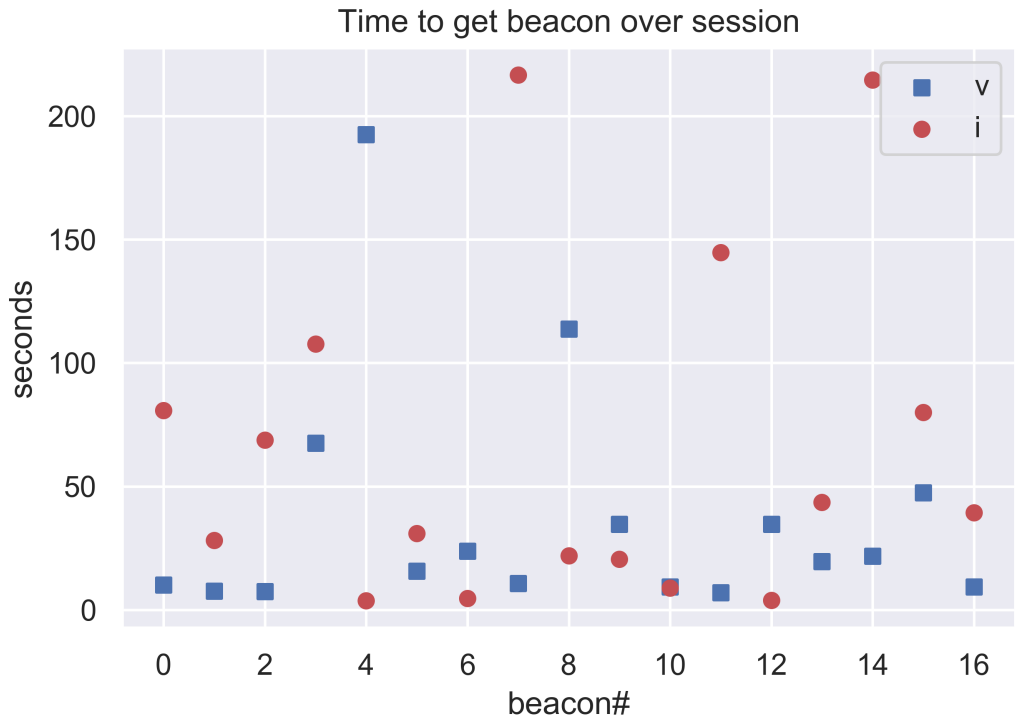
20200428_FS_Scatter_visible_invisible_KDE

May 1, 2020

0.1 This is designded to plot a scatter plot of invistble vs visible ITI to see if there is a large difference

In [166]:
```
fig, ax = plt.subplots(dpi= 500)
diff=np.diff(beacon_Day86_fs2[0])
session = 'FS2_86'
Beacons_vis = list(diff[1::2])
Beacons_invis = list(diff[::2])
time_range = np.arange(0,len(diff)/2)
ax.scatter(time_range,Beacons_vis,s=30, c='b', marker="s")
ax.scatter(time_range,Beacons_invis,s=30, c='r', marker="o")
ax.set_ylabel('seconds')
ax.set_xlabel('beacon#')
ax.set_title('Time to get beacon over session')
ax.legend('vi')
#ax.imshow()
from numpy import cov
from scipy.stats import pearsonr,spearmanr

corr2 = spearmanr(Beacons_vis, Beacons_invis)
correlation = pearsonr (Beacons_vis, Beacons_invis)
covariance = cov(Beacons_vis, Beacons_invis)
print (covariance)
print (correlation)
print (corr2)
```

```
[[2368.41410342 -943.73715931]
 [-943.73715931 4737.63691182]]
(-0.2817353545883915, 0.2732860066366472)
SpearmanrResult(correlation=-0.32843137254901966, pvalue=0.19806893186877195)
```



0.1.1 Now plot it over all sessions not wih group statistics... all individual points

0.1.2 Need to calculate long diff list for each but not everytime visible and invisible.

```
In [176]: visible=[]
          invisible = []
          beacons = [beacon_Day86_fs1,beacon_Day87_fs1,beacon_Day88_fs1,beacon_Day89_fs1,beacon
          # all beacons all animals
          for beacon in beacons:
              diff=np.diff(beacon[0])
              visible.extend(diff[1::2])
              invisible.extend (diff[0::2])

          print (sum(visible))
          print (sum(invisible))

          print ((visible))
          print ((invisible))
```

```
3516.2699999809265
21492.730000019073
[29.420000076293945, 50.80999994277954, 24.730000019073486, 14.429999828338623, 3.600000143051
[43.670000076293945, 26.15999984741211, 45.74000000953674, 104.09000015258789, 5.490000009536
```

0.2 List done, now simple statistics

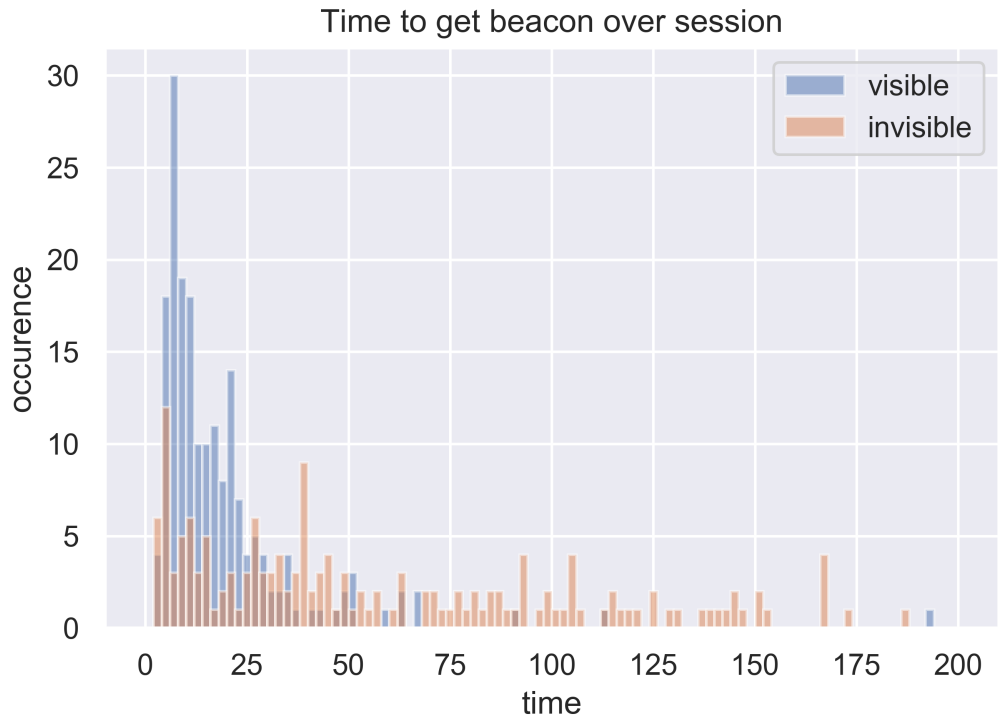
```
In [168]: import scipy
          visible_stats = scipy.stats.describe(visible)
          visible_stats

Out[168]: DescribeResult(nobs=187, minmax=(3.1500000953674316, 192.5899999141693), mean=18.8035

In [177]: invisible_stats = scipy.stats.describe(invisible)
          invisible_stats

Out[177]: DescribeResult(nobs=190, minmax=(3.640000104904175, 1169.2599999904633), mean=113.119
```

1 Covariance and correlations

```
In [170]: x_, y_ = np.array(visible+[18,19,19]), np.array(invisible) # adding means of visible
          x__, y__ = pd.Series(x_), pd.Series(y_)
          cov_matrix = np.cov(x_, y_)
          cov_matrix

Out[170]: array([[  404.42766908,  -285.06729496],
                 [ -285.06729496, 27202.3517048 ]])

In [178]: r, p = scipy.stats.pearsonr(x_, y_)
          r,p

Out[178]: (-0.08594561800502526, 0.23838069168294773)
```

