MEALOR_TD_tomo-v2

August 25, 2023

[1]:
```
import pandas as pd
import numpy as np
from glob import glob
import os
import matplotlib.pylab as plt
```

0.1 Load data

[2]:
```
# Enter your data folder path location
data_folder = "."
```

[3]:
```
data_csv_ech = sorted(glob(os.path.join(data_folder,"tptomo_*_surface.csv")))
data_csv_cav = sorted(glob(os.path.join(data_folder,"tptomo_*_cavites.csv")))
data_ech = [pd.read_csv(d) for d in data_csv_ech]
data_cav = [pd.read_csv(d) for d in data_csv_cav]
```

[4]:
```
centers = np.array([len(d)/2 for d in data_ech])
centers
```

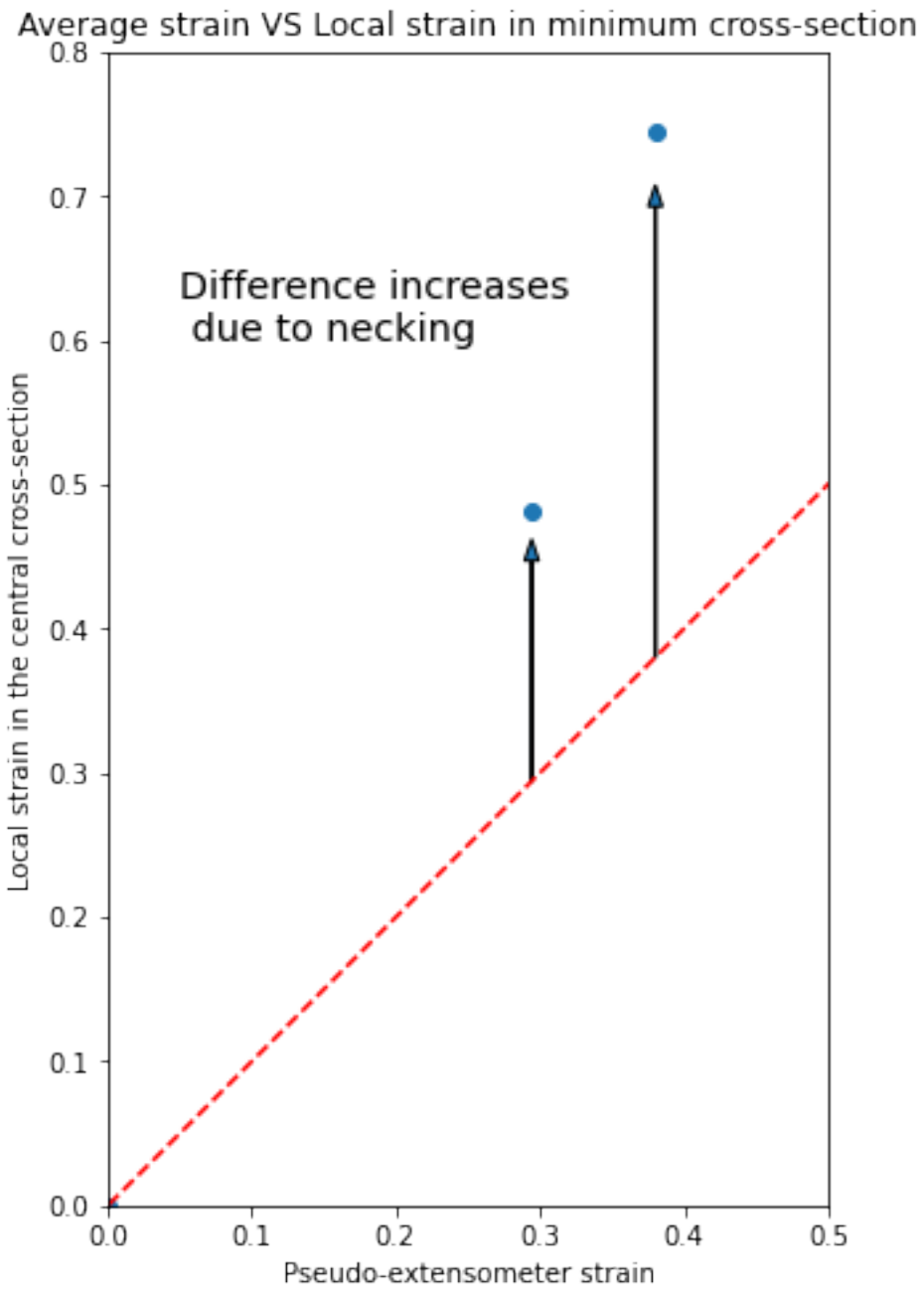
[4]:
```
array([320. , 429.5, 468. ])
```

