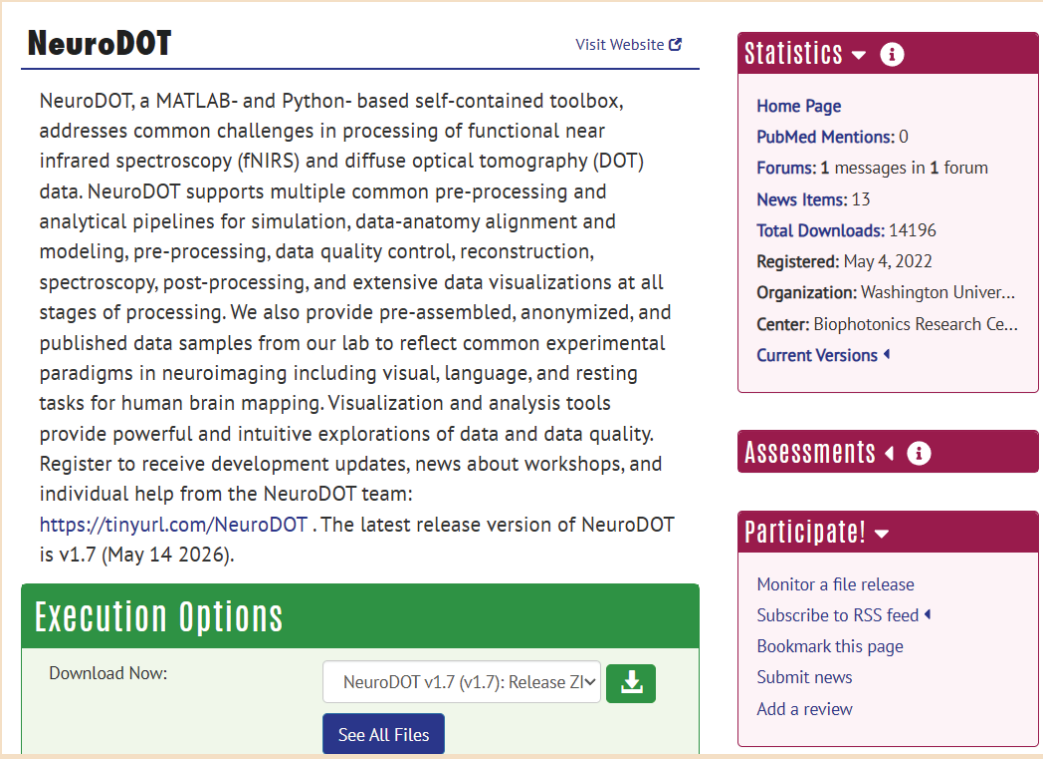
NeuroDOT

NeuroDOT Newsletter: May 26, 2026
NeuroDOT v1.7 and **NeuroDOT_py v1.3.0** Releases!

- Welcome to the NeuroDOT newsletter!
- We will be sending a newsletter along with each new release of the NeuroDOT toolbox, approximately every six months.
- On 5/14/2026 **NeuroDOT v1.7** and **NeuroDOT_py v1.3.0** were released, and are available for download on NITRC (https://www.nitrc.org/projects/neurodot) and from the Python Packaging Index (with pip).

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NeuroDOT

Release Updates

Matlab: NeuroDOT v1.7

Changes since NeuroDOT v1.6:

1. **Tutorials and Scripts**
   A. Added Basic_GLM_Script.m and Basic_GLM_Tutorial.pptx
   B. Added NeuroDOT_Basic_ParcelBased_FC_Script.m and NeuroDOT_Basic_ParcelBased_FC_Tutorial.pptx
2. **Support Files**
   A. Regions and Parcels: added Adult_96x92_Overlapped_Gordon_Parcels.mat to be used as an example set of overlapping Gordon parcels in NeuroDOT_Basic_ParcelBased_FC_Script
   B. Atlases: added Adult_96x92_FOV.mat to be used as an example field of view in NeuroDOT_Basic_ParcelBased_FC_Script
3. **Visualization Function Updates**
   A. Update to DrawColoredSynchpts to accommodate up to seven types of synchpts
   B. Update to PlotLRMeshes to add option for "anterior" view
   C. Update nlrGrayPlots_180818, Plot_RawData_Time_Traces_Overview, Plot_RawData_Cap_DQC, Plot_RawData_Metrics_I_DQC, and Plot_RawData_Metrics_II_DQC to use "Pixels" instead of "Normalized" units to define the figure size to ensure proper spatial layout of figures regardless of monitor size.
4. **Analysis Function Updates**
   A. Update to TtestWelch to default to two-tailed p-value. Optional "tail" parameter to select one-tailed left or right t-test.
5. **Light Modeling Function Updates**
   A. Update to Zero_Pad_Vol to correctly calculate center and return updated info
6. **System & Format Compatibility**
   A. Update to ndot2snirf to ensure correct dimensions of info.paradigm.synchpts
   B. Update to ndot2snirf to check if the nirs.aux field is missing

