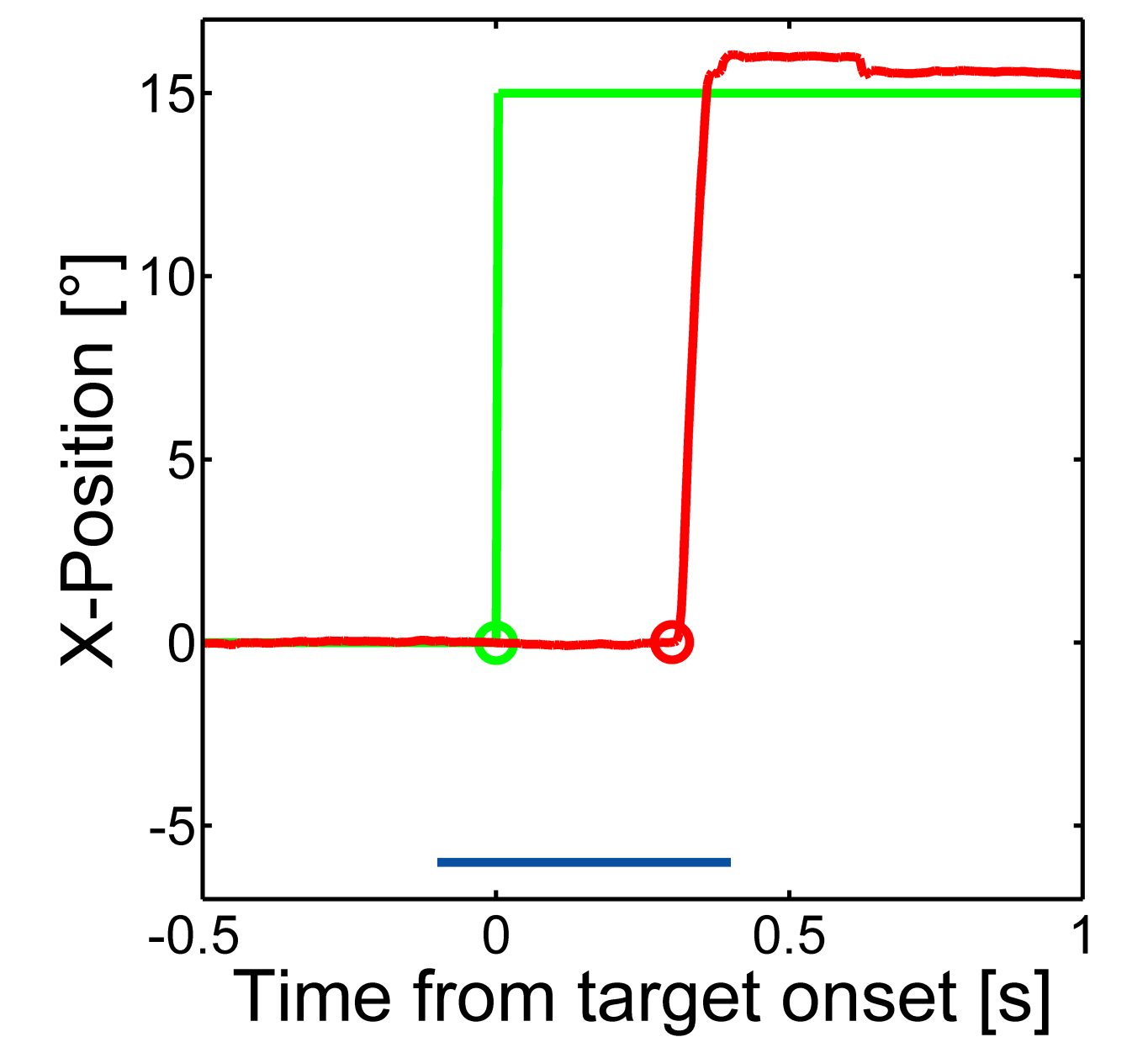
2. Ramp



3. Fast Ramp



4. Step



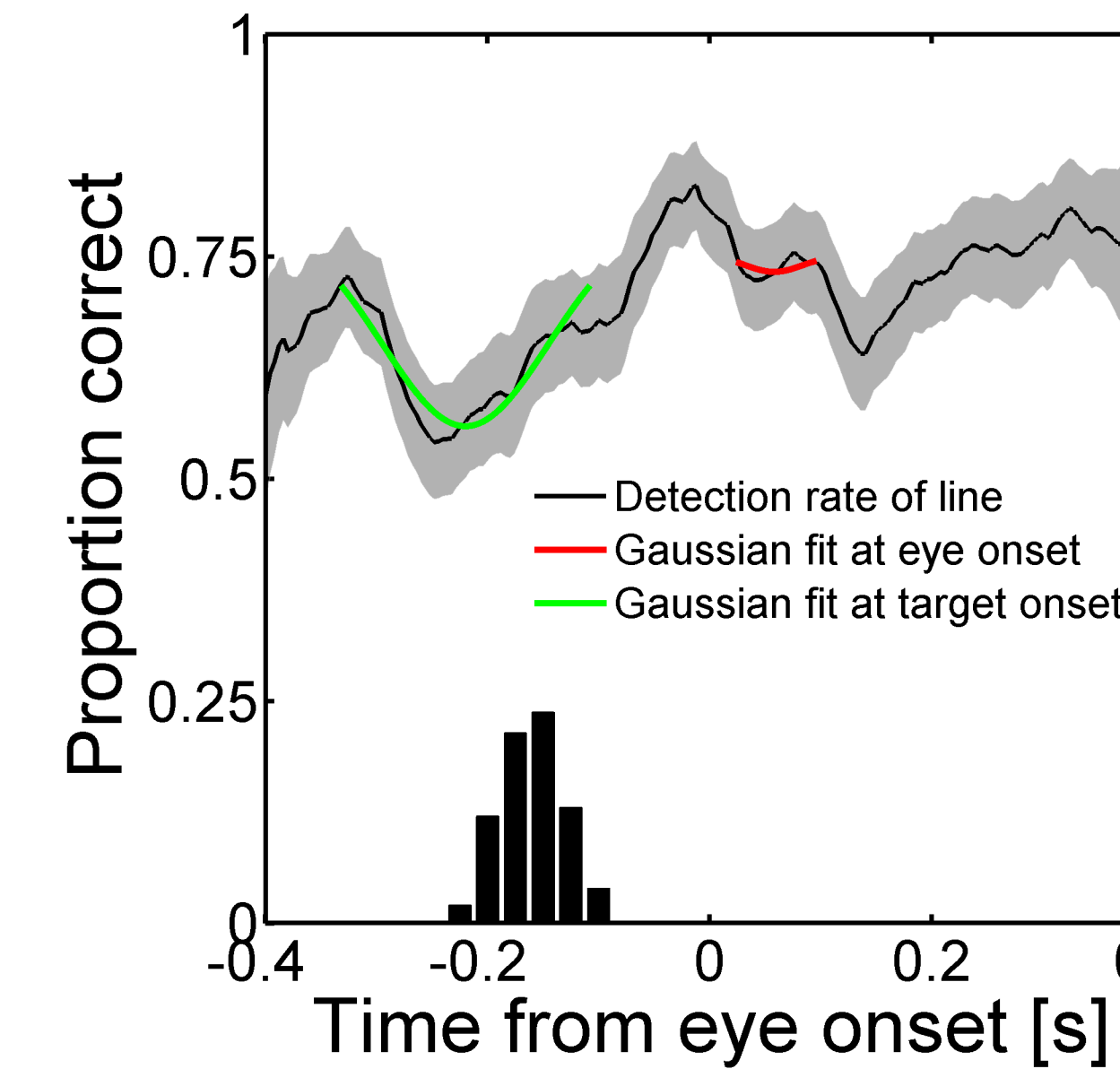
Results

In the upper figures the detection rate for the line stimulus is plotted over time by means of a weighted sliding histogram. In Exp. 1, the detection rate is aligned to pursuit onset, otherwise to saccade onset. The black line and grey area represent the detection rate of the line and its standard error.

