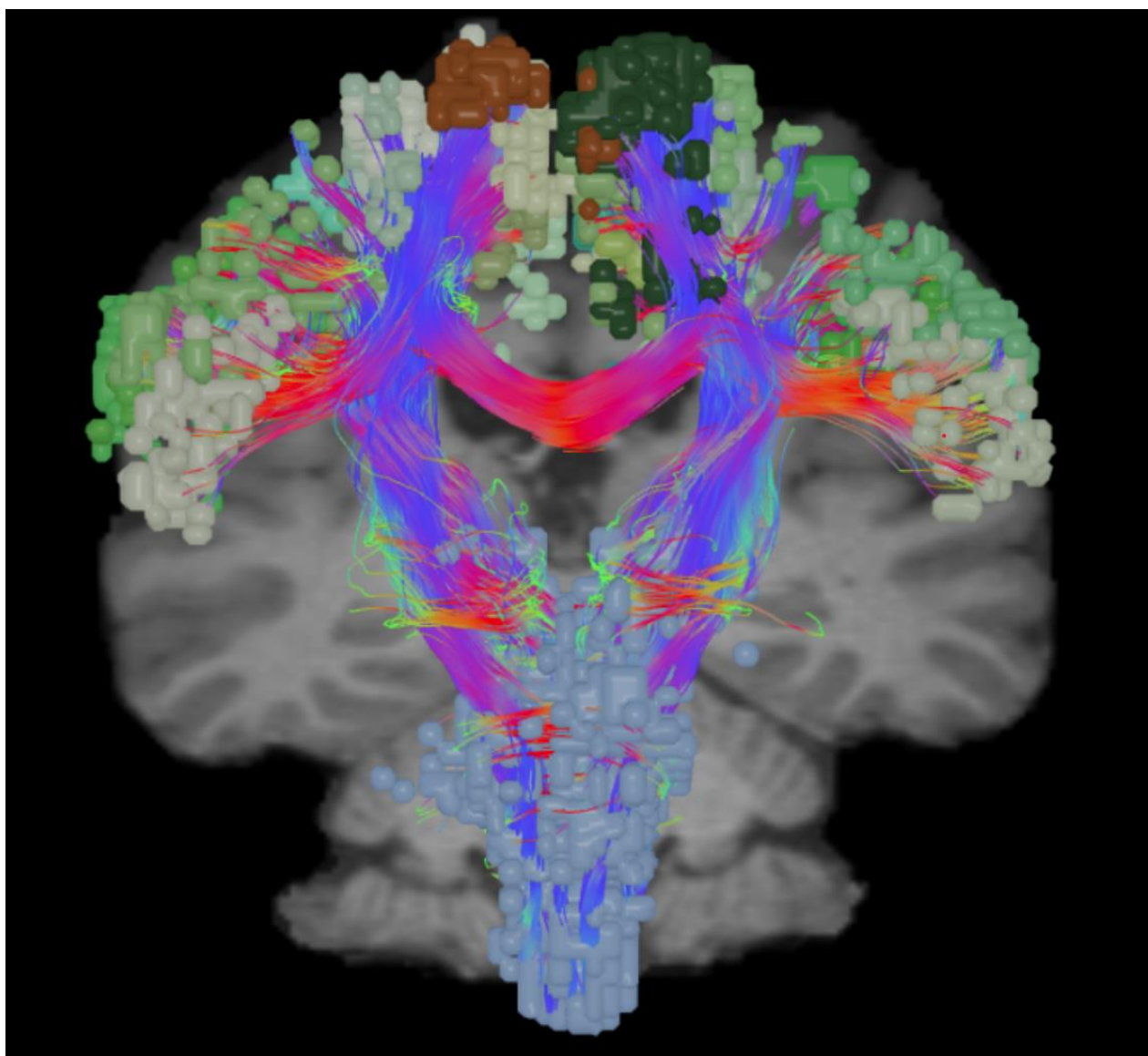


# Trajectories informed by connectomics



OMNISCIENT NEUROTECHNOLOGY WORKSHOP  
PART 1: INFORMING NEUROSURGICAL TRAJECTORIES  
WITH CONNECTOMICS

# Regions

**Pg 3**



Medial frontal

**Pg 10**



Lateral frontal

**Pg 18**



Temporal lobe

**Pg 26**



Insula

**Pg 29**



Medial parietal

**Pg 36**



Anterior occipital

**Pg 44**



Occipital lobe

**Pg 51**



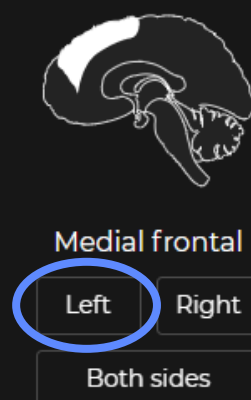
Lateral parietal

## CASE 1

# Medial Frontal Trajectories

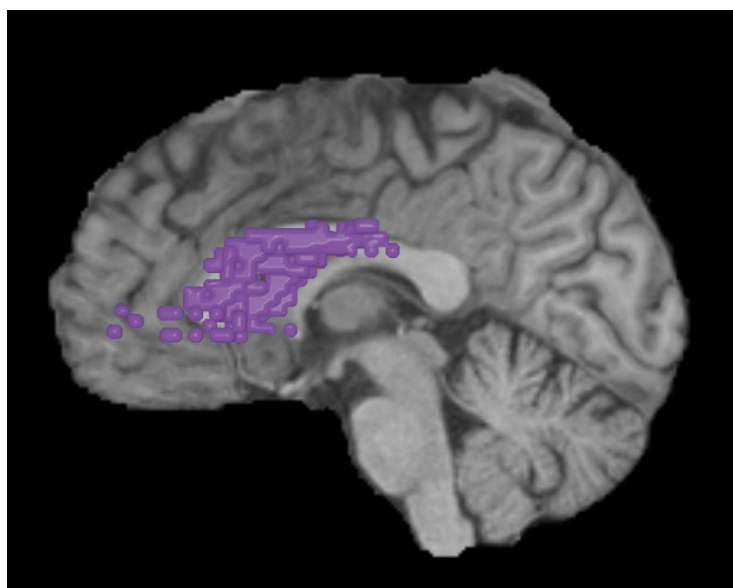
### Launching the case

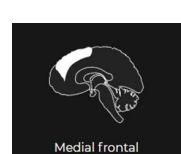
1. Find the case by searching and launching **"DEMO"**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Medial Frontal** and click **LEFT**



### Potential Targets

- Deep white matter of anterior frontal lobe
- Frontal horn of ventricle
- Caudate head

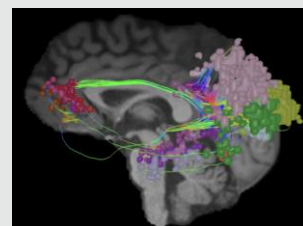




## Functional regions of concern

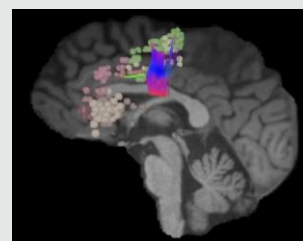
### Default mode network (DMN)

A critical network involved with cognitive and emotional regulation. Active during rest and sleep. Coordinates with other networks for passive sensory processing. Dysfunctions associated with neuropsychiatric disorders and may contribute to difficulty in processing social situations and information.



### Salience network (SN)

Involved in cognitive, emotional and motivational function. Monitors the external world and decides how other brain networks react to new information and stimuli in particular activating and deactivating the CEN and DMN.

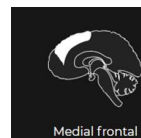


### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

### Frontal aslant tract (FAT)

Connects salience network to itself and thus links SMA to Broca's area.



## Where not to enter

### Area 8Av

Anxiosomatic  
region

### Area 55b

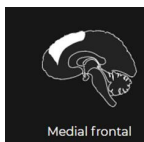
Motor cortex  
for larynx

### Area 8c

Hub of CEN

### Area 46

Depression center



## Examine functional areas via object tabs

Default mode network

Salience network

Corticospinal

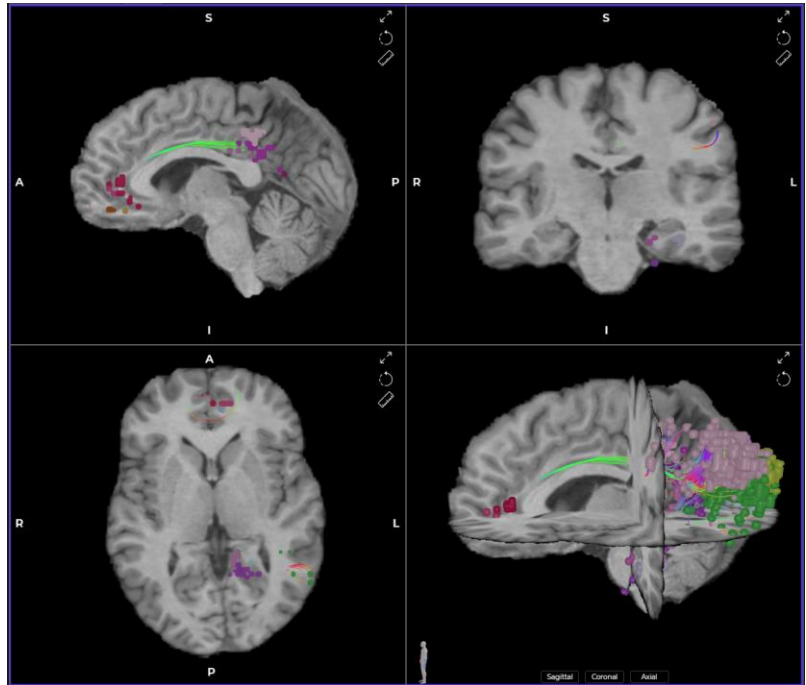
Central executive network

Frontal aslant tract

### Default mode network

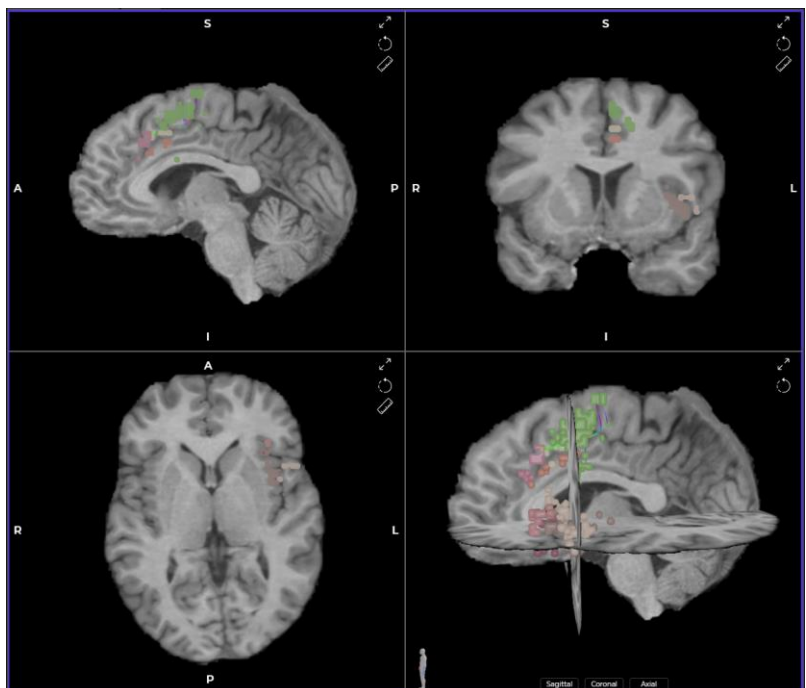
A critical network involved with cognitive and emotional regulation. Active during rest and sleep. Coordinates with other networks for passive sensory processing.

Dysfunctions associated with neuropsychiatric disorders and may contribute to difficulty in processing social situations and information.

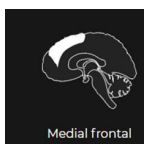


### Salience network

Involved in cognitive, emotional and motivational function. Monitors the external world and decides how other brain networks react to new information and stimuli in particular activating and deactivating the CEN and DMN.







## Examine functional areas via object tabs

Default mode network

Salience network

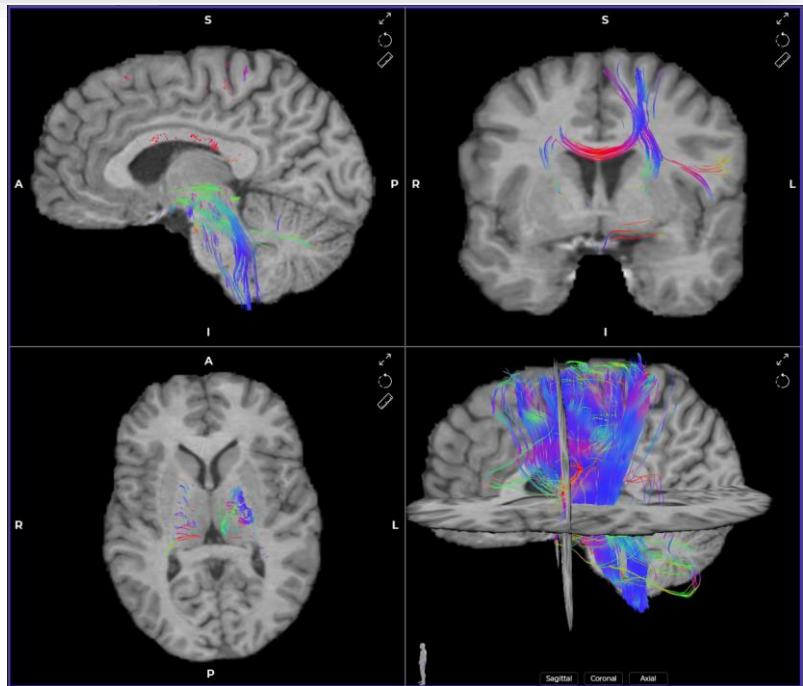
Corticospinal

Central executive network

Frontal aslant tract

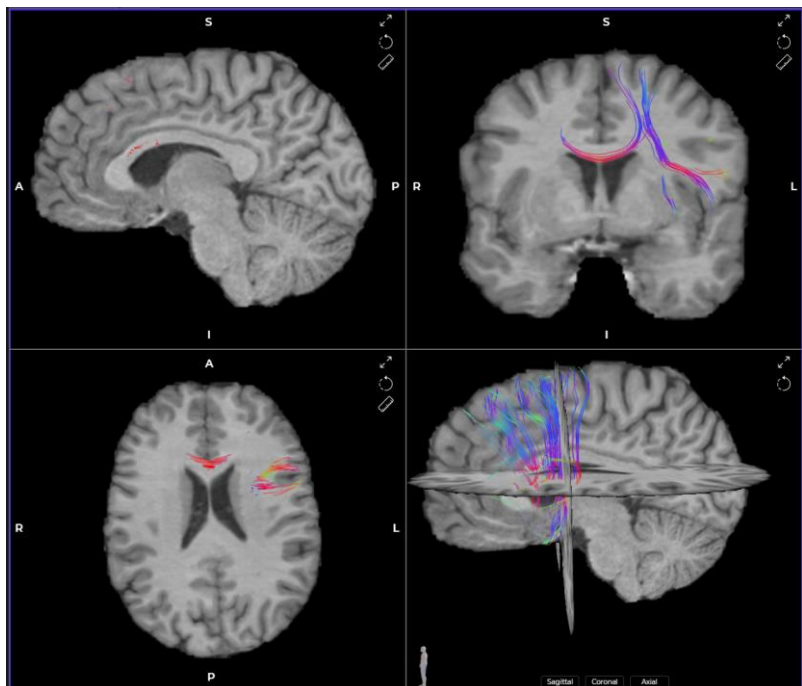
### Corticospinal tract

Connects sensorimotor cortex to spinal cord.



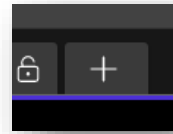
### Frontal aslant tract

Connects salience network to itself and thus links SMA to Broca's area.

