

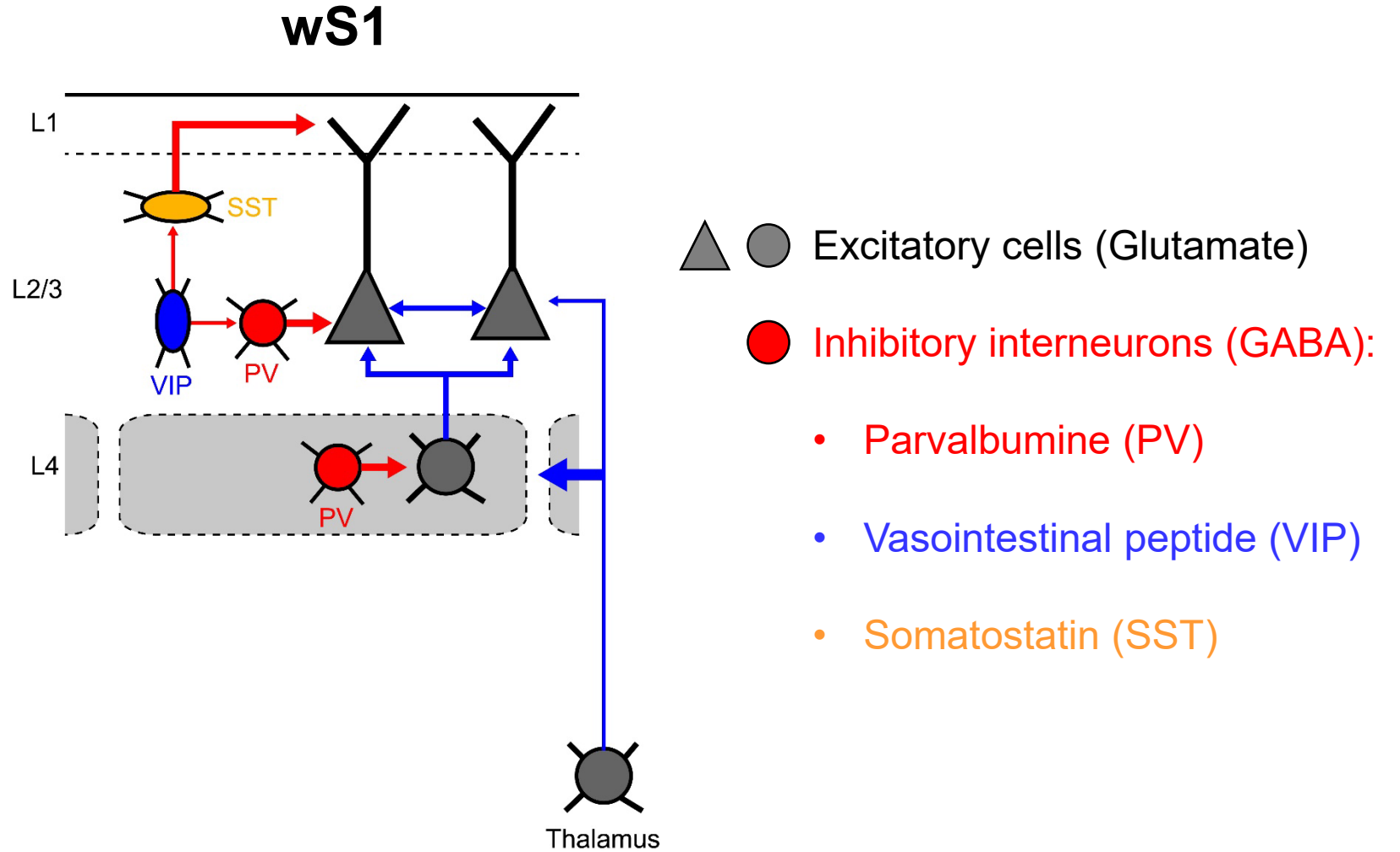
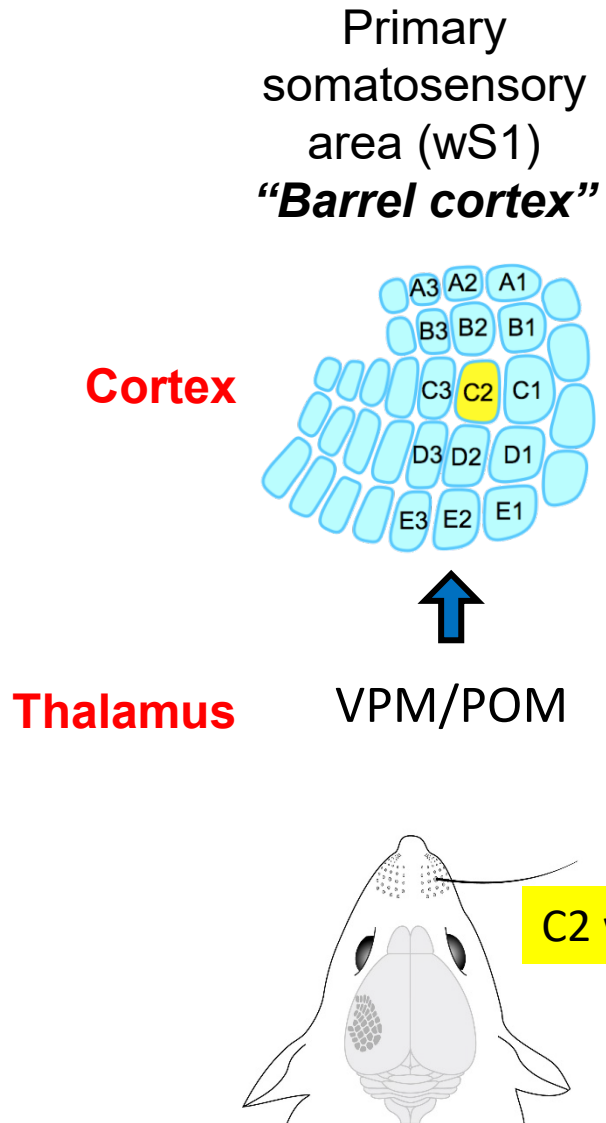
BIO-482 Neuroscience: cellular and circuit mechanisms