0.2 Strain

[5]:
```
l_0 = np.array([len(d.iloc[:,1]) for d in data_ech])
s_0 = np.array([d.iloc[:,1].min() for d in data_ech])
strain_average = np.log(l_0/l_0[0])
strain_local = np.log(s_0[0]/s_0)
print("Strain:")
print("      scan:   01    06    13")
print(" - average:", np.round(strain_average, 3))
print(" -   local:", np.round(strain_local, 3))
```

```
Strain:
      scan:   01    06    13
 - average: [0.    0.294 0.38 ]
 -   local: [0.    0.481 0.744]
```

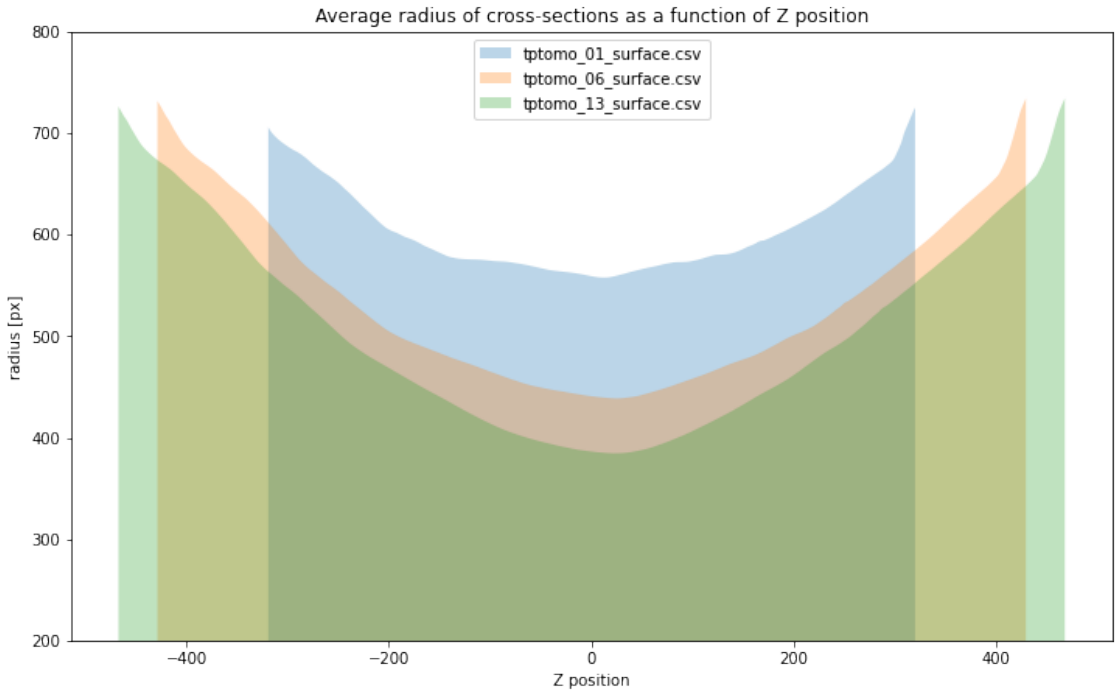
[6]:
```
plt.figure(figsize=(12,8))
plt.scatter(strain_average, strain_local)

plt.arrow(strain_average[1], strain_average[1], 0, 0.
 ↪9*(strain_local[1]-strain_average[1]), head_width=0.01,␣
 ↪length_includes_head=True)
plt.arrow(strain_average[2], strain_average[2], 0, 0.
 ↪9*(strain_local[2]-strain_average[2]), head_width=0.01,␣
 ↪length_includes_head=True)

plt.text(0.05, 0.6, "Difference increases\n due to necking", fontsize="x-large")

plt.plot([-0.1, 1], [-0.1, 1], '--r')
plt.gca().set_aspect('equal')
plt.xlim([-0., 0.5])
plt.ylim([-0., 0.8])

plt.title('Average strain VS Local strain in minimum cross-section')
plt.xlabel('Pseudo-extensometer strain')
plt.ylabel('Local strain in the central cross-section')
plt.show()
```



