



Exploring the diversity of cortical wave activity with a unifying workflow approach

Robin Gutzen



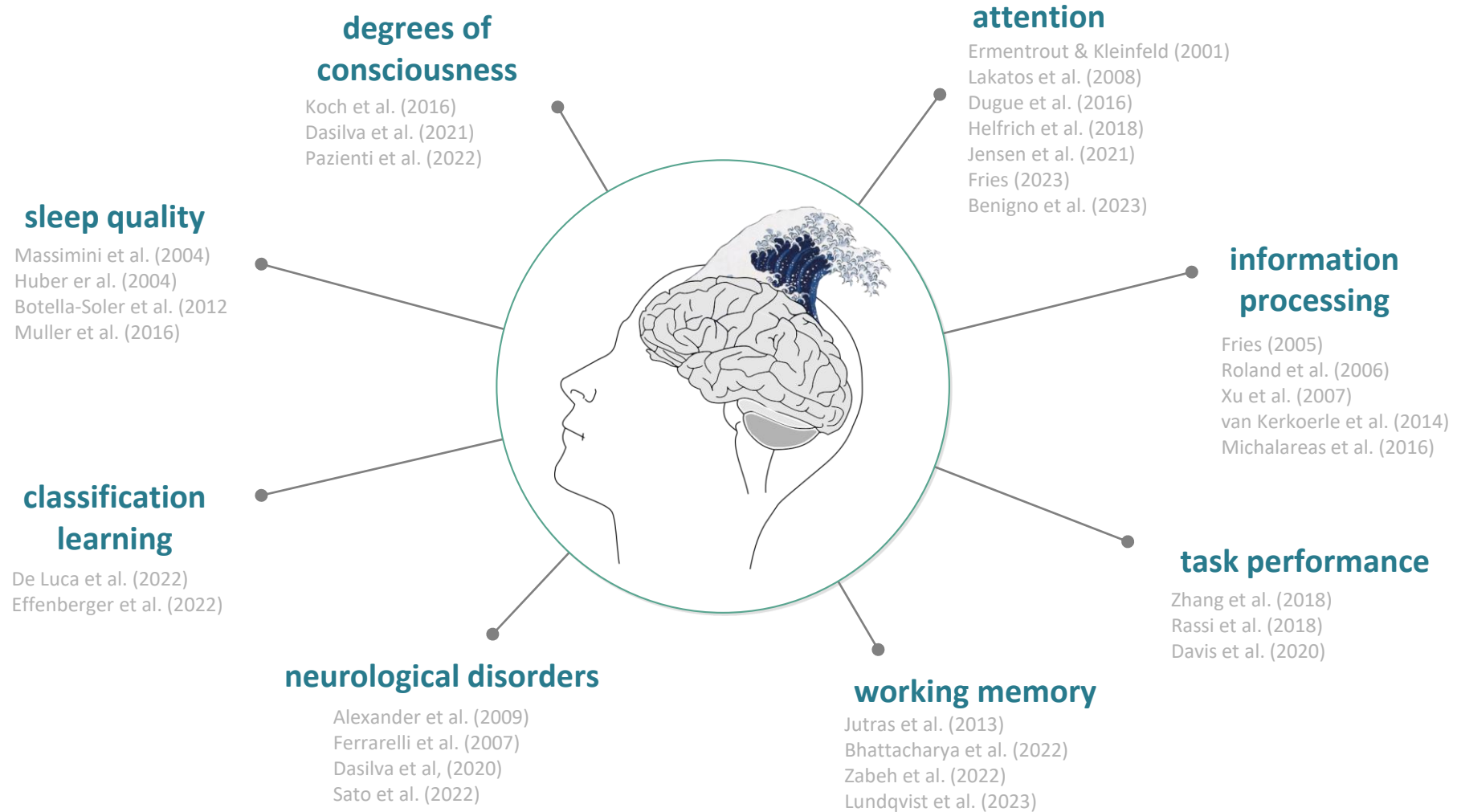
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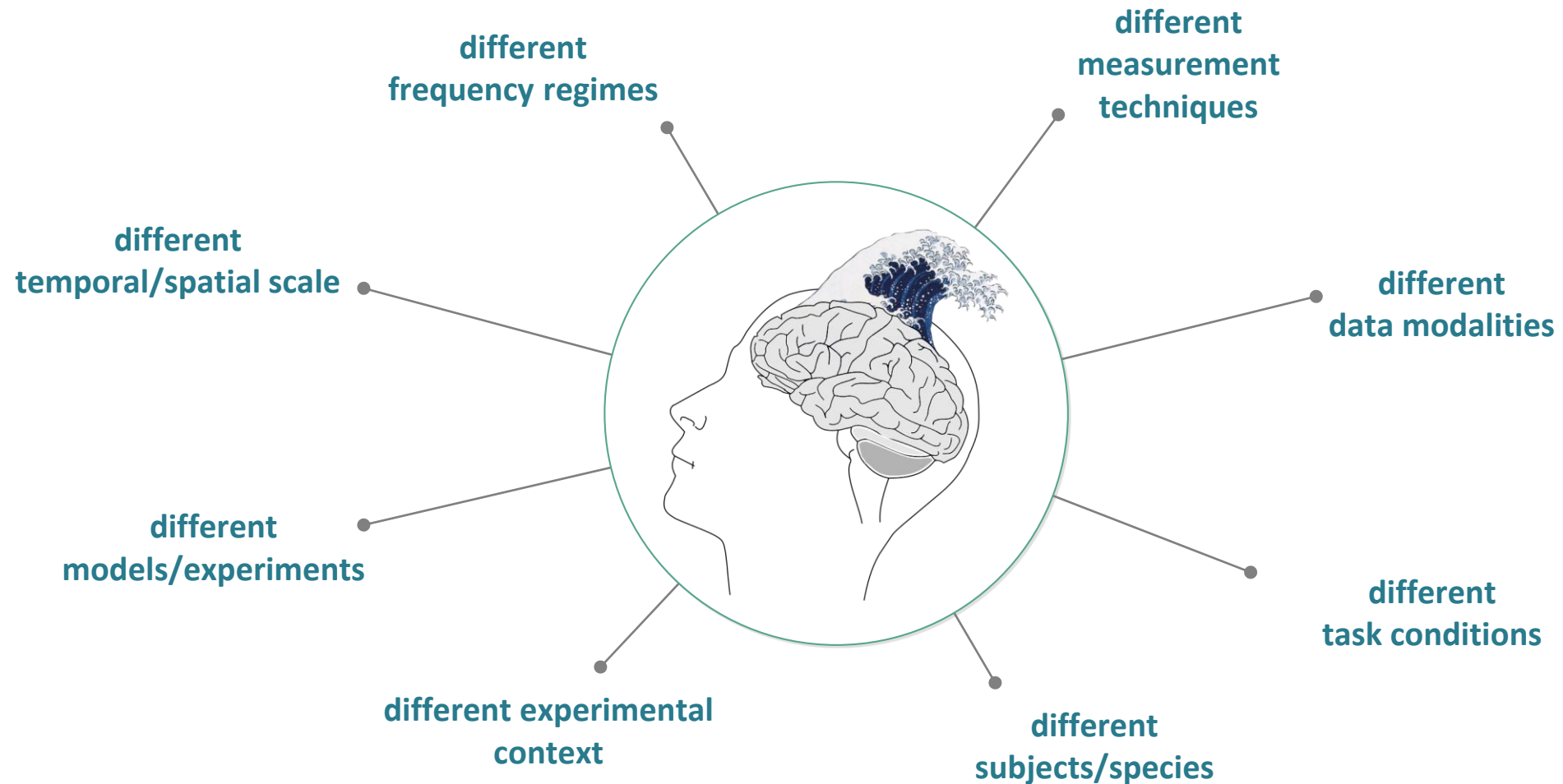
2023-09-12 | Human Brain Project Concluding Event



