# Running the Equiluminance Data Files to Extract Eye Position

Our dataset is generated using the code in https://github.com/iandol/equiluminance -- this repo contains both the experiment code and analysis code from the paper: https://www.nature.com/articles/s41598-024-51982-z

You need to add the equiluminance github to the MATLAB path and it depends on Opticka https://github.com/iandol/opticka as opticka contains the edfmex loading functions, base classes and other analysis code.

The experiment generates an EDF and MAT file with the same filename. The MAT file specifies all the experiment settings. To load data and run the pupilPower analysis use the `pupilPower` class; the run method will ask for an EDF file, there should be a matching MAT file in the same folder which specified the trial data:

```
p = pupilPower;
```

```
---> pupilPower#13097F5FD: You should REPARSE the data to fully enable this change
calibrateLuminance<1AACF535A> Deleting: 1AACF535A | DELETE Method
```

```
p.run;
```

```
---> stimulusSequence loadobj: Rebuilding  structure...

--->>> LOADING raw EDF data:
Loading:100%
:#: Loading Raw EDF Data took 2.92 secs
Parsing Eyelink Events: [====================] Done. [1 seconds]
Simple Parsing of EDF Trials took 1.04 secs
---> pupilPower FFT calculation took 0.217 secs
```
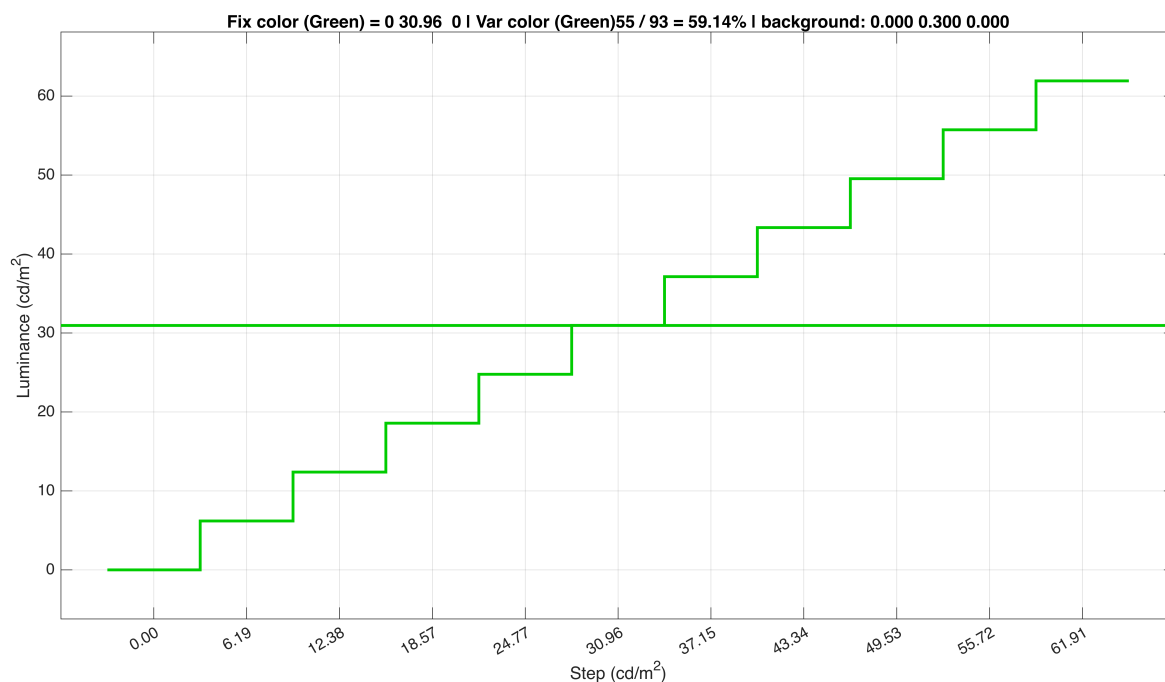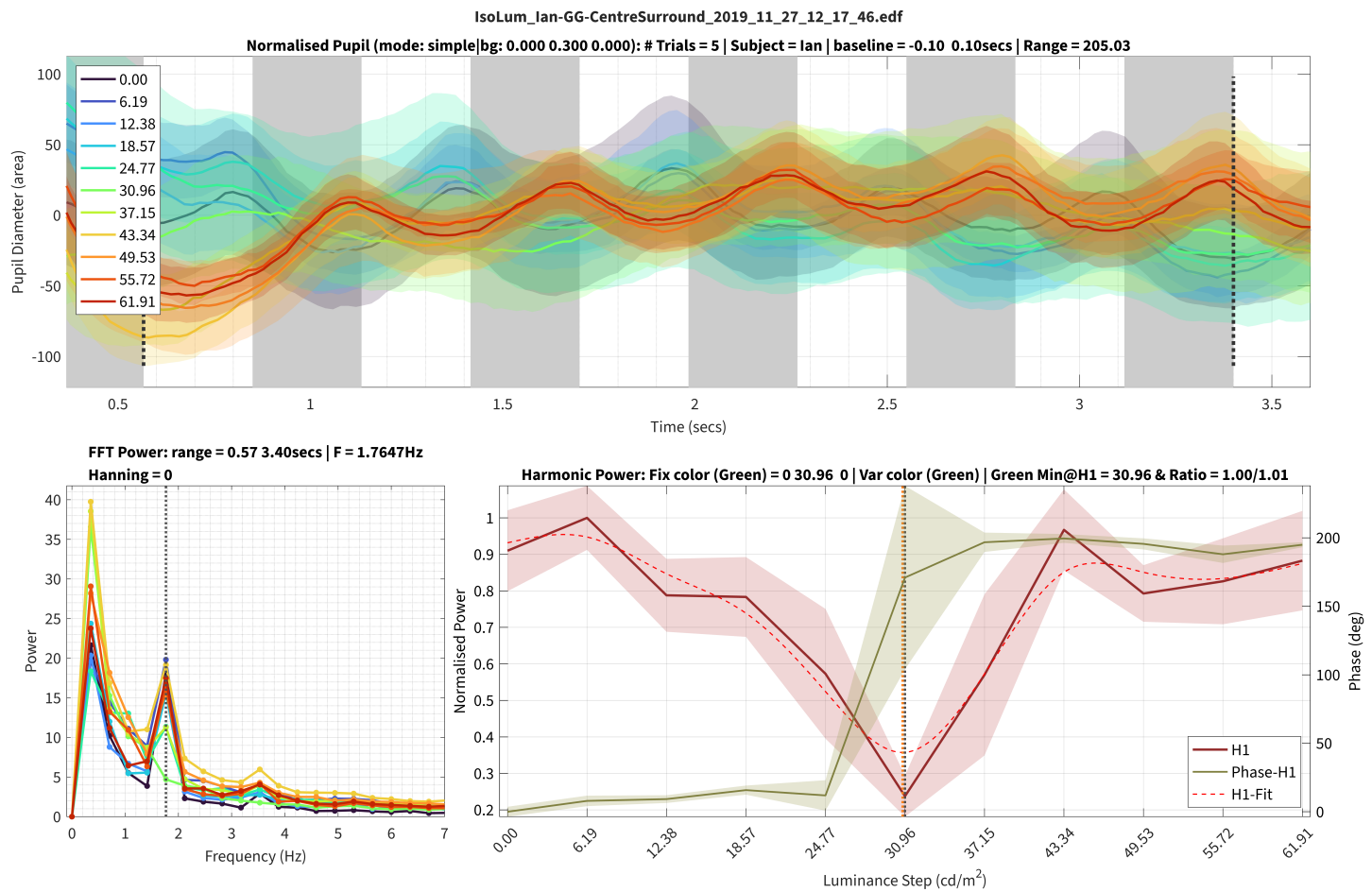


```
        sse: 0.0424
    rsquare: 0.9132
```

```
        dfe: 3.7221
 adjrsquare: 0.7668
       rmse: 0.1068
```

**IsoLum_Ian-GG-CentreSurround_2019_11_27_12_17_46.edf**

**Normalised Pupil (mode: simple|bg: 0.000 0.300 0.000): # Trials = 5 | Subject = Ian | baseline = -0.10  0.10secs | Range = 205.03**

This code loads the EDF and parses it into trials.

# Finding the raw data

You should see the result of the pupilPower analysis as a plot segmented into averaged trials for each luminance used. Each luminance variable has a different oscillation amplitude, choose one with the biggest amplitude. Now pupilPower extracts only the pupil signal locked to stimulus onset, yet the parsed EDF is available in the `pupilData` property:

```
data = p.pupilData; % raw and parsed eyelink data
```

```
---> : You should REPARSE the data to fully enable this change
```

```
disp(data)
```

```
  eyelinkAnalysis with properties:

                      file: 'IsoLum_Ian-GG-CentreSurround_2019_11_27_12_17_46.edf'
                       dir: '/Users/ian/'
     trialStartMessageName: 'TRIALID'
        variableMessageName: 'TRIALID'
```

```
       rtStartMessage: 'END_FIX'
         rtEndMessage: 'END_RT'
      trialEndMessage: 'TRIAL_RESULT'
    rtOverrideMessage: 'SYNCTIME'
   minSaccadeDistance: 1
                 VFAC: 5
               MINDUR: 2
                   tS: [0×0 struct]
     excludeIncorrect: 0
                  ROI: []
                  TOI: []
              verbose: 0
          pixelsPerCm: 27
             distance: 68
           useDiameter: {[0]  [9250]  [8]}
             isParsed: 1
           sampleRate: 1000
                  raw: [0×0 struct]
               trials: [1×93 struct]
                 vars: [1×11 struct]
             trialList: [−10 10 6 3 9 11 7 8 5 2 1 4 3 11 1 6 9 10 7 4 −2 −2 2 8 5 3 4 5 11 −10 −10
              correct: [1×1 struct]
             breakFix: [1×1 struct]
            incorrect: [1×1 struct]
              unknown: [1×1 struct]
              display: [1919 1079]
            otherinfo: [1×1 struct]
          needOverride: 0
              ROIInfo: []
              TOIInfo: []
           validation: [0×0 struct]
                  ppd: 32
               doPlots: 1
       baselineWindow: [−0.2000 0]
         measureRange: [0.5667 3.4002]
            plotRange: [−1.1010 6.5260]
        rootDirectory: ''
                   gd: [0×0 getDensity]
              options: [1×1 struct]
               openUI: 0
                 name: 'eyelinkAnal'
              comment: "** DATE: Wed Nov 27 14:06:05 2019↵** TYPE: EDF_FILE BINARY EVENT SAMPLE TAG
            dateStamp: 02−Oct−2024 12:15:52
                 uuid: '130983459'
                paths: [1×1 struct]
             fullName: 'eyelinkAnal<eyelinkAnalysis#130983459>'
```

```matlab
var1 = data.vars(1); % first varible (in this case luminance)

figure;
t=tiledlayout(2,2);
nexttile(t);
plot(var1.trial(1).times,var1.trial(1).gx);
xlabel('Time (ms)'); ylabel('X Position');grid on;axis tight;
nexttile(t);
plot(var1.trial(1).times,var1.trial(1).gy);
xlabel('Time (ms)'); ylabel('Y Position');grid on; axis tight;
nexttile
plot(var1.trial(1).gx,var1.trial(1).gy);
xlabel('X'); ylabel('Y');grid on; axis tight;
nexttile
plot(var1.trial(1).times,var1.trial(1).pa);
xlabel('Time (ms)'); ylabel('Pupil');grid on; axis tight;
```
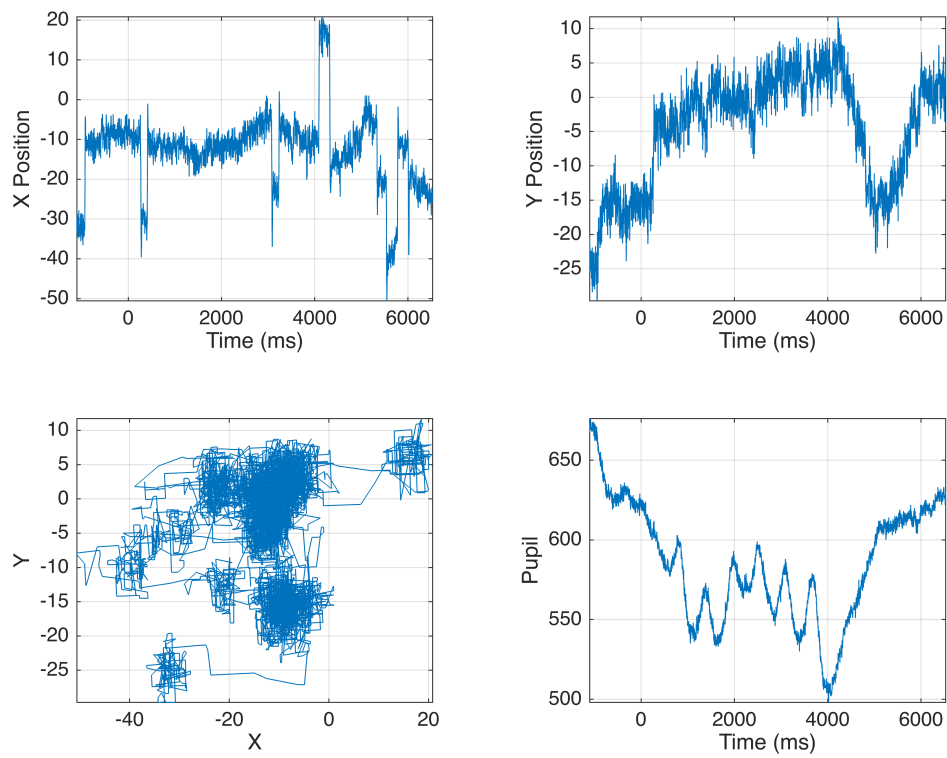
This plots the X and Y data linked to stimulus onset for the first trial of the first variable. The raw trials are in `data.trials` which include all variables and both correct and incorrect trials. `data.vars` should include only correct trials for that variable.