Gait dependent oscillations from LFP data in home-based recording

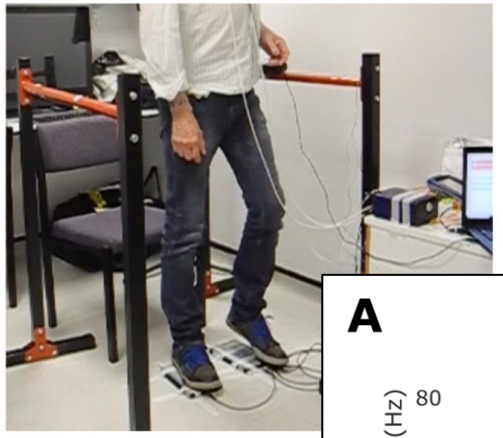
Project idea

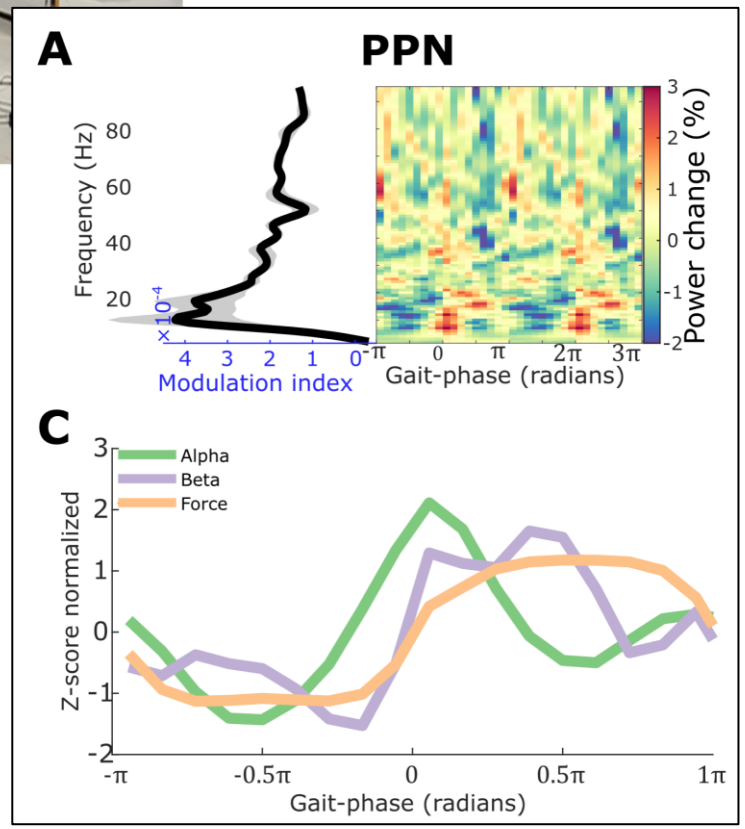
Project priors

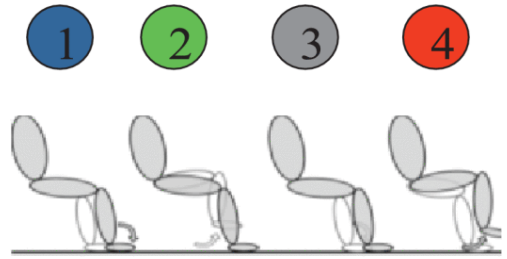
1. Gait events can be detected using IMUs in home-based enviroments
   - Deep learning for freezing of gait detection in Parkinson's disease patients in their homes using a waist-worn inertial measurement unit (Camps ea., *Knowledge-Based System*, 2018)
   - A Deep Learning Approach for Gait Event Detection from a Single Shank-Worn IMU: Validation in Healthy and Neurological Cohorts (Romijnders ea., *Sensors*, 2022)

