Dipole localization and causality

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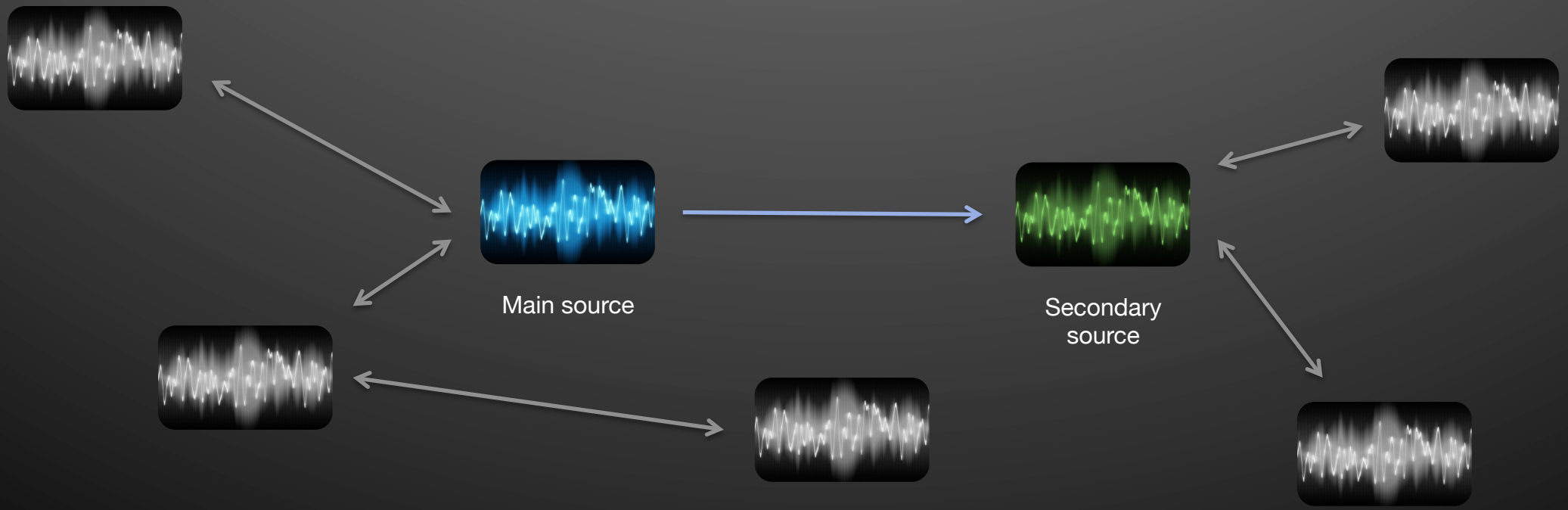
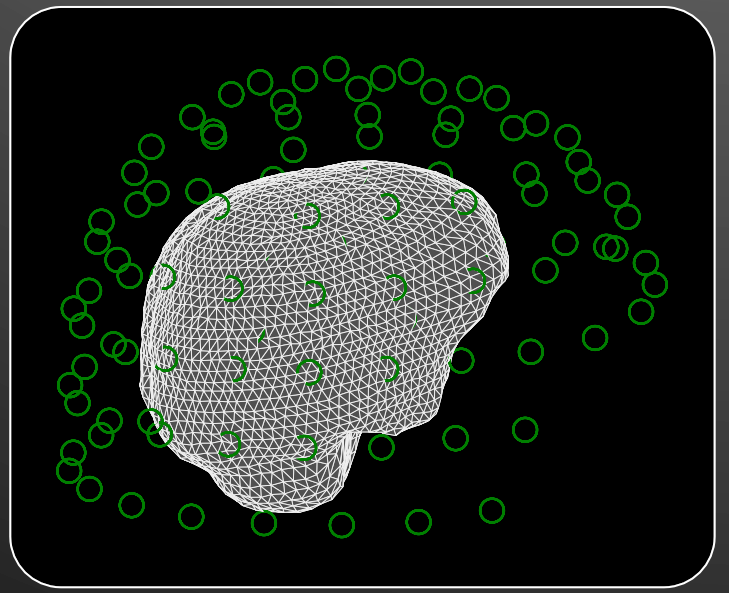
The challenge