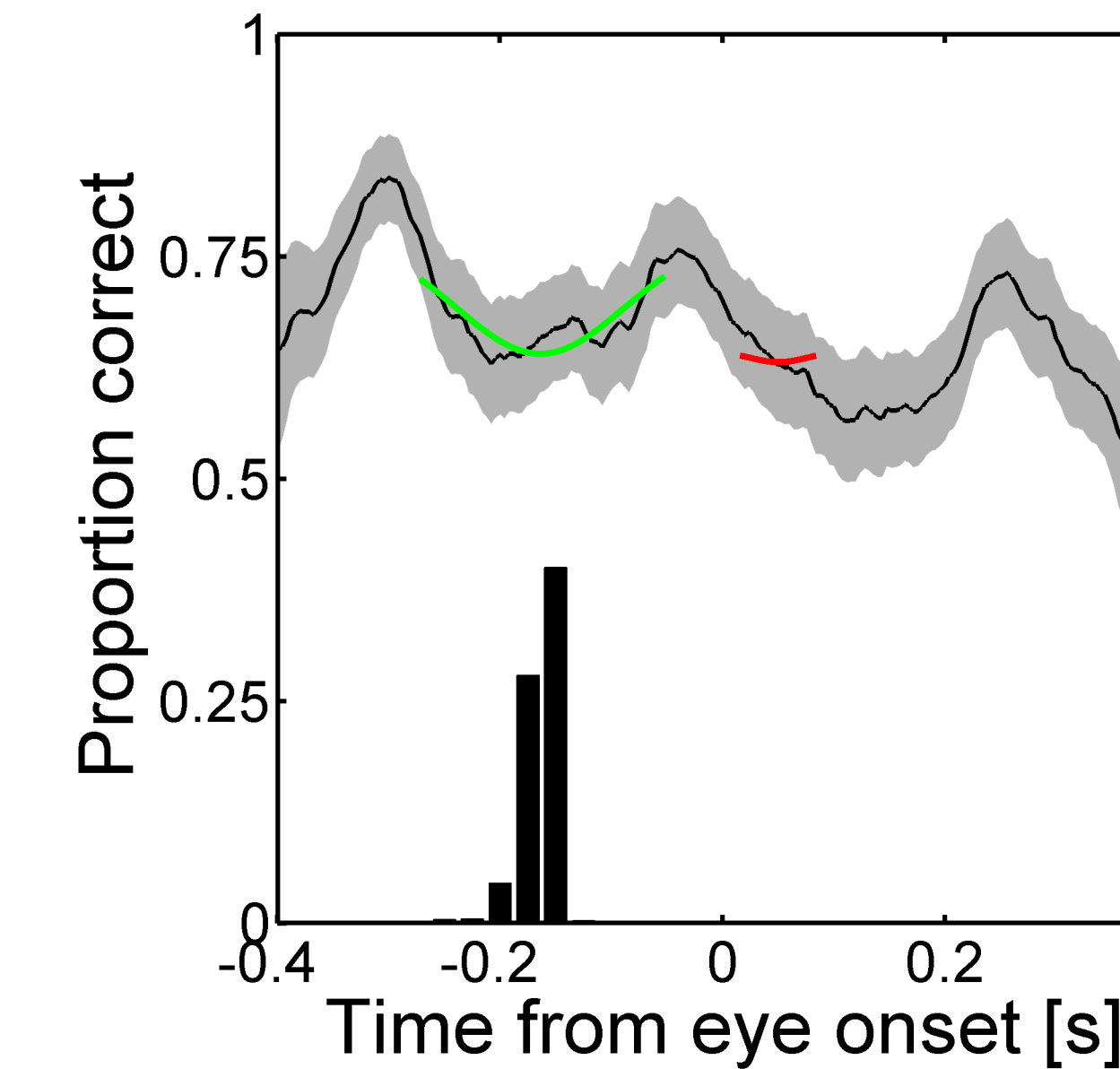
To quantify the amount of suppression, we fitted Gaussian distributions to the curvature of the detection rate. The amplitudes of the fitted Gaussian distributions were used as an estimation of suppression. Two regions of interest were tested: The time around target onset (green) and the time around eye onset (red).