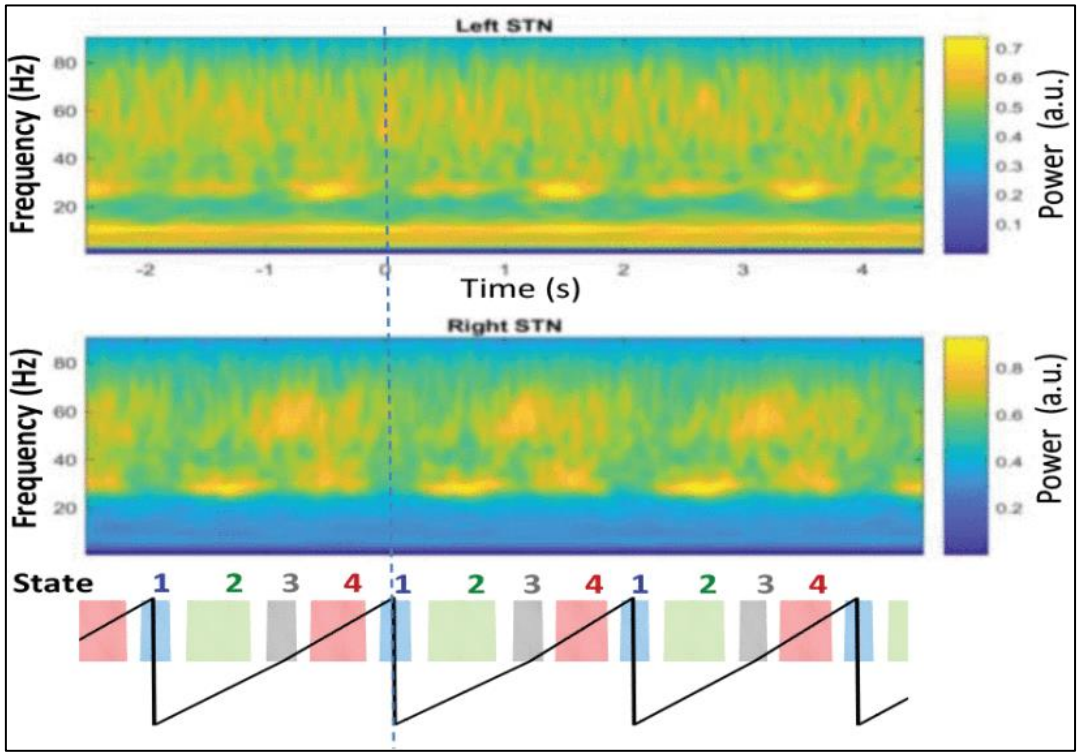
2. The gait cycle can be detected from LFPs in subcortical recordings
   - Decoding Movement States in Stepping Cycles Based on Subthalamic LFPs in Parkinsonian Patients (Tan ea., *IEEE*, 2018)
   - Gait-Phase Modulates Alpha and Beta Oscillations in the Pedunculopontine Nucleus (He, *Journal of Neuroscience*, 2021)

LFP decoding examples









Project aims

1. Understand how everyday gait is represented on a neural basis in LFPs
2. „Identify„ gait biomarkers from LFPs for adaptiv DBS

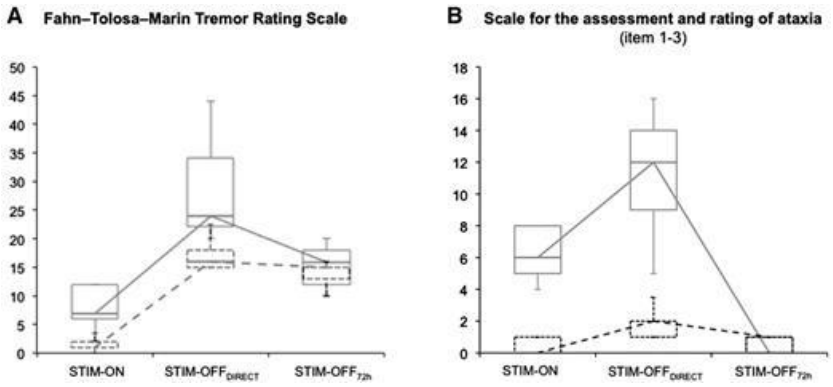


Figure 1 Clinical outcomes. (A) Fahn-Tolosa-Marin Tremor Rating Scale and (B) Assessment and Rating of Ataxia (mean ± SD).

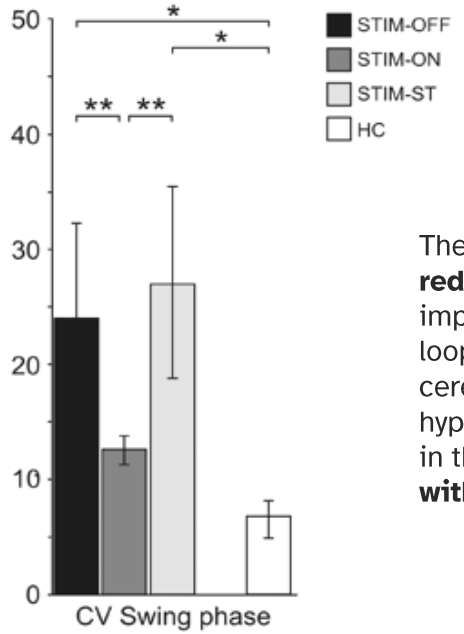


Figure 4 Mean coefficient of variation (CV) of swing phase measured during the tandem gait task.