Where there are Rhythms there are Waves



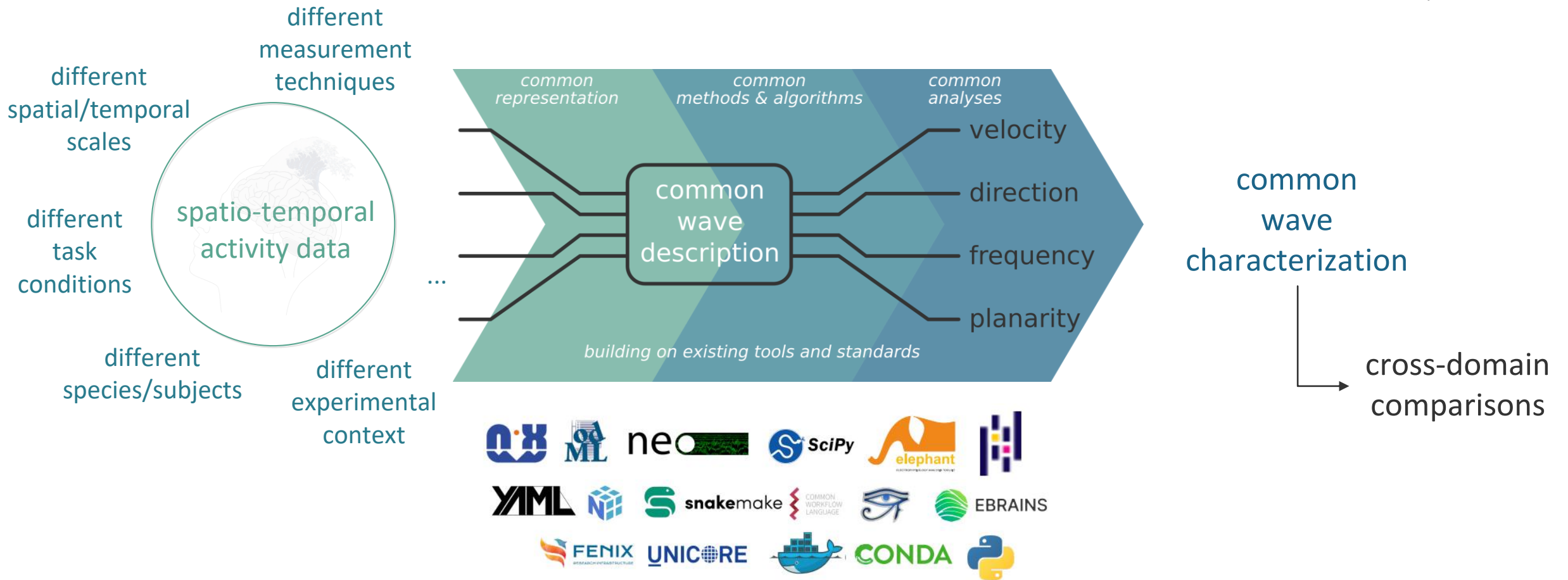
Where there is Heterogeneity there is a Need for Comparability



Comparability via Adaptable Reusable Workflows

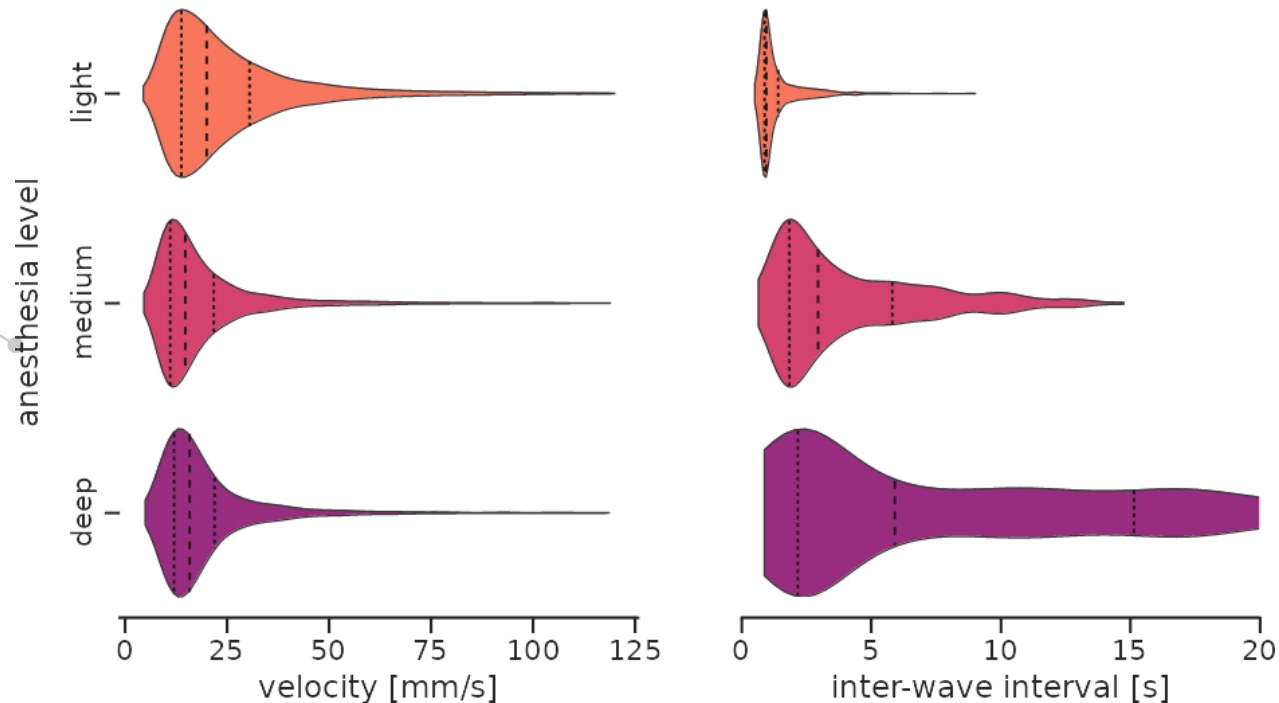


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Cross-domain Comparison Applications

