In [2]:
```
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# %matplotlib inline
import scipy.stats
from scipy.stats import norm, binom, poisson
from dtaidistance import dtw

import json
```

Different position of the sun

- right
- behind
- left
- front

Layered folders, parse into 2d lists of dicts

In [7]:
```
import os

txt_lists = [[], [], [], []]

for root, dirs, files in os.walk("./Simulations_Sun_Azimuth/route_highway_epoch24_clear-sunset-right"):
    for file in files:
        if file.endswith(".txt"):
             with open(os.path.join(root, file), encoding = 'utf-8') as f:
                read_string = f.read()
                json_object = json.loads(read_string)
                txt_lists[0].append(json_object)

for root, dirs, files in os.walk("./Simulations_Sun_Azimuth/route_highway_epoch24_clear-sunset-behind"):
    for file in files:
        if file.endswith(".txt"):
             with open(os.path.join(root, file), encoding = 'utf-8') as f:
                read_string = f.read()
                json_object = json.loads(read_string)
                txt_lists[1].append(json_object)
```

```
for root, dirs, files in os.walk("./Simulations_Sun_Azimuth/route_highway_epoch24_clear-sunset-left"):
    for file in files:
        if file.endswith(".txt"):
             with open(os.path.join(root, file), encoding = 'utf-8') as f:
                read_string = f.read()
                json_object = json.loads(read_string)
                txt_lists[2].append(json_object)

for root, dirs, files in os.walk("./Simulations_Sun_Azimuth/route_highway_epoch24_clear-sunset-front"):
    for file in files:
        if file.endswith(".txt"):
             with open(os.path.join(root, file), encoding = 'utf-8') as f:
                read_string = f.read()
                json_object = json.loads(read_string)
                txt_lists[3].append(json_object)
```

Examining results

In [8]:
```
count_array = []
for txt_list in txt_lists:
    count = 0
    for txt in txt_list:
        if txt['_checkpoint']['records'][0]['status'] == 'Completed':
            count += 1
    count_array.append(count/50)

print(count_array)
```

```
[1.0, 1.0, 1.0, 1.0]
```

In [14]:
```
count_array = []
outOfLane_array = []
for txt_list in txt_lists:
    count = 0
    outOfLane = 0
    for txt in txt_list:
        count += txt['_checkpoint']['records'][0]['scores']['score_route']
        if not txt['_checkpoint']['records'][0]['infractions']['outside_route_lanes']:
                outOfLane += 1
    count_array.append(count/50)
    outOfLane_array.append(outOfLane/50)
print(count_array, outOfLane_array)
```

```
[100.0, 100.0, 100.0, 100.0] [1.0, 1.0, 1.0, 1.0]
```

Setting up into 2d lists of DataFrames

In [34]:
```
dim = (4, 50)
df_array = np.ndarray(dim, dtype=object)
```

In [85]:
```
dir_path = './Simulations_Sun_Azimuth'

# list to store files
res = []
count = 0

# Iterate directory
for path in os.listdir(dir_path):
    # check if current path is a file

#     print(path)
    if not os.path.isfile(os.path.join(dir_path, path)):
        folder_list = []
        for folder in os.listdir(os.path.join(dir_path, path)):
            folder_list.append(folder)
        folder_list.sort()
#         print(folder_list)
        for i in range(len(folder_list)):
            folder = folder_list[i]
            temp = os.path.join(os.path.join(dir_path, path), folder)
            file_array = []
            for file in os.listdir(temp):
                file_array.append(file)
            file_array.sort()
            df = pd.DataFrame()
            for file in file_array:
                if "_ctl.csv" in file:
                    df = pd.read_csv(temp + '/' + file)
                elif "_cvip.csv" in file:
                    df = pd.concat([df, pd.read_csv(temp + '/' + file)], axis=1)
                elif "_traj.csv" in file:
                    df = pd.concat([df, pd.read_csv(temp + '/' + file)], axis=1)
            df_array[count][i%50]=df
    count += 1
```

In [36]:
```
legend = ['behind', 'front', 'left', 'right']
```

In [37]:
```
df_array[3][49]
```

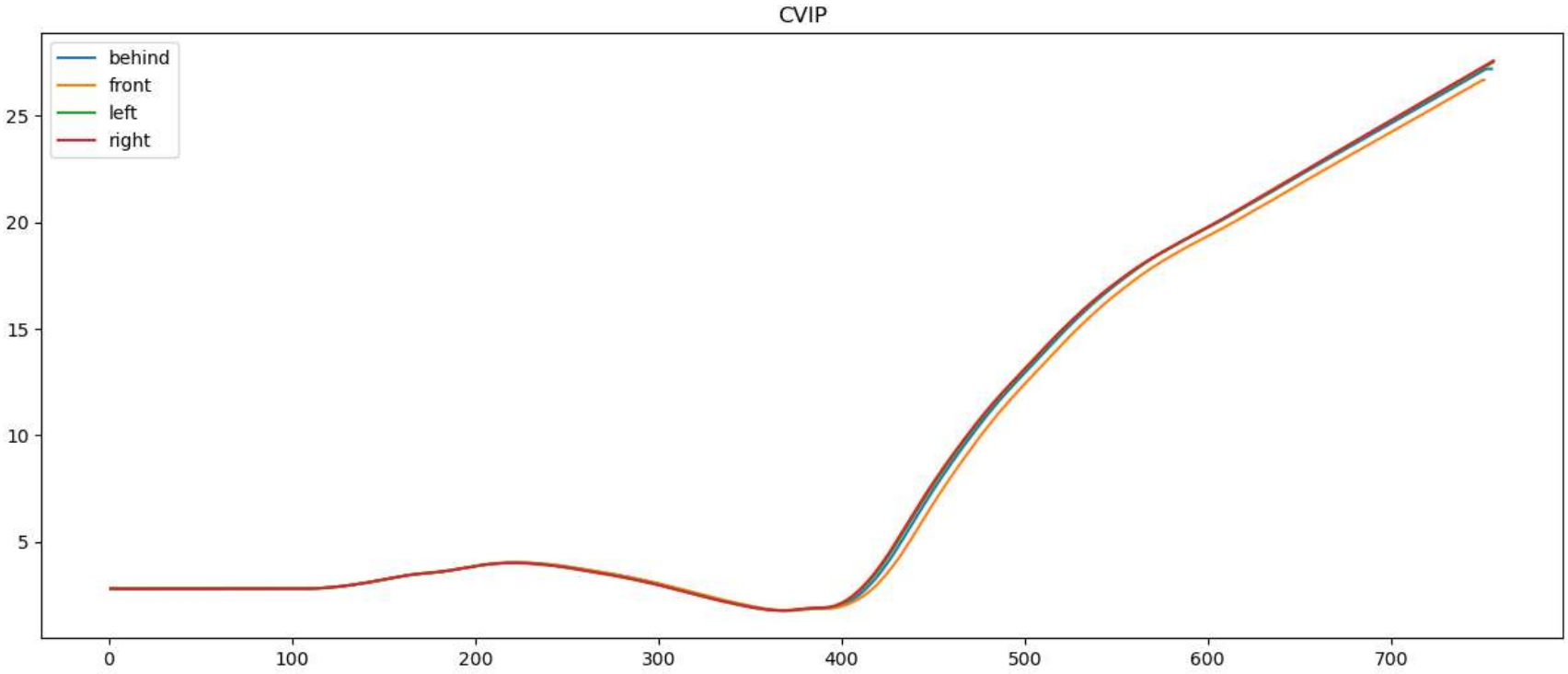
Out[37]:

	ts	agent_id	throttle	steer	brake	ts	agent_id	cvip	cvip_x	cvip_y	cvip_z	ts	agent_id	
0	462340	0	0.900000	-0.010153	0.0	462340	0	500.491189	198.767441	-95.832657	-499.819366	462340	0	192
1	462341	0	0.900000	-0.000256	0.0	462341	0	5.595580	195.567444	-90.832657	0.100000	462341	0	192
2	462342	0	0.900000	-0.011467	0.0	462342	0	5.592365	195.567444	-90.832657	0.095407	462342	0	192
3	462343	0	0.900000	-0.005085	0.0	462343	0	5.589578	195.567444	-90.832657	0.084691	462343	0	192
4	462344	0	0.900000	0.000549	0.0	462344	0	5.587154	195.567444	-90.832657	0.069311	462344	0	192
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
752	463092	0	0.489402	-0.001344	0.0	463092	0	54.806424	192.563019	97.781723	0.001830	463092	0	193
753	463093	0	0.495243	-0.001923	0.0	463093	0	54.905613	192.558350	98.114845	0.001836	463093	0	193
754	463094	0	0.478484	-0.001697	0.0	463094	0	55.004119	192.553375	98.447456	0.001843	463094	0	193
755	463095	0	0.461957	-0.002489	0.0	463095	0	55.102002	192.548126	98.779610	0.001849	463095	0	193
756	463096	0	0.466184	-0.001888	0.0	463096	0	55.199272	192.542572	99.111313	0.001854	463096	0	193

757 rows × 17 columns

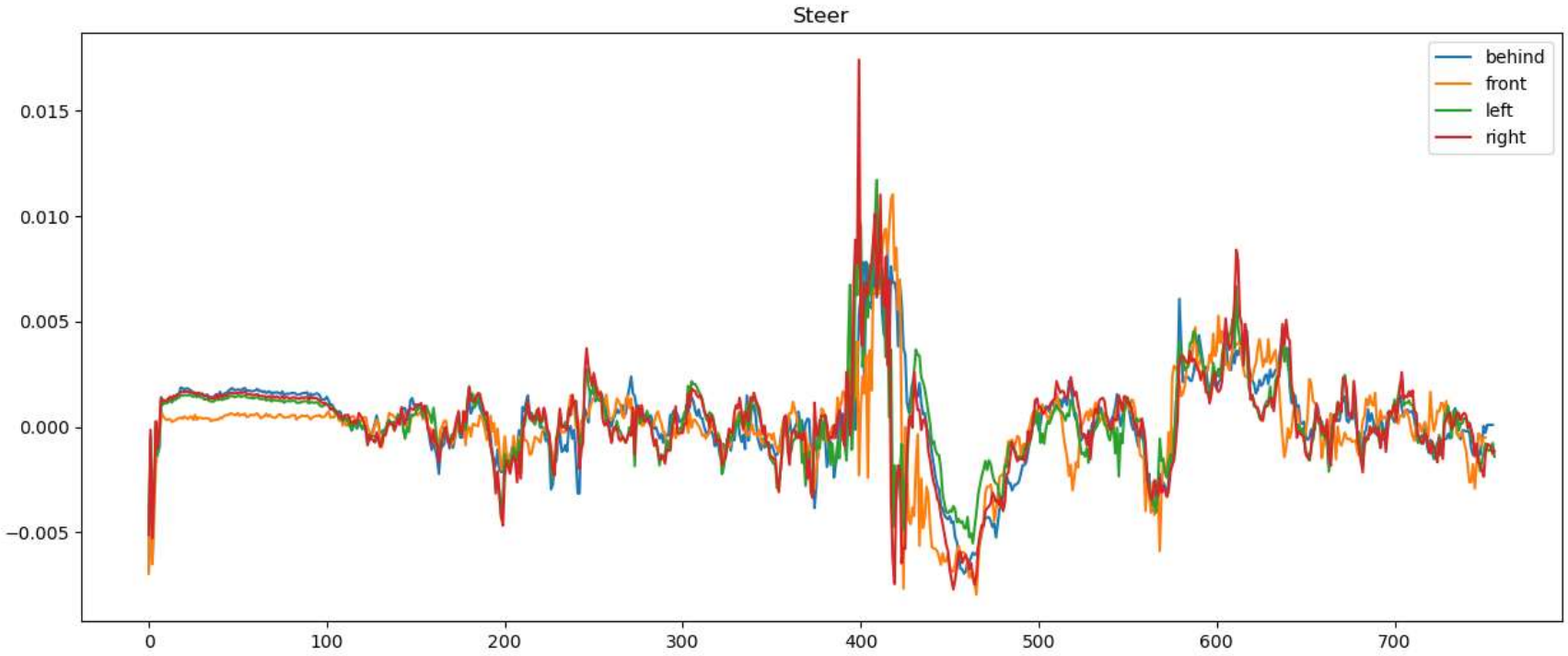
Since no accident, check cvip

In [82]:
```
df_cvip_avg_dict = {}
for weather in range(4):
    df_avg = df_array[weather][0]['cvip']
    for i in range(1, len(df_array[weather])):
        df_avg += df_array[weather][i]['cvip']
    df_avg = df_avg.interpolate().dropna()/100
    df_cvip_avg_dict.update({legend[weather]: df_avg.copy()})
    df_avg = df_avg[1:]
    df_avg.plot(figsize=(15, 6))
    plt.legend(legend)
    plt.title("CVIP")
plt.show()
```

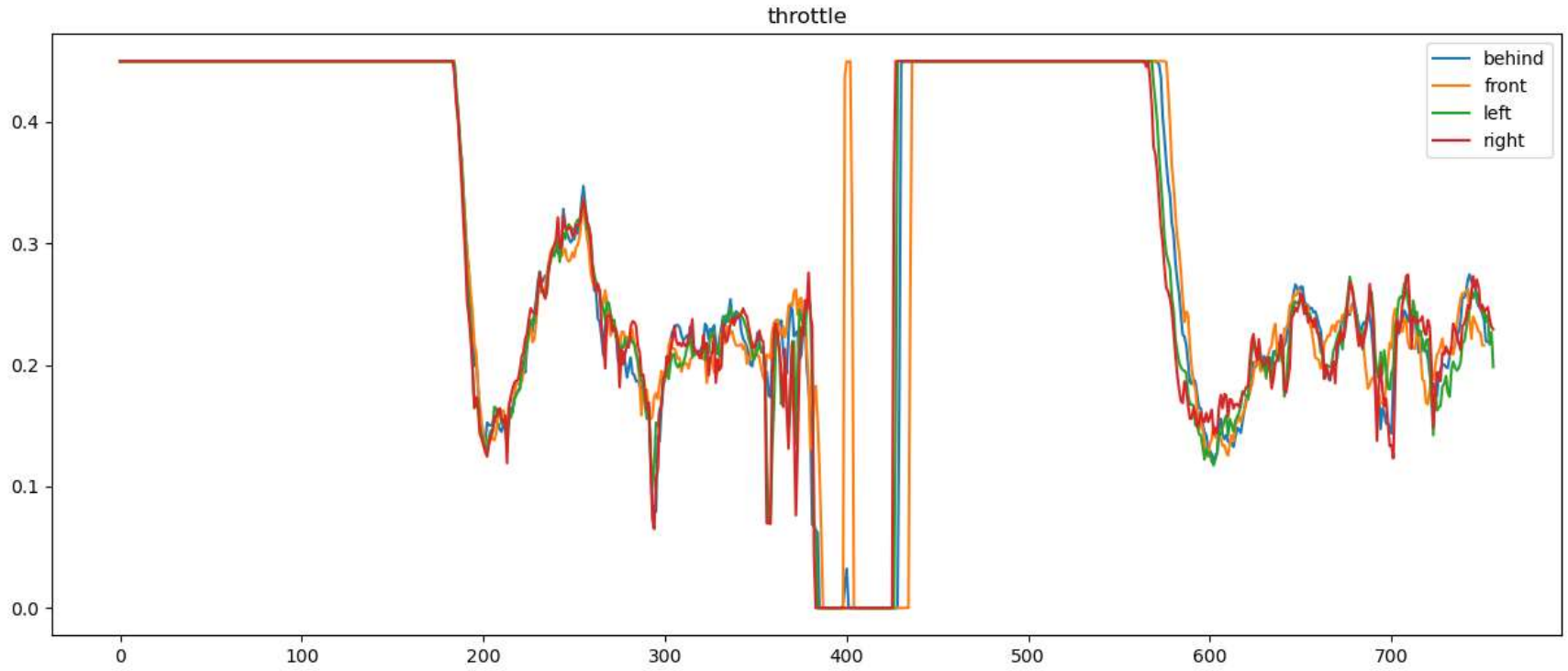


In [83]:

```
df_steer_avg_dict = {}
for weather in range(4):
    df_avg = df_array[weather][0]['steer']
    for i in range(1, len(df_array[weather])):
        df_avg += df_array[weather][i]['steer']
    df_avg = df_avg.interpolate().dropna()/100
    df_steer_avg_dict.update({legend[weather]: df_avg.copy()})
    df_avg.plot(figsize=(15, 6))
    df_avg = df_avg[1:]
    plt.legend(legend)
    plt.title("Steer")
plt.show()
```

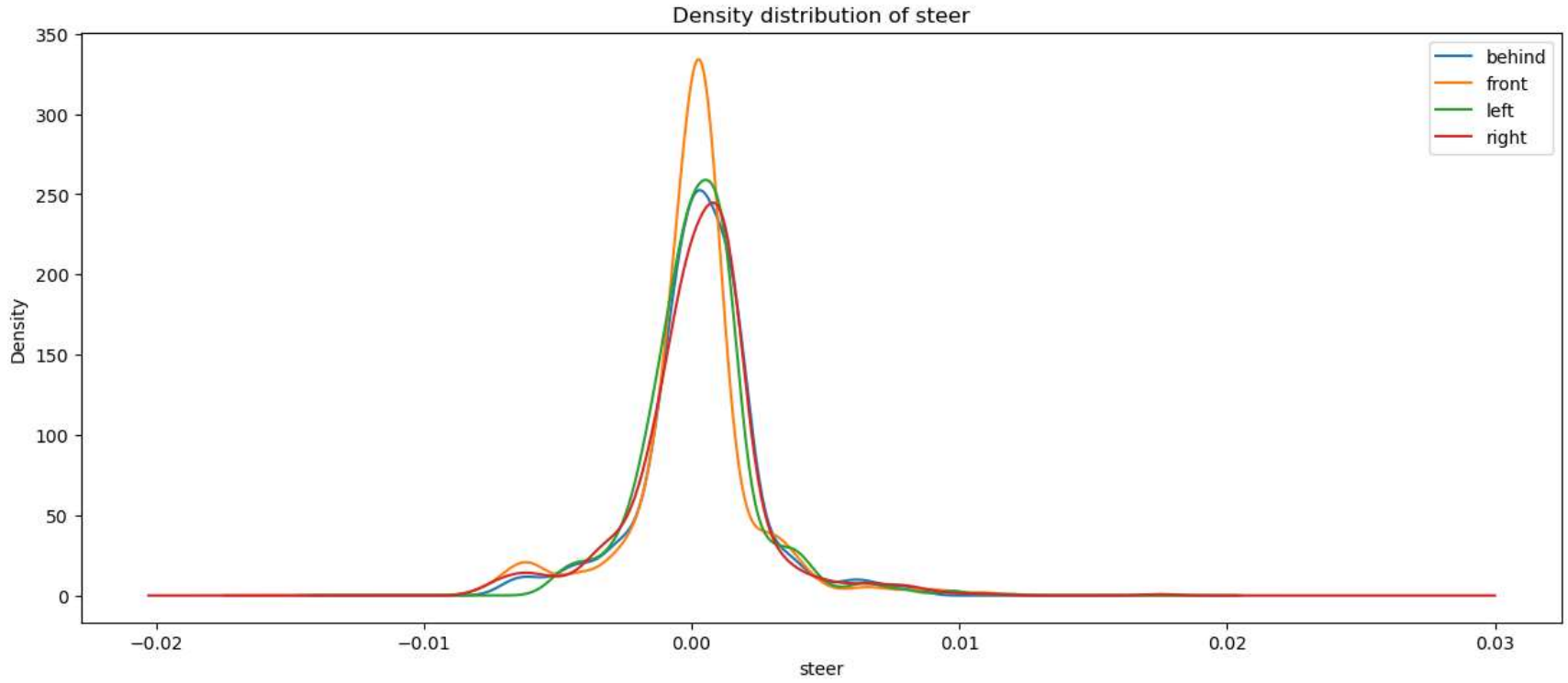


In [84]:
```
df_throttle_avg_dict = {}
for weather in range(4):
    df_avg = df_array[weather][0]['throttle']
    for i in range(1, len(df_array[weather])):
        df_avg += df_array[weather][i]['throttle']
    df_avg = df_avg.interpolate().dropna()/100
    df_throttle_avg_dict.update({legend[weather]: df_avg.copy()})
    df_avg.plot(figsize=(15, 6))
    df_avg = df_avg[1:]
    plt.legend(legend)
    plt.title("throttle")
plt.show()
```



