Report on PSO Detection In the Zemblys et al (2017) Paper.

First, let us review key literature on what a PSO is:

At the time of the Nystrom and Holmqvist (2010) [1], report, the events we now call PSOs were called glissades. So, let's see how [1] defines a glissade. Let us start with the first illustration in [1], figure 1.

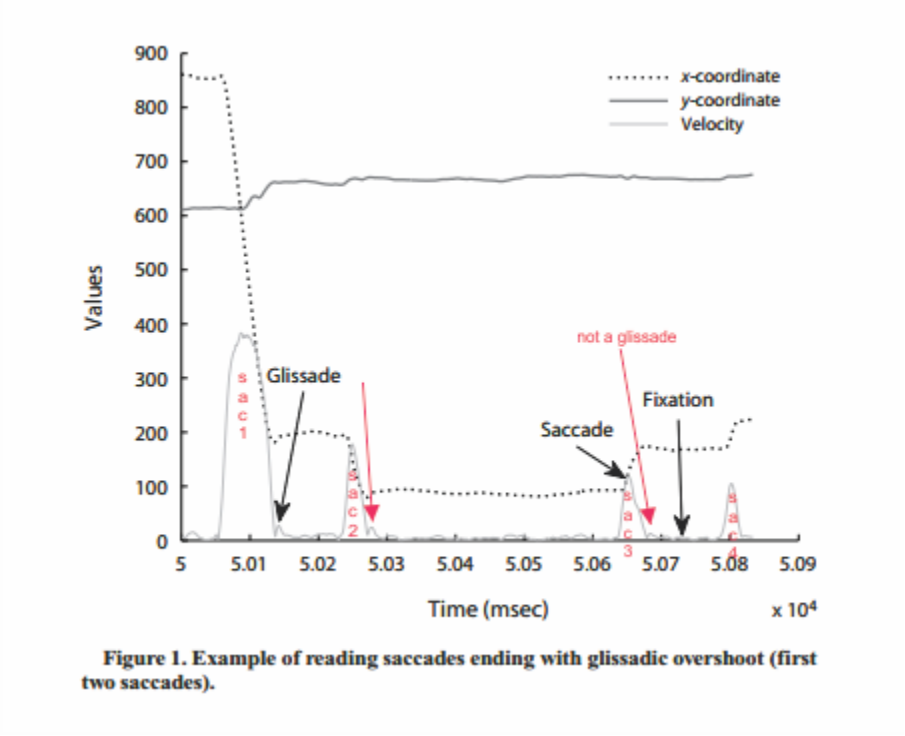


Figure 1. Example of reading saccades ending with glissadic overshoot (first two saccades).

Figure 1: Figure 1 from reference [1]. Our additions are in red. Note that the saccadic oscillations after saccade 1 and 2 meet the definition of glissades, but the much smaller oscillation after the 3rd saccade is not considered a glissade. The only reasonable conclusion is that glissades are small velocity peaks, immediately after saccades, and that to meet criteria, the peaks must be distinctive with respect to the surrounding fixation velocity noise.

Although the figure indicates that only the first post-saccadic event is a glissade, the caption indicates that both the first and second post-saccadic events are glissades.

Now, let's look at figure 9 from [1].

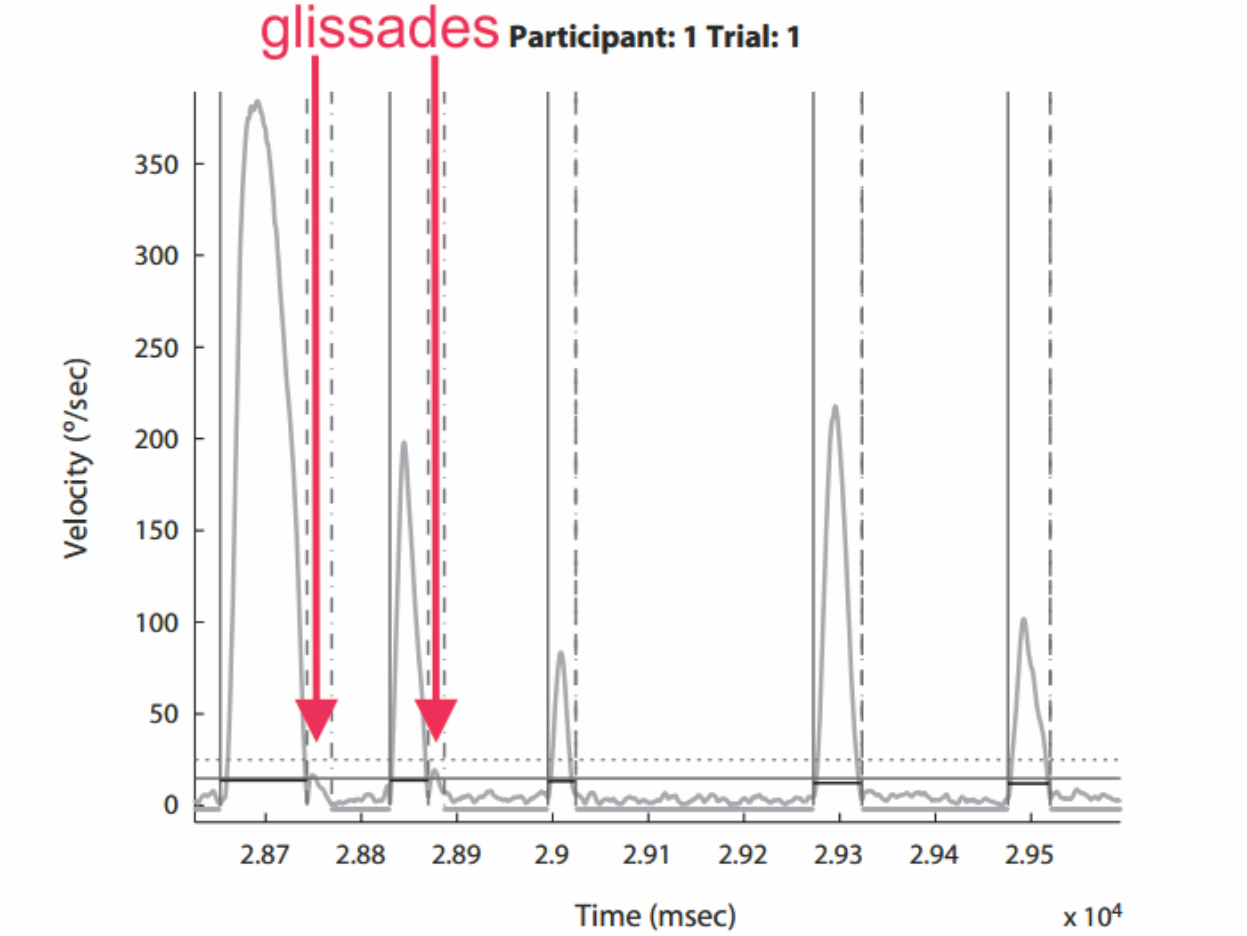


Figure 9. Results for fixation, saccade, and glissade detection of 1 person during reading. Solid, dashed, and dashed-dotted lines mark the saccade onset, saccade offset, and the glissade offset, respectively. Fixations are indicated by the thick lines at the bottom. The black horizontal lines within the saccades represent the saccade onset threshold after it has been adjusted by an estimation of the local noise level. As can been seen, the fixation velocity shown in the figure is lower than the global fixation velocity, since the adaptive threshold is lower than the global, trial-based one.