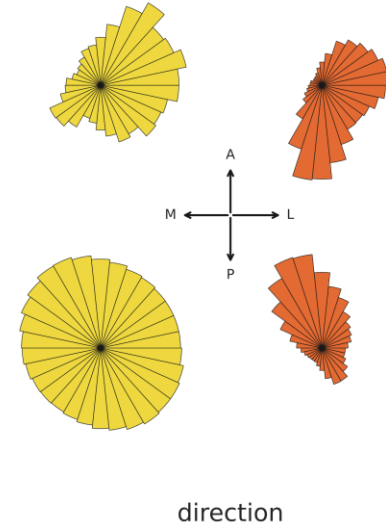
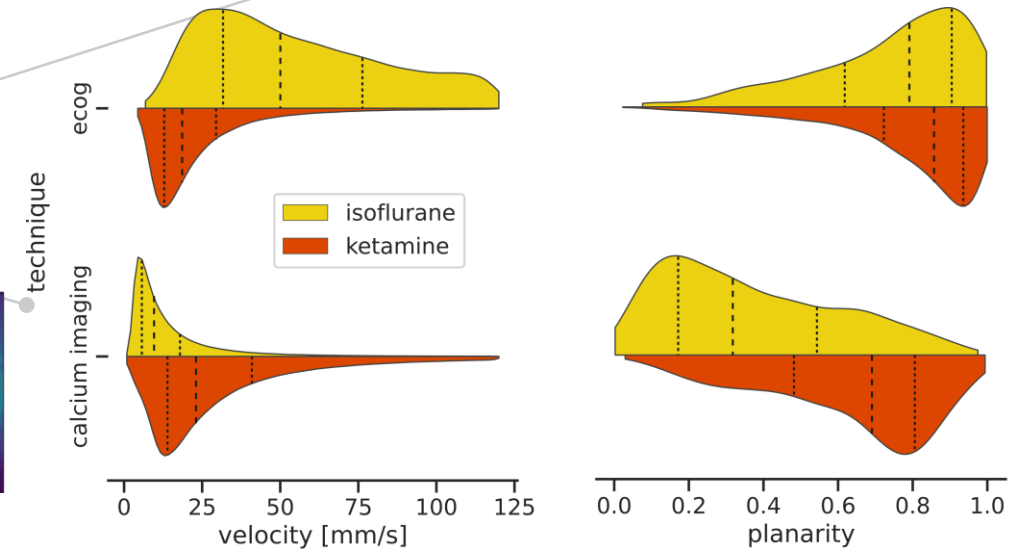
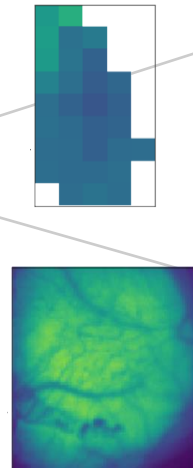
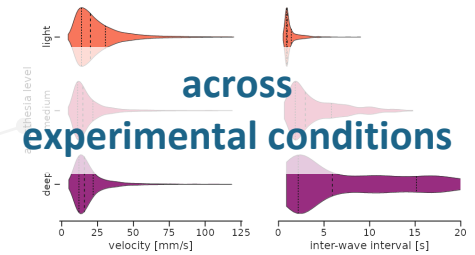
Comparing cortical waves across anesthesia levels in mice recordings to replicate findings of changing slow wave characteristics



Gutzen et al. (2023) in revision in Cell Reports Methods

Cross-domain Comparison Applications

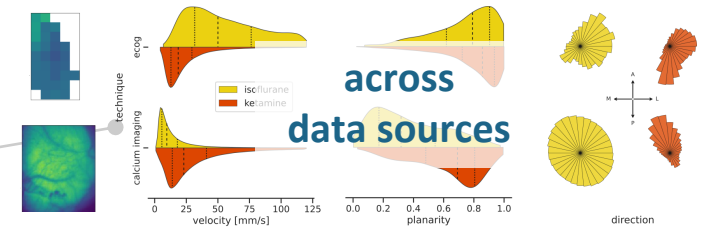
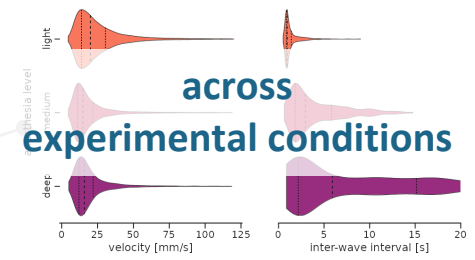
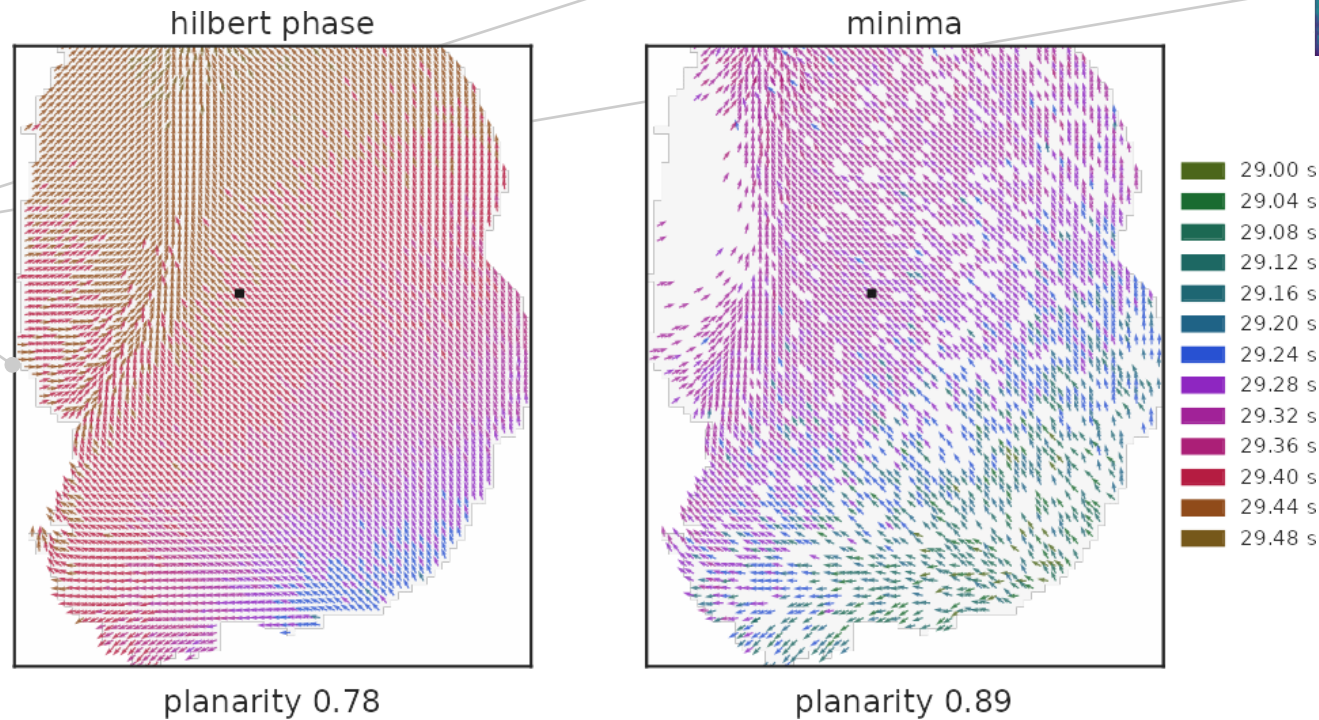
Comparing cortical waves across measurement techniques and anesthetics in mice recordings from different labs to reconcile different perspectives onto slow wave activity



