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Building adaptable and reusable pipelines for investigating the features of slow cortical rhythms across scales, methods, and species

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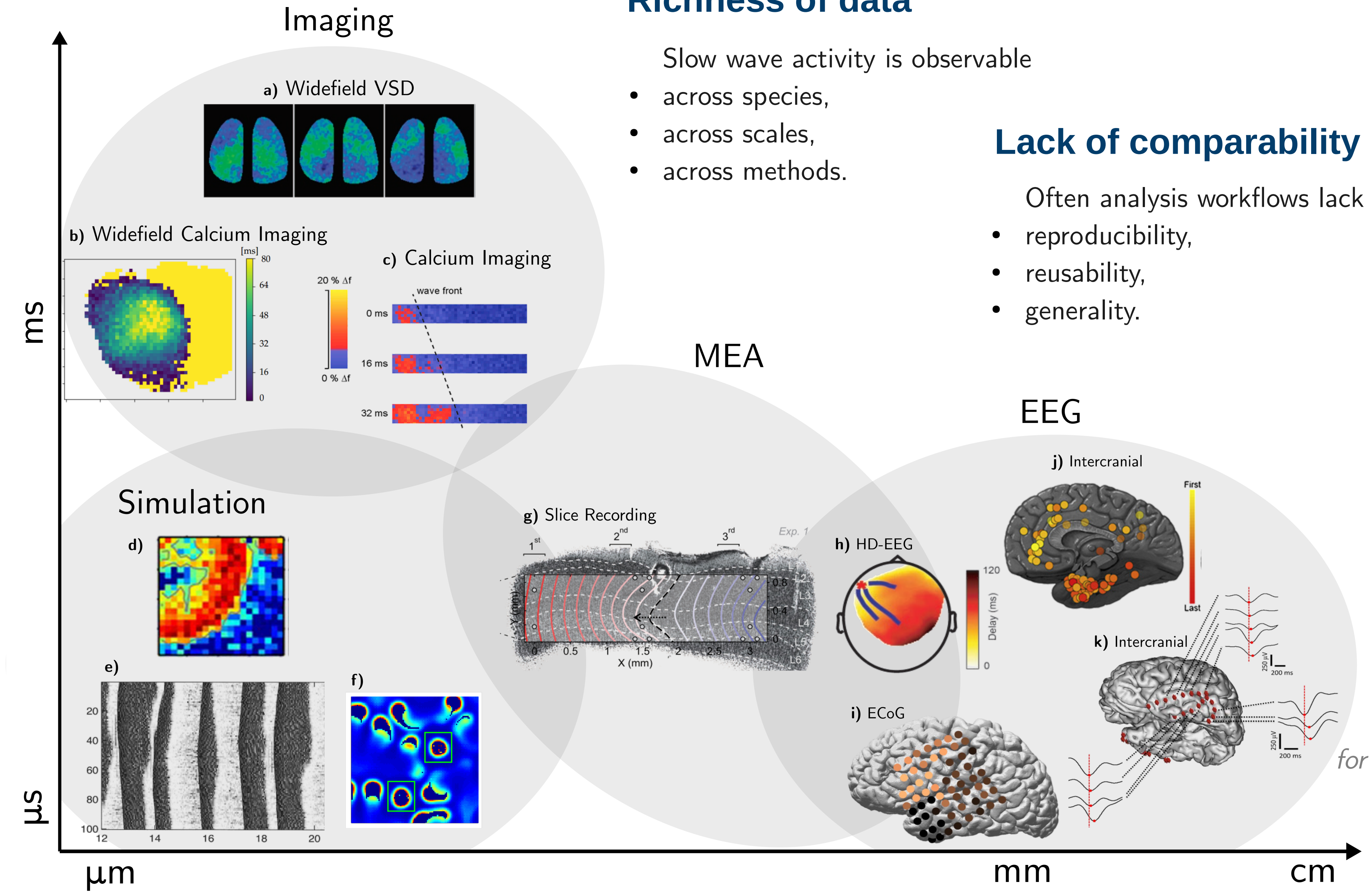
Slow Cortical Waves



Richness of data

Slow wave activity is observable

- across species,
- across scales,
- across methods.