Mini-project: Neurophysiological data analysis

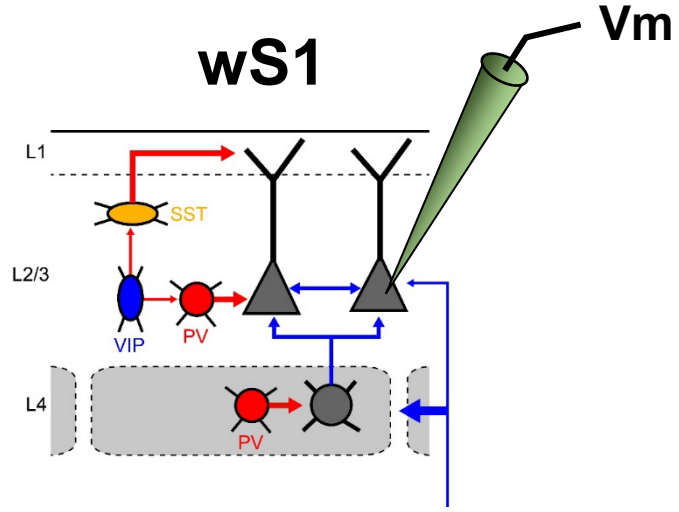
Sylvain Crochet & Carl Petersen

Laboratory of Sensory Processing

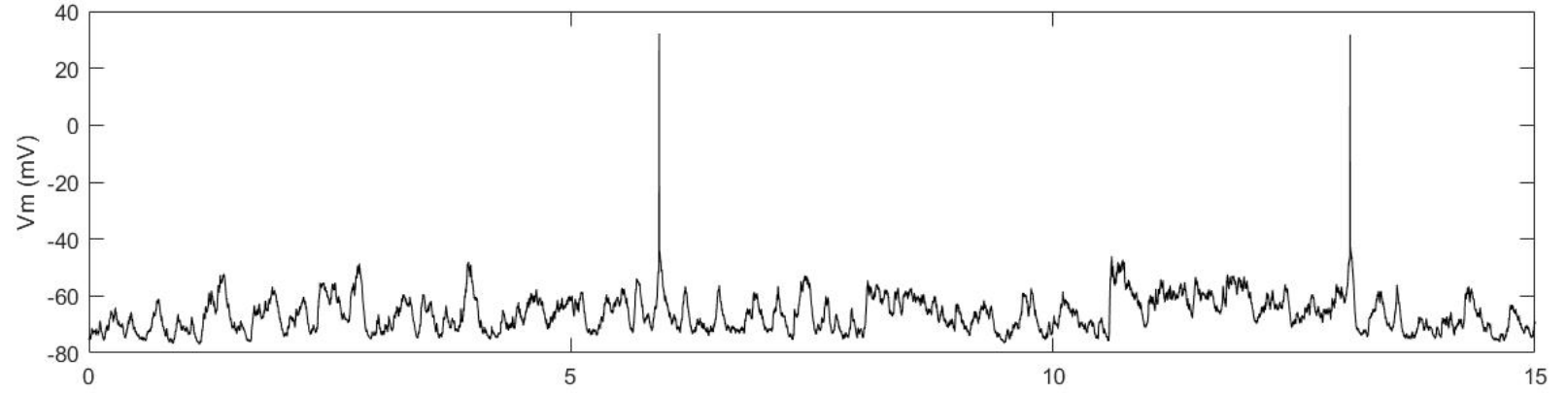
Recordings



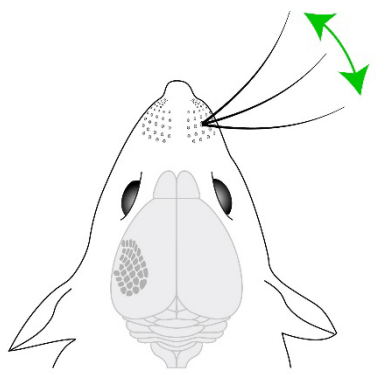
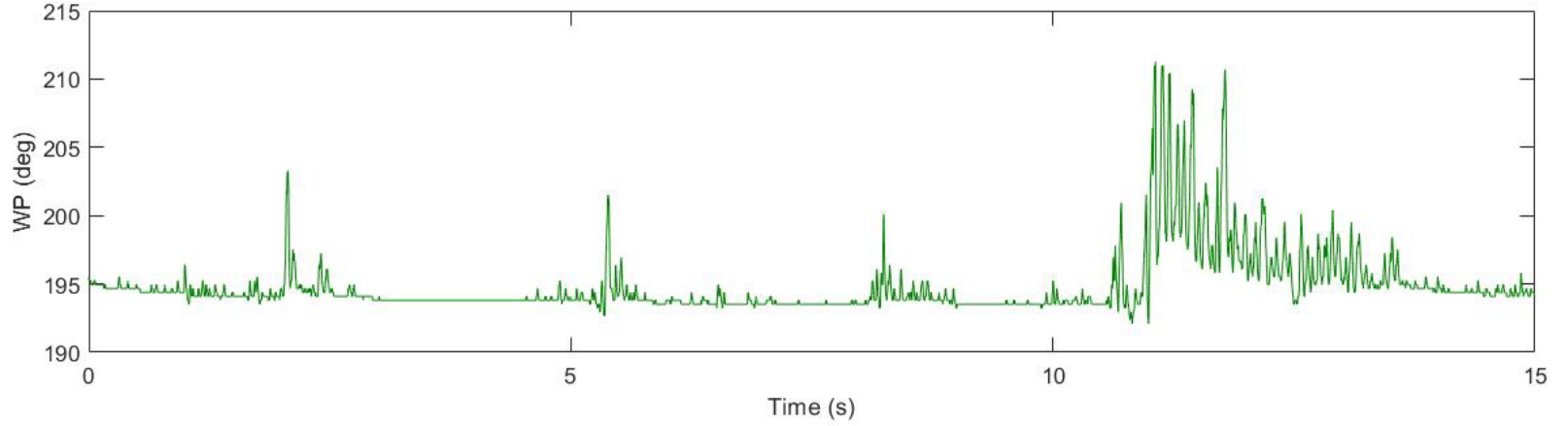
Recordings