Gutzen et al. (2023) in revision in Cell Reports Methods

Cross-domain Comparison Applications

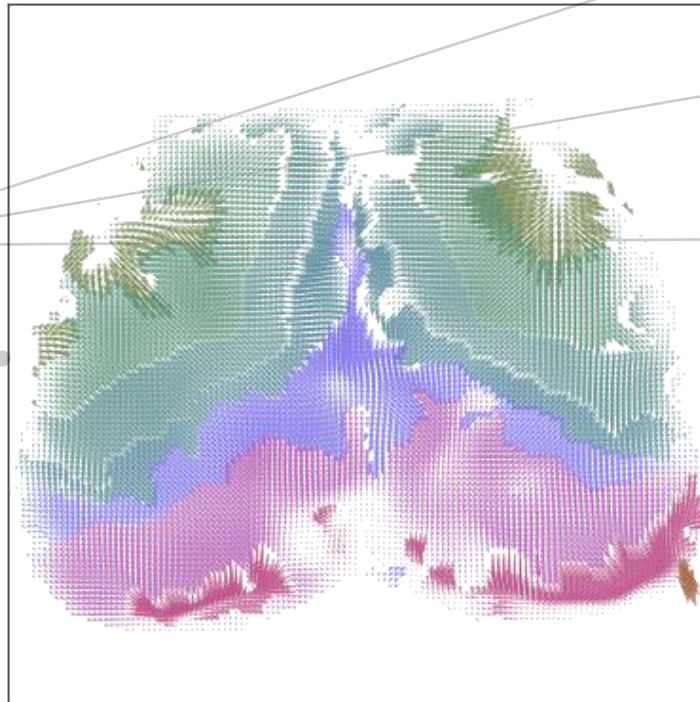
Comparing cortical waves across slow wave detection methods in the same data of anesthetized mice to benchmark the influence of individual analysis methods



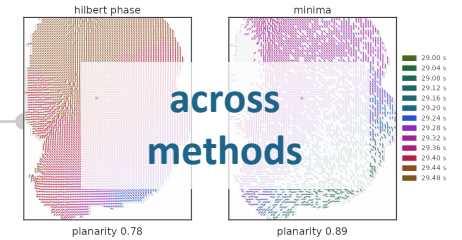
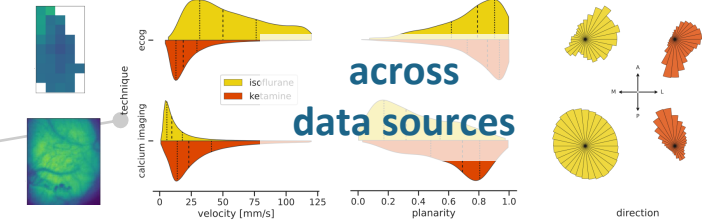
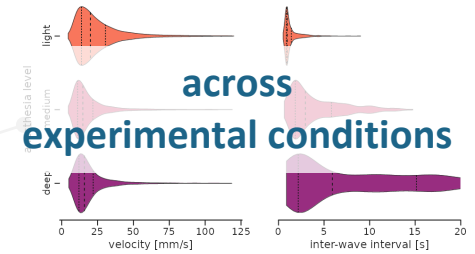
Gutzen et al. (2023) in revision in Cell Reports Methods

Cross-domain Comparison Applications

Comparing cortical waves across healthy and stroke-induced mice during sleep and anesthesia to evaluate functionalities of slow waves

