

THE REVOLUTION CONTINUES

CURRY6TM

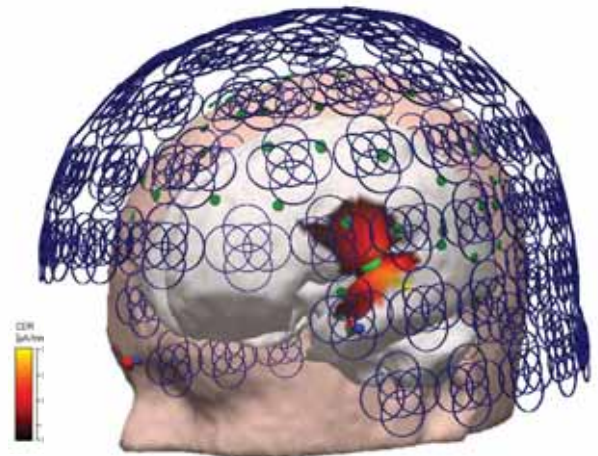
True Multi-Modal Neuroimaging



Multi-Modal Neuroimaging

CURRY integrates multiple complementary functional and image modalities (EEG, ECoG, MEG; MRI, fMRI, PET, SPECT and CT) in a single software package for the purpose of obtaining the maximum accuracy of electrical source analysis. CURRY uses the full physical anatomy from MR and CT to provide three-dimensional models of the skull and brain allowing the neural generators of the topographic EEG to be computed.

CURRY was developed for mapping and identification of the neural generators of EEG and MEG recordings. However, the functionality offered and the revolutionary changes in this latest version CURRY also make it suitable for wider application, including clinical applications in neurology, epilepsy and radiology.



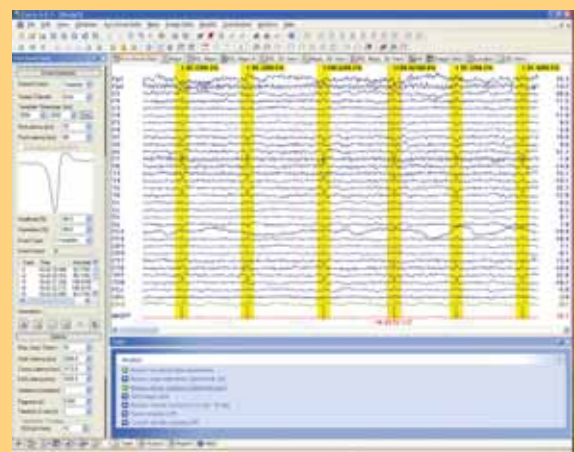
Simultaneous analysis of EEG and MEG data

Highlights

- Integration of EEG, MEG, ECoG, ECG, MCG, with MRI, fMRI, CT, PET, SPECT.
- Complete data processing from filtering to source analysis.
- Event support, template-based event detection.
- Principal and Independent Component Analysis (PCA, ICA) and filtering.
- Individual realistic head models using the Boundary Element Method (BEM).
- Pre-computed BEM and Finite Element Method (FEM) head models.
- Dipole fits. Dipole confidence ellipsoids are computed.
- Dipole scans, extended source (patch) scans, and MUSIC scans.
- Beamforming based on dipolar or extended sources.
- Current density analysis, extended sources, Lp norms, sLORETA, SWARM.
- Export of results in Excel, MATLAB, and SPM formats.
- Report generator.
- Windows multi-document user interface.
- Data import wizards for functional and image data.
- Multi-core support using thread-based multitasking and parallelization.
- Hardware accelerated real-time rendering of 3D scenarios.
- Context-sensitive HTML help system.
- Online updates.



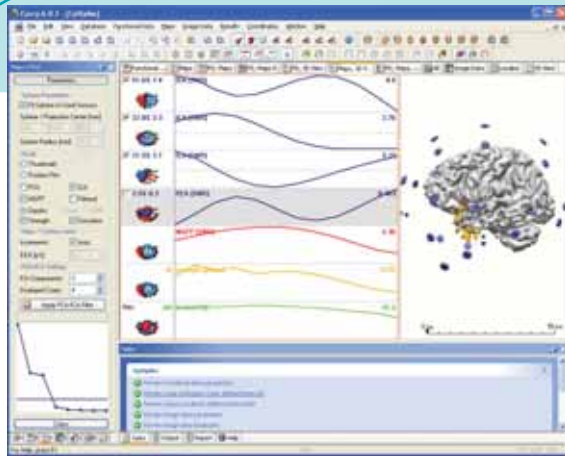
Dipole analysis of single-spike temporal lobe epilepsy data



Template-based event detection used for EKG artifact detection and removal.

CURRY6™

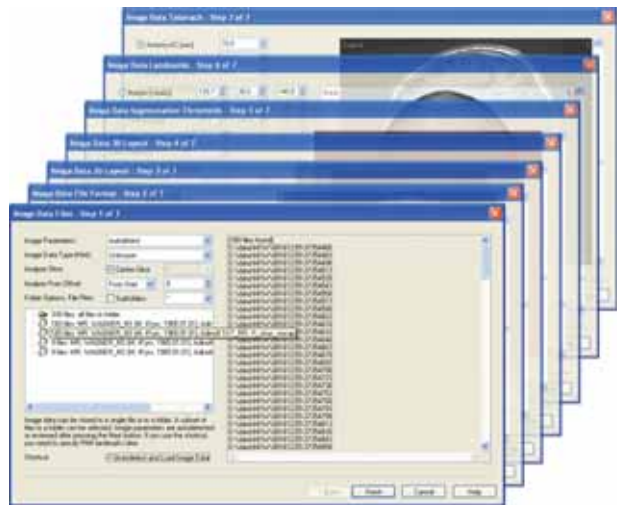
OVERVIEW OF FUNCTIONALITY



Task-based data analysis

User Interface

The entire functionality of CURRY is made available through a highly interactive, configurable, single-layer, Windows-standard user interface. Predefined tasks allow for a workflow-based approach to data analysis.



Step-by-step import of data files.

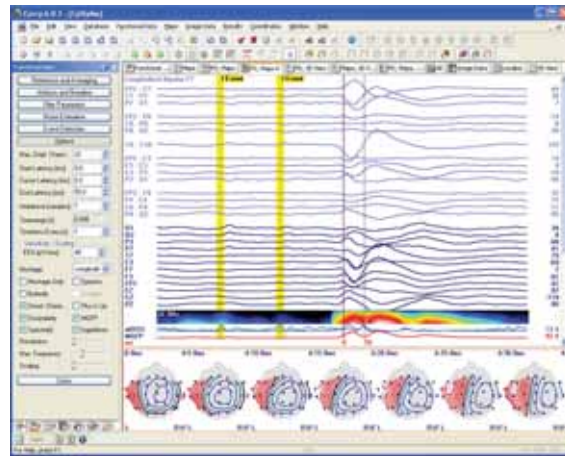
File Formats and Compatibility

CURRY reads a broad variety of EEG, MEG, digitizer, and image file formats. It utilizes advanced automated scripts to ensure that data entry is not an impediment to data processing. While standardized file formats for EEG, MEG, CT and MRI data are automatically recognized, the scripts will guide you through the process of identifying those formats that are not standardized.

Supported functional data formats include Neuroscan, Compumedics, BioSemi, BESA, BrainVision, EBF, EDF, EGI, Nervus, Nexstim, Persyst, Stellate, Telefactor, XLTec, 4D-Neuroimaging (BTI), CTF, Neuromag, Philips, raw floating point and ASCII.

Supported image data formats include DICOM, SPM, Analyze, BrainVoyager, Siemens, GE, ACR-NEMA, raw binary and floating point.

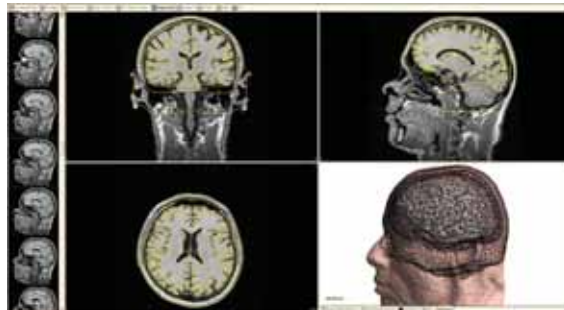
CURRY is backward compatible: It will read all CURRY 2 to CURRY 5 input files, as well as all CURRY 3 to CURRY 5 output files.



Montage channels, raw data, time-resolved frequency analysis and electrode maps.

Data Analysis

CURRY supports working with continuous, epoched, and averaged data, including event display and editing. After re-referencing, averaging, filtering, template matching, artifact rejection, baseline correction, and noise estimation, CURRY uses a principal component analysis (PCA, SVD) or Independent Component Analysis (ICA) to visualize the spatio-temporal features of EEG and MEG data. Display options include re-montaging and time-resolved frequency analysis.



Realistic head model, automatically generated from MRI data.

Head Models

CURRY can perform source reconstruction using the well-known spherical shell volume conductor models. However, one of its unique and powerful features is to generate a high-resolution realistic head model based on anatomical information. Such a realistic volume conductor model derived from individual MR Images (or CT) increases the accuracy of the reconstruction algorithms.

EEG signals and, to a smaller extent, MEG signals, are distorted by the electrically conducting head. Precise modeling of the compartments in the head using the Boundary Element Method (BEM) improves the accuracy of source reconstructions.

A built-in procedure performs fully automatic generation of the realistic volume conductor geometry (triangle nets) from T1-weighted MR images. A typical head model consists of 8000 triangles.

CURRY also comes with pre-computed realistic head models that are applicable to all EEG data, including an FEM mesh with anisotropic skull layer.

Dipole Fits

Based on the measured EEG and/or MEG data, the sensor positions and the volume conductor, a fit of one or more dipoles can be done. The position of the dipoles can be completely free (moving dipole) or can be restricted (rotating or fixed dipole, mirror or regional constraints).

Dipoles can be constrained to stay in the vicinity of a given location. Thus, it is possible to include prior knowledge from imaging modalities such as fMRI, PET, or SPECT.

Dipoles can also be fitted according to the MUSIC (Multiple Signal Classification) metric. If more than one dipole is computed, the fit is performed recursively (RAP-MUSIC).

For each fitted dipole, a confidence ellipsoid is computed which visualizes the localization accuracy corresponding to the signal-to-noise-ratio of the data.

In addition to fitting dipoles, CURRY allows you to verify the dipole locations by performing, for example: dipole cross-validation, deviation scan, MUSIC scan, or current density analysis.



Combination of Moving and Rotating dipoles on segmented cortex.

Dipole and Beamformer Scans

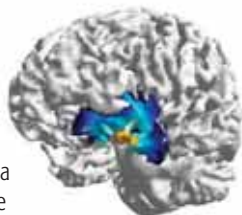
During a deviation scan, many points are scanned sequentially. On each point a measure is calculated for the possibility that a single dipole in that location could account for the measured EEG or MEG signal (in other words: would a dipole in this location be correct?). The results from a deviation scan are independent from the results of a dipole fit. Therefore it provides additional and new information. If a deviation scan shows a single, sharp "hot spot" that coincides with the location of a single dipole fit, the assumption that the measured signal can be explained by a dipole in that location is confirmed. If, however, a deviation scan shows a smeared out pattern, the underlying dipole model may be wrong. A deviation scan provides you with a confidence interval for a fitted single equivalent dipole.

Deviation scans can be performed for one or more dipoles. Multi-dipole deviation scans test dipole combinations.

MUSIC scans allow for the detection of multiple independent sources.

Beamformer scans for dipole sources taking the raw data covariances into account.

Scans can be performed for extended source patches instead of dipoles (point sources).



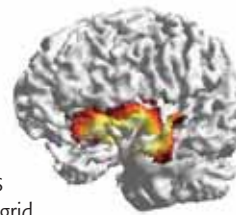
Deviation scan and single scan dipole results constrained to cortical surface

Current Density Reconstructions (CDR)

A current density map is another independent analysis. It computes a current pattern on a regular 3D grid or the cortex that would explain the measured EEG or MEG at a certain time point. Now, all points on the surface can be active simultaneously. In order to come up with a solution, additional assumptions are needed. For example: the minimum norm constraint (L1, Lp, or L2 norm), maximum smoothness constraints (LORETA), and statistical measures (sLORETA, SWARM) can be applied.

All current density methods work with an automatic calibration of the regularization parameter lambda (λ).

CDRs can be performed for extended source patches instead of dipoles (point sources).



CDR (sLORETA) results constrained to cortical surface.

Anatomical Constraints

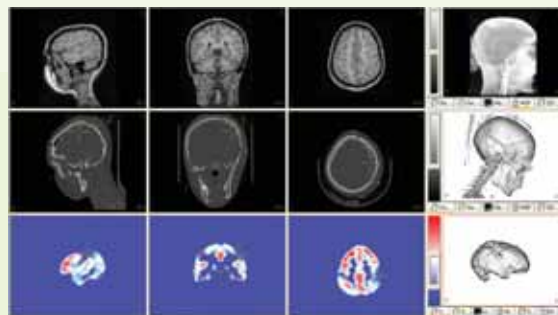
Both a deviation scan and a current density map provide you with the possibility to use anatomical constraints. Brain activity usually originates from the gray matter (the surface of the cortex). Using that information as a constraint improves your results.

A built-in procedure performs fully automatic segmentation of the gray matter geometry (triangle nets) using MRI data.

