

tCS: risks, benefits and the need for control

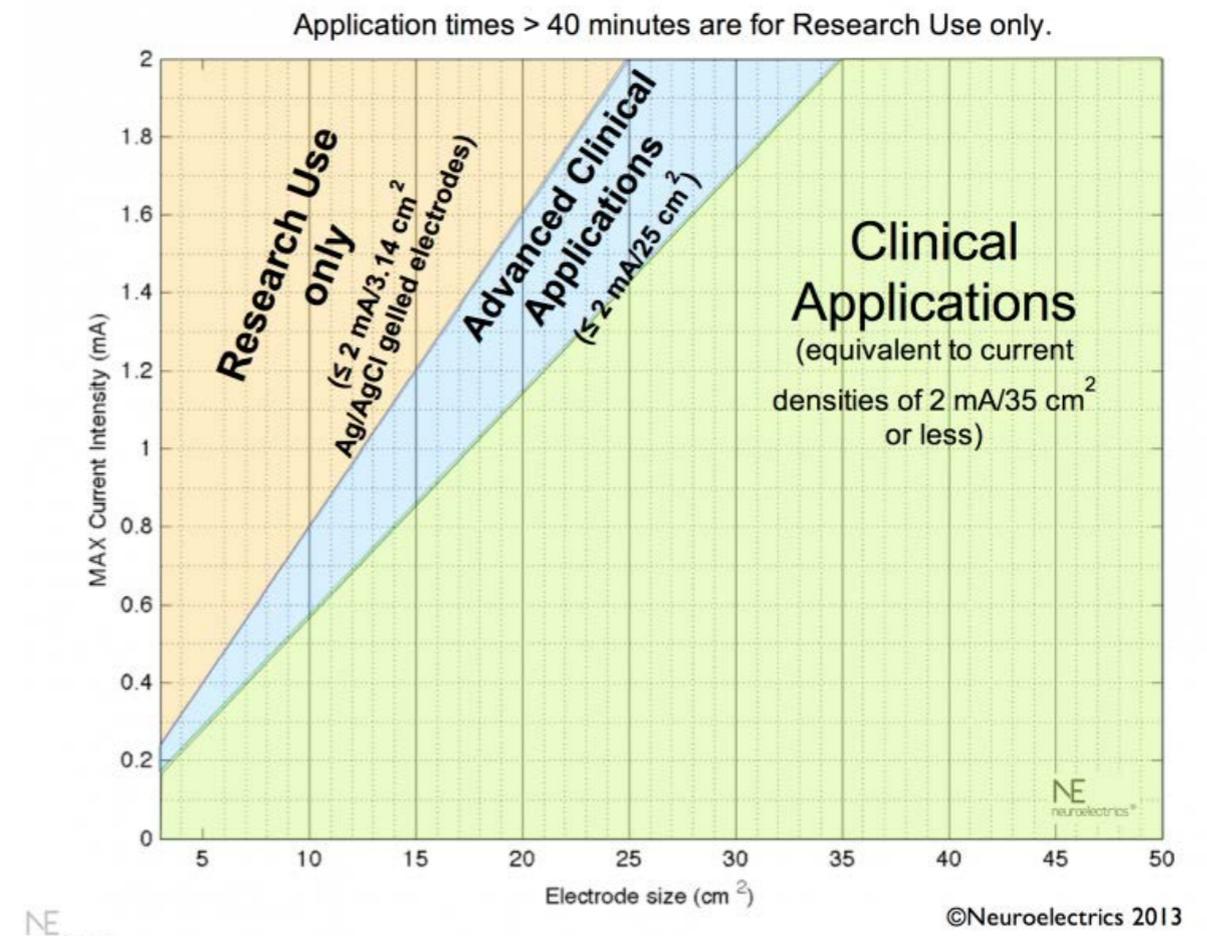
Giulio Ruffini - Neuroelectronics Corporation / Starlab



- Short term tDCS safety is well established using good practices both with sponges or Ag/AgCl electrodes +gel.
- Ill effects limited to skin irritation or small burns in rare cases (probably due to wrong placement of sponges)
- Safety verified in adults with intact skulls, no implants, etc. Other groups much less studied.
- Research studies carefully specify and limit duration, intensity, repetition of sessions.
- Other forms of tCS (such as tACS, tRNS) less studied