Membrane potential (Vm) – SR = 20 kHz

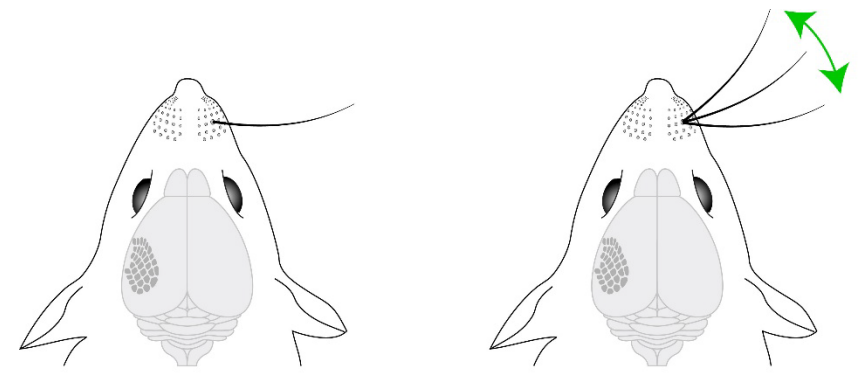


Whisker position (WP) – SR = 100 Hz



Recordings

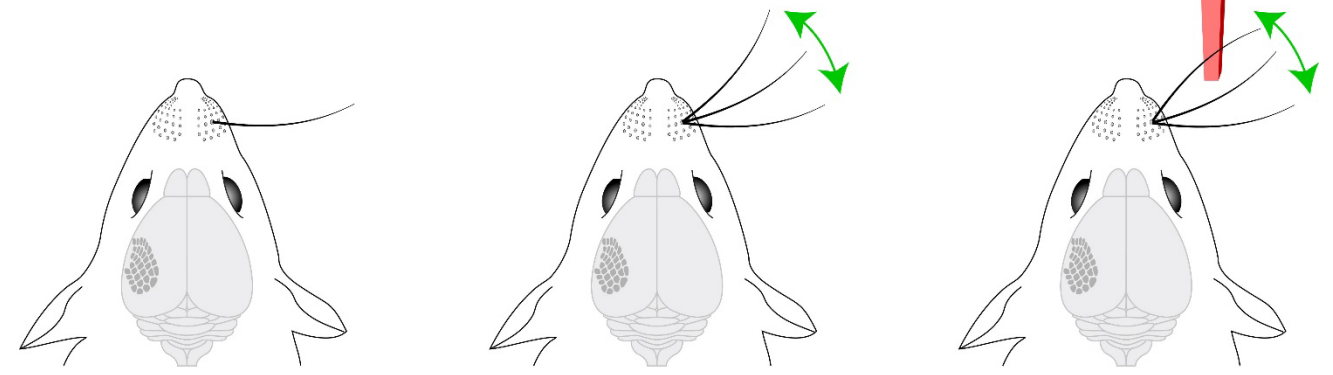
