

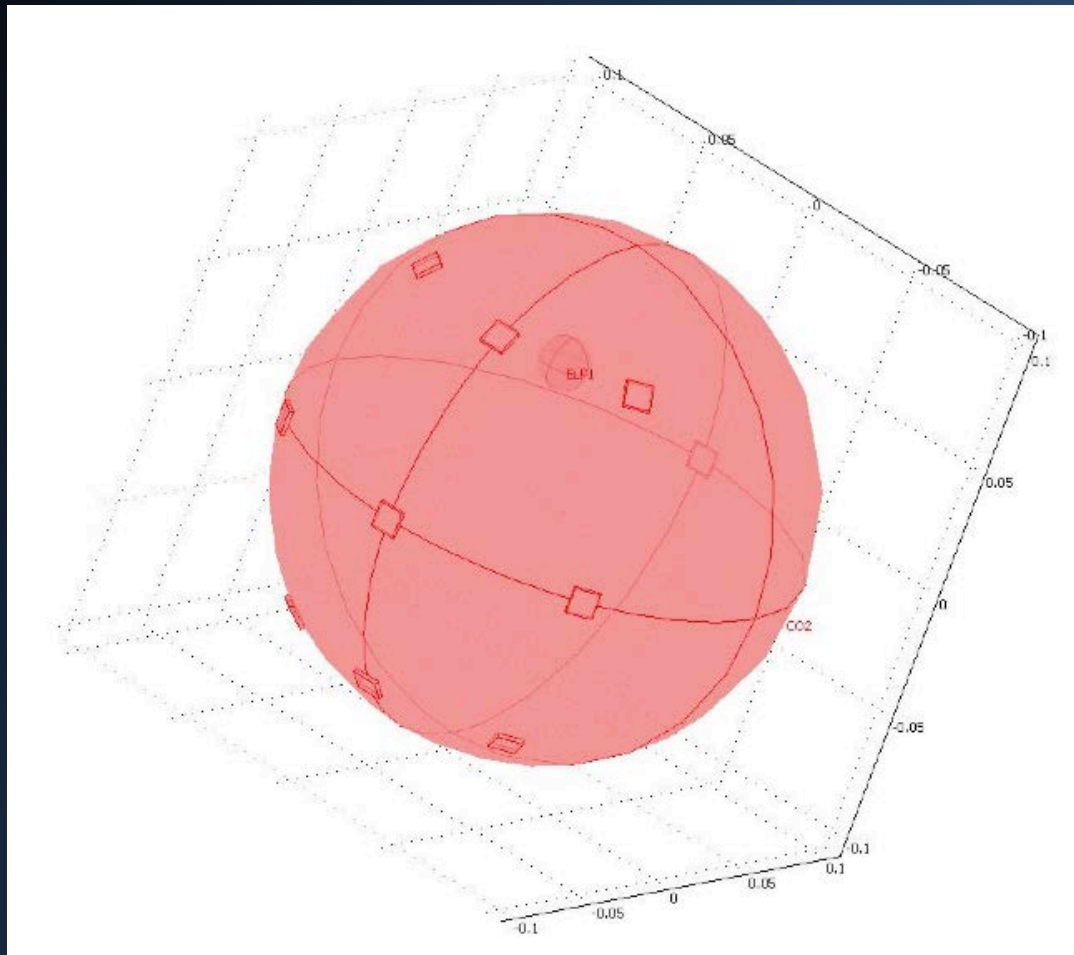
Conductivity Estimation of Breast Cancer Using COMSOL® Modeling of Microwave Scattering and Frechet Mean Estimate of Covariance

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Introduction

- Rapidly growing.
- Mammography: discomfort , ionization, false negatives
- Microwave imaging is “safe” but uninvestigated
- Noise levels, accuracy, imaging timelines

