

BESA MRI 3.0 Update History

Version 3.0 May 2020

New features

General

- Head models: Subject-specific boundary element models (BEMs) can now be calculated with BESA MRI. These models can be used for source analysis in BESA Research (from version 7.1). It is possible to create BEMs for EEG and MEG data. The algorithm is provided by the OpenMEEG libraries (cf. <https://openmeeg.github.io/>). The BESA MRI implementation uses a three-shell model (brain, skull, and skin). If you use the BESA MRI BEM in publications, please cite the following references:
 - Gramfort A., Papadopoulo T., Olivi E., Clerc M. OpenMEEG: opensource software for quasistatic bioelectromagnetics. BioMedical Engineering OnLine 45:9, 2010
 - Kybic J., Clerc M., Abboud T., Faugeras O., Keriven R., Papadopoulo T. A common formalism for the integral formulations of the forward EEG problem. IEEE Transactions on Medical Imaging, 24:12-28, 2005

Segmentation

- Brain atlases: Several brain atlases can be displayed as overlay on the structural MRI data (Talairach-transformed). These include Brainnetome, AAL, Brodmann, AAL2025, Talairach, Yeo7, and Yeo17. Atlas overlays can be shown using different options. Talairach coordinates of the current crosshair position are shown, as well as the corresponding atlas region.
- Visualization of dipole models: Dipole models exported from BESA Research can now be visualized on the structural MRI data (AC-PC and Talairach-transformed). If dipole solutions saved with BESA Research 7.1 or higher are opened, confidence limits can also be displayed.
- Multi-slice view: The MRI, with or without overlay of atlas data or dipole solutions including confidence limits, can be viewed in a multi-slice view, with configurable orientation, range, and spacing between slices.
- MEG sphere model visualization: The spherical model used for MEG can be visualized as overlay on the structural MRI data (AC-PC-transformed).

Coregistration

- Electrodes with standard labels following the 10-10 convention can now be placed on the reconstructed skin surface, without the need for digitization. This can be done in two ways:
 - either using an exported surface point file from BESA Research that contains only the electrodes used for the EEG recording,
 - or generating a surface point file from scratch in BESA MRI containing all 10-10 electrode labels, which can be read into BESA Research for an EEG recording, automatically using only the matching electrode labels.

Improvements

Segmentation

- DICOM data stored with lossless compression can now be read directly into BESA MRI.
- The handling of the DICOM folder option was improved: it is now sufficient to select just the folder in the File Open Dialog.
- The mouse wheel can now be used to slice through the MRI. This is particularly useful in work steps for identifying brain landmarks, and for reviewing segmentation results with overlay of atlas or dipole data
- The MRI can now be viewed without inhomogeneity correction. This can be useful if certain landmarks, malformations, or anatomical structures are hi-lighted in the structural MRI data. The feature can be enabled or disabled by default using an entry in the BESA MRI.cfg file. For details, please consult the appendix of the User Manual.
- When opening a data file, the “All Files” selector did not allow for Analyze, NifTI, or vmr files. This is now possible.
- The automatic scalp segmentation threshold for NifTI data format was too low. This was improved.

Coregistration

- Surface points can be excluded from the fit using the right mouse button to exclude bad digitization points.
- After completing the surface point fit, the projected position of electrodes on the skin can be displayed.
- The MEG sensor array can be shown in relation to the head surface after the surface point fit.

Bug fixes

Segmentation

- When switching between Segmentation workflow and Coregistration workflow many times, an error sometimes occurred (#224). This was fixed.
- If a data set is loaded that contains orientation information (DICOM), the work step Set Orientation is not required. If, however, a DICOM data set is loaded, then the user goes back in the workflow and changes the data set to a NifTI file, the work step Set Orientation is required but was not shown in this case (#672). This problem was fixed – the work step will now appear even in this scenario.
- When special characters appeared in the patient name imported from DICOM (e.g. Japanese characters), the project could not be saved (#213). This problem was fixed.

Coregistration

- If a head surface point file (*.sfh) written by BESA Research had special characters in the filename, it could not be read by BESA MRI (#229, #347). This is now possible.
- When opening a previously finalized MEG FEM project, then changing something in the Fit Surface Points work step, this did not issue a re-calculation of the MEG FEM leadfields (#677). This problem was fixed.

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- If the user opened an input file that did not have fiducial information yet, then went back and changed the file to a data set that did have fiducial information, this information was not shown (#505). This problem was fixed – now the fiducials will be shown even in this scenario.

Known issues

The following known issues were not fixed for this release, and remain in the software.

Segmentation

At time of release, no known issues remain in the software.

Coregistration

- Disabling surface points from fitting: Additional surface points can only be disabled for the fit if their label starts with the text "SfcExtra_" (#695). Note that this issue does not affect electrodes.
 - Workaround: Before opening the *.sfh file that was stored by BESA Research at the start of the co-registration, edit the file manually with a text editor and change the labels of affected additional surface points.