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SHORT REPORT

Figures and figure supplements

State-dependent cell-type-specific membrane potential dynamics and unitary synaptic inputs in awake mice

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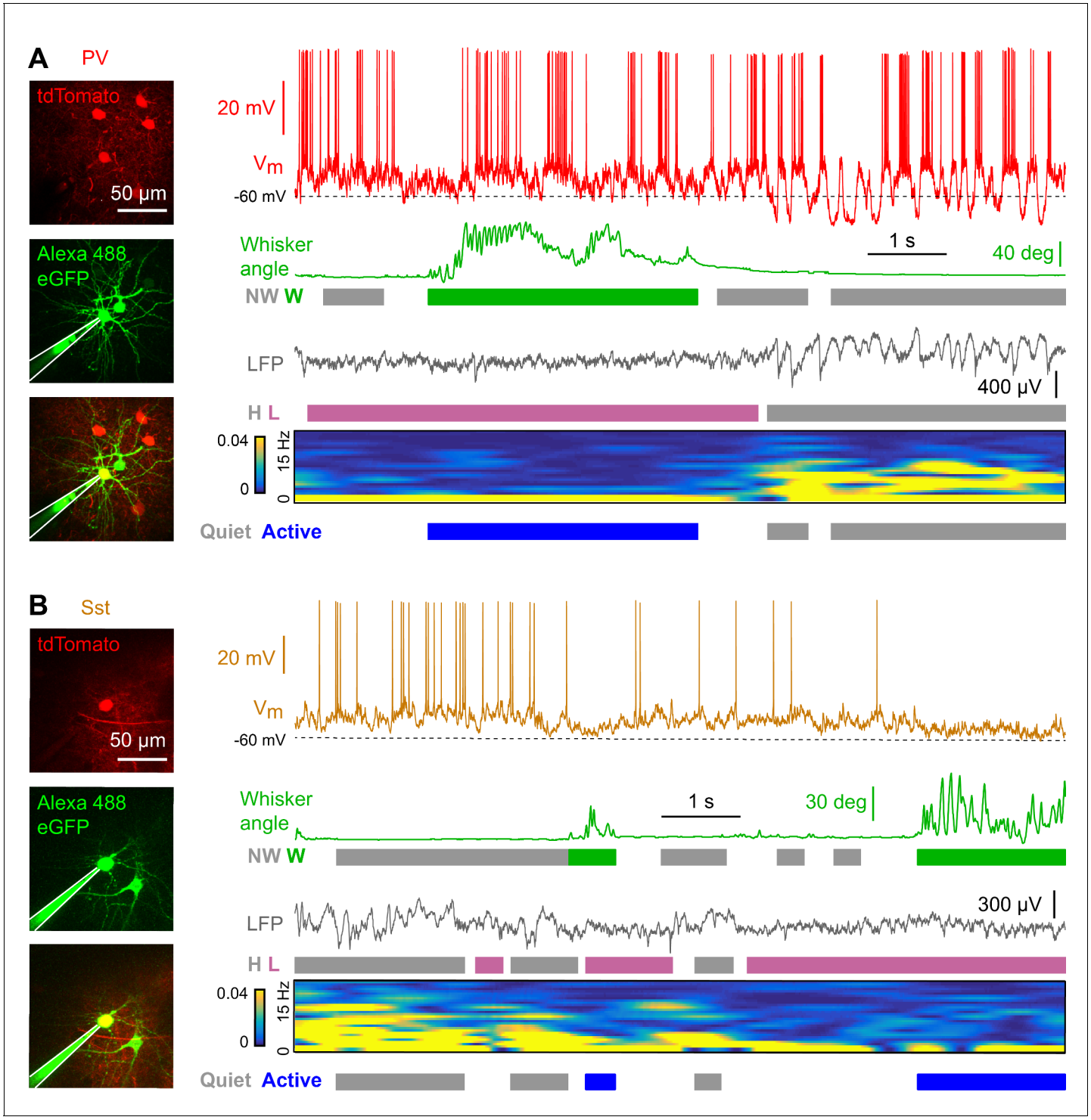

Figure 1. Membrane potential recordings of PV- and Sst-expressing GABAergic neurons in layer 2/3 of the awake mouse barrel cortex with simultaneous measurement of whisker position and local field potential. (**A**) Example recording of a PV-expressing neuron. From top to bottom: Membrane potential (V_m), whisker angle, local field potential (LFP), normalized LFP FFT power. Green/grey boxes represent Whisking/Not-Whisking states, pink/grey color boxes represent Low/High 1–5 Hz LFP power states, and blue/grey boxes represent Active/Quiet states. (**B**) Same as in panel A, but for a Sst-expressing neuron.