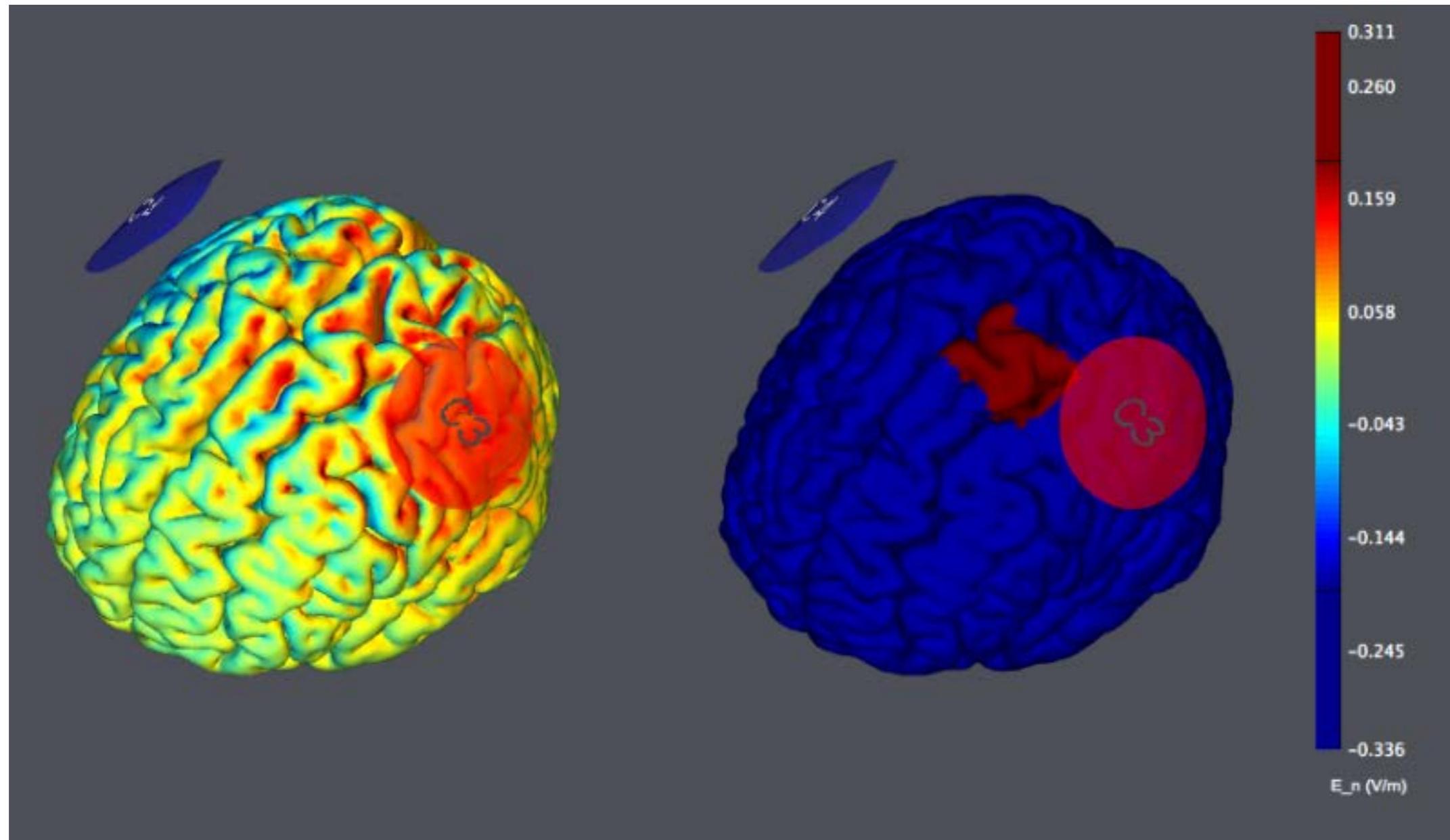
Safety aspects

- After thousands of hours of stimulation, short term ill effects associated to tCS in controlled settings remain scarce and minor
- Devices need to implement safety measures
- Starstim designed for safety:
 - Current at electrode < 2 mA
 - Max injected current < 4 mA
 - Programmend duration < 1 h
 - Impedance check before
 - Impedance check during
 - For use with our electrodes
- Our safety record is excellent