In the lower figures the amplitudes of the Gaussian fits at target onset are plotted against the amplitudes at eye onset. Open squares indicate data for individual subjects, the filled square indicates the mean with 95% confidence intervals for each dimension. In Exp. 3 and 4 there is a significant suppression at eye onset. In Exp. 1, 2 and 4 there is a significant suppression at target onset.

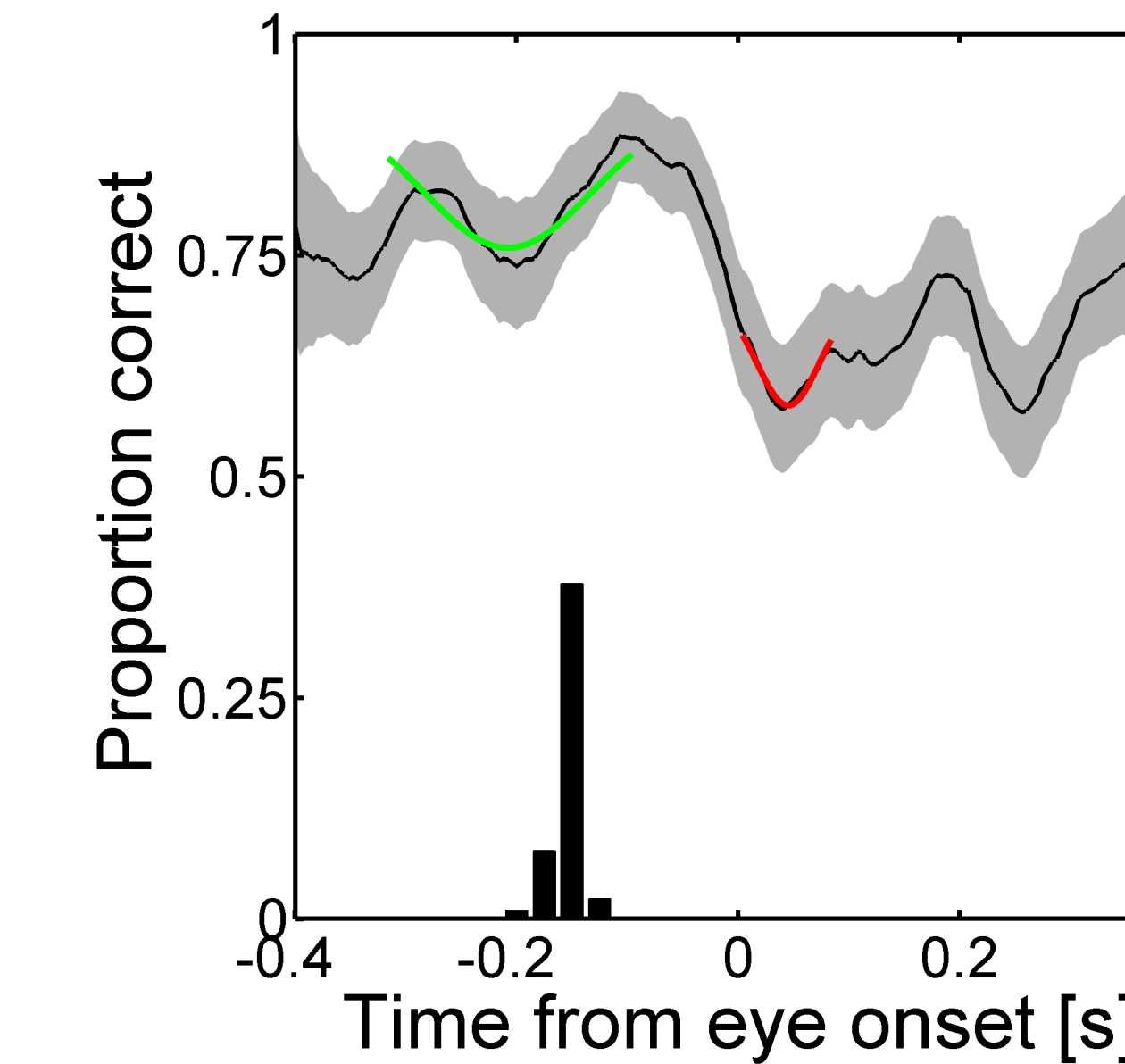
