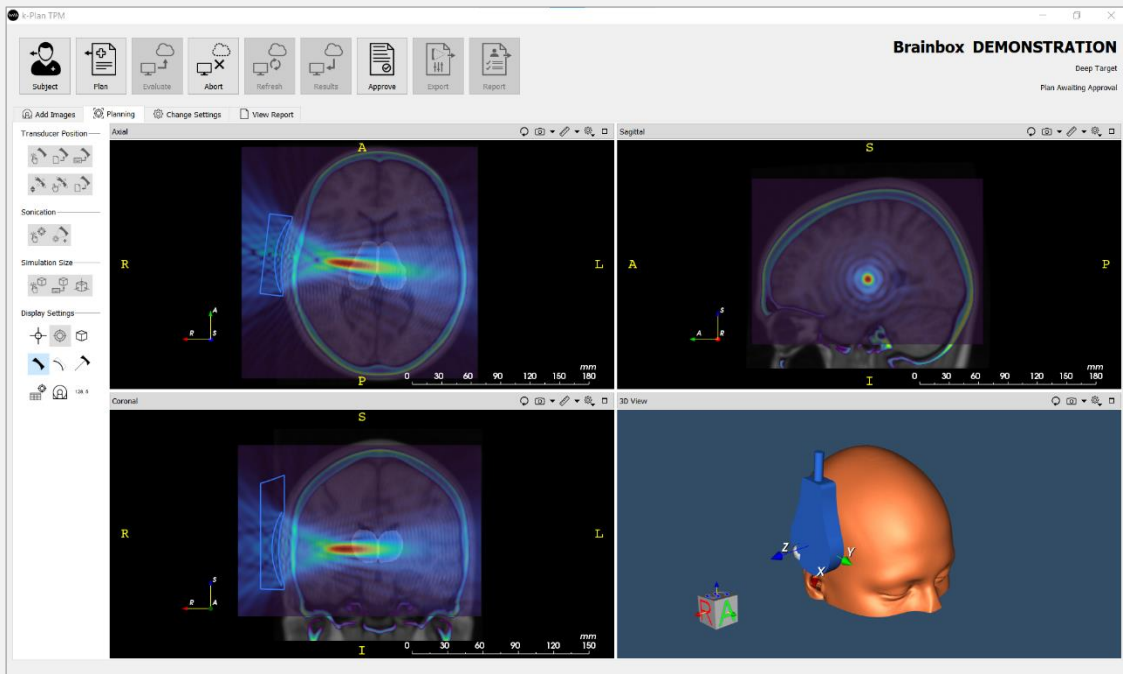# k-Plan

Ultrasound therapy planning

Available from

**BRAINBOX**

ADVANCED PLANNING, SIMPLIFIED

k-Plan is an advanced modelling tool for planning transcranial ultrasound procedures. It uses a streamlined and intuitive workflow that allows users to select an ultrasound device, position the device using a template or medical image, and specify the sonication parameters. High-resolution calculations of the ultrasound field and temperature inside the skull and brain are then automatically calculated in the cloud with a single click. No knowledge of numerical modelling or high-performance computing is required.

USER DRIVEN, RESEARCH BUILT

k-Plan is developed by researchers at *University College London* and the *Brno University of Technology* based on more than a decade of research into ultrasound modelling and planning for transcranial ultrasound therapy. More than just a research tool, k-Plan features a refined UI/UX shaped by extensive formative user testing. Features like transducer click-to-place, configurable image overlays, and automated report generation reduce setup time and increase productivity when running simulations.
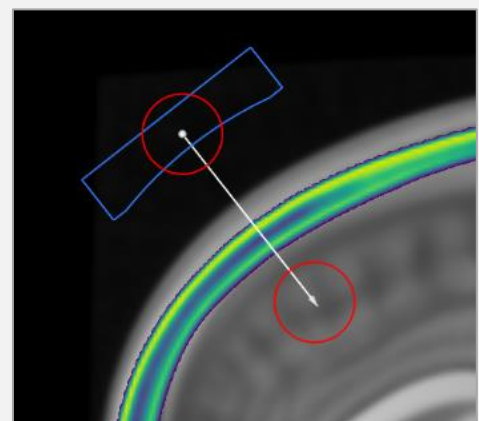
STUDY MANAGEMENT

k-Plan integrates a complete study management system. Users can capture study information, subject details, and study IDs according to study requirements, and then later easily de-identify or anonymise planning simulations while retaining simulation results.
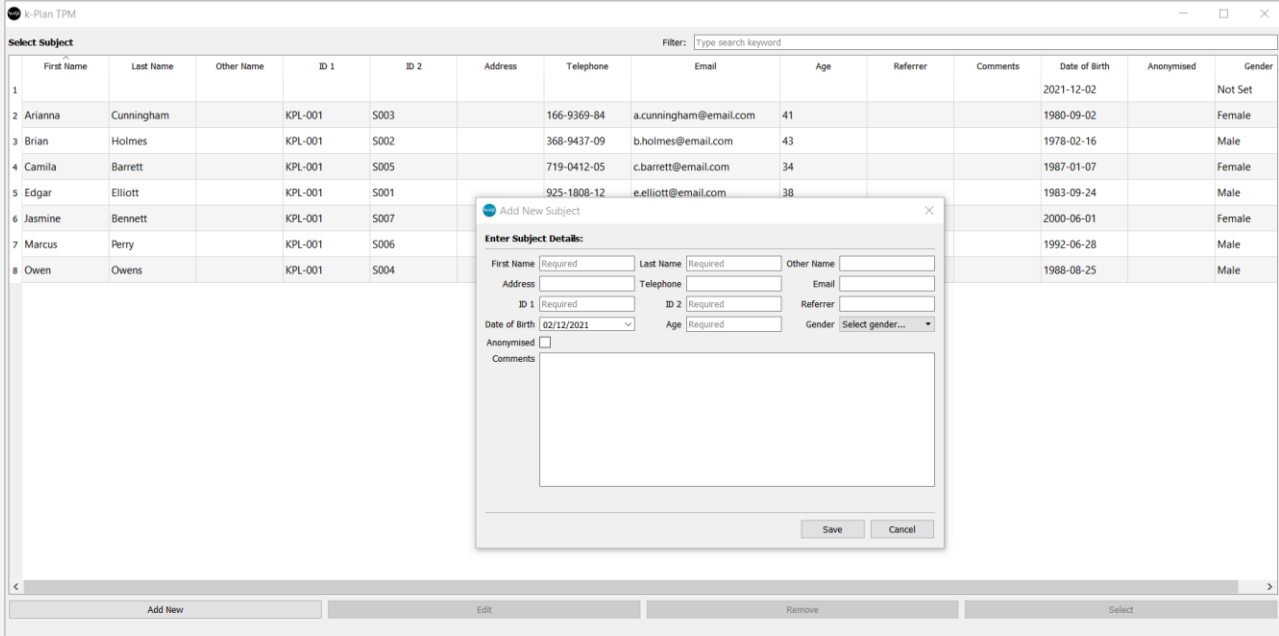
EXPANDABLE TRANSDUCER LIBRARY

k-Plan can model single element, annular array, and multi-element transducers. The transducer library is user-extendable to model transducers from a wide range of manufacturers or custom transducer designs.
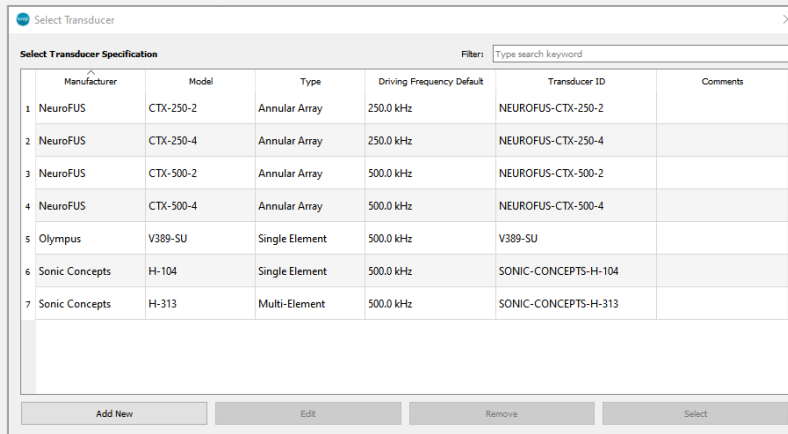

INTELLIGENT COMPUTE ENGINE

k-Plan's intelligent compute engine automates the process of running a planning simulation for transcranial ultrasound therapy. It automatically maps from CT skull images to material properties, generates an accurate model of the transducer based on geometric and calibration information, and then sets appropriate numerical and computational parameters. Simulation outputs are automatically processed to display the ultrasound field and temperature inside the brain, and to calculate exposure parameters.

STATE-OF-THE-ART SIMULATION TOOL

Behind the scenes, k-Plan runs simulations using k-Wave, a state-of-the-art simulation tool that is widely used across academia and industry to study acoustic wave propagation. It uses an experimentally-validated full-wave acoustic model to calculate how ultrasound waves travel from a therapy device through the skull and into the brain. This is coupled with a model of heat diffusion and perfusion to calculate temperature rise and thermal dose.
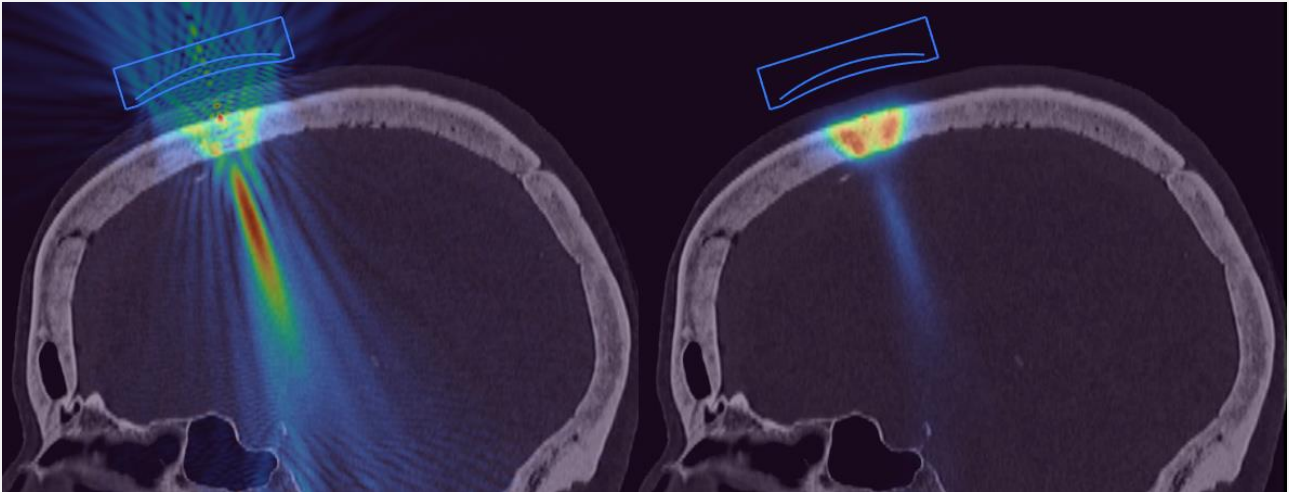

CLOUD-BASED PLANNING SIMULATIONS

k-Plan allows access to high-performance computing resources in the cloud to run high-resolution planning simulations with a single click. The simple installation procedure and intuitive workflow means users can be running simulations within minutes, with no additional resources or accounts required. k-Plan's automated dispatch server optimises the computing resources needed for every simulation, minimising the time between planning and results. The status of running simulations is automatically refreshed and displayed in the plan browser.

Select Plan   Filter: [Type search keyword]

	Label	Transducer	Comments	Status
1	FSL-Extracted Skull	CTX-500-4 (NeuroFUS)	Demonstration of using an FSL extracted h...	Server Running Simulation
2	Focal Length	CTX-500-4 (NeuroFUS)	Demonstration of changing the focal lengt...	Simulation Complete, Ready For Download
3	Skull Variation	CTX-500-2 (NeuroFUS)	Demonstration of the variability in skull att...	Simulation Complete, Ready For Download
4	Incidence Angle	CTX-500-2 (NeuroFUS)	Demonstration of changing the incidence ...	Downloading Plan Results
5	Deep Target	CTX-250-4 (NeuroFUS)	Demonstration of targeting a deep structur...	Plan Awaiting Approval
6	Skull Heating	CTX-500-2 (NeuroFUS)	Demonstration of how the sonication para...	Plan Awaiting Approval
7	Frequency Variation	CTX-250-2 (NeuroFUS)	Demonstration of how the transmit freque...	Awaiting Transducer Placement

| Add New | Edit | Remove | Duplicate | Refresh Status | Select |

TARGETTING

Alignment of the ultrasound beam with the brain target can be investigated by changing the transducer position and sonication parameters and comparing the calculated exposure and dose parameters. For multi-element phased-array transducers, automated correction for skull aberrations can also be performed to target the desired brain area.
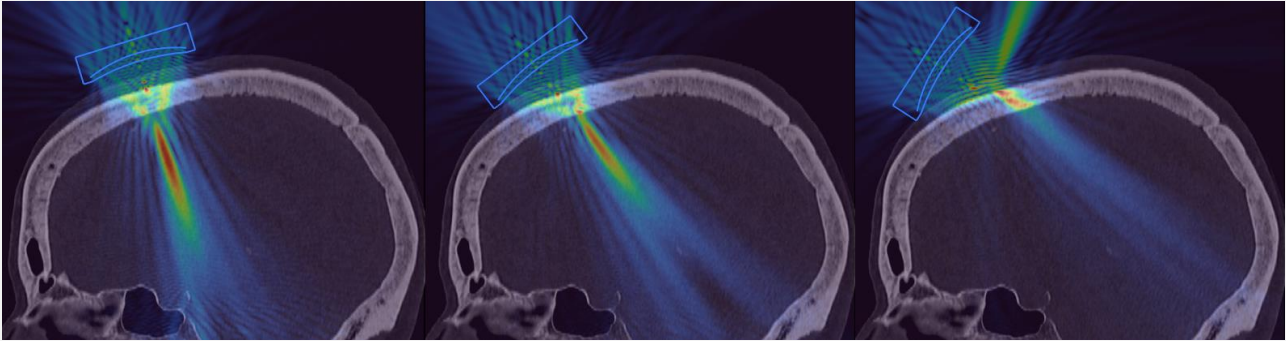
WORKFLOW INTEGRATION

k-Plan integrates into standard neurostimulation workflows, including importing and exporting transducer positions for use with neuronavigation systems, and exporting plan reports.

SECURE BY DESIGN

Subject data is stored in a password protected AES-256 encrypted database stored locally with each installation. Only pseudonymised data is transferred to the cloud using industry-standard encrypted communication protocols along with advanced data security and integrity measures.

ADVANCED WEB PORTAL

k-Plan's web portal provides a complete snapshot of your account, including current cloud computing allocations and usage history. Self-service options allow administrative users to add or remove accounts associated with the same software license and modify user privileges.

FURTHER DETAILS

k-Plan is developed by researchers at *University College London* and the *Brno University of Technology* and is available from *Brainbox, Ltd*. Brainbox brings several decades of experience in developing, integrating, and distributing cutting-edge neurotechnologies for neuromodulation and brain mapping to end user scientists, engineers, and physicians conducting neuroscience R&D.

For further information, please contact info@brainbox-neuro.com.

Note, k-Plan is available for <u>Research Use Only</u>. It is intended solely for basic research use in non-clinical applications.