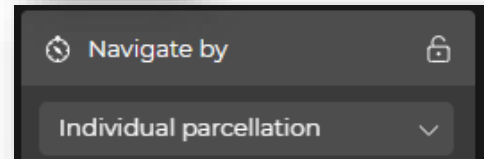


## Examine additional parcellations in a custom object tab

**Step 1** – Click the **+** symbol to create a new custom object

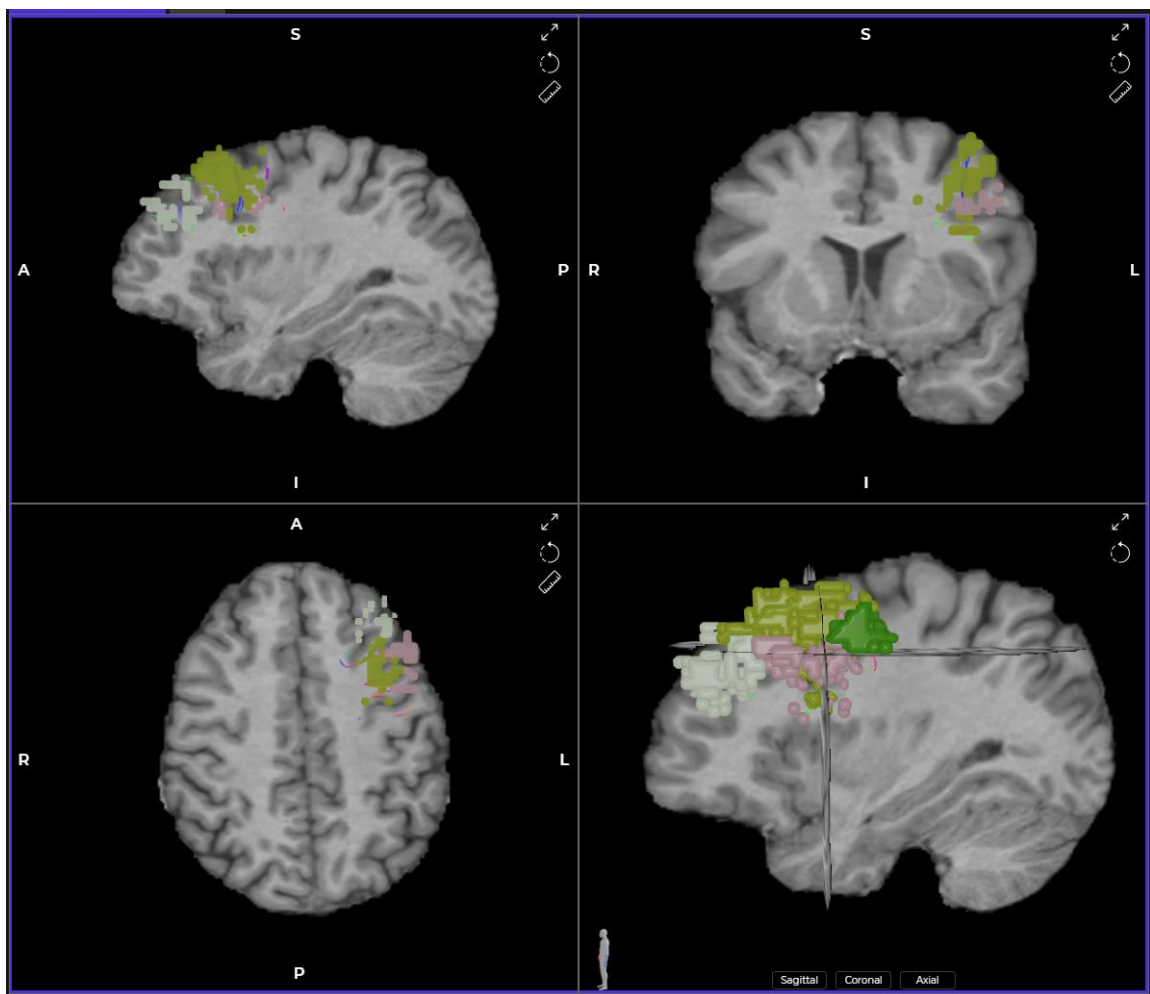


**Step 2** – In the dropdown menu on the left, select **Individual parcellation**

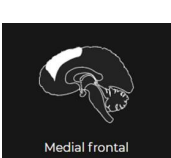


**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **46, 55b, 8Av, 8c**







## Examine objects together

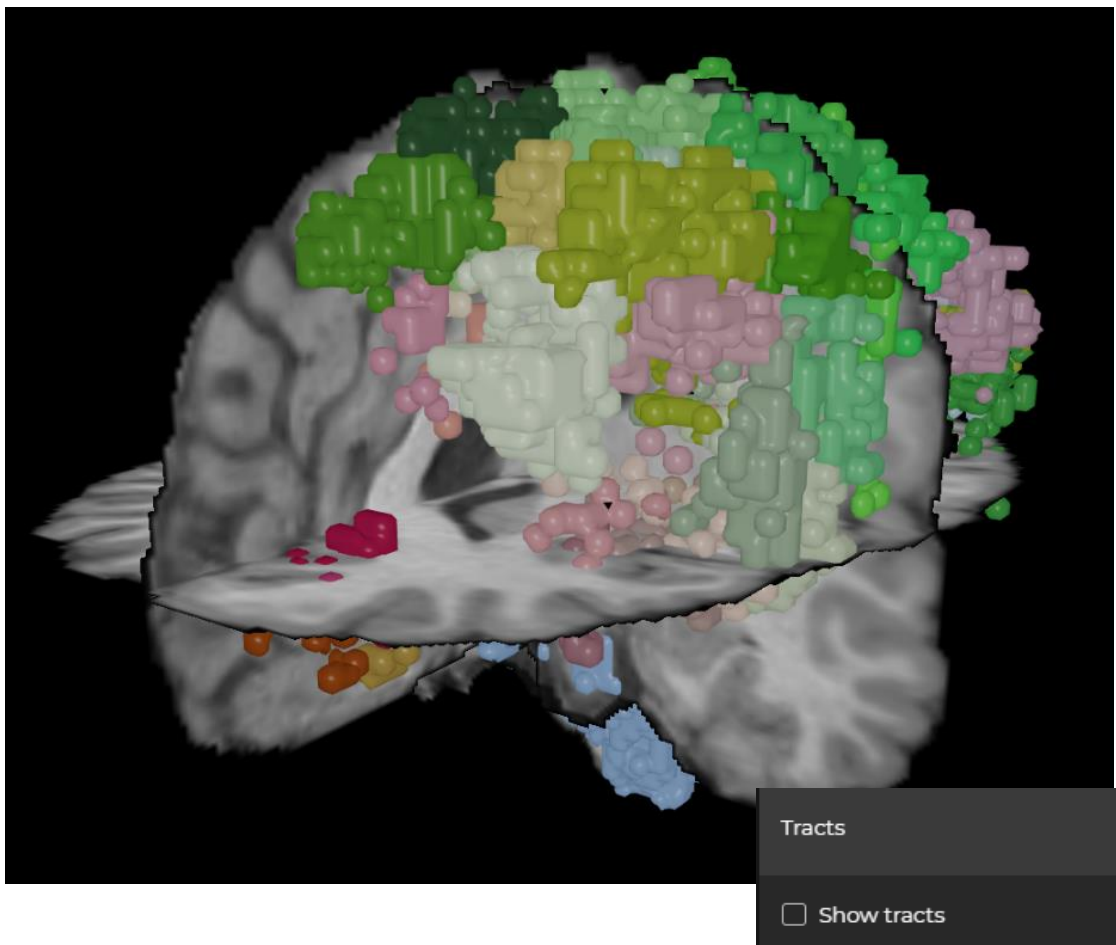
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Select **Default mode network (L)** and **Salience network (L)**

**Step 3** – Now, navigate by **Tractography bundle**

**Step 4** – Select **Frontal aslant tract (L)** and **Corticospinal tract (L)**

**Step 5** – (Optional) Toggle tracts on and off while examining

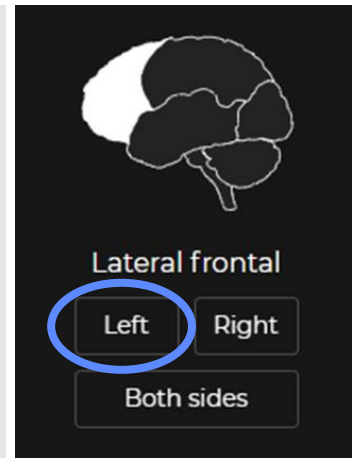


## CASE 2

# Lateral Frontal Trajectories

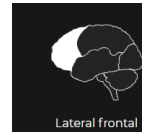
### Launching the case

1. Find the case by searching and launching **“DEMO”**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Lateral Frontal** and click **LEFT**



### Potential Targets

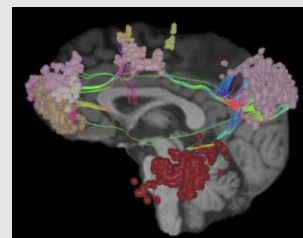
- Deep white matter of lateral anterior frontal lobe



## Functional regions of concern

### Central executive network (CEN)

Active during tasks and decision making. CEN deficits such as abnormal connectivity patterns have been reported in major psychiatric and neurological disorders e.g. depression, schizophrenia, autism.

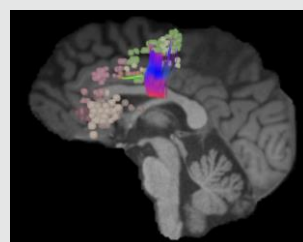


### Frontal aslant tract (FAT)

Connects salience network to itself and thus links SMA to Broca's area.

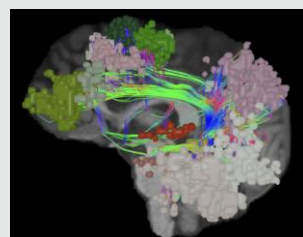
### Salience network (SN)

Involved in cognitive, emotional and motivational function. Monitors the external world and decides how other brain networks react to new information and stimuli in particular activating and deactivating the CEN and DMN.



### Language system

Often referred to as an "eloquent region" of the brain due to its critical role in and independent function. Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways

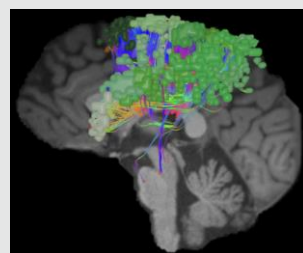


### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

### Sensorimotor network

Responsible for sensing physical inputs, converting them to electrical signals to initiate a physical response. Abnormalities can cause sensory and movement disorders, degenerative diseases, developmental delays and mental health disorders







## Additional cortical parcellations of concern

**Area 8c**  
Hub of CEN

**Area 44**  
Broca's area

**Area 45**  
Also Broca's area

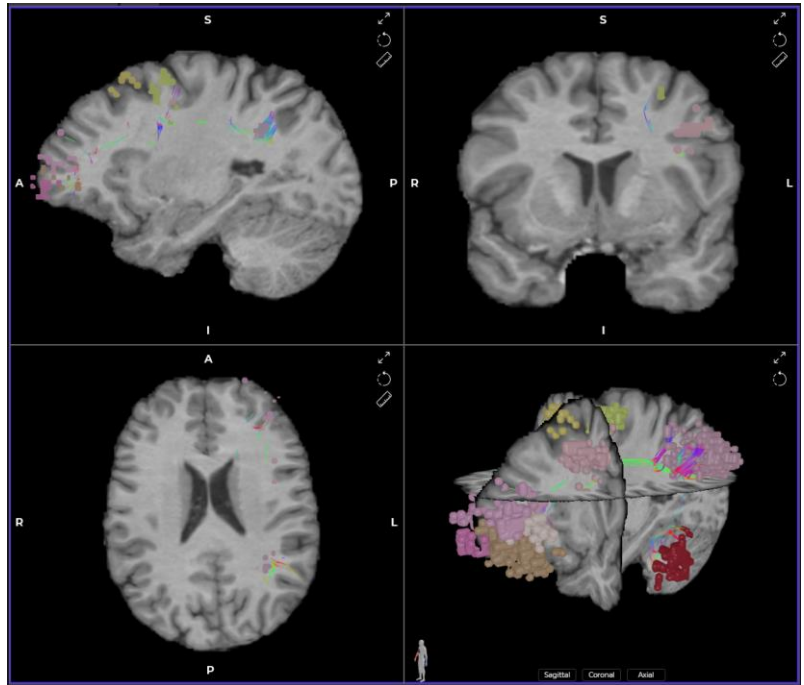
## Examine functional areas via object tabs

Central executive network Frontal aslant tract Salience network Language system Corticospinal Sensorimotor network 

### Central executive network

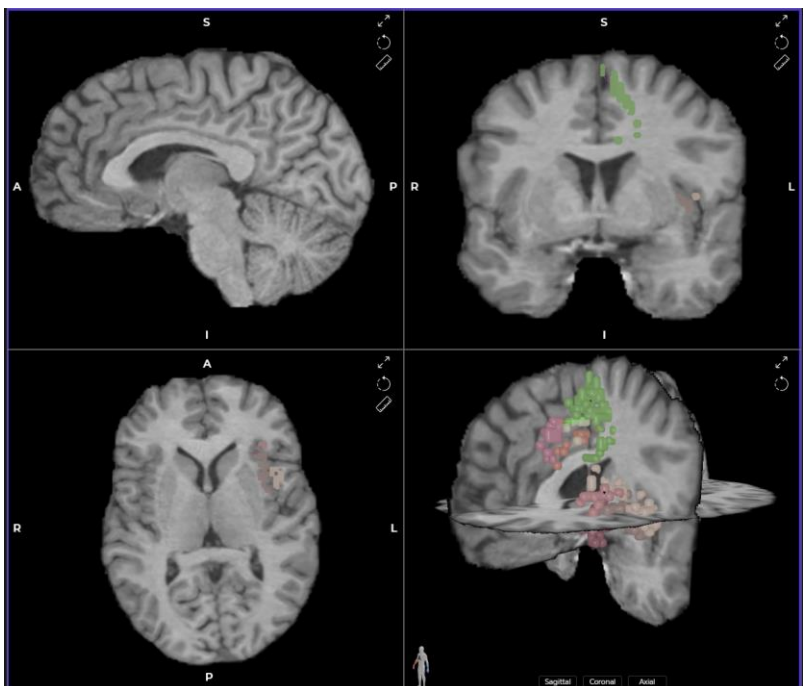
Active during tasks and decision making. CEN deficits such as abnormal connectivity patterns have been reported in major psychiatric and neurological disorders e.g. depression, schizophrenia, autism.

#### Main concern






### Salience network

Involved in cognitive, emotional and motivational function. Monitors the external world and decides how other brain networks react to new information and stimuli in particular activating and deactivating the CEN and DMN.



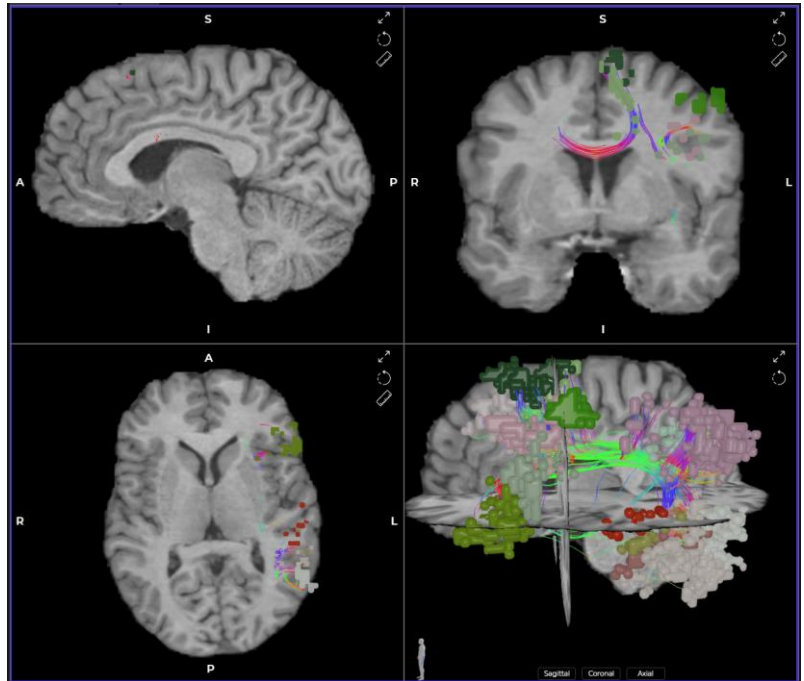
## Examine functional areas via object tabs

Central executive network Frontal aslant tract Salience network Language system Corticospinal Sensorimotor network 

### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

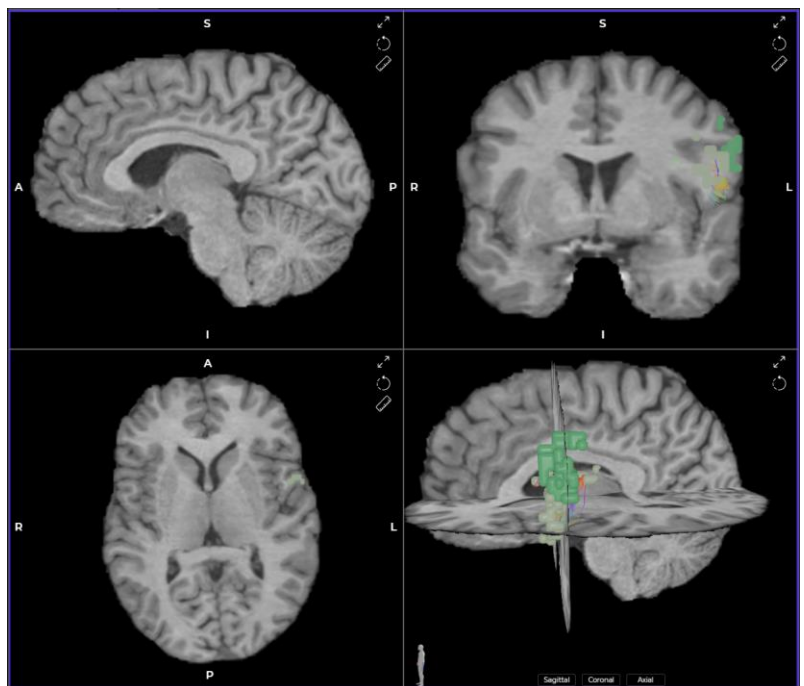
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Sensorimotor system



Responsible for sensing physical inputs, converting them to electrical signals to initiate a physical response.

Abnormalities can cause sensory and movement disorders, degenerative diseases, developmental delays and mental health disorders



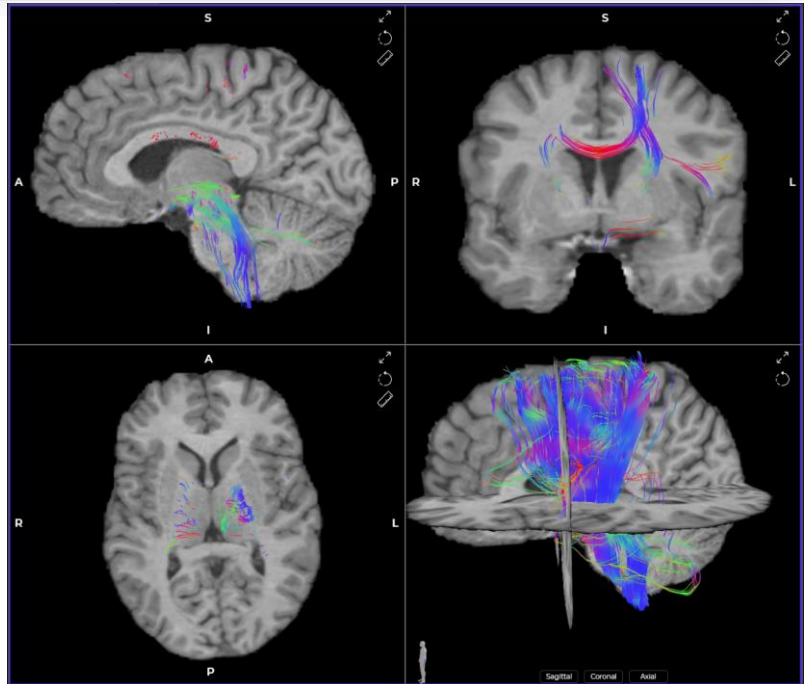


## Examine functional areas via object tabs

Default mode network Salience network Corticospinal Central executive network Frontal aslant tract 

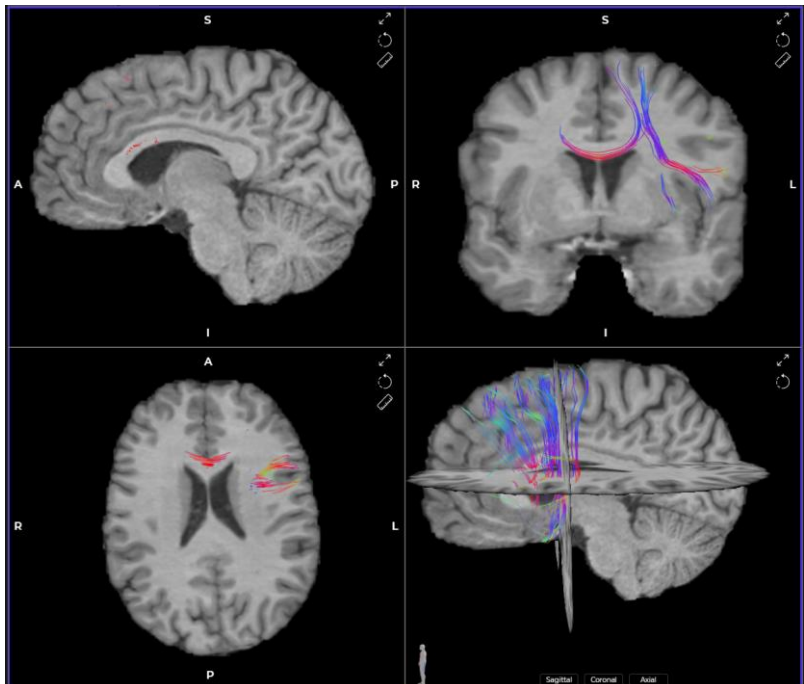
### Corticospinal tract

Connects sensorimotor cortex to spinal cord.



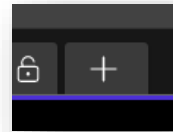
### Frontal aslant tract

Connects salience network to itself and thus links SMA to Broca's area.

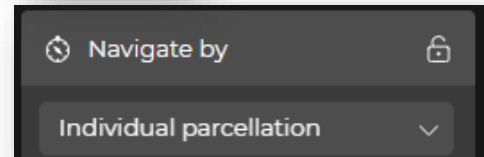


## Examine additional parcellations in a custom object tab

**Step 1** – Click the **+** symbol to create a new custom object

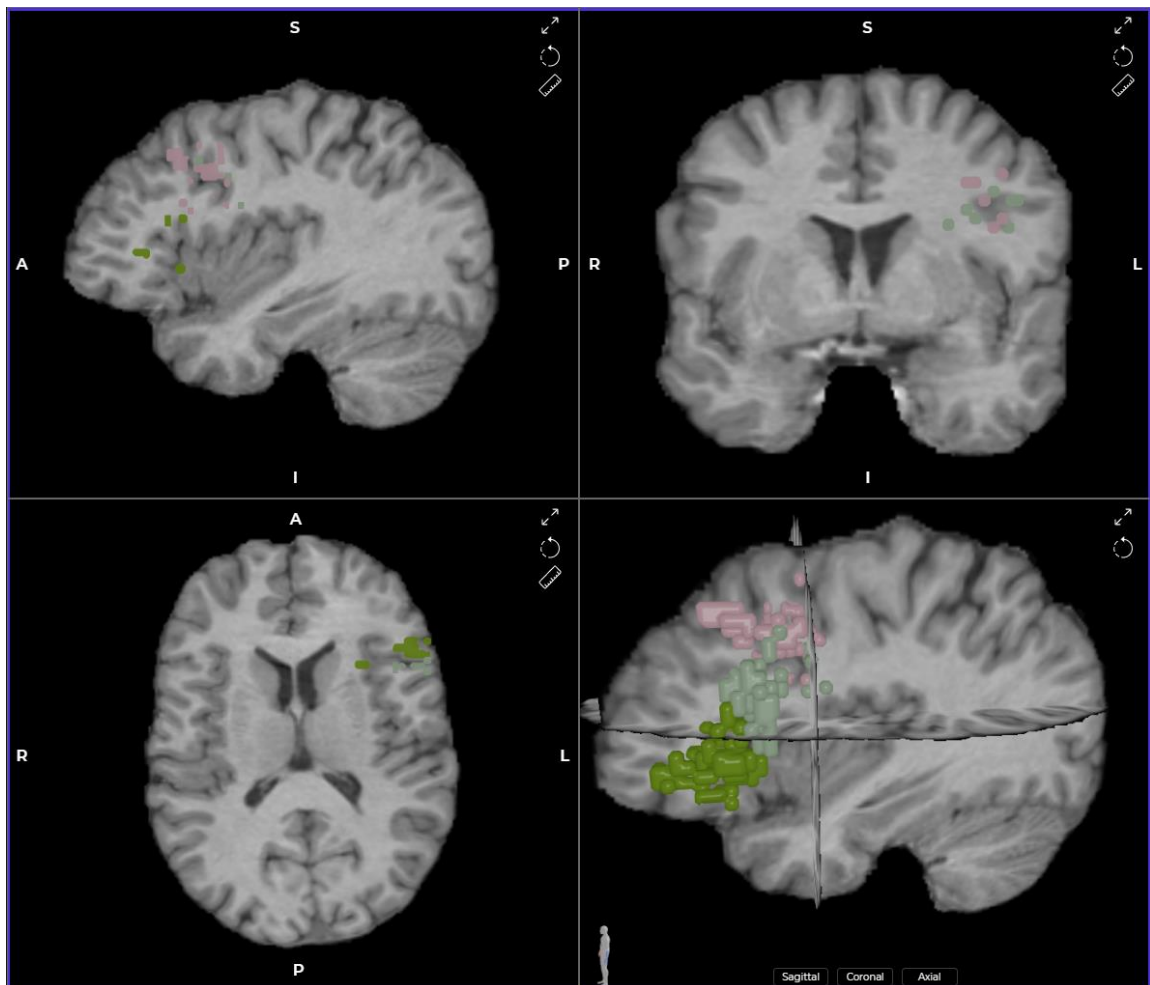


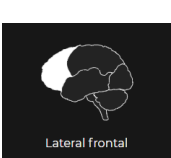
**Step 2** – In the dropdown menu on the left, select **Individual parcellation**



**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **44, 45, 8c**





## Examine objects together

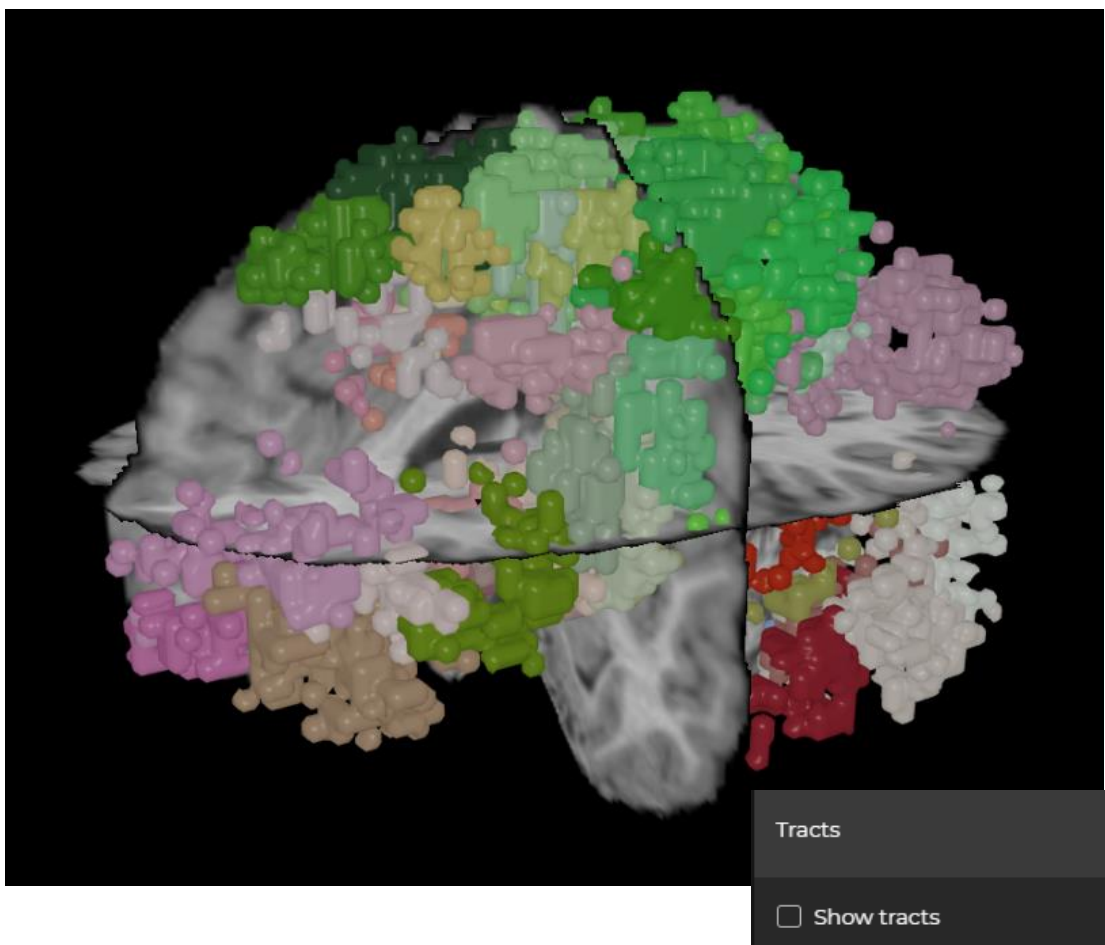
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Toggle on/off **Central executive network, Salience network, Language system, Sensorimotor system**

**Step 3** – Now, navigate by **Tractography bundle**

**Step 4** – Toggle on/off **Frontal aslant tract** and **Corticospinal tract**

**Step 5** – (Optional) Toggle tracts on and off while examining

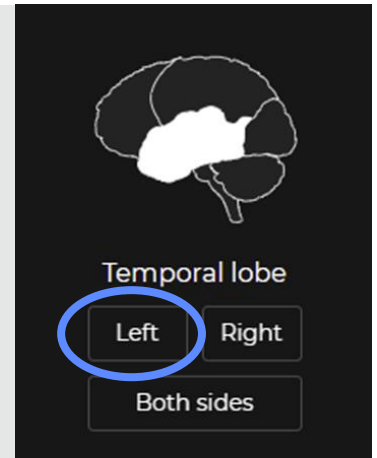


## CASE 3

# Temporal Lobe Trajectories

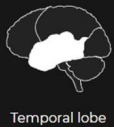
### Launching the case

1. Find the case by searching and launching **“DEMO”**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Temporal Lobe** and click **LEFT**



### Potential Targets

- Hippocampus
- Amygdala
- Temporal horn



## Functional regions of concern

### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

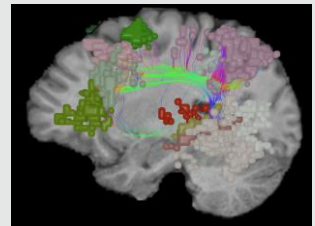
### Inf. fronto-occipital fasciculus (IFOF)

Associated with semantic language processing and goal-oriented behavior.

### Language system

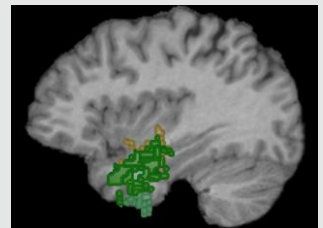
Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Accessory Language

The left temporal pole is increasingly recognized to play a key role in verbal memory, and surgical resection of the anterior temporal lobe on the left, which includes this network of middle temporal gyrus regions, can cause memory decline.



### Inf. Longitudinal fasciculus (ILF)

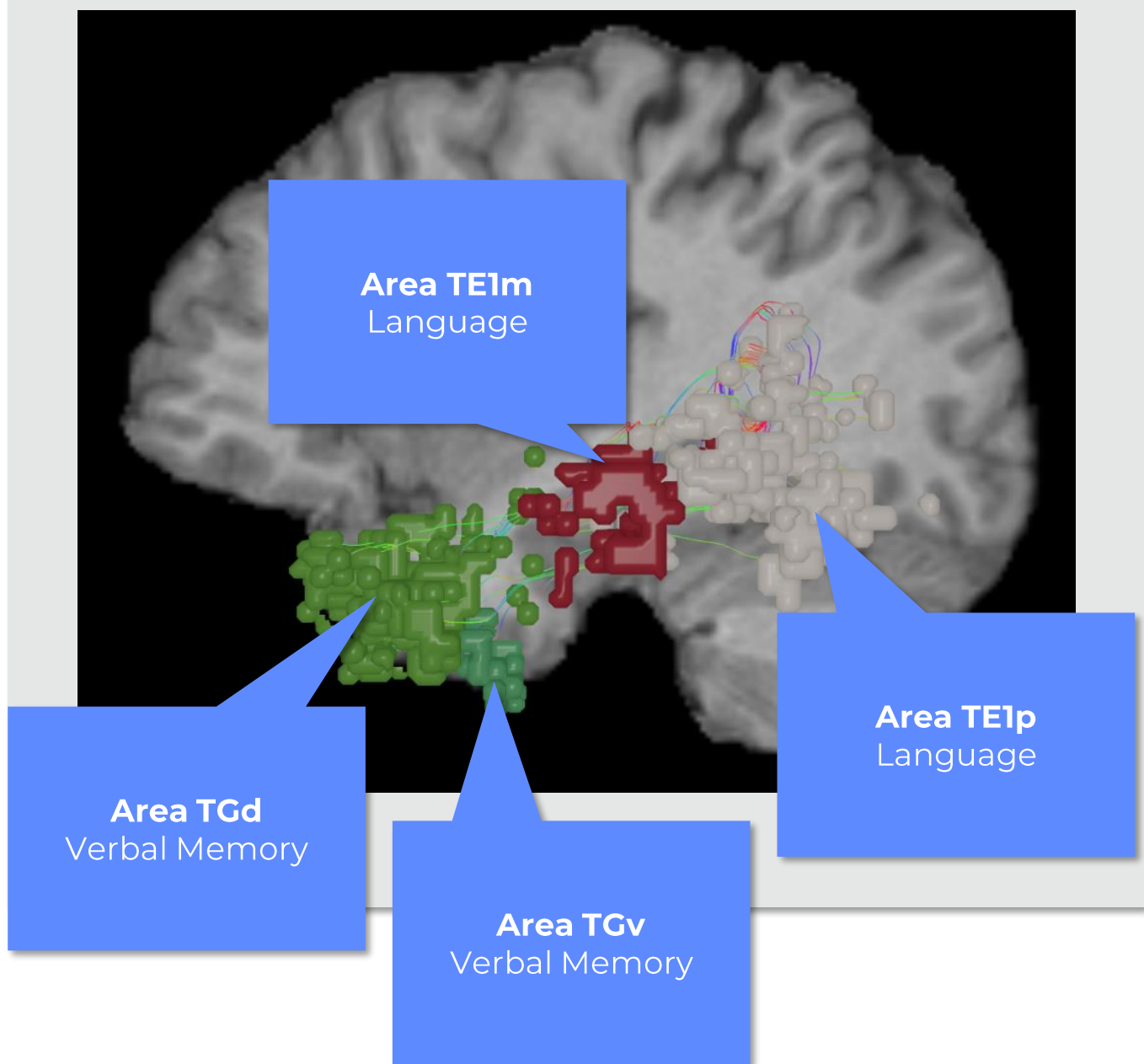
One of the major occipitotemporal association tracts associated with visual to memory transfer

### Optic radiations

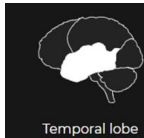
Connects lateral geniculate nucleus with primary visual cortex.







## Additional cortical parcellations of concern







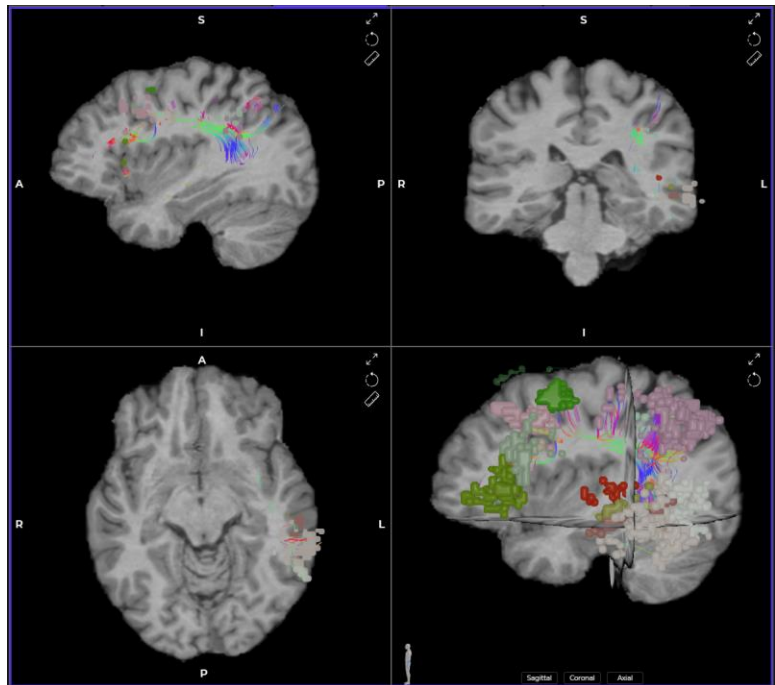
## Examine functional areas via object tabs

Corticospinal Inf. fronto-occipital fasciculus Language system Inf. longitudinal fasciculus Optic radiations 

### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

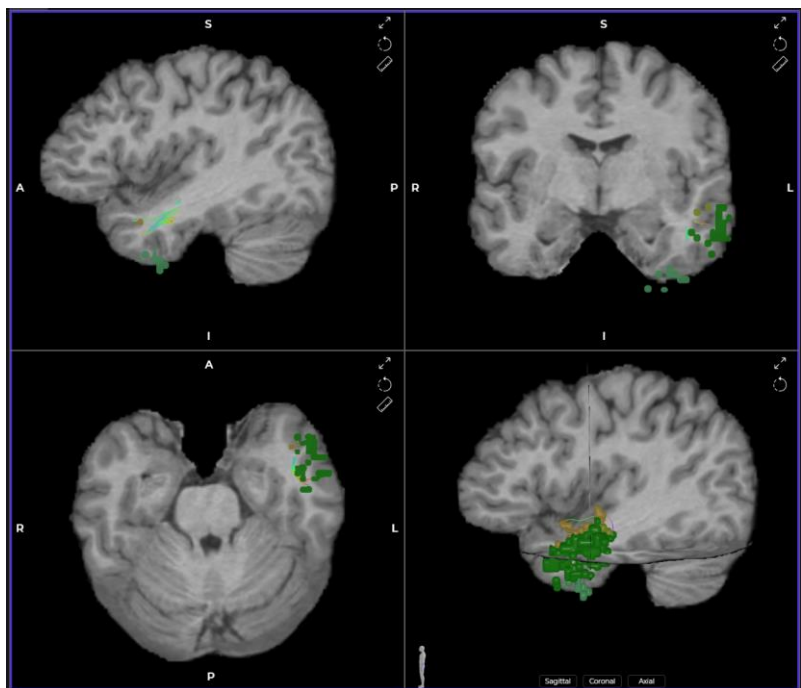
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways

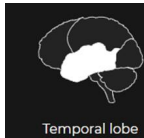


### Accessory language network





Create a custom object then add **Accessory Language** from **Network templates**.

The left temporal pole is increasingly recognized to play a key role in verbal memory, and surgical resection of the anterior temporal lobe on the left, which includes this network of middle temporal gyrus regions, can cause memory decline.





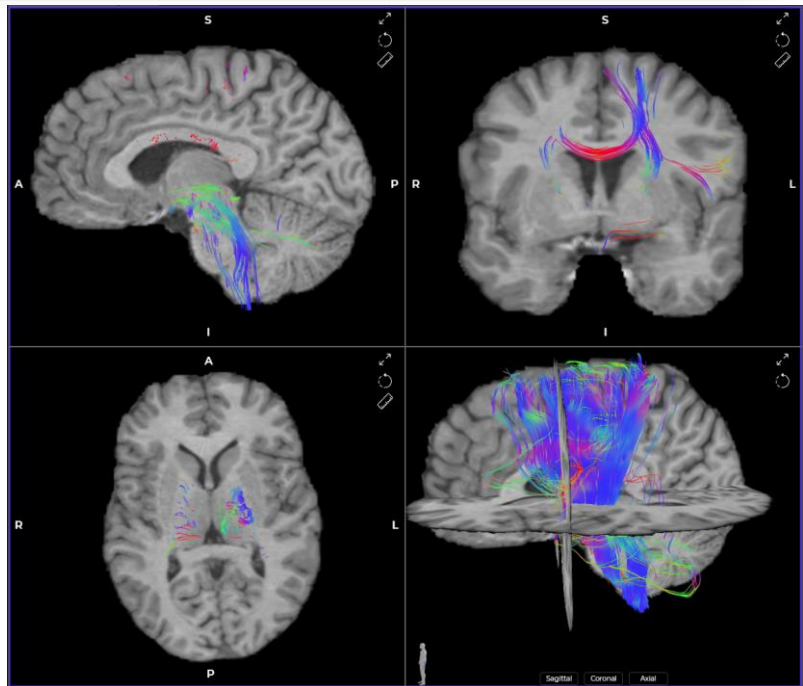
## Examine functional areas via object tabs

Corticospinal Inf. fronto-occipital fasciculus Language system Inf. longitudinal fasciculus Optic radiations 

+

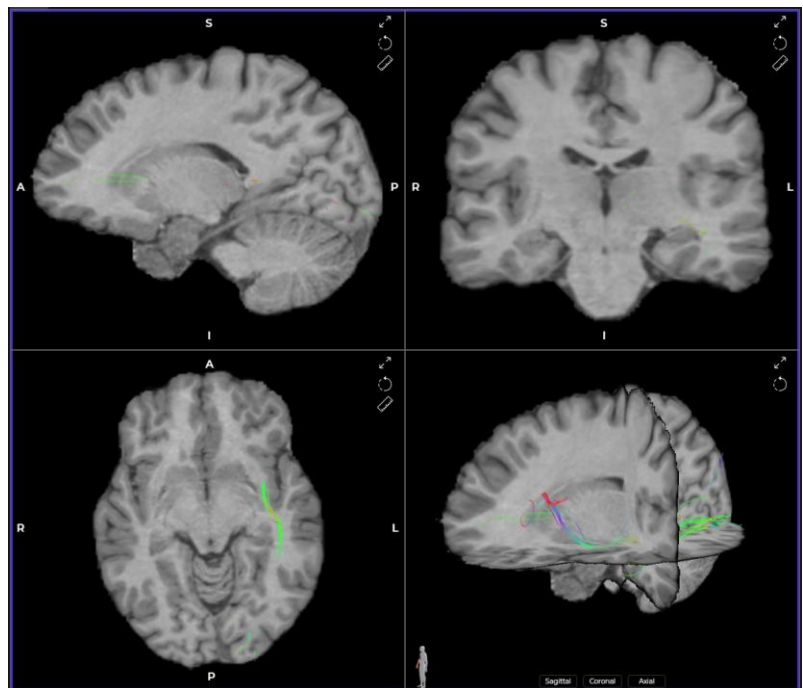
### Corticospinal tract

Connects sensorimotor cortex to spinal cord.








### Inf. fronto-occipital fasciculus (IFOF)

Associated with semantic language processing and goal-oriented behavior.





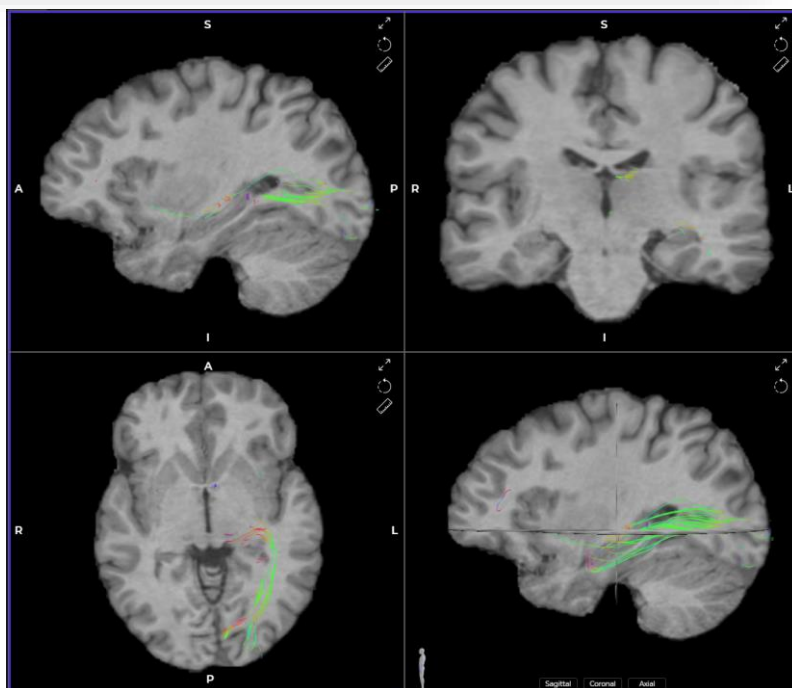
## Examine functional areas via object tabs

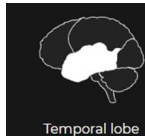
Corticospinal Inf. fronto-occipital fasciculus Language system Inf. longitudinal fasciculus Optic radiations 

+

### Optic radiations

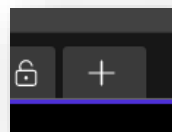
Connects lateral geniculate nucleus with primary visual cortex.



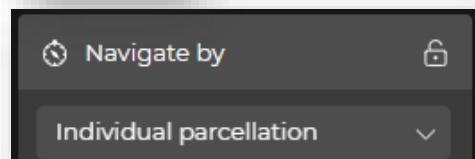


## Examine additional parcellations in a custom object tab

**Step 1** – Click the **+** symbol to create a new custom object

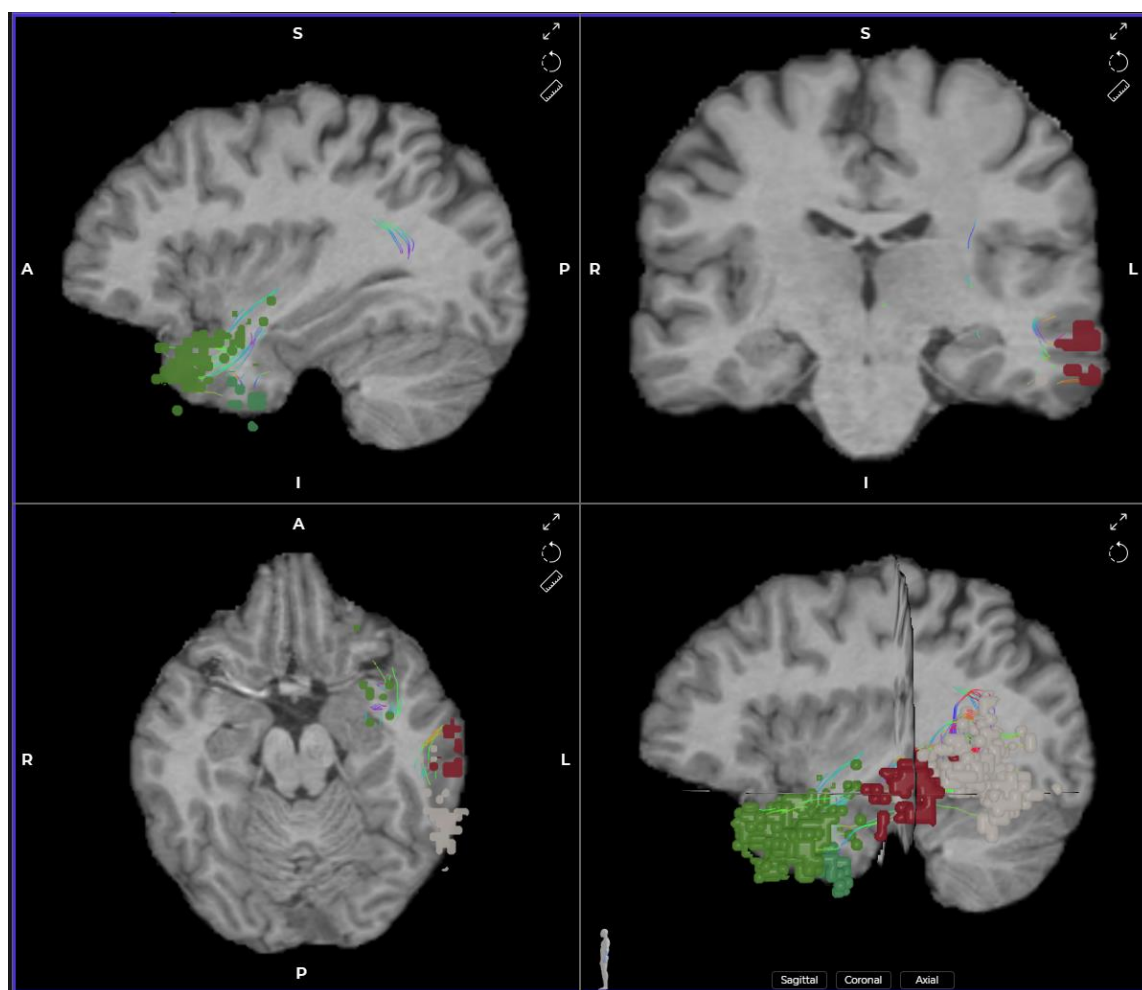


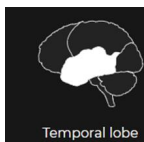
**Step 2** – In the dropdown menu on the left, select **Individual parcellation**



**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **TE1m, TE1p, TGd, TGv**





## Examine objects together

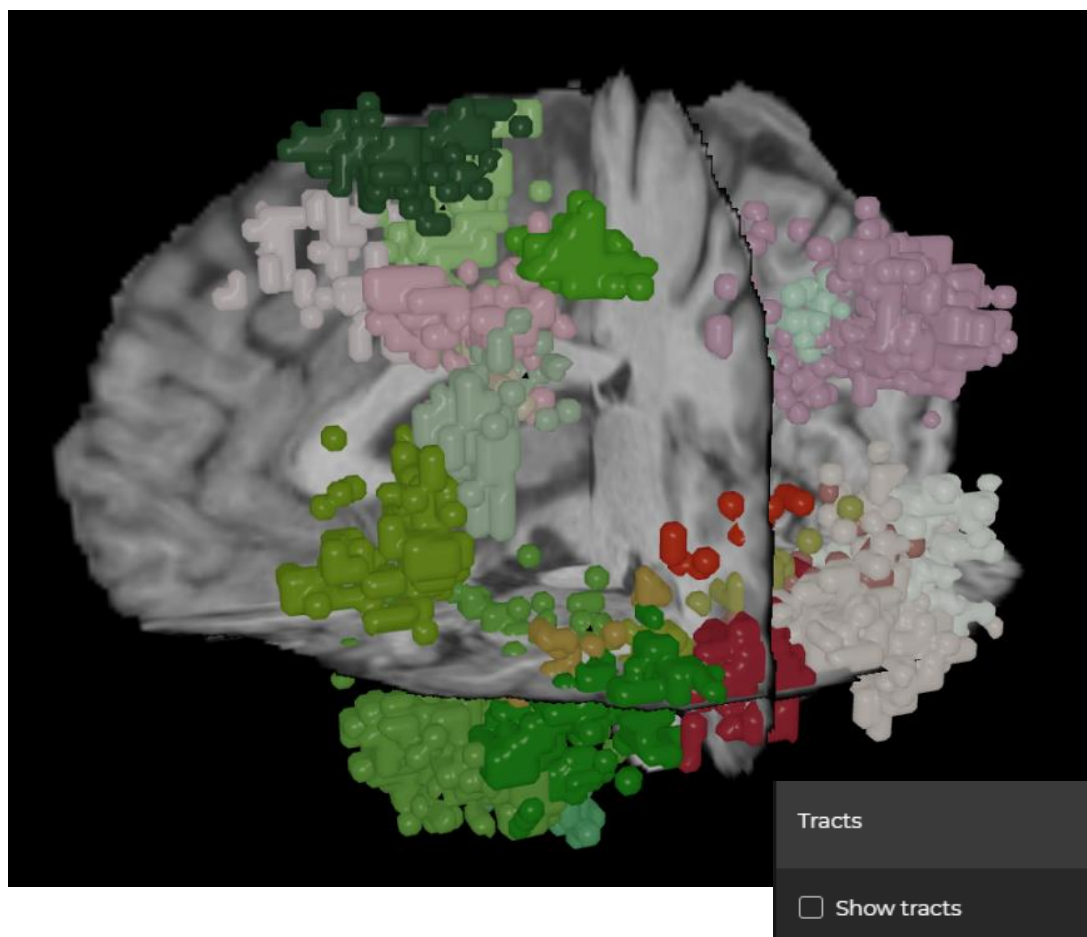
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Toggle on/off **Language system** and **Accessory language network**

**Step 3** – (Optional as tracts are deep) Now, navigate by **Tractography bundle**

**Step 4** – Select **IFOF**, **Optic radiations**, and **Corticospinal tract**

**Step 5** – (Optional) Toggle tracts on and off while examining

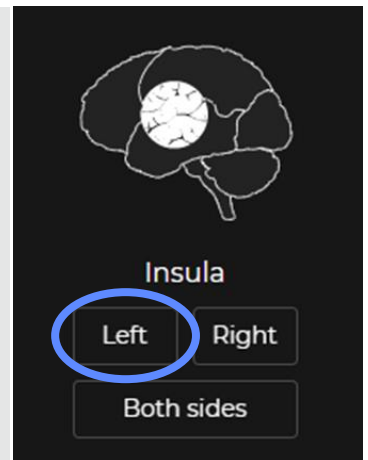


## CASE 4

# Insula Trajectories

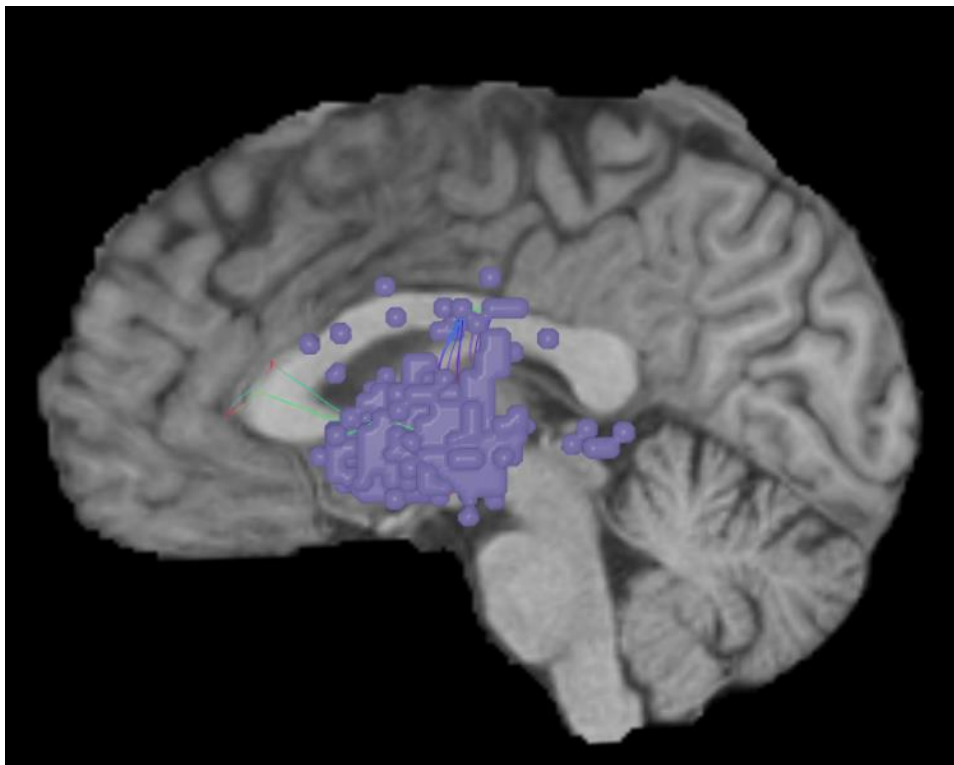
### Launching the case

1. Find the case by searching and launching **"DEMO"**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Insula** and click **LEFT**

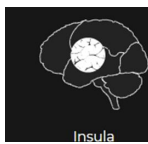


## Potential Targets

- Putamen







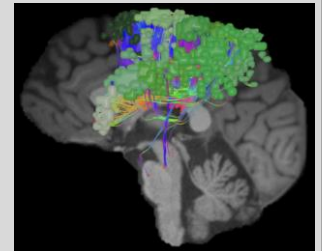
## Functional regions of concern

### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

### Sensorimotor system

Responsible for sensing physical inputs, converting them to electrical signals to initiate a physical response. Abnormalities can cause sensory and movement disorders, degenerative diseases, developmental delays and mental health disorders

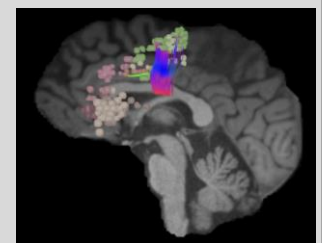


### Frontal aslant tract (FAT)

Connects salience network to itself and thus links SMA to Broca's area.

### Salience network

Involved in cognitive, emotional and motivational function. Monitors the external world and decides how other brain networks react to new information and stimuli in particular activating and deactivating the CEN and DMN.



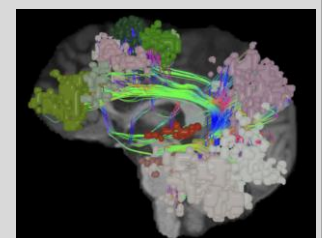
### IFOF

Associated with semantic language processing and goal-oriented behavior.

## Main concern

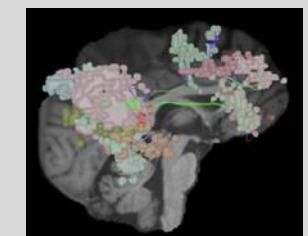
### Language system [Left]

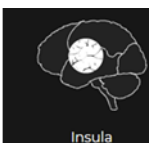
Often referred to as an “eloquent region” of the brain due to its critical role in and independent function. Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways




### Ventral attention network (VAN) [Right]

Involved with stimulus driven attention. Damage results in hemispatial neglect and other cognitive dysfunction





## Examine functional areas via object tabs

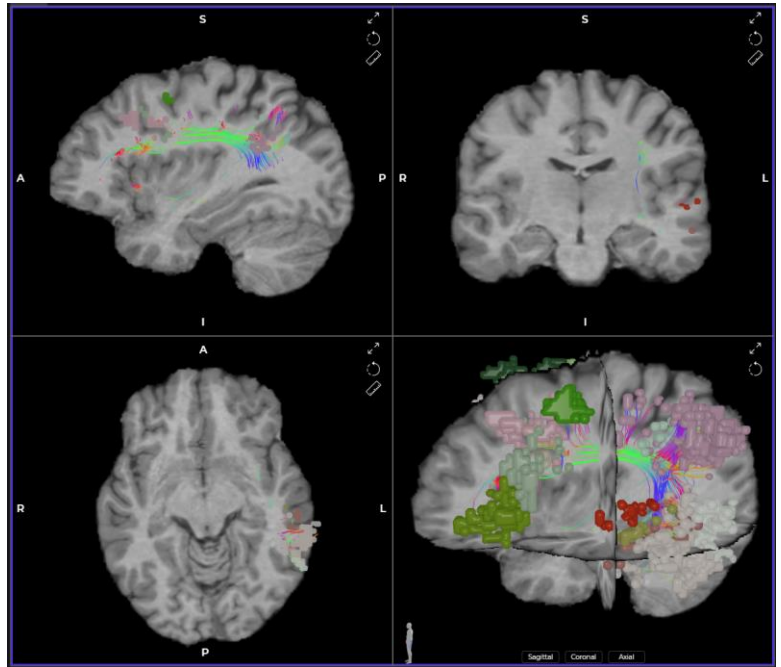
Corticospinal Inf. fronto-occipital fasciculus Language system Inf. longitudinal fasciculus Optic radiations 

+

### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

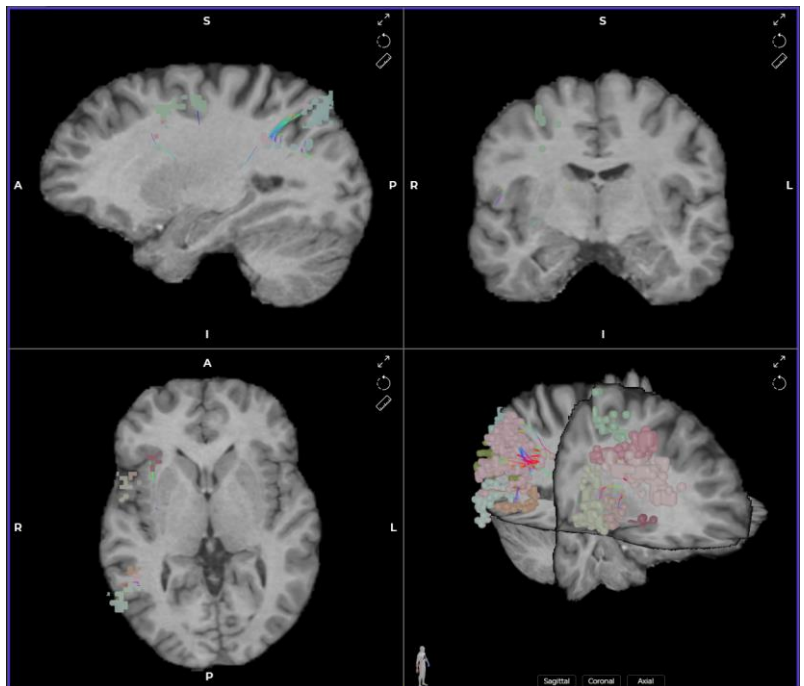
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Ventral attention network

Create a custom object then add **Ventral attention network** from **Network templates**.

Involved with stimulus driven attention. Damage results in hemispatial neglect and other cognitive dysfunction

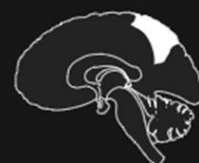


## CASE 5

# Medial Parietal Trajectories

### Launching the case

1. Find the case by searching and launching **“DEMO”**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Medial Parietal** and click **LEFT**



Medial parietal

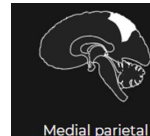
Left

Right

Both sides

### Potential Targets

- Atrium of lateral ventricle
- Posterior thalamus
- Fornix
- Splenium corpus callosum
- Medial temporal lobe



## Functional regions of concern

### Corticospinal tract

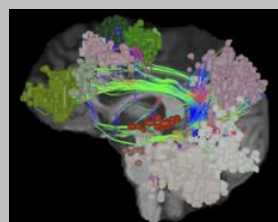
Connects sensorimotor cortex to spinal cord.

### Optic radiations

Connects lateral geniculate nucleus with primary visual cortex.

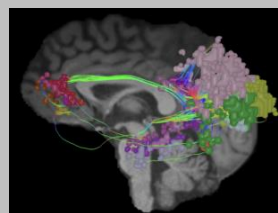
### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function. Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



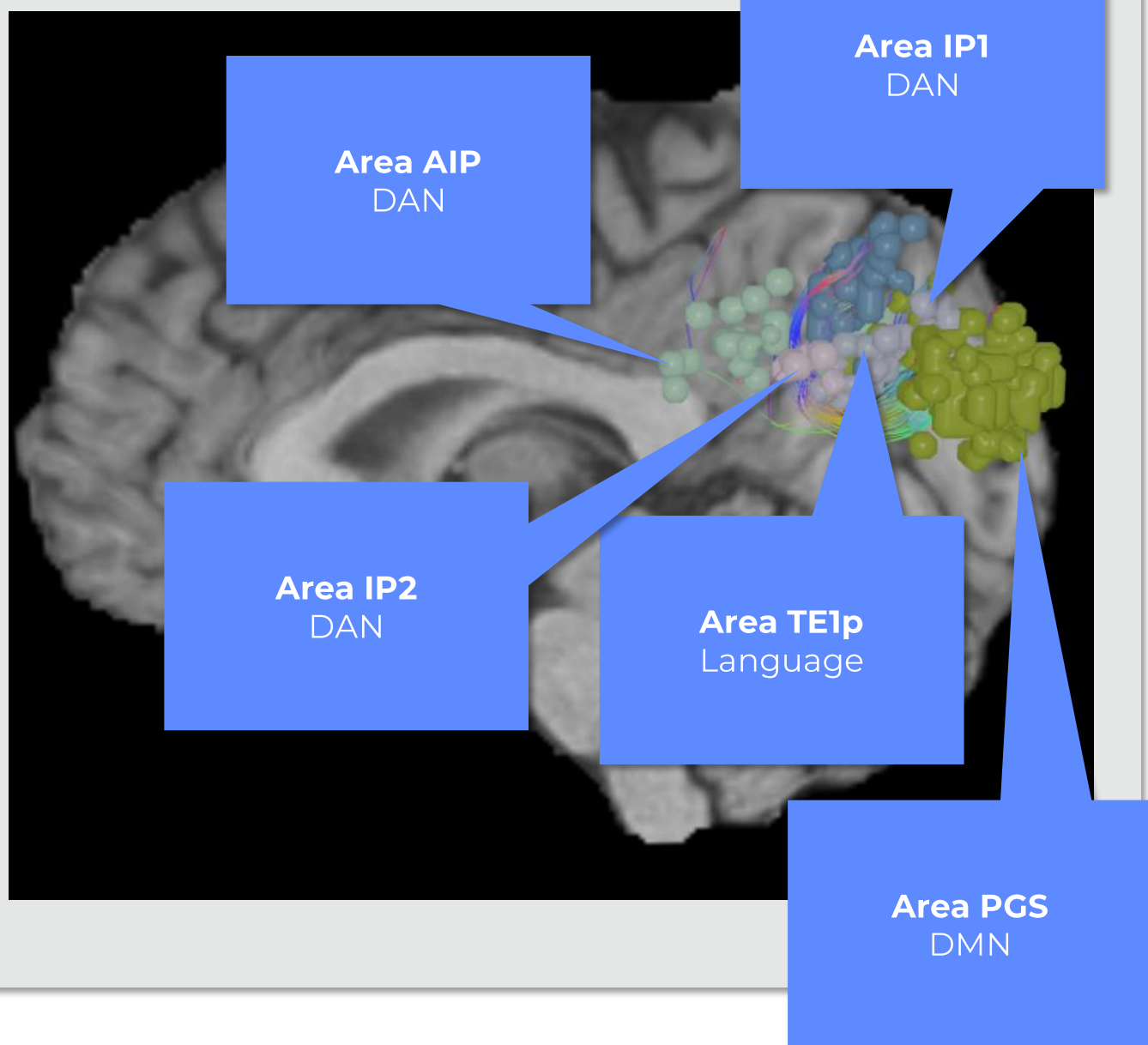
### Default mode network (DMN)

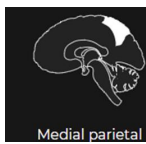
A critical network involved with cognitive and emotional regulation. Active during rest and sleep. Coordinates with other networks for passive sensory processing. Dysfunctions associated with neuropsychiatric disorders and may contribute to difficulty in processing social situations and information.



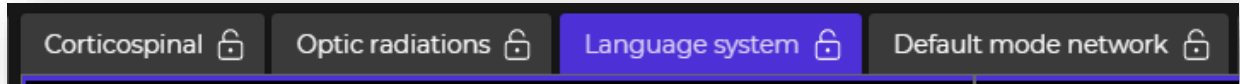


## Additional cortical parcellations of concern





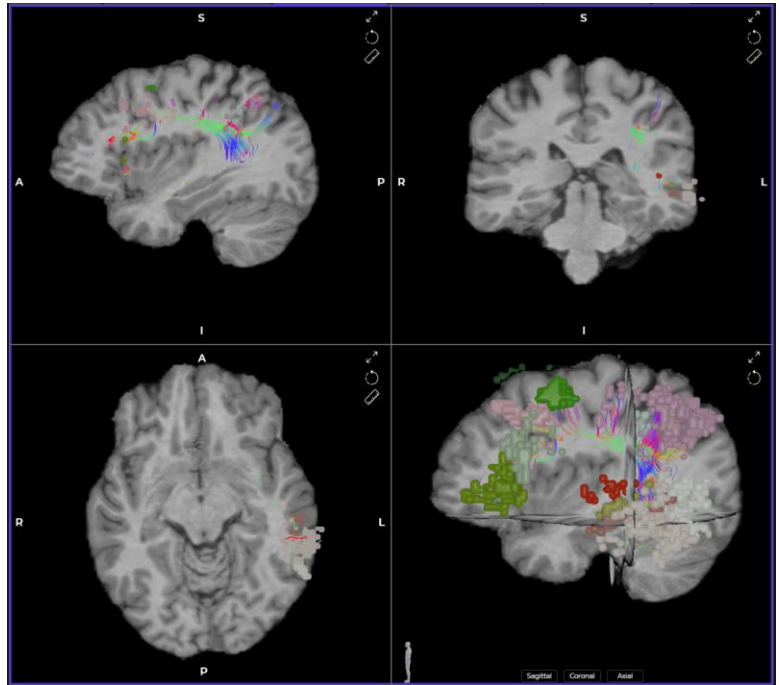
## Examine functional areas via object tabs



### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

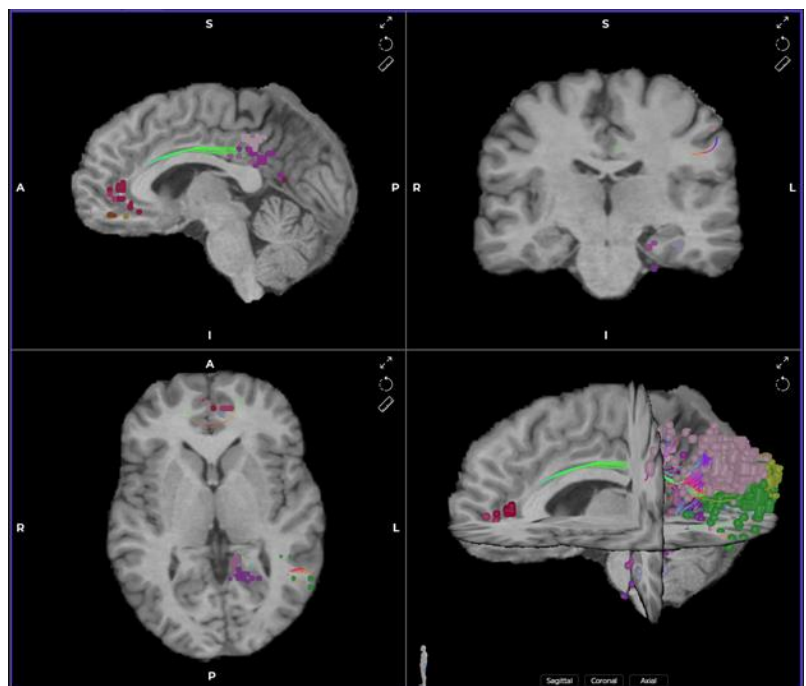
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



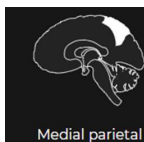
### Default mode network

A critical network involved with cognitive and emotional regulation. Active during rest and sleep. Coordinates with other networks for passive sensory processing.

Dysfunctions associated with neuropsychiatric disorders and may contribute to difficulty in processing social situations and information.







## Examine functional areas via object tabs

Corticospinal

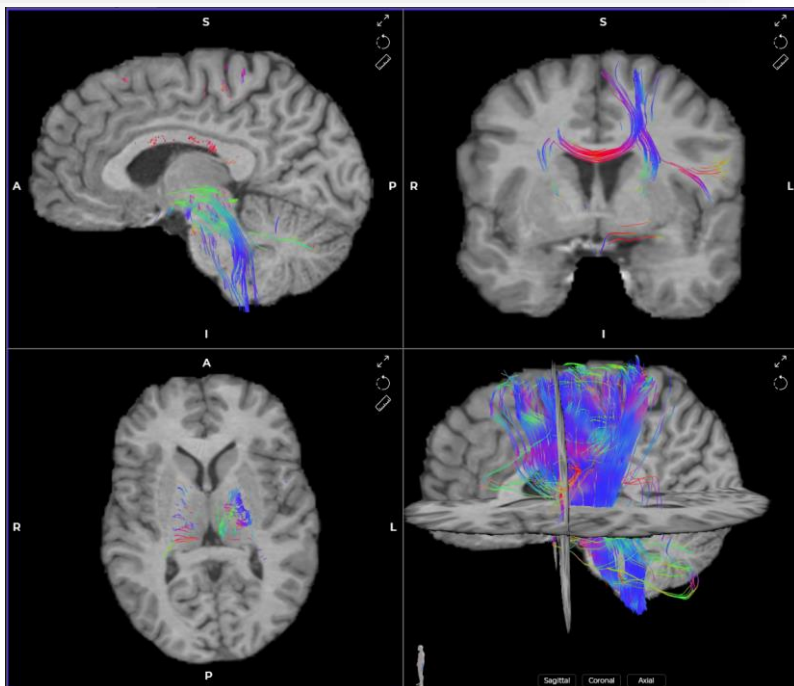
Optic radiations

Language system

Default mode network

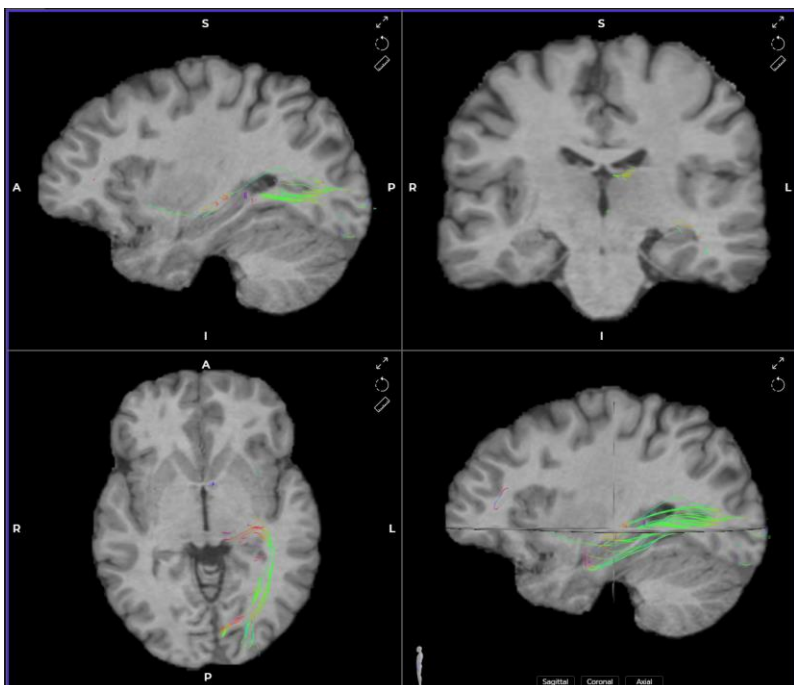
### Corticospinal tract

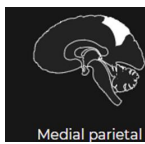
Connects sensorimotor cortex to spinal cord.



### Optic radiations

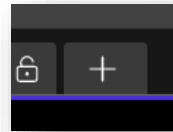
Connects lateral geniculate nucleus with primary visual cortex.



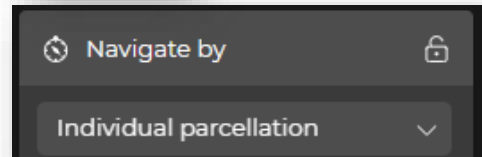


## Examine additional parcellations in a custom object tab

**Step 1** – Click the **+** symbol to create a new custom object

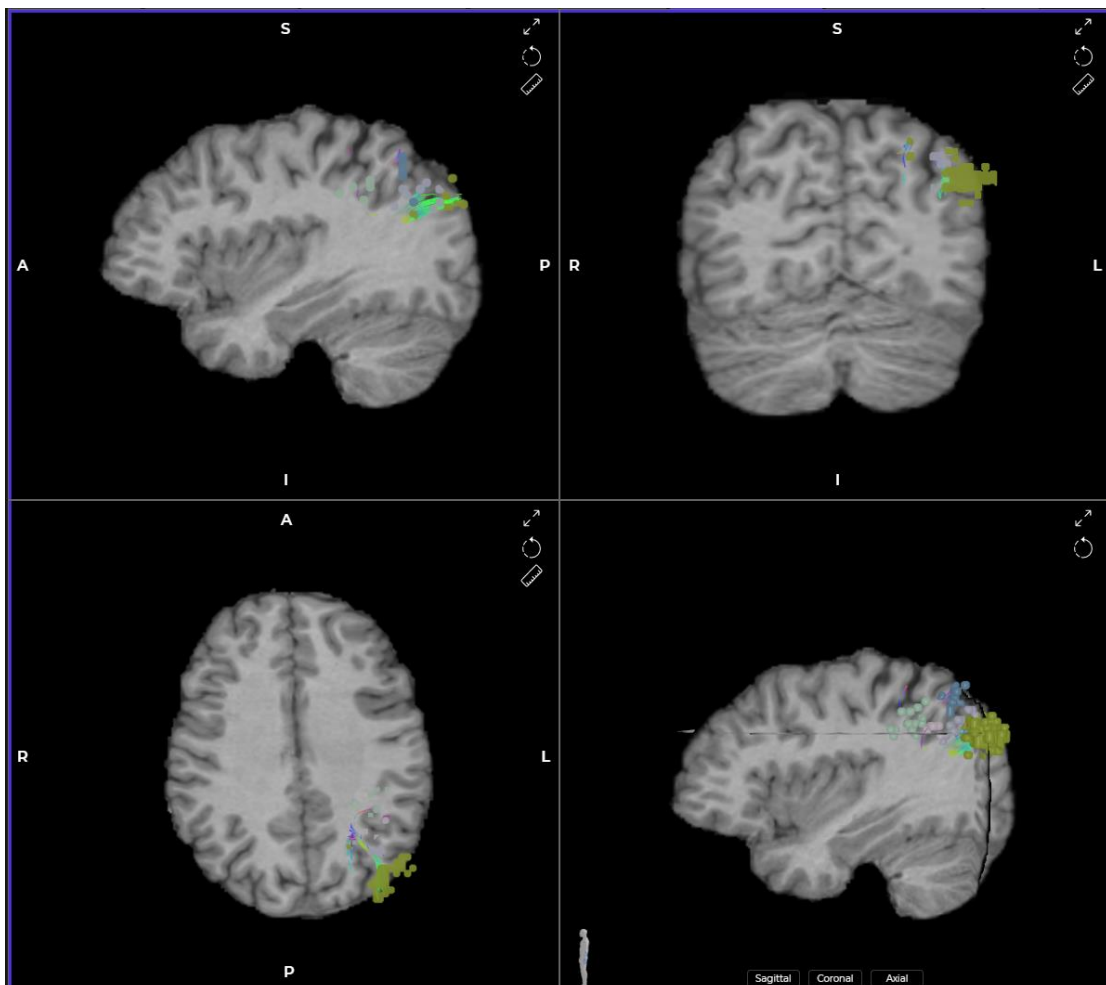


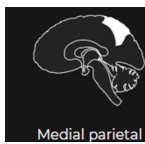
**Step 2** – In the dropdown menu on the left, select **Individual parcellation**



**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **AIP, LIPd, LIPv, IP1, IP2, PGs**





## Examine objects together

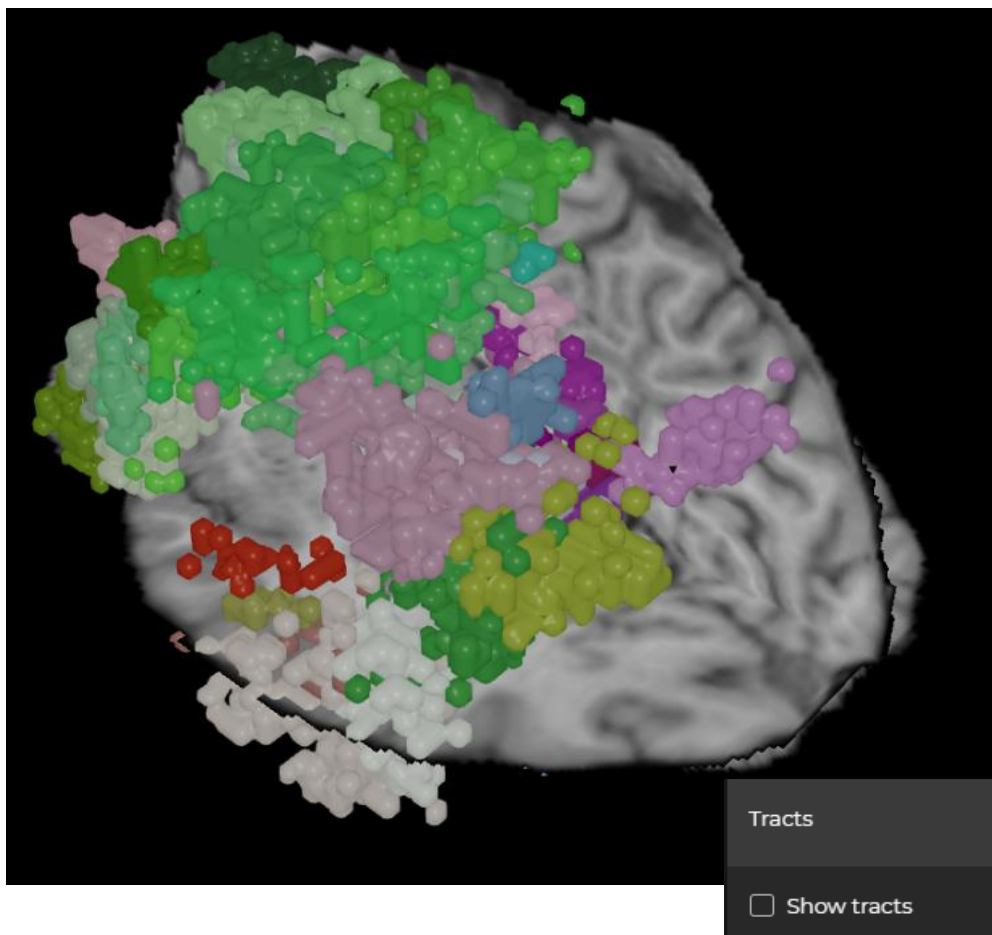
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Toggle on/off **Language system** and **Default mode network (L)**

**Step 3** – Now, navigate by **Tractography bundle**

**Step 4** – Select **Optic radiations**, and **Corticospinal tract**

**Step 5** – (Optional) Toggle tracts on and off while examining

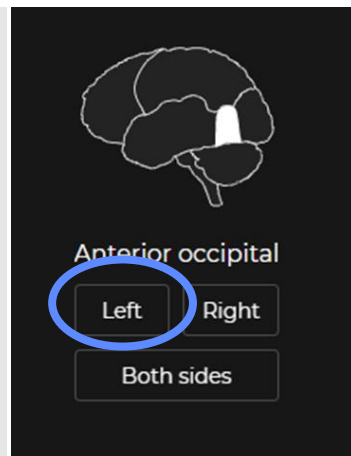


## CASE 6

# Anterior Occipital Trajectories

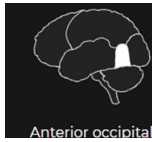
### Launching the case

1. Find the case by searching and launching **“DEMO”**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Anterior occipital** and click **LEFT**



### Potential Targets

- Back of hippocampus
- Inferior cingulate gyrus



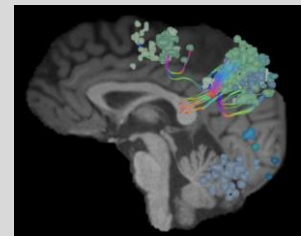
## Functional regions of concern

### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

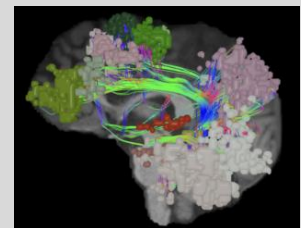
### Dorsal attention network

The DAN holds attention for a person to focus and ignore miscellaneous noises or environmental changes. In addition to attentional and sensory disruption due to neurodegenerative disorders, the DAN is also associated with neuropsychiatric disorders, like schizophrenia.



### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function. Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Inf. longitudinal fasciculus (ILF)

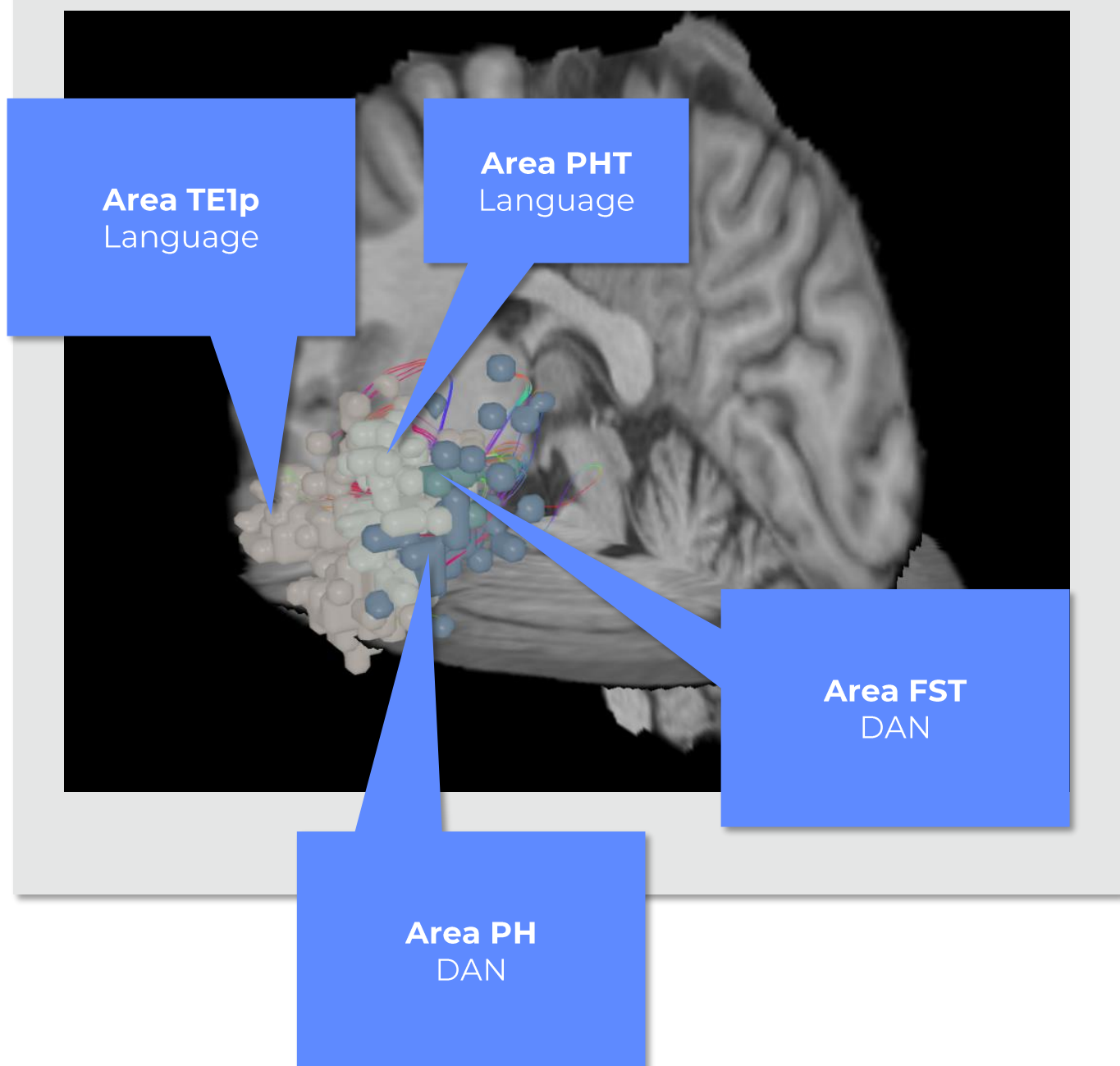
One of the major occipitotemporal association tracts associated with visual to memory transfer

### Optic radiations

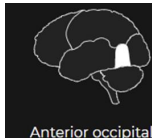
Connects lateral geniculate nucleus with primary visual cortex.



## Additional cortical parcellations of concern







## Examine functional areas via object tabs

Corticospinal

Optic radiations

Language system

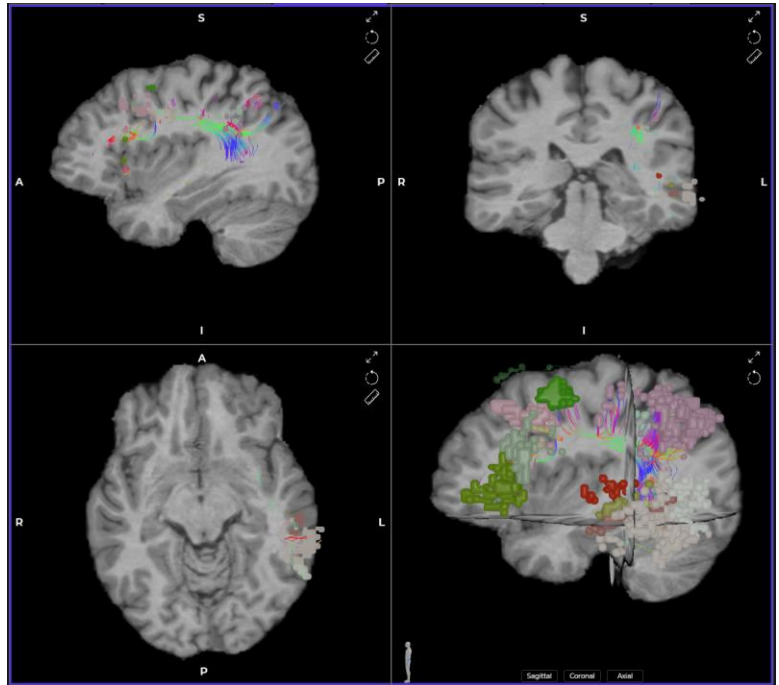
Inf. longitudinal fasciculus

Dorsal attention network

### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

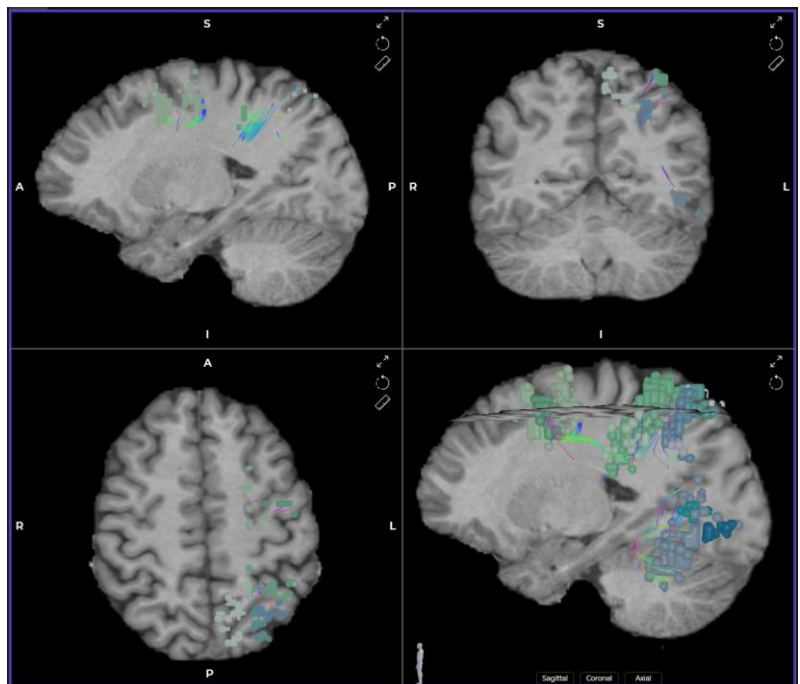
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways

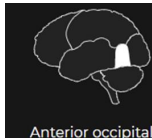


### Dorsal attention network (DAN)




The DAN holds attention for a person to focus and ignore miscellaneous noises or environmental changes.

