Resolution as a function of Stimulation and Measurement Patterns

Andy Adler[1] and Zhanqi Zhao[2]

[1]Systems and Computer Engineering, Carleton University, Ottawa, Canada
[2]Institute of Technical Medicine, Furtwangen University, Villingen-Schwenningen, Germany

# Adjacent vs. opposite current injections

Hypothesis:

- Adjacent stimulations have lower current density in the center of the measurement so that they should have lower distinguishability in the center?

- Opposite stimulations have less independent voltage measurements per frame so that they should have lower resolution?

However:

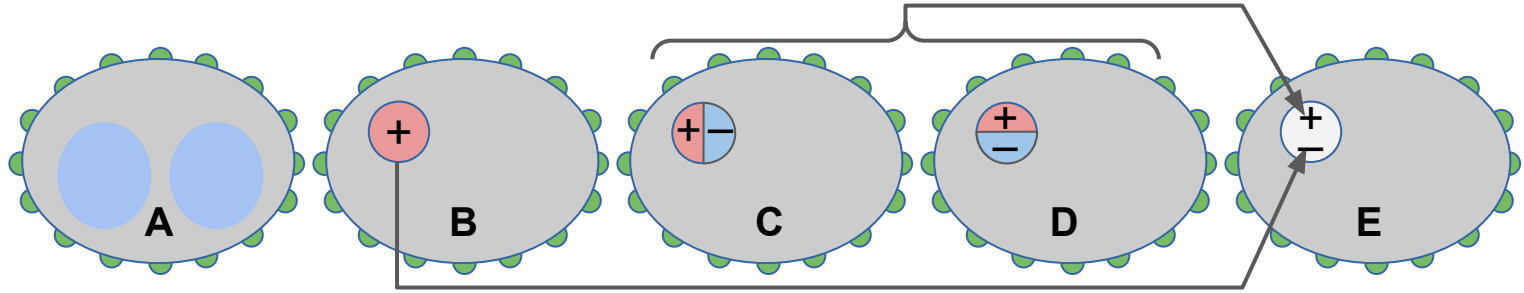- Adjacent can better distinguish two lungs? Why?
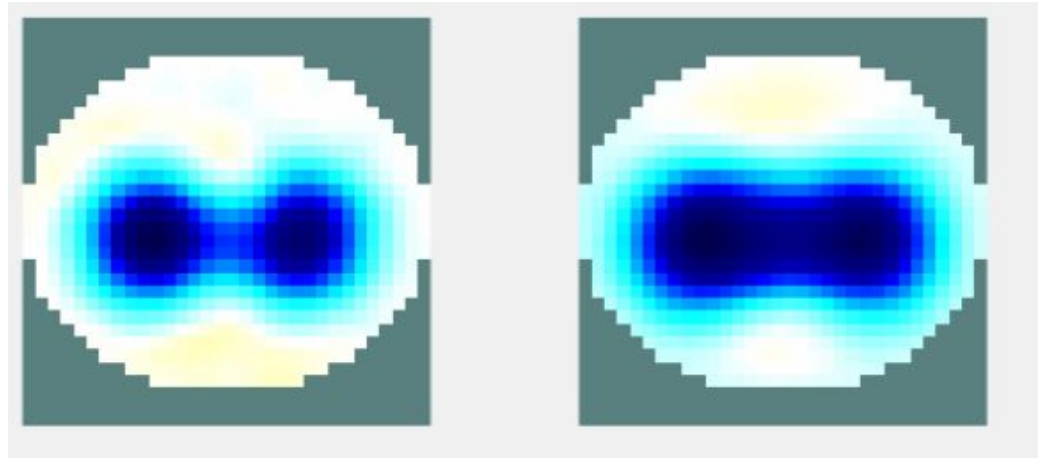
The problem
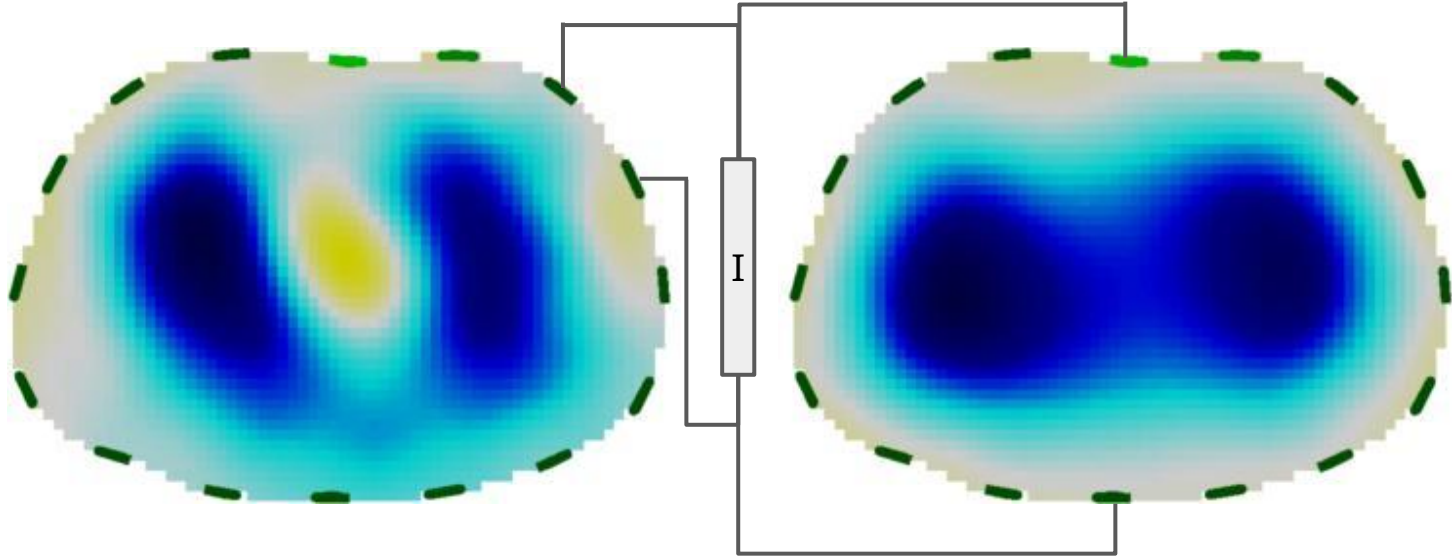
Tidal breathing in healthy subject for different Stim+Meas Patterns (Adjacent vs Opposite).

