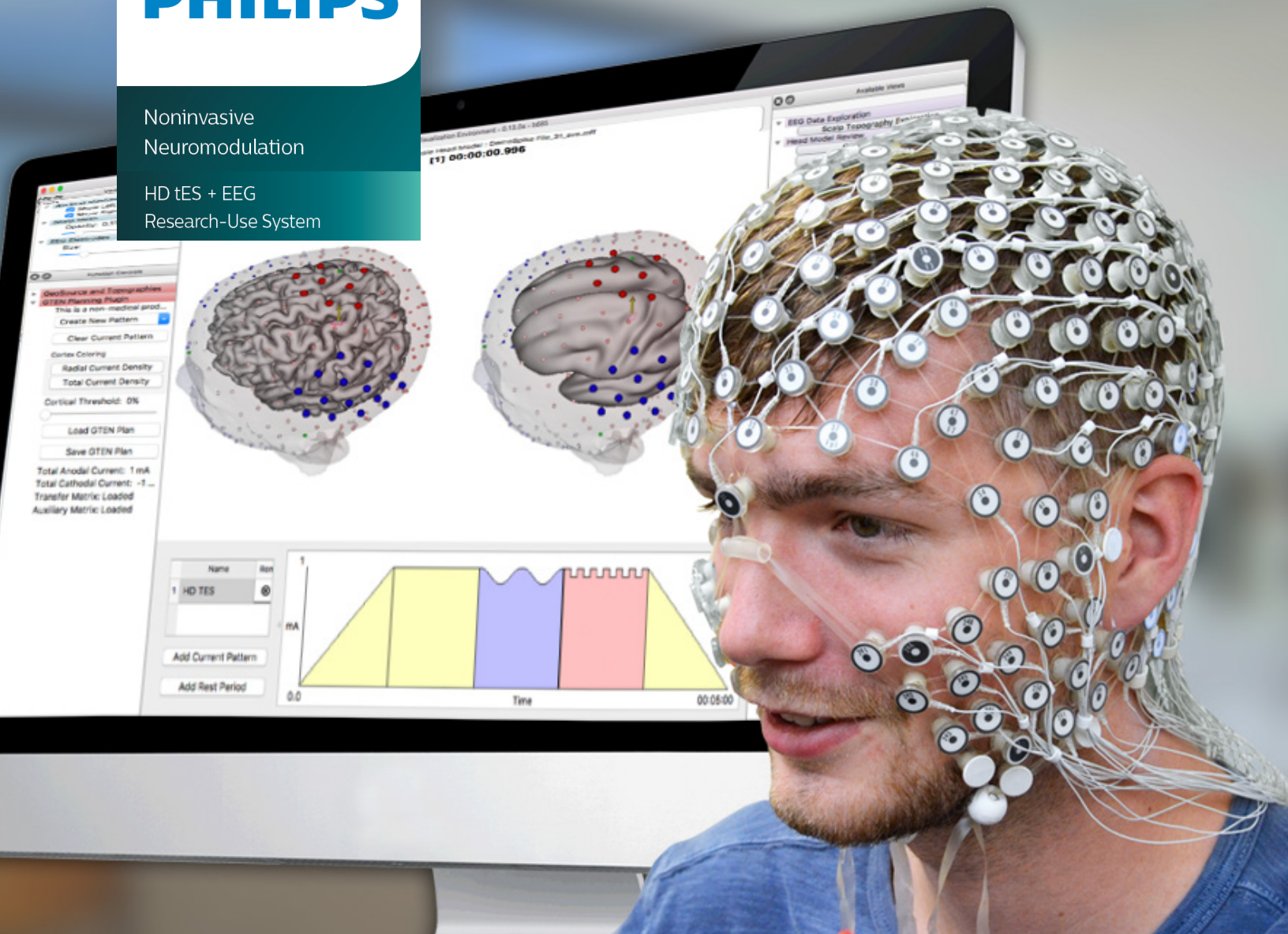# PHILIPS

Noninvasive
Neuromodulation

HD tES + EEG
Research-Use System

# Improve **neuromodulation** methods with **HD EEG**

Geodesic Transcranial Electrical Neuromodulation (GTEN) System*,
a fully-integrated upgrade kit for the Geodesic EEG System 400

Utilize individualized measures to achieve individualized changes

HD EEG and electrical neuromodulation in a single platform

Record EEG and deliver current simultaneously using the same Geodesic Sensor Net

- Enables customized stimulation montages using the 32, 64, 128 or 256 channel sensor nets - any electrode can serve as anodes or cathodes interchangeably
- Enables any combination of HD tDCS, tACS, tPCS, and tRNS within a single protocol
- Improves target planning through high density, whole-head electrical source localization
- Provides the ability to build individualized MR-based head models, or instead use the included age-matched atlases
- Identifies the functional cortex for target planning
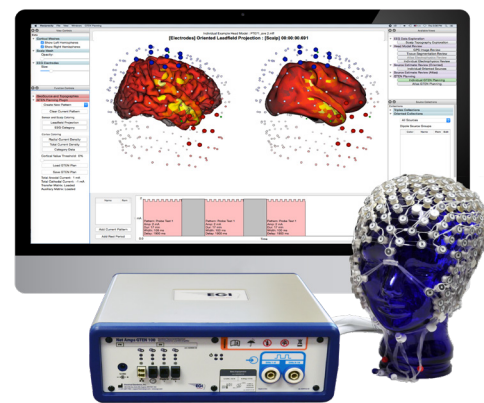
GTEN 100 Neuromodulation Research System

Increase reproducibility by incorporating electrical source imaging
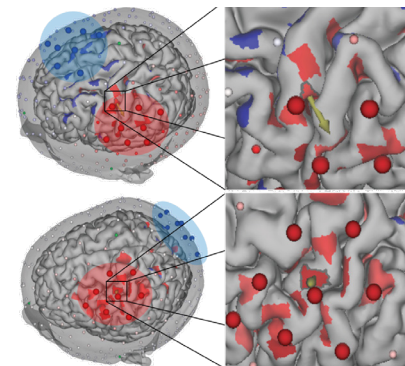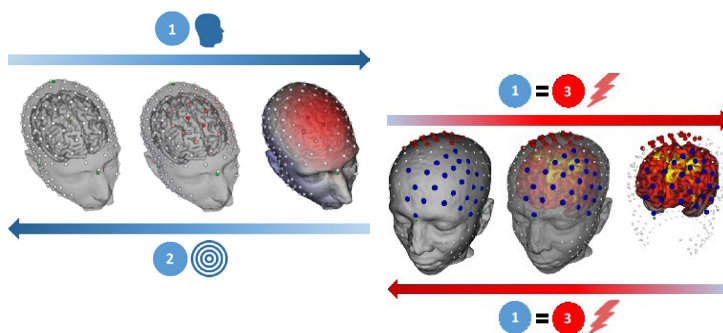
High resolution atlases for accurate source imaging and tES

High resolution head modeling leads to more reproducible neuromodulation and cortical source localization. The GTEN system allows for transcranial electrical stimulation (tES) planning based upon the reciprocity theorem: a source's scalp voltage projection and the stimulation pattern required to modulate that source are the same. By this theorem, GTEN's high resolution atlas head models will improve source localization and neuromodulation outcomes.

Individualized head models

To account for differences in anatomy across subjects, Philips Neuro offers source localization software that can build individualized MR-based head models. This provides an accurate picture of the cortical surface, informing the placement of scalp anodal and cathodal electrodes.[1]

Creating a new standard for multimodal intervention research

Supports whole-head arrays for all established tES modes

Move beyond your standard protocols in both spatial and temporal domains with any combination of high density transcranial direct, alternating, and/or pulsed current stimulation – or even incorporate transcranial random noise stimulation. Then monitor the resulting EEG patterns in real-time, and iterate accordingly.
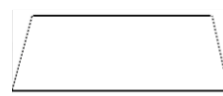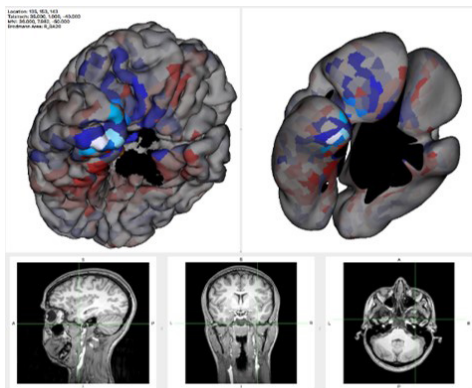
tDCS
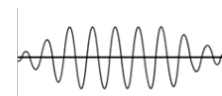
tACS

tRNS

tPCS

Provides automatic or manual montage selection

Use targeting algorithms to automatically determine the optimal electrode montage for stimulating any region of interest, or manually select electrodes to serve as the anodes and cathodes. When deciding upon a target region of interest, you have the option to leverage source localization from HD EEG data collected with the same net. All electrodes within the sensor net are ideally sized and evenly spaced to provide increased degrees of freedom for optimal precision.

Allows for rotating and changing configurations

GTEN offers robust stimulation options that far exceed the scope of traditional two patchelectrode or ring tES – including protocols with anodes and cathodes that change location over time.
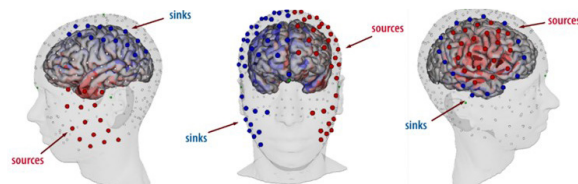
GTEN can be purchased as a new system, or as an easy upgrade from the Geodesic EEG System 400

Product packages

Product name	Details
GTEN 100 Research Neuromodulation System — 32, 64, 128, or 256 channel	• Net Amps GTEN 100 amplifier • GTEN targeting and planning software module • GTEN control software module • Hospital grade isolation transformer • Premium iMac computer • Net Station software license and HASP • Articulated Arm and mounting brackets • Net Support Kit
GTEN 100 Research Conversion Package – 32, 64, 128, or 256 channel[2]	• Net Amps 400 amplifier conversion to Net Amps GTEN 100 amplifier • GTEN targeting and planning software module • GTEN control software module

Options

Geodesic Sensor Net	Sponge-based HydroCel Nets for rapid application
GeoSource 3 software	Electrical source imaging software with atlas models, or individualized head models
Geodesic Photogrammetry System	For 3D sensor registration
GeoScan Sensor Digitization Device	For 3D sensor registration

*Geodesic Transcranial Electrical Neuromodulation (GTEN) System is not intended for use in diagnosis or treatment of any disease or condition. It is a scientific research instrument designed for performing measurements and acquiring data for neurophysiological research. Philips makes no representation of the suitability of the instrument for any particular research study.

1. P. Luu et al., "Slow-Frequency Pulsed Transcranial Electrical Stimulation for Modulation of Cortical Plasticity Based on Reciprocity Targeting with Precision Electrical Head Modeling," Front Hum Neurosci, vol. 10, p. 377, 2016.
2. This package requires that you already have a 256 channel Geodesic EEG System 400 system with Net Station 5.3 or later software. Once the Net Amps 400 amplifier in your GES 400 system is converted to a GTEN 100 amplifier, it will still record EEG signals, but will no longer be a clinically cleared device and will be FOR RESEARCH USE ONLY.