Figure 2: Figure 9 from [1]. Our additions in red. There are only 2 glissades, marked with rea arrows, in this figure. Note that the small velocity peaks identified as PSOs are nonetheless distinctive when compared to random peaks that appear in nearby fixation velocity noise.

Some have defined PSOs based on their appearance in the position trace. For example, see reference [2]. Here is the left half of figure 2 from that paper:

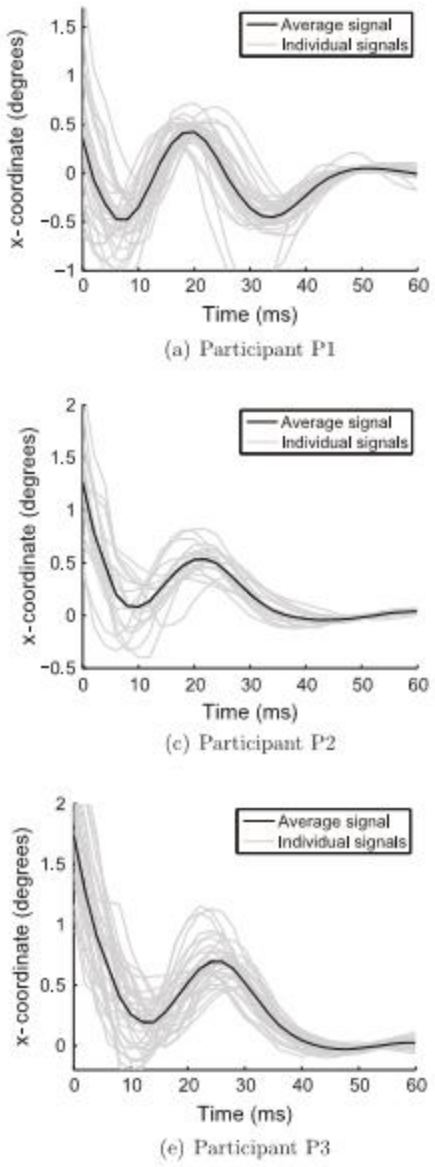
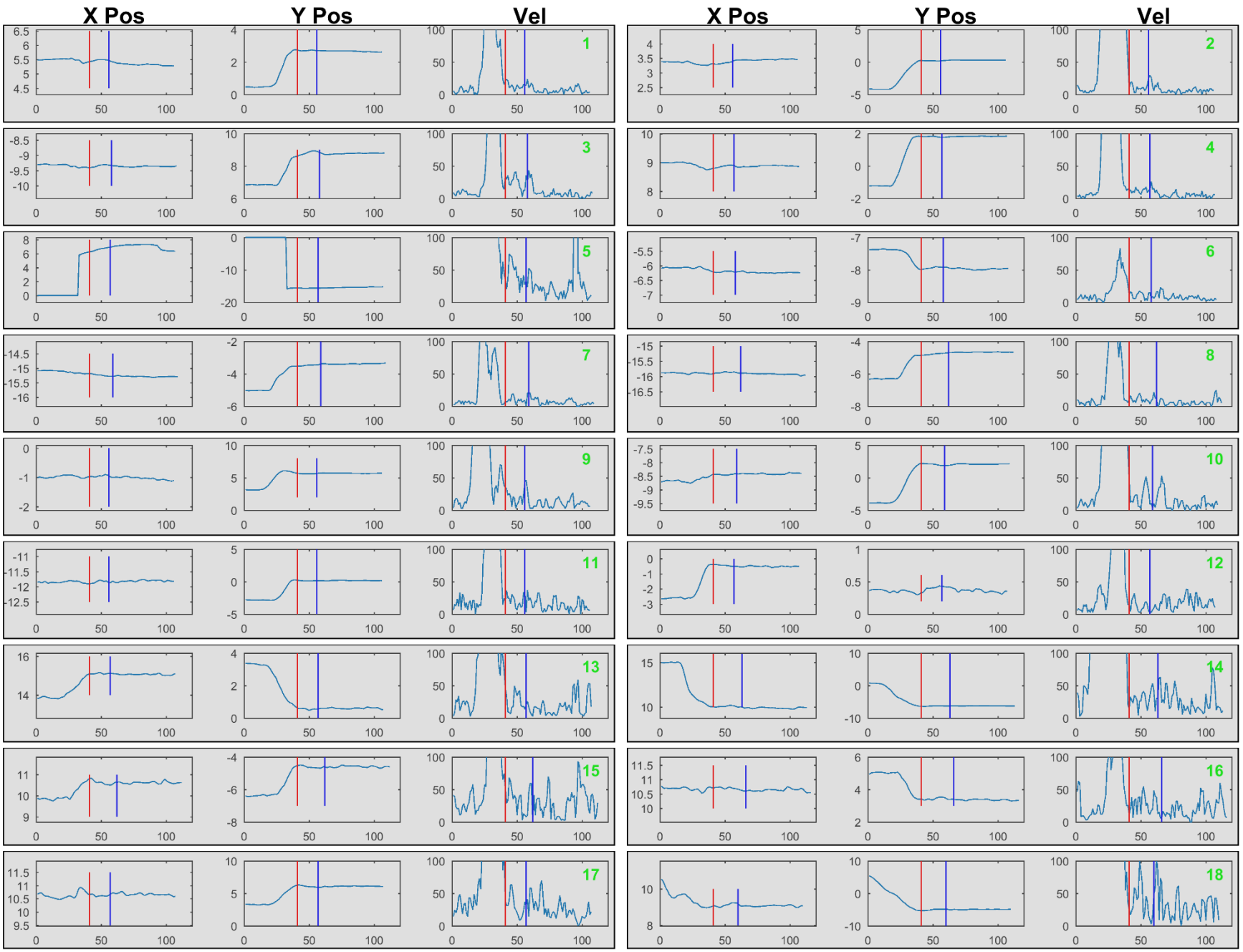


Figure 3: Horizontal position traces and average traces for PSOs for 3 participants. "Starting with the eye-tracker signals, it can clearly be seen that the PSOs are systematic across saccades within each participant; the majority of signals follow the same horizontal path. The oscillations have amplitudes between 0.5 and 1 and last for about 30–40 msec from the peak of the first overshoot until the signal has reached its steady-state value.