Free whisking



Quiet

Whisking

Active touch

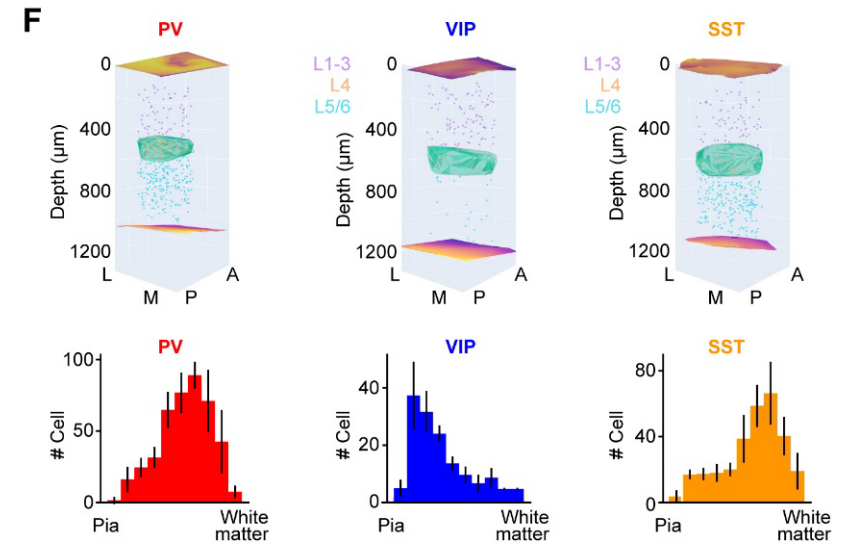
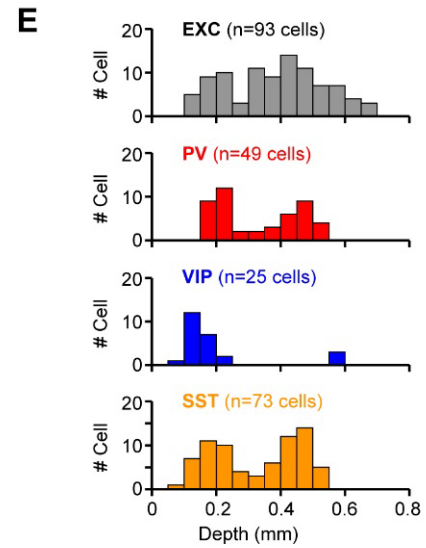
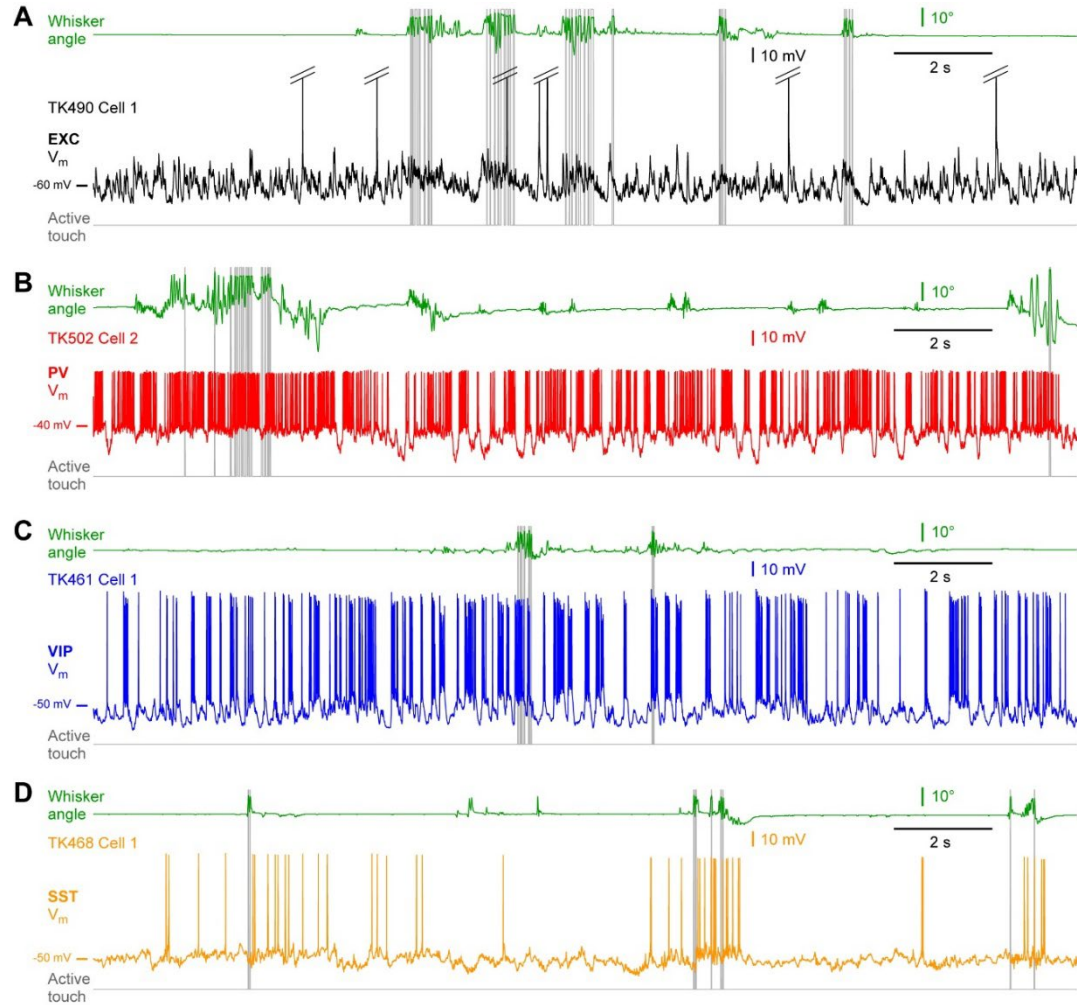


