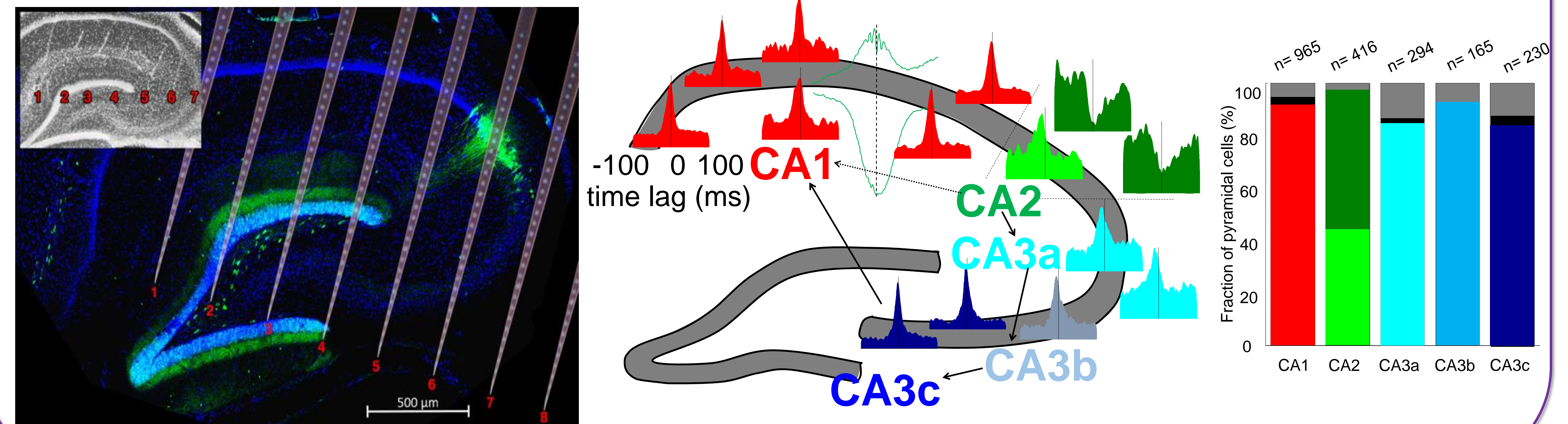


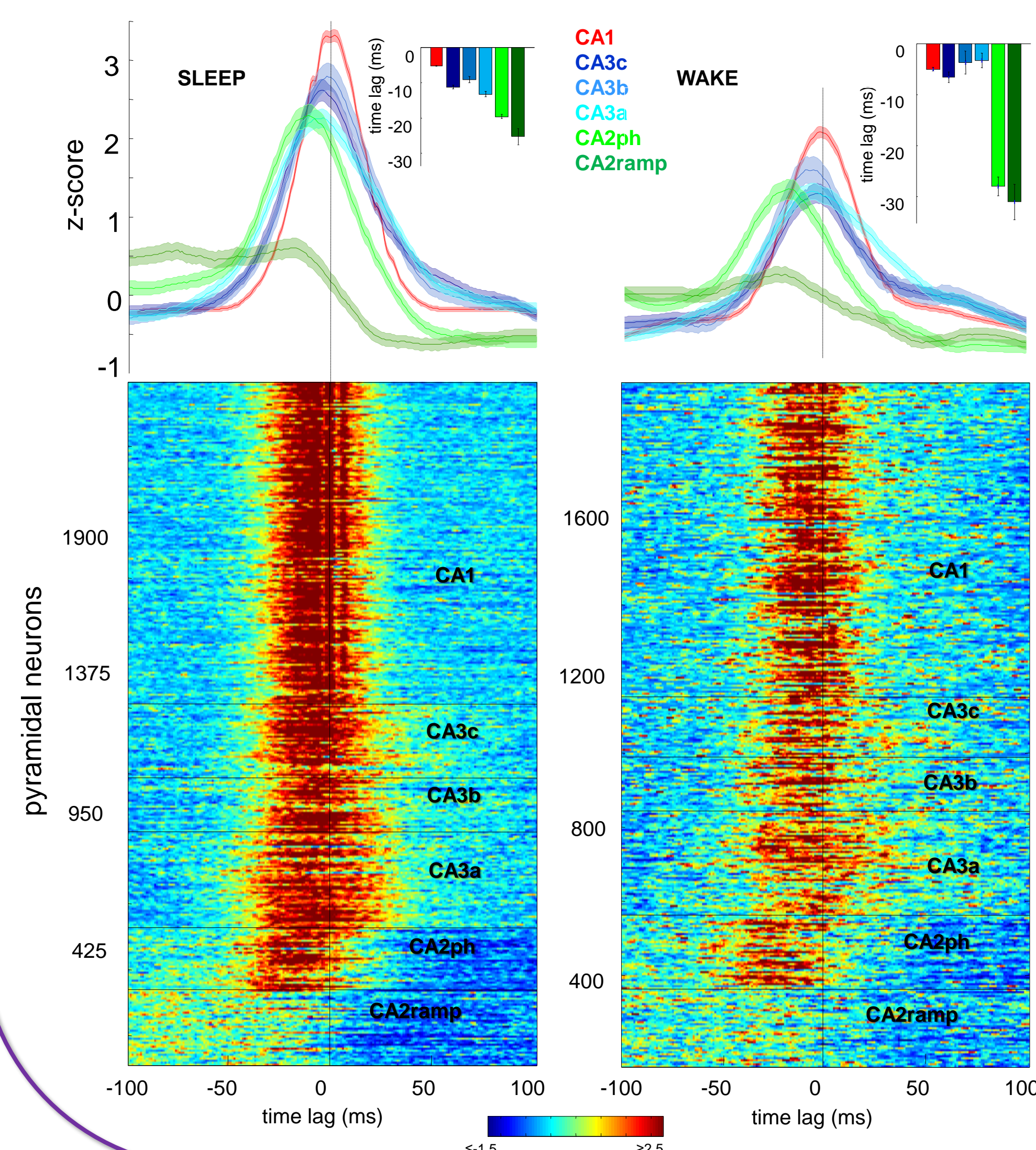
## Summary

**Sharp-wave ripples (SPW-Rs)** are network oscillations in the mammalian hippocampus that have been shown to be involved in memory consolidation. However the mechanisms of their generation remains unclear. Using two-dimensional silicon probe electrode arrays, we investigated the **propagation of SPW-Rs across the CA1, CA2 and CA3** subregions of the hippocampus. We found that **synchronous activation** of neuronal ensembles in the **CA2** region **preceded SPW-R** related population activity in CA3 and CA1 regions. **Deep CA2** neurons showed a gradual increase in activity prior to ripples and were strongly suppressed by the time population activity built up in CA3-CA1 neurons (ripple ramp cells). **Superficial CA2** cells organized into a population burst prior to the activity surge in CA3-CA1 (phasic-cells). The leading role of the CA2 region in SPW-R was more pronounced during walking than sleeping. Together with the particular CA2 firing properties, these results implicate the CA2 region as an **initiation zone for SPW-Rs**.