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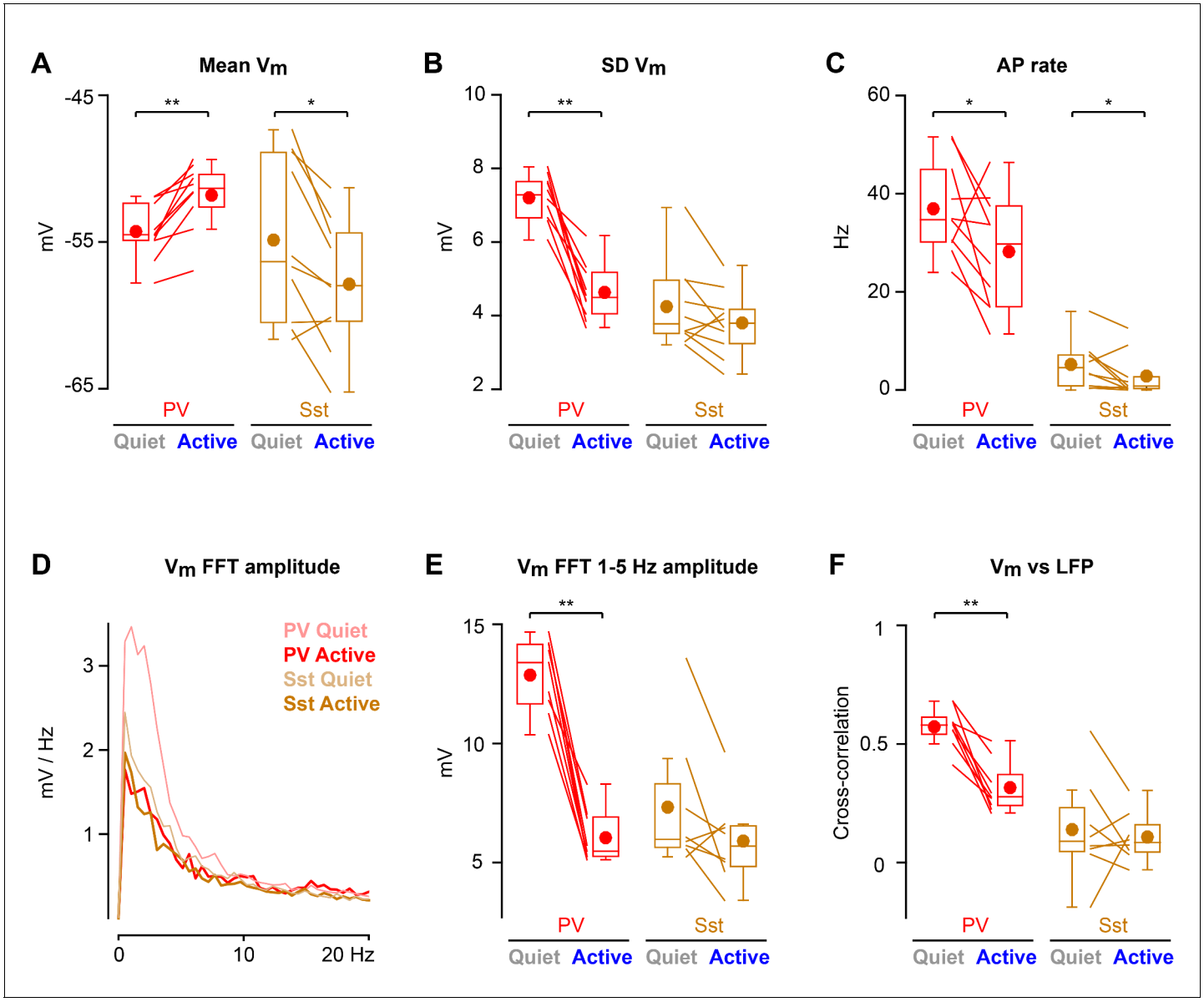

Figure 2. State-dependent modulation of membrane potential dynamics in PV and Sst neurons. (**A**) Mean membrane potential (V_m). (**B**) Standard deviation (SD) of V_m. (**C**) Spontaneous action potential (AP) rate. (**D**) V_m FFT amplitude spectrum. (**E**) V_m FFT amplitude in the 1–5 Hz frequency band. (**F**) Peak cross-correlation between V_m and LFP. Two-tailed Wilcoxon signed-rank test assessed statistical significance, with ** indicating $p<0.01$ and * indicating $p<0.05$.