0.3 cross section profile

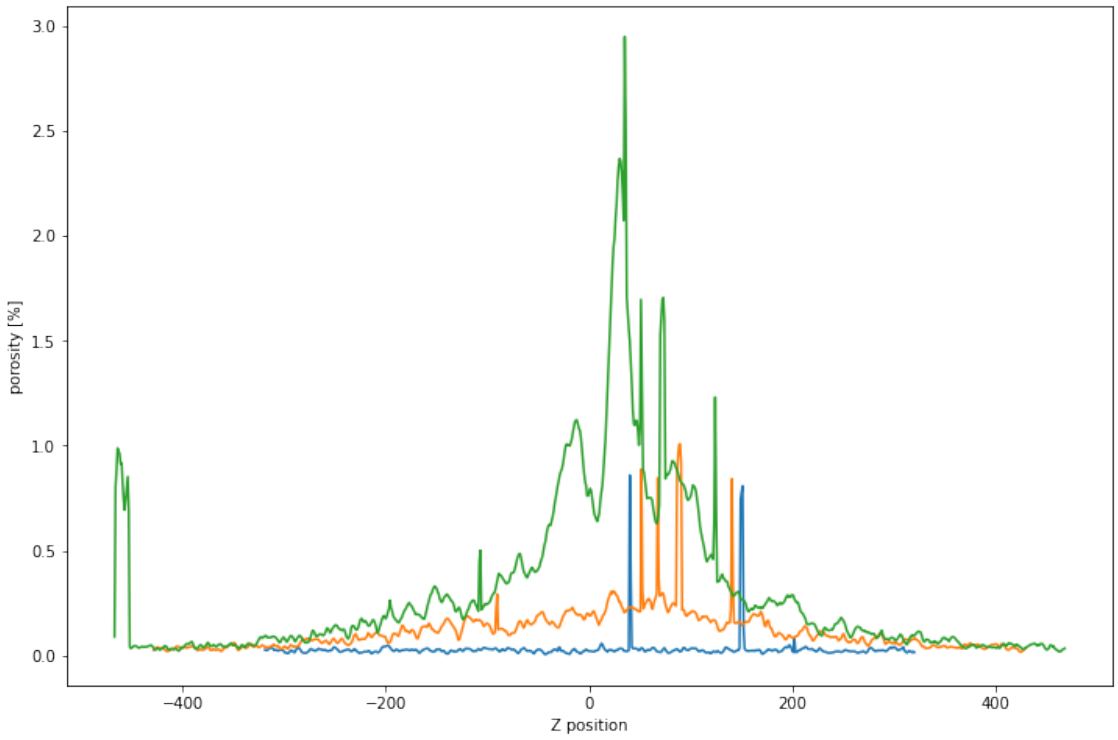
[7]:
```
plt.figure(figsize=(12,8))
for d, t in zip(data_ech, data_csv_ech):
    x, y = d.iloc[:,0], d.iloc[:,1]
    plt.fill_between(x-len(x)/2, np.sqrt(y/np.pi), label=t.split("/")[-1],␣
 ↪alpha=.3)
```

```
plt.ylim([200, 800])
plt.gca().set_aspect('equal')
plt.legend(loc='upper center')
plt.title('Average radius of cross-sections as a function of Z position')
plt.xlabel("Z position")
plt.ylabel("radius [px]")
plt.show()
```