Now, let's look at 189 "PSOs" classified by the IRF in the original data set. These "PSO" events all were 15 msec or longer and were were detected based on the fact that the peak velocity during the "PSO" was not greater than the peak velocity during the subsequent 50 msec of fixation. The vertical red line indicates the onset of a PSO and the blue vertical line represents the end of the "PSO". Each gray rectangle is one event. As you look at these "PSOs" classified by the IRF, ask yourselves how similar these events look to the velocity and position profiles noted above. In our view, very few of them look anything like PSOs as defined by Holmqvist and colleagues. If there is a basis for calling these events PSOs, then it is up to Dr. Zemblys to supply it.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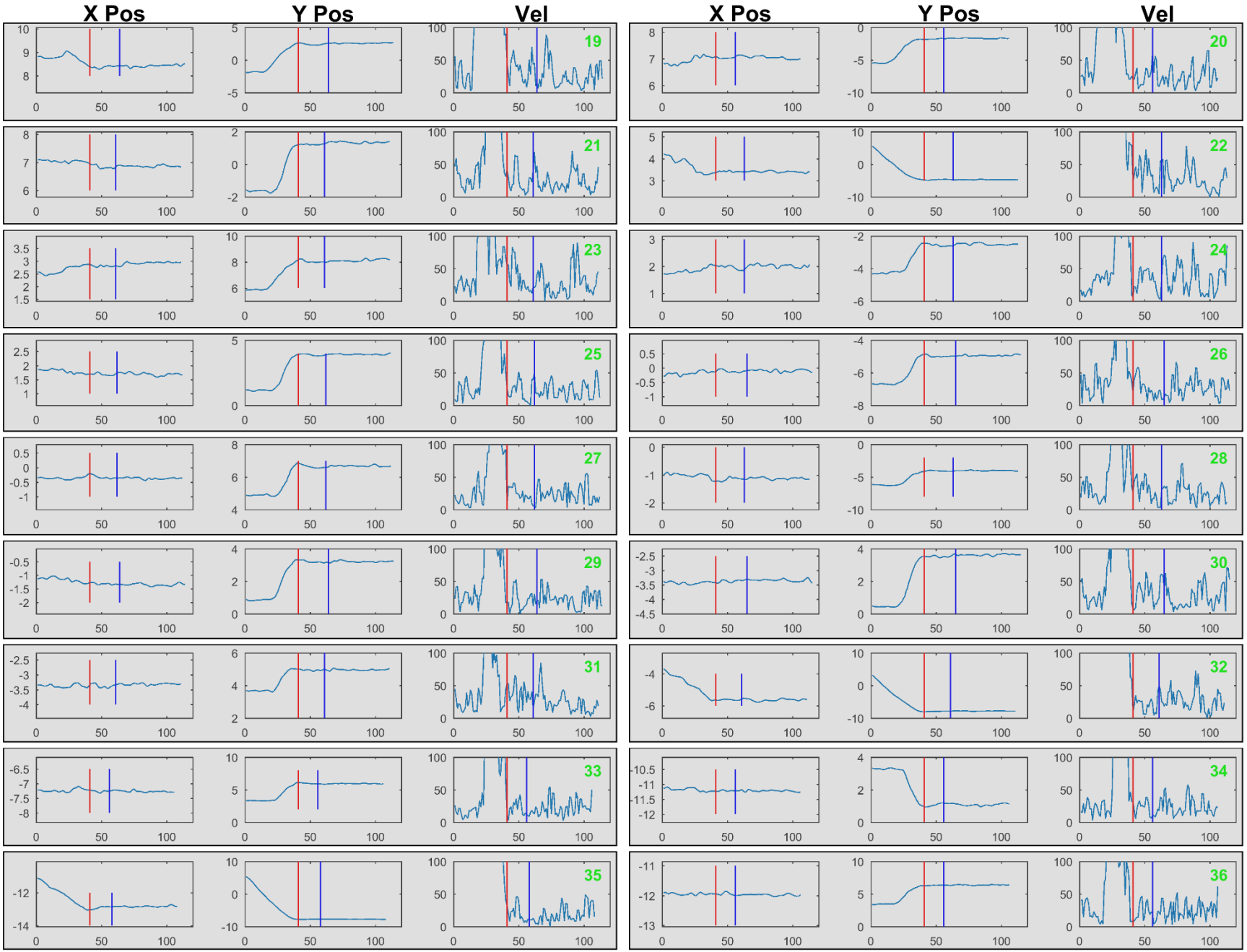
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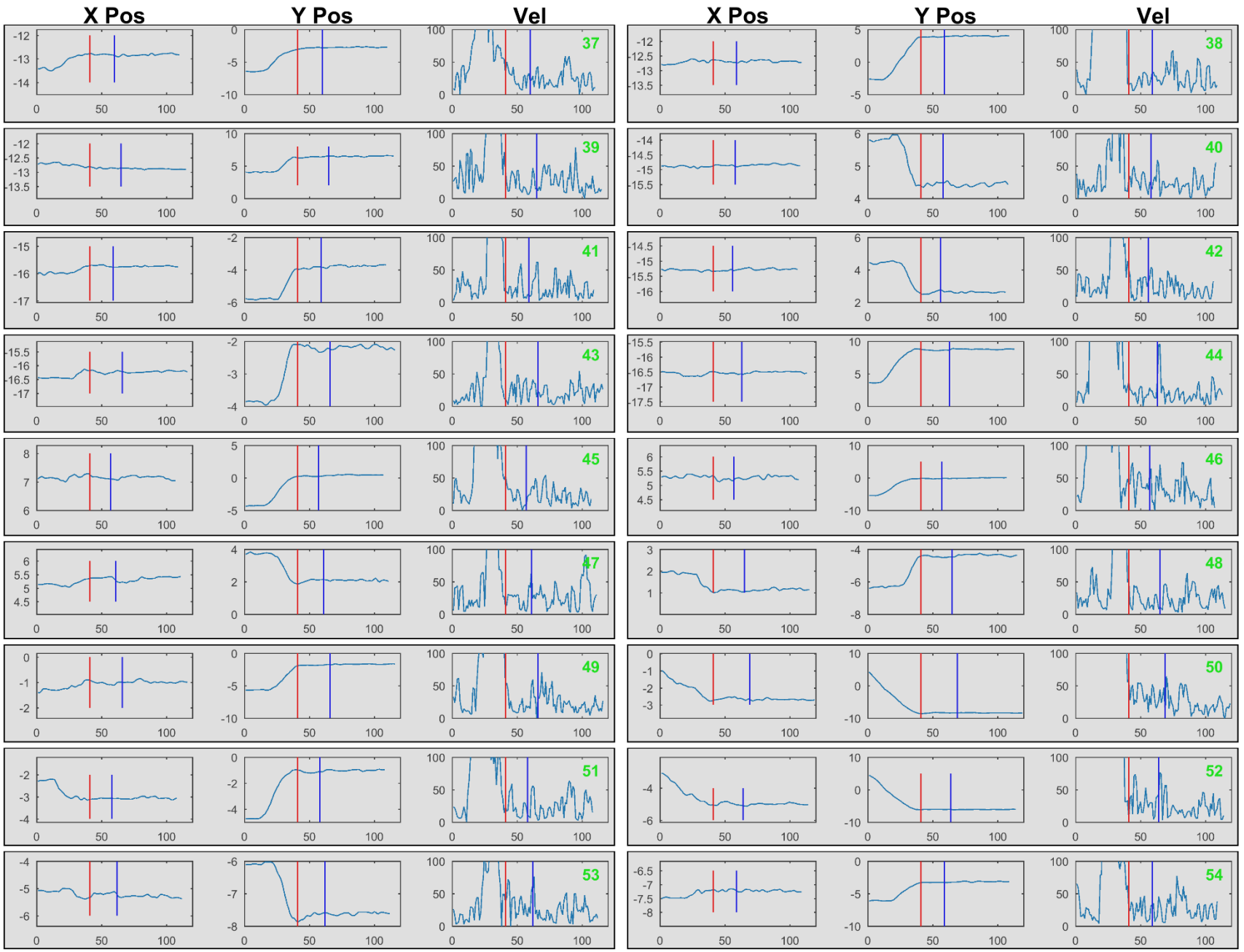
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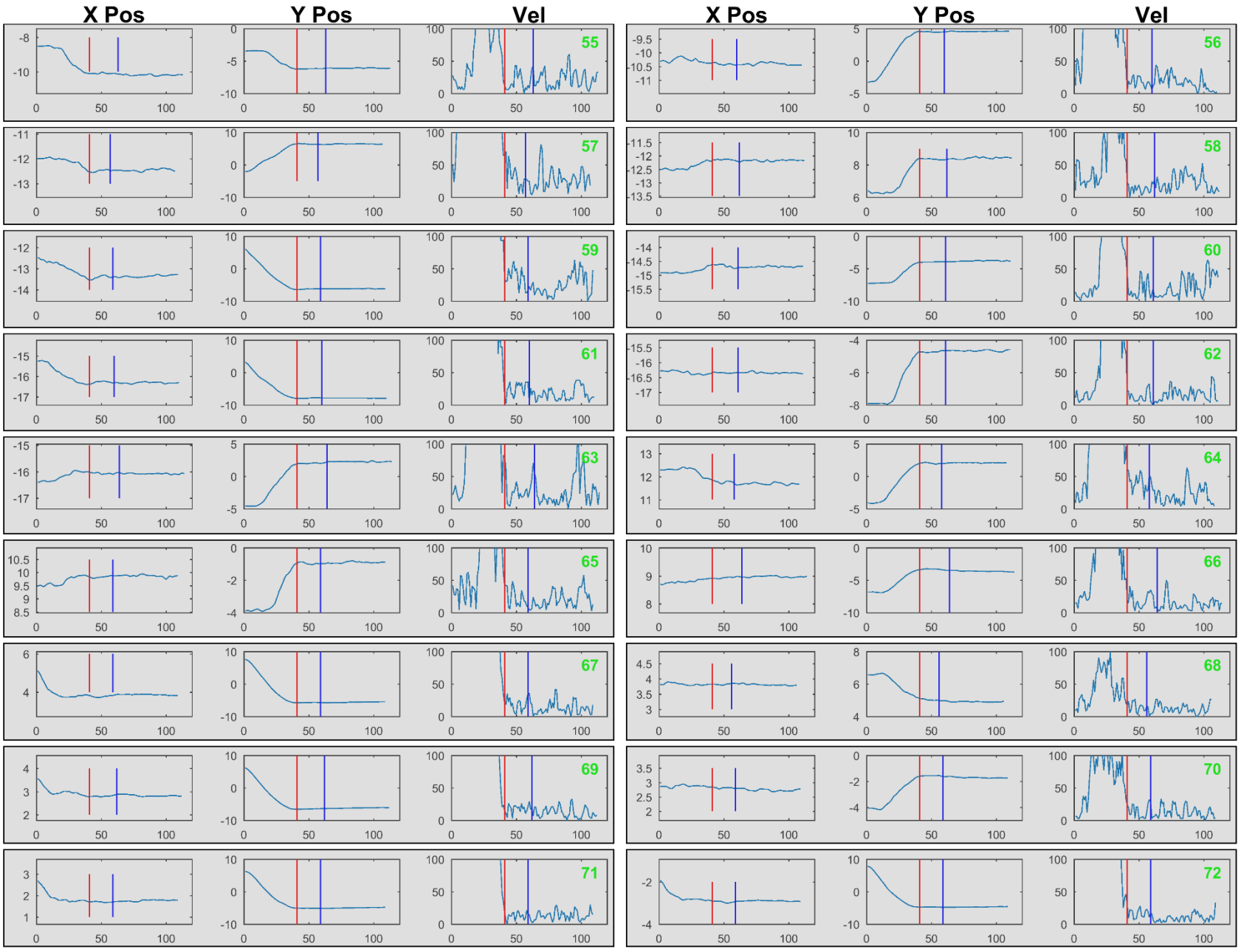
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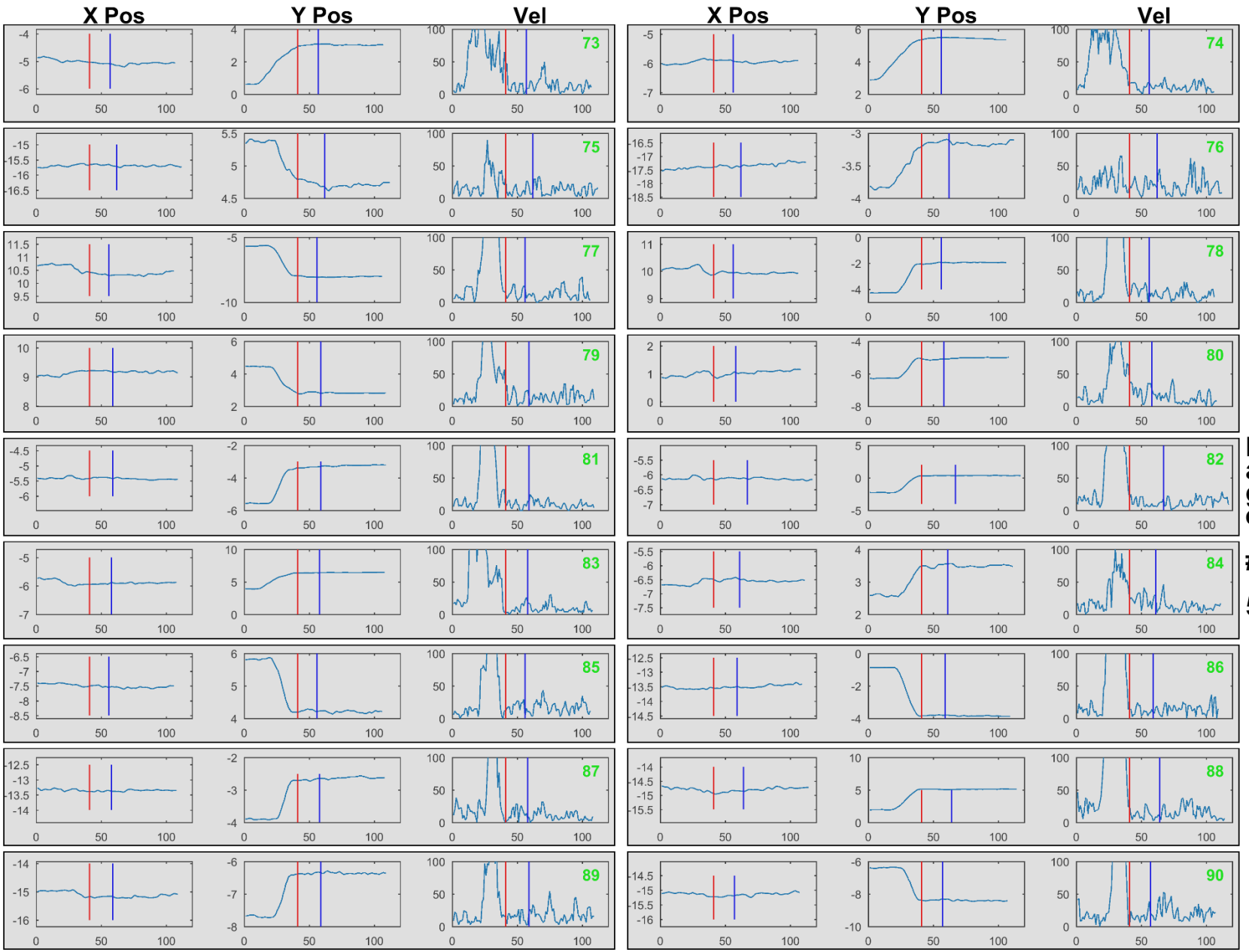
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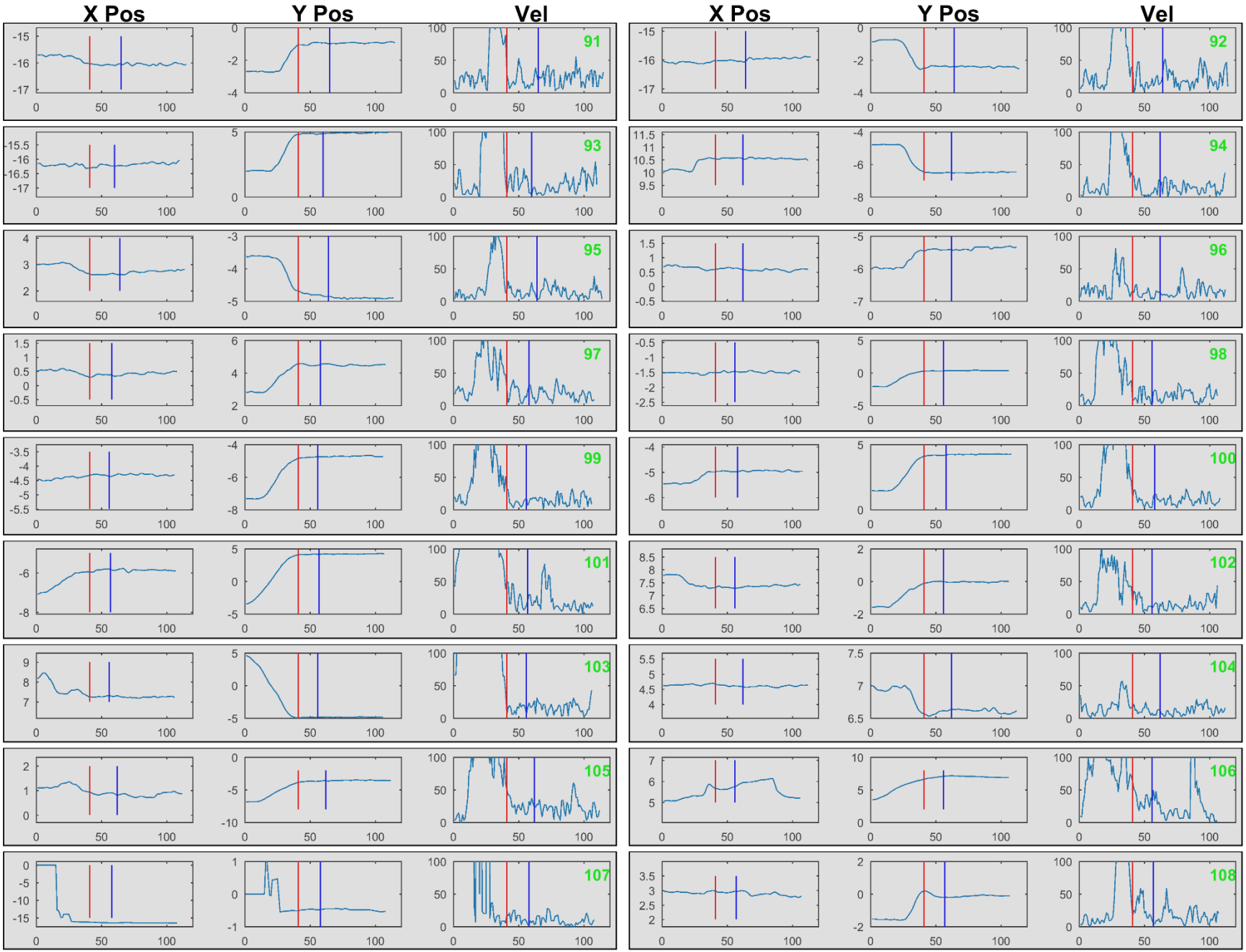
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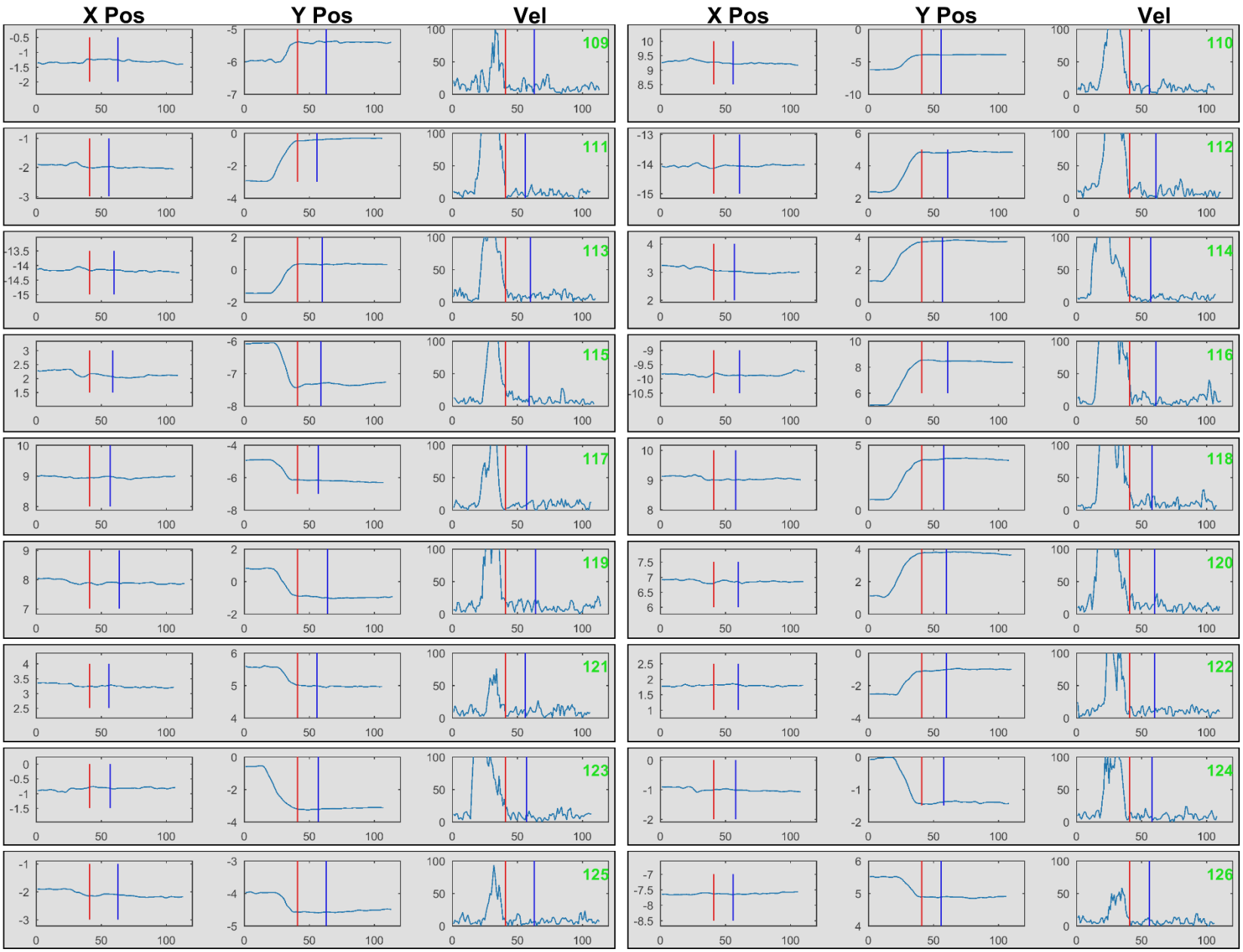
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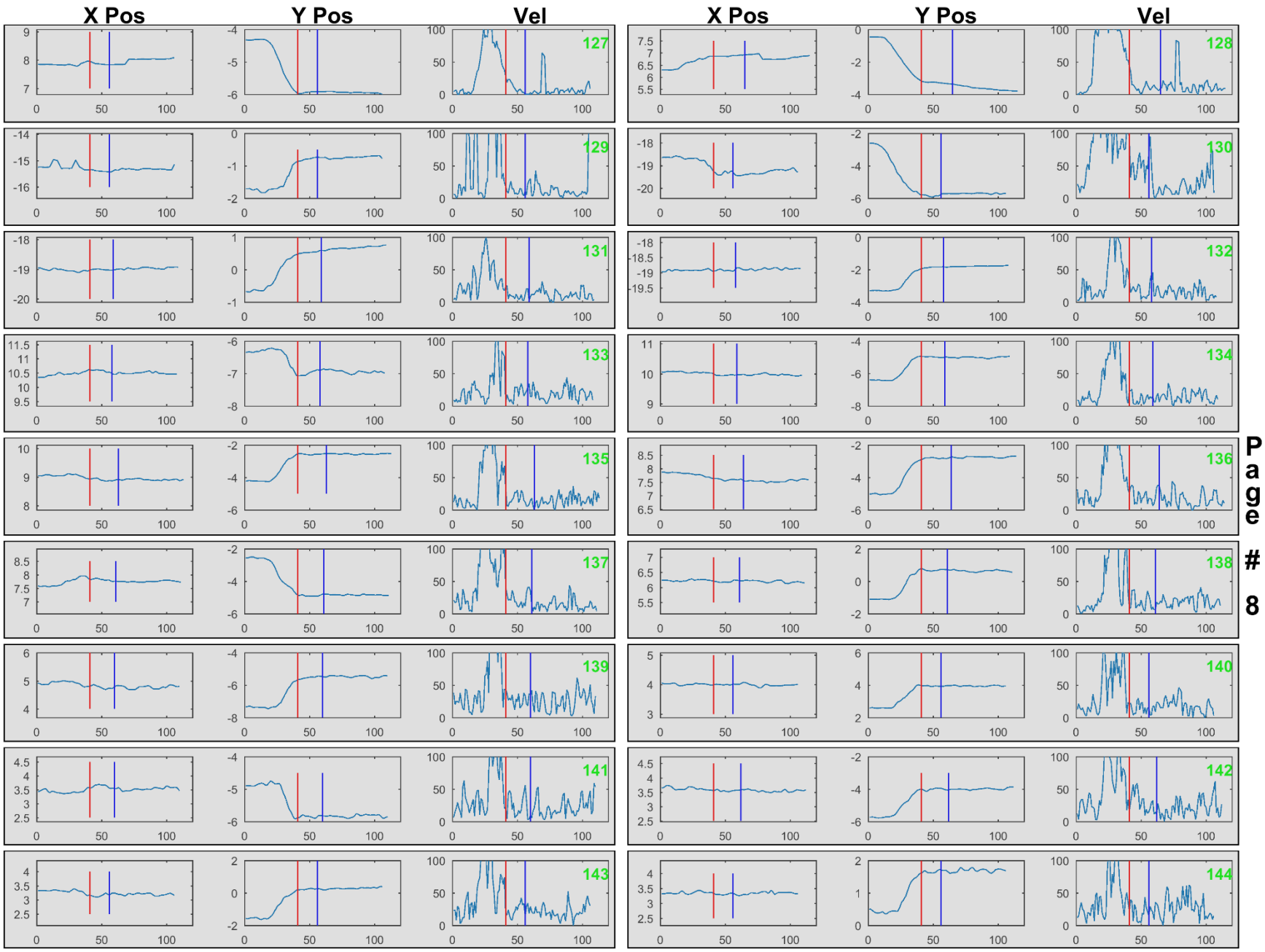