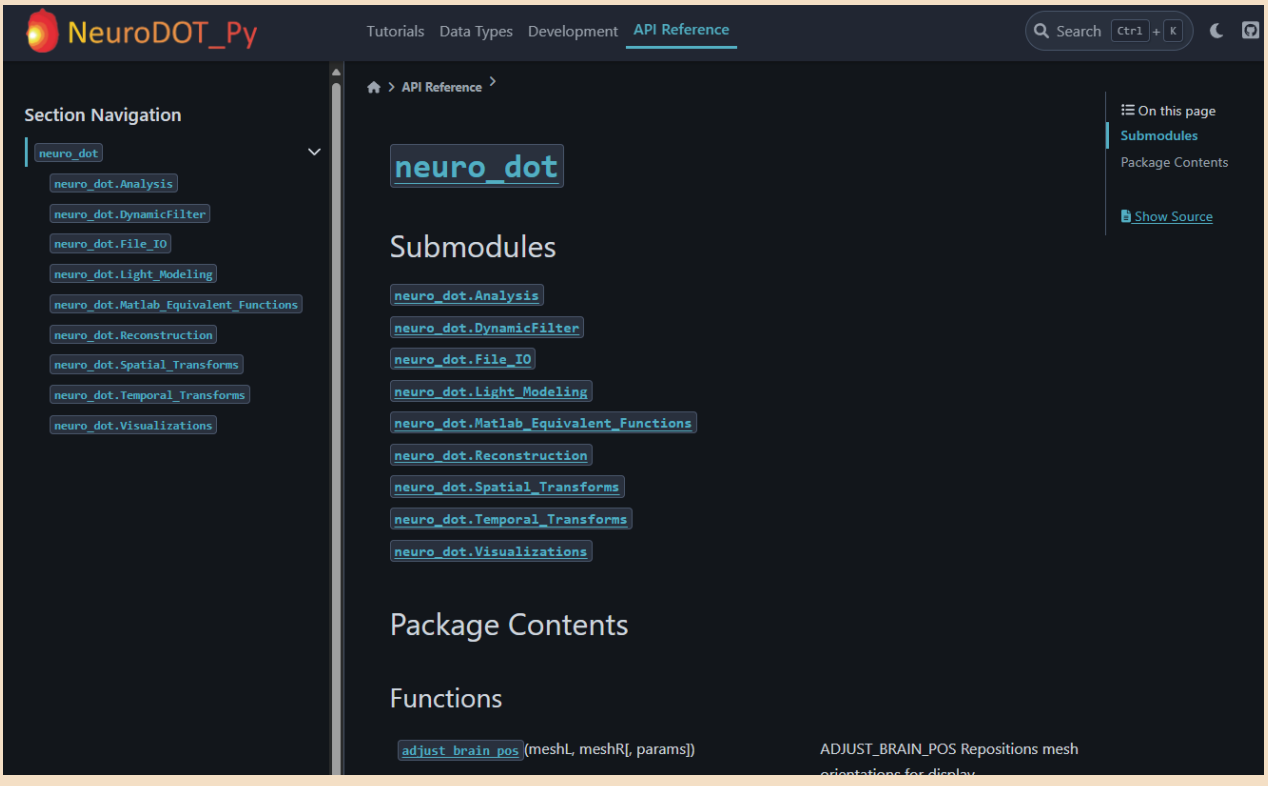
NeuroDOT

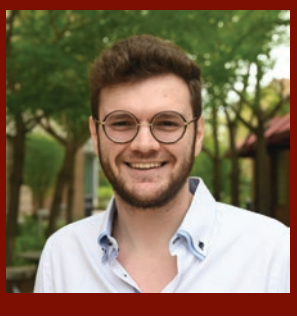
Release Updates

Python: NeuroDOT_Py v1.3.0

Changes since NeuroDOT_Py v1.2.0:

1. **Analysis Functions**
   A. Add GLM to General Linear Model based on a hemodynamic response function (HRF) and stimulus times (info['paradigm']['synchpts'])
   B. Add parcel_based_fc to calculate parcel-based functional connectivity between a volumetric dataset and a set of volumetrically defined parcels.
2. **Pipelines**
   A. Added Basic_GLM_Notebook.ipynb to run GLM on an example alternating checkerboards dataset and create surface maps of left, right, and left minus right contrasts. Example dataset and support files can be downloaded from NITRC (**https://www.nitrc.org/frs/?group_id=1563**)
   B. Added Basic_Parcelbased_FC_Notebook.ipynb to calculate parcel-based functional connectivity on an example resting state dataset using the Gordon 333 parcels and plot example parcel functional connectivity maps for Visual, Auditory, SMhand, and Fronto-Parietal networks. Example dataset and support files can be downloaded from NITRC (**https://www.nitrc.org/frs/?group_id=1563**)
3. **Support Files**
   A. Regions_and_Parcels: added Adult_96x92_FOV.mat for example use with Basic_Parcelbased_FC_Notebook.ipynb
   B. Atlases: added Adult_96x92_Overlapped_Gordon_Parcels.mat for example use with Basic_Parcelbased_FC_Notebook.ipynb
4. **Dependencies**
   A. Add 'nbformat' to requirements.txt for Jupyter Notebook compatibility
5. **Visualization Functions**
   A. Refactor conditions for empty data checks for compatibility with the latest NumPy version (2.4.0)
6. **File IO Functions**
   A. Fix item access in nifti_4dfp for 'revorder' variable





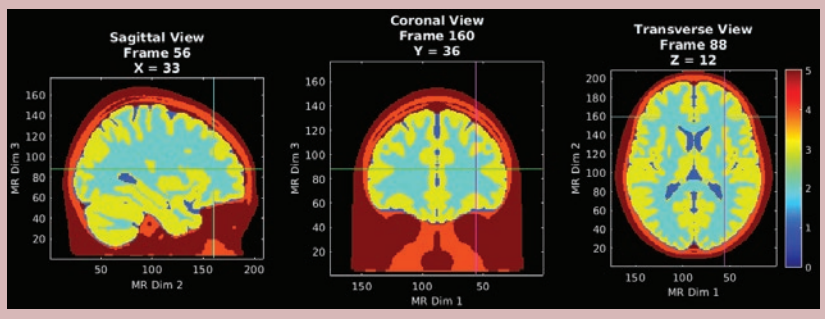
Developer's Corner - Ari

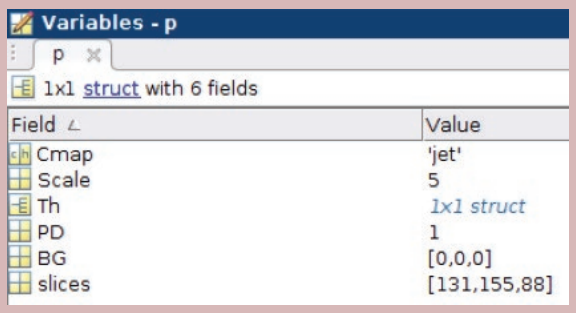
Updates to **PlotSlices** and **PlotSlicesTimeTrace**

PlotSlices and **PlotSlicesTimeTrace** have received a quality of life update! Shoutout to Sankhonil from the Kallepalli lab at University of Strathclyde for this idea. Both functions now output a parameter structure containing a slices field (shown in the right figure). This field will allow for users to more easily reproduce images with **PlotSlices** and **PlotSlicesTimeTrace**.