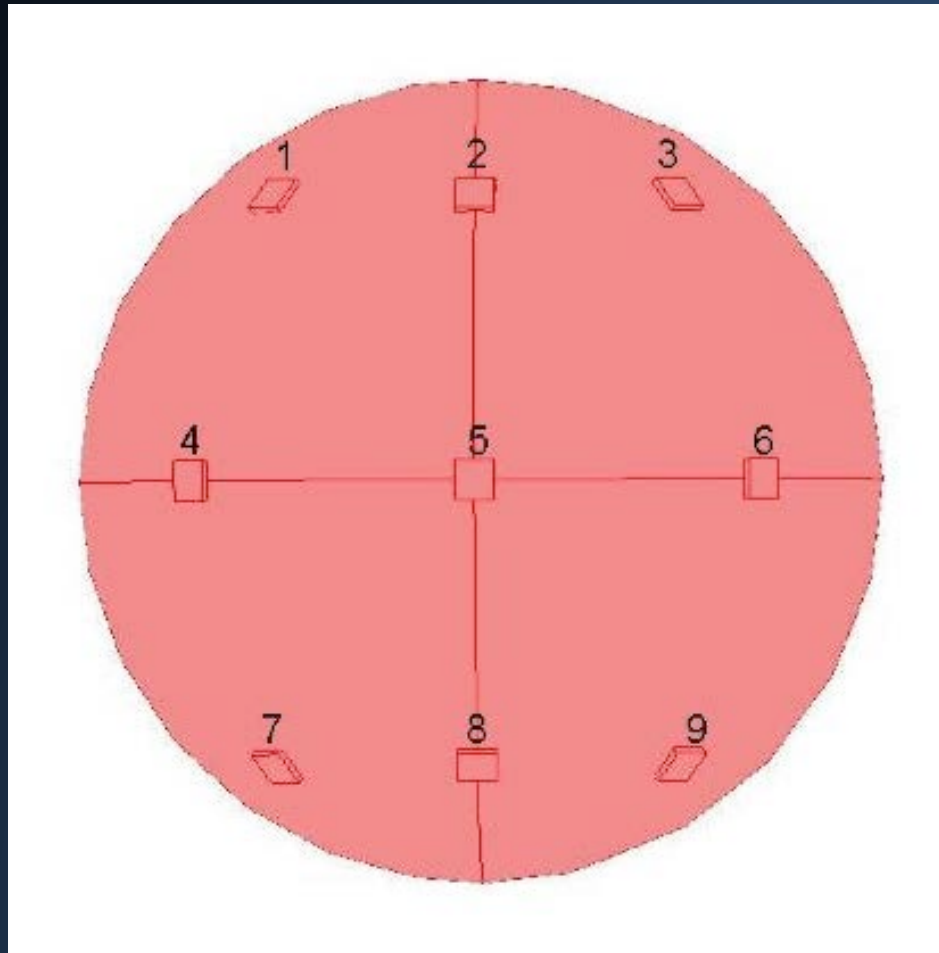
COMSOL Model



COMSOL Model (Cont'd)

- Cancer – different conductivity/permittivity
- Scattering of microwave
- Model predicted vs. measured
- Estimate parameters
- Detect presence of scattering
- Decide: cancer/not

