

## Import libraries

```
In [1]: # Python libraries
import os
import sys
import pandas as pd # for data manipulation
import numpy as np # for data manipulation
import tensorflow as tf
from sklearn.model_selection import train_test_split
from datetime import datetime
import time

# Plotting
import matplotlib.pyplot as plt

# To enable LaTeX and select a font
plt.rcParams.update({
    "text.usetex": True,
    "font.family": "sans-serif",
    "font.sans-serif": "Helvetica",
})

# Using ipynb import functions defined in other nb
sys.path.append("myfun/")
from ipynb.fs.defs.myfun_load_dataset import *
from ipynb.fs.full.myfun_nn import *
from ipynb.fs.defs.myfun_plot import *
```

2023-12-10 09:32:23.046993: I tensorflow/core/platform/cpu\_feature\_guard.cc:193] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: SSE4.1 SSE4.2 AVX AVX2 FMA To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.

Tensorflow/Keras: 2.11.0  
sklearn: 1.3.0

## Data Acquisition

```
In [2]: # Load the dataset
par_dir = os.path.dirname(os.getcwd()) # parent dir
dir_name = par_dir + "/NN-interaction"
```

```
In [3]: processed_flag = 'pre'
# load the data
_, dflist = load_dataset(dir_name, processed_flag)
dataset = dflist

print(f"In this dataset we have {np.sum([d.shape[0] for d in dataset])}
```

In this dataset we have 671 scenes

## Params

```
In [4]: # params
DOE =[1,10,1] #Design of experiment

v0 = 30
NUM_ITER = 500
LEARNING_RATE_v0 = 0.5
test = 0.33

plot_flag=True
flag_save = True
```

**NN: 1-10-1**

```
In [5]: info_nn10, model_trained = solve_nn_dataset(dataset, DOE, v0, process
                                                test, plot_flag)
```

```
-----
Analyzing 10 dfs. NN structure: 1-10-1
*****
*****
```

```
Analyzing 1/10 dfs.
```

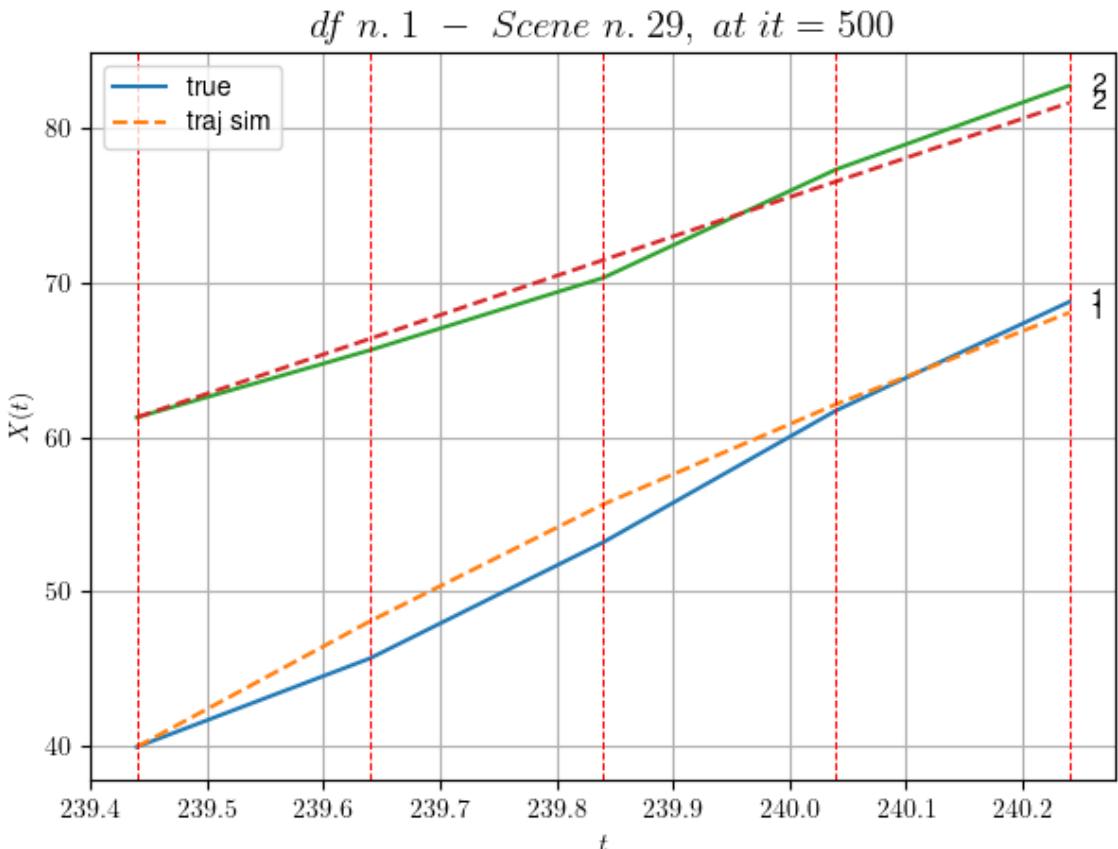
```
In DataFrame n.1 we have 109 scenes.
```

```
To train the model we use 73 scenes, the remaining 36 to test t
he model.
```

```
Training step. (73 scenes)
=====
=====
```

```
DataFrame n.1. Scene n.1/73
-----
```

```
We have 4 time intervals inside [239.44,240.24]
```



```
For scene 1/73:
```

```
* After LR finder: LR_NN=1e-05 with mse=3.3304361384930514
```

```
at it=24
```

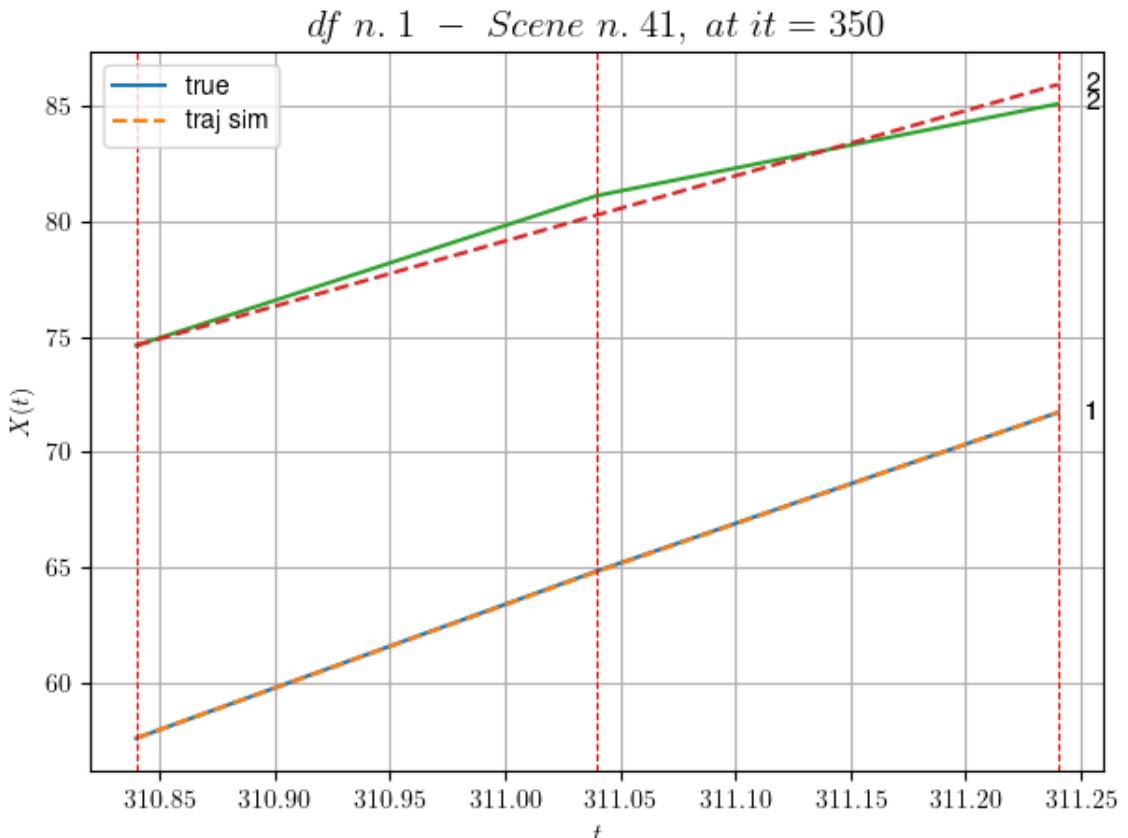
```
* v0 = 25.426381424530017
```

```
* MSE = 1.4531209467906976
```

```
* iterations = 500
```

DataFrame n.1. Scene n.2/73

We have 2 time intervals inside [310.84,311.24]



For scene 2/73:

\* After LR finder:  $LR_{NN}=0.0001$  with  $mse=0.4207711531697073$

at it=24

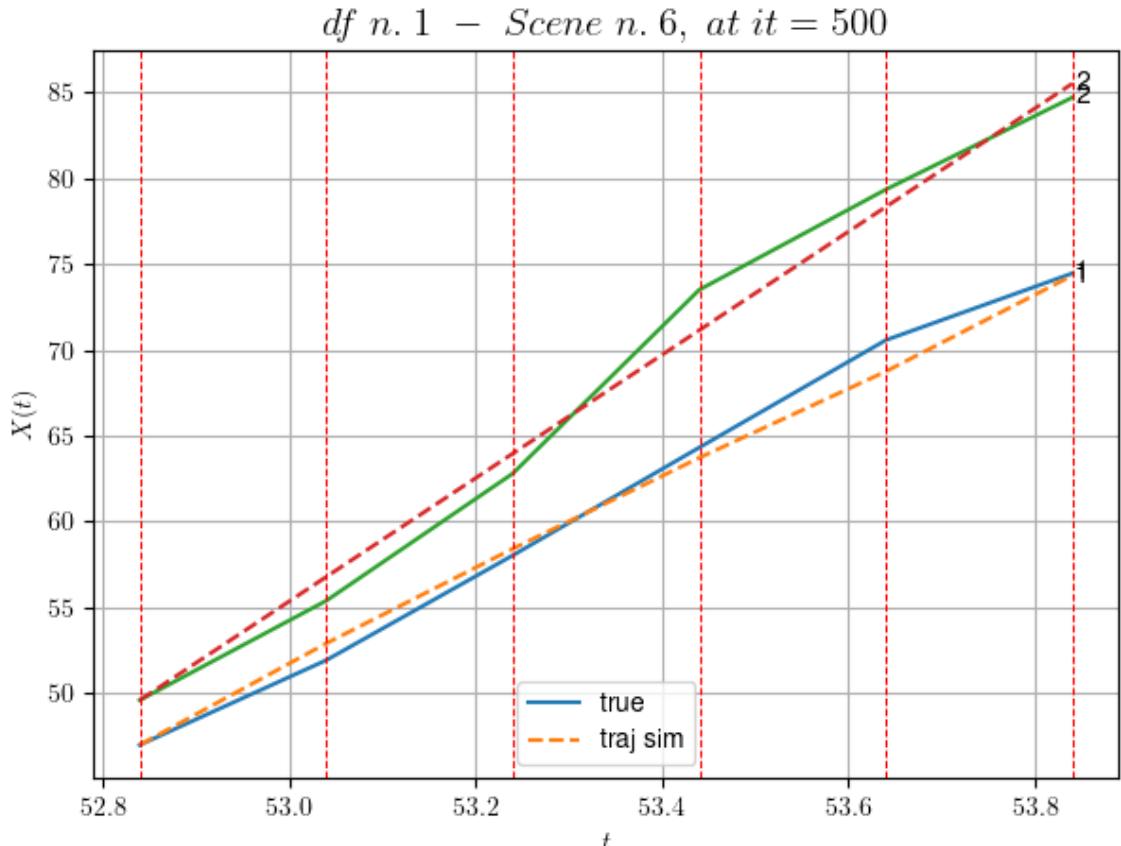
\*  $v_0 = 28.339874490952024$

\*  $MSE = 0.23575057704769153$

\* iterations = 350

DataFrame n.1. Scene n.3/73

We have 5 time intervals inside [52.84,53.84]



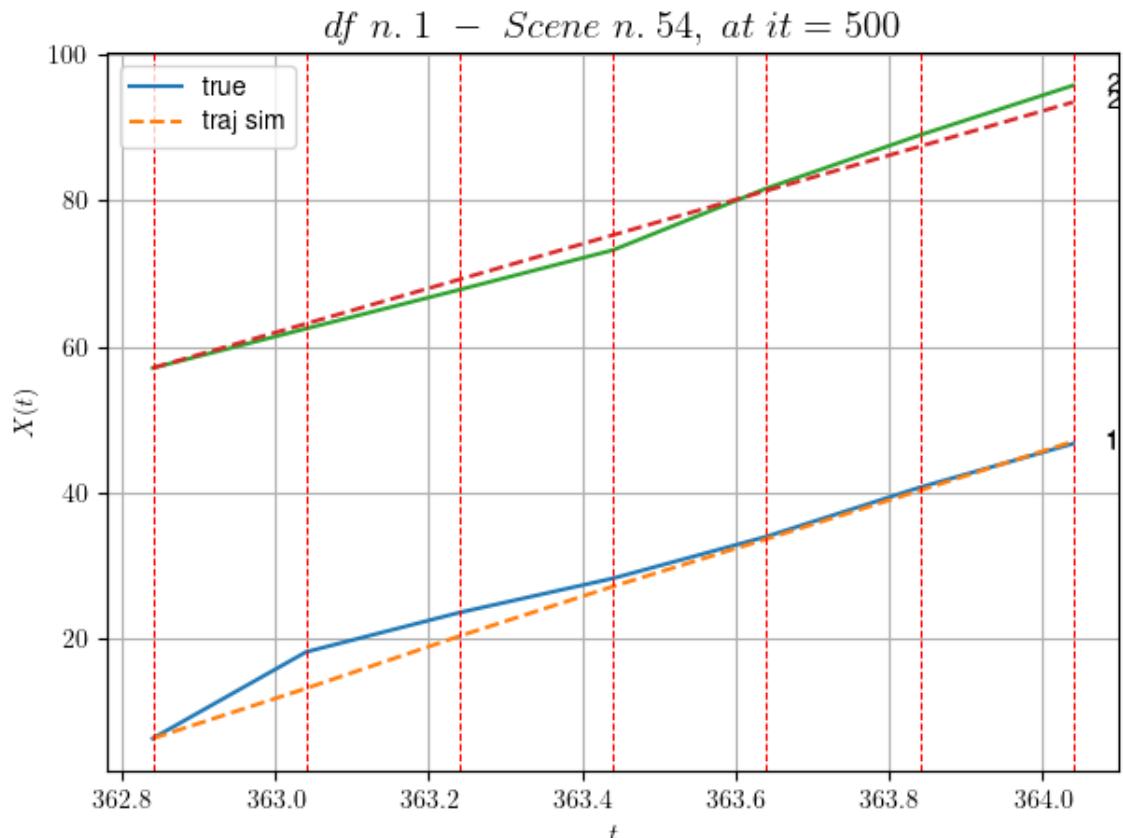
For scene 3/73:

\* After LR finder: LR\_NN=0.001 with mse=15.337423364268542  
at it=24

- \*  $v_0 = 35.9128223540259$
- \* MSE = 1.250386270013988
- \* iterations = 500

DataFrame n.1. Scene n.4/73

We have 6 time intervals inside [362.84, 364.04]



---

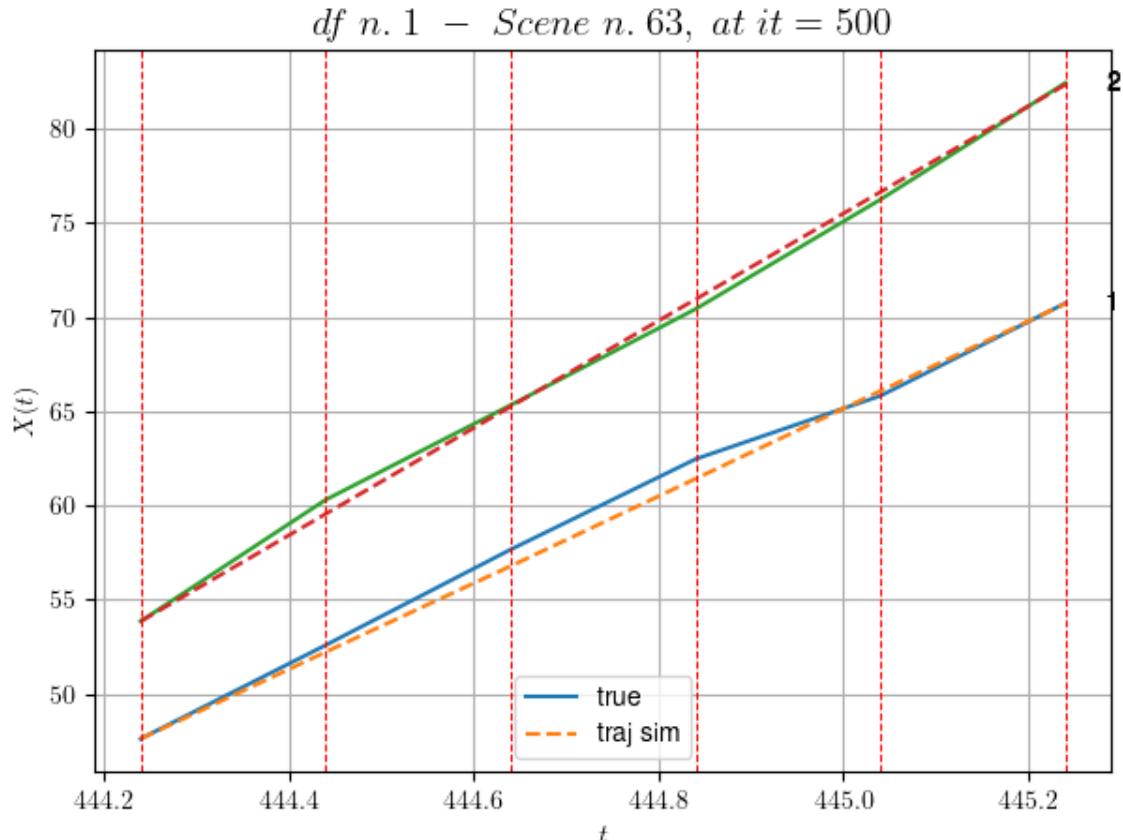
For scene 4/73:  
\* After LR finder: LR\_NN=0.0001 with mse=3.4454402742612498  
at it=24  
\* v0 = 30.313976428341373  
\* MSE = 3.385250068686453  
\* iterations = 500

---

DataFrame n.1. Scene n.5/73

---

We have 5 time intervals inside [444.24,445.24]



---

For scene 5/73:

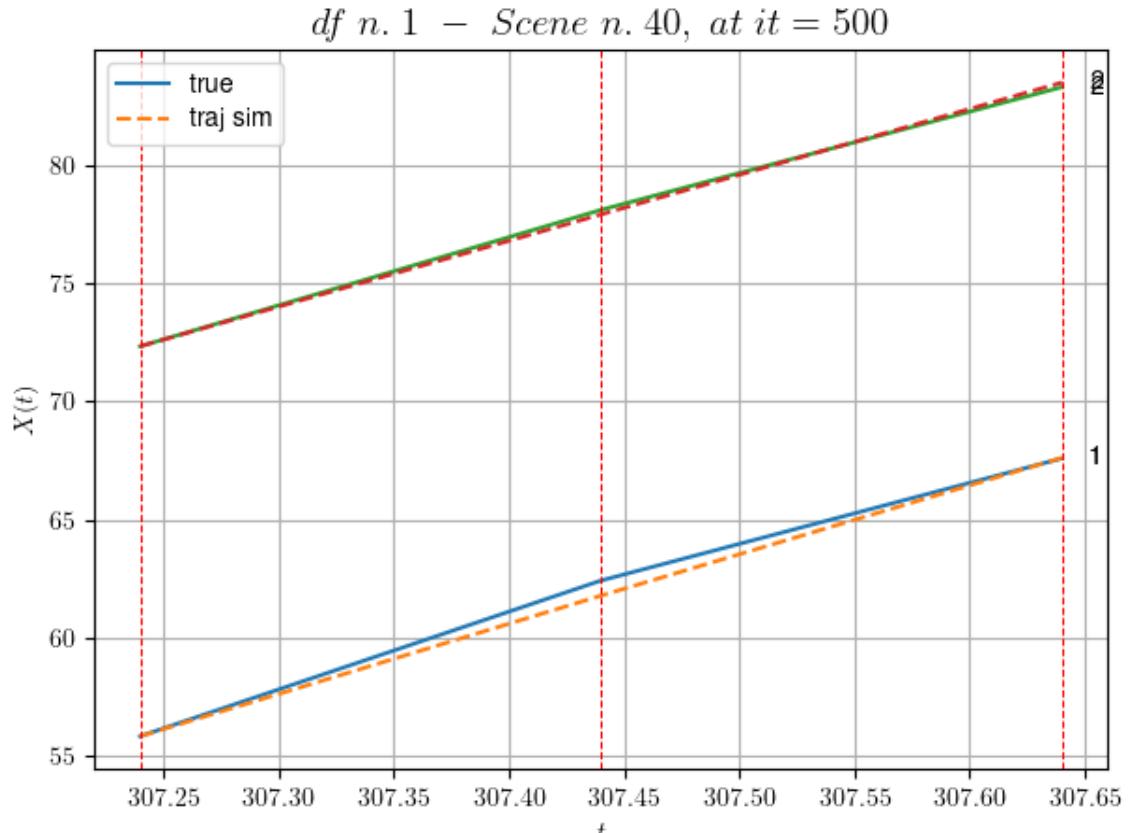
- \* After LR finder: LR\_NN=0.0005 with mse=2.027137365543992
- at it=24
- \* v<sub>0</sub> = 28.494973095574913
- \* MSE = 0.2558807677072541
- \* iterations = 500

---

DataFrame n.1. Scene n.6/73

---

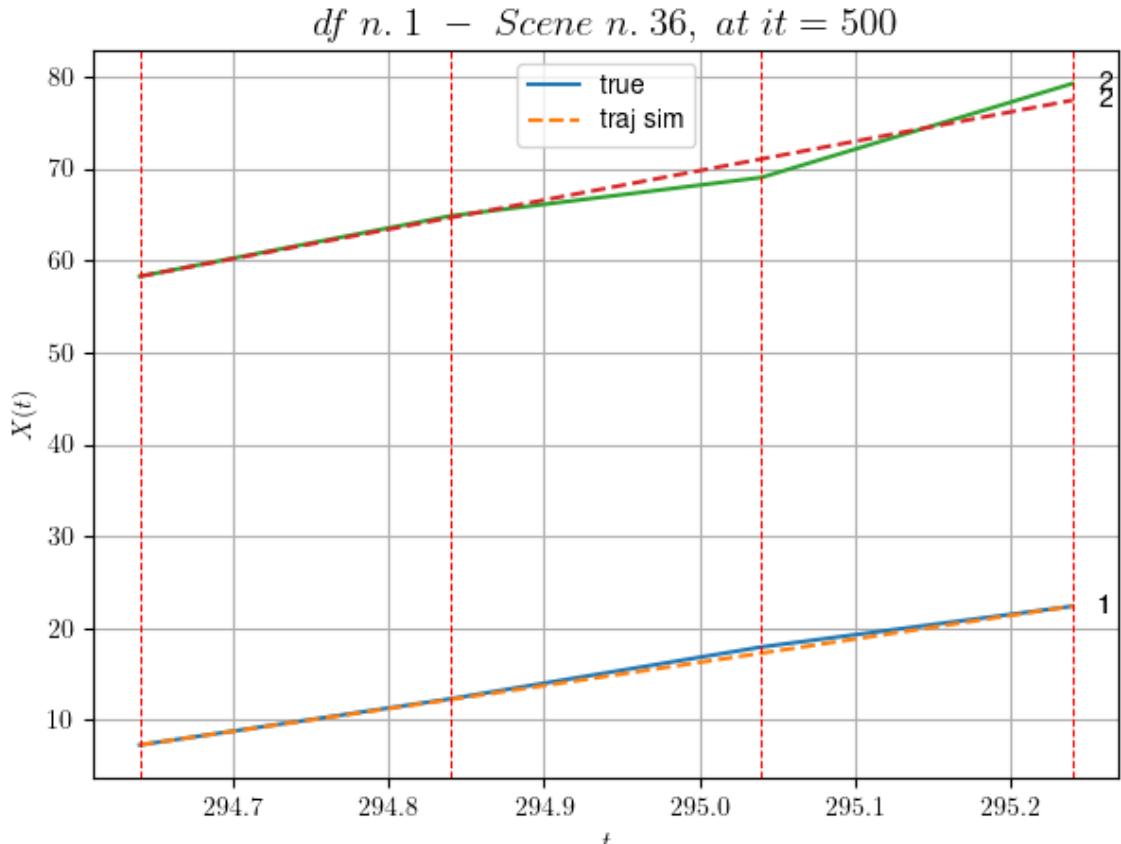
We have 2 time intervals inside [307.24,307.64]



For scene 6/73:  
\* After LR finder: LR\_NN=5e-05 with mse=0.24937732238363353  
at it=24  
\* v0 = 27.87316406556783  
\* MSE = 0.07998696848210063  
\* iterations = 500

DataFrame n.1. Scene n.7/73

We have 3 time intervals inside [294.64, 295.24]

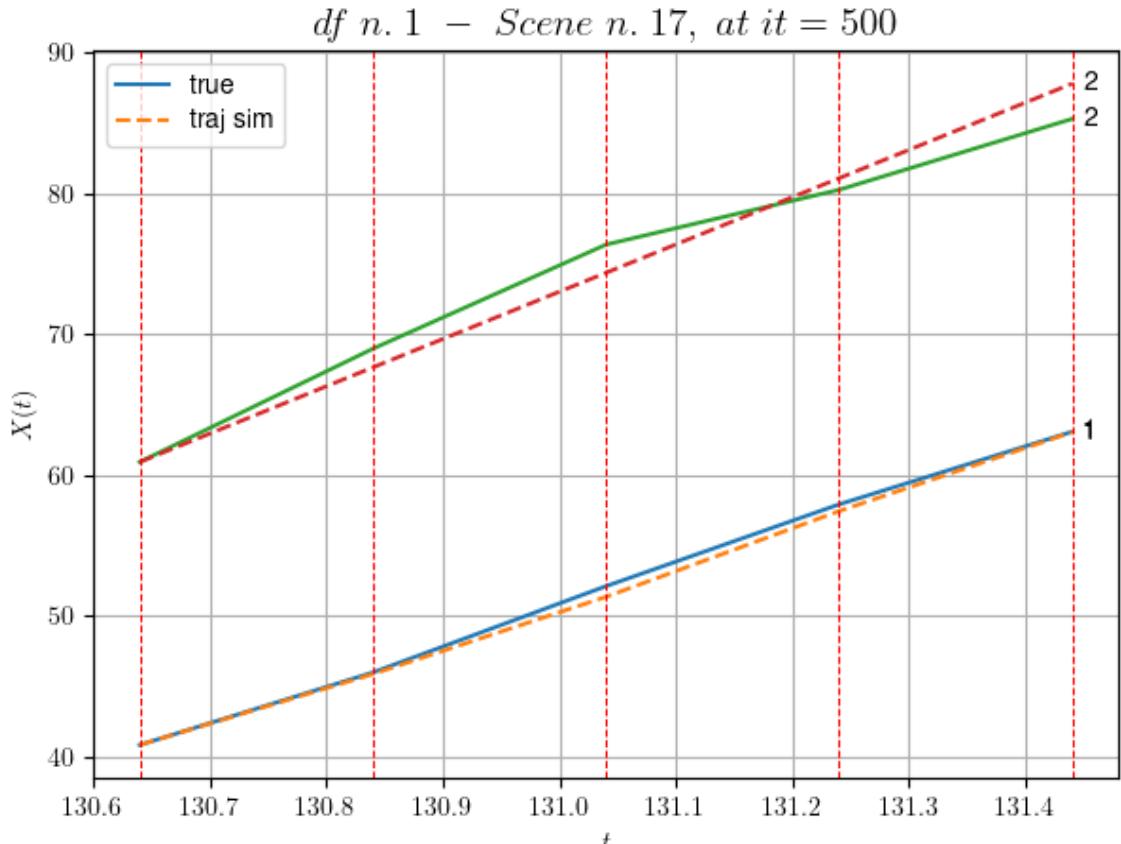


For scene 7/73:

\* After LR finder: LR\_NN=5e-05 with mse=1.3925874718463511  
at it=24  
\* v0 = 31.912591419185986  
\* MSE = 0.9811203150617305  
\* iterations = 500

DataFrame n.1. Scene n.8/73

We have 4 time intervals inside [130.64,131.44]

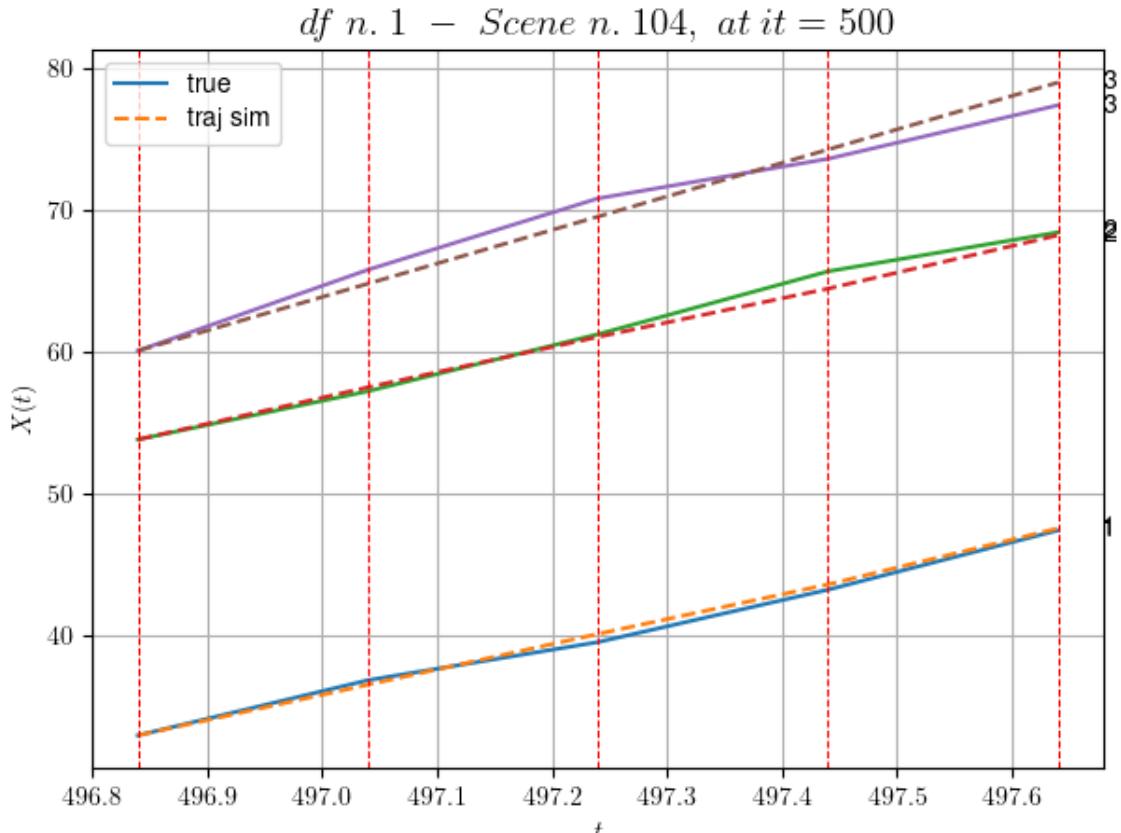


For scene 8/73:

\* After LR finder: LR\_NN=0.0005 with mse=1.8747221972832877  
at it=24  
\* v0 = 33.61924590429456  
\* MSE = 1.1794618393427687  
\* iterations = 500

DataFrame n.1. Scene n.9/73

We have 4 time intervals inside [496.84,497.64]



---

For scene 9/73:

- \* After LR finder:  $LR\_NN=0.001$  with  $mse=13.388096816612405$

at it=24

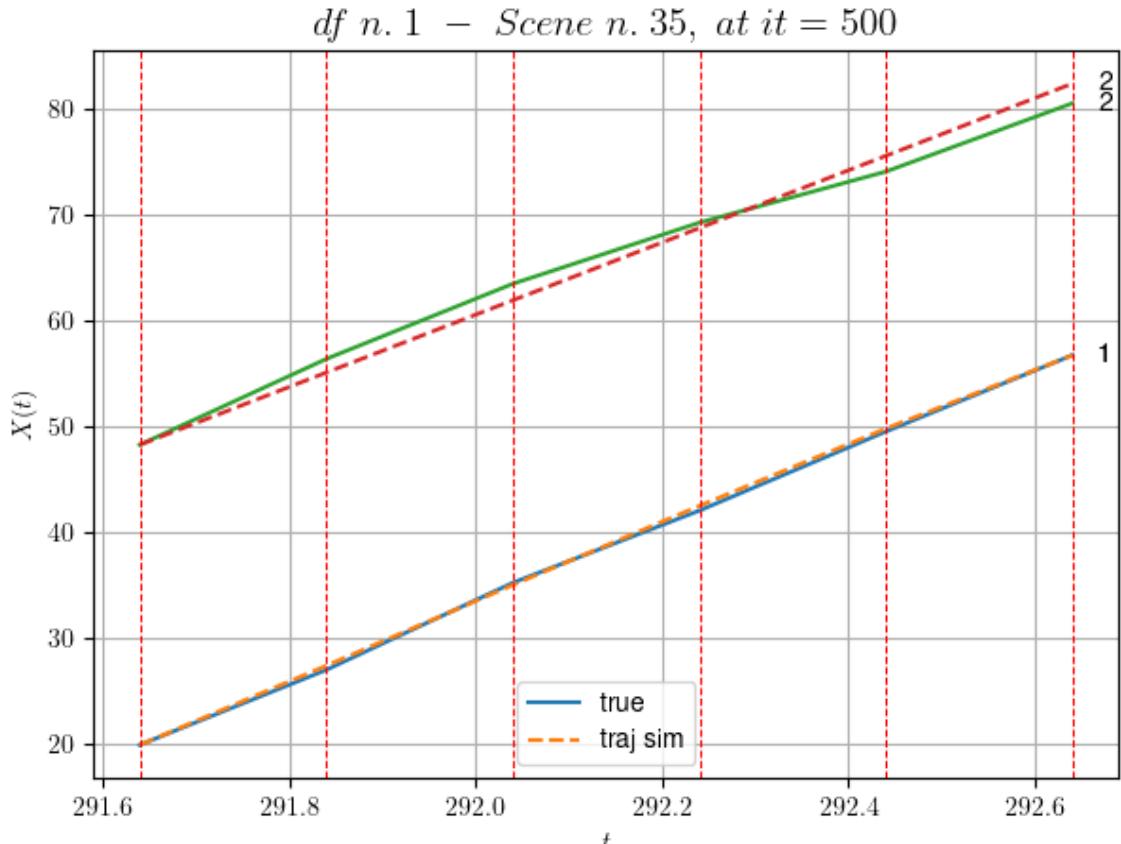
- \*  $v_0 = 23.67102213011825$
- \* MSE = 0.5214771121435829
- \* iterations = 500

---

DataFrame n.1. Scene n.10/73

---

We have 5 time intervals inside [291.64, 292.64]

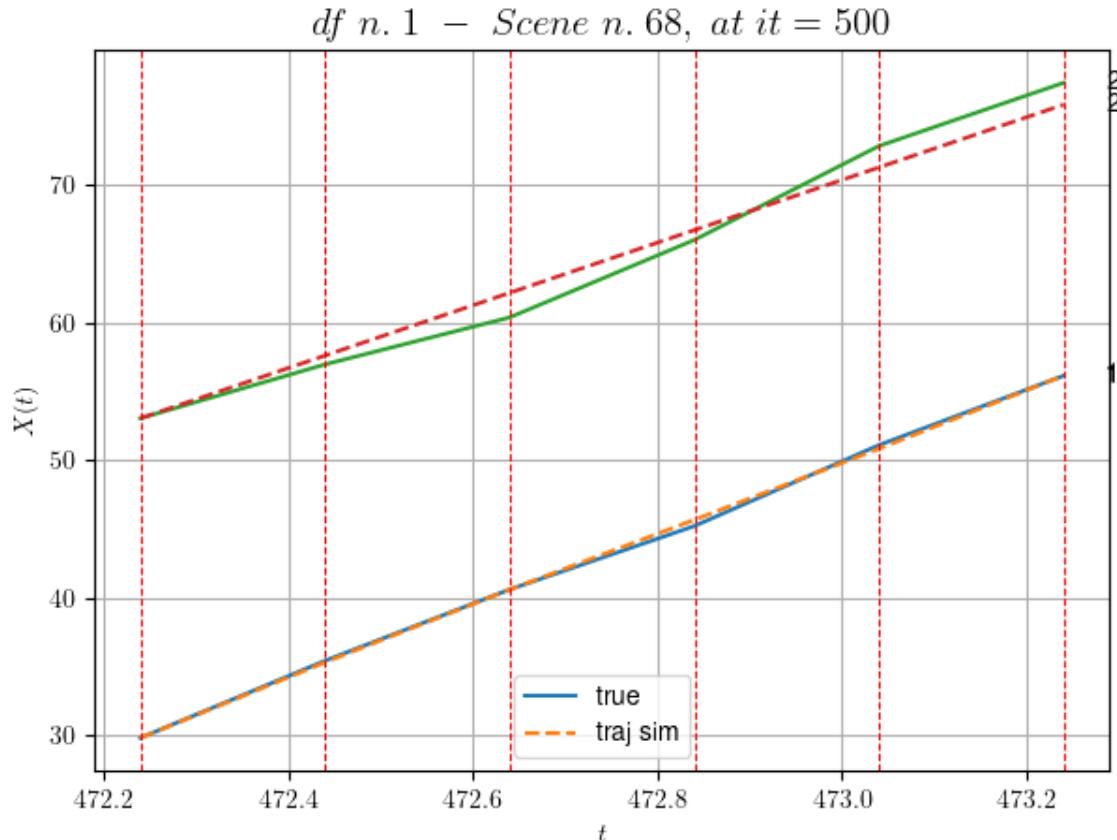


For scene 10/73:

\* After LR finder: LR\_NN=1e-05 with mse=2.774698722750408 at it=24  
\* v0 = 34.11909568875032  
\* MSE = 0.7440560050416197  
\* iterations = 500

DataFrame n.1. Scene n.11/73

We have 5 time intervals inside [472.24,473.24]



---

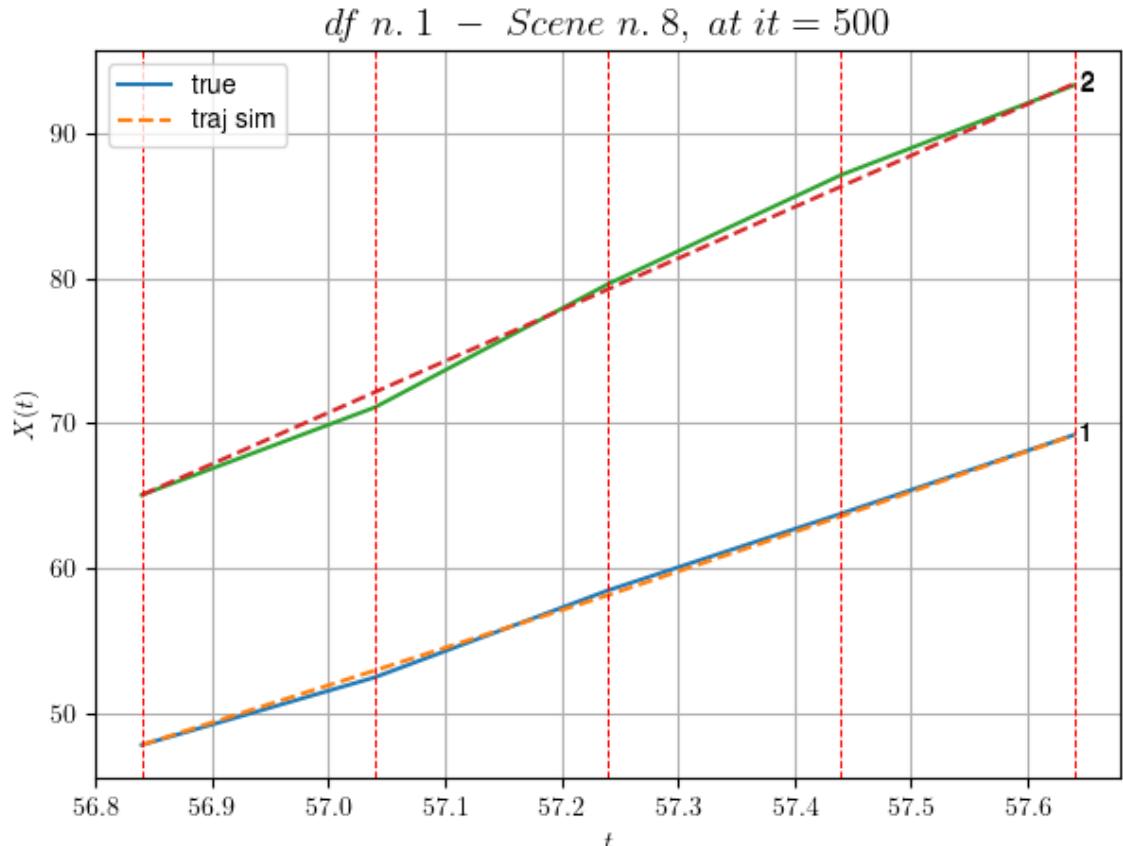
For scene 11/73:  
\* After LR finder: LR\_NN=5e-05 with mse=8.503546024985116 at it=24  
\* v0 = 22.764702156056572  
\* MSE = 0.6869268621709972  
\* iterations = 500

---

DataFrame n.1. Scene n.12/73

---

We have 4 time intervals inside [56.84,57.64]

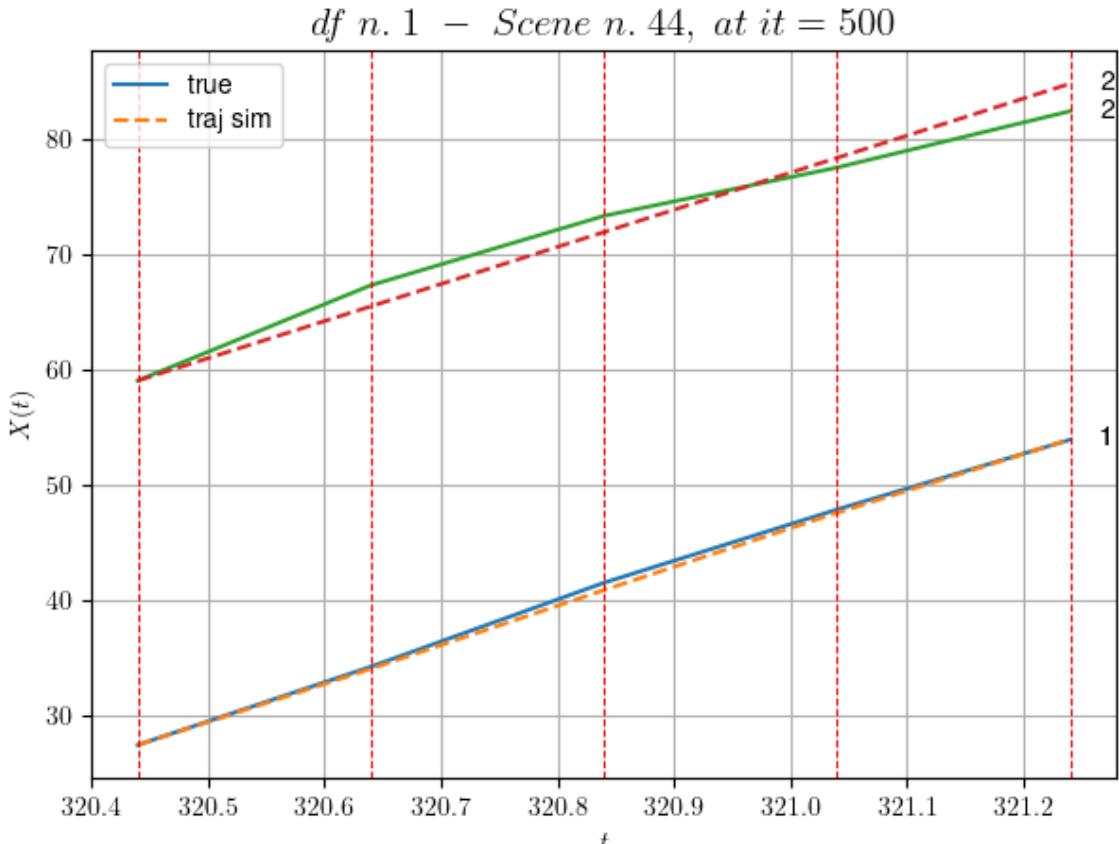


For scene 12/73:

\* After LR finder: LR\_NN=5e-05 with mse=4.487013104467577 at it=24  
\* v0 = 35.49695649017791  
\* MSE = 0.2233599743674699  
\* iterations = 500

DataFrame n.1. Scene n.13/73

We have 4 time intervals inside [320.44,321.24]

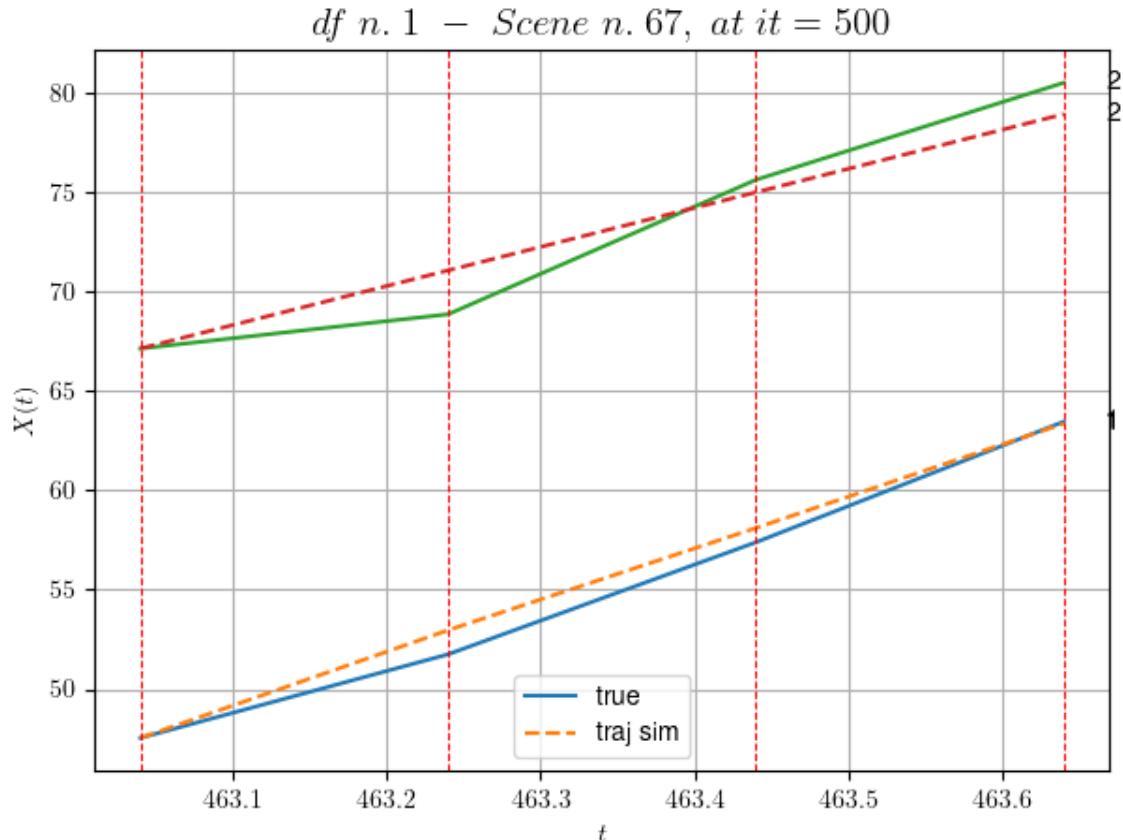


For scene 13/73:

\* After LR finder: LR\_NN=5e-05 with mse=1.1303852498501488  
at it=24  
\* v0 = 32.19336724924334  
\* MSE = 1.0636850806233267  
\* iterations = 500

DataFrame n.1. Scene n.14/73

We have 3 time intervals inside [463.04,463.64]



---

For scene 14/73:

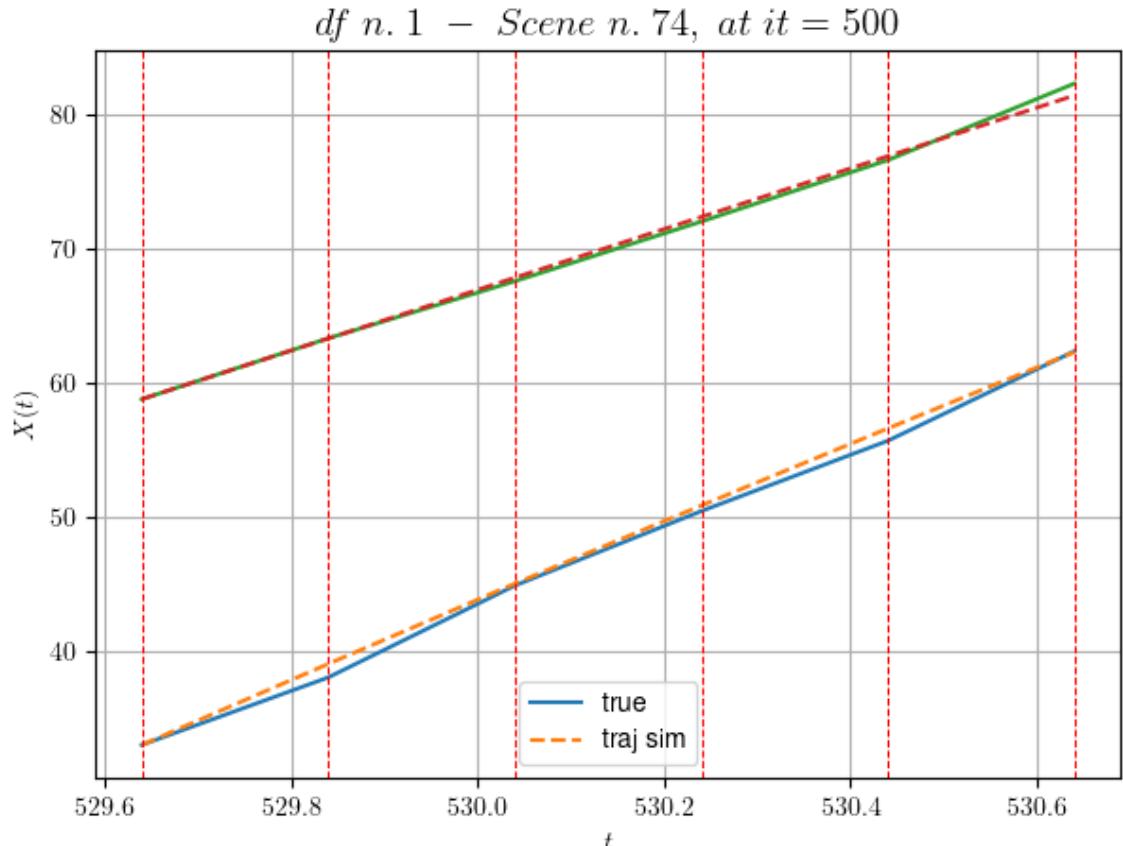
```
* After LR finder: LR_NN=5e-05 with mse=6.851440615435513 at it=24
* v0 = 19.662006047653765
* MSE = 1.116131202150651
* iterations = 500
```

---

DataFrame n.1. Scene n.15/73

---

We have 5 time intervals inside [529.64, 530.64]



For scene 15/73:

\* After LR finder: LR\_NN=1e-05 with mse=10.082270344079348

at it=24

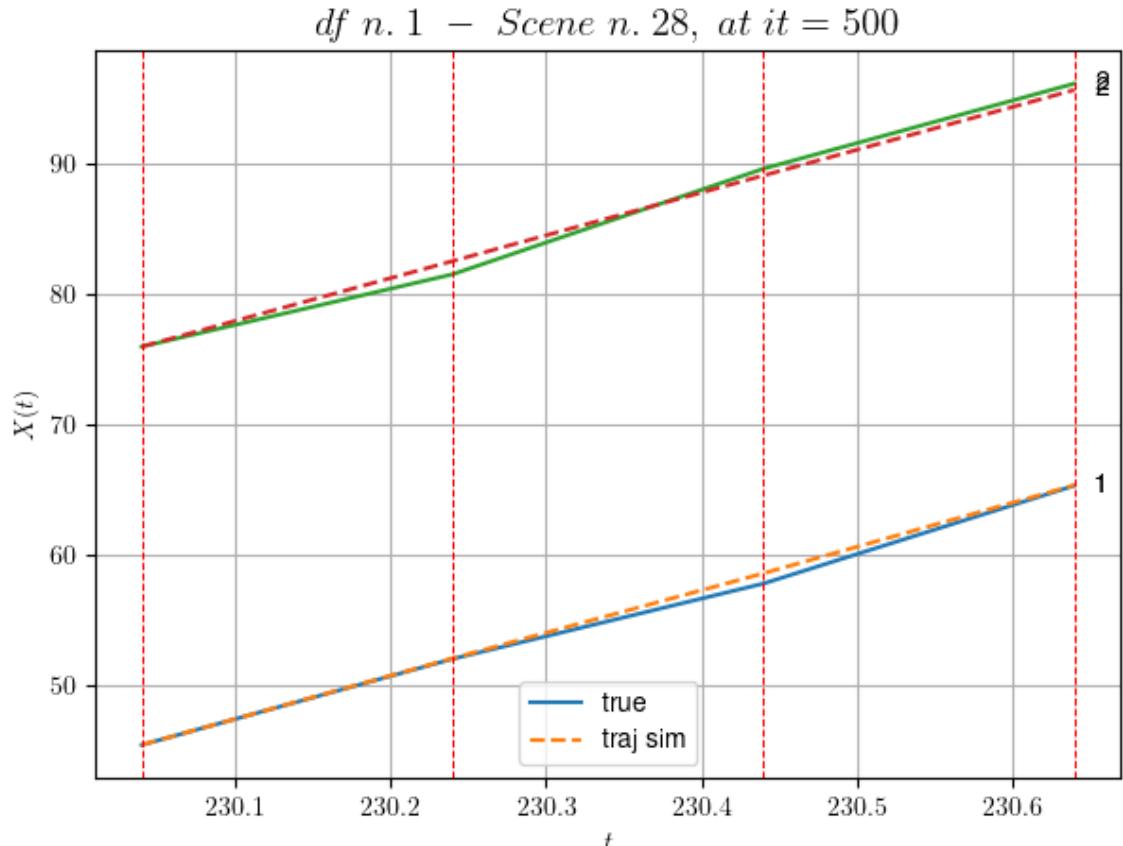
\* v0 = 22.628998285035525

\* MSE = 0.25848260283480423

\* iterations = 500

DataFrame n.1. Scene n.16/73

We have 3 time intervals inside [230.04, 230.64]

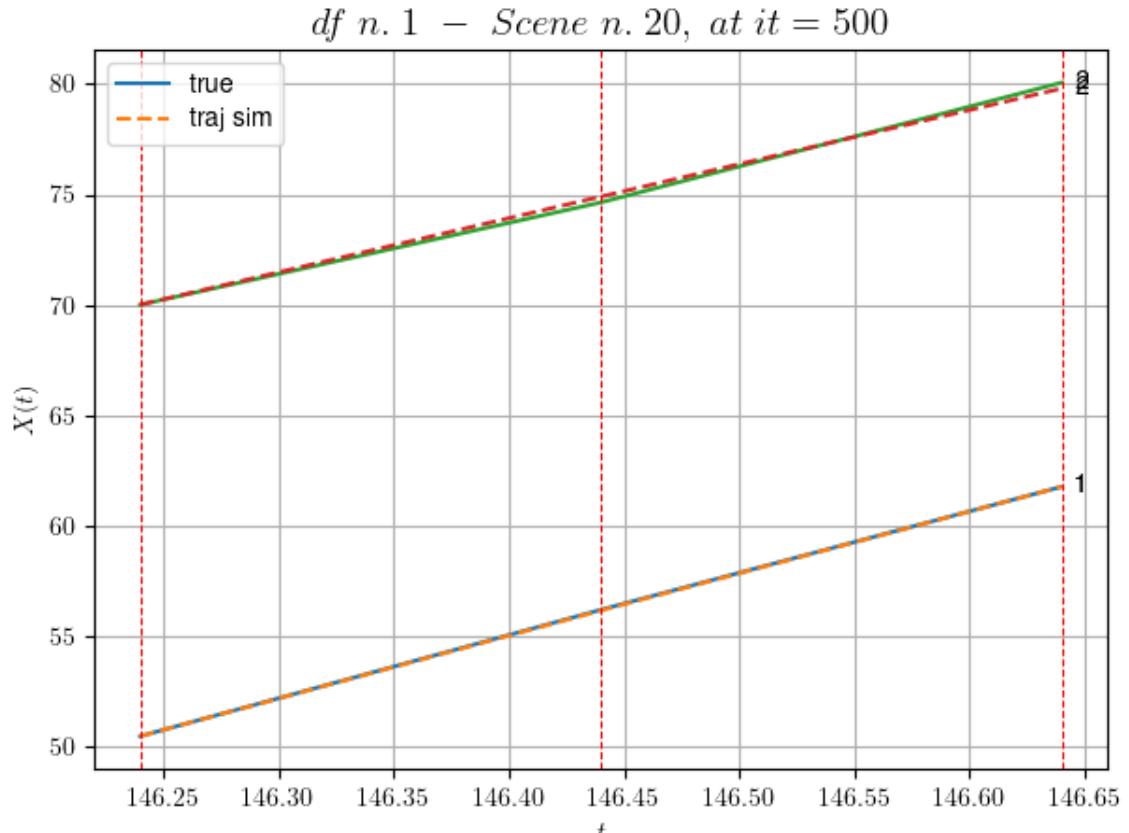


For scene 16/73:

\* After LR finder: LR\_NN=1e-05 with mse=1.001432346552668 at it=24  
\* v0 = 32.80710231491772  
\* MSE = 0.26969590851434977  
\* iterations = 500

DataFrame n.1. Scene n.17/73

We have 2 time intervals inside [146.24,146.64]



---

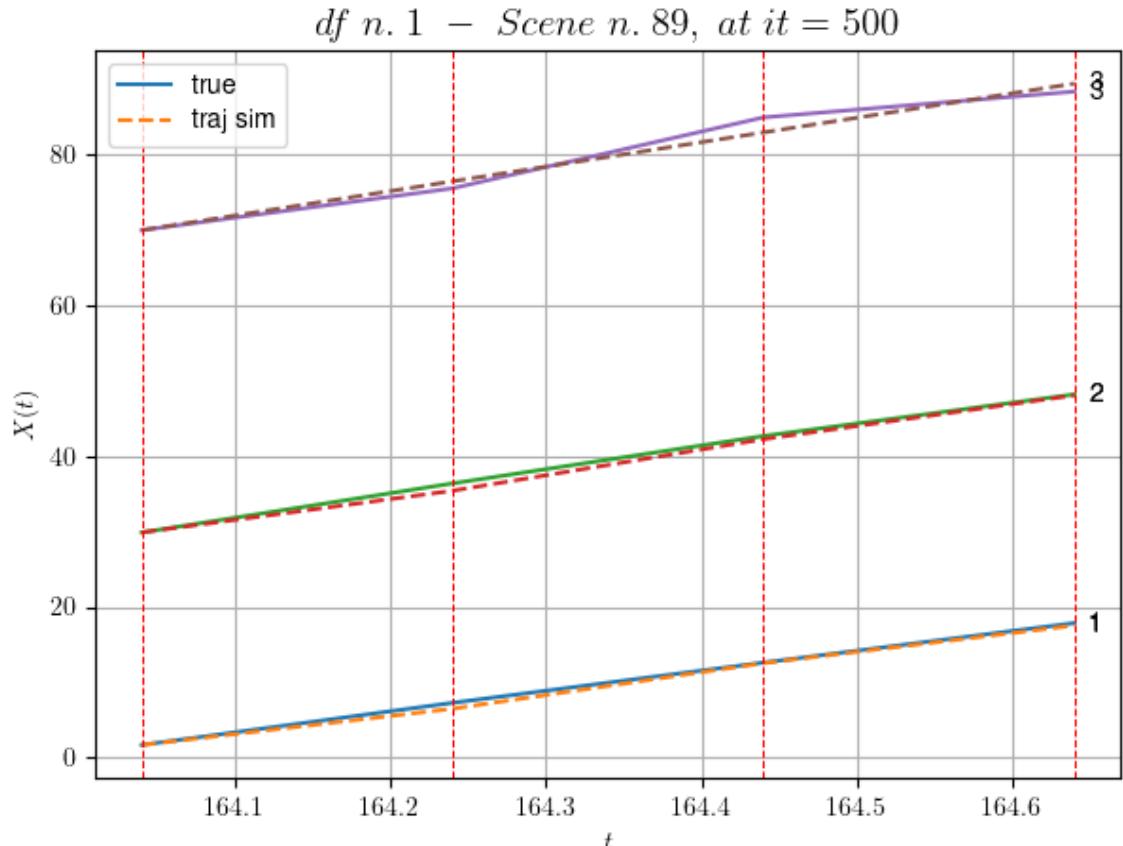
For scene 17/73:  
\* After LR finder: LR\_NN=5e-05 with mse=0.9427864831755766  
at it=24  
\* v0 = 24.481033300048846  
\* MSE = 0.021235577259214072  
\* iterations = 500

---

DataFrame n.1. Scene n.18/73

---

We have 3 time intervals inside [164.04,164.64]

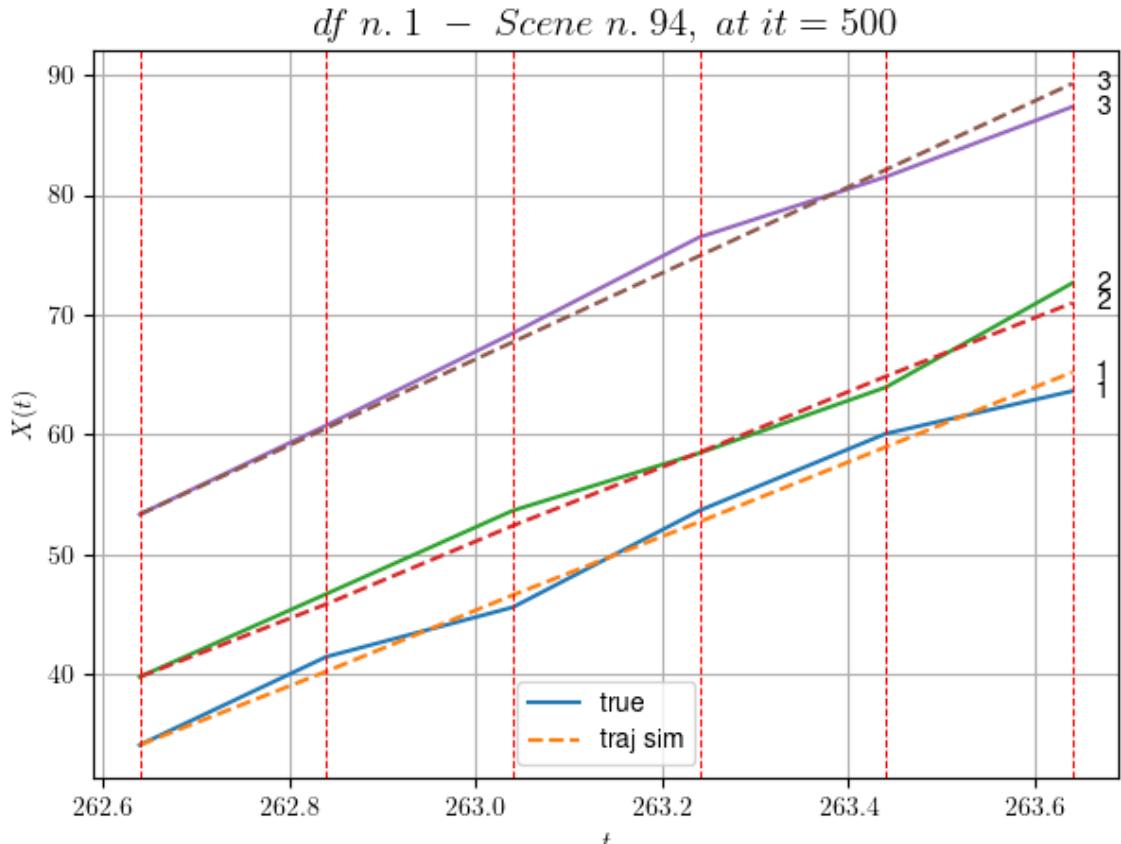


For scene 18/73:

\* After LR finder: LR\_NN=0.0005 with mse=1.5184281535001436  
at it=24  
\* v0 = 32.43285094624352  
\* MSE = 0.5750744997976579  
\* iterations = 500

DataFrame n.1. Scene n.19/73

We have 5 time intervals inside [262.64,263.64]

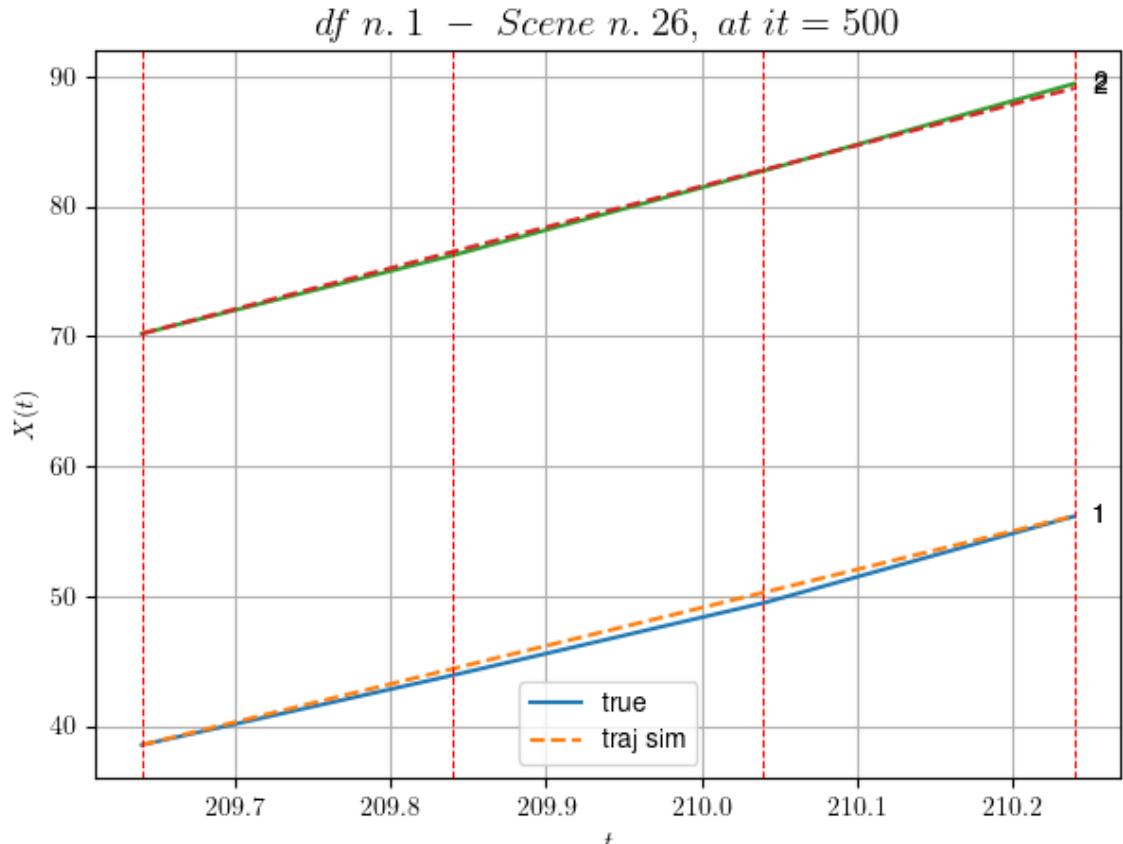


For scene 19/73:

\* After LR finder: LR\_NN=0.0005 with mse=28.42339218478818  
at it=24  
\* v0 = 35.931097427464465  
\* MSE = 1.117748797697476  
\* iterations = 500

DataFrame n.1. Scene n.20/73

We have 3 time intervals inside [209.64,210.24]

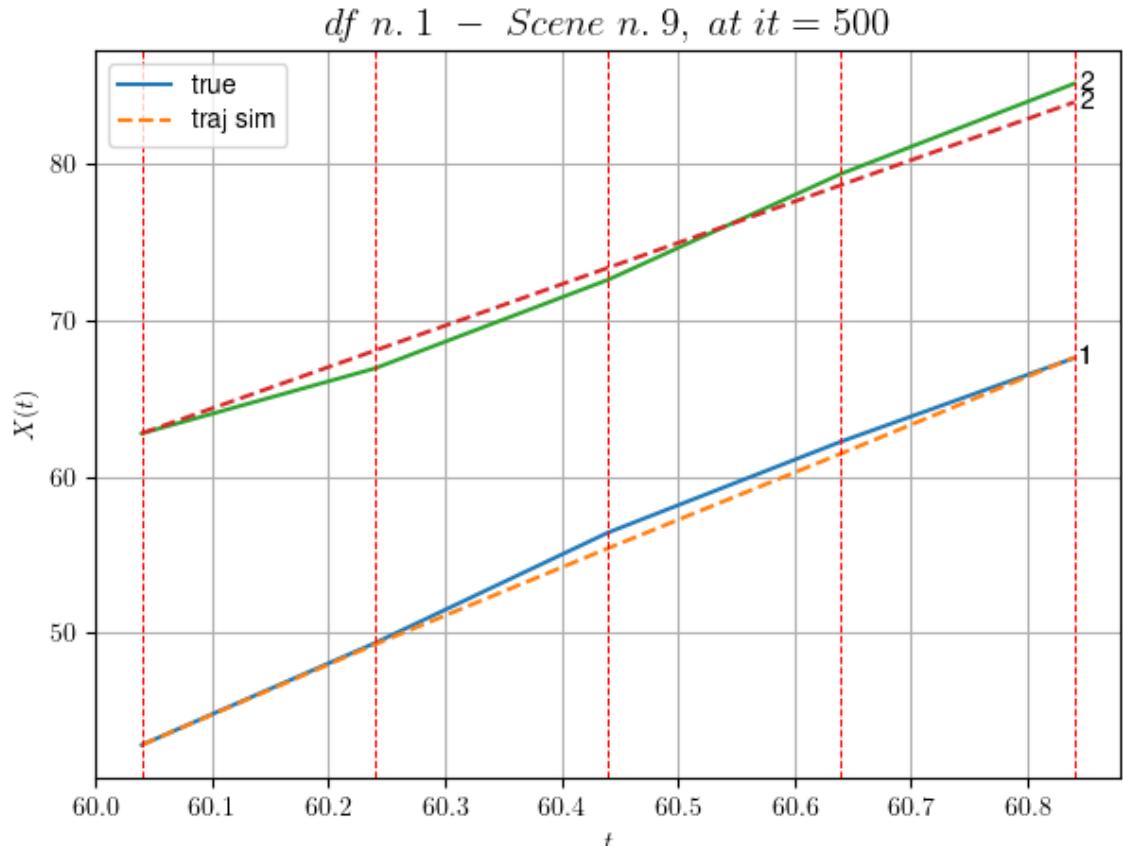


For scene 20/73:

\* After LR finder: LR\_NN=1e-05 with mse=0.3591151669714573  
at it=24  
\* v0 = 31.507071372239306  
\* MSE = 0.13884316236384636  
\* iterations = 500

DataFrame n.1. Scene n.21/73

We have 4 time intervals inside [60.04,60.84]



---

For scene 21/73:

\* After LR finder: LR\_NN=5e-05 with mse=1.3544127850885515  
at it=24  
\* v0 = 26.521619591085845  
\* MSE = 0.5442130662973161  
\* iterations = 500

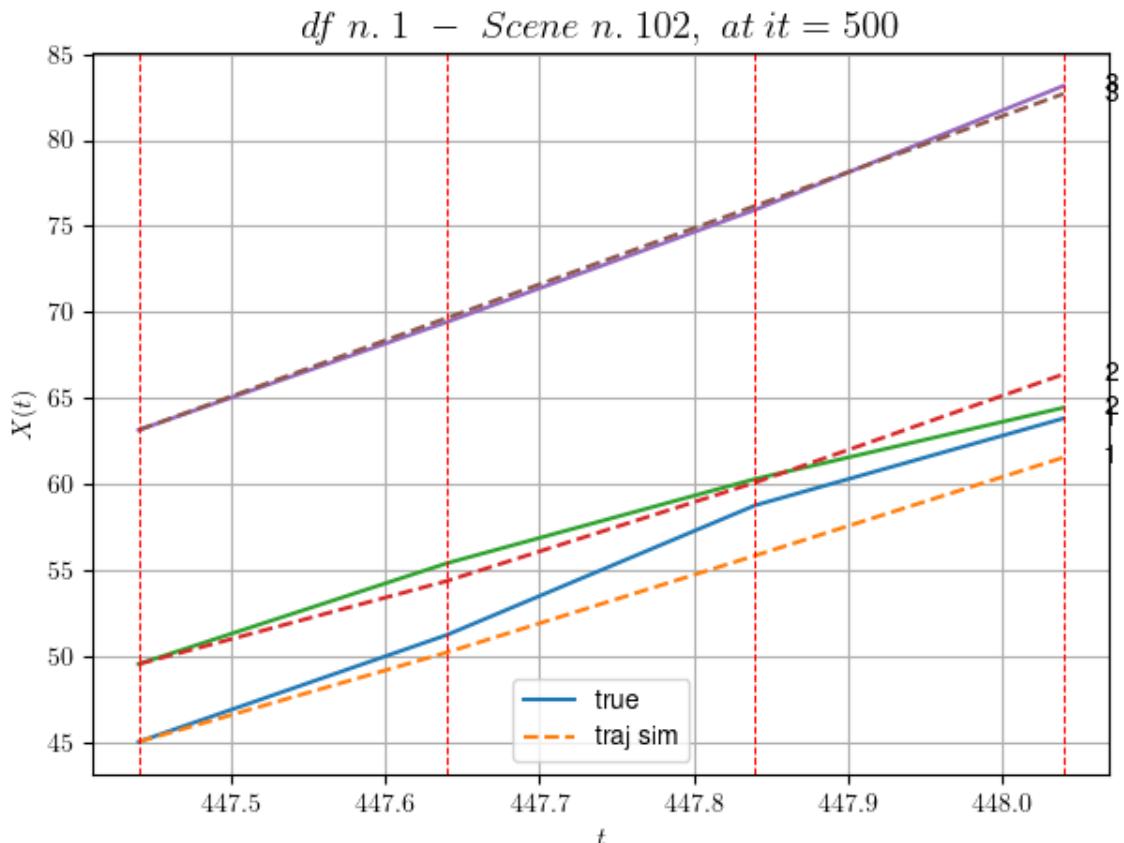
---

---

DataFrame n.1. Scene n.22/73

---

We have 3 time intervals inside [447.44,448.04]



---

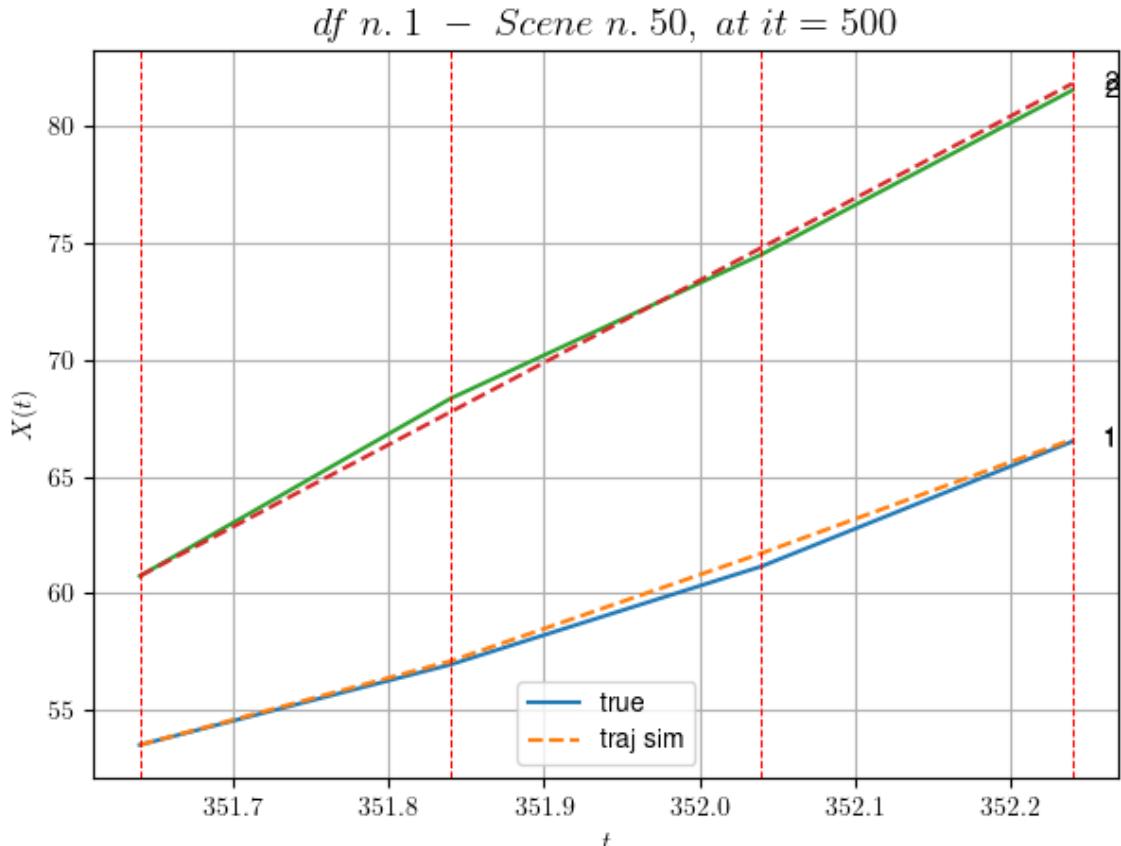
For scene 22/73:  
\* After LR finder: LR\_NN=0.001 with mse=18.63388426241622 at it=24  
\* v0 = 32.58486004517711  
\* MSE = 1.6617219883602086  
\* iterations = 500

---

DataFrame n.1. Scene n.23/73

---

We have 3 time intervals inside [351.64, 352.24]

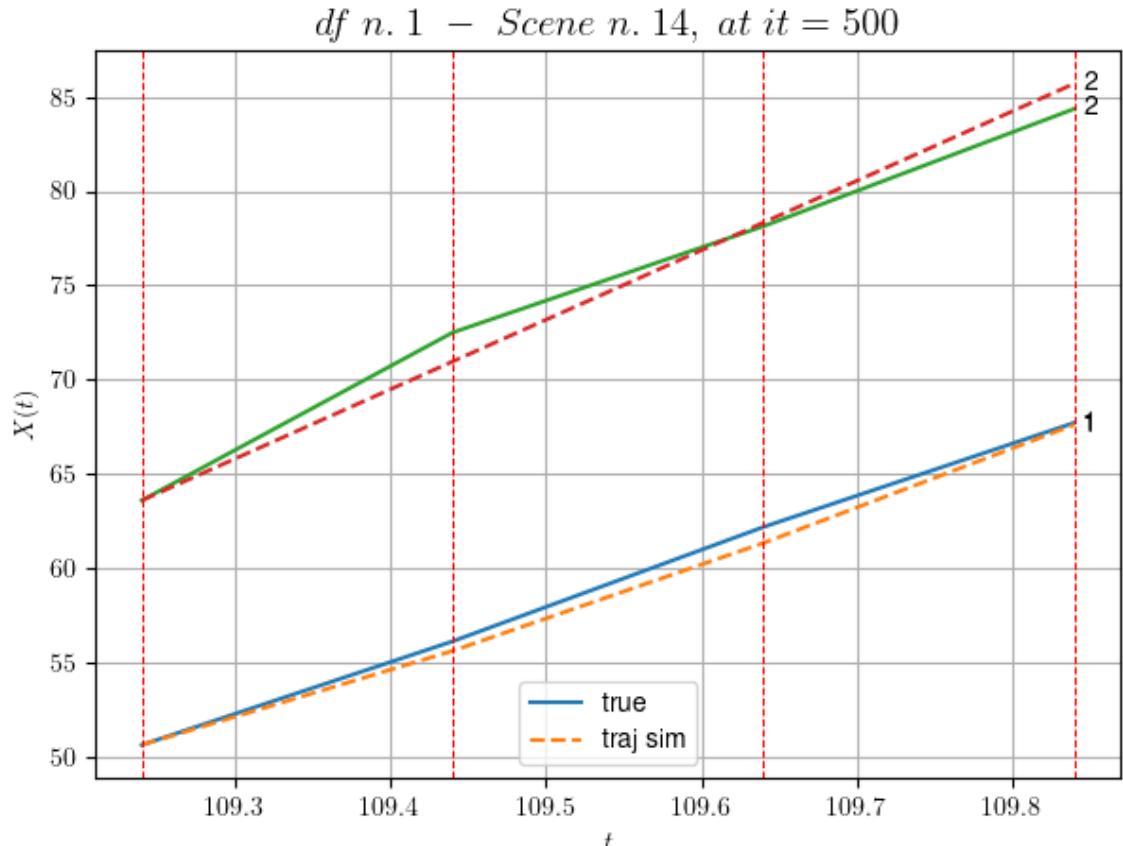


For scene 23/73:

\* After LR finder: LR\_NN=0.0005 with mse=1.7167279001208493  
at it=24  
\* v0 = 35.128237730719775  
\* MSE = 0.10475649669205596  
\* iterations = 500

DataFrame n.1. Scene n.24/73

We have 3 time intervals inside [109.24,109.84]

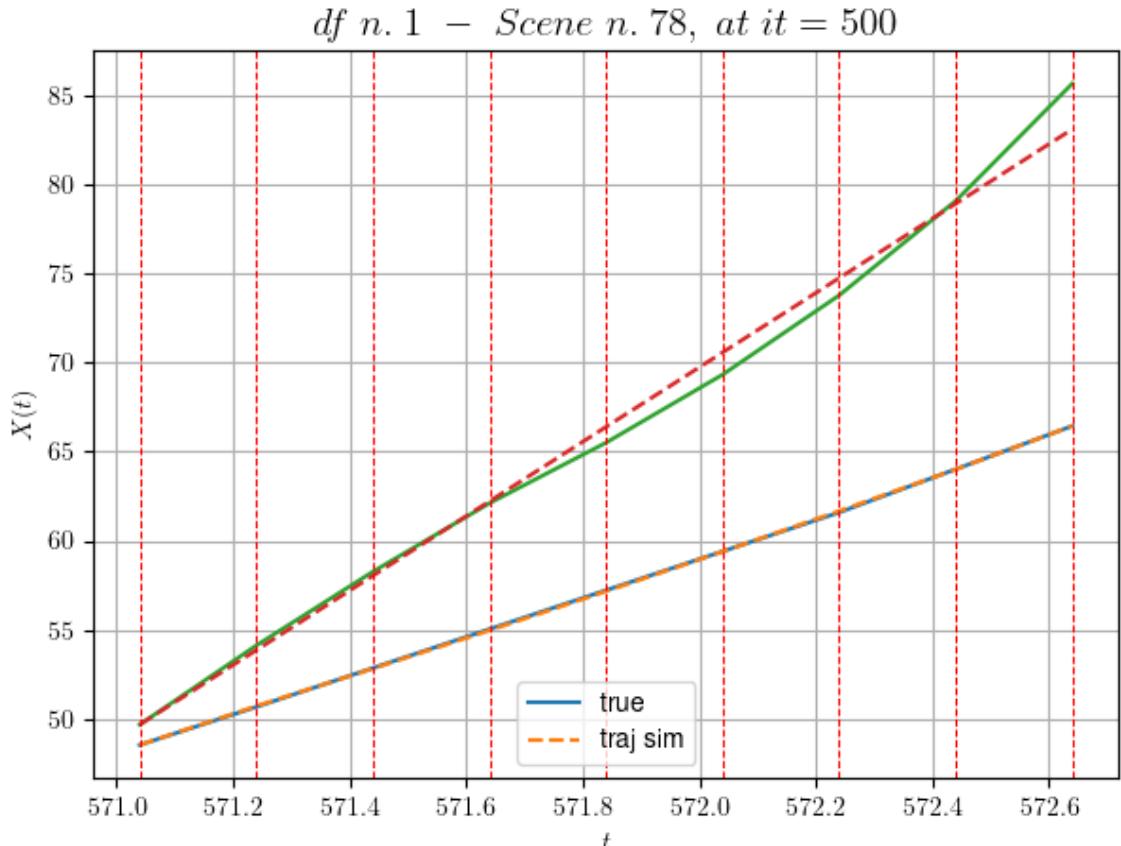


For scene 24/73:

\* After LR finder: LR\_NN=0.001 with mse=2.931405288485088 at it=24  
\*  $v_0 = 36.870360267952954$   
\* MSE = 0.5003337910065855  
\* iterations = 500

DataFrame n.1. Scene n.25/73

We have 8 time intervals inside [571.04,572.64]

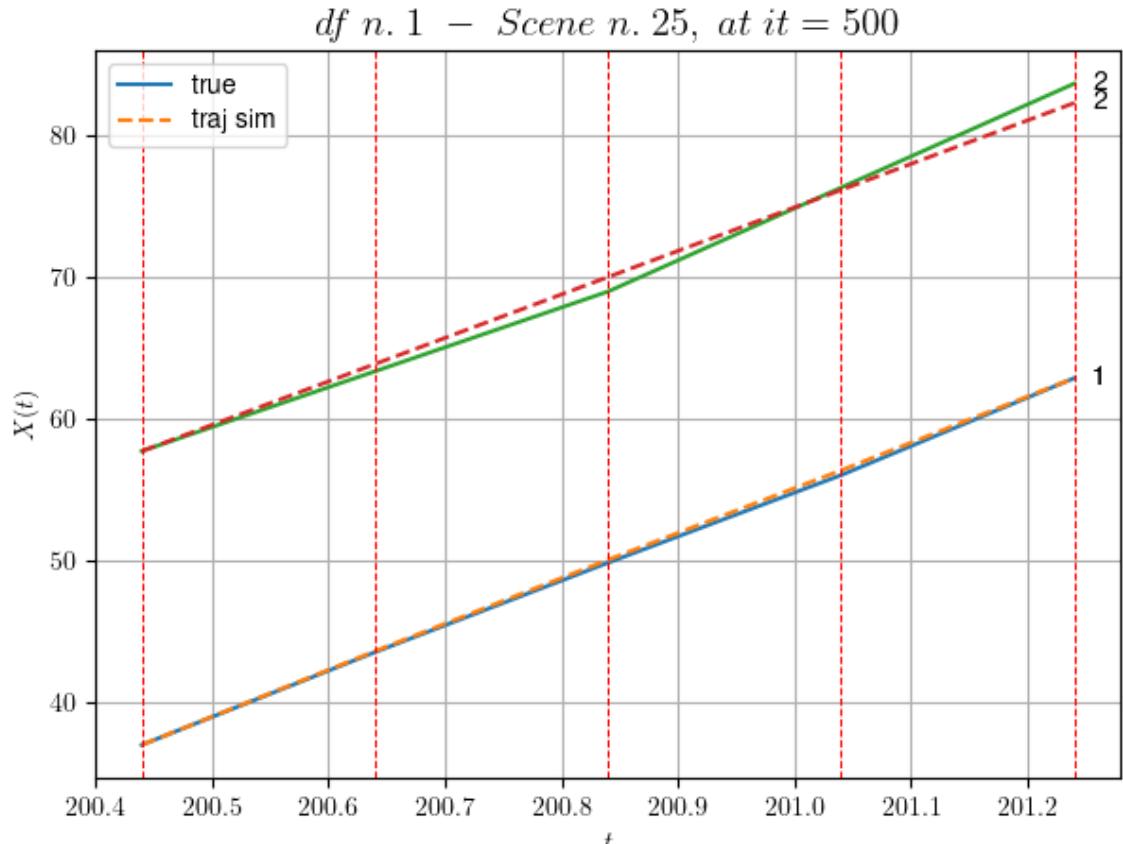


For scene 25/73:

\* After LR finder: LR\_NN=0.001 with mse=42.104584008353754  
at it=24  
\* v0 = 20.877122500554435  
\* MSE = 0.5447725014671053  
\* iterations = 500

DataFrame n.1. Scene n.26/73

We have 4 time intervals inside [200.44,201.24]



---

For scene 26/73:

\* After LR finder: LR\_NN=5e-05 with mse=0.4979795166738432  
at it=24  
\* v0 = 30.710273891218204  
\* MSE = 0.33580000829494205  
\* iterations = 500

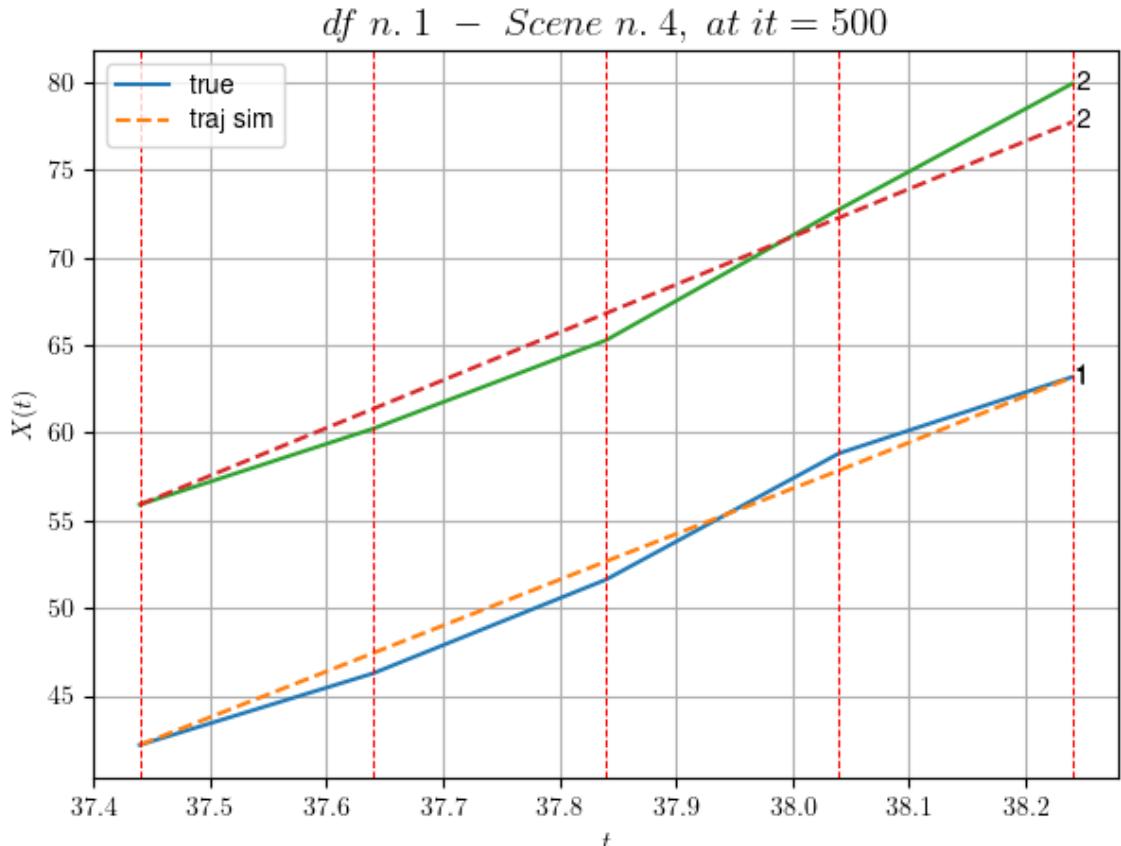
---

---

DataFrame n.1. Scene n.27/73

---

We have 4 time intervals inside [37.44,38.24]

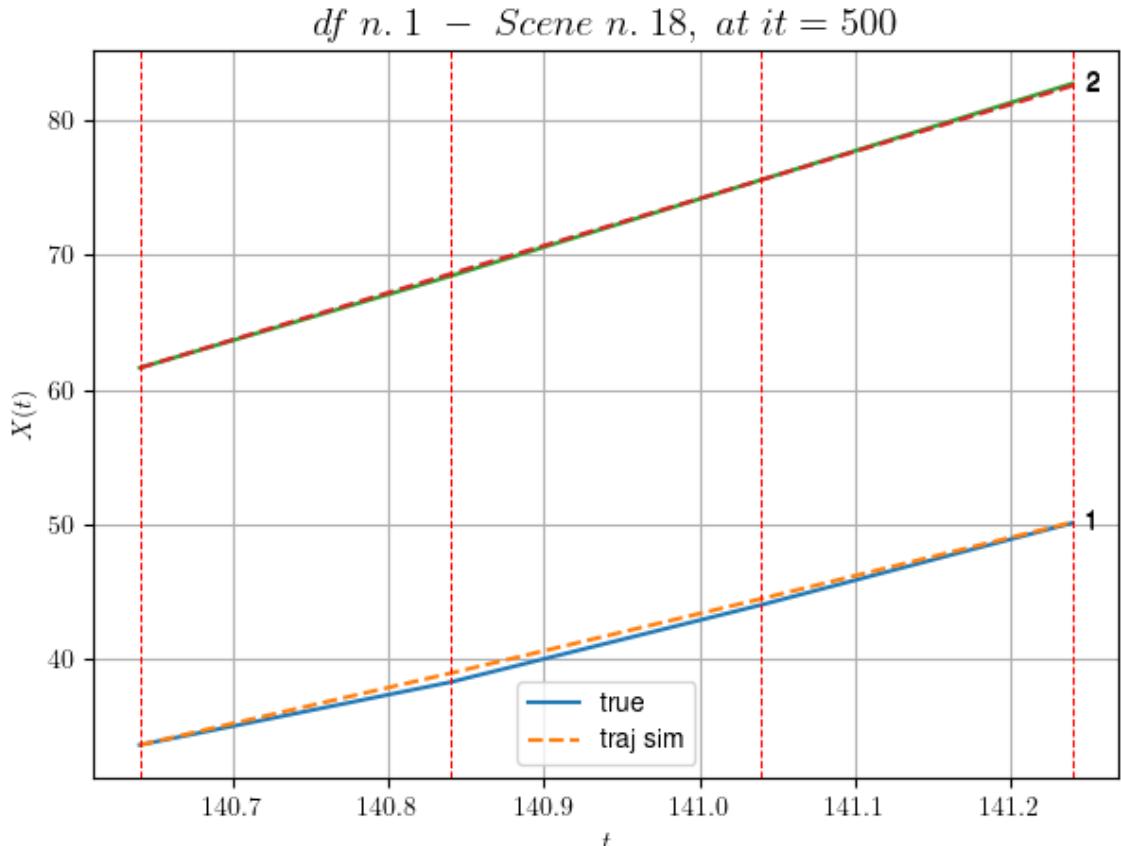


For scene 27/73:

\* After LR finder: LR\_NN=5e-05 with mse=1.4465003107926504  
at it=24  
\* v0 = 27.295254165821063  
\* MSE = 1.0925649349622093  
\* iterations = 500

DataFrame n.1. Scene n.28/73

We have 3 time intervals inside [140.64,141.24]



---

For scene 28/73:

\* After LR finder: LR\_NN=1e-05 with mse=1.8178278493246598  
at it=24  
\* v0 = 34.92834910020676  
\* MSE = 0.08745330564209748  
\* iterations = 500

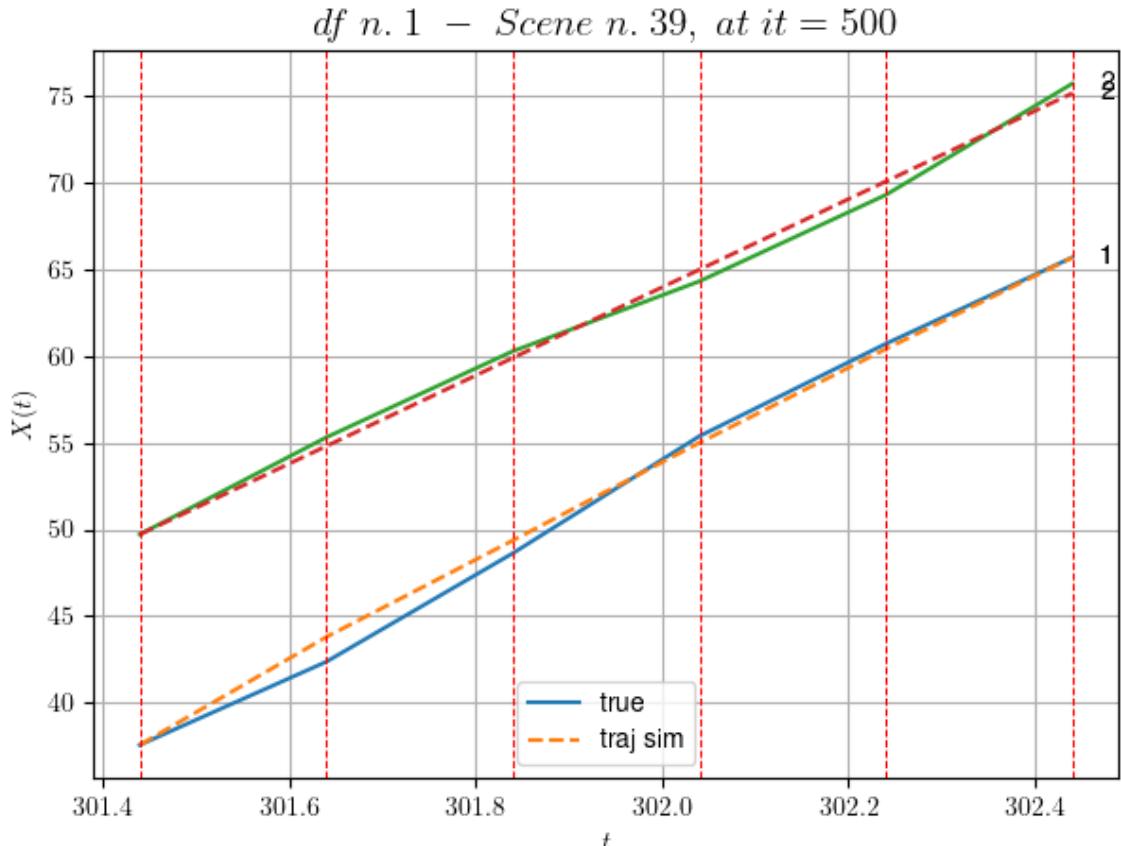
---

---

DataFrame n.1. Scene n.29/73

---

We have 5 time intervals inside [301.44,302.44]

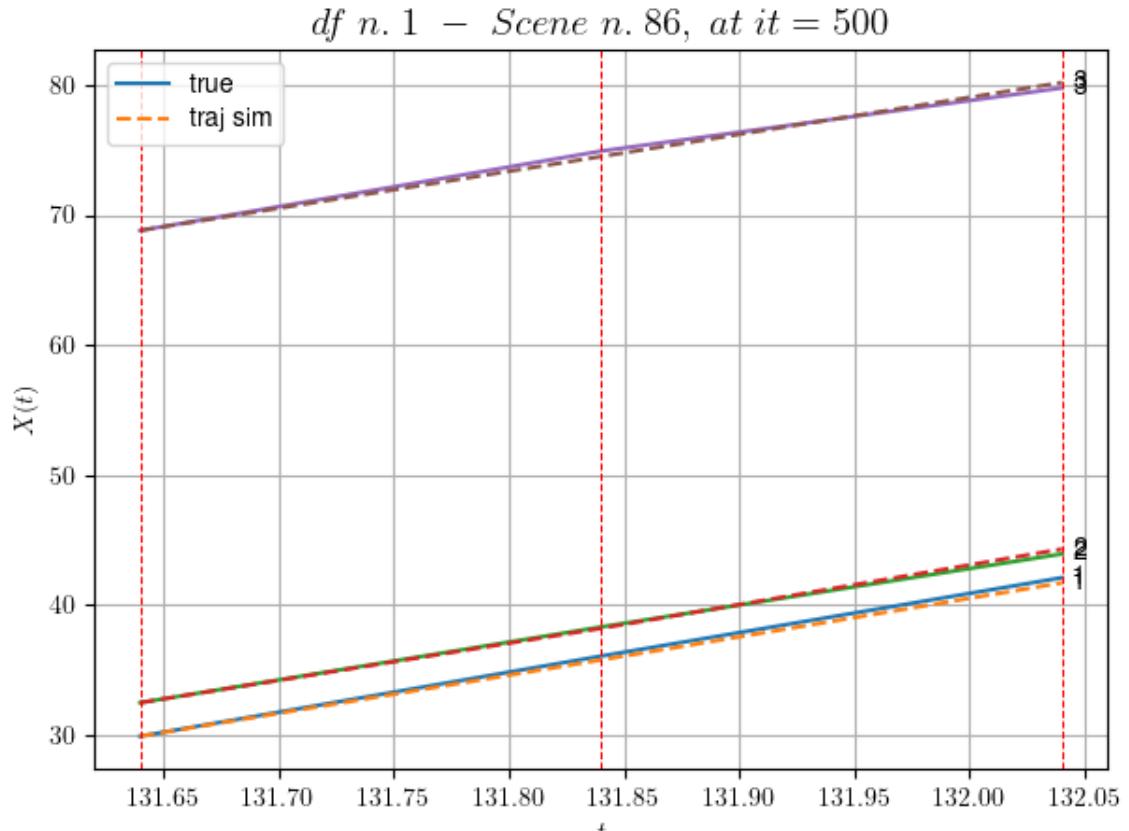


For scene 29/73:

\* After LR finder: LR\_NN=0.001 with mse=4.660137797415938 at it=24  
\*  $v_0 = 25.44608174700868$   
\* MSE = 0.3556973080663149  
\* iterations = 500

DataFrame n.1. Scene n.30/73

We have 2 time intervals inside [131.64,132.04]



---

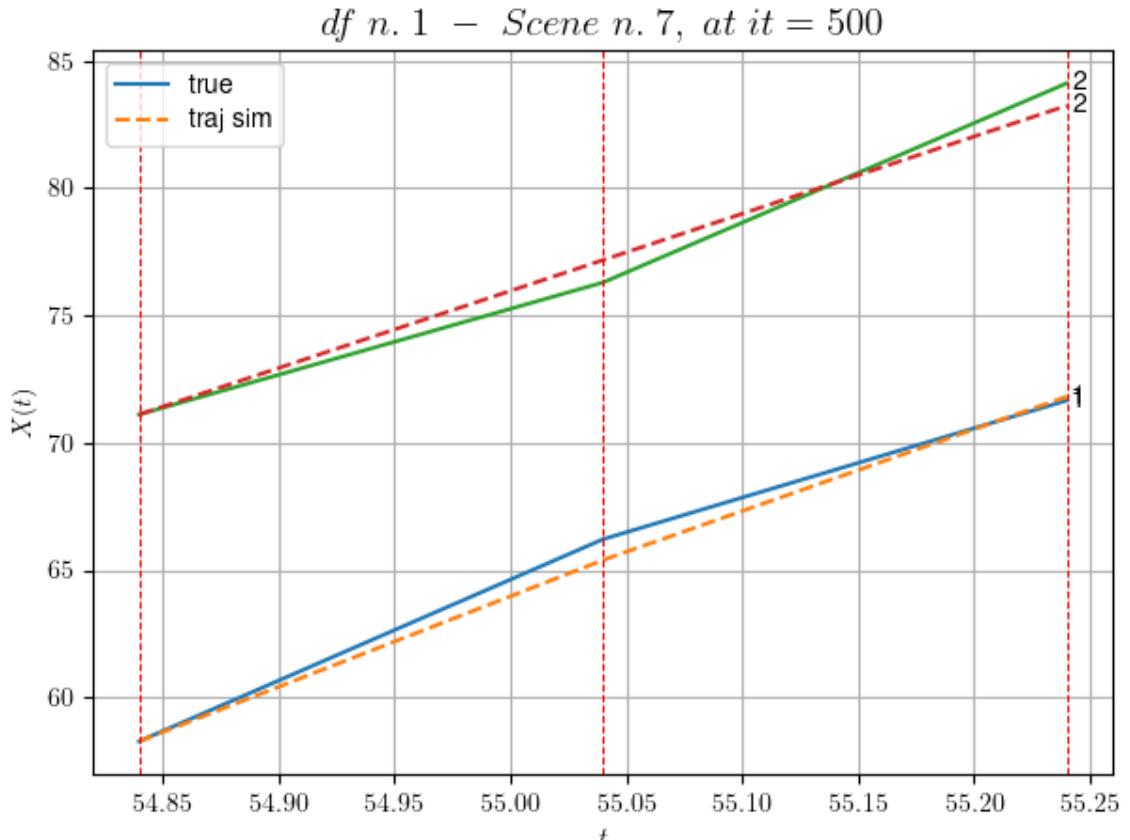
For scene 30/73:  
\* After LR finder: LR\_NN=0.0005 with mse=14.812746576456314  
at it=24  
\* v0 = 28.442892702247057  
\* MSE = 0.08253796617327848  
\* iterations = 500

---

DataFrame n.1. Scene n.31/73

---

We have 2 time intervals inside [54.84,55.24]



For scene 31/73:

\* After LR finder:  $\text{LR\_NN}=0.0001$  with  $\text{mse}=0.3156957296073748$

5 at it=24

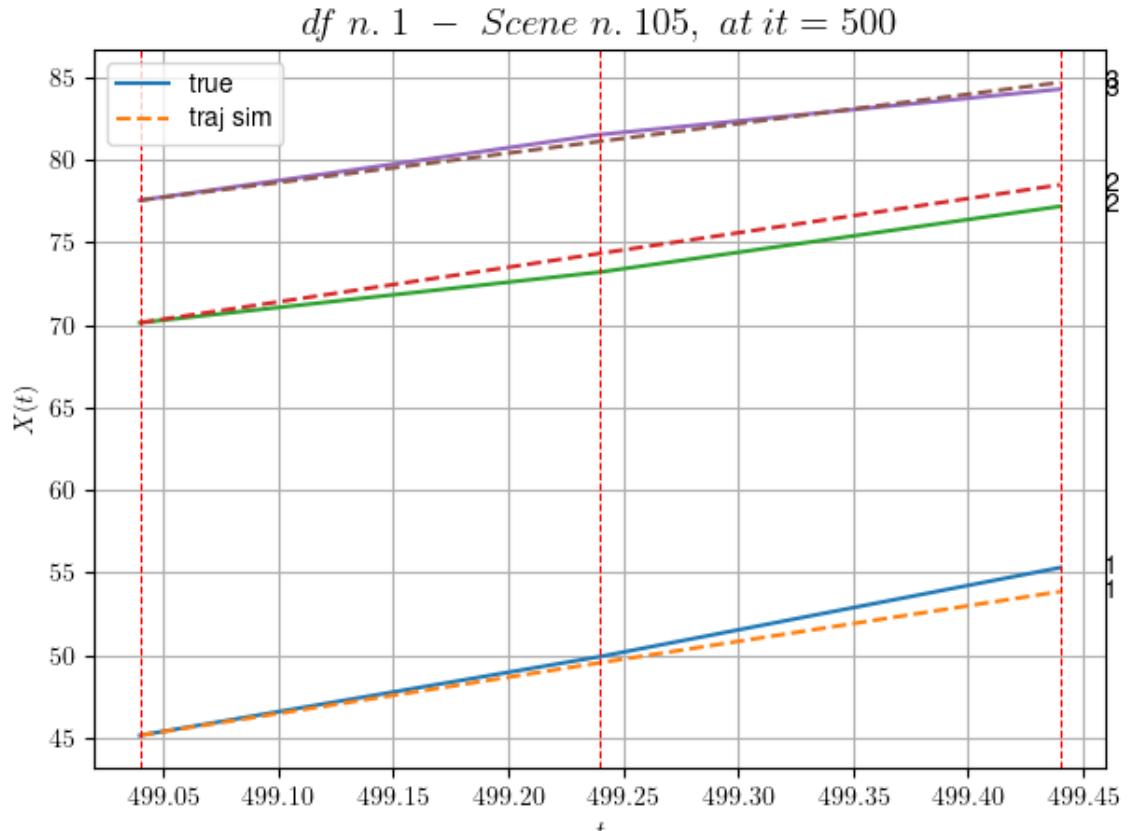
\*  $v_0 = 30.333444658289245$

\* MSE = 0.3736235561895231

\* iterations = 500

DataFrame n.1. Scene n.32/73

We have 2 time intervals inside [499.04, 499.44]