Whenever the parameter input into these two functions contains a slices field, the resultant visualizations will no longer be interactive. Instead, the visualizations will be static and show the slices that were input in p.slices.

```
p = PlotSlices(mask, infoT1, p)
```

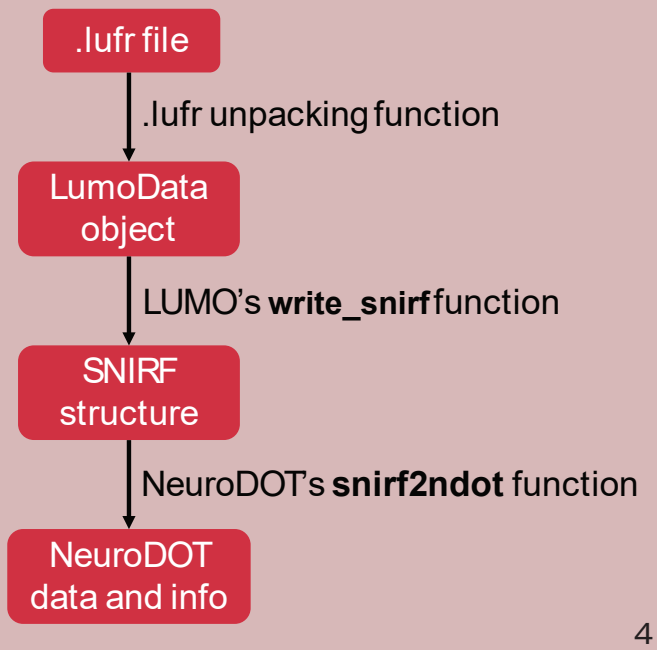




Lumo2ndot

Lumo2ndot is NeuroDOT's conversion function for .lufr output from LUMO systems by Gowerlabs. This function utilizes the *lumomat-master* toolbox from Gowerlabs to first unpack the .lufr data into snirf format. Data in snirf format is then run through NeuroDOT's **snirf2ndot** function to convert into NeuroDOT's .mat format.

As *lumomat-master* is currently a MATLAB only toolbox, this function is only supported in the MATLAB release of NeuroDOT. **Lumo2ndot** can be found in the NeuroDOT toolbox within the *functions/file_IO* folder.





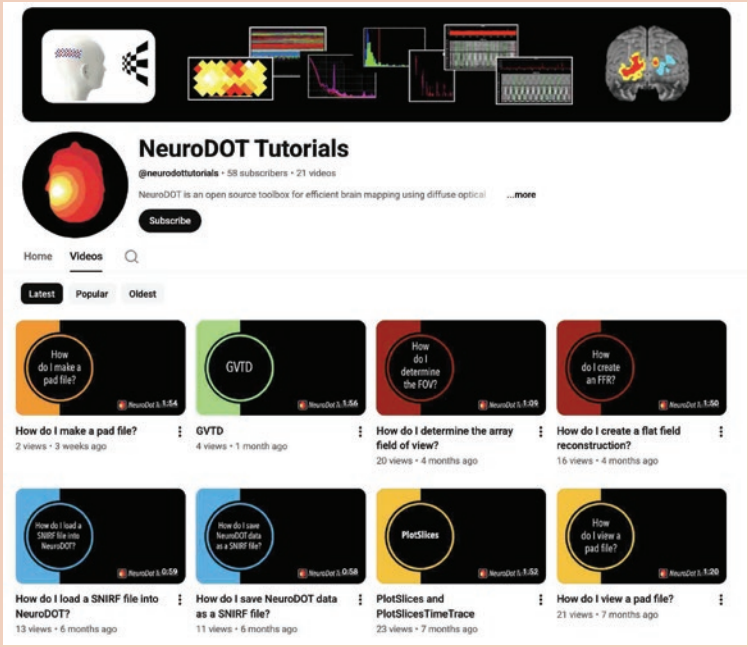
Developer's Corner - Mike

YouTube Channel Shorts

In addition to long-form videos and lectures, the NeuroDOT YouTube channel includes a growing collection of shorts. These are brief (around two minutes), narraration-less tutorials focused on a single topic (or aspect of a topic) that needs some explanation. Basically, shorts answer the question How do I do X in NeuroDOT? or summarize a feature that users may find confusing.

Currently the selection includes creating and viewing a Pad File, creating and viewing the flat field reconstruction (FFR) and array field of view (FOV), use of **PlotSlices**, Shared Near-Infrared Spectroscopy Format (SNIRF) input and output, and an overview of global variance of the temporal derivative (GVTD).

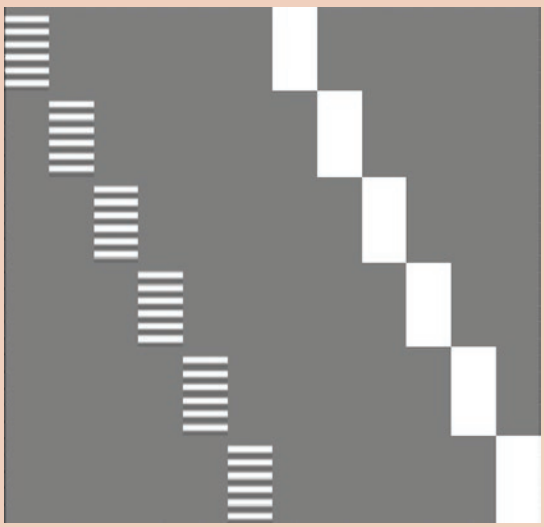
And we always welcome ideas for future tutorials. If there is a topic you would find helpful -- for either a short or a long-form video -- email us at **neurodot-support@wustl.edu** or post your suggestion in the channel comments. Visit the NeuroDOT YouTube channel: **https://www.youtube.com/@neurodottutorials**



Coming Soon: **ND_GLM** with expanded documentation (Mat/Py)

Many users are not aware that statistical modeling can be performed in NeuroDOT using the General Linear Model. Although our GLM implementation is not as full-featured as that offered in dedicated statistical packages, it is fast, easy to use, and offers options specific to HDDOT applications such as GVTD-based denoising. Additionally, the NeuroDOT GLM function understands NeuroDOT data structures, so it can build a design matrix from the same information that was used to define your experimental protocol and data acquisition.