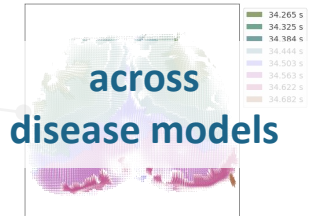
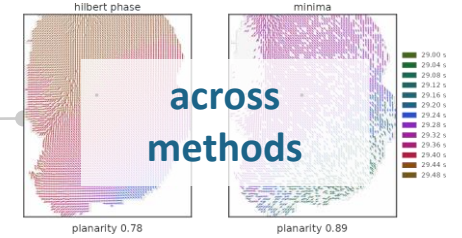
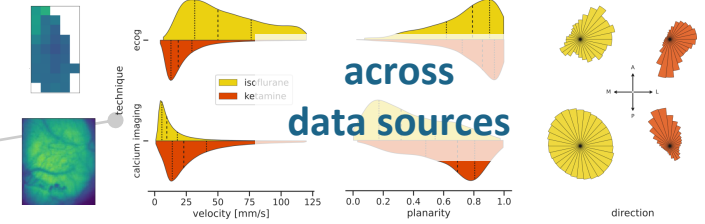
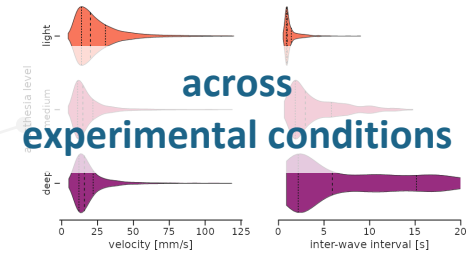
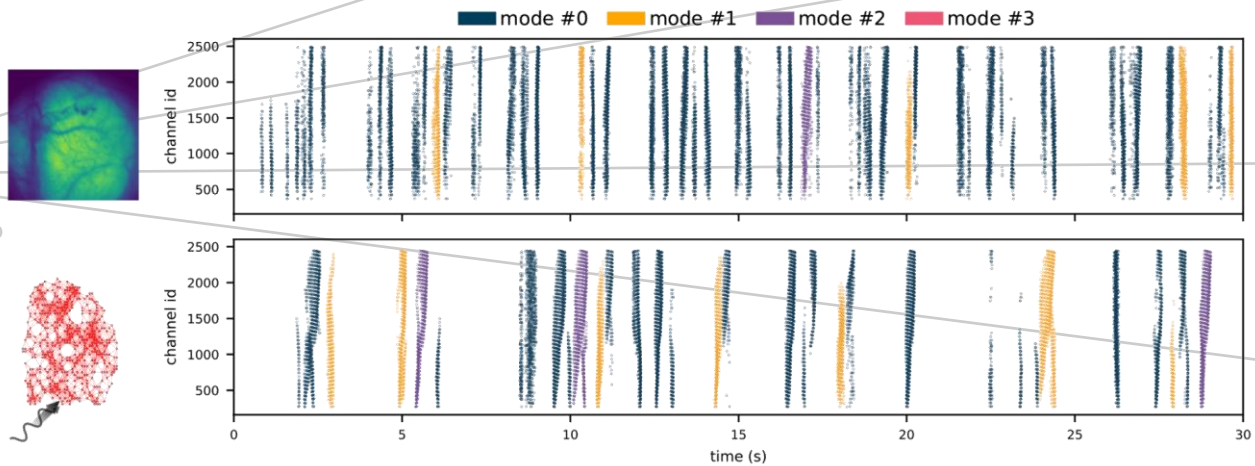


Landsness et al. (2023) in preparation



Cross-domain Comparison Applications

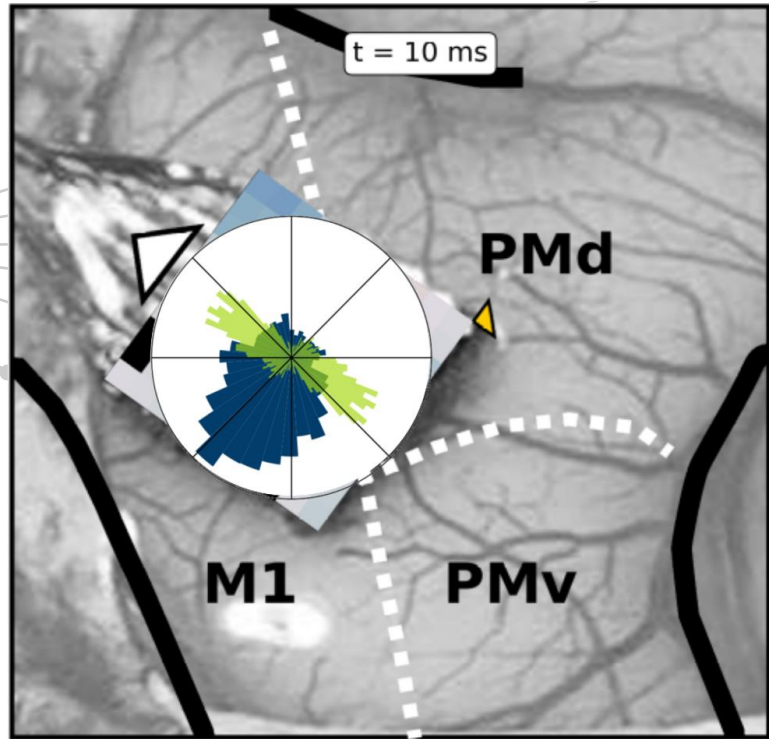
Comparing cortical waves between experimental data and simulations of a data-driven mean field model for model calibration and validation



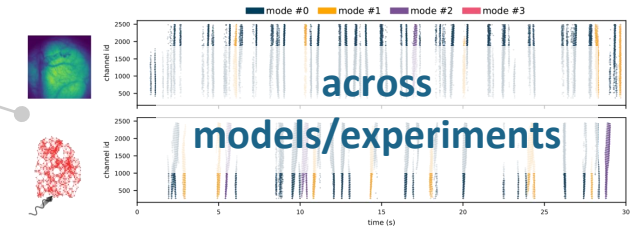
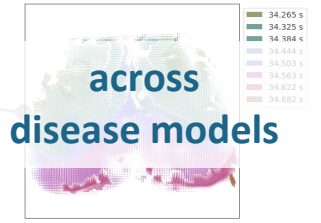
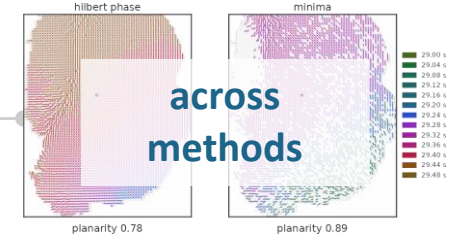
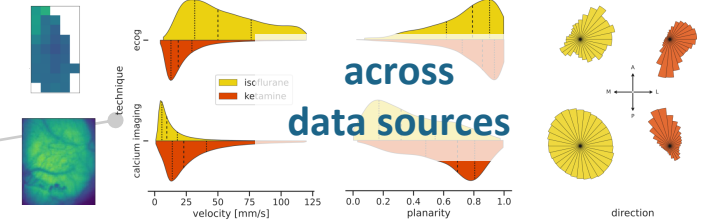
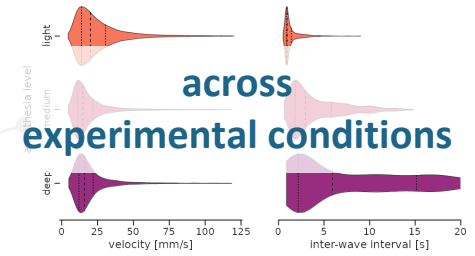
Capone et al. (2023) Communications Biology