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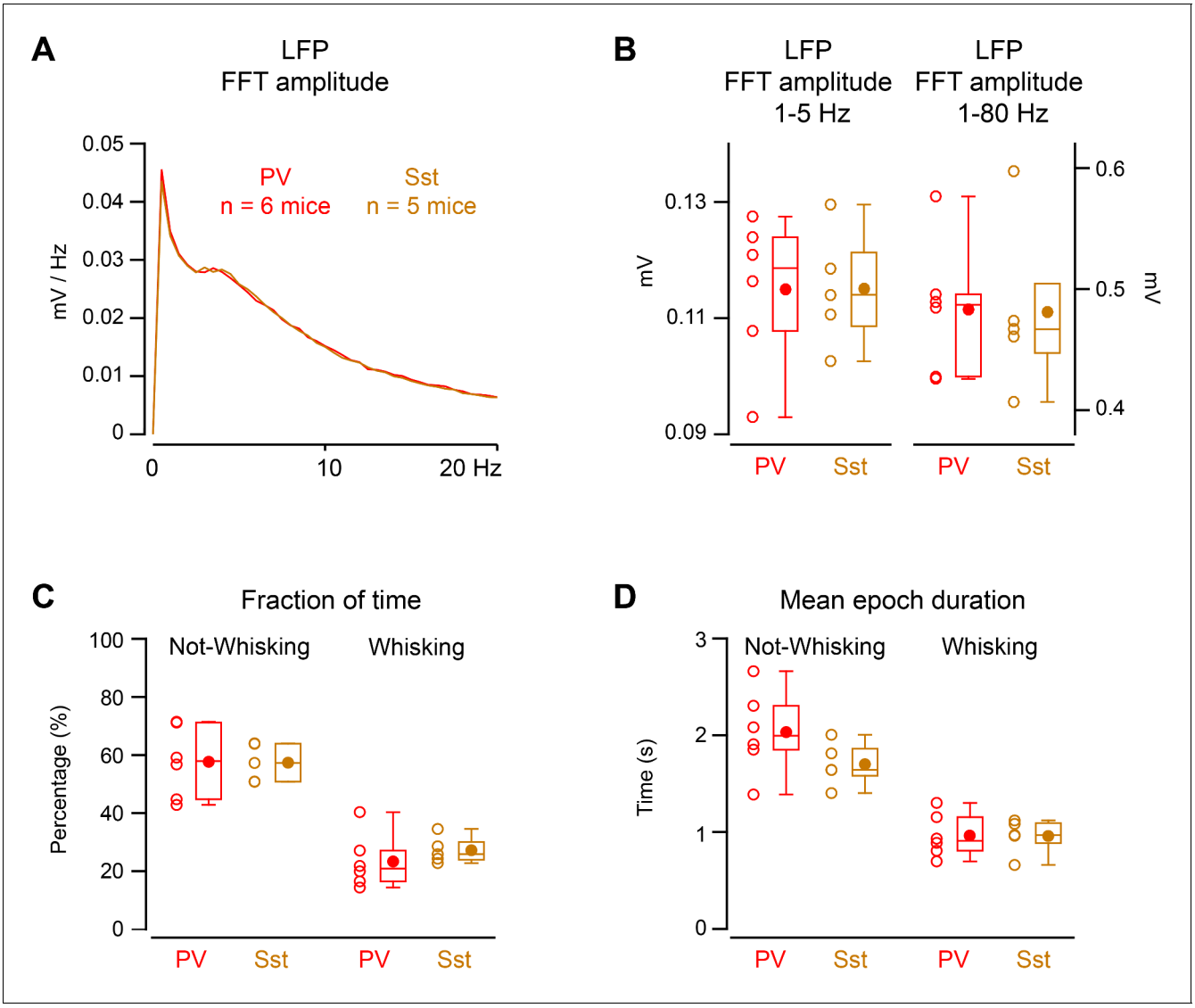

Figure 2—figure supplement 1. LFP dynamics and whisking behavior are similar in PV-Cre x LSL-tdTomato and Sst-Cre x LSL-tdTomato. (**A**) LFP FFT amplitude spectrum. (**B**) LFP FFT amplitude in the 1–5 Hz and 1–80 Hz frequency bands. (**C**) Fraction of time spent in Not-Whisking and Whisking states. (**D**) Mean duration of Not-Whisking and Whisking epochs. Two-tailed Wilcoxon rank-sum test assessed for statistical significance and none was found.