In addition to attentional and sensory disruption due to neurodegenerative disorders, the DAN is also associated with neuropsychiatric disorders, like schizophrenia.



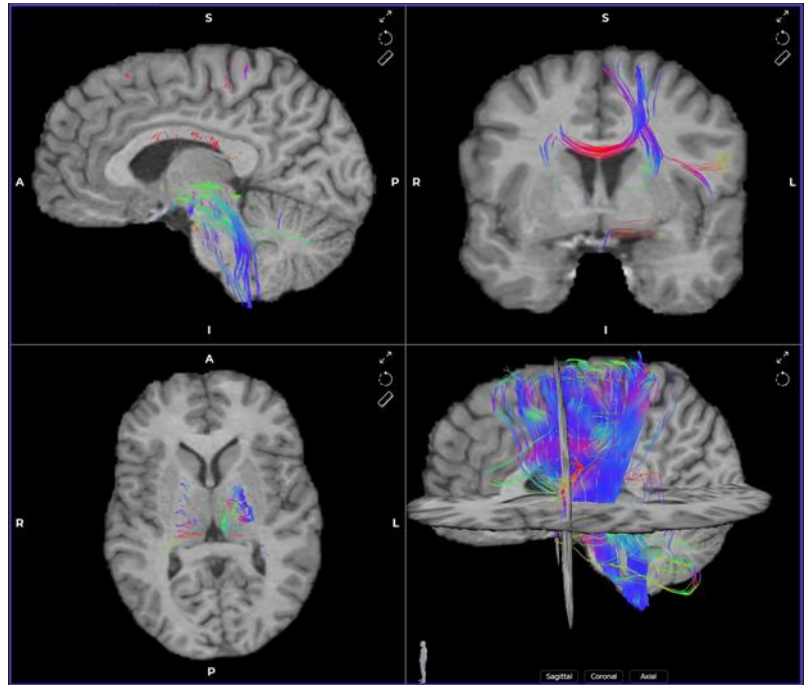


## Examine functional areas via object tabs

Corticospinal Optic radiations Language system Inf. longitudinal fasciculus Dorsal attention network 

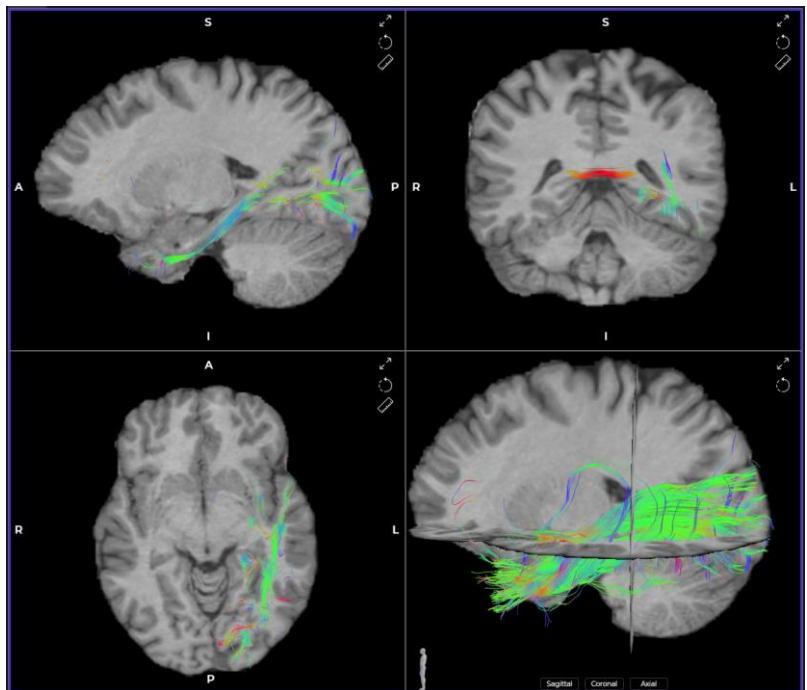
### Corticospinal tract

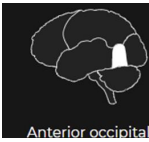
Connects sensorimotor cortex to spinal cord.



### Inf. longitudinal fasciculus (ILF)

One of the major occipitotemporal association tracts associated with visual to memory transfer





## Examine functional areas via object tabs

Corticospinal

Optic radiations

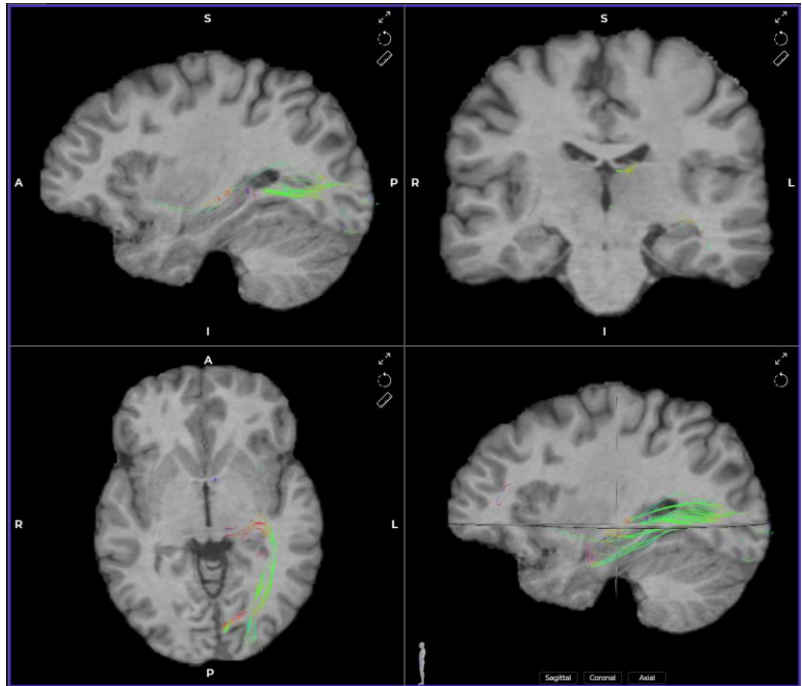
Language system

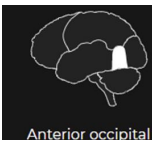
Inf. longitudinal fasciculus

Dorsal attention network

### Optic radiations

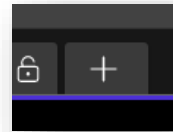
Connects lateral geniculate nucleus with primary visual cortex.



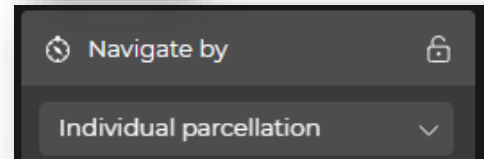


## Examine additional parcellations in a custom object tab

**Step 1** – Click the + symbol to create a new custom object

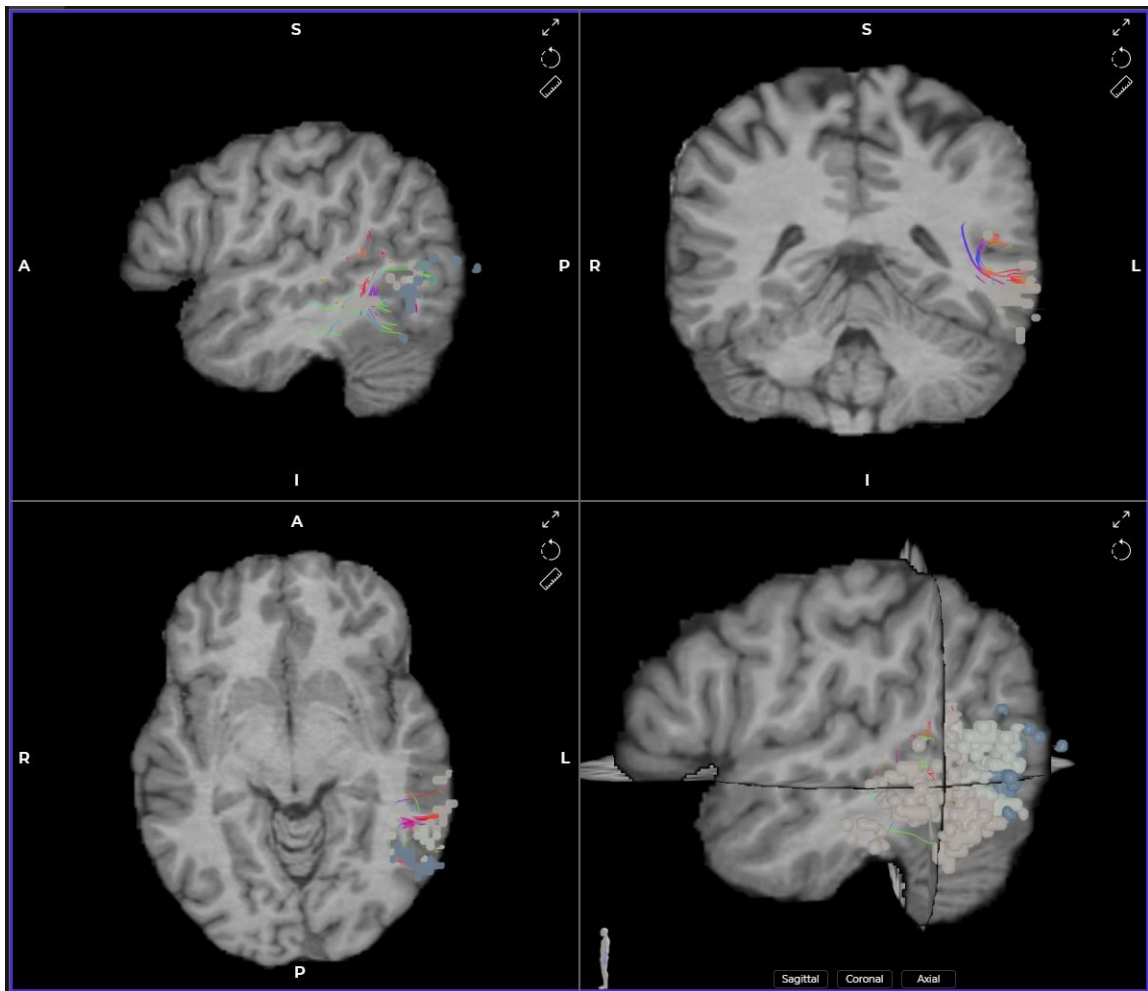


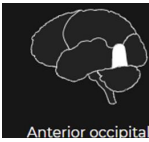
**Step 2** – In the dropdown menu on the left, select **Individual parcellation**



**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **PHT, TE1p, FST, PH**





## Examine objects together

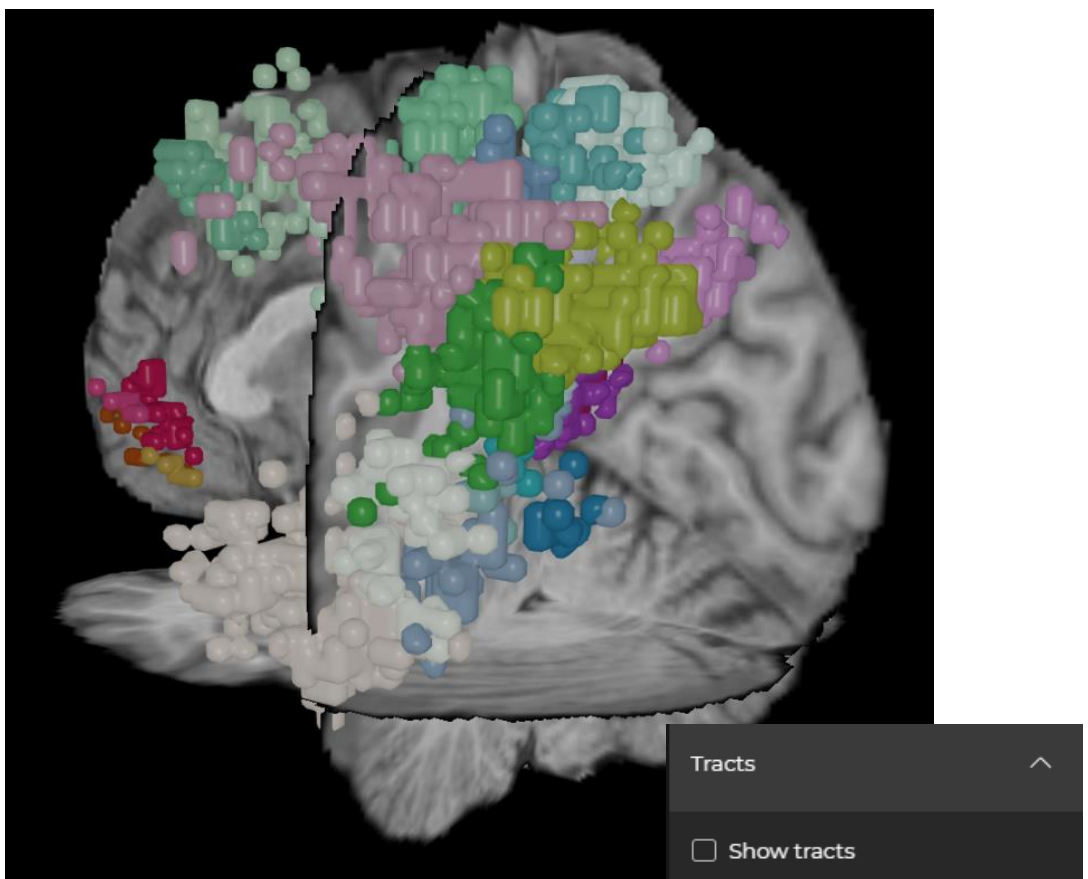
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Select **Language system (L)** and **Dorsal attention network (L)**

**Step 3** – Now, navigate by **Tractography bundle**

**Step 4** – Toggle **ILF (L)**, **Optic radiations (L)** and **Corticospinal tract (L)**

**Step 5** – (Optional) Toggle tracts on and off while examining

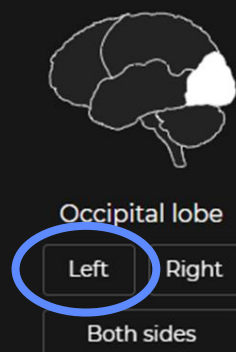


## CASE 7

# Occipital lobe Trajectories

### Launching the case

1. Find the case by searching and launching **“DEMO”**
2. Select workflow: Click **Surgical planning**
3. Select brain region: Hover over **Anterior occipital** and click **LEFT**



### Potential Targets

- Back of hippocampus
- Inferior cingulate gyrus





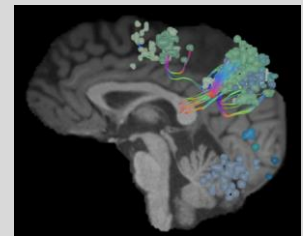
## Functional regions of concern

### Corticospinal tract

Connects sensorimotor cortex to spinal cord.

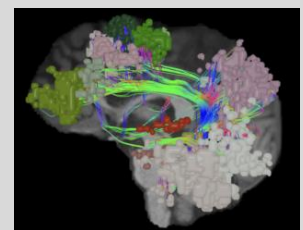
### Dorsal attention network

The DAN holds attention for a person to focus and ignore miscellaneous noises or environmental changes. In addition to attentional and sensory disruption due to neurodegenerative disorders, the DAN is also associated with neuropsychiatric disorders, like schizophrenia.



### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function. Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Inf. longitudinal fasciculus (ILF)

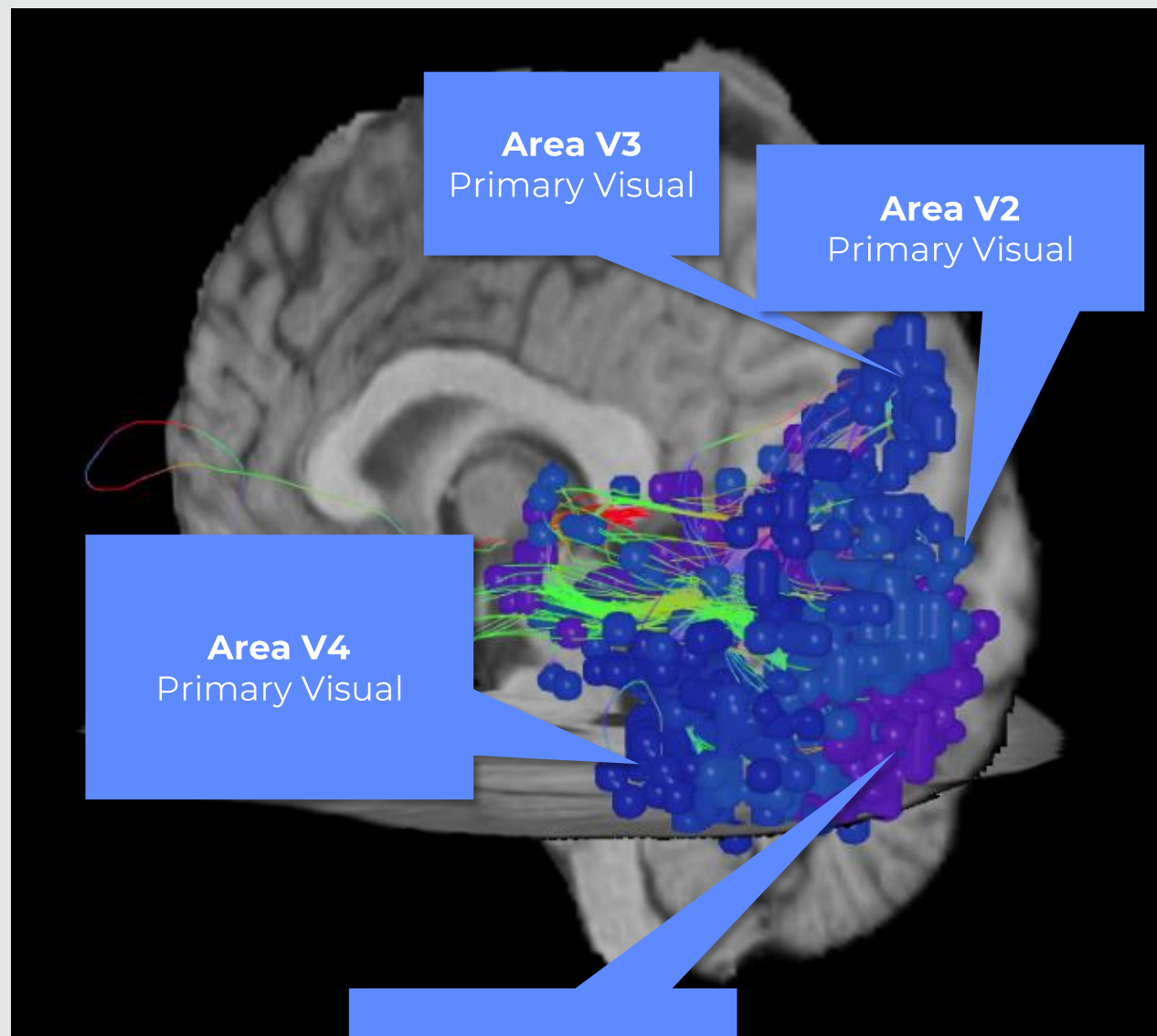
One of the major occipitotemporal association tracts associated with visual to memory transfer

### Optic radiations

Connects lateral geniculate nucleus with primary visual cortex.



## Additional cortical parcellations of concern



**Area V3**  
Primary Visual



**Area V2**  
Primary Visual

**Area V4**  
Primary Visual

**Area V6**  
Primary Visual



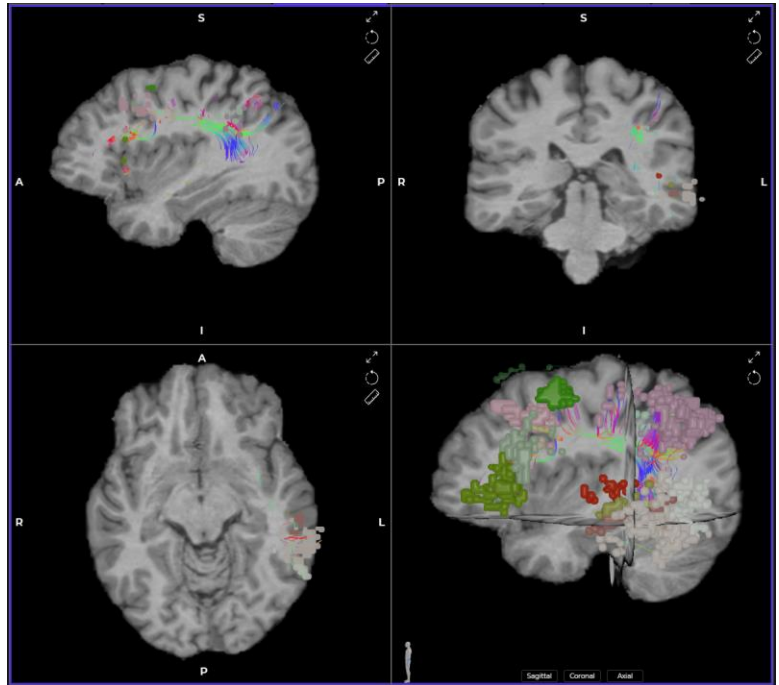
## Examine functional areas via object tabs

Language system Optic radiations Default mode network Dorsal attention network 

### Language system

Often referred to as an “eloquent region” of the brain due to its critical role in and independent function.

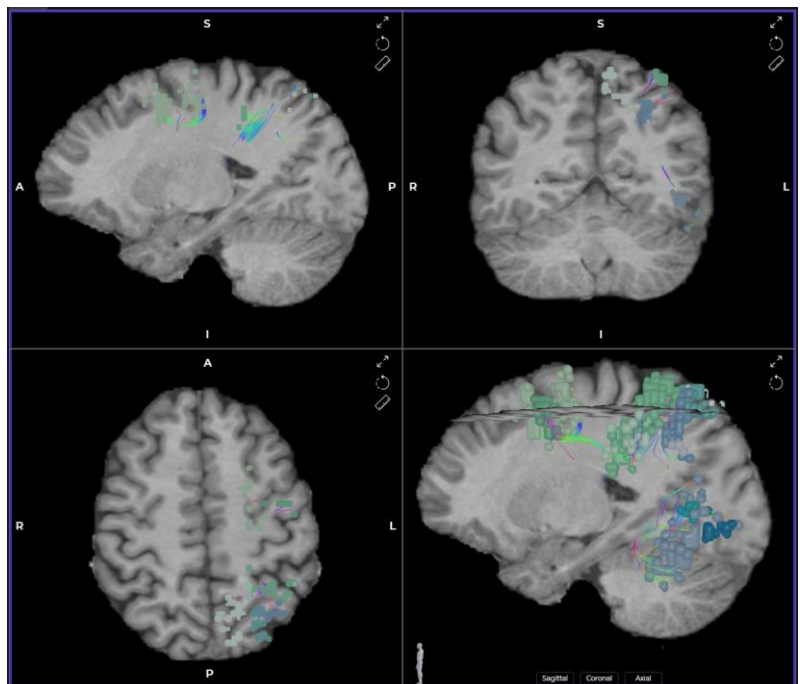
Recent neuroimaging publications have extended anatomical classification of network including new cortical parcellations and tract pathways



### Dorsal attention network (DAN)


The DAN holds attention for a person to focus and ignore miscellaneous noises or environmental changes.

In addition to attentional and sensory disruption due to neurodegenerative disorders, the DAN is also associated with neuropsychiatric disorders, like schizophrenia.





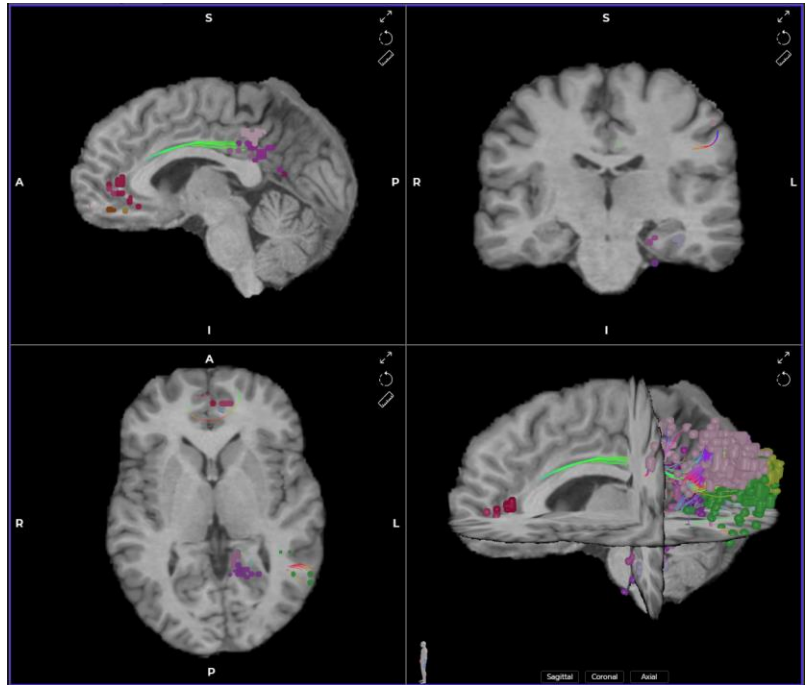
## Examine functional areas via object tabs

Language system Optic radiations Default mode network Dorsal attention network 

### Default mode network

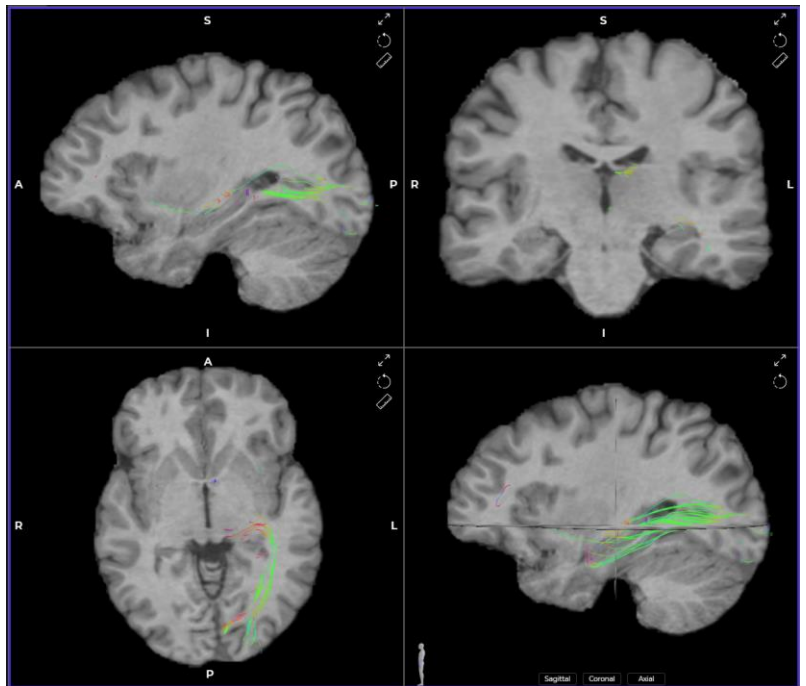
A critical network involved with cognitive and emotional regulation. Active during rest and sleep. Coordinates with other networks for passive sensory processing.

Dysfunctions associated with neuropsychiatric disorders and may contribute to difficulty in processing social situations and information.



### Optic radiations

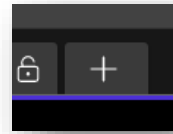
Connects lateral geniculate nucleus with primary visual cortex.



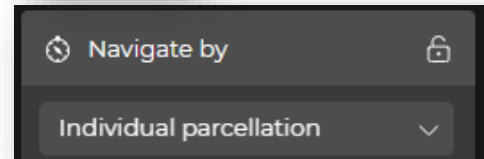


## Examine additional parcellations in a custom object tab

**Step 1** – Click the **+** symbol to create a new custom object

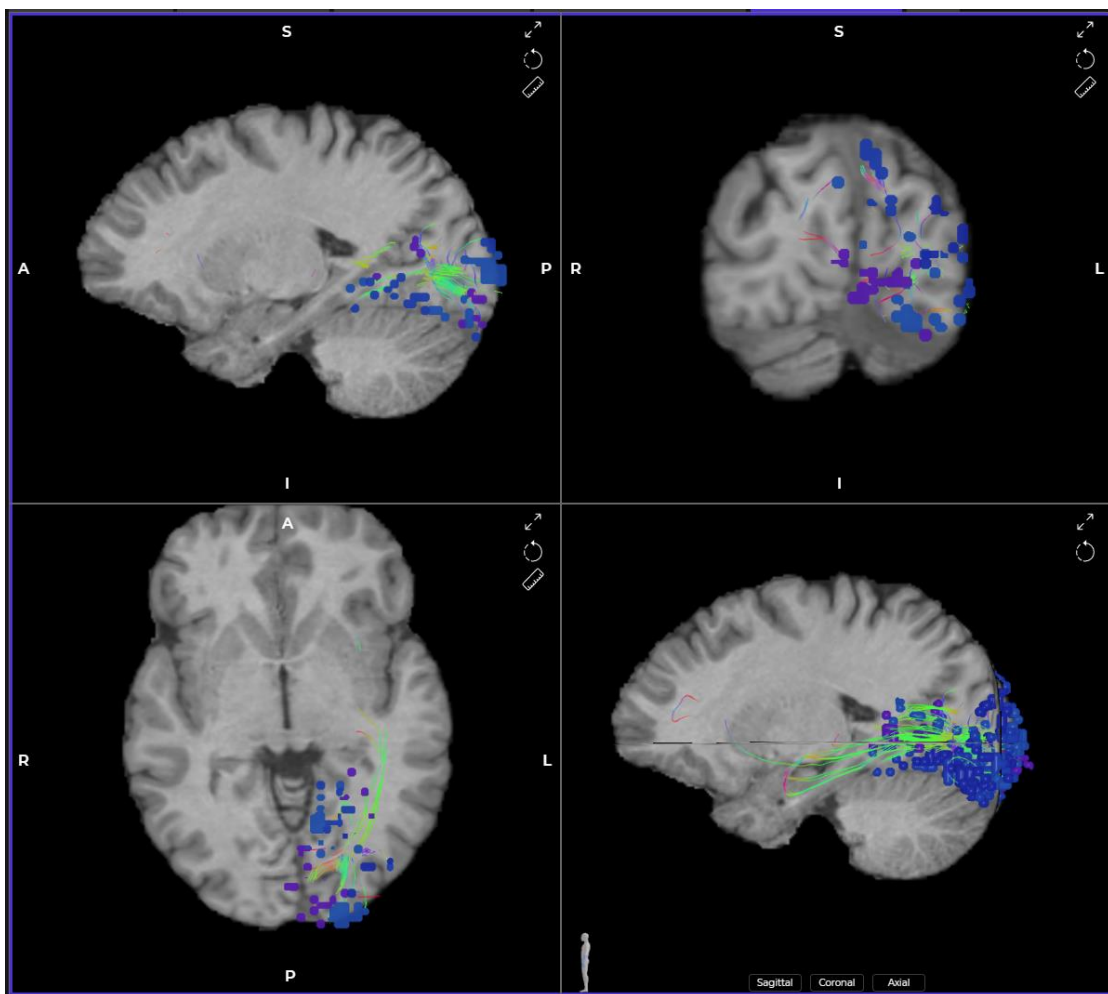


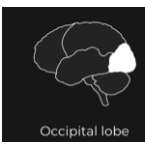
**Step 2** – In the dropdown menu on the left, select **Individual parcellation**



**Step 3** – Expand **Left** and **Cortical**

**Step 4** – Select **V1, V2, V3, V4**





## Examine objects together

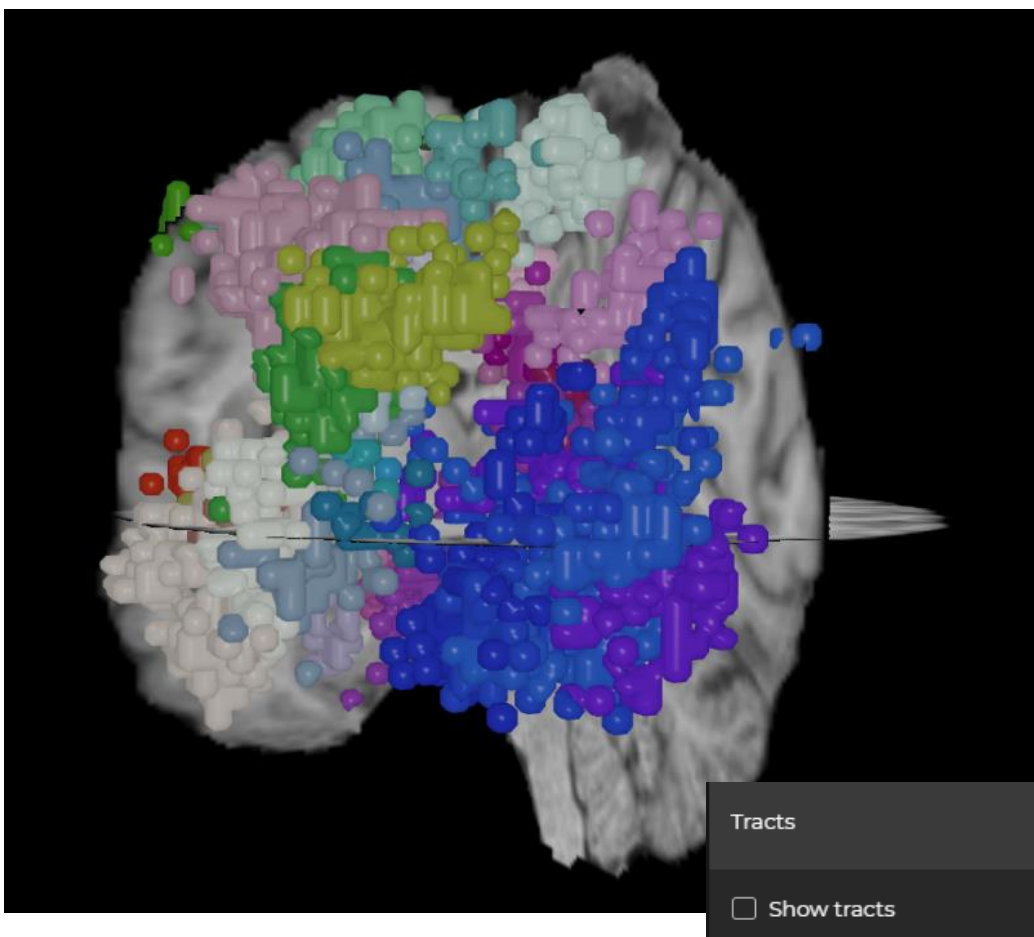
**Step 1** – Staying on the custom object, navigate by **Network Templates**

**Step 2** – Select **Language system (L)**, **Dorsal attention network (L)**, and **Default Mode Network (L)**

**Step 3** – Now, navigate by **Tractography bundle**

**Step 4** – Toggle **Optic radiations (L)**

**Step 5** – (Optional) Toggle tracts on and off while examining





## CASE 8

# Lateral Parietal Trajectories

- Trajectory approach should be avoided
- No target worth chasing that cannot be accessed via another region