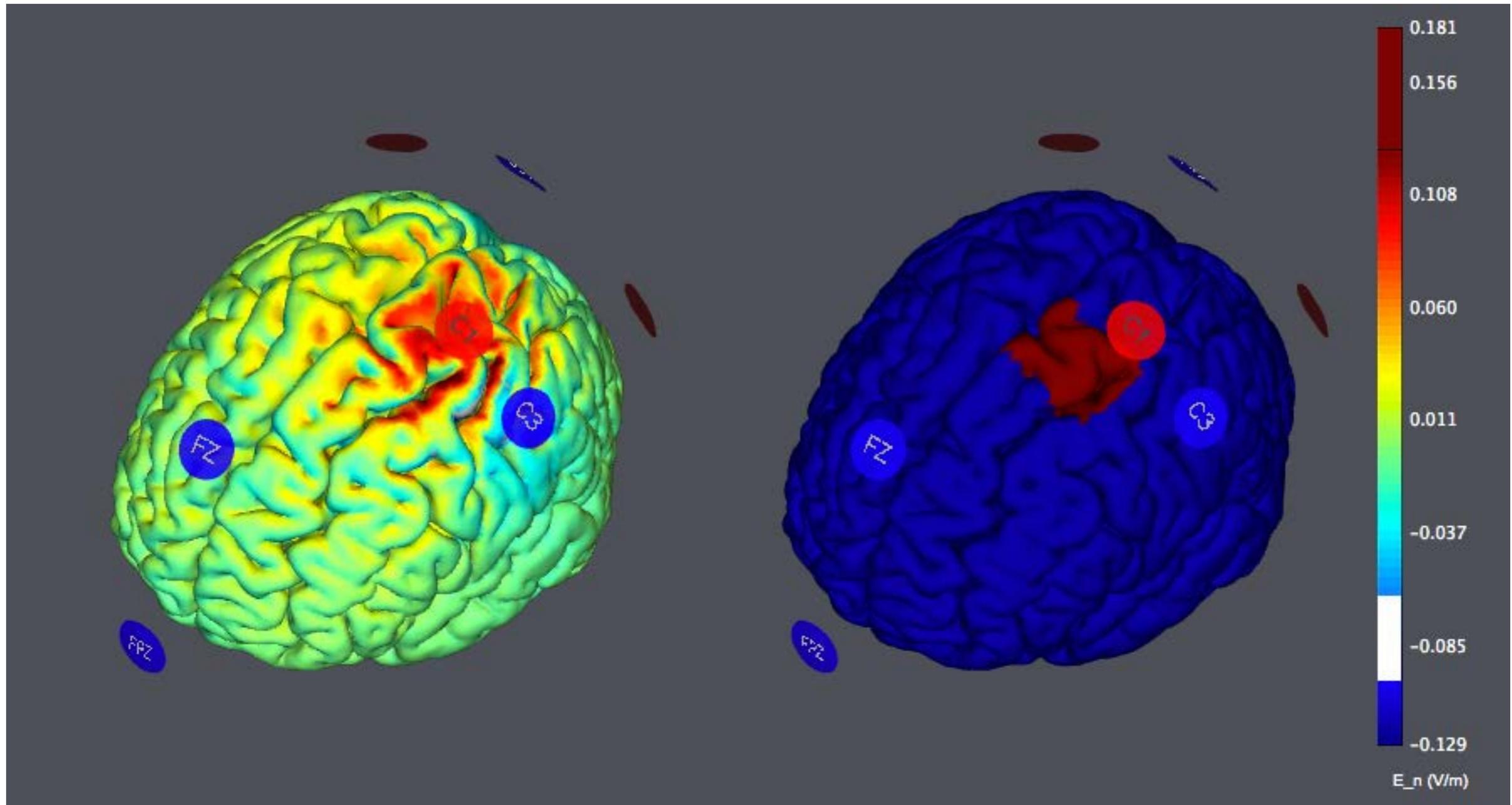


- Long term safety not so clear
- tCS has demonstrated physiological effects
- **Stimulation affects brain connectivity and brain function**
- Effects depend on many factors: montage, intensity, duration, repetition framework, brain state. Age probably important.
- Response function of brain not 100% understood. E.g., intensity: more is less? Enhancement at a price (Ioculano & Kadosh 2013)?
- Classical paradigms employing large stimulation areas probably affect large areas of the brain
- Need to understand these phenomena well in a controlled fashion (i.e., medical, research settings) before unleashing tCS to the public.