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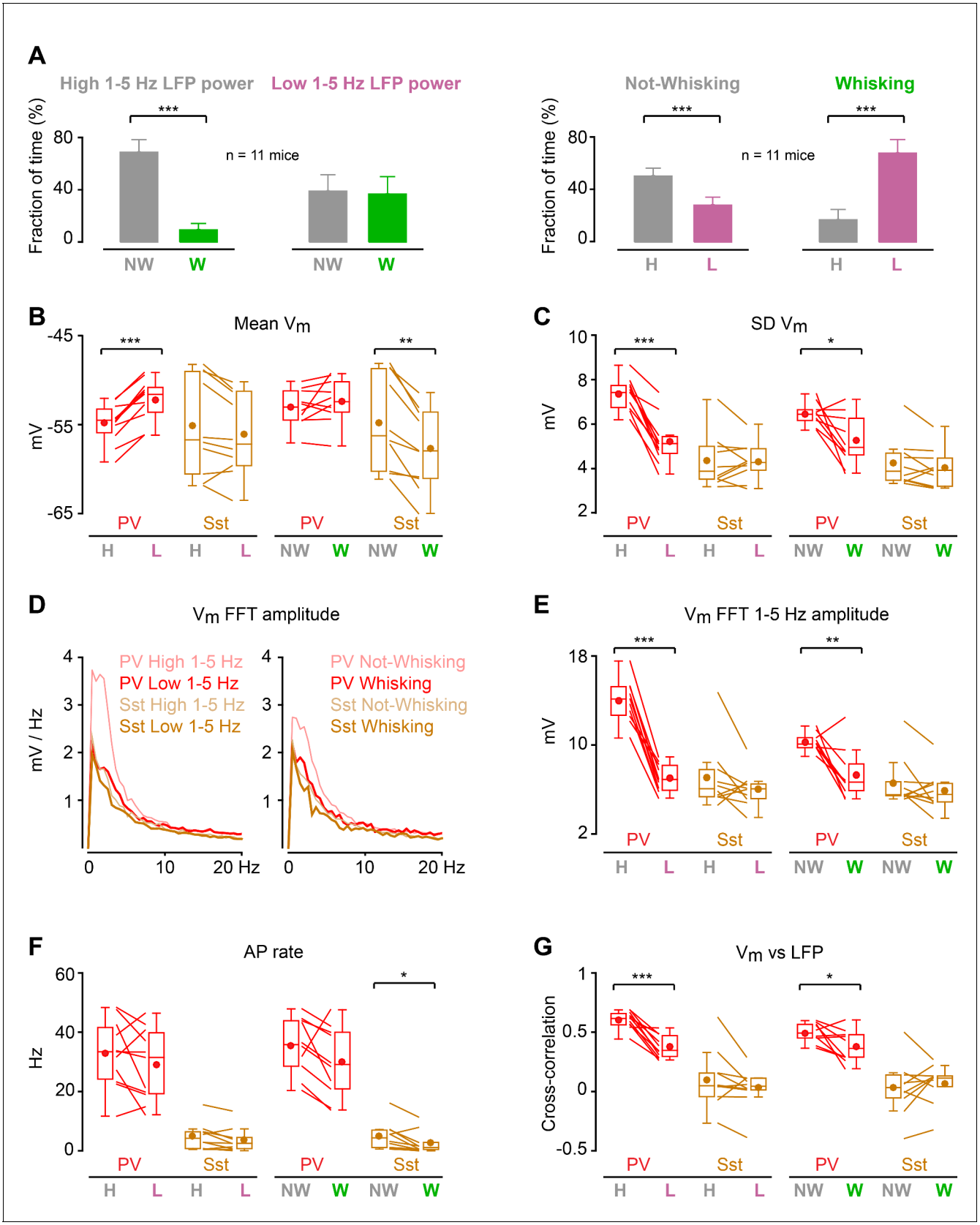

Figure 2—figure supplement 2. Differential modulation of membrane potential dynamics in PV and Sst neurons by cortical state and whisking behavior. (**A**) Fraction of time spent in Low 1–5 Hz LFP power (**L**), High 1–5 Hz LFP power (**H**), Whisking (**W**) and Not-Whisking (NW) states. (**B**) Mean

Figure 2—figure supplement 2 continued on next page

Figure 2—figure supplement 2 continued

membrane potential (V_m). (**C**) Standard deviation (SD) of V_m. (**D**) V_m FFT amplitude spectrum. (**E**) V_m FFT amplitude in the 1–5 Hz frequency band. (**F**) Spontaneous AP rate. (**G**) Peak cross-correlation between V_m and LFP. H: High 1–5 Hz LFP power, L: Low 1–5 Hz LFP power, NW: Not-Whisking, W: Whisking. Two-tailed Wilcoxon signed-rank test assessed statistical significance, with *** indicating $p<0.001$, ** indicating $p<0.01$ and * indicating $p<0.05$.

