

«به نام خدا»



آزمایشگاه علوم اعصاب

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fMRI آزمایش

ترم 1402_02

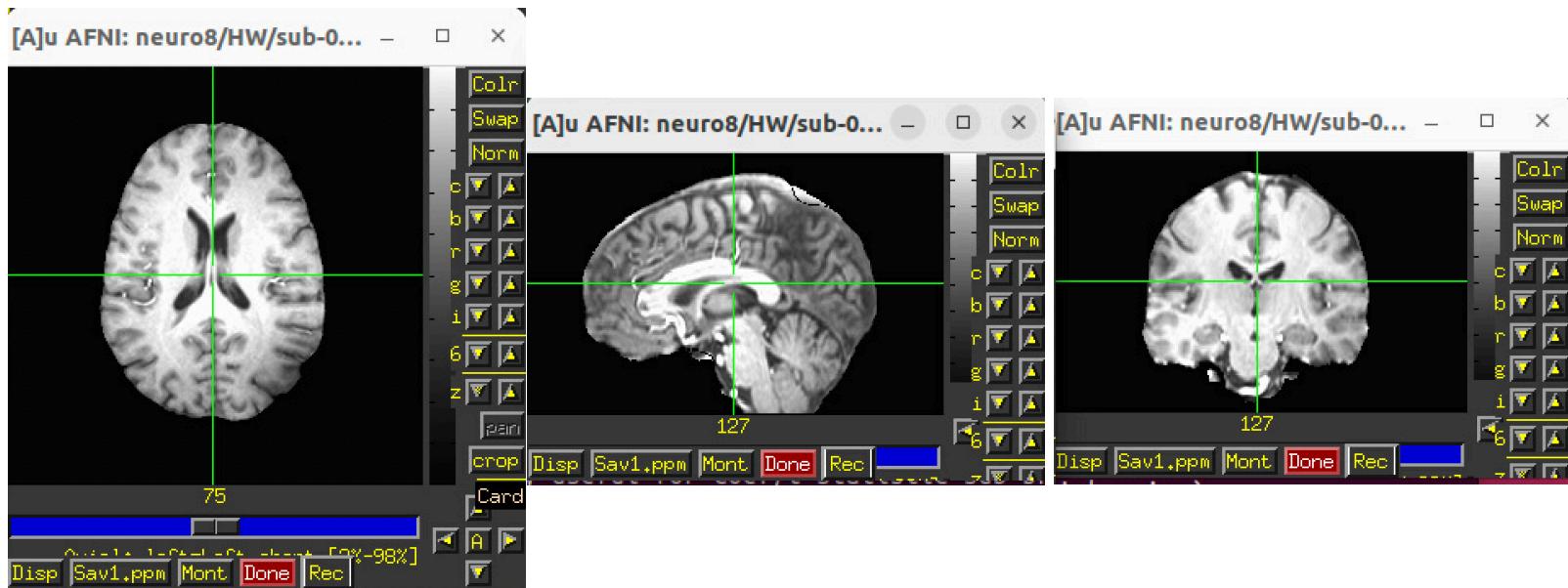
Convert data to AFNI format:

```
3dcopy sub-09_T1w.nii.gz sub-09_T1w
```

1. Structural Data

a. Remove skull:

```
3dSkullStrip -input sub-09_T1w+orig -prefix sub-09_T1w_stripped
```

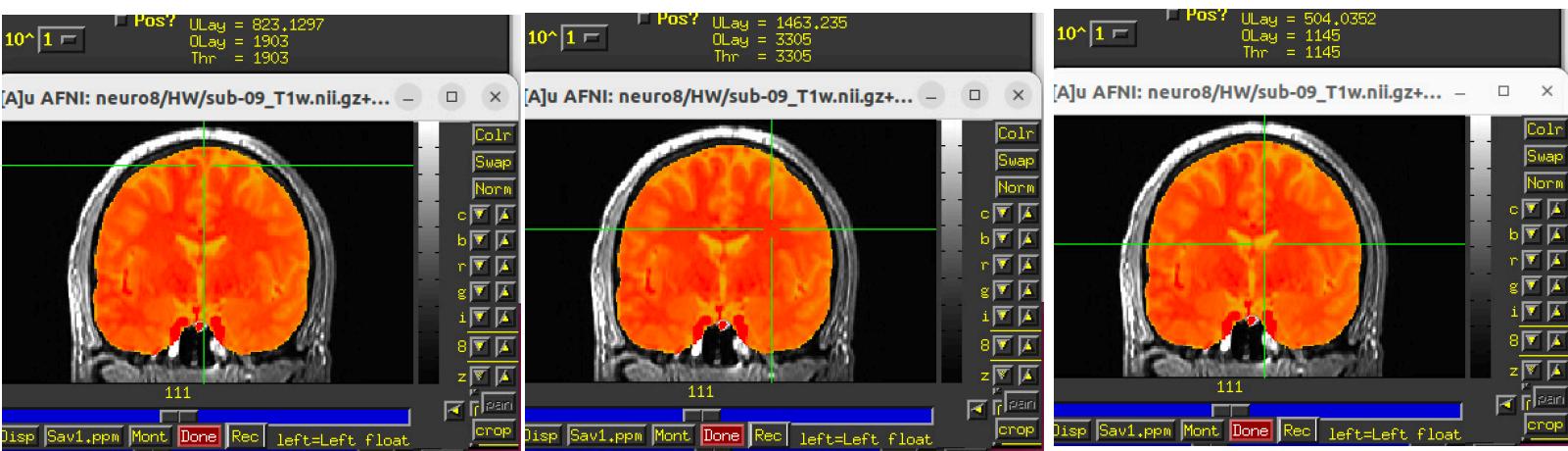


b. Extract the volume of the brain:

```
3dBrickStat -volume sub-09_T1w_stripped+orig
```

Volume = 8640000.000000

C.