Typical montage: very large action area

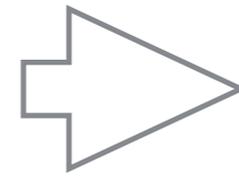


Quasi-monopolar stimulation using multi-electrode techniques

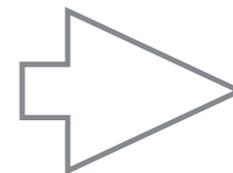


What “controlled fashion” means

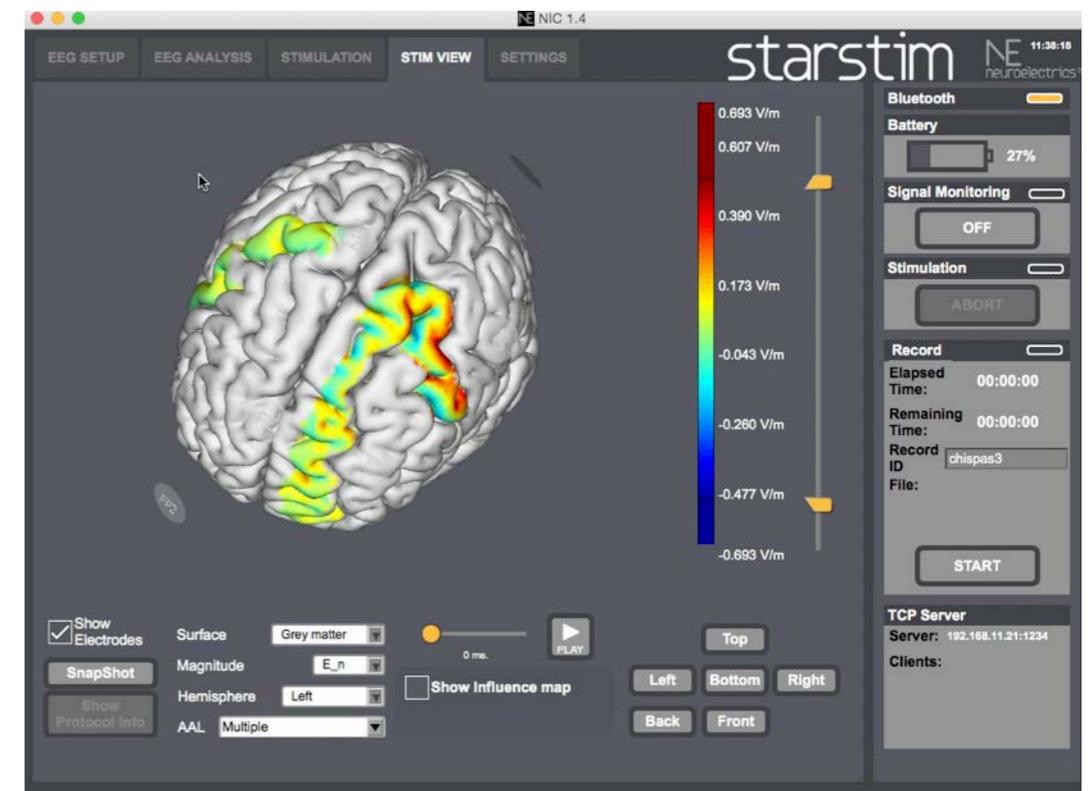
- Today: lab, clinical settings
- Transition to **tele-monitored home use** to better understand impact of repeated use in natural settings (NE has already begun doing this with partners)
- Use of repeatable montages; protocols aiming for specificity of stimulation effects (e.g., targeted rather than “shotgun”).



[Protocol = specification of electrode type, positions, current type and intensity, duration, session sequencing.]



- Modeling of electric fields
- Coregistration to study physiological effects such as EEG, fMRI, etc.
- Safety documentation to continue checking for short term effects



Thank you for your attention!

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