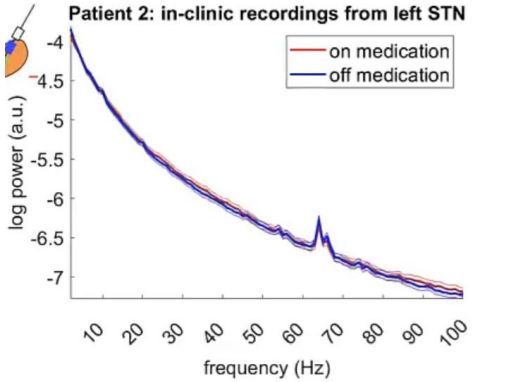
The results of our study suggest **that DBS reduces ataxia** by reducing a functional impairment of the cerebello-cortico-cerebellar loop caused by abnormal entrainment of cerebellar pathways. **Excessive DBS** is hypothesized to disrupt normal neuronal traffic in this loop, **resulting in a return of ataxia without tremor**.

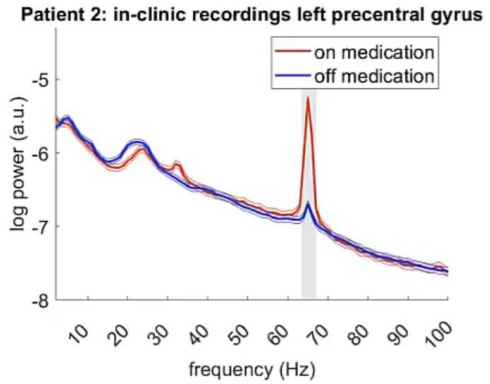
Reich ea., *Brain*, 2016; Fasano ea., *Brain*, 2010

Project idea (currently at UCSF)

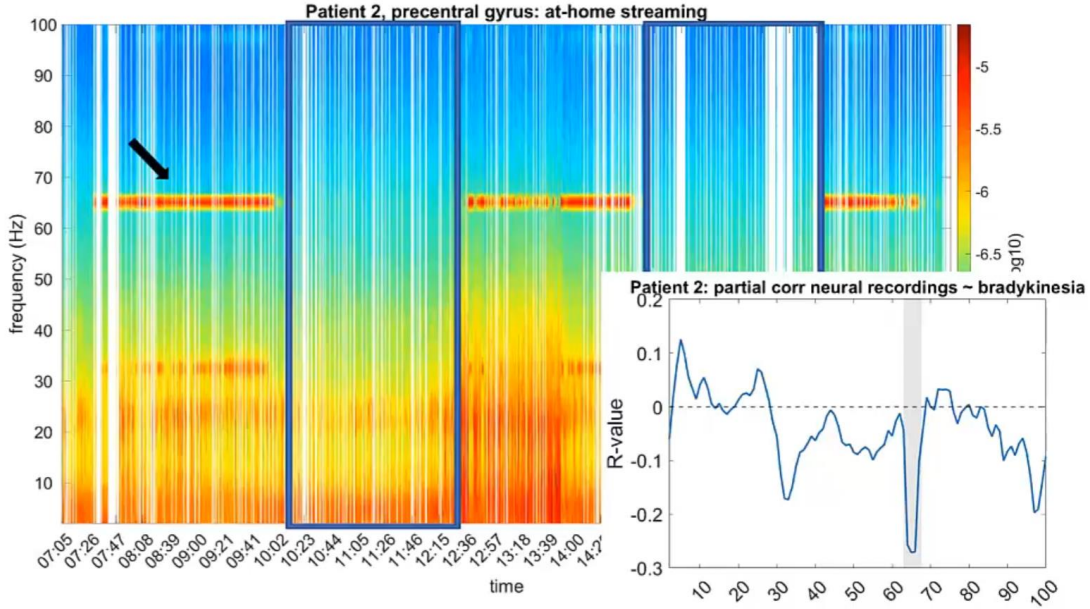
Patient 2: biomarker identification

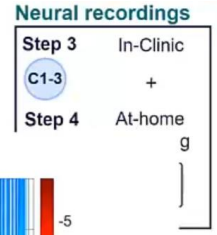
1. In-clinic: med > stim effects





2. At home: check functional relevance of biomarker