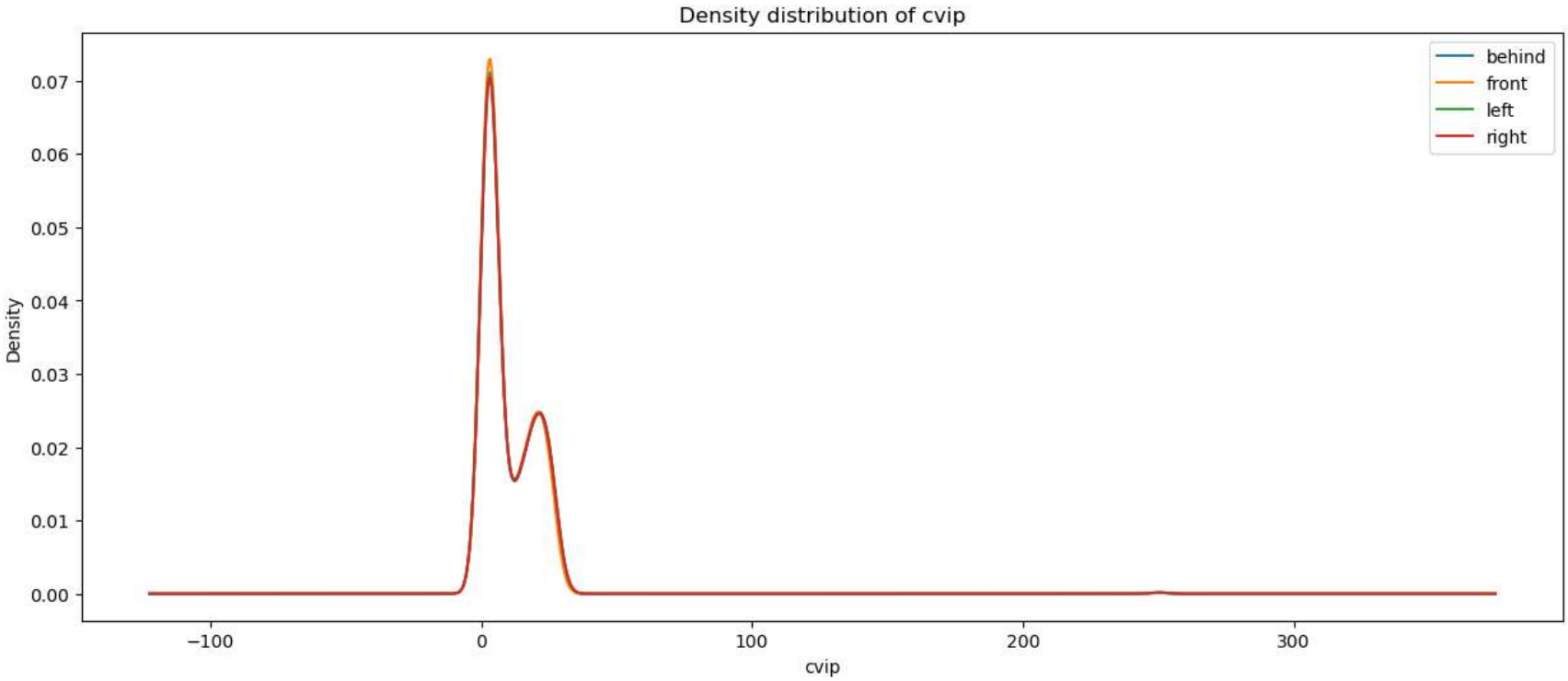
In [78]:
```
fig = plt.figure(figsize=(15, 6))

for i in legend:
    df_steer_avg_dict[i].plot.density()
plt.xlabel("steer")
plt.title('Density distribution of steer')
plt.legend(legend)
plt.show()
```



