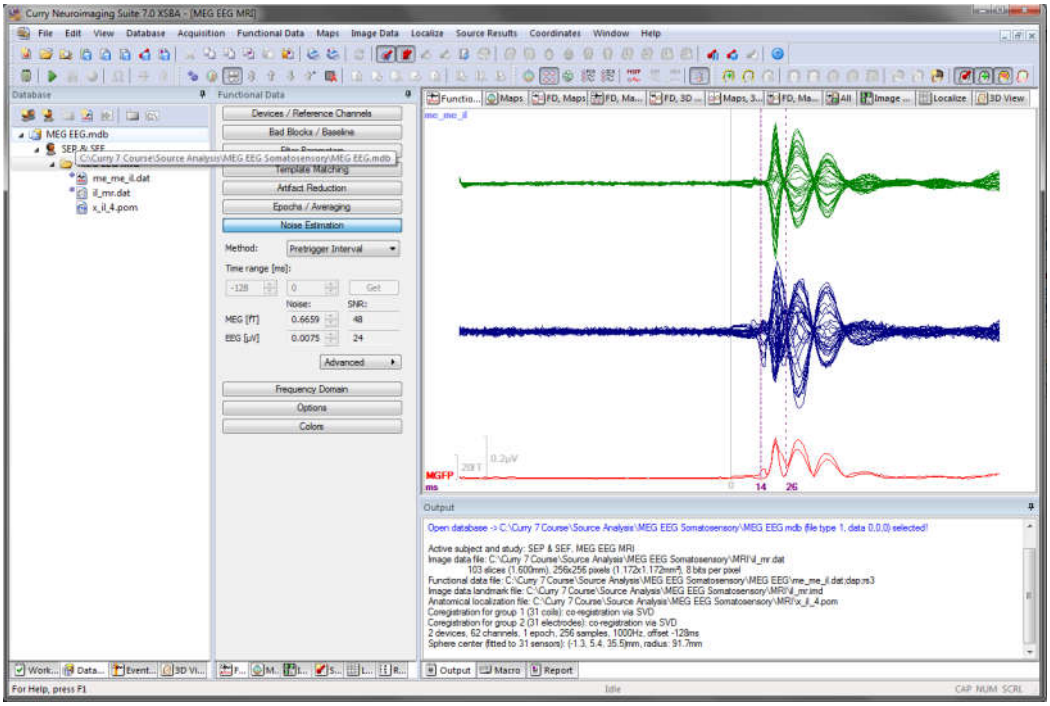
COMBINED MEG/EEG-SOURCE ANALYSIS

- Start Curry: *double-click* the **Curry 7** icon.
- Open the following database:
  C:\Curry 7 Course\Source Analysis\MEG EEG Somatosensory\MEG EEG.mdb
- Expand Subject **SEP & SEF**.
- Open study **MEG EGG MRI**.
  (the data import wizard does not appear as data have already been parameterized)
- Select **Butterfly Plot** (*Alt+B*).
- In Noise Estimation, use **Pretrigger Interval**.
- Use **14…26ms** as the analysis timerange (*Ctrl/Alt+left/right cursor keys*).



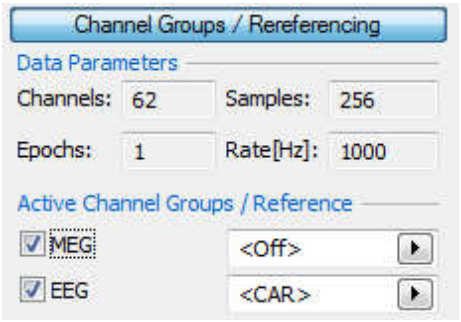
For combined EEG and MEG analysis, data from both modalities must be stored in the same data file or in separate matching (sampling rate, number of samples) files with MEG first.

NOTES

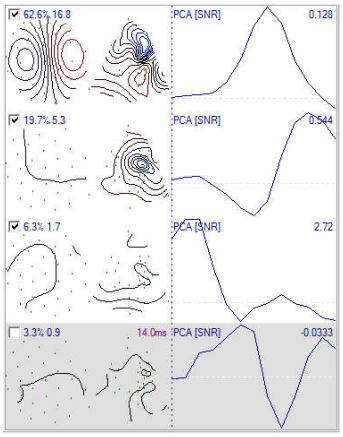
PCA Analysis

Use PCA for MEG and EEG alone and combined to learn about data complexity:

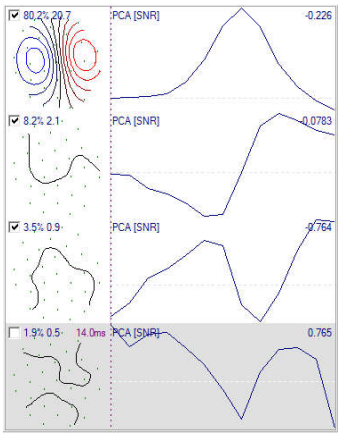
- *Ctrl-click* to change the display but not the parameters.
- From the toolbar, activate a **PCA** .
- In the Functional Data parameters, expand Channel Groups / Rereferencing.
- Take a look at the PCA components and their SNRs for MEG&EEG combined, MEG alone, and EEG alone:
- Uncheck **EEG**.
- Check **EEG**, uncheck **MEG**.
- Check **EEG** and **MEG**.



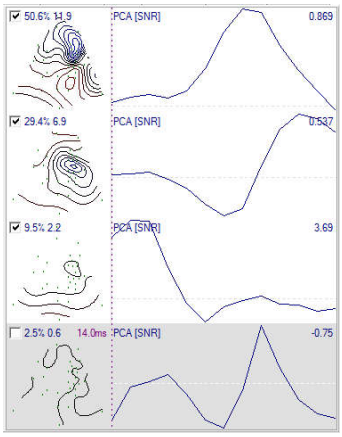
MEG & EEG



MEG



EEG



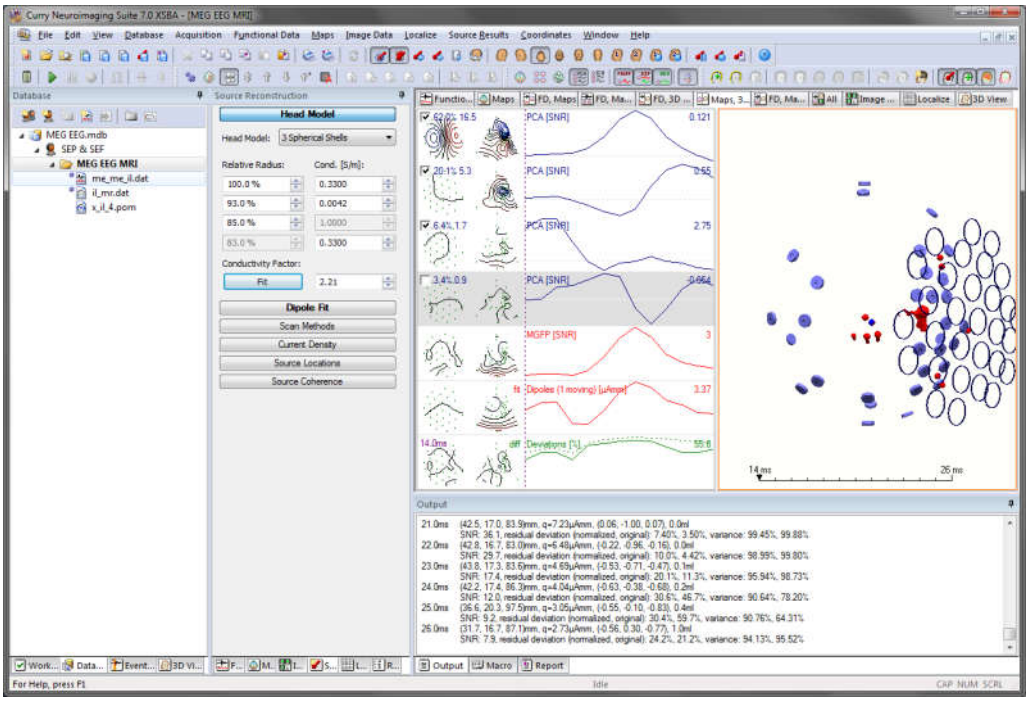
MEG data shows higher SNR and less complexity.

NOTES

Dipole Analysis

Perform dipole fits for the different modalities and observe the achieved goodness-of-fit:

- Switch to the Maps, 3D View display.
- In Dipole Fit, change the **Dipole Type** to **Moving**.
- From the toolbar, activate **MGFP**, **Dipole Strengths**, and **Goodness-Of-Fit** MGFP DIP DEV. The achieved goodness-of-fit is well below the expected goodness-of-fit (dotted line).
- In Channel Groups / Rereferencing (*click* Functional Data parameters), uncheck **EEG**. For most samples, achieved and expected goodness-of-fit match.
- Check **EEG** and uncheck **MEG**. Achieved and expected goodness-of-fit match.
- Check both **EEG** and **MEG**.
- In Head Model (*click* Source Reconstruction parameters), press **Conductivity Factor: Fit**. The conductivity factor (2.22) is fitted. Achieved and expected goodness-of-fit match.
- Change dipole type **Fixed MUSIC**, set **Number of Dipoles** to **3**.



The MEG-EEG **head model conductivity factor** is a calibration factor for the conductivities which are used for an EEG analysis. (MEG signal strengths only depend on relative conductivities, while EEG signal strengths depend on absolute conductivities.)

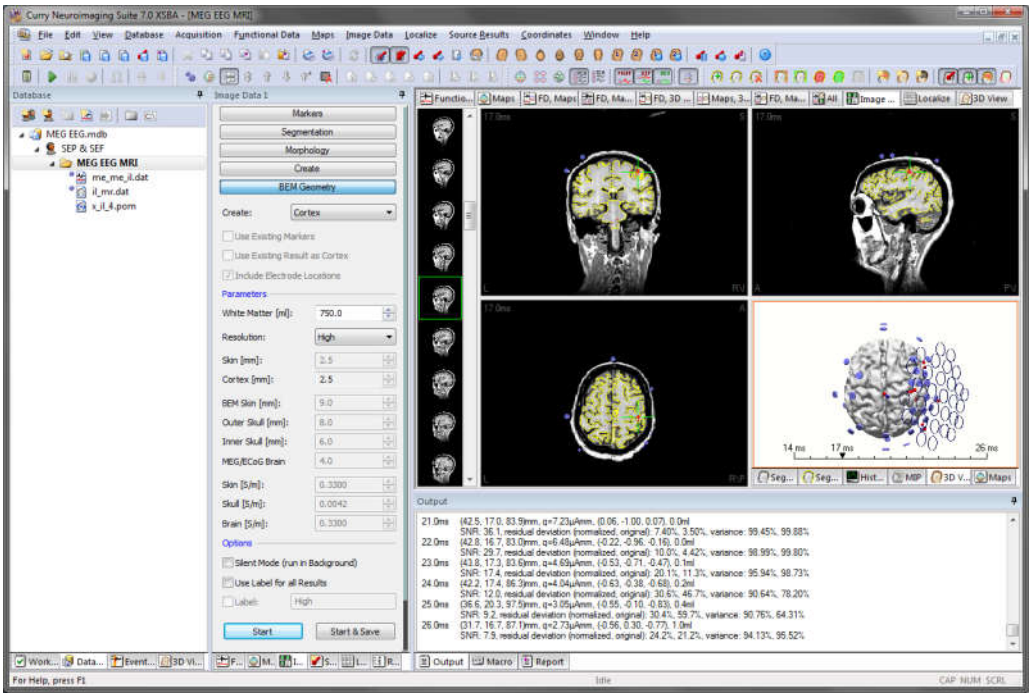
M Fuchs, M Wagner *et al., 1998. Improving source reconstructions by combining bioelectric and biomagnetic data. Electroenceph clin Neurophysiol 107:93-111*

NOTES

IMAGE ANALYSIS

Load image data and view the dipole results in their anatomical context:

- Switch to the Image Data display.
- Make sure **Time Range mode** is activated (press toolbar button).
- Step through the dipole results using the **Previous/Next Dipole** toolbar buttons .
- Zoom in and out using the + and – keys.
- Press the **Setup BEM Geometry** toolbar button .
- Change **Create** to **Cortex** and press **Start**.



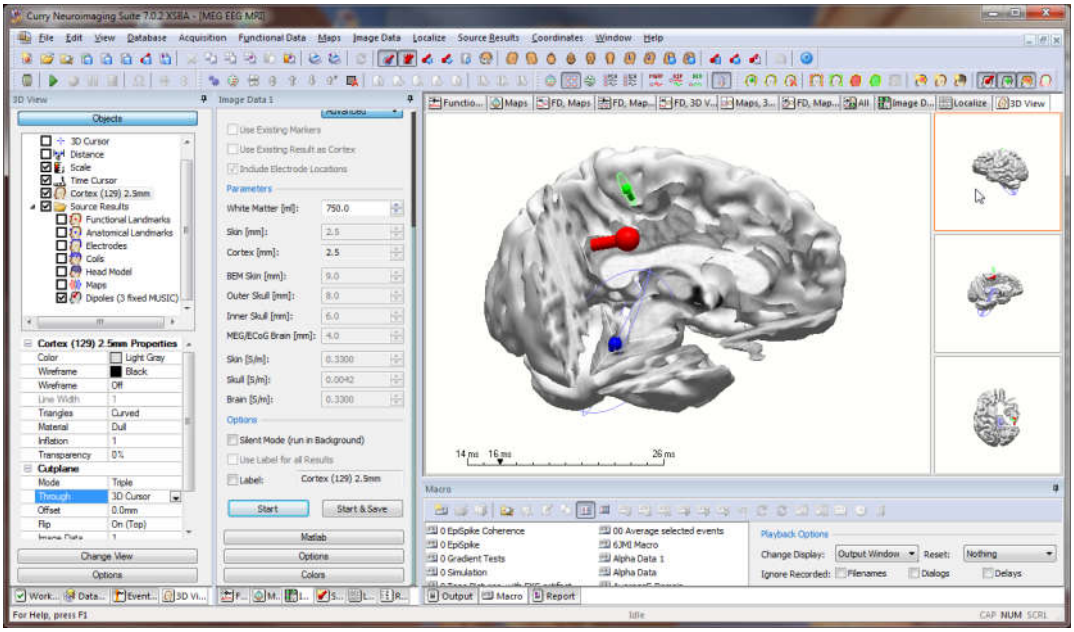
The **Previous/Next Dipole** toolbar buttons iterate through the active dipole results.

NOTES

Cutplane Overlay

View the dipole results in their anatomical context:

- Switch the display to 3D View and switch to **Right View**, slightly rotate the cortex surface and zoom in using the mouse wheel.
- Switch off Functional Landmarks, Anatomical Landmarks, Electrodes, and Coils.
- In the Cortex (129) 2.5mm properties set **Cutplane** Mode | Triple and Through | 3D Cursor
- Make sure **Time Range mode** is activated (press toolbar button).
- Step through the dipole results using the **Previous/Next Dipole** toolbar buttons.



- Switch on Functional Landmarks, Anatomical Landmarks, Electrodes, and Coils.
- In the Cortex (129) 2.5mm properties set **Cutplane** Mode | Off.

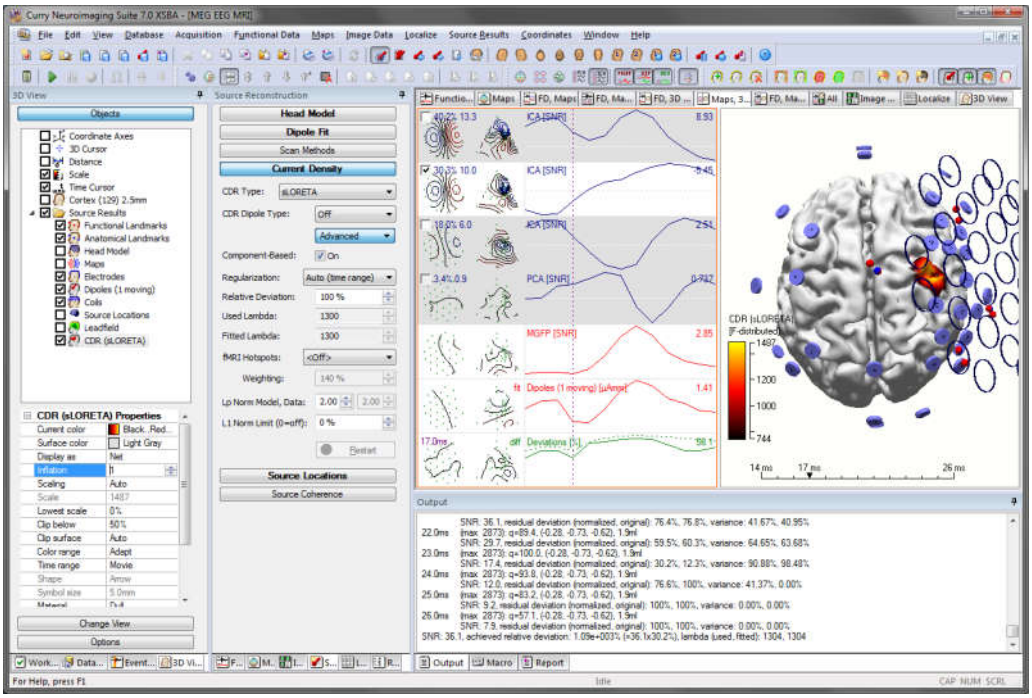
The Image Data display can also be used to set the 3D Cursor position for the cutplanes.

NOTES

Current Density Analysis

Perform a cortical current density analysis:

- Switch to the Maps, 3D View display, **Top View** .
- Perform an **sLORETA** analysis using the cortical mesh (**Cortex (129) 2.5mm**) as the source space.
- Activate **ICA** and perform a **Component-Based sLORETA** CDR for the first three ICA components.
  (*Ctrl-click* a component to deselect all others)



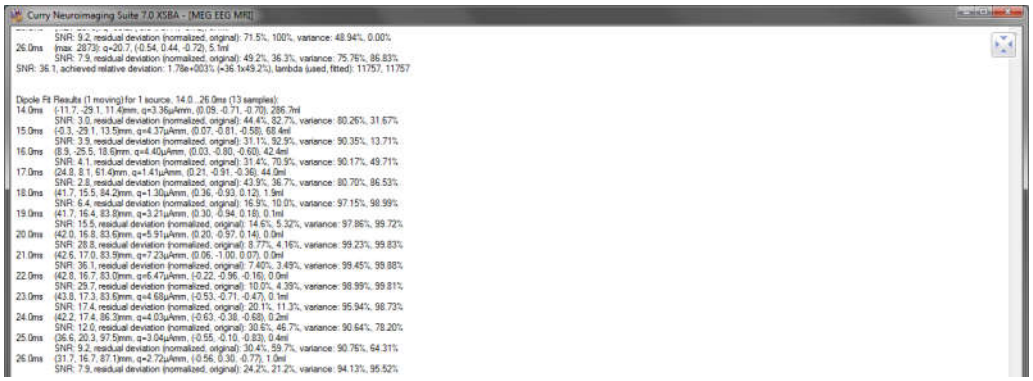
Component-Based CDR allows to compute the source image per ICA component.

NOTES

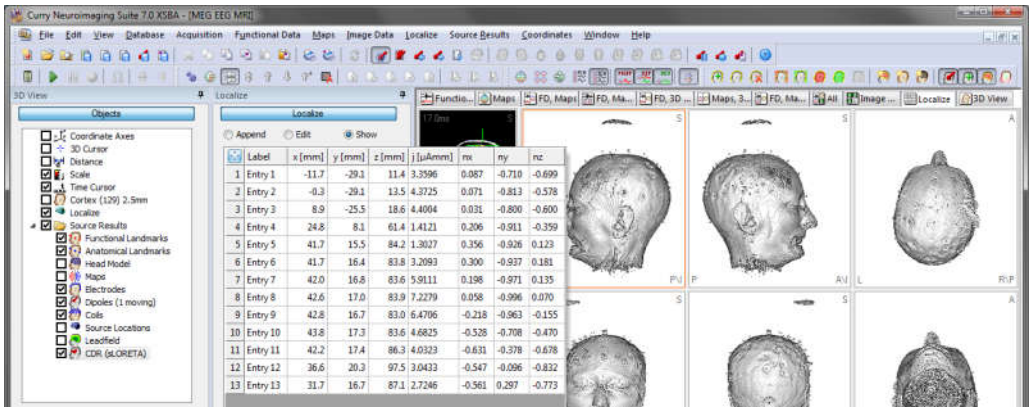
Display Control

View results within Curry:

- In Output, in the upper right corner, press the **Maximize** button  .
  The output field fills the whole display area.
- Press the **Shrink** button  .



- Switch the display to Localize.
- *Right-click* and select **Import Dipoles**.
- In Localize, in the upper left of the location list, press the **Maximize** button  .
  The Localize list is completely visible.
- Press the **Shrink** button  .



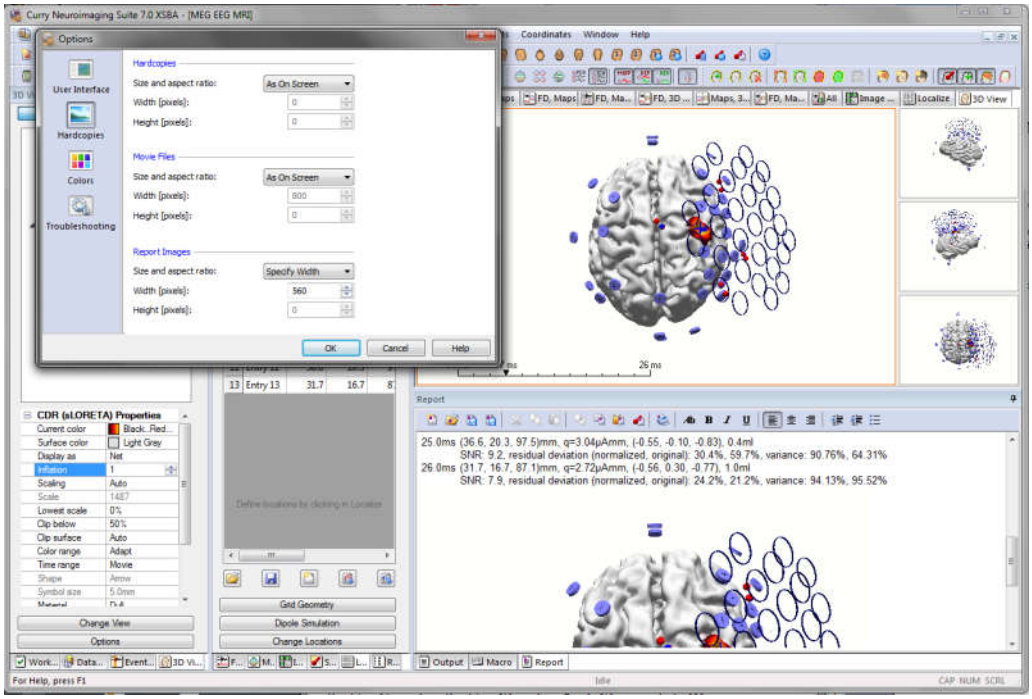
Maximize buttons make it possible to focus on a part of the display or the user interface.

NOTES

REPORTS

Paste results and images to the Report:

- Switch to the Report.
- From the **Source Results** menu, select **Report** and **Append Dipole Description**. (or press the toolbar button). Dipole results are appended to the report.
- In the 3D View display, *right-click* and select **Hardcopy** and **Append Image to Report** (or *Ctrl+Shift+R*). The image is appended to the report.
- *Right-click* the **Report** and select **Open in Editor…**. Microsoft Word or another Rich Text Format (rtf) editor opens.
- From the **Edit** menu, select **Options…** and switch to the **Hardcopies** page. On this page, the resolution of hardcopies and movie files can be adjusted.



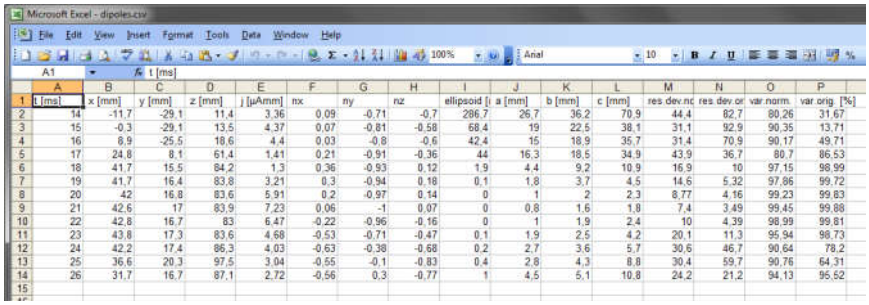
The **Report** module can be used to collect textual and pictorial results. It is a convenient alternative to saving multiple screenshots.

NOTES

Results Export

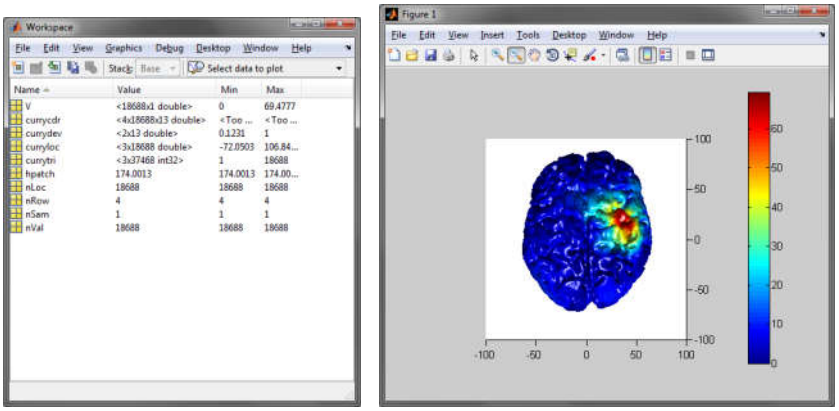
Export results in Excel and MATLAB formats:

- From the **Source Results** menu, select **Export Results** and **Export Dipoles to Excel…**
- Enter a filename and check **Open in Excel**. Press **Save**.
  A .csv file is written, Excel opens, and dipoles are displayed as a spreadsheet.



t [ms]	x [mm]	y [mm]	z [mm]	j [µAmm]	nx	ny	nz	ellipsoid [i	a [mm]	b [mm]	c [mm]	res dev.nc	res dev.or	var norm	var orig [%]
14	-11,7	-29,1	11,4	3,36	0,09	-0,71	-0,7	286,7	26,7	36,2	70,9	44,4	82,7	80,26	31,67
15	-0,3	-29,1	13,5	4,37	0,07	-0,81	-0,58	68,4	19	22,5	38,1	31,1	92,9	90,35	13,71
16	8,9	-25,5	18,6	4,4	0,03	-0,8	-0,6	42,4	15	18,9	35,7	31,4	70,9	90,17	49,71
17	24,8	8,1	61,4	1,41	0,21	-0,91	-0,36	44	16,3	18,5	34,9	43,9	36,7	80,7	86,53
18	41,7	15,5	84,2	1,3	0,36	-0,93	0,12	1,9	4,4	9,2	10,9	16,9	10	97,15	98,99
19	41,7	16,4	83,8	3,21	0,3	-0,94	0,18	0,1	1,8	3,7	4,5	14,6	5,32	97,86	99,72
20	42	16,8	83,6	5,91	0,2	-0,97	0,14	0	1	2	2,3	8,77	4,16	99,23	99,83
21	42,6	17	83,9	7,23	0,06	-1	0,07	0	0,8	1,6	1,8	7,4	3,49	99,45	99,88
22	42,8	16,7	83	6,47	-0,22	-0,96	-0,16	0	1	1,9	2,4	10	4,39	98,99	99,81
23	43,8	17,3	83,6	4,68	-0,53	-0,71	-0,47	0,1	1,9	2,5	4,2	20,1	11,3	95,94	98,73
24	42,2	17,4	86,3	4,03	-0,63	-0,38	-0,68	0,2	2,7	3,6	5,7	30,6	46,7	90,64	78,2
25	36,6	20,3	97,5	3,04	-0,55	-0,1	-0,83	0,4	2,8	4,3	8,8	30,4	59,7	90,76	64,31
26	31,7	16,7	87,1	2,72	-0,56	0,3	-0,77	1	4,5	5,1	10,8	24,2	21,2	94,13	95,52

- From the **Source Results** menu, select **Export Results** and **Export Currents to MATLAB…**
- Enter a filename and check **Open in MATLAB**. Press **Save**.
  MATLAB opens (better if already running) and currents are displayed.



- Exit Curry

When exporting to **Excel**, a Comma Separated Values (csv) file is written (can be opened in all spreadsheet programs).
When exporting to **MATLAB**, a .mat file is written. If **Open in MATLAB** is checked, a sample .m-file is additionally written, showing how to access the exported data.

NOTES