# Idea #1: Develop a Distinguishability / Resolution metric

The *distinguishability* of EIT defined as area-weighted image amplitude for a small contrast (**B**).

Image resolution can be defined by the ability of EIT to resolve high spatial-resolution features. **C** and **D** show horizontal and vertical circles split into positive and negative halves.

E shows the radio of *resolution*/*distinguishability*
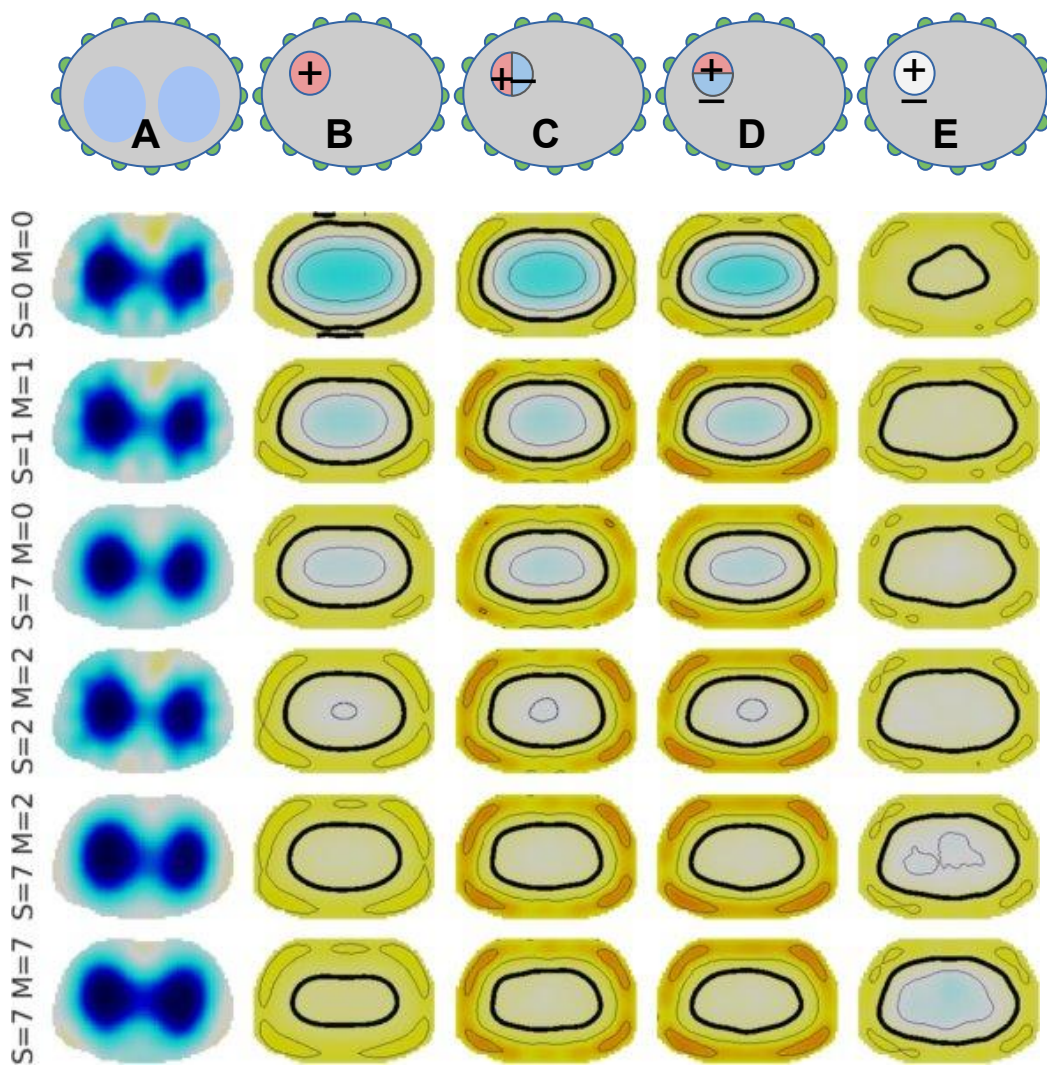
Distinguishability as hypothesis testing
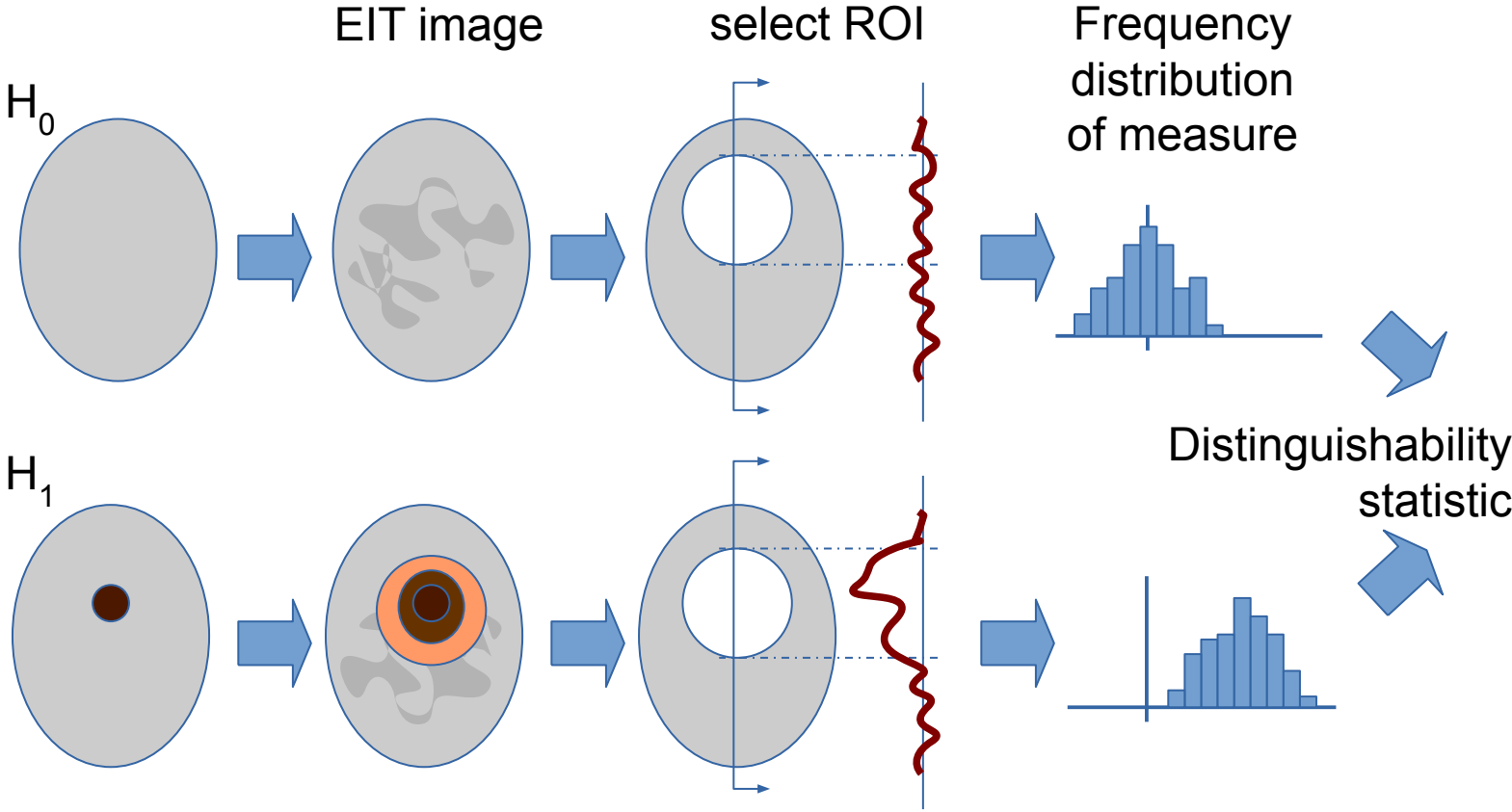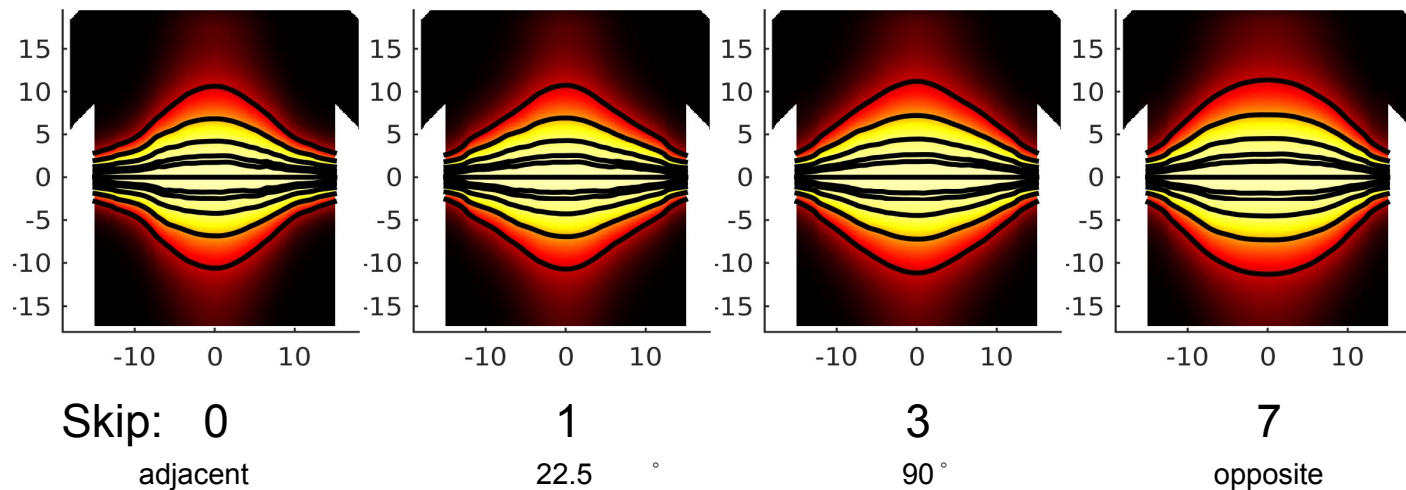
Resolution as hypothesis testing
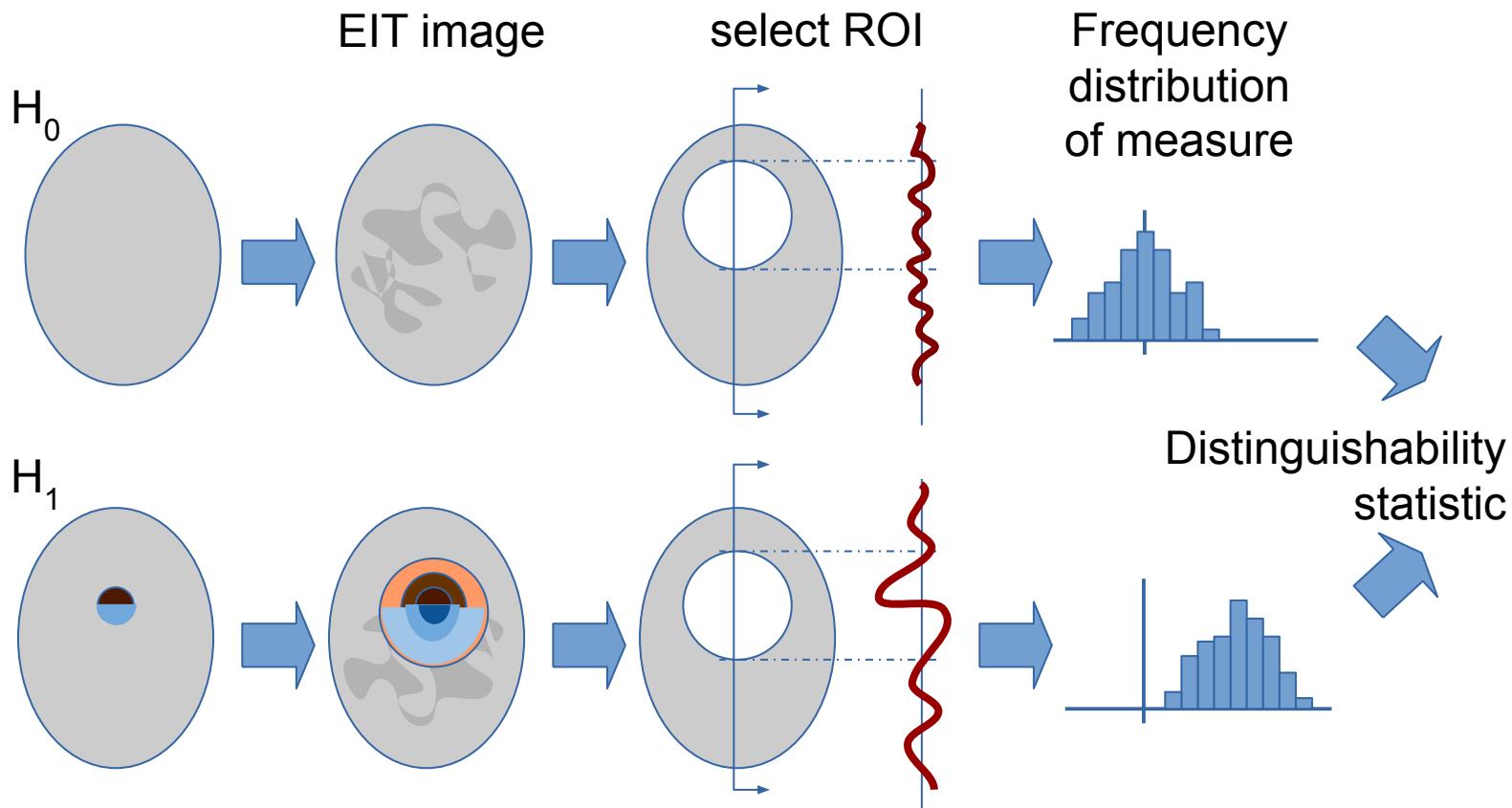
Metric Versus Skip (S) Measurement (M) pattern

Idea #2 Vertical Resolution

Off-plane sensitivity of EIT

Skip: 0   1   3   7

adjacent   22.5 °   90 °   opposite

Coronal plane sensitivities for different skip patterns (indicated). Black lines are the sensitivity contours.
(from Adler, Frerichs, Grychtol, EIT2017)

Discussion