1. Step-Ramp



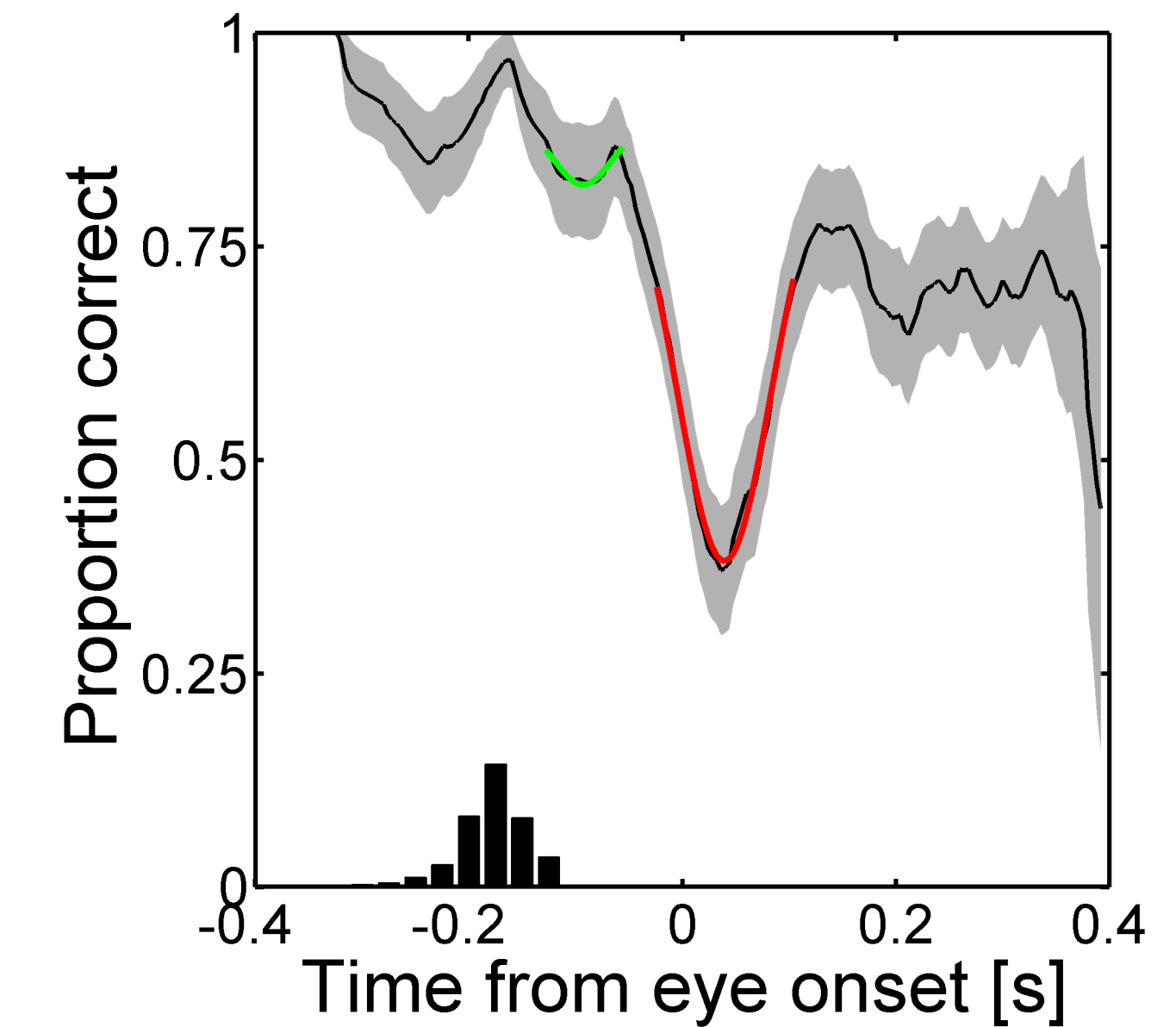
2. Ramp



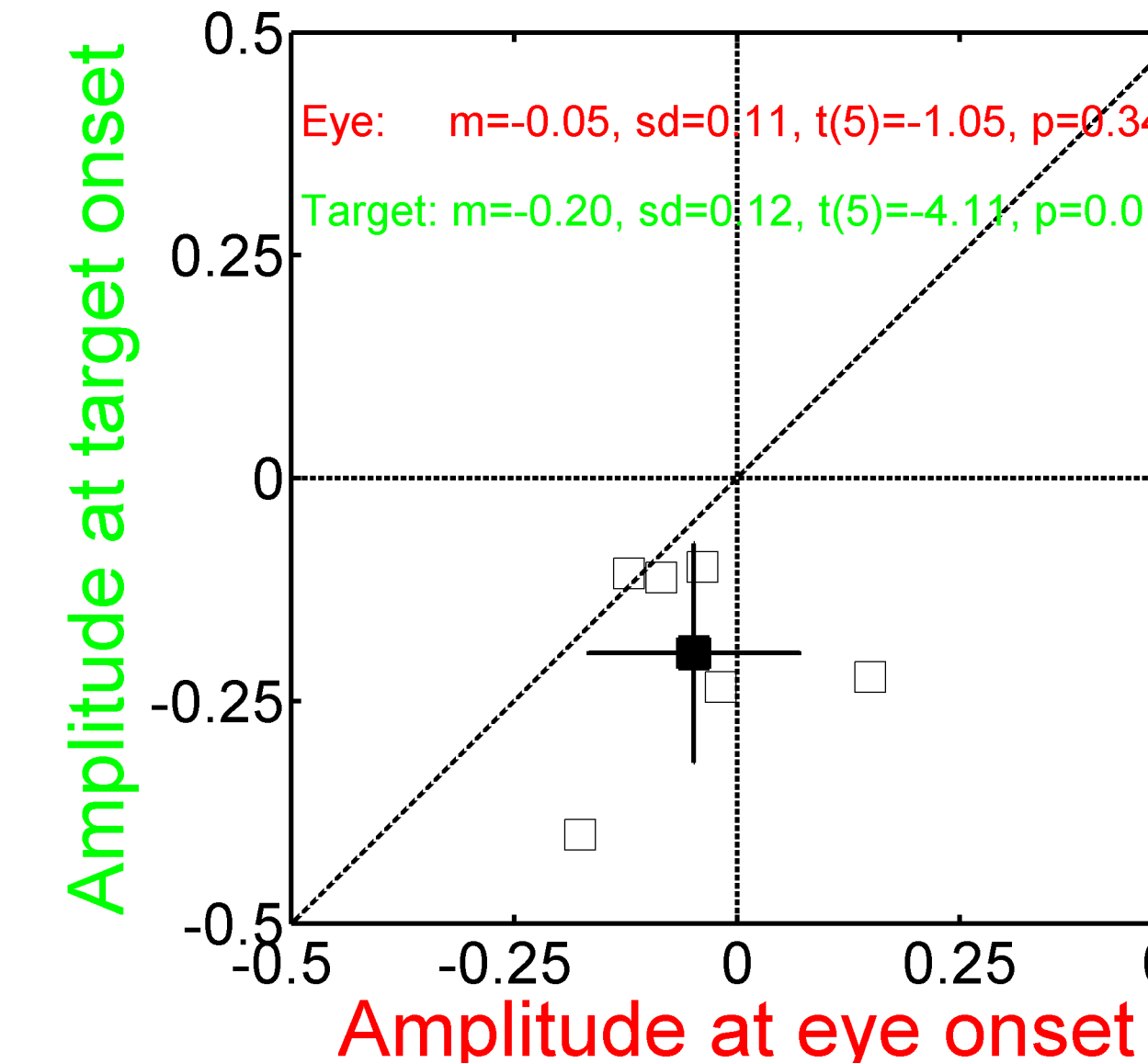
3. Fast Ramp