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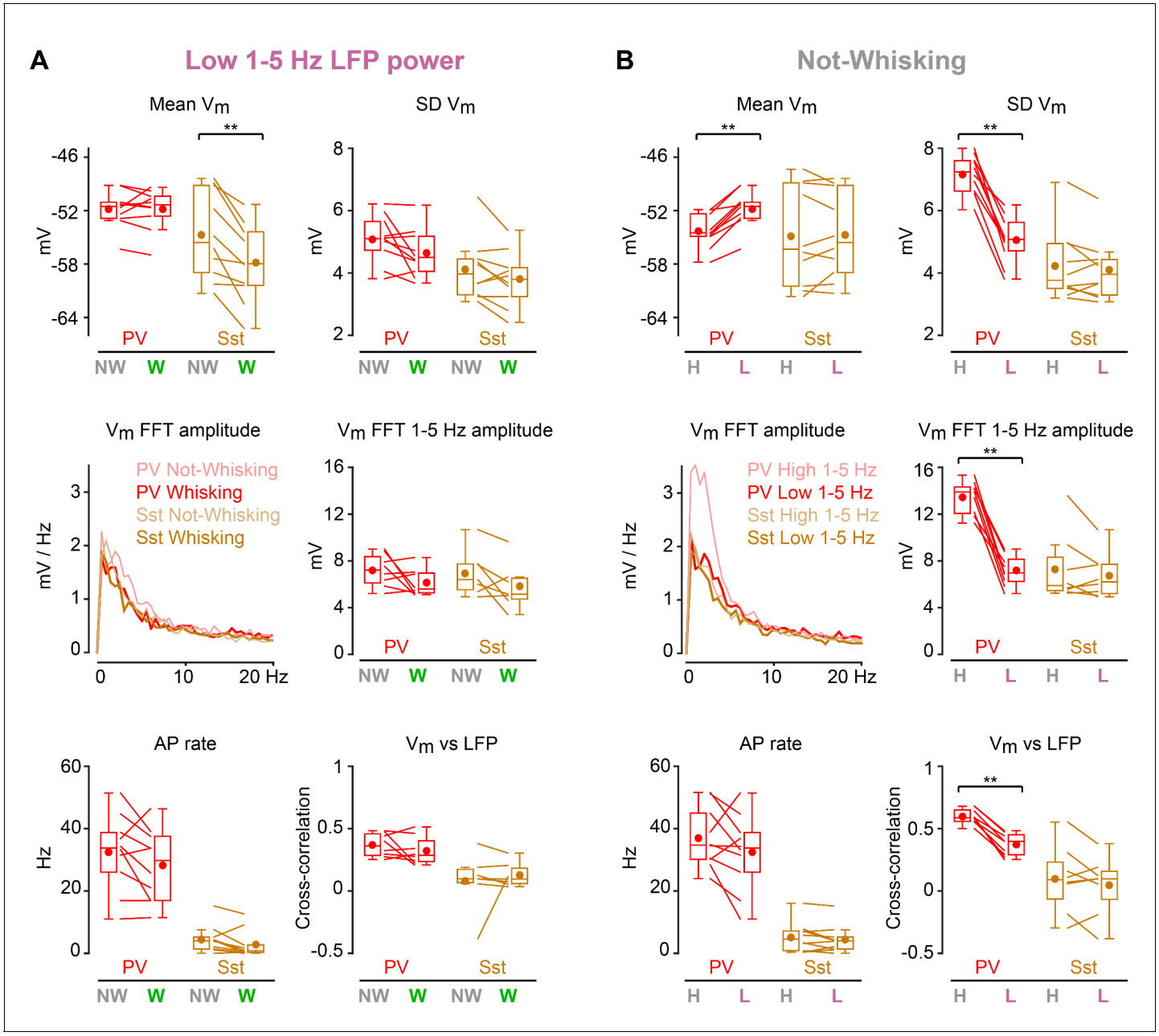

Figure 2—figure supplement 3. Membrane potential dynamics of PV neurons apear to be more strongly modulated by cortical state, whereas Sst neurons appear to be more strongly modulated by whisking behavior. (**A**) Mean V_m; Standard deviation (SD) of V_m; V_m FFT amplitude spectrum; V_m FFT amplitude in the 1–5 Hz frequency band; Spontaneous AP rate; and Peak cross-correlation between V_m and LFP. Comparison between Not-Whisking and Whisking epochs occurring during Low 1–5 Hz LFP power. (**B**) Same as panel A, but comparing epochs of High and Low 1–5 Hz LFP power occurring during Not-Whisking periods. NW: Not-Whisking, W: Whisking, H: High 1–5 Hz LFP power, L: Low 1–5 Hz LFP power. Two-tailed Wilcoxon signed-rank test assessed statistical significance, with ** indicating p<0.01.

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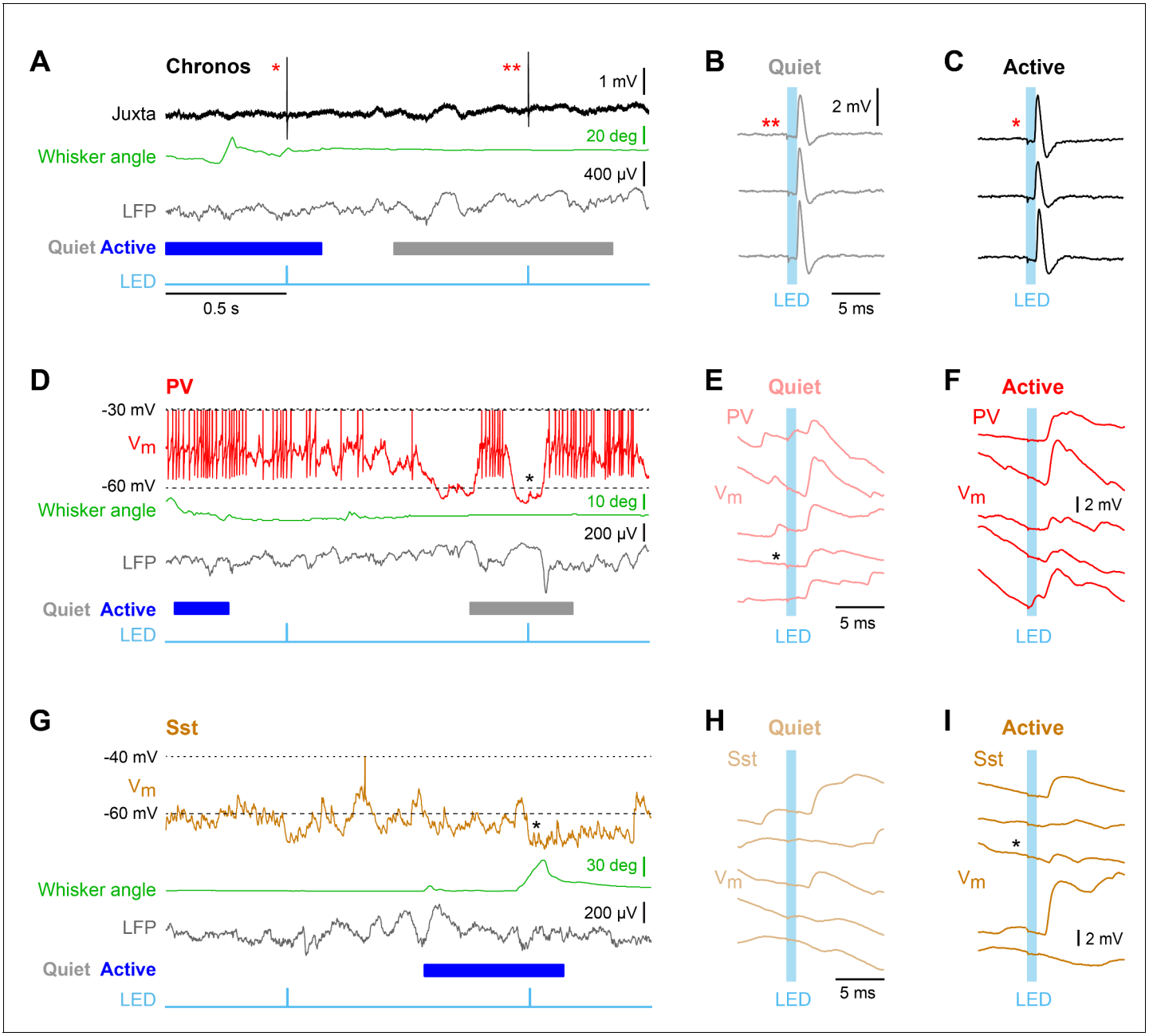

Figure 3. Unitary excitatory postsynaptic potentials in PV and Sst neurons in layer 2/3 of the awake mouse barrel cortex measured together with whisker position and local field potential. (**A**) Example juxtacellular recording of a presynaptic *Chronos*-expressing neuron. From top to bottom: Extracellular signal (Juxta), whisker angle, LFP, and light stimulus (LED). Blue/grey color boxes represent Active and Quiet states. (**B and C**) Time-locked individual APs evoked by a 1 ms LED stimulus during Quiet and Active states. (**D**) Example whole-cell recording from a PV neuron together with whisker angle, LFP and LED stimulus. (**E and F**) Individual uEPSP responses to 1 ms optogenetic stimuli during Quiet and Active states. (**G–I**) Same as panels D-F, but for a Sst neuron.

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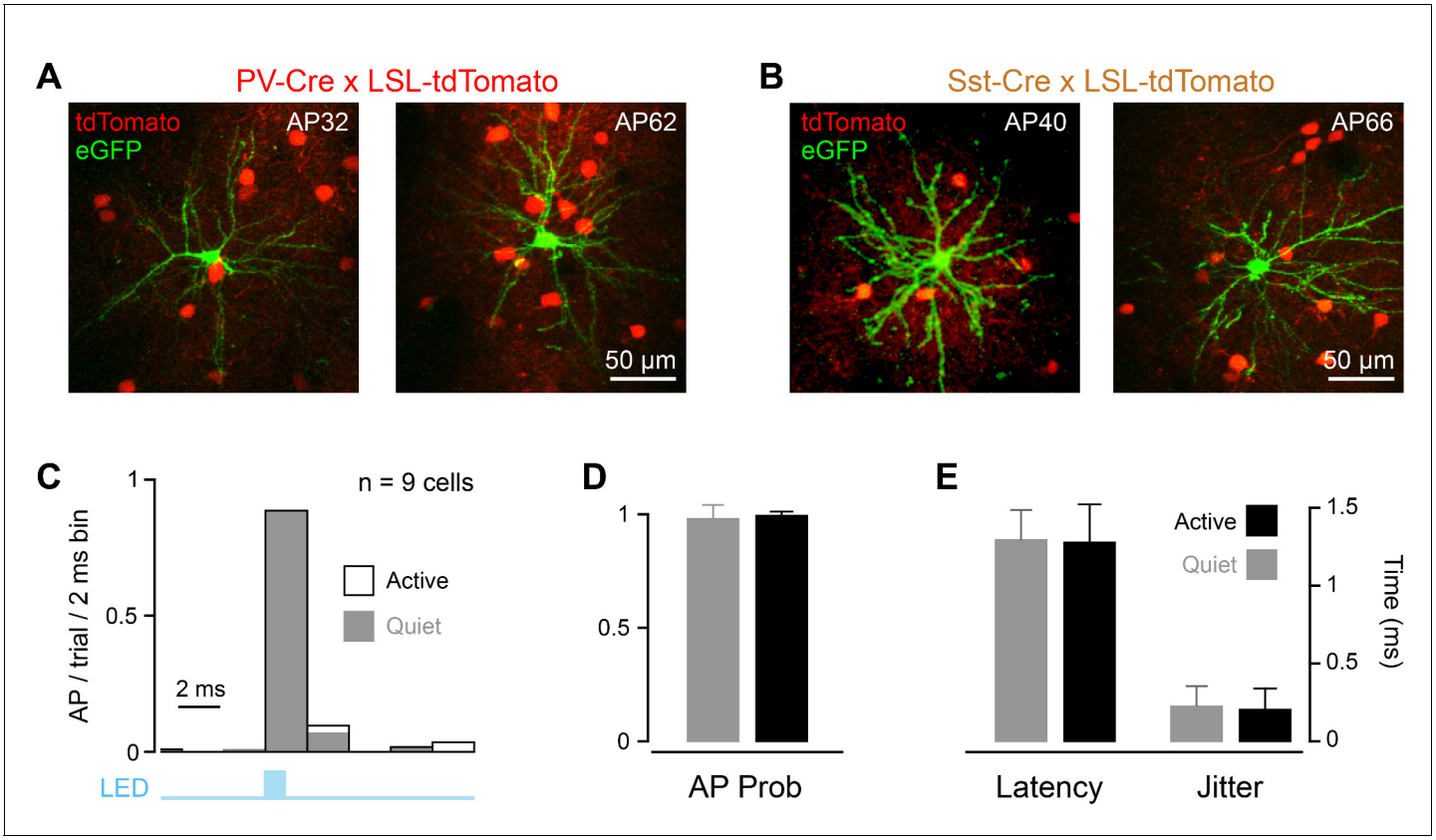

Figure 3—figure supplement 1. Precisely-evoked single action potentials in excitatory neurons expressing *Chronos*. (**A**) Example single excitatory neurons expressing *Chronos*-eGFP in PV-Cre x LSL-tdTomato mice 24 hr post electroporation. (**B**) Same as in panel A, but in Sst-Cre x LSL-tdTomato mice. (**C**) PSTH of AP peak time in *Chronos*-expressing excitatory neurons during Quiet and Active states. (**D**) Reliable evoked single APs during Quiet and Active states. (**E**) Comparable short latency and small jitter of light-evoked APs across Quiet and Active states. Two-tailed Wilcoxon signed-rank test assessed statistical significance, and none was found.