3dcalc:

```
3dcalc -a sub-09_T1w_stripped+orig -expr 'within(a, 1500, 2500)' -prefix sub-09_T1w_GM_mask
```



2. Functional Data Preprocessing:

a. Make a copy:

```
3dcopy sub-09_task-visualoddballwithbuttonresponsetotargetstimuli_run-01_bold.nii.gz  
sub-09_task
```

b. Slice Time correction

Using 3dinfo we get some information such as:

Number of time steps = 170 Time step = 2.00000s Origin = 0.00000s Number
time-offset slices = 32 Thickness = 0.000

Time-offsets per slice: 1.000 7.000 13.000 19.000 25.000 31.000 2.000 8.000
14.000 20.000 26.000 32.000 3.000 9.000 15.000 21.000 27.000 4.000 10.000
16.000 22.000 28.000 5.000 11.000 17.000 23.000 29.000 6.000 12.000 18.000
24.000 30.000

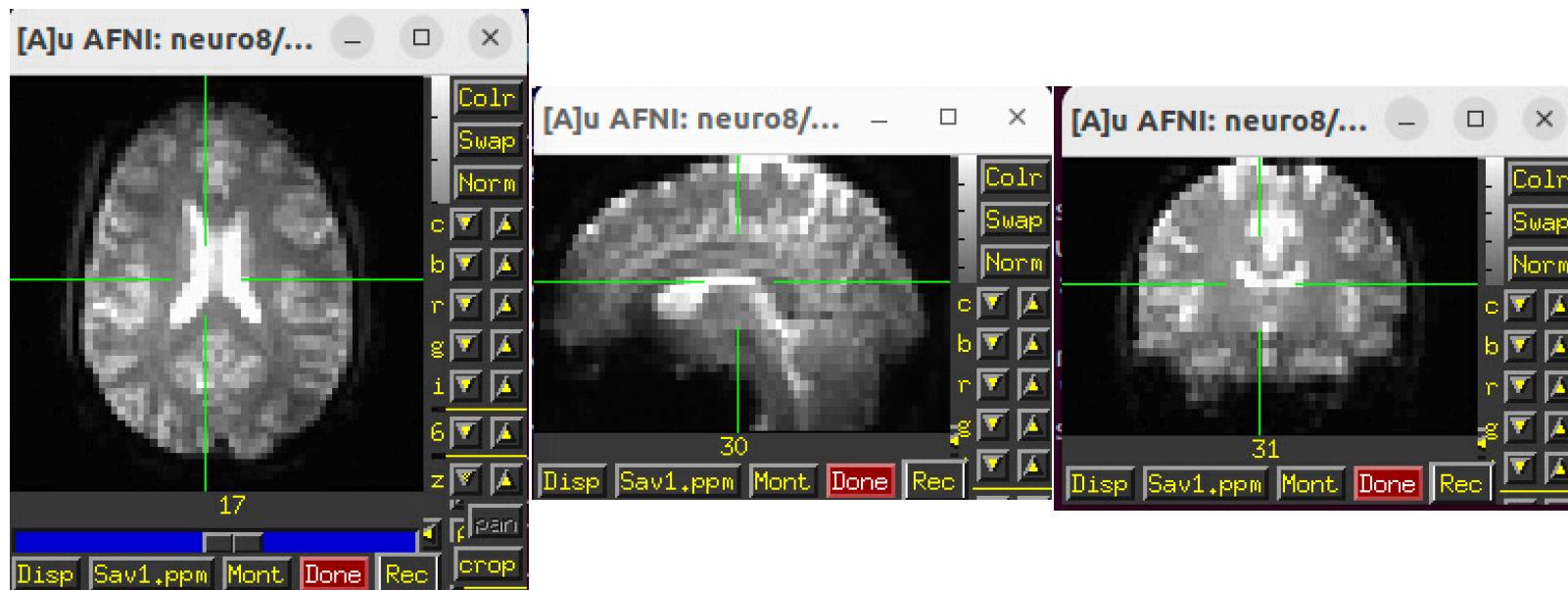
So the steps in slice_order is $2000/32 = 62.5$, starting from 0:
0, 62.5, 125, 187.5, ...

Then we use 3dTshift:

```
3dTshift -prefix sub-09_task_tshift -tpattern @slice_order.txt sub-09_task+orig
```

c. Motion Correction:

```
3dvolreg -verbose -zpad 1 -base sub-09_task_tshift+orig[2] -1Dfile dfile.FT1.1D -prefix sub-09_task_tshift.volreg -cubic -1Dmatrix_save mat.FT1.vr.aff12.1D sub-09_task_tshift+orig
```