Quiet

Whisking

Active Touch

Kiritani et al., PLOS 2024 <https://dx.plos.org/10.1371/journal.pone.0287174>




Data structure => flat data structure : 1 line = 1 continuous recording (Sweep)

	Field 1	Field 2	...	Field N
Sweep 1				
Sweep 2				
...				
...				
...				
Sweep N				

=> Fields can contain **Meta-Data** or **Data** of different types: String, Number, Vector ...

=> 1 Sweep = 1 continuous recording from 1 neuron (~30-90 s)

Meta-Data



Mouse Name	Mouse DOB	Mouse ...	Cell Counter	Cell ID	Cell Type	Cell ...	Sweep Counter	Sweep Type	Sweep ...
TK355			1	TK355_1	EXC		1	Free Whisking	
TK355			1	TK355_1	EXC		2	Active Touch	
TK355			1	TK355_1	EXC		3	Free Whisking	
TK355			2	TK355_2	PV		1	Free Whisking	
TK358			1	TK358_1	SST		1	Active Touch	
TK358			1	TK358_1	SST		2	Active Touch	

Mouse

Cell

Sweep

Mouse Name	Mouse DOB	Mouse ...	Cell Counter	Cell ID	Cell Type	Cell ...	Sweep Counter	Sweep Type	Sweep ...
TK355			1	TK355_1	EXC		1	Free Whisking	
TK355			1	TK355_1	EXC		2	Active Touch	
TK355			1	TK355_1	EXC		3	Free Whisking	
TK355			2	TK355_2	PV		1	Free Whisking	
TK358			1	TK358_1	SST		1	Active Touch	
TK358			1	TK358_1	SST		2	Active Touch	

Data structure

Meta-Data

Data

Mouse Name	Cell Counter	Sweep Counter	Sweep Type	Whisker Angle	Whisker Angle SR	Vm	Vm SR	Whisking Times	Contact Times
TK355	1	1	Free Whisking	6000x1 double	100	1200000x1 double	20000	Nx2 double	[]
TK355	1	2	Active Touch	6000x1 double	100	1200000x1 double	20000	Nx2 double	Nx2 double
TK355	1	3	Free Whisking	600x1 double	100	600000x1 double	20000	Nx2 Double	[]
TK355	2	1	Free Whisking	6000x1 double	100	1200000x1 double	20000	Nx2 Double	[]
TK358	1	1	Active Touch	6000x1 double	100	1200000x1 double	20000	Nx2 Double	Nx2 double
TK358	1	2	Active Touch	9000x1 double	100	1800000x1 double	20000	Nx2 double	Nx2 double

Data structure

1 Cell = unique Mouse Name + unique Cell Counter (ex: TK355 1) => Cell ID

Mouse Name	Cell Counter	Sweep Counter	Sweep Type	Whisker Angle	Whisker Angle SR	Vm	Vm SR	Whisking Times	Contact Times
TK355	1	1	Free Whisking	6000x1 double	100	1200000x 1 double	20000	Nx2 double	[]
TK355	1	2	Active Touch					Nx2 double	Nx2 double
TK355	1	3	Free Whisking					Nx2 Double	[]
TK355	2	1	Free Whisking					Nx2 Double	[]
TK358	1	1	Active Touch					Nx2 Double	Nx2 double
TK358	1	2	Active Touch					Nx2 double	Nx2 double