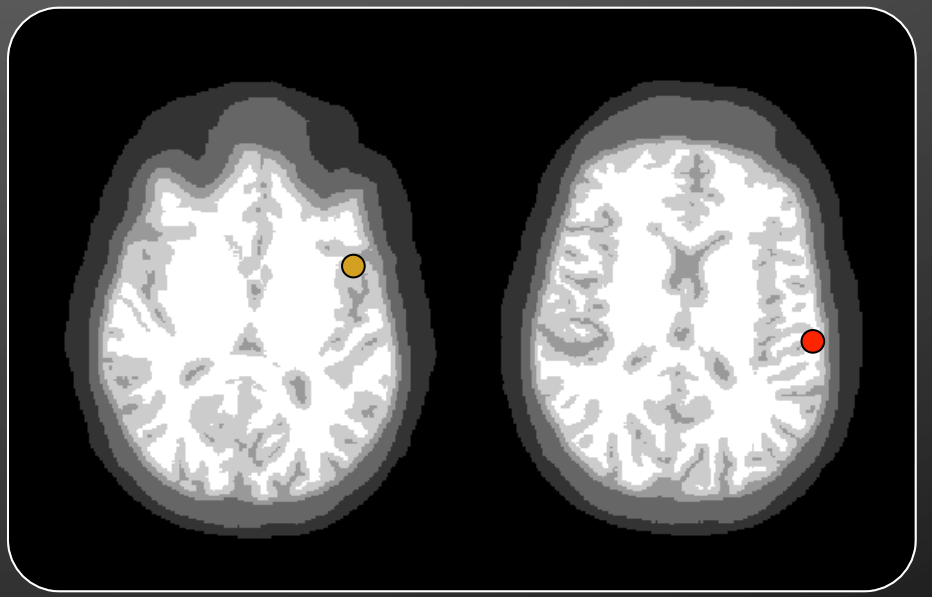
The challenge:
background activity



Forward model

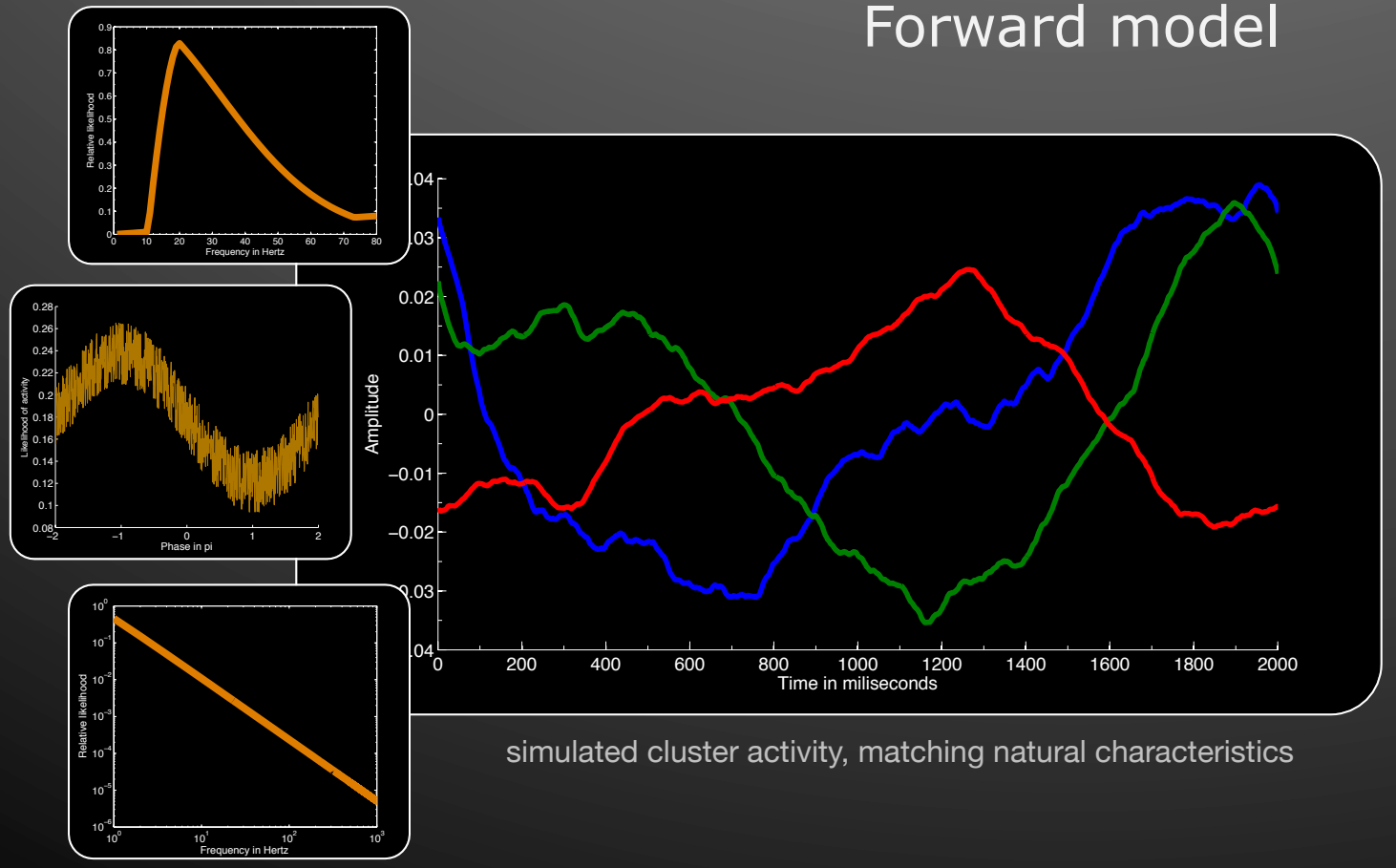


2mm, 5 layers (isotropic)

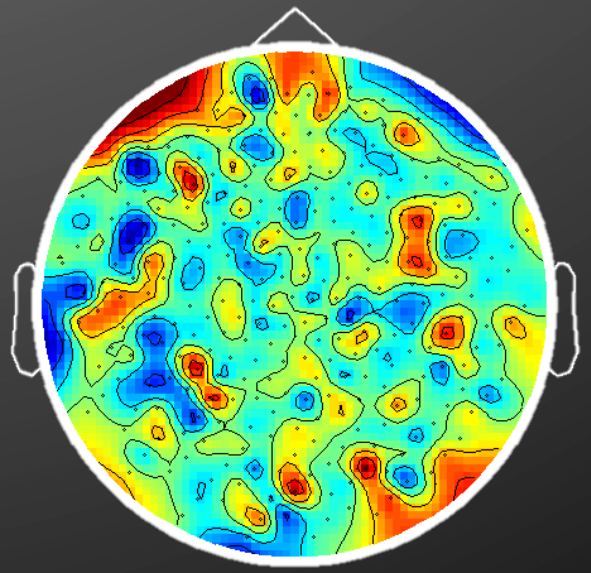


Cortical dipoles (main, secondary)