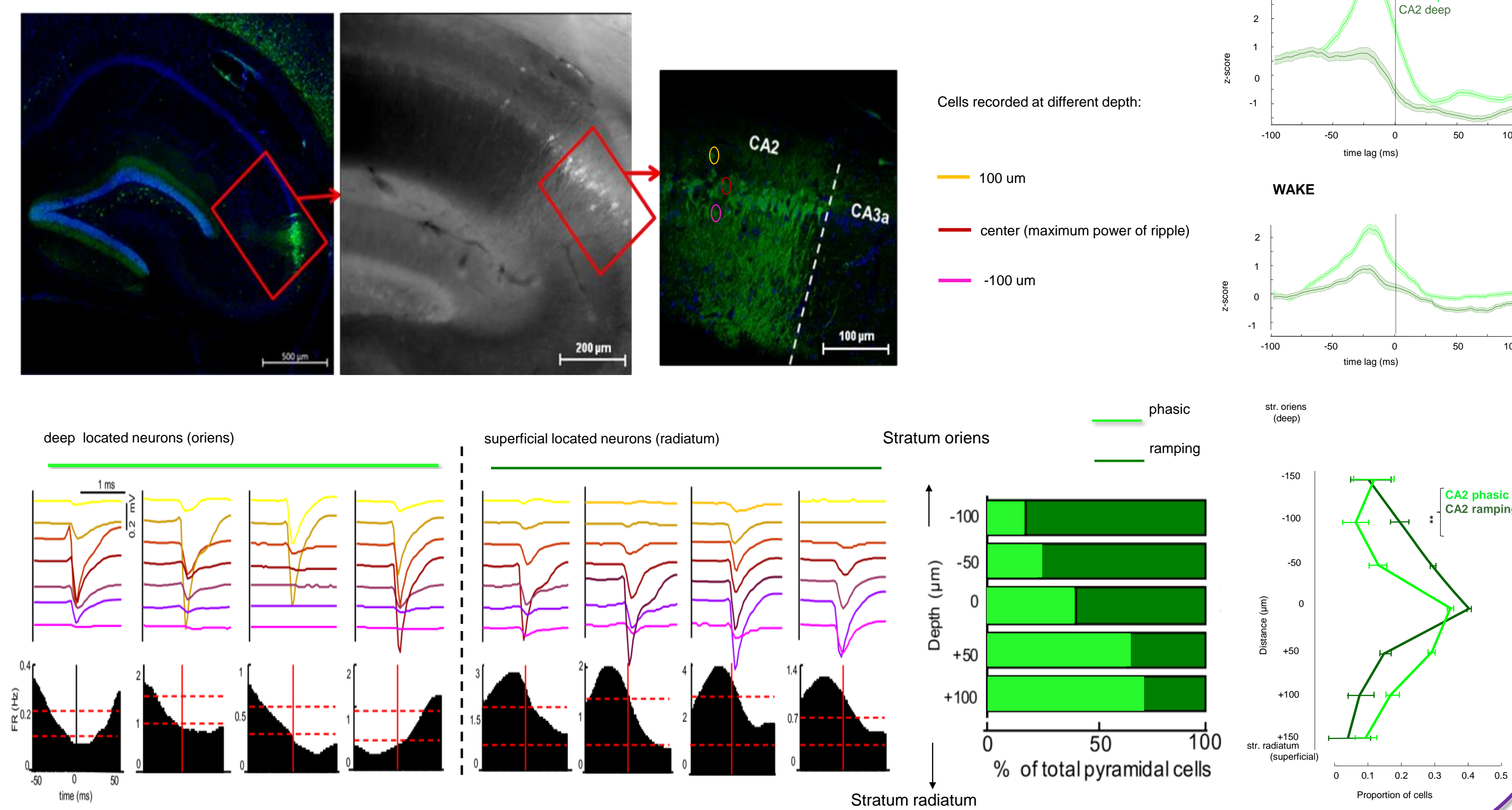
## 1. Large scale electrophysiological recordings show heterogeneity of ripple response in CA1, CA2 and CA3



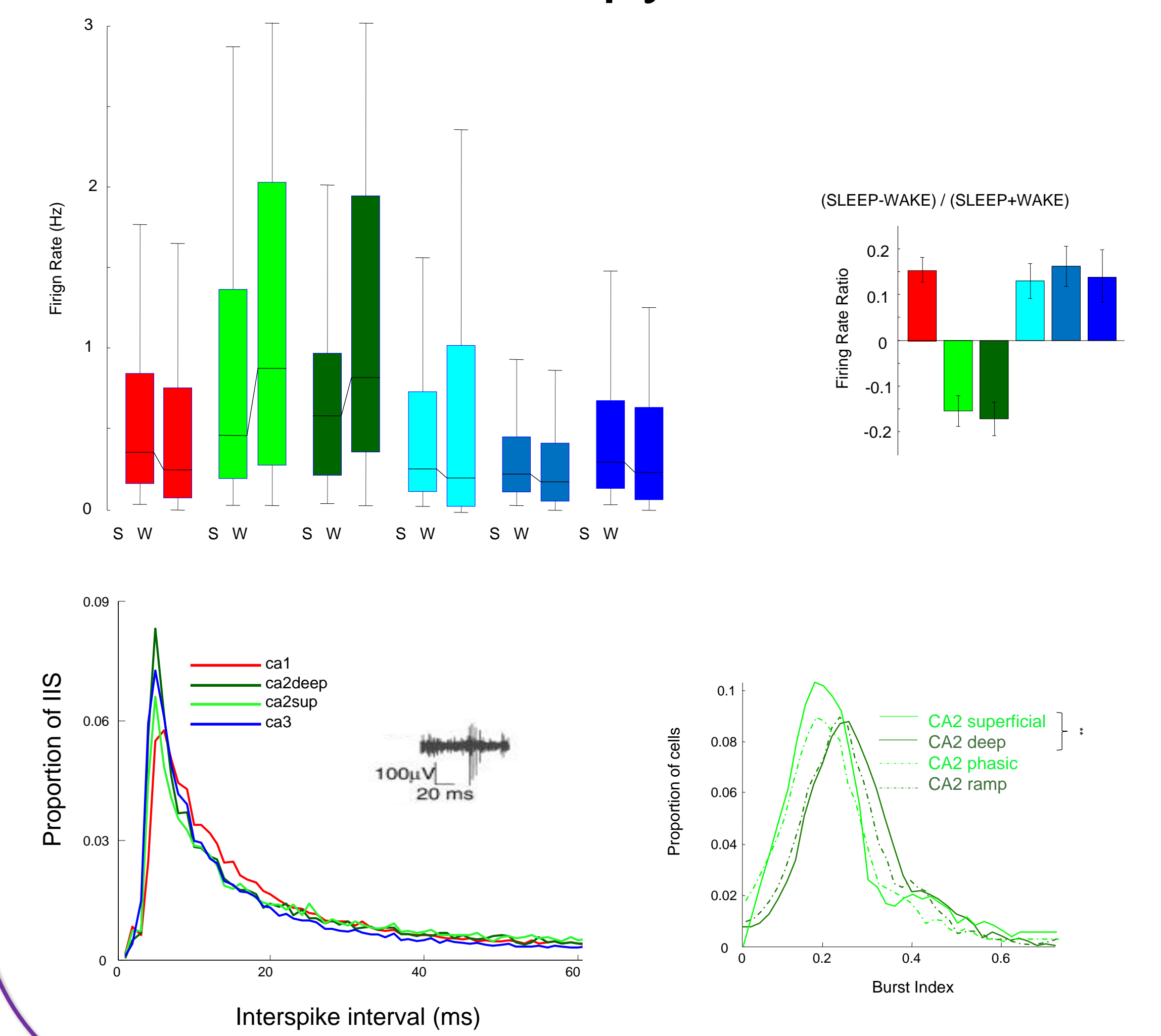
## 2.a Propagation of synchronous firing from CA2 to CA3 and CA1 during ripples



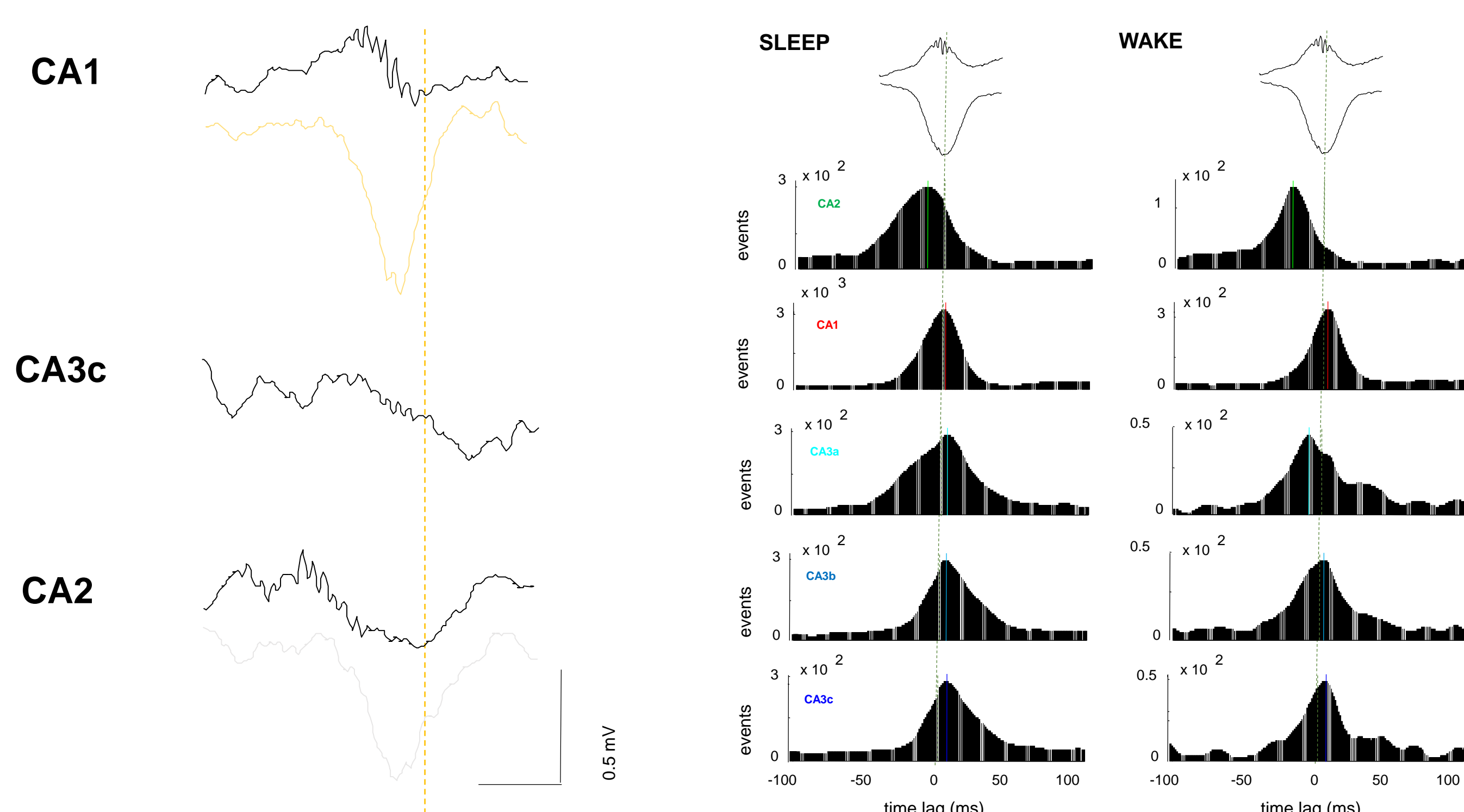
## 2.b Anatomical segregation of phasic and ramping CA2 