1.1 Plotting the histogram to see differences

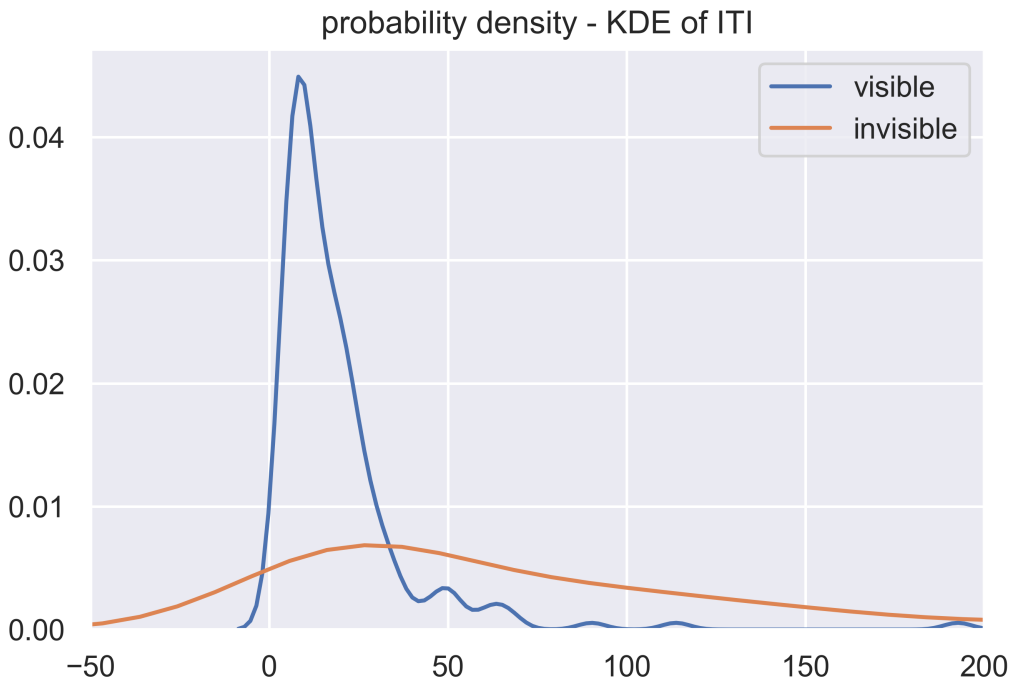
```
In [179]: import scipy.stats as st
          n_bins = 100
          rangehist = (0,200)
          fig, ax = plt.subplots(dpi= 500)
          time_range = np.arange(0,len(diff)/2)
          ax.hist(visible, alpha = .5, bins=n_bins,histtype='bar',range =rangehist, label="visi
          ax.hist(invisible, alpha = .5, bins=n_bins,histtype='bar',range =rangehist,label="inv

          ax.set_ylabel('occurence')
          ax.set_xlabel('time')
          ax.set_title('Time to get beacon over session')
          ax.legend(loc="upper right")

Out[179]: <matplotlib.legend.Legend at 0x25e79e48>
```



2 clearly most ITI visible times are located in first 25 ms, and the invisible distribution has a long tail

2.1 Now look into the KDE plot

```
In [181]: import numpy as np; np.random.seed(10)
          import seaborn as sns; sns.set(color_codes=True)
          plt.figure(dpi=(500))
          ax = sns.kdeplot(visible,label ='visible')
          ax = sns.kdeplot(invisible,label ='invisible')
          ax.set(xlim=(-50, 200))
          ax.set_title('probability density - KDE of ITI')

Out[181]: Text(0.5, 1.0, 'probability density - KDE of ITI')
```



2.2 More covariaces and correlations

```
In [180]: from numpy import cov
          from scipy.stats import pearsonr,spearmanr
          visible_190 = visible+[18,19,19] # suplementing mean for better stats
          corr2 = spearmanr(visible_190, invisible)
          correlation = pearsonr (visible_190, invisible)
          covariance = cov(visible_190, invisible)
          print(corr2,correlation,covariance)
```

```
SpearmanrResult(correlation=-0.20413031735168258, pvalue=0.0047283239286661964) (-0.0859456180
 [ -285.06729496 27202.3517048 ]]
```

2.3 All the imports - need to be ran first

```
In [175]: import pandas as pd
          import matplotlib.pyplot as plt
          import matplotlib as mpl
          import seaborn as sns
          from matplotlib.patches import Circle
          import matplotlib.tri as tri
          import numpy as np
          from scipy.spatial.transform import Rotation as R
```

```
root = 'C:/Users/Fabian/Desktop/Analysis/Multiple_trial_analysis/Data/Raw/'
figures = 'C:/Users/Fabian/Desktop/Analysis/Multiple_trial_analysis/Figures/'

#Data with beacon metadata

beacon_Day86_fs2 = pd.read_csv(root+'beacons 20200128-151826.txt',sep=" ", header=Nor
beacon_Day86_fs1 = pd.read_csv(root+'beacons 20200128-160013.txt',sep=" ", header=Nor

beacon_Day87_fs2 = pd.read_csv(root+'beacons 20200129-153534.txt',sep=" ", header=Nor
beacon_Day87_fs1 = pd.read_csv(root+'beacons 20200129-161806.txt',sep=" ", header=Nor

beacon_Day88_fs2 = pd.read_csv(root+'beacons 20200130-102126.txt',sep=" ", header=Nor
beacon_Day88_fs1 = pd.read_csv(root+'beacons 20200130-111741.txt',sep=" ", header=Nor

beacon_Day89_fs2 = pd.read_csv(root+'beacons 20200130-161126.txt',sep=" ", header=Nor
beacon_Day89_fs1 = pd.read_csv(root+'beacons 20200130-151829.txt',sep=" ", header=Nor

beacon_Day90_fs2 = pd.read_csv(root+'beacons 20200203-154441.txt',sep=" ", header=Nor
beacon_Day90_fs1 = pd.read_csv(root+'beacons 20200203-145842.txt',sep=" ", header=Nor

beacon_Day91_fs2 = pd.read_csv(root+'beacons 20200204-125552.txt',sep=" ", header=Nor
beacon_Day91_fs1 = pd.read_csv(root+'beacons 20200204-133905.txt',sep=" ", header=Nor

beacon_Day92_fs2 = pd.read_csv(root+'beacons 20200205-143220.txt',sep=" ", header=Nor
beacon_Day92_fs1 = pd.read_csv(root+'beacons 20200205-151052.txt',sep=" ", header=Nor

beacon_Day93_fs2 = pd.read_csv(root+'beacons 20200206-133529.txt',sep=" ", header=Nor
beacon_Day93_fs1 = pd.read_csv(root+'beacons 20200206-125706.txt',sep=" ", header=Nor


Day46_fs1 = pd.read_csv(root+'position 20190923-174441.txt',sep=" ", header=None)
Day46_fs2 = pd.read_csv(root+'position 20190923-171112.txt',sep=" ", header=None)
Day47_fs1 = pd.read_csv(root+'position 20191001-112411.txt',sep=" ", header=None)
Day47_fs2 = pd.read_csv(root+'position 20191001-115127.txt',sep=" ", header=None)
Day48_fs1 = pd.read_csv(root+'position 20191002-115000.txt',sep=" ", header=None)
Day48_fs2 = pd.read_csv(root+'position 20191002-111038.txt',sep=" ", header=None)
Day51_fs1 = pd.read_csv(root+'position 20191106-170809.txt',sep=" ", header=None)
Day52_fs2 = pd.read_csv(root+'position 20191107-174215.txt',sep=" ", header=None)