---

For scene 32/73:

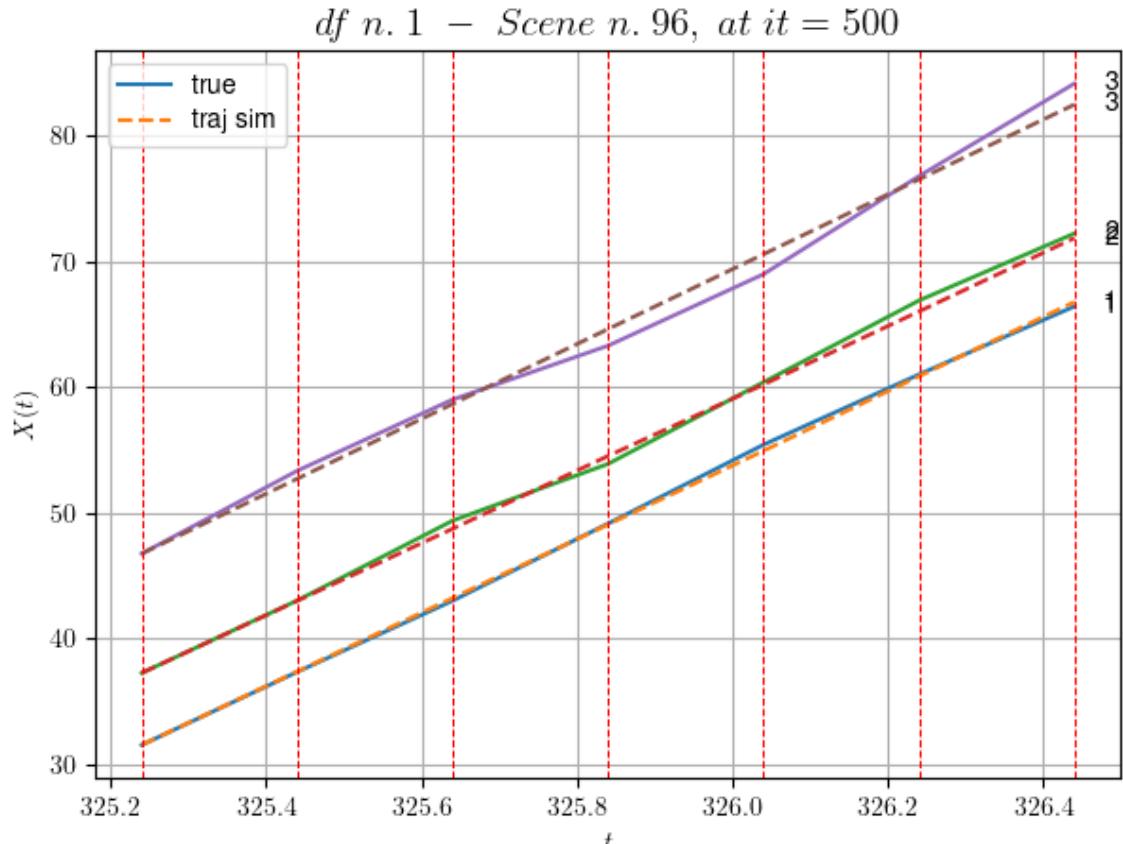
- \* After LR finder: LR\_NN=5e-05 with mse=4.951138413950112 at it=24
- \* v0 = 17.832163517130862
- \* MSE = 0.2062426980896882
- \* iterations = 500

---

DataFrame n.1. Scene n.33/73

---

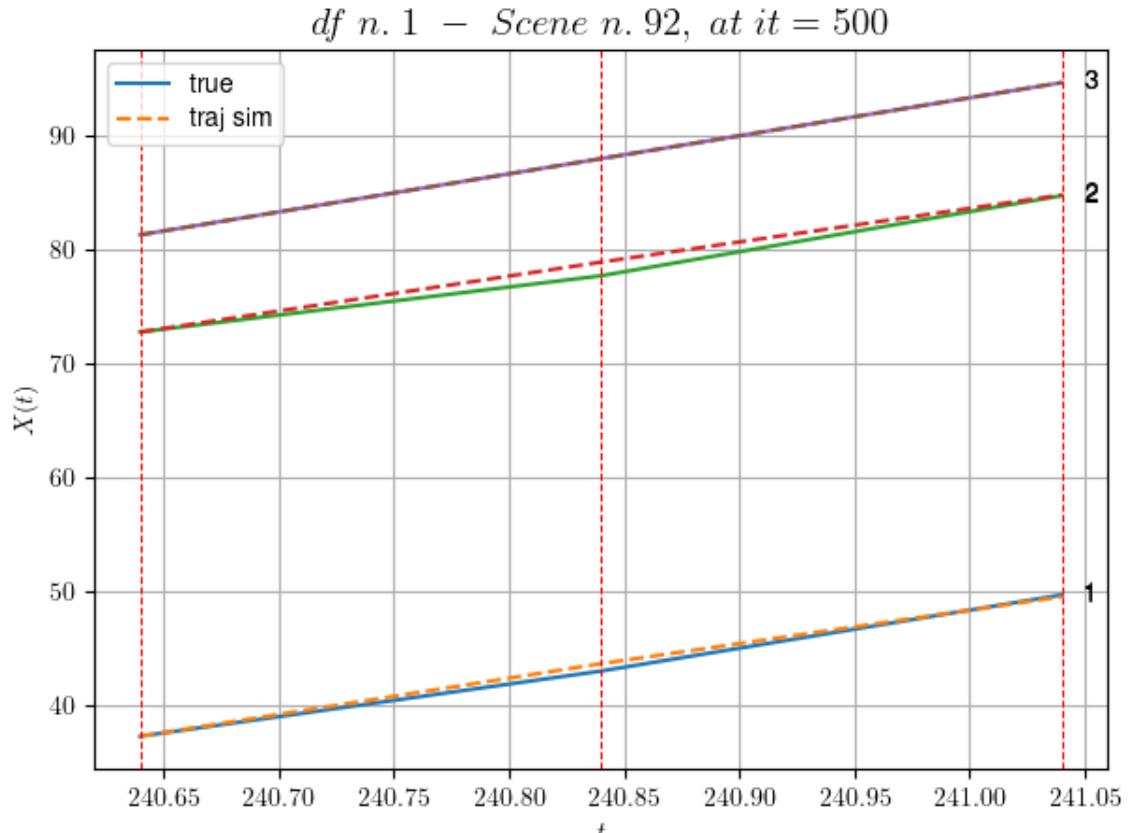
We have 6 time intervals inside [325.24, 326.44]



DataFrame n.1. Scene n.34/73

-----

We have 2 time intervals inside [240.64,241.04]



---

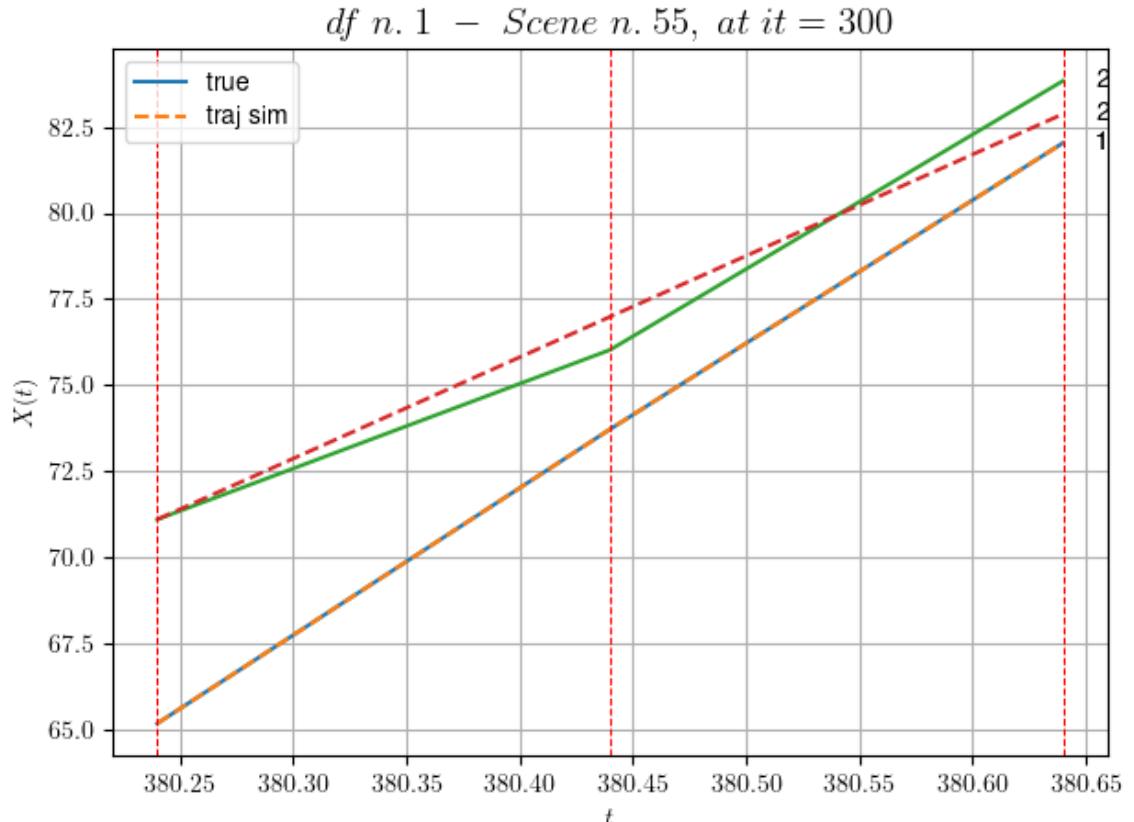
For scene 34/73:  
\* After LR finder: LR\_NN=0.0001 with mse=9.59156208576056 at it=24  
\* v0 = 33.3447698410862  
\* MSE = 0.20067932267235689  
\* iterations = 500

---

DataFrame n.1. Scene n.35/73

---

We have 2 time intervals inside [380.24,380.64]



---

For scene 35/73:

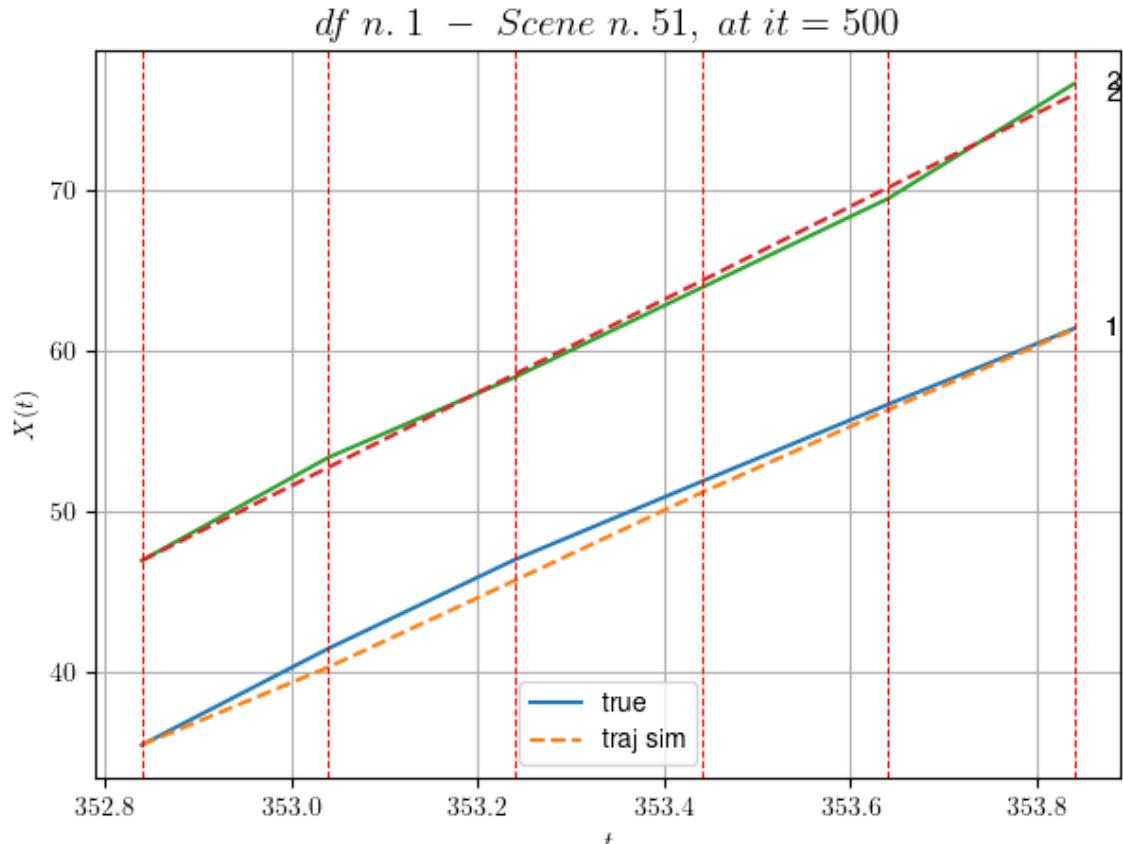
- \* After LR finder: LR\_NN=0.0005 with mse=1.4923208889463824
- at it=24
  - \* v0 = 29.441226387393282
  - \* MSE = 0.2939849808718431
  - \* iterations = 300

---

DataFrame n.1. Scene n.36/73

---

We have 5 time intervals inside [352.84,353.84]



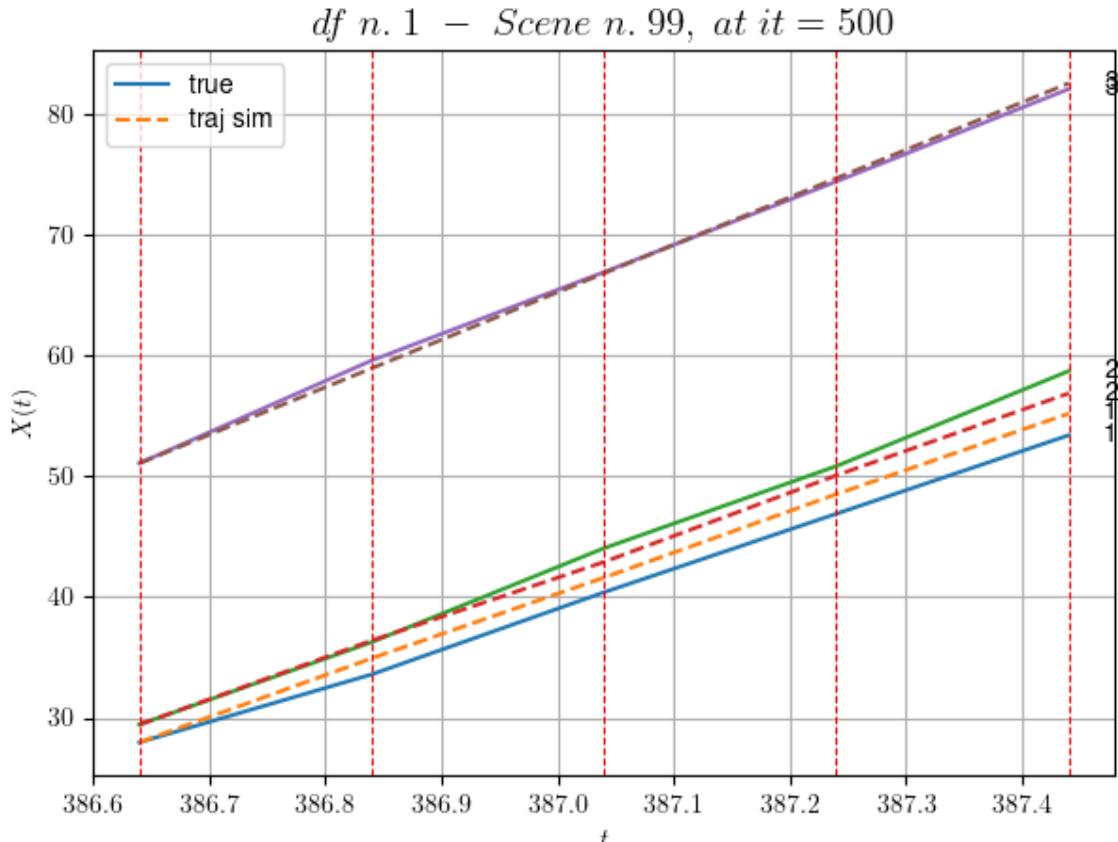
For scene 36/73:

\* After LR finder: LR\_NN=0.001 with mse=0.7853431055202378  
at it=24

- \* v0 = 29.02856357779682
- \* MSE = 0.3229806243808212
- \* iterations = 500

DataFrame n.1. Scene n.37/73

We have 4 time intervals inside [386.64,387.44]



---

For scene 37/73:

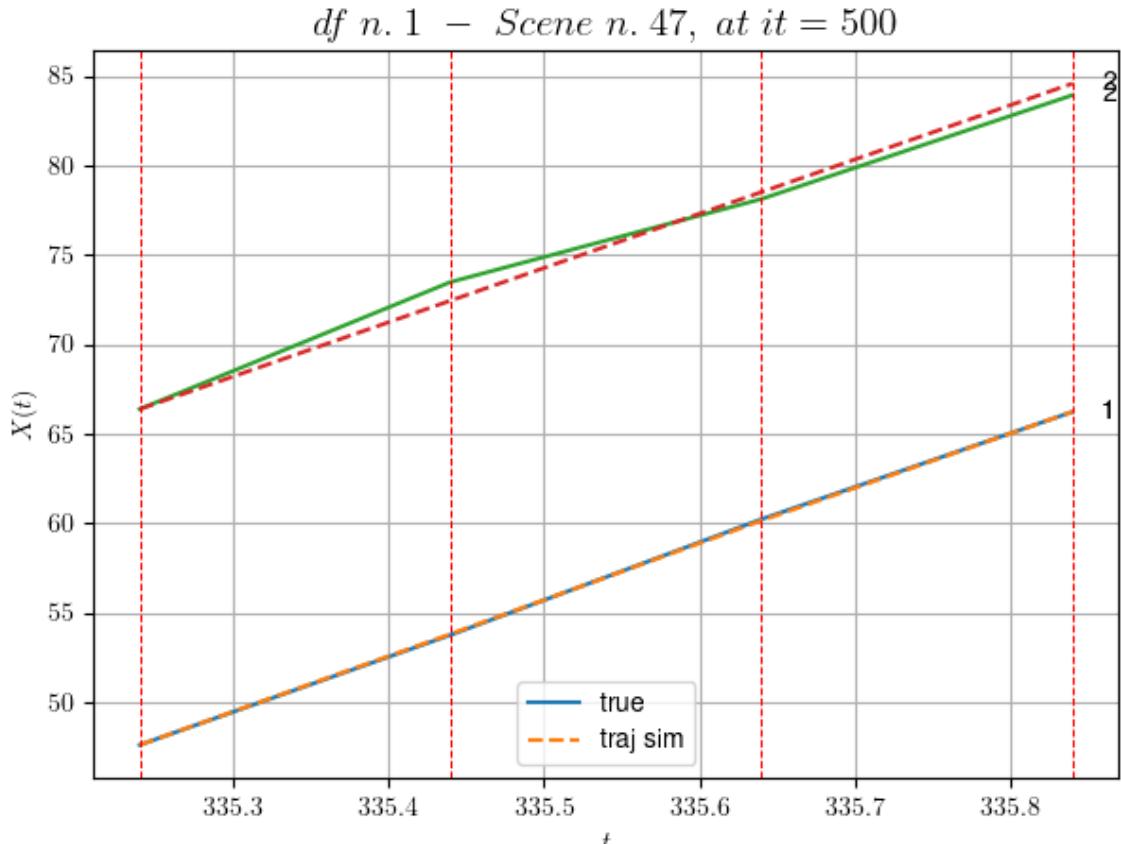
\* After LR finder:  $LR\_NN=0.001$  with  $mse=31.554540588161142$   
at it=24  
\*  $v_0 = 39.34610016762259$   
\* MSE = 1.0086917883458166  
\* iterations = 500

---

DataFrame n.1. Scene n.38/73

---

We have 3 time intervals inside [335.24,335.84]



For scene 38/73:

\* After LR finder: LR\_NN=5e-05 with mse=0.1871739903604787

at it=24

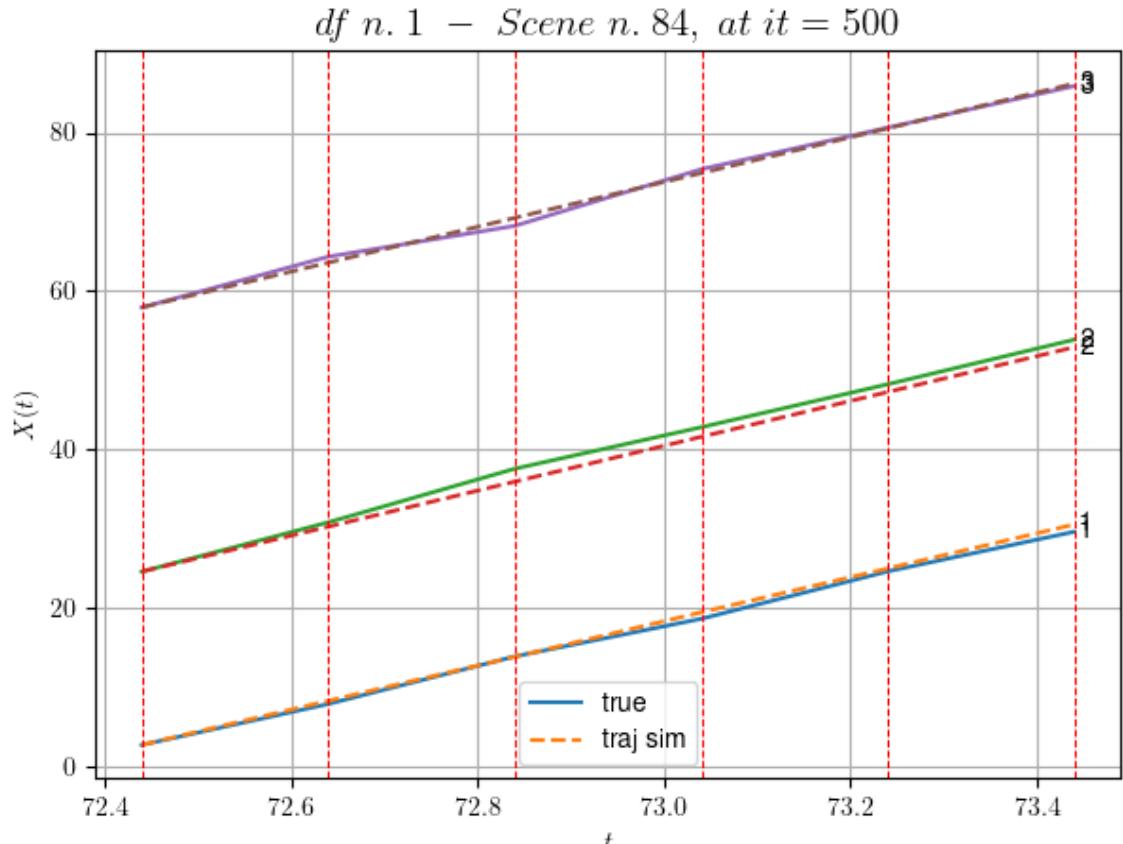
\* v0 = 30.3372393874489

\* MSE = 0.19206490741350649

\* iterations = 500

DataFrame n.1. Scene n.39/73

We have 5 time intervals inside [72.44,73.44]

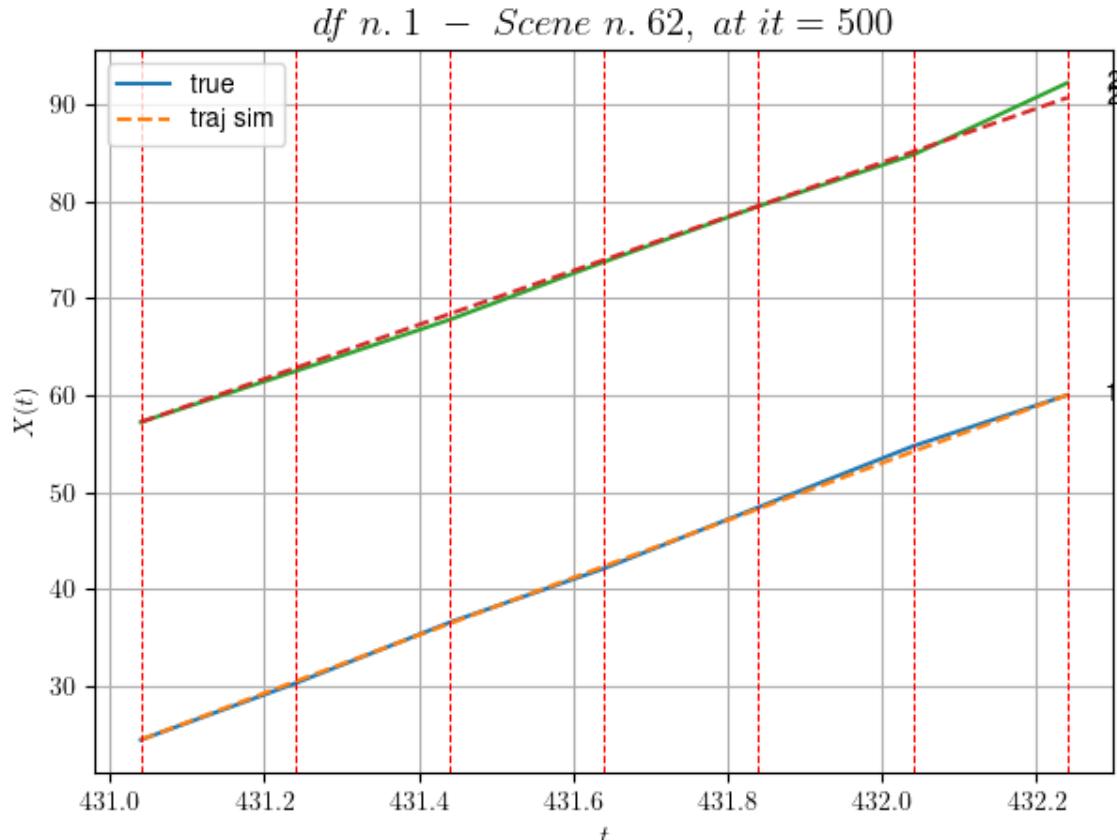


For scene 39/73:

\* After LR finder: LR\_NN=5e-05 with mse=3.0535059057296774  
at it=24  
\* v0 = 28.250920573908502  
\* MSE = 0.28385394854451923  
\* iterations = 500

DataFrame n.1. Scene n.40/73

We have 6 time intervals inside [431.04,432.24]



---

For scene 40/73:

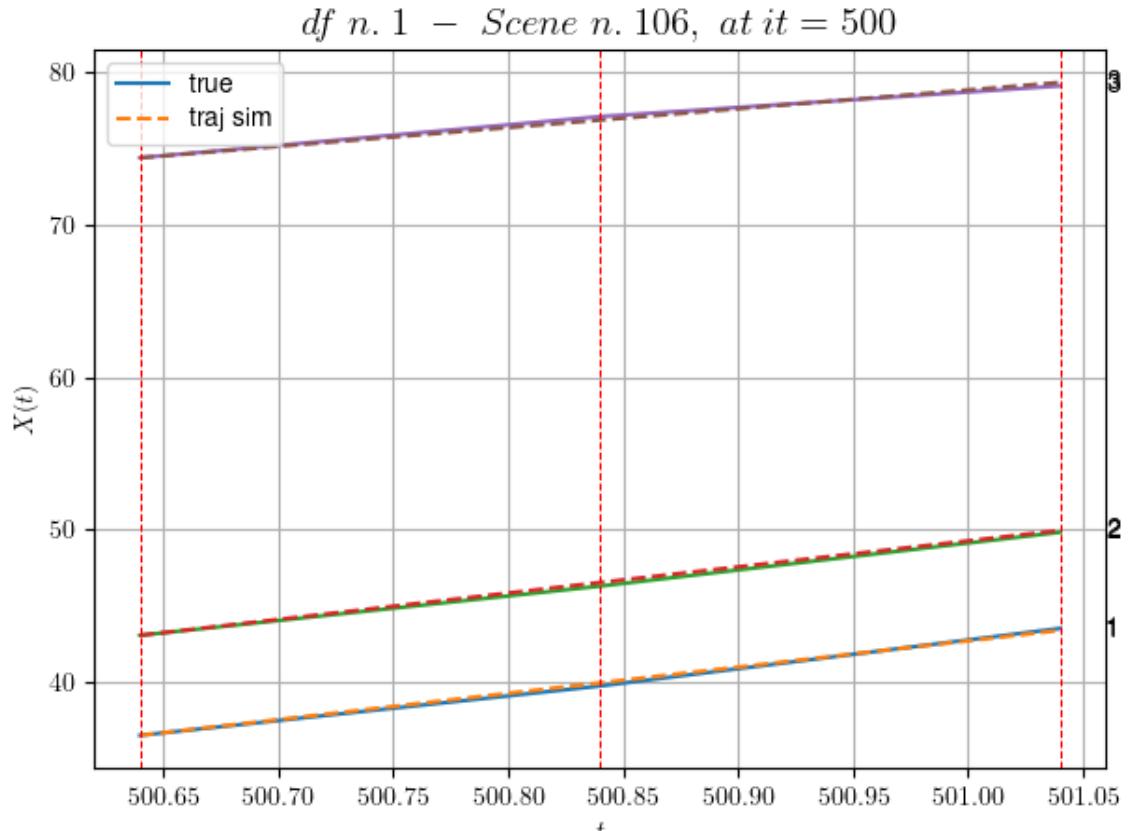
\* After LR finder:  $\text{LR\_NN}=1e-05$  with  $\text{mse}=1.0710672192394184$   
at it=24  
\*  $v_0 = 27.914827173163303$   
\*  $\text{MSE} = 0.22830560215727552$   
\* iterations = 500

---

DataFrame n.1. Scene n.41/73

---

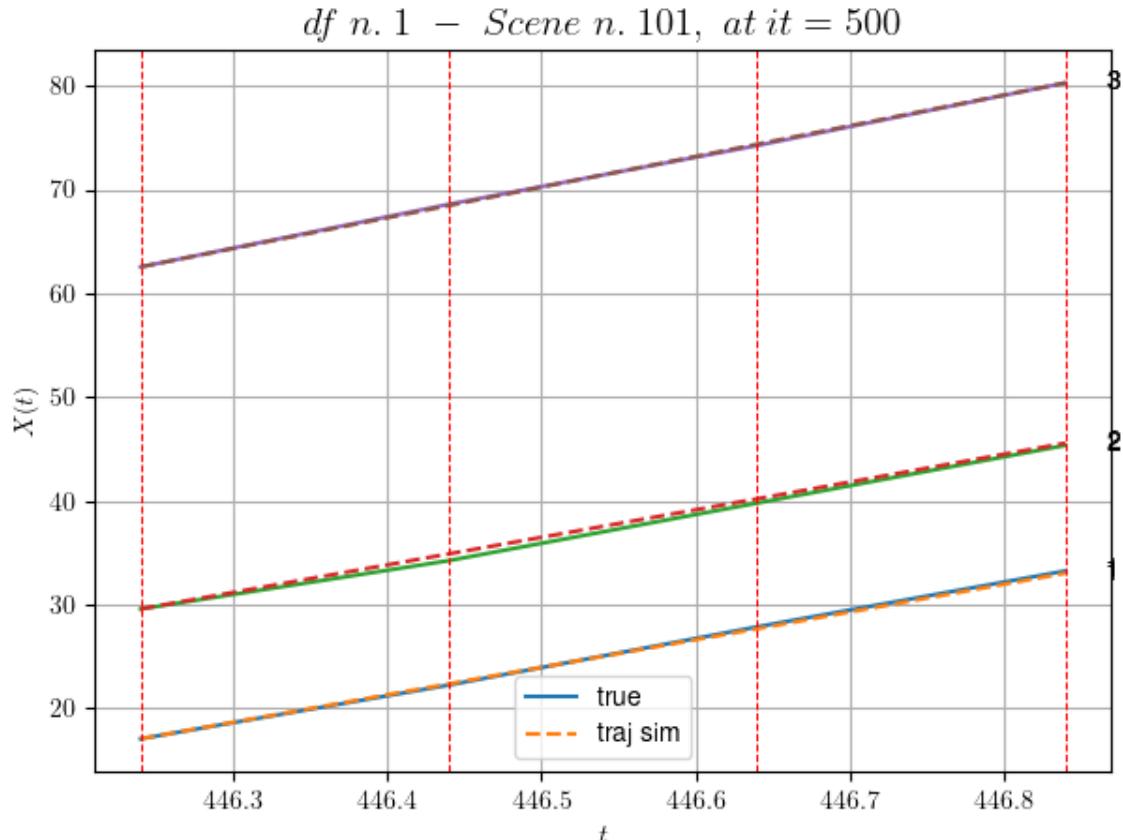
We have 2 time intervals inside [500.64, 501.04]



For scene 41/73:  
\* After LR finder: LR\_NN=0.0001 with mse=10.68002941831252  
at it=24  
\* v0 = 12.361370218693642  
\* MSE = 0.026641123610384006  
\* iterations = 500

DataFrame n.1. Scene n.42/73

We have 3 time intervals inside [446.24, 446.84]

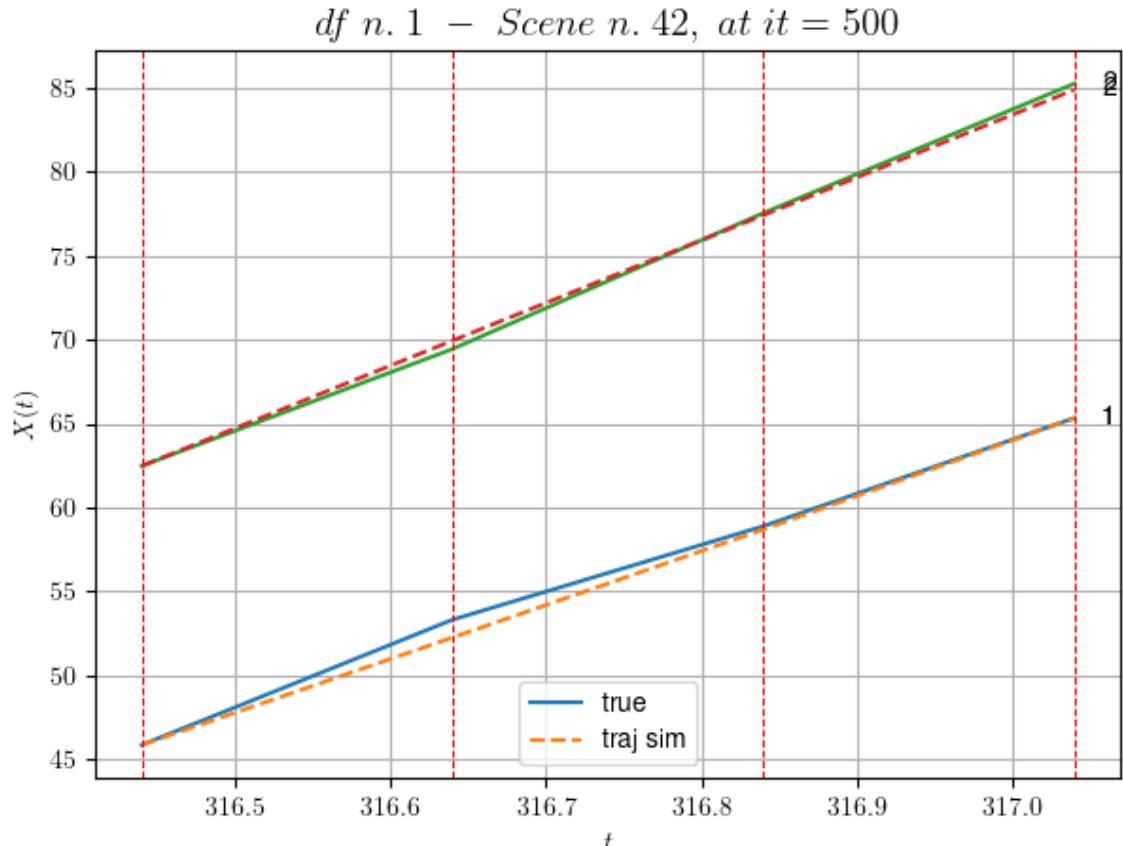


For scene 42/73:

\* After LR finder: LR\_NN=0.0001 with mse=10.920041472768288  
at it=24  
\*  $v_0 = 29.554429209125935$   
\* MSE = 0.06312198567738639  
\* iterations = 500

DataFrame n.1. Scene n.43/73

We have 3 time intervals inside [316.44, 317.04]

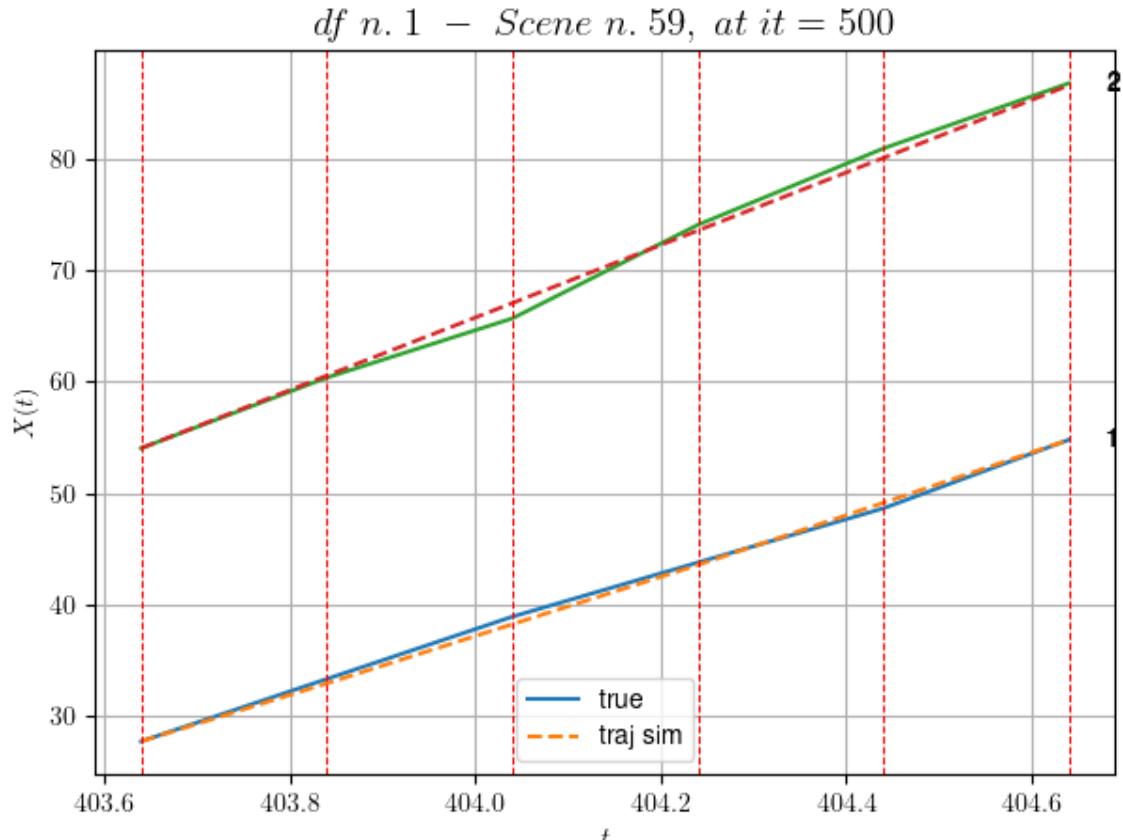


For scene 43/73:

\* After LR finder: LR\_NN=5e-05 with mse=4.387656550943156 at it=24  
\* v0 = 37.334341227147725  
\* MSE = 0.1905049648074211  
\* iterations = 500

DataFrame n.1. Scene n.44/73

We have 5 time intervals inside [403.64,404.64]

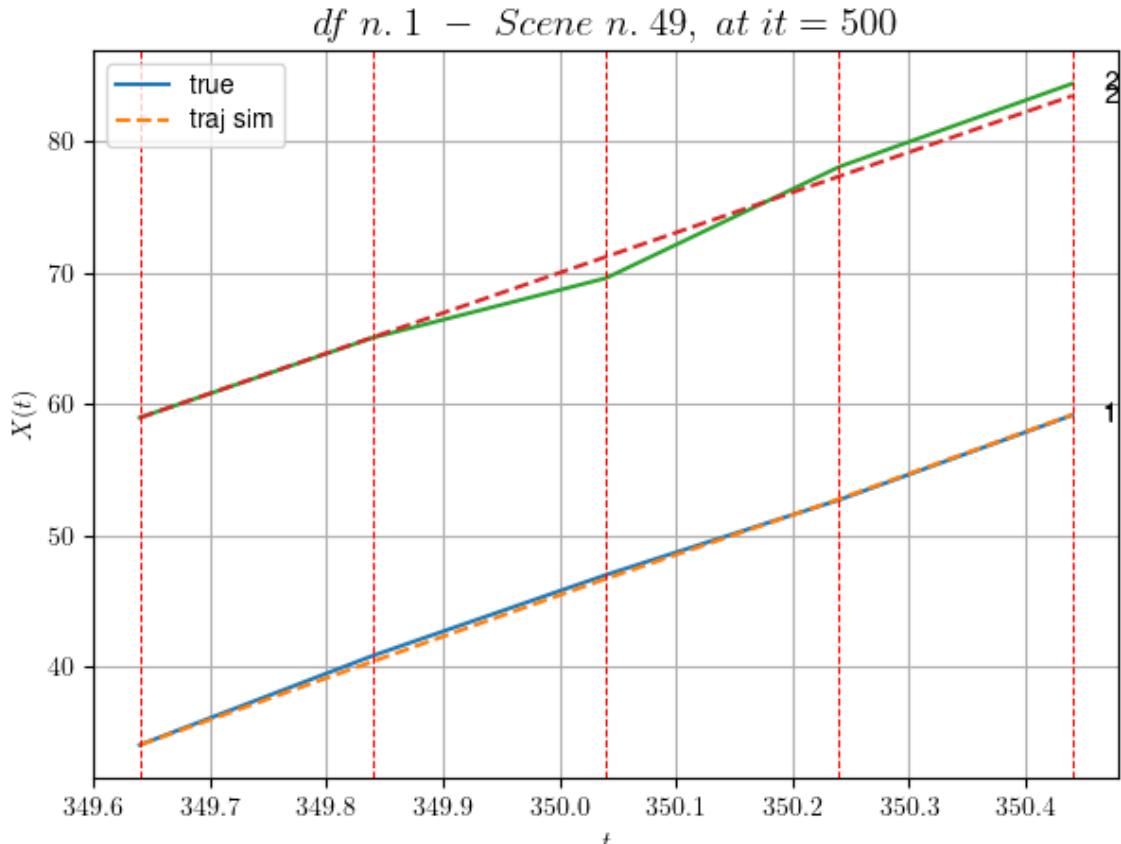


For scene 44/73:

\* After LR finder:  $LR_{NN}=0.0001$  with  $mse=1.8781688341598144$   
at it=24  
\*  $v_0 = 32.57978285326543$   
\*  $MSE = 0.3225559248840559$   
\* iterations = 500

DataFrame n.1. Scene n.45/73

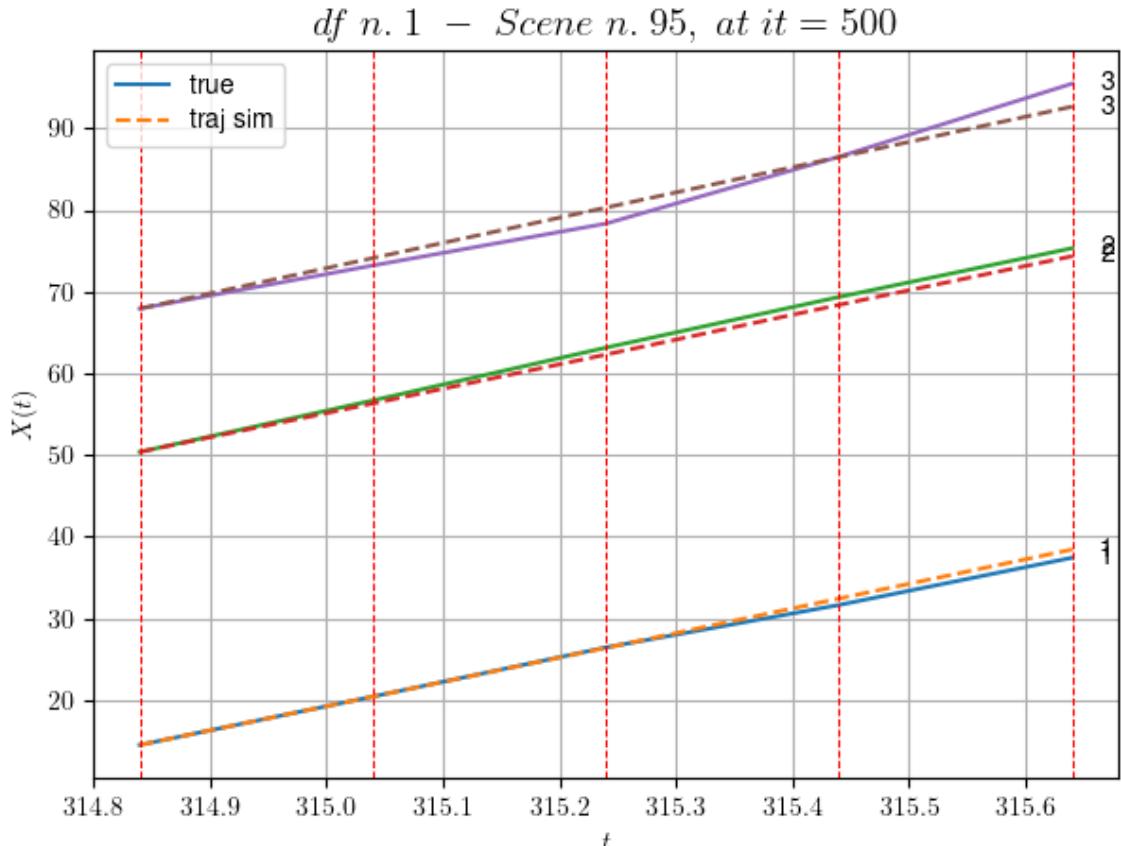
We have 4 time intervals inside [349.64, 350.44]



DataFrame n.1. Scene n.46/73

-----

We have 4 time intervals inside [314.84,315.64]



For scene 46/73:

\* After LR finder: LR\_NN=5e-05 with mse=22.005021610845827

at it=24

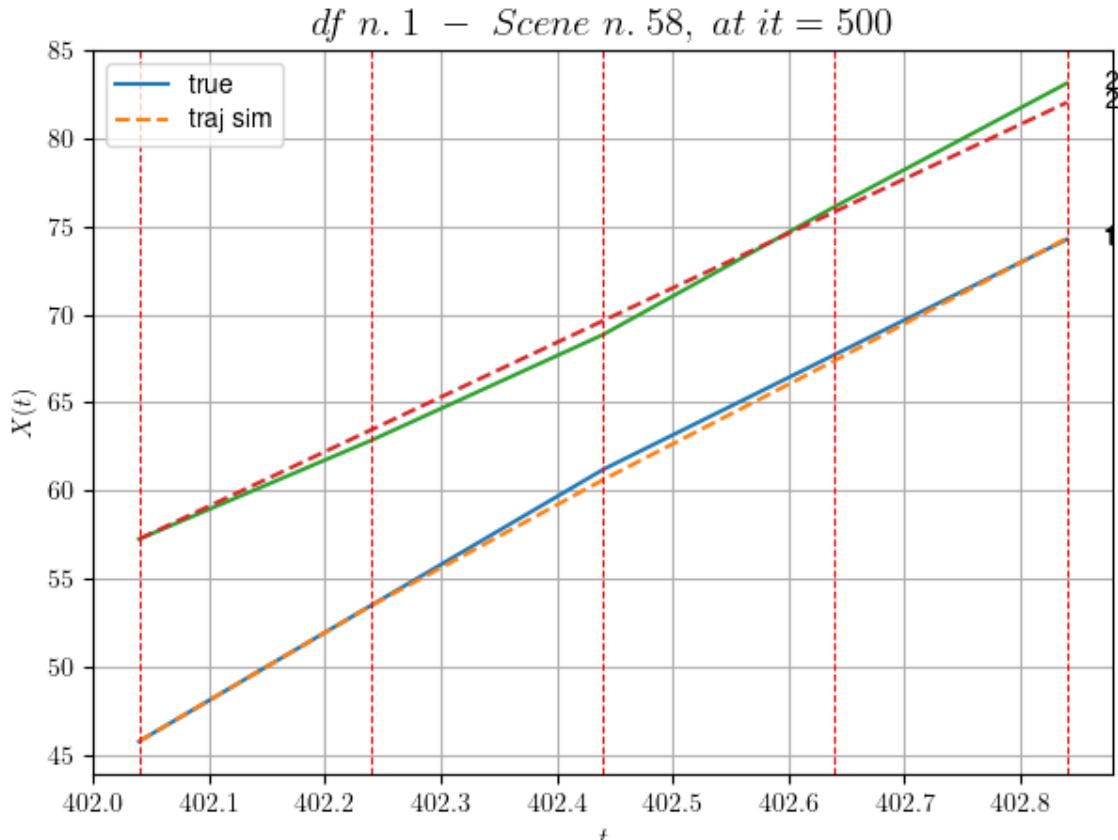
\* v0 = 30.926247858927194

\* MSE = 1.1320289942062285

\* iterations = 500

DataFrame n.1. Scene n.47/73

We have 4 time intervals inside [402.04,402.84]



---

For scene 47/73:  
\* After LR finder: LR\_NN=0.0001 with mse=0.6815037835012865  
at it=24  
\* v0 = 31.00675921223543  
\* MSE = 0.27244749202542645  
\* iterations = 500

---

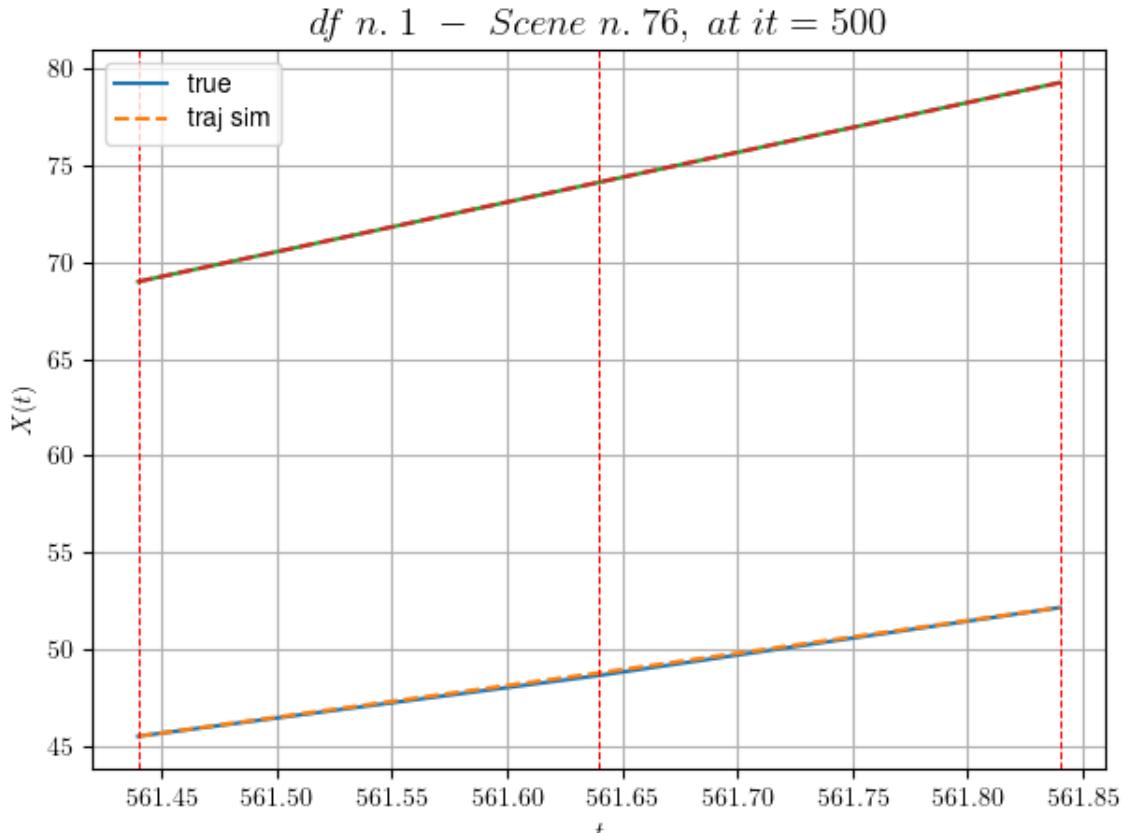
---

DataFrame n.1. Scene n.48/73

---

---

We have 2 time intervals inside [561.44, 561.84]



---

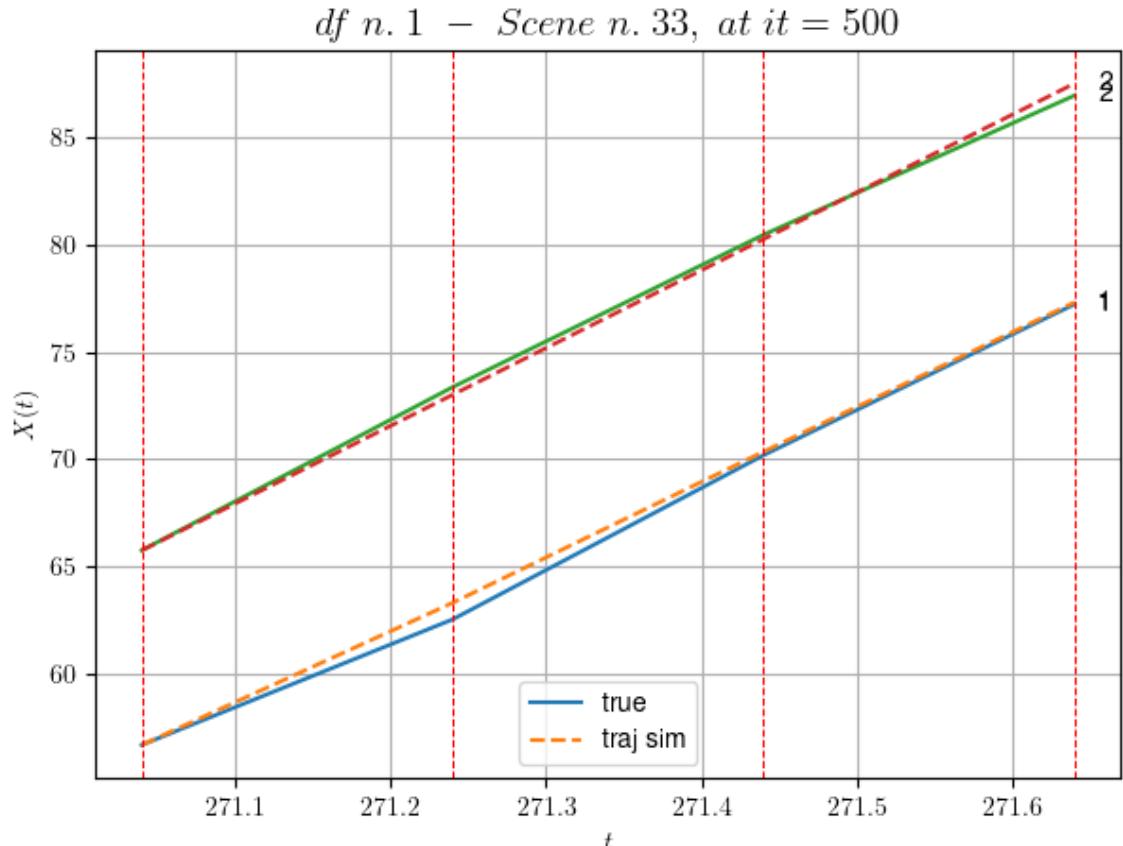
For scene 48/73:  
\* After LR finder: LR\_NN=0.0001 with mse=0.6066856070006375  
at it=24  
\* v0 = 25.727722160465014  
\* MSE = 0.0029823008445743525  
\* iterations = 500

---

DataFrame n.1. Scene n.49/73

---

We have 3 time intervals inside [271.04,271.64]



---

For scene 49/73:

\* After LR finder: LR\_NN=0.0001 with mse=2.5631317135197946  
at it=24  
\* v0 = 36.298884665015926  
\* MSE = 0.13908099632044046  
\* iterations = 500

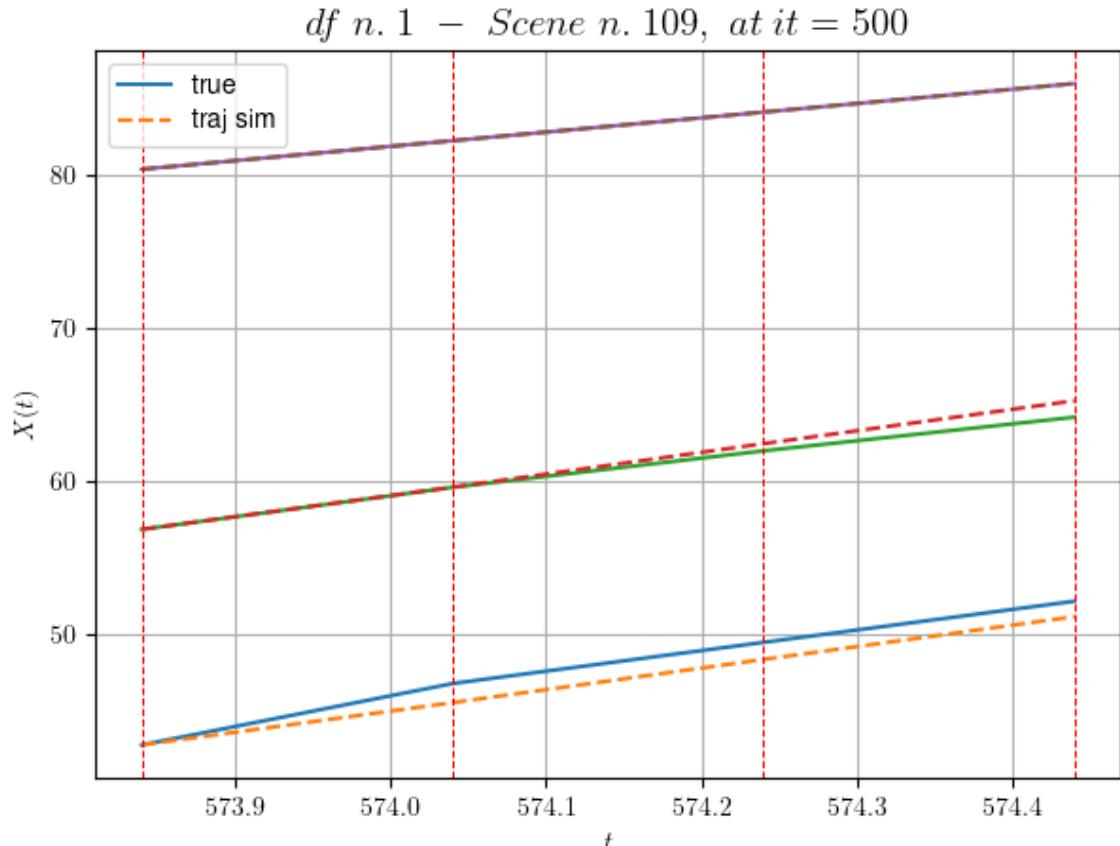
---

---

DataFrame n.1. Scene n.50/73

---

We have 3 time intervals inside [573.84,574.44]



---

For scene 50/73:

\* After LR finder: LR\_NN=5e-05 with mse=22.797221830402226  
at it=24  
\* v0 = 9.338719660907456  
\* MSE = 0.37995466665963046  
\* iterations = 500

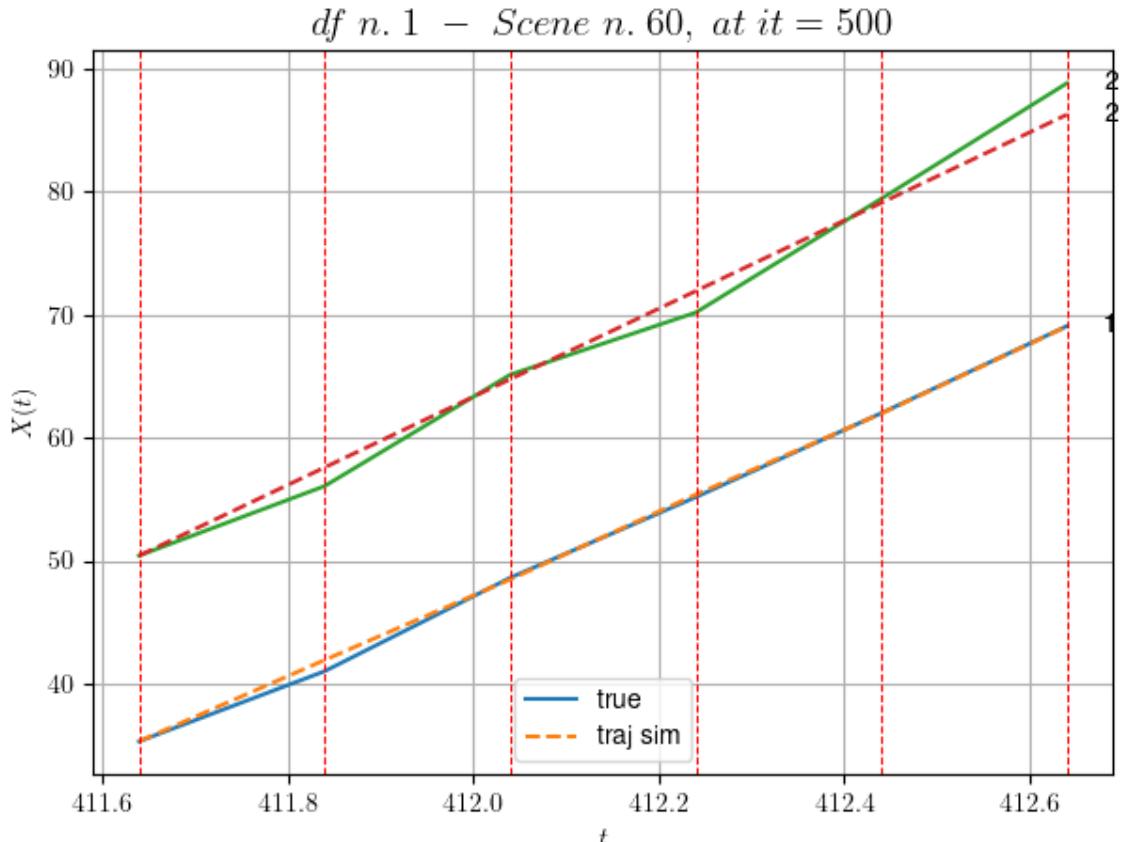
---

---

DataFrame n.1. Scene n.51/73

---

We have 5 time intervals inside [411.64,412.64]

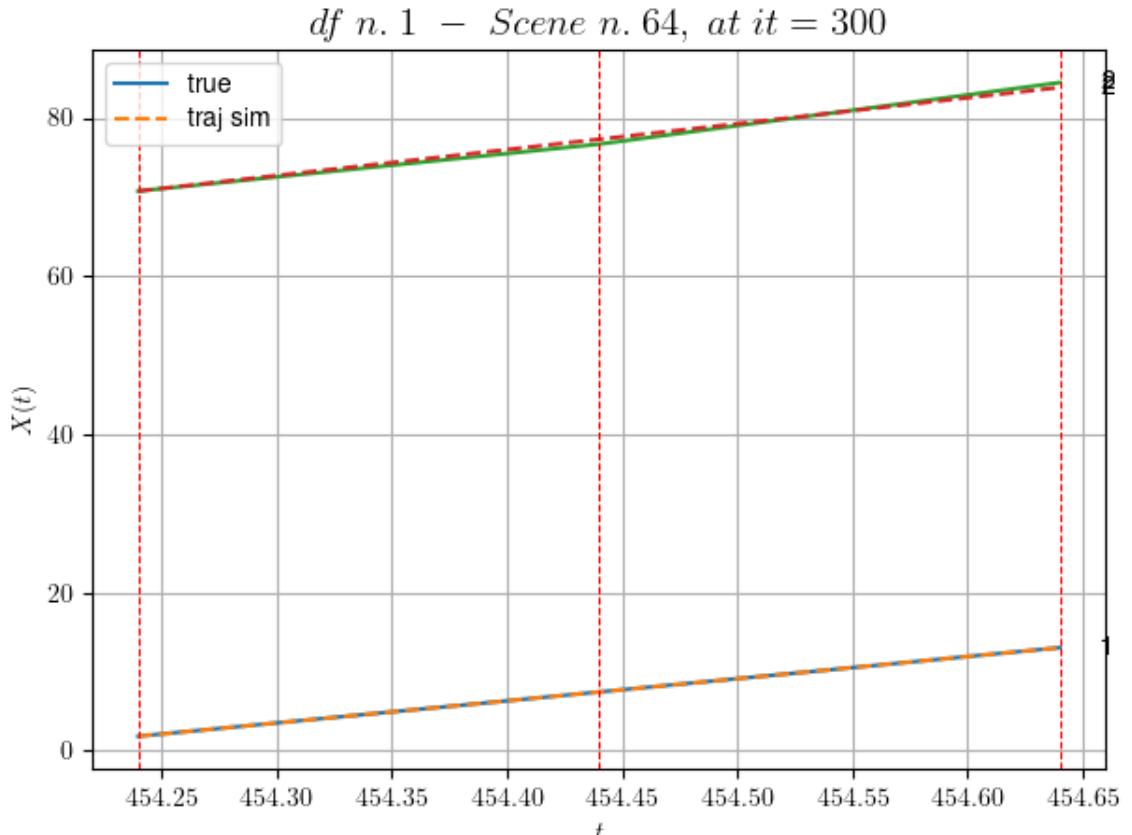


For scene 51/73:

\* After LR finder:  $LR\_NN=5e-05$  with  $mse=8.975939008811654$  at  
it=24  
\*  $v_0 = 35.852941117112294$   
\*  $MSE = 1.0855176978774606$   
\* iterations = 500

DataFrame n.1. Scene n.52/73

We have 2 time intervals inside [454.24, 454.64]



---

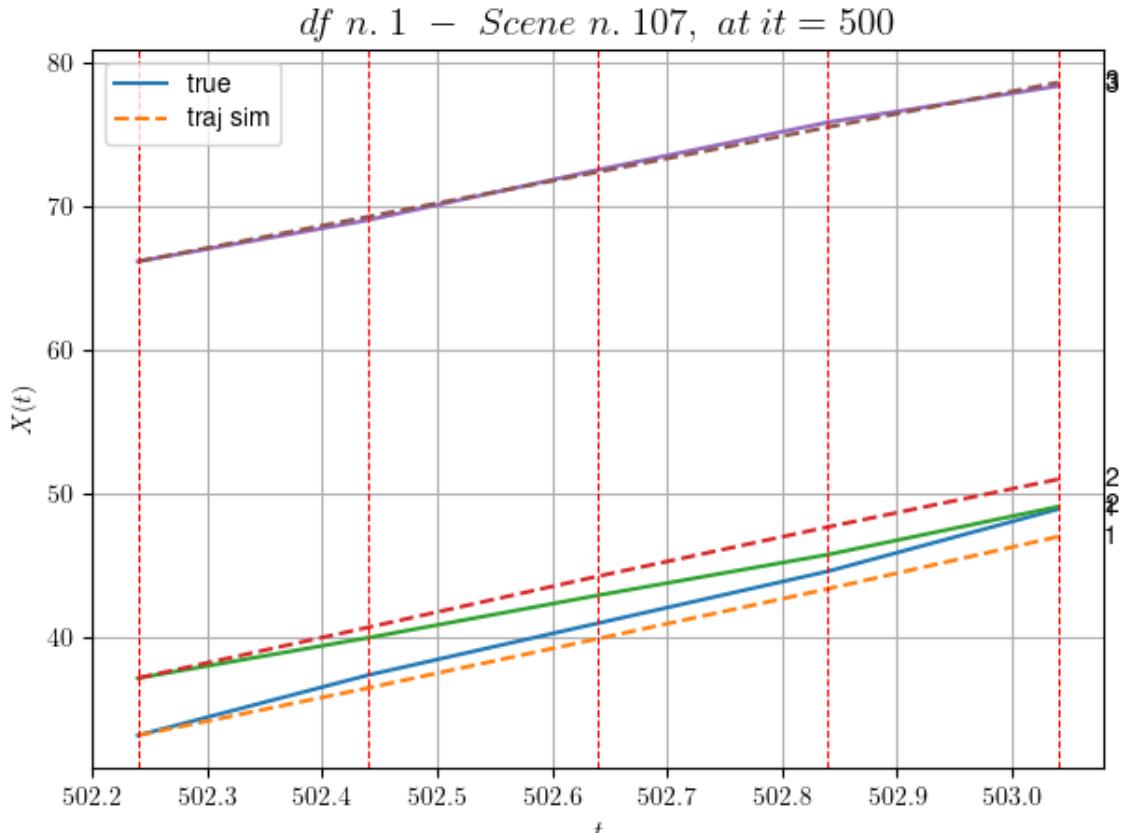
For scene 52/73:  
\* After LR finder: LR\_NN=1e-05 with mse=0.4982359240372556  
at it=24  
\* v0 = 32.767095328183636  
\* MSE = 0.12846281211357743  
\* iterations = 300

---

DataFrame n.1. Scene n.53/73

---

We have 4 time intervals inside [502.24, 503.04]



---

For scene 53/73:

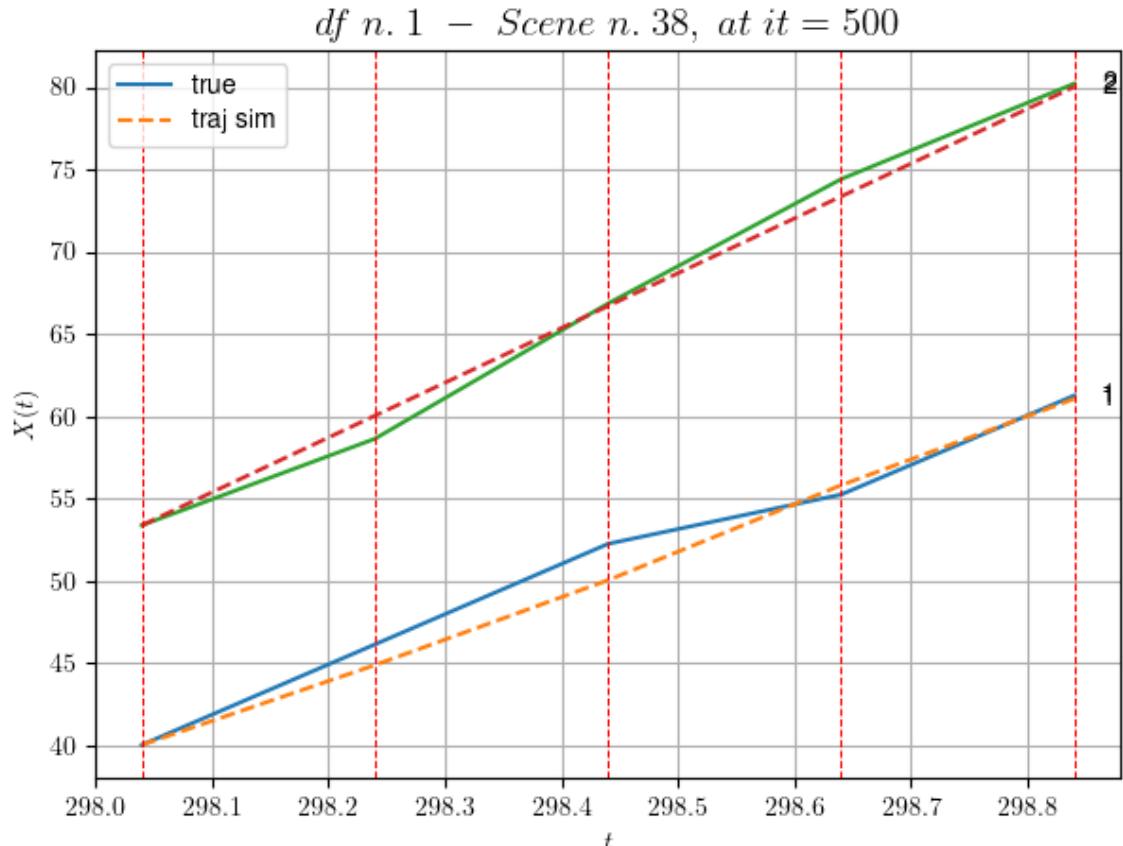
- \* After LR finder: LR\_NN=0.001 with mse=28.93646108114484 at it=24
- \* v0 = 15.58101672293398
- \* MSE = 1.1333113158969932
- \* iterations = 500

---

DataFrame n.1. Scene n.54/73

---

We have 4 time intervals inside [298.04,298.84]

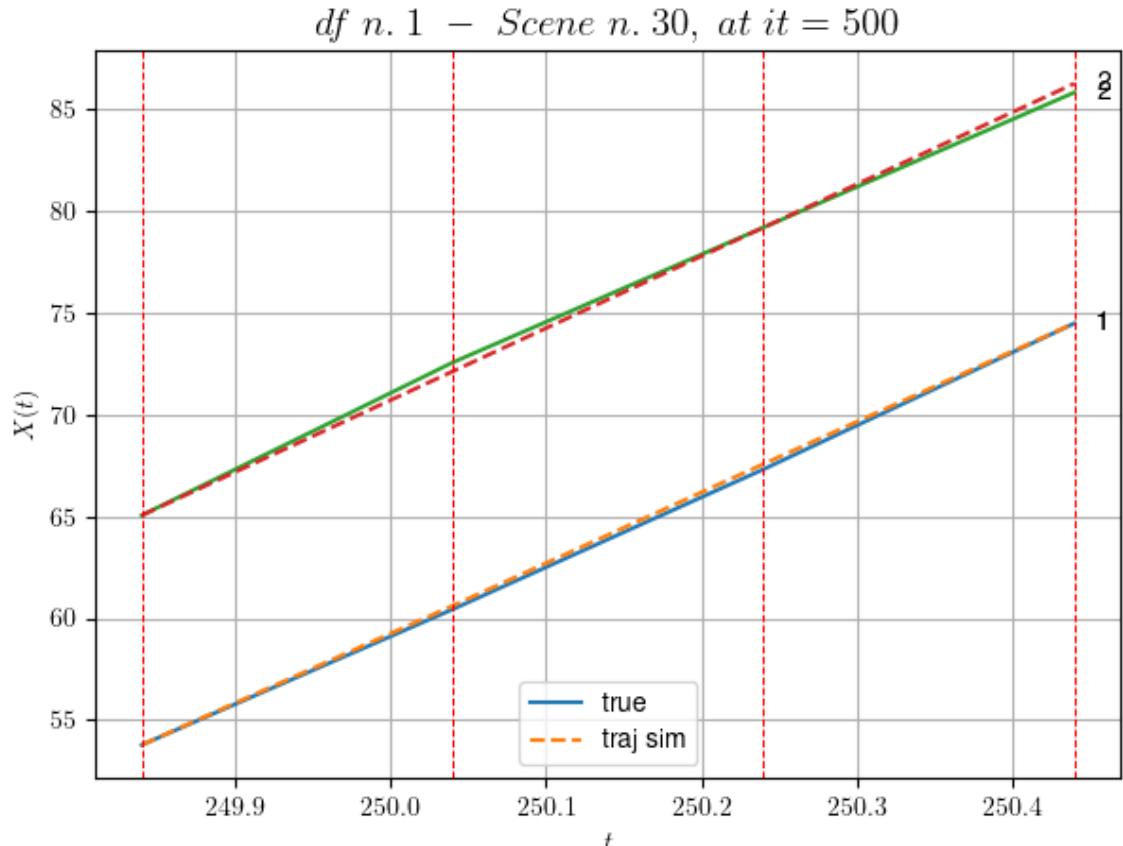


For scene 54/73:

\* After LR finder: LR\_NN=0.0005 with mse=3.393795493793675  
at it=24  
\* v0 = 33.34266245905228  
\* MSE = 0.9968354544826644  
\* iterations = 500

DataFrame n.1. Scene n.55/73

We have 3 time intervals inside [249.84,250.44]

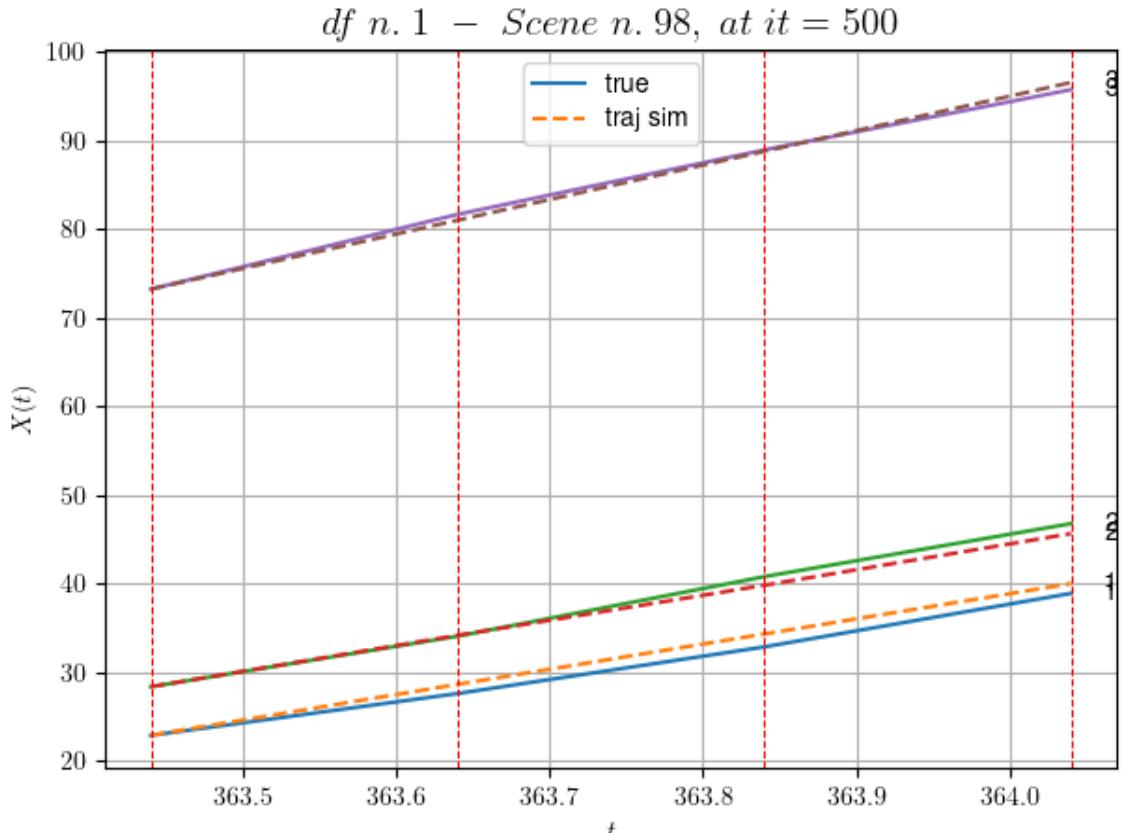


For scene 55/73:

\* After LR finder: LR\_NN=5e-05 with mse=1.8340583333508356  
at it=24  
\* v0 = 35.36623656084871  
\* MSE = 0.05361087060662473  
\* iterations = 500

DataFrame n.1. Scene n.56/73

We have 3 time intervals inside [363.44,364.04]



---

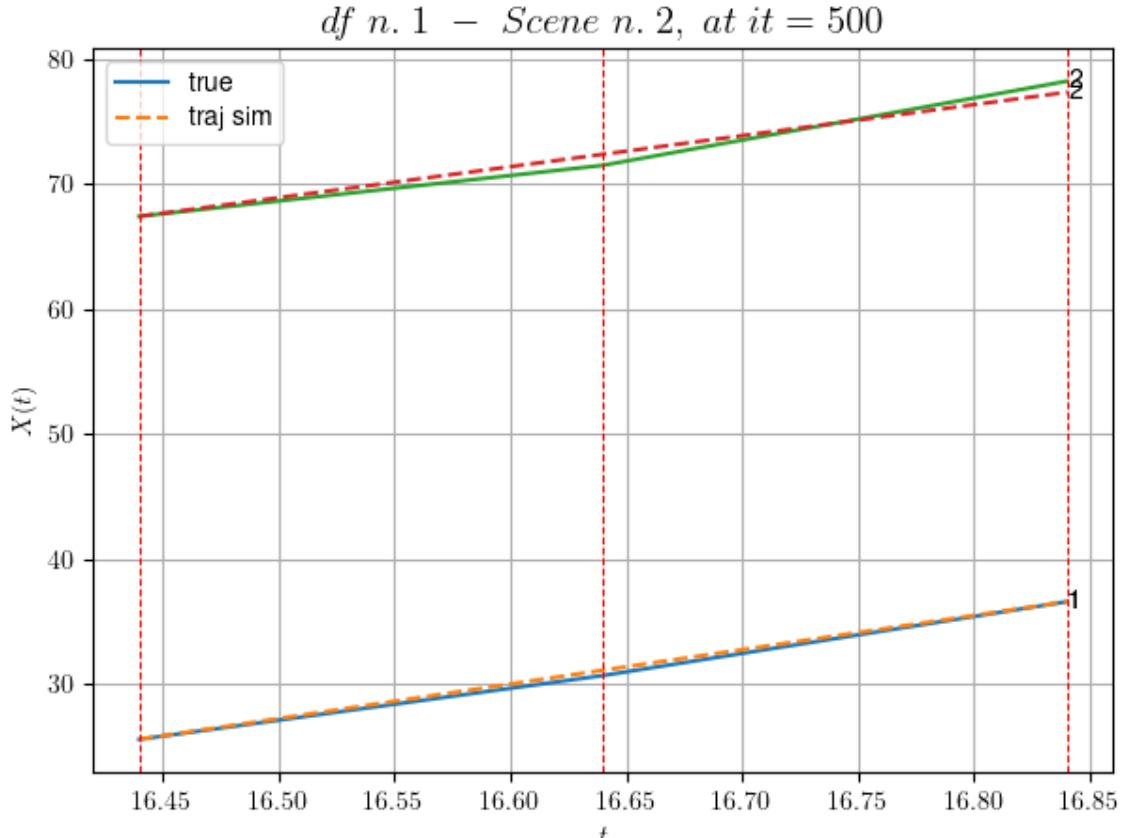
For scene 56/73:  
\* After LR finder: LR\_NN=0.0001 with mse=22.126404719215248  
at it=24  
\* v0 = 38.92349444301484  
\* MSE = 0.4309201904497704  
\* iterations = 500

---

DataFrame n.1. Scene n.57/73

---

We have 2 time intervals inside [16.44, 16.84]

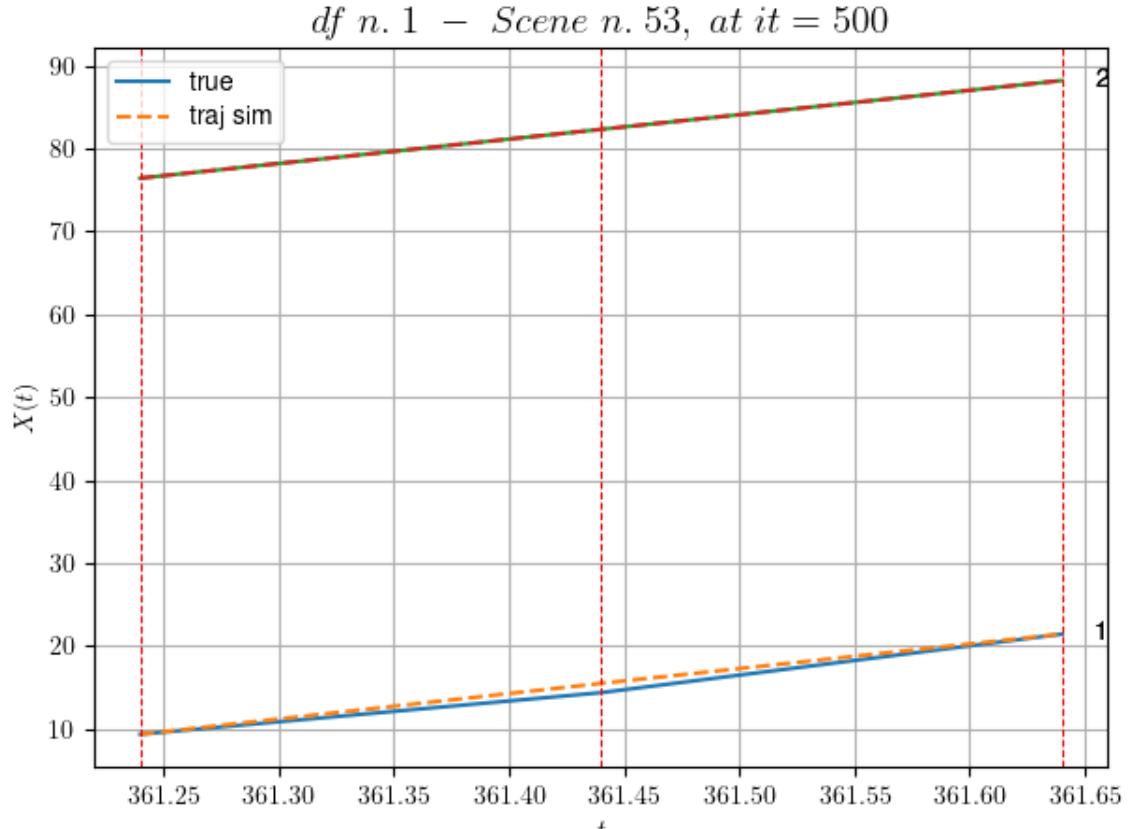


For scene 57/73:

\* After LR finder:  $LR\_NN=1e-05$  with  $mse=0.8835806575479787$   
at it=24  
\*  $v_0 = 24.819169840097558$   
\* MSE = 0.2656366909248902  
\* iterations = 500

DataFrame n.1. Scene n.58/73

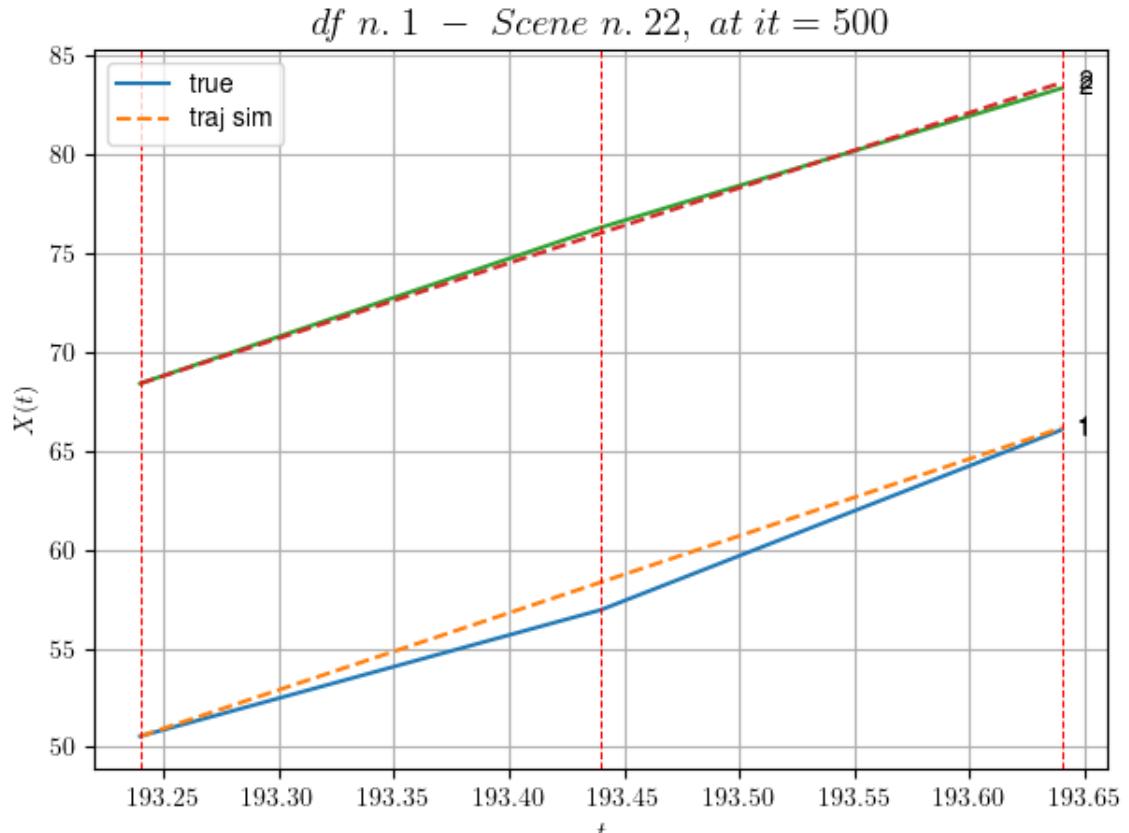
We have 2 time intervals inside [361.24, 361.64]



-----  
For scene 58/73:  
\* After LR finder: LR\_NN=1e-05 with mse=0.26182193964358397  
at it=24  
\* v0 = 29.453860908620893  
\* MSE = 0.20442584701847732  
\* iterations = 500  
-----

DataFrame n.1. Scene n.59/73

We have 2 time intervals inside [193.24,193.64]



---

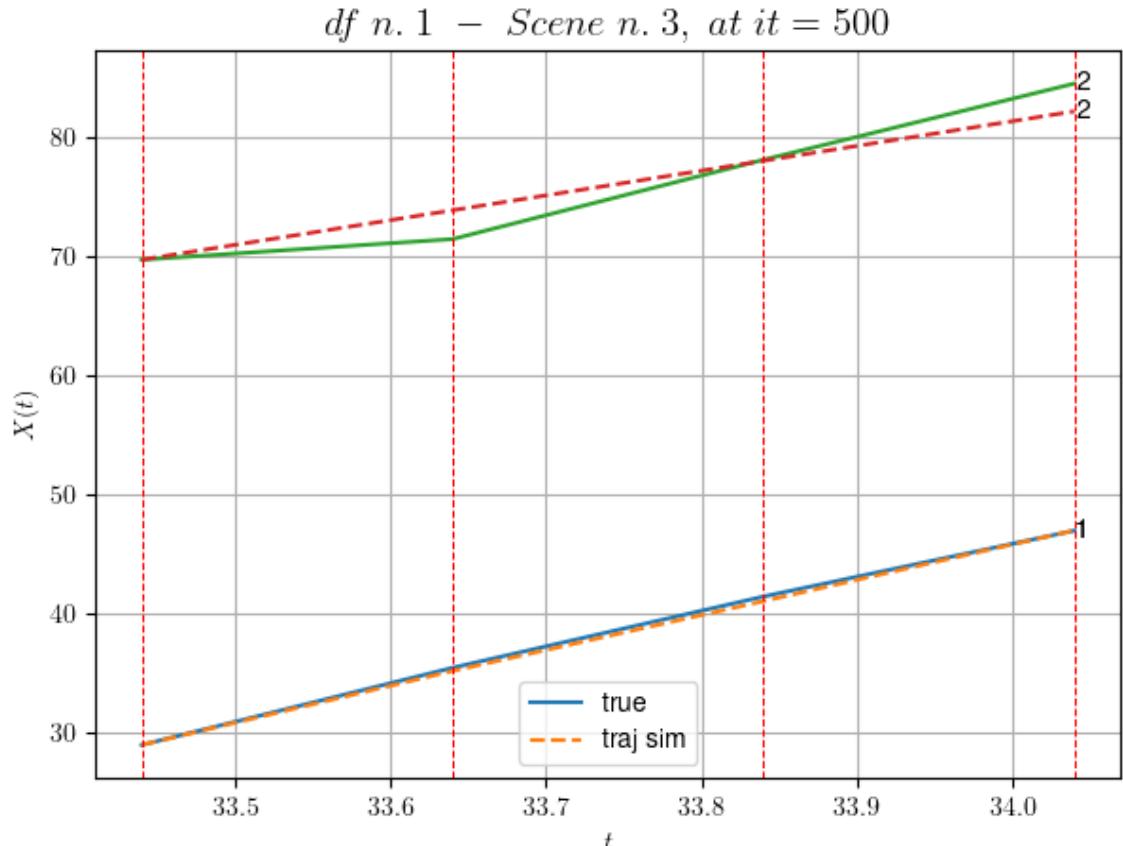
For scene 59/73:  
\* After LR finder: LR\_NN=5e-05 with mse=2.2774474416757977  
at it=24  
\* v0 = 38.083999376914235  
\* MSE = 0.35491544010088816  
\* iterations = 500

---

DataFrame n.1. Scene n.60/73

---

We have 3 time intervals inside [33.44,34.04]

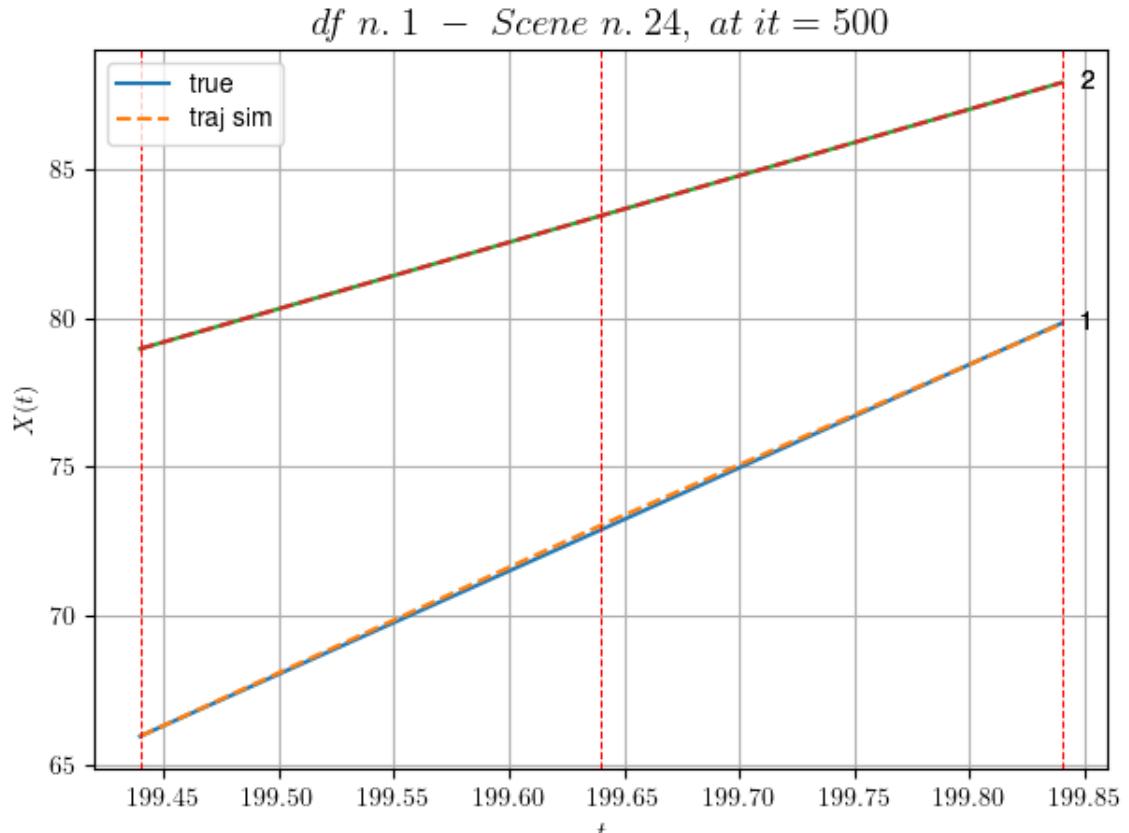


For scene 60/73:

\* After LR finder: LR\_NN=5e-05 with mse=5.233376765776411 at it=24  
\*  $v_0 = 20.73562398523792$   
\* MSE = 1.2932384337258043  
\* iterations = 500

DataFrame n.1. Scene n.61/73

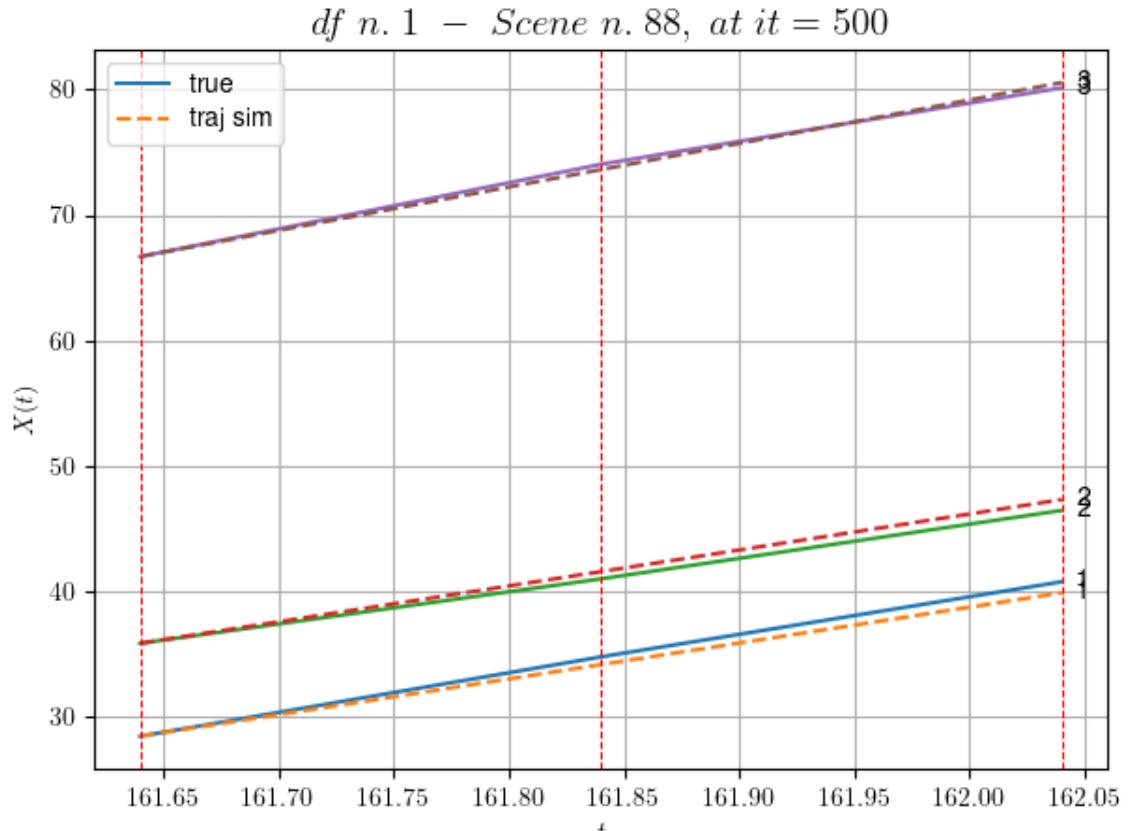
We have 2 time intervals inside [199.44,199.84]



For scene 61/73:  
\* After LR finder: LR\_NN=0.0001 with mse=2.014143579815099  
at it=24  
\* v0 = 22.403012729860457  
\* MSE = 0.003991672940245181  
\* iterations = 500

DataFrame n.1. Scene n.62/73

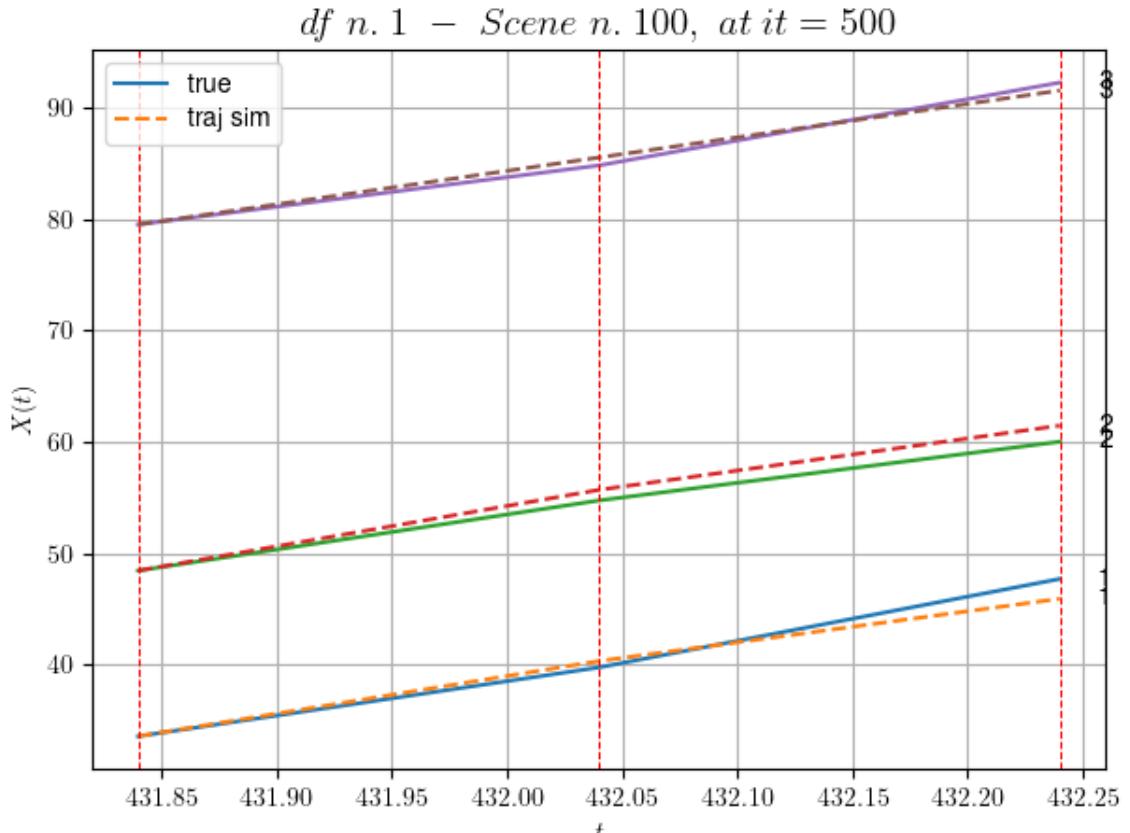
We have 2 time intervals inside [161.64,162.04]



-----  
For scene 62/73:  
\* After LR finder: LR\_NN=5e-05 with mse=12.860188766016103  
at it=24  
\* v0 = 34.711815198036454  
\* MSE = 0.28894693031434837  
\* iterations = 500  
-----

DataFrame n.1. Scene n.63/73

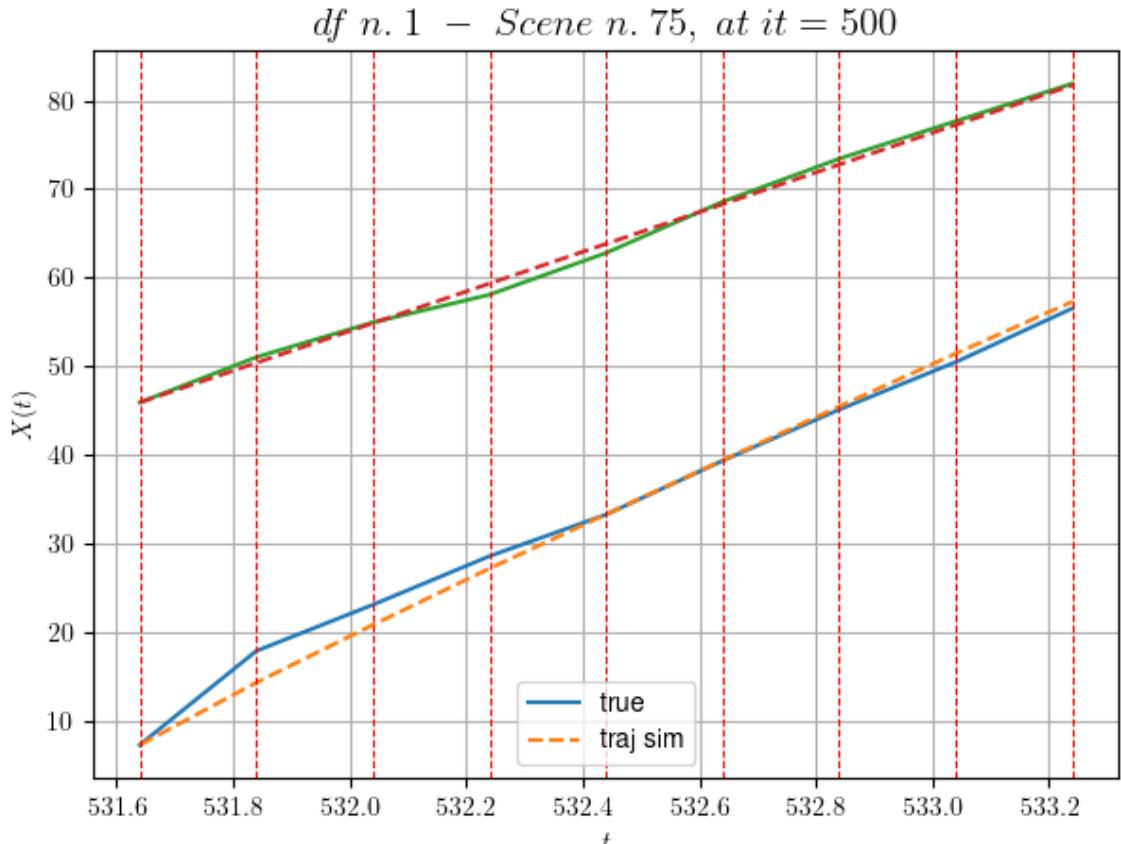
-----  
We have 2 time intervals inside [431.84, 432.24]



-----  
For scene 63/73:  
\* After LR finder: LR\_NN=0.0005 with mse=7.461460550870972  
at it=24  
\* v0 = 30.08416163618877  
\* MSE = 0.835395007991473  
\* iterations = 500  
-----

DataFrame n.1. Scene n.64/73

We have 8 time intervals inside [531.64, 533.24]

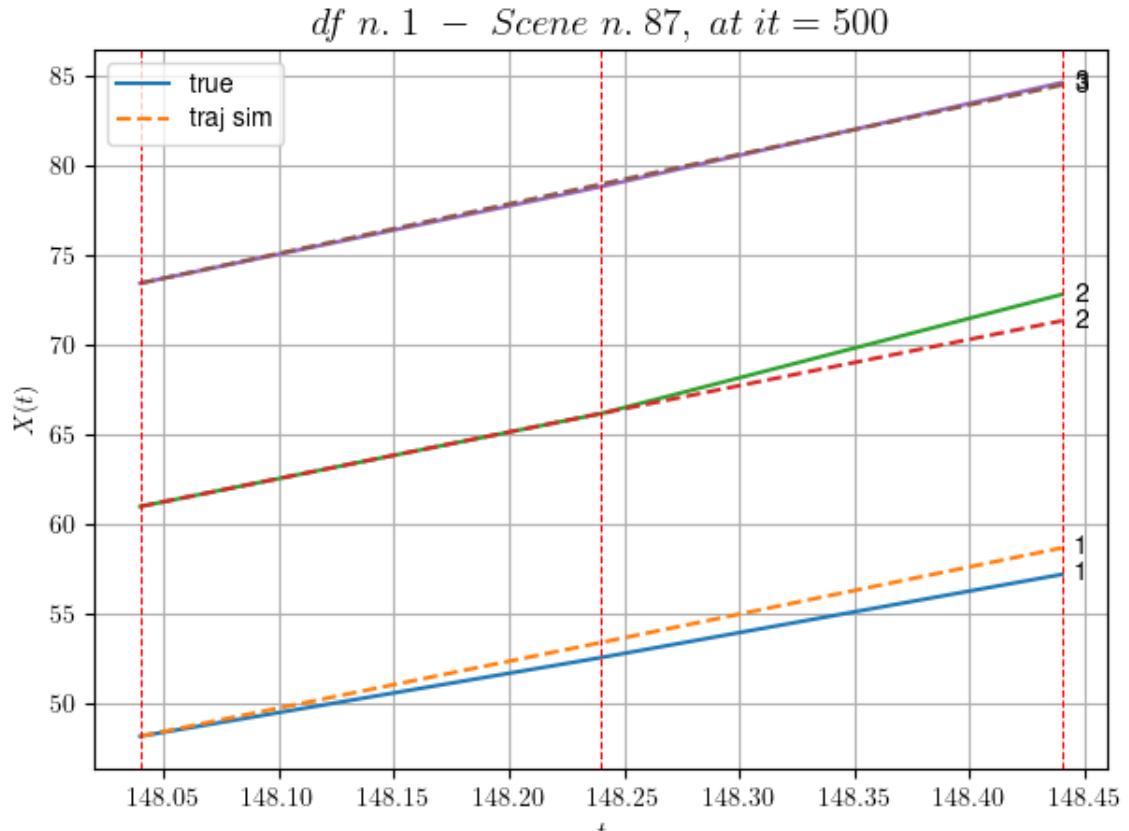


For scene 64/73:

\* After LR finder: LR\_NN=1e-05 with mse=26.811486858050447  
at it=24  
\* v0 = 22.38264840590257  
\* MSE = 1.4041601922920448  
\* iterations = 500

DataFrame n.1. Scene n.65/73

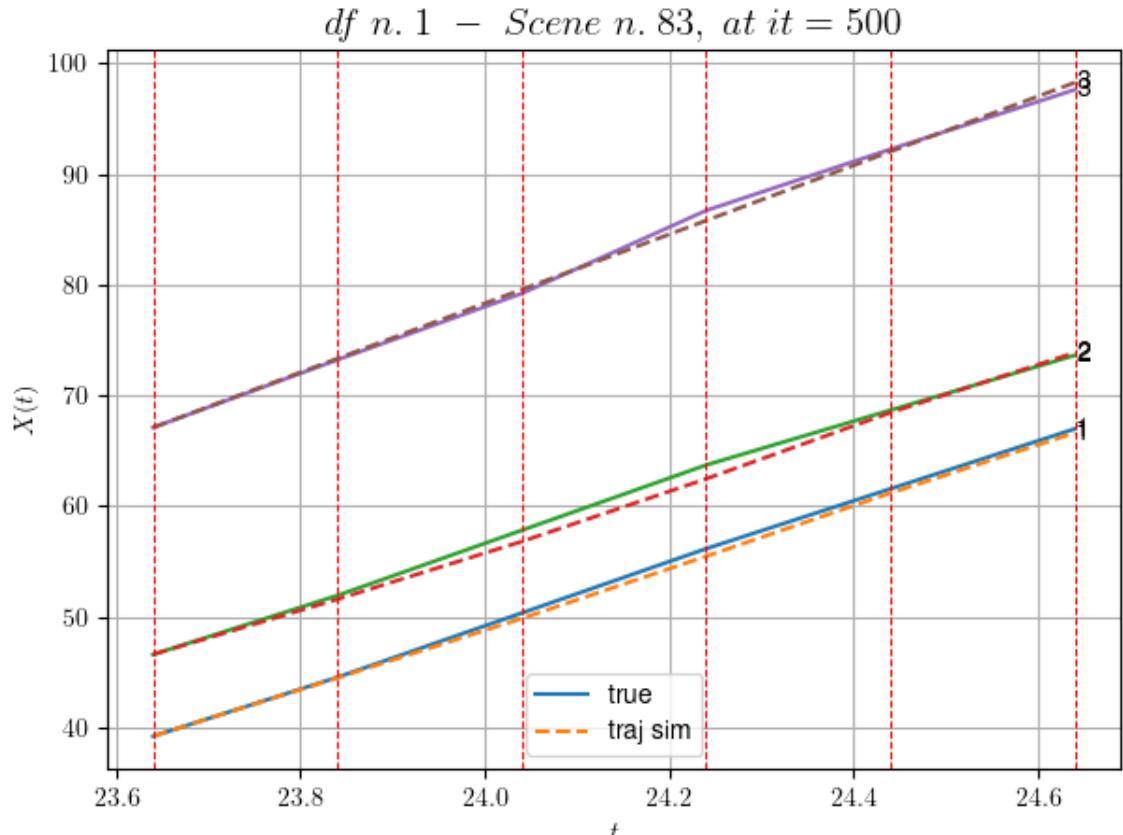
We have 2 time intervals inside [148.04,148.44]



-----  
For scene 65/73:  
\* After LR finder: LR\_NN=0.0001 with mse=0.8109042367658277  
at it=24  
\* v0 = 27.62165672121592  
\* MSE = 0.5101513523939744  
\* iterations = 500  
-----

DataFrame n.1. Scene n.66/73

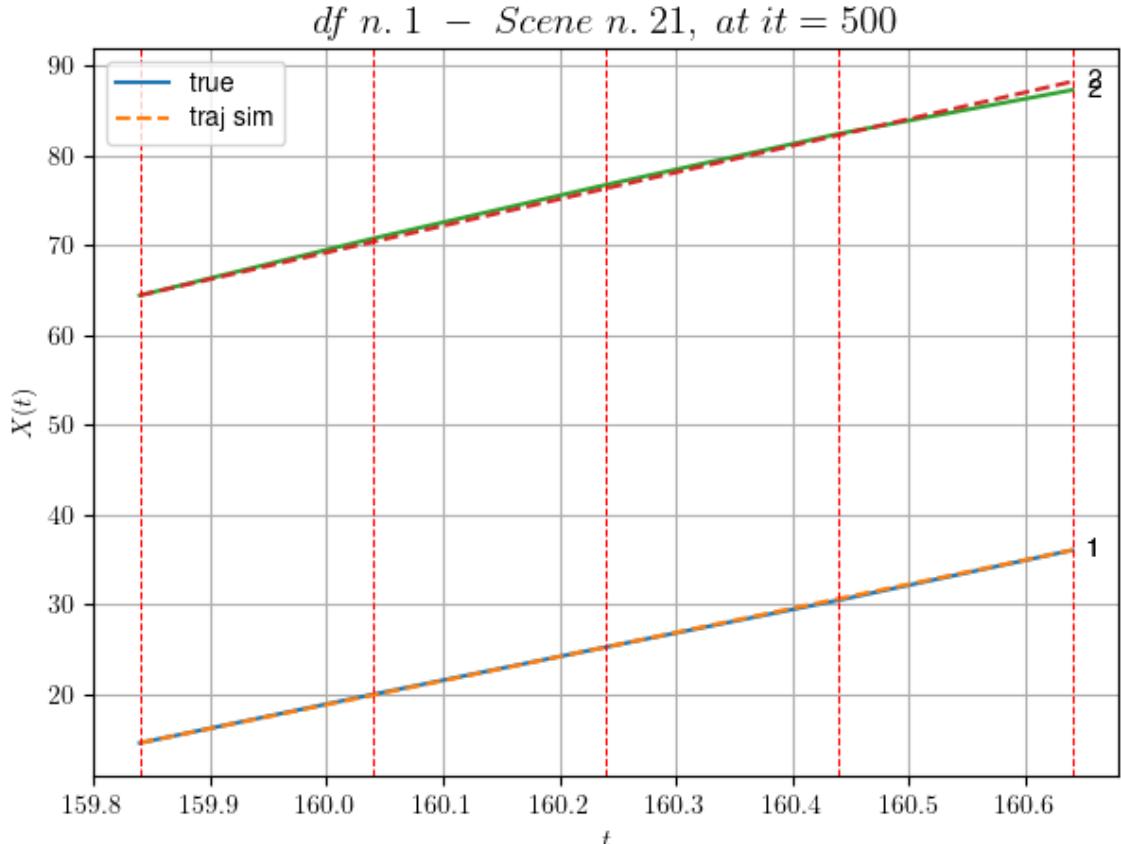
-----  
We have 5 time intervals inside [23.64,24.64]



-----  
For scene 66/73:  
\* After LR finder: LR\_NN=0.001 with mse=22.818091199095022  
at it=24  
\* v0 = 31.184420565840167  
\* MSE = 0.15726218453734112  
\* iterations = 500  
-----

DataFrame n.1. Scene n.67/73

-----  
We have 4 time intervals inside [159.84,160.64]

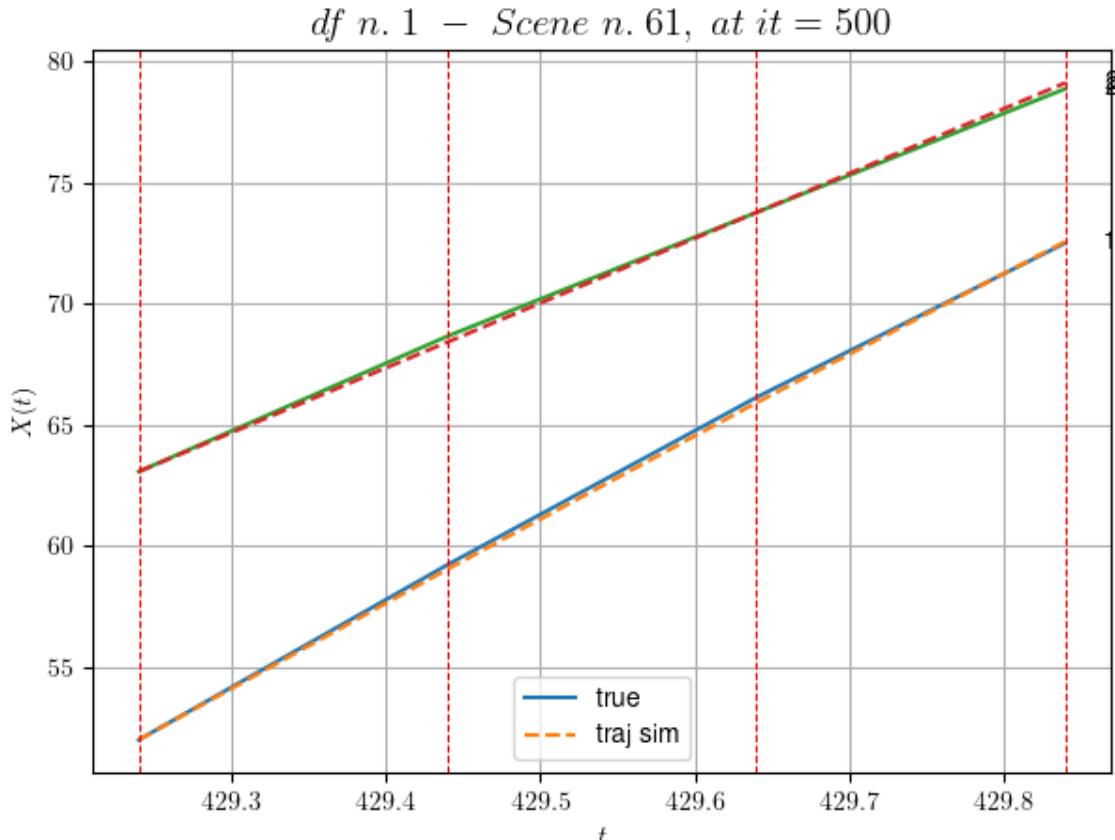


For scene 67/73:

\* After LR finder: LR\_NN=1e-05 with mse=0.14969987235536394  
at it=24  
\* v0 = 29.7990654156743  
\* MSE = 0.12440948601576636  
\* iterations = 500

DataFrame n.1. Scene n.68/73

We have 3 time intervals inside [429.24,429.84]



---

For scene 68/73:

\* After LR finder: LR\_NN=0.0001 with mse=0.9584718856154559  
at it=24

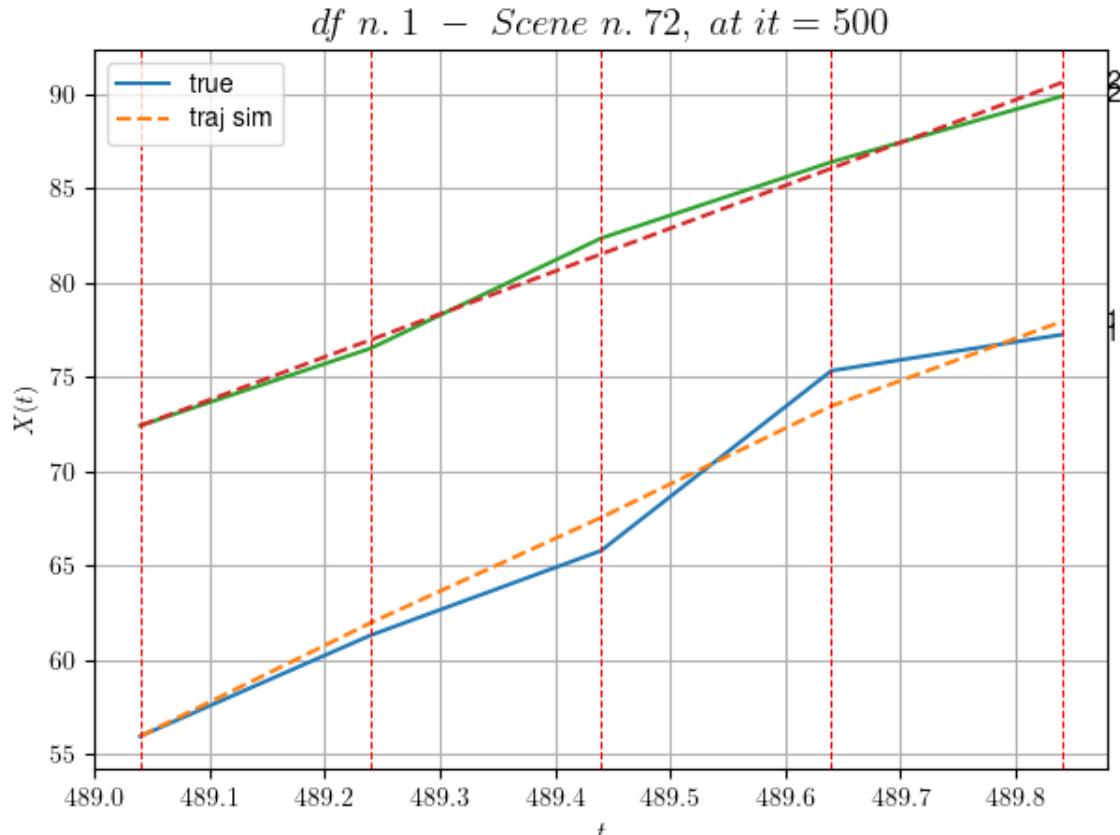
- \*  $v_0 = 26.764923514728967$
- \* MSE = 0.025480541416989355
- \* iterations = 500

---

DataFrame n.1. Scene n.69/73

---

We have 4 time intervals inside [489.04, 489.84]



---

For scene 69/73:

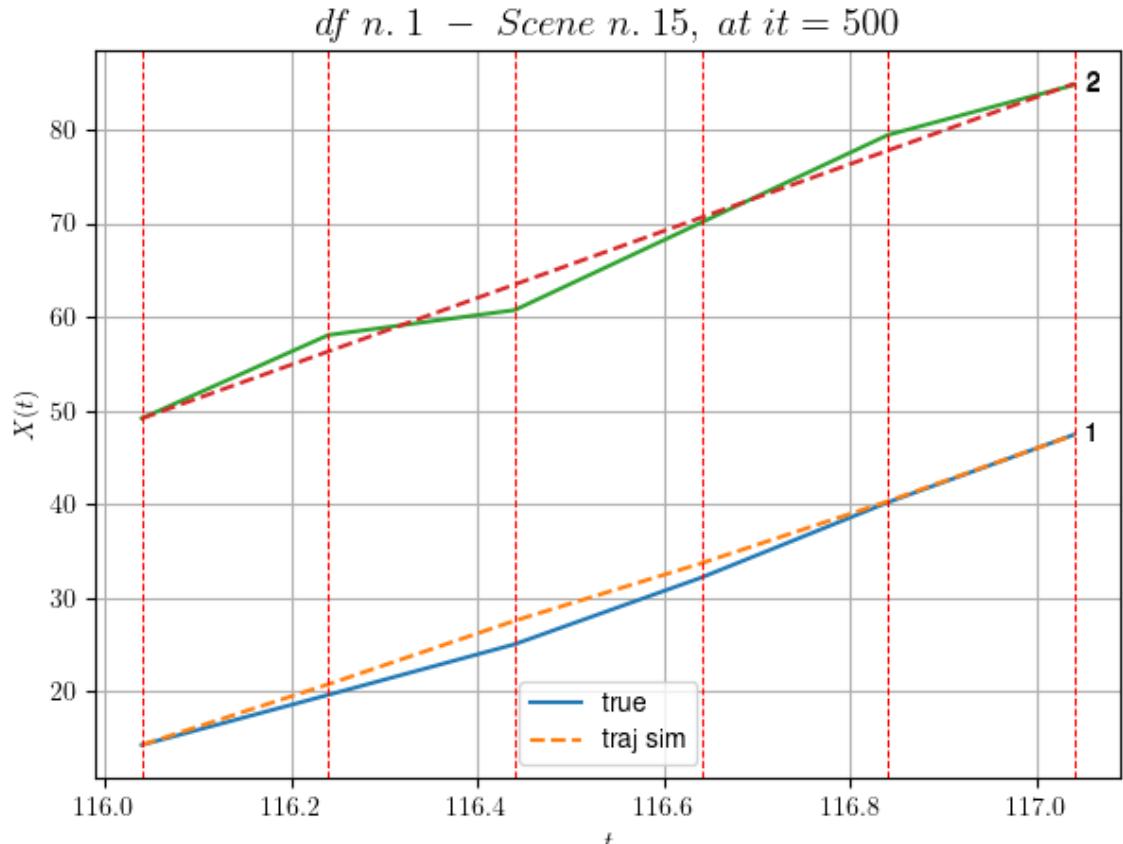
- \* After LR finder: LR\_NN=5e-05 with mse=7.471217321235389 at it=24
- \* v0 = 22.72973419671942
- \* MSE = 0.9053799300493035
- \* iterations = 500

---

DataFrame n.1. Scene n.70/73

---

We have 5 time intervals inside [116.04,117.04]



For scene 70/73:

\* After LR finder: LR\_NN=0.0001 with mse=7.777470113771512

at it=24

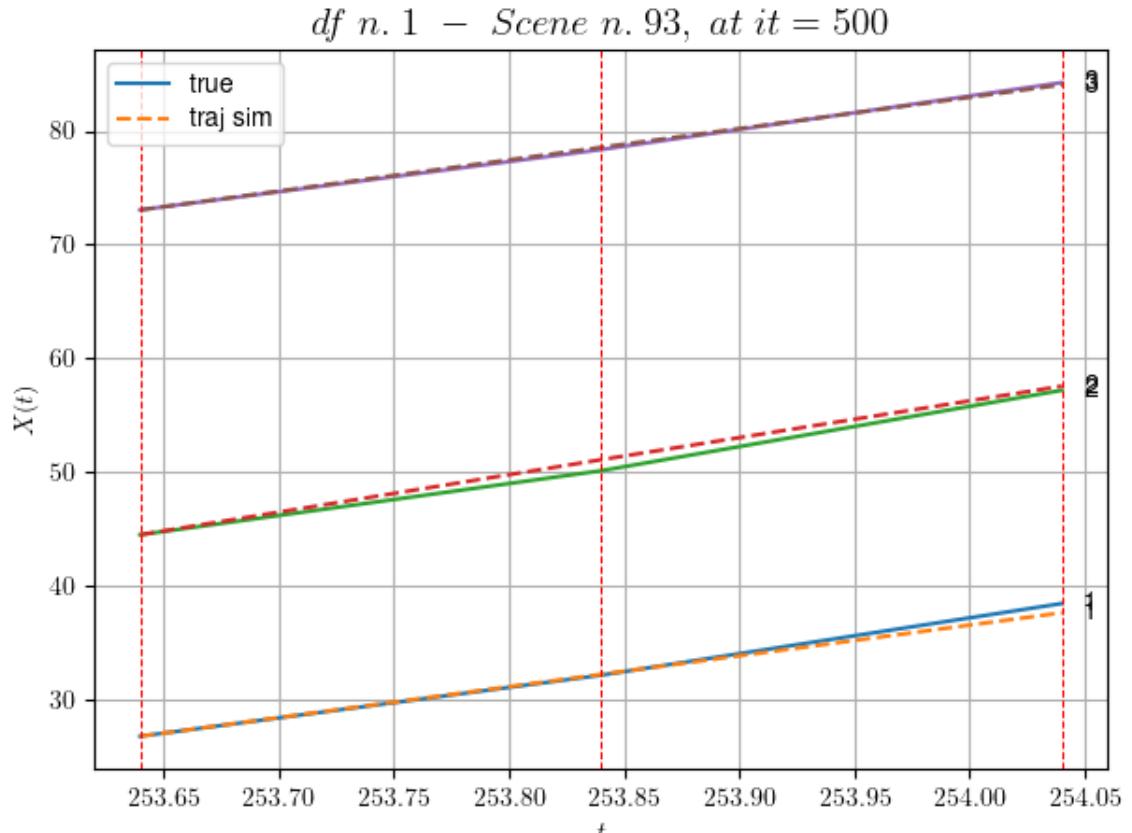
\* v0 = 35.75445949476166

\* MSE = 1.8178015496198623

\* iterations = 500

DataFrame n.1. Scene n.71/73

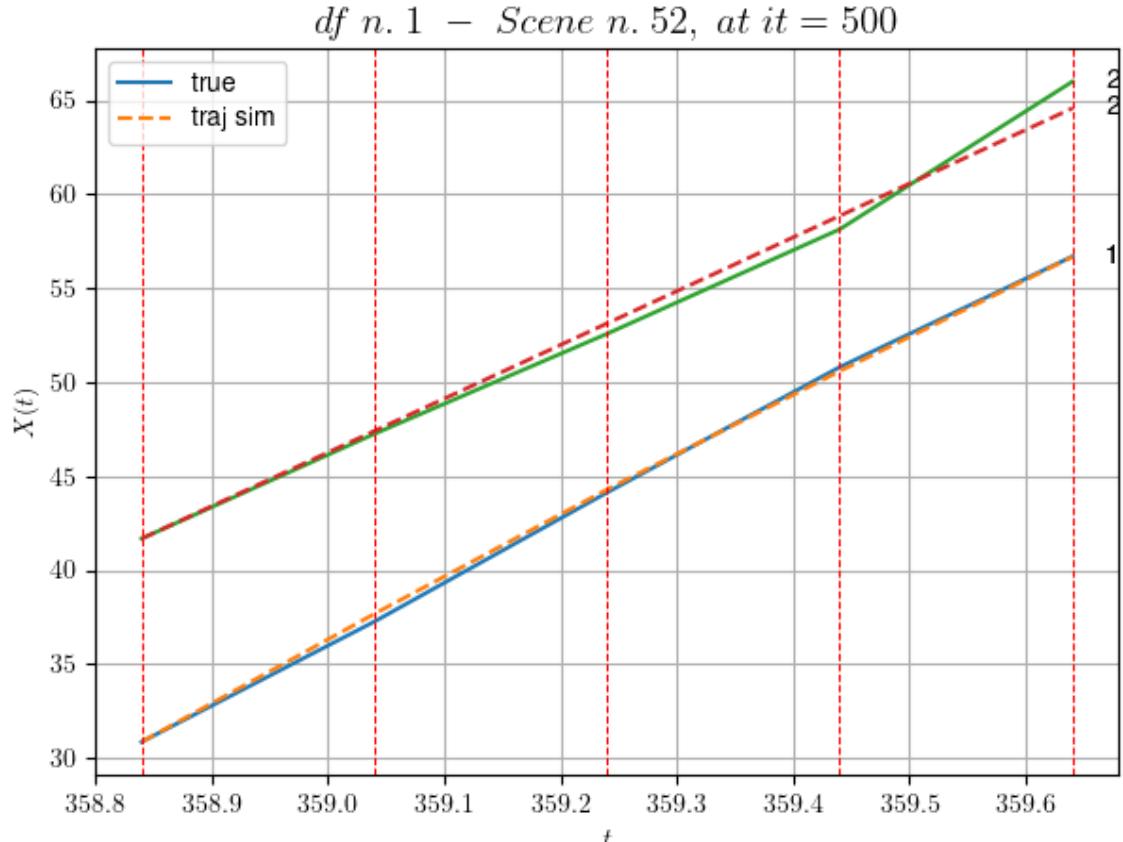
We have 2 time intervals inside [253.64, 254.04]



-----  
For scene 71/73:  
\* After LR finder: LR\_NN=5e-05 with mse=1.5703965321952633  
at it=24  
\* v0 = 27.474879582348724  
\* MSE = 0.20281594457929208  
\* iterations = 500  
-----

DataFrame n.1. Scene n.72/73

-----  
We have 4 time intervals inside [358.84,359.64]

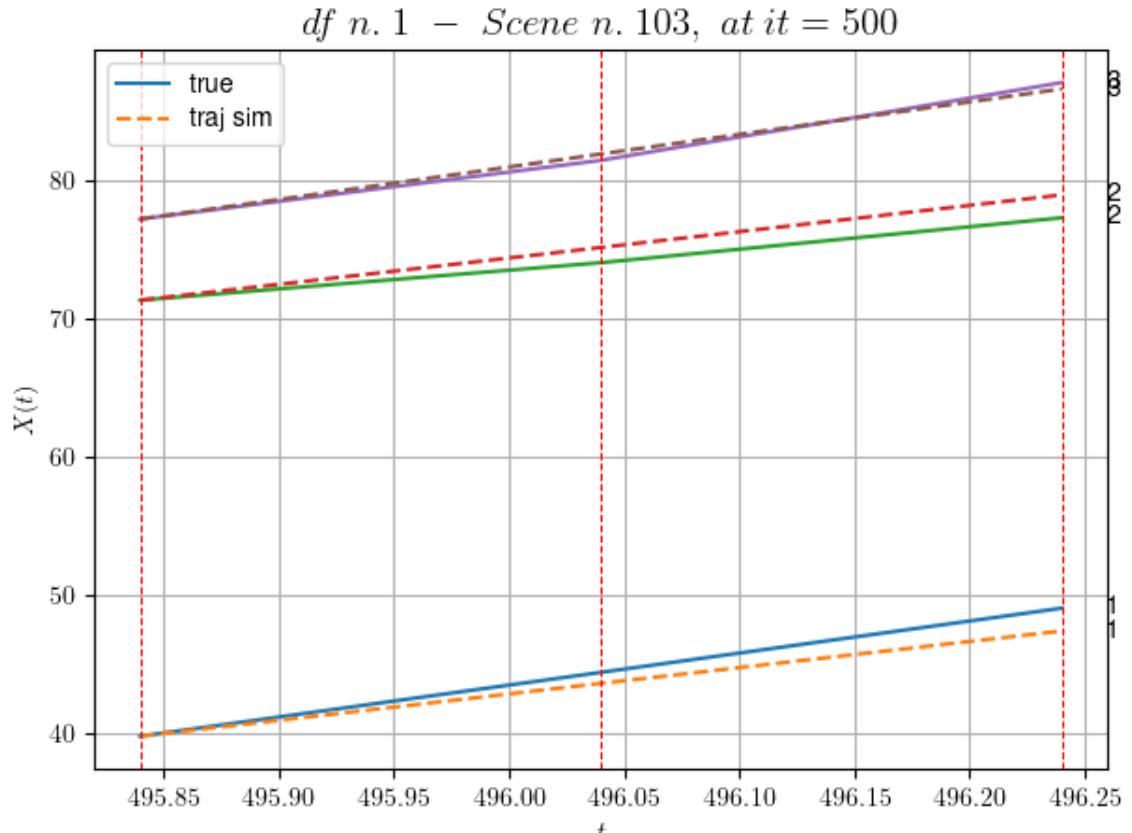


For scene 72/73:

\* After LR finder: LR\_NN=5e-05 with mse=0.6606431894073106  
at it=24  
\* v0 = 28.626441976920297  
\* MSE = 0.29551047695937915  
\* iterations = 500

DataFrame n.1. Scene n.73/73

We have 2 time intervals inside [495.84,496.24]

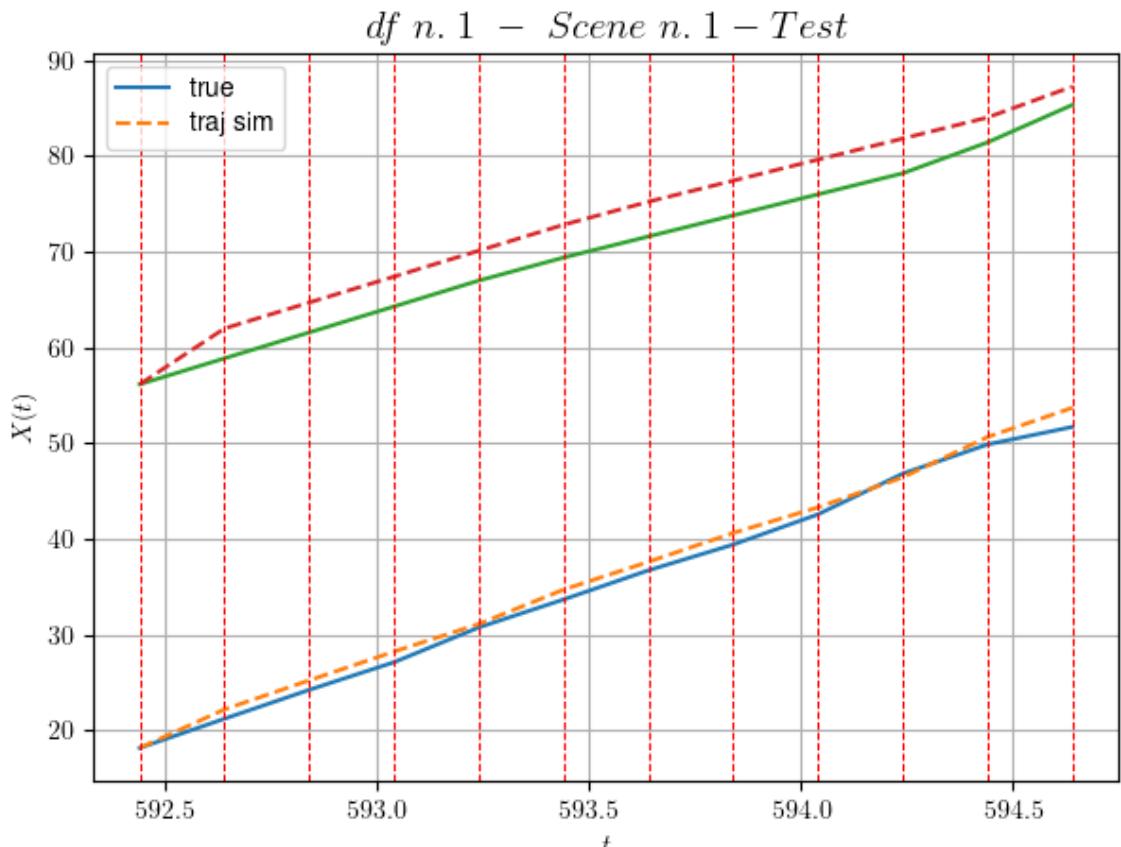


For scene 73/73:  
\* After LR finder: LR\_NN=5e-05 with mse=2.7657255927802598  
at it=24  
\* vθ = 23.563093490871932  
\* MSE = 0.8605337203270662  
\* iterations = 500

MSE train: 0.5587260530280083

Testing step. (36 scenes)

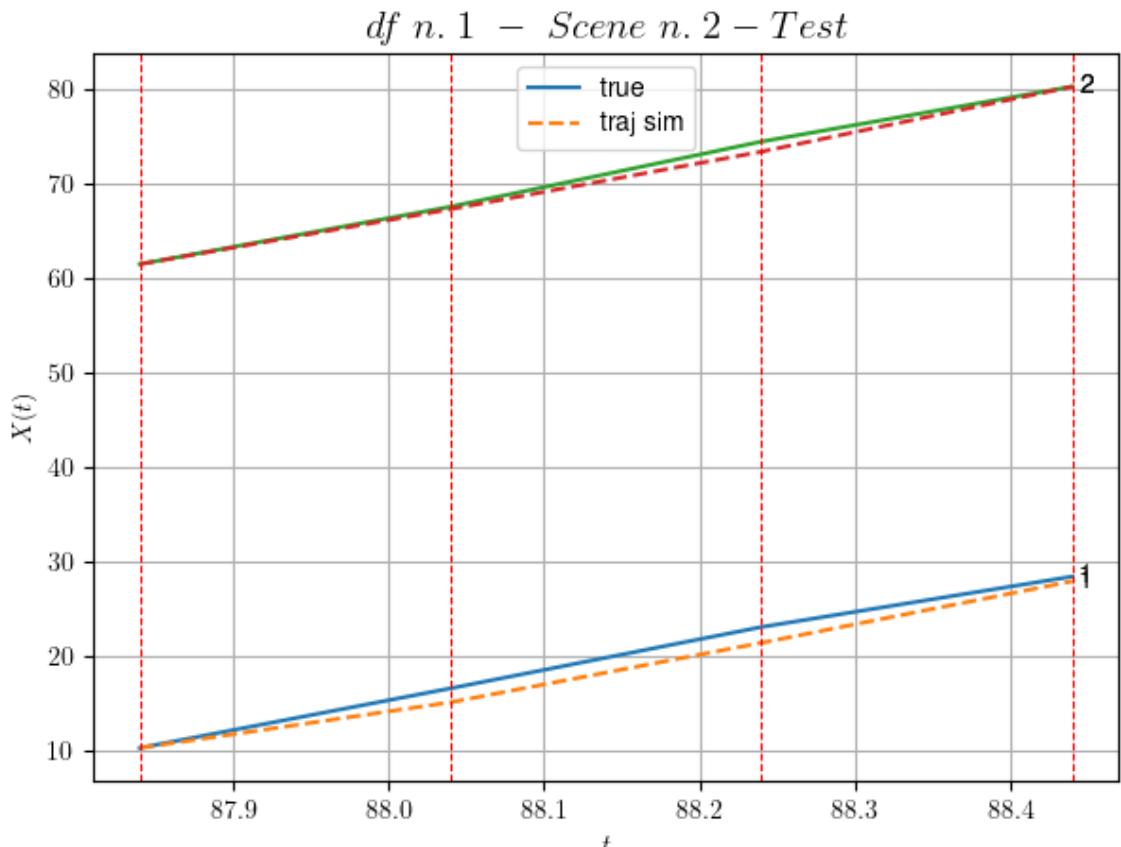
DataFrame n.1. Scene n.1/36



For scene 1/36:  
\* MSE = 5.239013303069074

---

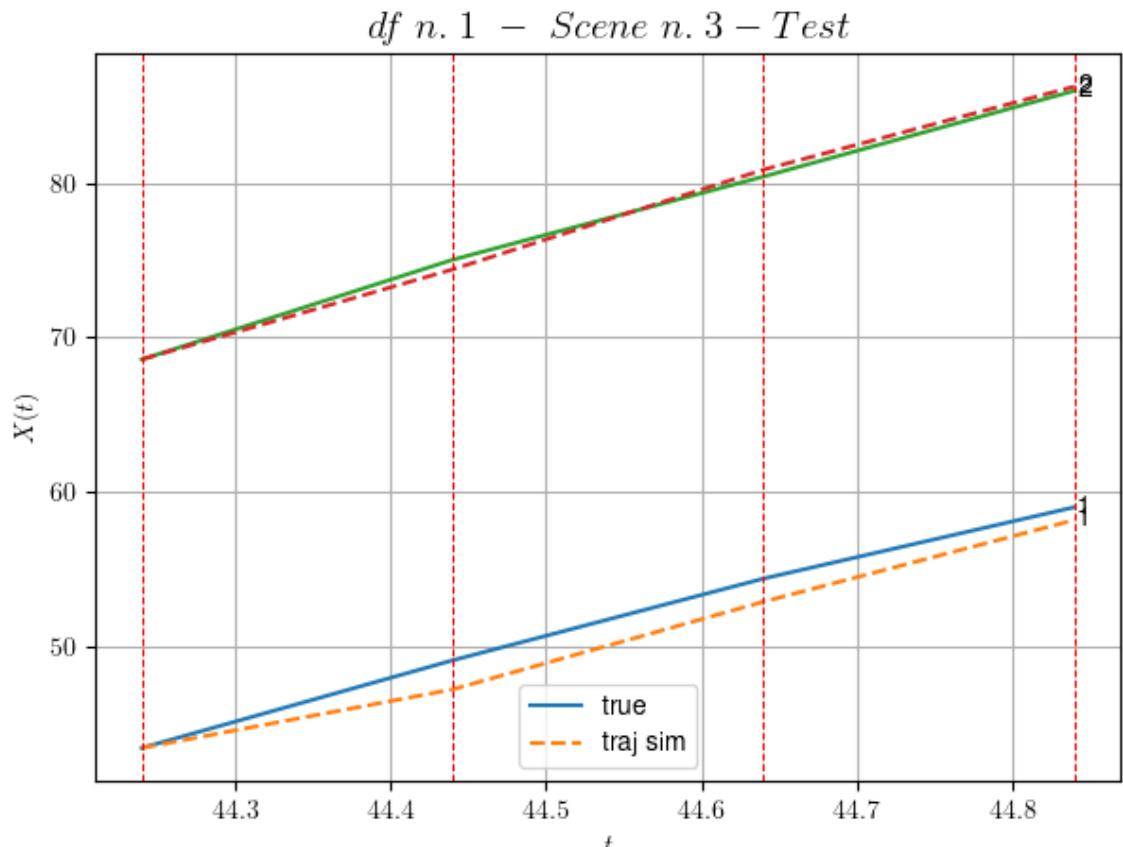
DataFrame n.1. Scene n.2/36



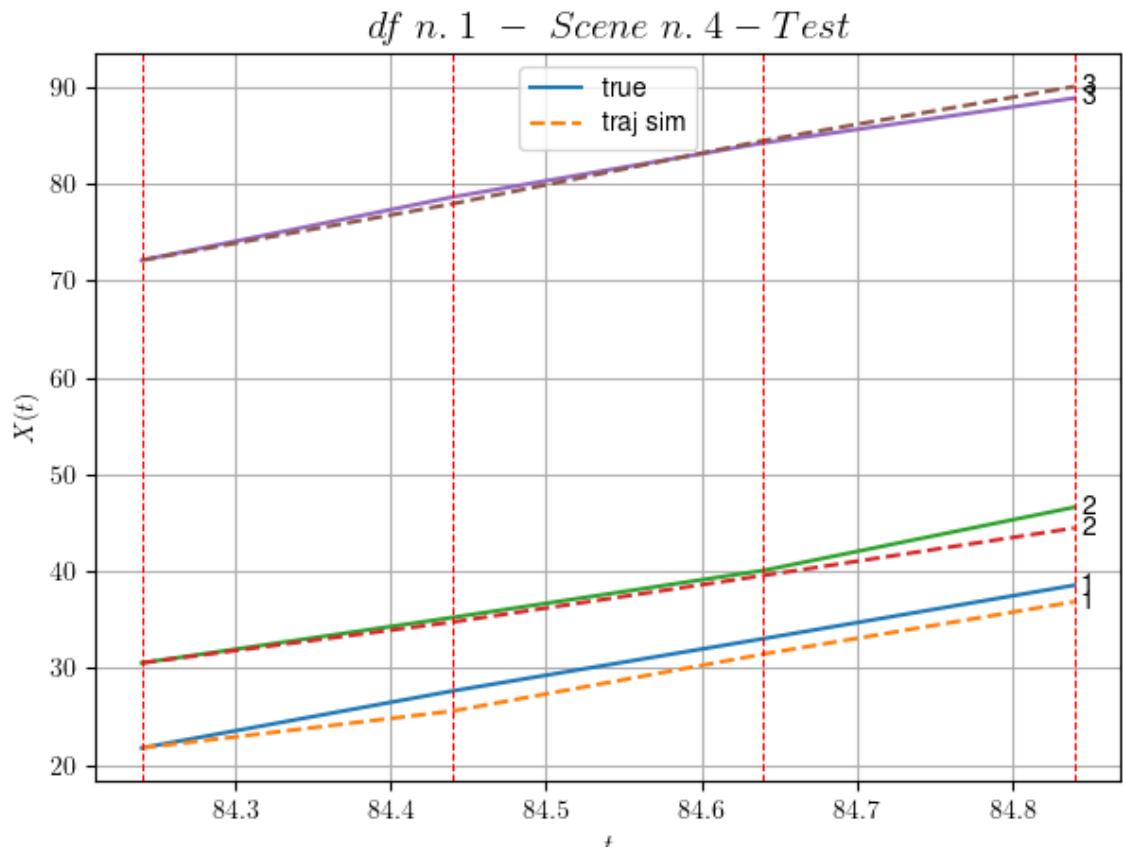
For scene 2/36:  
\* MSE = 0.8063327947489352

---

DataFrame n.1. Scene n.3/36



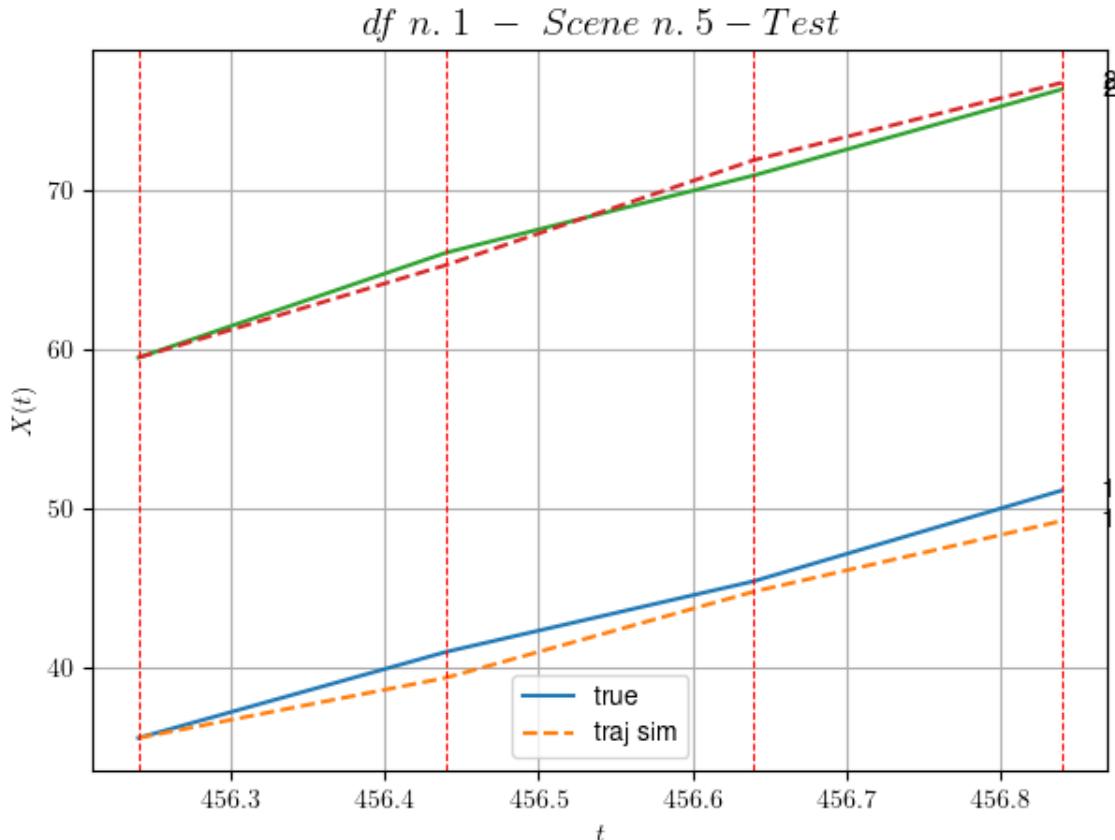
DataFrame n.1. Scene n.4/36



For scene 4/36:  
\* MSE = 1.403929833202221

---

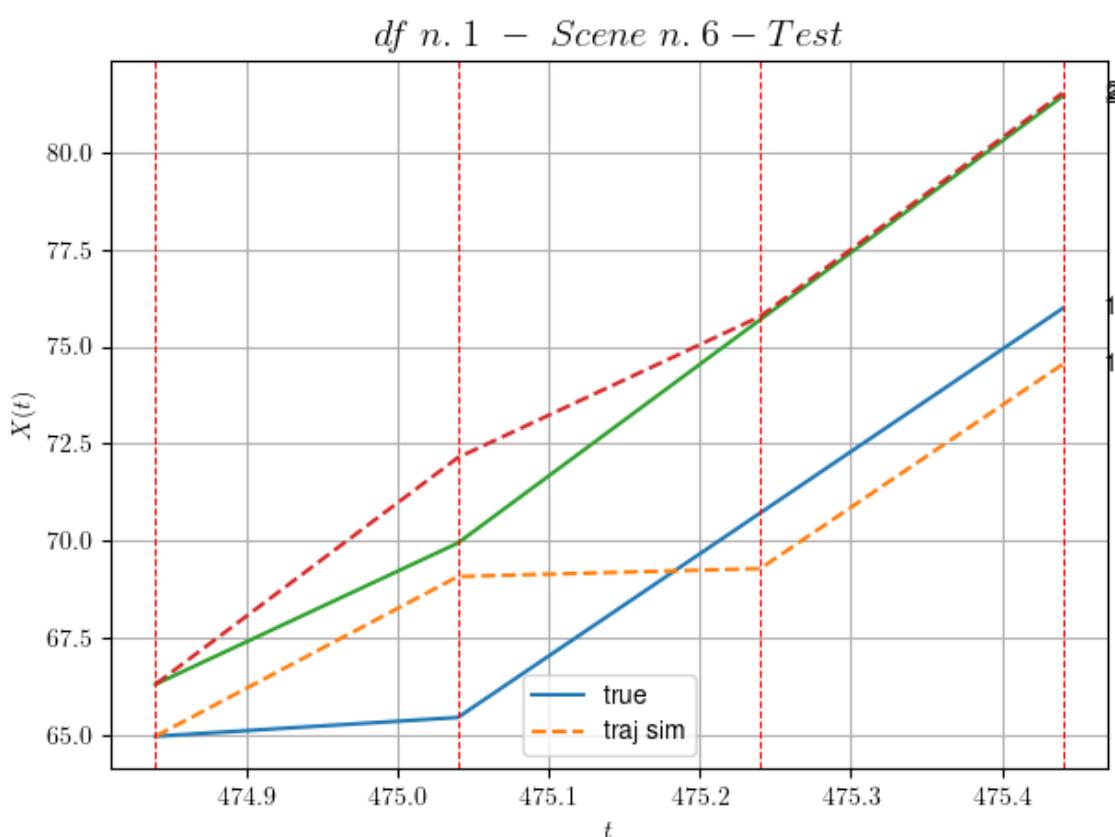
DataFrame n.1. Scene n.5/36



For scene 5/36:  
\* MSE = 1.0586185906038006

---

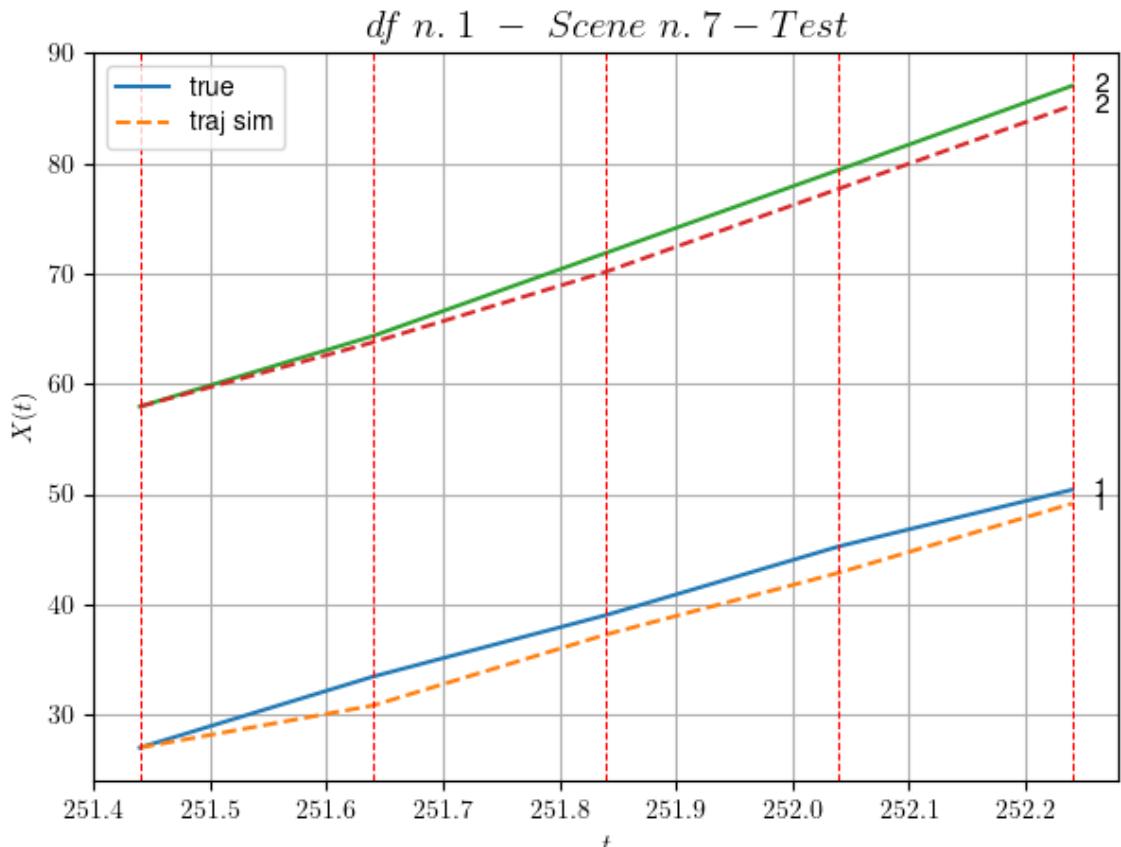
DataFrame n.1. Scene n.6/36



For scene 6/36:  
\* MSE = 2.762216307820697

---

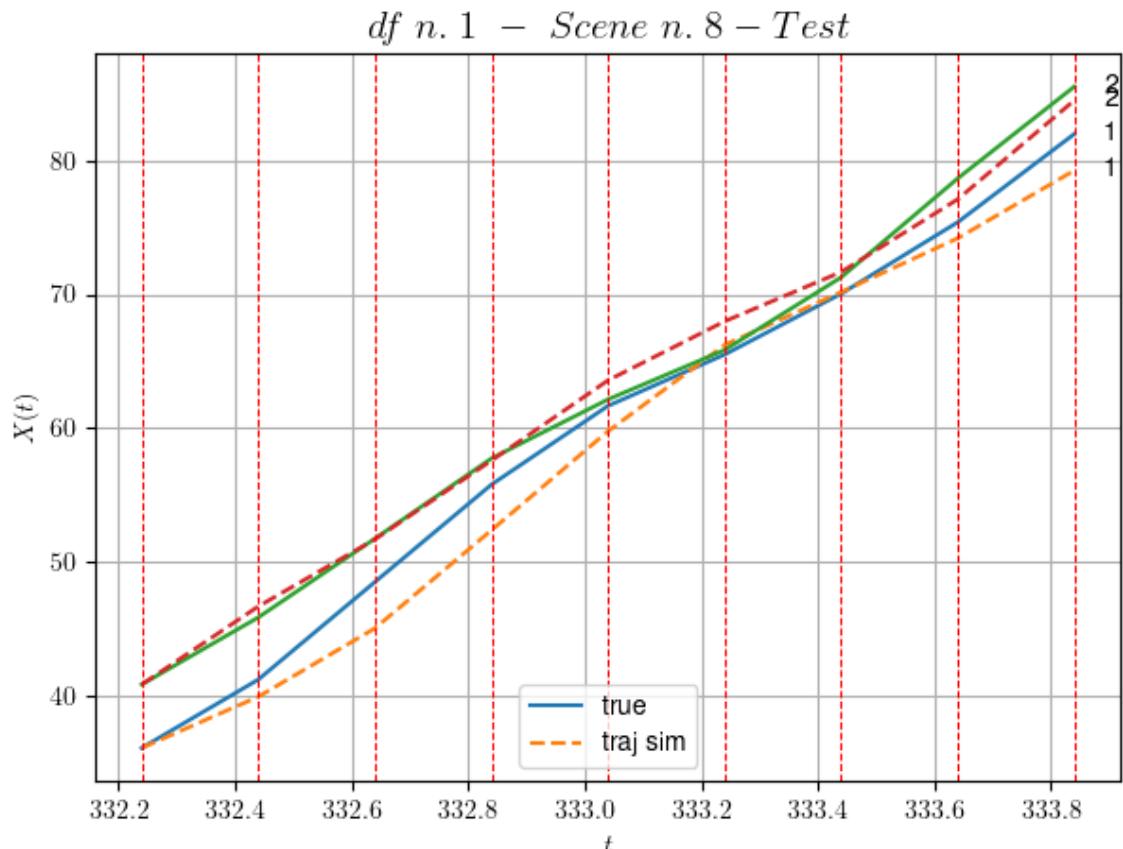
DataFrame n.1. Scene n.7/36



For scene 7/36:  
\* MSE = 2.664170770509064

---

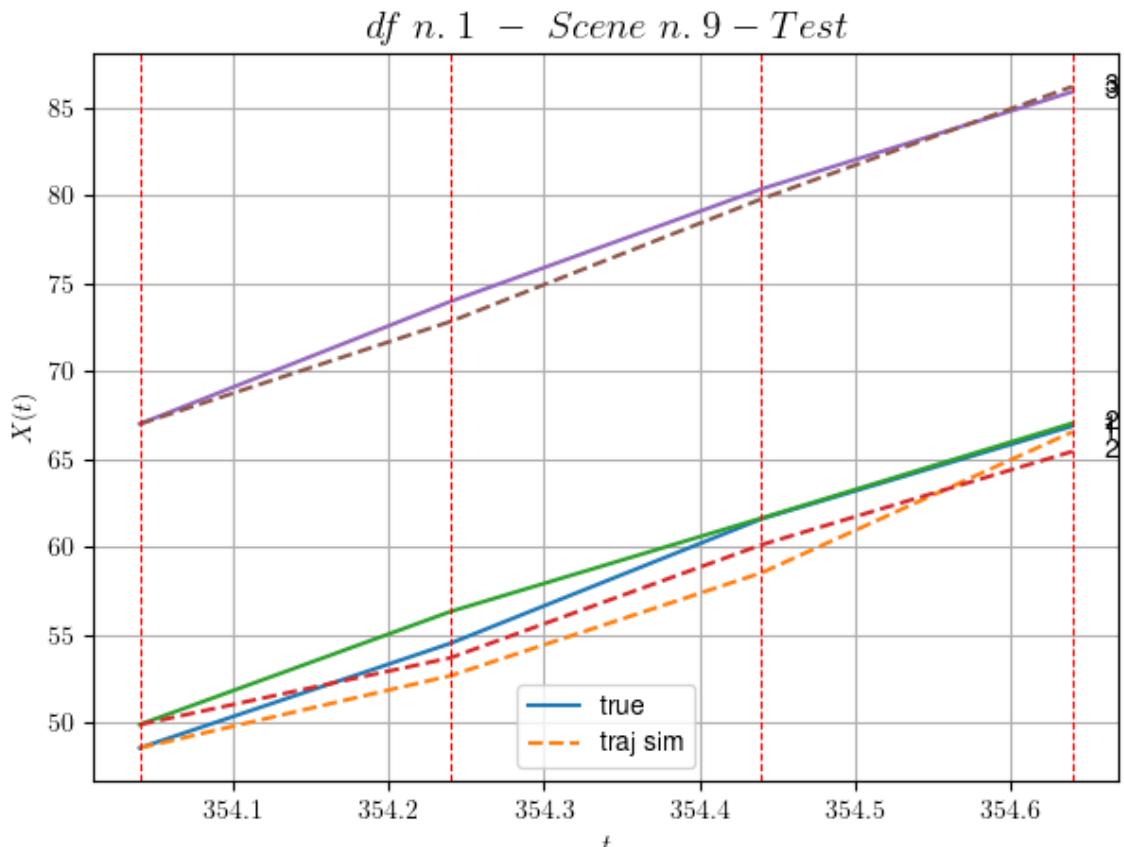
DataFrame n.1. Scene n.8/36



For scene 8/36:  
\* MSE = 2.7296042342481397

---

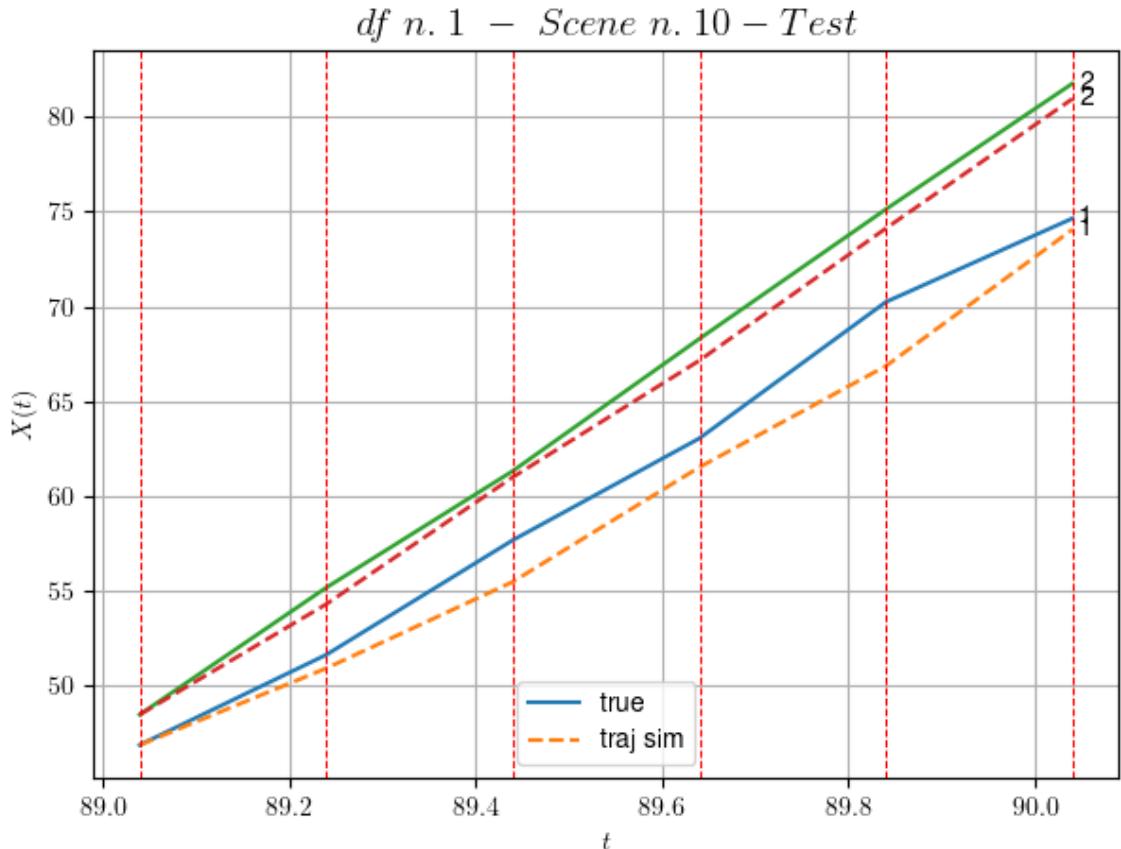
DataFrame n.1. Scene n.9/36



For scene 9/36:  
\* MSE = 2.2016041932770993

---

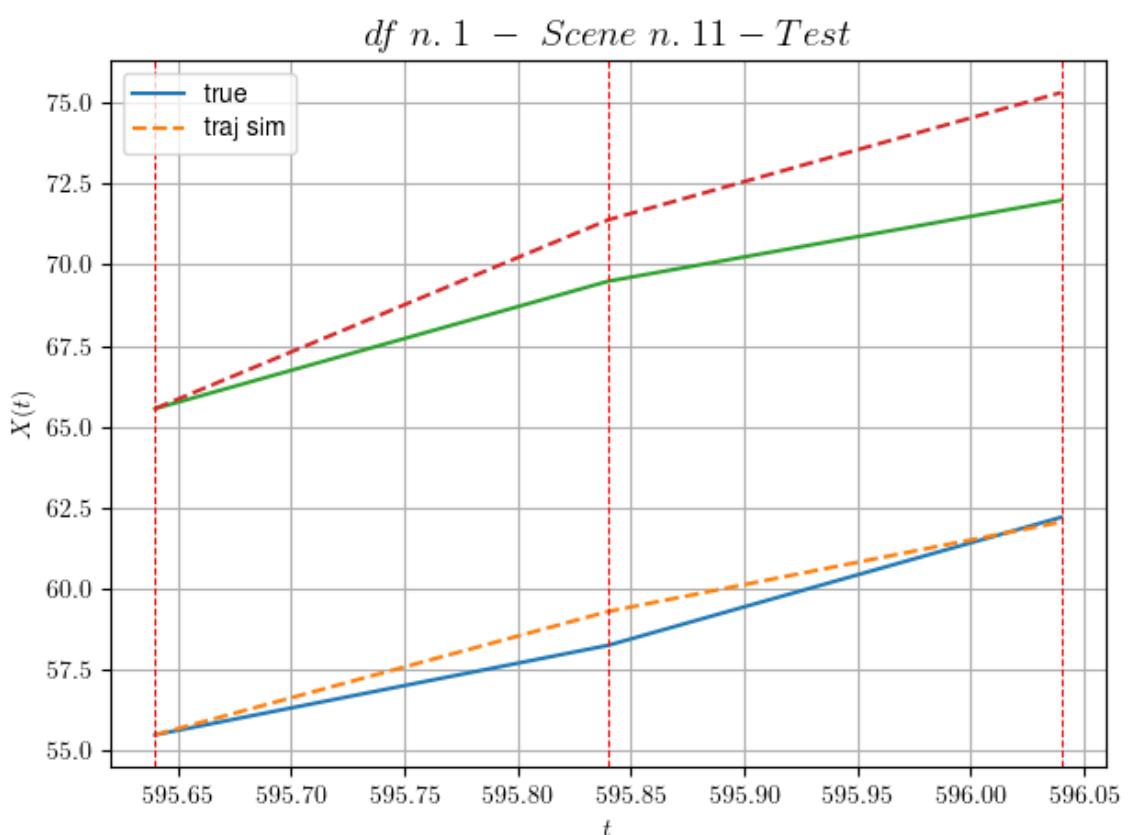
DataFrame n.1. Scene n.10/36



For scene 10/36:  
\* MSE = 1.9397451635194316

---

DataFrame n.1. Scene n.11/36

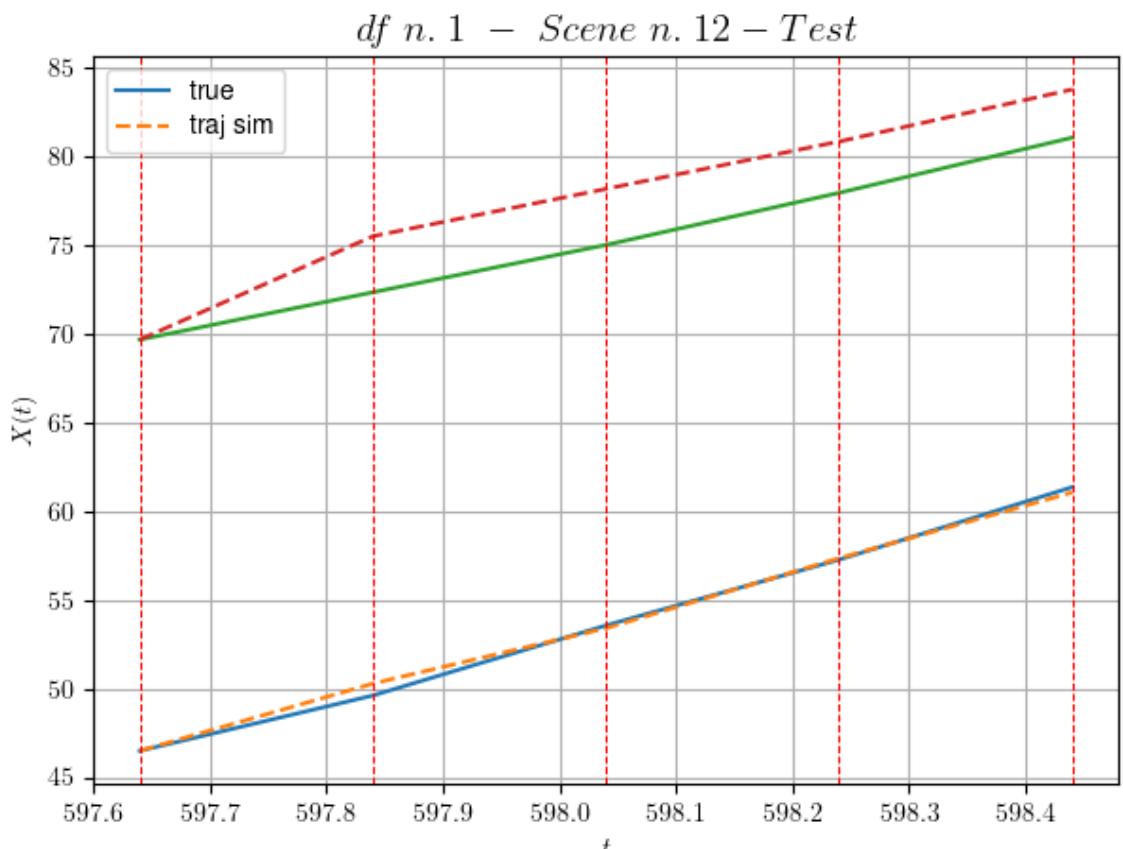


For scene 11/36:  
\* MSE = 2.6297752305640247

---

---

DataFrame n.1. Scene n.12/36

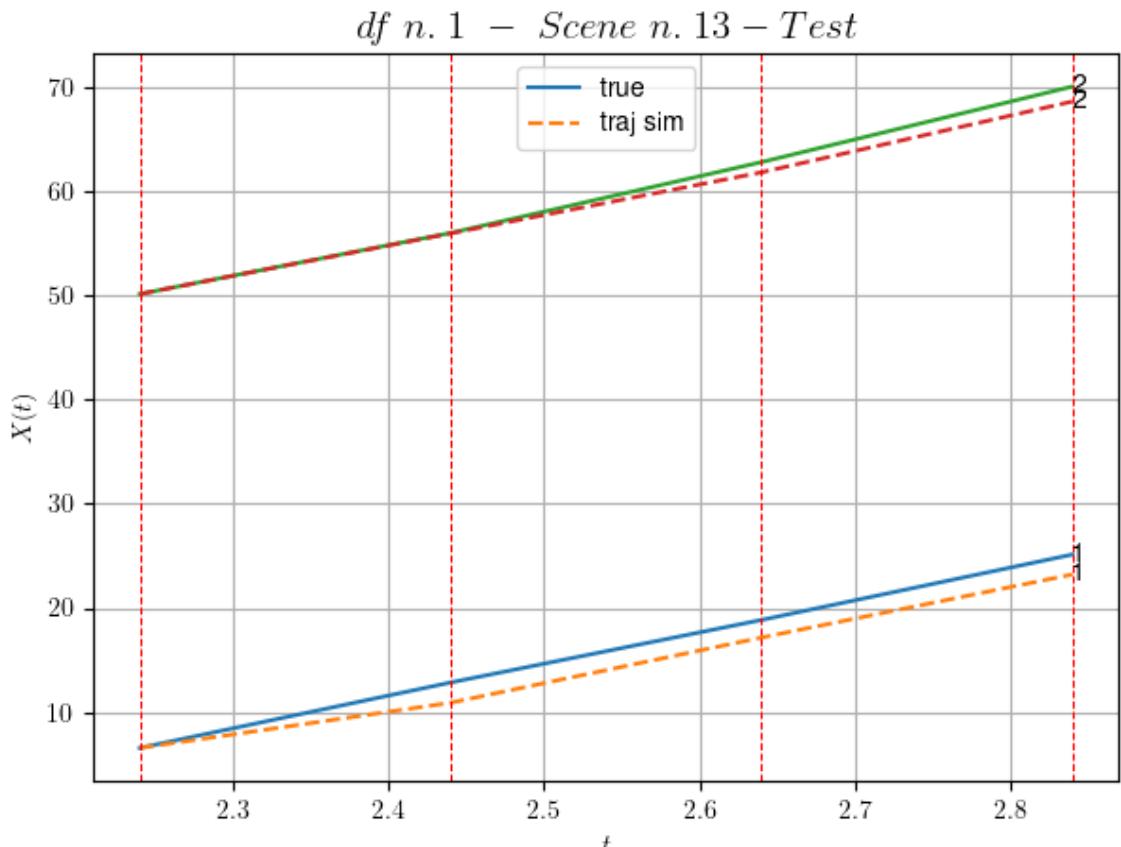


For scene 12/36:  
\* MSE = 3.6268675933870473

---

---

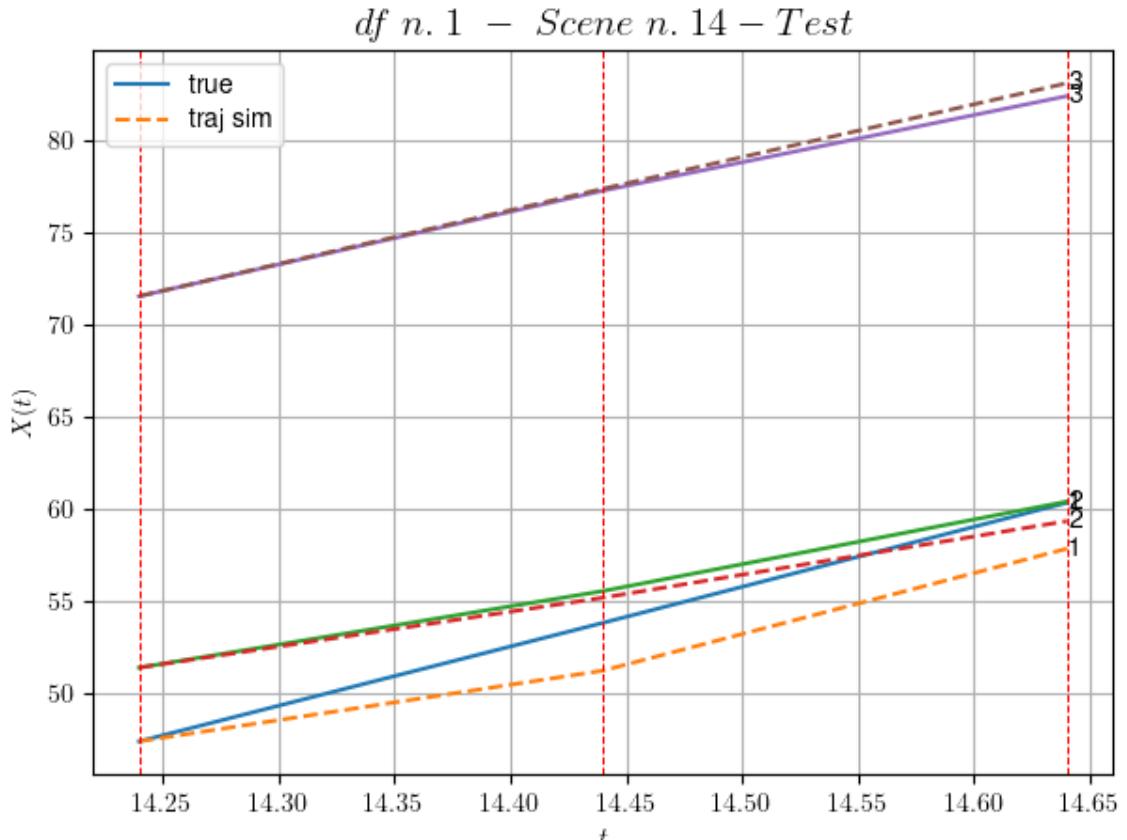
DataFrame n.1. Scene n.13/36



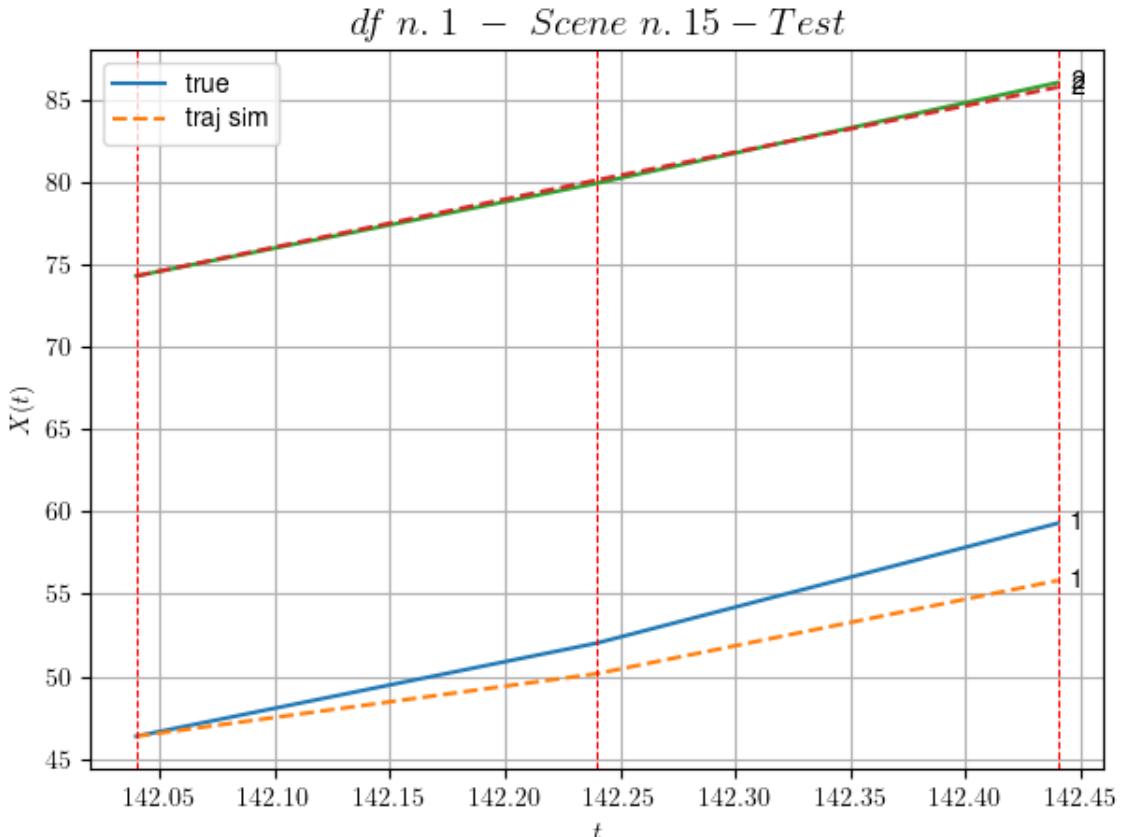
For scene 13/36:  
\* MSE = 1.669642961105215