Lack of comparability

Often analysis workflows lack

- reproducibility,
- reusability,
- generality.

Requirement of cross-domain comparison

Comparability is needed for

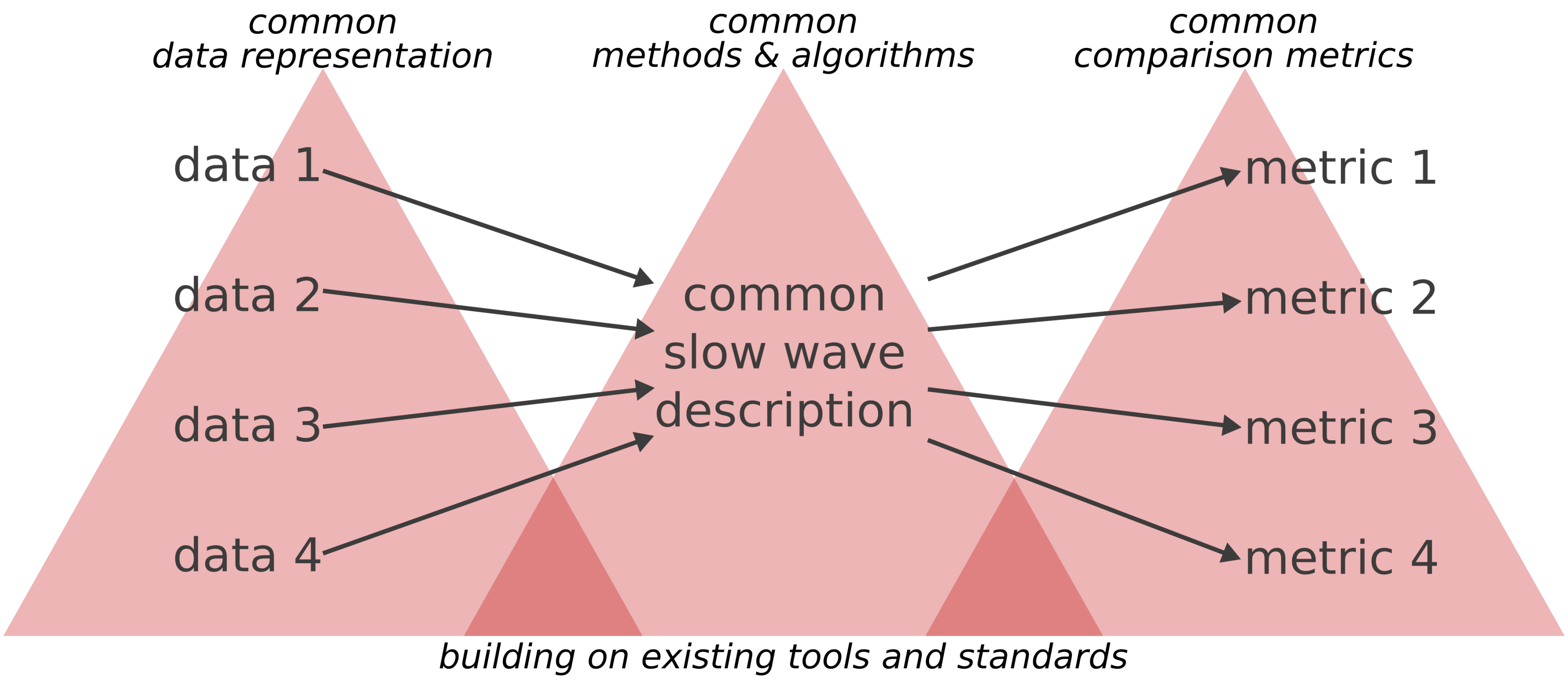
- integration of multiple data sources,
- model calibration & validation,
- quantifying experimental variability.

for references see Appendix

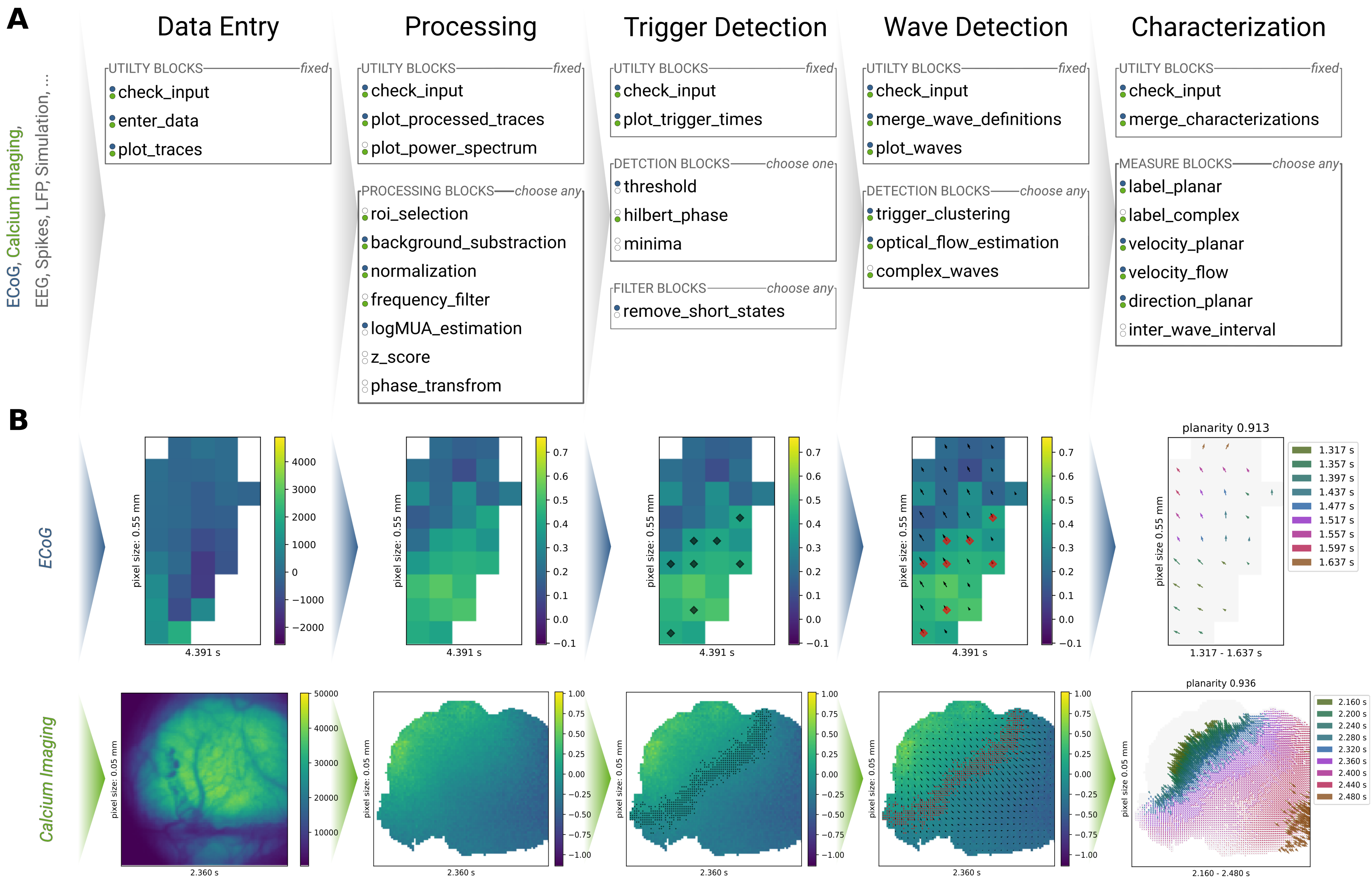
Approach: Adaptable and Reusable Analysis Pipeline

There is no need to reinvent the wheel.

There is value in bringing together existing methods, tools, and standards.



Slow Waves Analysis Pipeline

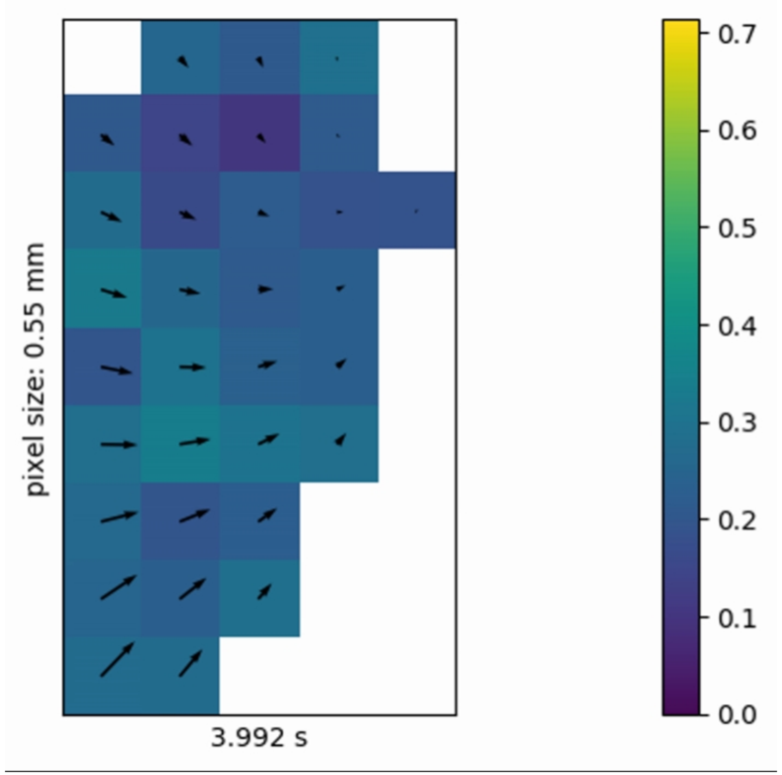


- Pipeline = series of stages
- Stage = collection of blocks
- Workflow = path along blocks
- Benefit:
  Each element of the pipeline is reusable and exchangeable.

Results

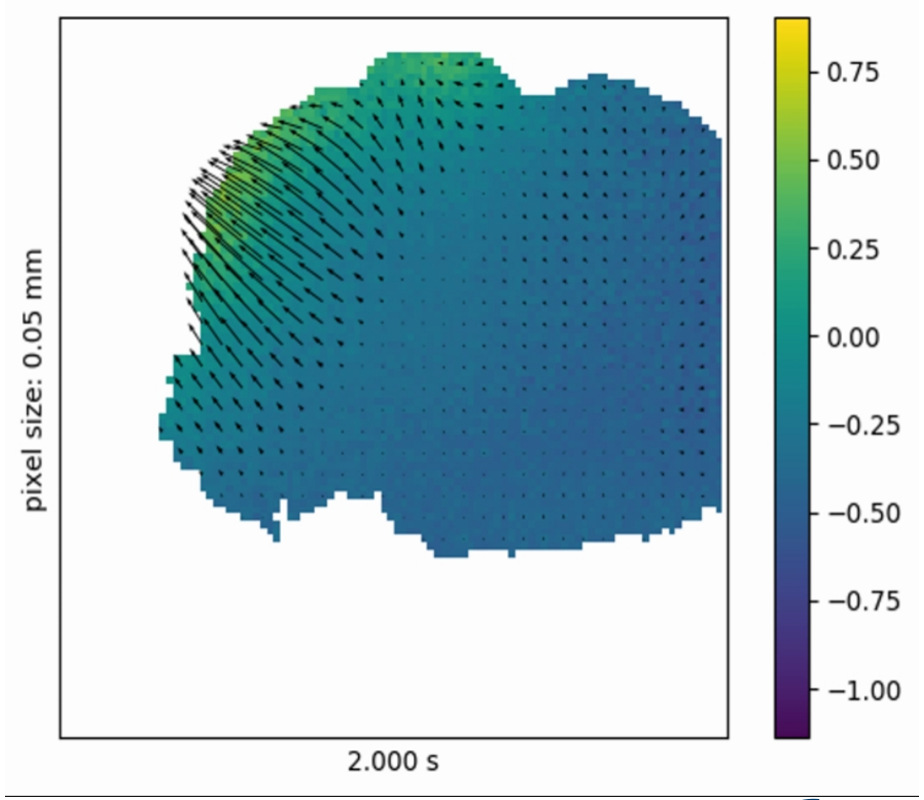
Our approach enables diverse data to be compared in terms of abstract phenomenon descriptions (i.e. slow waves)

ECoG



Video Link

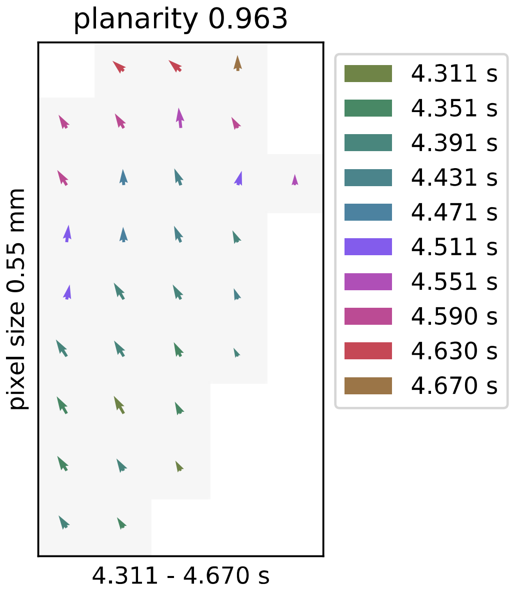
Calcium Imaging



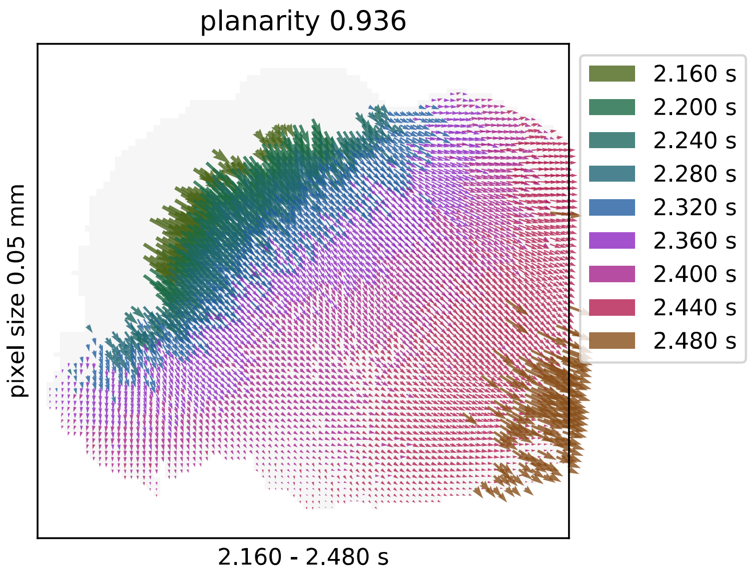
Video Link

Results: Wave Planarity

