well_profile

Release 0.3.10

Pro Well Plan AS

May 17, 2022

CONTENTS:

This is the official documentation of pwploads. Here you will find all the relevant information about any function included in this package.

CHAPTER

ONE

INSTALLATION

well_profile is written to be compatible with Python 3+. The best way to install is using pip.

```
$ pip install well_profile
```

This will make sure that all the dependencies are installed. This requirements are listed below.

1.1 Requirements

- numpy
- pandas
- openpyxl
- plotly

CHAPTER

TWO

CREATING A WELLBORE TRAJECTORY

well_profile.**get**(*mdt*, *profile='V'*, *build_angle=1*, *kop=0*, *eob=0*, *sod=0*, *eod=0*, *kop2=0*, *eob2=0*, ***kwargs*)

Generate a wellpath.

Parameters

- **mdt** (*num*) – target depth, m or ft
- **profile** (*str*) – 'V' for vertical, 'J' for J-type, 'S' for S-type, 'H1' for Horizontal single curve and 'H2' for Horizontal double curve
- **build_angle** (*num*) – building angle, °
- **kop** (*num*) – kick-off point, m or ft
- **eob** (*num*) – end of build, m or ft
- **sod** (*num*) – start of drop, m or ft
- **eod** (*num*) – end of drop, m or ft
- **kop2** (*num*) – kick-off point 2, m or ft
- **eob2** (*num*) – end of build 2, m or ft

Keyword Arguments

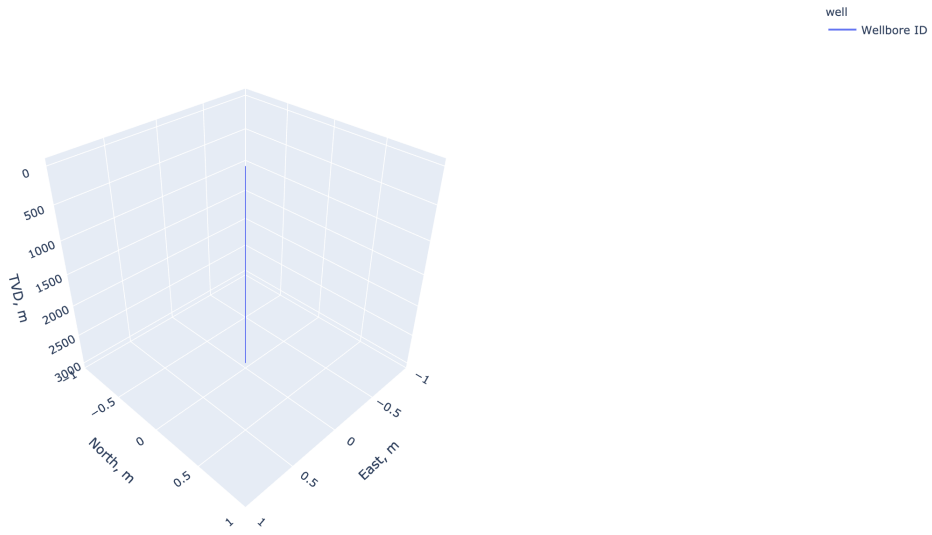
- **points** (*int*) – number of points
- **set_start** (*dict, None*) – set initial point in m {'north': 0, 'east': 0}.
- **change_azimuth** (*float, int, None*) – add specific degrees to azimuth values along the entire well.
- **set_info** (*dict, None*) – dict, {'dlsResolution', 'wellType': 'onshore'|'offshore', 'units': 'metric'|'english'}.

Returns **well** – A wellpath object with 3D position

Return type well object

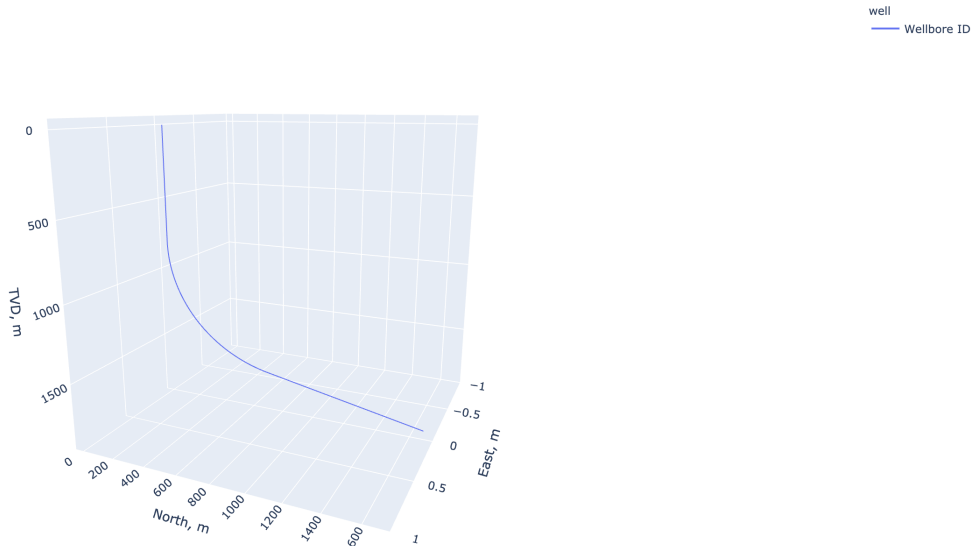
2.1 Vertical well

```
>>> import well_profile as wp
>>> well = wp.get(3000,   # define target depth (md) in m or ft
>>>               profile='V',    # set Vertical well profile
>>>               set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>               # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>               # for meters or 'english' for feet
>>>               set_start={'north': 0, 'east': 0, 'depth': 0})    # (optional) set the␣
↪location of initial point
>>>               points=100,   # (optional) define number of points
>>> well.plot(names=['Wellbore ID']).show()
```



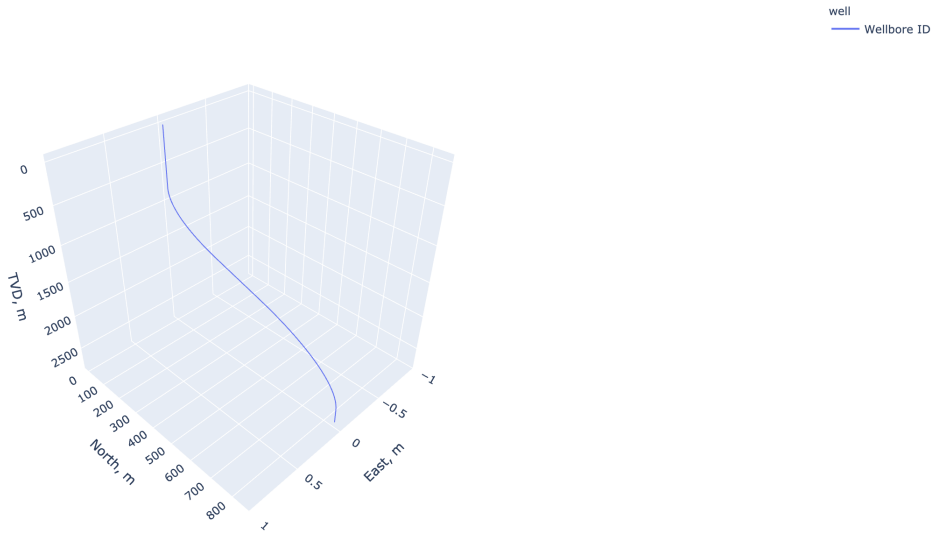
2.2 J-type well

```
>>> import well_profile as wp
>>> well = wp.get(3000,   # define target depth (md) in m or ft
>>>               profile='J',    # set J-type well profile
>>>               kop=800,    # set kick off point in m or ft
>>>               eob=2000,   # set end of build in m or ft
>>>               build_angle=78,   # set build angle in °
>>>               set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>               # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>               # for meters or 'english' for feet
>>>               set_start={'north': 0, 'east': 0, 'depth': 0})    # (optional) set the␣
↪location of initial point
>>>               points=100,   # (optional) define number of points
>>> well.plot(names=['Wellbore ID']).show()
```



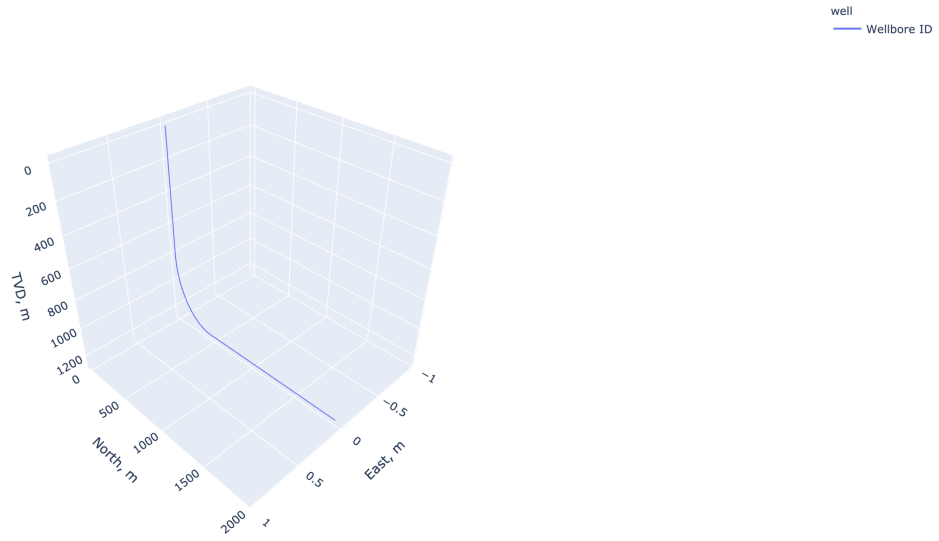
2.3 S-type well

```
>>> import well_profile as wp
>>> well = wp.get(3000,   # define target depth (md) in m or ft
>>>               profile='S',    # set S-type well profile
>>>               kop=800,    # set kick off point in m or ft
>>>               eob=1500,   # set end of build in m or ft
>>>               build_angle=45,   # set build angle in °
>>>               sod=1800,   # set start of drop in m or ft
>>>               eod=2800,   # set end of drop in m or ft
>>>               set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>               # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>               # for meters or 'english' for feet
>>>               set_start={'north': 0, 'east': 0, 'depth': 0})    # (optional) set the␣
↪location of initial point
>>>               points=100,   # (optional) define number of points
>>> well.plot(names=['Wellbore ID']).show()
```



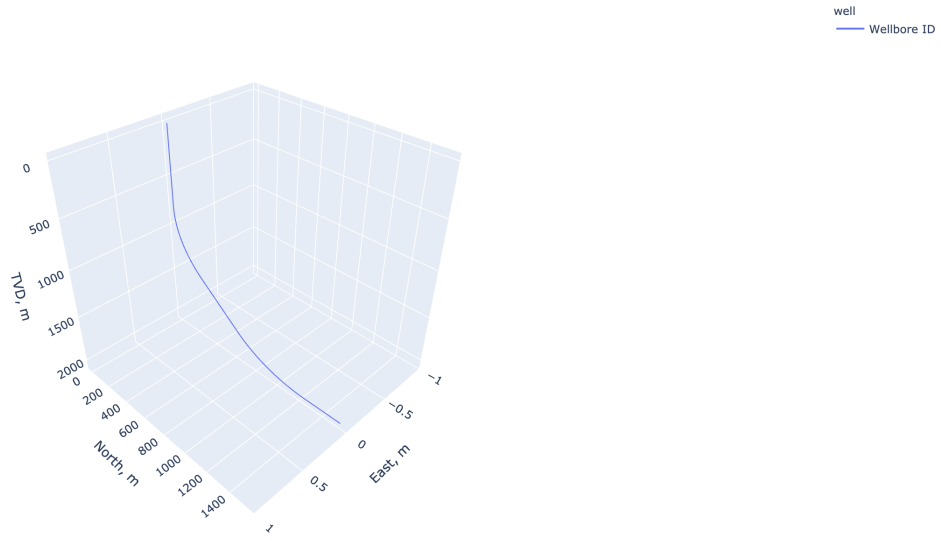
2.4 Horizontal single curve well

```
>>> import well_profile as wp
>>> well = wp.get(3000,   # define target depth (md) in m or ft
>>>               profile='H1',    # set horizontal single curve well profile
>>>               kop=800,    # set kick off point in m or ft
>>>               eob=1500,   # set end of build in m or ft
>>>               build_angle=45,   # set build angle in °
>>>               set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>               # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>               # for meters or 'english' for feet
>>>               set_start={'north': 0, 'east': 0, 'depth': 0})    # (optional) set the␣
↪location of initial point
>>>               points=100,   # (optional) define number of points
>>> well.plot(names=['Wellbore ID']).show()
```



2.5 Horizontal double curve well

```
>>> import well_profile as wp
>>> well = wp.get(3000,   # define target depth (md) in m or ft
>>>               profile='H2',    # set horizontal double curve well profile
>>>               kop=800,    # set kick off point in m or ft
>>>               eob=1500,   # set end of build in m or ft
>>>               build_angle=45,   # set build angle in °
>>>               set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>               # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>               # for meters or 'english' for feet
>>>               set_start={'north': 0, 'east': 0, 'depth': 0})    # (optional) set the␣
↪location of initial point
>>>               points=100,   # (optional) define number of points
>>> well.plot(names=['Wellbore ID']).show()
```



2.6 Using two points

This function allows to generate a wellbore trajectory by seeting kick-off point (KOP) and target.

`well_profile.`**`two_points`**(*points*, *inner_points=20*)

Parameters

- **points** – {'kickoff':{'north': num, 'east': num, 'tvd': num}, 'target': {'north': num, 'east': num, 'tvd': num}}
- **inner_points** – number of points between curved zone

Returns a wellpath object with 3D position

```
>>> import well_profile as wp
>>> well = wp.two_points({'kickoff': {'north': 0, 'east': 0, 'tvd': 100},
>>>                       'target': {'north': 500, 'east': 800, 'tvd': 800}})
```

CHAPTER

THREE

LOADING A WELLBORE TRAJECTORY

well_profile.**load**(*data*, ***kwargs*)

Load an existing wellpath.

Parameters **data** – Excel file, dataframe or list of dictionaries. Must contain at least md, inclination and azimuth. Can also contain tvd, northing and easting.

Keyword Arguments

- **set_start** (*dict, None*) – set initial point in m {'north': 0, 'east': 0}.
- **change_azimuth** (*float, int, None*) – add specific degrees to azimuth values along the entire well.
- **set_info** (*dict, None*) – dict, {'dlsResolution', 'wellType': 'onshore'|'offshore', 'units': 'metric'|'english'}.
- **inner_pts** (*num*) – include certain amount of inner points between survey stations.

Returns **well** – A wellpath object with 3D position

Return type well object

3.1 Load excel file

Example of a file is shown below. In case TVD is not included, the package calculates the values using the minimum curvature method. North and East coordinates also can be included.

	A	B	C	D	E	F
1	md	inclination	azimuth	tvd		
2	145,9	0	0	145,9		
3	146	0	0	146		
4	154,9	0,16	221,03	154,9		
5	195,3	0,28	98,15	195,3		
6	221	0,51	63,39	221		
7	235,6	0,64	43,64	235,6		
8	276	1,51	188,03	276		
9	316,4	2,21	178,31	316,4		
10	356,7	4,11	173,29	356,6		
11	397,1	7,66	171,91	396,8		
12	437,5	9,13	178,88	436,8		
13	477,8	10,58	180,1	476,5		
14	518,2	11,35	177,18	516,1		
15	558,5	11,51	168,58	555,6		
16	598,9	12,38	160,99	595,2		

```
>>> import well_profile as wp
>>> well = wp.load('trajectory1.xlsx',   # loading excel file
>>>                set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>                # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>                # for meters or 'english' for feet
```

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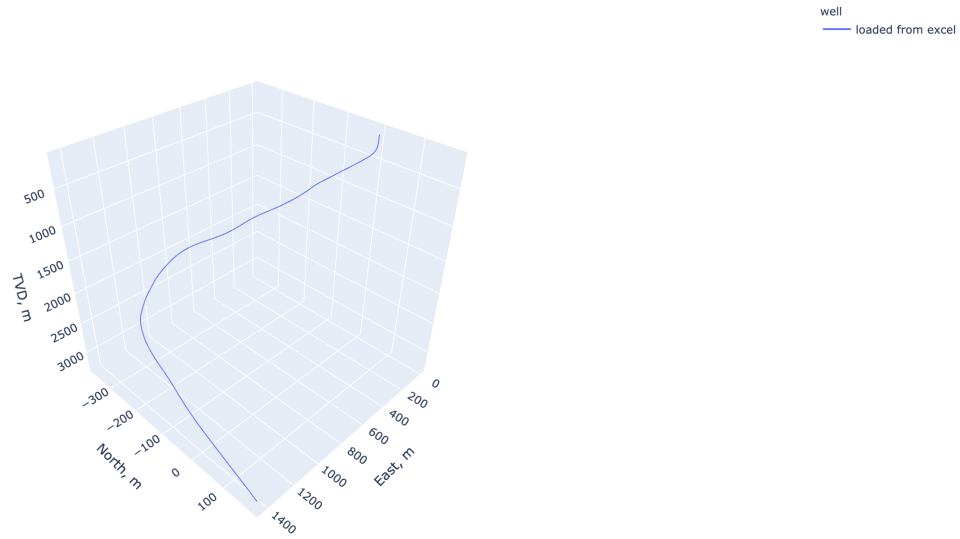
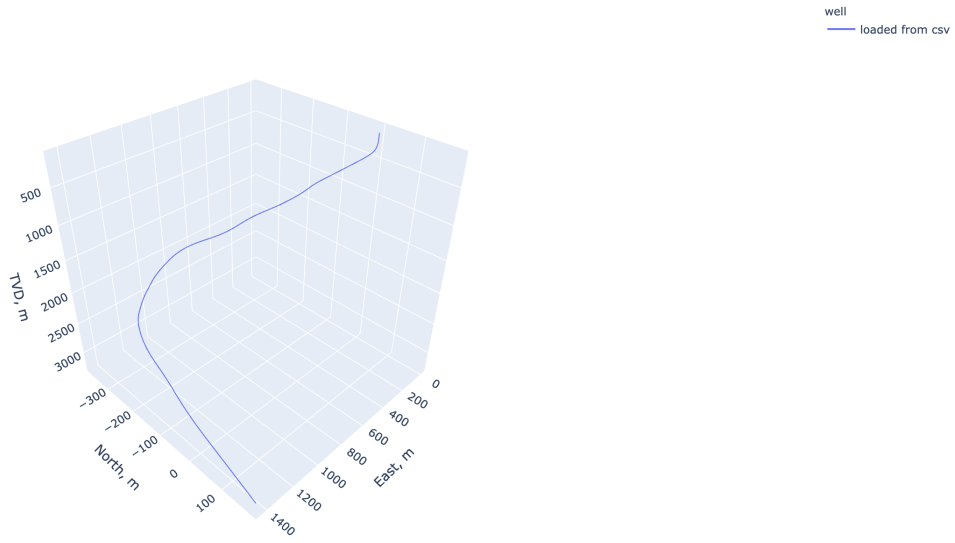
```
>>>                 set_start={'north': 0, 'east': 0, 'depth': 0})  # (optional) set the␣
↪location of initial point
>>> well.plot(names=['loaded from excel']).show()
```



3.2 Load csv file

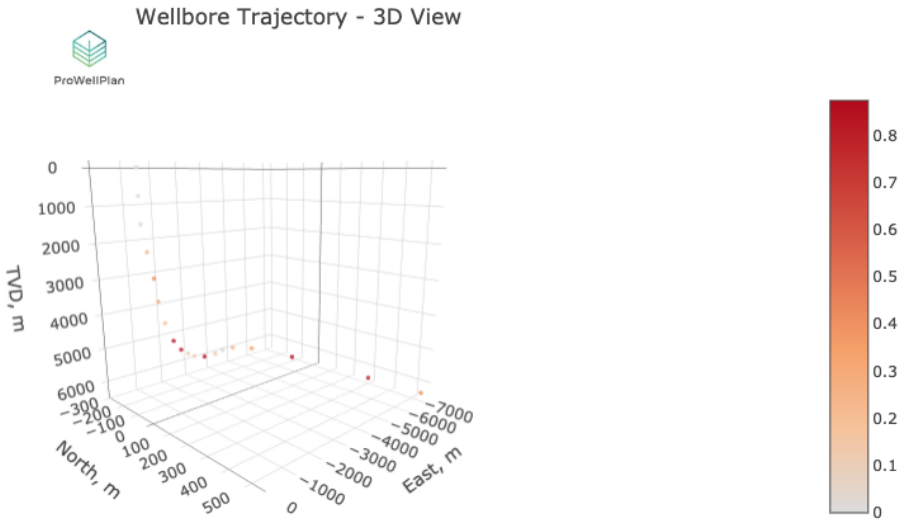
```
>>> import well_profile as wp           # loading csv file
>>> well = wp.load('trajectory1.csv',   # define target depth (md) in m or ft
>>>                 set_info={'dlsResolution': 30, 'wellType': 'offshore', 'units': 'metric
↪'},
>>>                 # (optional) define the resolution for dls calculation, well type and␣
↪system of units 'metric'
>>>                 # for meters or 'english' for feet
>>>                 set_start={'north': 0, 'east': 0, 'depth': 0})  # (optional) set the␣
↪location of initial point
>>> well.plot(names=['loaded from csv']).show()
```



3.3 Generate more data points from survey

With `well_profile` you can generate multiple data points between the survey stations by using the argument `inner_points`.

```
>>> import well_profile as wp
>>> well = wp.load('trajectory1.xlsx')   # loading file with only original survey points
>>> well.plot(style={'color': 'dls'}).show()
```




```
>>> import well_profile as wp
>>> well = wp.load('trajectory1.xlsx', inner_points=5)   # loading file with only␣
↪original survey points
```

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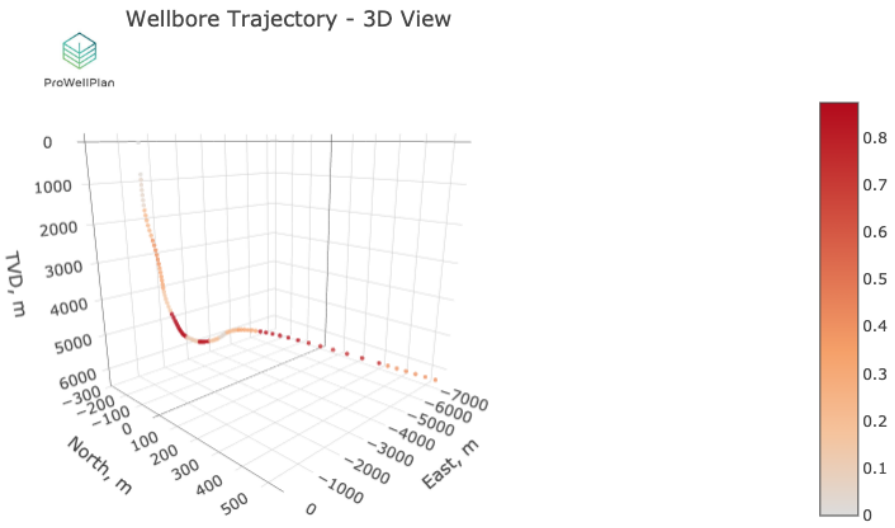
```
>>> well.plot(style={'color': 'dls'}).show()
```



CHAPTER

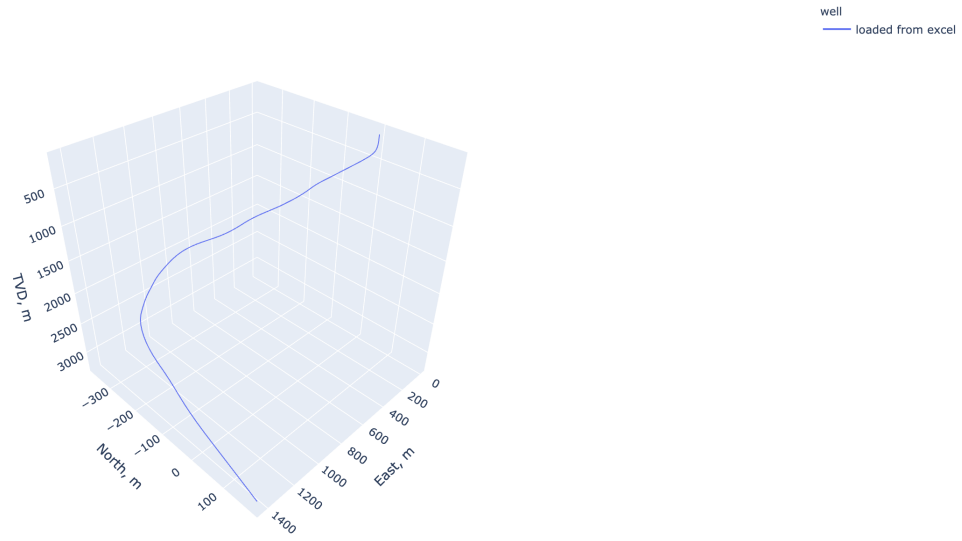
FOUR

INTERPOLATING POINTS ALONG THE TRAJECTORY

You can get all the relevant data for any specifc MD value along the wellbore trajectory.

```
>>> import well_profile as wp
>>> well = wp.load('trajectory1.xlsx')   # loading excel file
>>> wb1.get_point(3750)     # get data at 3750m MD
```

```
{'md': 3750,
 'dl': 0.5573264781490191,
 'inc': 52.9126735218509,
 'azi': 22.04,
 'north': 113.70285532280701,
 'east': 1340.3801459482888,
 'tvd': 3220.9879889843924,
 'pointType': 'interpolated',
 'sectionType': 'drop-off'}
```

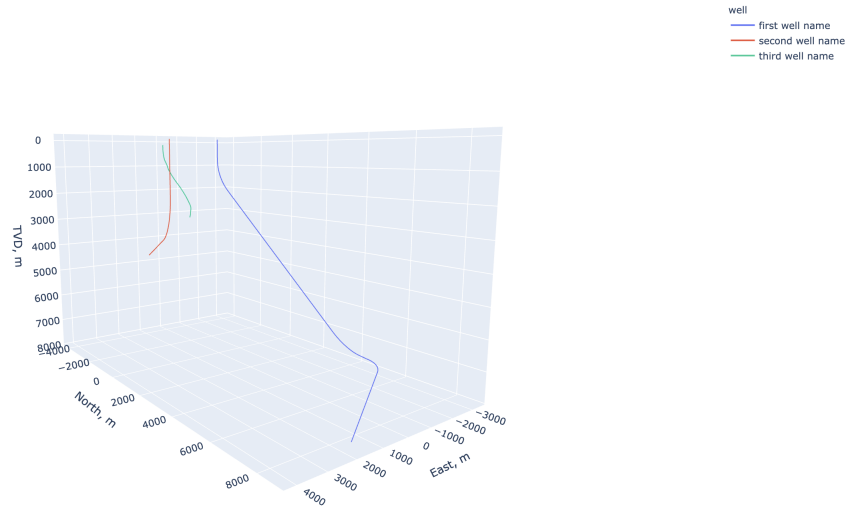


CHAPTER

FIVE

CHANGING THE AZIMUTH

```
>>> import well_profile as wp
>>> well_1 = wp.load('trajectory1.xlsx', change_azimuth=180)      # LOAD WELL 1 -->␣
↪Azimuth: + 180°
>>> well_2 = wp.get(6000, profile='J', kop=2000, eob=4000, build_angle=85,
>>>                 set_start={'east':2000}, change_azimuth=42)       # GET WELL 2 -->␣
↪Azimuth: + 42°
>>> well_3 = wp.load('trajectory2.xlsx', set_start={'north':-4000})        # LOAD WELL 3
>>> well_1.plot(add_well=[well_2, well_3],
>>>             names=['first well name',
>>>                    'second well name',
>>>                    'third well name']).show()        # Generate 3D plot for well 1␣
↪including wells 2 and 3
```



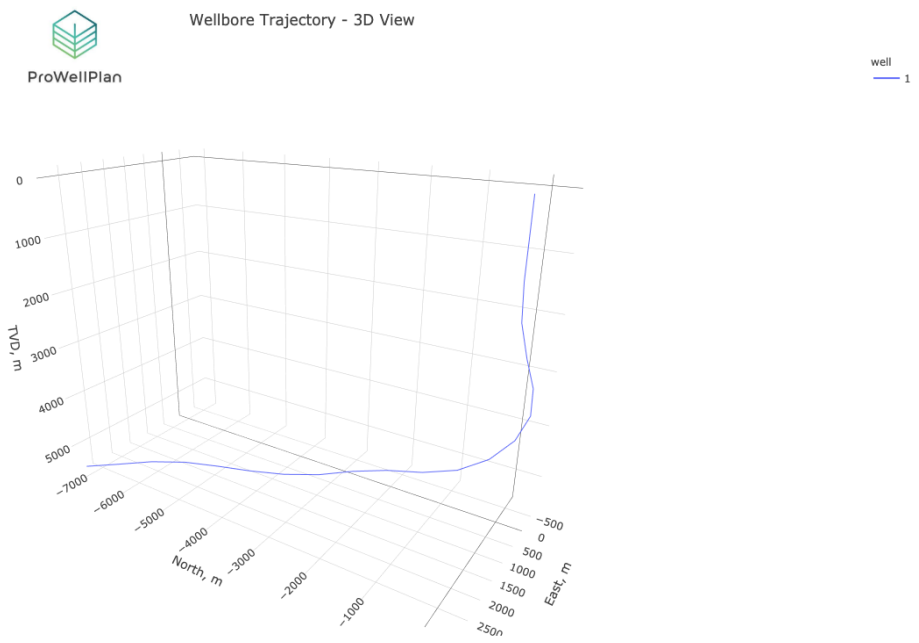
CHAPTER

SIX

PLOTTING TRAJECTORIES

6.1 3D view - single trajectory

```
>>> import well_profile as wp
>>> w1 = wp.load('wellbore1.xlsx')
>>> w1.plot().show()
```



6.2 3D view - plot multiple trajectories

6.2.1 Same location

```
>>> import well_profile as wp
>>> well_1 = wp.load('trajectory1.xlsx')       # LOAD WELL 1
>>> well_2 = wp.get(5000, profile='J', kop=2000, eob=3000, build_angle=85)        # GET␣
↪WELL 2
```

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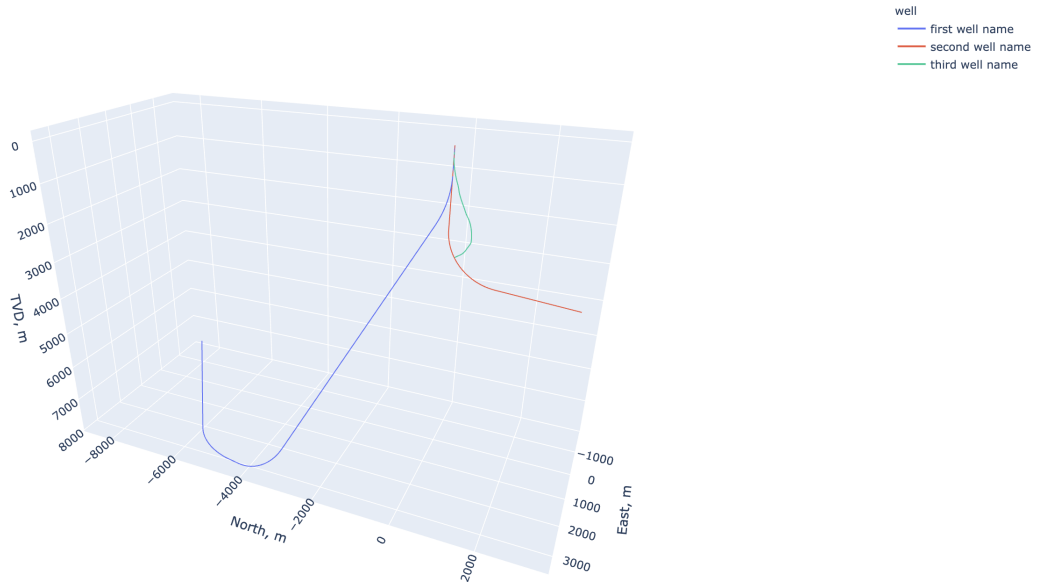
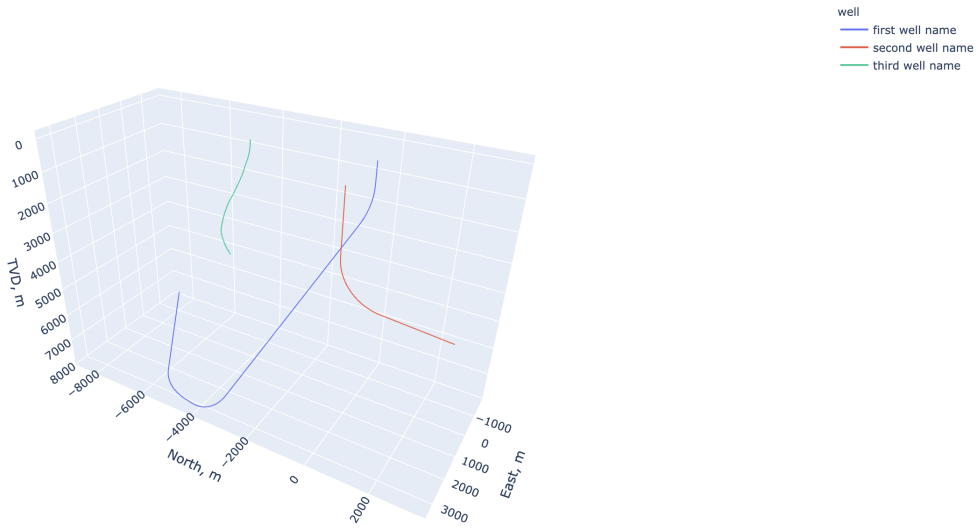
```
>>> well_3 = wp.load('trajectory2.xlsx')         # LOAD WELL 3
>>> well_1.plot(add_well=[well_2, well_3],
>>>              names=['first well name',
>>>                     'second well name',
>>>                     'third well name']).show()        # Generate 3D plot for well 1␣
↪including wells 2 and 3
```



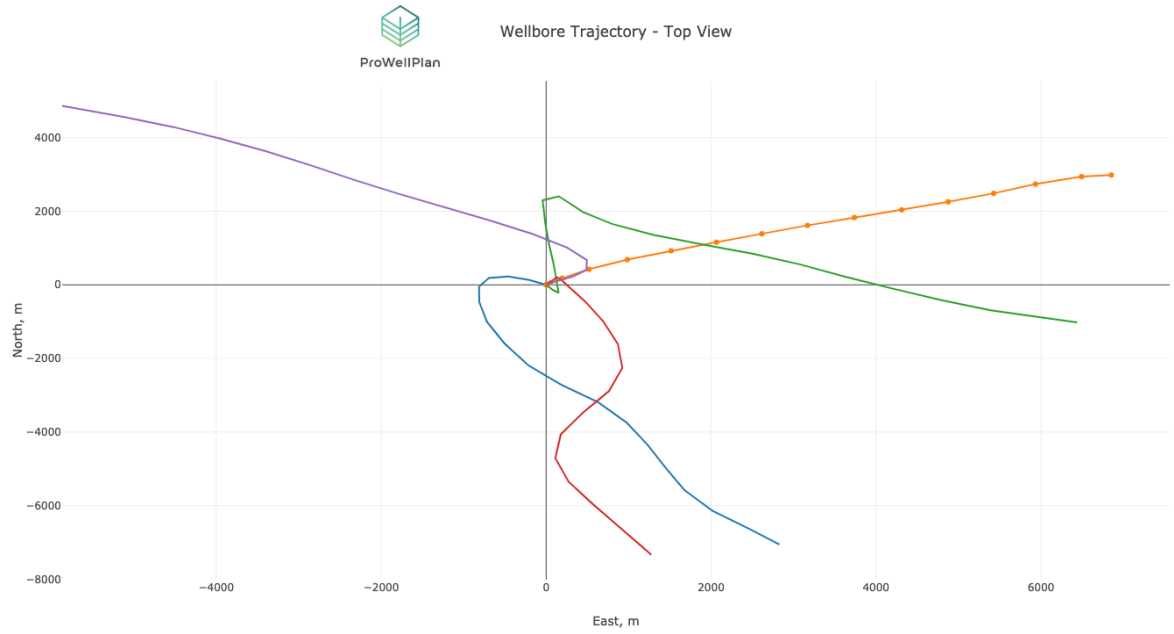
6.2.2 Different location

```
>>> import well_profile as wp
>>> well_1 = wp.load('trajectory1.xlsx')       # LOAD WELL 1
>>> well_2 = wp.get(5000, profile='J', kop=2000, eob=3000, build_angle=85, set_start={
↪'east':2000})        # GET WELL 2 --> North: 0 m, East: 2000 m
>>> well_3 = wp.load('trajectory2.xlsx', set_start={'north':-3000})        # LOAD WELL 3␣
↪--> North: -3000 m, East: 0 m
>>> well_1.plot(add_well=[well_2, well_3],
>>>              names=['first well name',
>>>                     'second well name',
>>>                     'third well name']).show()        # Generate 3D plot for well 1␣
↪including wells 2 and 3
```



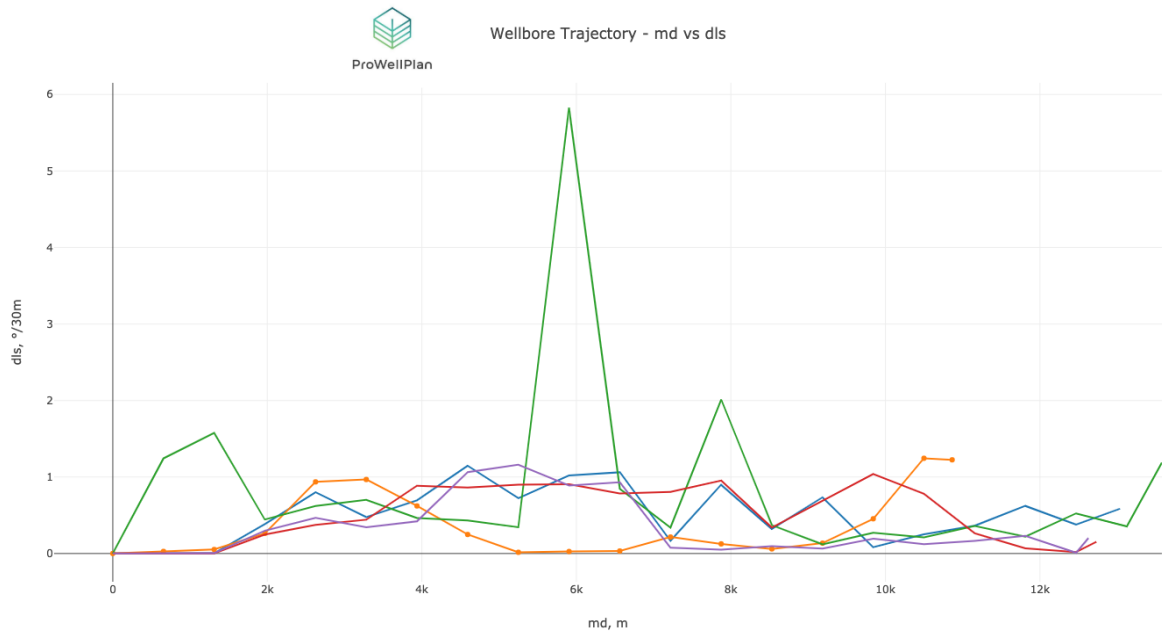
6.3 Top view

```
>>> import well_profile as wp
>>> w1 = wp.load('wellbore1.xlsx')
>>> w2 = wp.load('wellbore2.xlsx')
>>> w3 = wp.load('wellbore3.xlsx')
>>> w4 = wp.load('wellbore4.xlsx')
>>> w5 = wp.load('wellbore5.xlsx')
>>> w1.plot(add_well=[w2, w3, w4], plot_type='top').show()
```



6.4 Versus view

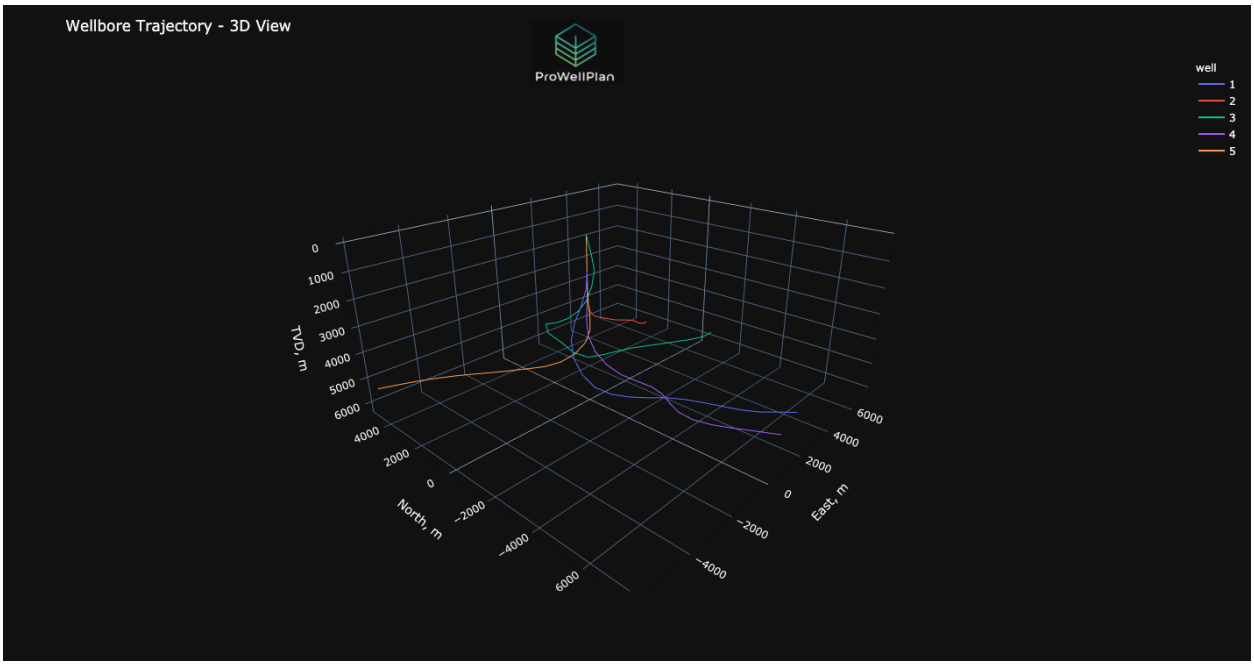
```
>>> import well_profile as wp
>>> w1 = wp.load('wellbore1.xlsx')
>>> w2 = wp.load('wellbore2.xlsx')
>>> w3 = wp.load('wellbore3.xlsx')
>>> w4 = wp.load('wellbore4.xlsx')
>>> w5 = wp.load('wellbore5.xlsx')
>>> w1.plot(add_well=[w2, w3, w4, w5], plot_type='vs', x_axis='md', y_axis='dls').show()
```



6.5 Dark mode

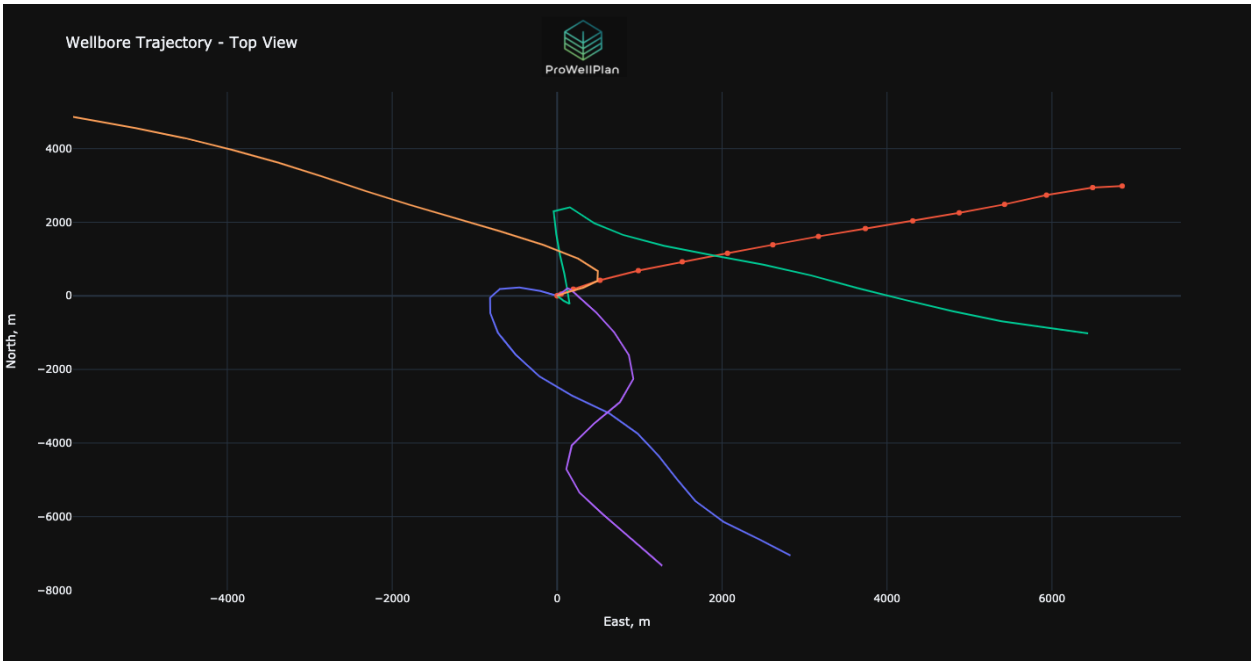
6.5.1 on 3D view

```
>>> import well_profile as wp
>>> w1 = wp.load('wellbore1.xlsx')
>>> w2 = wp.load('wellbore2.xlsx')
>>> w3 = wp.load('wellbore3.xlsx')
>>> w4 = wp.load('wellbore4.xlsx')
>>> w5 = wp.load('wellbore5.xlsx')
>>> w1.plot(add_well=[w2, w3, w4, w5], style={'darkMode': True}).show()
```



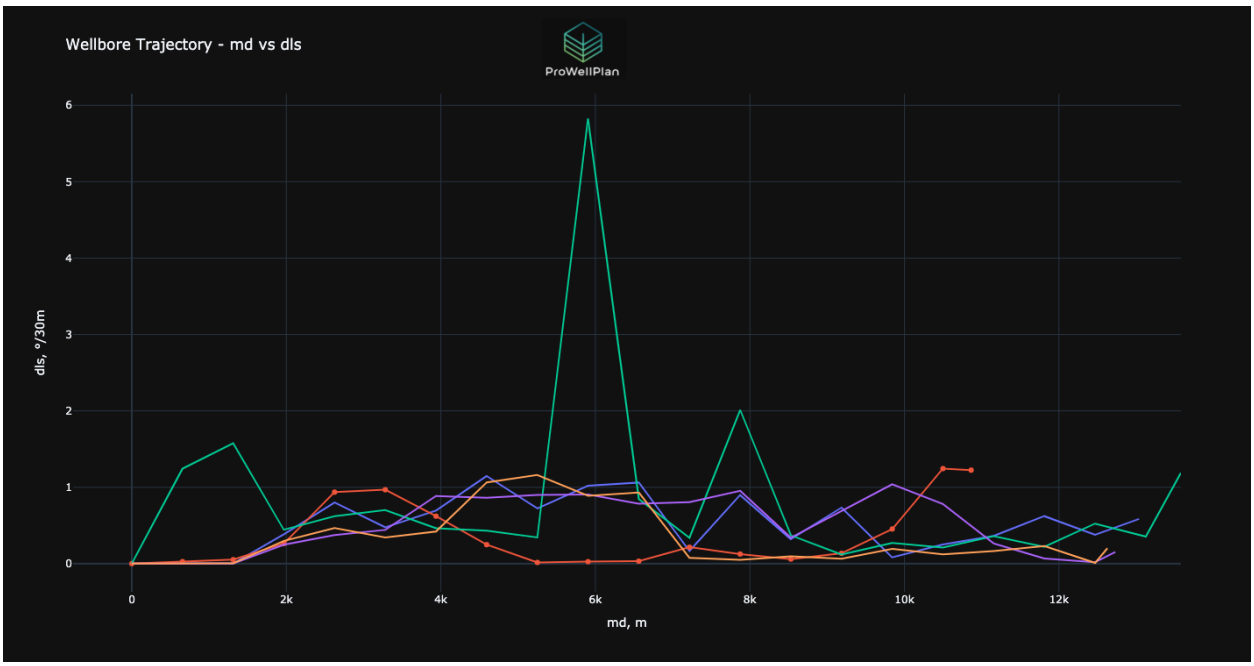
6.5.2 on Top view

```
>>> w1.plot(add_well=[w2, w3, w4, w5], plot_type='top', style={'darkMode': True}).show()
```



6.5.3 on Versus view

```
>>> w1.plot(add_well=[w2, w3, w4, w5], plot_type='vs', x_axis='md', y_axis='dls', style={
↪'darkMode': True}).show()
```



CHAPTER

SEVEN

ABOUT PRO WELL PLAN

Pro Well Plan offers an easy and effective well planning platform for the entire team. Check out our website to know more about us.

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