We are currently updating this functionality. The new version will feature an expanded interface, Python refactoring, and expanded documentation, including both PowerPoint and video tutorials. Look for these in an upcoming NeuroDOT release!





Developer's Corner - Emma

Assessing Data Quality on OXI

On Optical-imaging XNAT-enabled Informatics (OXI, **oxi.xnatworks.io**) we have created a Docker container for data quality control. The container outputs four figures in a "QC" folder: time traces overview, data quality metrics overview, Cap data quality overview, and NLR Gray plots.

Additionally, you will be able to create an "fNIRS QC", shown on the left, which loads the snapshots of all the quality control (QC) images, displays selected QC metrics (% good measurements, median signal-to-noise ratio (SNR), and median GVTD), and you can provide ratings. The QC review can be saved and viewed later by you or others in your team.

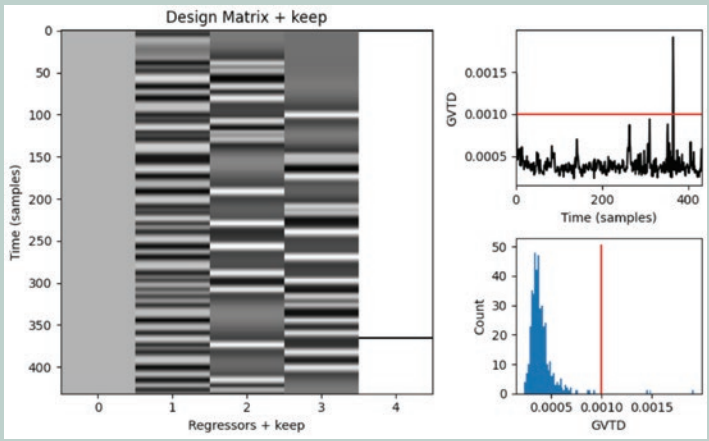


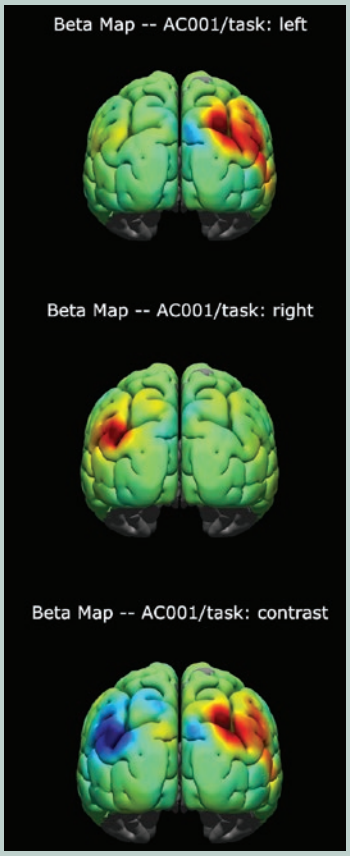
Post-processing with GLM in Python

We recently refactored the NeuroDOT function ***GLM_181206.m*** to Python. We have provided a Jupyter notebook "***Basic_GLM_Notebook.ipynb***" on NITRC with a simple example of using the General Linear Model (GLM) function to analyze an alternating checkerboards (AC) dataset and plot beta maps for each task condition (Left and Right checkerboards) and contrast maps of Left minus Right.

To use the GLM function in Python, for example if you import the NeuroDOT_py toolbox as ndot:

b,e,DM,EDM,keep, r_sqrd = **ndot.GLM**(cortex_Hb[:, :, 0], hrf, info, params)