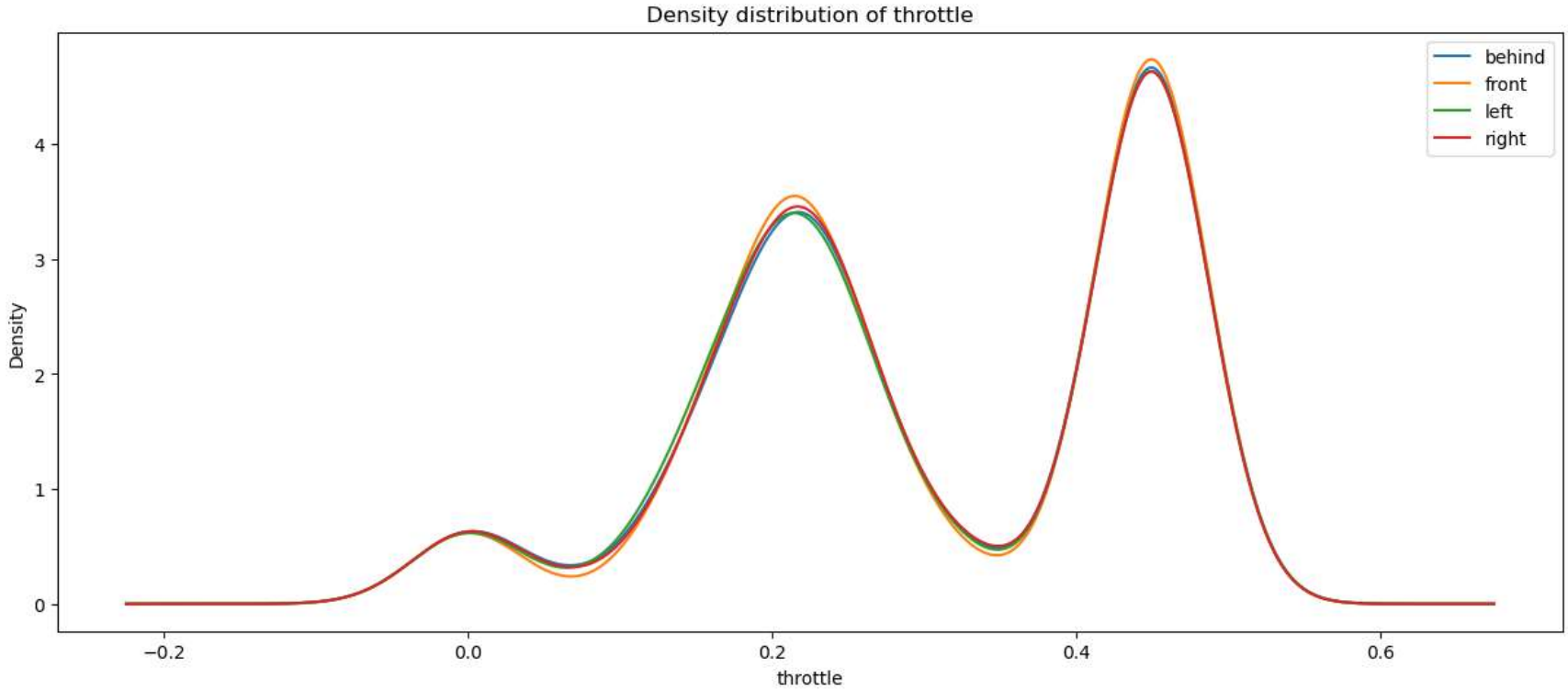
In [79]:
```
fig = plt.figure(figsize=(15, 6))

for i in legend:
    df_cvip_avg_dict[i].plot.density()
plt.xlabel("cvip")
plt.title('Density distribution of cvip')
plt.legend(legend)
plt.show()
```



In [80]:
```
fig = plt.figure(figsize=(15, 6))

for i in legend:
    df_throttle_avg_dict[i].plot.density()
plt.xlabel("throttle")
plt.title('Density distribution of throttle')
plt.legend(legend)
plt.show()
```


Density distribution of throttle
behind
front
left
right
Density
0
1
2
3
4
−0.2
0.0
0.2
0.4
0.6
throttle