

Electrode localization SOP

- Open PAV005_Implantation.pptx from PennEMU/EMU_Data/PAV005/Imaging
- Go to electrode montage slices

	RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11	RA12	RB1	RB2	RB3	RB4
GND	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

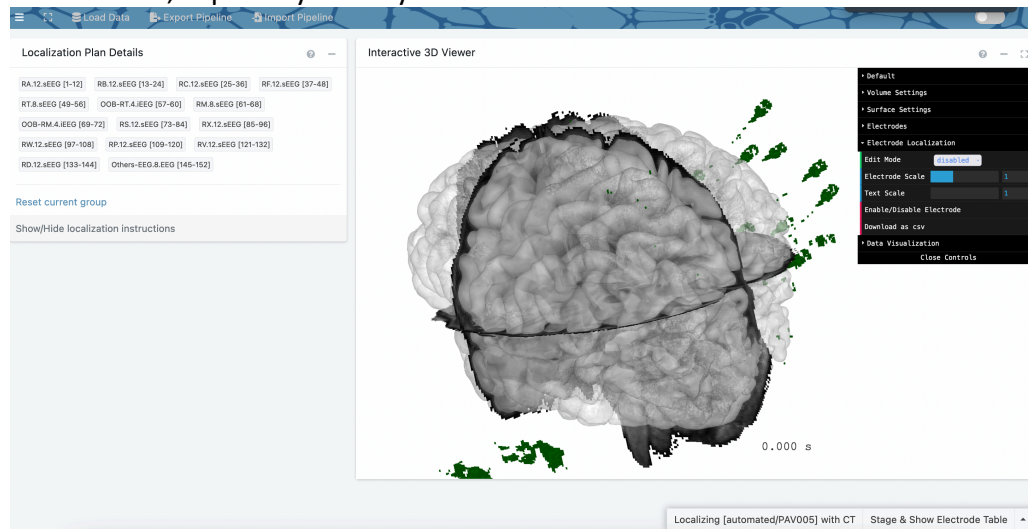
RB5	RB6	RB7	RB8	RB9	RB10	RB11	RB12	RC1	RC2	RC3	RC4	RC5	RC6	RC7	RC8
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

RC9	RC10	RC11	RC12	RF1	RF2	RF3	RF4	RF5	RF6	RF7	RF8	RF9	RF10	RF11	RF12
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48

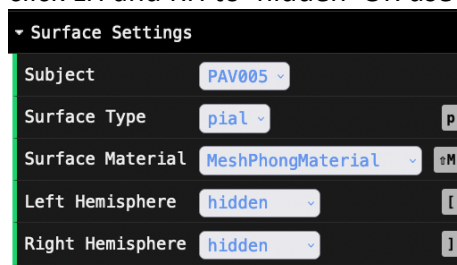
	RT1	RT2	RT3	RT4	RT5	RT6	RT7	RT8					RM1	RM2	RM3	RM4
REF	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64

- Open RAVE 2.0 commandline, go to [Surface & Electrodes > Electrode Localization]
- In RAVE, set Project to be “automated” (hard-coded) and Subject to be PAV005
- Choose CT to be “ct_in_t1.nii.gz”
- In the right-hand “Electrode Plan” tab, add group labels, dimension & type in ORDER based on montage slices
 - For example, in the above screenshot, channel 1-12 are RA (Group Label), with Dimension 12, and Type “sEEG” (depth electrodes)
 - For grid electrodes such as 8x8 electrodes, enter Dimension “8x8” and Type “ECoG”
 - If you are not sure about the electrode type, enter iEEG for sEEG & ECoG combined, or EEG if electrode is on the scalp
 - Make sure that the total channel number on the electrode montage pptx matches the total electrode number at the bottom of the rave page (above load subject)

- After finishing the electrode plan, press “Load subject” button. The loading progress will take a while, especially when you run for the first time



- You can hide the brain surface by going to “Surface Settings” in the control panel, click LH and RH to ‘hidden’ OR use the keyboard shortcut “[” for LH and “]” for RH



- To expose and visualize the electrode contacts (for clarity of each electrode), adjust the CT threshold in “Volume Settings” > “Voxel Min”

Volume Settings

Show Panels ☐

Reset Position

Coronal (P – A) 0 e/E

Axial (I – S) 0 q/Q

Sagittal (L – R) 0 w/W

Intersect MNI305 3.0, 0.2, -4.3

Overlay Coronal ☒ C

Overlay Axial ☒ A

Overlay Sagittal ☒ S

Dist. Threshold 2

Voxel Type CT

Voxel Display normal l

Voxel Opacity 0

Voxel Min 2296.25

Voxel Max 3071

- In the left-input panel “Localization Plan Details”, click on the first electrode group (in the screenshot below, this is “RA.12.sEEG” (Group RA, 12 electrodes, sEEG type)

Localization Plan Details ? -

RA.12.sEEG [1-12] RB.12.sEEG [13-24] RC.12.sEEG [25-36] RF.12.sEEG [37-48]

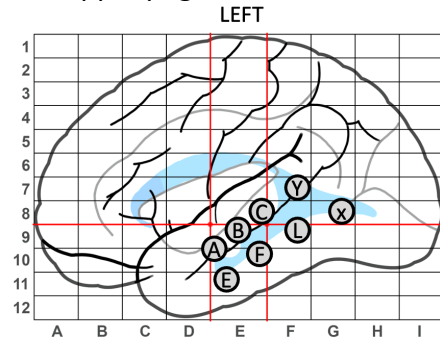
RT.8.sEEG [49-56] OOB-RT.4.iEEG [57-60] RM.8.sEEG [61-68]