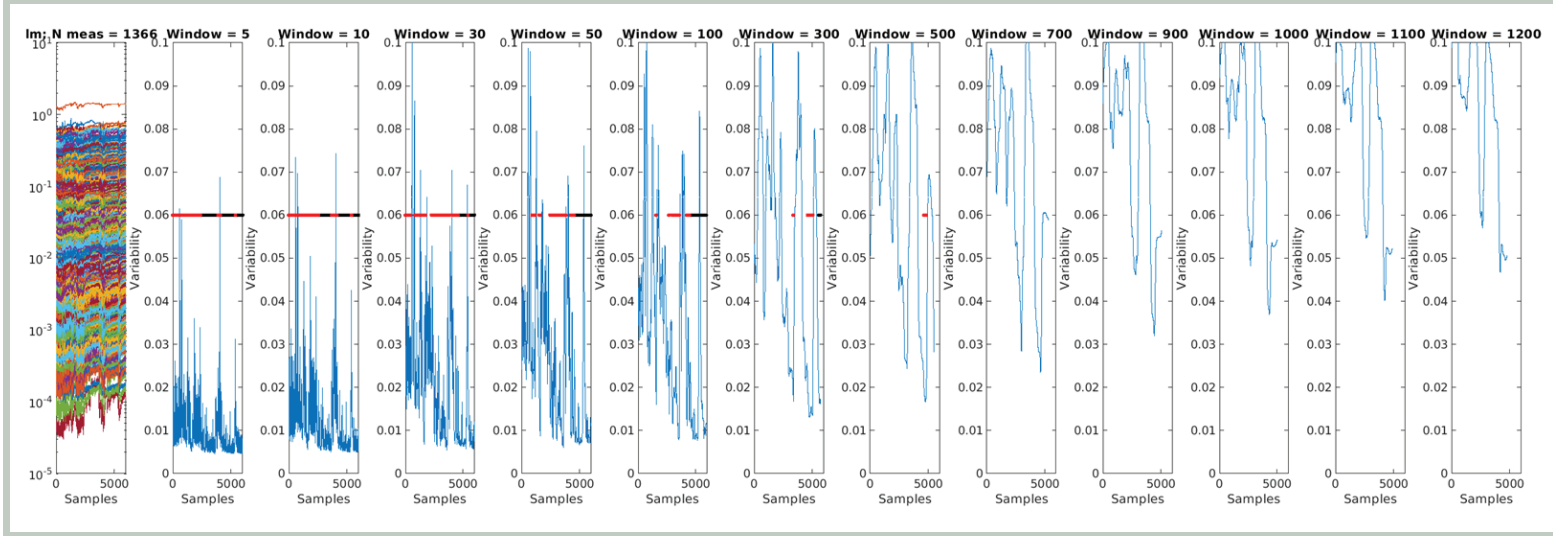


Developer's Corner - Bow

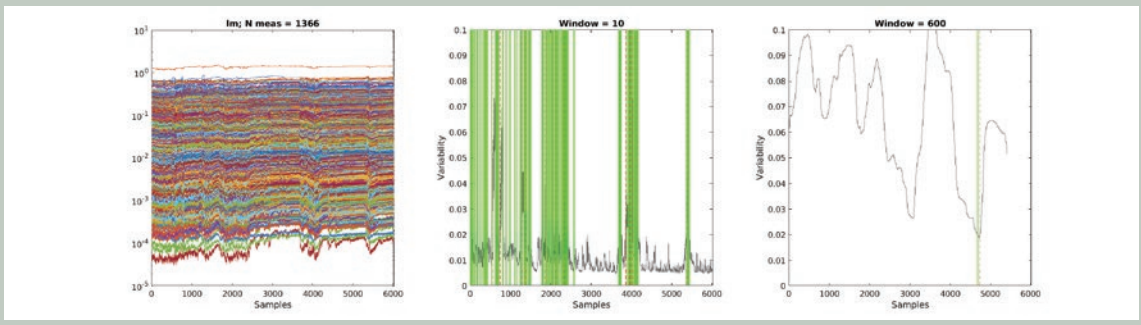
Methods For Identifying Motion

I like to use plots of raw diffuse optical tomography (DOT) data to inform my development of an algorithmic metric for identifying motion in optical neuroimaging data. Once I have plotted a few time trace figures using the **Plot_RawData_Time_Traces_Overview** function, I like to work towards building other kinds of figures which corroborate my initial data quality assessments. I first take the log-mean of the data. Then I use the **FindGoodMEAS** function to ensure that I am only including measurements which meet our good measurement criteria.

Once I have done those things, I am able to create plots of standard deviation by passing in the data which has been filtered and plotting the resulting values in MATLAB. After this, setting a variance threshold is the final step to use this method to computationally distinguish between motion-contaminated data and data which can go on to further processing with DOT.



Standard deviation values for a high motion run of DOT data calculated using sliding window procedure. Segments of data which will go on to further processing are marked in black. Segments which are too short to continue on in data processing are marked in red.



Another visualization of the same dataset shows how different window sizes will effect the amount of good data segments that we are able to retain. For this dataset, a smaller window size (window = 10 frames), several short segments of data were marked for retention. With the larger window size (window = 600 frames), only one segment was marked for retention. These data segments will only be processed further if they are long enough to be used for the desired analysis.



Developer's Corner - Sungmin

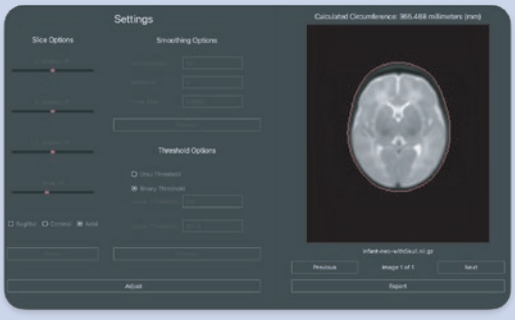
Atlas-Based Pediatric Head Modeling

Many functional near-infrared spectroscopy (fNIRS) and diffuse optical tomography (DOT) researchers work with pediatric populations, where significant heterogeneity in head shape, size, skull thickness, and tissue type all influence light modeling and high-density diffuse optical tomography (HD-DOT) reconstruction. While the MRI community has developed several pediatric atlases, not all are well-suited for optical head modeling. Here's what makes a good one:

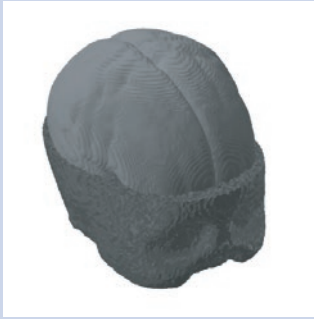
1. Unscaled and population-representative. Many pediatric atlases are scaled to match a standard space (ICBM, MNI, etc.), but optical head modeling requires heads that reflect actual pediatric head dimensions.
2. Skull and scalp present. Some MRI atlases omit extracerebral tissue, but scalp and skull are essential for modeling light propagation through tissue.
3. Tissue segmentations included. The atlas should provide segmentations of skin, skull, cerebrospinal fluid (CSF), gray matter (GM), and white matter (WM), whether as 5-, 4-, or 3-layer model.
4. Cortical surface meshes (optional): enables volumetric data to be interpolated and visualized via NeuroDOT's **PlotInterpSurfMesh** function.
5. Transformations to standard space (optional): allows volumetric data to be mapped to ICBM/MNI space for use with standard parcellations and cortical surface meshes.

We've found the UNC 0-1-2 atlas (https://www.nitrc.org/projects/pediatricatlas/) from *Shi et al. Human Brain Mapping, 2014* to be a strong option. In the next release, we'll be including an example MATLAB script for generating a head mesh model using this atlas.