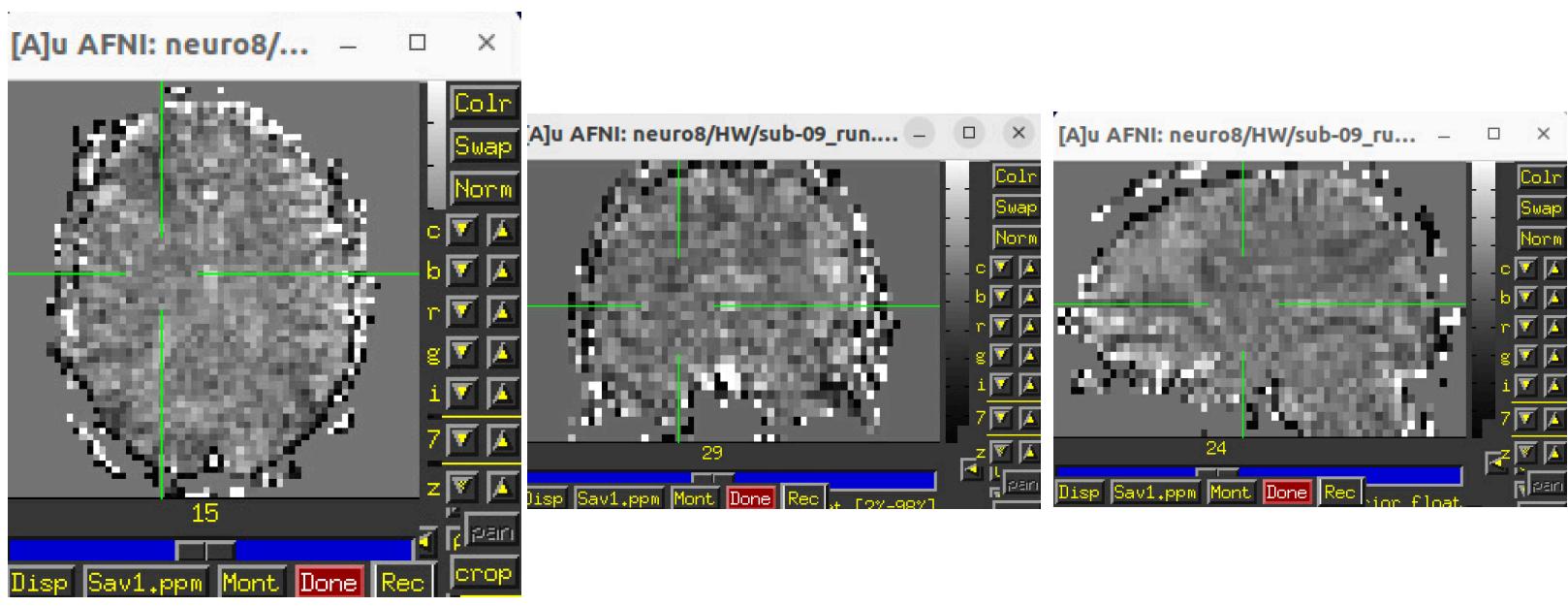


d. Normalization

```
3dTstat -mean -prefix meanfunc.nii.gz sub-09_task_tshift.volreg+orig
```

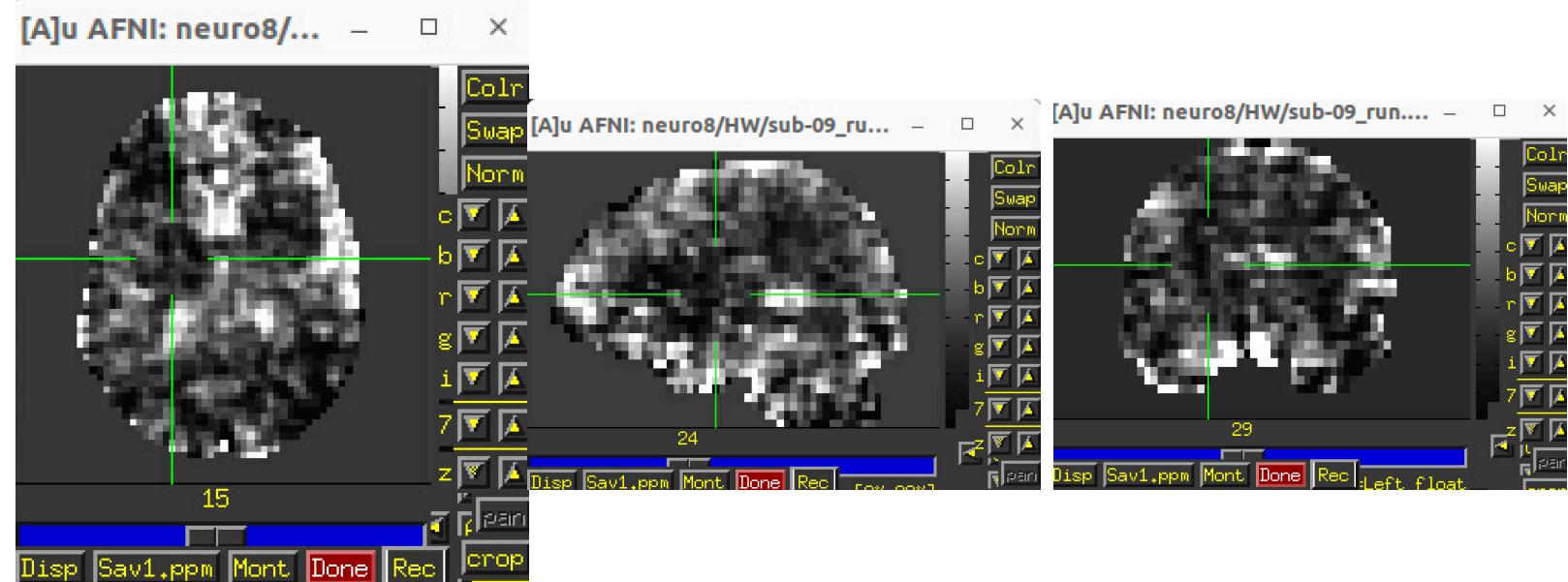
```
3dAutomask -clfrac 0.4 -prefix clean_base.nii.gz meanfunc.nii.gz
```

```
3dcalc -a sub-09_task_tshift.volreg+orig -b meanfunc.nii.gz -expr '(a-b)/(abs(b)+1)*astep(b,200)*100' -prefix sub-09_run.scale
```



e.

```
3dBandpass -input sub-09_run.scale+orig -mask clean_base.nii.gz -blur 5 -band 0.01  
0.1 -prefix sub-09_run.scale.smooth
```