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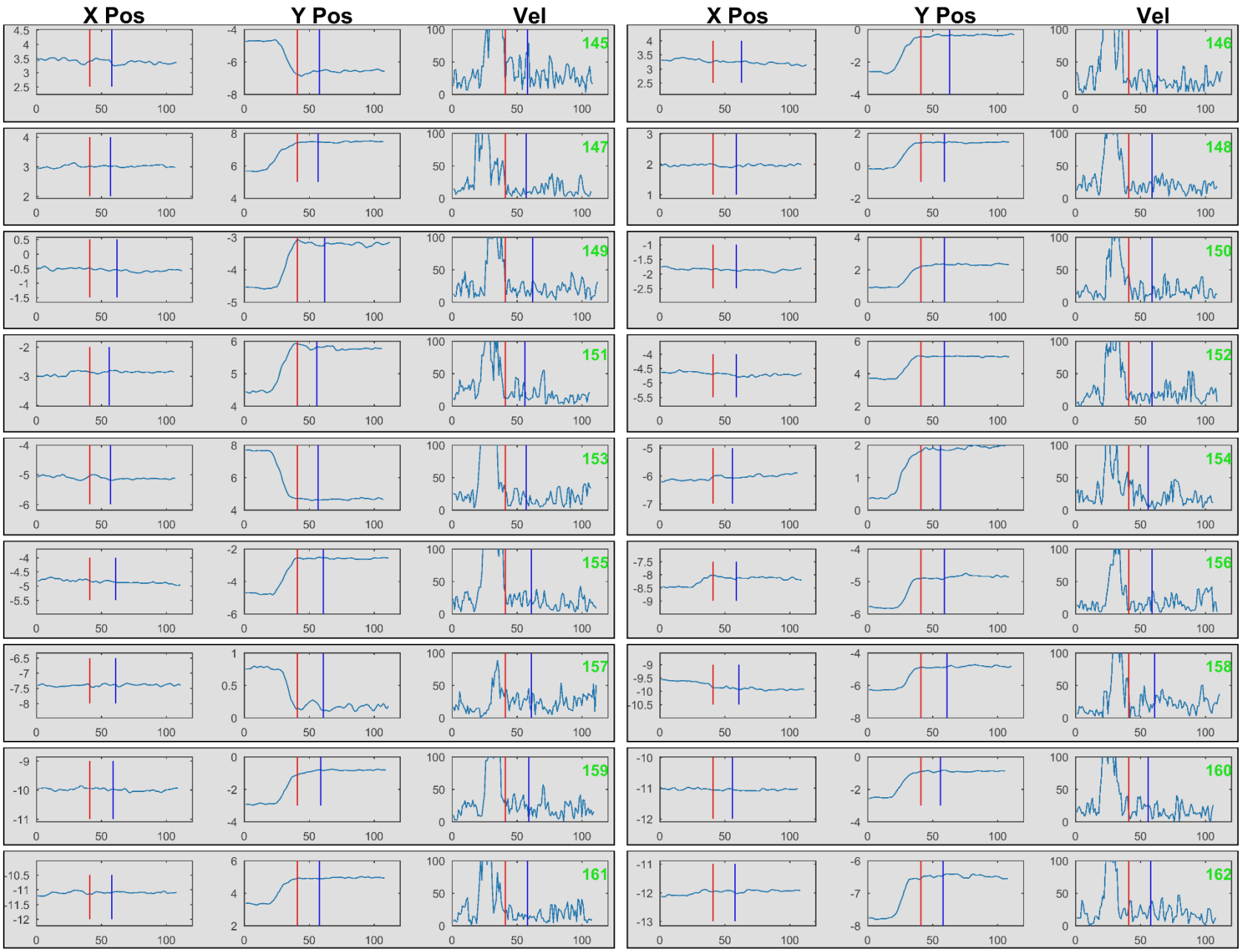
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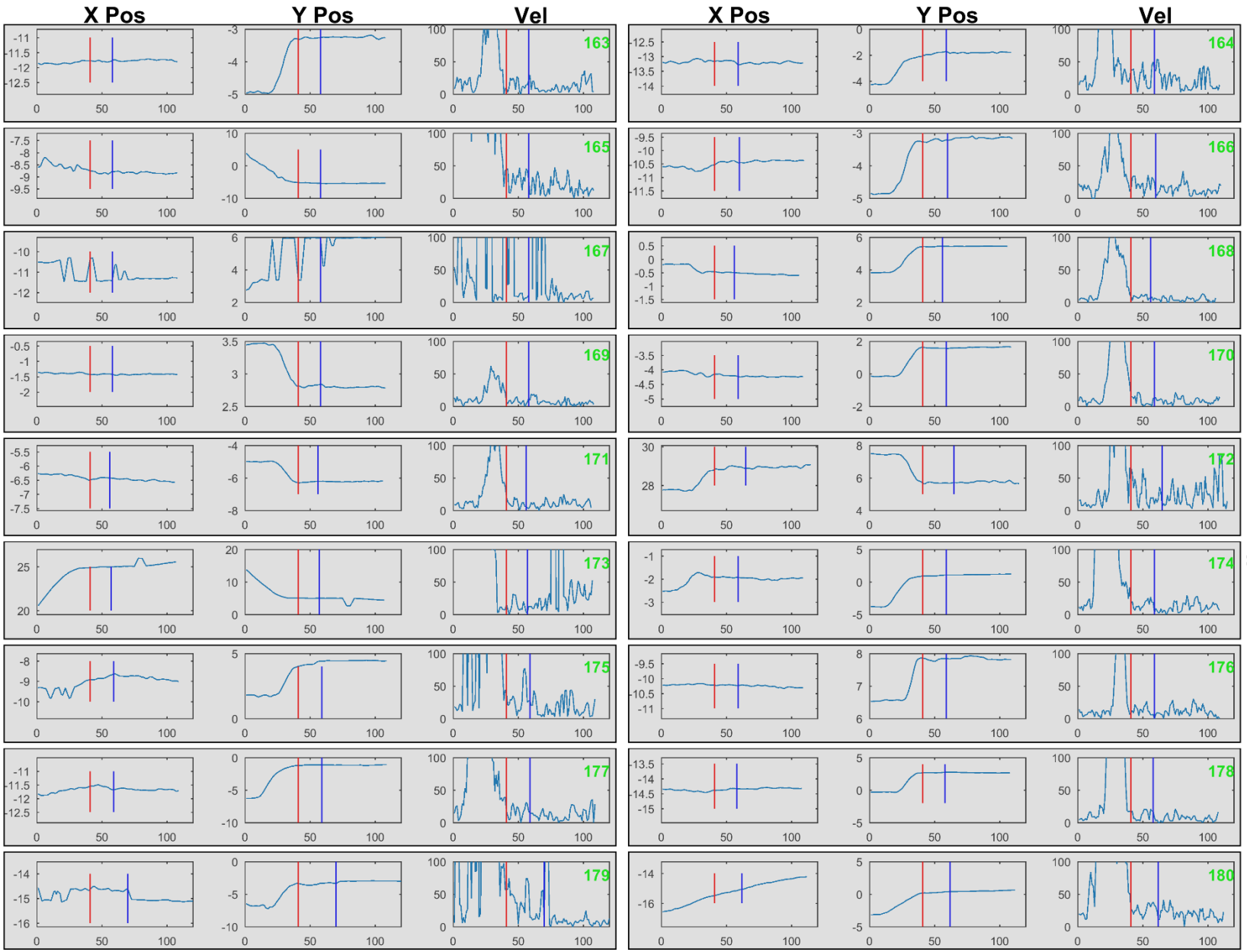
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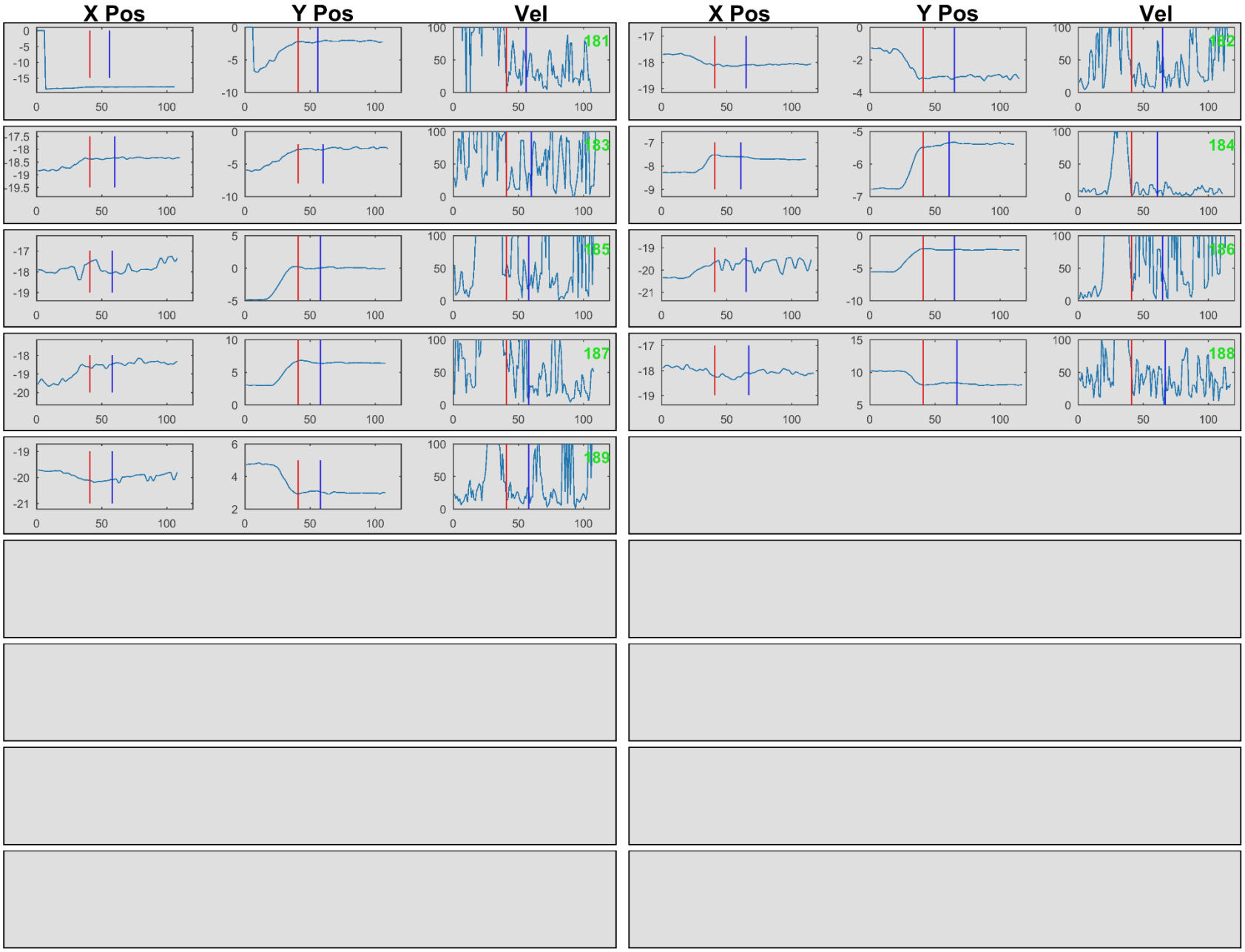
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References

[1] M. Nystrom and K. Holmqvist, "An adaptive algorithm for fixation, saccade, and glissade detection in eyetracking data," *Behav Res Methods,* vol. 42, pp. 188-204, Feb 2010.

[2] M. Nystrom, I. Hooge, and K. Holmqvist, "Post-saccadic oscillations in eye movement data recorded with pupil-based eye trackers reflect motion of the pupil inside the iris," *Vision Res,* vol. 92, pp. 59-66, Nov 2013.