---

DataFrame n.1. Scene n.14/36



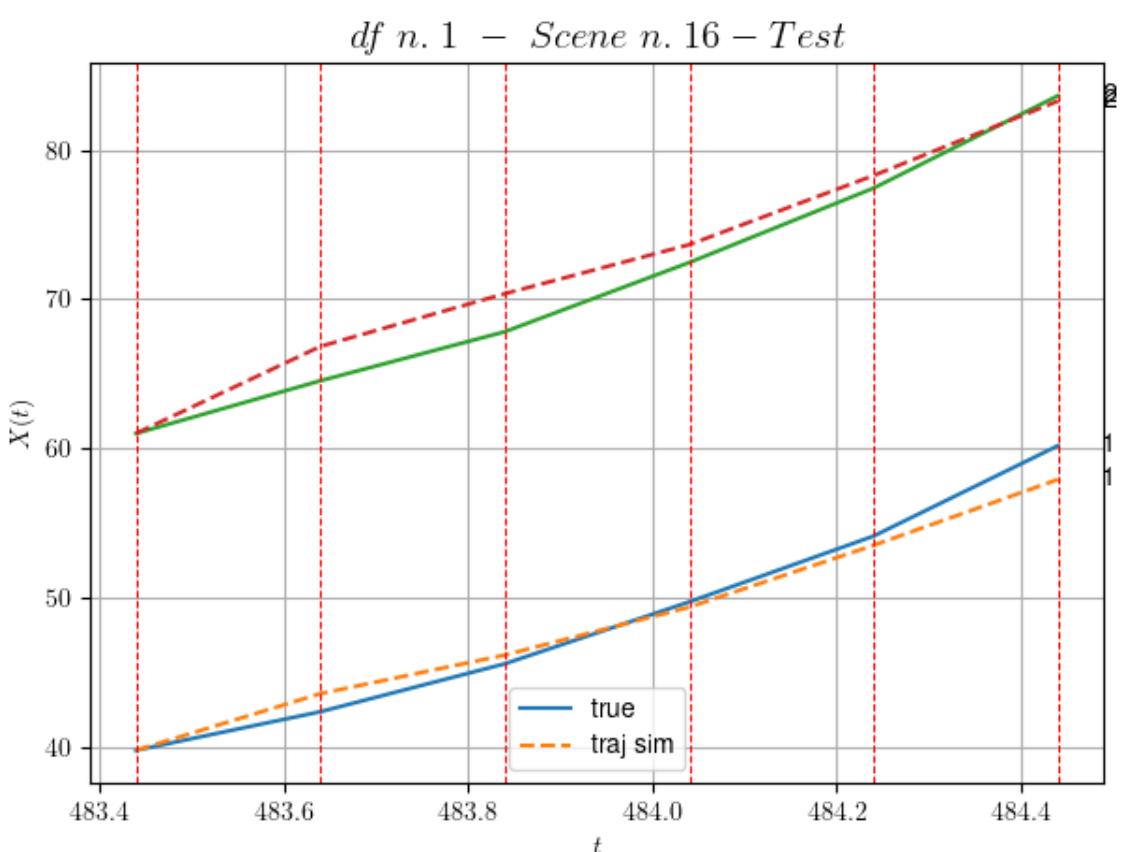
DataFrame n.1. Scene n.15/36



For scene 15/36:  
\* MSE = 2.6070104387523005

---

DataFrame n.1. Scene n.16/36

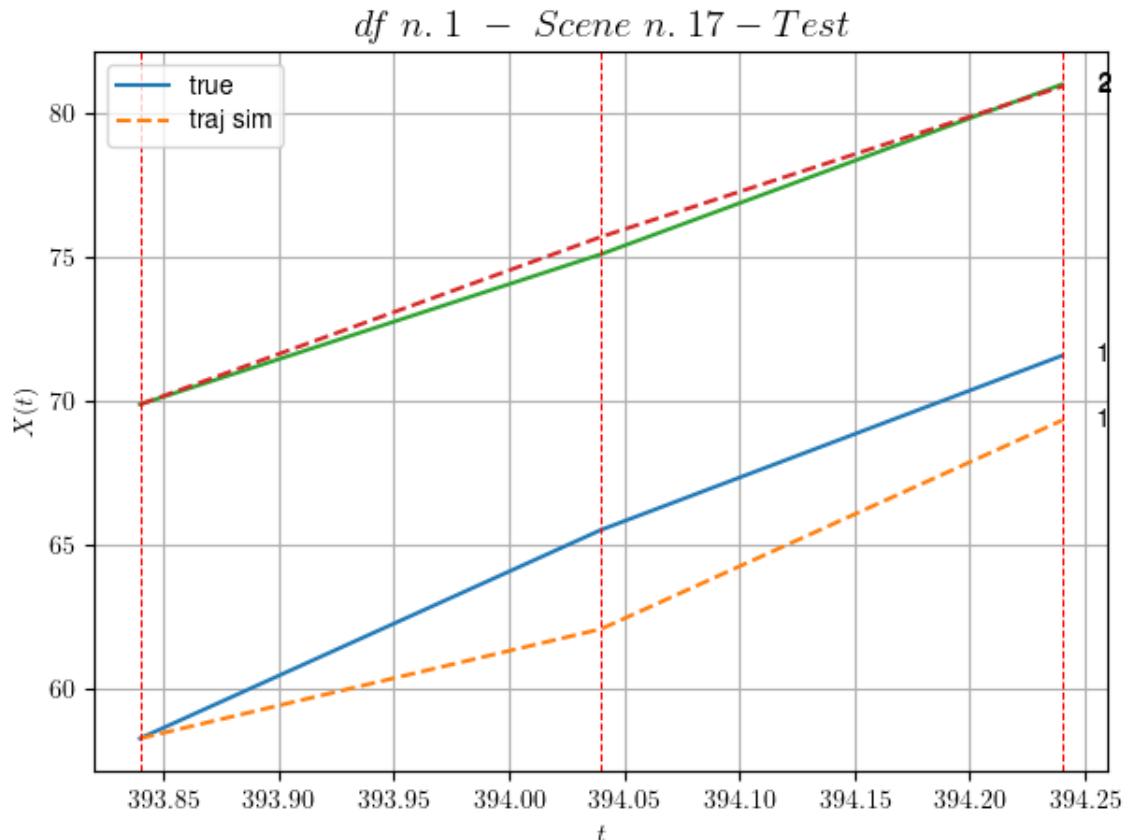


For scene 16/36:  
\* MSE = 1.7896879084231396

---

---

DataFrame n.1. Scene n.17/36

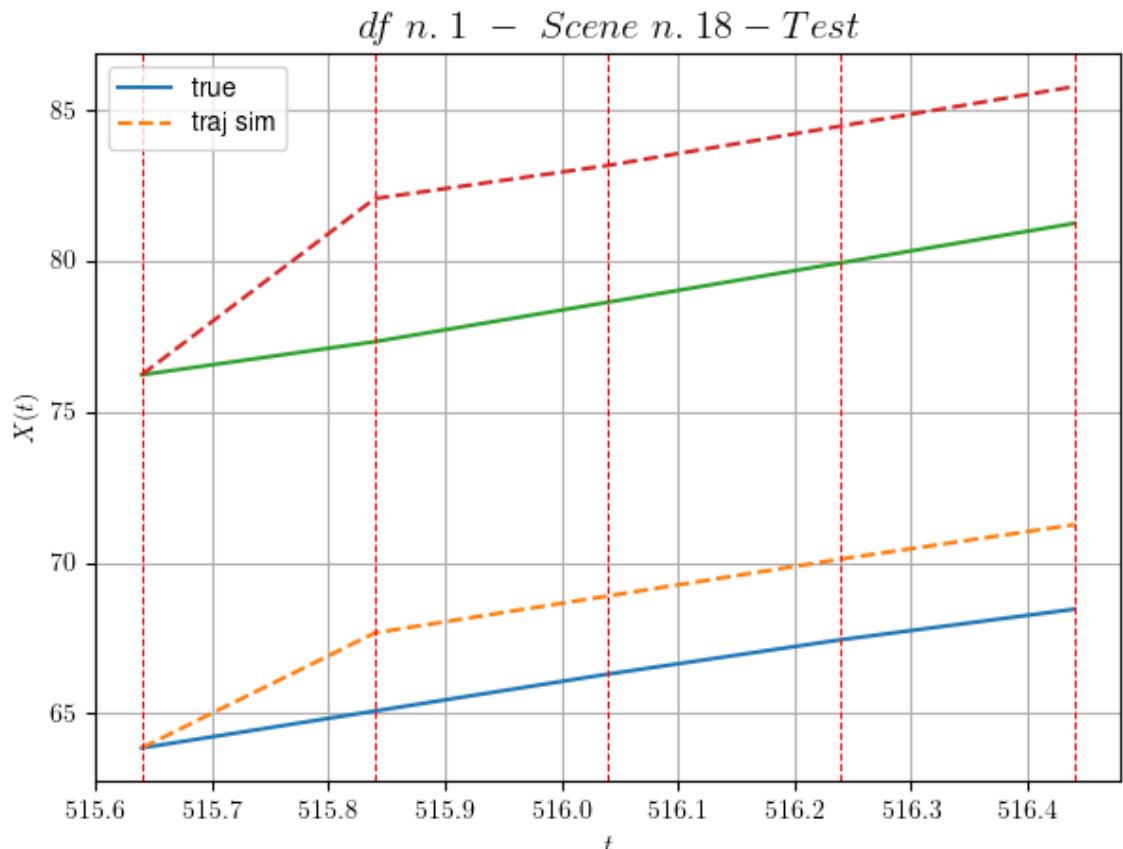


For scene 17/36:  
\* MSE = 2.8871967989677514

---

---

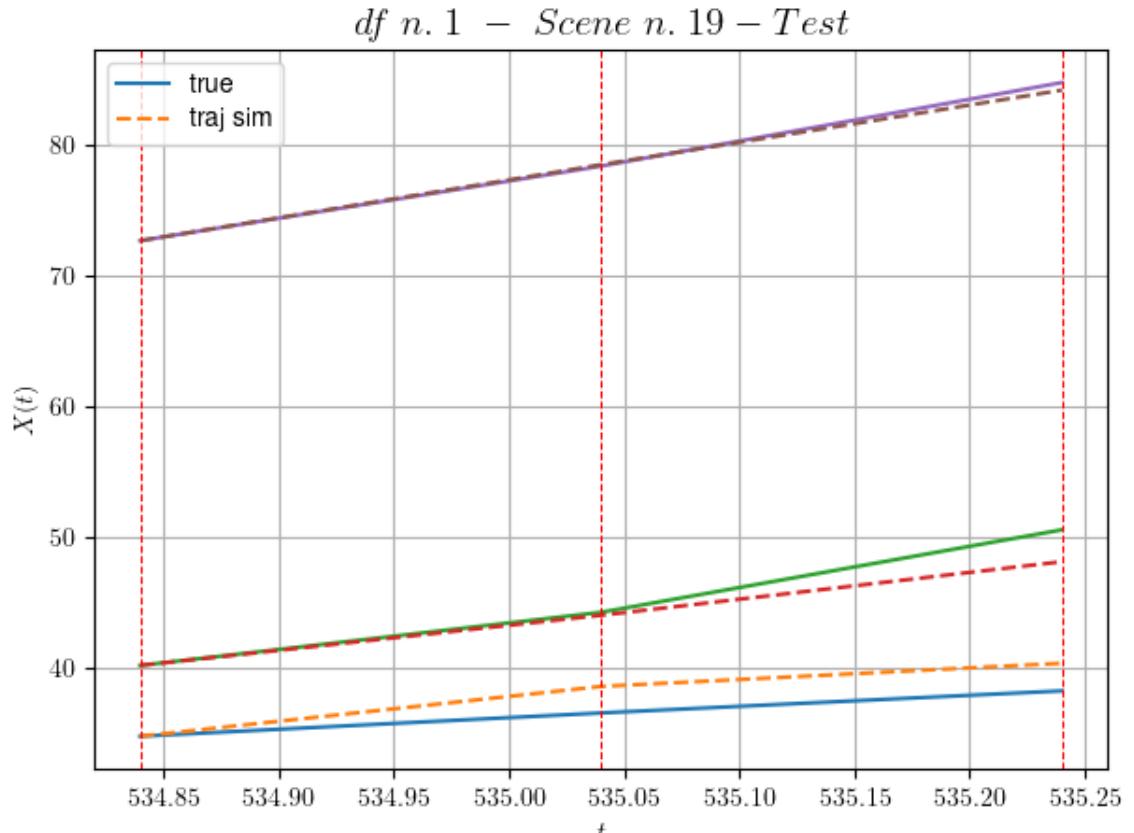
DataFrame n.1. Scene n.18/36



For scene 18/36:  
\* MSE = 11.21056249646586

---

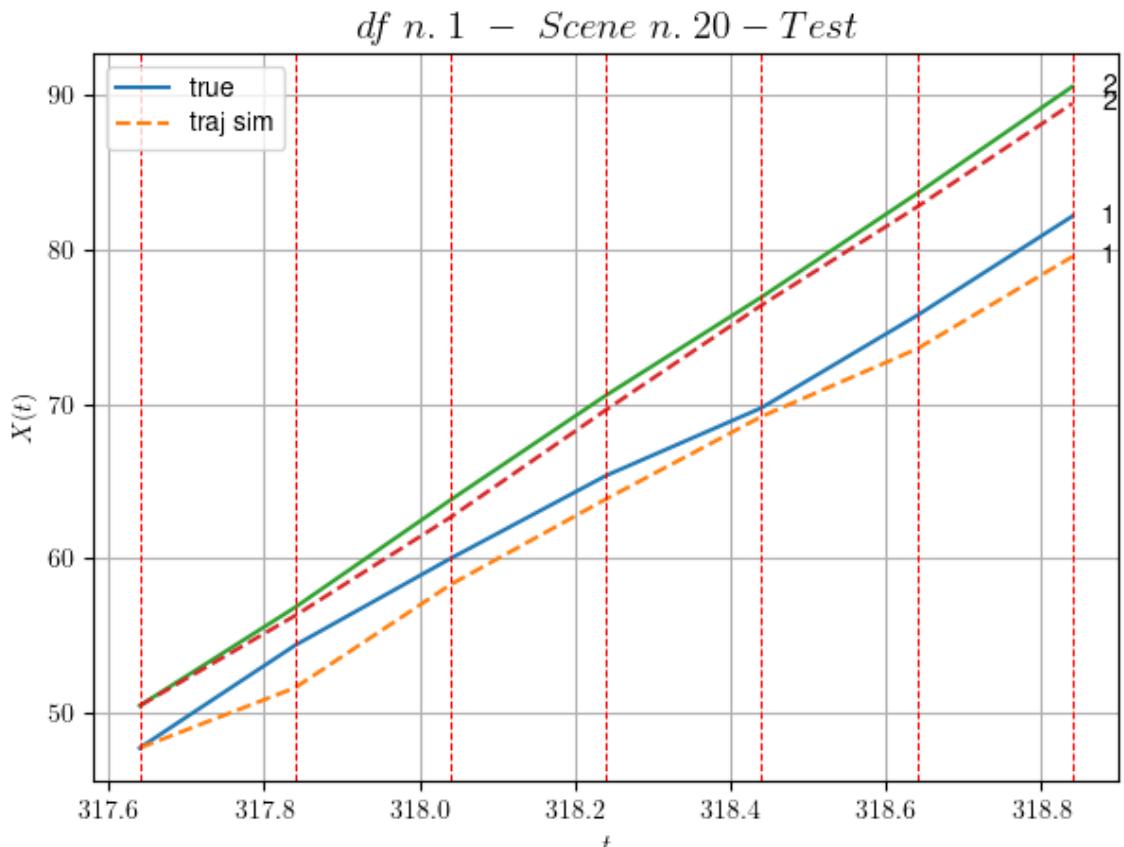
DataFrame n.1. Scene n.19/36



For scene 19/36:  
\* MSE = 1.6661590576403118

---

DataFrame n.1. Scene n.20/36

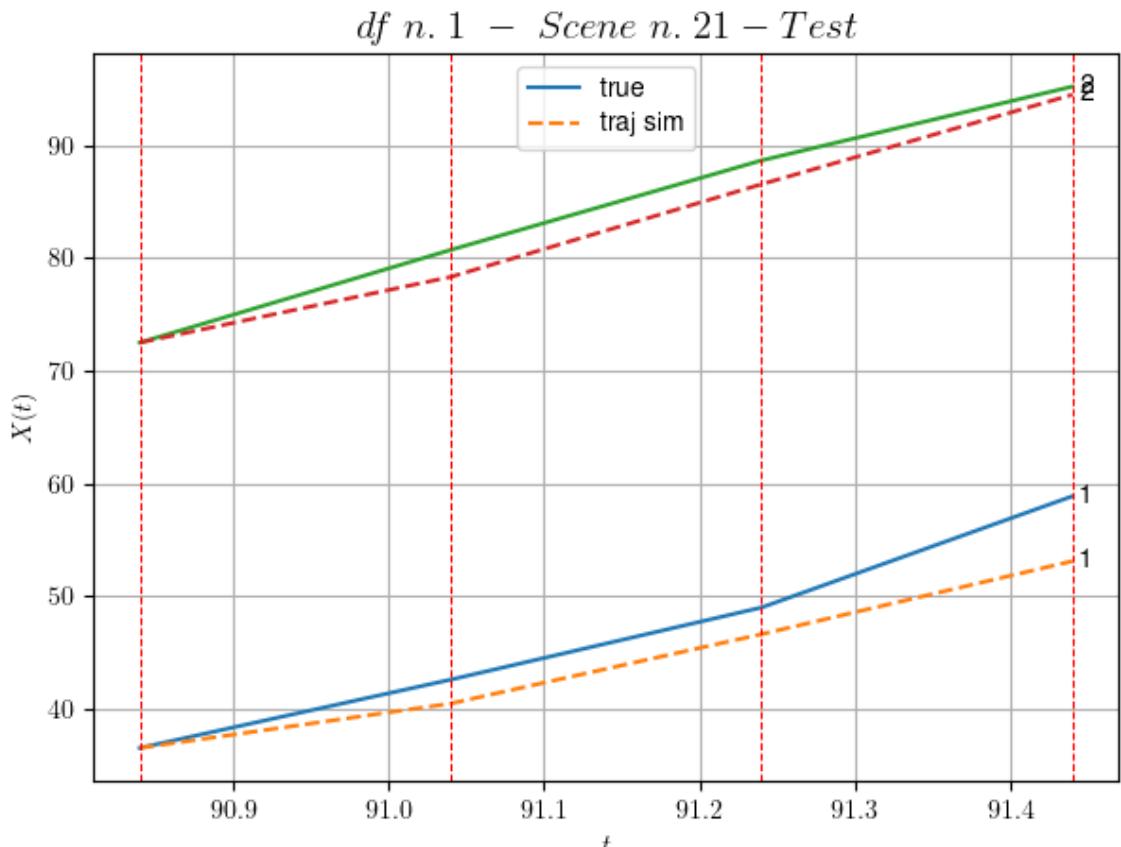


For scene 20/36:  
\* MSE = 2.086045771282148

---

---

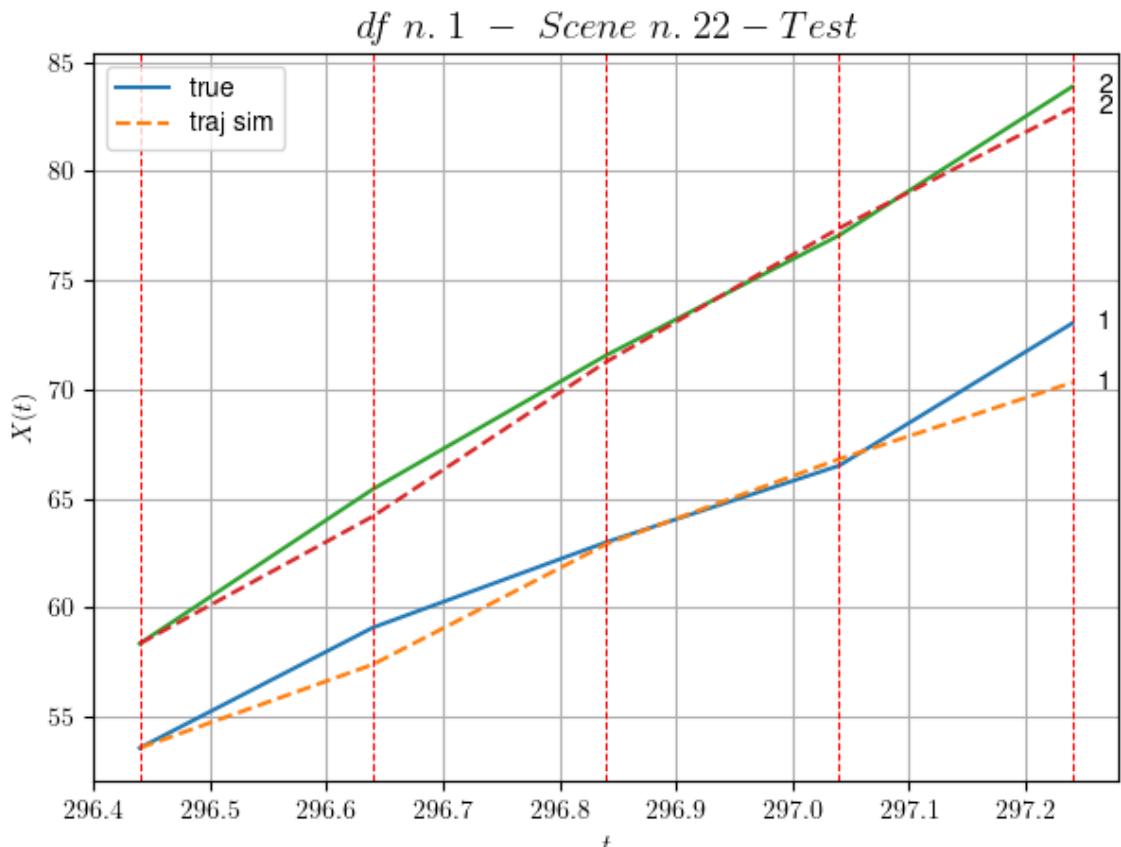
DataFrame n.1. Scene n.21/36



For scene 21/36:  
\* MSE = 6.754092845723534

---

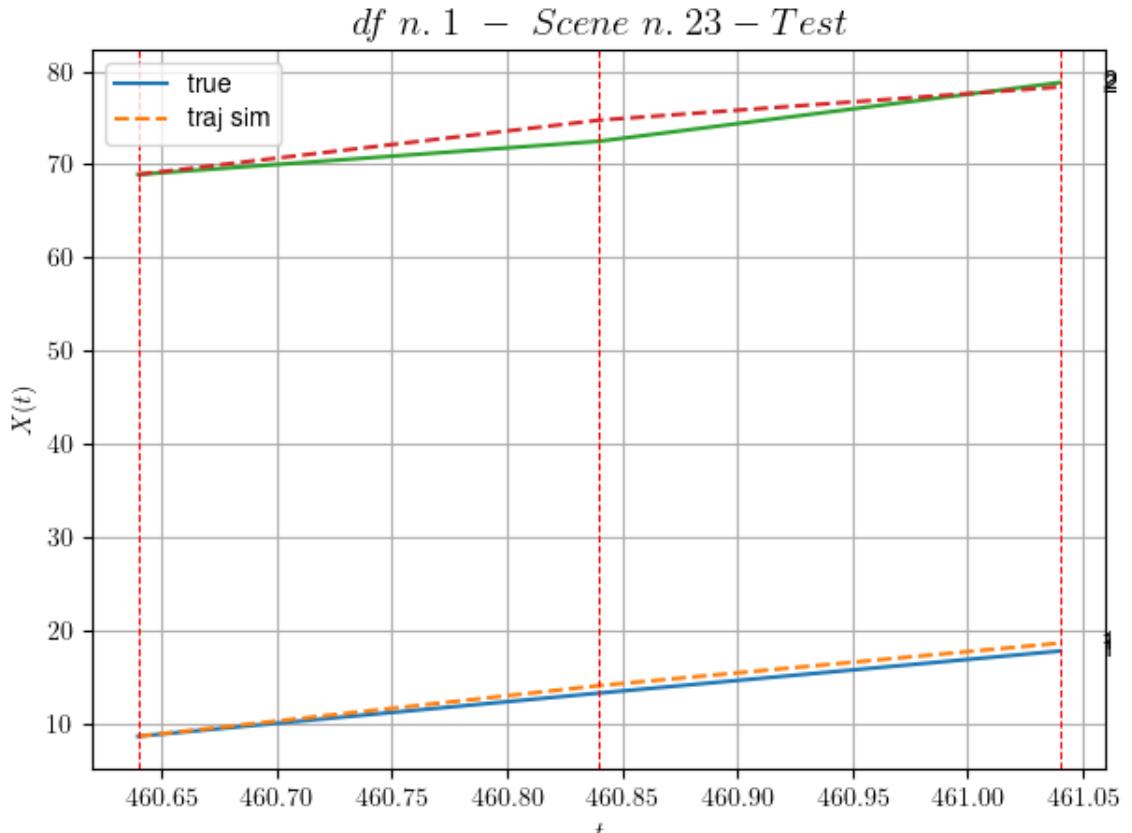
DataFrame n.1. Scene n.22/36



For scene 22/36:  
\* MSE = 1.3060154653254932

---

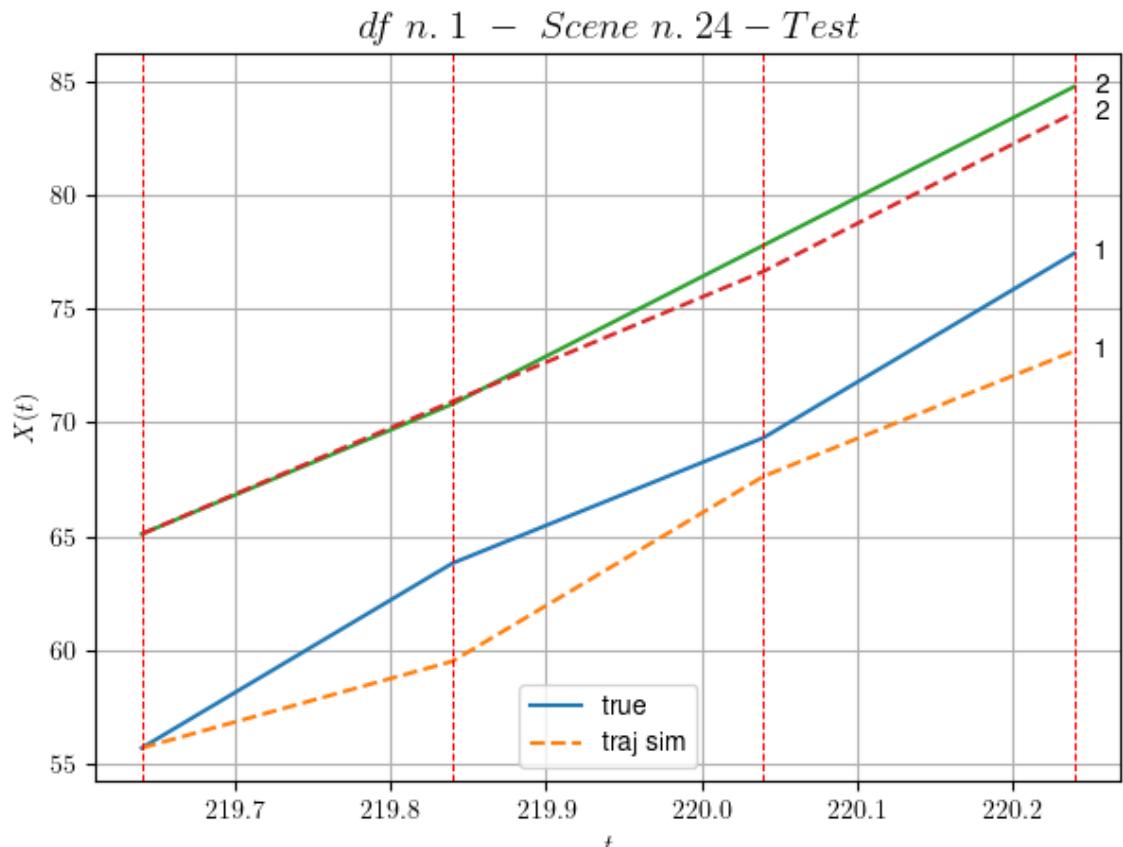
DataFrame n.1. Scene n.23/36



For scene 23/36:  
\* MSE = 1.120715319884972

---

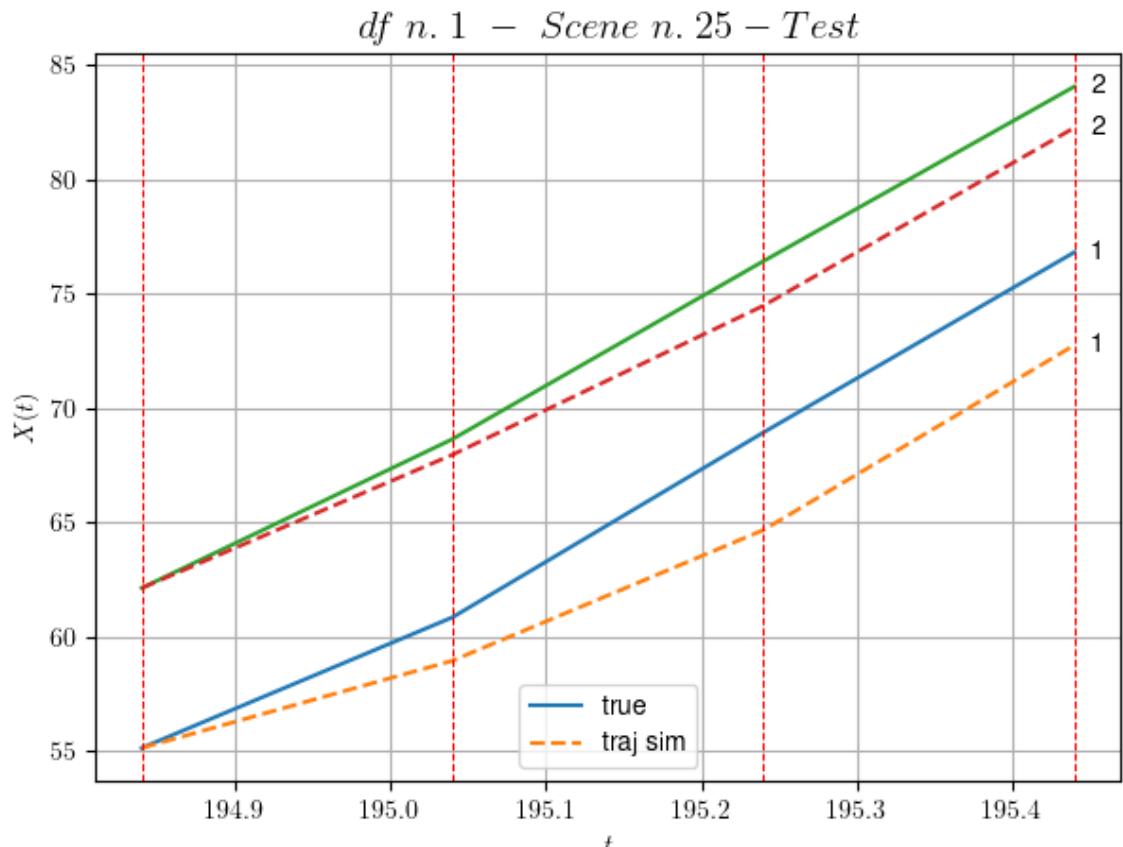
DataFrame n.1. Scene n.24/36



For scene 24/36:  
\* MSE = 5.322219332348085

---

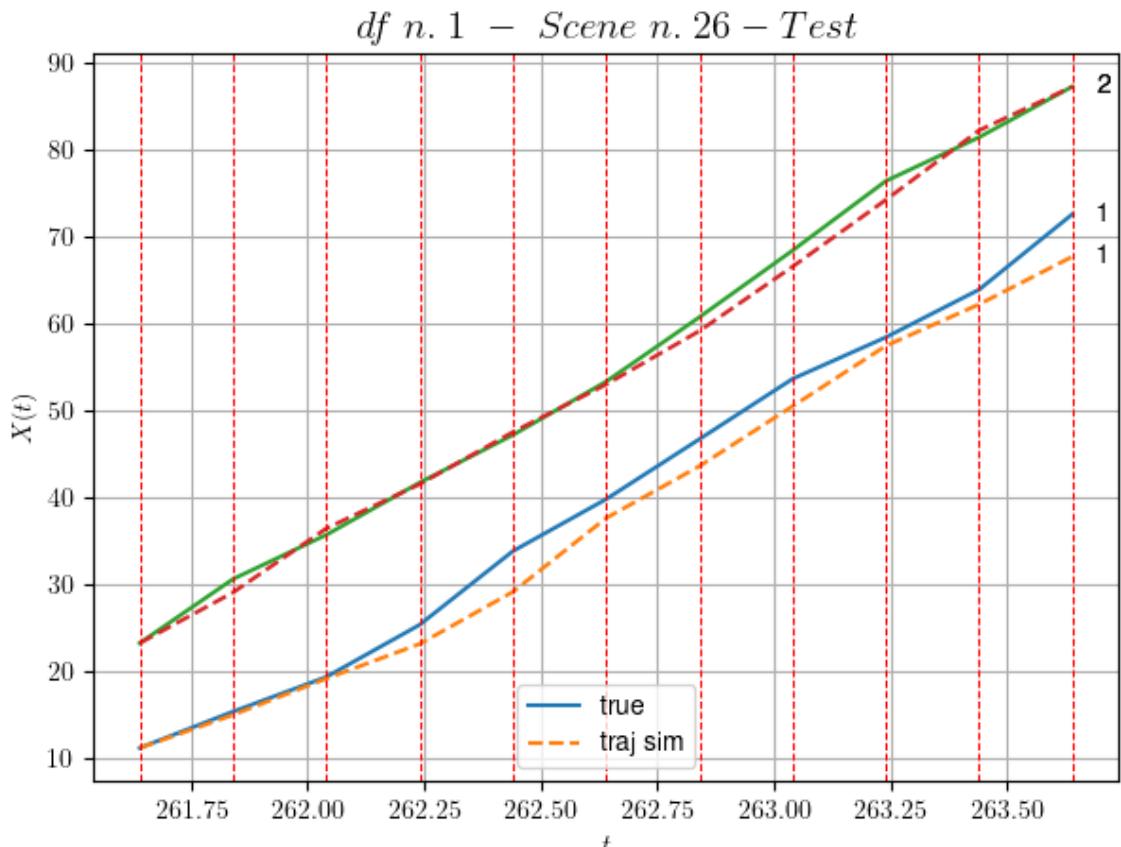
DataFrame n.1. Scene n.25/36



For scene 25/36:  
\* MSE = 5.719035774194834

---

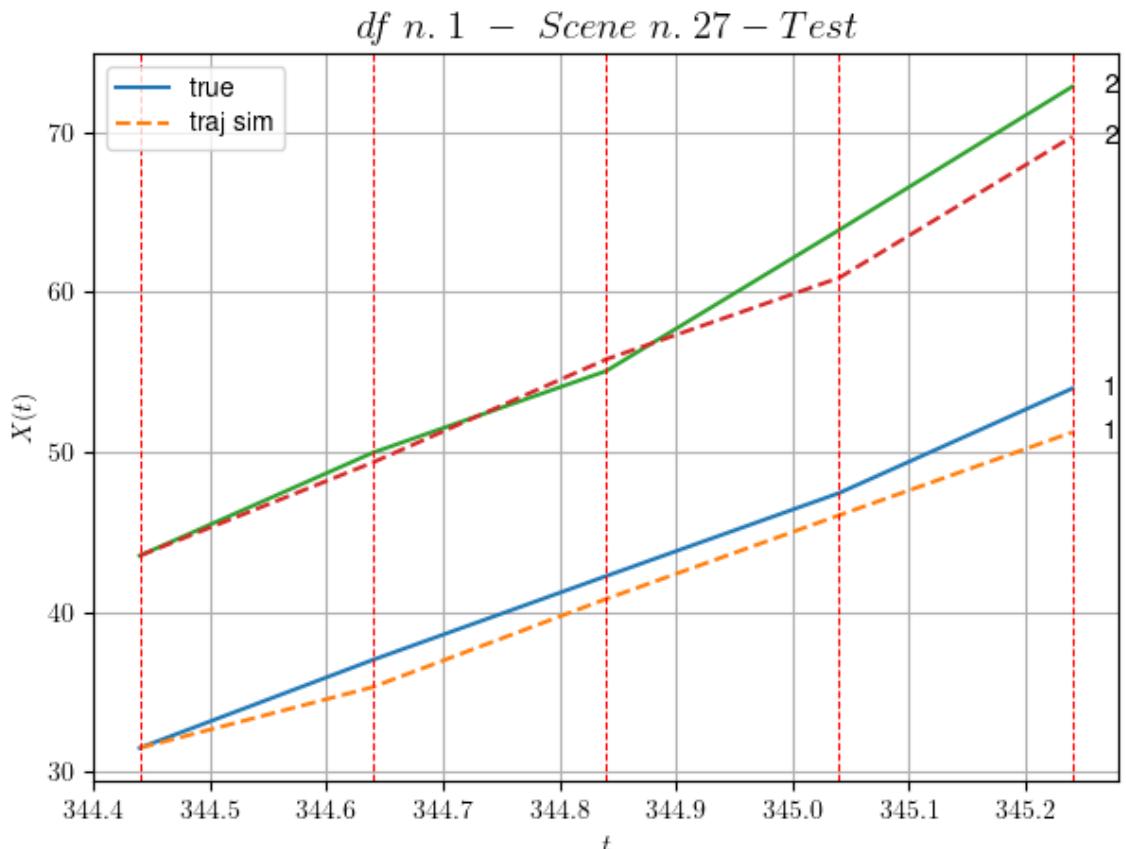
DataFrame n.1. Scene n.26/36



For scene 26/36:  
\* MSE = 4.258304576356048

---

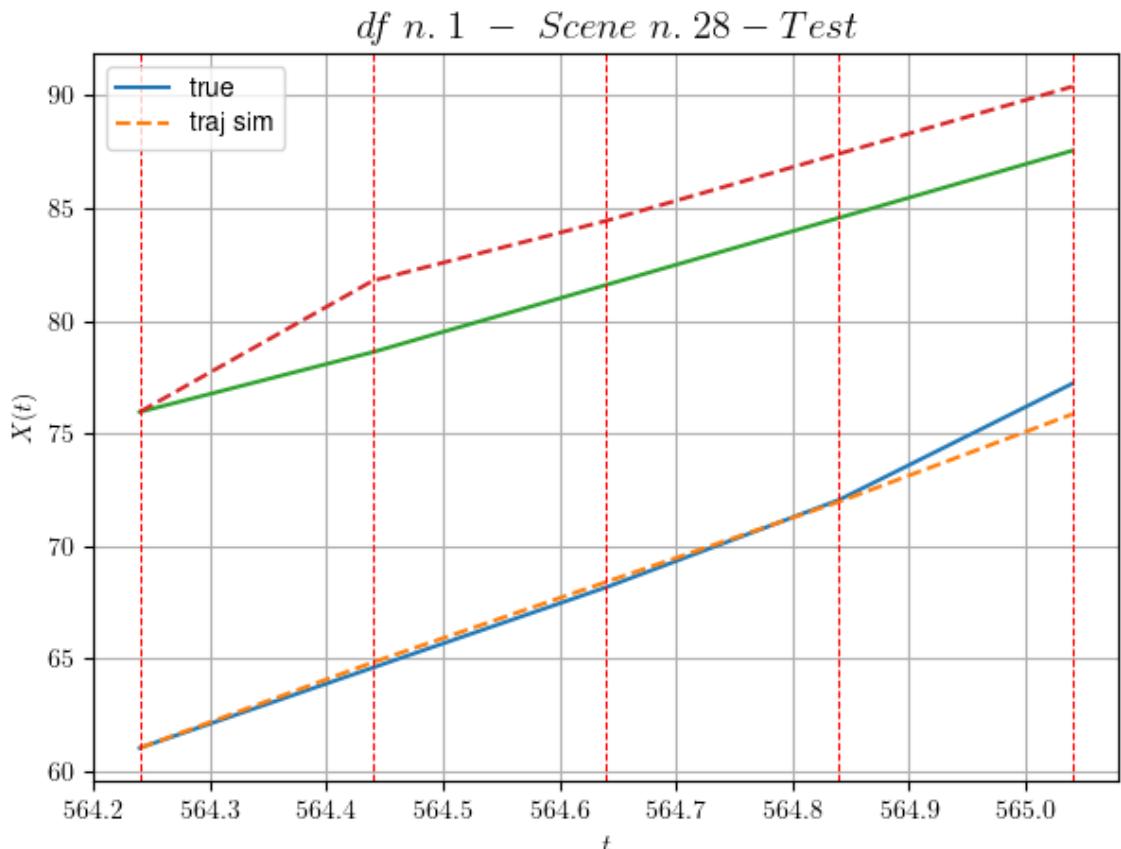
DataFrame n.1. Scene n.27/36



For scene 27/36:  
\* MSE = 3.4000155074087863

---

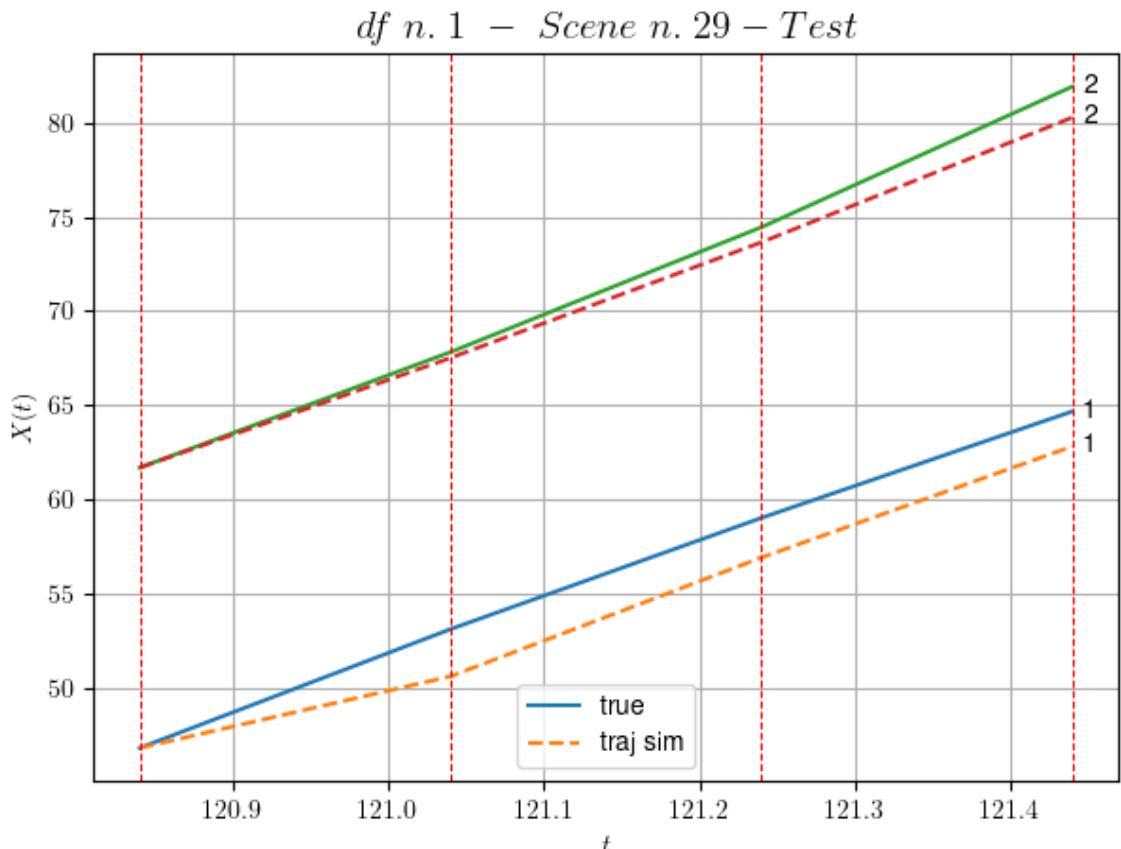
DataFrame n.1. Scene n.28/36



For scene 28/36:  
\* MSE = 3.6328344366417906

---

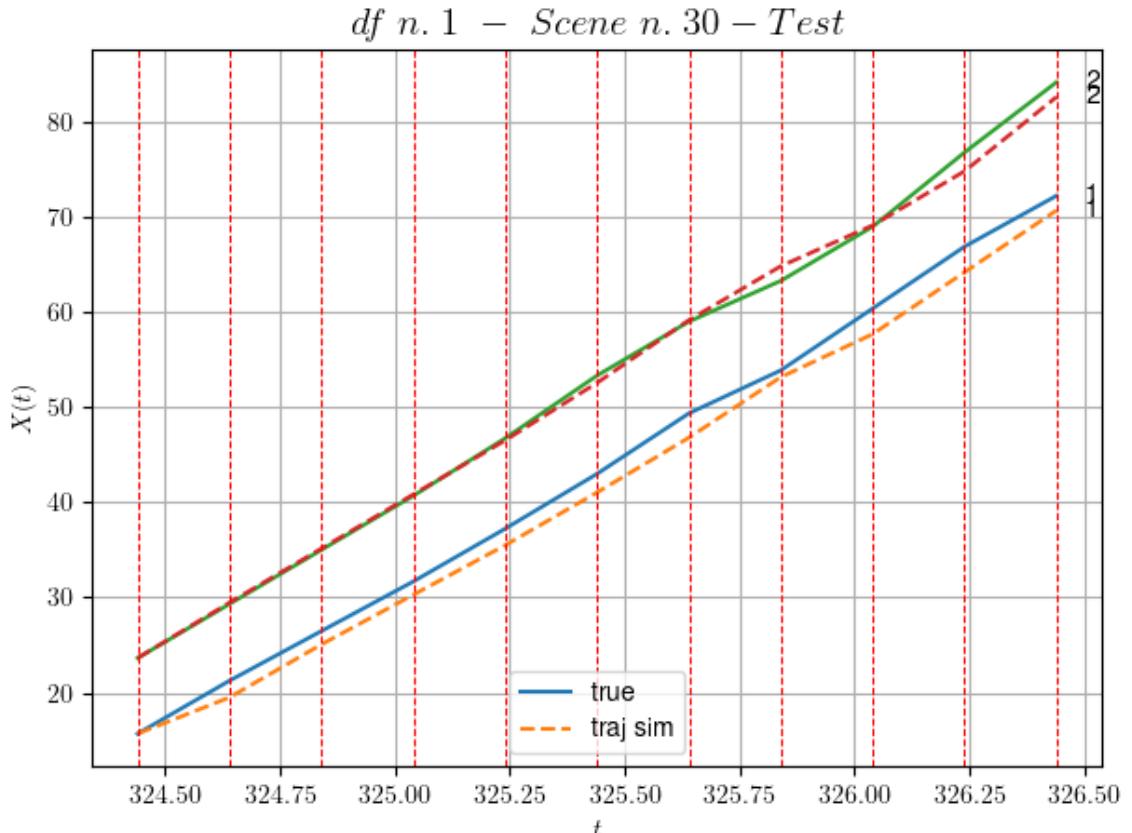
DataFrame n.1. Scene n.29/36



For scene 29/36:  
\* MSE = 2.1991895299080526

---

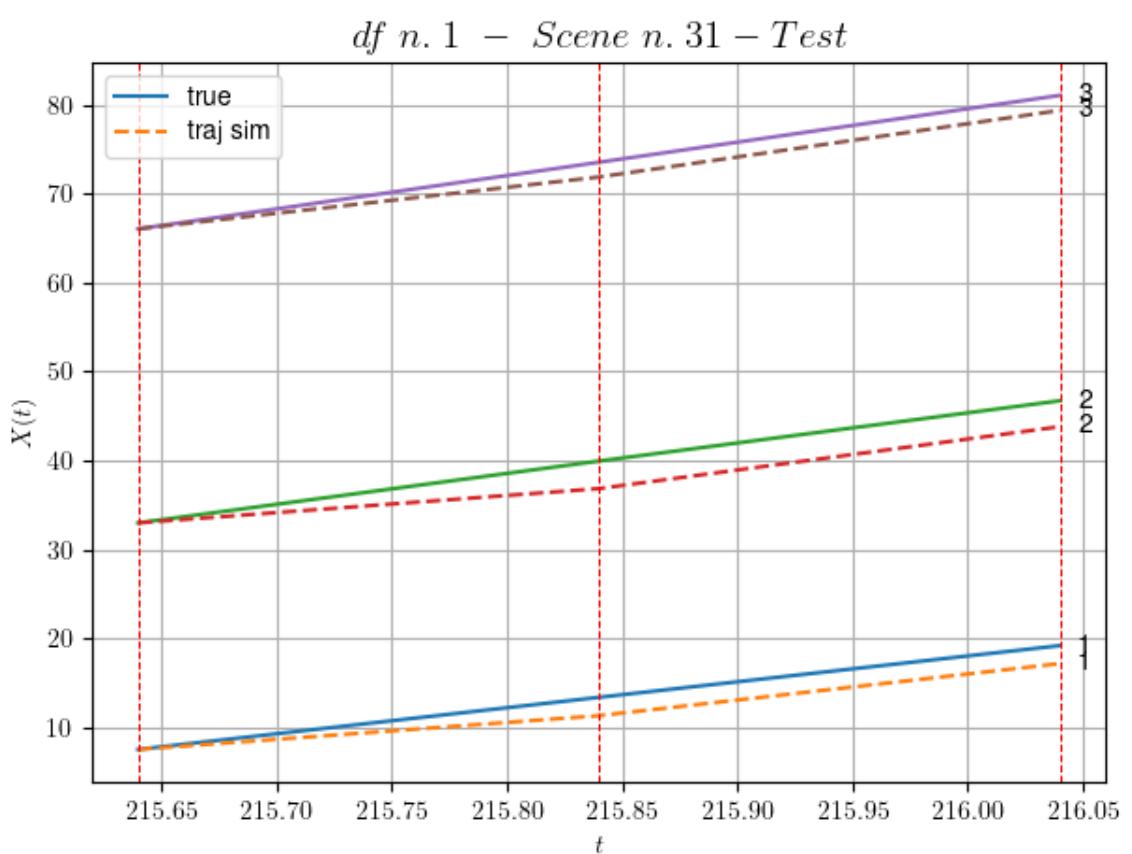
DataFrame n.1. Scene n.30/36



For scene 30/36:  
 \* MSE = 2.144880043513049

---

DataFrame n.1. Scene n.31/36

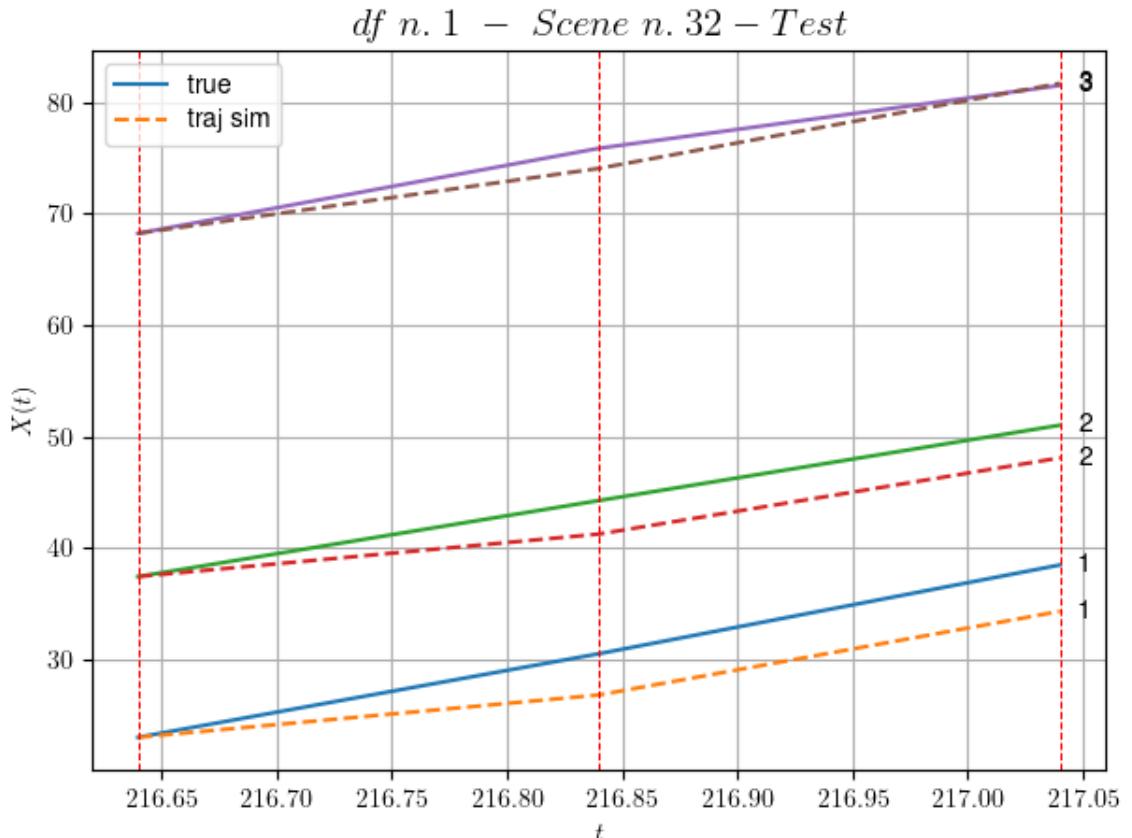


For scene 31/36:  
\* MSE = 3.5494799038777995

---

---

DataFrame n.1. Scene n.32/36

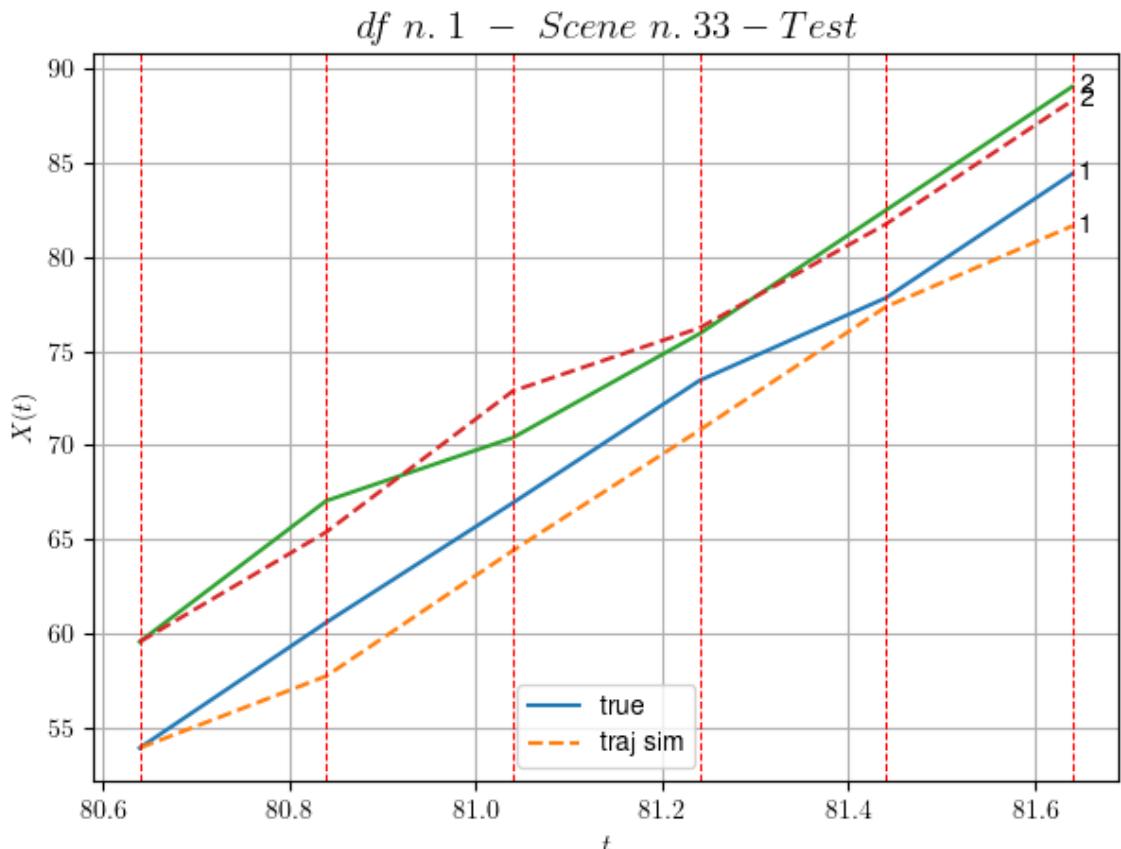


For scene 32/36:  
\* MSE = 5.774095509759339

---

---

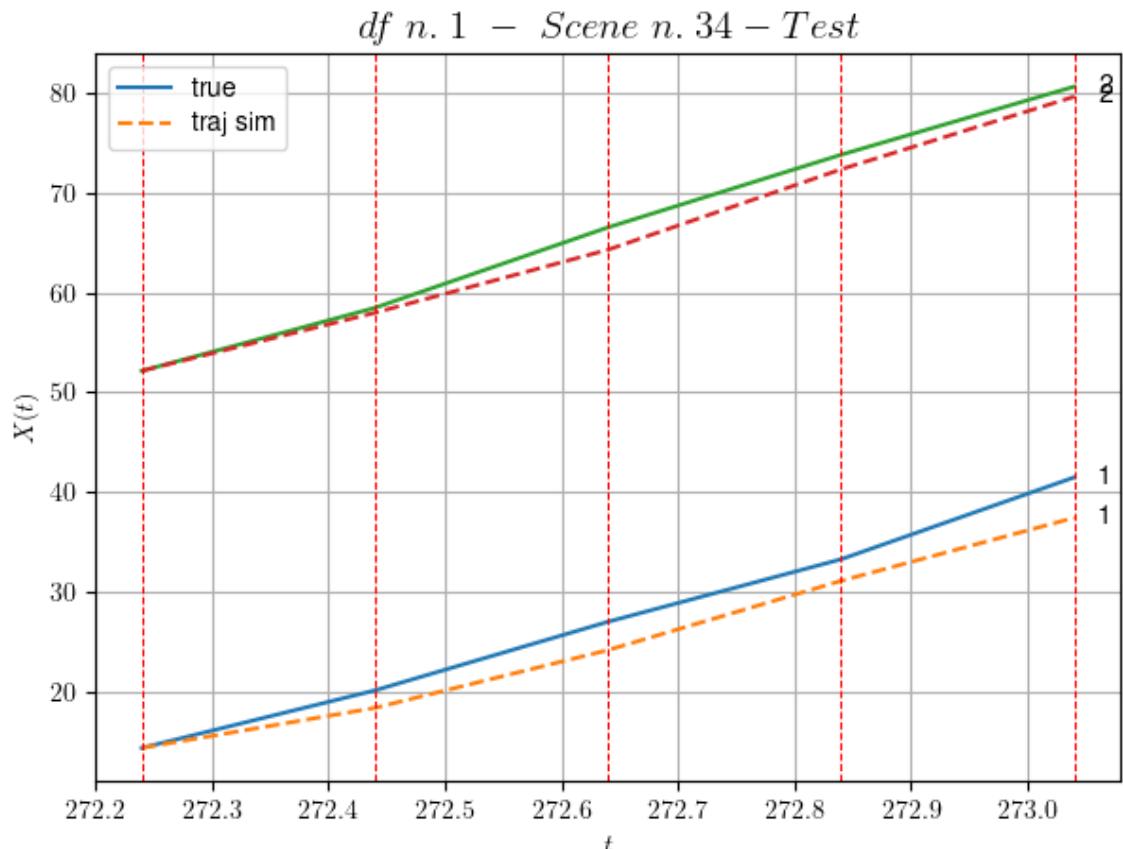
DataFrame n.1. Scene n.33/36



For scene 33/36:  
\* MSE = 3.2967160702265317

---

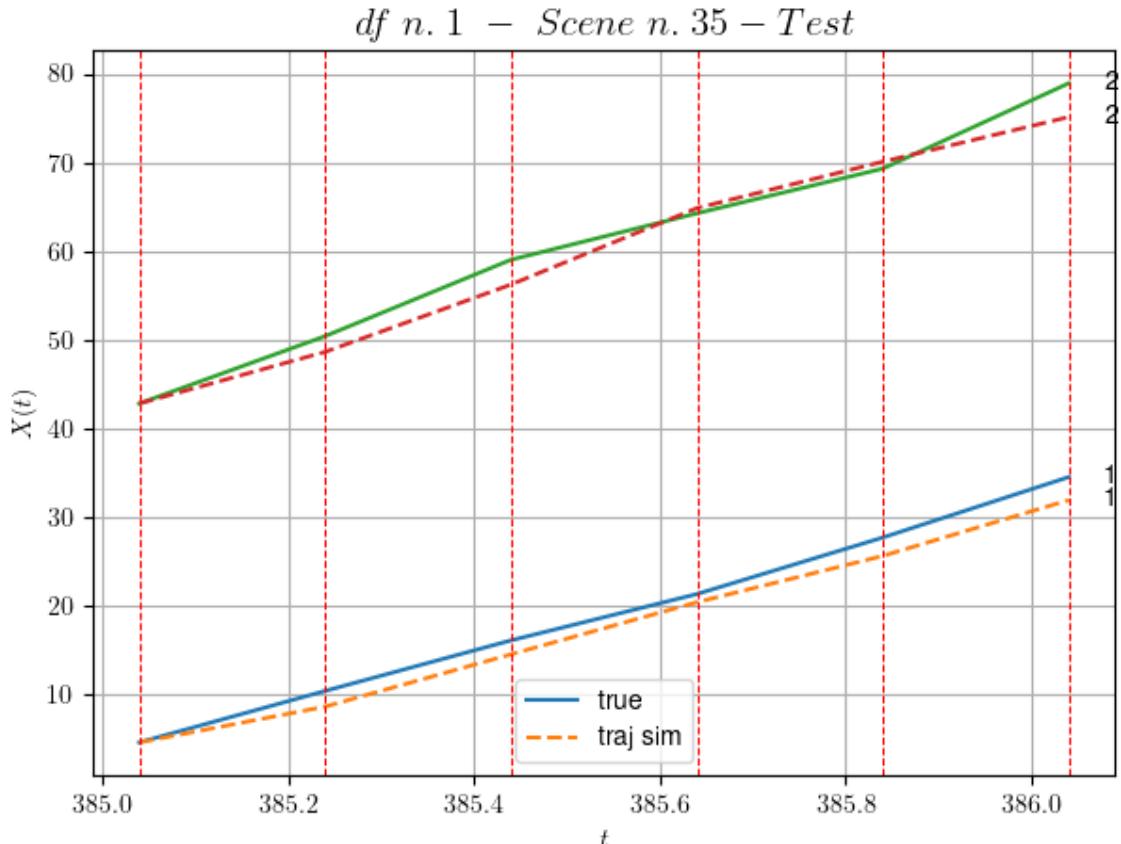
DataFrame n.1. Scene n.34/36



For scene 34/36:  
\* MSE = 4.073211305034778

---

DataFrame n.1. Scene n.35/36

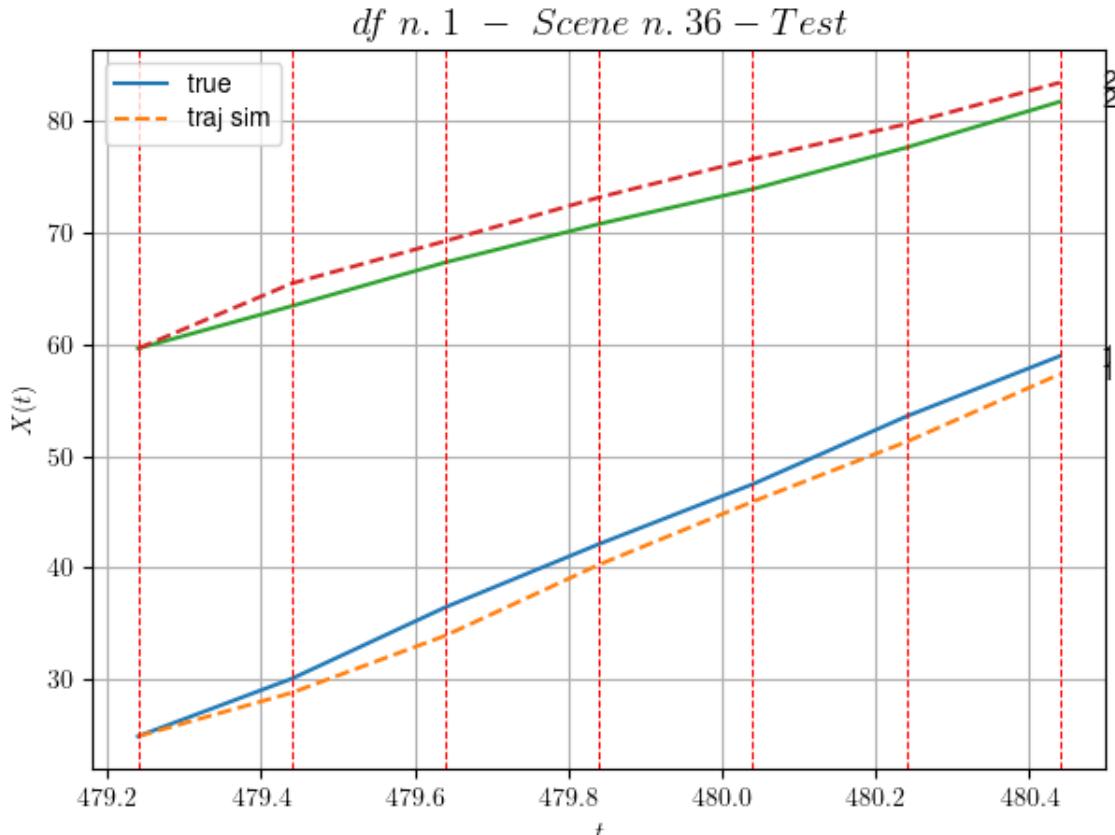


For scene 35/36:  
\* MSE = 3.6725794319820873

---

---

DataFrame n.1. Scene n.36/36



For scene 36/36:  
 \* MSE = 3.5641199901097105

---

MSE test: 3.14687152921484

---

Summing up:  
 \* MSE train: 0.5587260530280083  
 \* MSE test: 3.14687152921484

---

Analyzing 2/10 dfs.

In DataFrame n.2 we have 69 scenes.

To train the model we use 46 scenes, the remaining 23 to test the model.

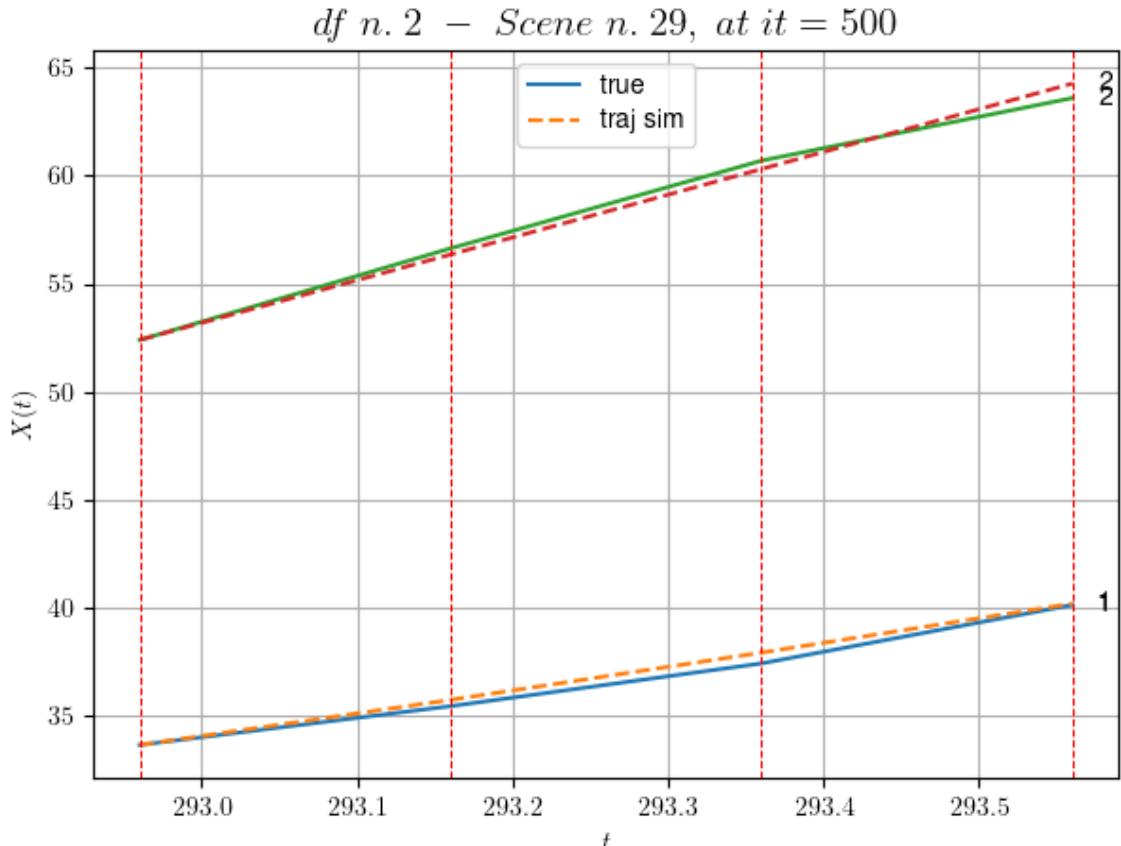
Training step. (46 scenes)

---

DataFrame n.2. Scene n.1/46

---

We have 3 time intervals inside [292.96, 293.56]



---

For scene 1/46:

\* After LR finder: LR\_NN=0.0001 with mse=7.917156838905665  
at it=24  
\* v0 = 19.771247175293336  
\* MSE = 0.1270887535240097  
\* iterations = 500

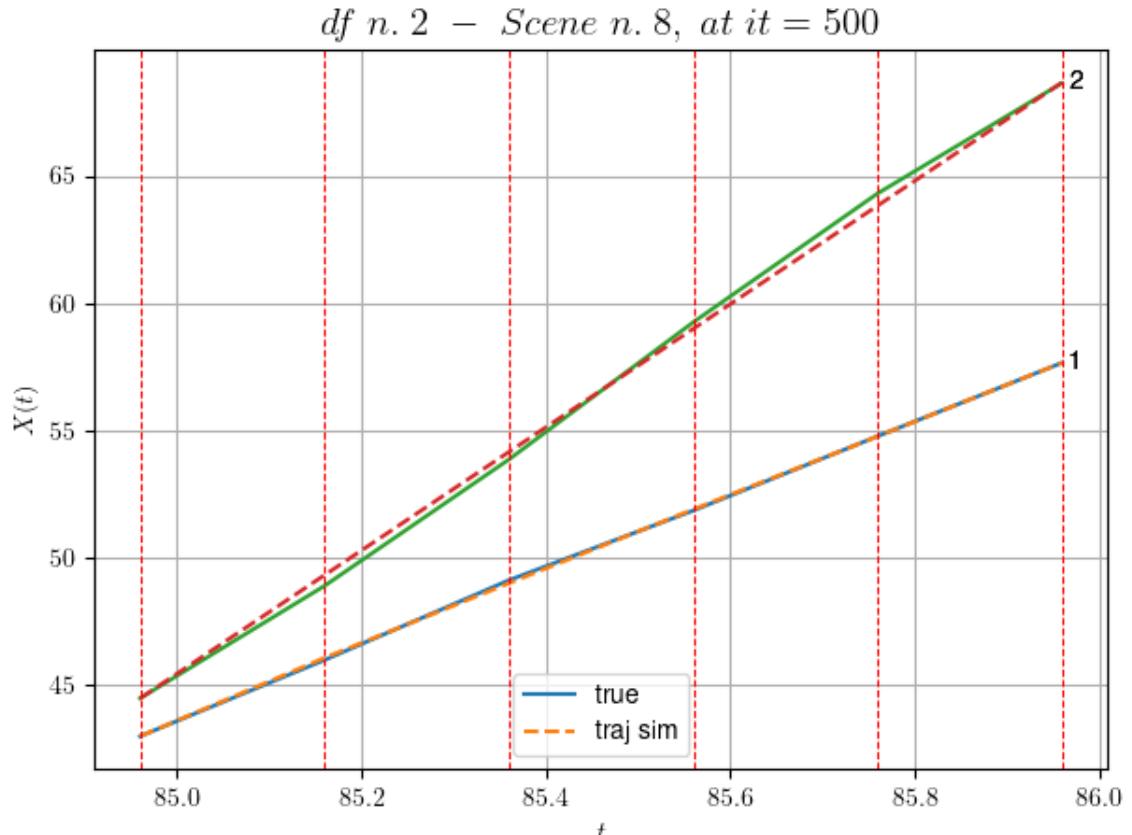
---

---

DataFrame n.2. Scene n.2/46

---

We have 5 time intervals inside [84.96,85.96]

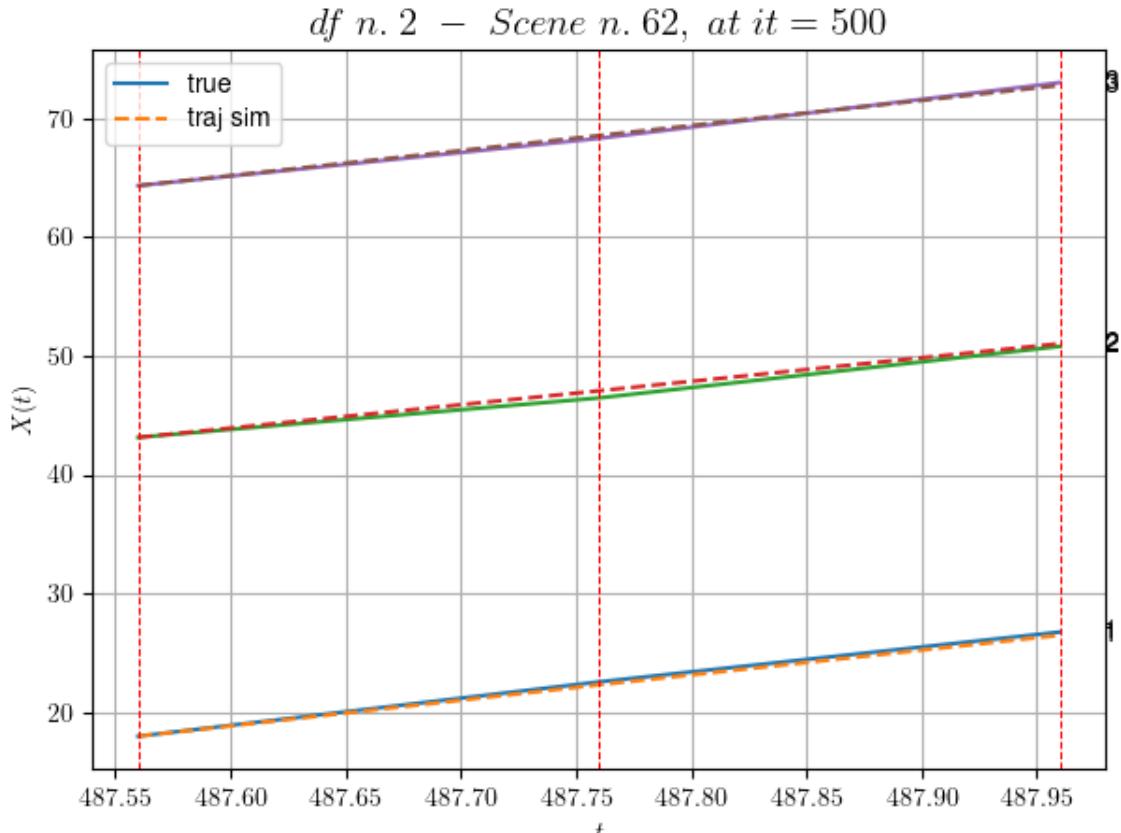


For scene 2/46:

\* After LR finder: LR\_NN=0.001 with mse=9.247877022123577 at it=24  
\*  $v_0 = 24.168678500842805$   
\* MSE = 0.04573480930901698  
\* iterations = 500

DataFrame n.2. Scene n.3/46

We have 2 time intervals inside [487.56, 487.96]



---

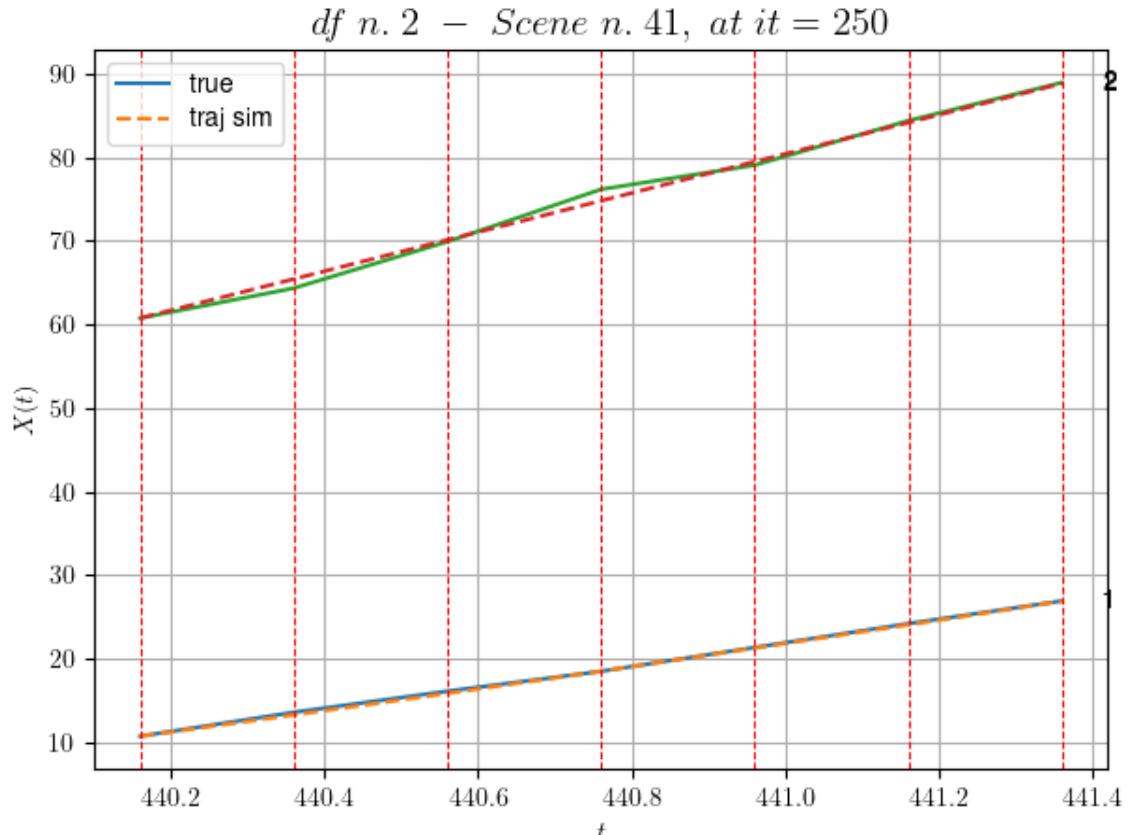
For scene 3/46:  
\* After LR finder: LR\_NN=5e-05 with mse=1.6965957133455472  
at it=24  
\* v0 = 21.111900247991574  
\* MSE = 0.06372997588114802  
\* iterations = 500

---

DataFrame n.2. Scene n.4/46

---

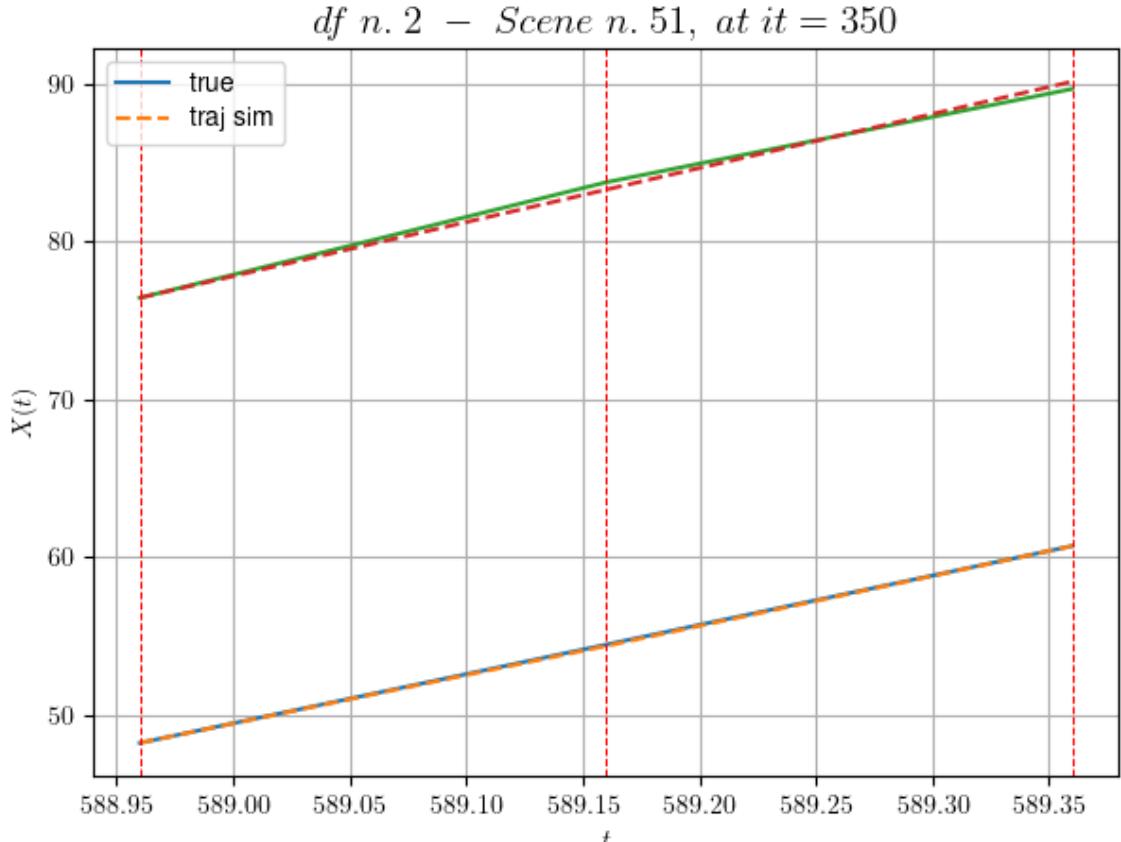
We have 6 time intervals inside [440.16,441.36]



-----  
For scene 4/46:  
\* After LR finder: LR\_NN=1e-05 with mse=11.145751970022332  
at it=24  
\* v0 = 23.380834105019503  
\* MSE = 0.24879518692595715  
\* iterations = 250  
-----

DataFrame n.2. Scene n.5/46

We have 2 time intervals inside [588.96, 589.36]

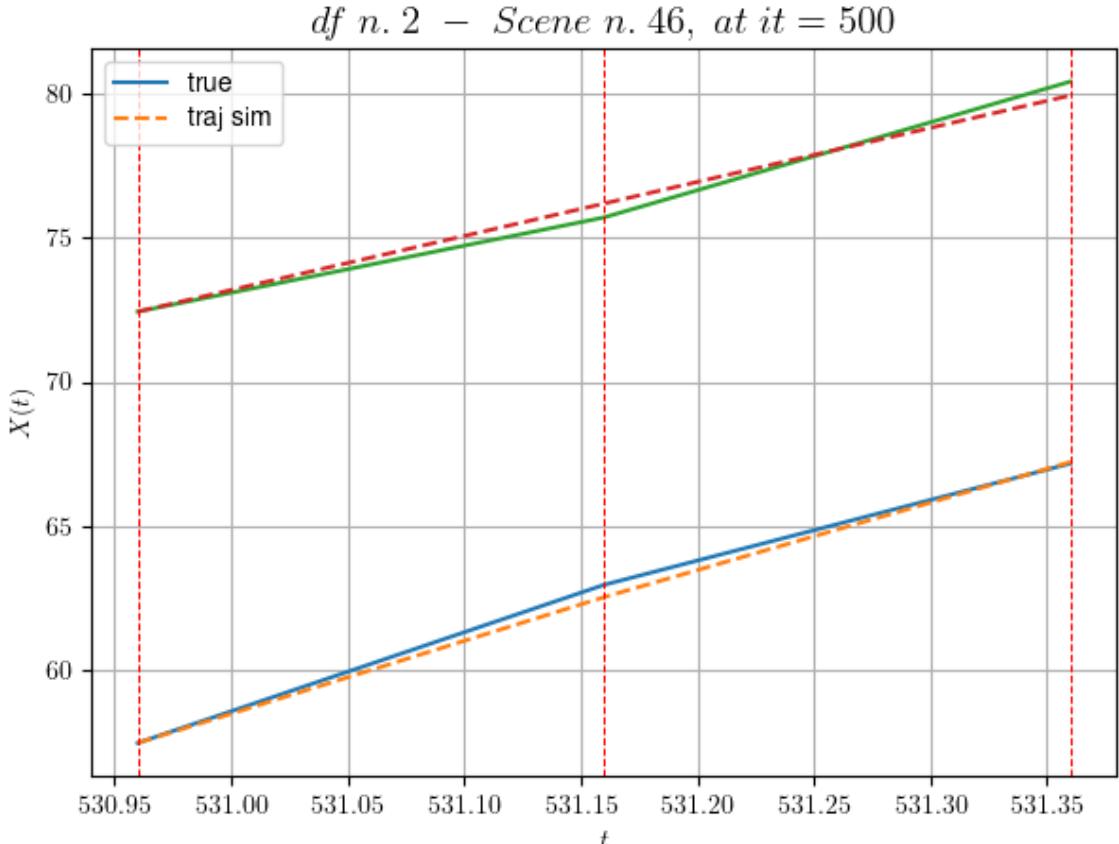


For scene 5/46:

\* After LR finder: LR\_NN=5e-05 with mse=0.5381796314954719  
at it=24  
\* v0 = 34.2211096191089  
\* MSE = 0.06660043487051817  
\* iterations = 350

DataFrame n.2. Scene n.6/46

We have 2 time intervals inside [530.96,531.36]

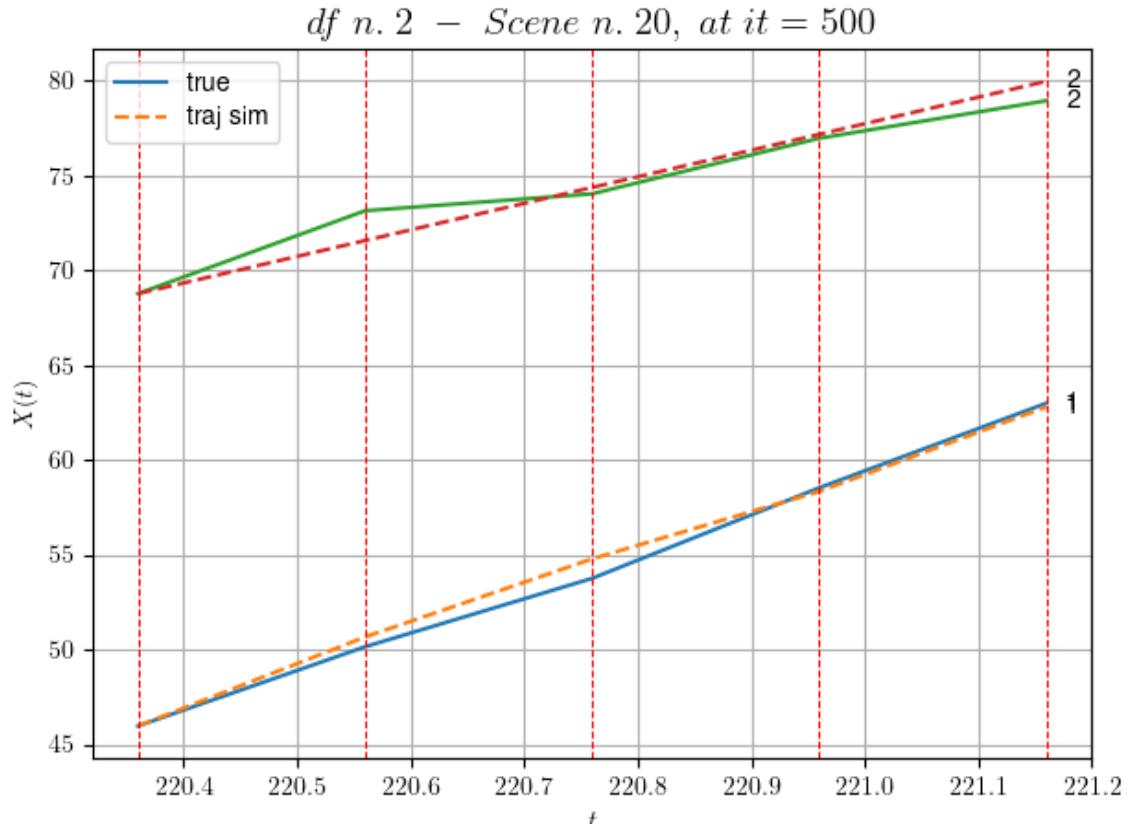


For scene 6/46:

\* After LR finder: LR\_NN=0.0001 with mse=3.9194207600572266  
at it=24  
\* v0 = 18.78540832306874  
\* MSE = 0.10855289803977601  
\* iterations = 500

DataFrame n.2. Scene n.7/46

We have 4 time intervals inside [220.36,221.16]



---

For scene 7/46:

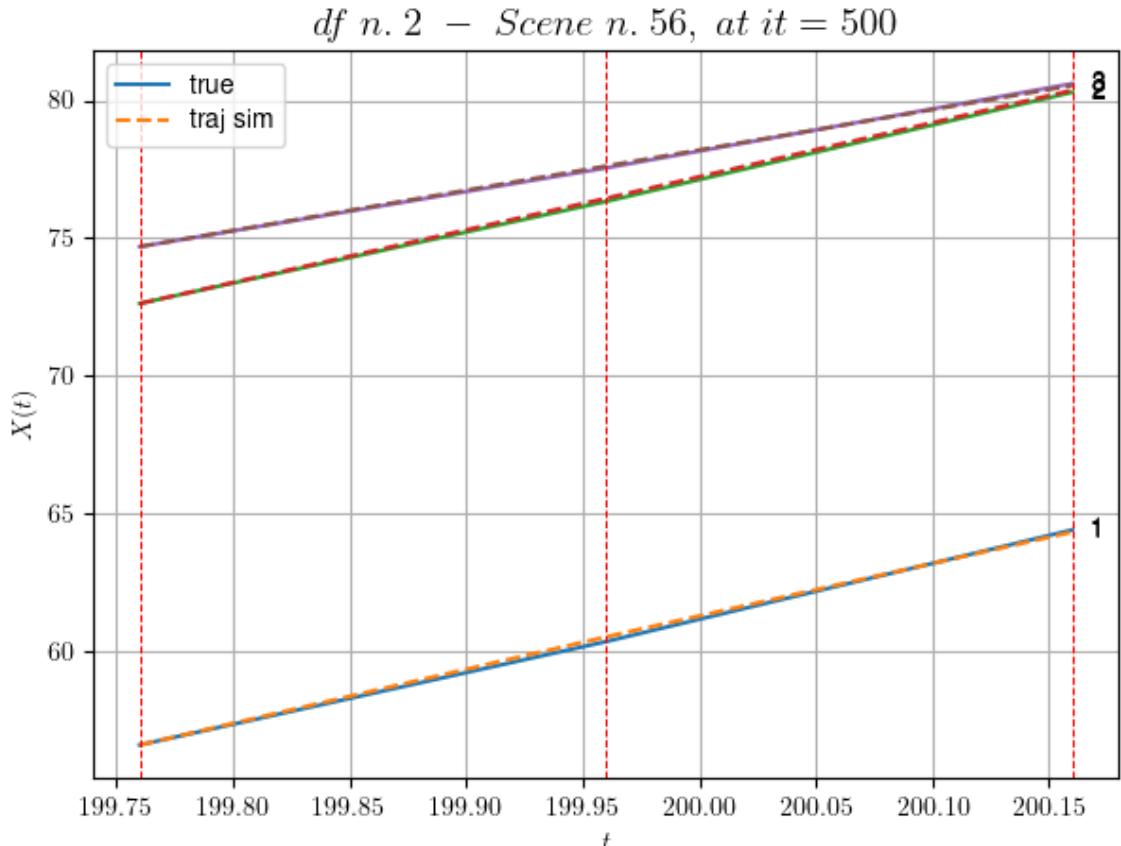
- \* After LR finder: LR\_NN=0.001 with mse=33.73484121670592 at it=24
- \* v0 = 13.99642713341011
- \* MSE = 0.5065072206622455
- \* iterations = 500

---

DataFrame n.2. Scene n.8/46

---

We have 2 time intervals inside [199.76,200.16]

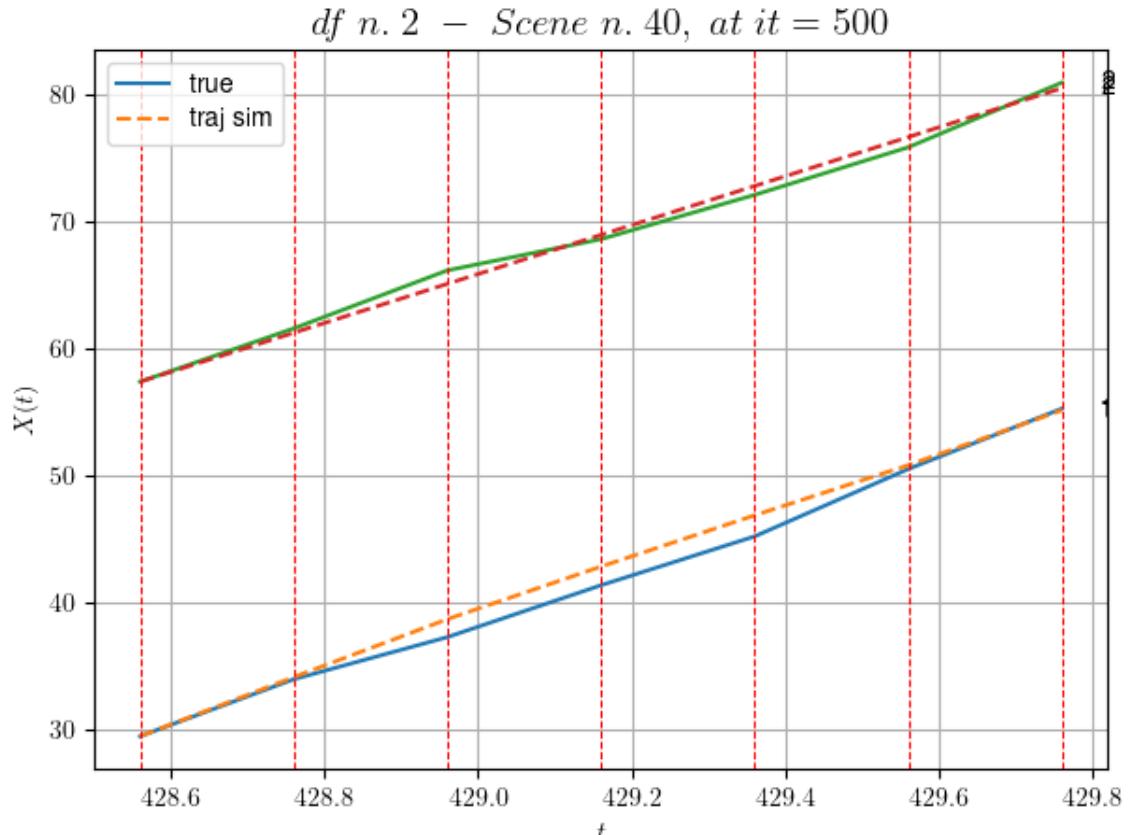


For scene 8/46:

\* After LR finder: LR\_NN=0.001 with mse=7.602107144503699 at it=24  
\* v0 = 14.651669964039854  
\* MSE = 0.0068938498880447745  
\* iterations = 500

DataFrame n.2. Scene n.9/46

We have 6 time intervals inside [428.56,429.76]



---

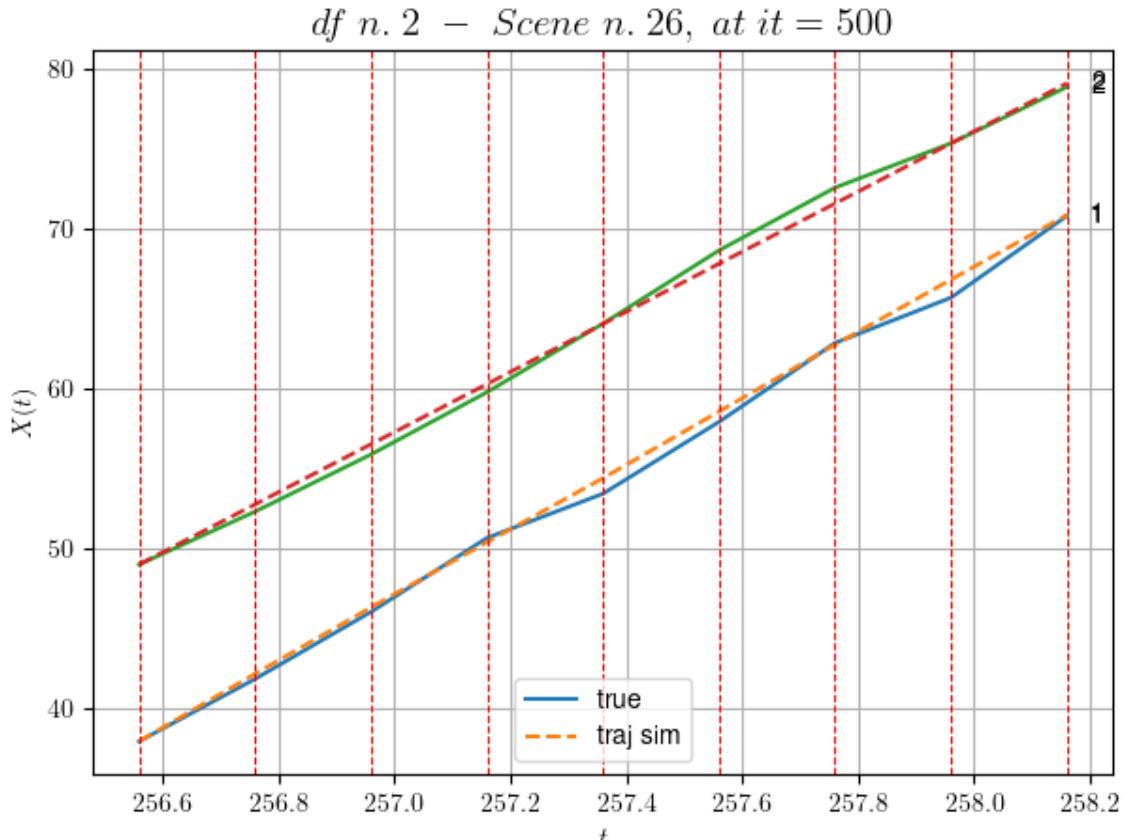
For scene 9/46:  
\* After LR finder: LR\_NN=0.0005 with mse=31.255787722758466  
at it=24  
\* v0 = 19.277810356523222  
\* MSE = 0.5074305117146222  
\* iterations = 500

---

DataFrame n.2. Scene n.10/46

---

We have 8 time intervals inside [256.56, 258.16]



---

For scene 10/46:

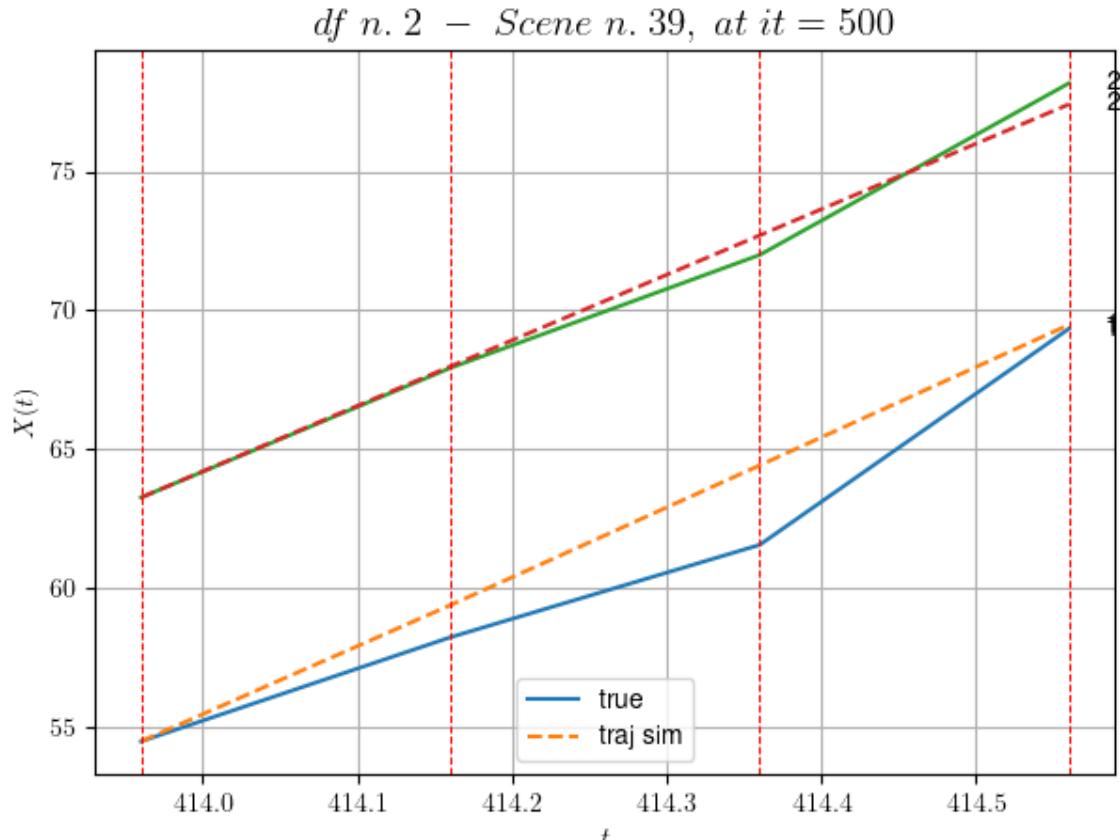
- \* After LR finder:  $LR\_NN=5e-05$  with  $mse=55.64624143125795$  at  $it=24$
- \*  $v_0 = 18.8329780454622$
- \*  $MSE = 0.3037306711765623$
- \* iterations = 500

---

DataFrame n.2. Scene n.11/46

---

We have 3 time intervals inside [413.96, 414.56]

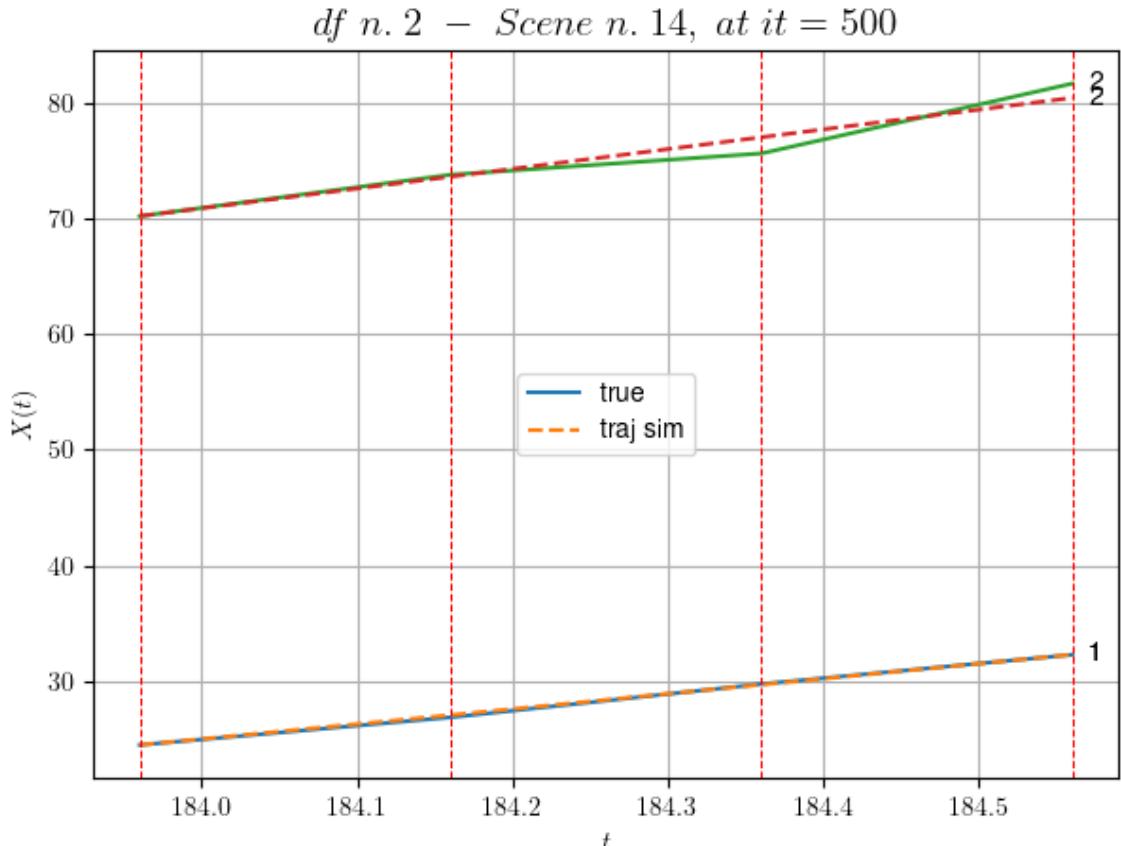


For scene 11/46:

\* After LR finder: LR\_NN=0.0001 with mse=3.74610245263879 at it=24  
\*  $v_0 = 23.615524542916997$   
\* MSE = 1.3206868933208704  
\* iterations = 500

DataFrame n.2. Scene n.12/46

We have 3 time intervals inside [183.96, 184.56]

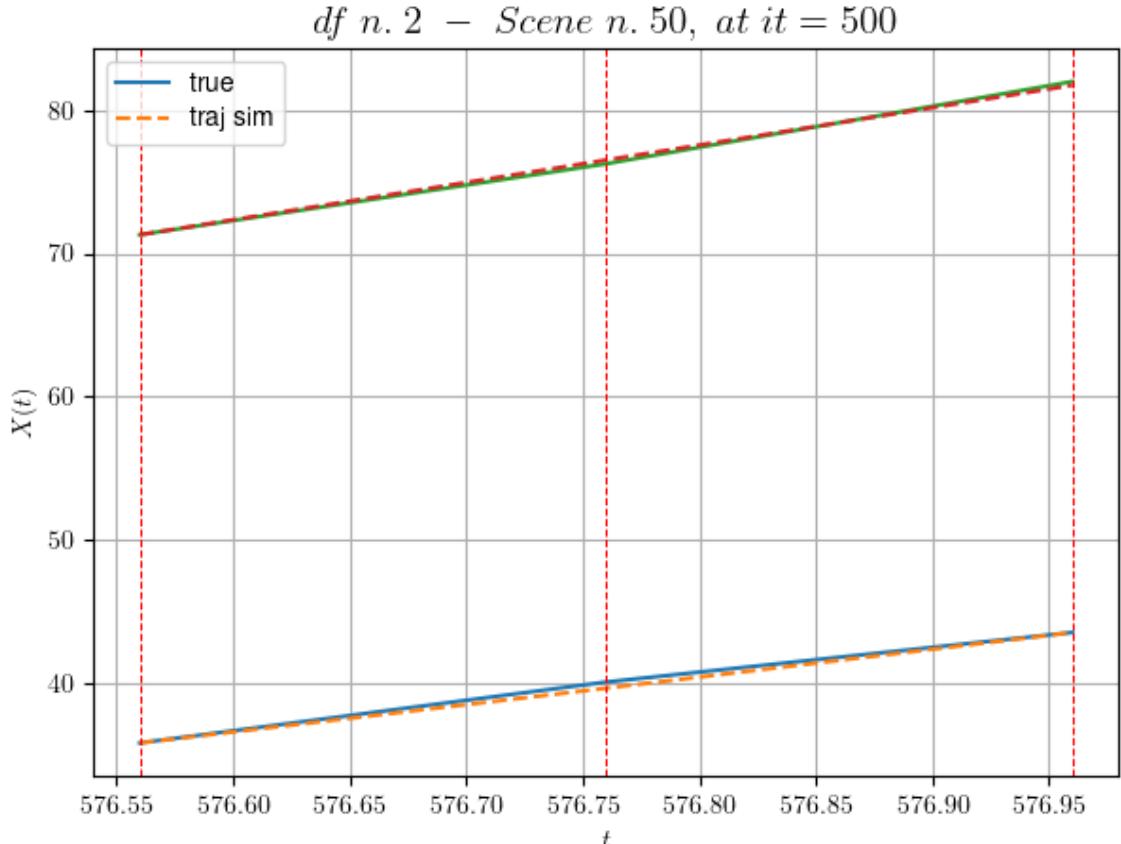


For scene 12/46:

\* After LR finder: LR\_NN=1e-05 with mse=11.492574022177019  
at it=24  
\* v0 = 17.051810908720785  
\* MSE = 0.4331178009798467  
\* iterations = 500

DataFrame n.2. Scene n.13/46

We have 2 time intervals inside [576.56,576.96]



---

For scene 13/46:  
\* After LR finder: LR\_NN=1e-05 with mse=0.5066143808788415  
at it=24  
\* v0 = 26.06956909512544  
\* MSE = 0.05372676647398149  
\* iterations = 500

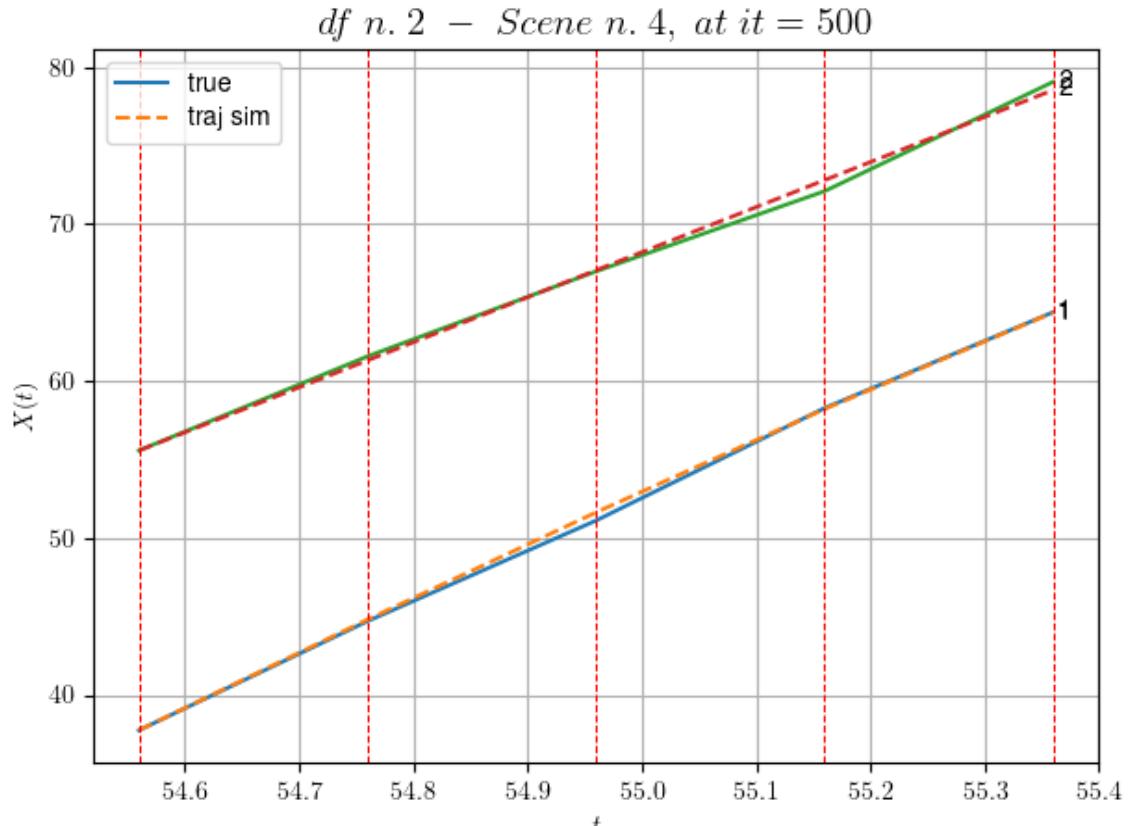
---

---

DataFrame n.2. Scene n.14/46

---

We have 4 time intervals inside [54.56,55.36]



---

For scene 14/46:

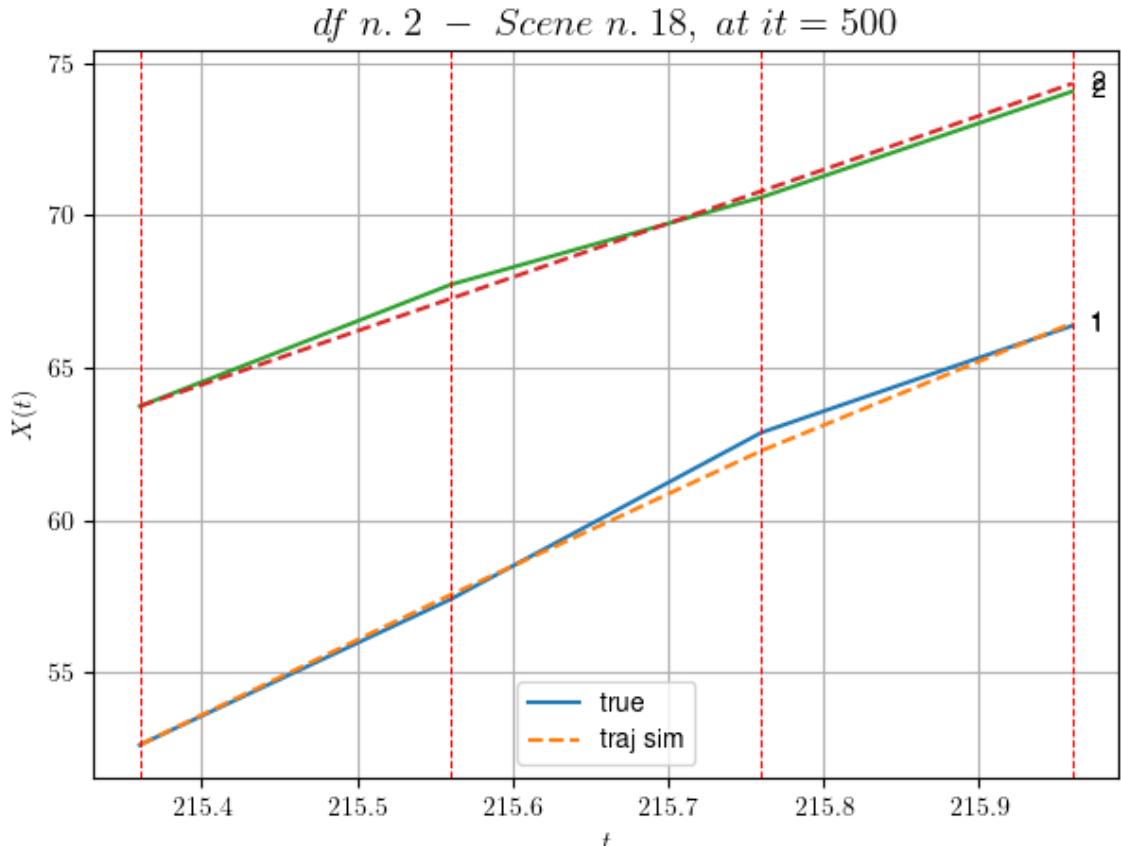
- \* After LR finder: LR\_NN=5e-05 with mse=0.4070303661670245
- at it=24
  - \* v0 = 28.716321309649818
  - \* MSE = 0.11212848390402687
  - \* iterations = 500

---

DataFrame n.2. Scene n.15/46

---

We have 3 time intervals inside [215.36, 215.96]



---

For scene 15/46:

\* After LR finder: LR\_NN=0.0001 with mse=11.200863431414662  
at it=24  
\* v0 = 17.64323253685192  
\* MSE = 0.08775371167435525  
\* iterations = 500

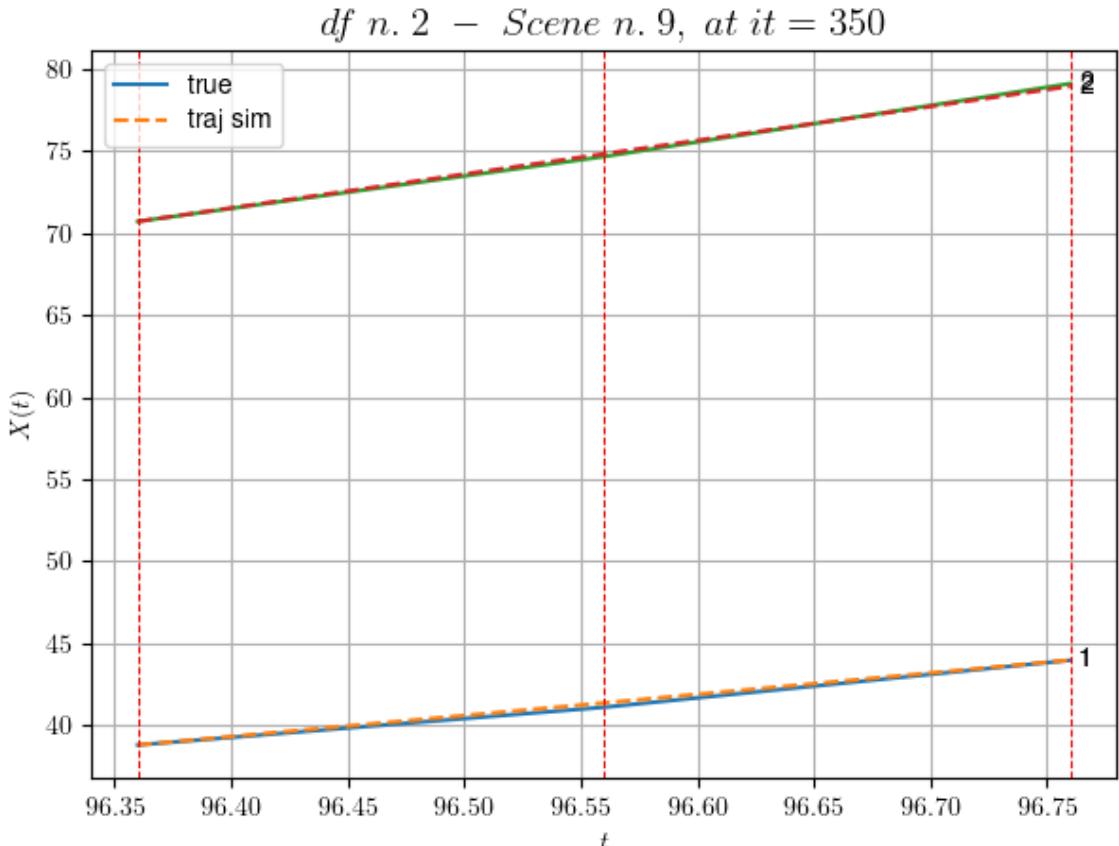
---

---

DataFrame n.2. Scene n.16/46

---

We have 2 time intervals inside [96.36, 96.76]

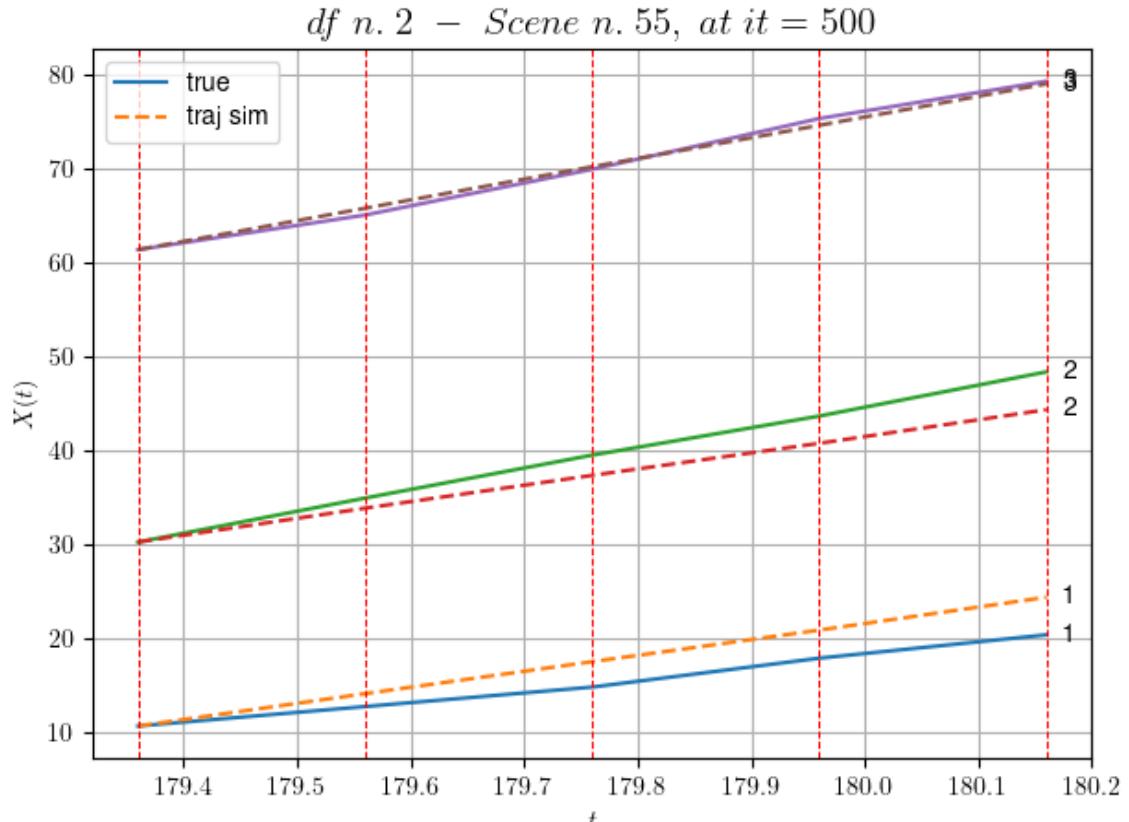


For scene 16/46:

\* After LR finder: LR\_NN=5e-05 with mse=2.8618863840844315  
at it=24  
\* v0 = 20.598848373580598  
\* MSE = 0.020417134698436645  
\* iterations = 350

DataFrame n.2. Scene n.17/46

We have 4 time intervals inside [179.36,180.16]

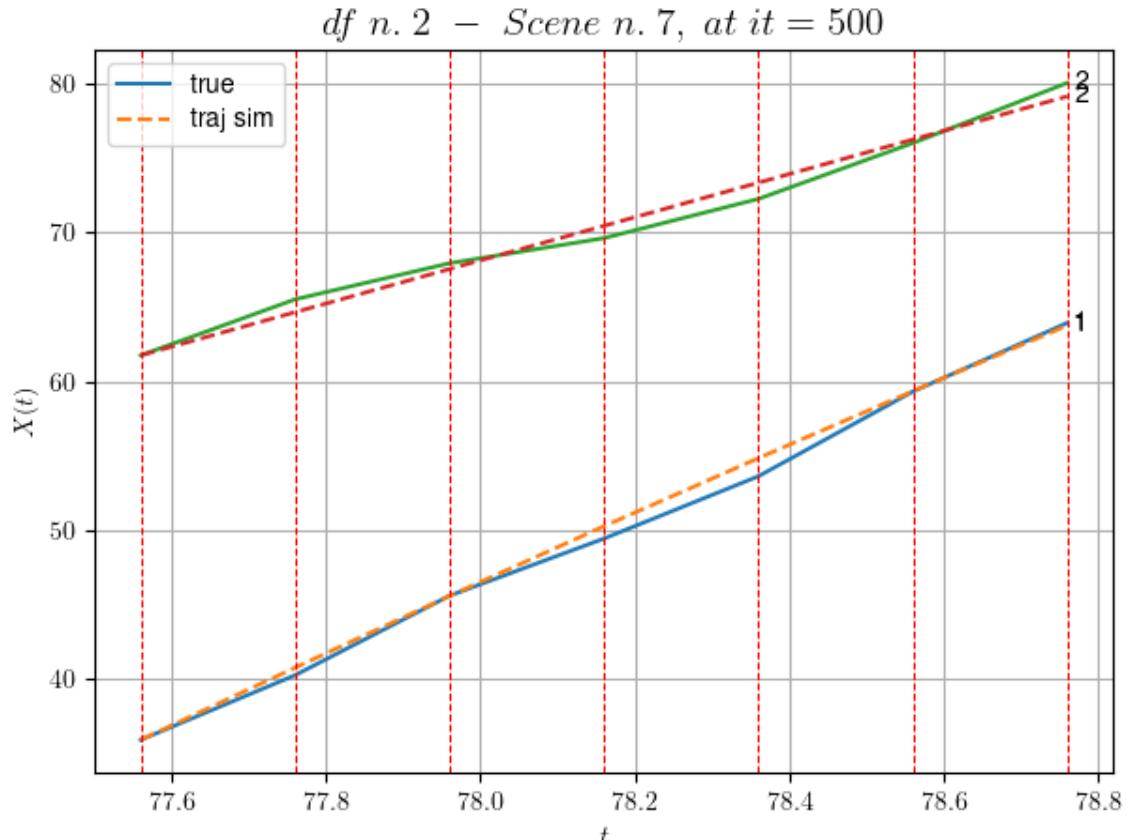


For scene 17/46:

\* After LR finder: LR\_NN=0.0005 with mse=6.01115918056896 at it=24  
\* v0 = 22.081999529879017  
\* MSE = 2.6543919881124505  
\* iterations = 500

DataFrame n.2. Scene n.18/46

We have 6 time intervals inside [77.56, 78.76]



---

For scene 18/46:

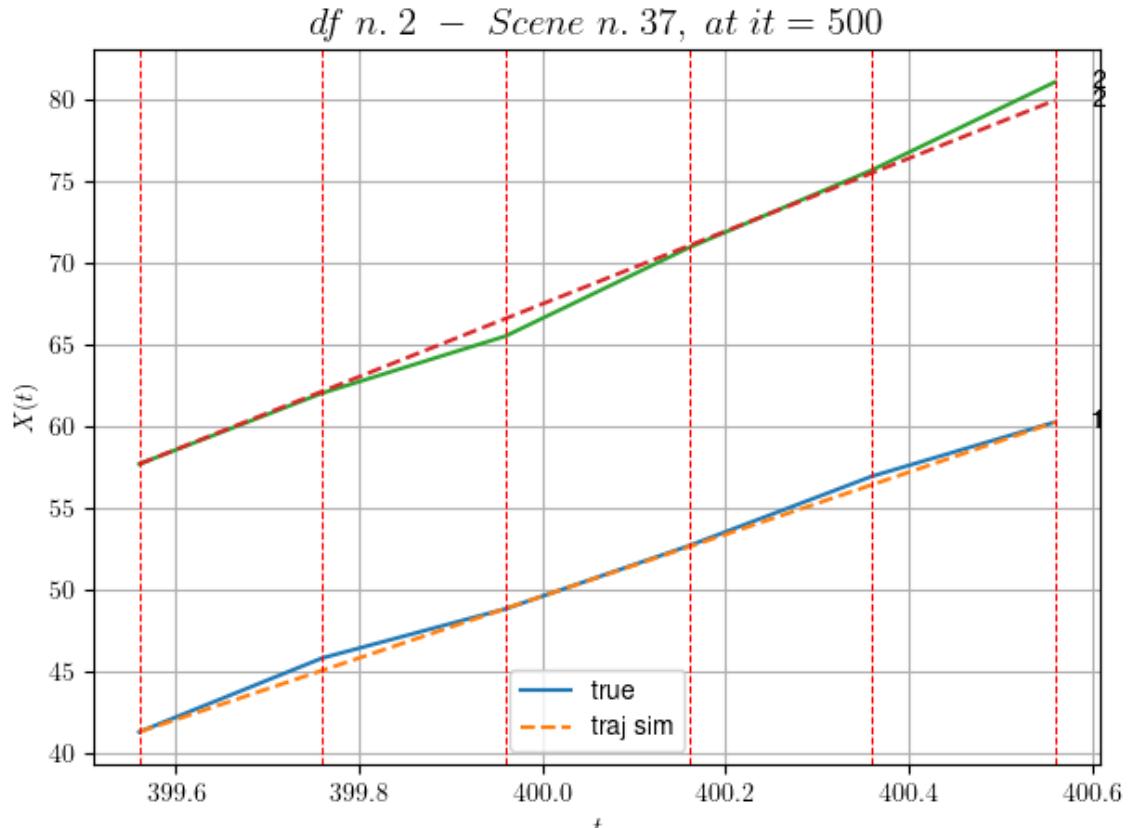
```
* After LR finder: LR_NN=1e-05 with mse=63.70107653528956 at it=24
* v0 = 14.529876108312944
* MSE = 0.43693139273163206
* iterations = 500
```

---

DataFrame n.2. Scene n.19/46

---

We have 5 time intervals inside [399.56, 400.56]



---

For scene 19/46:

\* After LR finder: LR\_NN=5e-05 with mse=10.382062942916635  
at it=24  
\* v0 = 22.28590148402837  
\* MSE = 0.25875977663623534  
\* iterations = 500

---

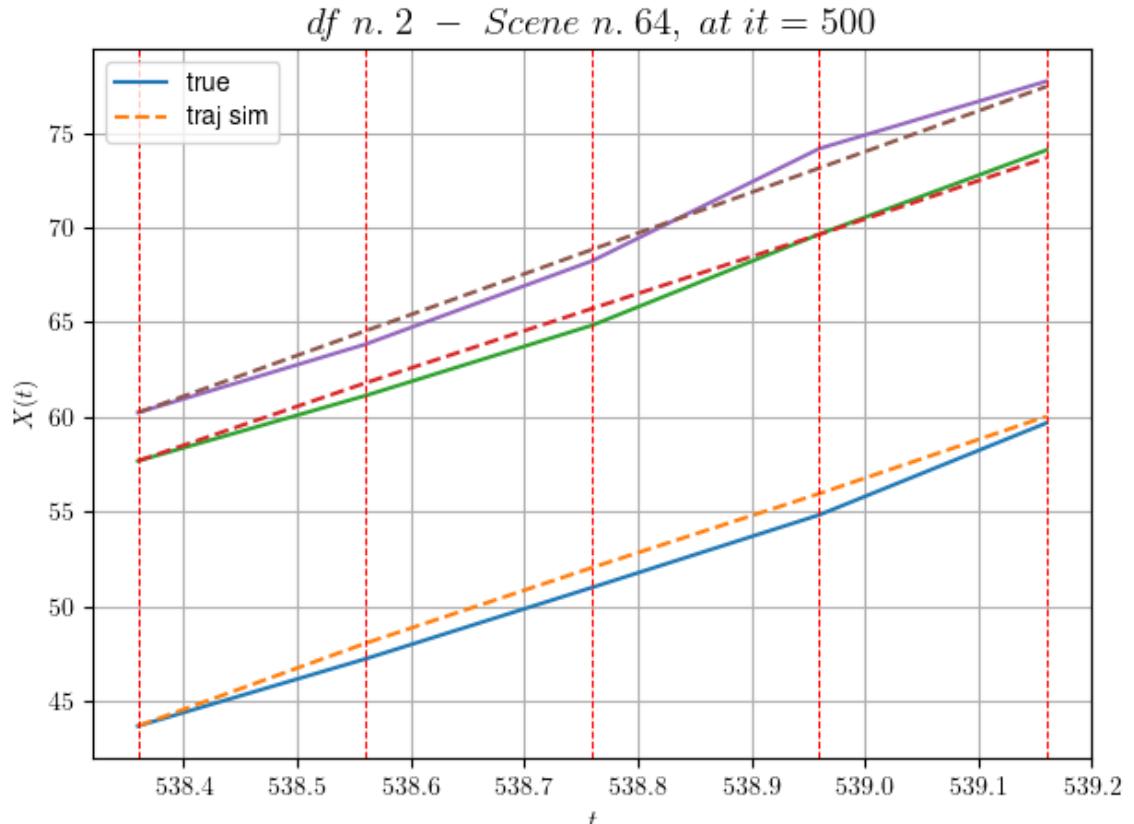
---

DataFrame n.2. Scene n.20/46

---

We have 4 time intervals inside [538.36,539.16]

---



---

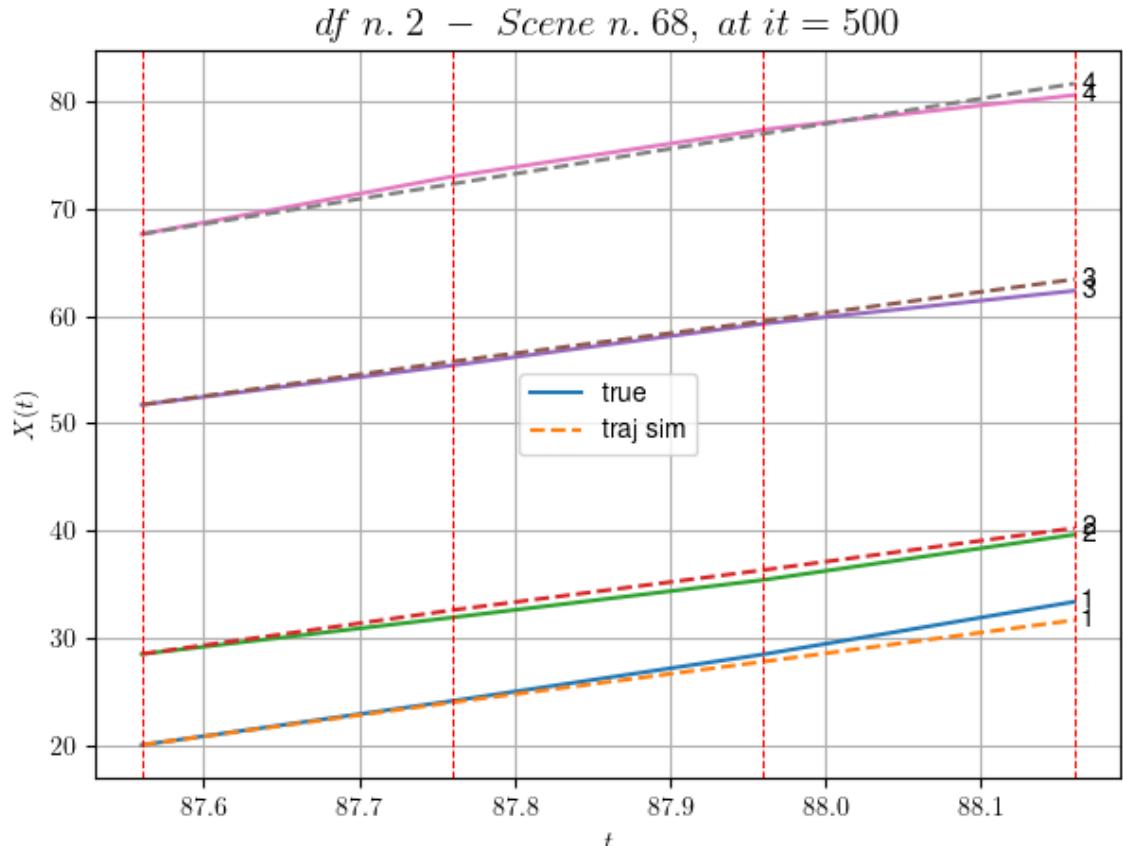
For scene 20/46:  
\* After LR finder: LR\_NN=0.001 with mse=11.906952116087576  
at it=24  
\* v0 = 21.518869344523466  
\* MSE = 0.43249644825813566  
\* iterations = 500

---

DataFrame n.2. Scene n.21/46

---

We have 3 time intervals inside [87.56,88.16]

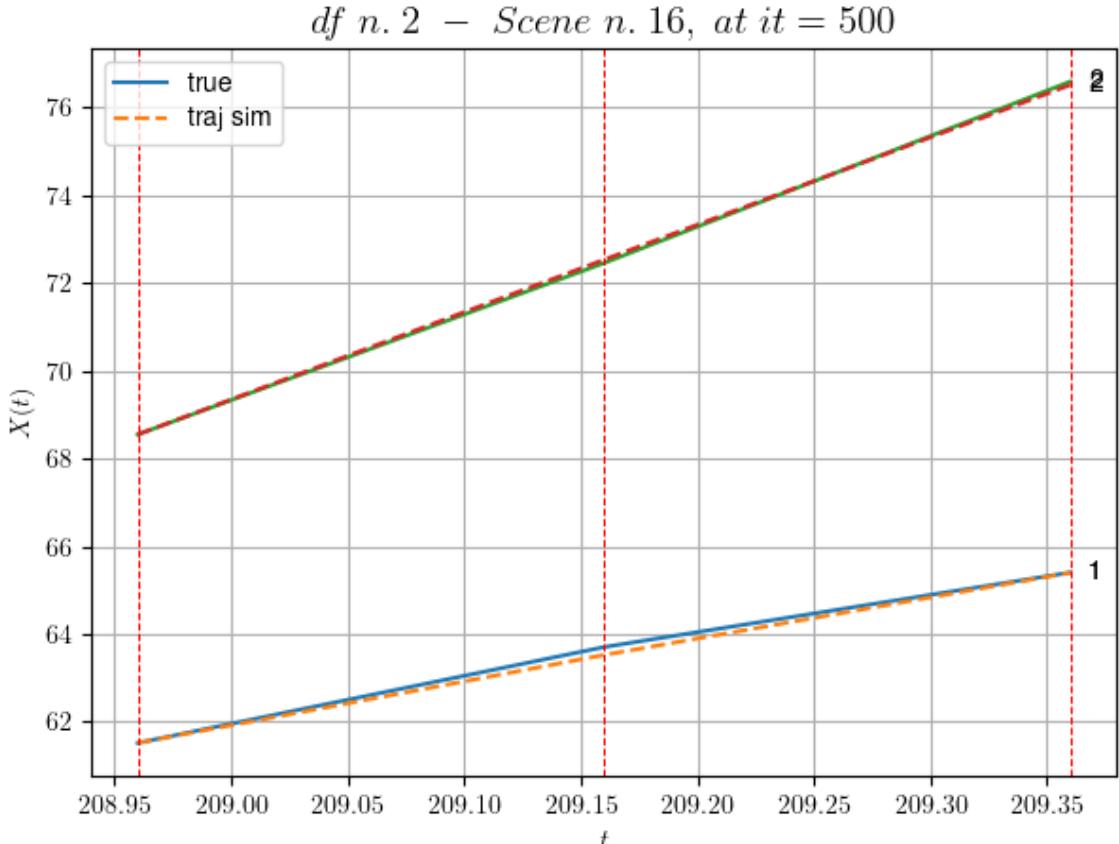


For scene 21/46:

\* After LR finder: LR\_NN=0.001 with mse=8.729317435674048 at it=24  
\*  $v_0 = 23.399103331764525$   
\* MSE = 0.5156125436382419  
\* iterations = 500

DataFrame n.2. Scene n.22/46

We have 2 time intervals inside [208.96,209.36]



---

For scene 22/46:  
\* After LR finder: LR\_NN=5e-05 with mse=3.3797555394849748  
at it=24  
\* v0 = 19.925309614241876  
\* MSE = 0.006472719818243862  
\* iterations = 500

---

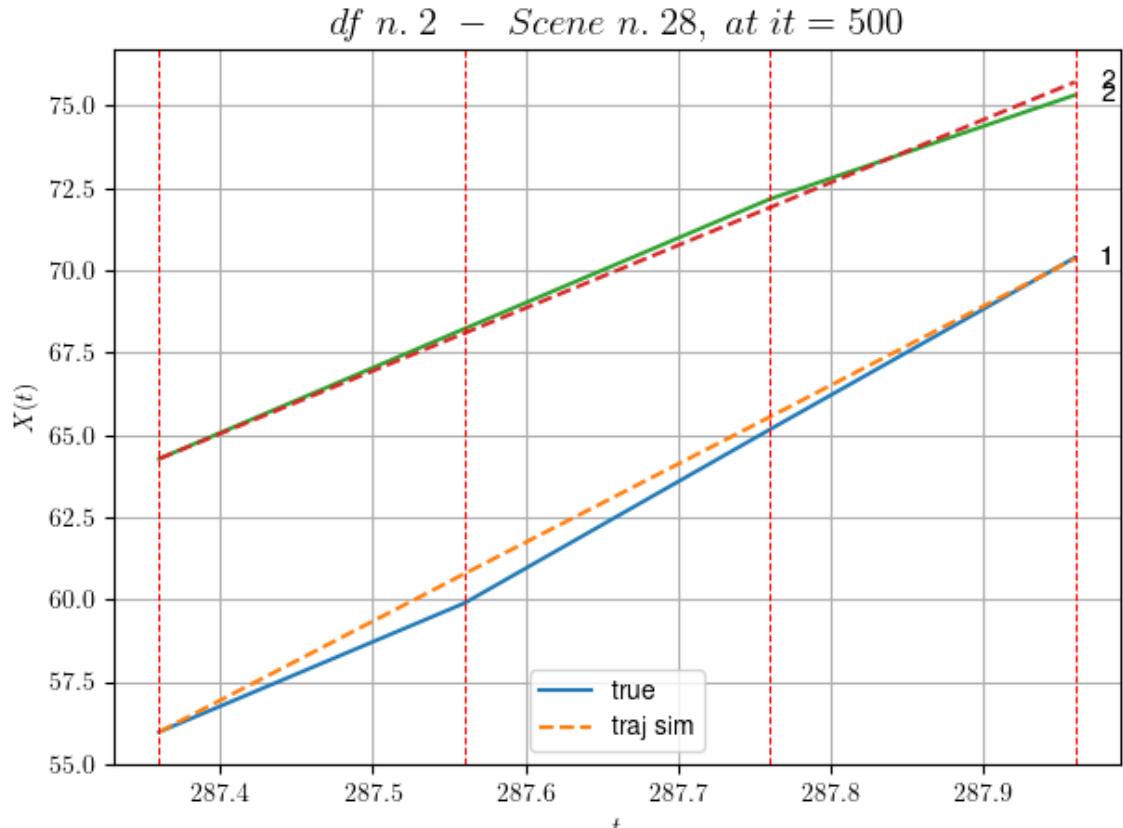
---

DataFrame n.2. Scene n.23/46

---

---

We have 3 time intervals inside [287.36,287.96]