OOB-RM.4.iEEG [69-72] RS.12.sEEG [73-84] RX.12.sEEG [85-96]

RW.12.sEEG [97-108] RP.12.sEEG [109-120] RV.12.sEEG [121-132]

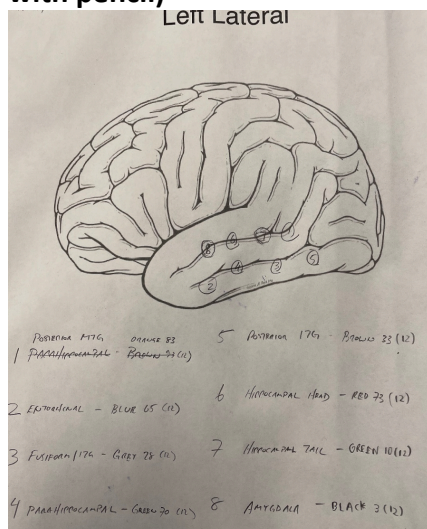
RD.12.sEEG [133-144] Others-EEG.8.EEG [145-152]

- Go to the pptx page with both the electrode group and surgeon label:



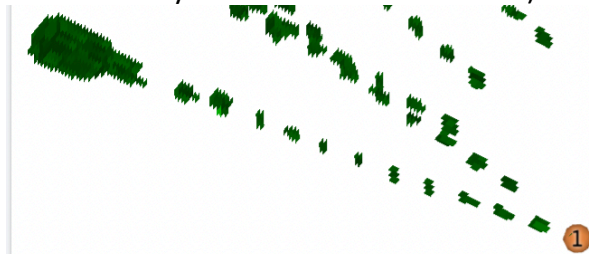
Target	Surgeon's Label	Color - Number	# of contacts
LA Amygdala	8	Brown 33	12
LB Hippocampal Head	6	Red 73	12
LC Hippocampal Tail	7	Green 10	12
LY Posterior MTG	1	Orange 83	12
LF Parahippocampal Gyrus	4	Green 70	12
LE Entorhinal Cortex	2	Blue 65	12
LL Fusiform ITG	3	Green 78	12
LX Posterior ITG	5	Brown 33	12

- Here you will see the electrode group (in the first column) and its corresponding surgeon label (in the third column)
- Locate the rows of the **current electrode group label** you are localizing and find the corresponding **surgeon's label**; for example – If you are localizing the channel group “LA”, then the corresponding surgeon's label is 8
- ***IMPORTANT*** Go to the surgeon drawn notes of the electrode locations (drawn with pencil)**



Find the location of Electrode Shaft '8' (this is the actual implantation location) DO NOT LOOK AT THE PPTX PRE IMPLANT PAGE FOR LOCATION, ALWAYS REFER TO THE SURGEON DRAWING NOTE FOR SHAFT LOCATION CORRESPONDING TO SURGEON LABEL

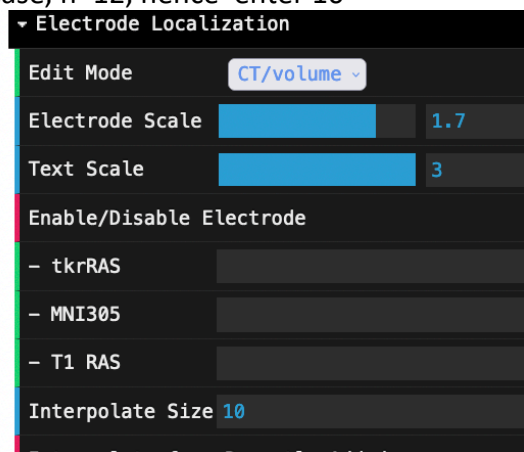
- To better find the electrode shaft on the RAVE 3D-viewer, you can ‘un-hide’ or display the surface using the rave shortcuts “[” or “]” (make sure the mouse pointer is hovered on top of the brain for RAVE to capture keyboard shortcut). Also you can change the transparency of the surface models by “shift+[” or “shift+]”. *The electrode marked on surgeon’s drawing is the entry point*
- Now you can double-click on the CT voxels (Green color) to create electrodes.
 - To start localizing along the shaft, double-click on the inner-most contact (this contact always has the smallest number)



- Next, click on the last electrode of this shaft (for RA, this is electrode 12)



- Go to 3D viewer control panel, “Electrode Localization” > “Interpolate Size”, enter n-2, where n is the total number of electrode contacts along the shaft. In “RA” case, n=12, hence enter 10



- Adjust the CT threshold in “Volume Settings” > “Voxel Min” such that all the contacts appear in the 3D viewer,

- Click on 3D viewer controller “Electrode Localization” > “Interpolate from Recently Added”, then the 12 electrodes are automatically generated



- **Once you finish the each shaft, press “Stage & Show Electrode Table” on your bottom-right screen and click on “Dismiss” button.** This will stage (temporarily save your electrodes in case RAVE crashes).
- Click on the next electrode group (in this case, this is “RB.12.sEEG”), repeat the previous step XXX – XXX until all the electrodes are localized.
- Once you finish **the last shaft**, press “Stage & Show Electrode Table” on your bottom-right screen and click on **“Save to Subject” button**.