Cross-domain Comparison Applications

Comparing cortical waves with co-occurring synchronous spike patterns in awake monkeys performing a visuomotor task as a mechanism to spatially coordinate network activity

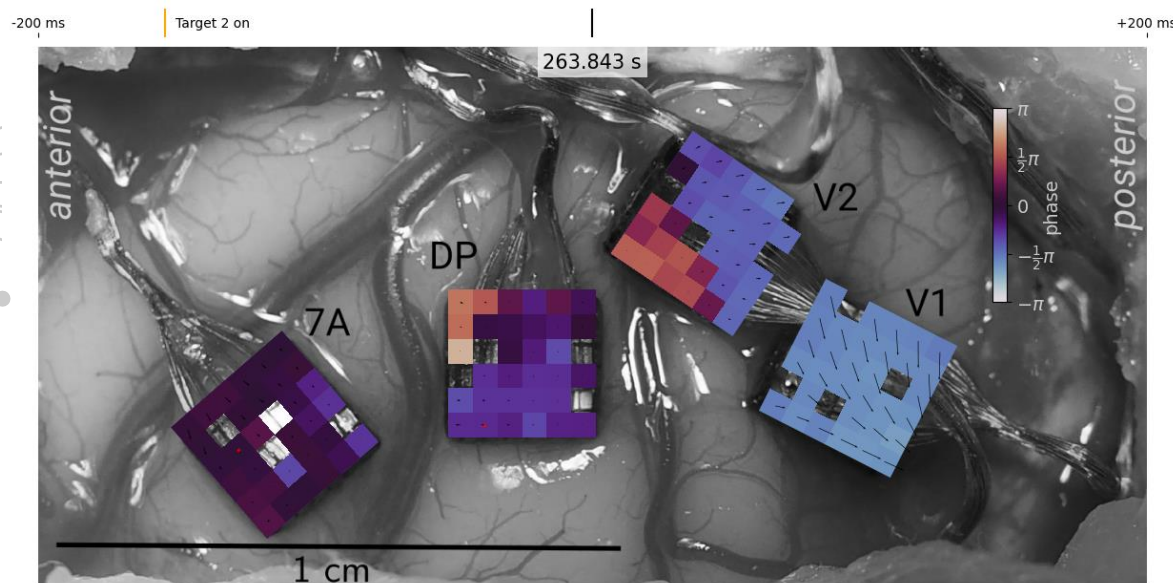


Krauße et al. (2023) in preparation

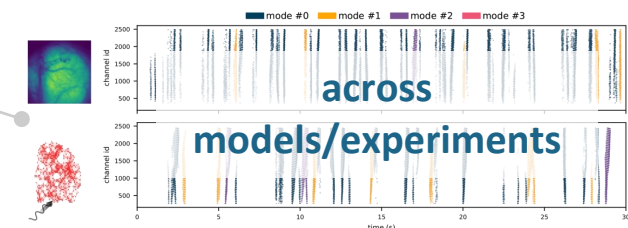
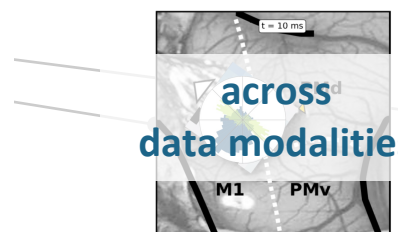
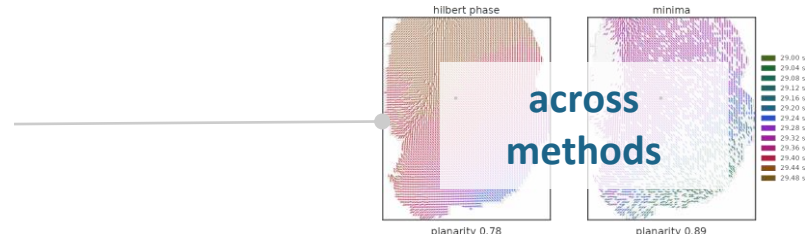
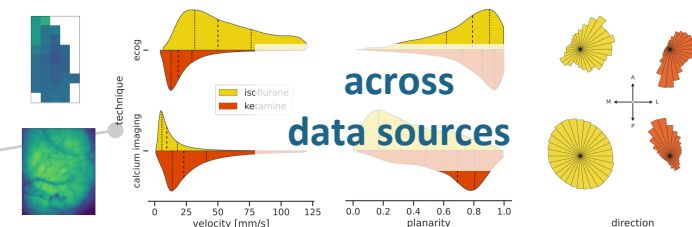
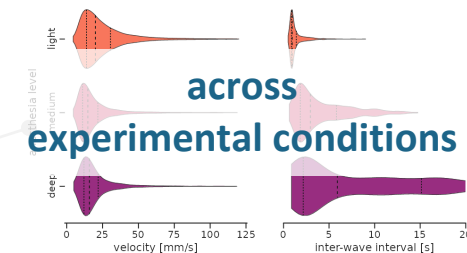


Cross-domain Comparison Applications

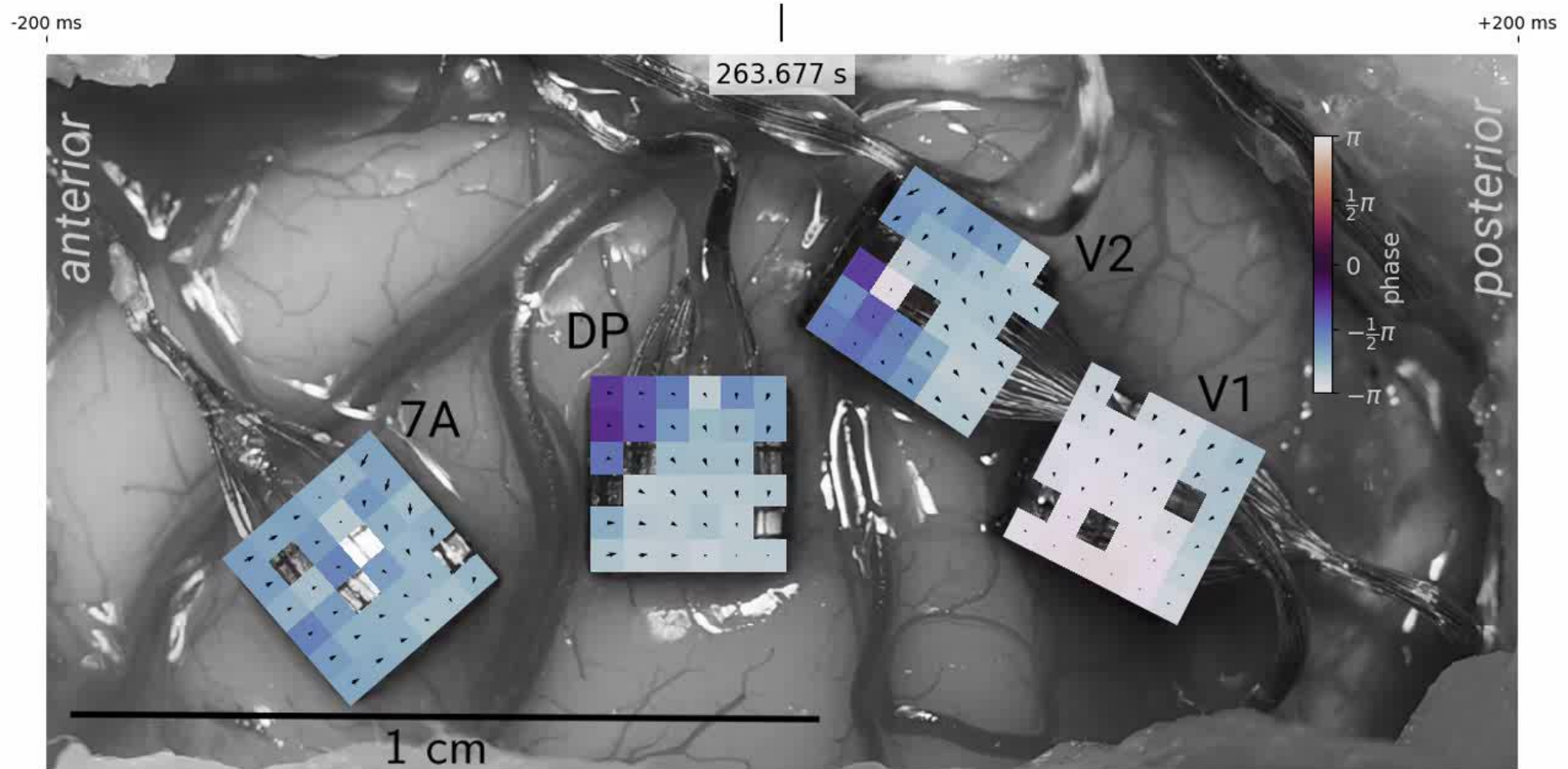
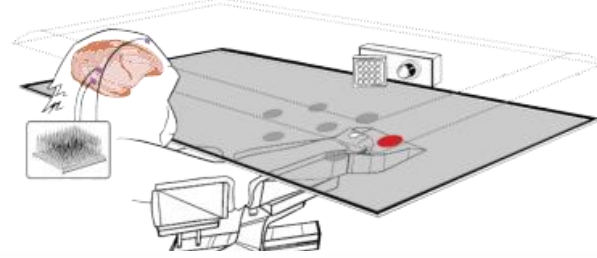
Comparing cortical waves across visual areas and frequency regimes in awake monkeys performing a visuomotor task to probe perceptual attention mechanisms



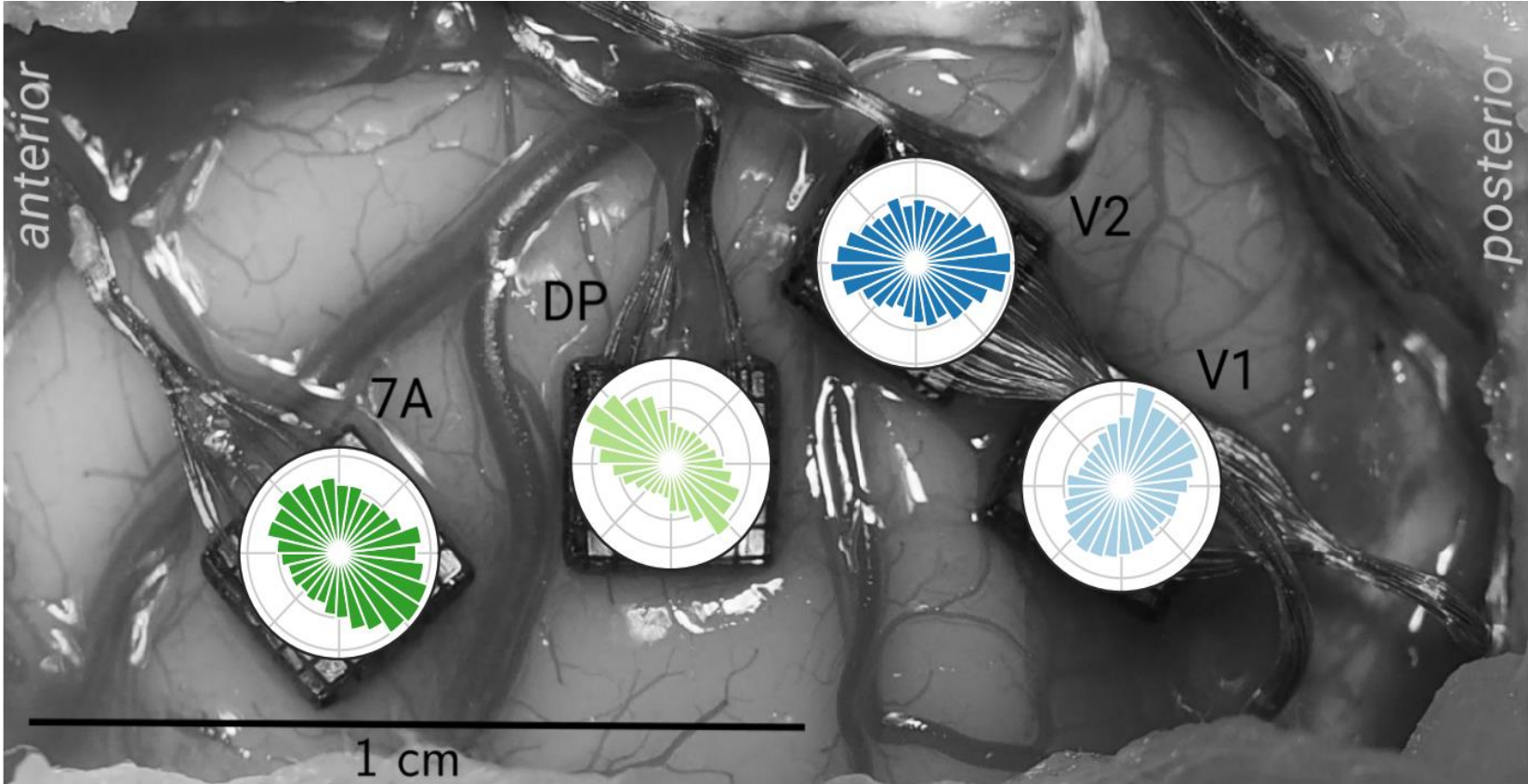
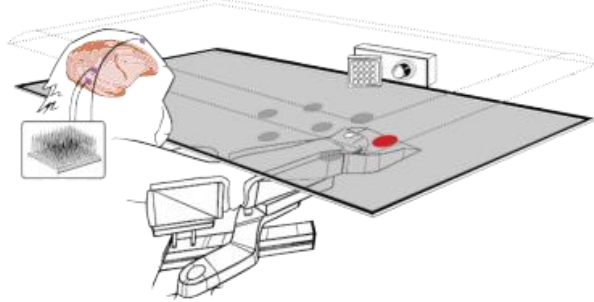
Gutzen et al. (2023) in preparation