Antenna Positions



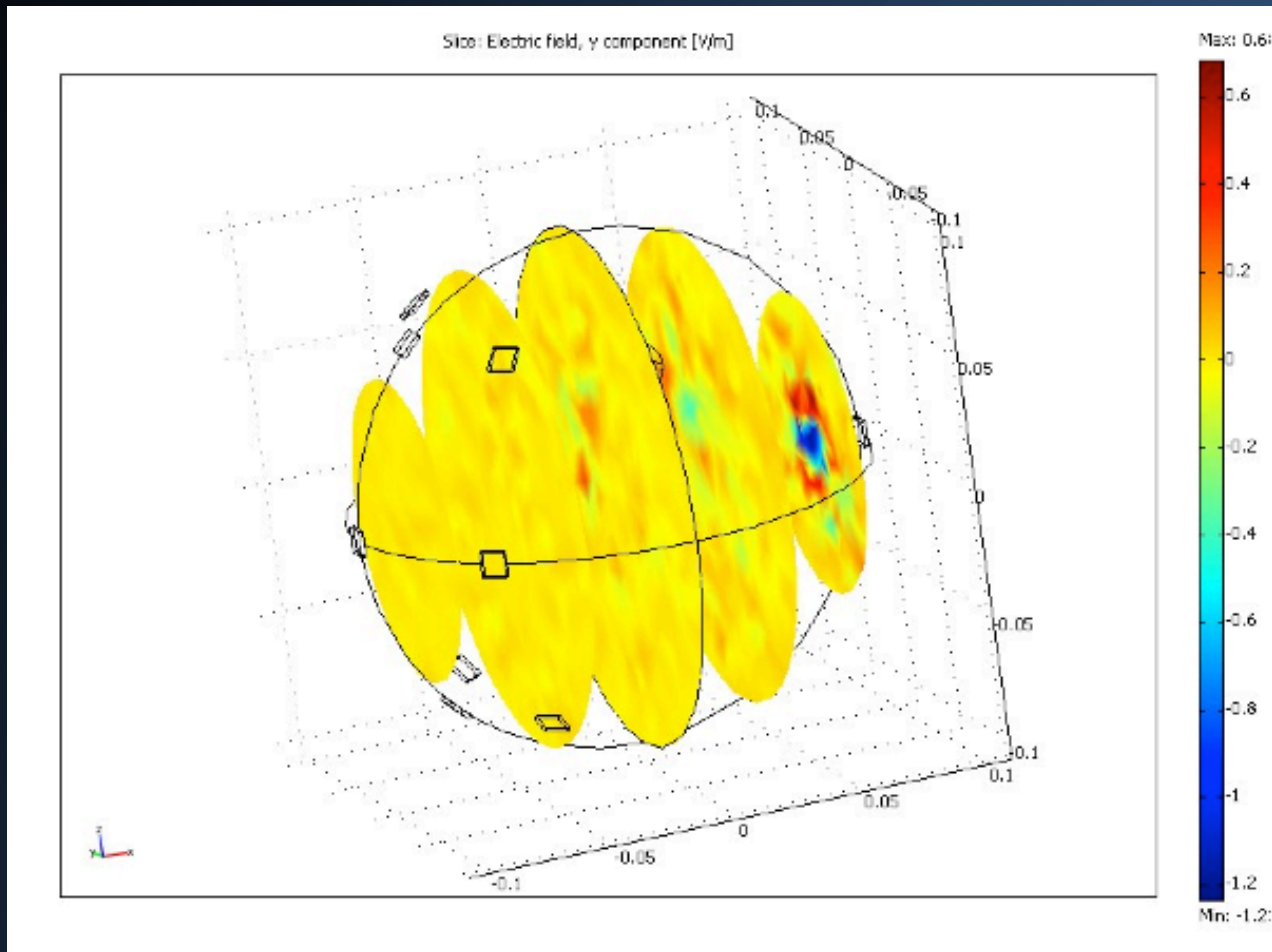
Signal Model

- H0: No signal, the measurement only noise
- H1: Nonlinear function, COMSOL built parametric version, with respect to position, size, properties of cancer