Forward model

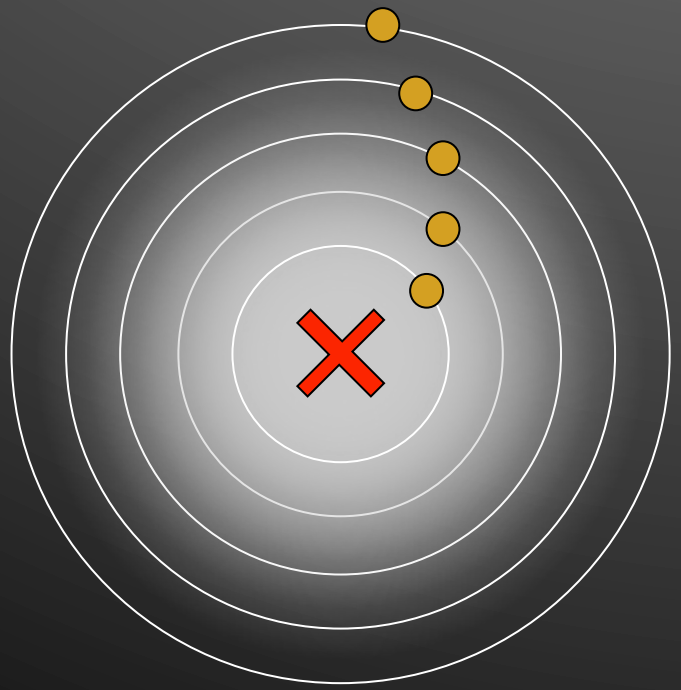


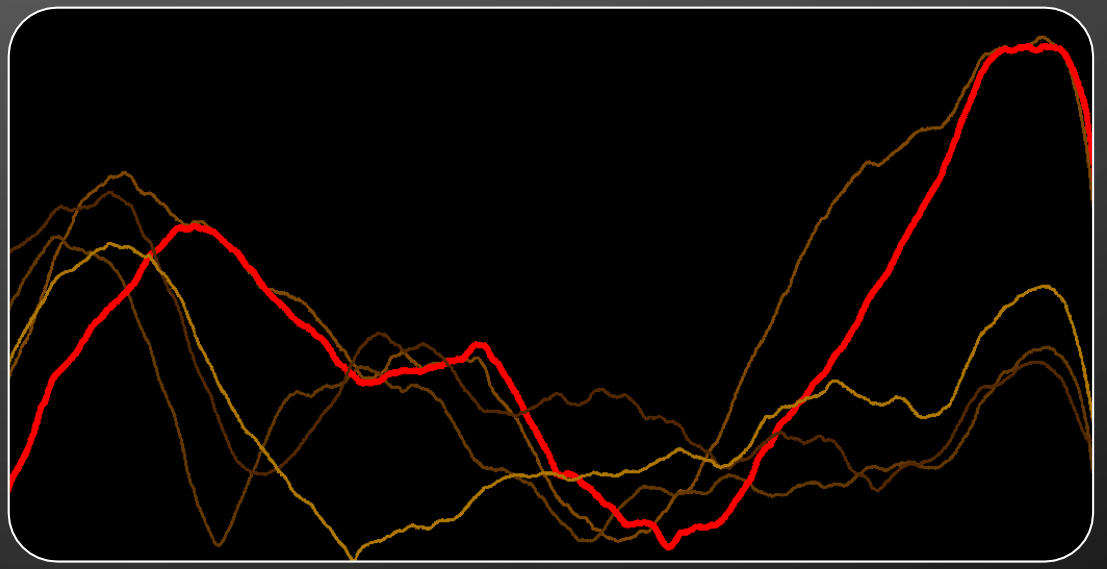
simulated cluster activity, matching natural characteristics