=> 1 Cell

Data structure

Mouse Name	Cell Counter	Sweep Counter	Sweep Type	Whisker Angle	Whisker Angle SR	Vm	Vm SR	Whisking Times	Contact Times
TK355	1	1	Free Whisking	6000x1 double	100	1200000x1 double	20 000	Nx2 double	[]
TK355	1	2	Active Touch	6000x1 double	100	1200000x1 double	20 000	Nx2 double	Nx2 double
TK355	1	3	Free Whisking	3000x1 double	100	1200000x1 double	20 000	Nx2 Double	[]
TK355	2	1	Free Whisking	6000x1 double	100	1200000x1 double	20 000	Nx2 Double	[]
TK358	1	1	Active Touch	6000x1 double	100	1200000x1 double	20 000	Nx2 Double	Nx2 double
TK358	1	2	Active Touch	9000x1 double	100	1800000x1 double	20 000	Nx2 double	Nx2 double

⇒ 1 Cell
TK355_1

⇒ 1 Cell
TK355_2

⇒ 1 Cell
TK358_1

Data structure

Mouse Name	Cell Counter	Sweep Counter	Sweep Type	Whisker Angle	Whisker Angle SR	Vm	Vm SR	Whisking Times	Contact Times
TK355	1	1	Free Whisking	6000x1 double	100	1200000x1 double	20000	Nx2 double	[]
TK355	1	2	Active Touch	6000x1 double	100	1200000x1 double	20000	Nx2 double	Nx2 double
TK355	1	3	Free Whisking	3000x1 double	100	600000x1 double	20000	Nx2 Double	[]
TK355	2	1	Free Whisking	6000x1 double	100	1200000x1 double	20000	Nx2 Double	[]
TK358	1	1	Active Touch	6000x1 double	100	1200000x1 double	20000	Nx2 Double	Nx2 double
TK358	1	2	Active Touch	9000x1 double	100	1800000x1 double	20000	Nx2 double	Nx2 double

'free whisking' sweeps for Cell TK355_1



Data structure – fields description

- Data.Mouse_Name** : Name of the mouse ('LLNNN')
- Data.Mouse_DateOfBirth** : Mouse date of birth [Year; Month; day]
- Data.Mouse_Sex** : Mouse sex ('f' or 'm')
- Data.Mouse_Genotype** : Mouse genotype [Parent1 ; Parent2]
- Data.Cell_Counter** : Cell counter (Numb)
- Data.Cell_Type** : Cell Type ['EXC', 'PV', 'VIP' or 'SST']
- Data.Cell_Depth** : Cell recording depth (in μm from brain surface)
- Data.Cell_Layer** : Cell cortical layer ['L2/3', 'L4' or 'L5']
- Data.Cell_TargetedBrainArea** : Cell cortical area ['C2 barrel column of wS1']
- Data.Cell_tdTomatoExpressing** : Expression of tdTomato ['true' or 'false']
- Data.Cell_ID** : unique Cell ID (Mouse_Name _ Cell_Counter)
- Data.Cell_APTThreshold_Slope** : Threshold to detect AP initiation from dV_m/dt ($V.s^{-1}$)
- Data.Sweep_Counter** : Recording sweep counter (Numb)
- Data.Sweep_Type** : Recording sweep type ['free whisking' or 'active touch']
- Data.Sweep_StartTime** : Recording sweep start time [Year; Month; day; hour; minute; second]
- Data.Sweep_MembranePotential** : Membrane potential recording (vector; V)
- Data.Sweep_MembranePotential_SamplingRate** : Sampling rate of membrane potential (sample.s⁻¹)
- Data.Sweep_WhiskerAngle** : Whisker angle position (vector, deg)
- Data.Sweep_WhiskerAngle_SamplingRate** : Sampling rate of whisker angle (sample.s⁻¹)
- Data.Sweep_QuietTimes** : Onset and Offset times of quiet periods (2xN matrix, s)
- Data.Sweep_WhiskingTimes** : Onset and Offset times of whisking periods (2xN matrix, s)
- Data.Sweep_ActiveContactTimes** : Onset and Offset times of active contacts (2xN matrix, s)
- Data.Sweep_PassiveContactTimes** : Onset and Offset times of passive contacts (2xN matrix, s)
- Data.Cell_Anatomy** : Cell anatomy for identified cells ['layer'; 'barrel column']

Dataviewer demo