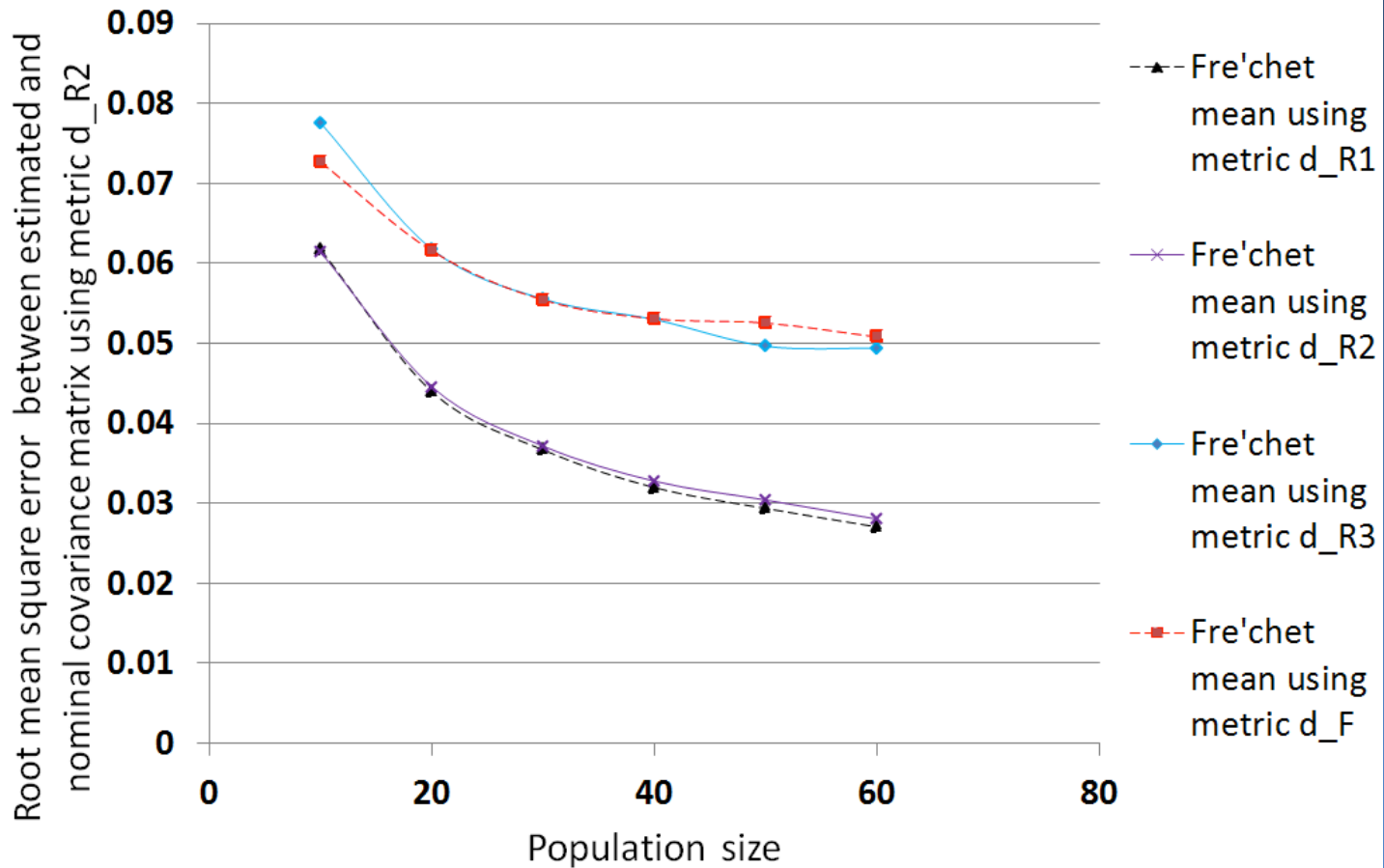
Frechet Mean

- Difference between two matrices can be measured using different distances
- Instead of arithmetic mean geometric mean can be used
- Ensures positive definite property for the covariance
- In correlated noise – almost always !!!!

