Experimental goals

- test for presence of P, PE signalling in layer 2/3 and layer 5
- identify PE neurons in layer 5
- correlate to eye movements

Workflow

- Linear corridor with mismatch and playback sessions like in Keller, Jordan, Leinweber, Attinger
- **Glossary**
    - Closed-loop mode: locomotion (ball movement) and visual flow (VR) are coupled by a factor (gain)
    - Open-loop mode: locomotion and visual flow are fully decoupled
    - Mismatch: global halts/change in speed of visual flow during running
    - Playback: replay of visual flow in presence / absence of running
- Example videos: https://www.cell.com/cell/fulltext/S0092-8674(17)30583-4?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0092867417305834%3Fshowall%3Dtrue#supplementaryMaterial
- During habituation (**training**): mice run in *closed loop mode* with optic flow in VR coupled to movement*
- Each **experimental session** will be composed by a combination of these blocks:
    - 1) baseline block: closed loop mode
    - 2) mismatch block type 1: closed-loop + visual flow halts
    - 3) mismatch block type 2: closed-loop + visual flow gain change
    - 4) playback block: open-loop mode; the visual flow presented to the mice consists of playback stimuli ("movies") selected from a pre saved library created for each mouse (i.e. record VR from baseline block)

Parameters (json file):

- Global level parameters + a sequence of block parameters (baseline/mismatch/playback)
- Global level
    - VR gain: default value
    - Running threshold: predetermined from previous recordings
- Baseline and Mismatch blocks (closed-loop)
    - VR gain: default global gain is used if this is not set
    - Stimuli
        - Grating
            - Spatial frequency
            - Square or sinusoidal grating
        - Texture
            - Filename

        - Motion cloud
            - Link to python configuration script
        - Path to save visual flow to (i.e. to create the library for subsequent playback block): could be visual flow speed/running speed rather than heavier VR movies
    - Visual flow halts (shown if the mouse is running - see algorithm 1 below)
        - Halt probability (e.g. 0.5): whether we do the halt at a given time of running
        - Minimum running time delay (e.g. 2 sec): how long we wait after deciding to show halt
        - Random delay (e.g. Gaussian): the delay sampled from random distribution, shown after the minimum delay
        - Running threshold: optionally variable on the level of single blocks, but very unlikely this will be needed
        - Halt time (e.g. 1 sec)
        - Gain multiplier: for visual flow halts it's set to 0, for speeding up the visual field it's going to be positive value higher than the default
- <u>Playback (open-loop)</u>
    - VR gain
    - Stimuli
        - Path to library of playbacks saved during baseline block
    - Playback halts/speed ups
        - Halt probability: probability of the played back flow stopping at each given time
        - Minimum delay between halts (e.g. 2 sec): the delay before trying to halt again
        - Predictable stimulus during running (always happening after running initiation - see algorithm 2 below)
            - Enable (True/False)
            - Minimum running time delay
            - Running threshold
            - Stimulus time (e.g. 1 sec)
            - Gain multiplier as above

Internal logic in stimuli workflow:

- Algorithm 1
    - Detect running state using running threshold
    - Apply halt probability - result: halt True or halt False
    - If halt True:
        - Wait for minimum running time delay
        - Sample random delay
        - Check if still running after delays
        - If running True:
            - Deliver halt (alternatively, change gain multiplier)
        - If running False: restart
    - If halt False: restart
- Algorithm 2
    - Detect running state using running threshold in present session AND in playback session

- Wait for minimum running time delay
- Check if still running after delay in present session AND in playback session
- If running True:
    - Deliver halt (alternatively, change gain multiplier)
- If running False: restart