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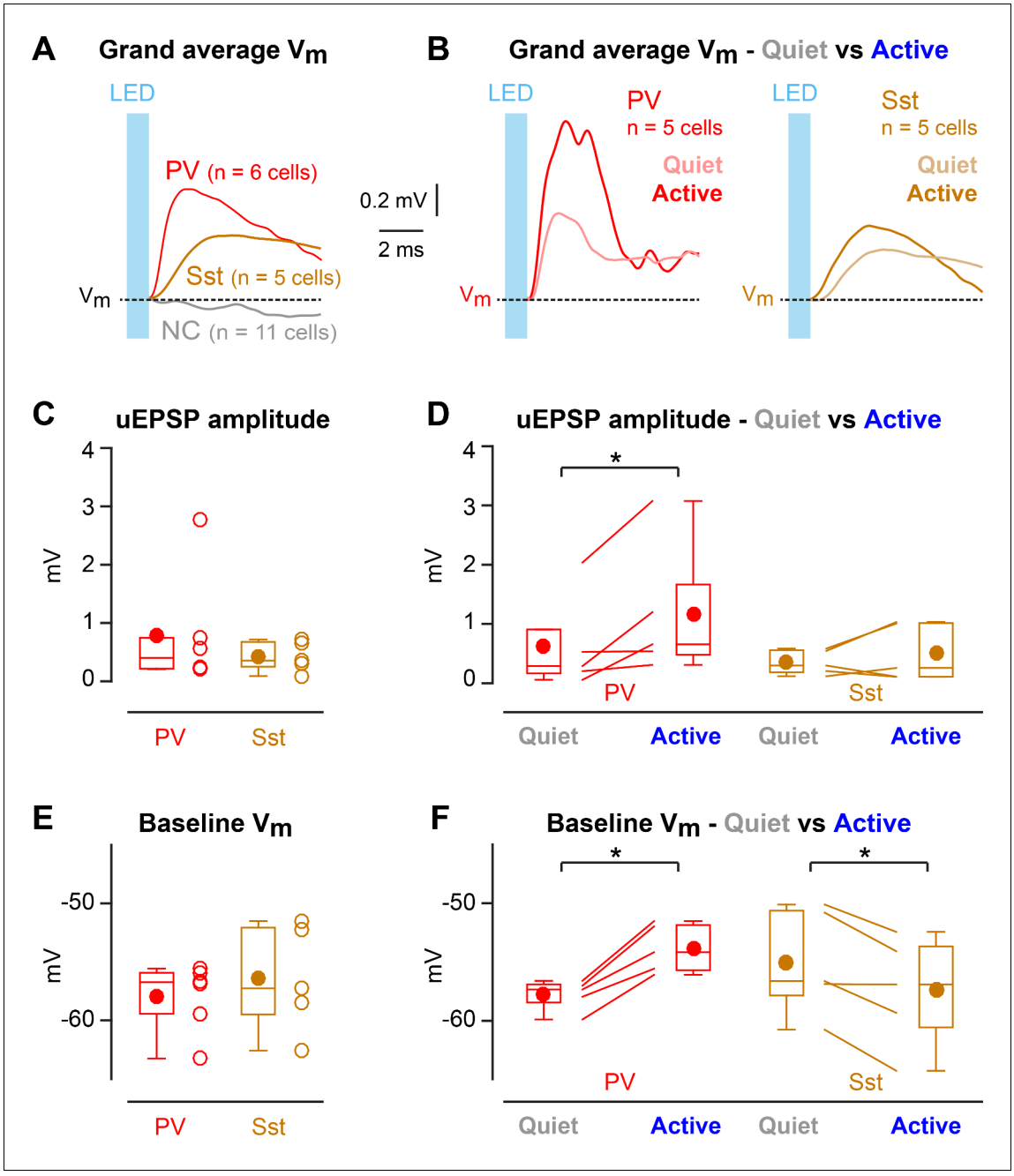

Figure 4. State-dependent modulation of excitatory synaptic input in PV neurons. (**A**) Mean optogenetically-evoked V_m responses for PV, Sst, and all non-connected (NC) neurons. (**B**) Mean uEPSPs evoked in PV and Sst neurons during Quiet and Active states. (**C**) uEPSP amplitudes across PV and Sst neurons. (**D**) uEPSP amplitudes in PV and Sst neurons during Active and Quiet states. (**E**) Baseline V_m at uEPSP onset in PV and Sst neurons. (**F**) Baseline V_m at uEPSP onset in PV and Sst neurons during Active and Quiet states. Two-tailed Wilcoxon rank-sum test assessed statistical significance for panels C and E, and none was found. One-tailed Wilcoxon signed-rank test assessed statistical significance for panels D and F, with * indicating $p<0.05$.

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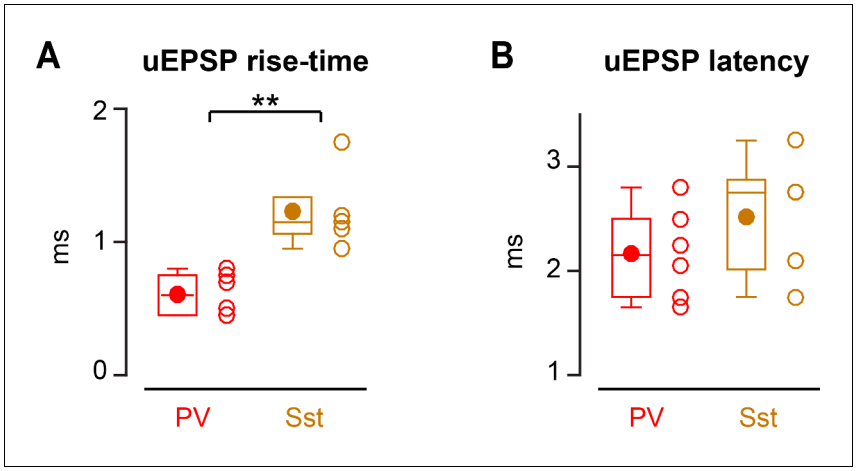

Figure 4—figure supplement 1. Kinetics of excitatory synaptic input in PV and Sst neurons. (**A**) uEPSP rise-time is faster in PV neurons compared to Sst neurons. (**B**) uEPSP onset latency is comparable across PV and Sst neurons. Two-tailed Wilcoxon rank-sum test assessed statistical significance, with ** indicating $p<0.01$.
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