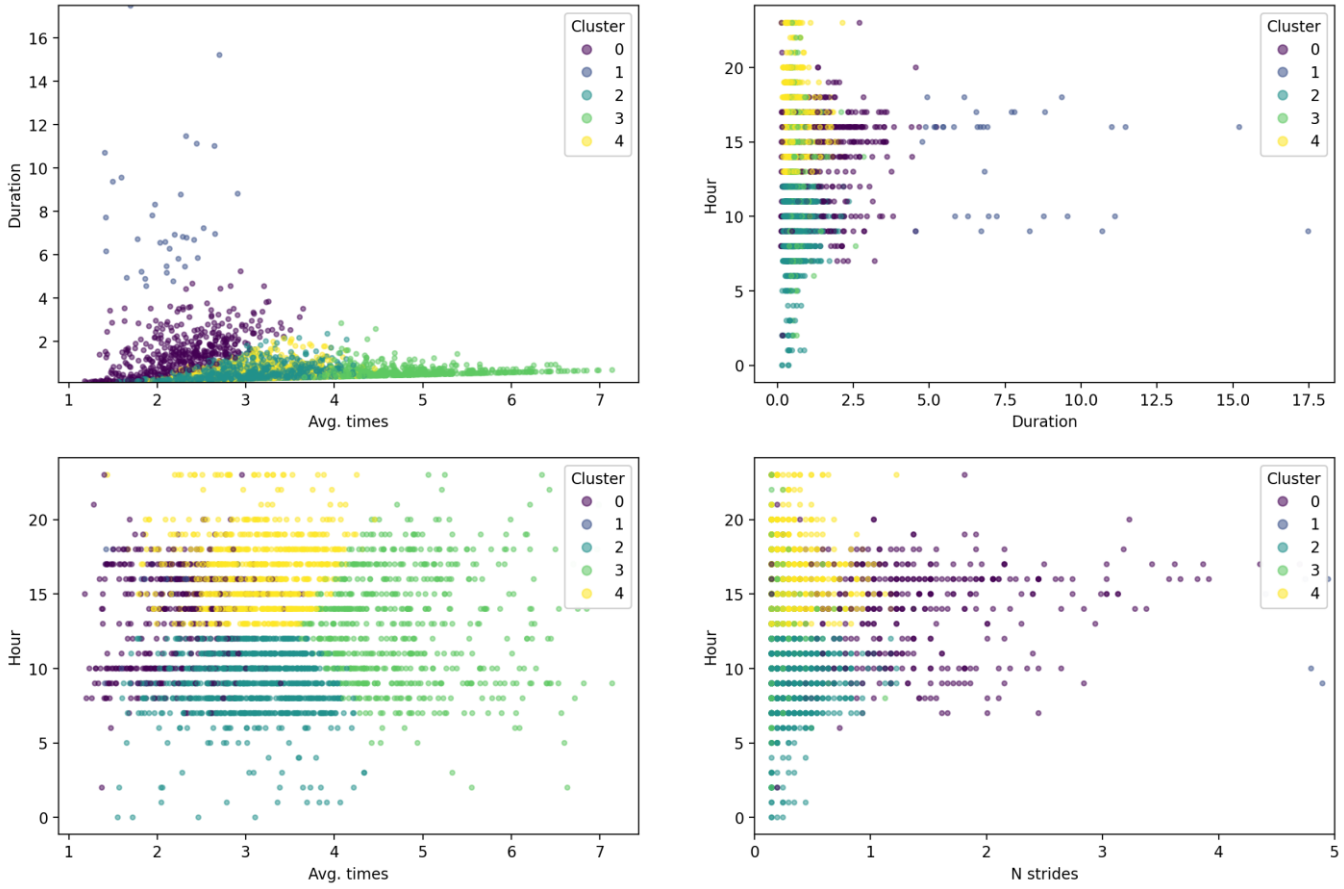


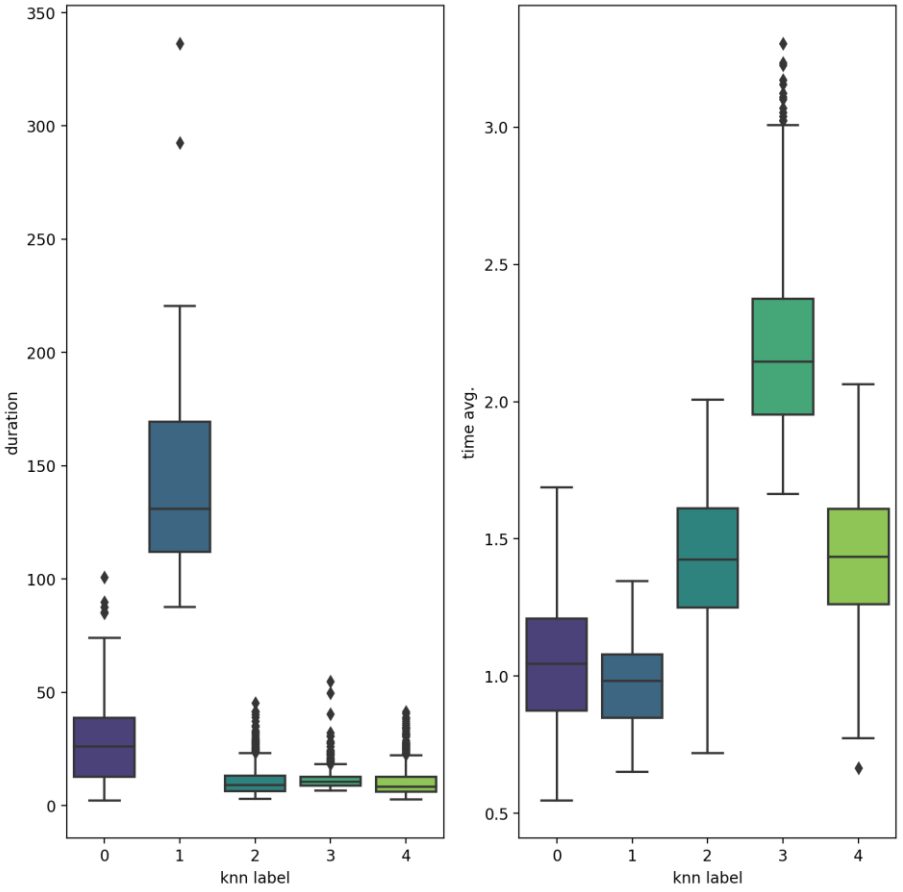


Residual motor symptoms on cDBS:
Bradykinesia and dyskinesia

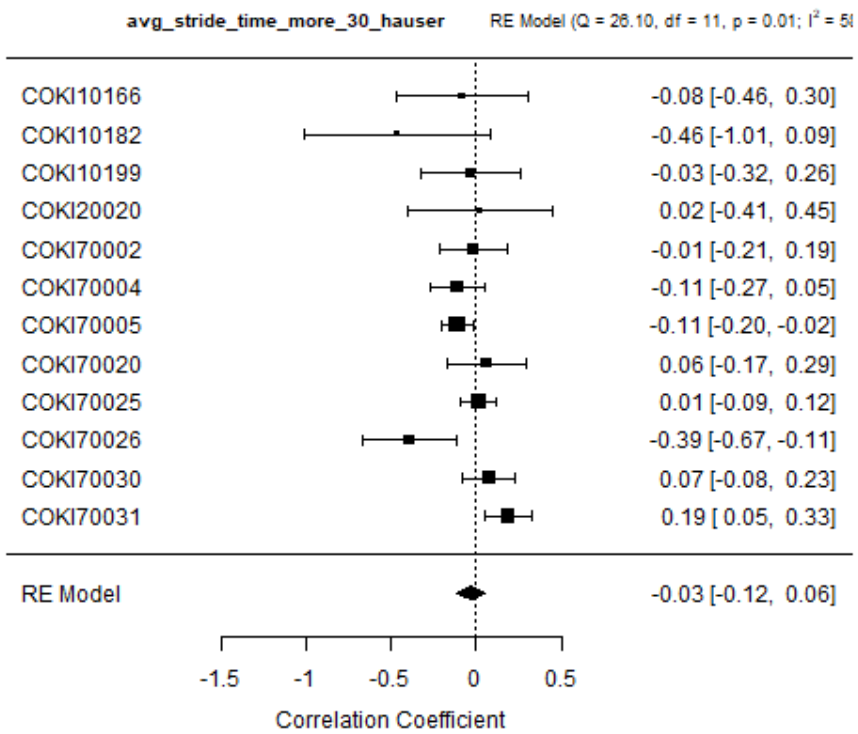
What can we learn from walking bouts?

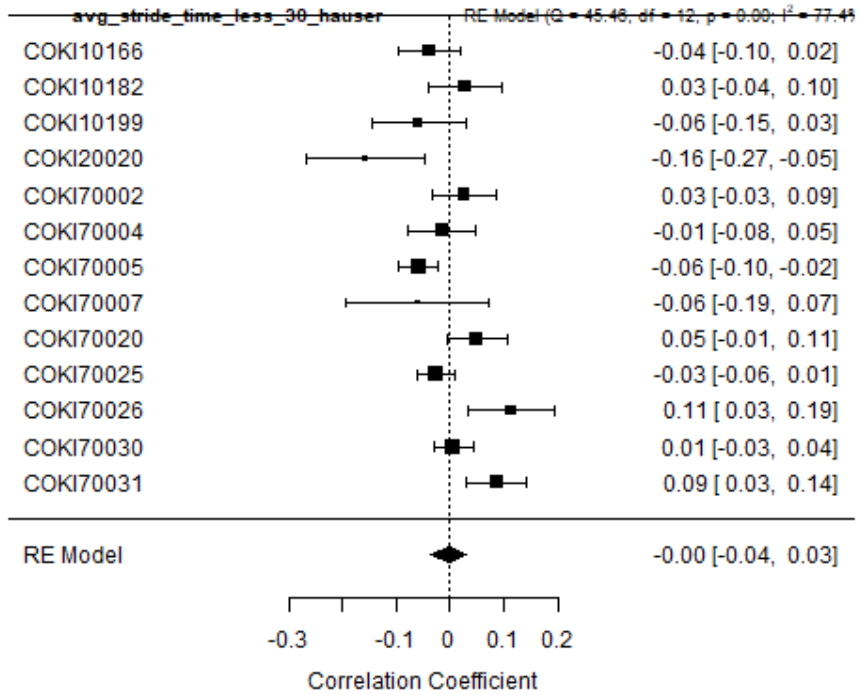
Clustering approach (1 participant)



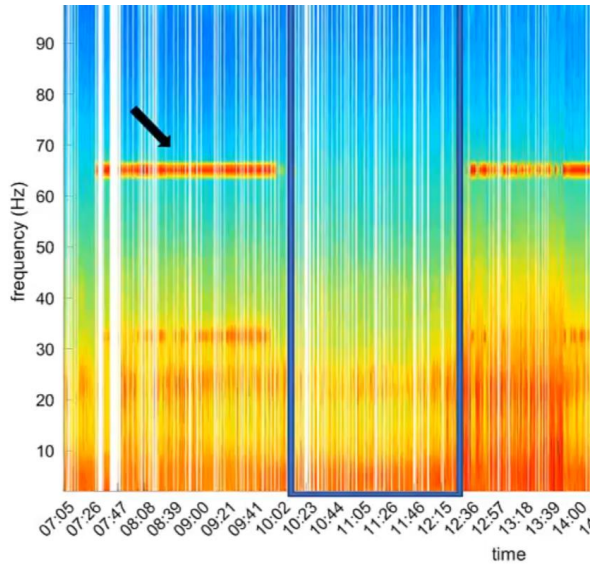


Individual biomarker for aDBS





How?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30
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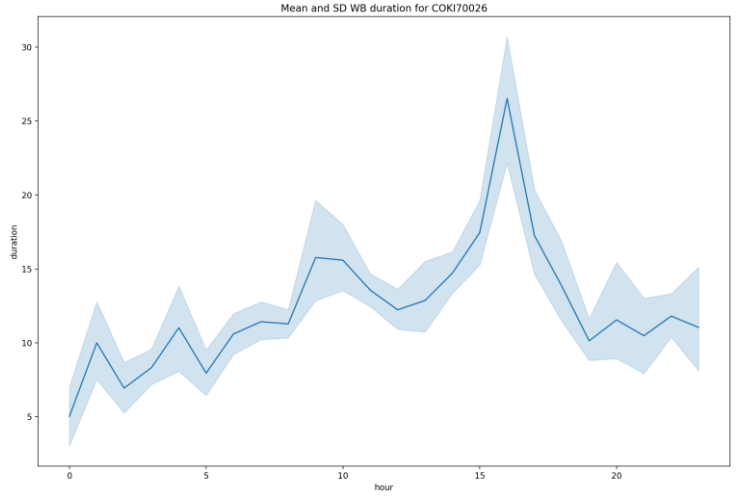
13:18
13:39
14:00
time


Mean and SD WB duration for COKI70026
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10
5
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5
10
15
20
hour