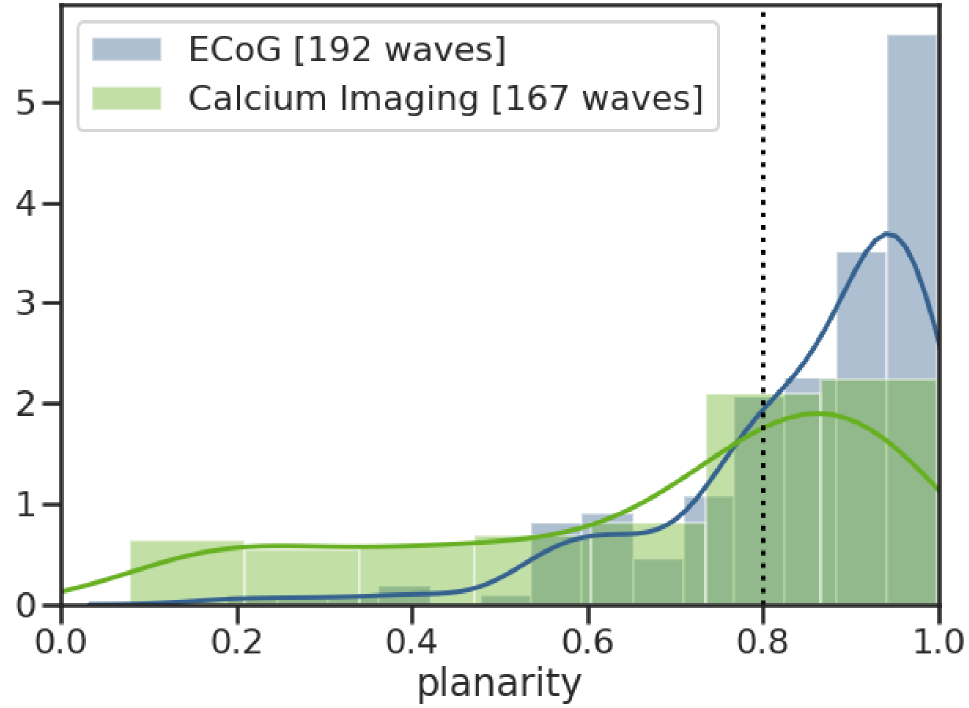
ECoG



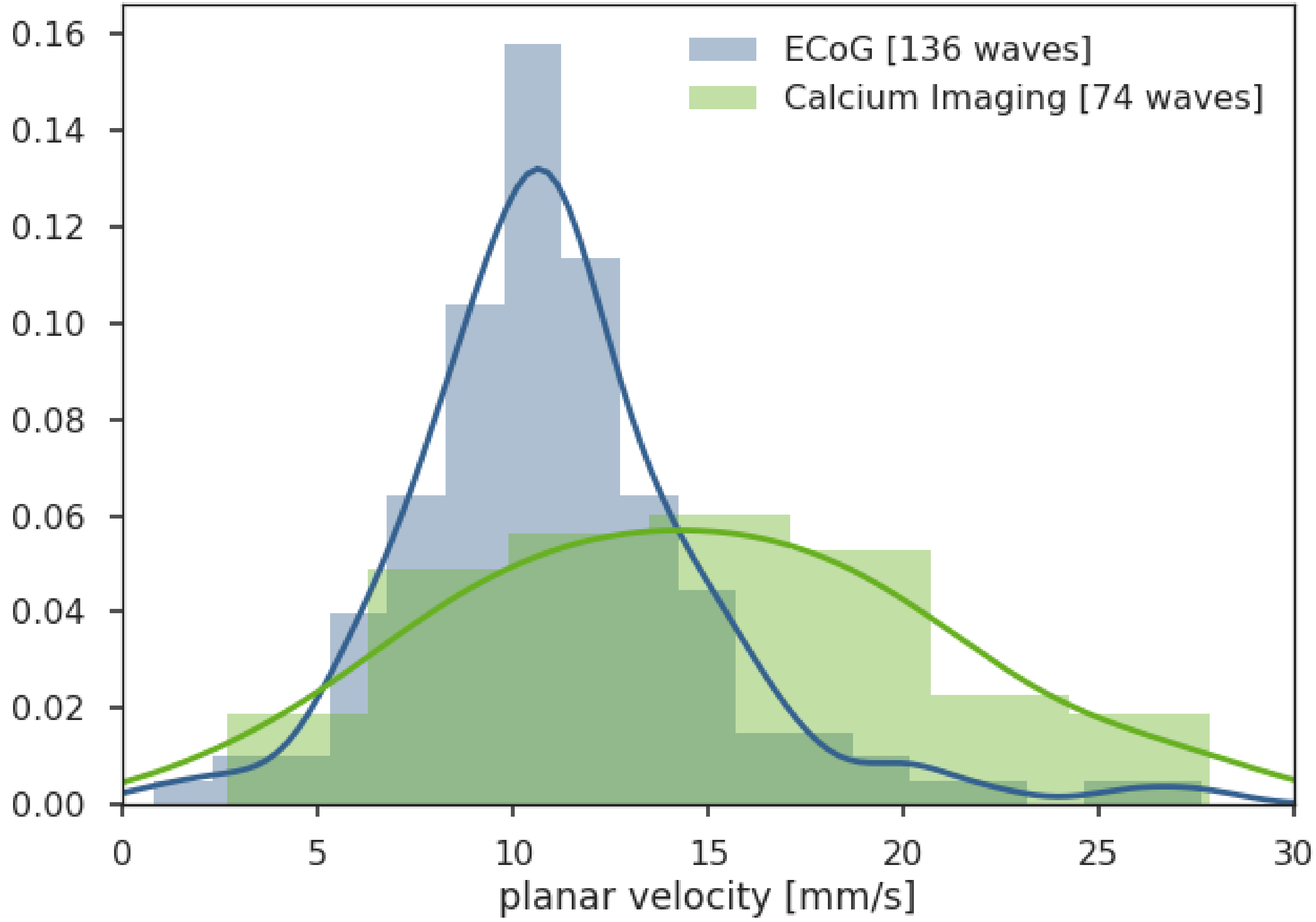
Calcium Imaging



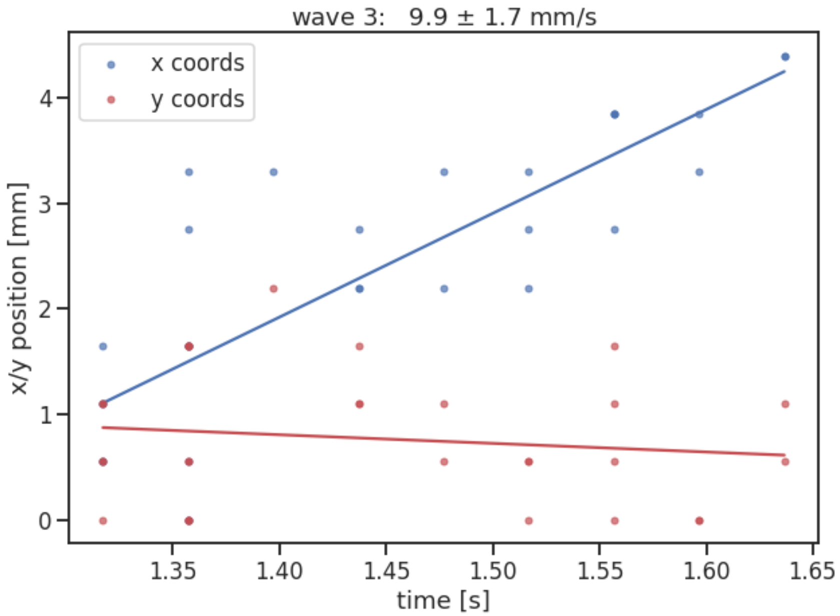
$$\text{planarity} = \frac{||\sum \vec{v}_i||}{\sum ||\vec{v}_i||}$$



Results: Planar Wave Velocity



planar velocity = linear interpolation of trigger displacement in x and y direction