3. Align Epi to Anat:

```
align_epi_anat.py -anat2epi -anat sub-09_T1w_stripped+orig \
    -anat_has_skull no -suffix _al_junk \
    -epi clean_base.nii.gz -epi_base 0 \
    -epi_strip 3dAutomask \
    -cost nmi -giant_move -check_flip \
    -volreg off -tshift off

cat_matvec sub-09_T1w_stripped_al_junk_mat.aff12.1D -I > func2mri_warp.1D
```

4. Data:

```
awk -F'\t' '$3 == "visual standard stimulus presentation" {print $1}' sub-09_task-
visualoddballwithbuttonresponsetotargetstimuli_run-01_events.tsv > stim_times_regular.1D

awk -F'\t' '$3 == "visual oddball stimulus presentation" {print $1}' sub-09_task-
visualoddballwithbuttonresponsetotargetstimuli_run-01_events.tsv > stim_times_unusual.1D

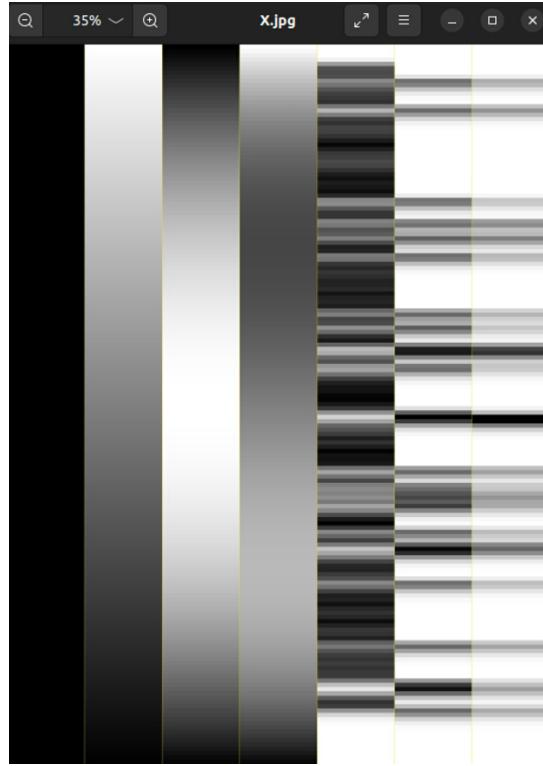
awk -F'\t' '$3 == "behavioral response time following visual oddball stimulus onset" {print $1 ":" \
$2-0.2}' sub-09_task-visualoddballwithbuttonresponsetotargetstimuli_run-01_events.tsv >
stim_times_button.1D
```

5. Regressors:

Its correct to use this function here

```
3dcalc -a sub-09_run.scale.smooth+orig -b clean_base.nii.gz -expr 'a*b' -prefix sub-
09_run.scale.smooth.maskd

3dDeconvolve -input sub-09_run.scale.smooth.maskd+orig.HEAD \
    -polort A \
    -num_stimts 3 \
    -stim_times 1 stim_times_regular.1D 'BLOCK(0.2,1)' -stim_label 1 Standard \
    -stim_times 2 stim_times_unusual.1D 'BLOCK(0.2,1)' -stim_label 2 Oddball \
    -stim_times_AM2 3 stim_times_button.1D 'dmBLOCK' -stim_label 3 Reaction \
    -gltsym 'SYM: +Standard -Oddball' -glt_label 1 Standard_vs_Oddball \
    -bucket stats_AA2 \
    -x1D X.xmat.1D \
    -xjpeg X.jpg \
    -errts errts.FT_run1
```



6.

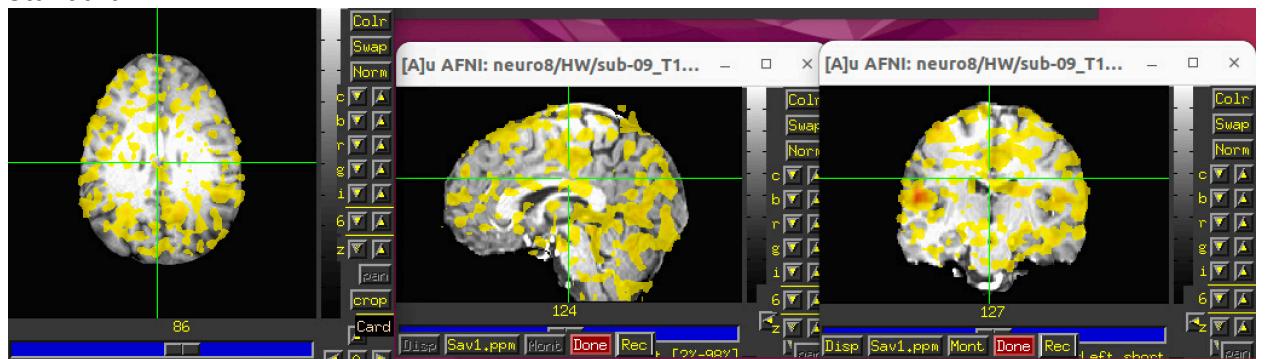
```
3dAllineate -base sub-09_T1w_stripped+orig \
    -input stats_AA2+orig'[0]' \
    -1Dmatrix_apply func2mri_warp.1D \
    -prefix beta_1_aligned2.nii.gz
```

```
3dAllineate -base sub-09_T1w_stripped+orig \
    -input stats_AA2+orig'[1]' \
    -1Dmatrix_apply func2mri_warp.1D \
    -prefix beta_2_aligned2.nii.gz
```

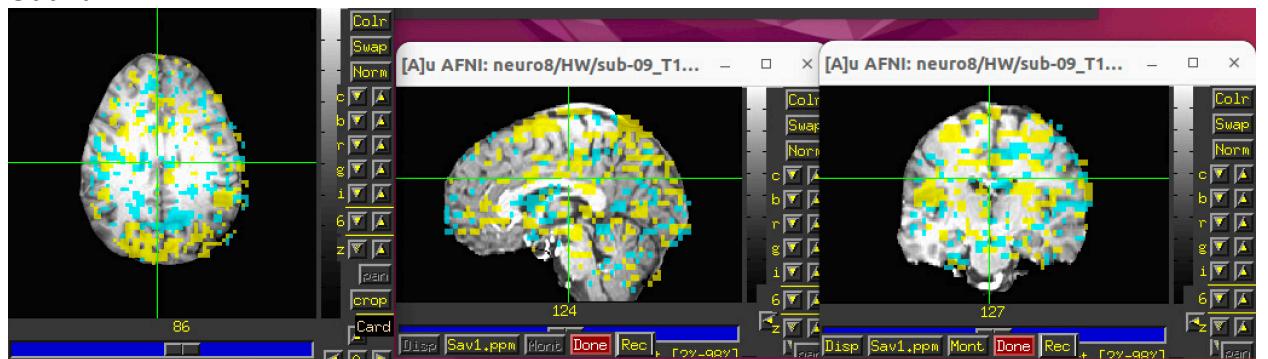
```
3dAllineate -base sub-09_T1w_stripped+orig \
    -input stats_AA2+orig'[2]' \
    -1Dmatrix_apply func2mri_warp.1D \
    -prefix beta_3_aligned2.nii.gz
```

```
3dAllineate -base sub-09_T1w_stripped+orig \
    -input stats_AA2+orig'[3]' \
    -1Dmatrix_apply func2mri_warp.1D \
    -prefix beta_4_aligned2.nii.gz
```

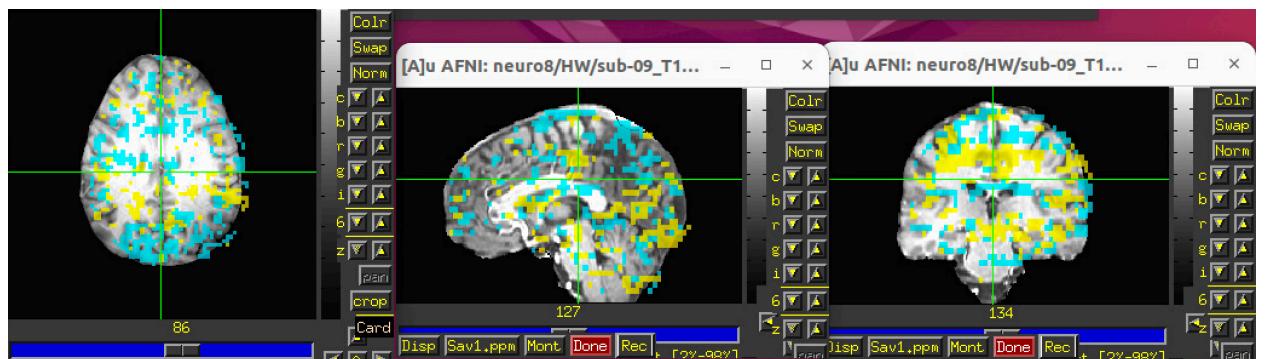
Standard:



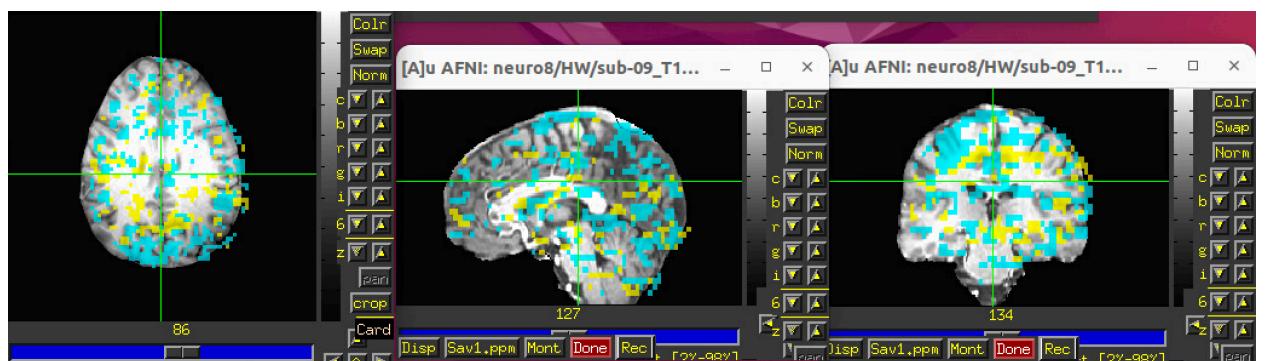
OddBall:



Behavioral:



OddBall vs. Standard:

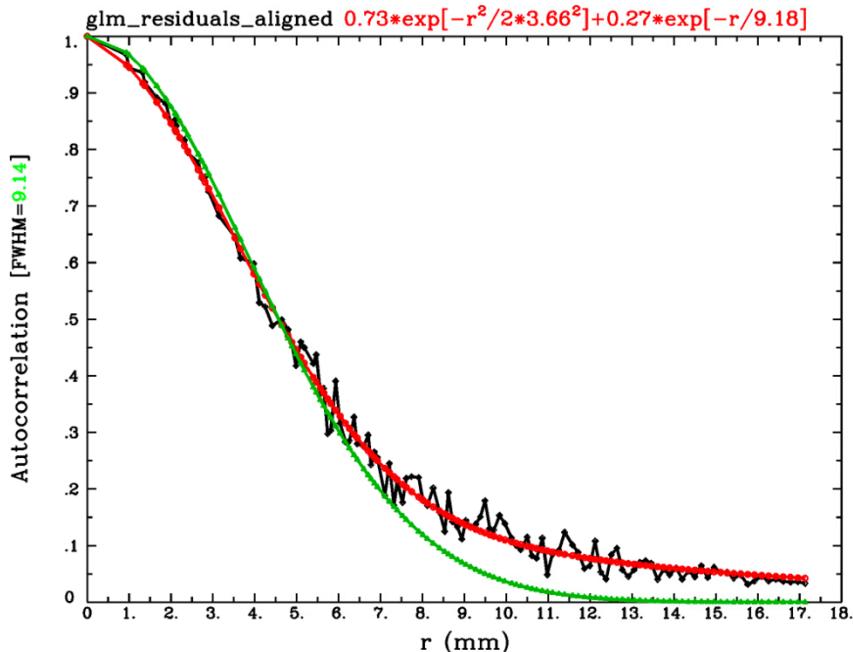


7.

a)

```
3dAllineate -base sub-09_T1w_stripped+orig \
-input errts.FT_run1+orig \
-1Dmatrix_apply func2mri_warp.1D \
-prefix glm_residuals_aligned.nii.gz
```

```
3dFWHMx -input glm_residuals_aligned.nii.gz -mask sub-09_T1w_GM_mask+orig -acf -out
acf_params2.1D
```

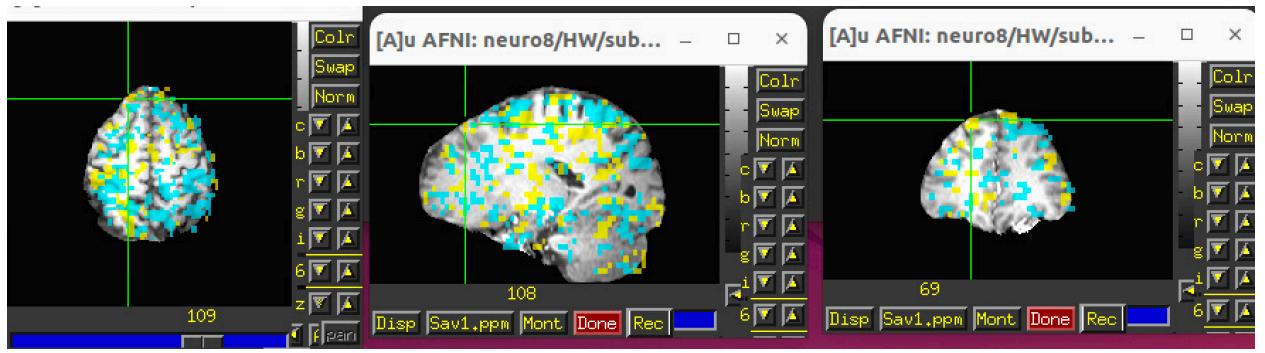
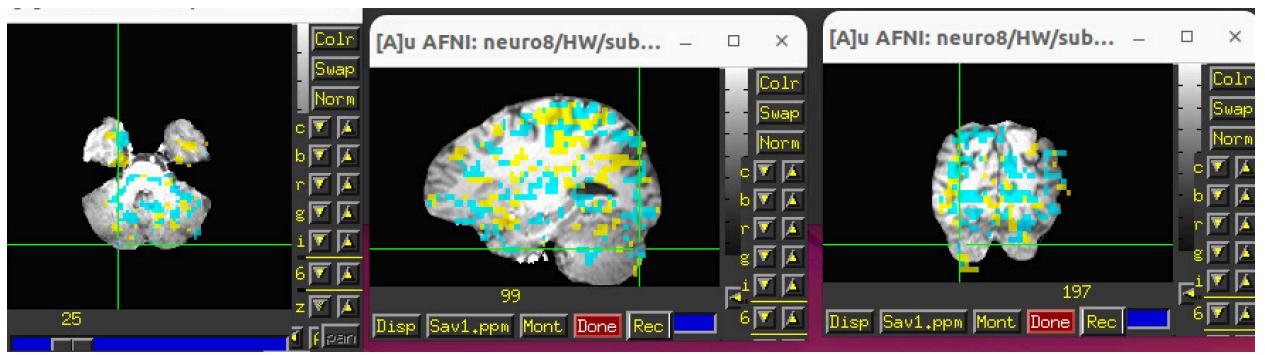
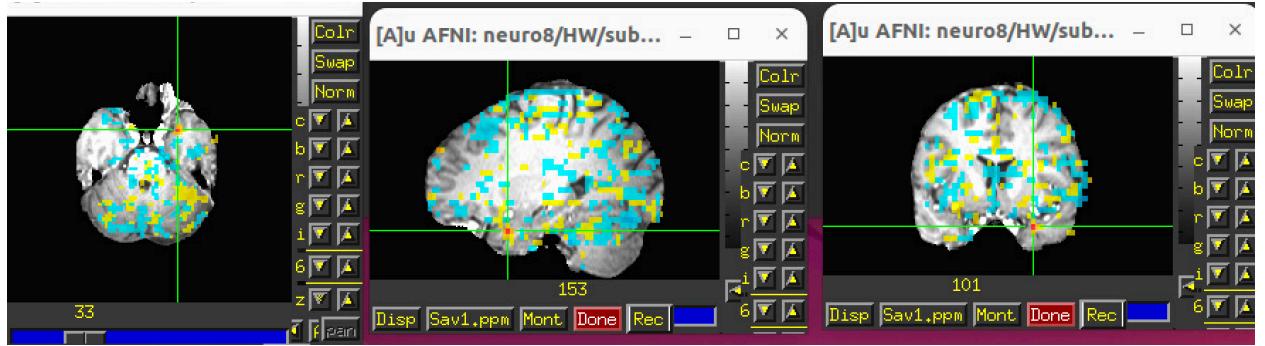


```
3dClustSim -mask sub-09_T1w_GM_mask+orig -acf $(cat acf_) -prefix clustsim_results
```

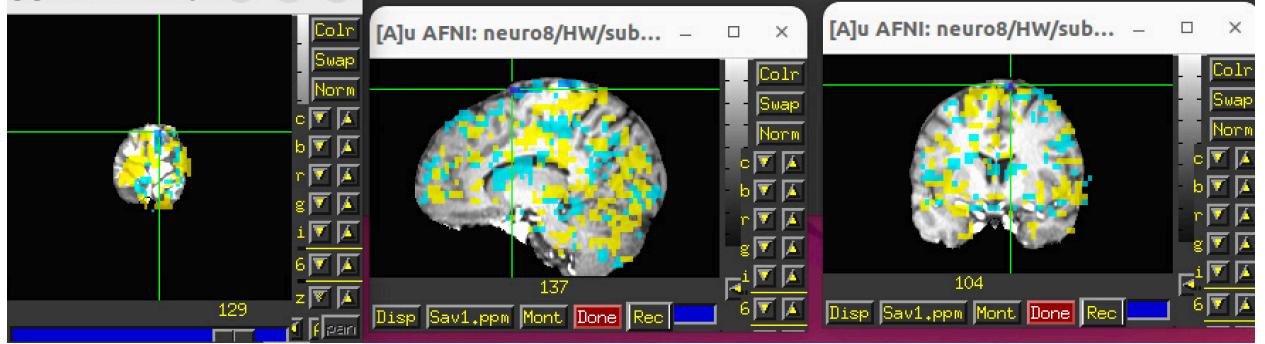
```
1 # 3dClustSim -mask sub-09_T1w_GM_mask+orig -acf 0.704438 3.69686 8.32211 -prefix clustsim_results
2 # 1-sided thresholding
3 # Grid: 256x256x150 0.94x0.94x1.00 mm^3 (684250 voxels in mask)
4 #
5 # CLUSTER SIZE THRESHOLD(pthr,alpha) in Voxels
6 # -NN 1 | alpha = Prob(Cluster >= given size)
7 # ptthr | .10000 .05000 .02000 .01000
8 # ----- | -----
9 0.050000 3539.0 4321.5 5386.0 6188.0
.0 0.020000 1359.5 1634.3 2022.0 2347.0
.1 0.010000 791.0 953.5 1157.0 1331.0
.2 0.005000 508.4 610.8 753.3 855.0
.3 0.002000 301.5 364.7 459.3 529.0
.4 0.001000 210.3 257.2 325.5 379.5
.5 0.000500 149.1 185.7 237.0 288.8
.6 0.000200 96.1 120.8 157.2 196.8
.7 0.000100 68.6 88.6 119.0 144.8
```

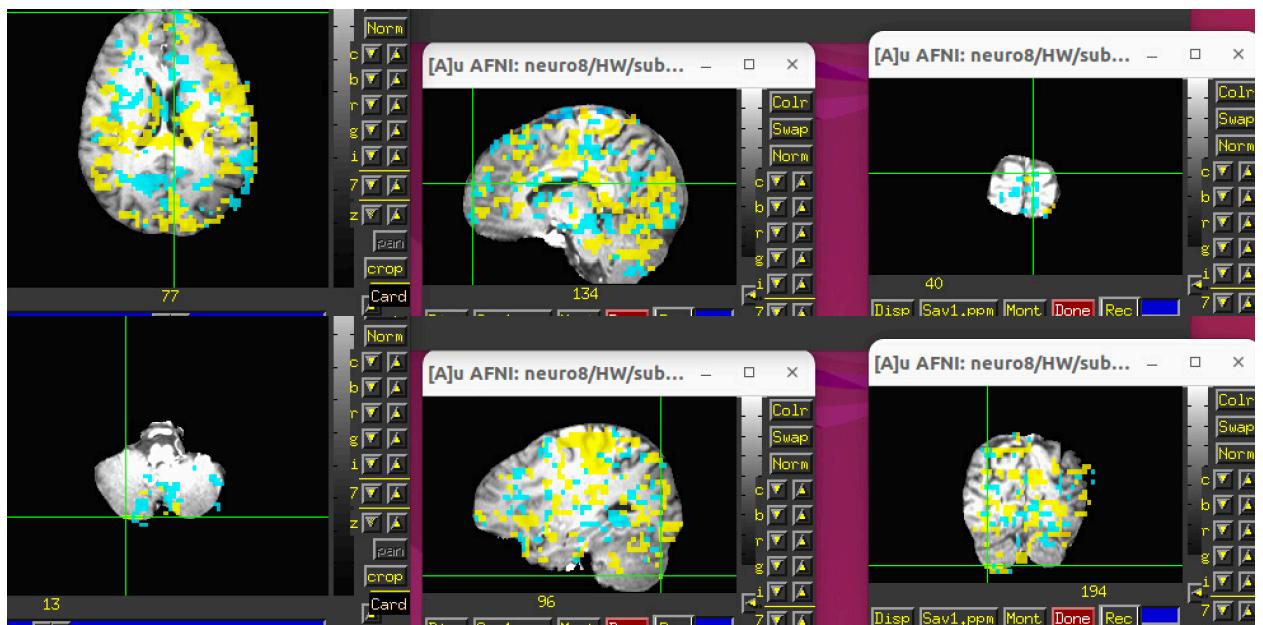
b)

Standard:

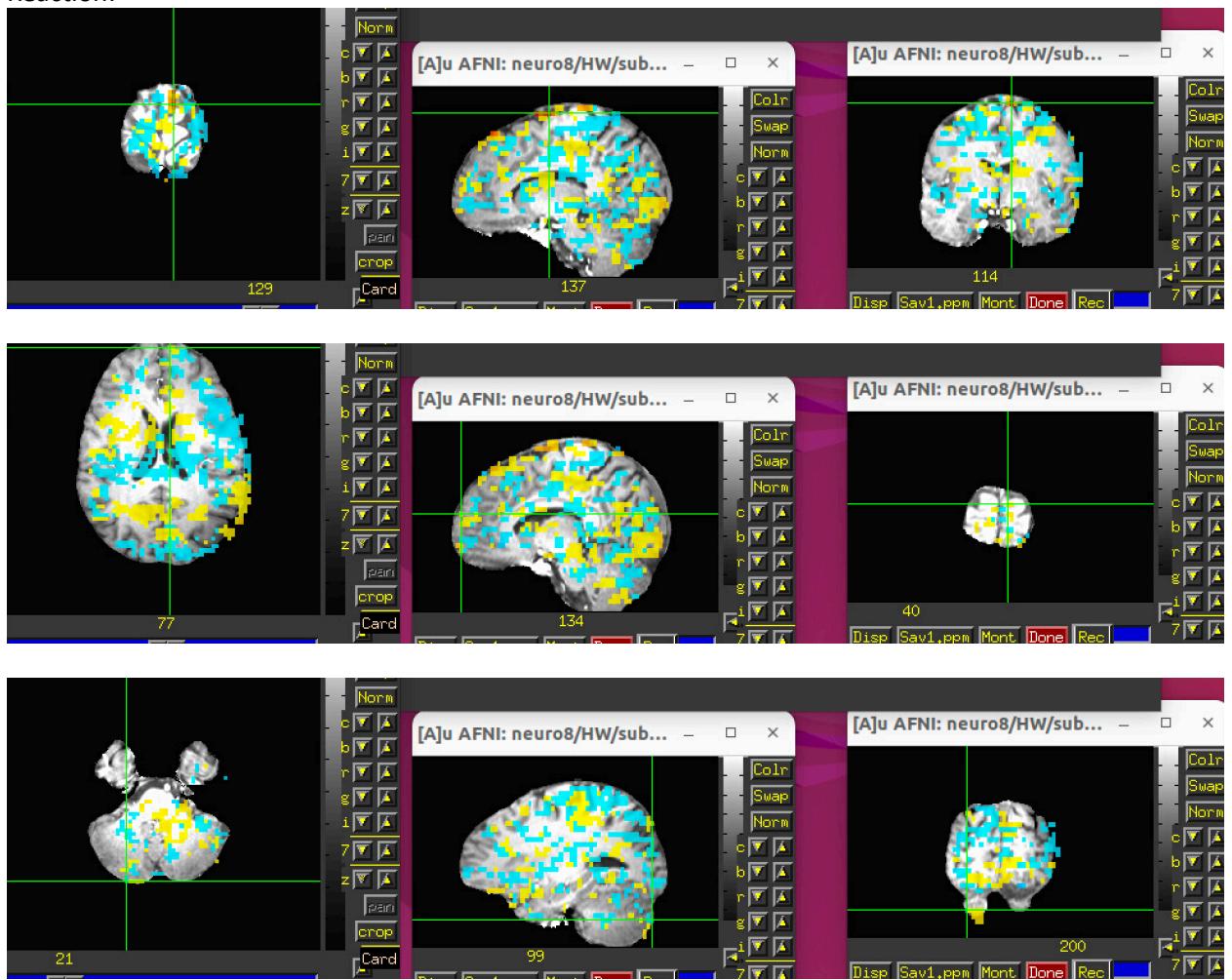


OddBall:





Reaction:



Standard Vs. OddBall:

