**Supplementary Figure 1:** Influence of transient AIS Na\(^+\) current density and voltage-dependence on spike initiation with a 60% reduction of persistent Na\(^+\) current only at the AIS. **A** Plot of the delay between time of maximal rise in the AIS and somatic spike over \(\Delta V_{1/2}\) for different AIS Na\(^+\) current densities (panel a). An equivalent graph is shown for the spike threshold (panel b). **B** Illustration of the dependence of the axo-somatic delay on the density of axonal Na\(^+\) current for different values of \(\Delta V_{1/2}\) (see legend, panel a). An equivalent diagram is shown for the spike threshold (panel b).

**Supplementary Figure 2:** Description of modelled spike parameters. **A** Spike amplitude measured from resting membrane potential to the peak of the spike. **B, C** Peak dV/dt of the rising (B) and falling phases (C) of the spike. **D** Width of spikes measured at the half-maximal amplitude (half-width). All parameters are depicted for different relations of somatic vs. AIS \(I_{NaT}\) density (light gray, gray and black, see legend). \(\Delta V_{1/2}\) values on the x-axis correspond to the shift in the voltage-dependence of activation of \(I_{NaT}\) at the AIS relative to the soma.