raport

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[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

import uncertainties
from uncertainties import ufloat
from uncertainties.umath import *
from IPython.display import display, Math, Latex
```

[ ]:
```
df_CPD_Au = pd.read_csv("Wyniki pomiarow CPD dla Au.dat", skipfooter=31,␣
 ↪usecols=range(10), engine='python')
df_CPD_X1 = pd.read_csv("Wyniki pomiarow CPD dla probki X1.dat", skipfooter=31,␣
 ↪usecols=range(10), engine='python')
df_CPD_X2 = pd.read_csv("Wyniki pomiarow CPD dla probki X2.dat", skipfooter=31,␣
 ↪usecols=range(10), engine='python')
df_CPD_X2
```

[ ]:

	Point	WF (mV)	WFRA (mV)	WFDel (mV)	Std WF	GD (au)	Std GD	\
0	0	-514.9	-514.9	0.0	0.0	299.6	0.0	
1	1	-517.6	-516.3	-2.7	0.0	299.8	0.0	
2	2	-518.9	-516.7	-3.9	0.0	300.0	0.0	
3	3	-510.3	-515.6	4.6	2.0	299.9	0.2	
4	4	-514.3	-514.5	0.6	3.8	299.6	0.2	
…	…	…	…	…	…	…	…	
1496	1496	-517.2	-517.1	-2.3	2.9	294.5	1.5	
1497	1497	-517.0	-517.1	-2.1	2.9	294.4	1.5	
1498	1498	-510.5	-514.9	4.5	2.9	294.6	1.5	
1499	1499	-515.1	-514.2	-0.2	2.9	294.3	1.5	
1500	1500	-510.8	-512.1	4.1	2.9	294.4	1.5	

	Z Height (um)	User	Time(Secs)
0	0.0	1.6	0.000
1	0.0	1.4	0.561
2	0.0	1.4	1.139

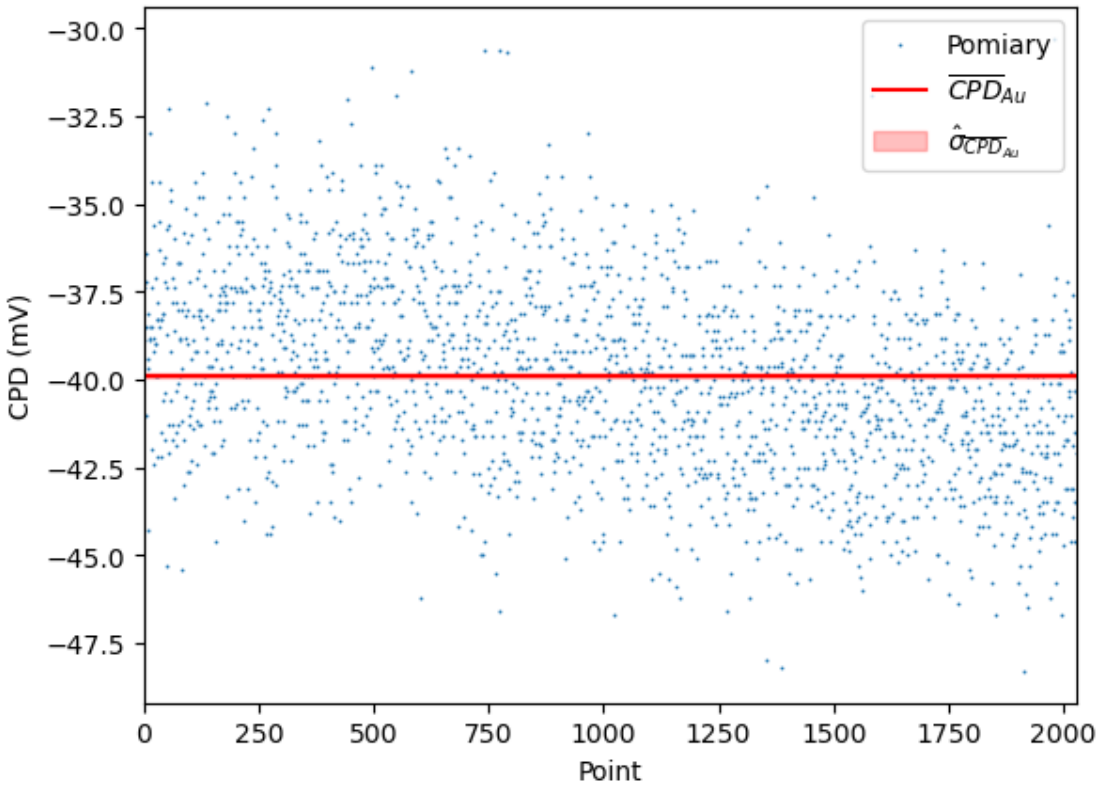
```
3              0.0   0.9       1.685
4              0.0   1.2       2.246
…              …     …         …
1496           0.0   0.5     863.803
1497           0.0   1.3     864.411
1498           0.0   1.4     865.004
1499           0.0   1.3     865.581
1500           0.0   0.3     866.190

[1501 rows x 10 columns]
```

[ ]:
```
CPD_Au = ufloat(df_CPD_Au['CPD (mV)'].mean(), df_CPD_Au['CPD (mV)'].sem()) # mV

graph = sns.scatterplot(x="Point", y="CPD (mV)", data=df_CPD_Au, s=2,␣
 ↪label="Pomiary")
graph.axhline(CPD_Au.n, color='r', linestyle='-',␣
 ↪label='$\overline{CPD}_{Au}$')
graph.fill_between(df_CPD_Au["Point"], CPD_Au.n-CPD_Au.s, CPD_Au.n+CPD_Au.s,␣
 ↪color='r', alpha=0.25, label='$\hat{\sigma}_{\overline{CPD}_{Au}}$')
graph.set_xlim(df_CPD_Au["Point"].min(), df_CPD_Au["Point"].max())
graph.legend()
display(Latex(f"$\overline{{CPD}}_{{Au}} =$ {CPD_Au:.2uP} mV"))
```

$\overline{CPD}_{Au}$ = -39.886±0.060 mV



[ ]:
```
WF_Au = ufloat(4800, 3) # meV
# e = 1.602176634e-19 # C
e = 1 # e
WF_tip = WF_Au - 1*e * CPD_Au
display(Latex(f"$WF_{{tip}} =$ {WF_tip:.2uP} meV"))
```

$WF_{tip} = 4839.9 \pm 3.0$ meV

Zaokrąglanie liczb i niepewności zgodnie z wytycznymi Particle Data Group https://pdg.lbl.gov/2010/reviews/rpp2010-rev-rpp-intro.pdf

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