Day52_fs1 = pd.read_csv(root+'position 20191107-183857.txt',sep=" ", header=None)
Day53_fs2 = pd.read_csv(root+'position 20191108-142321.txt',sep=" ", header=None)
Day53_fs1 = pd.read_csv(root+'position 20191108-145125.txt',sep=" ", header=None)
Day66_fs1 = pd.read_csv(root+'position 20191118-161325.txt',sep=" ", header=None)
Day66_fs2 = pd.read_csv(root+'position 20191118-171209.txt',sep=" ", header=None)
Day72_fs1 = pd.read_csv(root+'position 20191127-122008.txt',sep=" ", header=None)
Day72_fs2 = pd.read_csv(root+'position 20191127-132223.txt',sep=" ", header=None)


Day79_fs2 = pd.read_csv(root+'position 20200121-154004.txt',sep=" ", header=None)
```

```
Day79_fs1 = pd.read_csv(root+'position 20200121-161359.txt',sep=" ", header=None)

Day80_fs2 = pd.read_csv(root+'position 20200122-141738.txt',sep=" ", header=None)
Day80_fs1 = pd.read_csv(root+'position 20200122-133022.txt',sep=" ", header=None)

Day81_fs2 = pd.read_csv(root+'position 20200123-141930.txt',sep=" ", header=None)
Day81_fs1 = pd.read_csv(root+'position 20200123-150059.txt',sep=" ", header=None)

Day82_fs2 = pd.read_csv(root+'position 20200124-151642.txt',sep=" ", header=None)
Day82_fs1 = pd.read_csv(root+'position 20200124-160826.txt',sep=" ", header=None)

Day83_fs2 = pd.read_csv(root+'position 20200126-183810.txt',sep=" ", header=None)
Day83_fs1 = pd.read_csv(root+'position 20200126-180200.txt',sep=" ", header=None)

Day84_fs2 = pd.read_csv(root+'position 20200127-205615.txt',sep=" ", header=None)
Day84_fs1 = pd.read_csv(root+'position 20200127-155645.txt',sep=" ", header=None)

Day85_fs2 = pd.read_csv(root+'position 20200128-112255.txt',sep=" ", header=None)
Day85_fs1 = pd.read_csv(root+'position 20200128-104637.txt',sep=" ", header=None)

Day86_fs2 = pd.read_csv(root+'position 20200128-160013.txt',sep=" ", header=None)
Day86_fs1 = pd.read_csv(root+'position 20200128-151826.txt',sep=" ", header=None)

Day87_fs2 = pd.read_csv(root+'position 20200129-153534.txt',sep=" ", header=None)
Day87_fs1 = pd.read_csv(root+'position 20200129-161806.txt',sep=" ", header=None)

Day88_fs2 = pd.read_csv(root+'position 20200130-102126.txt',sep=" ", header=None)
Day88_fs1 = pd.read_csv(root+'position 20200130-111741.txt',sep=" ", header=None)

Day89_fs2 = pd.read_csv(root+'position 20200130-161126.txt',sep=" ", header=None)
Day89_fs1 = pd.read_csv(root+'position 20200130-151829.txt',sep=" ", header=None)

Day90_fs2 = pd.read_csv(root+'position 20200203-154441.txt',sep=" ", header=None)
Day90_fs1 = pd.read_csv(root+'position 20200203-145842.txt',sep=" ", header=None)

Day91_fs2 = pd.read_csv(root+'position 20200204-125552.txt',sep=" ", header=None)
Day91_fs1 = pd.read_csv(root+'position 20200204-133905.txt',sep=" ", header=None)

Day92_fs2 = pd.read_csv(root+'position 20200205-143220.txt',sep=" ", header=None)
Day92_fs1 = pd.read_csv(root+'position 20200205-151052.txt',sep=" ", header=None)

Day93_fs2 = pd.read_csv(root+'position 20200206-133529.txt',sep=" ", header=None)
Day93_fs1 = pd.read_csv(root+'position 20200206-125706.txt',sep=" ", header=None)
```

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