pyramidal cells



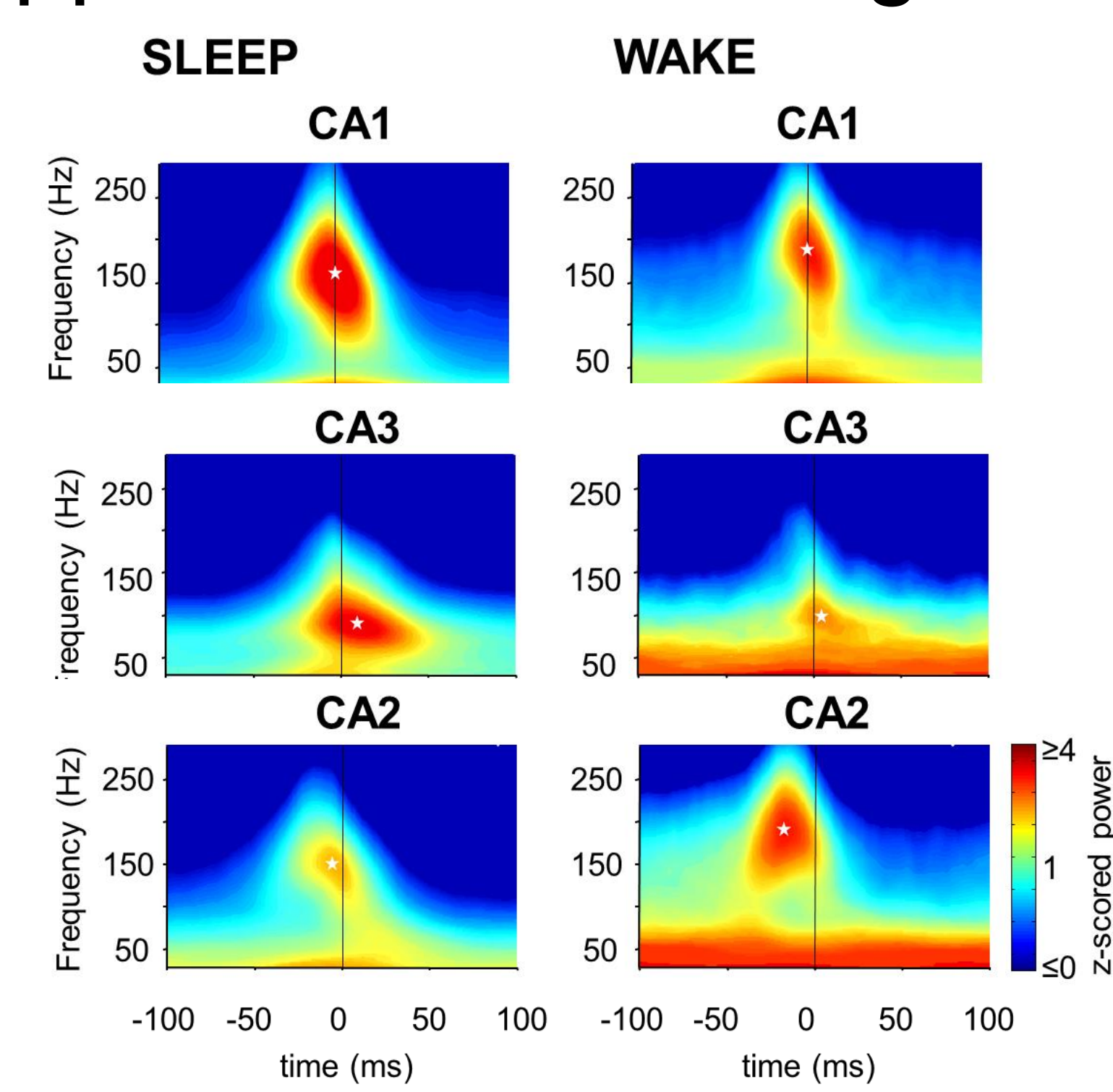
## 4. Different firing properties of CA1, CA2 and CA3 pyramidal cells



## 3.a Temporal relation of population activity during ripples in CA1, CA2 and CA3



## 3.b Spatiotemporal characteristic of ripples in different regions



## Conclusions

- With simultaneous recordings along CA1, CA2 and CA3 regions, we found that synchronous discharge of CA2 pyramidal cells precede SPW-Rs generation
- We found two functional subpopulations of CA2 pyramidal cells. Ramping cells show a slow early ramping-up and sudden decrease of the firing rate approximately 20ms prior to CA1 ripple peak. Phasic cells fire synchronously preceding CA3 and CA1 activation
- CA2 cells contribute more to SPW-R generation during WAKE state while CA3 cells participate more strongly to SLEEP SPW-Rs
- Both subtypes of CA2 pyramidal cells are anatomically segregated along the pyramidal layer. Ramping cells are more deeply located inside the pyramidal layer and phasic cells more superficially
- Firing properties of CA2 pyramidal cells support their role as the initiation zone of SPW-Rs