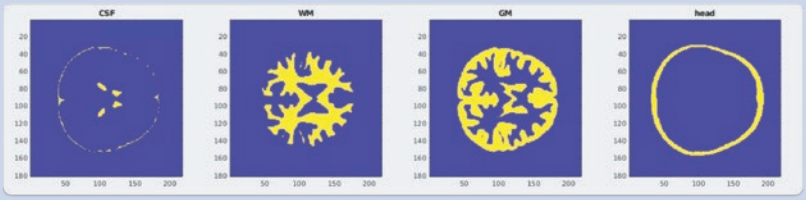
Know of an atlas that checks all the boxes? We'd love to hear about it and incorporate it into NeuroDOT!



[1] NeuroRuler (**https://github.com/NIRALUser/NeuroRuler**) can be helpful for approximating head circumference from .nii files.



[4] Cortical surface mesh generated from UNC 0-1-2 atlas using Surfice: (**https://www.nitrc.org/projects/surfice/**). Head mesh is cut to visualize brain mesh. Surfice is a surface rendering tool and can generate mesh (.obj, ply, etc.) objects from .nii files.



[2,3] Example of segmented tissue (CSF, WM, GM, and Scalp+skull) from UNC 0-1-2 atlas.



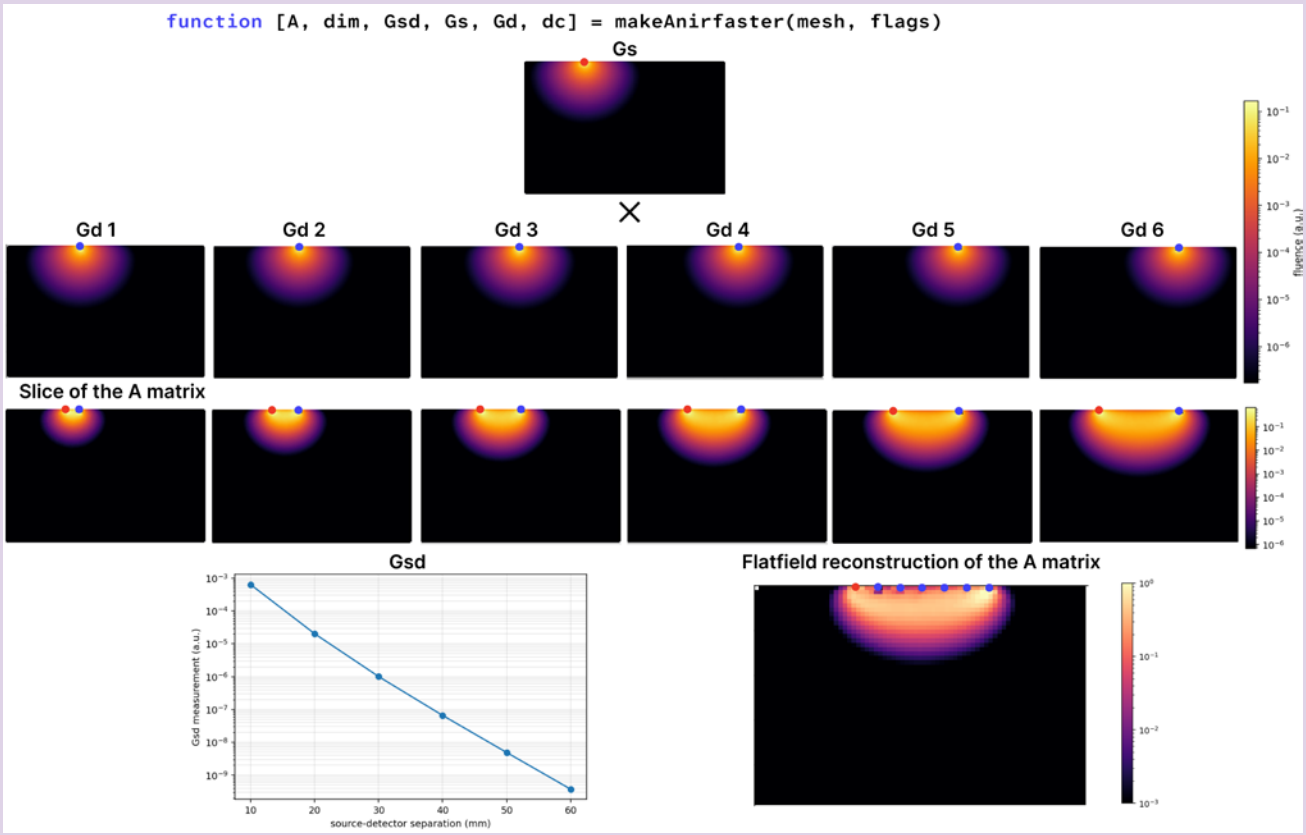
Developer's Corner - Yutian

From Green's function to A matrix

NeuroDOT provides simple ways to get the Green's function, which represents the fluence rate or impulse response of a light source within a medium, the fluence, which is the measured light intensity at detectors, and the A matrix, which is the Jacobian or the sensitivity matrix of the light source-detector pairs on the medium.

In NeuroDOT, the function '**makeAnirfaster**' enables the calculation the Green's function of sources (Gs) and detectors (Gd), and specific detector responses to sources (Gsd) , and the whole sensitivity matrix (A) in one simple line of code. Within this function, the Green's functions for each source and detector are calculated individually. These are then multiplied according to the defined source-detector geometry to generate single-channel specific sensitivity profile, which are finally assembled into the full-array sensitivity matrix A. This architecture allows for multi-level inspection, from individual point-source Green's functions to the comprehensive sensitivity profile of the entire imaging pad. By analyzing both the Green's functions and the sensitivity matrix, we gain a clearer understanding of light propagation within the medium, allowing us to optimize source-detector geometries and maximize regional sensitivity prior to data collection.

This architecture allows for multi-level inspection, from individual point-source Green's functions to the comprehensive sensitivity profile of the entire imaging pad. By analyzing both the Green's functions and the sensitivity matrix, we gain a clearer understanding of light propagation within the medium, allowing us to optimize source-detector geometries and maximize regional sensitivity prior to data collection.



The function makeAnirfaster output, Gs, Gd, Gsd, and A matrix for a slab model.



Developer's Corner - Dalin

fMRI-based ROI Selection for Optical Neuroimaging

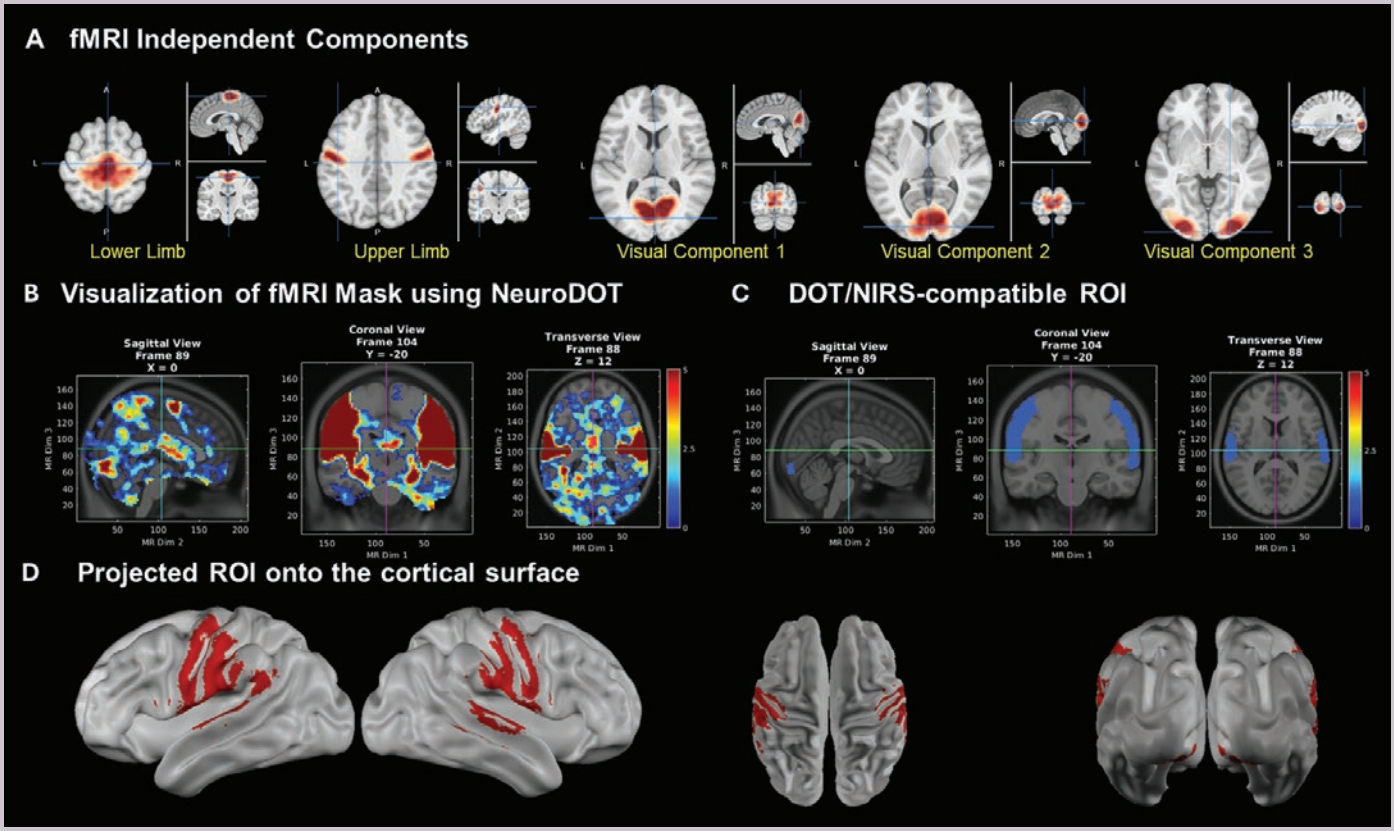
I would like to introduce a practical workflow for converting fMRI-defined regions of interest (ROIs) for use in optical imaging studies. fMRI is widely regarded as a gold-standard method for functional brain mapping, and researchers often use fMRI-derived activation maps or independent components to define ROIs associated with specific brain functions.

As an example, Figure A shows visual and motor independent components originally defined by *Nebel et al. Biological Psychiatry, 2016.*

The workflow is as follows, using the NIfTI file containing the ROI:

1. Load the volumetric ROI using the **LoadVolumetricData** function and visualize it with **PlotSlices** (Figure B).
2. Load the DOT/NIRS field of view and convert it into the same anatomical space using an affine transformation.
3. Intersect the fMRI ROI and DOT/fNIRS field of view to create a DOT/NIRS-compatible ROI restricted to the measurable optical imaging coverage (Figure C).
4. Visualize the resulting ROI in volumetric space or projected onto the cortical surface (Figure D) .

This converted ROI provides a study-specific anatomical or functional mask that can be used for subsequent DOT/NIRS analyses, including signal extraction, group comparisons, and functional connectivity analyses.



Workflow for Adapting fMRI-Defined Regions of Interest to Optical Imaging Studies

NeuroDOT

Contribute your ideas!

Please submit your feedback: https://forms.gle/iEYfEZhfj99FVEs29

- Request new features
- Resolve bugs
- Share your opinions
  - Let us know what you think about this newsletter
  - Any and all comments are welcome!

Need help integrating NeuroDOT into your workflow?

Contact the NeuroDOT development team directly for one-on-one assistance: neurodot-support@wustl.edu

Become a registered user! We are interested in knowing what part of the world you're in, your research focus, and your goals with NeuroDOT:
https://forms.gle/vrE2Y3cNkUGnbFF6A

Join the Growing Global Community of NeuroDOT Users!