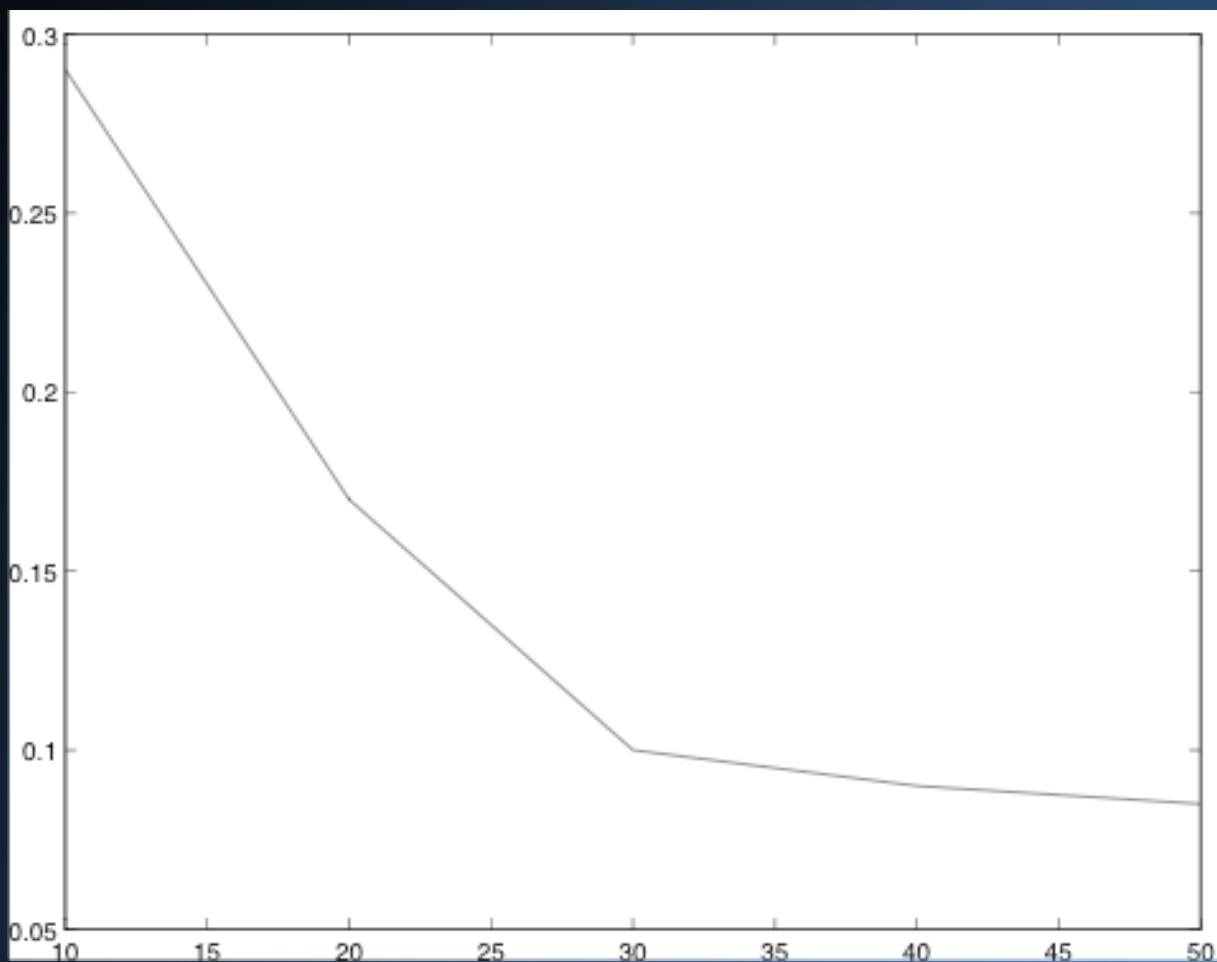
Results



Estimation



Detection



Conclusions

- Signal processing algorithms will provide key answers: noise levels, antenna powers, reliability, screening frequency, etc.
- More advanced techniques can provide significant improvements in imaging analysis