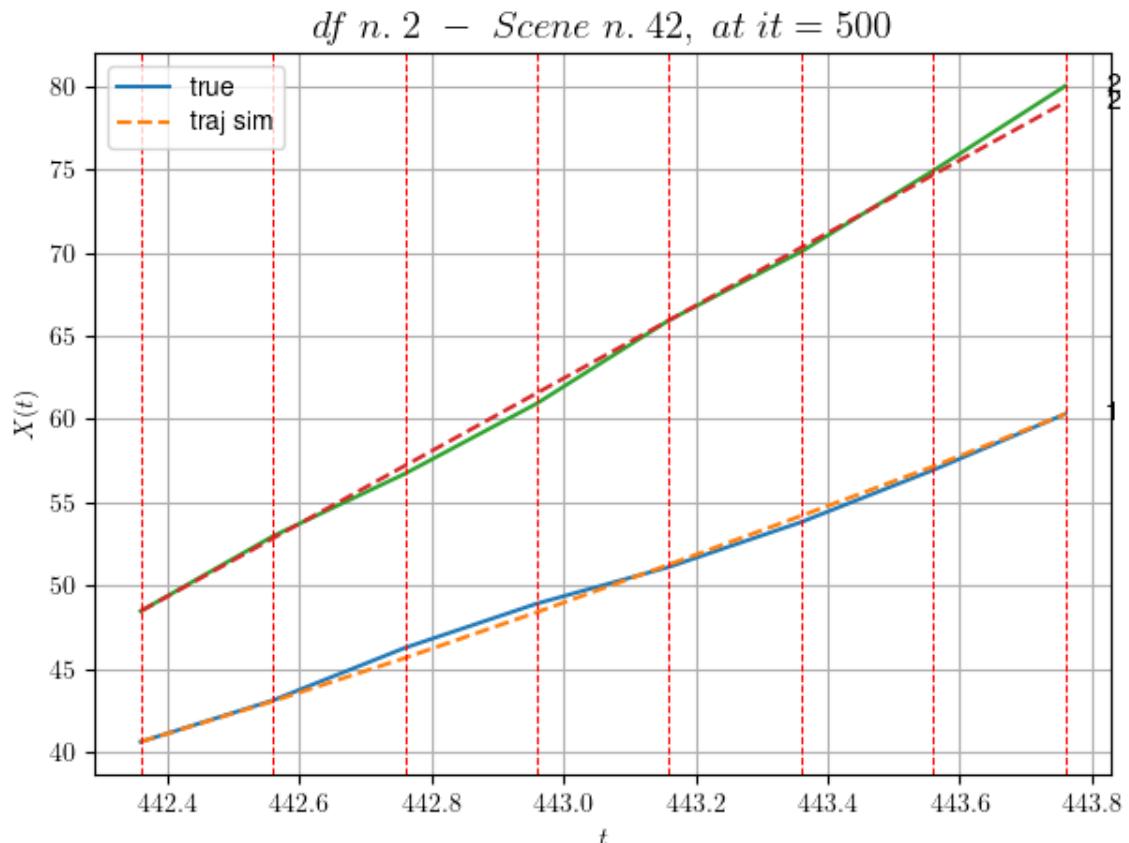


For scene 23/46:

\* After LR finder: LR\_NN=0.0001 with mse=8.857589596610593  
at it=24  
\* v0 = 19.081744094340344  
\* MSE = 0.1480973983951739  
\* iterations = 500

DataFrame n.2. Scene n.24/46

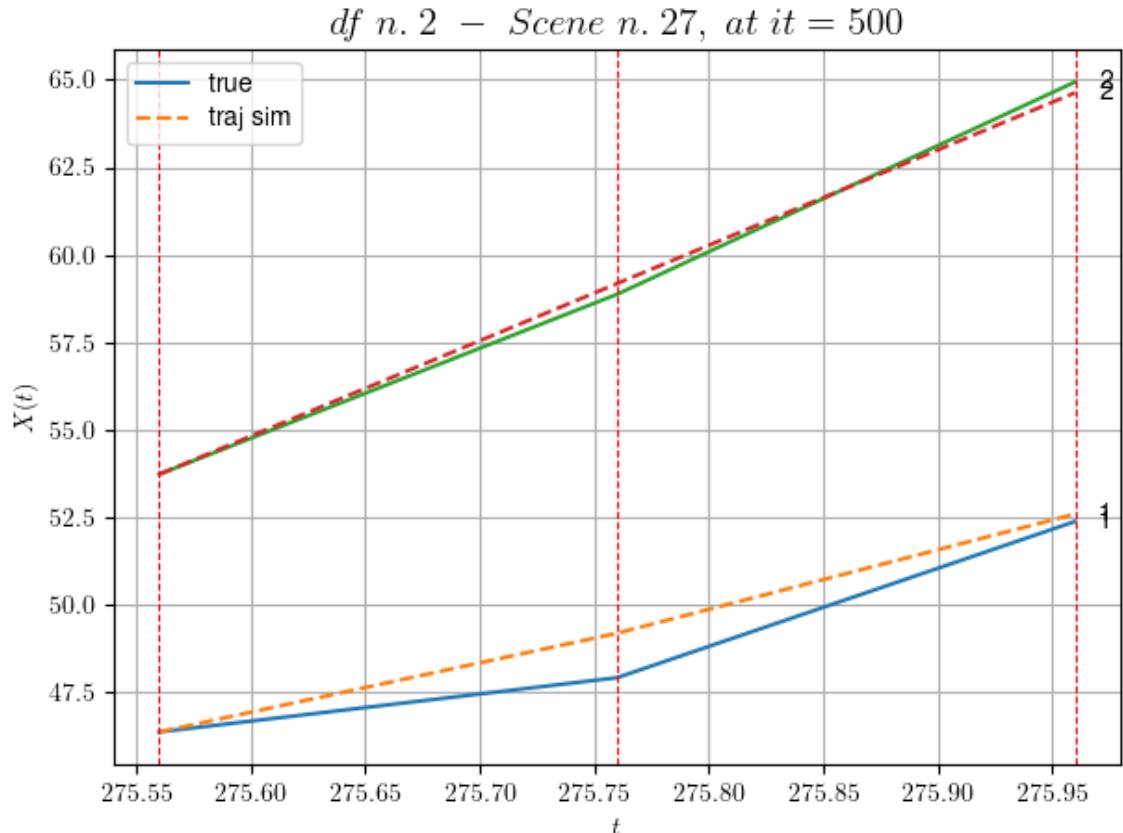
We have 7 time intervals inside [442.36,443.76]



DataFrame n.2. Scene n.25/46

-----  
-----

We have 2 time intervals inside [275.56,275.96]



---

For scene 25/46:

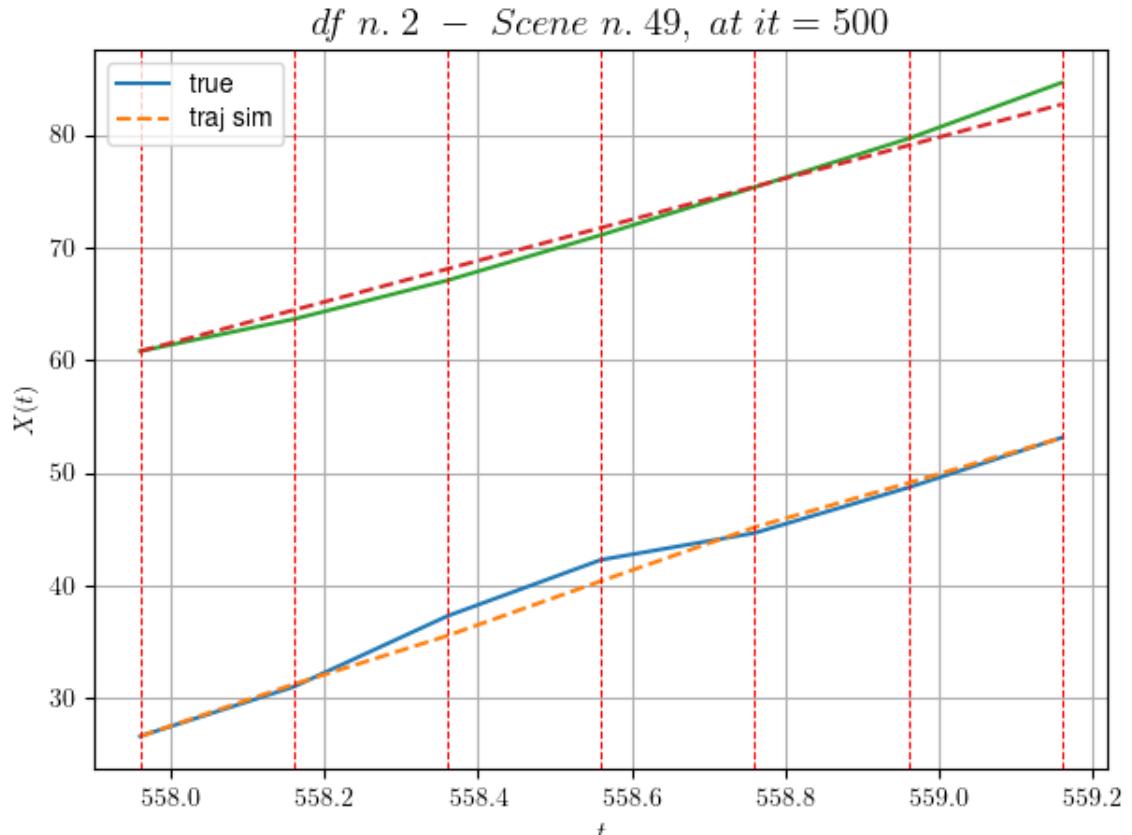
\* After LR finder: LR\_NN=5e-05 with mse=0.3815595752096964  
at it=24  
\* v0 = 27.245148829197323  
\* MSE = 0.3076404517819496  
\* iterations = 500

---

DataFrame n.2. Scene n.26/46

---

We have 6 time intervals inside [557.96,559.16]



---

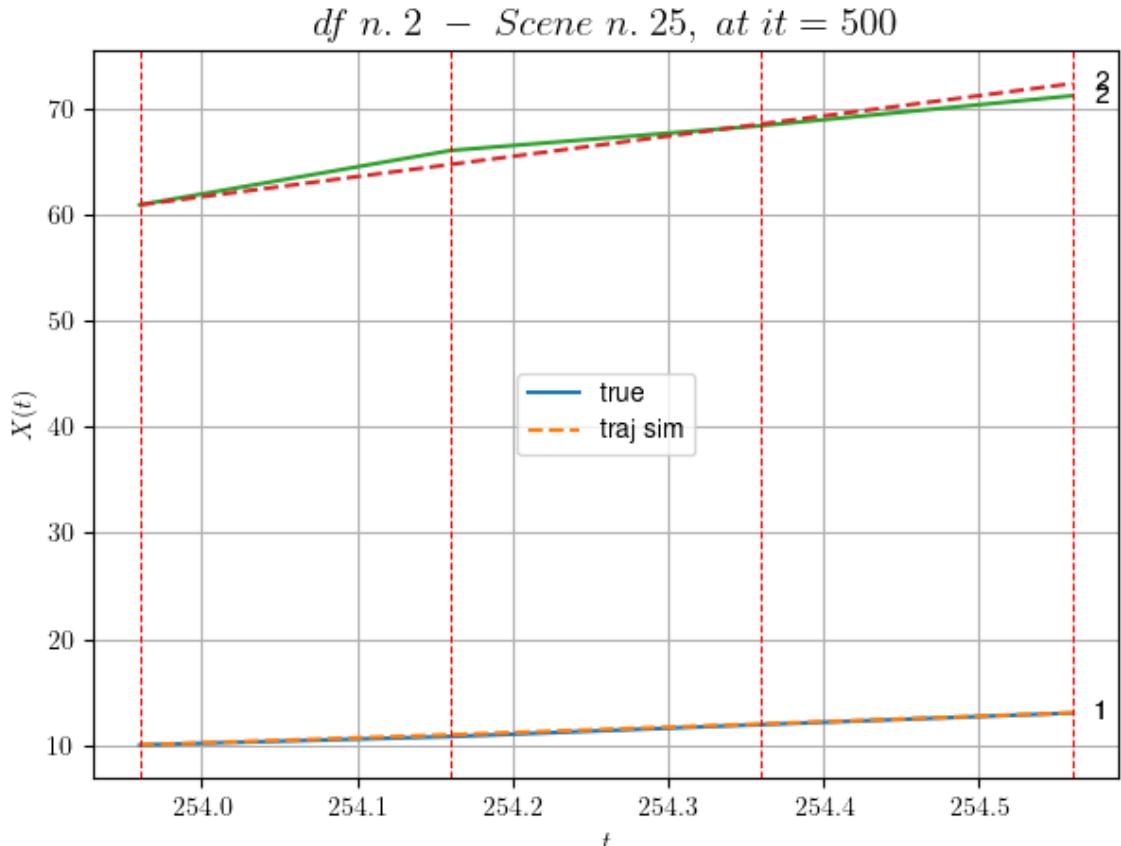
For scene 26/46:  
\* After LR finder: LR\_NN=0.0005 with mse=33.4449296022054 at it=24  
\* v0 = 18.26598960498406  
\* MSE = 0.7894493984750757  
\* iterations = 500

---

DataFrame n.2. Scene n.27/46

---

We have 3 time intervals inside [253.96, 254.56]

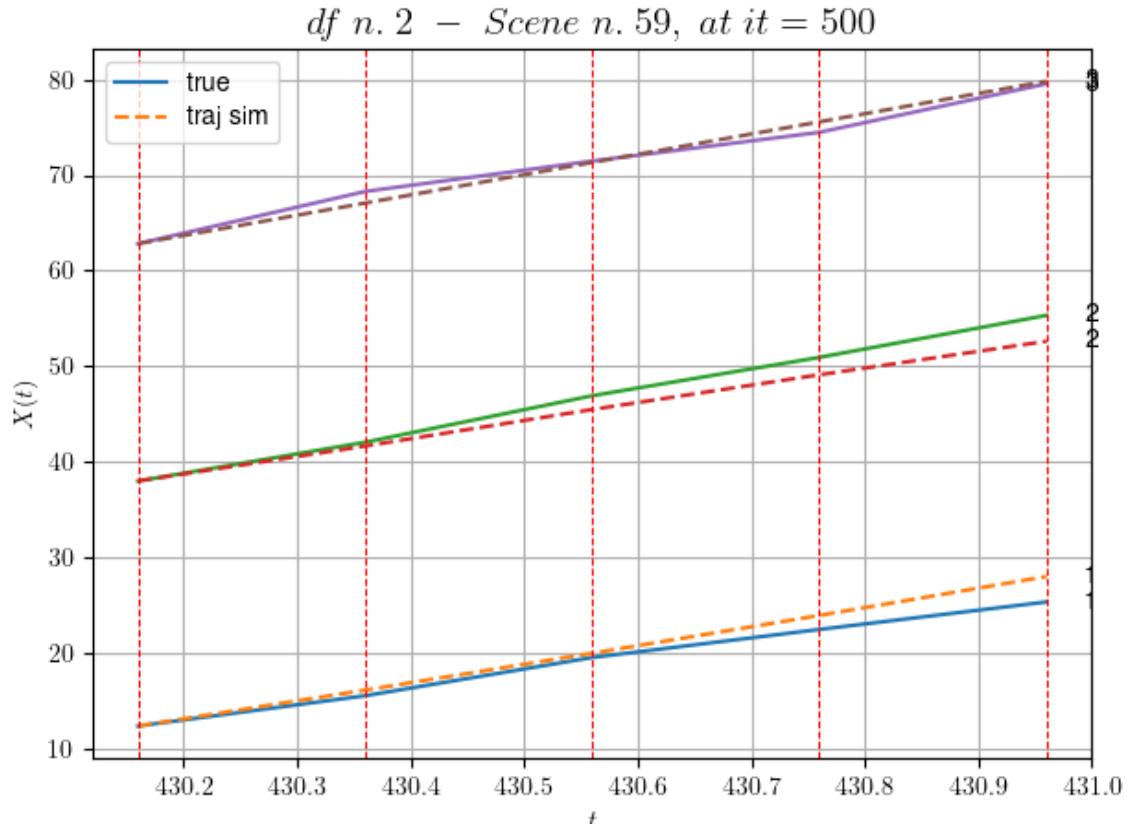


For scene 27/46:

\* After LR finder: LR\_NN=5e-05 with mse=10.11551588109387 at it=24  
\* v0 = 19.0598843092021  
\* MSE = 0.38925565490801134  
\* iterations = 500

DataFrame n.2. Scene n.28/46

We have 4 time intervals inside [430.16,430.96]

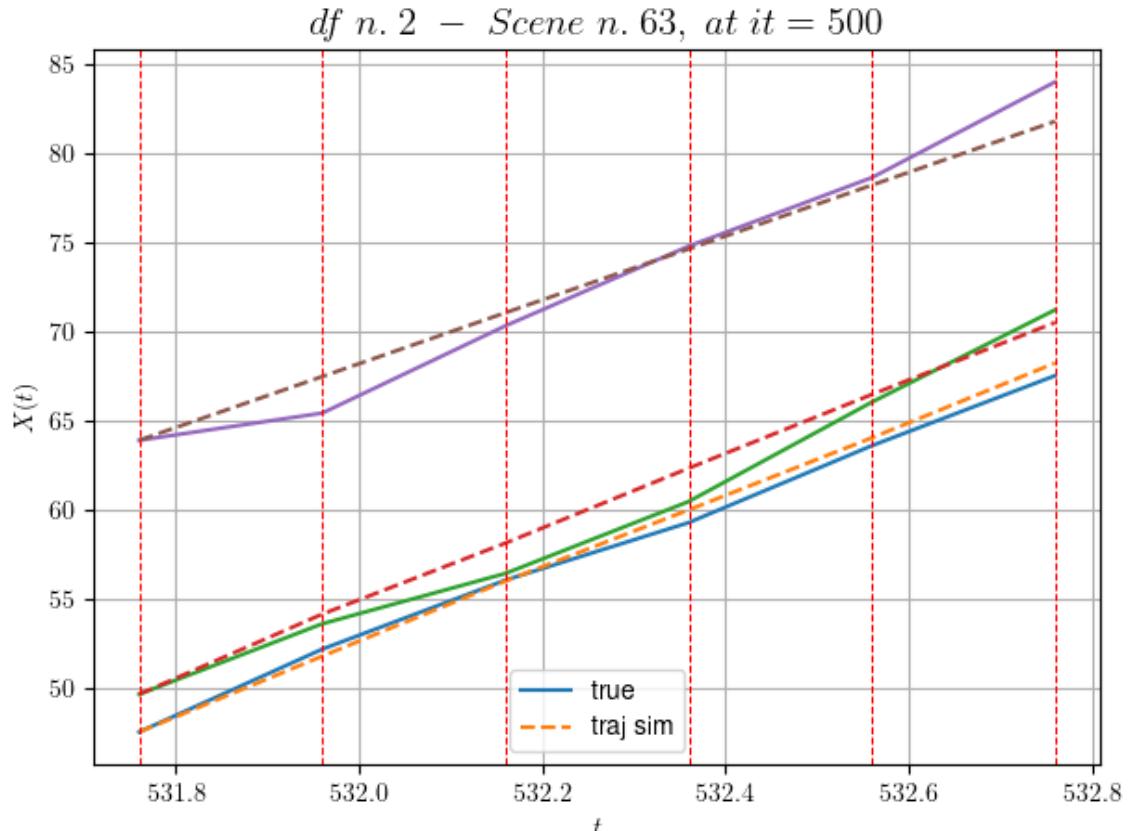


For scene 28/46:

\* After LR finder: LR\_NN=1e-05 with mse=8.67562169457562 at  
it=24  
\*  $v_0 = 21.236902740721774$   
\* MSE = 1.6942552497476095  
\* iterations = 500

DataFrame n.2. Scene n.29/46

We have 5 time intervals inside [531.76,532.76]

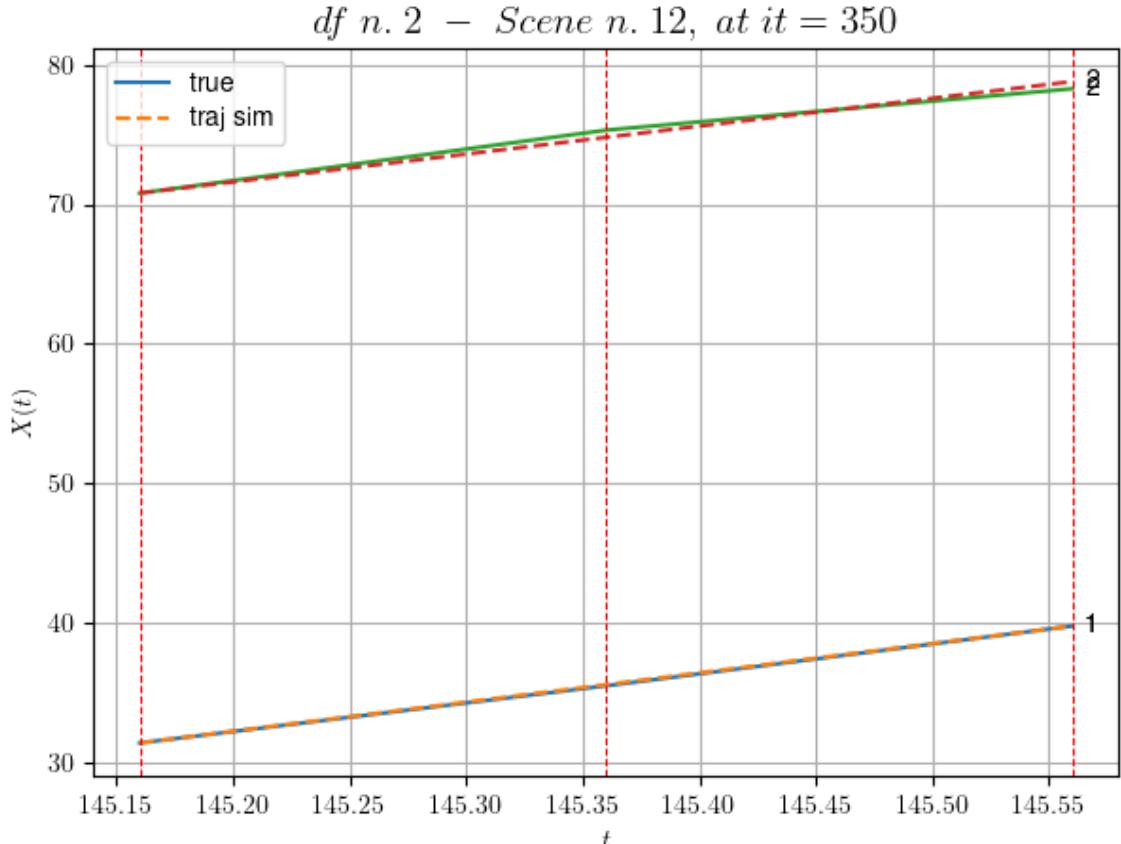


For scene 29/46:

\* After LR finder: LR\_NN=0.001 with mse=23.45709513734151 at it=24  
\*  $v_0 = 17.911731328079323$   
\* MSE = 1.0318254274455596  
\* iterations = 500

DataFrame n.2. Scene n.30/46

We have 2 time intervals inside [145.16,145.56]

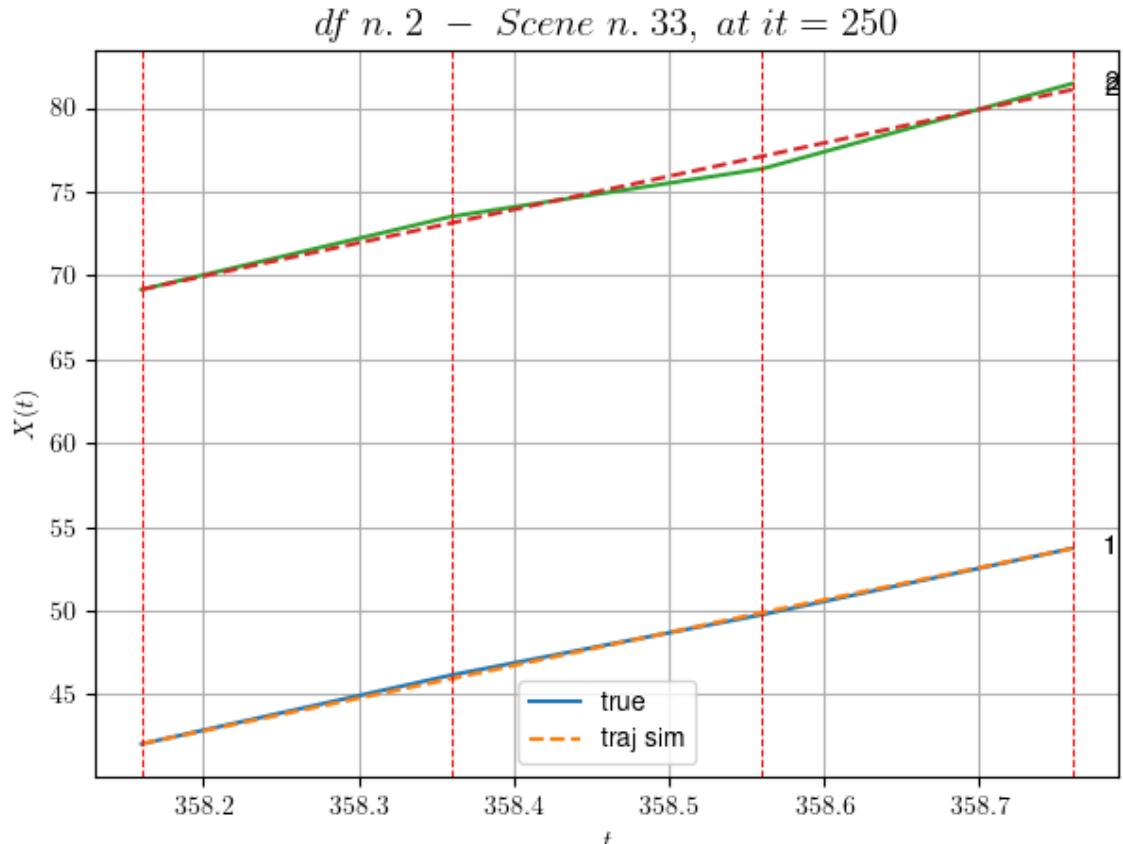


For scene 30/46:

\* After LR finder: LR\_NN=5e-05 with mse=3.7550230543087126  
at it=24  
\* v0 = 20.018762484246597  
\* MSE = 0.0902366352613396  
\* iterations = 350

DataFrame n.2. Scene n.31/46

We have 3 time intervals inside [358.16,358.76]

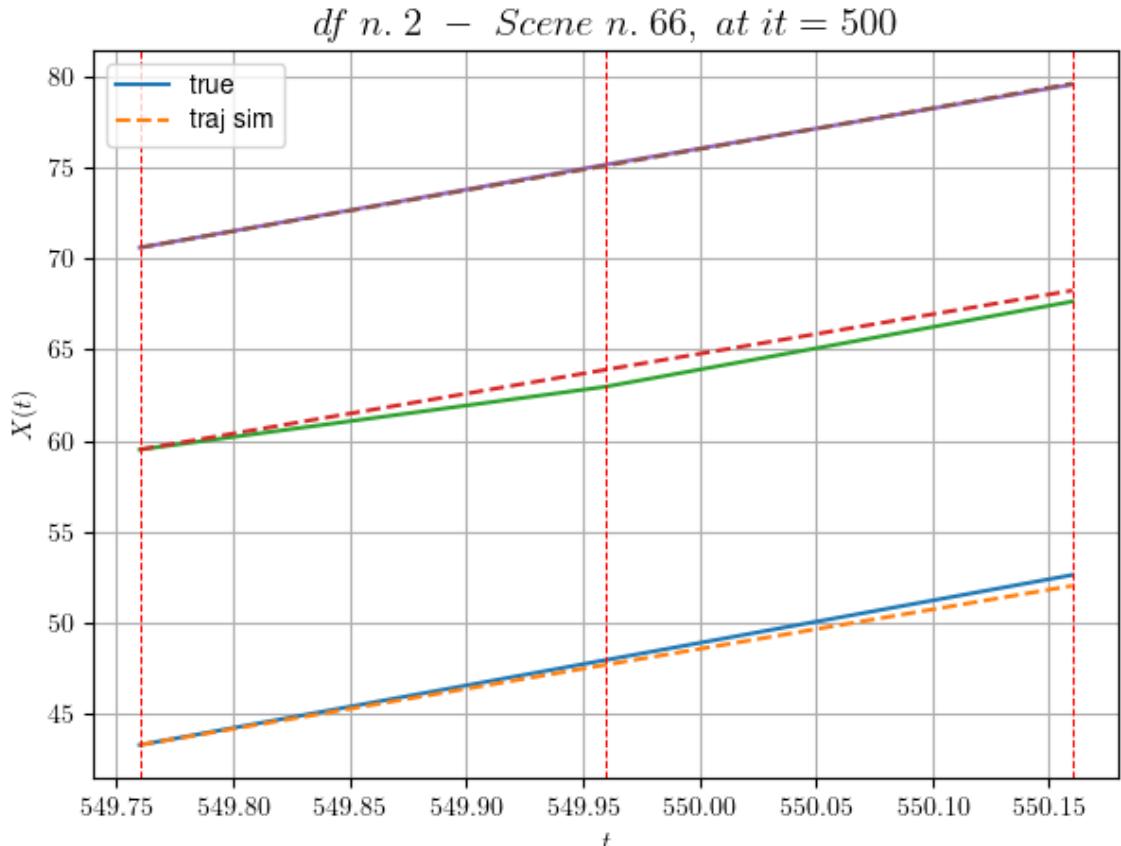


For scene 31/46:

\* After LR finder: LR\_NN=5e-05 with mse=7.297768094400405 at it=24  
\*  $v_0 = 19.877126560273183$   
\* MSE = 0.1132158540286545  
\* iterations = 250

DataFrame n.2. Scene n.32/46

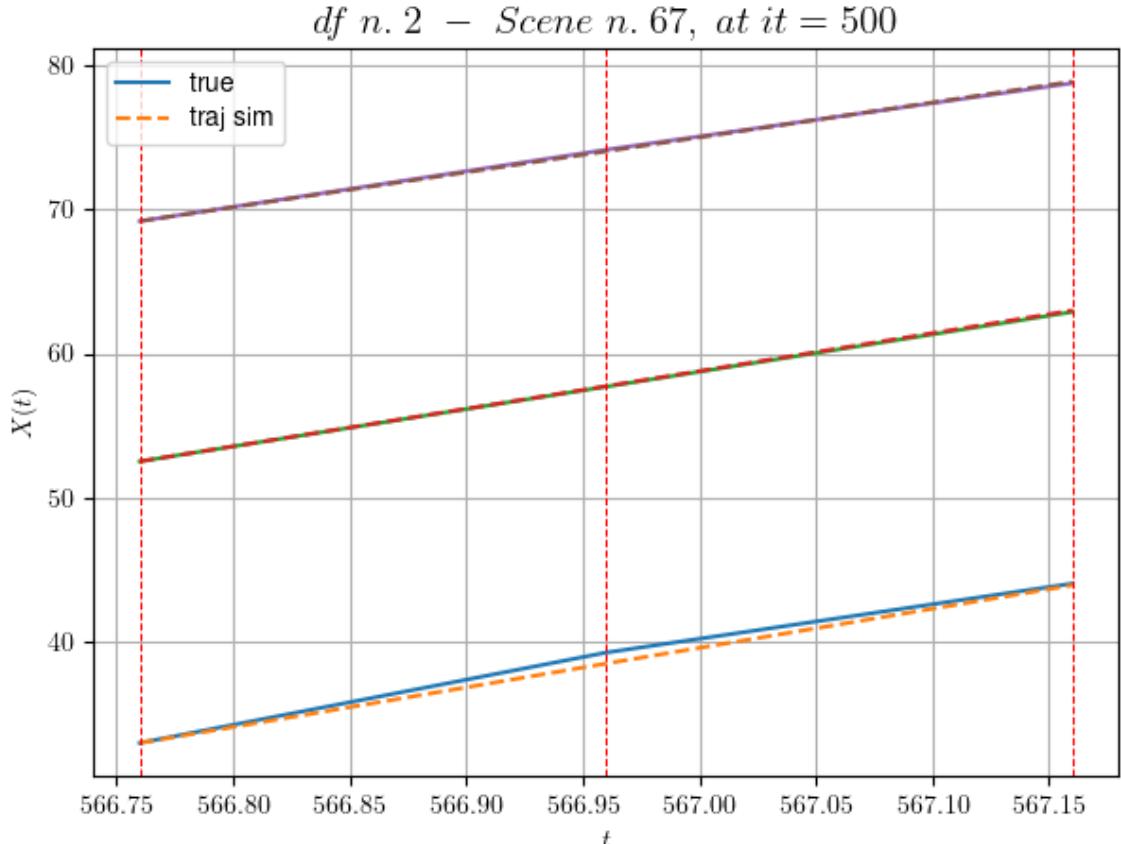
We have 2 time intervals inside [549.76,550.16]



DataFrame n.2. Scene n.33/46

-----

We have 2 time intervals inside [566.76,567.16]

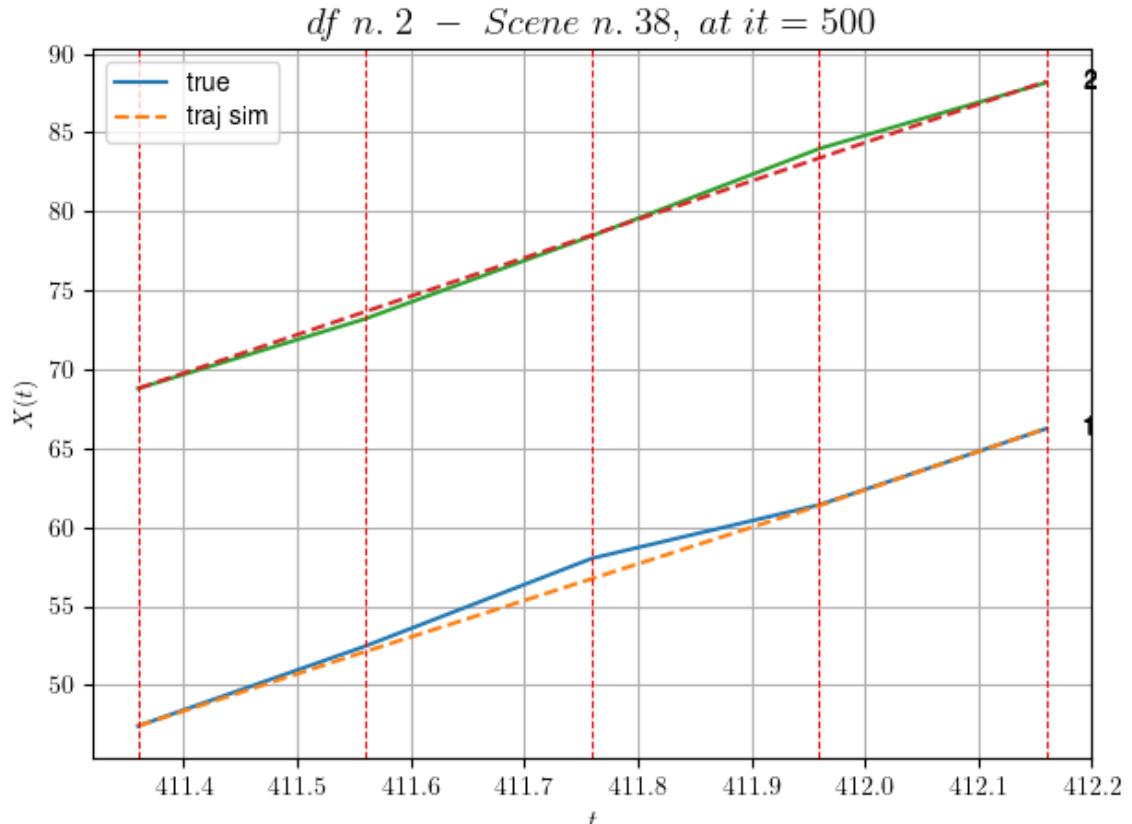


For scene 33/46:

\* After LR finder: LR\_NN=0.0001 with mse=0.836805203108863  
at it=24  
\* v0 = 24.222520391151  
\* MSE = 0.06940732413823227  
\* iterations = 500

DataFrame n.2. Scene n.34/46

We have 4 time intervals inside [411.36,412.16]



---

For scene 34/46:

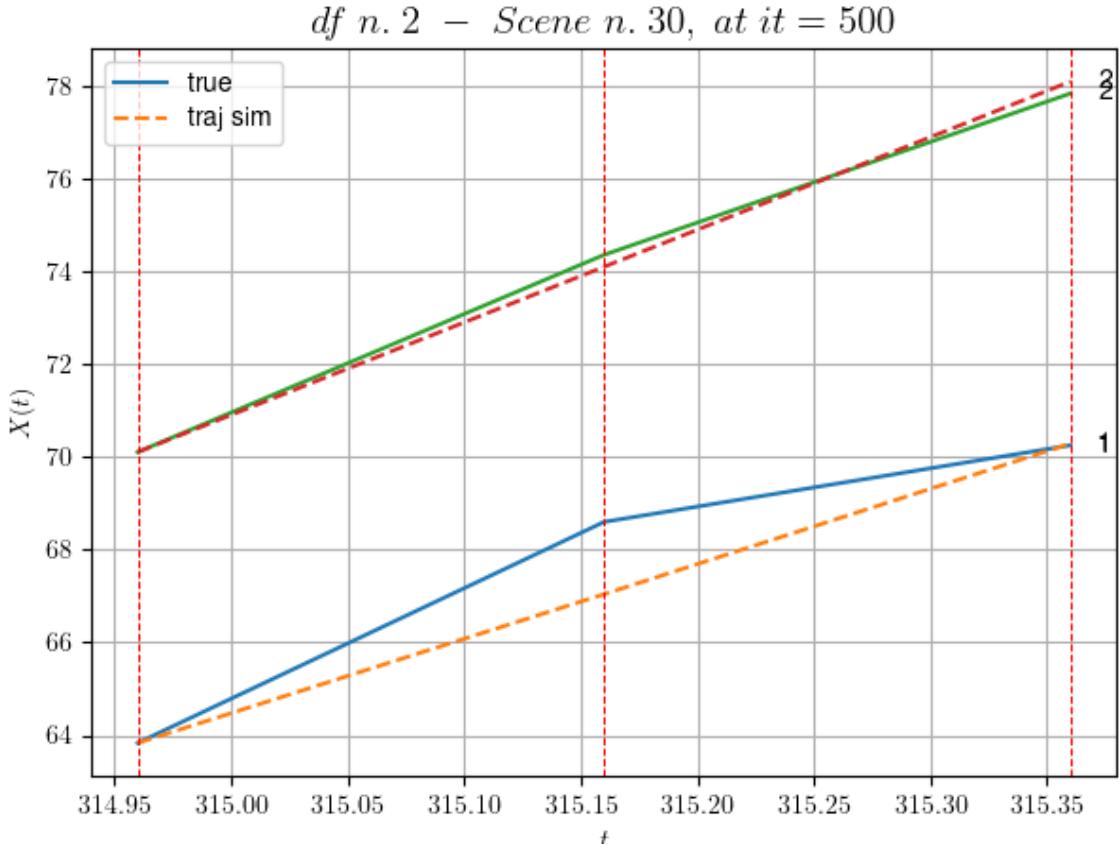
\* After LR finder: LR\_NN=5e-05 with mse=3.915502730515973 at it=24  
\* vθ = 24.33774318153091  
\* MSE = 0.23365637114264964  
\* iterations = 500

---

DataFrame n.2. Scene n.35/46

---

We have 2 time intervals inside [314.96,315.36]



---

For scene 35/46:

\* After LR finder:  $LR\_NN=0.0005$  with  $mse=3.9470417558455653$   
at it=24  
\*  $v_0 = 19.975403002157083$   
\*  $MSE = 0.4271688668270568$   
\* iterations = 500

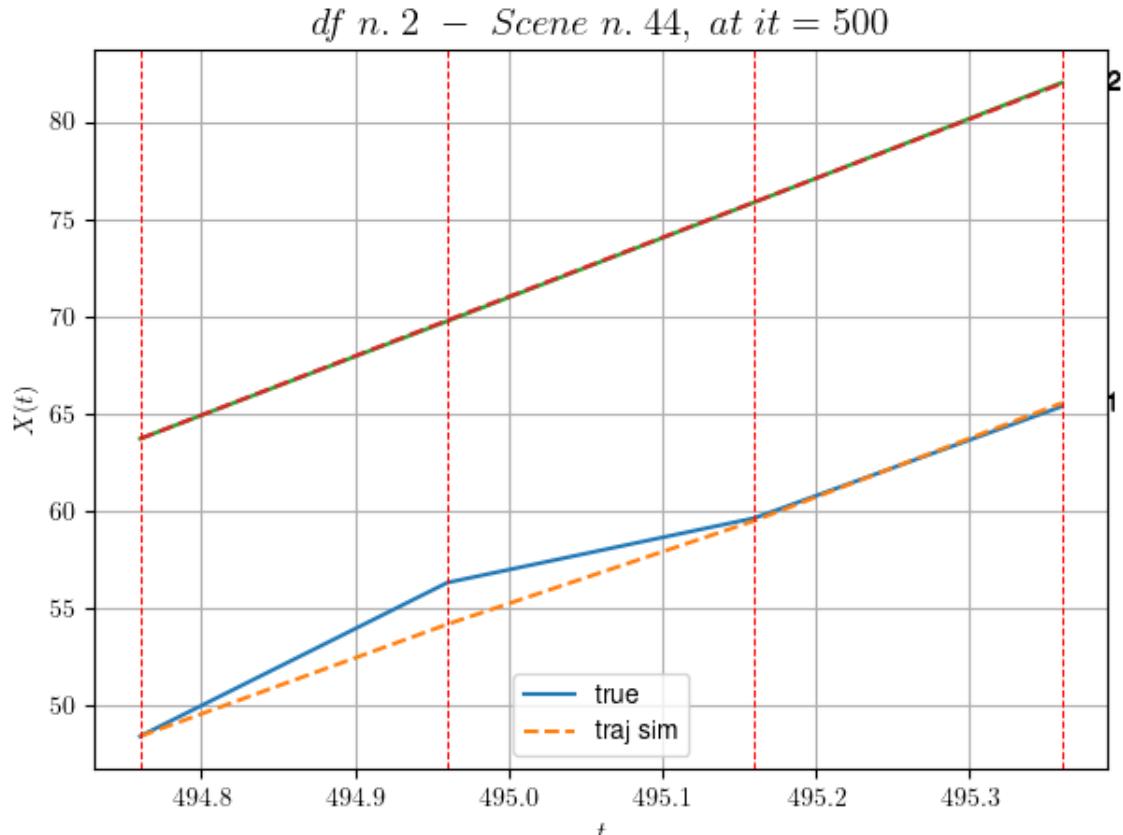
---

---

DataFrame n.2. Scene n.36/46

---

We have 3 time intervals inside [494.76,495.36]



---

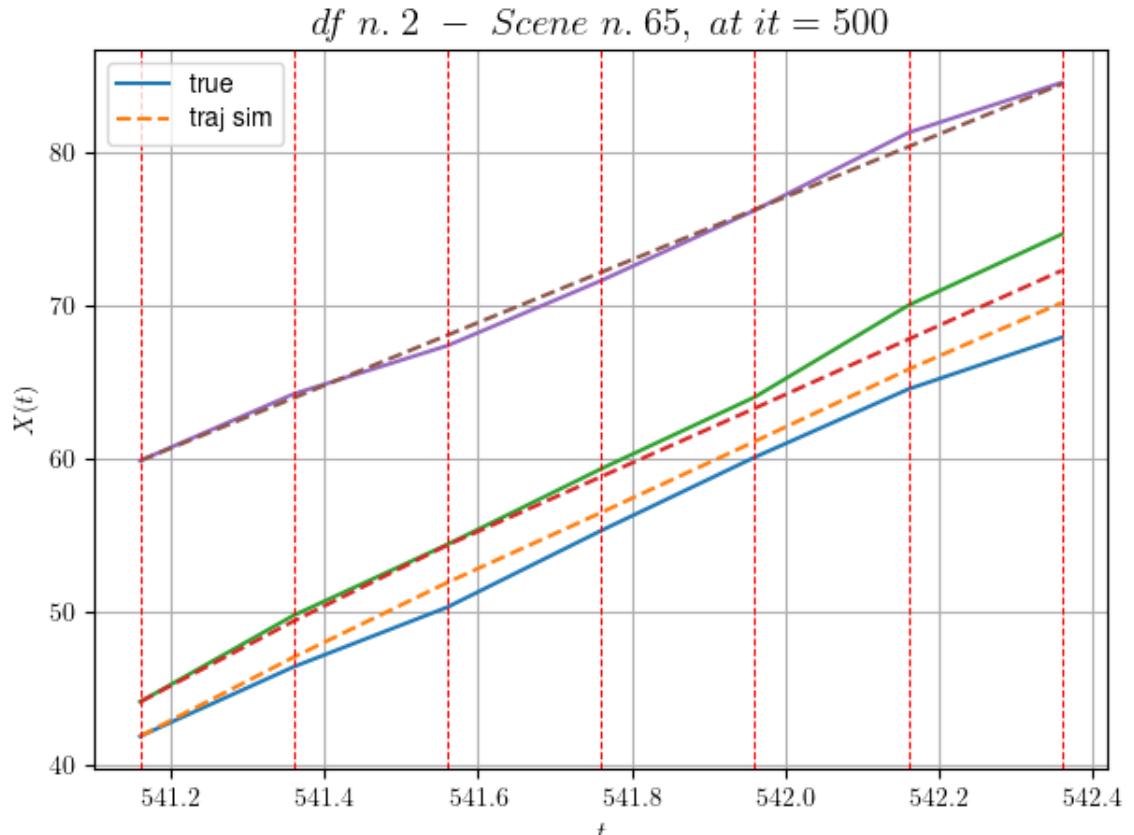
For scene 36/46:  
\* After LR finder: LR\_NN=5e-05 with mse=0.6197233666092262  
at it=24  
\* v0 = 30.442979864260895  
\* MSE = 0.5662022277595024  
\* iterations = 500

---

DataFrame n.2. Scene n.37/46

---

We have 6 time intervals inside [541.16,542.36]



---

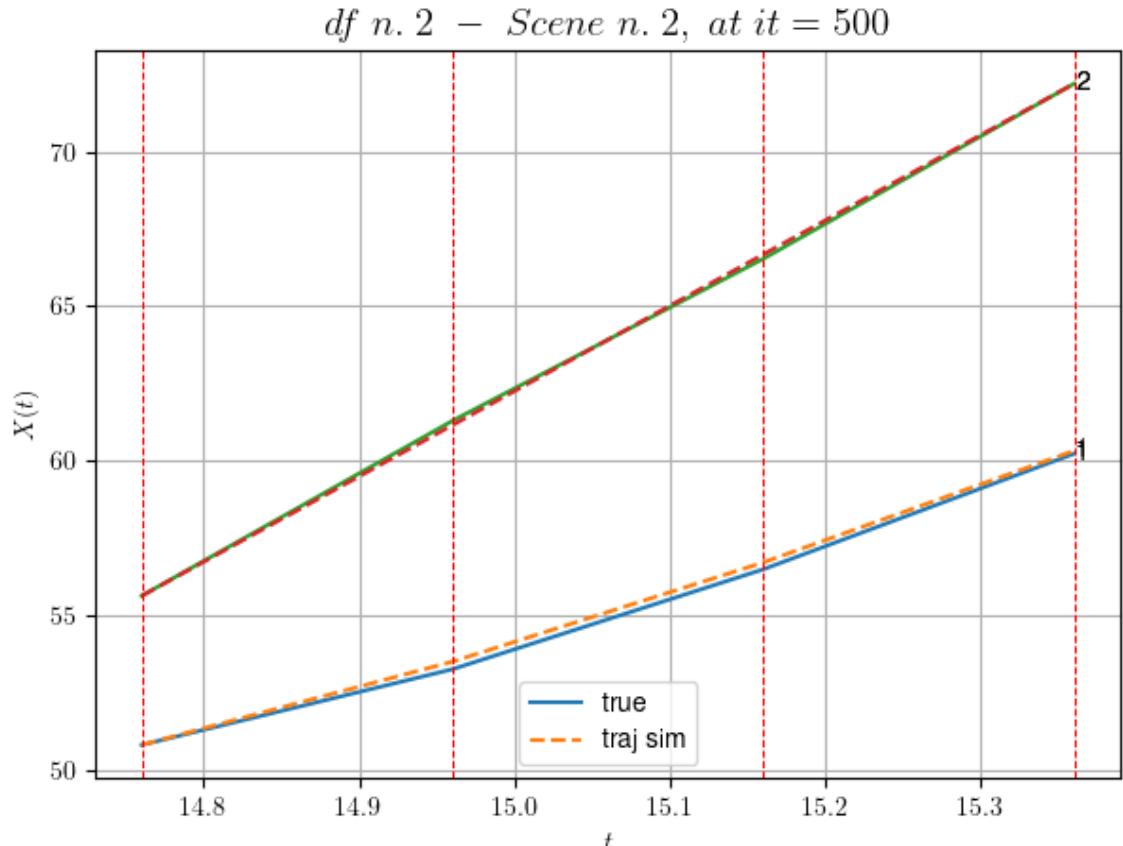
For scene 37/46:  
\* After LR finder: LR\_NN=0.001 with mse=23.276373518910816  
at it=24  
\* v0 = 20.48999097546651  
\* MSE = 1.2099493311188385  
\* iterations = 500

---

DataFrame n.2. Scene n.38/46

---

We have 3 time intervals inside [14.76,15.36]

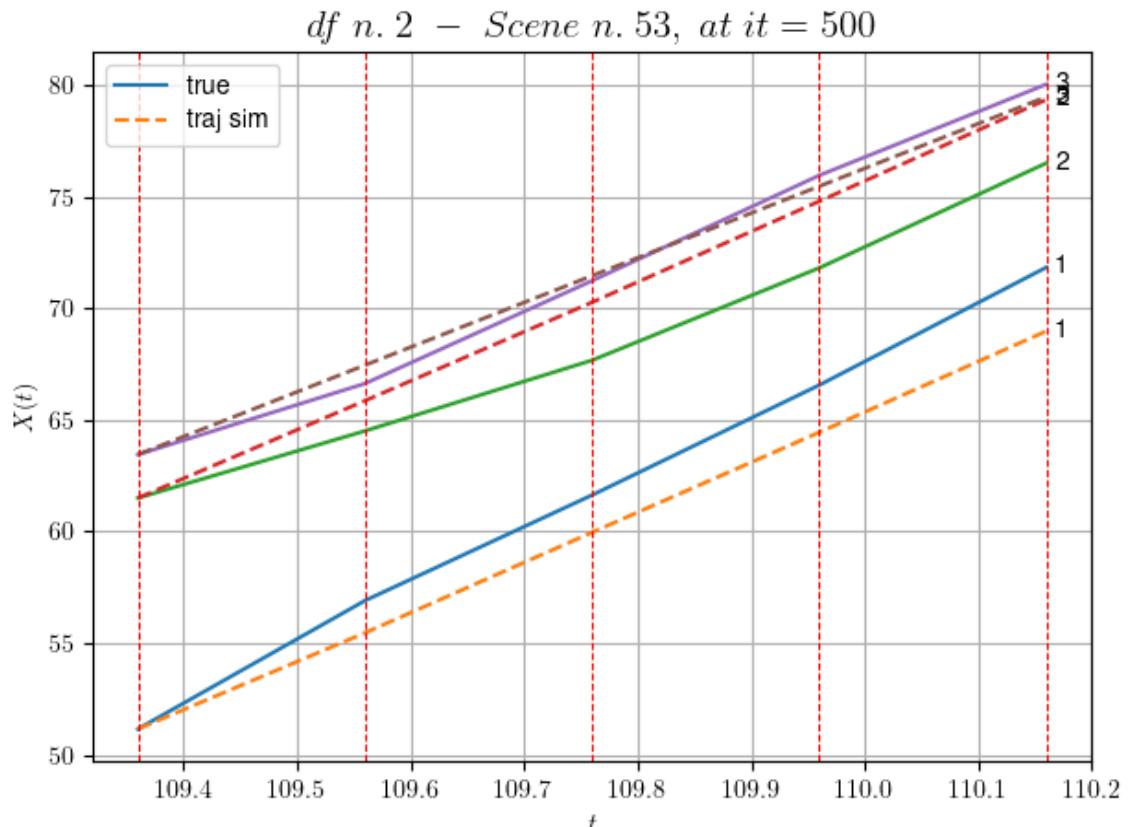


For scene 38/46:

\* After LR finder: LR\_NN=0.0001 with mse=0.4916859067956963  
5 at it=24  
\* v0 = 27.615406088656982  
\* MSE = 0.019736094144542804  
\* iterations = 500

DataFrame n.2. Scene n.39/46

We have 4 time intervals inside [109.36,110.16]

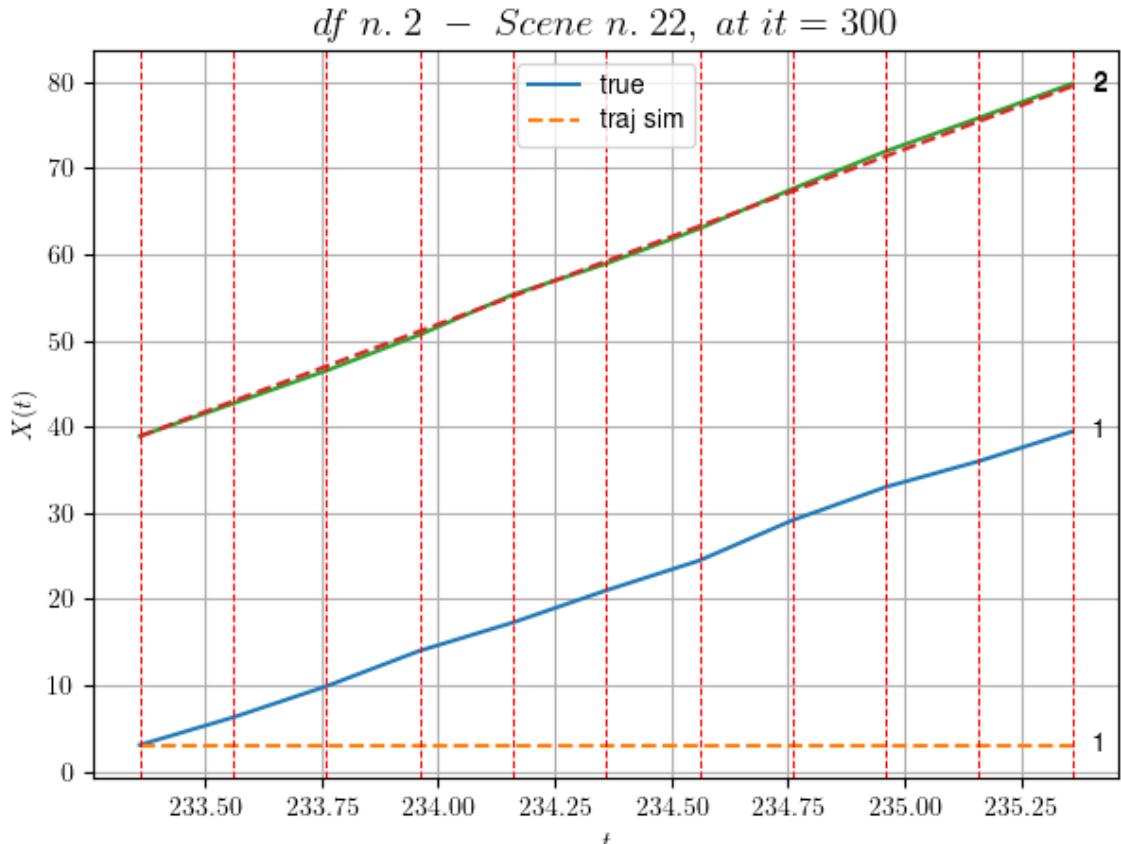


For scene 39/46:

\* After LR finder: LR\_NN=0.001 with mse=9.176009156307158 at it=24  
\* vθ = 20.03385870433154  
\* MSE = 2.9591063764817593  
\* iterations = 500

DataFrame n.2. Scene n.40/46

We have 10 time intervals inside [233.36, 235.36]



---

For scene 40/46:

\* After LR finder: LR\_NN=0.0005 with mse=64.59302623438295  
at it=24  
\* v0 = 20.30078554583282  
\* MSE = 178.90645597016095  
\* iterations = 300

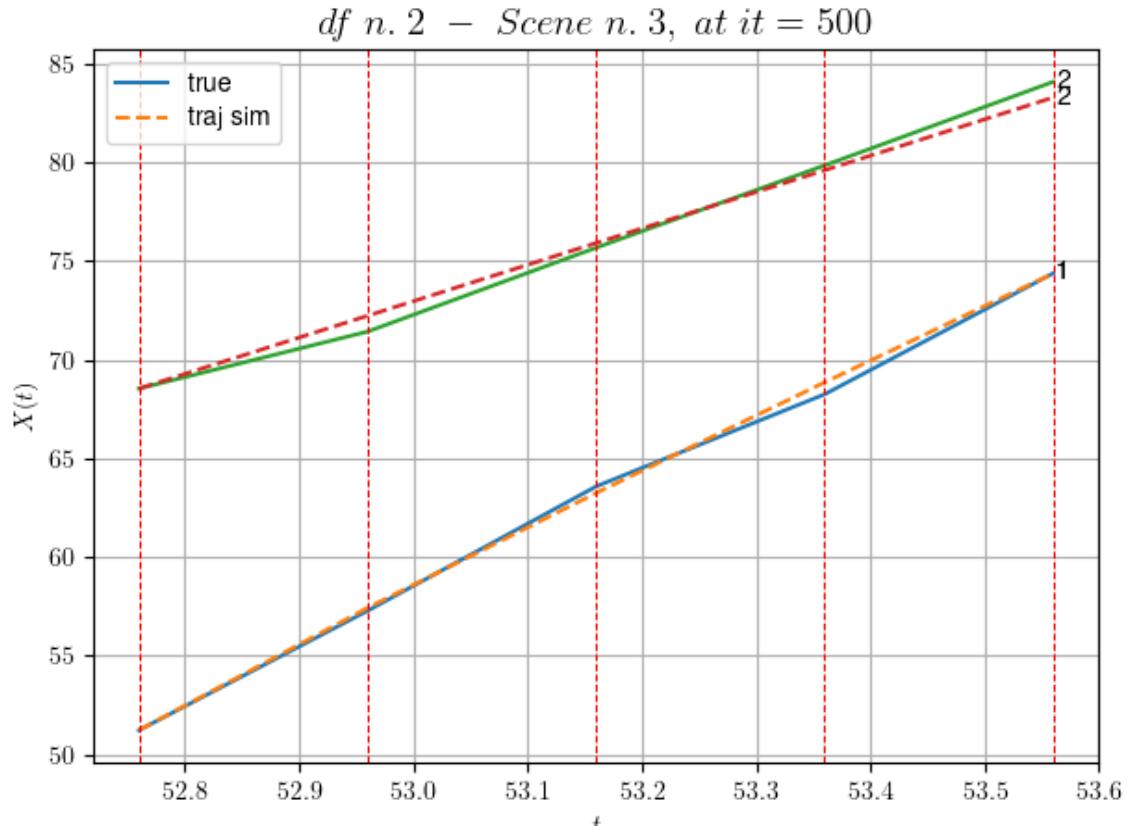
---

---

DataFrame n.2. Scene n.41/46

---

We have 4 time intervals inside [52.76,53.56]

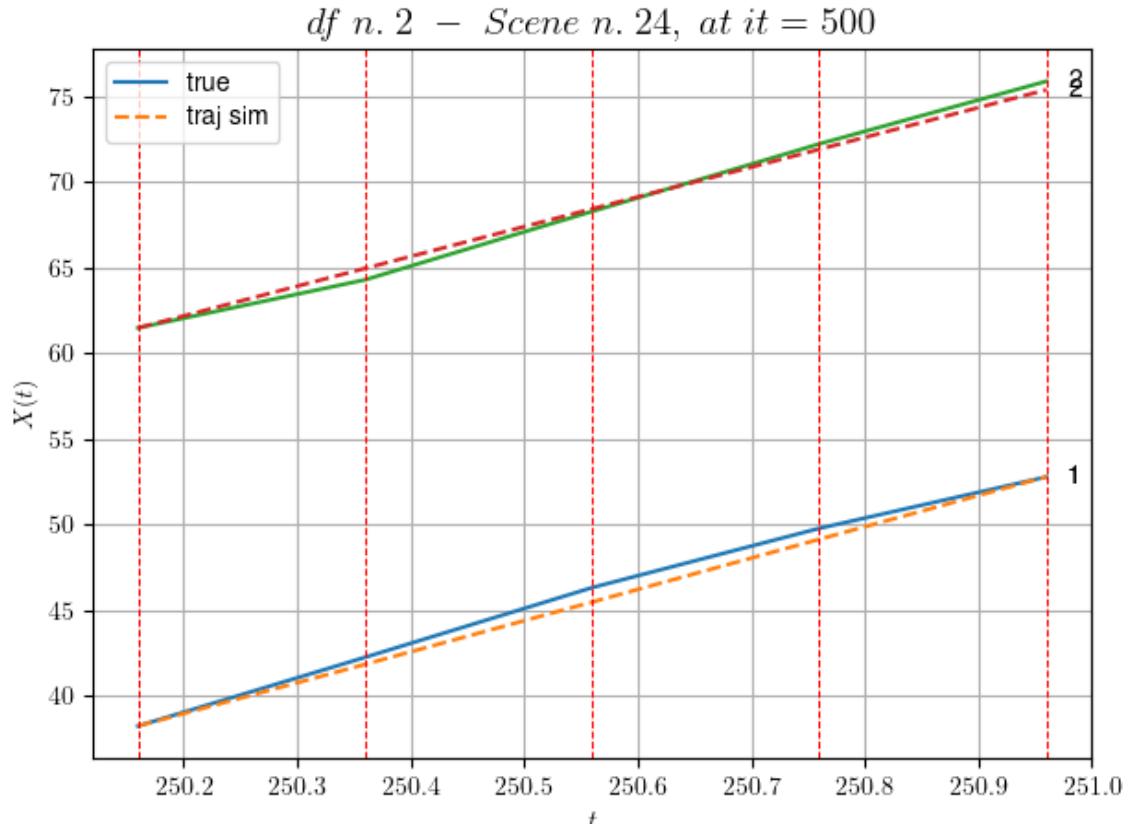


For scene 41/46:

\* After LR finder: LR\_NN=5e-05 with mse=15.245011322526661  
at it=24  
\* v0 = 18.43493729530433  
\* MSE = 0.1662498421273313  
\* iterations = 500

DataFrame n.2. Scene n.42/46

We have 4 time intervals inside [250.16, 250.96]



For scene 42/46:  
\* After LR finder: LR\_NN=5e-05 with mse=18.359333893716226  
at it=24  
\* v0 = 17.364515373912557  
\* MSE = 0.20659295365744895  
\* iterations = 500

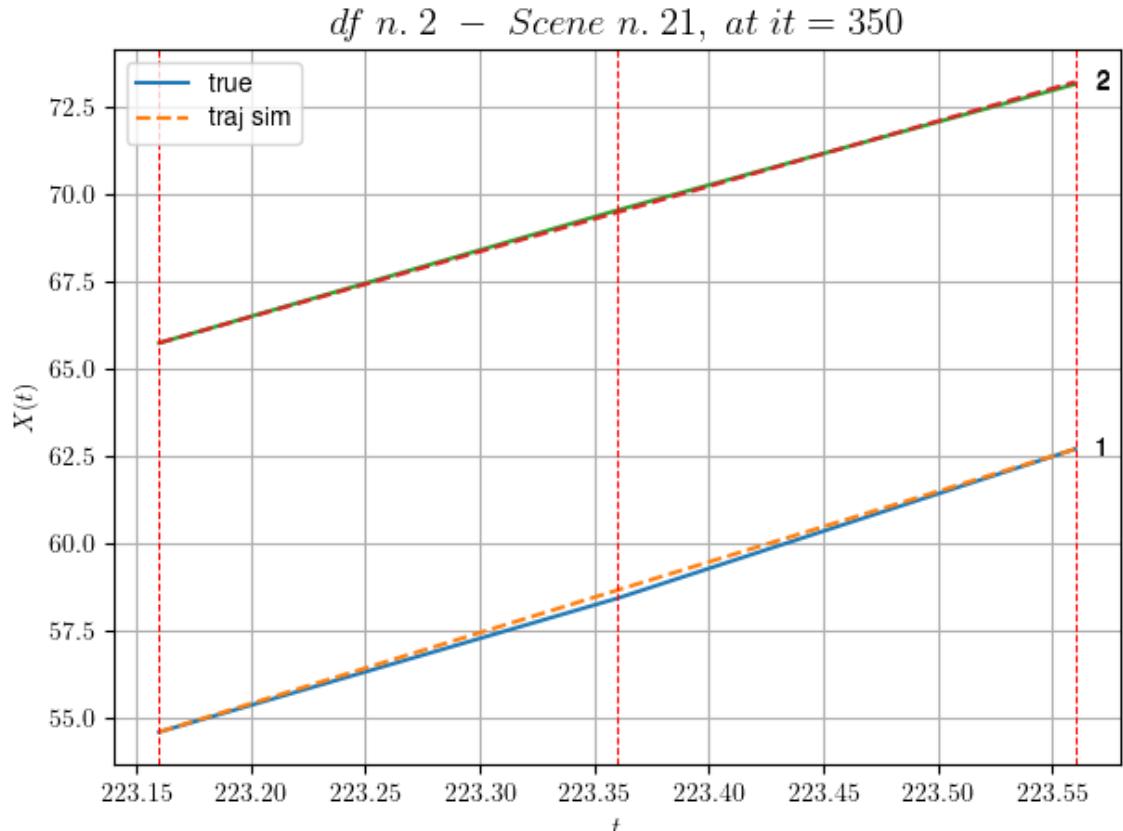
---

---

DataFrame n.2. Scene n.43/46

---

We have 2 time intervals inside [223.16,223.56]

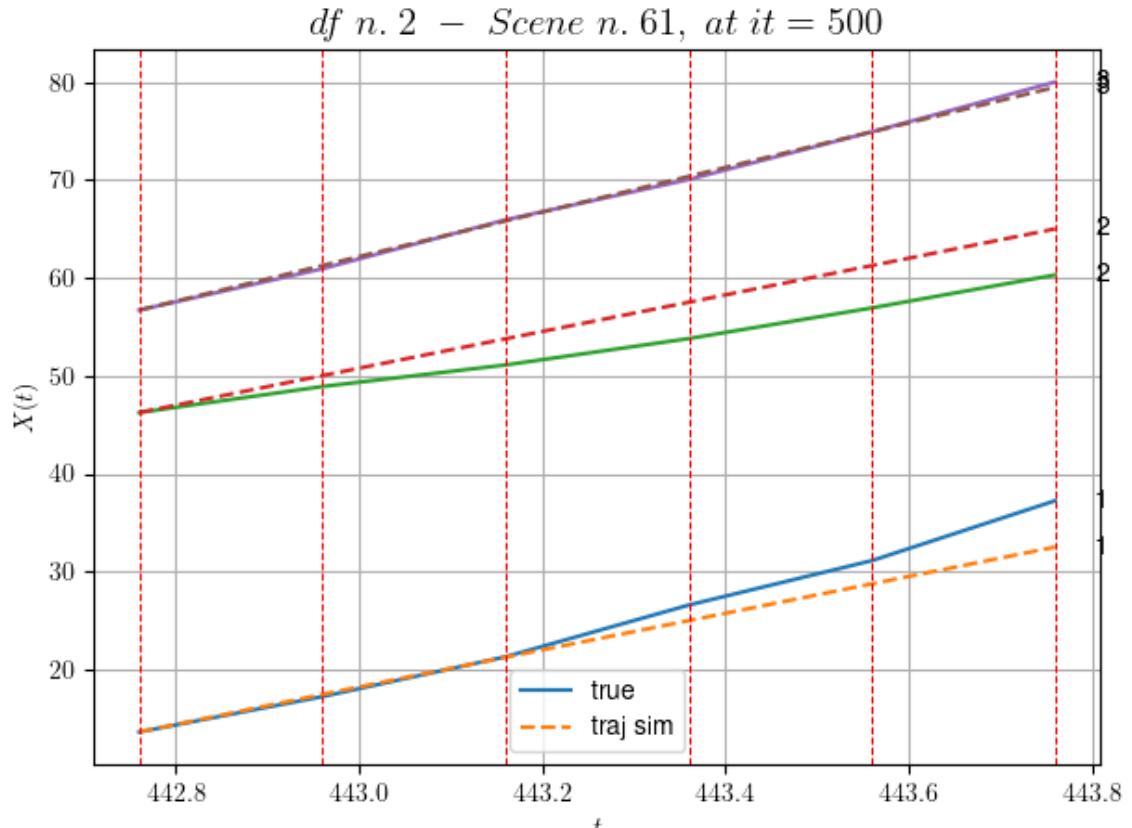


For scene 43/46:

\* After LR finder: LR\_NN=0.0001 with mse=4.313724015230945  
at it=24  
\* v0 = 18.698370395221772  
\* MSE = 0.010432890321256575  
\* iterations = 350

DataFrame n.2. Scene n.44/46

We have 5 time intervals inside [442.76,443.76]

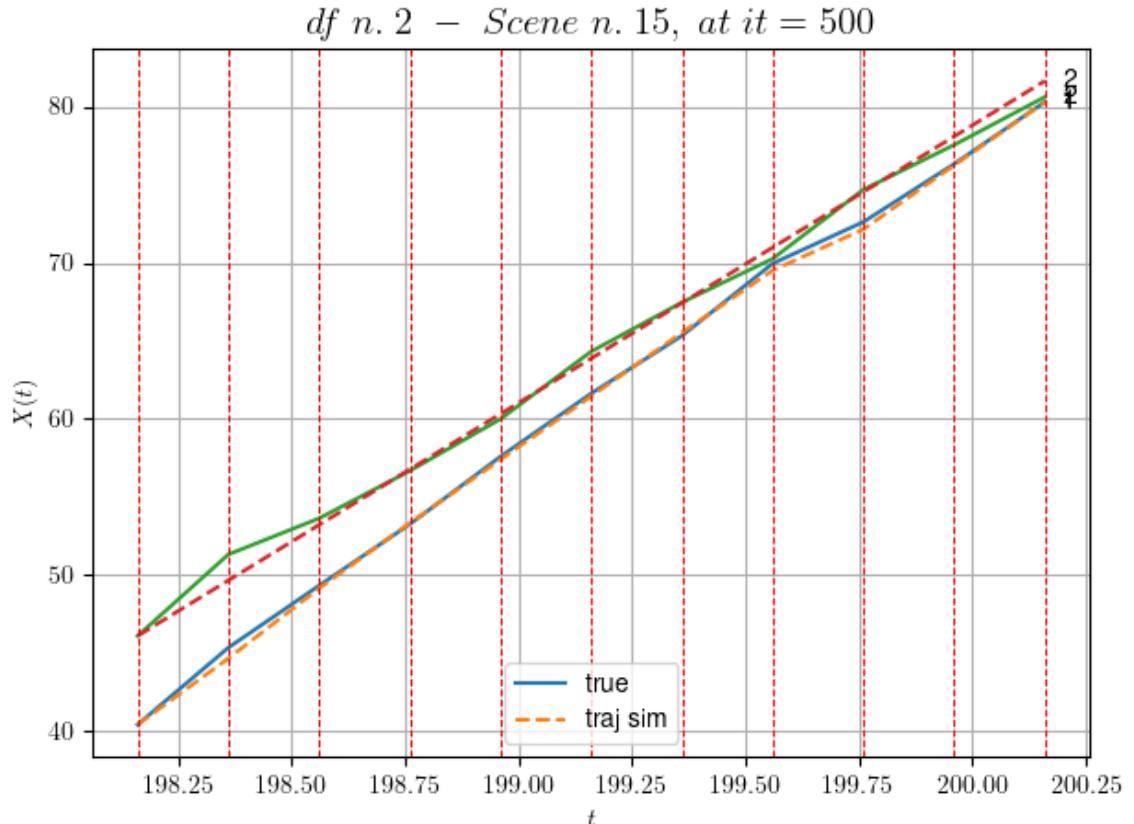


For scene 44/46:

\* After LR finder: LR\_NN=5e-05 with mse=7.922683143187569 at it=24  
\*  $v_0 = 22.775896802504608$   
\* MSE = 5.2311294900534255  
\* iterations = 500

DataFrame n.2. Scene n.45/46

We have 10 time intervals inside [198.16,200.16]



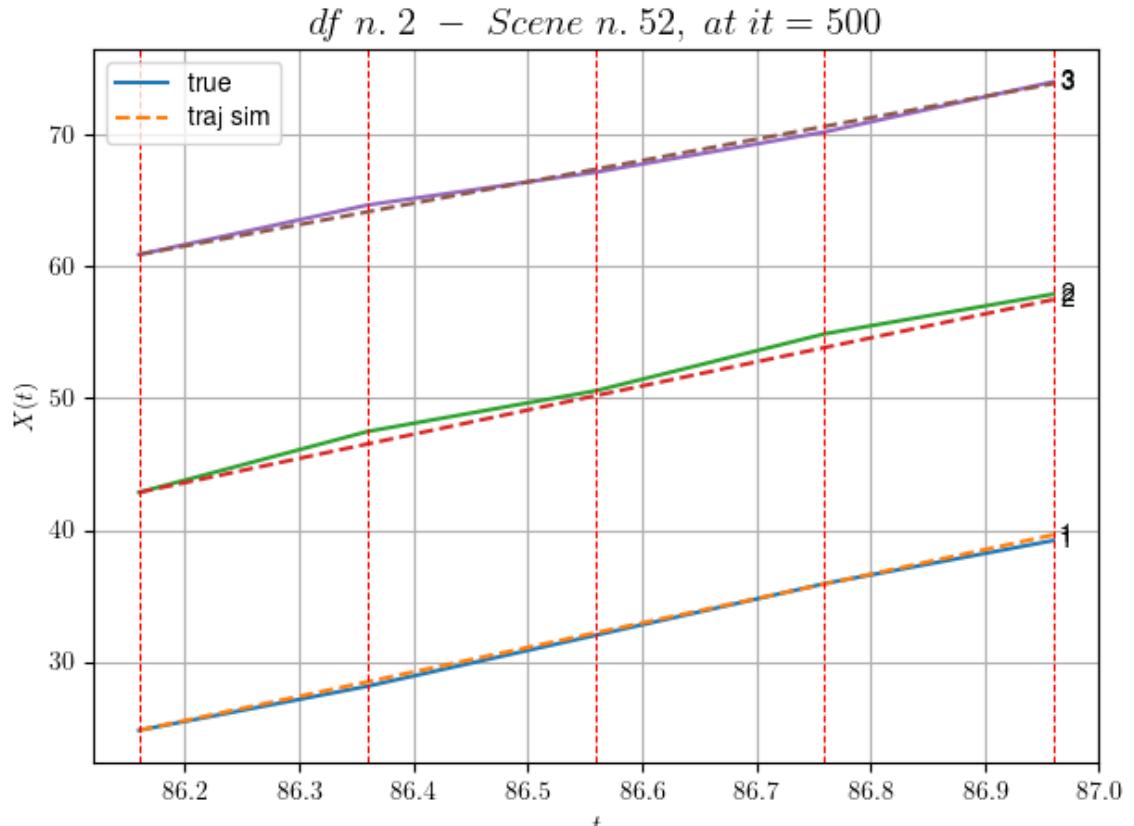
-----  
For scene 45/46:

\* After LR finder: LR\_NN=0.005 with mse=109.06190907797277  
at it=24  
\* v0 = 17.75627925151305  
\* MSE = 0.2804583619273894  
\* iterations = 500  
-----  
-----

DataFrame n.2. Scene n.46/46

-----  
-----

We have 4 time intervals inside [86.16,86.96]



---

For scene 46/46:  
\* After LR finder: LR\_NN=5e-05 with mse=15.838701421567272  
at it=24  
\* vθ = 16.235330060145927  
\* MSE = 0.20927935912711407  
\* iterations = 500

---

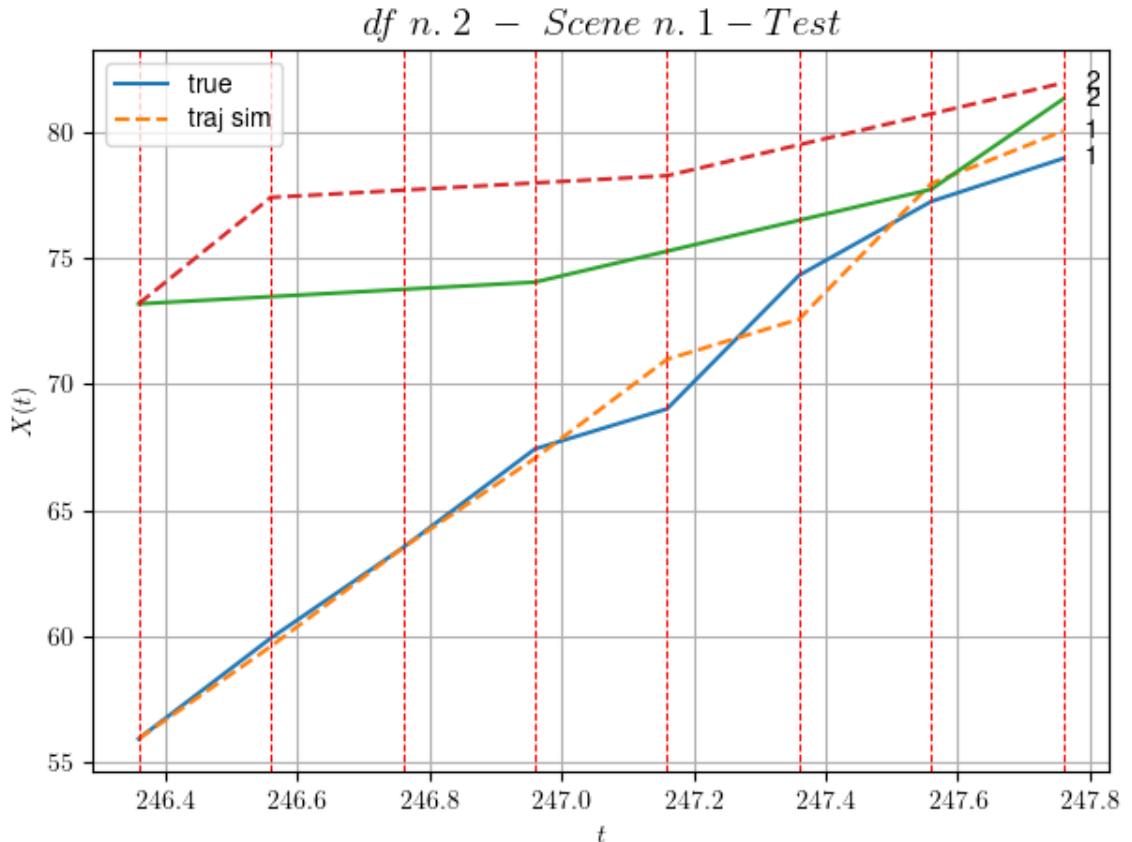
MSE train: 4.425533195947605

---

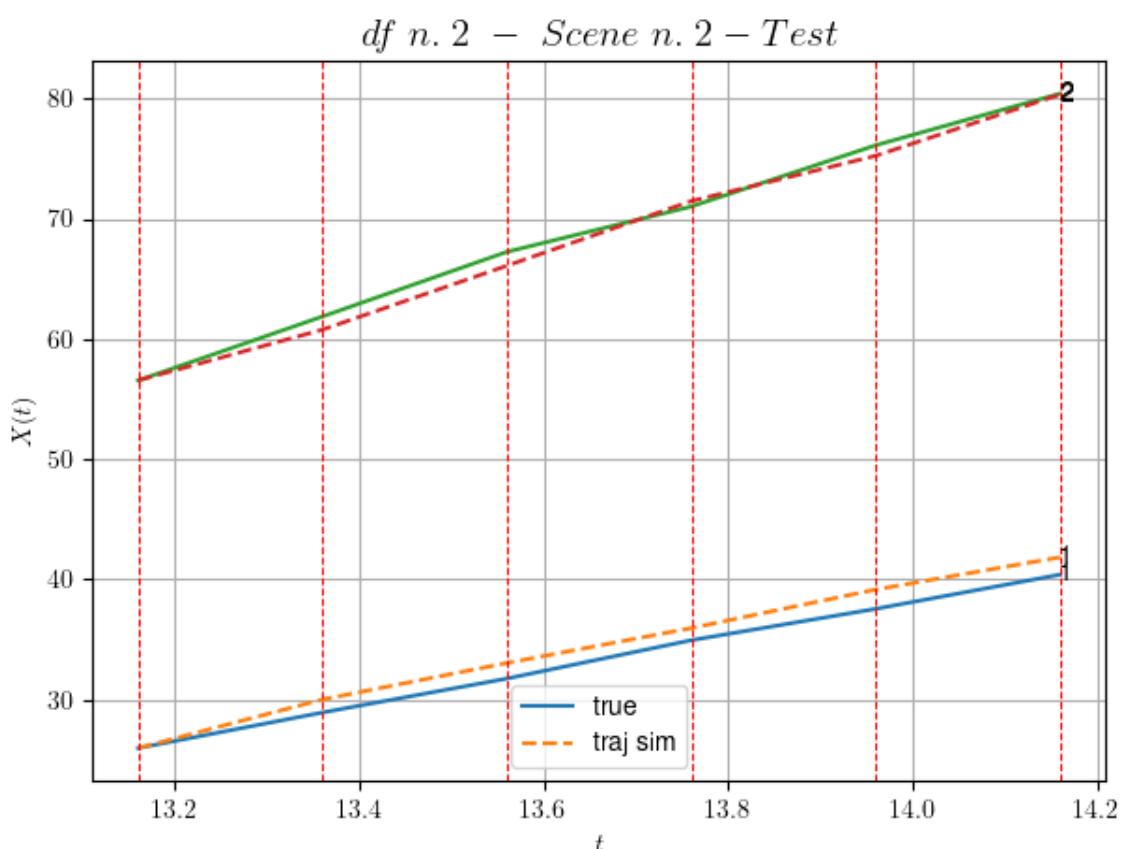
Testing step. (23 scenes)

---

DataFrame n.2. Scene n.1/23



DataFrame n.2. Scene n.2/23

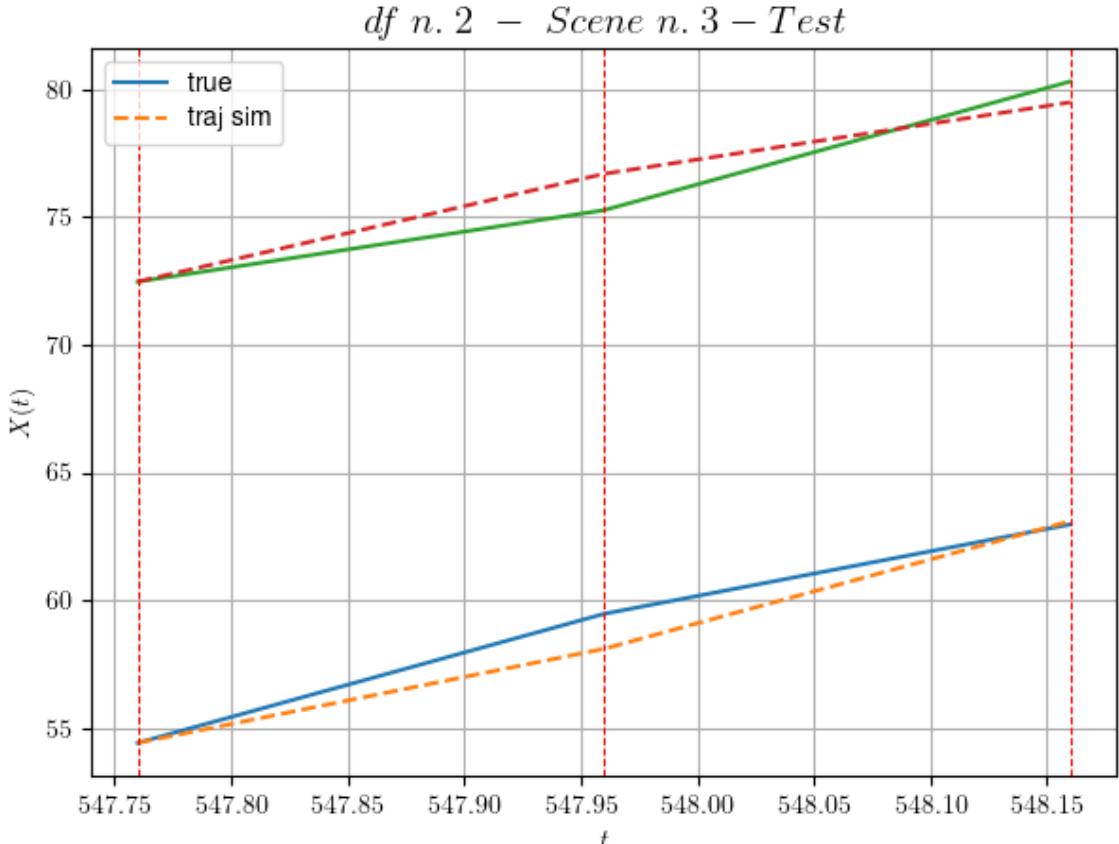


For scene 2/23:  
\* MSE = 1.0031212630610913

---

---

DataFrame n.2. Scene n.3/23

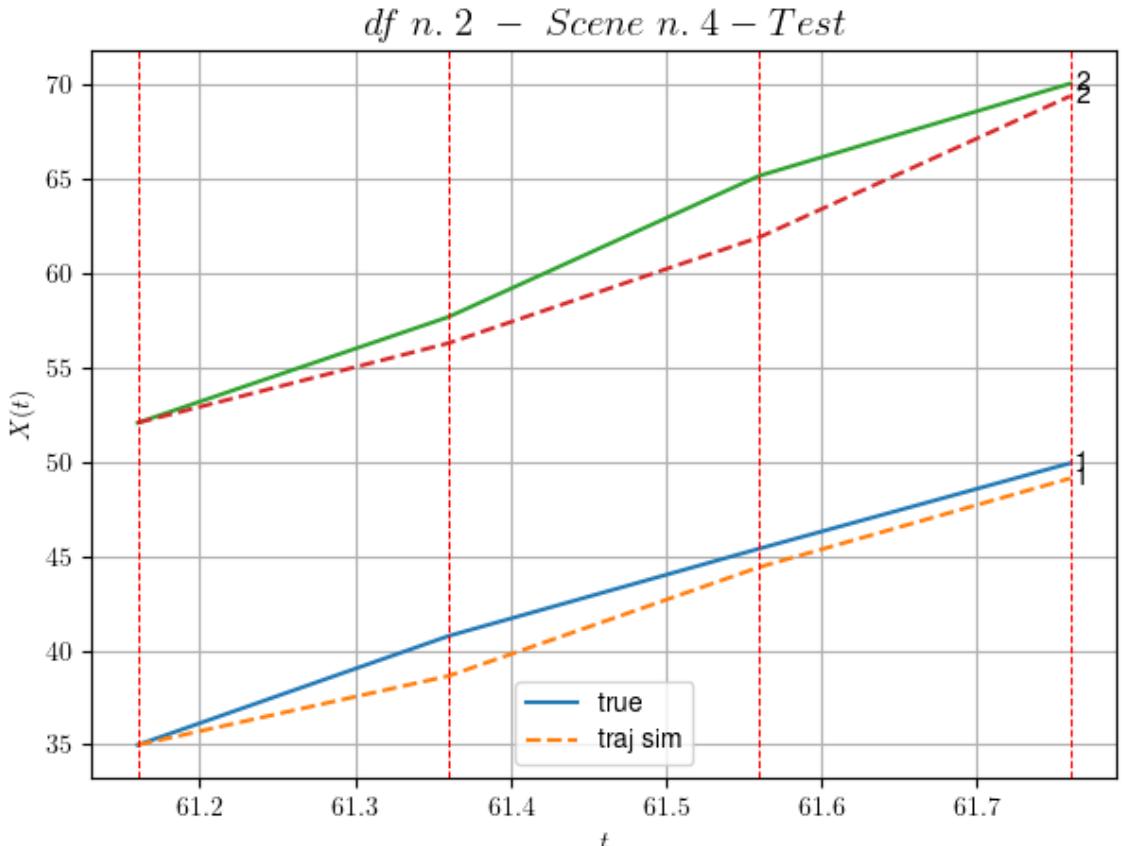


For scene 3/23:  
\* MSE = 0.7638290906336754

---

---

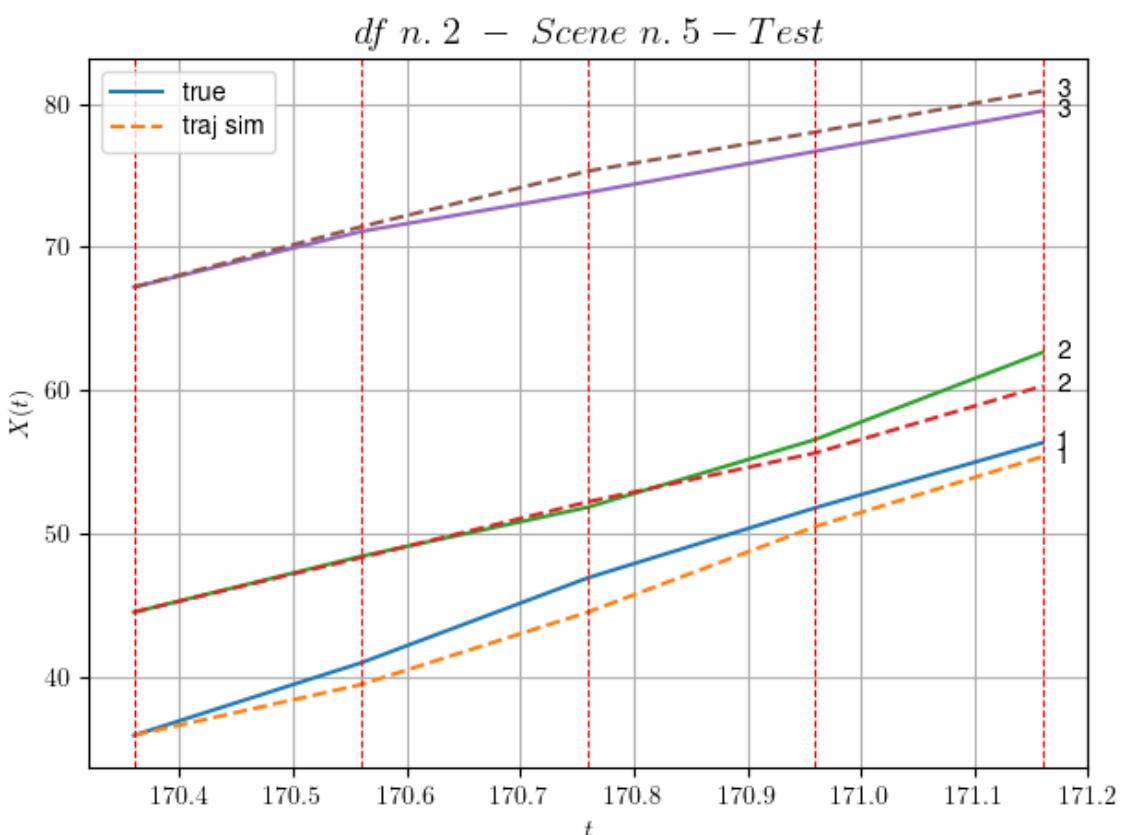
DataFrame n.2. Scene n.4/23



For scene 4/23:  
\* MSE = 2.3902721200964976

---

#### DataFrame n.2. Scene n.5/23

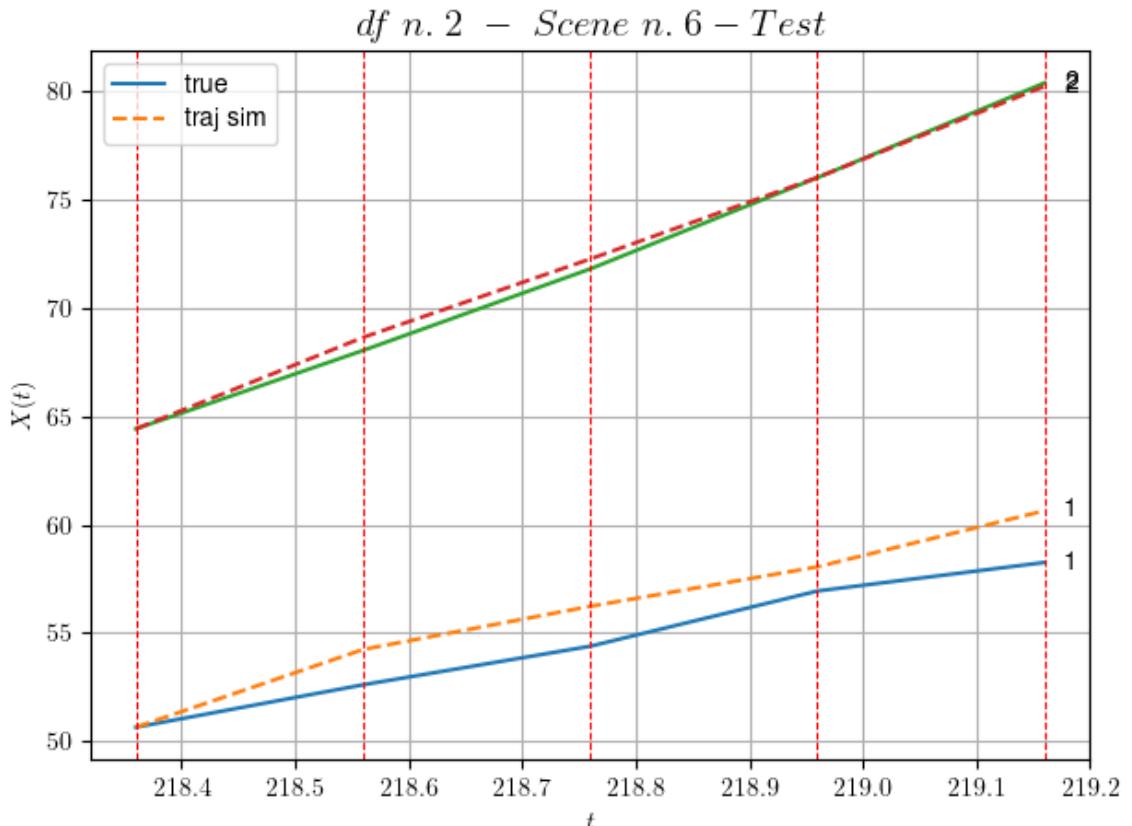


For scene 5/23:  
\* MSE = 1.5587960992769936

---

---

DataFrame n.2. Scene n.6/23

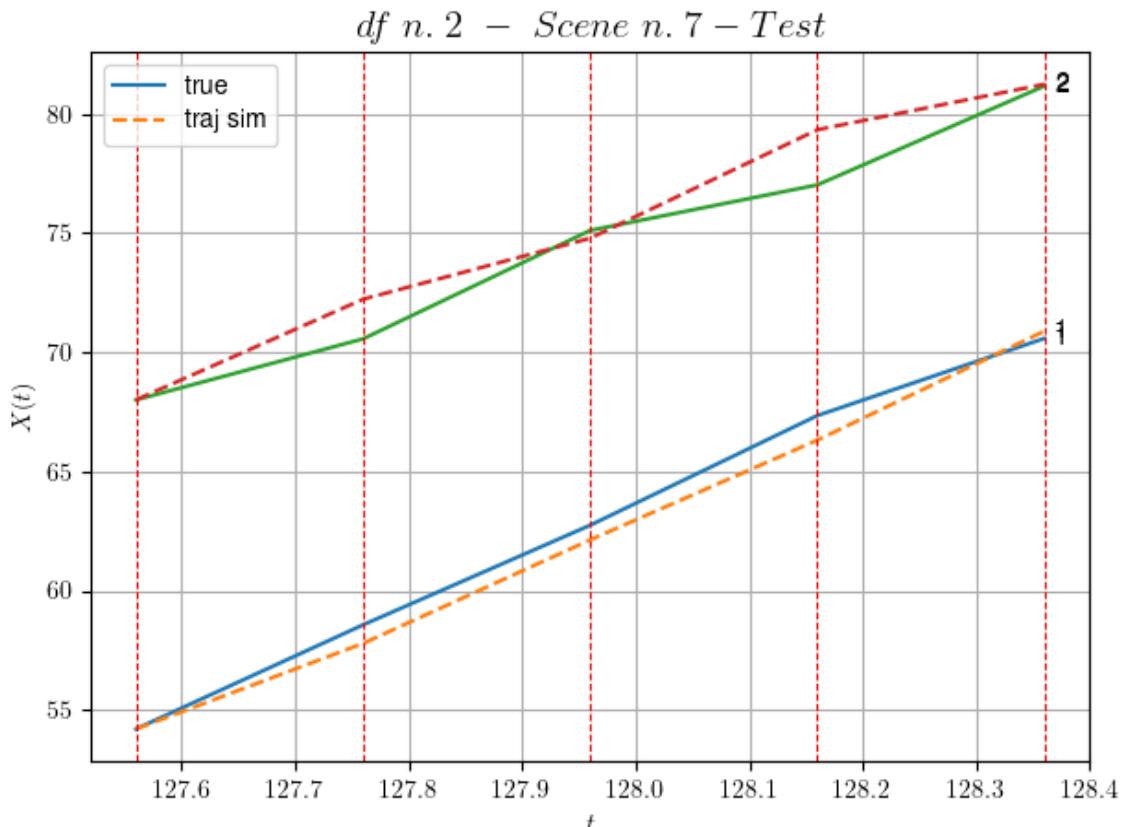


For scene 6/23:  
\* MSE = 1.3595468833010043

---

---

DataFrame n.2. Scene n.7/23

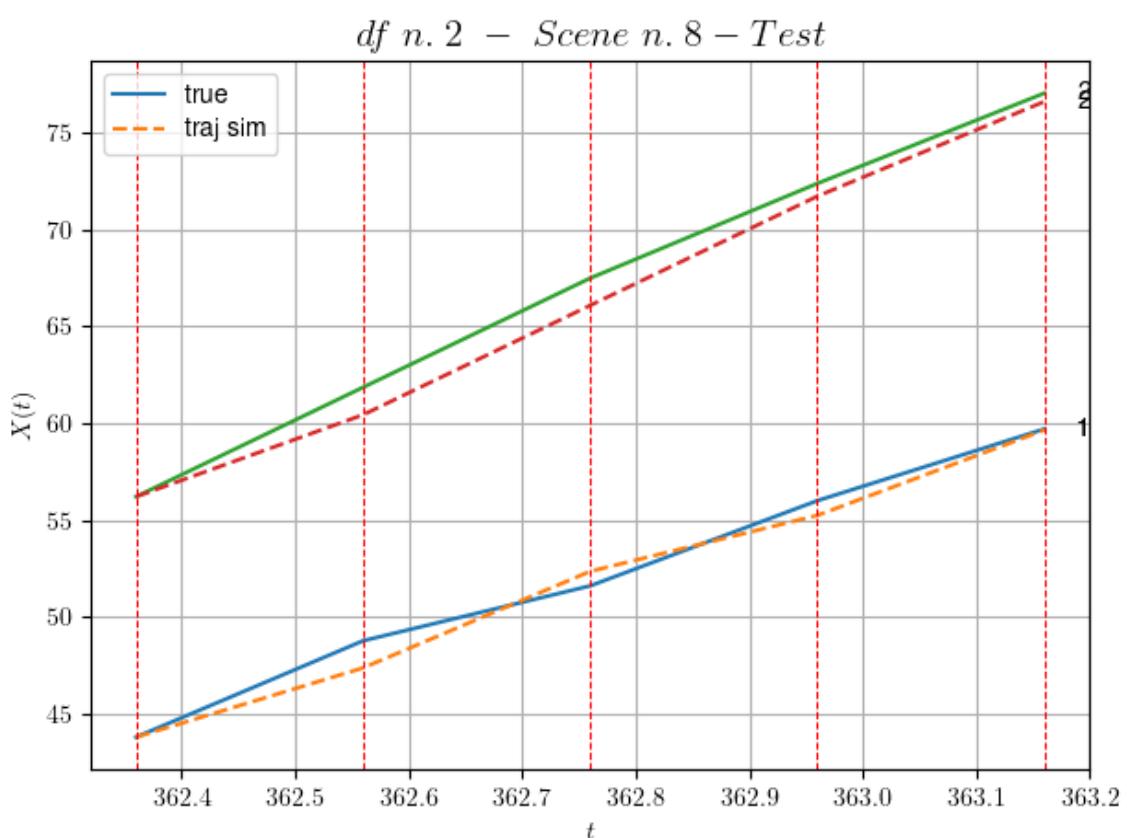


For scene 7/23:  
\* MSE = 1.0370305881512534

---

---

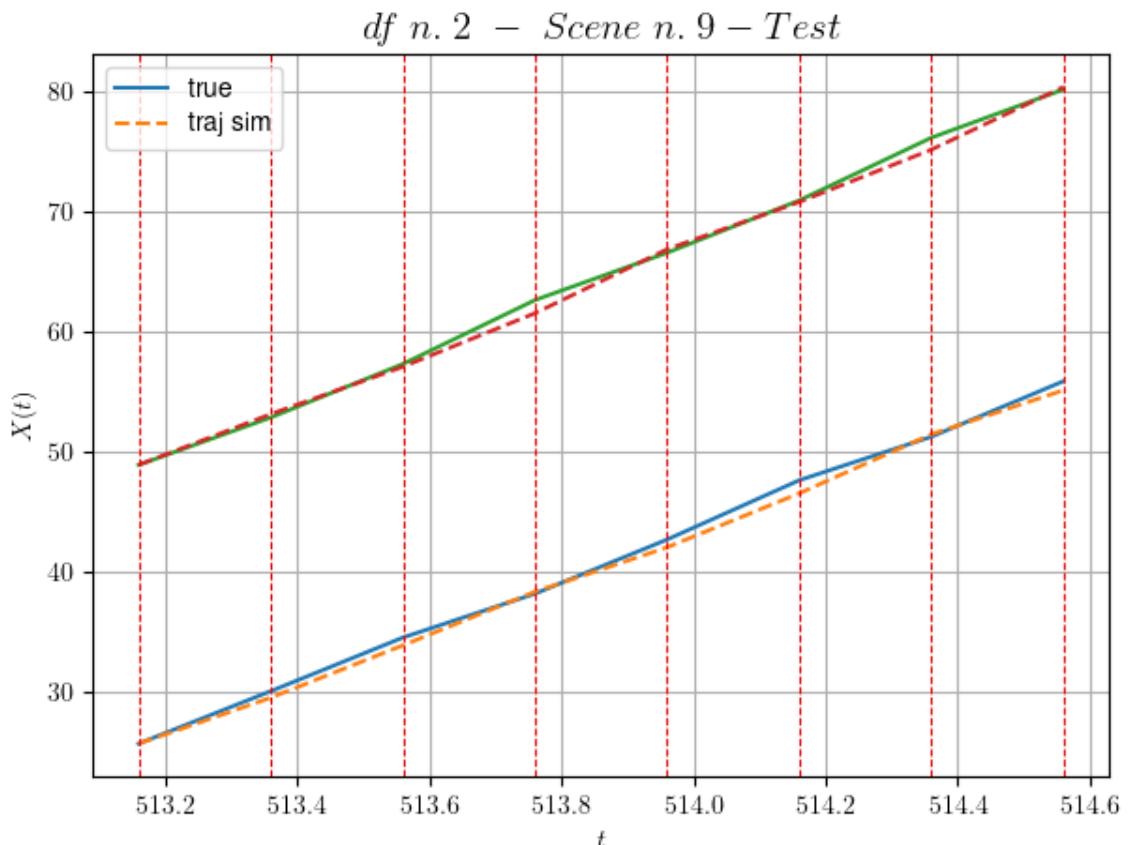
DataFrame n.2. Scene n.8/23



For scene 8/23:  
\* MSE = 0.7691822743347254

---

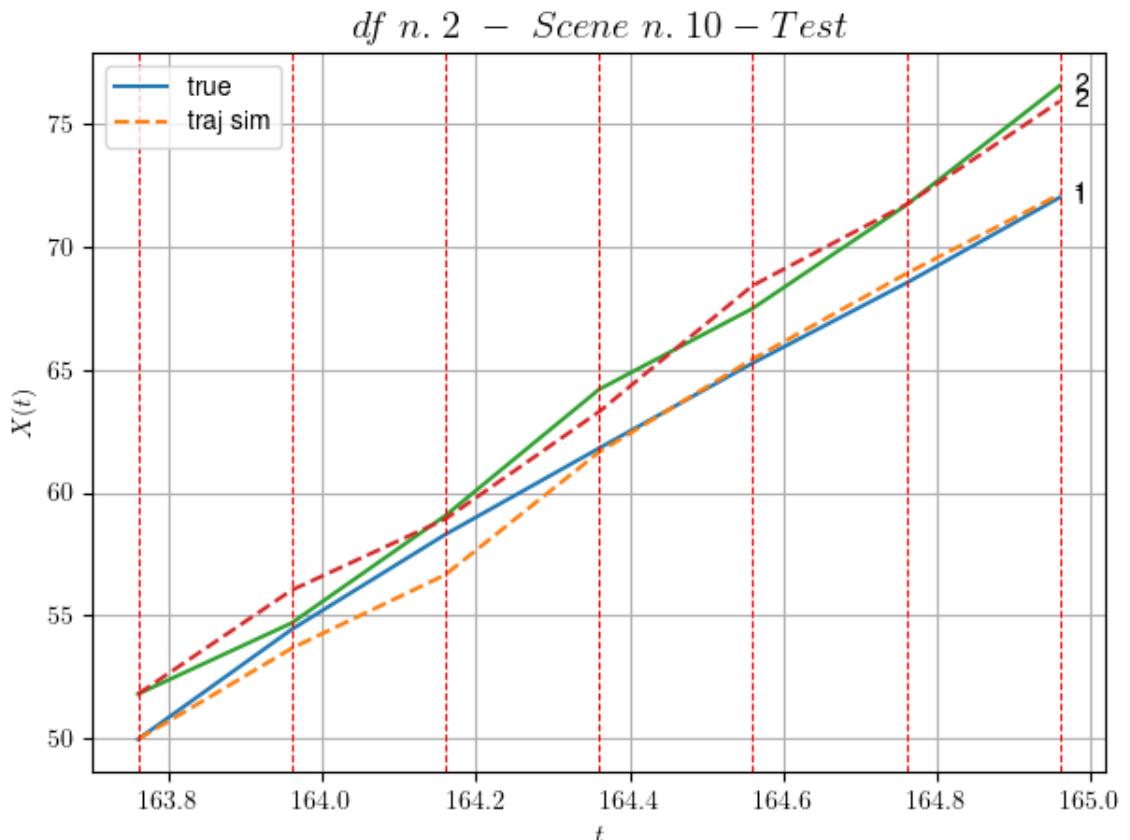
DataFrame n.2. Scene n.9/23



For scene 9/23:  
\* MSE = 0.33867579858235214

---

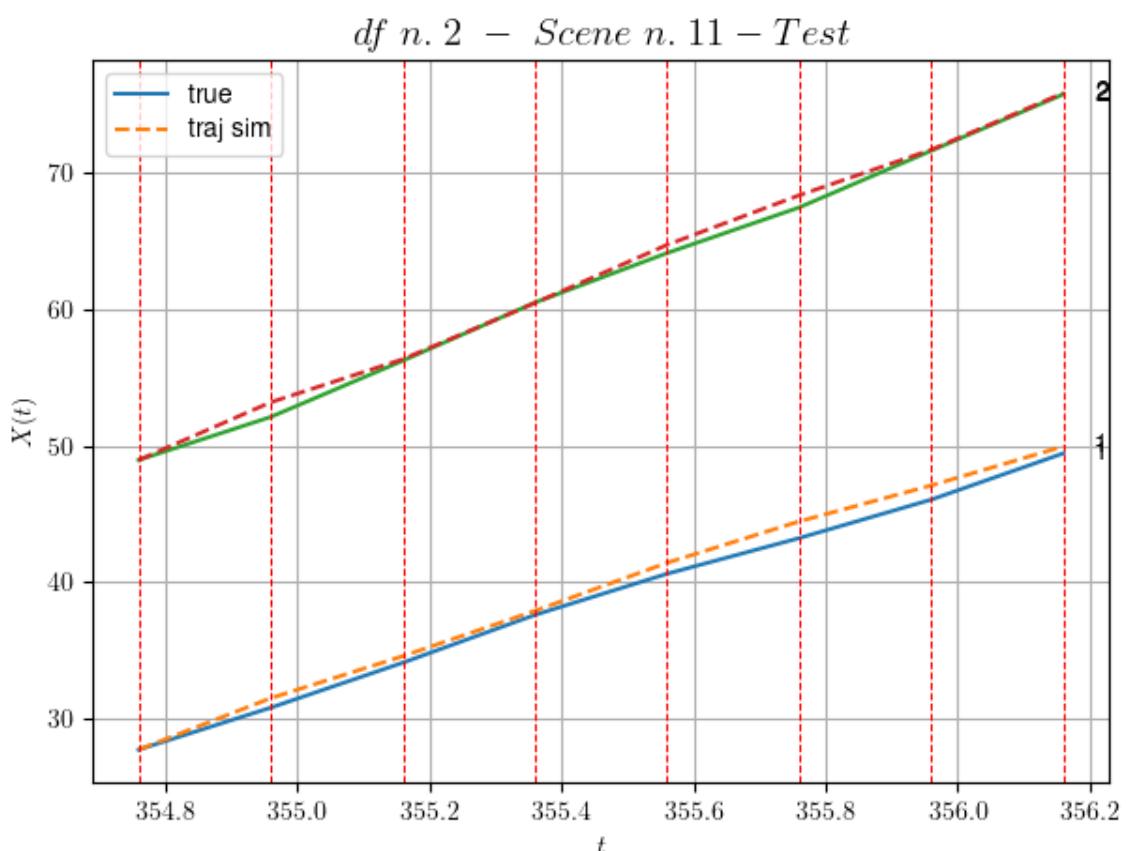
DataFrame n.2. Scene n.10/23



For scene 10/23:  
\* MSE = 0.5270400883993211

---

DataFrame n.2. Scene n.11/23

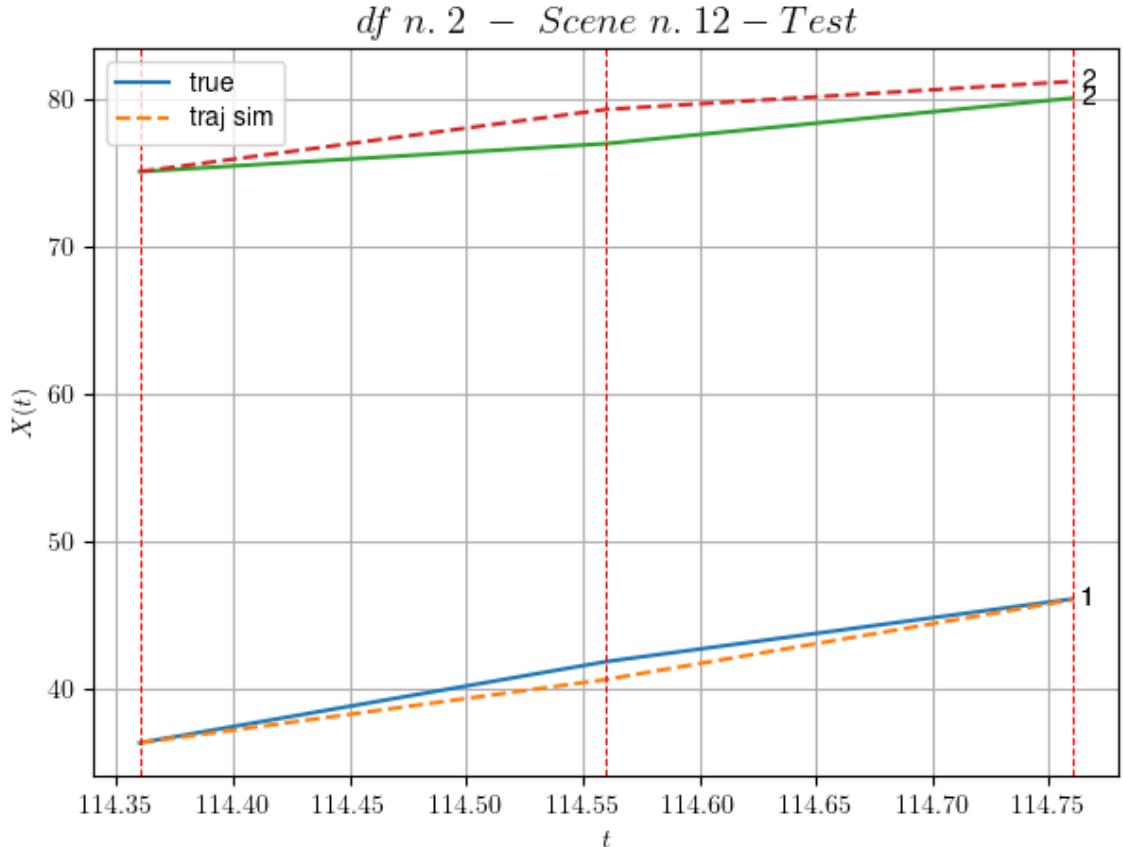


For scene 11/23:  
\* MSE = 0.41149552120385224

---

---

DataFrame n.2. Scene n.12/23

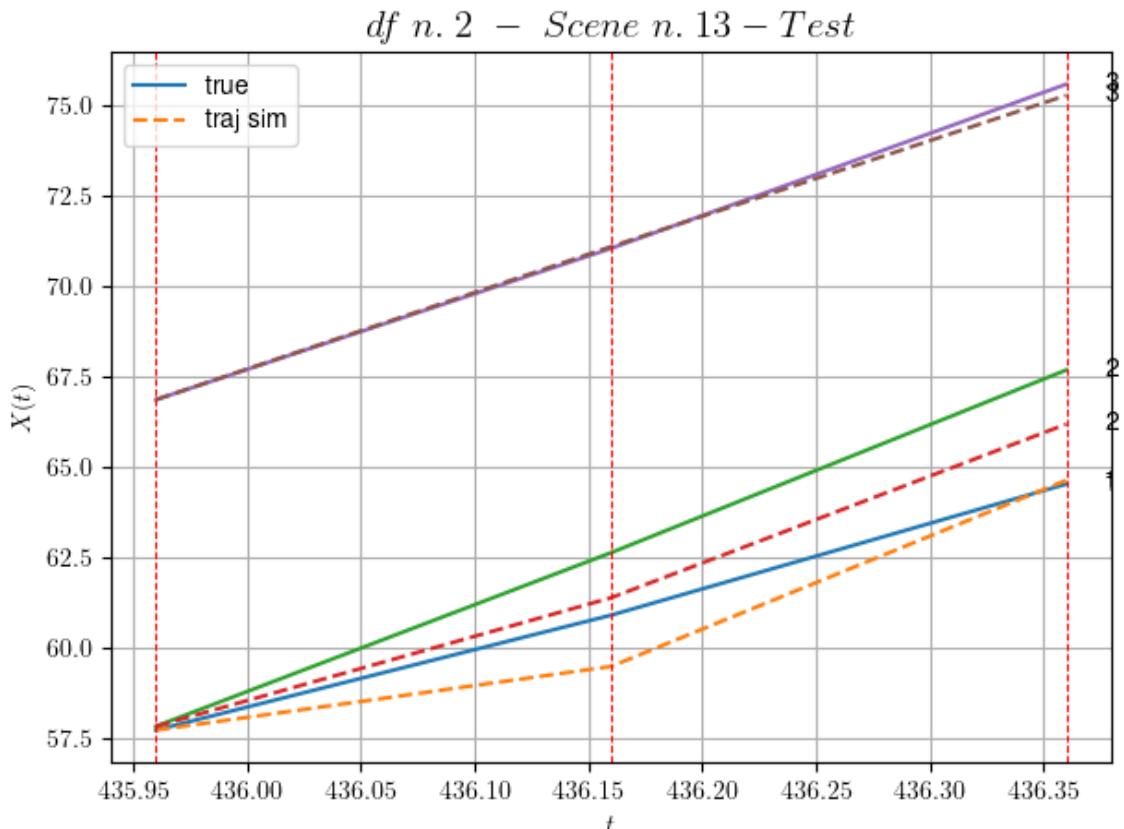


For scene 12/23:  
\* MSE = 1.3597823733358416

---

---

DataFrame n.2. Scene n.13/23

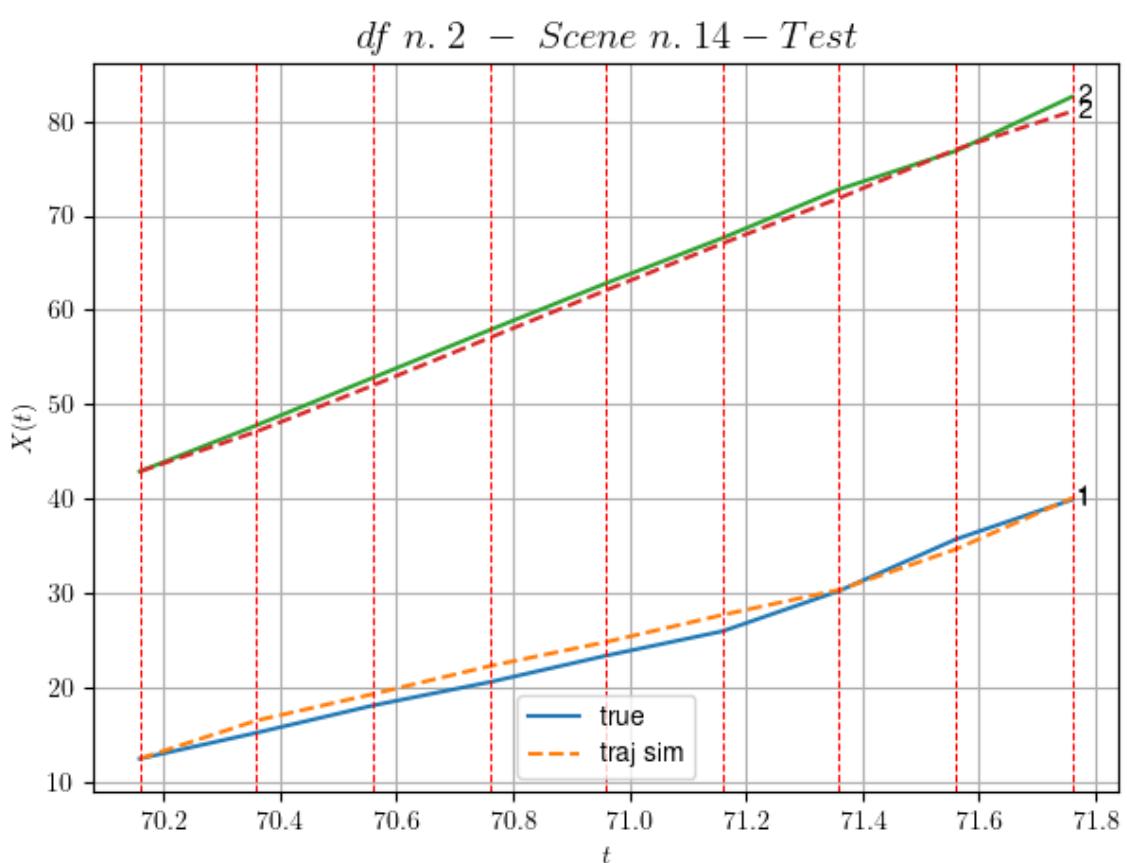


For scene 13/23:  
\* MSE = 0.6537048036771845

---

---

DataFrame n.2. Scene n.14/23

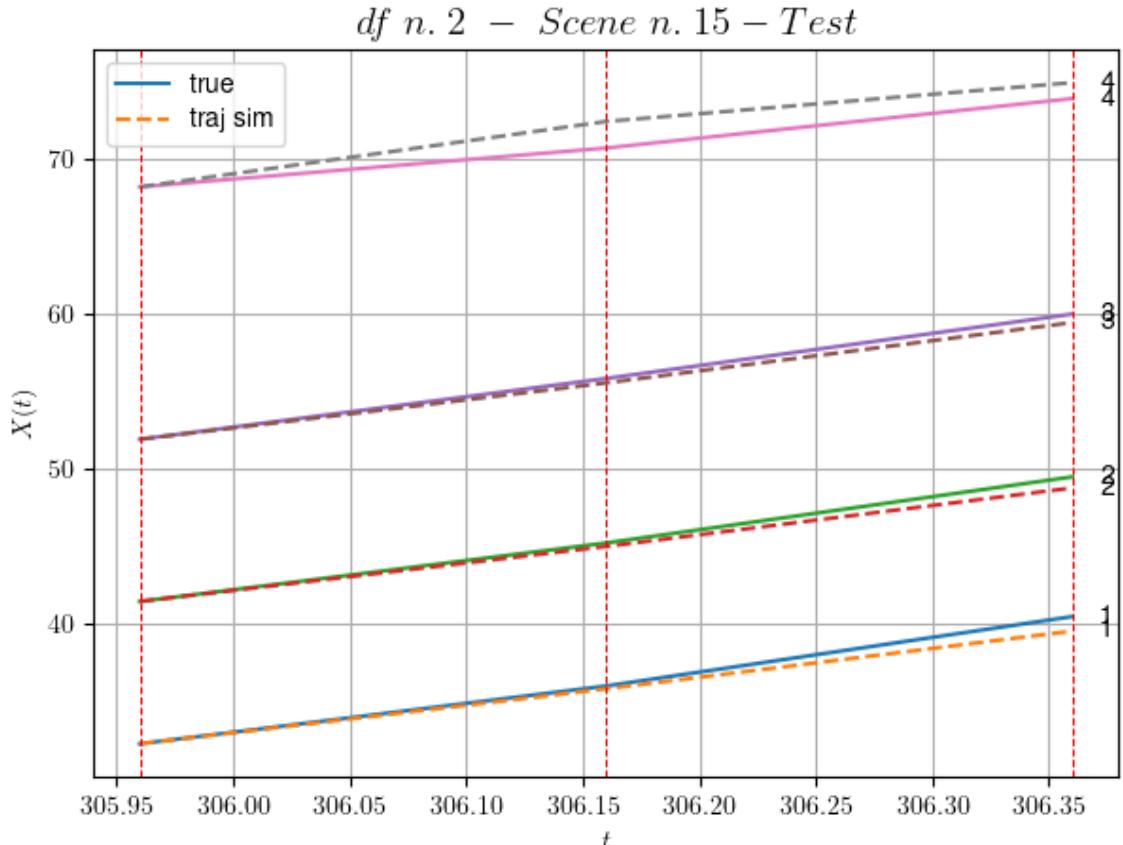


For scene 14/23:  
\* MSE = 1.014837509016476

---

---

DataFrame n.2. Scene n.15/23

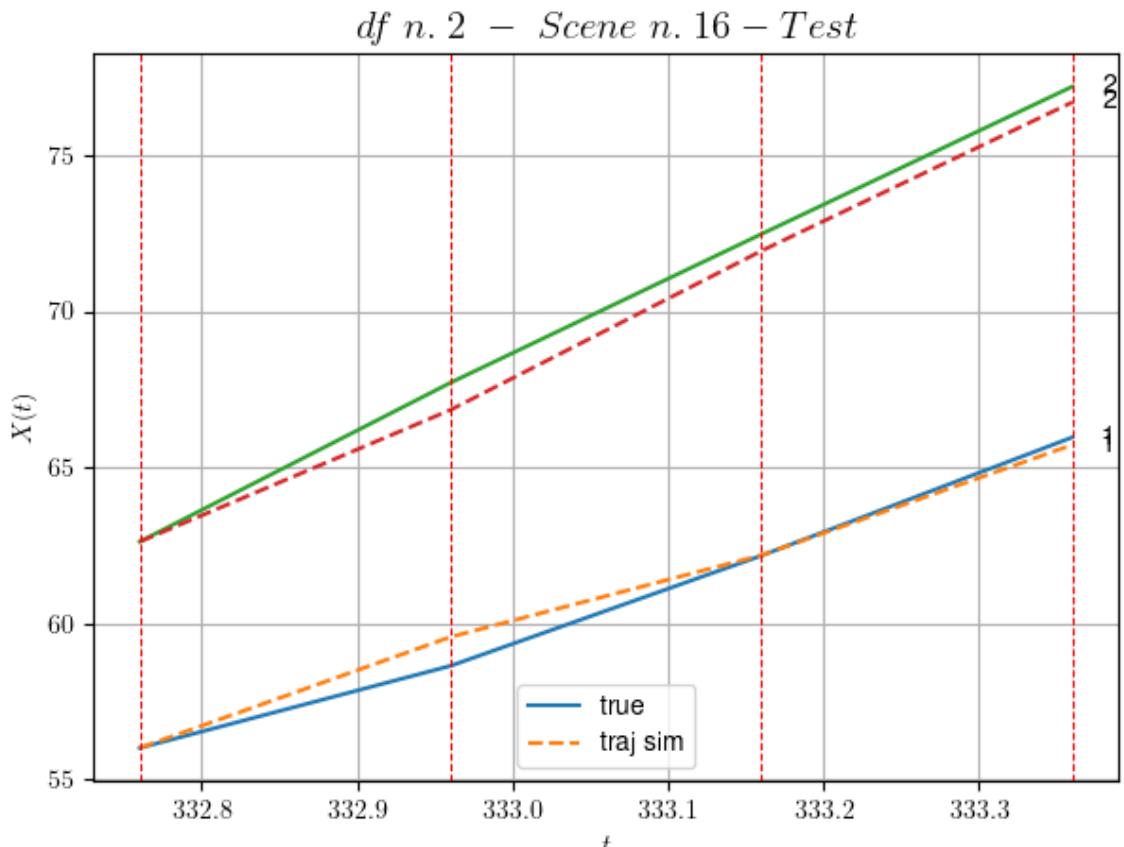


For scene 15/23:  
\* MSE = 0.48821389982044244

---

---

DataFrame n.2. Scene n.16/23

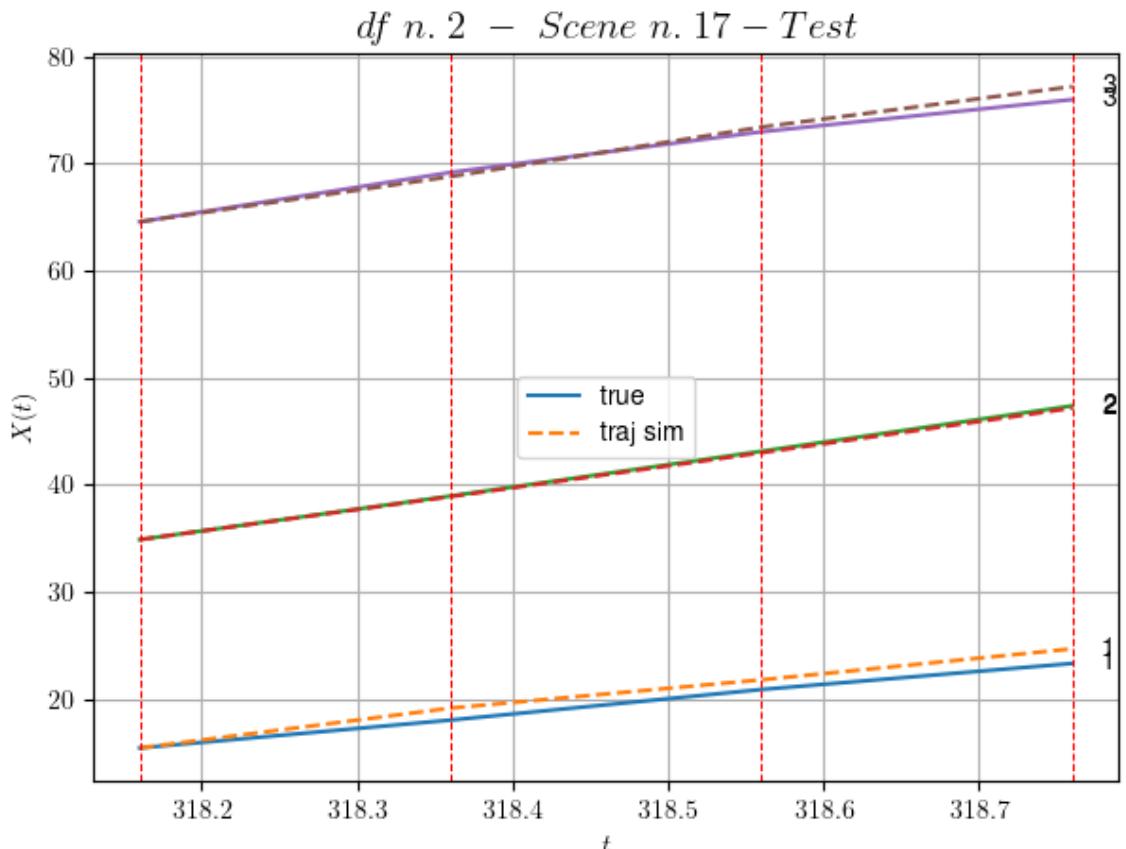


For scene 16/23:  
\* MSE = 0.27682185345627003

---

---

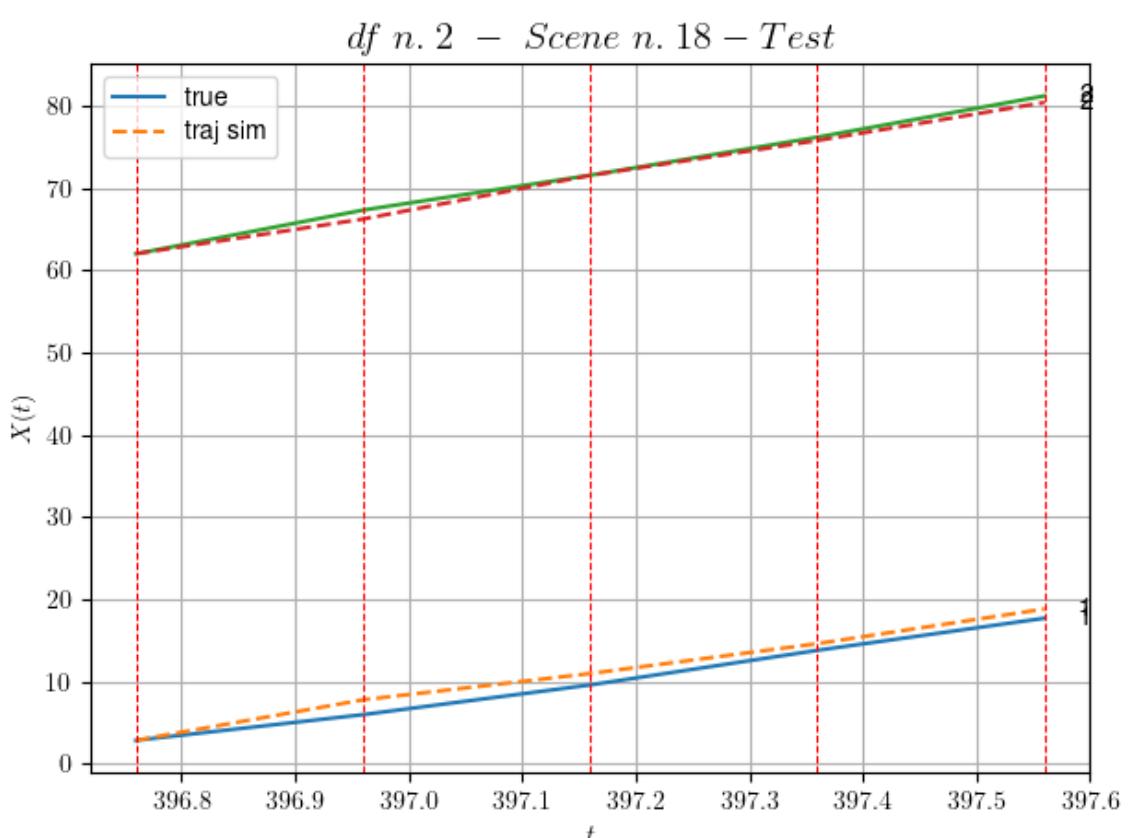
DataFrame n.2. Scene n.17/23



For scene 17/23:  
\* MSE = 0.4843605160392275

---

DataFrame n.2. Scene n.18/23

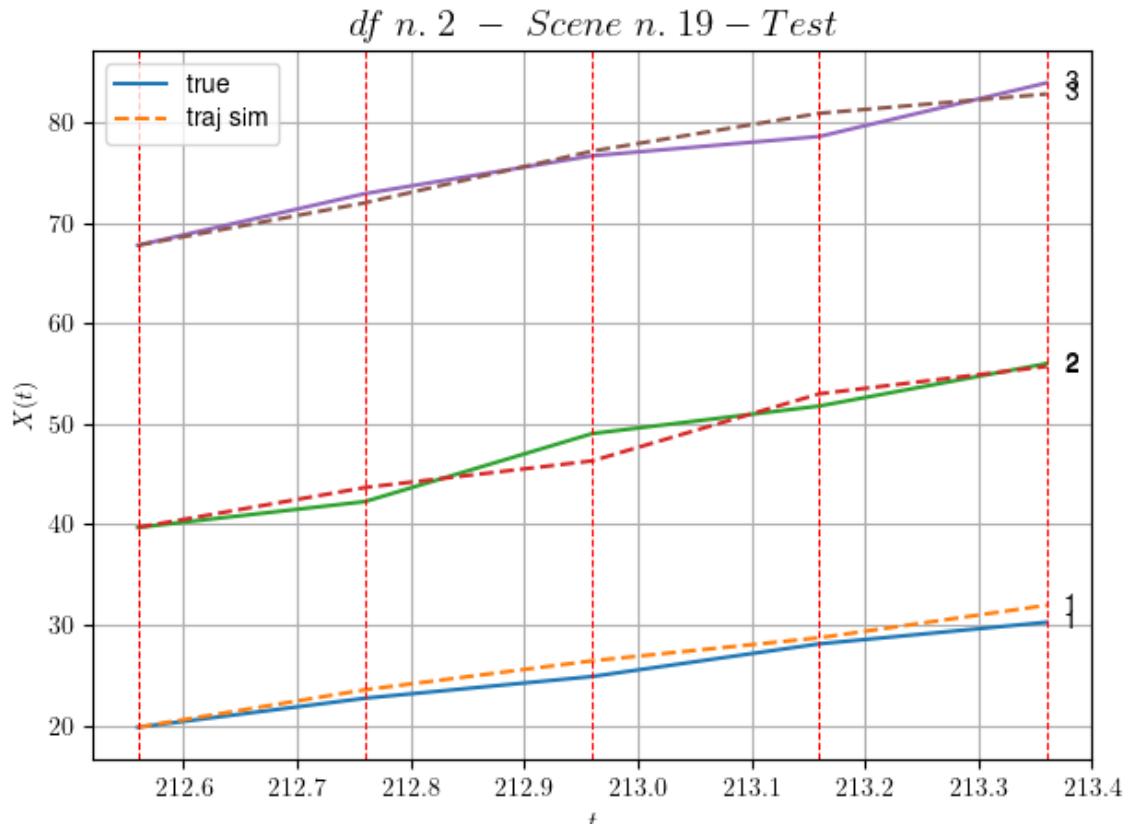


For scene 18/23:  
\* MSE = 0.9086616090658002

---

---

DataFrame n.2. Scene n.19/23

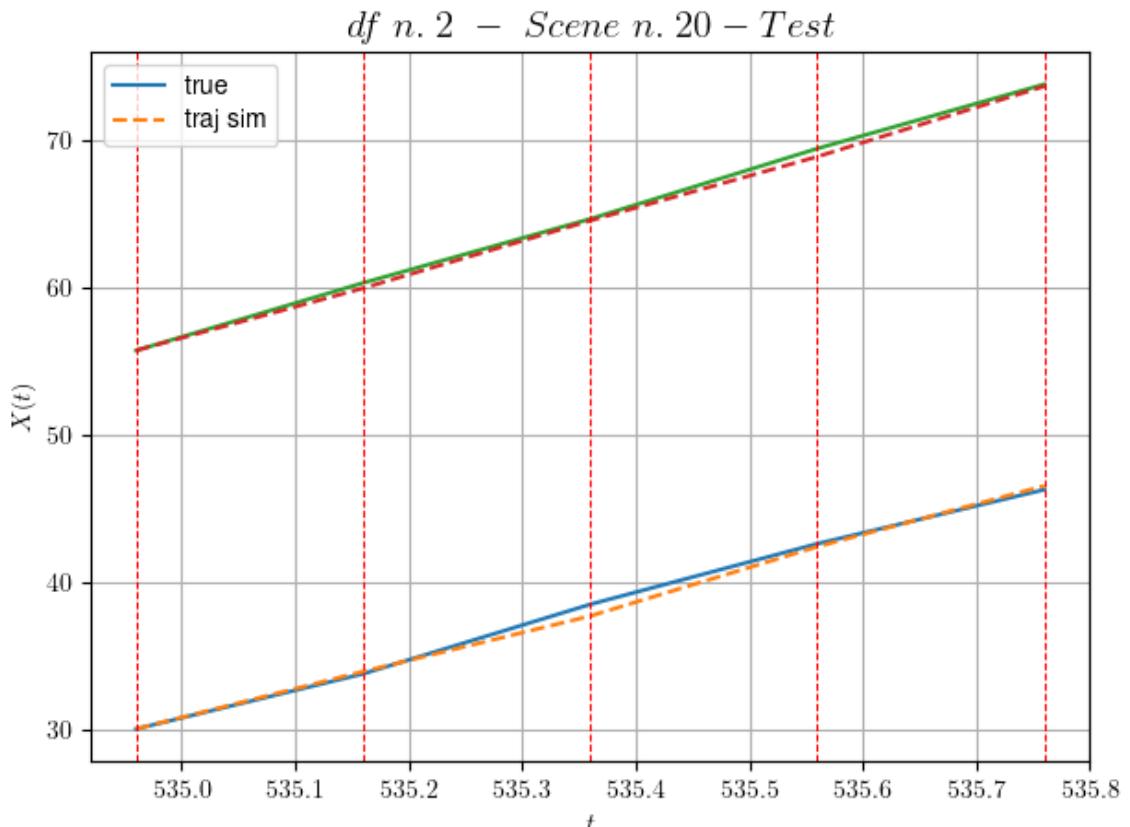


For scene 19/23:  
\* MSE = 1.6554837837661343

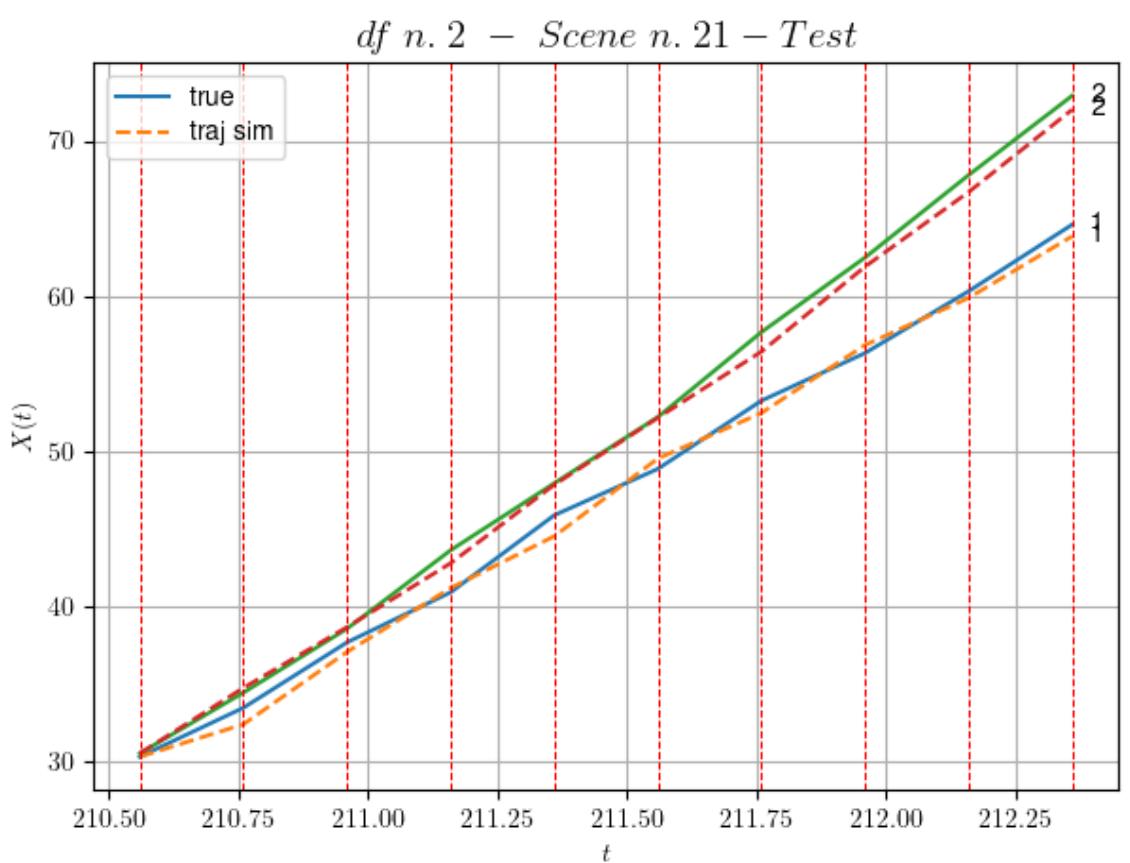
---

---

DataFrame n.2. Scene n.20/23



DataFrame n.2. Scene n.21/23

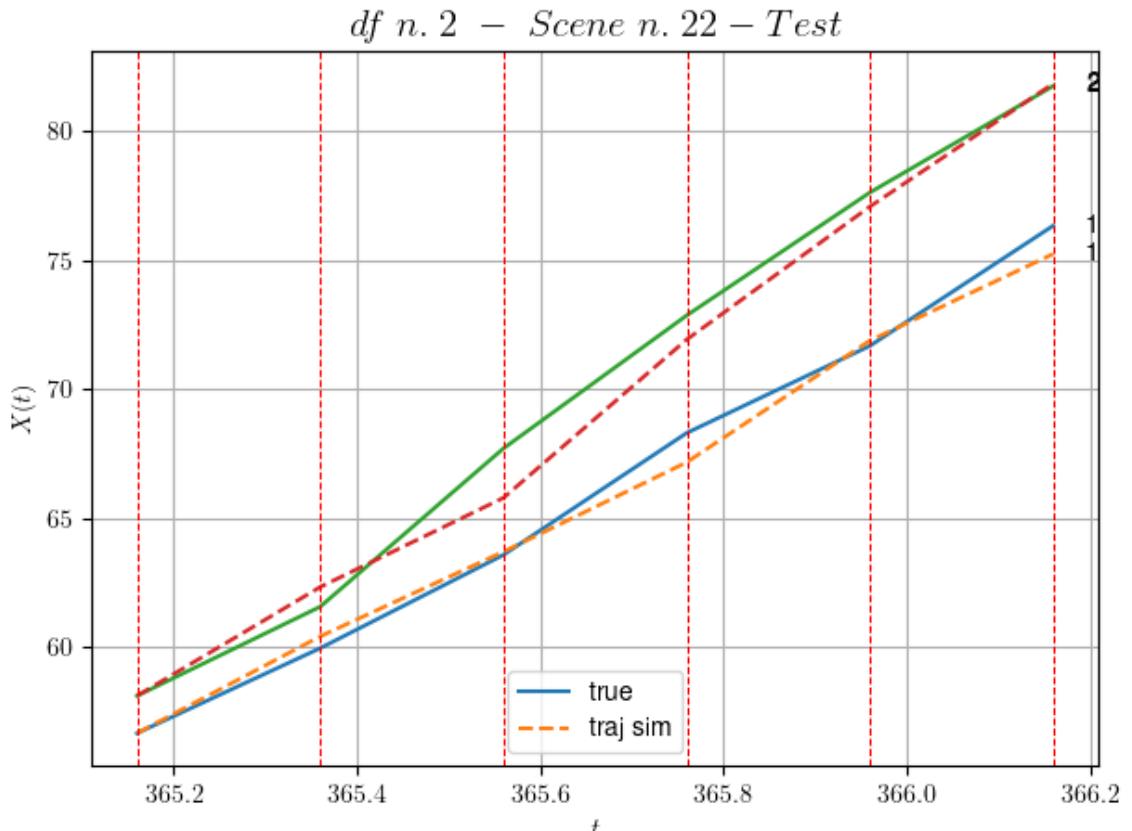


For scene 21/23:  
\* MSE = 0.5126402017100655

---

---

DataFrame n.2. Scene n.22/23

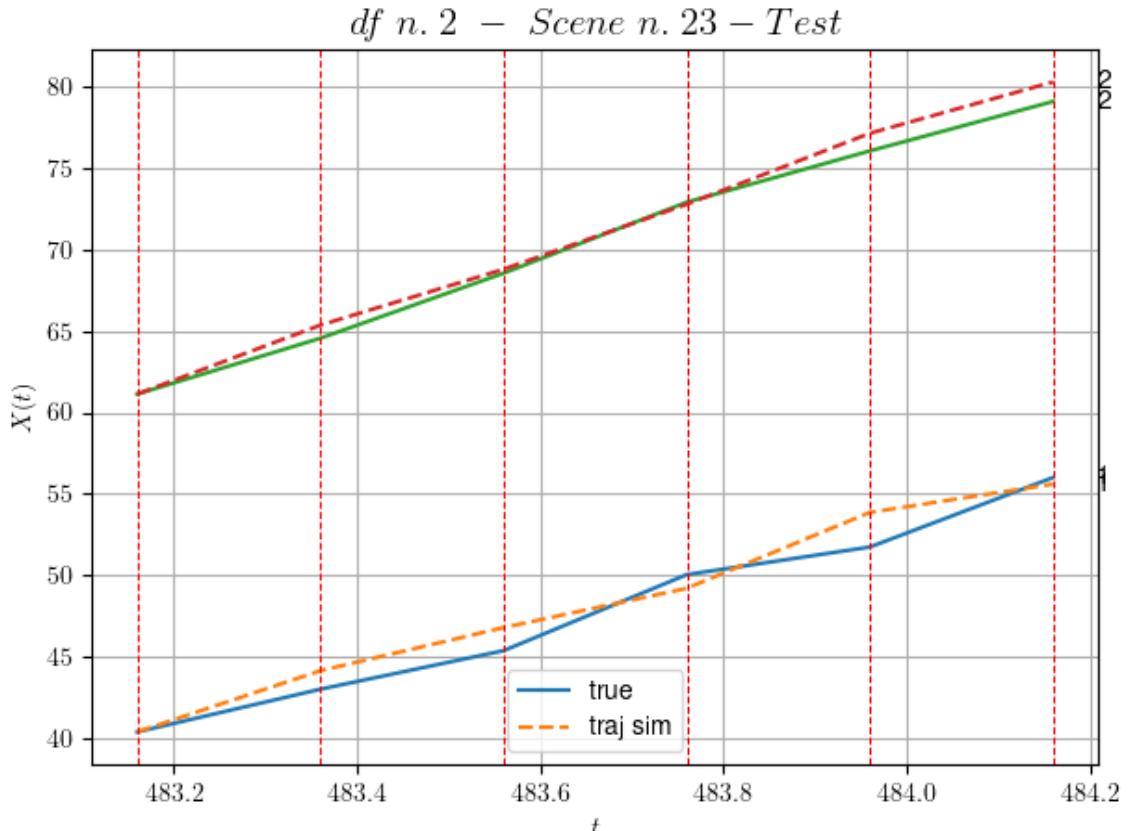


For scene 22/23:  
\* MSE = 0.683830397973103

---

---

DataFrame n.2. Scene n.23/23



For scene 23/23:  
 \* MSE = 0.9968802034549216

---

MSE test: 1.0643333470181997

---

Summing up:  
 \* MSE train: 4.425533195947605  
 \* MSE test: 1.0643333470181997

---

Analyzing 3/10 dfs.  
 In DataFrame n.3 we have 90 scenes.  
 To train the model we use 60 scenes, the remaining 30 to test the model.

Training step. (60 scenes)

---

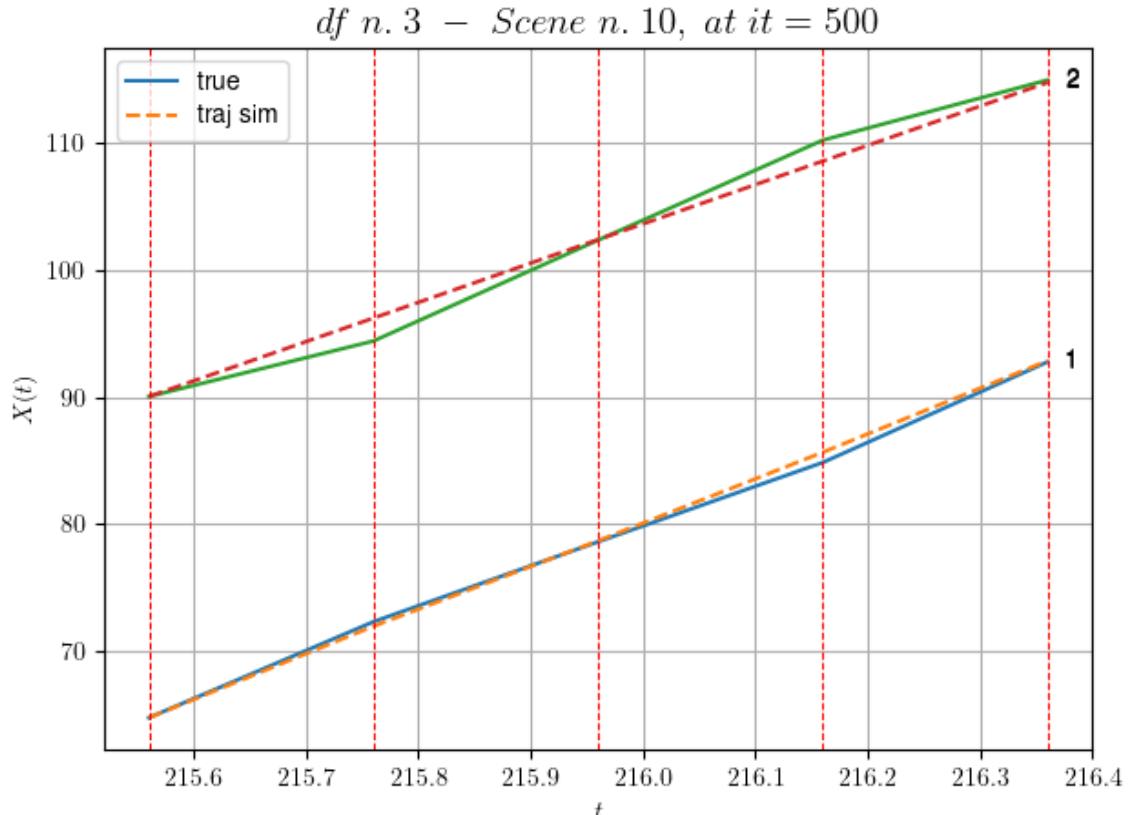


---

DataFrame n.3. Scene n.1/60

---

We have 4 time intervals inside [215.56, 216.36]



---

For scene 1/60:

- \* After LR finder:  $\text{LR\_NN}=1e-05$  with  $\text{mse}=0.8492704730252832$

at it=24

- \*  $v_0 = 30.84289726497002$
- \* MSE = 0.6775973415990167
- \* iterations = 500

---

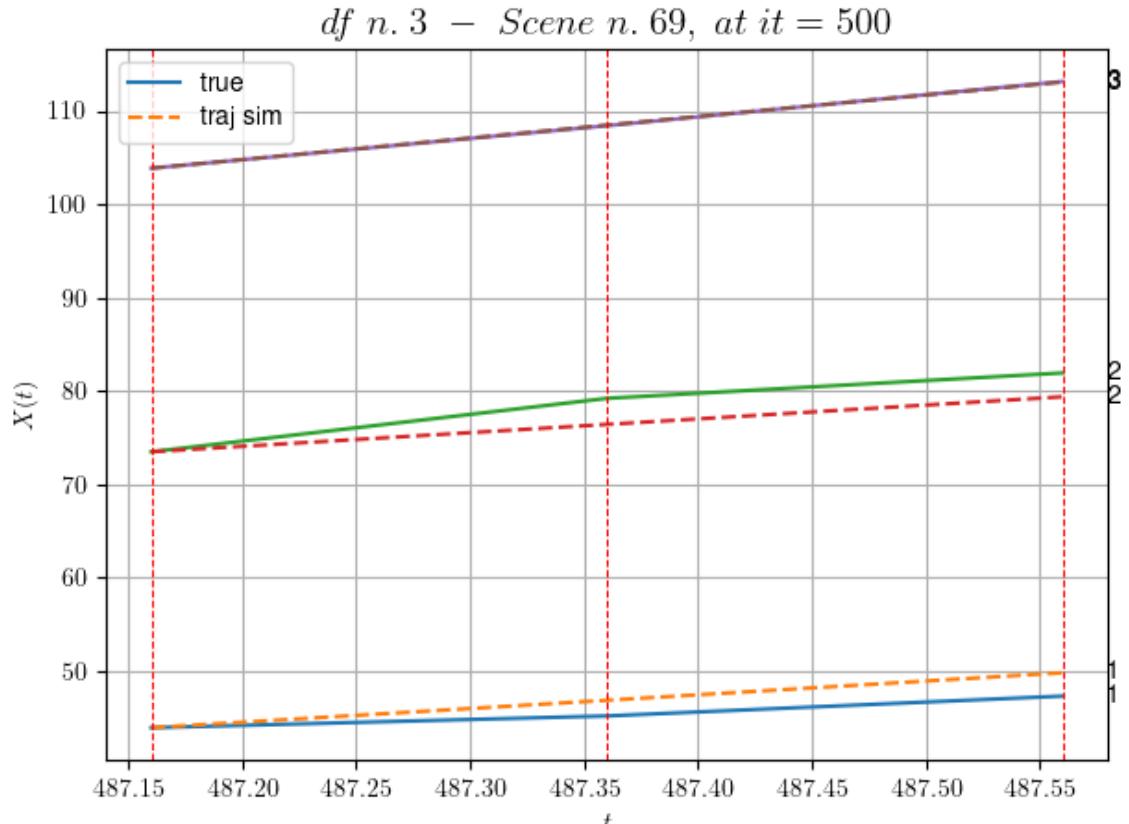
---

DataFrame n.3. Scene n.2/60

---

---

We have 2 time intervals inside [487.16, 487.56]

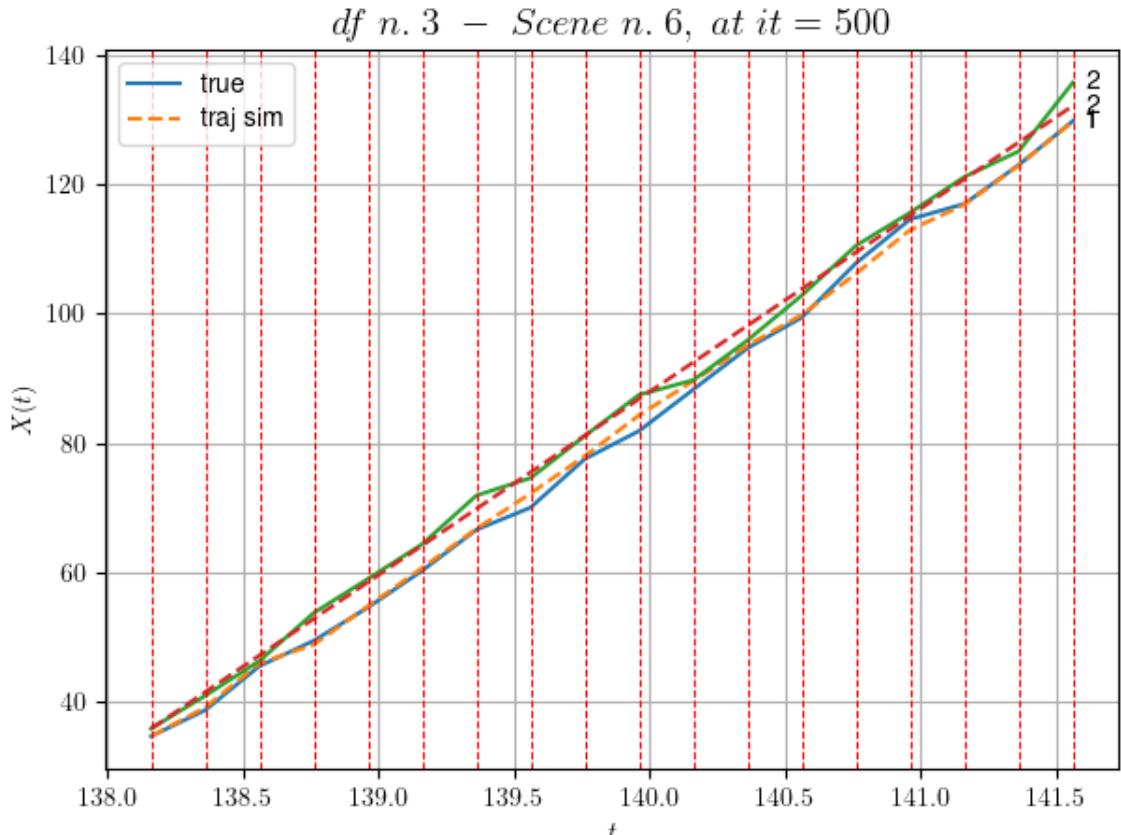


For scene 2/60:

\* After LR finder: LR\_NN=1e-05 with mse=3.864321777185793 at it=24  
\* v0 = 23.071831621686442  
\* MSE = 2.594547789353683  
\* iterations = 500

DataFrame n.3. Scene n.3/60

We have 17 time intervals inside [138.16,141.56]



---

For scene 3/60:

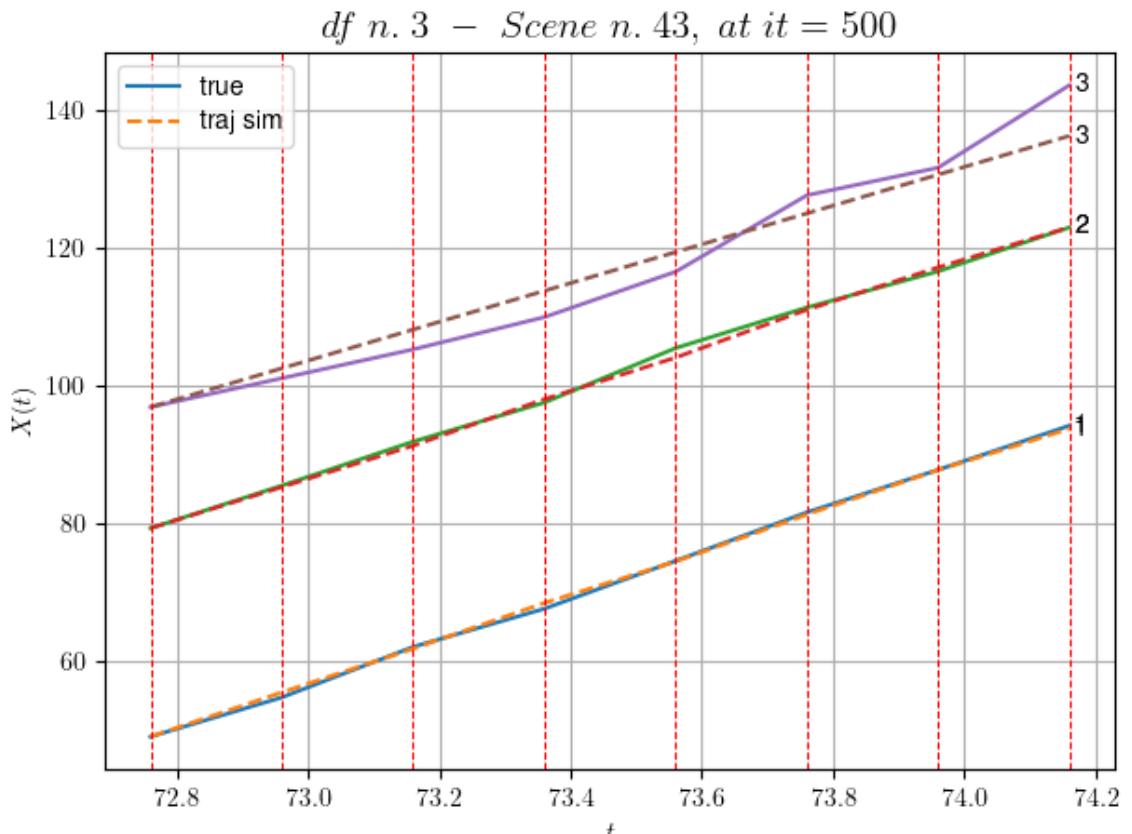
- \* After LR finder: LR\_NN=0.001 with mse=8.766987713882047 at it=24
- \* v0 = 28.318639127967728
- \* MSE = 1.5773022065046458
- \* iterations = 500

---

DataFrame n.3. Scene n.4/60

---

We have 7 time intervals inside [72.76,74.16]



---

For scene 4/60:

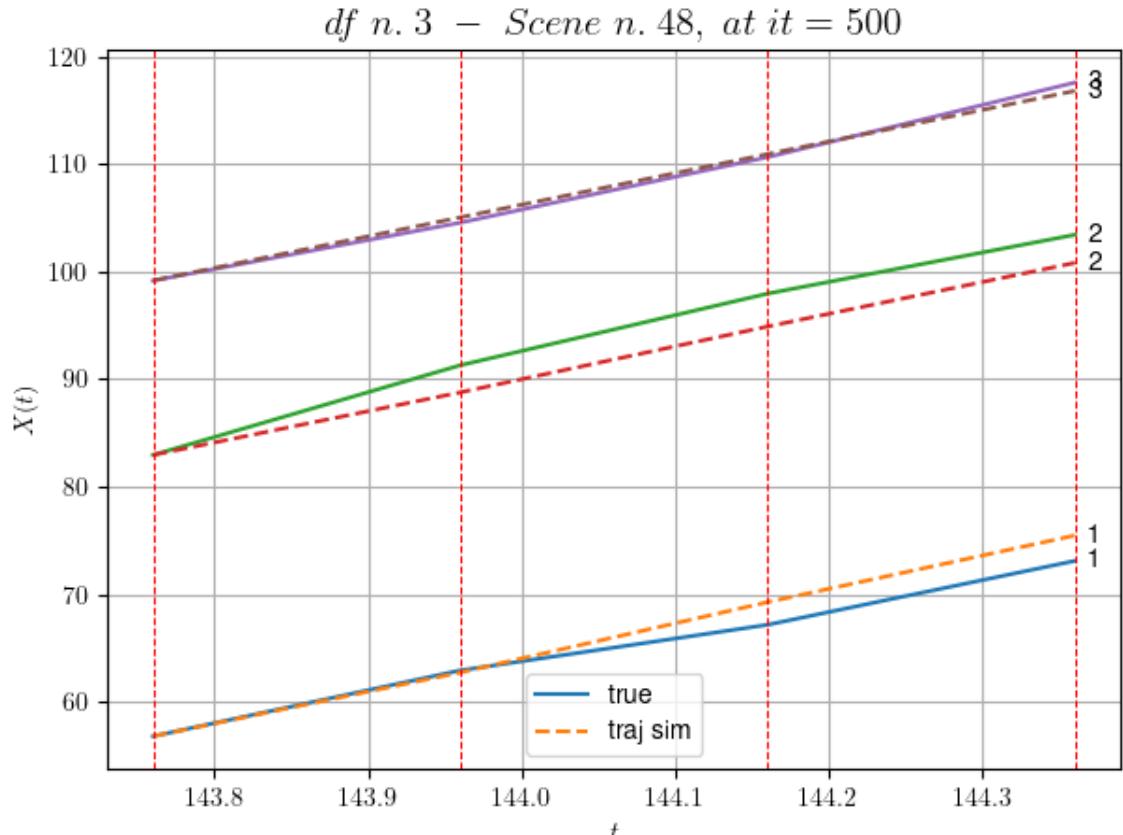
- \* After LR finder: LR\_NN=0.0005 with mse=43.77296992175758
- at it=24
- \* v0 = 28.121240263140205
- \* MSE = 4.153882897468465
- \* iterations = 500

---

DataFrame n.3. Scene n.5/60

---

We have 3 time intervals inside [143.76,144.36]

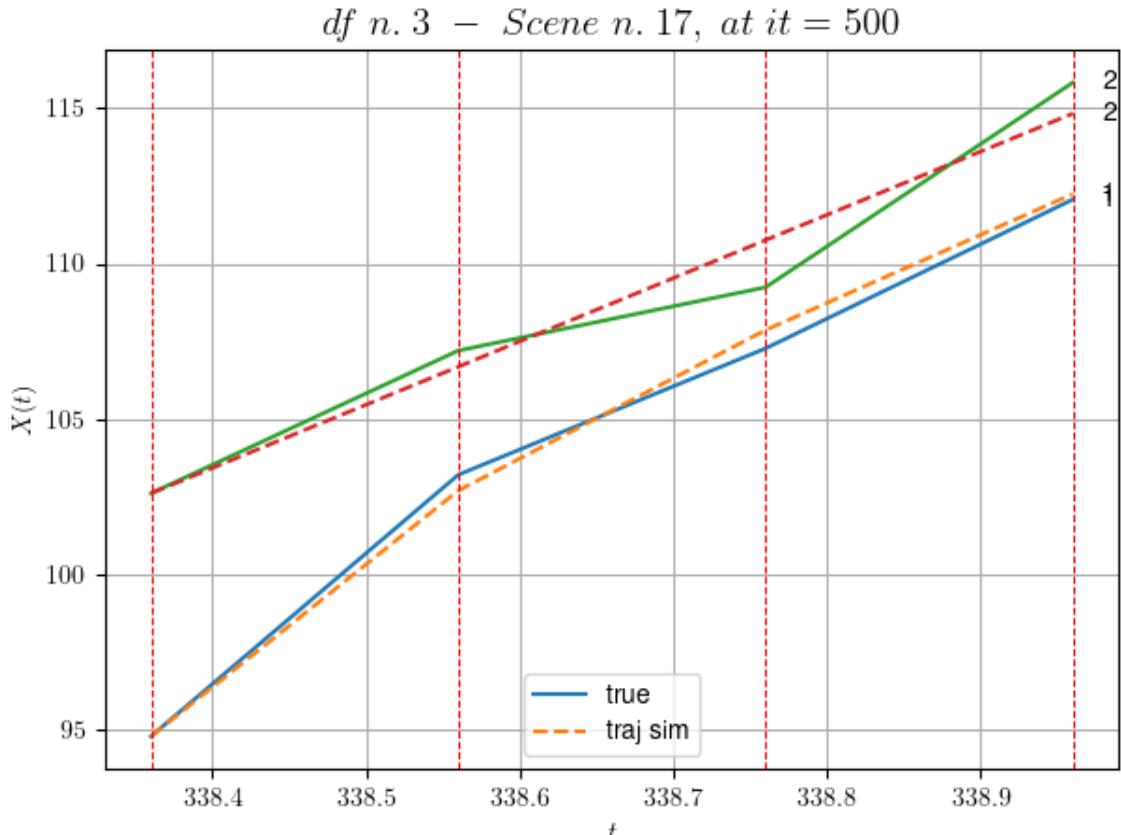


For scene 5/60:

\* After LR finder: LR\_NN=5e-05 with mse=16.644787196244533  
at it=24  
\* v0 = 29.414744463246628  
\* MSE = 1.9985656418612183  
\* iterations = 500

DataFrame n.3. Scene n.6/60

We have 3 time intervals inside [338.36,338.96]



---

For scene 6/60:

- \* After LR finder: LR\_NN=0.0005 with mse=6.9871320778940245

at it=24

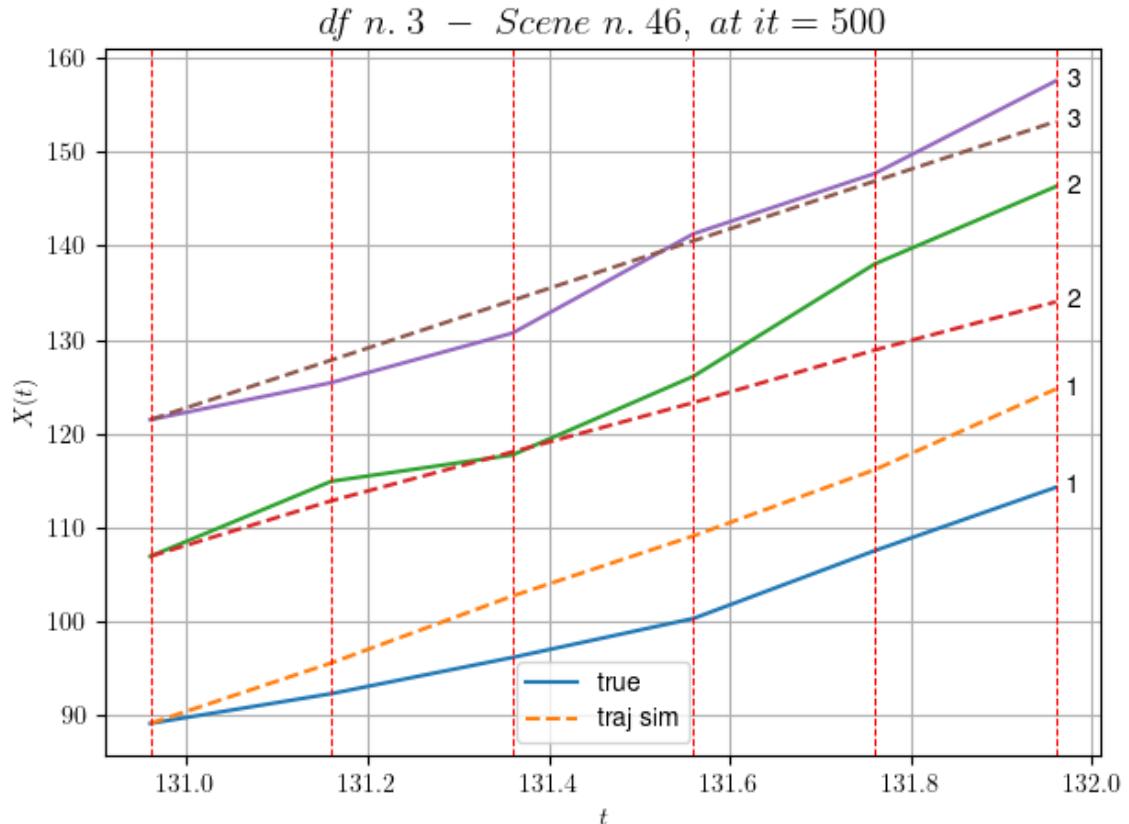
- \* v0 = 20.358070226673096
- \* MSE = 0.525326377614261
- \* iterations = 500

---

DataFrame n.3. Scene n.7/60

---

We have 5 time intervals inside [130.96,131.96]

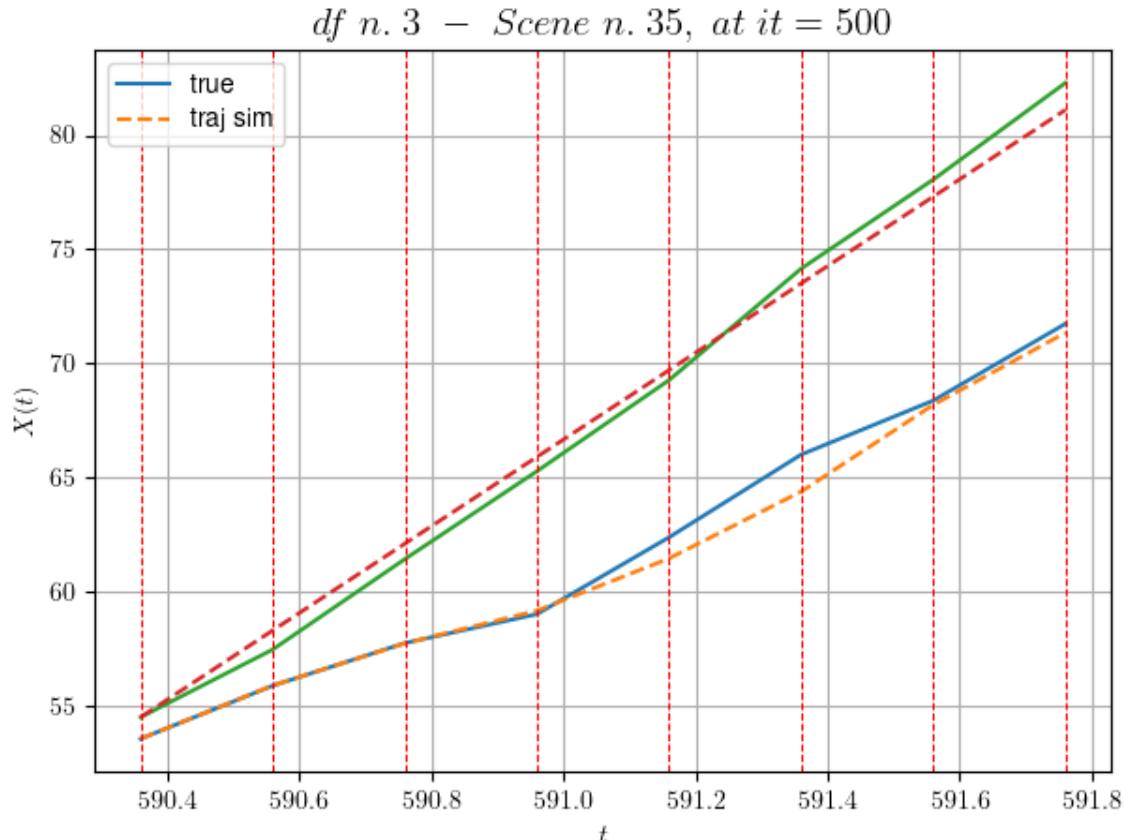


For scene 7/60:

\* After LR finder: LR\_NN=0.0001 with mse=56.180770905113555  
at it=24  
\*  $v_0 = 31.75233788512409$   
\* MSE = 33.305751139112694  
\* iterations = 500

DataFrame n.3. Scene n.8/60

We have 7 time intervals inside [590.36, 591.76]



---

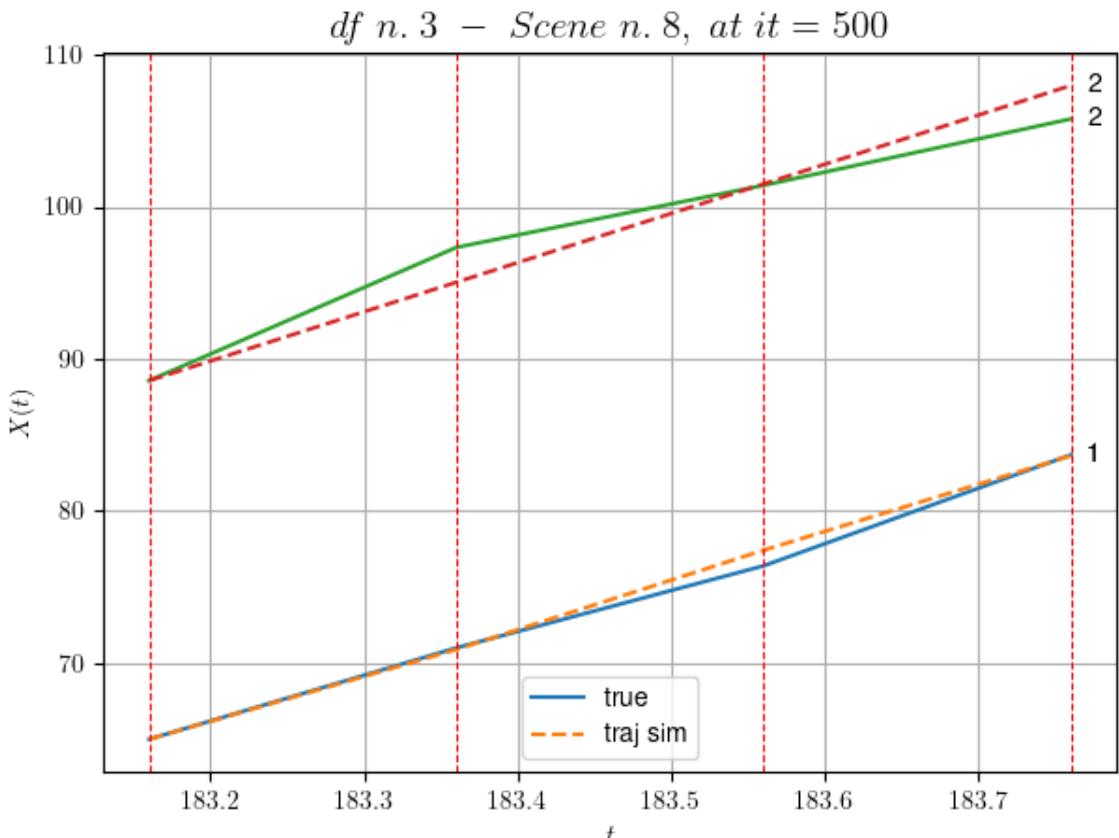
For scene 8/60:  
\* After LR finder: LR\_NN=0.005 with mse=39.760500415304406  
at it=24  
\* v0 = 19.035476639426857  
\* MSE = 0.3167994789464795  
\* iterations = 500

---

DataFrame n.3. Scene n.9/60

---

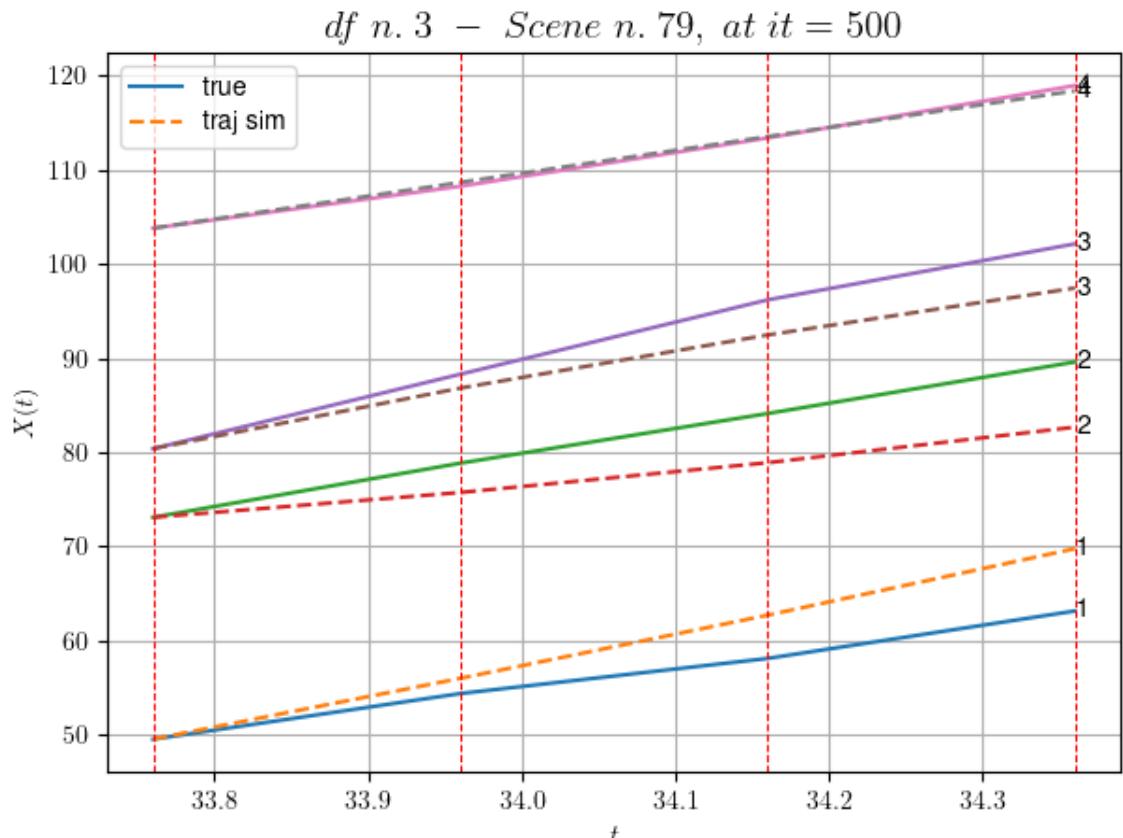
We have 3 time intervals inside [183.16,183.76]



For scene 9/60:  
\* After LR finder: LR\_NN=1e-05 with mse=1.23836054200711 at  
it=24  
\* v0 = 32.313983310469524  
\* MSE = 1.334597837384571  
\* iterations = 500

DataFrame n.3. Scene n.10/60

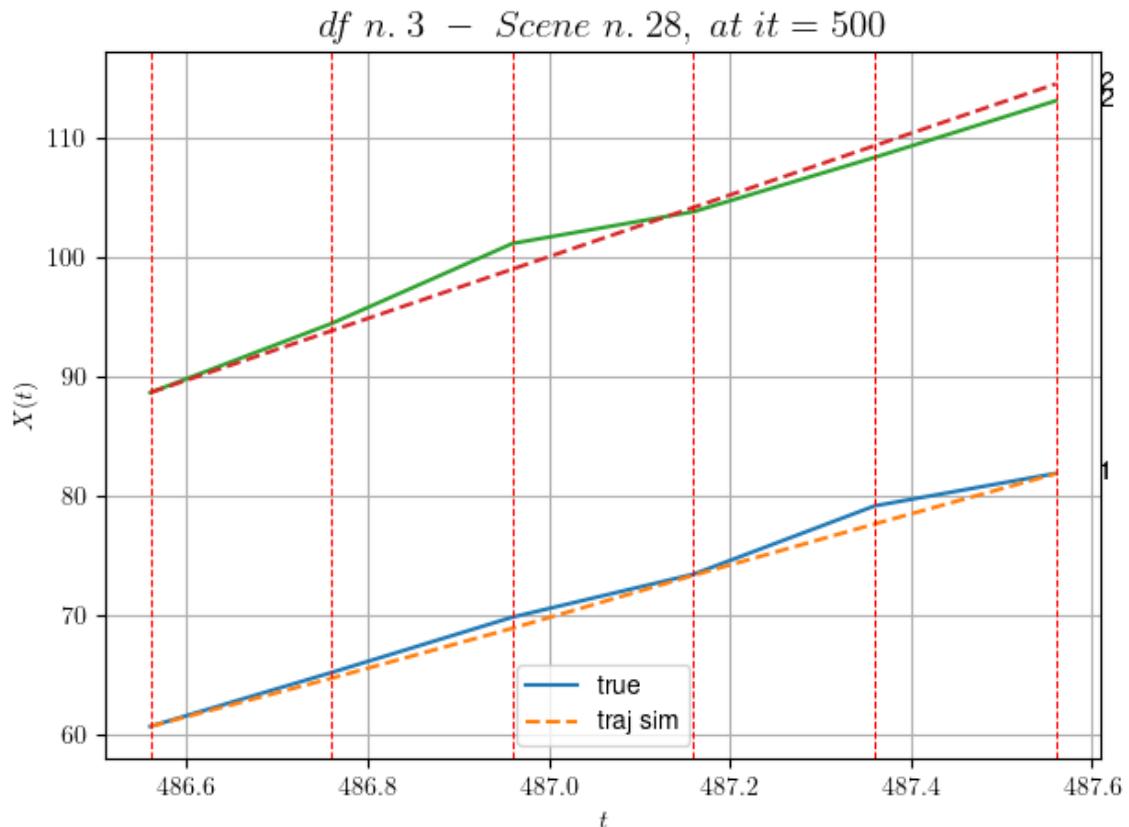
We have 3 time intervals inside [33.76,34.36]



-----  
For scene 10/60:  
\* After LR finder: LR\_NN=5e-05 with mse=14.451624272408136  
at it=24  
\* v0 = 24.31564748296743  
\* MSE = 11.93432513901914  
\* iterations = 500  
-----

DataFrame n.3. Scene n.11/60

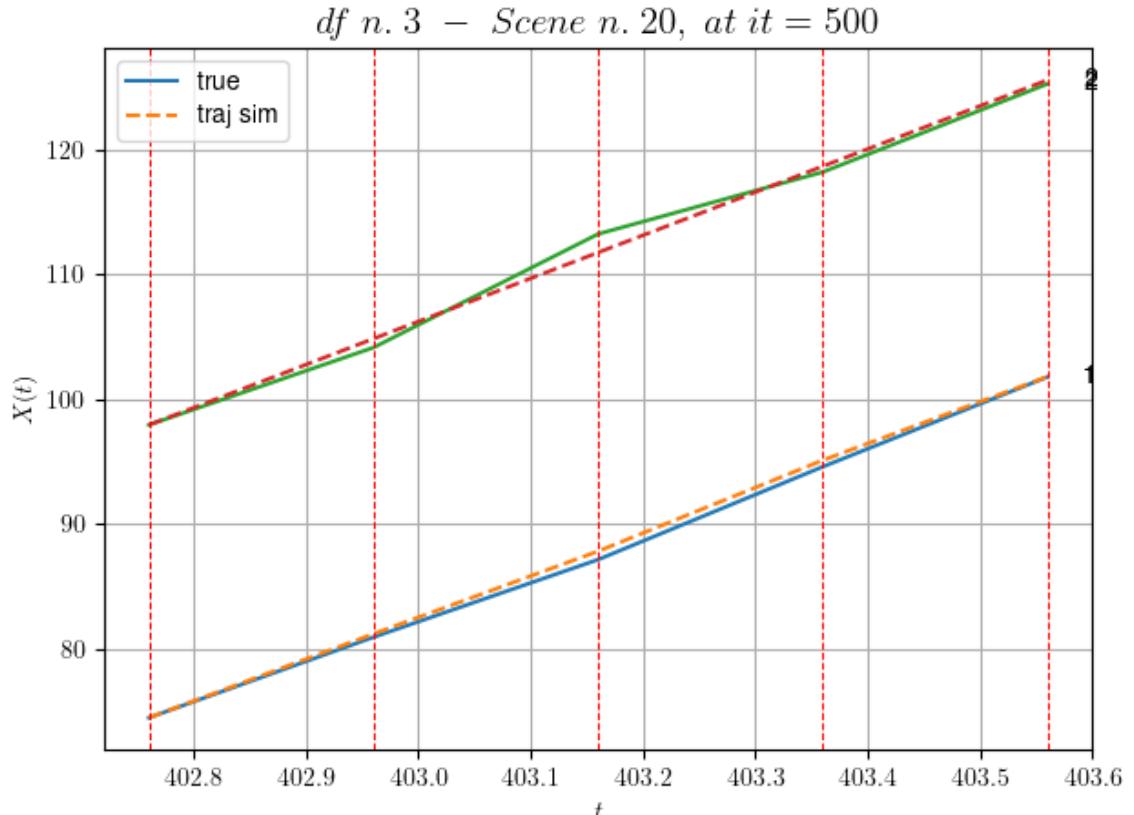
-----  
We have 5 time intervals inside [486.56,487.56]



-----  
For scene 11/60:  
\* After LR finder: LR\_NN=1e-05 with mse=5.1266073867841735  
at it=24  
\* v0 = 25.858119431709085  
\* MSE = 0.9527610434919251  
\* iterations = 500  
-----

DataFrame n.3. Scene n.12/60

We have 4 time intervals inside [402.76,403.56]



---

For scene 12/60:

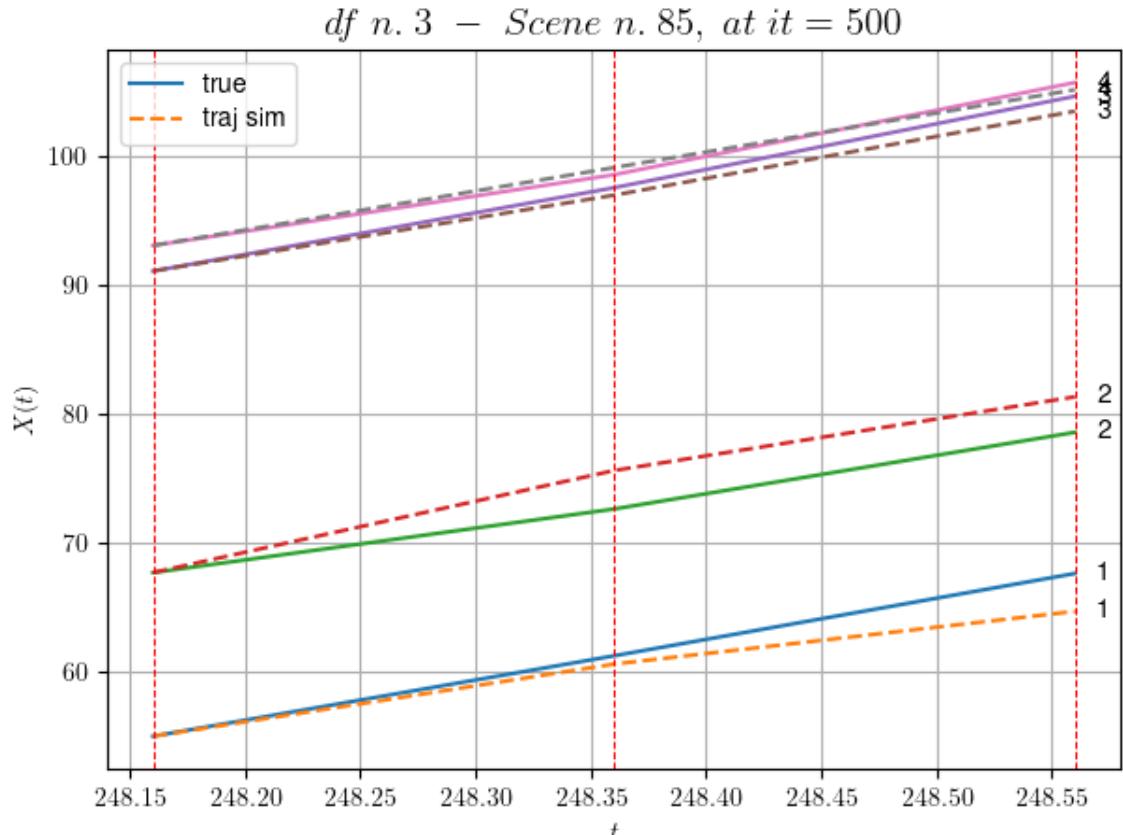
- \* After LR finder:  $LR\_NN=5e-05$  with  $mse=2.759306299737444$  at  $it=24$
- \*  $v_0 = 34.51967072229279$
- \* MSE = 0.3788187524548786
- \* iterations = 500

---

DataFrame n.3. Scene n.13/60

---

We have 2 time intervals inside [248.16, 248.56]



---

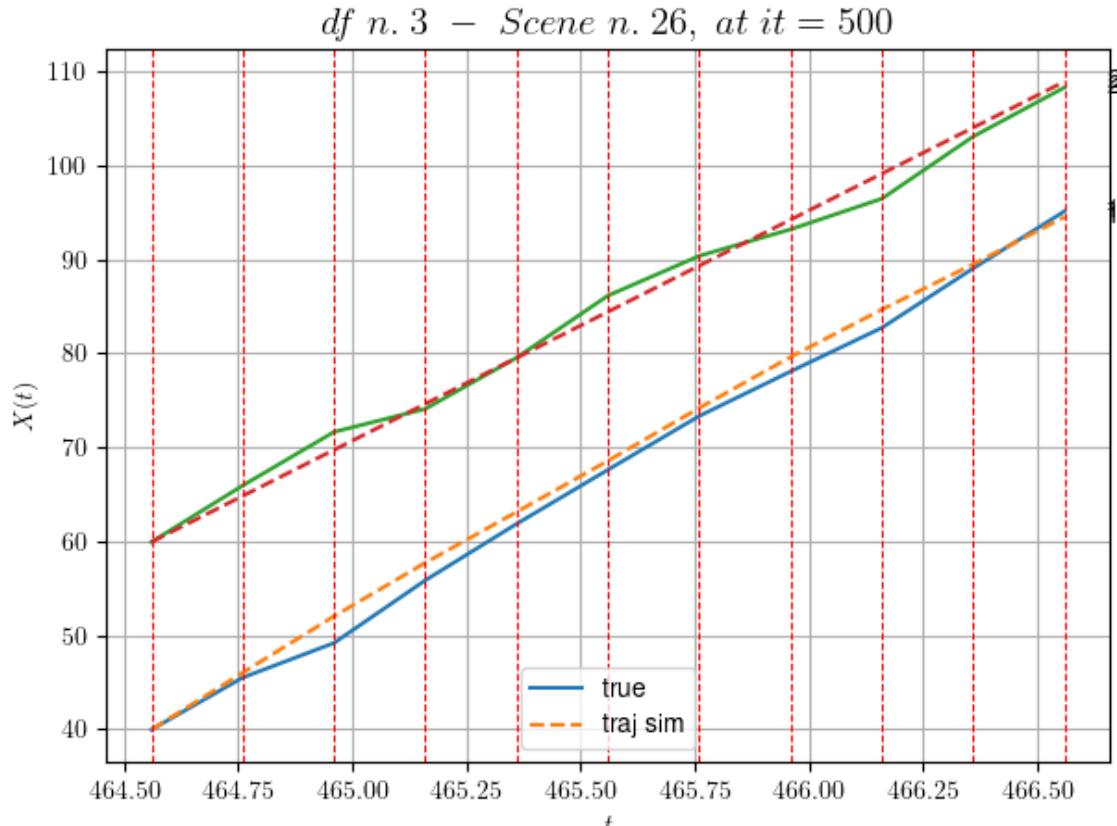
For scene 13/60:  
\* After LR finder: LR\_NN=0.001 with mse=13.48239645937436 at it=24  
\* v0 = 30.248970609827353  
\* MSE = 1.814474339507791  
\* iterations = 500

---

DataFrame n.3. Scene n.14/60

---

We have 10 time intervals inside [464.56, 466.56]

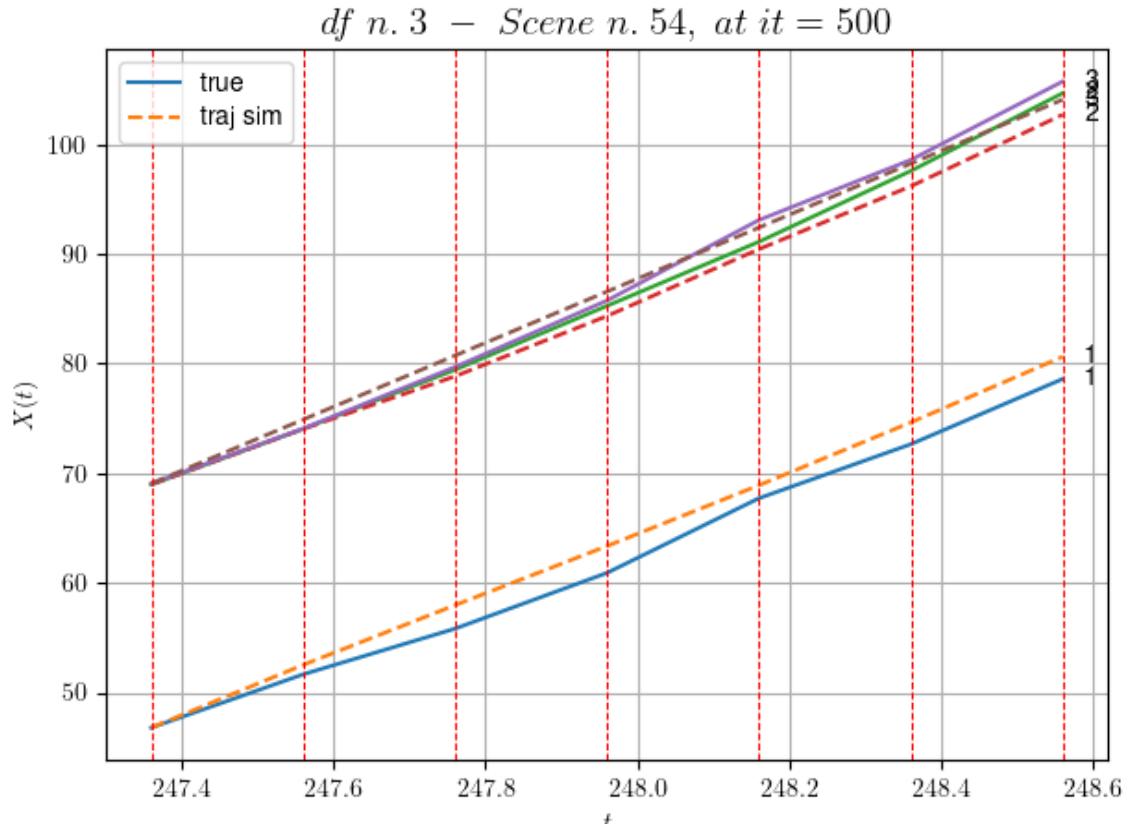


For scene 14/60:

\* After LR finder: LR\_NN=0.0005 with mse=26.005781098948766  
at it=24  
\* v0 = 24.49860270488089  
\* MSE = 1.8387841427267024  
\* iterations = 500

DataFrame n.3. Scene n.15/60

We have 6 time intervals inside [247.36,248.56]



---

For scene 15/60:

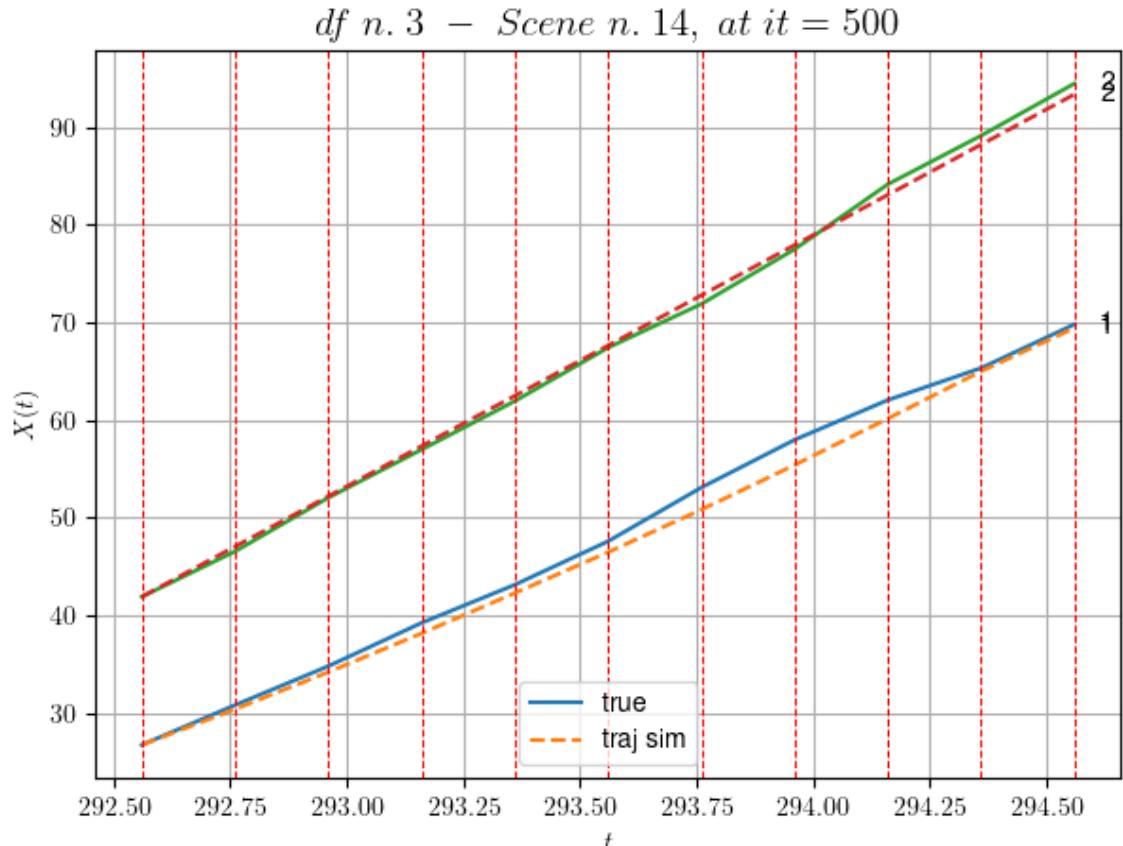
- \* After LR finder: LR\_NN=0.001 with mse=1.8263831185837731
- at it=24
  - \* vθ = 29.199545092787773
  - \* MSE = 1.2097316768511133
  - \* iterations = 500

---

DataFrame n.3. Scene n.16/60

---

We have 10 time intervals inside [292.56, 294.56]

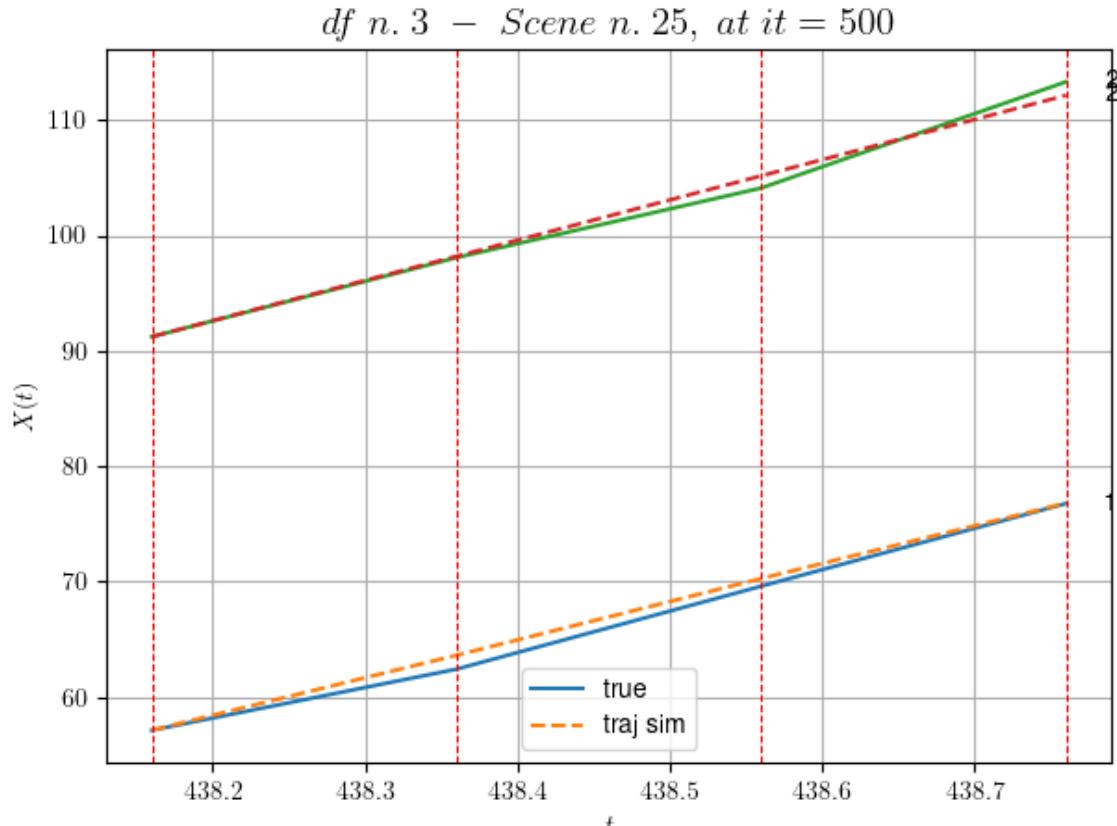


For scene 16/60:

\* After LR finder: LR\_NN=0.001 with mse=11.97538995457592 at it=24  
\*  $v_0 = 25.740986248381294$   
\* MSE = 0.3467985130387968  
\* iterations = 500

DataFrame n.3. Scene n.17/60

We have 3 time intervals inside [438.16,438.76]

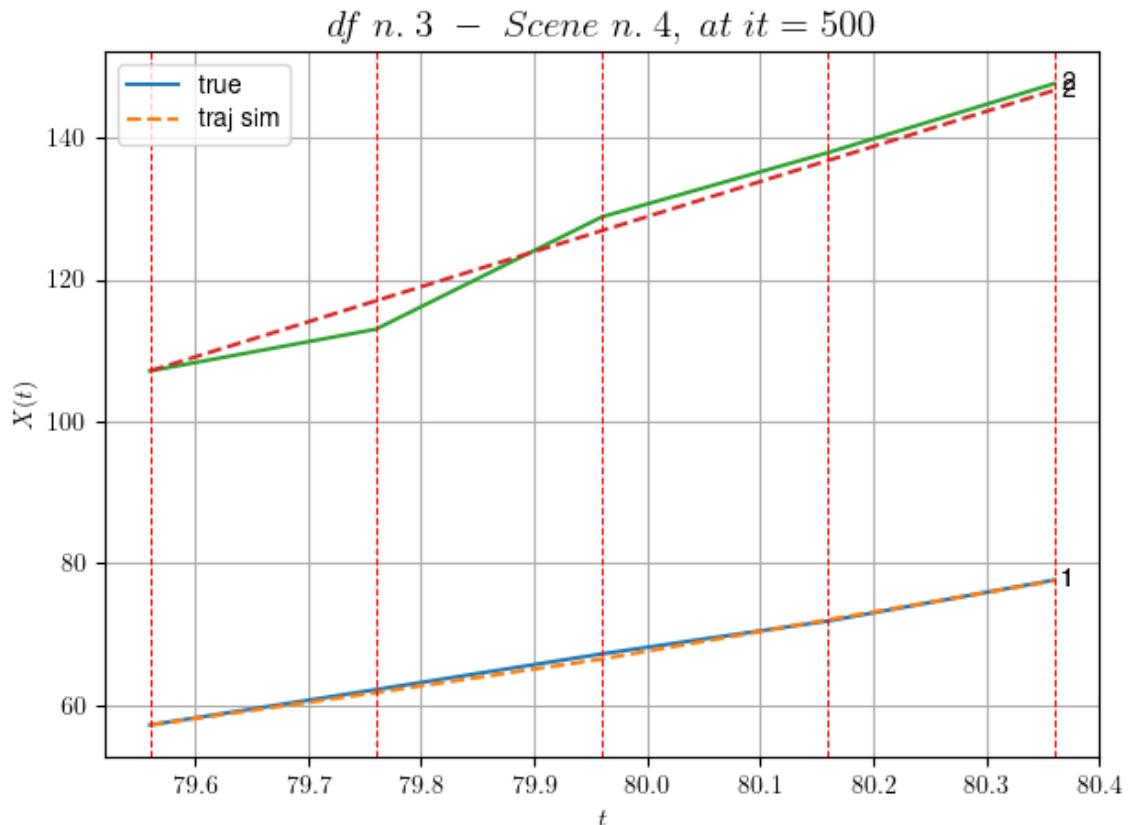


For scene 17/60:

\* After LR finder: LR\_NN=1e-05 with mse=2.510526829725137 at it=24  
\* v0 = 34.868378093315634  
\* MSE = 0.5492402296221651  
\* iterations = 500

DataFrame n.3. Scene n.18/60

We have 4 time intervals inside [79.56,80.36]

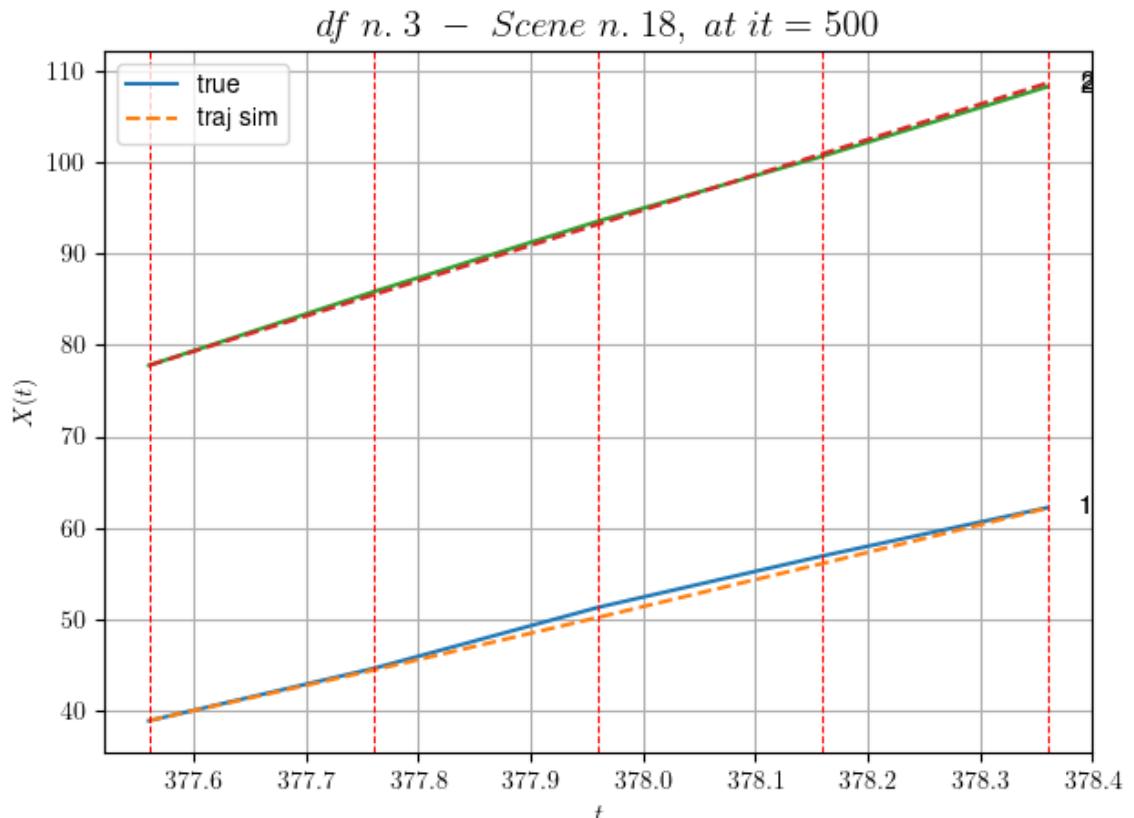


For scene 18/60:

\* After LR finder: LR\_NN=0.0001 with mse=53.082519262793134  
at it=24  
\* v0 = 49.42636153730843  
\* MSE = 2.2617862476994155  
\* iterations = 500

DataFrame n.3. Scene n.19/60

We have 4 time intervals inside [377.56,378.36]



---

For scene 19/60:

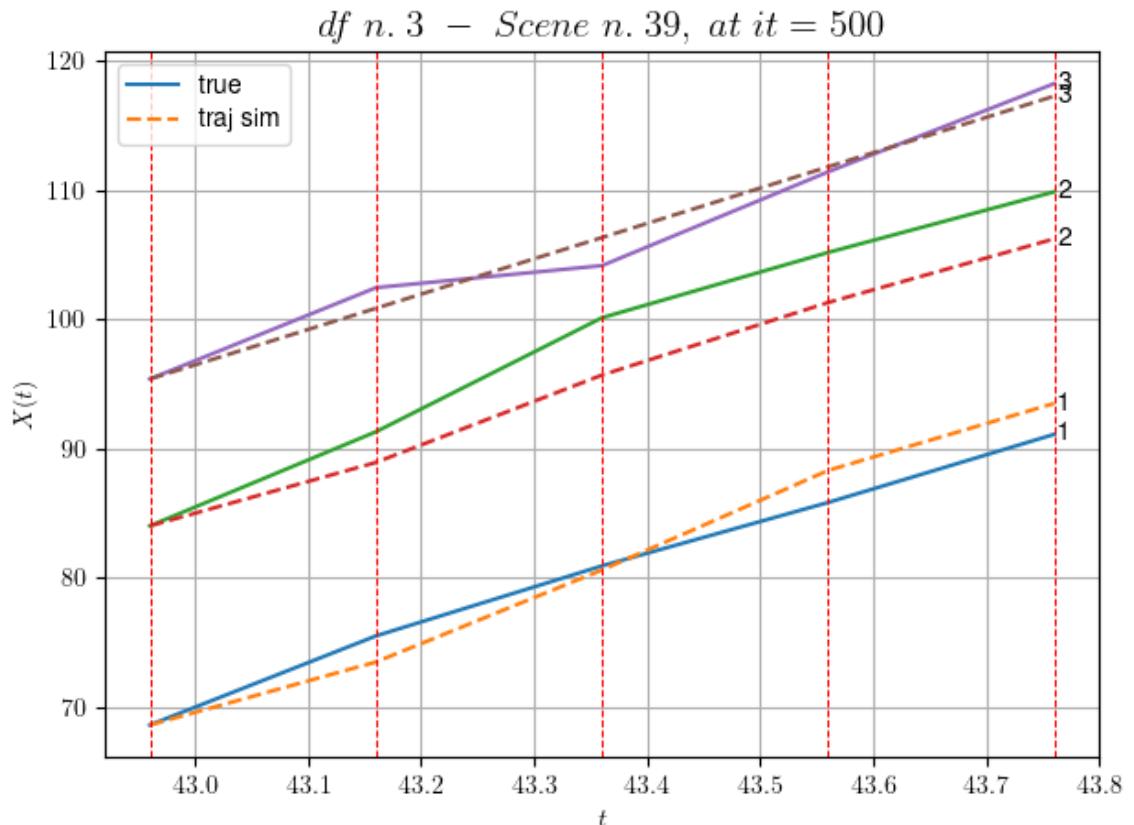
```
* After LR finder: LR_NN=1e-05 with mse=8.705815793607936 at it=24
* v0 = 38.599928283779676
* MSE = 0.2375358644658733
* iterations = 500
```

---

DataFrame n.3. Scene n.20/60

---

We have 4 time intervals inside [42.96,43.76]

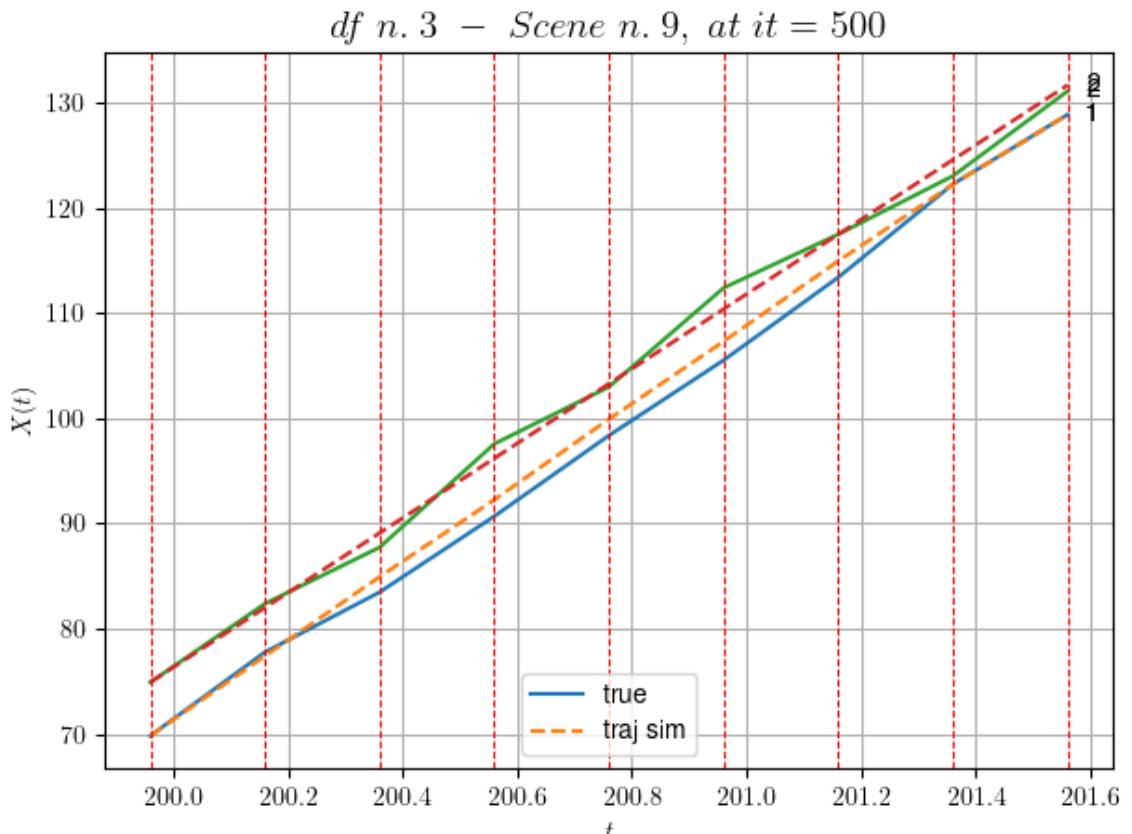


For scene 20/60:

\* After LR finder: LR\_NN=0.001 with mse=18.761390571048278  
at it=24  
\*  $v_0 = 27.35067344092243$   
\* MSE = 4.8738778942956955  
\* iterations = 500

DataFrame n.3. Scene n.21/60

We have 8 time intervals inside [199.96, 201.56]

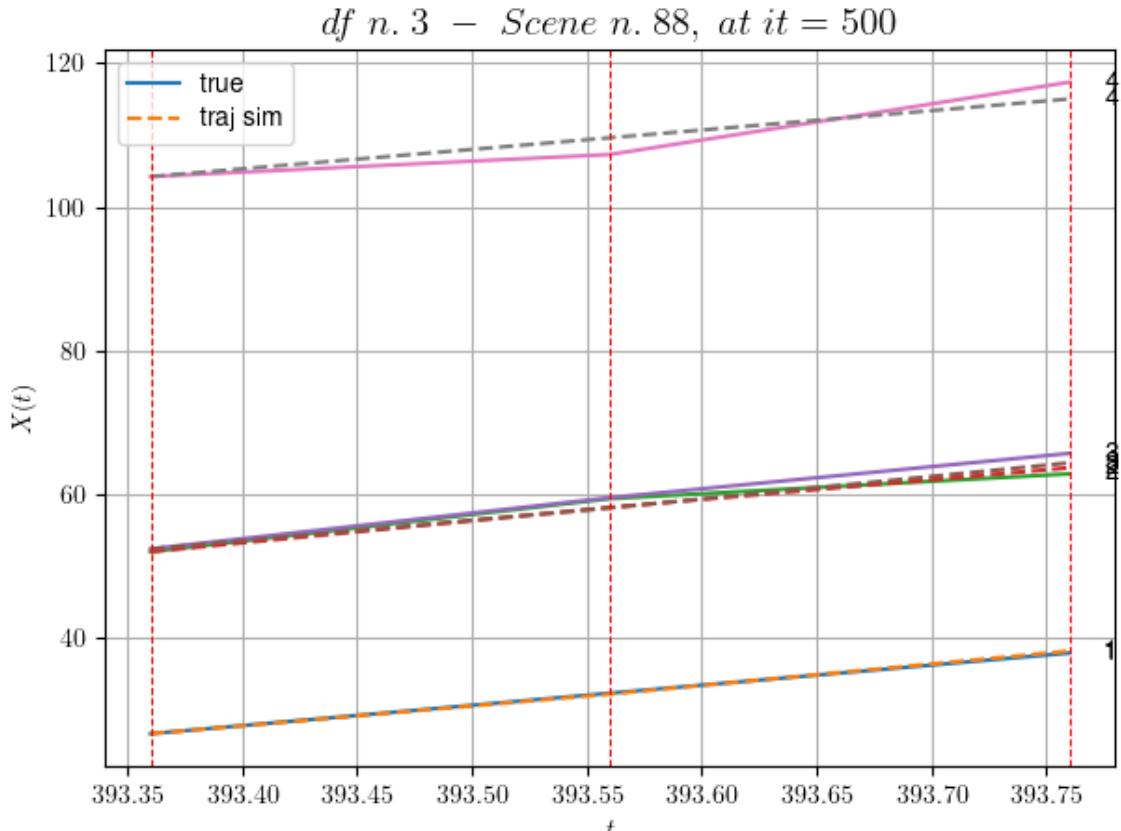


For scene 21/60:

\* After LR finder: LR\_NN=0.0005 with mse=15.851762558720049  
at it=24  
\* v0 = 35.48263392775835  
\* MSE = 1.2902011344875772  
\* iterations = 500

DataFrame n.3. Scene n.22/60

We have 2 time intervals inside [393.36,393.76]

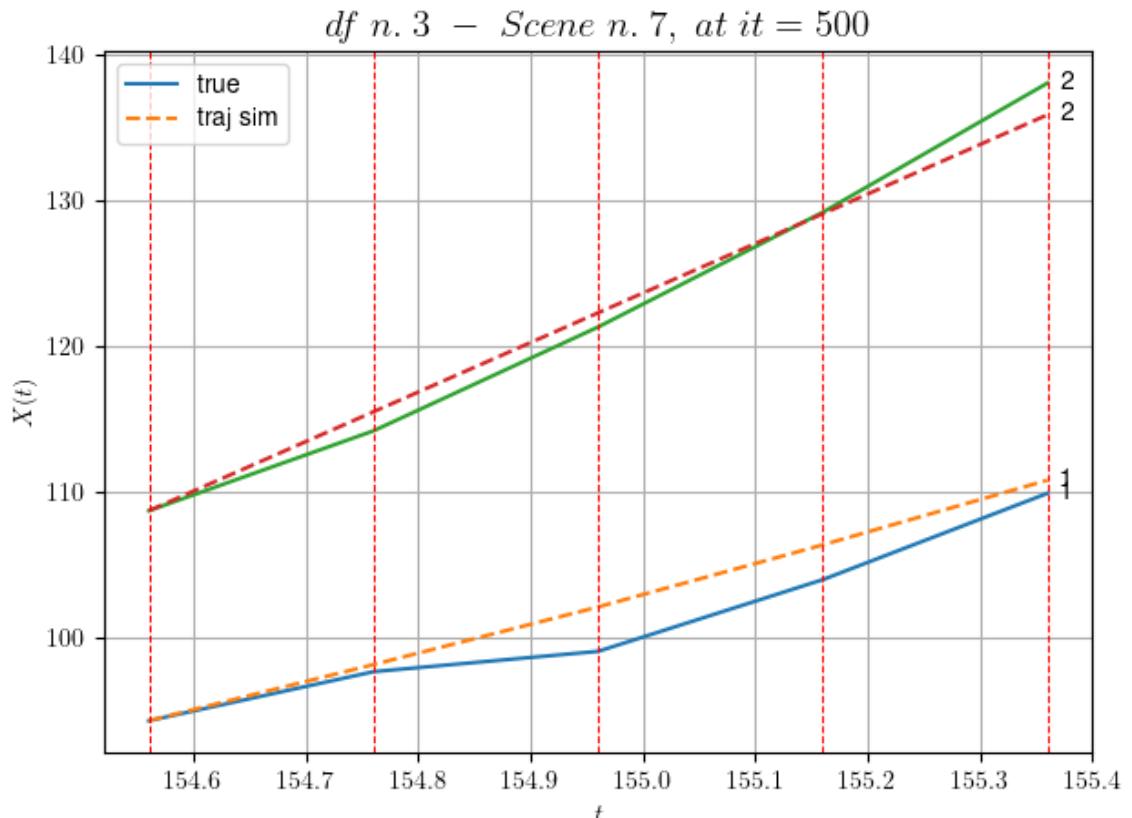


For scene 22/60:

\* After LR finder:  $LR\_NN=0.0001$  with  $mse=15.00353941902325$   
at it=24  
\*  $v_0 = 27.00629353640555$   
\*  $MSE = 1.3977317819190342$   
\* iterations = 500

DataFrame n.3. Scene n.23/60

We have 4 time intervals inside  $[154.56, 155.36]$



---

For scene 23/60:  
\* After LR finder: LR\_NN=1e-05 with mse=3.726896626904071 a  
t it=24  
\* v0 = 33.88242010375711  
\* MSE = 2.3333545339517276  
\* iterations = 500

---

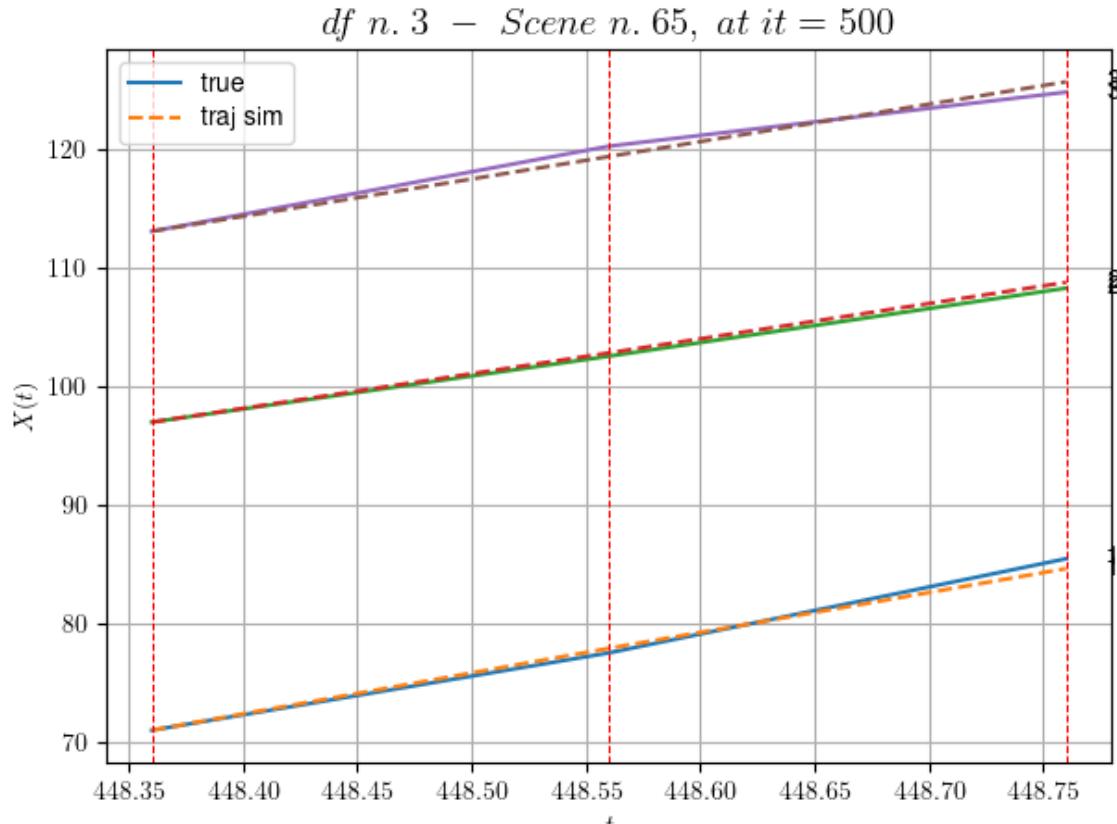
---

DataFrame n.3. Scene n.24/60

---

---

We have 2 time intervals inside [448.36, 448.76]

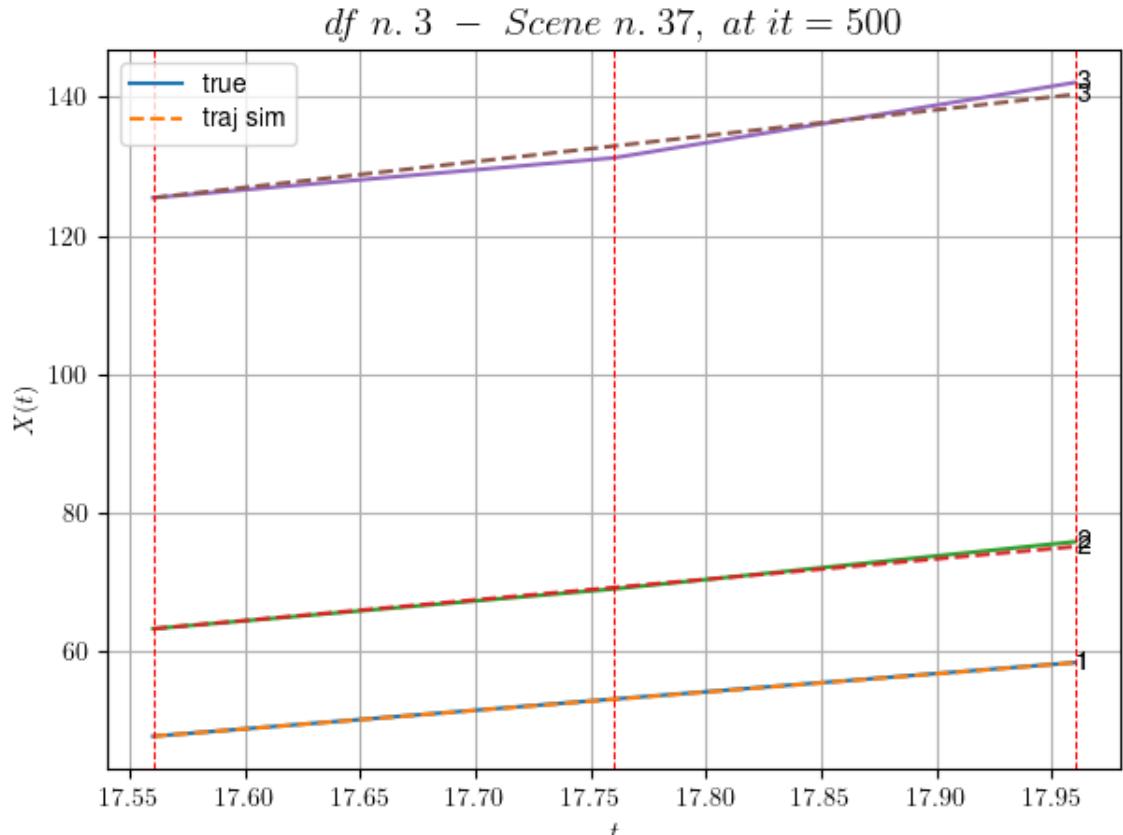


For scene 24/60:

\* After LR finder:  $\text{LR\_NN}=5\text{e-}05$  with  $\text{mse}=0.6006143040911185$   
at  $\text{it}=24$   
\*  $v_0 = 31.585048186376667$   
\*  $\text{MSE} = 0.22353679984762742$   
\*  $\text{iterations} = 500$

DataFrame n.3. Scene n.25/60

We have 2 time intervals inside  $[17.56, 17.96]$



---

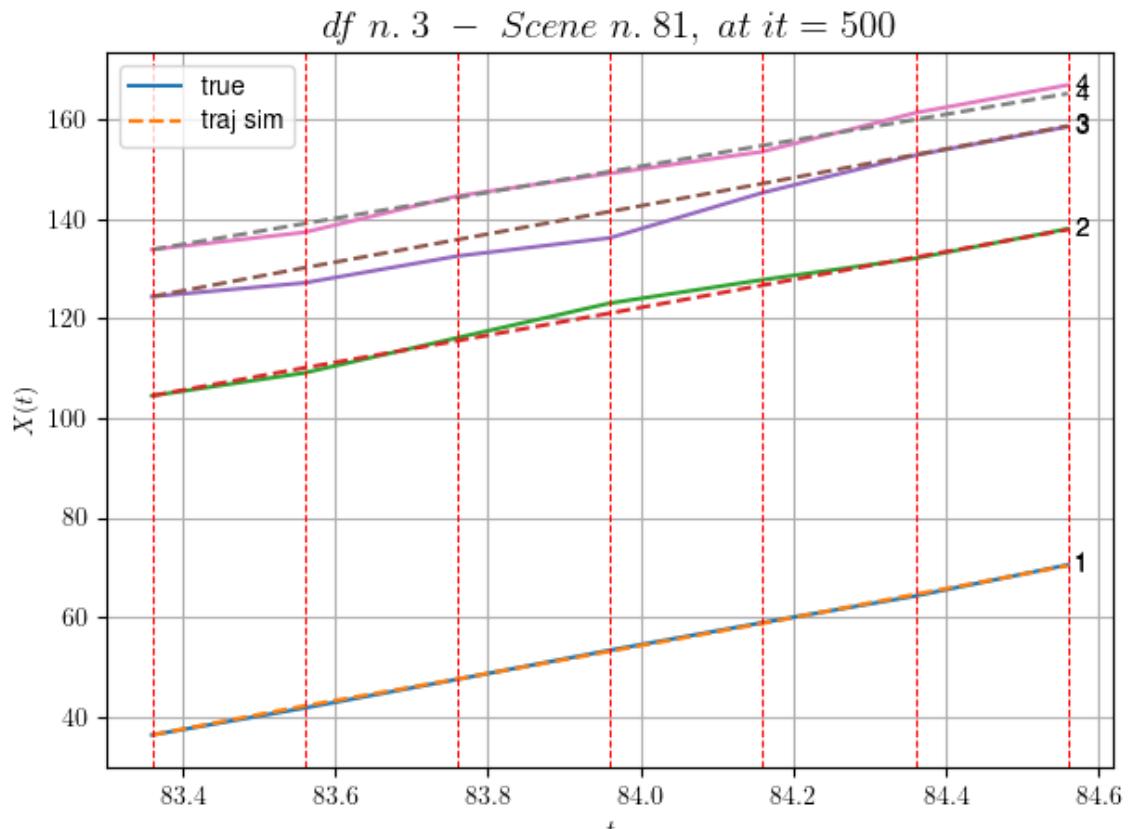
For scene 25/60:  
\* After LR finder: LR\_NN=1e-05 with mse=9.67781392453484 at  
it=24  
\* v0 = 37.341608941889014  
\* MSE = 0.7037229080046968  
\* iterations = 500

---

DataFrame n.3. Scene n.26/60

---

We have 6 time intervals inside [83.36,84.56]

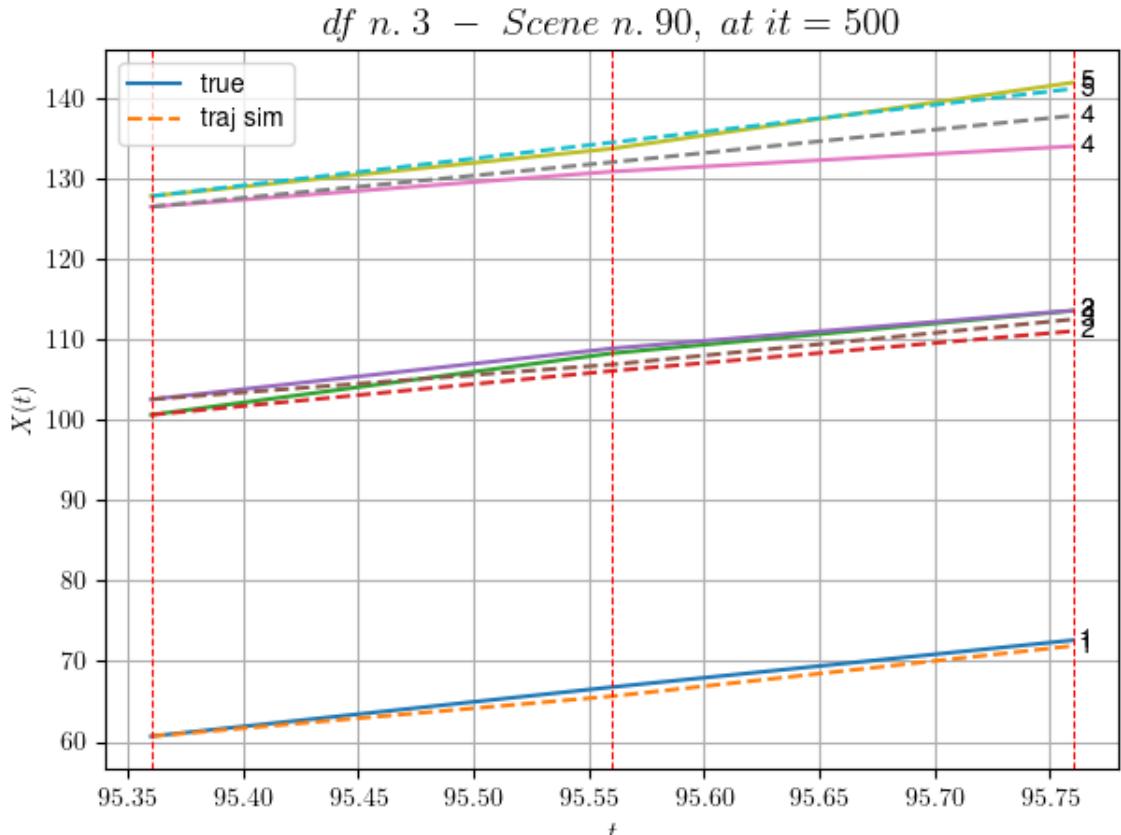


For scene 26/60:

\* After LR finder: LR\_NN=0.0001 with mse=95.43250982183648  
at it=24  
\* v0 = 26.1077241973145  
\* MSE = 2.380186691672939  
\* iterations = 500

DataFrame n.3. Scene n.27/60

We have 2 time intervals inside [95.36,95.76]

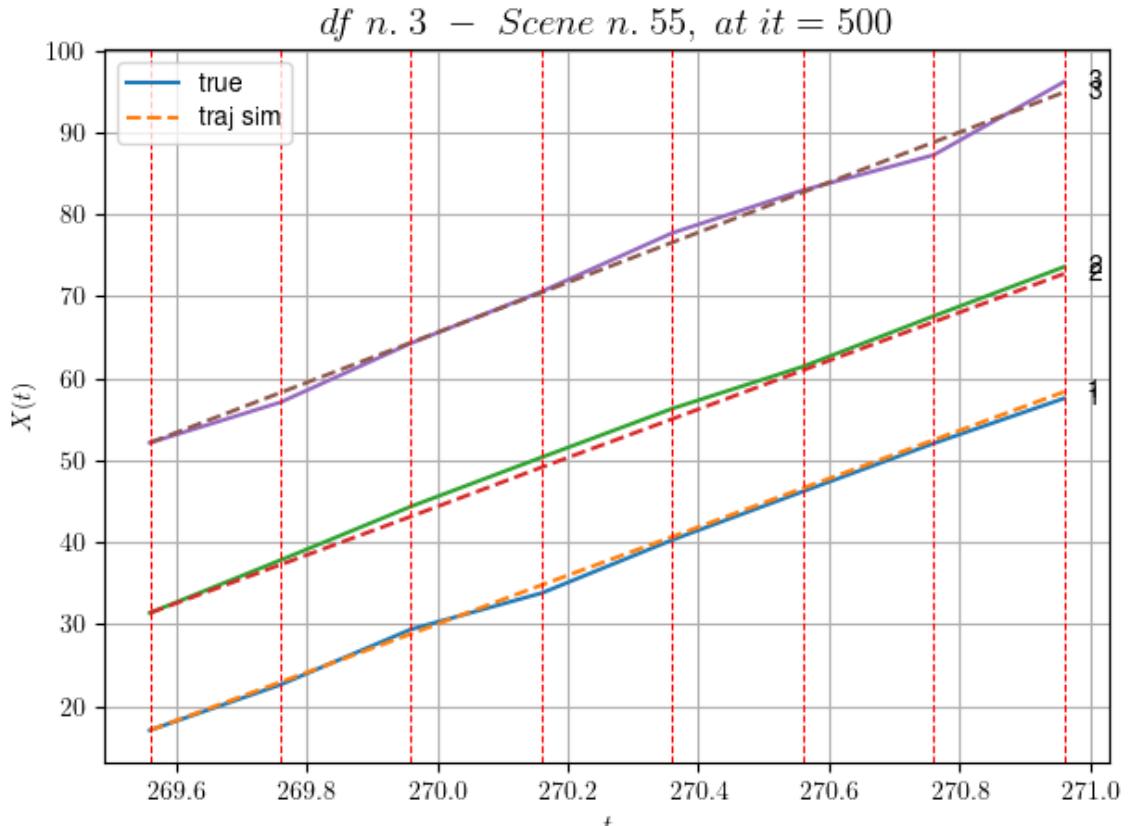


For scene 27/60:

\* After LR finder: LR\_NN=0.0005 with mse=15.740967817780932  
at it=24  
\* v0 = 33.35137428698109  
\* MSE = 2.32511133781595  
\* iterations = 500

DataFrame n.3. Scene n.28/60

We have 7 time intervals inside [269.56,270.96]

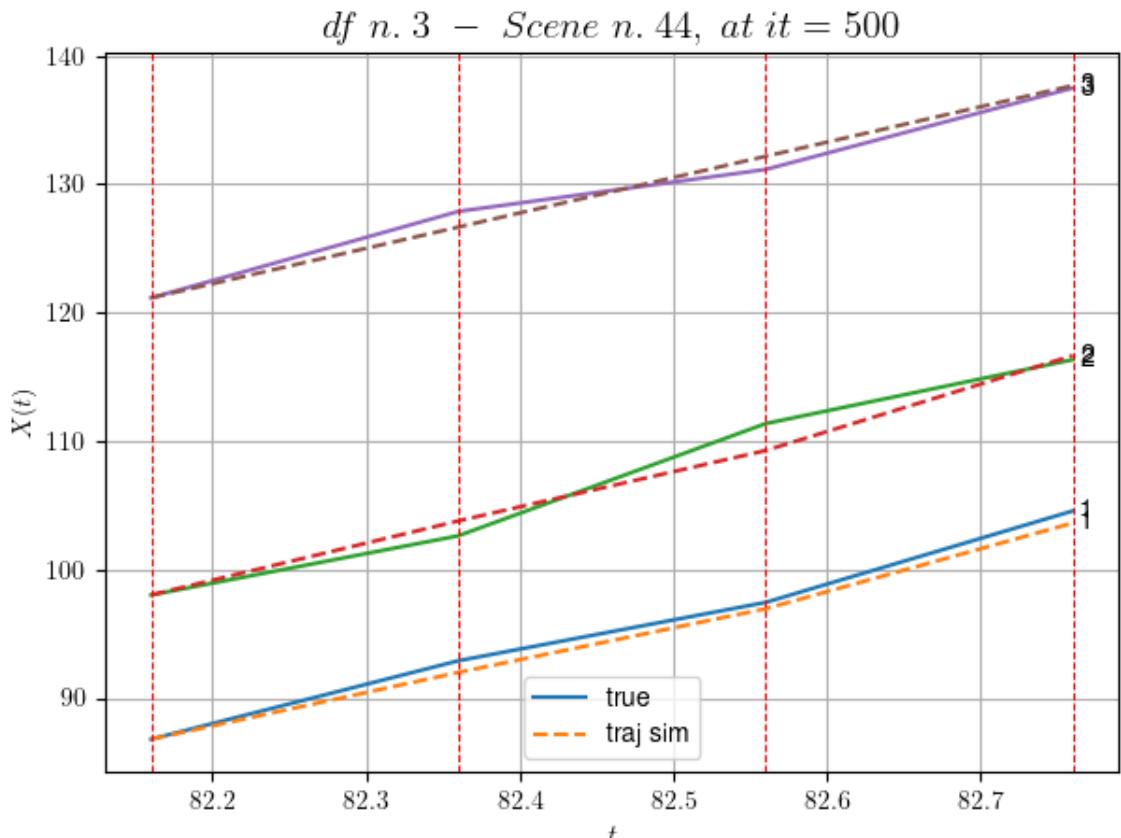


For scene 28/60:

\* After LR finder: LR\_NN=0.0001 with mse=6.03063682446912 at it=24  
\* v0 = 30.53917566971255  
\* MSE = 0.630240241684849  
\* iterations = 500

DataFrame n.3. Scene n.29/60

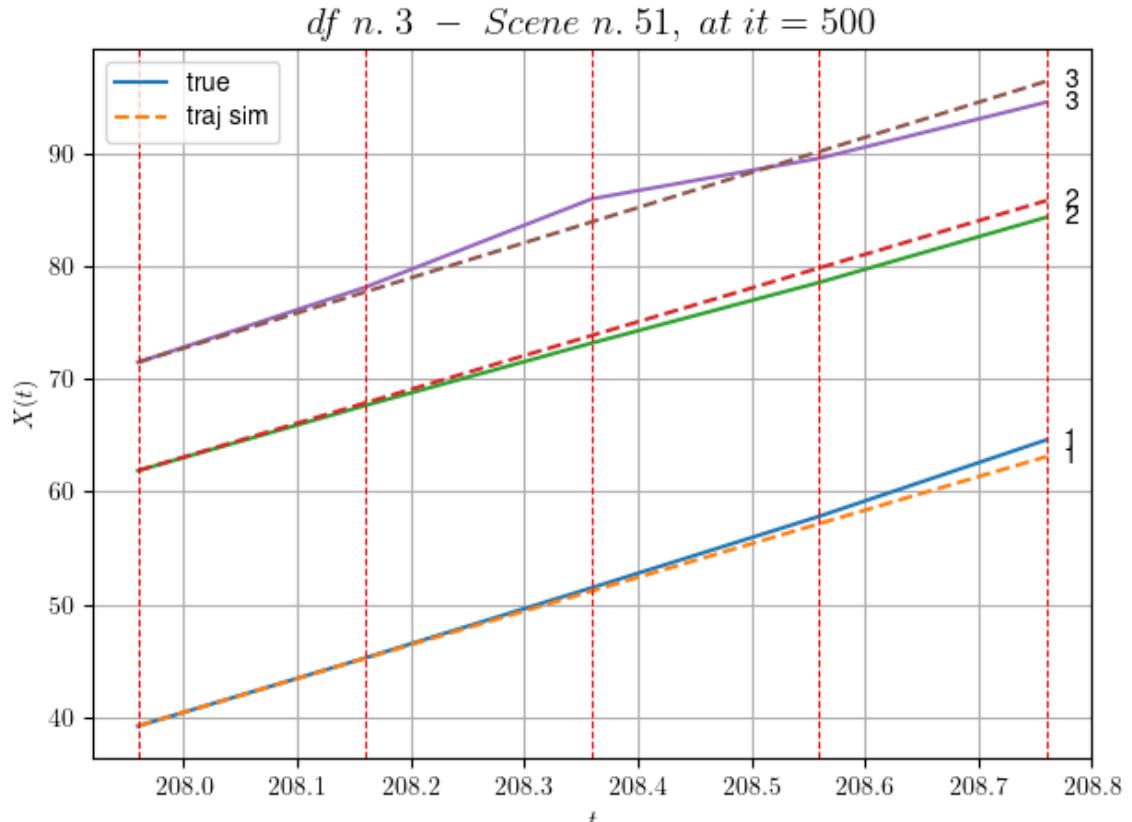
We have 3 time intervals inside [82.16,82.76]



-----  
For scene 29/60:  
\* After LR finder: LR\_NN=0.001 with mse=7.242915933035287 at it=24  
\* v0 = 27.550237413707237  
\* MSE = 0.8640272654596459  
\* iterations = 500  
-----

DataFrame n.3. Scene n.30/60

-----  
We have 4 time intervals inside [207.96,208.76]

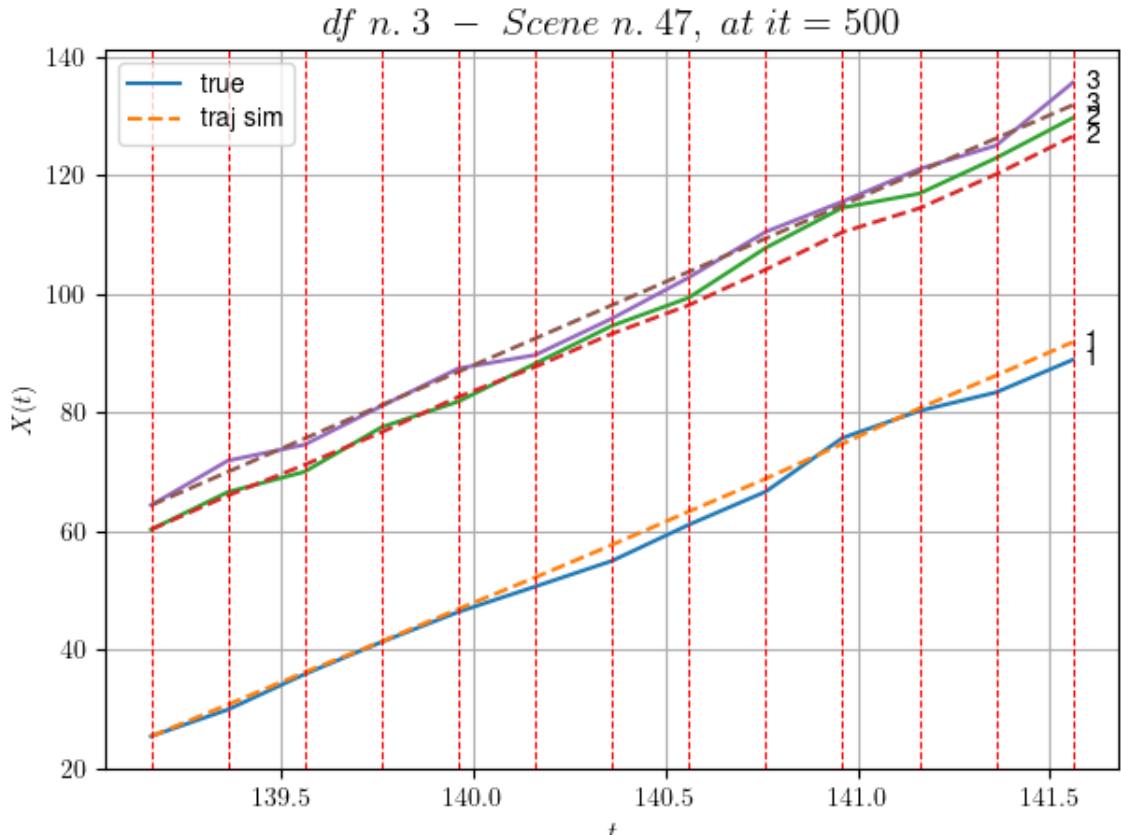


For scene 30/60:

\* After LR finder: LR\_NN=0.0001 with mse=9.746172570907682  
at it=24  
\* v0 = 31.124909645190584  
\* MSE = 0.5358054560434411  
\* iterations = 500

DataFrame n.3. Scene n.31/60

We have 12 time intervals inside [139.16, 141.56]



---

For scene 31/60:

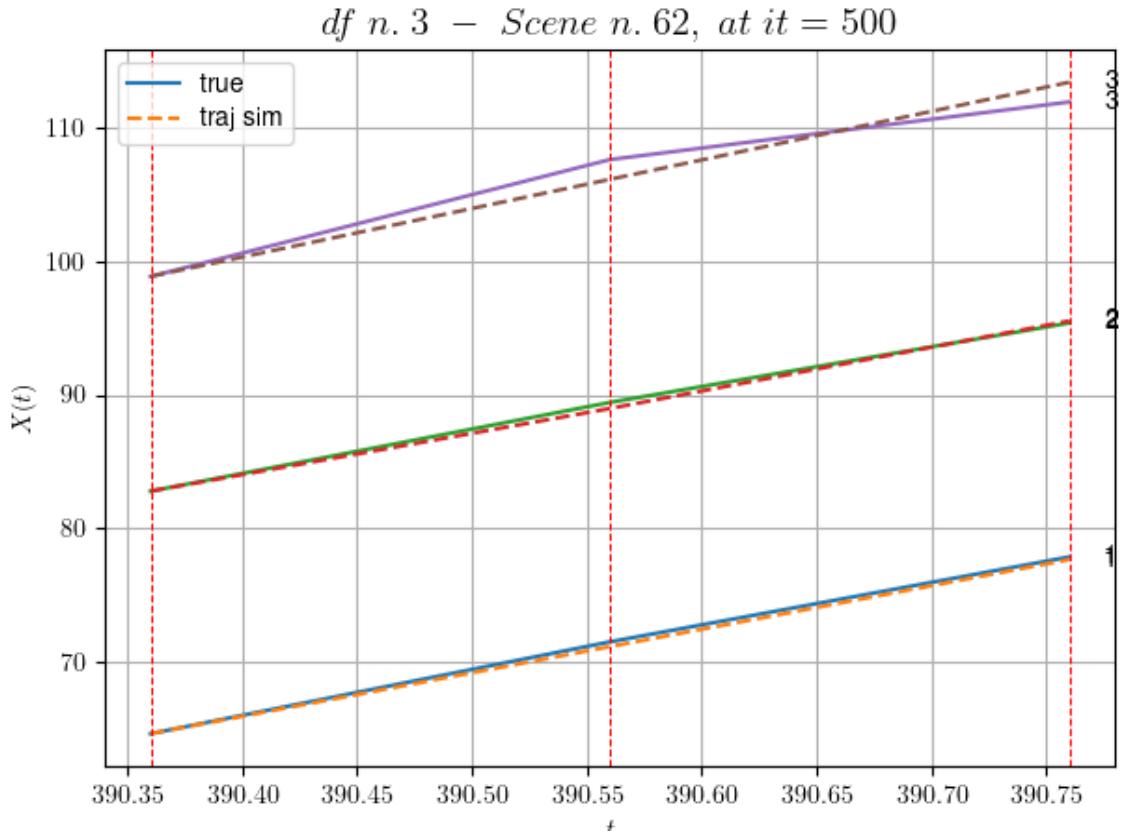
- \* After LR finder: LR\_NN=0.0005 with mse=99.5805982773083 at it=24
- \* v0 = 28.144630567259124
- \* MSE = 2.451380520555574
- \* iterations = 500

---

DataFrame n.3. Scene n.32/60

---

We have 2 time intervals inside [390.36,390.76]



---

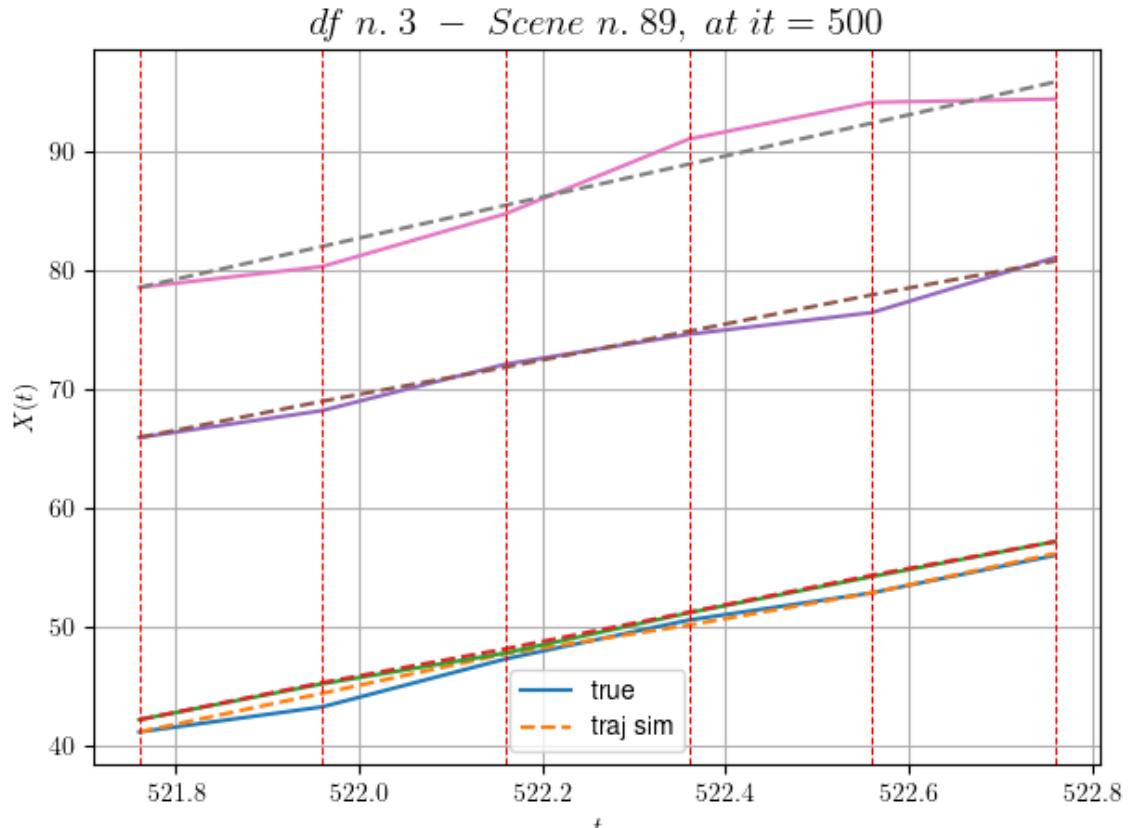
For scene 32/60:  
\* After LR finder: LR\_NN=5e-05 with mse=1.0437835777790012  
at it=24  
\* v0 = 36.35426043628983  
\* MSE = 0.48312498874455284  
\* iterations = 500

---

DataFrame n.3. Scene n.33/60

---

We have 5 time intervals inside [521.76, 522.76]

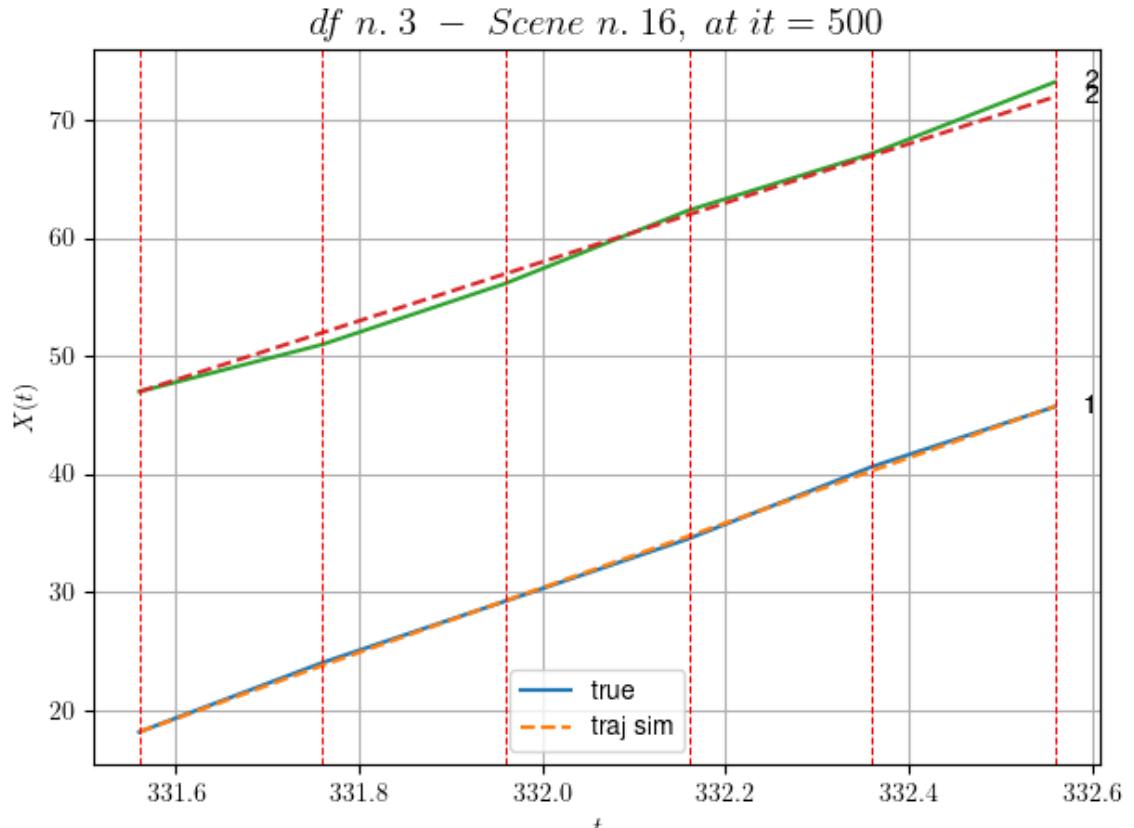


For scene 33/60:

\* After LR finder: LR\_NN=0.001 with mse=29.434326962966157  
at it=24  
\*  $v_0 = 17.24778766704637$   
\* MSE = 0.7343665007506677  
\* iterations = 500

DataFrame n.3. Scene n.34/60

We have 5 time intervals inside [331.56,332.56]

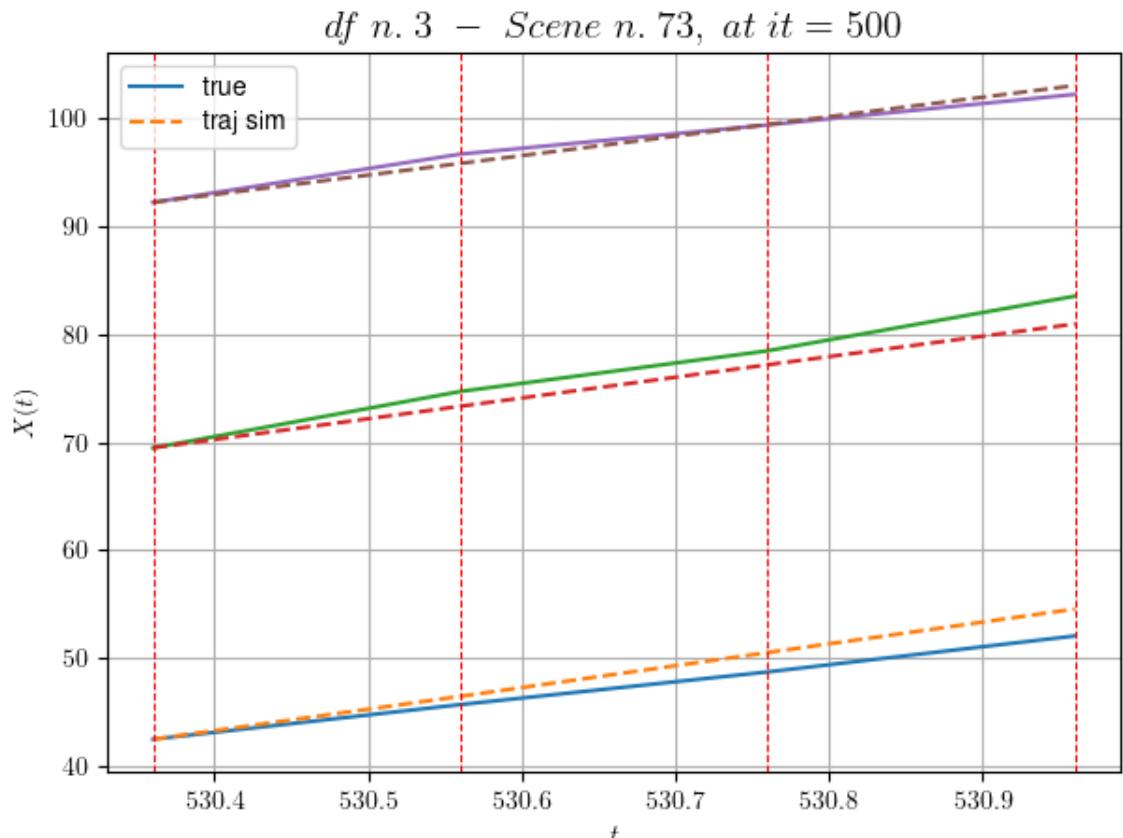


For scene 34/60:

\* After LR finder: LR\_NN=5e-05 with mse=3.9641636437293513  
at it=24  
\* v0 = 25.00216687994922  
\* MSE = 0.26026650713083566  
\* iterations = 500

DataFrame n.3. Scene n.35/60

We have 3 time intervals inside [530.36,530.96]



---

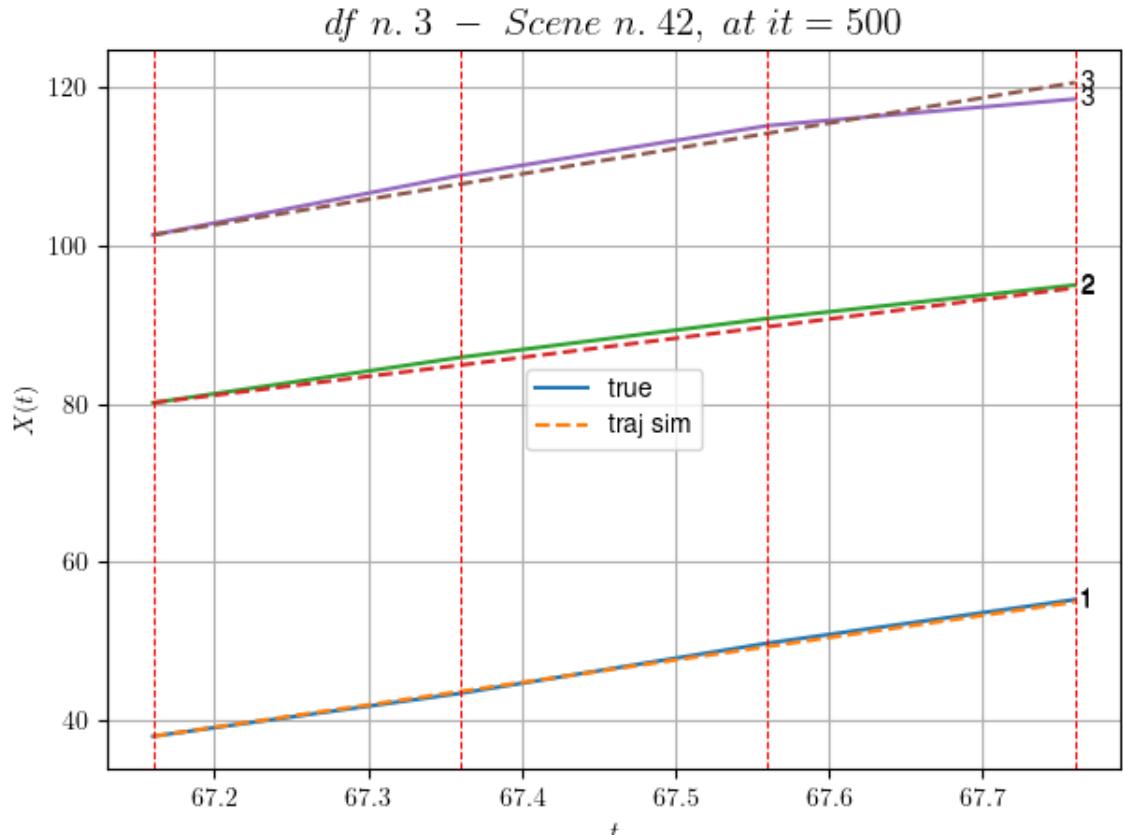
For scene 35/60:  
\* After LR finder: LR\_NN=5e-05 with mse=10.879702269938164  
at it=24  
\* v0 = 18.054855152784132  
\* MSE = 1.807393831261874  
\* iterations = 500

---

DataFrame n.3. Scene n.36/60

---

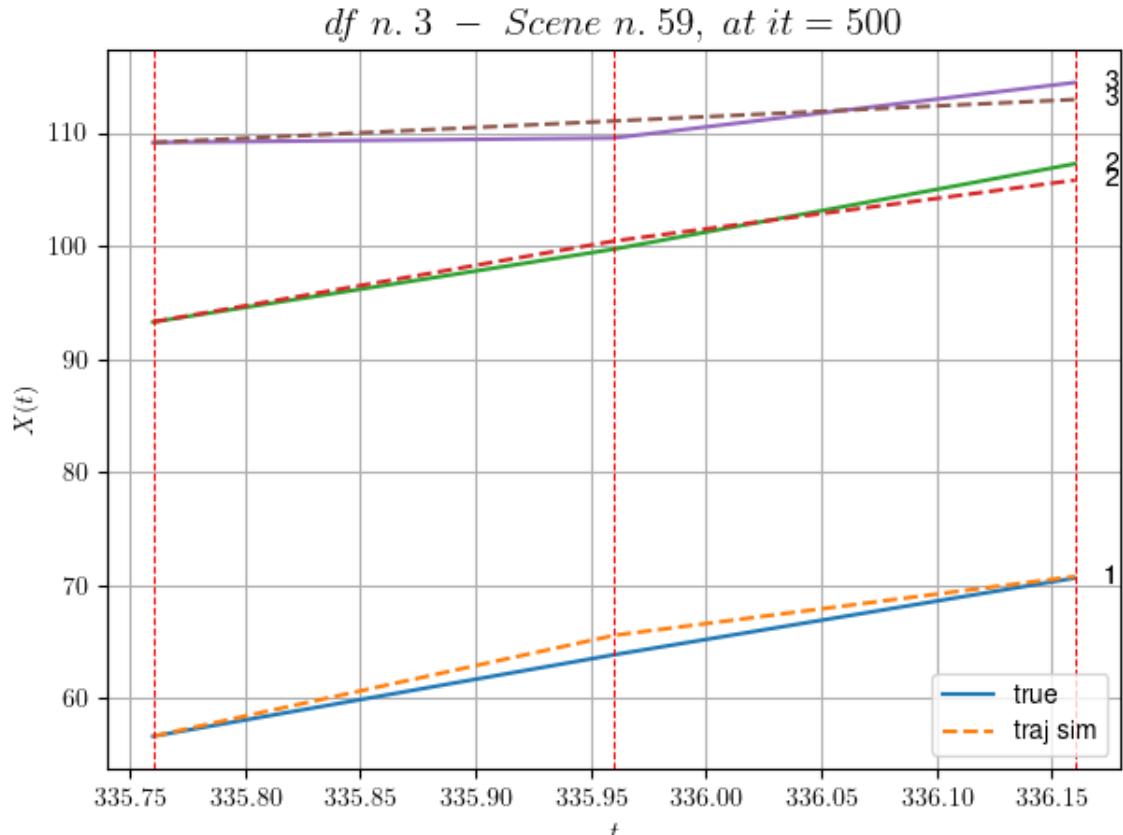
We have 3 time intervals inside [67.16,67.76]



-----  
For scene 36/60:  
\* After LR finder: LR\_NN=1e-05 with mse=4.332441265353143 at it=24  
\* v0 = 32.139321542456436  
\* MSE = 0.7552788527379962  
\* iterations = 500  
-----

DataFrame n.3. Scene n.37/60

We have 2 time intervals inside [335.76,336.16]

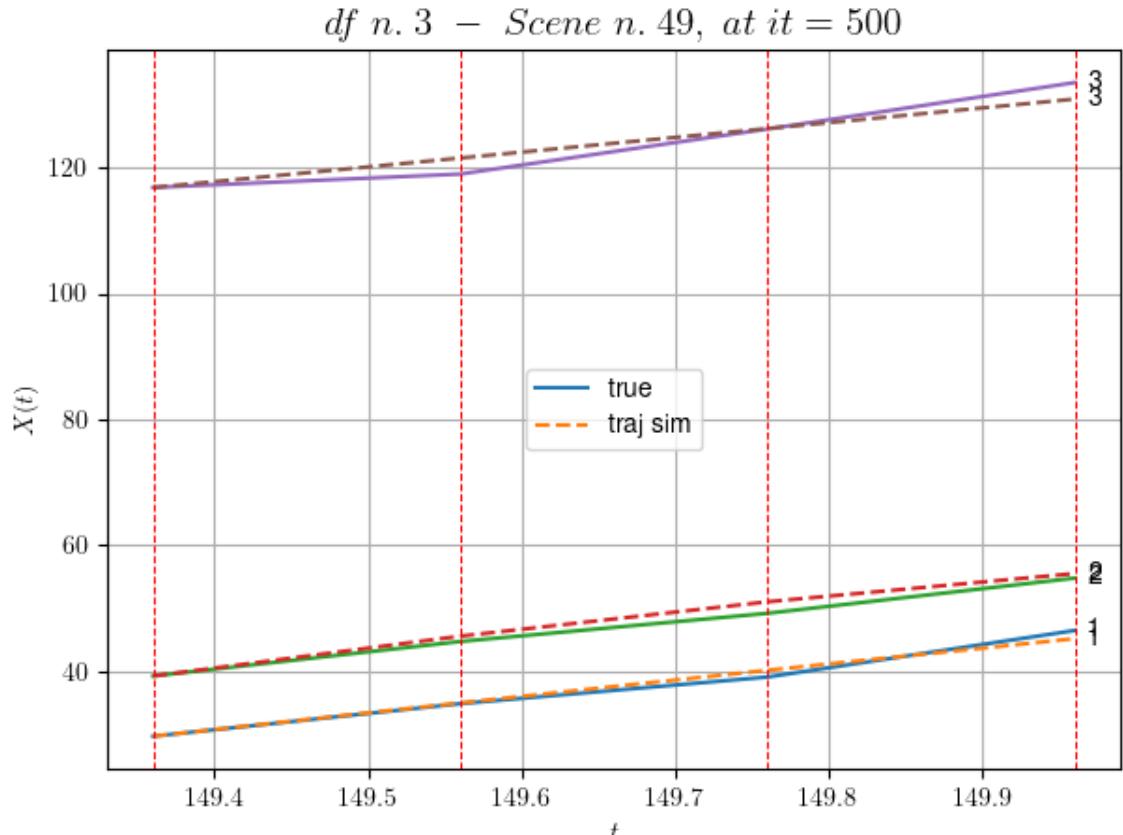


-----  
For scene 37/60:  
\* After LR finder: LR\_NN=0.0005 with mse=16.6058509425972 at it=24  
\* v0 = 9.495680524399367  
\* MSE = 1.0873438828783857  
\* iterations = 500  
-----

DataFrame n.3. Scene n.38/60

-----

We have 3 time intervals inside [149.36, 149.96]



---

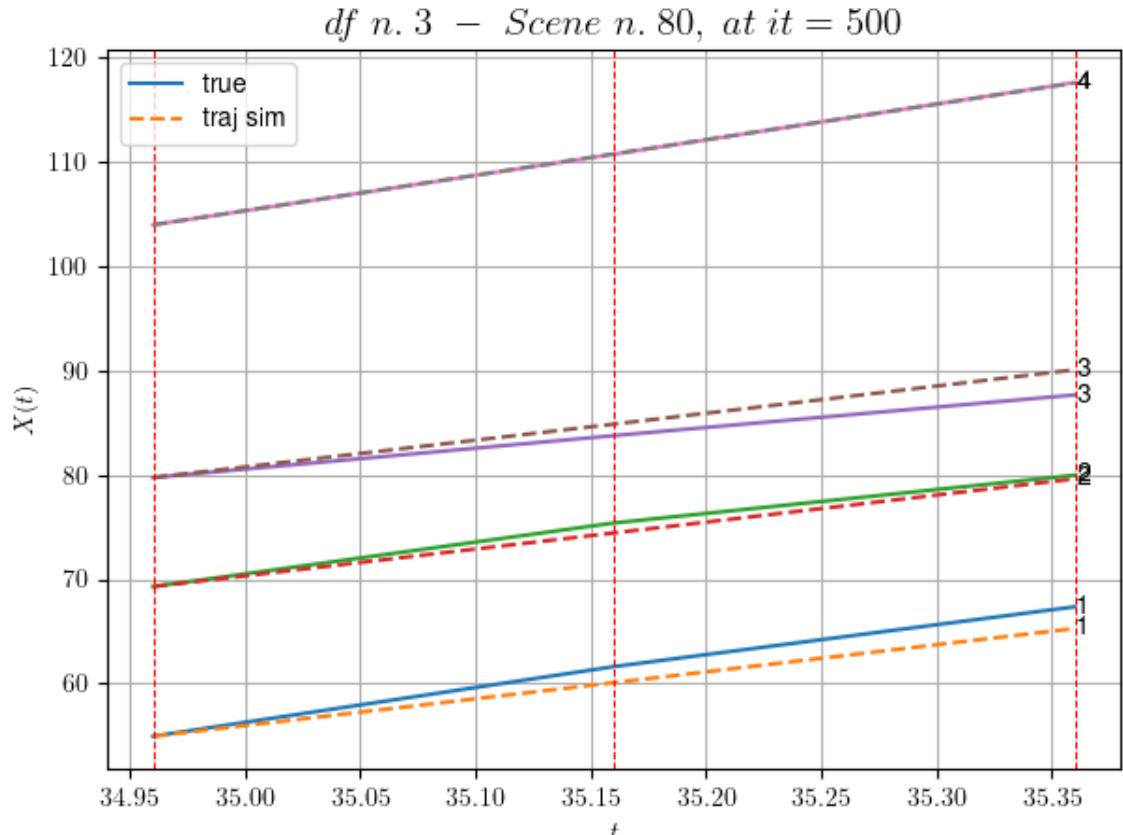
For scene 38/60:  
\* After LR finder: LR\_NN=0.0001 with mse=23.998154871965955  
at it=24  
\* v0 = 23.44355532852092  
\* MSE = 1.7389618687115294  
\* iterations = 500

---

DataFrame n.3. Scene n.39/60

---

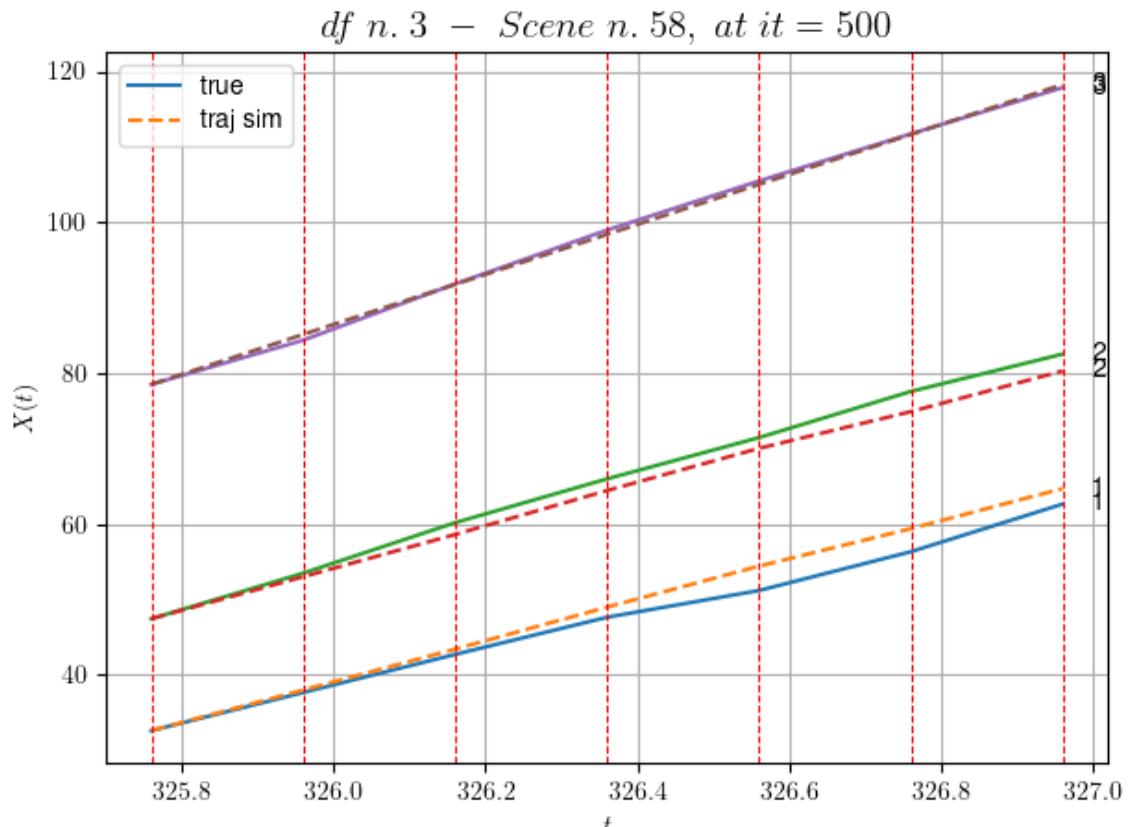
We have 2 time intervals inside [34.96,35.36]



-----  
For scene 39/60:  
\* After LR finder: LR\_NN=0.0001 with mse=9.317772849107072  
at it=24  
\* v0 = 34.04452453089859  
\* MSE = 1.230478316484884  
\* iterations = 500  
-----

DataFrame n.3. Scene n.40/60

-----  
We have 6 time intervals inside [325.76,326.96]

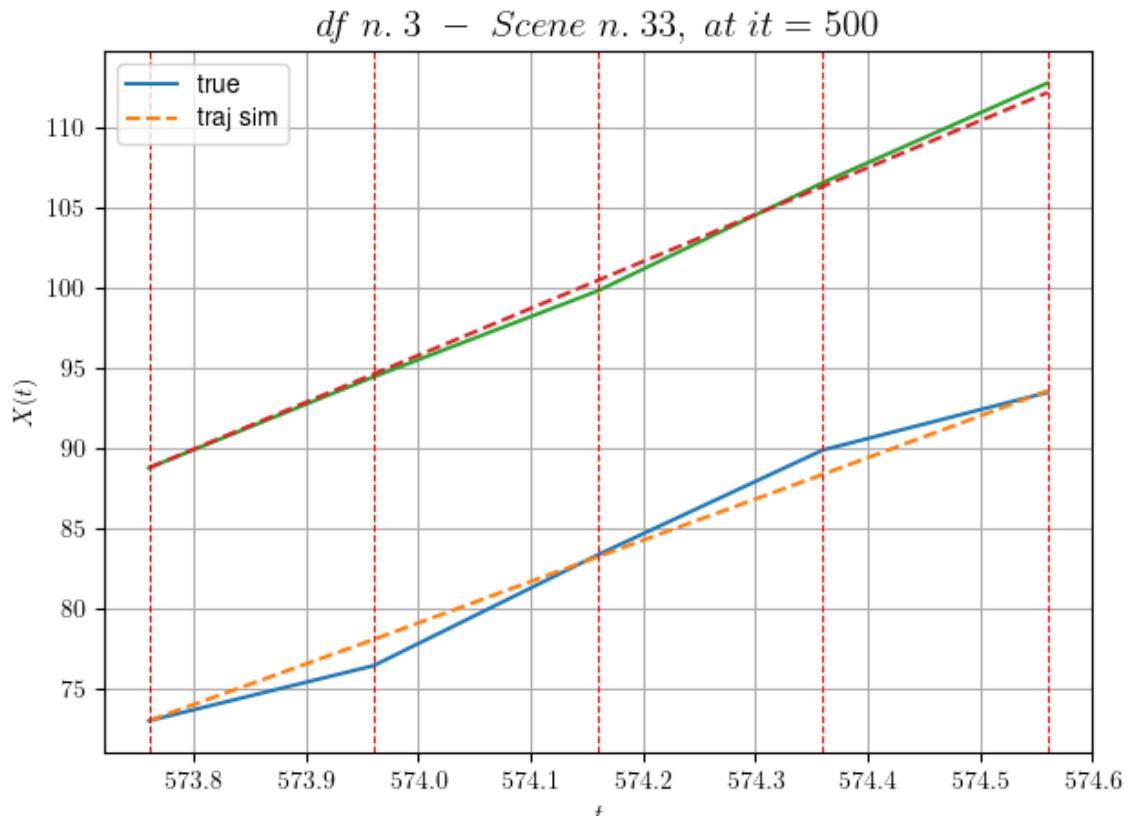


For scene 40/60:

\* After LR finder: LR\_NN=0.0005 with mse=10.361038273278787  
at it=24  
\*  $v_0 = 33.13555230710668$   
\* MSE = 1.521883054689695  
\* iterations = 500

DataFrame n.3. Scene n.41/60

We have 4 time intervals inside [573.76, 574.56]



---

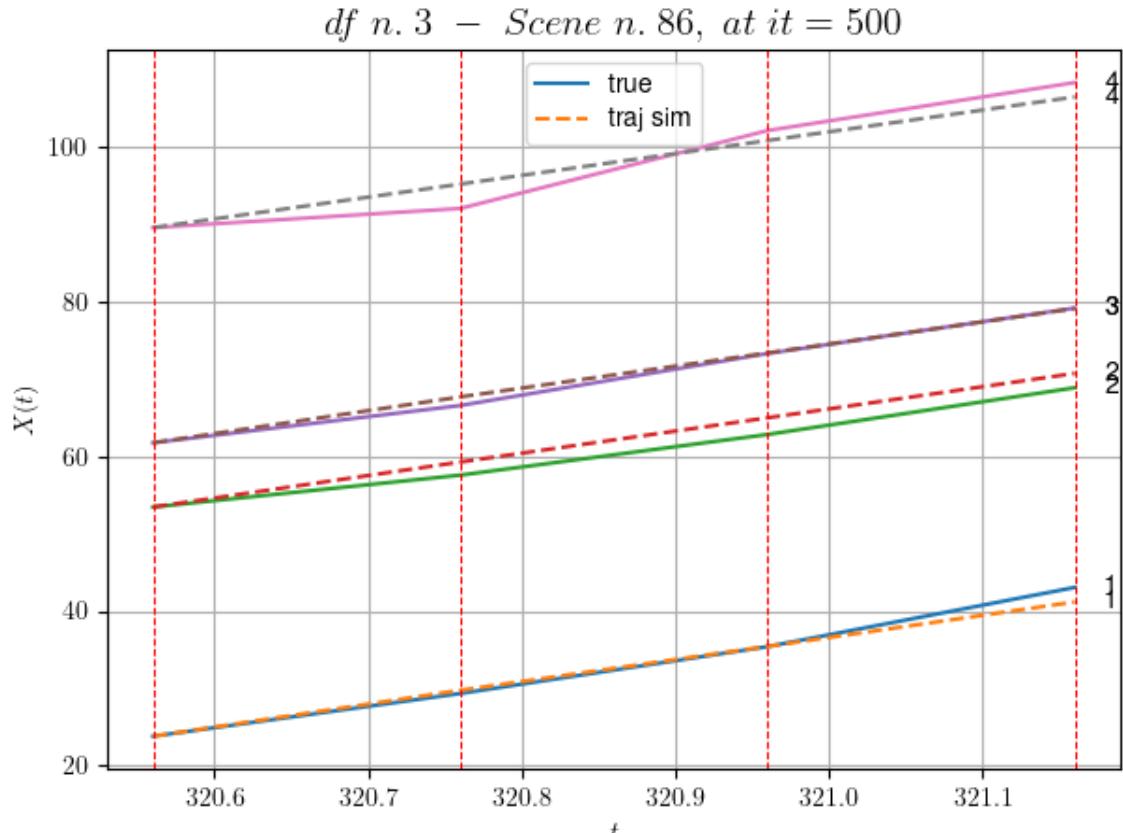
For scene 41/60:  
\* After LR finder: LR\_NN=5e-05 with mse=0.5494459244550984  
at it=24  
\* v0 = 29.32939981960101  
\* MSE = 0.5892204780313718  
\* iterations = 500

---

DataFrame n.3. Scene n.42/60

---

We have 3 time intervals inside [320.56,321.16]



---

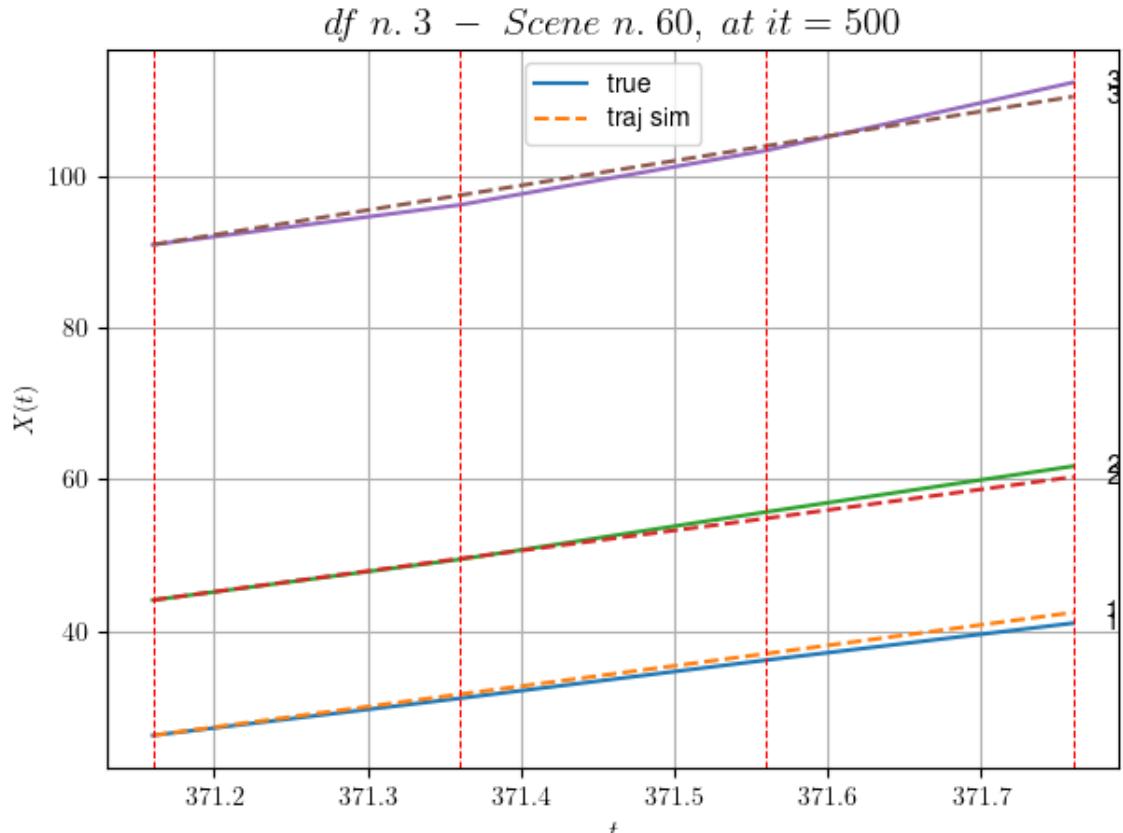
For scene 42/60:  
\* After LR finder: LR\_NN=0.0001 with mse=7.3837520090128725  
at it=24  
\* v0 = 28.13014094914278  
\* MSE = 1.2030870694020286  
\* iterations = 500

---

DataFrame n.3. Scene n.43/60

---

We have 3 time intervals inside [371.16,371.76]



---

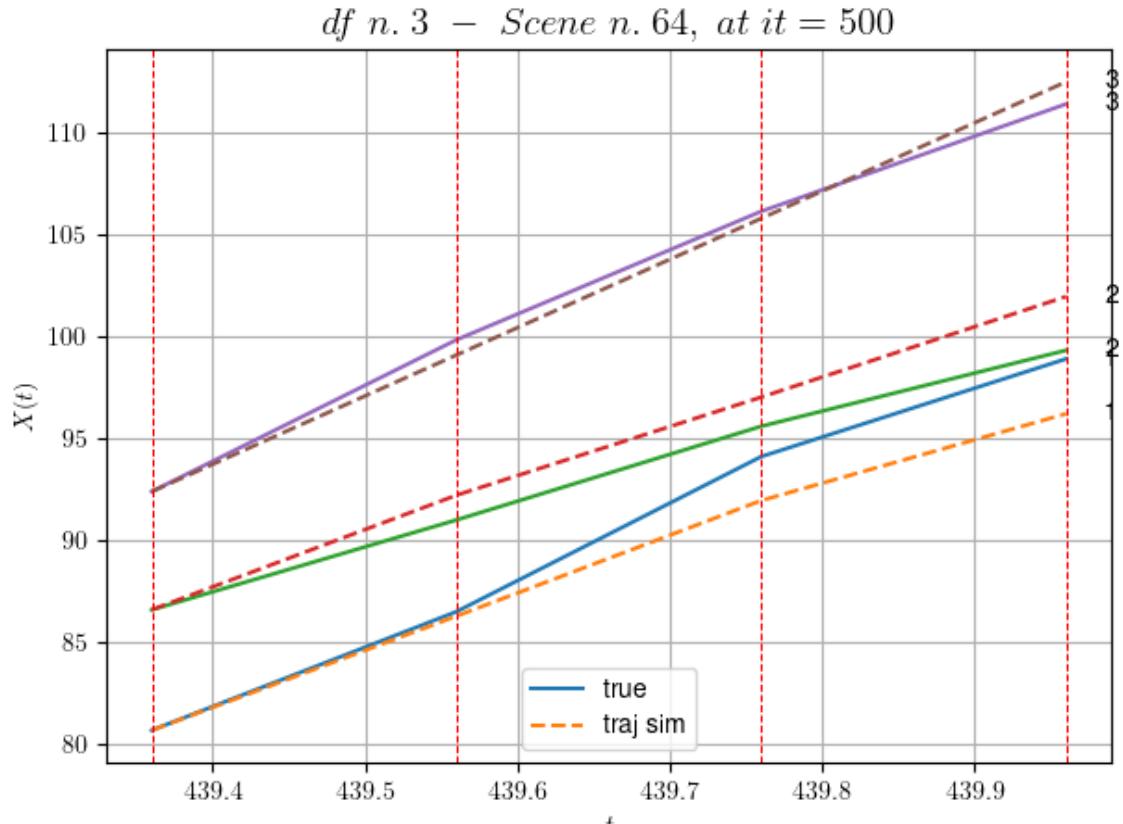
For scene 43/60:  
\* After LR finder: LR\_NN=0.0001 with mse=7.478794496759641  
at it=24  
\* v0 = 32.539507599225885  
\* MSE = 0.9273324904954908  
\* iterations = 500

---

DataFrame n.3. Scene n.44/60

---

We have 3 time intervals inside [439.36, 439.96]

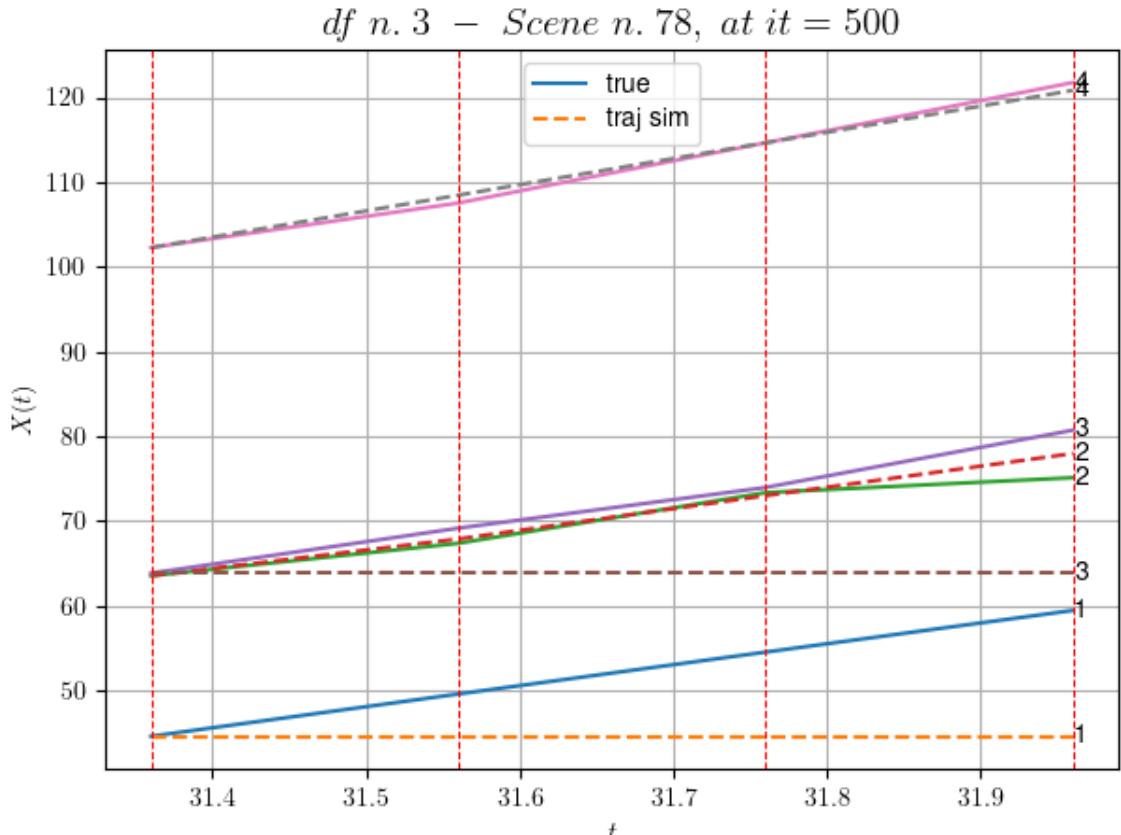


For scene 44/60:

\* After LR finder:  $LR\_NN=0.001$  with  $mse=13.716569629852701$   
at  $it=24$   
\*  $v_0 = 33.53637857273001$   
\*  $MSE = 2.002401423536667$   
\* iterations = 500

DataFrame n.3. Scene n.45/60

We have 3 time intervals inside  $[31.36, 31.96]$

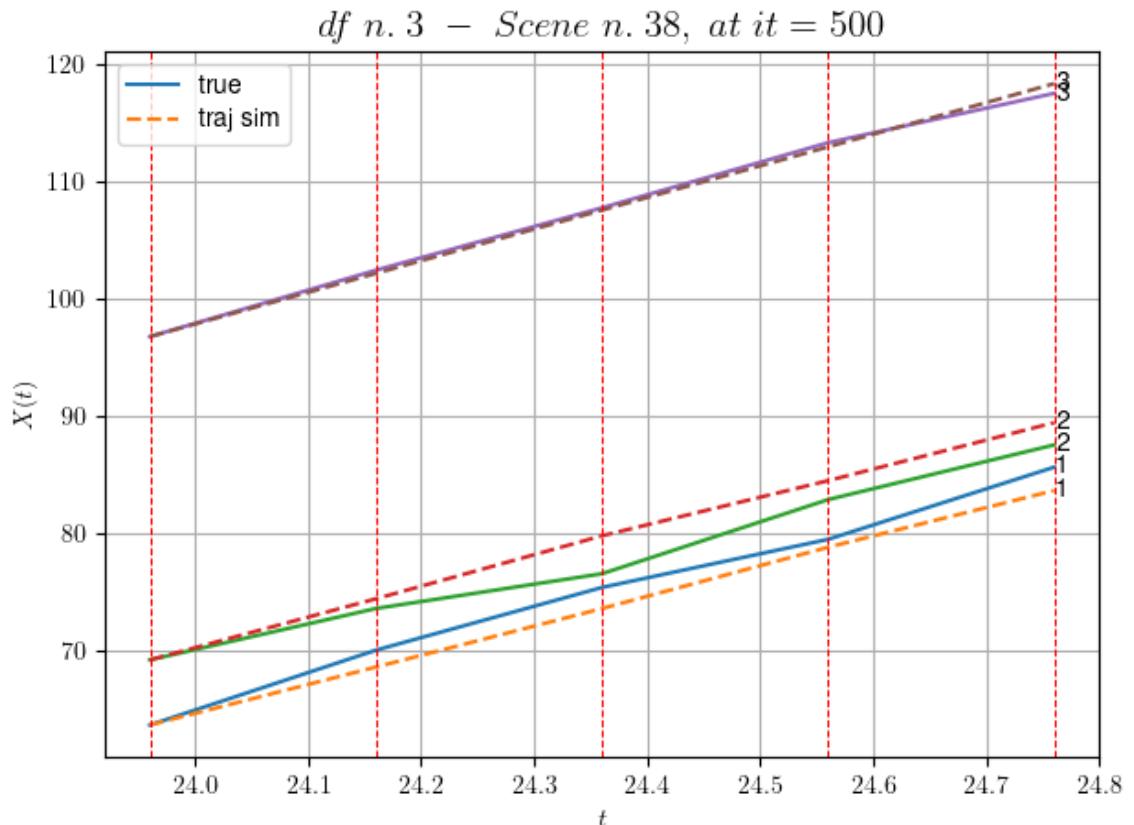


For scene 45/60:

\* After LR finder:  $LR_{NN}=0.001$  with  $mse=8.08775784870968$  at  
it=24  
\*  $v_0 = 30.917174059156007$   
\*  $MSE = 11.934040557240653$   
\* iterations = 500

DataFrame n.3. Scene n.46/60

We have 4 time intervals inside  $[23.96, 24.76]$

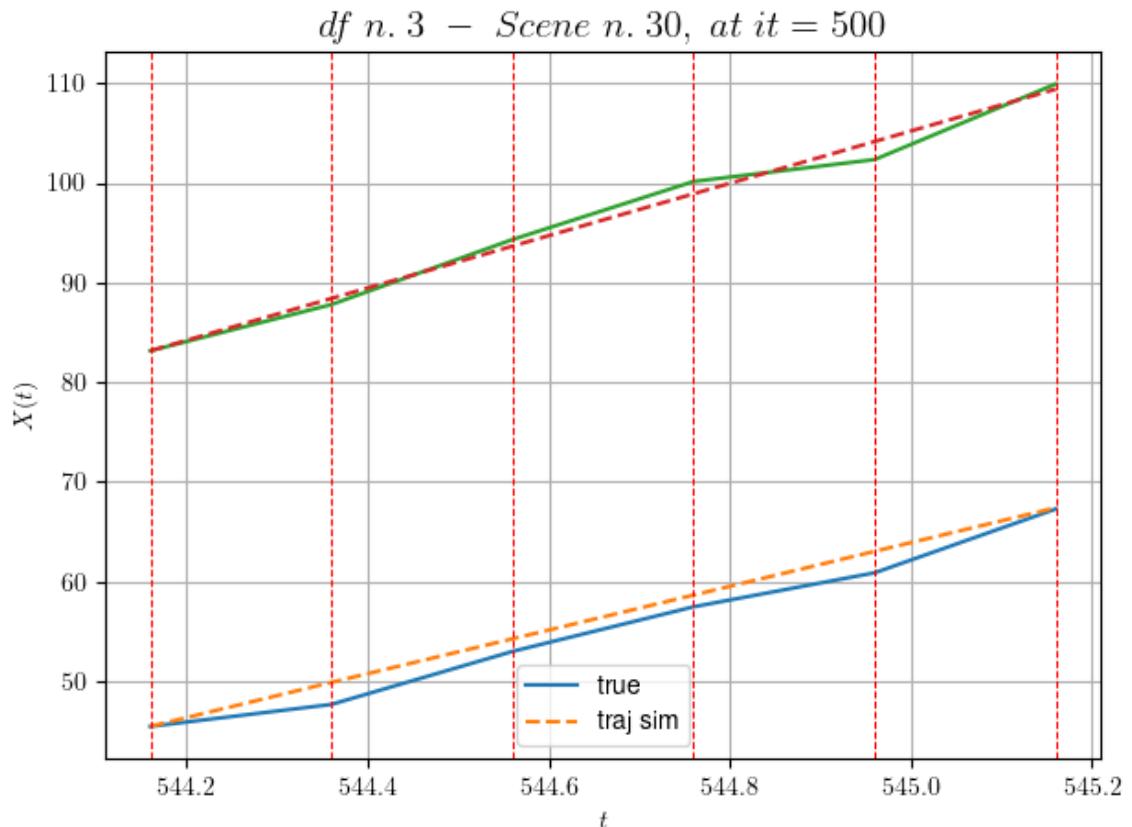


For scene 46/60:

\* After LR finder: LR\_NN=0.0005 with mse=29.805492511081766  
at it=24  
\*  $v_0 = 27.016664353697216$   
\* MSE = 0.9293553619110552  
\* iterations = 500

DataFrame n.3. Scene n.47/60

We have 5 time intervals inside [544.16, 545.16]



---

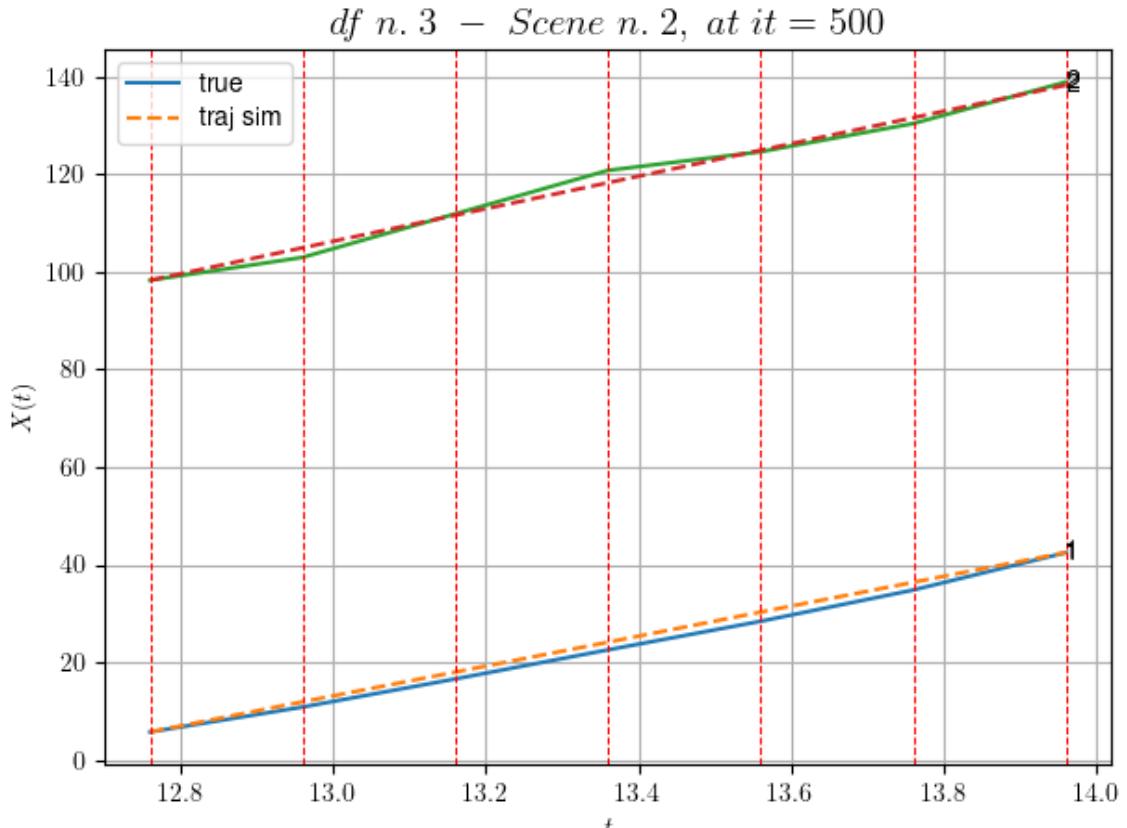
For scene 47/60:  
\* After LR finder: LR\_NN=1e-05 with mse=3.8330653330190407  
at it=24  
\* v0 = 26.24502129326933  
\* MSE = 1.5306404435117074  
\* iterations = 500

---

DataFrame n.3. Scene n.48/60

---

We have 6 time intervals inside [12.76,13.96]

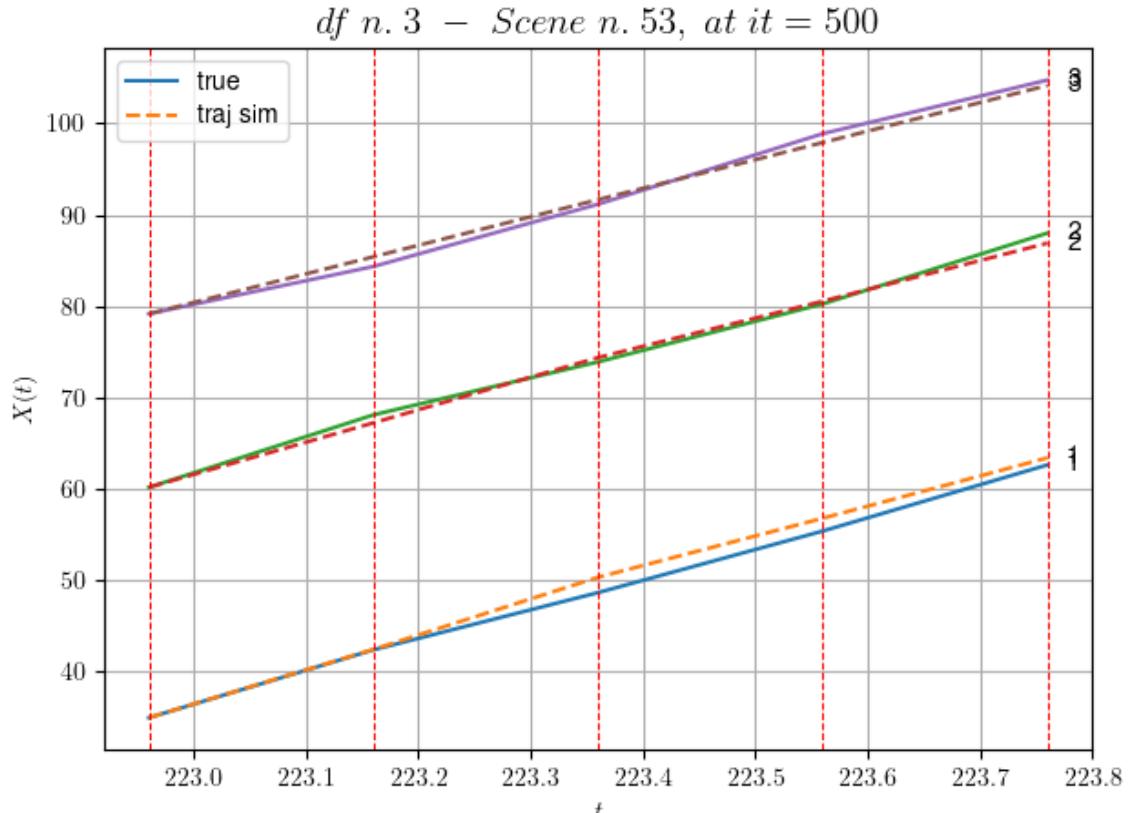


For scene 48/60:

\* After LR finder: LR\_NN=1e-05 with mse=4.891399703480567 at it=24  
\* v0 = 33.329707464158126  
\* MSE = 1.713380458721403  
\* iterations = 500

DataFrame n.3. Scene n.49/60

We have 4 time intervals inside [222.96,223.76]

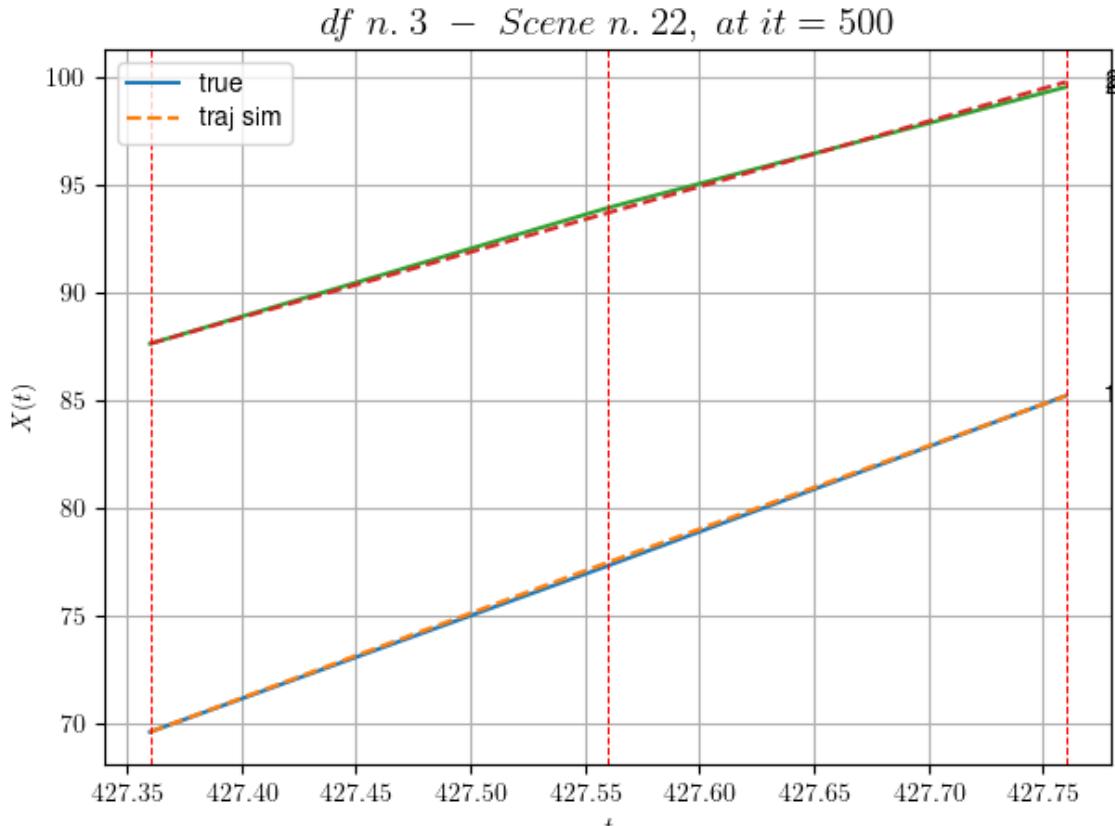


For scene 49/60:

\* After LR finder:  $LR\_NN=0.0005$  with  $mse=6.227620933977232$   
at it=24  
\*  $v_0 = 31.279750687418026$   
\* MSE = 0.6893327789418532  
\* iterations = 500

-----  
DataFrame n.3. Scene n.50/60

-----  
We have 2 time intervals inside [427.36, 427.76]

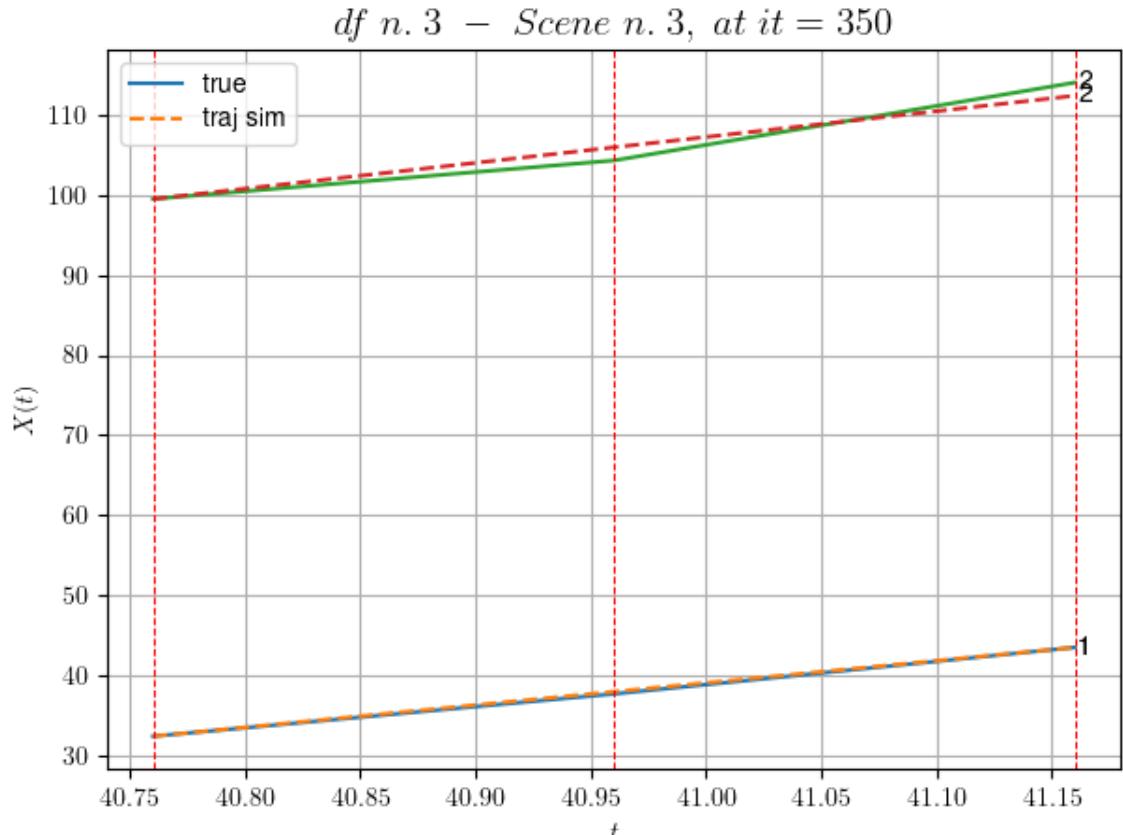


For scene 50/60:

\* After LR finder:  $\text{LR\_NN}=5\text{e-}05$  with  $\text{mse}=0.04928159829639406$   
at it=24  
\*  $v_0 = 30.36152559681279$   
\*  $\text{MSE} = 0.020289369505616613$   
\* iterations = 500

DataFrame n.3. Scene n.51/60

We have 2 time intervals inside [40.76,41.16]



---

For scene 51/60:

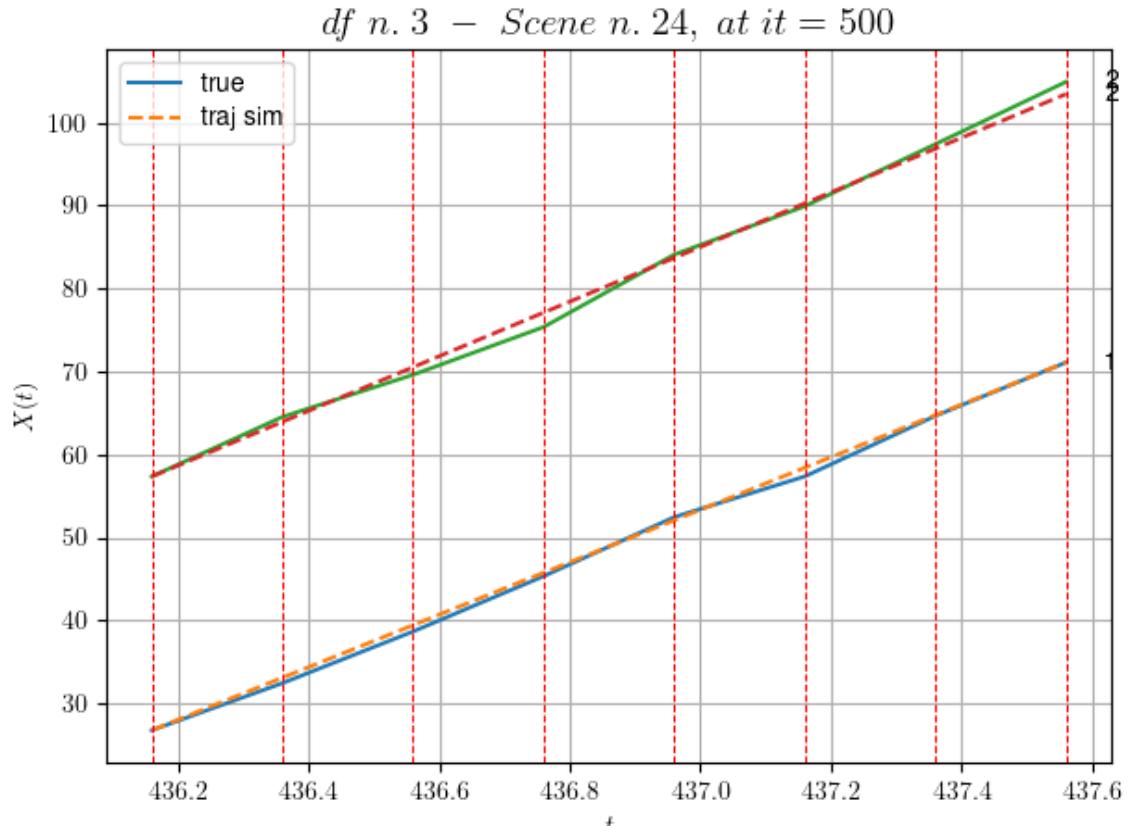
- \* After LR finder: LR\_NN=1e-05 with mse=1.318094899948956 at it=24
- \* v0 = 32.20688347720759
- \* MSE = 0.9102290772252988
- \* iterations = 350

---

DataFrame n.3. Scene n.52/60

---

We have 7 time intervals inside [436.16, 437.56]

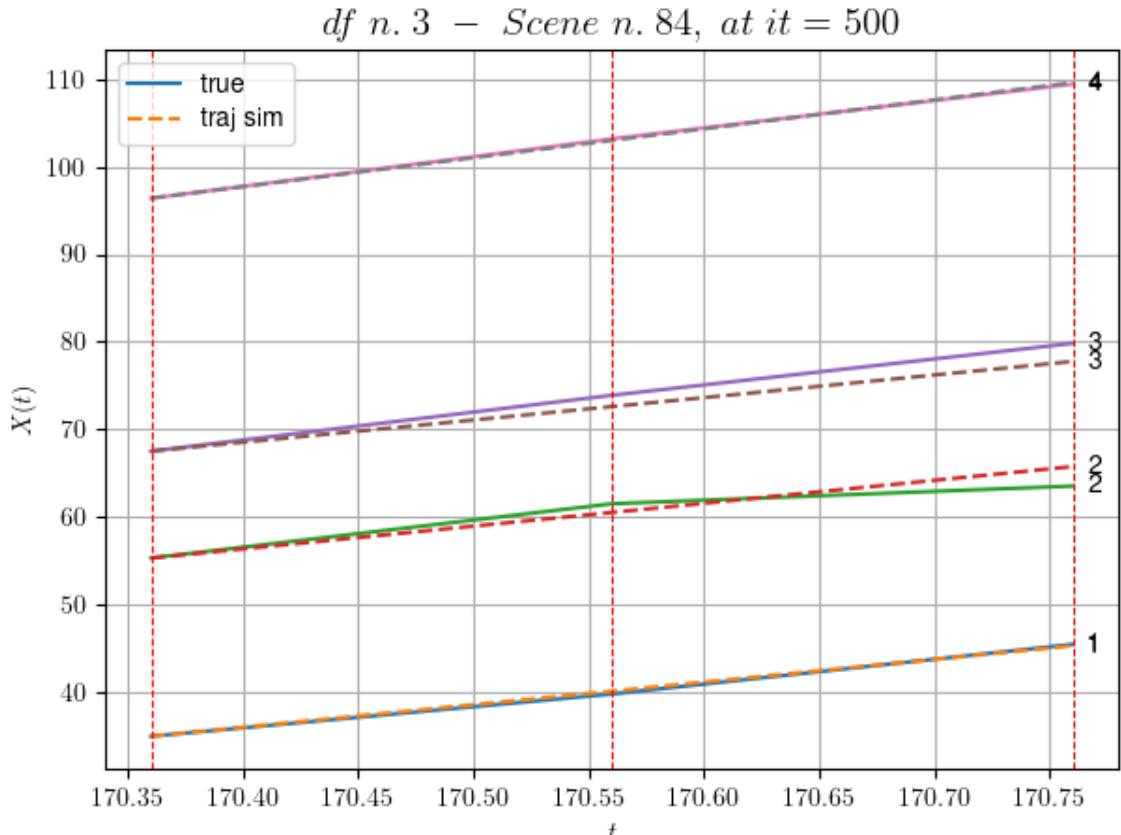


For scene 52/60:

\* After LR finder: LR\_NN=1e-05 with mse=4.059735726333796 at it=24  
\* v0 = 32.923939302764374  
\* MSE = 0.5883205910542035  
\* iterations = 500

DataFrame n.3. Scene n.53/60

We have 2 time intervals inside [170.36,170.76]

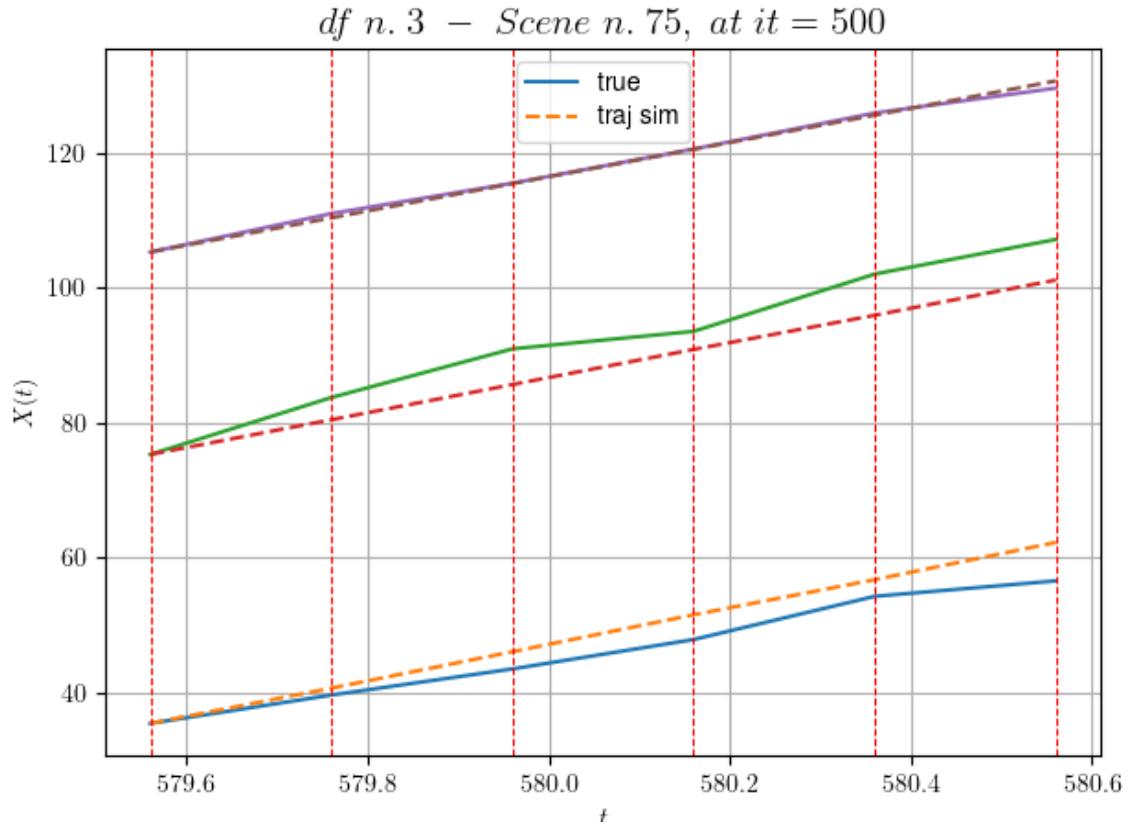


-----  
For scene 53/60:  
\* After LR finder: LR\_NN=5e-05 with mse=1.9619510446497623  
at it=24  
\* v0 = 32.99653993565741  
\* MSE = 1.0043126246183198  
\* iterations = 500  
-----