Wave Dynamics in the Visual Cortex

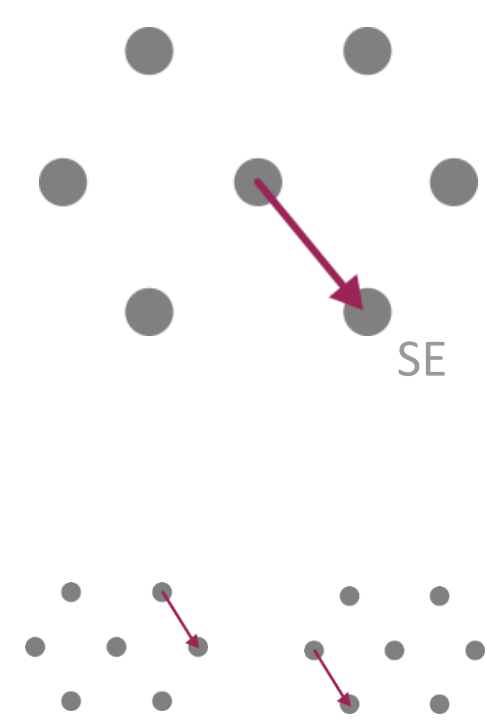
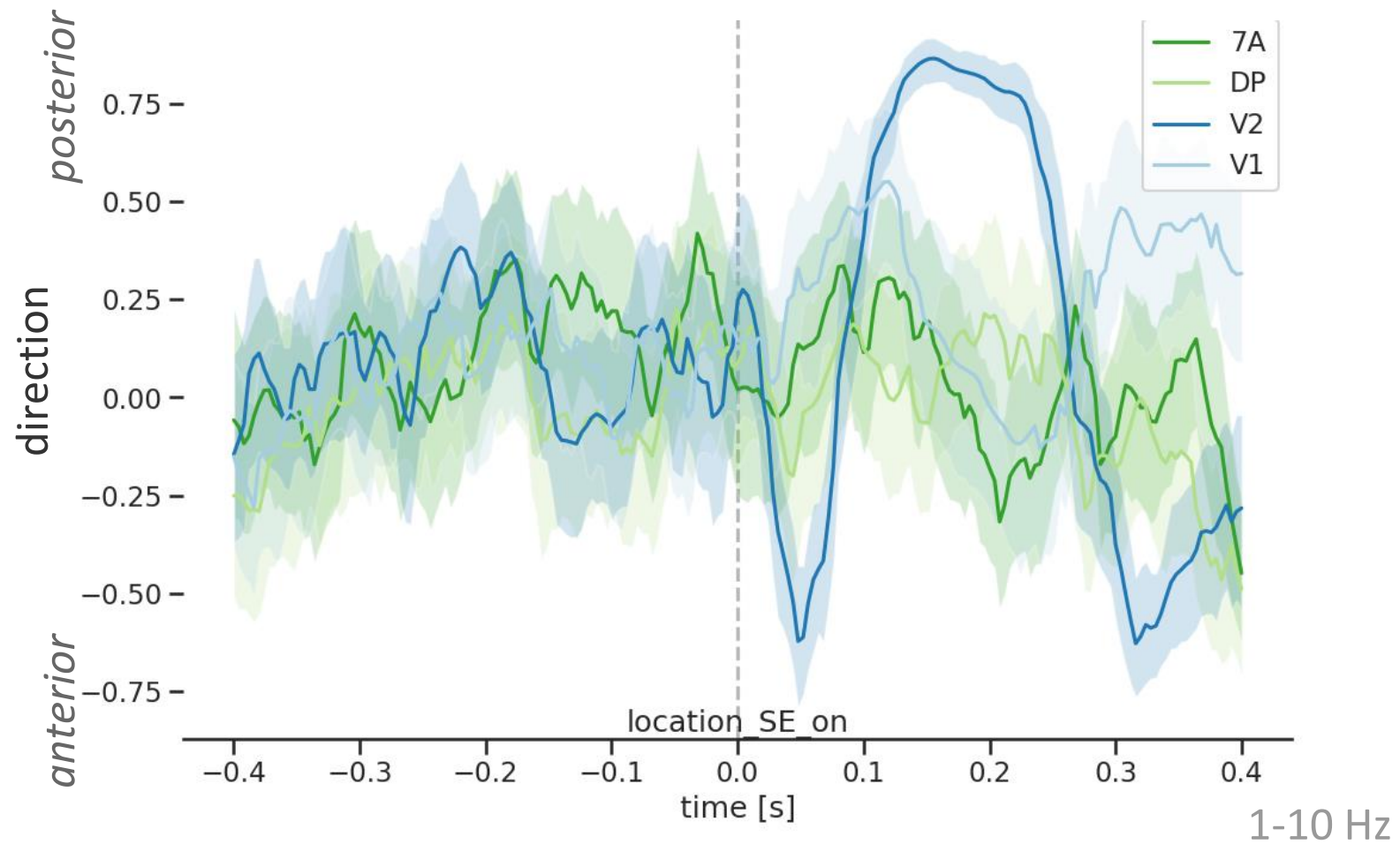


Wave Directions in the Visual Cortex



1-10 Hz

Wave Directions in Response to Visual Stimuli



In Conclusion

There are considerable neuroscientific advances to be made by “just” addressing the challenges in the required computational tools.

Cortical wave dynamics are likely to play a role in several cognitive functions (e.g., sleep, attention).

Adaptable and reusable analysis workflows amplify succeeding research applications and collaborative science.



IDIBAPS



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