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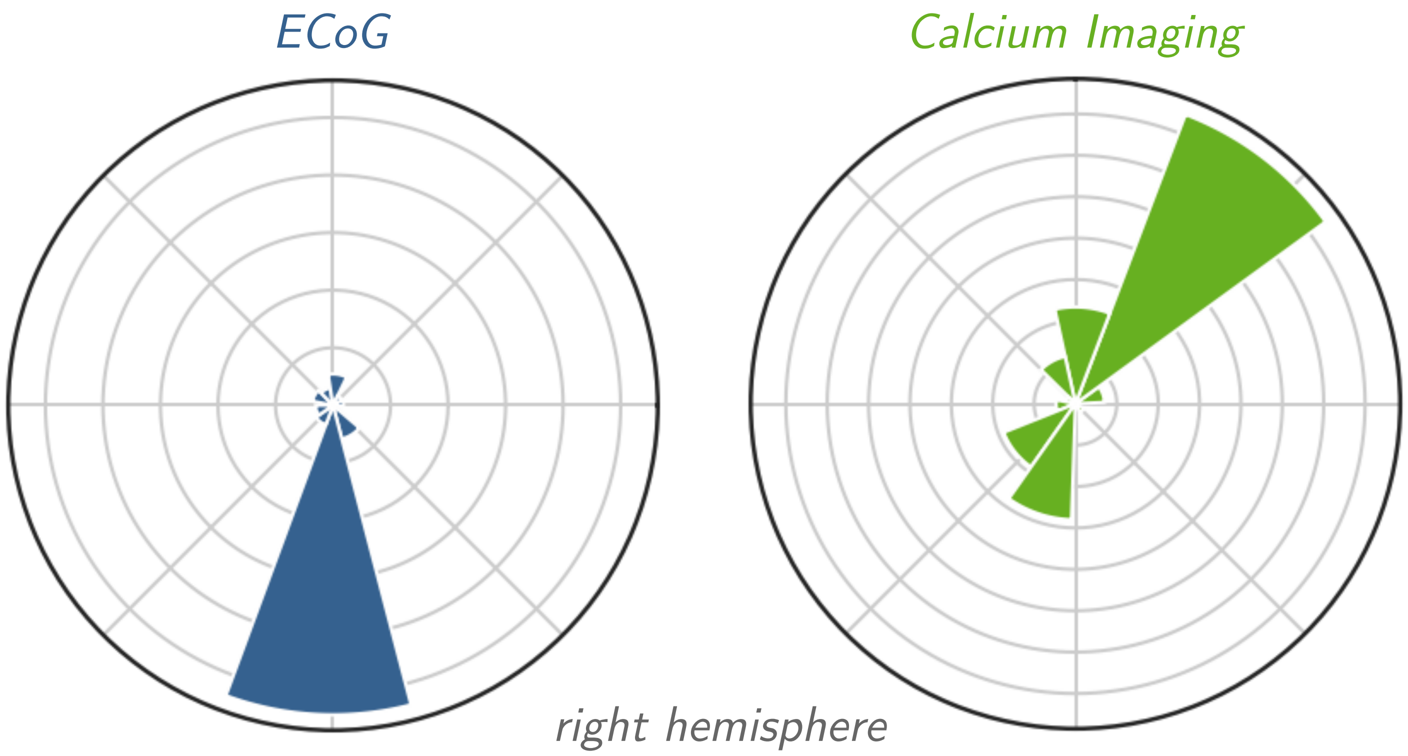
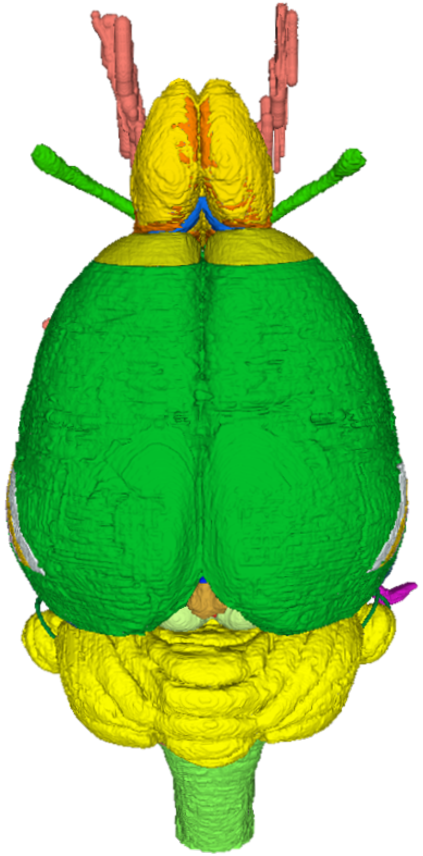
Results: Planar Wave Direction





Waxholm Space rat brain atlas

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- *EBRAINS collab: wiki.ebrains.eu/bin/view/Collabs/slow-wave-analysis-pipeline*
- *The pipeline code is open-source: github.com/INM-6/wavescalephant*
- *Preprint coming soon...*

References for inset figures on slide 1

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