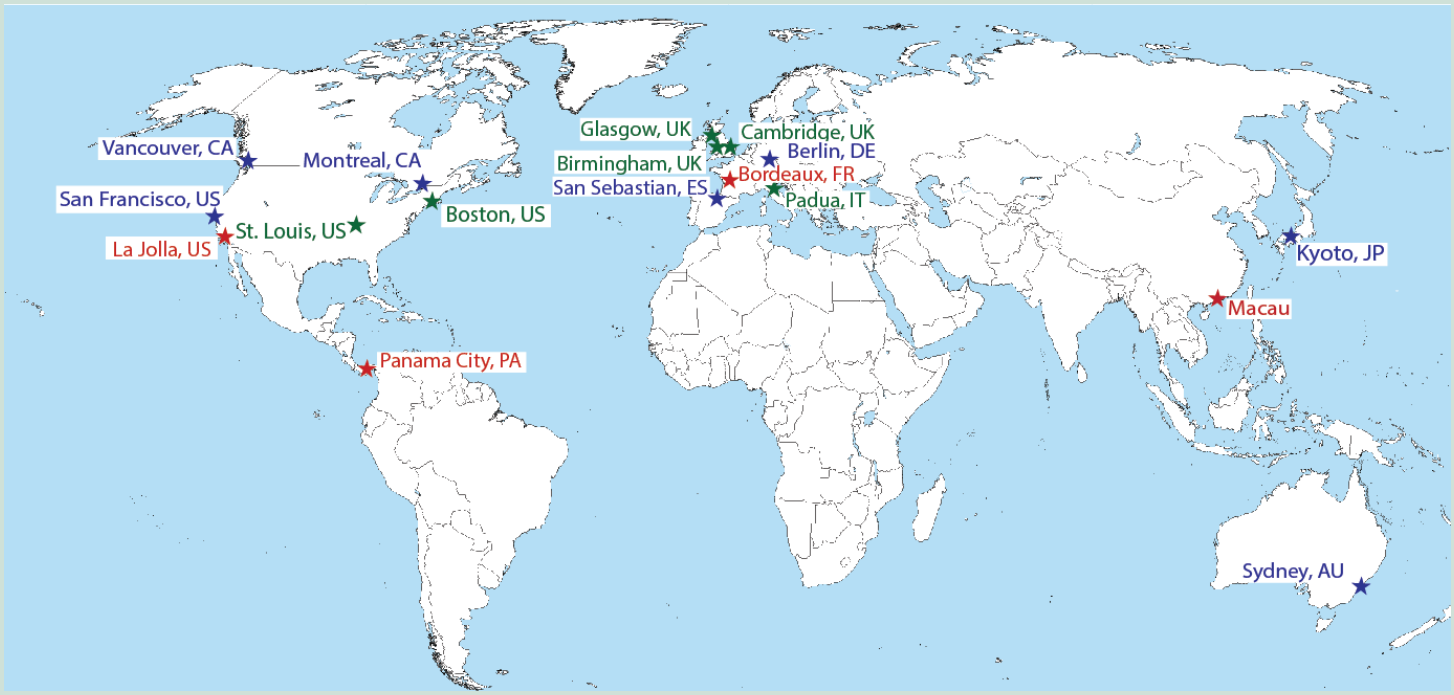


NeuroDOT

Attend a NeuroDOT Workshop!

We are very interested in expanding the planned workshop locations at conferences and at institutes and communites that are interested in learning about NeuroDOT.

If you are interested in a new NeuroDOT workshop at a conference or destination, or a workshop on any specific topic, please reach out to us: neurodot-support@wustl.edu



Upcoming Workshops:

1. NeuroDOT Hands-on at High-Density DOT Workshop | Pre OHBM Event, Bordeaux, France, Saturday June 13,2026.
   - Link to register: https://www.eventbrite.de/e/high-density-dot-workshop-pre-ohbm-event-tickets-1980183871264?aff=oddtdtcreator
2. Diffuse Optical Mapping of Human Brain Function Using NeuroDOT and OXI: A Hands-on course, International Congress of Infant Studies (ICIS), Panama City, Panama, July 6, 2026
3. Mapping of Human Brain Function with fNIRS and HD-DOT using NeuroDOT and OXI computational methods: a Hands-on course, FLUX Pre-Conference Workshop, Monday, September 7, 2026
4. Diffuse Optical Mapping of Human Brain Function using NeuroDOT and OXI: A Hands-on course, Society for Functional Near Infrared Spectroscopy (fNIRS) Conference, Macau, China, October 16, 2026

NeuroDOT

Past NeuroDOT Workshops

1. HD-DOT and NeuroDOT x LUMO Workshop (University of Strathclyde, Glasgow, UK) – March 18-19, 2026
2. Diffuse optical mapping of human brain function using NeuroDOT and OXI: a hands-on course (fNIRS UK Conference, Cambridge, UK) – September 2025
3. Society for fNIRS Summer School (St. Louis, MO) – July 2025
4. Functional Near-Infrared Spectroscopy (fNIRS) with NeuroDOT for Psychology and Neuroscience (University of Padua, Padua, IT) – June/July 2025
5. NeuroDOT LUMO Workshop (University of Cambridge, Cambridge, UK) – May 15-16, 2025
6. Computational tools and models in diffuse optical tomography (University of Birmingham, Birmingham, UK) – December 2024
7. Diffuse Optical Mapping of Human Brain Function using NIRFAST and NeuroDOT: A Hands-on course (Society for Functional Near-Infrared Spectroscopy Conference, Birming ham, UK) – September 2024
8. NeuroDOT Workshop (Washington University School of Medicine, St. Louis, MO) – July 2023
9. Diffuse optical mapping of human brain function using NIRFAST and NeuroDOT (Society for Functional Near-Infrared Spectroscopy Conference, Boston, MA) – October 2022
10. Optical Methods for Reliable and High Fidelity Human Brain Mapping – A Hands-on course (Organization for Human Brain Mapping Conference, Glasgow, UK) – June 2022

University of Cambridge, May 2025



fNIRS Summer School, July 2025



fNIRS UK, September 2025



University of Strathclyde, March 2026