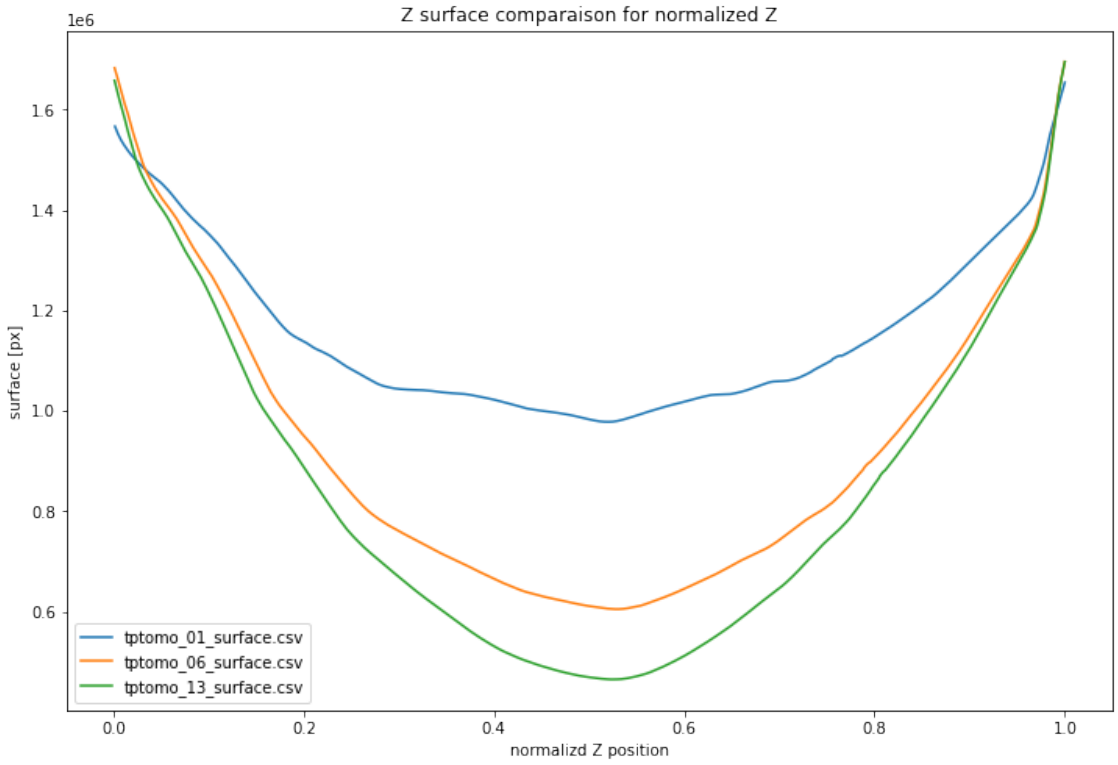
0.4 Density

[8]:
```
plt.figure(figsize=(12,8))
for i in range(3):
    x_e, y_e = data_ech[i].iloc[:,0], data_ech[i].iloc[:,1]
    x_c, y_c = data_cav[i].iloc[:,0], data_cav[i].iloc[:,1]
    plt.plot(x_e-centers[i], y_c/y_e*100)

plt.xlabel("Z position")
plt.ylabel("porosity [%]")
plt.show()
```