Average activity from 100 background sources

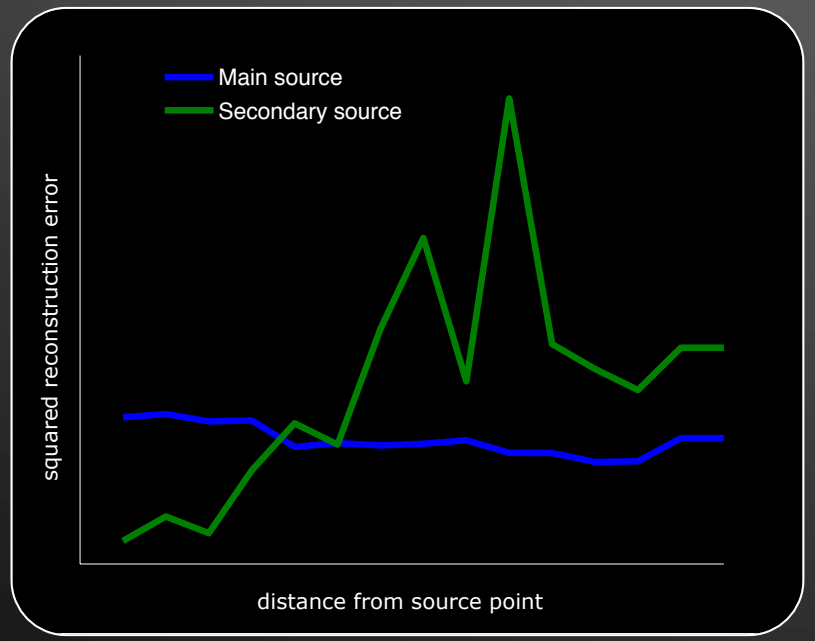
Inverse approach



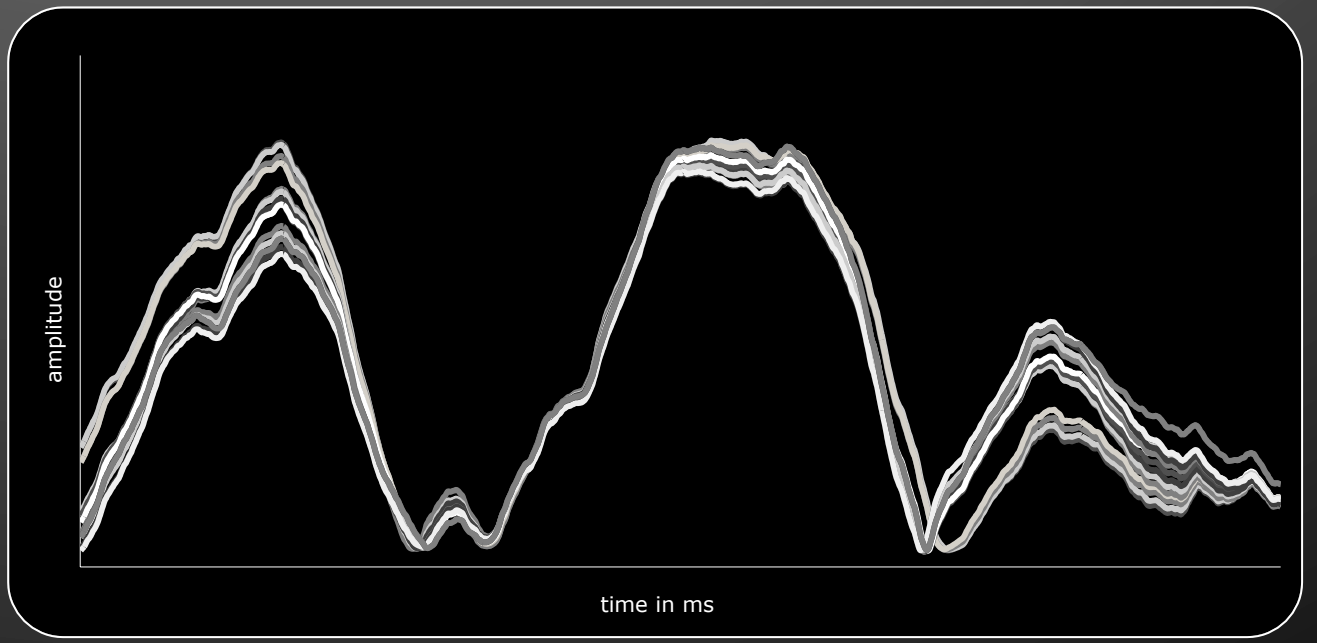


Source activity and reconstructed source activity

Inverse approach



