electrode implanted into the hippocampus (see part B for schematic). The same electrode was used for recording hippocampal local field potential (LFP). 10s after seizure onset, we delivered a 10s-long train of blue light pulses (473nm; pulse duration 40ms, frequency 10Hz) into the PPT. We also recorded LFP and multiunit activity from the orbitofrontal cortex (OFC). In control seizures (not shown), in which YFP but no ChR2 had been injected into the PPT, cortical slow wave activity persisted throughout the seizure as previously described [8; 9]. (A) Optogenetic stimulation of the PPT following ChR2 injection resulted in a transition of the cortical LFP from slow waves to low voltage fast activity. (B) Schematic of seizure experimental setup. (C-D) Changes in cortical LFP delta (0.5-4Hz) and gamma (30-100Hz) power in response to optogenetic stimulation. LFP Power was quantified shortly after seizure onset and following optogenetic stimulation (5-15s and 18-28s after seizure onset, respectively), and the percent change in power between the two time windows was averaged across seizures. * $P<0.05$.

SUPPLEMENTARY FIGURE LEGENDS

Supplementary Figure S1. Optimization of neural responses in the PPT to light-pulse trains of varying frequency and pulse duration. We delivered 473nm laser light to the PPT and recorded multi-unit neural activity proximal to the tip of the optic fiber. (A) Quantification of neural response to light trains of different frequencies (n=4 rats, 1 to 3 recording sites per animal). Total duration of the pulse-train was 5sec; duration of the light-pulses for each recording is indicated in the inset (each color represents a different recording). (B) Examples of multi-unit activity (MUA) responses from a single recording site for different train frequencies (corresponding to the dark-green trace in (A); 20ms light pulses). (C) Quantification of responses

to different pulse widths (n=5 rats, single recording site per animal; each color represents a different recording). (D) Examples of MUA responses from a single recording for different pulse widths (corresponding to yellow trace in (B); 10Hz stimulation). Both frequencies and durations in these recordings were randomized to avoid order effects.

Supplementary Figure S2. **Peak changes in cortical LFP power occur with a delay after onset of optogenetic stimulation of the PPT.** (A-B) Changes in orbital frontal cortical (OFC) LFP delta (0.5-4Hz) and gamma (30-100Hz) power in different 7s time windows after optogenetic stimulation. Percent change in LFP power was quantified between baseline (3-10 s after seizures initiation, to avoid stimulation artifact) and sequential 7s epochs averaged across seizures. Peak changes occurred in the window of 18-25s after seizure onset. Optogenetic stimulation was 10-20s after seizure onset. Therefore, the epoch of peak changes (18-25s) occurred with a delay after onset of optogenetic stimulation. * $P<0.05$. (C-F) Power spectral changes between baseline (3-10 s after seizure onset, Pre-stim grey lines) and the epoch of peak optogenetic-induced changes (18-25 s after seizure onset, Post-stim yellow lines). Red areas indicate increases in power post optogenetic stimulation; blue areas indicate decreases. Optogenetic stimulation with ChR2-YFP~~YPF~~ decreases delta frequency (0.5 to 4 Hz) power (C), while increasing gamma frequency (30 to 100 Hz) power (D). Identical stimulation with YFP~~YPF~~-only (control) induces no significant changes (E, F). Values for power spectra are expressed as the normalized log power within the specified frequency band and time window. Power was calculated by fast Fourier transform and then normalized as [log power – mean of log baseline power] / [standard deviation of log baseline power]; where the mean and standard deviations were calculated between 0 and 100 Hz. Data for A-F are from same seizures and animals as in Figure 2 C, D (n=41 for Ch2-YFP; n=26 for YFP-only control).

Supplementary Figure S3. Spectrograms showing contrasting changes in 0.5-4 Hz and 30-100 Hz frequency bands of cortical LFP power after optogenetic stimulation of the PPT. (A) Spectrogram between 0 and 100 Hz calculated by multi-taper (3 tapers) fast Fourier transform in windows of 1 s duration, with 0.5 s overlap between windows. Spectrograms were first normalized by dividing by the maximum power in each frequency band (frequency bins of 0.97 Hz), and then displayed as the difference between the optogenetic stimulus with ChR2-YFP and YFP~~YPF~~-only control averaged across all seizures. For color scales on right, warm colors (positive values) indicate ChR2-YFP > YFP-only control, and cool colors (negative values) indicate YFP-only control > ChR2-YFP (arbitrary units). The initial 3s after seizure initiation were removed to avoid stimulation artifact. The red window indicates the period of optogenetic stimulation (OPTO STIM). (B) 30-100 Hz section of the spectrogram from (A), showing increased gamma frequency power after optogenetic stimulus. (C) 0-10 Hz section of the spectrogram from (A), showing decreased delta frequency power in the 0.5-4 Hz range after optogenetic stimulus. Data are from same seizures and animals as in Figure 2 C, D, and Supplementary Figure S2 (n=41 for Ch2-YFP; n=26 for YFP-only control).