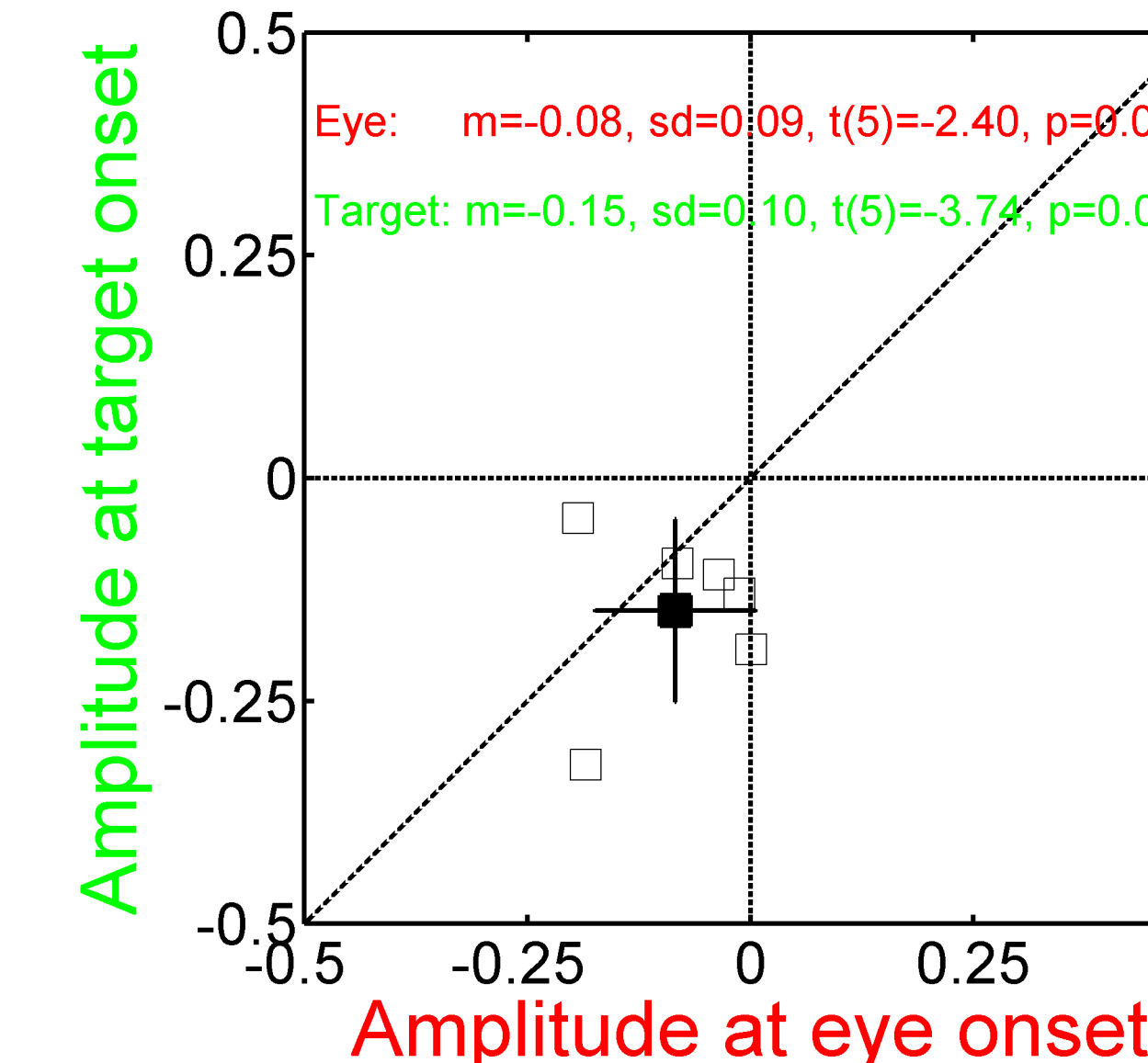
4. Step



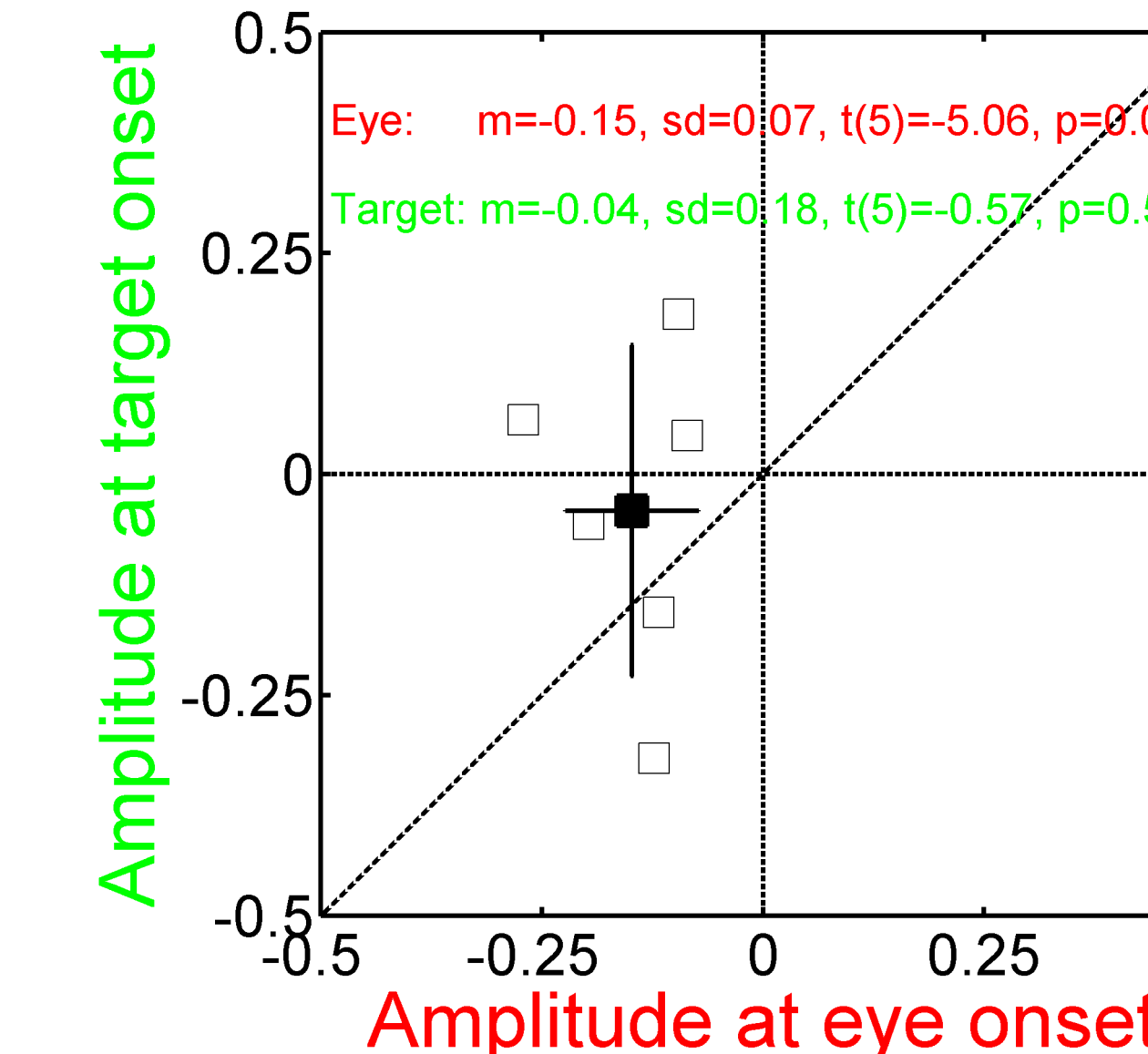
1. Step-Ramp



2. Ramp



3. Fast Ramp



4. Step