Functional Constraints

fMRI, PET, or SPECT images can provide anatomical and functional constraints for dipole and current density analysis. This is achieved by enhancing source probability in the vicinity of hotspots, or by seeding dipole fits from hotspot locations.

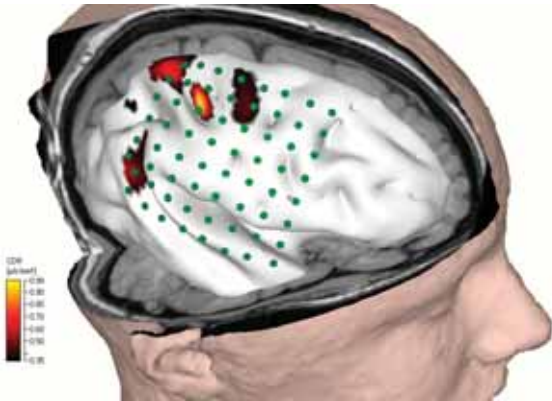
To allow for an easy inclusion of functional images, a total of three image modalities with full co-registration features are available.



Coregistered MRI, CT, and PET image data

Image Processing

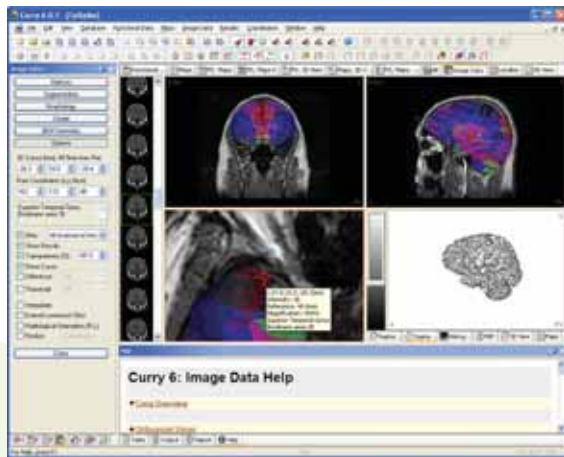
CURRY has powerful tools for reading and processing all kinds of medical 3D image data. These tools include automatic co-registration, automatic cortex and head model setup, segmentation, morphological operations, and meshing. Images from two or three modalities can be used simultaneously.



CDR analysis of ECoG (grid) data visualized on smoothed (inflated) cortical surface

Processing and Positioning of ECoG Data

Using advanced imaging and placement tools, grid electrodes can be fit to the individual's brain. Automated processing is provided to assist with the grid localization and co-registration between the data sets. This integration of grid data, surface data, CT and MRI images allow for the highest quality localization and confirmation of topographical measures.



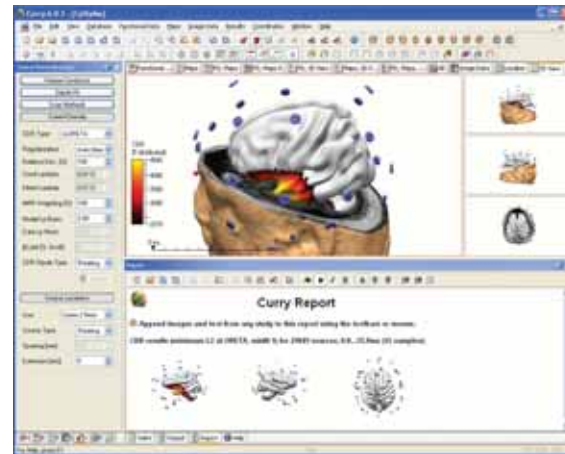
Overlay of MRI and atlas data in Talairach space.

Talairach coordinates and Atlas support

By specifying AC, PC, and the brain extensions, results can be transformed into Talairach coordinates and extensive anatomical and functional atlas information (Brodmann areas) can be accessed.

Working without Individual Anatomical Data

If no anatomical data is available, CURRY automatically uses its built-in gross average MRI data set, also with Talairach and atlas support.



CDR analysis visualized on smoothed (inflated) cortical surface and report generator.

Viewing and Documentation of Results

Results of dipole fits, deviation scans and current density analyses as well as other results can be viewed in 3D images and in 2D images. Activation timecourses for dipoles and current densities can be displayed.

CURRY provides logging to a window and to a file with selectable verbiage. Extensive hardcopy features create png, bmp, or jpg images and avi movies.

Report Generator

A new interface allows for descriptive text and screen shots to be collected, edited, and exported into a Word (rtf) document suitable for comments and documentation. Thus, graphical results and solutions can now easily be stored in a document independent of CURRY for presentation and publication, as well as for general reference.

Export of Results in Excel, MATLAB, and SPM Formats

Data is easily exported to third party programs for additional analysis. Virtually all solutions are available to export including the leadfield matrix, dipole and CDR models. Coordinate system of solutions can be altered to fit surgical and TMS navigation systems.

Database

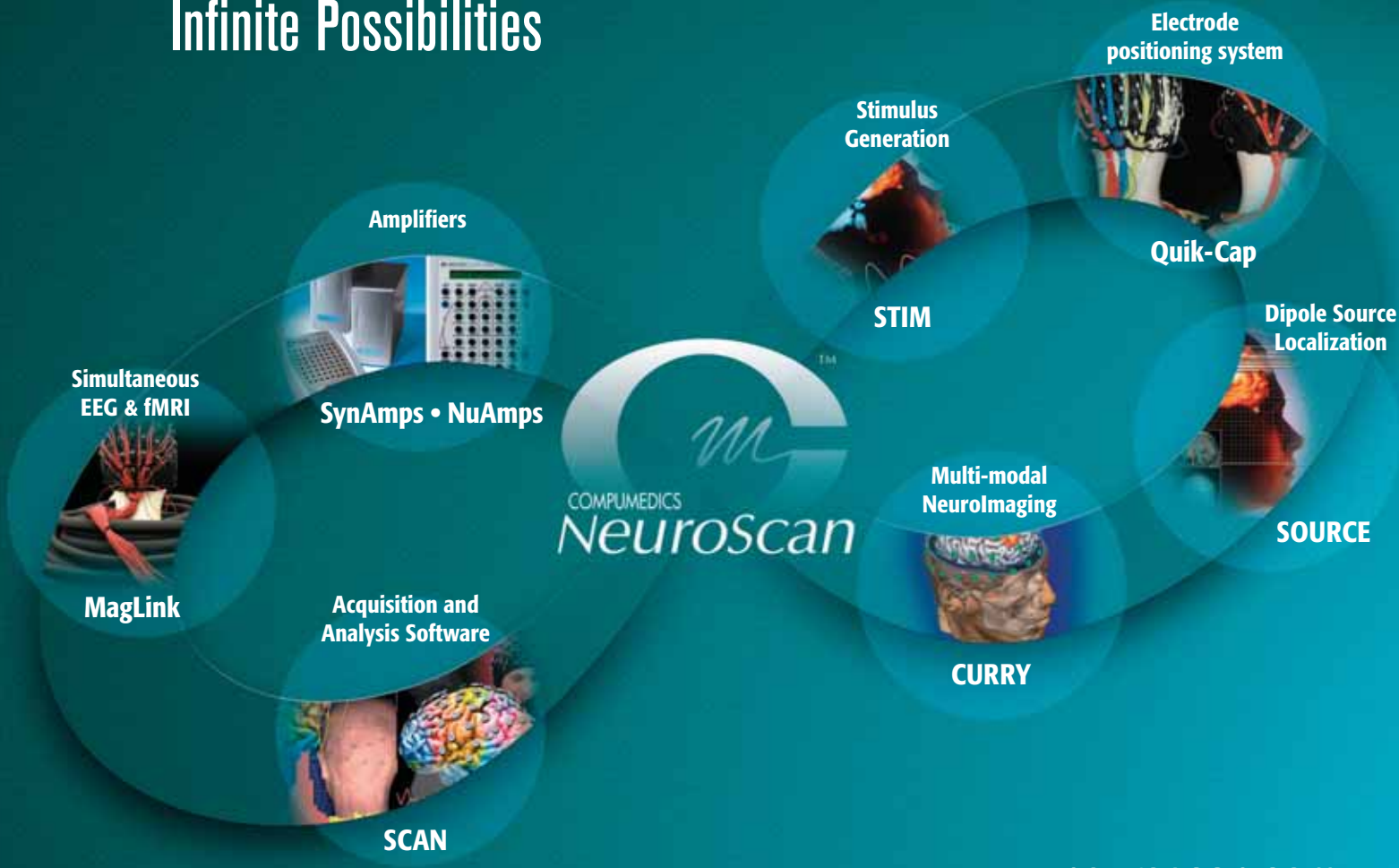
All data files, result files, and configurations are organized using a database. This makes it possible to access multiple data files (functional data, anatomical data, digitizer files, results, default parameters) with a single mouse click.



Computer Platforms

- PC with Windows 2000 (SP3) or later. Windows XP Professional recommended.
- Multi-Core processor recommended.
- 2GB RAM recommended.
- Wheel mouse recommended.
- OpenGL support. 256MB graphics card memory recommended.
- 1280x1024 screen size recommended.

No Compromises Infinite Possibilities



www.neuroscan.com

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