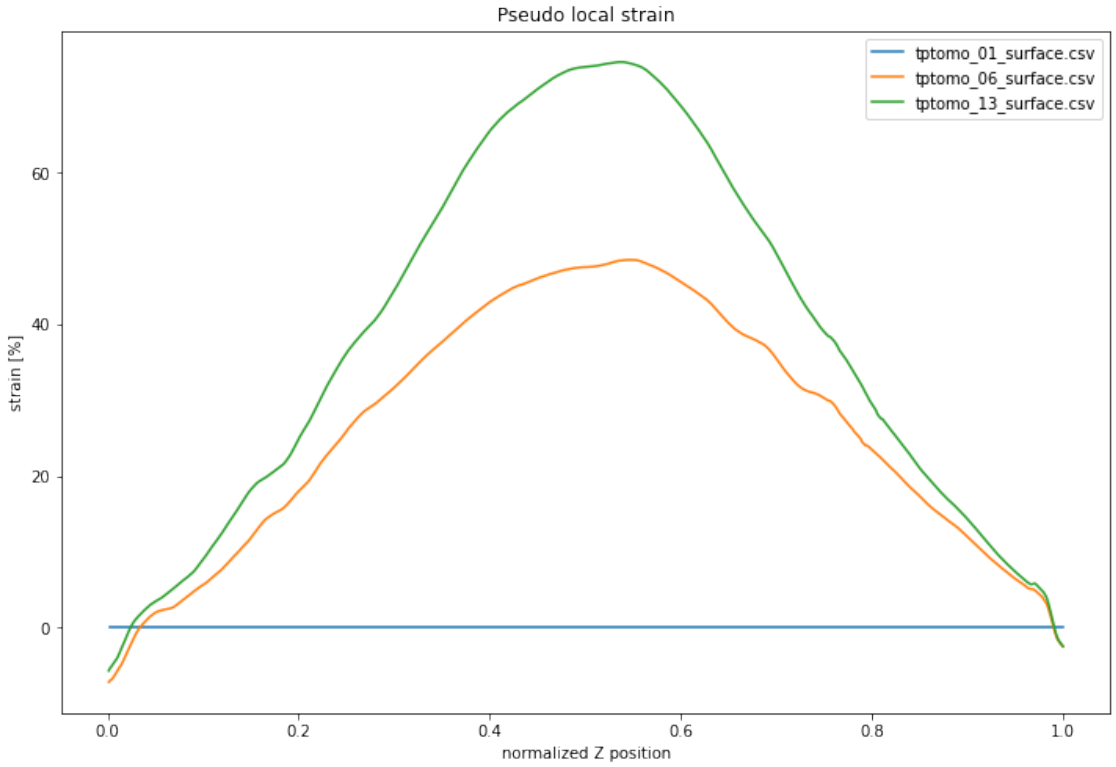


0.5 pseudo local strain

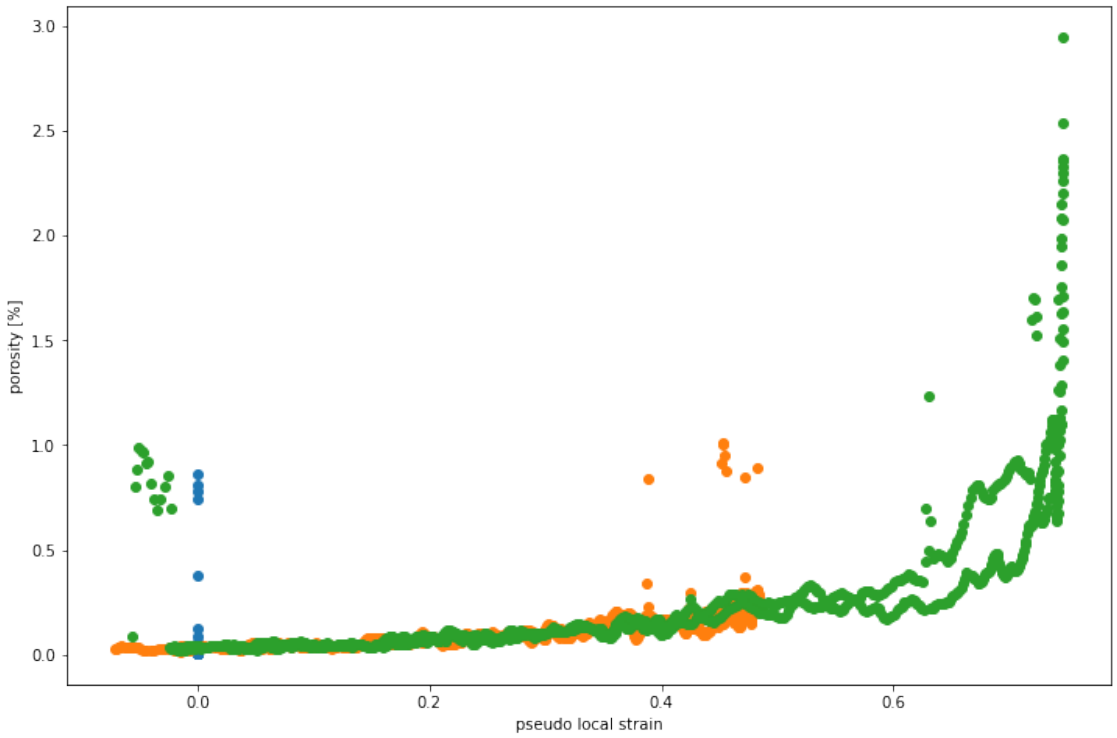
[9]:
```
plt.figure(figsize=(12,8))

for i in range(3):
    _x = data_ech[i].iloc[:,0]/(2*centers[i])
    _y = data_ech[i].iloc[:,1]
    plt.plot(_x, _y, label=data_csv_ech[i].split("/")[-1])

plt.legend()
plt.title('Z surface comparaison for normalized Z')
plt.xlabel("normalizd Z position")
plt.ylabel("surface [px]")
plt.show()
```



[10]:
```
plt.figure(figsize=(12,8))
_x0 = data_ech[0].iloc[:,0]/(2*centers[0])
_y0 = data_ech[0].iloc[:,1]
for i in range(3):
    _x = data_ech[i].iloc[:,0]/(2*centers[i])
    _y = data_ech[i].iloc[:,1]
    plt.plot(_x, np.log(np.interp(_x, _x0, _y0)/_y)*100, label=data_csv_ech[i].
 ↪split("/")[-1])


#plt.plot(_x, np.interp(_x, _x0, _y0), "*", label="fit")

#plt.ylim([200, 800])
#plt.gca().set_aspect('equal')
plt.legend()
plt.title('Pseudo local strain')
plt.xlabel("normalized Z position")
plt.ylabel("strain [%]")
plt.show()
```



[11]:
```
plt.figure(figsize=(12,8))
_x0 = data_ech[0].iloc[:,0]/(2*centers[0])
_y0 = data_ech[0].iloc[:,1]
for i in range(3):
    _x = data_ech[i].iloc[:,0]/(2*centers[i])
    _y = data_ech[i].iloc[:,1]
    x_e, y_e = data_ech[i].iloc[:,0], data_ech[i].iloc[:,1]
    x_c, y_c = data_cav[i].iloc[:,0], data_cav[i].iloc[:,1]
    plt.scatter(np.log(np.interp(_x, _x0, _y0)/_y), y_c/y_e*100)

plt.xlabel("pseudo local strain")
plt.ylabel("porosity [%]")
plt.show()
```


3.0
2.5
2.0
1.5
1.0
0.5
0.0
porosity [%]
0.0
0.2
0.4
0.6
pseudo local strain

[ ]: