

## **Converting POS Files for Use with the NIRS-SPM and SPM-fNIRS Toolboxes via POS2SPM**

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POS2SPM CONVERSION TOOL  
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POS2SPM is classified as "Individual Efforts" under the Gallaudet University Administration and Operations Manual § 1.09.II.A.5, see <<http://www.gallaudet.edu/af/aando-manual.html>>.

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## Preface

The POS2SPM software package was created using channel configurations from ETG 4000 (Hitachi Medical Systems). AC (alternating current) electromagnetic 3D digitization information was obtained using a Polhemus Patriot M™ motion tracker (Polhemus, Colchester, VT). POS2SPM is intended to be a versatile tool, compatible with other channel configurations from either ETG 4000 or another system, though other channel configurations and systems have not yet been tested or integrated with the POS2SPM package.

The POS2SPM software package was made possible by the pos2csv and ReadPos functions created by and available from the Functional Brain Science Laboratory at the Center for Development of Advanced Medical Technology, Jichi Medical University<sup>1,2,3</sup>. Portions of these functions were modified and/or adapted to be used in conjunction with a number of proprietary scripts and files written by the author.

If, while using the POS2SPM software package, you have any questions or encounter any bugs or errors, please contact the author ([Bradley.White@gallaudet.edu](mailto:Bradley.White@gallaudet.edu)).

## Software Requirements

POS2SPM requires MATLAB (Mathworks, Natick, MA). Though this package was written and developed using the R2012b release of MATLAB, no errors have been encountered using other releases of the software.

The output files of POS2SPM are compatible with the NIRS-SPM and SPM-fNIRS toolboxes. Both of these toolboxes require a version of the statistical parametric mapping software package (Wellcome Trust Centre for Neuroimaging, University College London, London, UK). All of the software mentioned in this section can be found using the following web links:

MATLAB (<http://www.mathworks.com>)

NIRS-SPM ([https://www.nitrc.org/projects/nirs\\_spm](https://www.nitrc.org/projects/nirs_spm))

SPM5 (<http://www.fil.ion.ucl.ac.uk/spm/software/spm5/>)

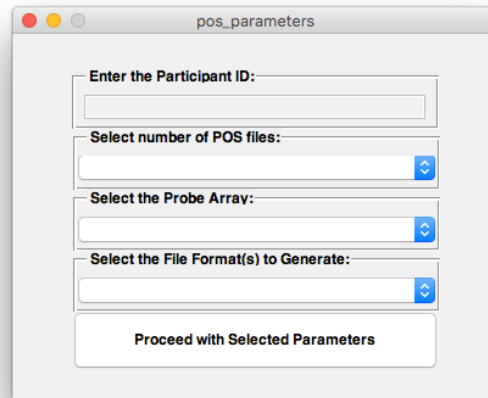
SPM8 (<http://www.fil.ion.ucl.ac.uk/spm/software/spm8/>)

SPM-fNIRS ([https://www.nitrc.org/projects/spm\\_fnirs](https://www.nitrc.org/projects/spm_fnirs))

SPM12 (<http://www.fil.ion.ucl.ac.uk/spm/software/spm12/>)

## Stepwise Conversion

1. Open MATLAB.
2. In the MATLAB command window type “pos2spm” and press enter to initiate the conversion process. The following graphical user interface (GUI) will appear:

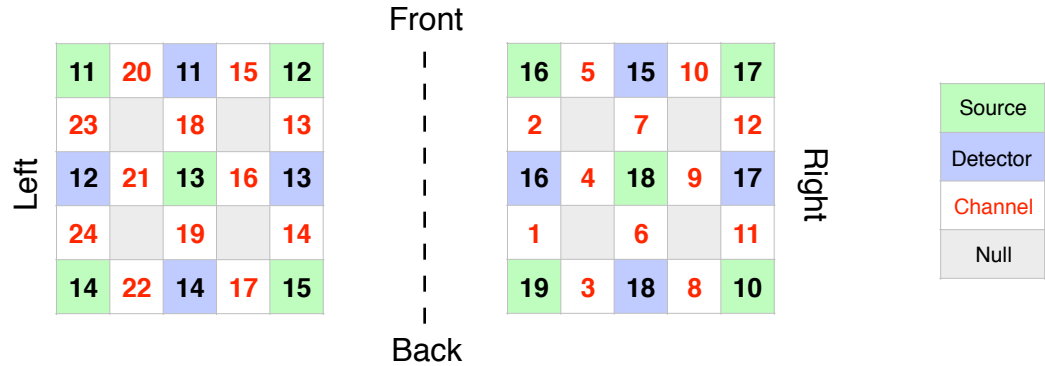


3. When the “pos\_parameters” GUI appears, you will need to enter the information for which it asks. All fields must be complete to continue with the conversion process. Information entered in the participant ID field will be prepended to some of the output files for organizational purposes. The number of POS files refers to the number of measurement files with which you would like to use. The probe array refers to the specific arrangement of your optodes (i.e., 2 sets of 3x3, 2 sets of 3x5, or 1 set of 3x11). The channel configurations currently compatible with POS2SPM can be found either in the channel configuration folder within the package or in the appropriate section of this document. The file format(s) to generate refer to specific versions of toolboxes for functional near-infrared spectroscopy. POS2SPM will generate appropriately formatted files for use with the NIRS-SPM (SPM5 or SPM8), SPM-fNIRS (SPM12), or both. After you have established the parameters for converting your POS file, click the “Proceed with Selected Parameters” button.
4. You will now be prompted to pick your POS file(s). A dialogue box will appear before you can search for your file. This box indicates which file you should select. If you indicated that you are only working with 1 POS file, you will be prompted to select that file in the next window. If you selected that you are working with 2 POS files, you will be prompted to select the first POS file in the next window followed by a prompt for the second POS file and another window.
5. After you have selected all of your POS files and the conversion process is complete, a dialogue box will appear to indicate that you have successfully created all of the files specified. These files have been saved to a folder labeled “Polhemus” and can be located one level above the path from which the POS files were selected.

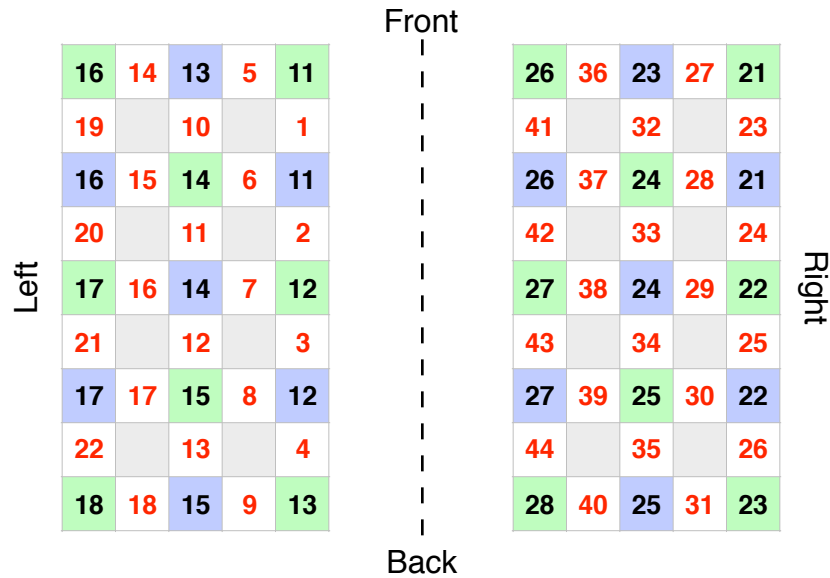
### Packaged Channel Configurations

Below are the channel configurations currently packaged within the POS2SPM files. Other configurations can be requested from the author. The scripts within the package can also be modified to accommodate for other configurations.

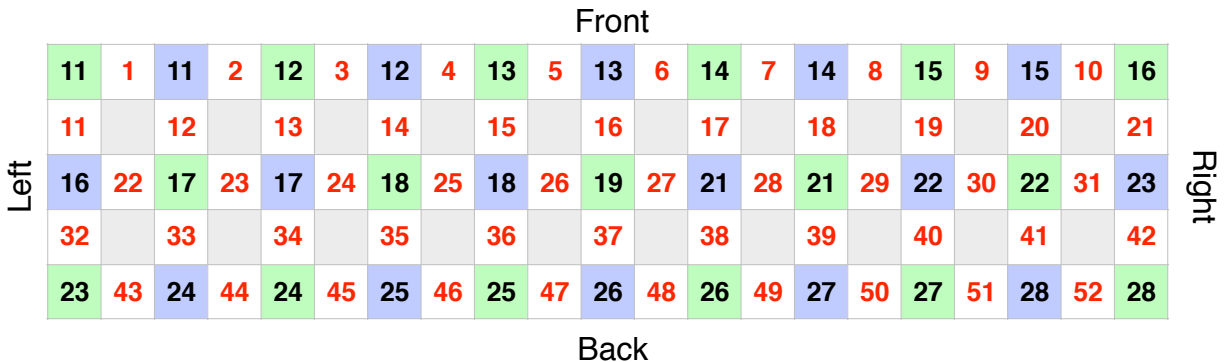
#### 3x3 x2 Channel Configuration (24 Channels)



#### 3x5 x2 Channel Configuration (44 Channels)



#### 3x11 x1 Channel Configuration (52 Channels)



## **POS2SPM Logistics**

This section briefly describes how POS2SPM handles the spatial data packed within 1 or 2 POS files to (i) generate estimated channel positions when dealing with 1 POS file, (ii) generate average optode and estimated channel positions when dealing with more than 1 POS file, and (iii) generate appropriately formatted output files for either or both NIRS-SPM and SPM-fNIRS.

### **1 POS File**

When working with one measurement file, the operations required to calculate estimated channel positions and generate the appropriately formatted output file(s) is relatively straightforward. POS2SPM functions in the following manner to complete these tasks:

1. The data packaged in the POS file is nothing more than a list of labels and coordinates. The first thing that POS2SPM does is extract the appropriate coordinates for building two files: a reference file containing the coordinates for the 10-20 head measurements and an optode file containing the coordinates for all of the source and detector probes. The order of some of these coordinates is different in the POS file than what needs to be in the output files for the SPM toolboxes, but POS2SPM will extract the appropriate coordinates and put them in the correct order for you.
2. Now that all of the measurement data needed has been extracted, POS2SPM will generate estimated channel coordinates based on the channel configuration for your probe array. This is done by averaging the coordinates of the source and detector that make up a specific channel. These averages then become the estimated coordinates for that channel and are added to the spatial data that was extracted previously.
3. This information is packaged into files that are appropriately formatted for the NIRS-SPM toolbox in two CSV files: ParticipantID\_origin.csv (reference positions) and ParticipantID\_others.csv (optode positions).
4. Generating the appropriately formatted files for the SPM-fNIRS toolbox uses the information in CSV files created above and replaces the labels and filename to be compatible with the SPM-fNIRS toolbox.
5. A new folder exactly 1 level up from where the POS files were selected will be created with the name "Polhemus."
6. Files are then saved to the "Polhemus" folder or deleted as determined by the file output(s) established in the parameters GUI.
7. The appropriate channel configuration files for the probe array and channel configuration with which you are working are also copied from the POS2SPM package to the Polhemus folder.

### **2 POS Files**

When working with two measurement files, the operations required to calculate estimated channel positions, average optode and channel positions of both POS files, and generate the appropriately formatted output file(s) is slightly more complicated than

working with 1 POS file. POS2SPM functions in the following manner to complete these tasks:

1. The first thing that POS2SPM will do is to extract the coordinate information for the reference and optode positions (just as it would do for 1 POS file), but for each of the POS files separately. Now there are 2 sets of reference positions and 2 sets of optode positions.
2. Now that both sets of measurement data have been extracted, POS2SPM will generate the estimated channel coordinates based on the channel configuration for your probe array. This is done for each set of measurement data separately by averaging the coordinates of the source and detector that make up a specific channel. These averages then become the estimated coordinates for that channel and are added to corresponding spatial data that was extracted previously.
3. Two complete sets of measurement data, including estimated channel positions, have been generated. A third set of measurement data will be composed of the averages of each of the following sets of measurement data. The reference positions, optode positions, and channel positions will be averaged. These averages will make-up the final measurements that will be used for the rest of the conversion process.
4. This averaged information is packaged into files that are appropriately formatted for the NIRS-SPM toolbox in two CSV files: ParticipantID\_origin.csv (reference positions) and ParticipantID\_others.csv (optode positions).
5. Generating the appropriately formatted files for the SPM-fNIRS toolbox uses the information in CSV files created above and replaces the labels and filename to be compatible with the SPM-fNIRS toolbox.
6. A new folder exactly 1 level up from where the POS files were selected will be created with the name "Polhemus."
7. Files are then saved to the "Polhemus" folder or deleted as determined by the file output(s) established in the parameters GUI.
8. The appropriate channel configuration files for the probe array and channel configuration with which you are working are also copied from the POS2SPM package to the Polhemus folder.



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Version 3, 29 June 2007

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