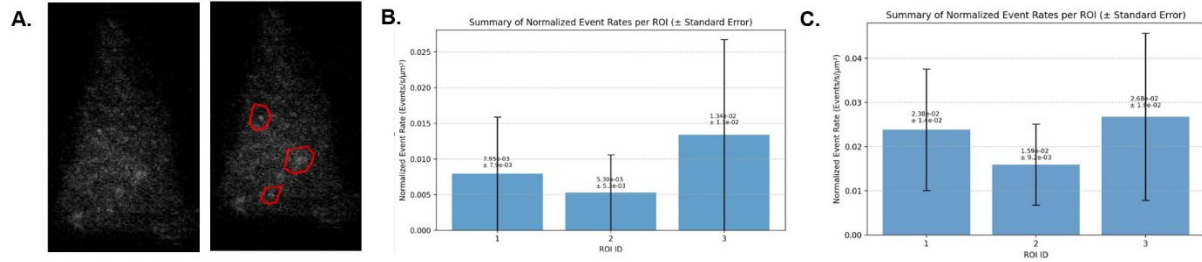


**Fig S1.** Adaptive parameter estimation is critical for robust detection of synaptic vesicle fusion events.



*Note.* (A) Representative maximum intensity projection of the time-lapse recording showing three manually selected Regions of Interest (ROIs 1–3). (B) Representative Bar charts shows normalized event rates (Events  $s^{-1} \mu m^{-2}$ ) for each ROI, with data expressed as mean  $\pm$  SEM manually enabled Threshold, Difference of Gaussians (DoG), and Scission-like detectors but without automated parameter estimation. (C) Bar charts represent normalized event rates (Events  $s^{-1} \mu m^{-2}$ ) for each ROI, with data expressed as mean  $\pm$  SEM with Auto-set parameters enabled.