Squared source error levels over distance

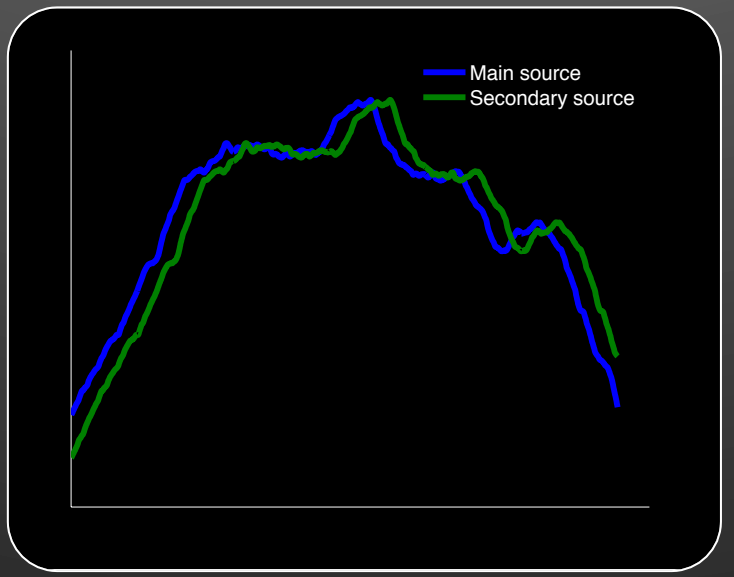


Source reconstruction time courses (<15mm) in a benign environment

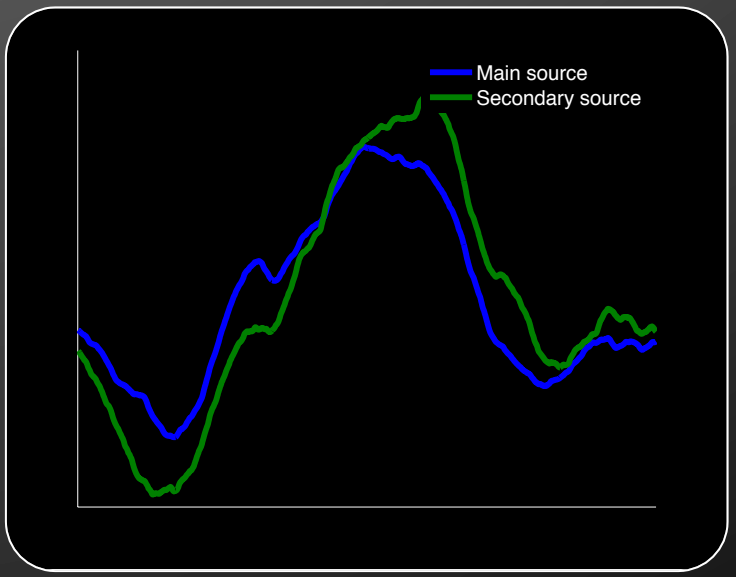
Causality analysis

Transfer entropy analysis:

- shift delay test
- volume conduction test
- causation test

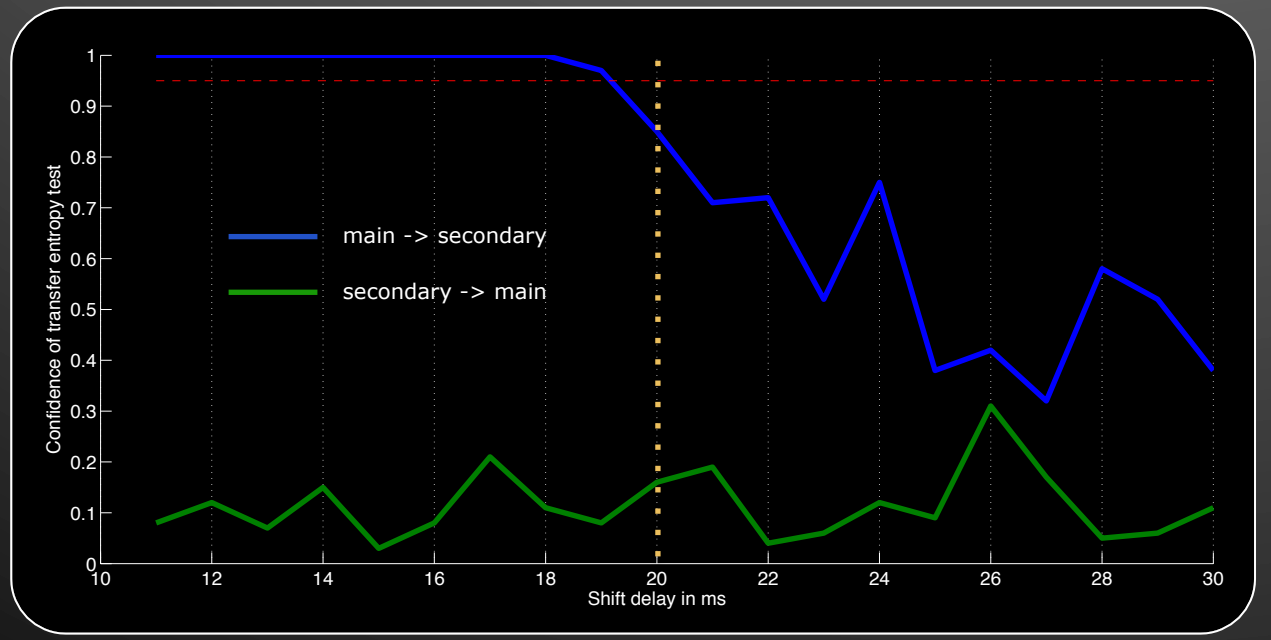


original sources

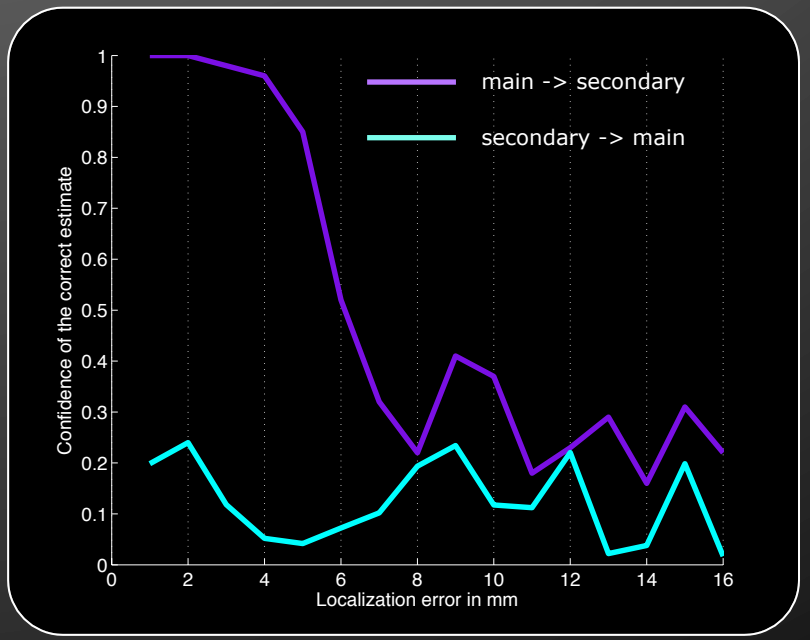


reconstructed sources (at radius 5)

Causation analysis



Shift delay confidence for r = 5



Confidence for all localization errors

Strengths

Realistic sensor data

- complex source behavior
- FEM-based leadfield

Robust setup

- high control over the localization error

Limitations

Simplistic head model

- Single shell model for the inverse solution
- limited amount of background sources

Simplistic dipole model

- single dipole search

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Thank you!

…Questions?