DataFrame n.3. Scene n.54/60

-----

We have 5 time intervals inside [579.56, 580.56]

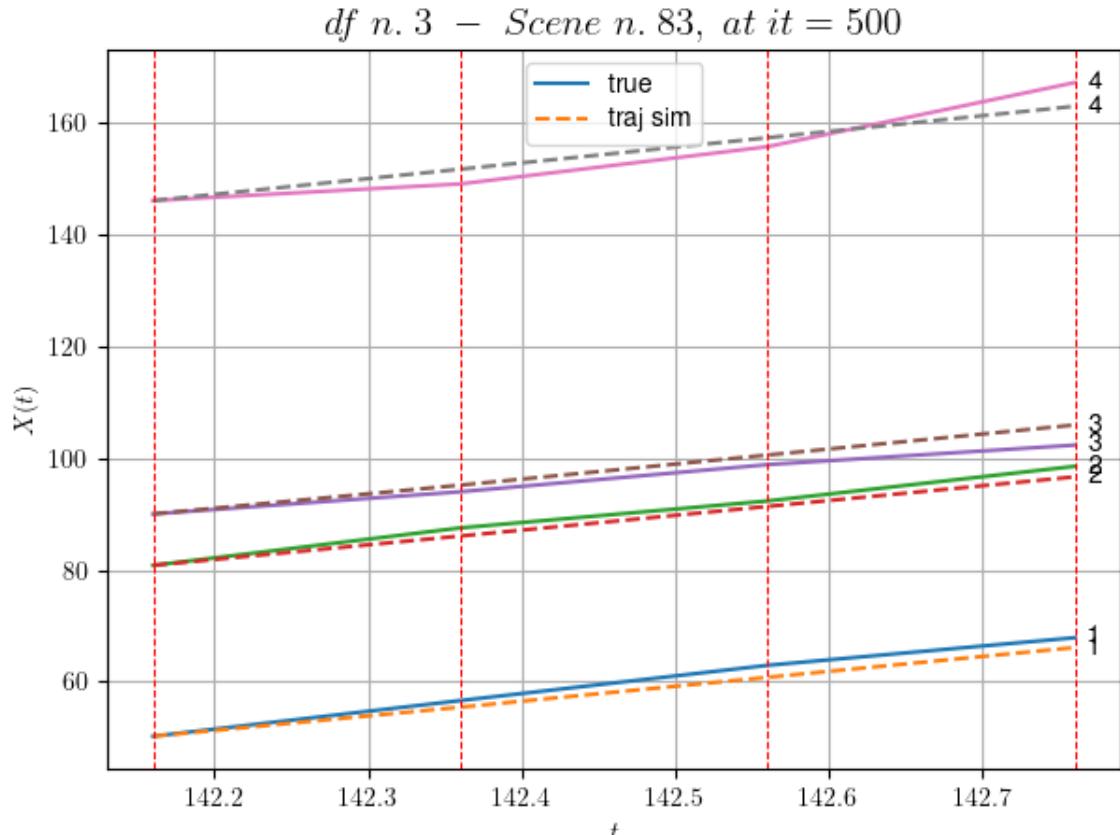


For scene 54/60:

\* After LR finder: LR\_NN=5e-05 with mse=37.49639158117758 at it=24  
\* v0 = 25.358404463471214  
\* MSE = 10.038653080770256  
\* iterations = 500

DataFrame n.3. Scene n.55/60

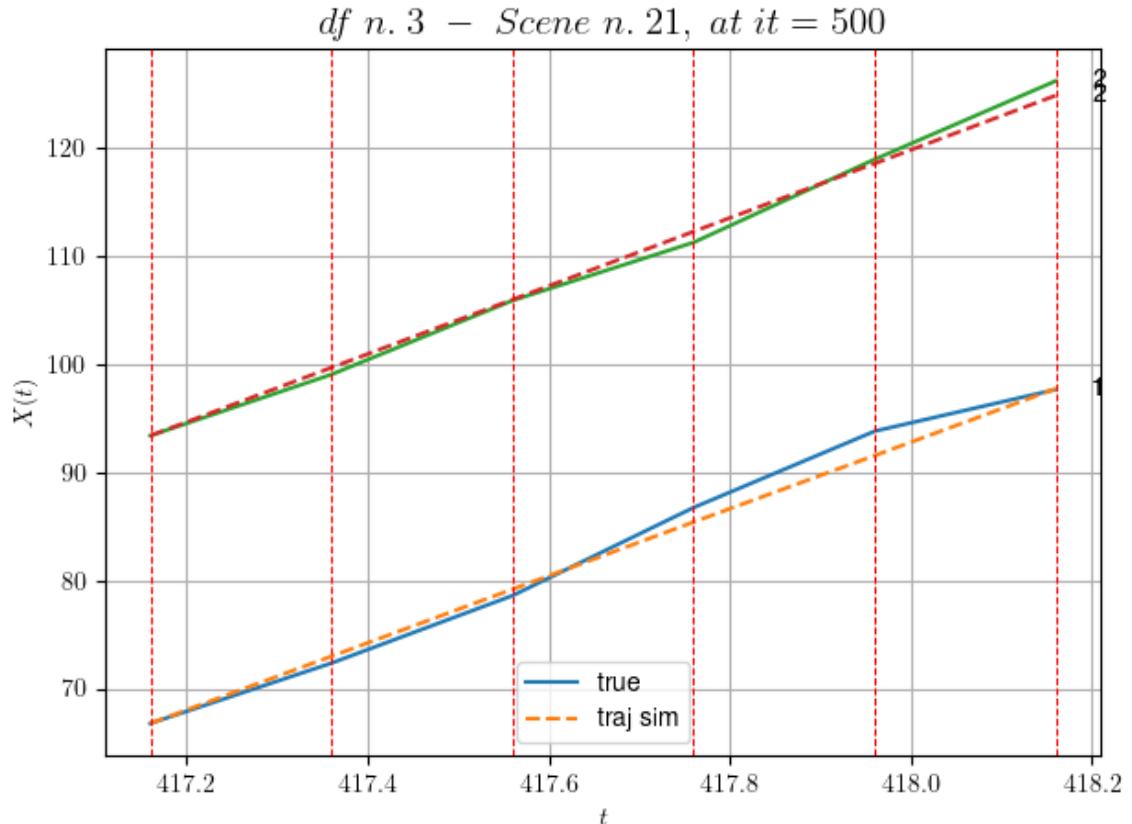
We have 3 time intervals inside [142.16,142.76]



-----  
For scene 55/60:  
\* After LR finder: LR\_NN=0.0001 with mse=31.37975197329223  
at it=24  
\* v0 = 28.121237748537737  
\* MSE = 3.7674274303354753  
\* iterations = 500  
-----

DataFrame n.3. Scene n.56/60

-----  
We have 5 time intervals inside [417.16,418.16]



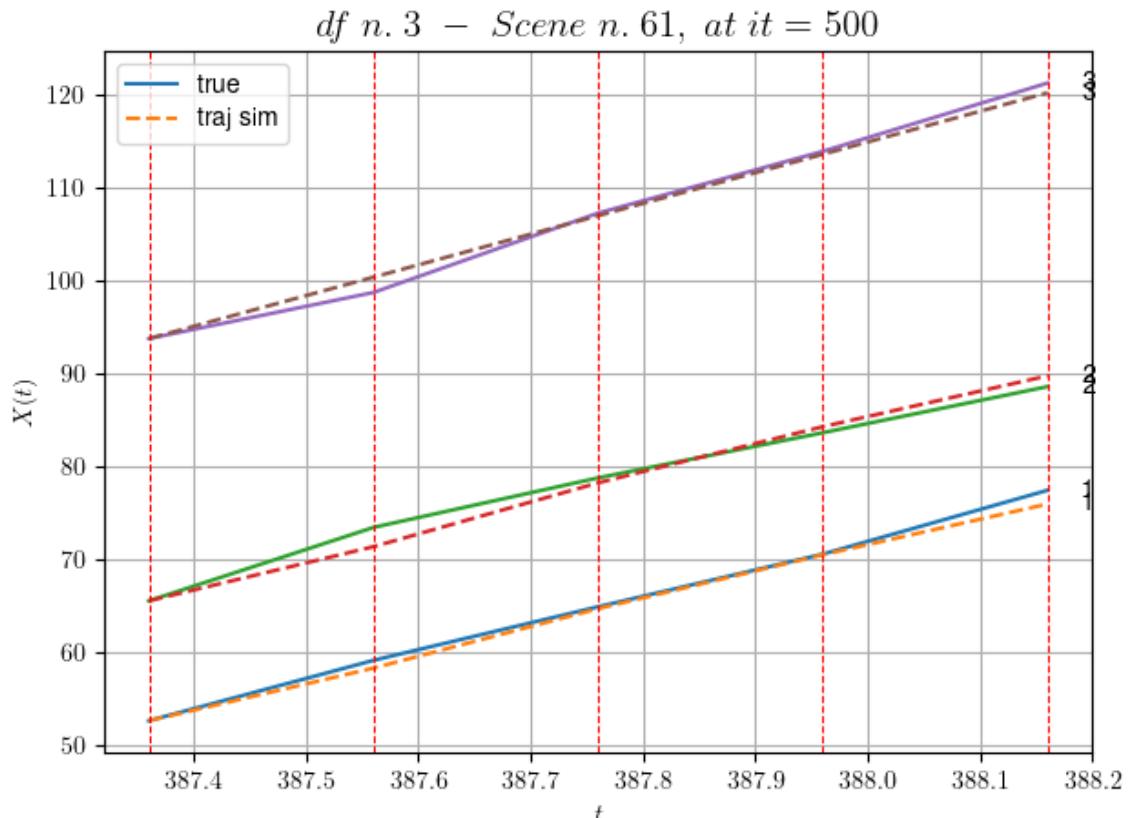
For scene 56/60:

\* After LR finder: LR\_NN=1e-05 with mse=1.43703796521986 at  
it=24

- \*  $v_0 = 31.447990123716497$
- \* MSE = 0.910281432352841
- \* iterations = 500

DataFrame n.3. Scene n.57/60

We have 4 time intervals inside [387.36,388.16]



---

For scene 57/60:

\* After LR finder:  $LR_{NN}=0.0005$  with  $mse=14.778878636849578$   
at it=24  
\*  $v_0 = 33.03189808825611$   
\*  $MSE = 0.8830026053366263$   
\* iterations = 500

---

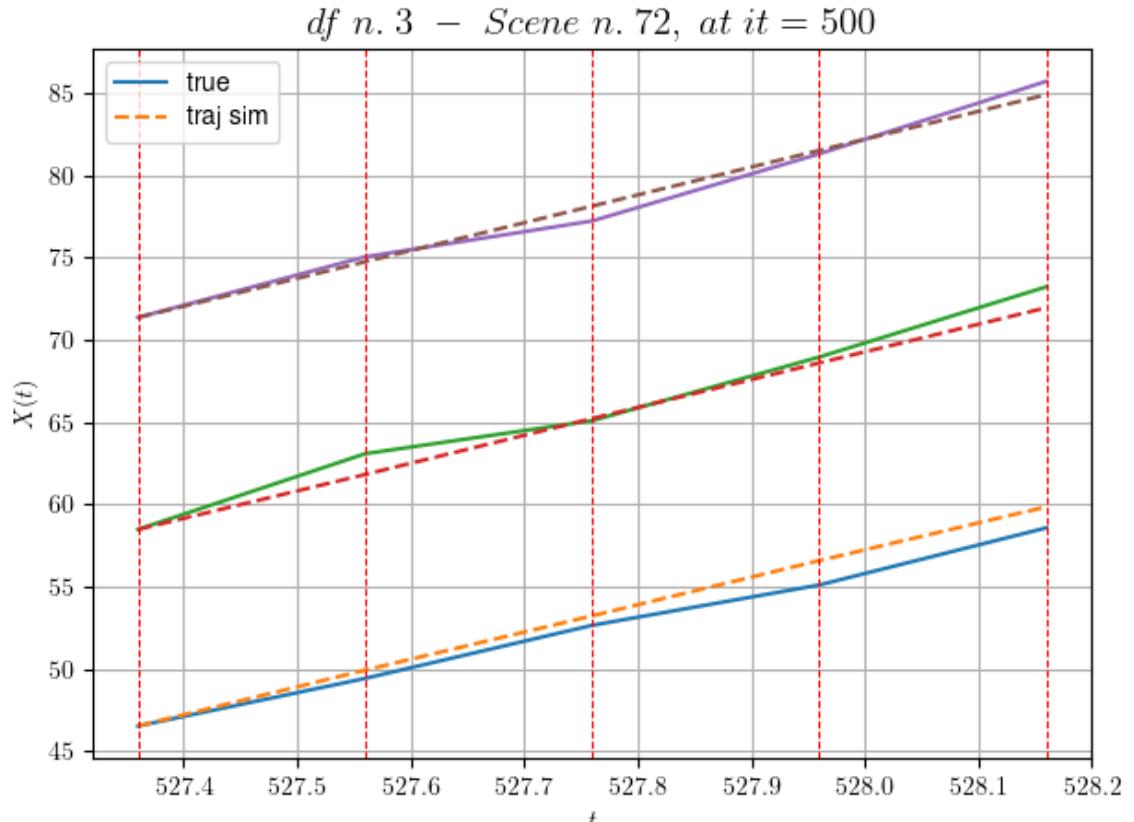
---

DataFrame n.3. Scene n.58/60

---

---

We have 4 time intervals inside [527.36, 528.16]

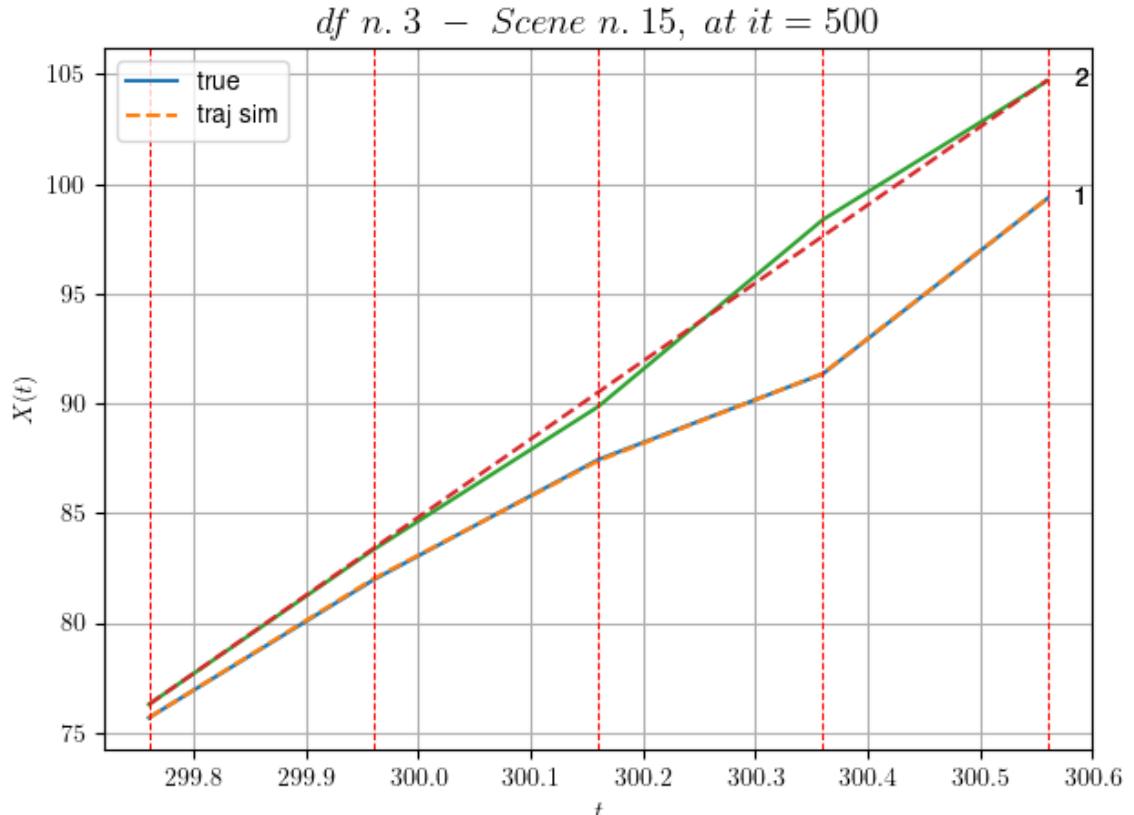


-----  
For scene 58/60:

\* After LR finder: LR\_NN=5e-05 with mse=14.096921053210503  
at it=24  
\* v0 = 16.920906022775245  
\* MSE = 0.6218282442132047  
\* iterations = 500  
-----  
-----

DataFrame n.3. Scene n.59/60

-----  
We have 4 time intervals inside [299.76,300.56]



---

For scene 59/60:

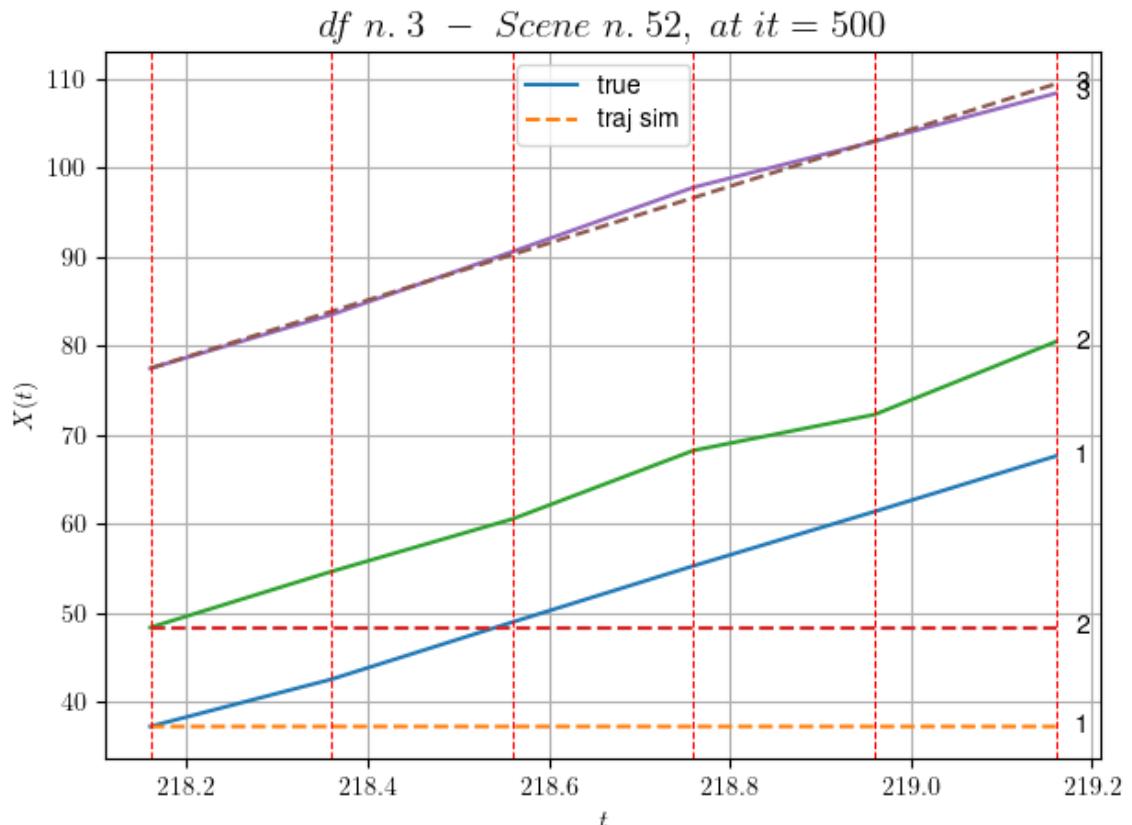
- \* After LR finder:  $LR_{NN}=0.001$  with  $mse=5.329072388433794$  at  $it=24$
- \*  $v_0 = 35.5562018199701$
- \*  $MSE = 0.10039702856815914$
- \* iterations = 500

---

DataFrame n.3. Scene n.60/60

---

We have 5 time intervals inside [218.16, 219.16]



-----  
For scene 60/60:  
\* After LR finder: LR\_NN=0.0005 with mse=27.878939148336304  
at it=24  
\* v0 = 31.946925583263344  
\* MSE = 232.38781159587026  
\* iterations = 500  
-----  
-----

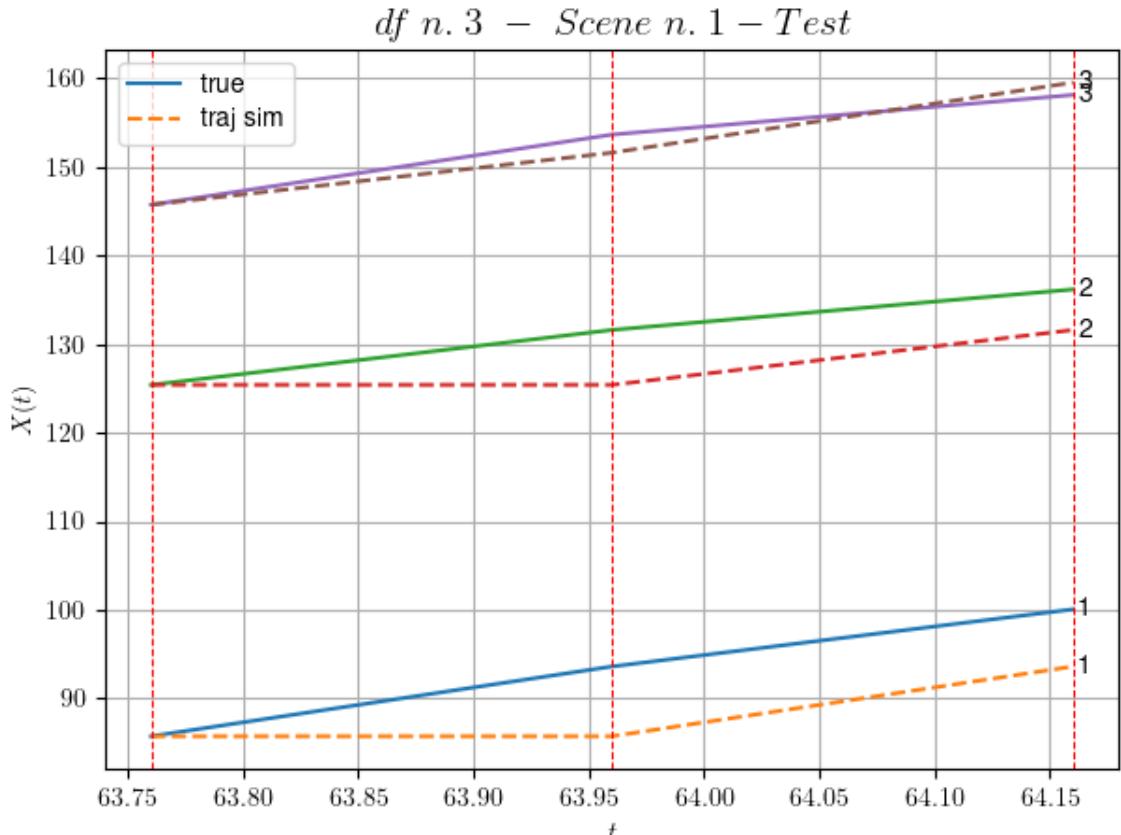
MSE train: 6.173137419491575

-----  
-----  
-----

Testing step. (30 scenes)

=====

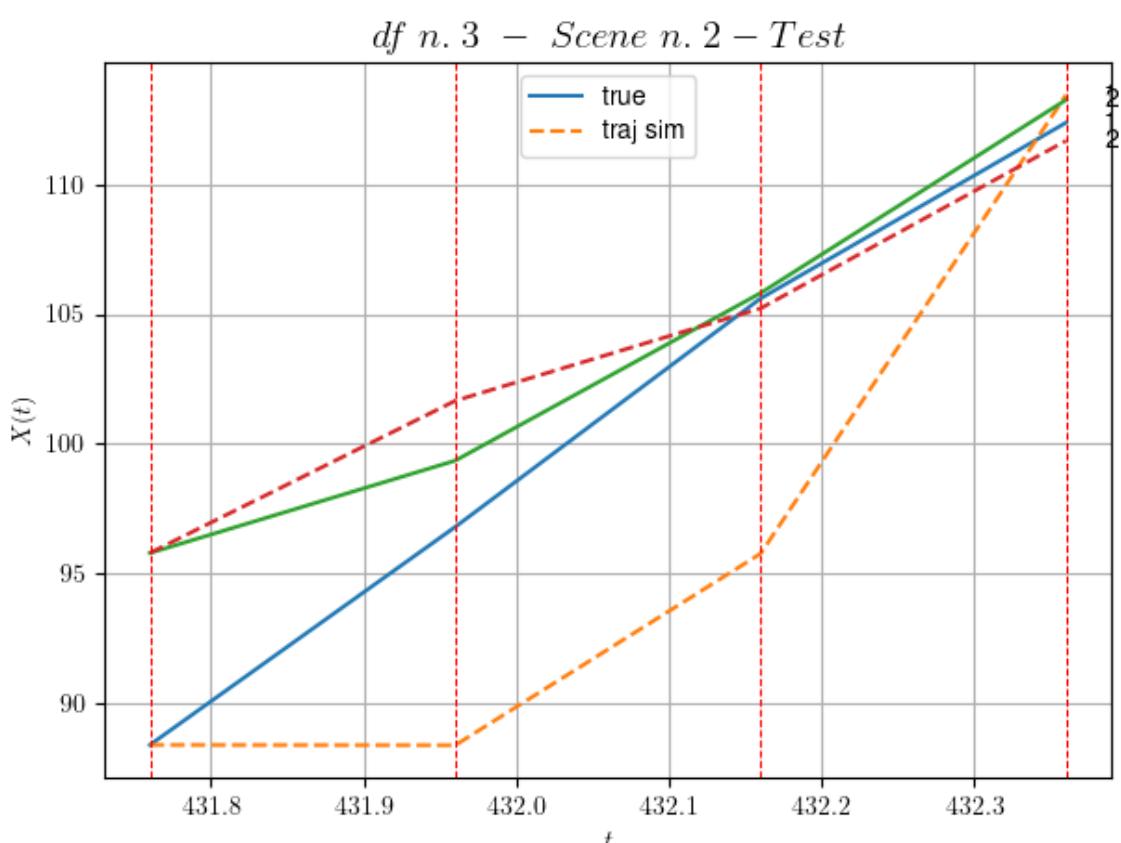
DataFrame n.3. Scene n.1/30



For scene 1/30:  
\* MSE = 18.757419812432342

---

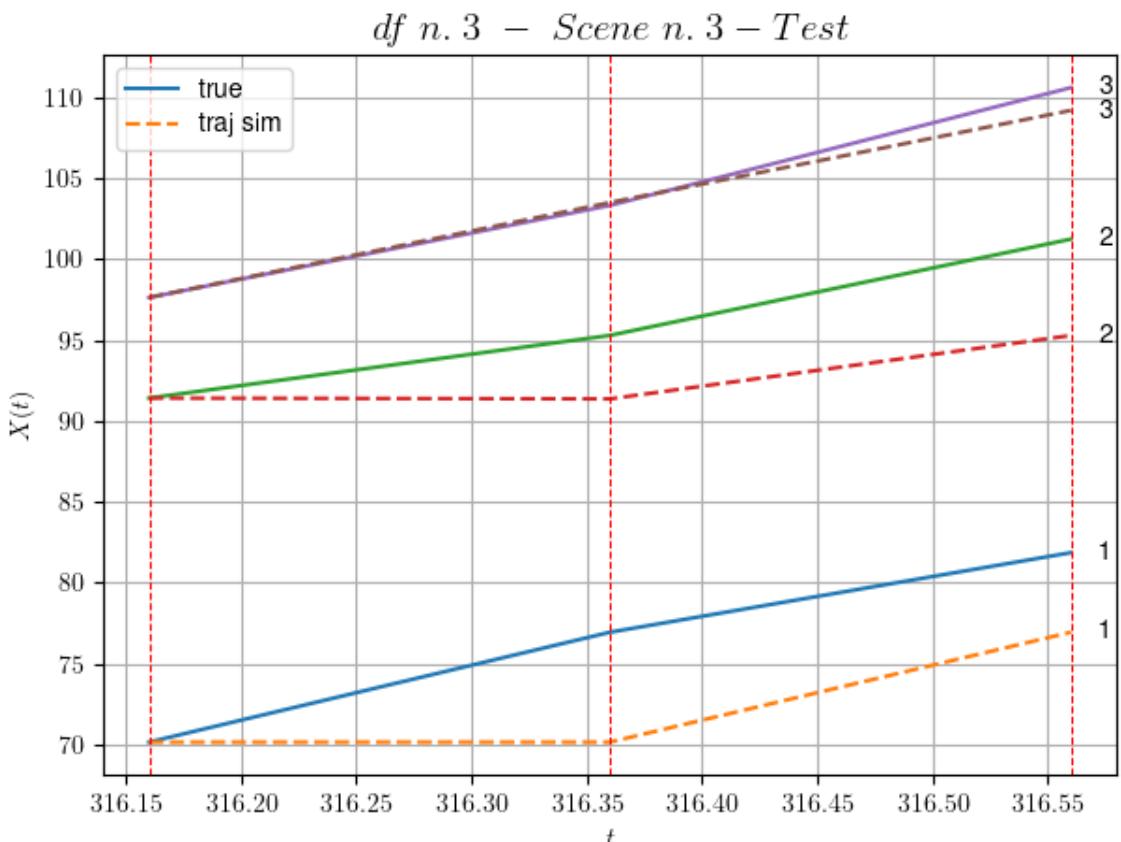
#### DataFrame n.3. Scene n.2/30



For scene 2/30:  
\* MSE = 22.144685523290324

---

DataFrame n.3. Scene n.3/30

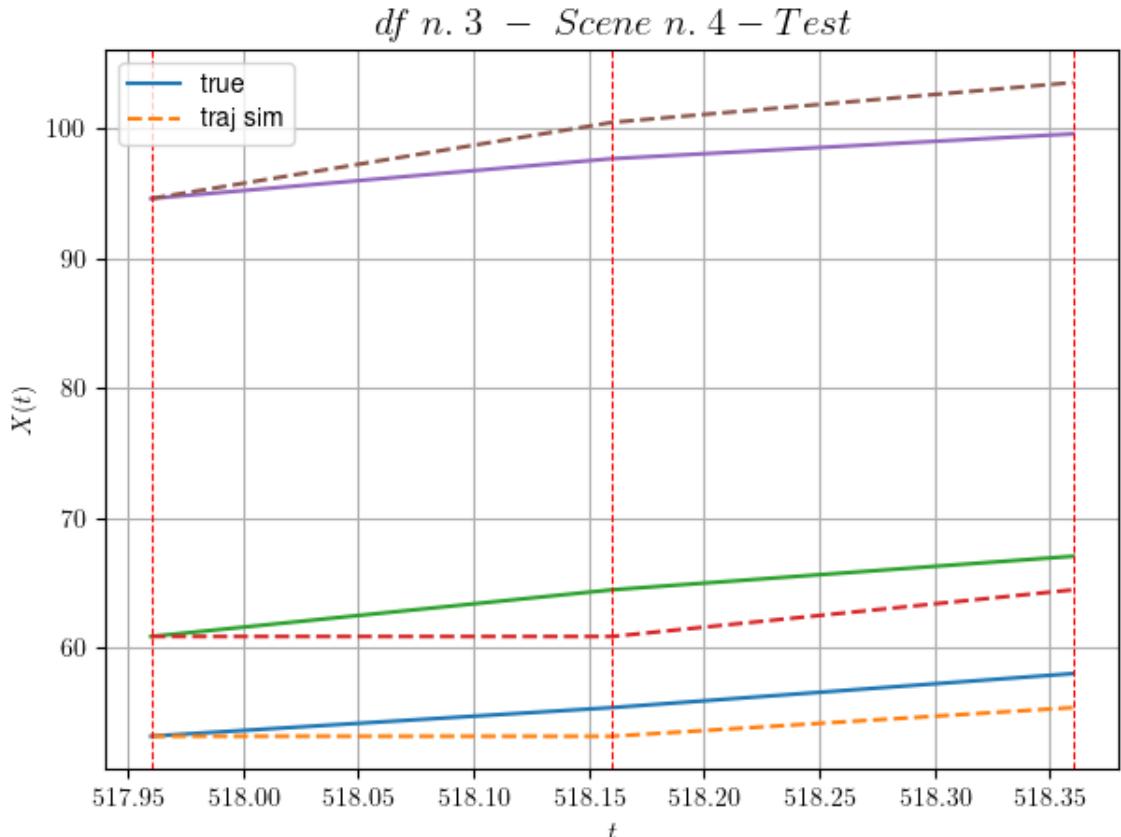


For scene 3/30:  
\* MSE = 13.694323662647053

---

---

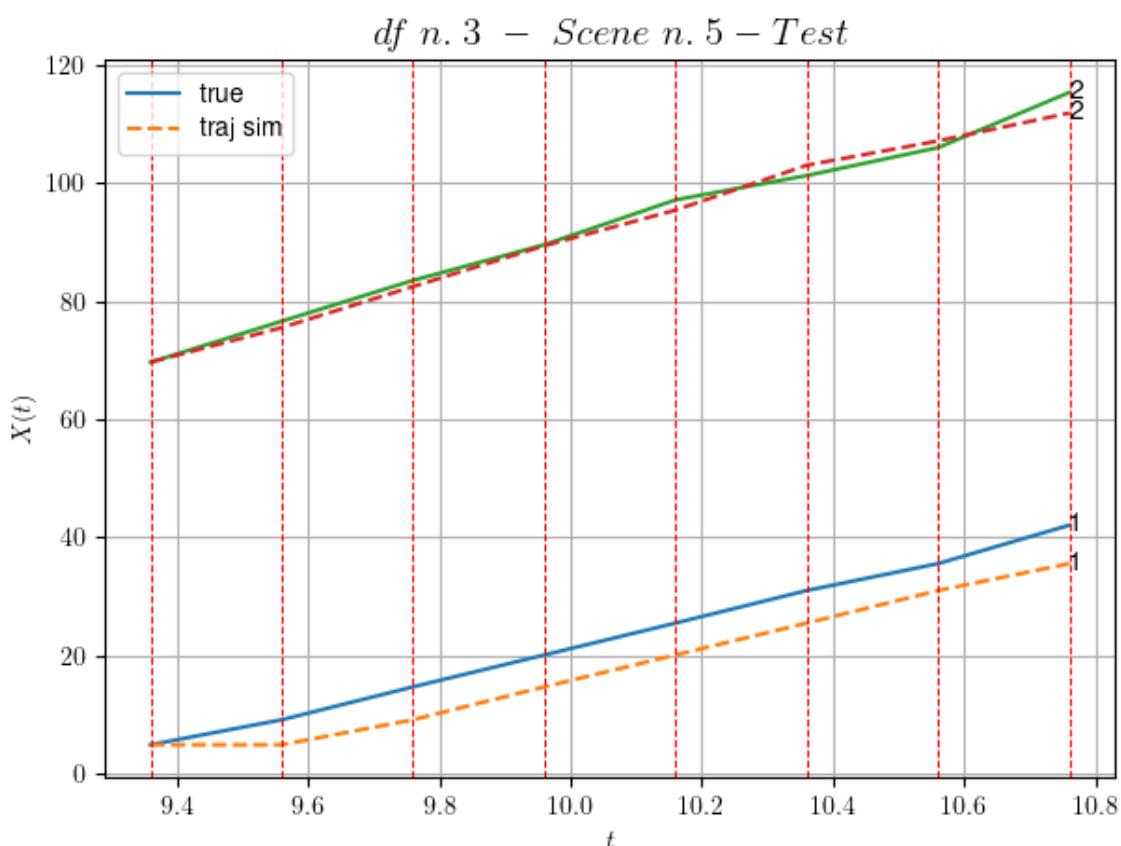
DataFrame n.3. Scene n.4/30



For scene 4/30:  
\* MSE = 6.104279510775142

---

#### DataFrame n.3. Scene n.5/30

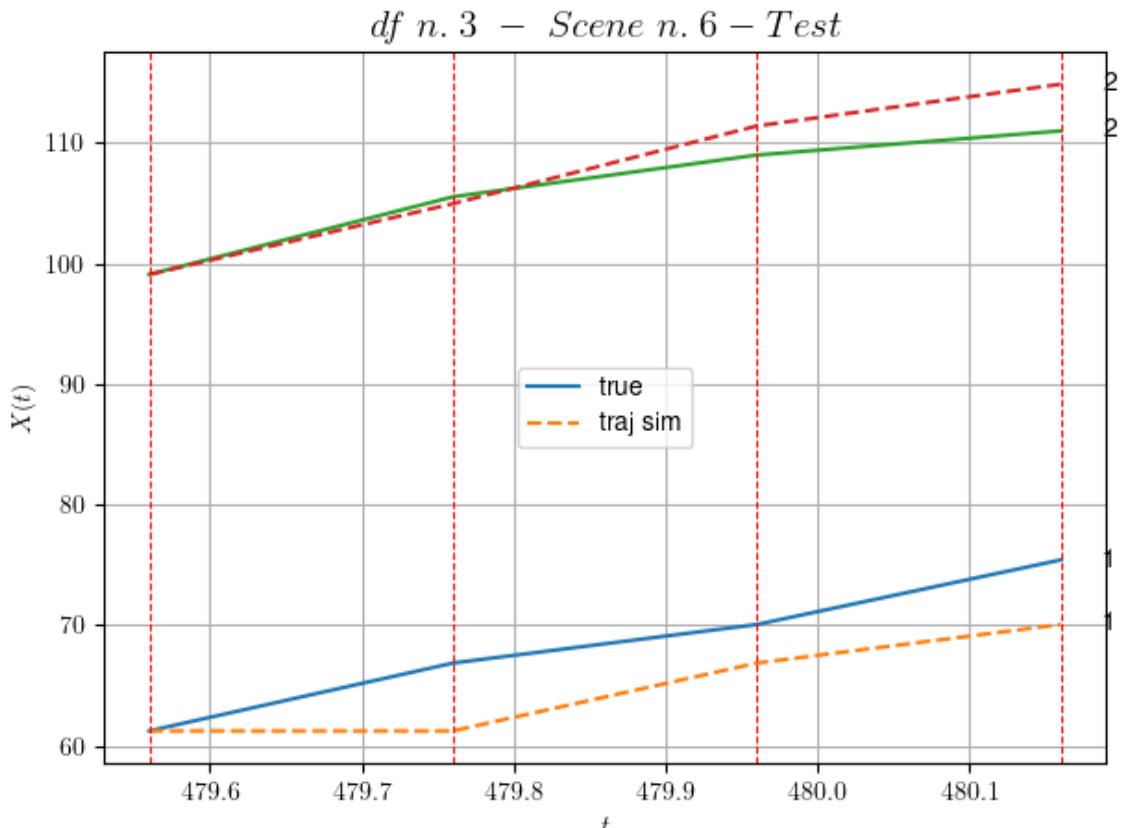


For scene 5/30:  
\* MSE = 13.967014468460311

---

---

DataFrame n.3. Scene n.6/30

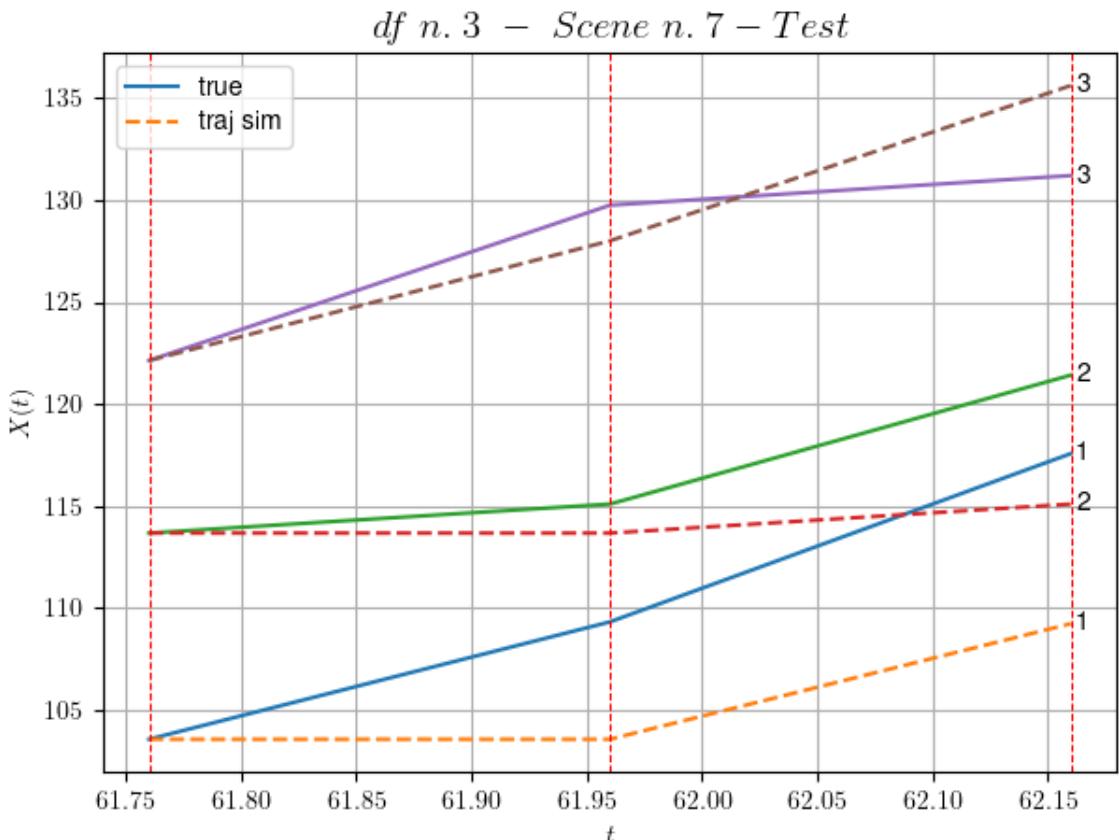


For scene 6/30:  
\* MSE = 11.466827131456288

---

---

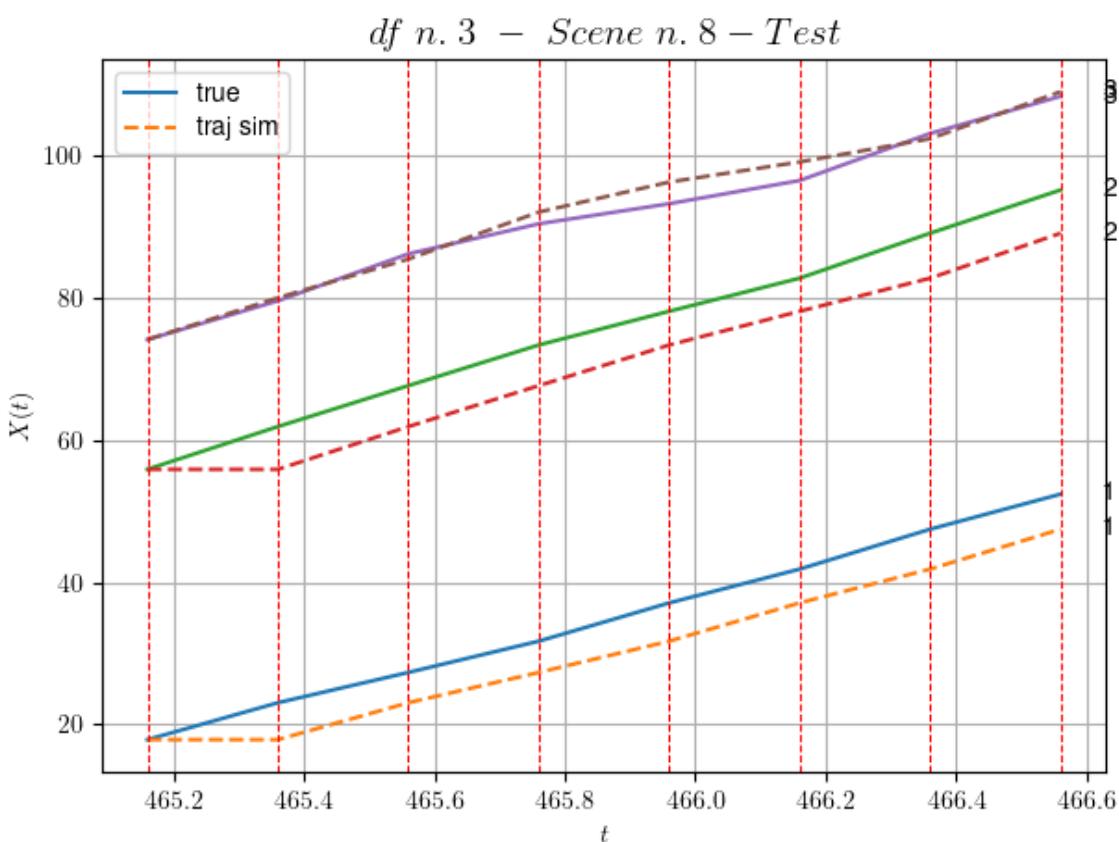
DataFrame n.3. Scene n.7/30



For scene 7/30:  
\* MSE = 18.609449782876332

---

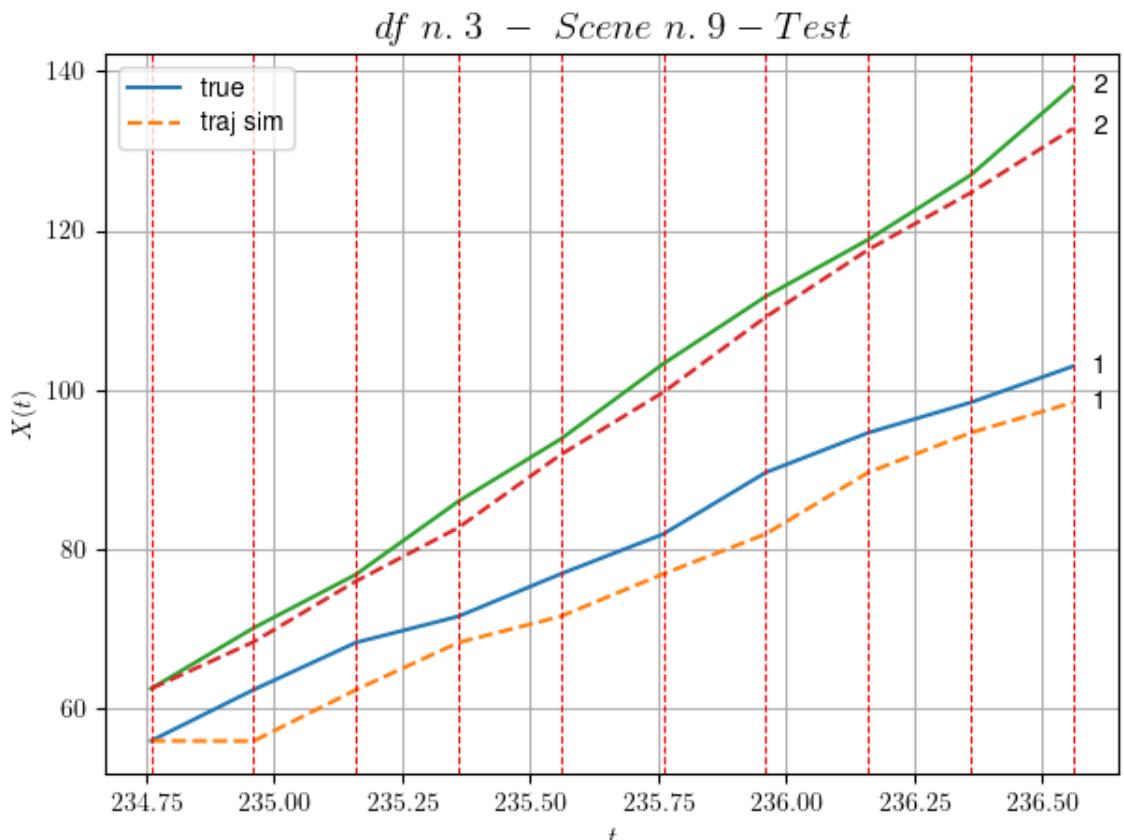
#### DataFrame n.3. Scene n.8/30



For scene 8/30:  
\* MSE = 17.297429095663436

---

DataFrame n.3. Scene n.9/30

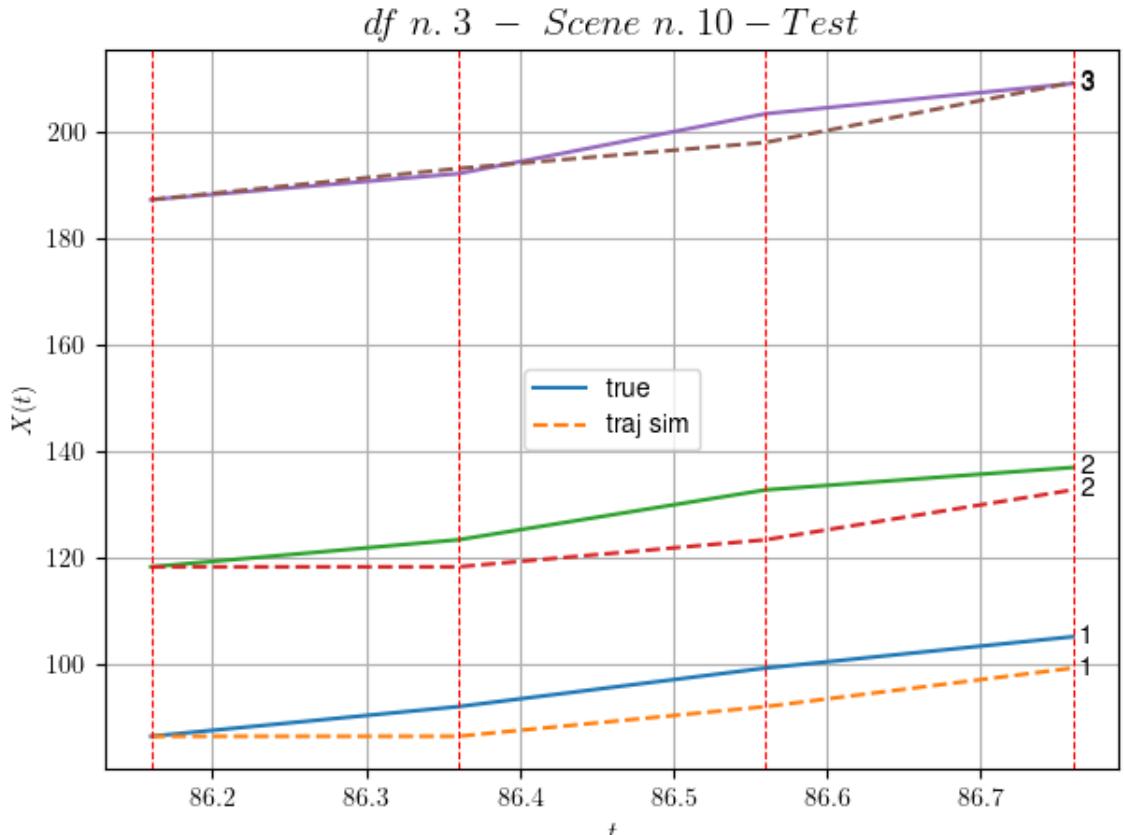


For scene 9/30:  
\* MSE = 16.648124338518095

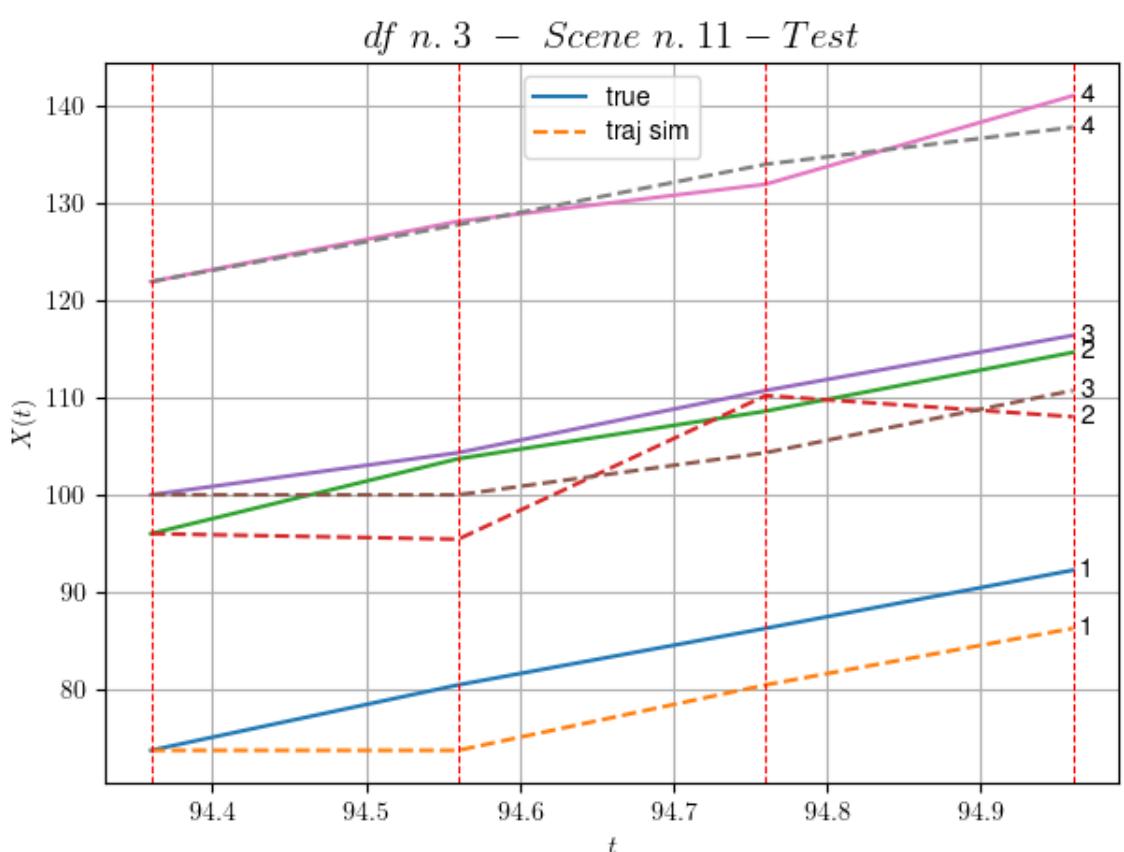
---

---

DataFrame n.3. Scene n.10/30



DataFrame n.3. Scene n.11/30

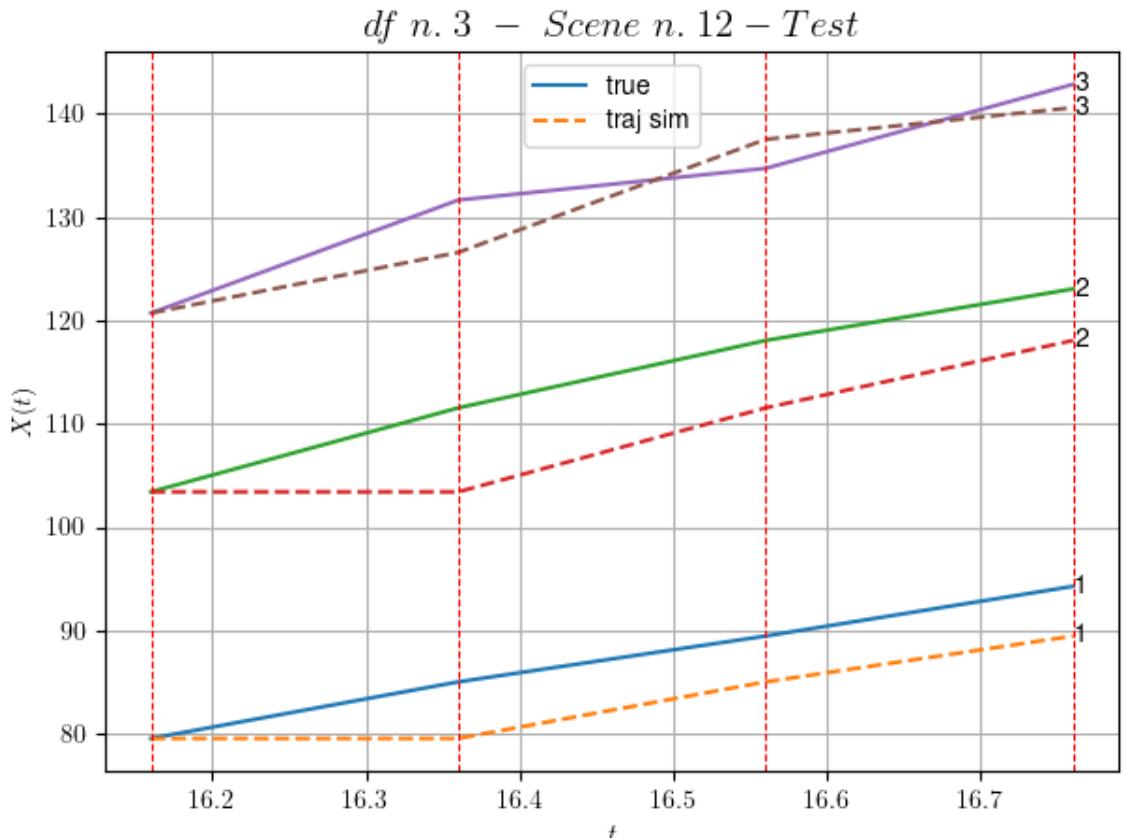


For scene 11/30:  
\* MSE = 21.10412794332405

---

---

DataFrame n.3. Scene n.12/30

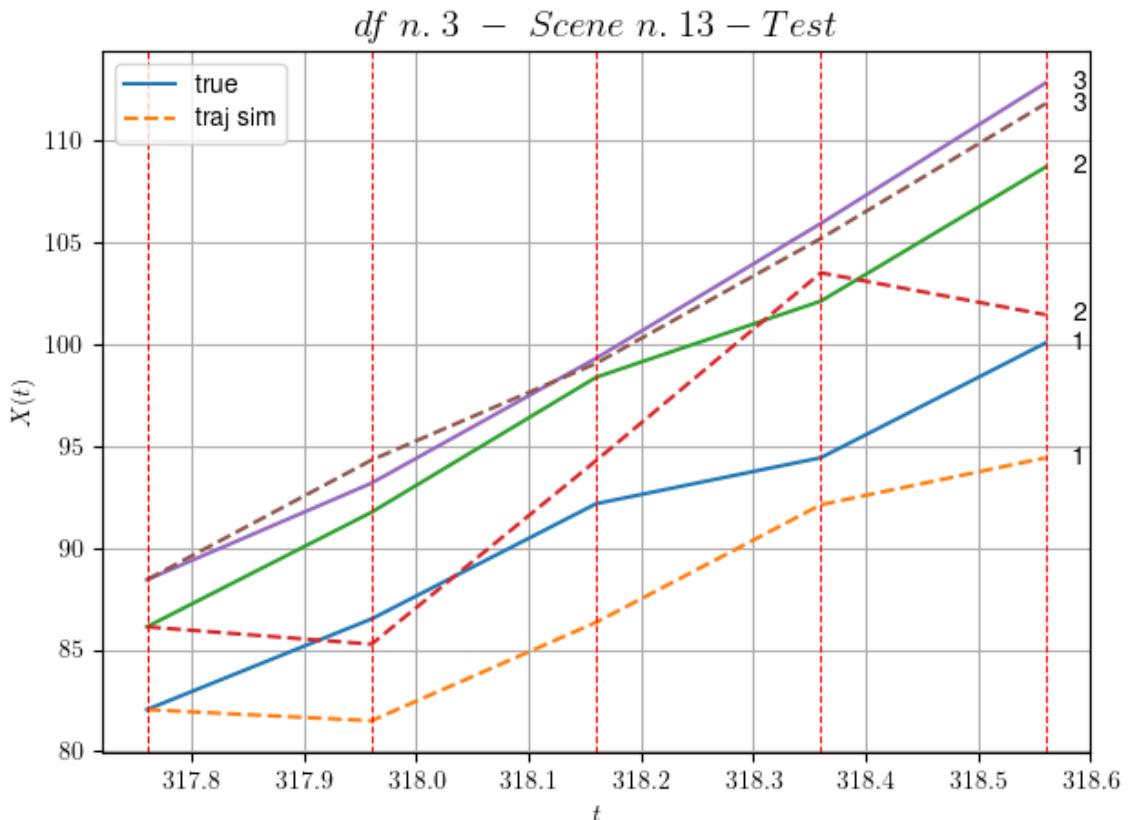


For scene 12/30:  
\* MSE = 20.38941105961131

---

---

DataFrame n.3. Scene n.13/30



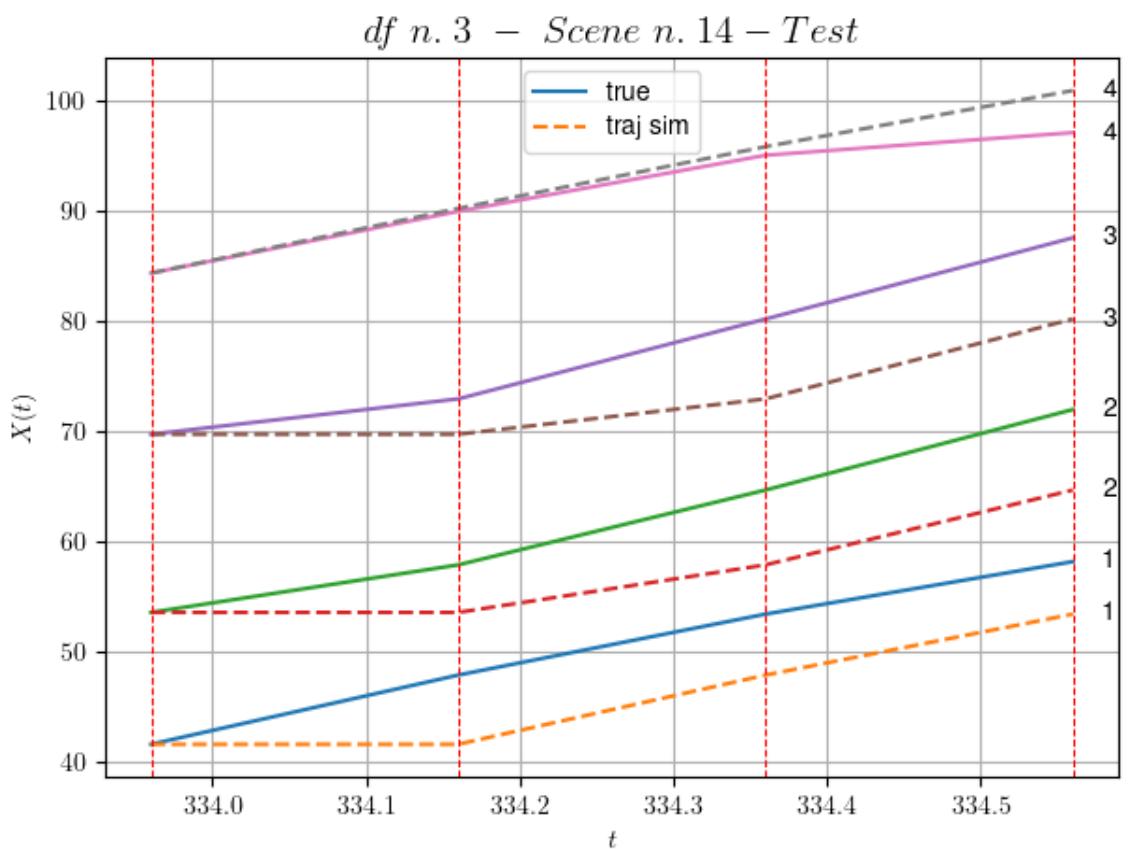
For scene 13/30:  
 \* MSE = 14.110140823760858

---



---

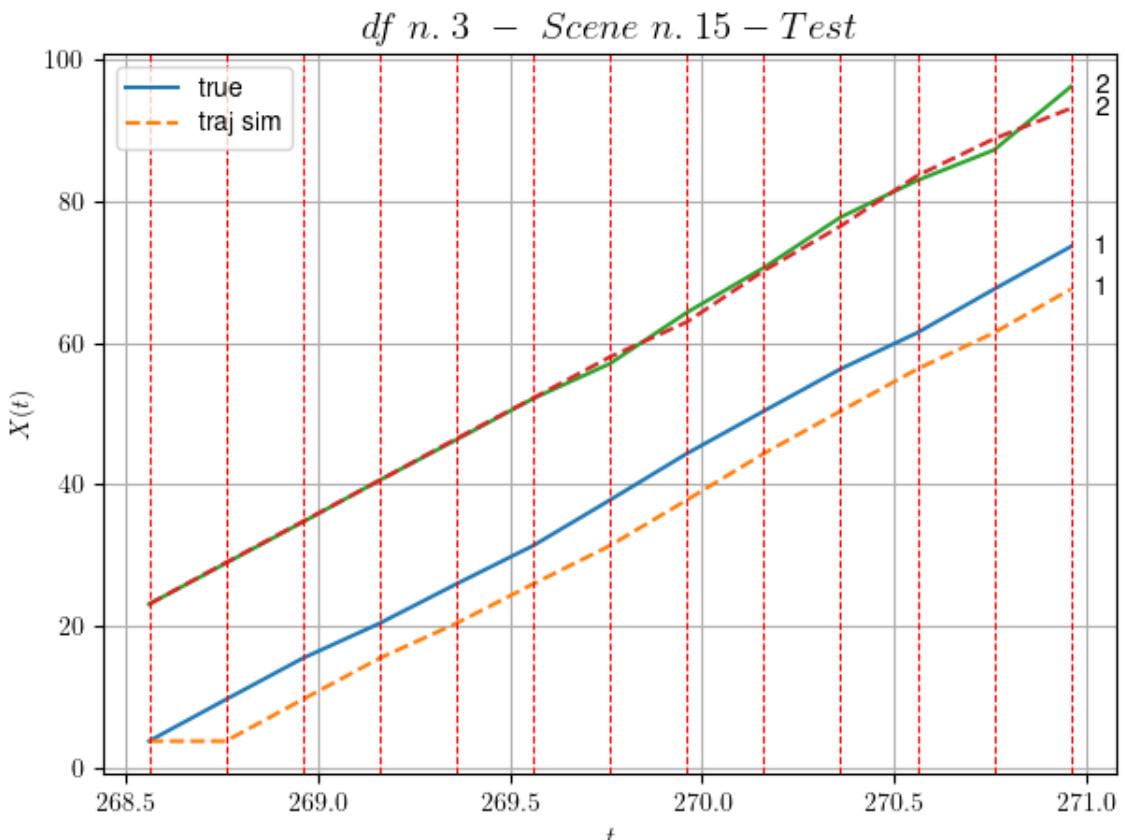
DataFrame n.3. Scene n.14/30



For scene 14/30:  
\* MSE = 21.462471160611248

---

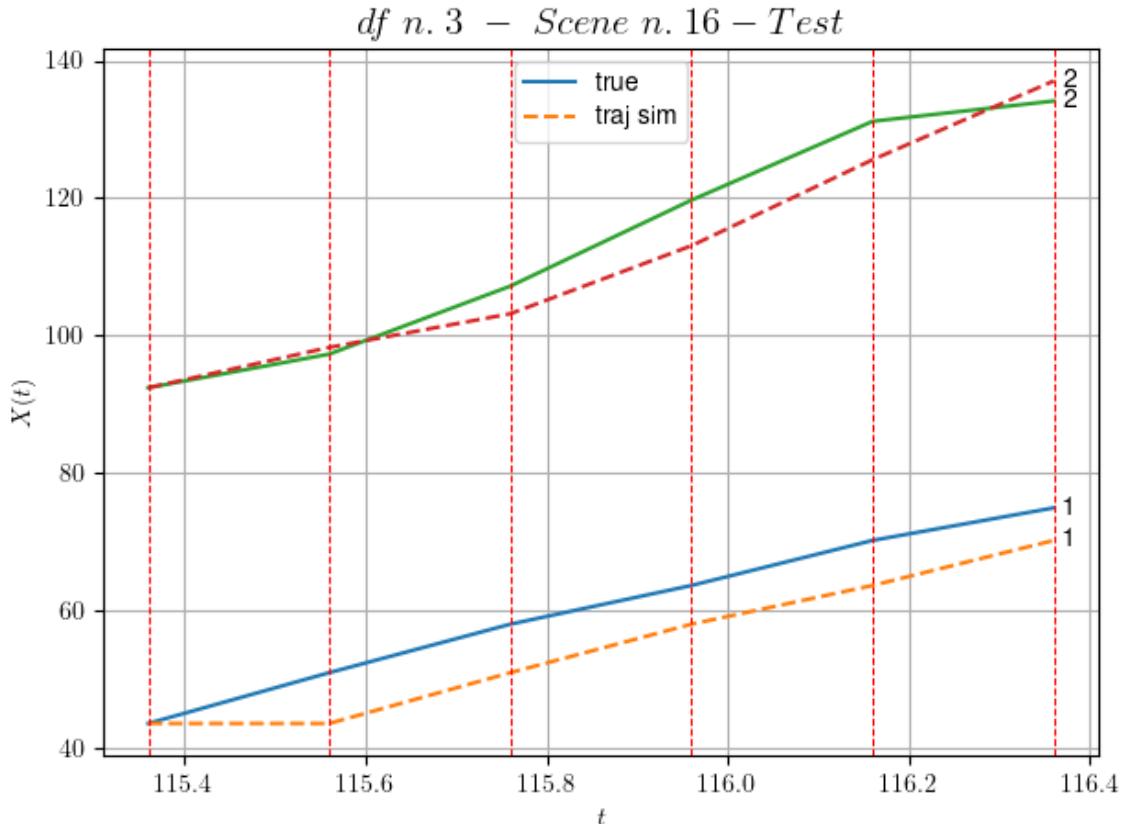
DataFrame n.3. Scene n.15/30



For scene 15/30:  
\* MSE = 16.360797315249975

---

DataFrame n.3. Scene n.16/30

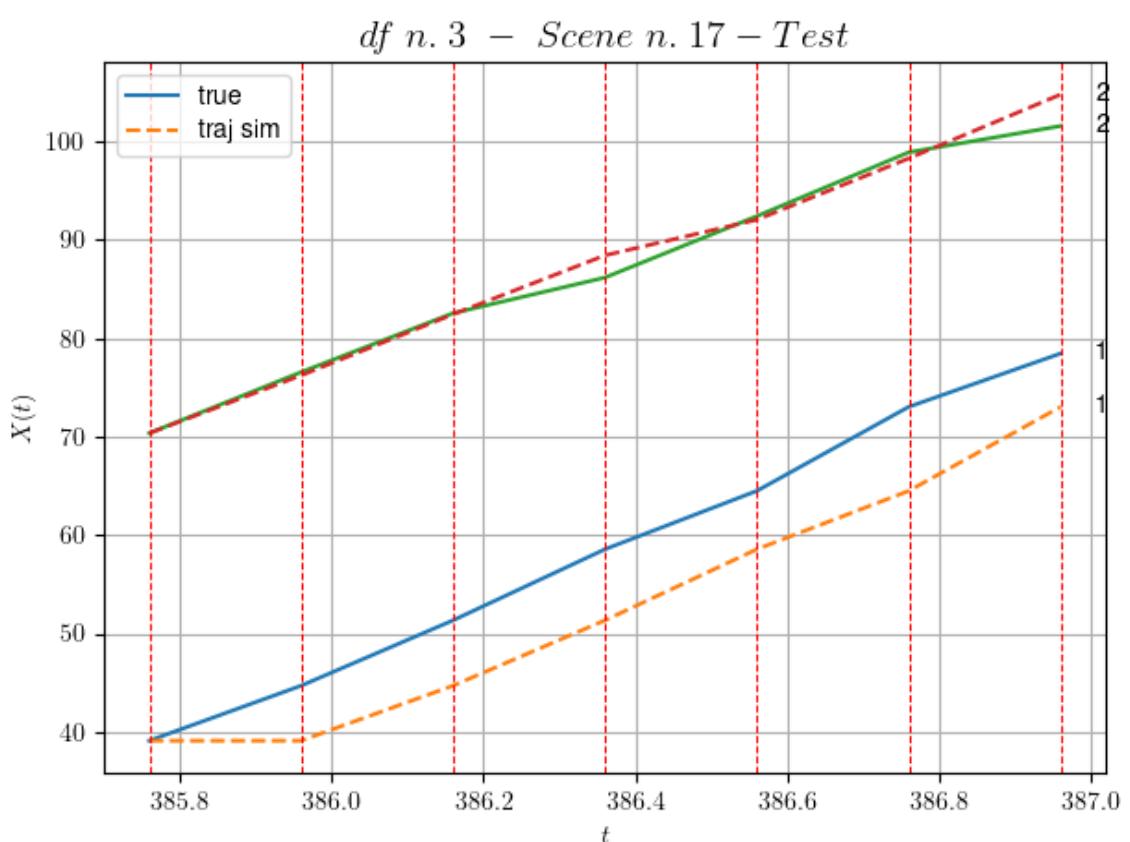


For scene 16/30:  
\* MSE = 25.157408694188355

---

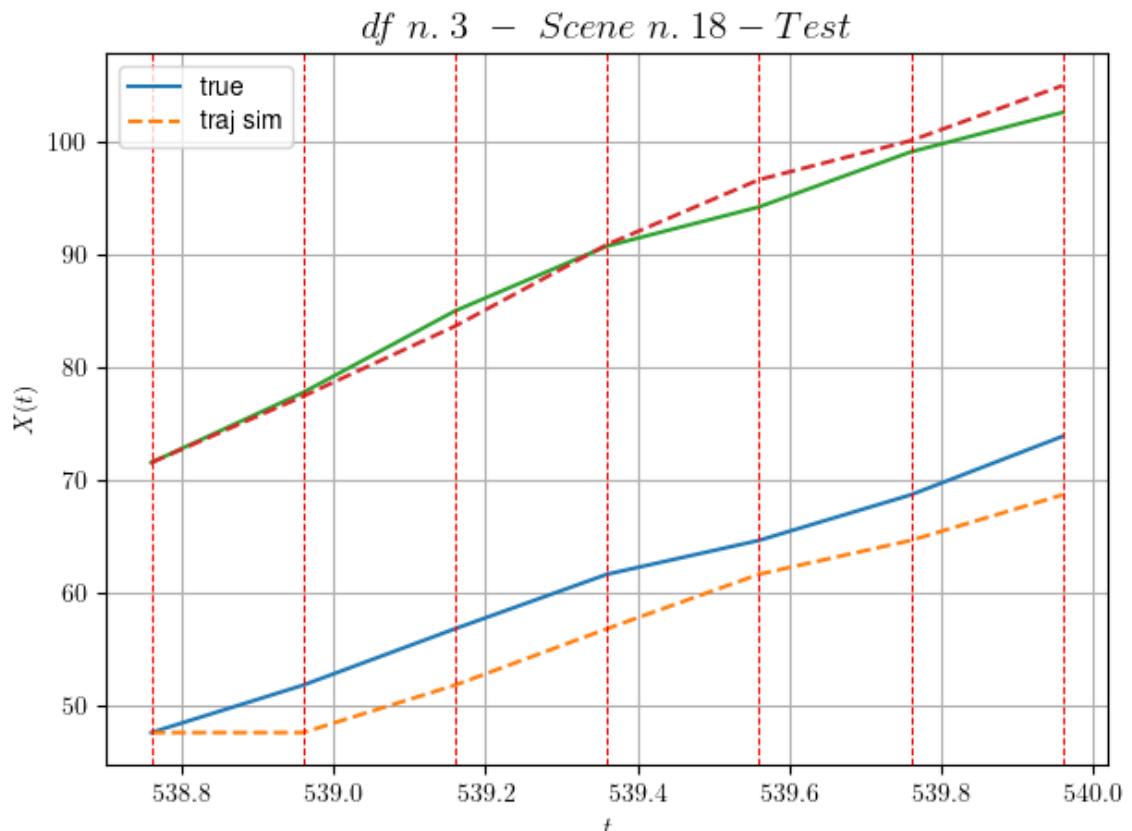
---

DataFrame n.3. Scene n.17/30



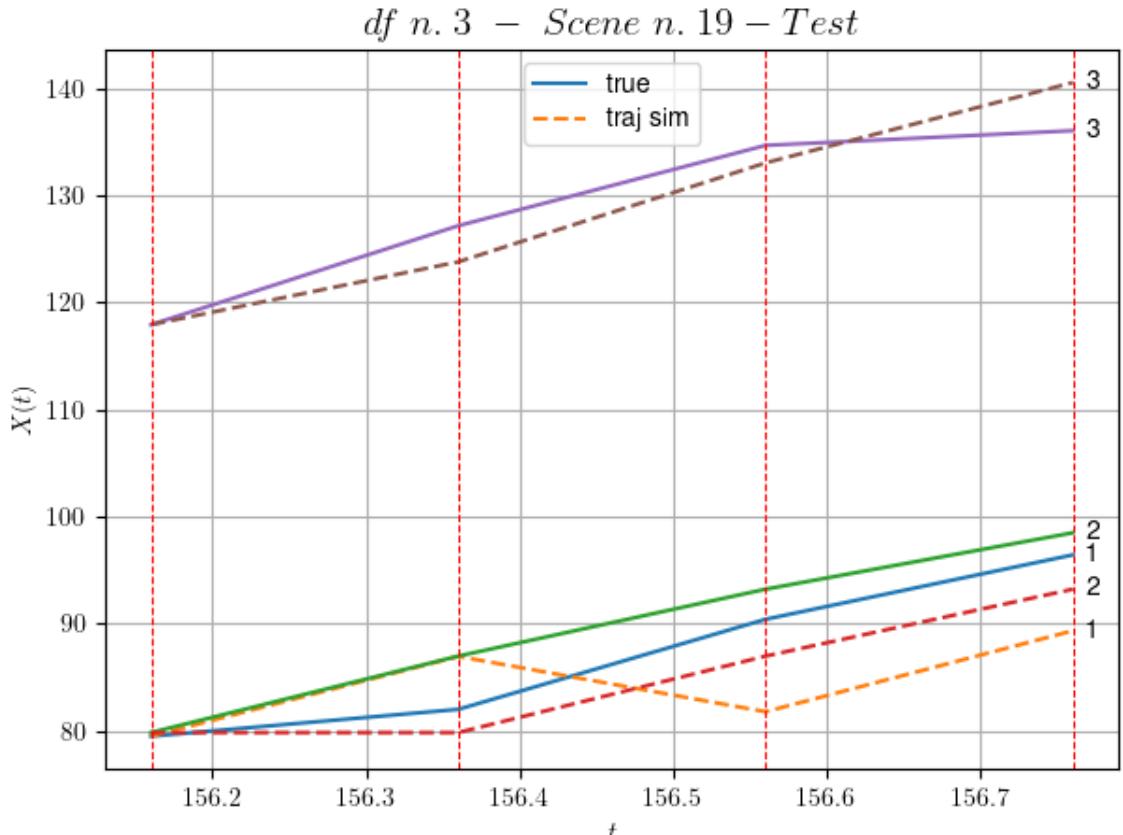
For scene 17/30:  
\* MSE = 20.06864982868479

DataFrame n.3. Scene n.18/30



For scene 18/30:  
\* MSE = 9.456524163395178

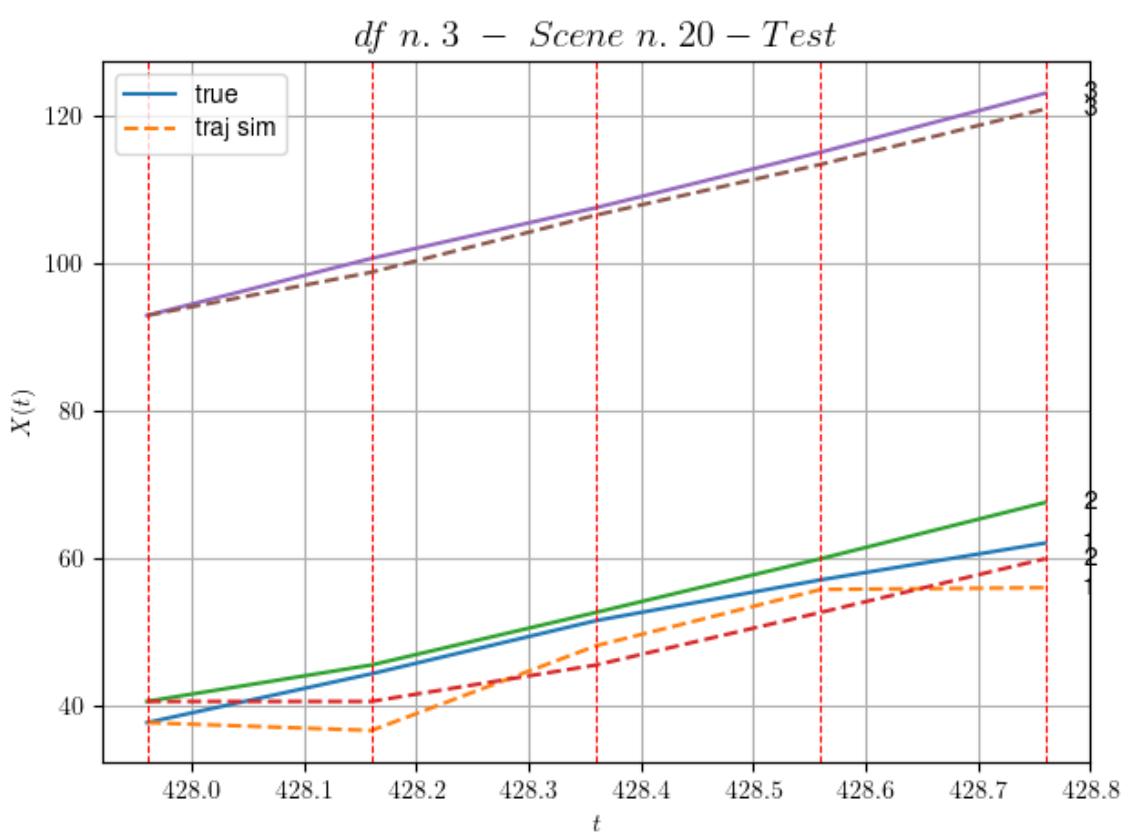
DataFrame n.3. Scene n.19/30



For scene 19/30:  
\* MSE = 25.126740329806825

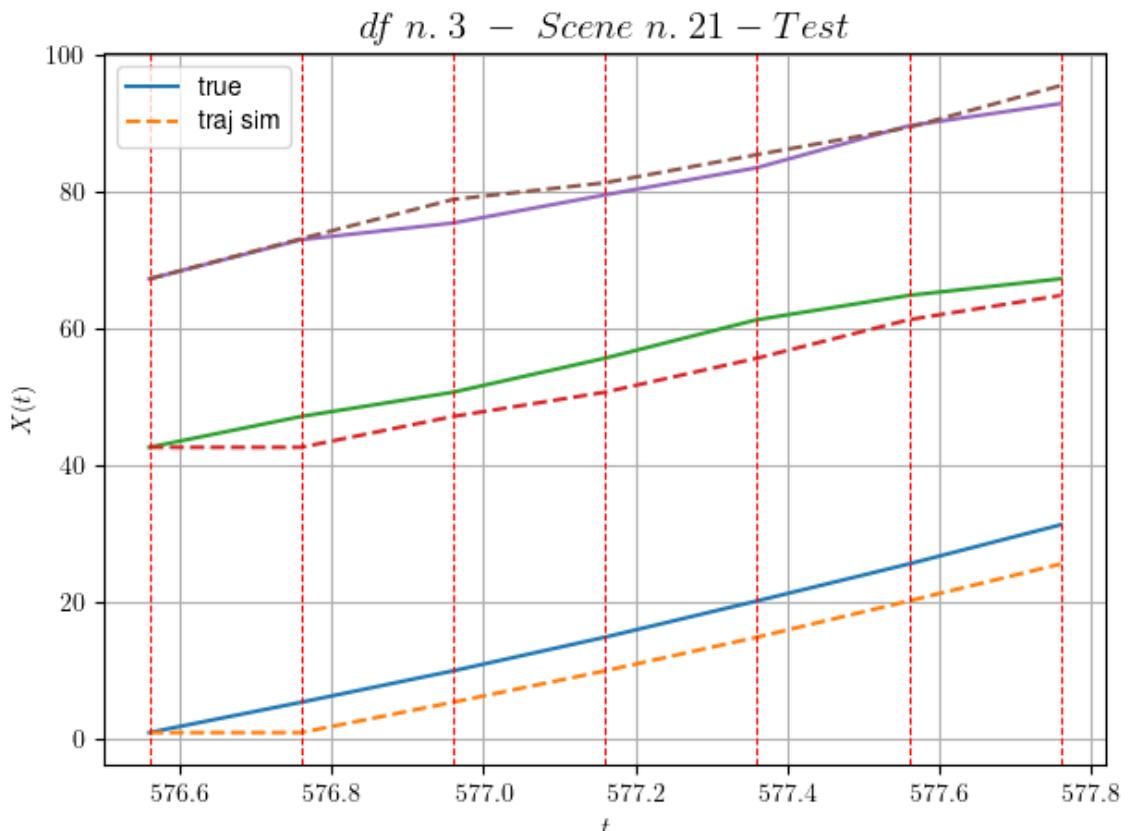
---

#### DataFrame n.3. Scene n.20/30



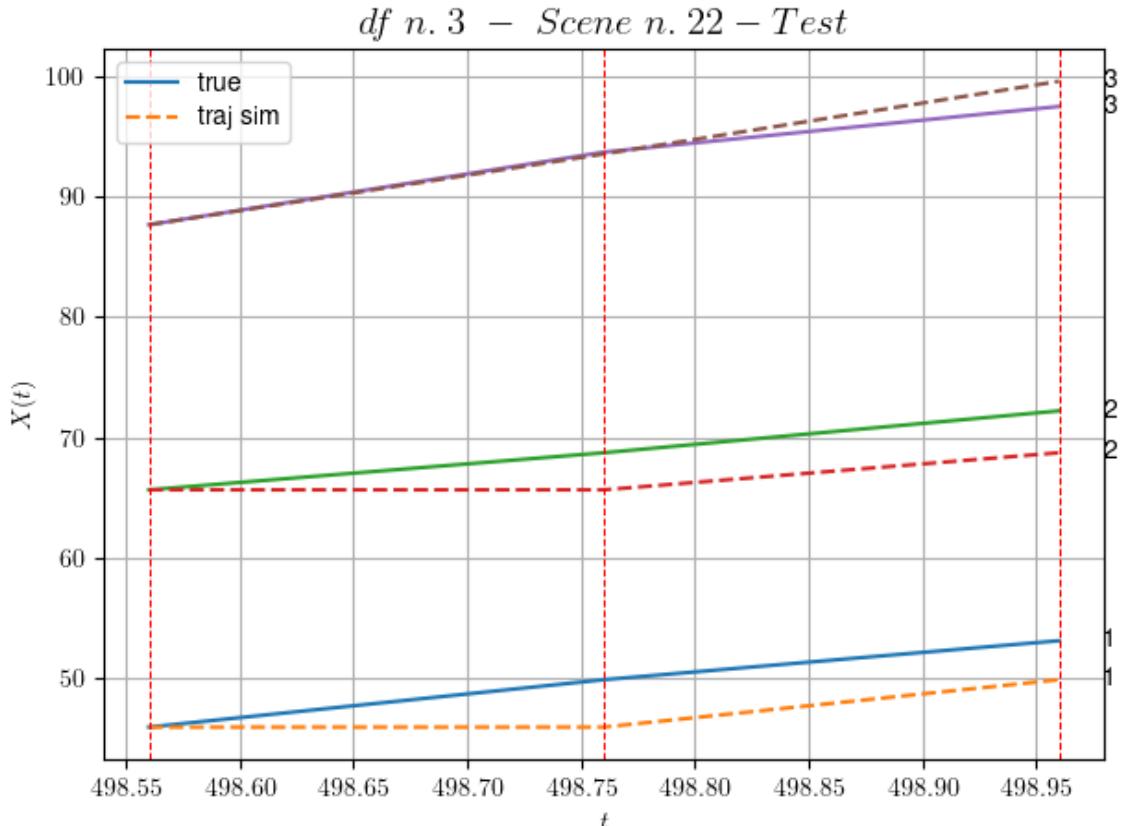
For scene 20/30:  
\* MSE = 20.51565225049655

DataFrame n.3. Scene n.21/30



For scene 21/30:  
\* MSE = 13.691766305006757

DataFrame n.3. Scene n.22/30

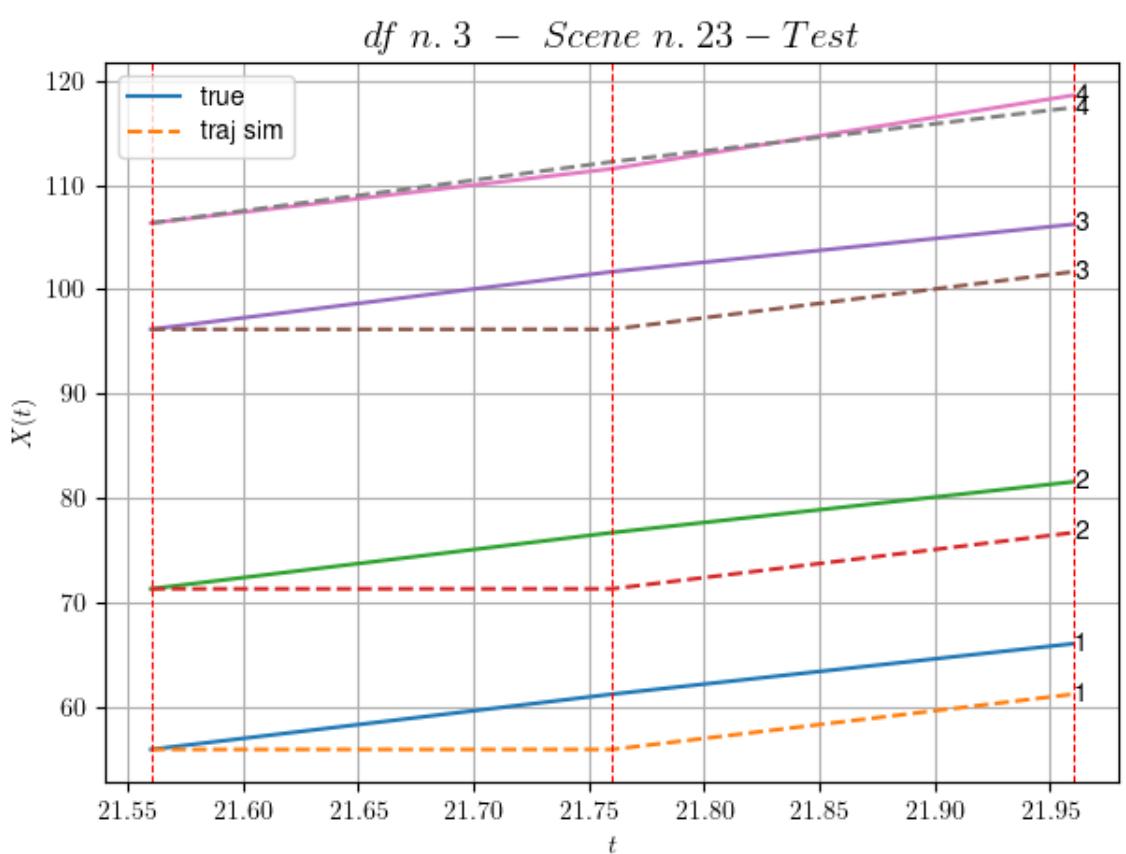


For scene 22/30:  
\* MSE = 5.76392963042485

---

---

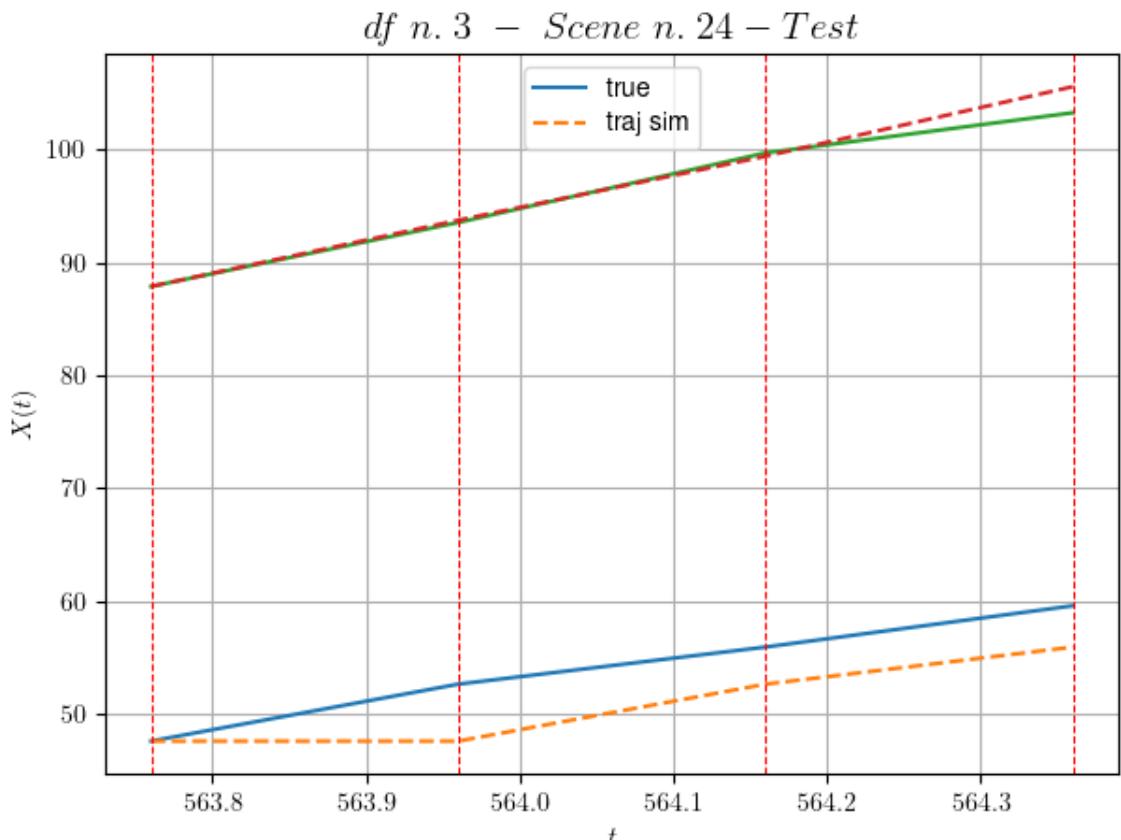
#### DataFrame n.3. Scene n.23/30



For scene 23/30:  
\* MSE = 13.099329426582678

---

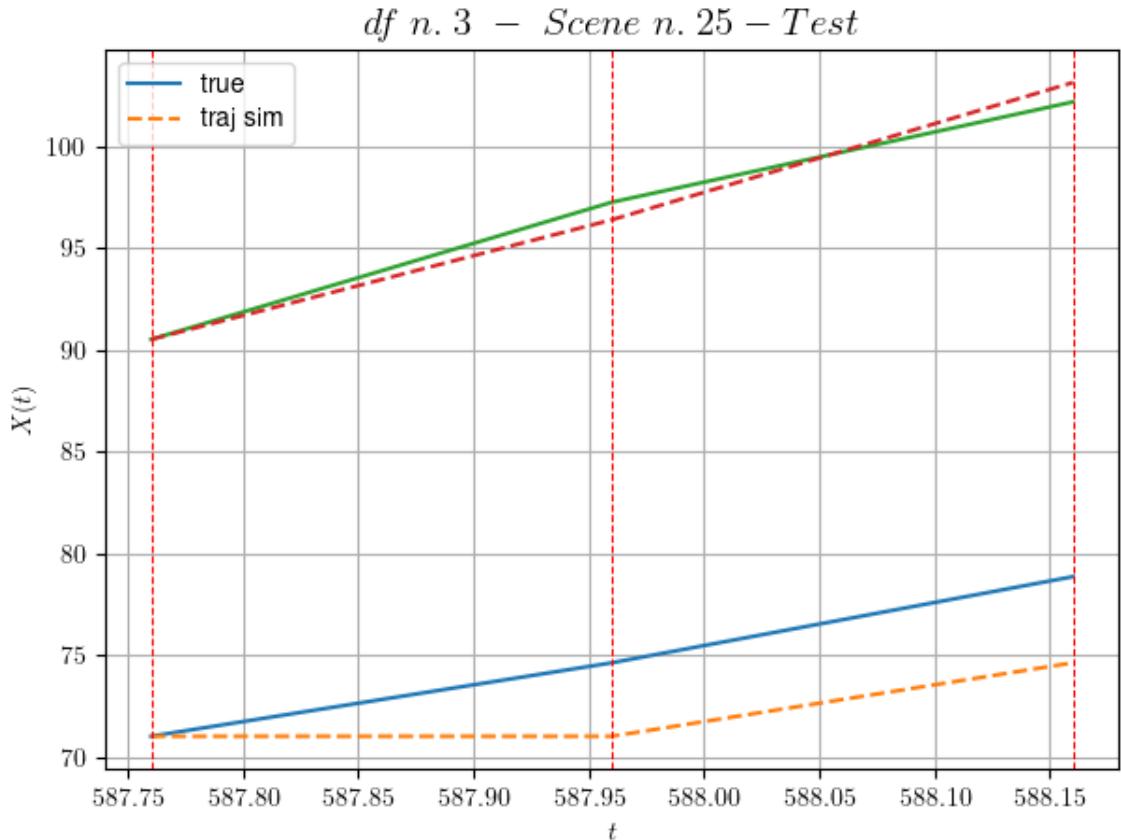
DataFrame n.3. Scene n.24/30



For scene 24/30:  
\* MSE = 6.902159308720192

---

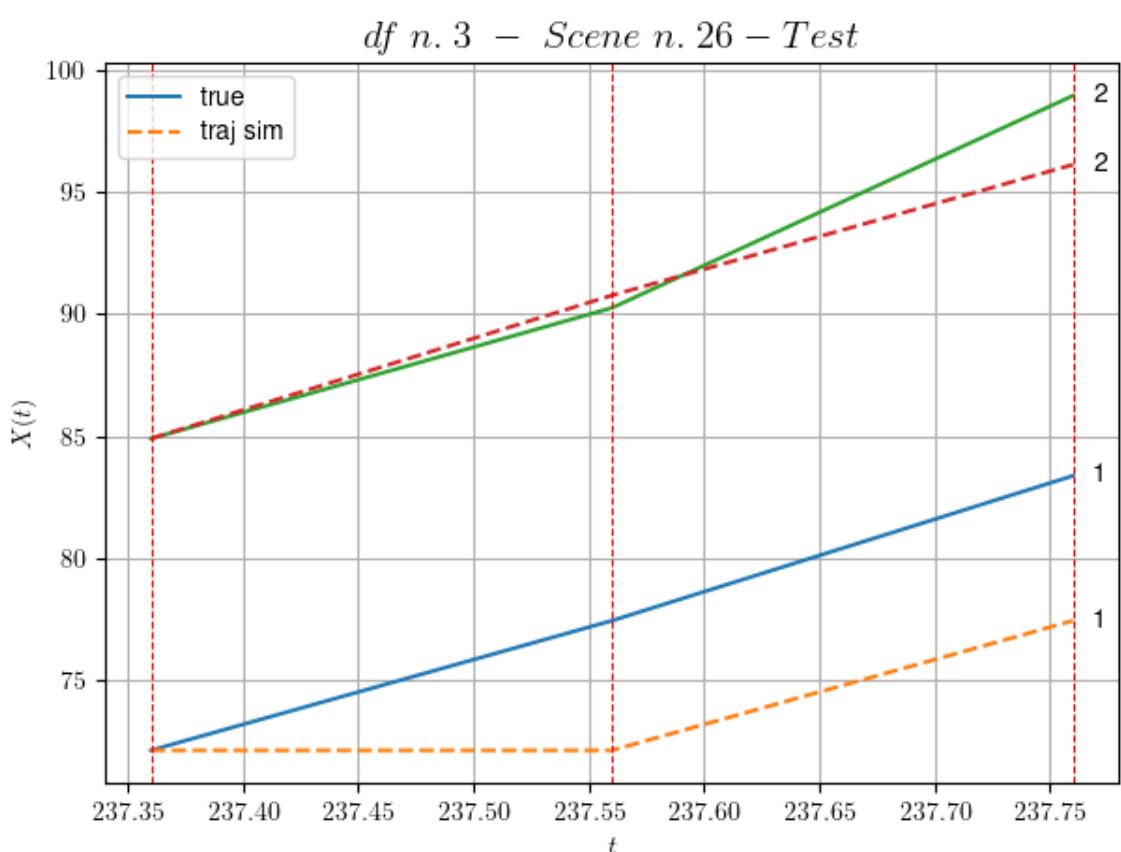
DataFrame n.3. Scene n.25/30



For scene 25/30:  
\* MSE = 5.419156052002059

---

DataFrame n.3. Scene n.26/30

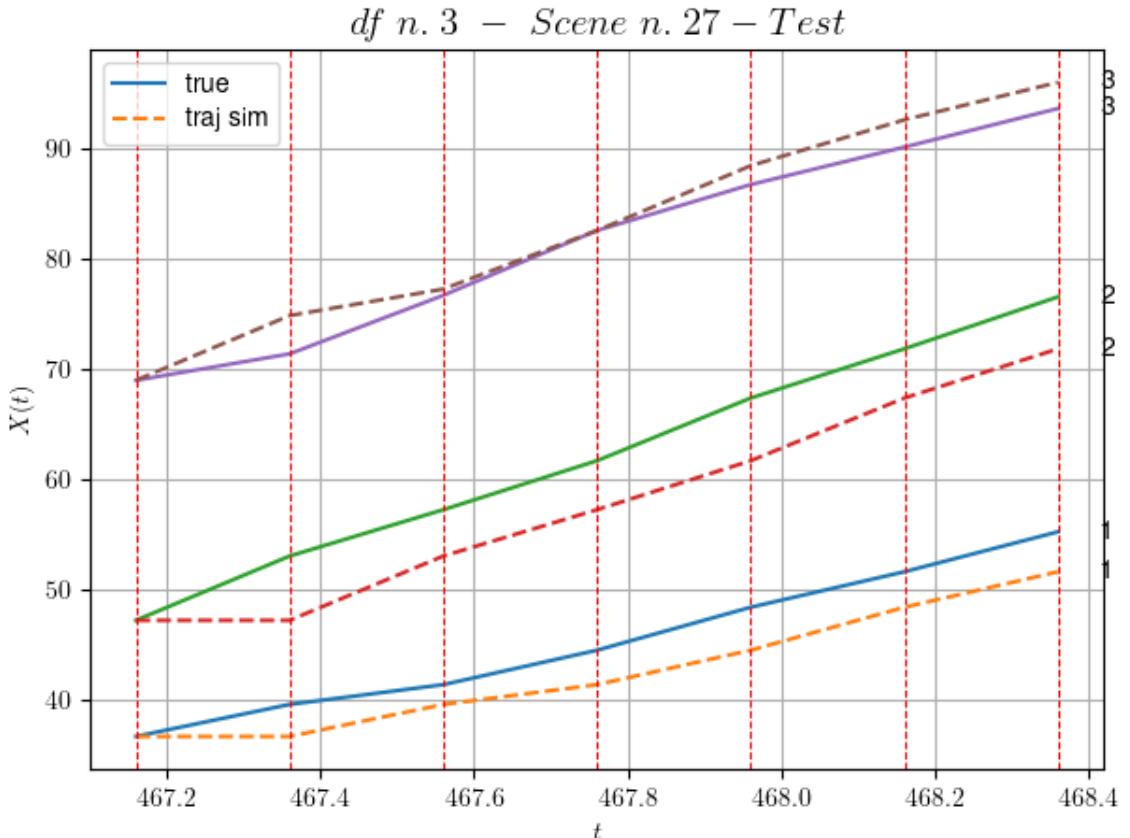


For scene 26/30:  
\* MSE = 11.969752891936718

---

---

DataFrame n.3. Scene n.27/30

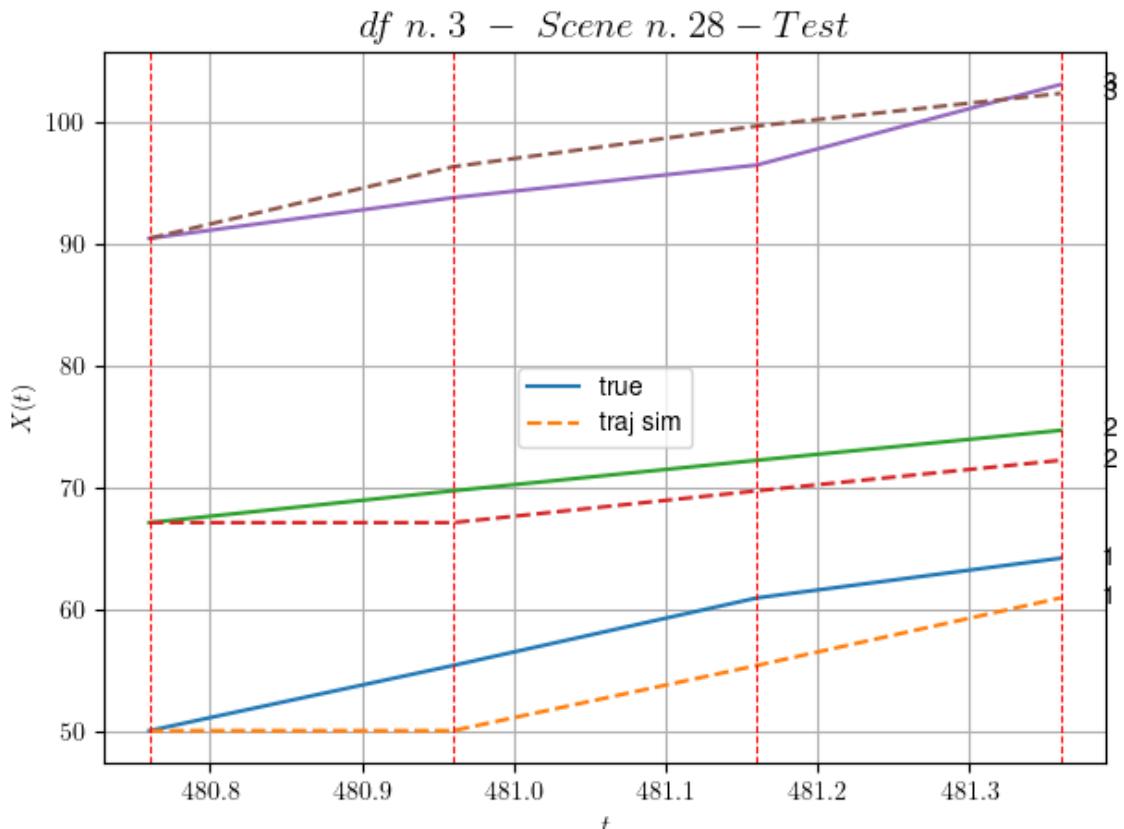


For scene 27/30:  
\* MSE = 11.094083833881148

---

---

DataFrame n.3. Scene n.28/30

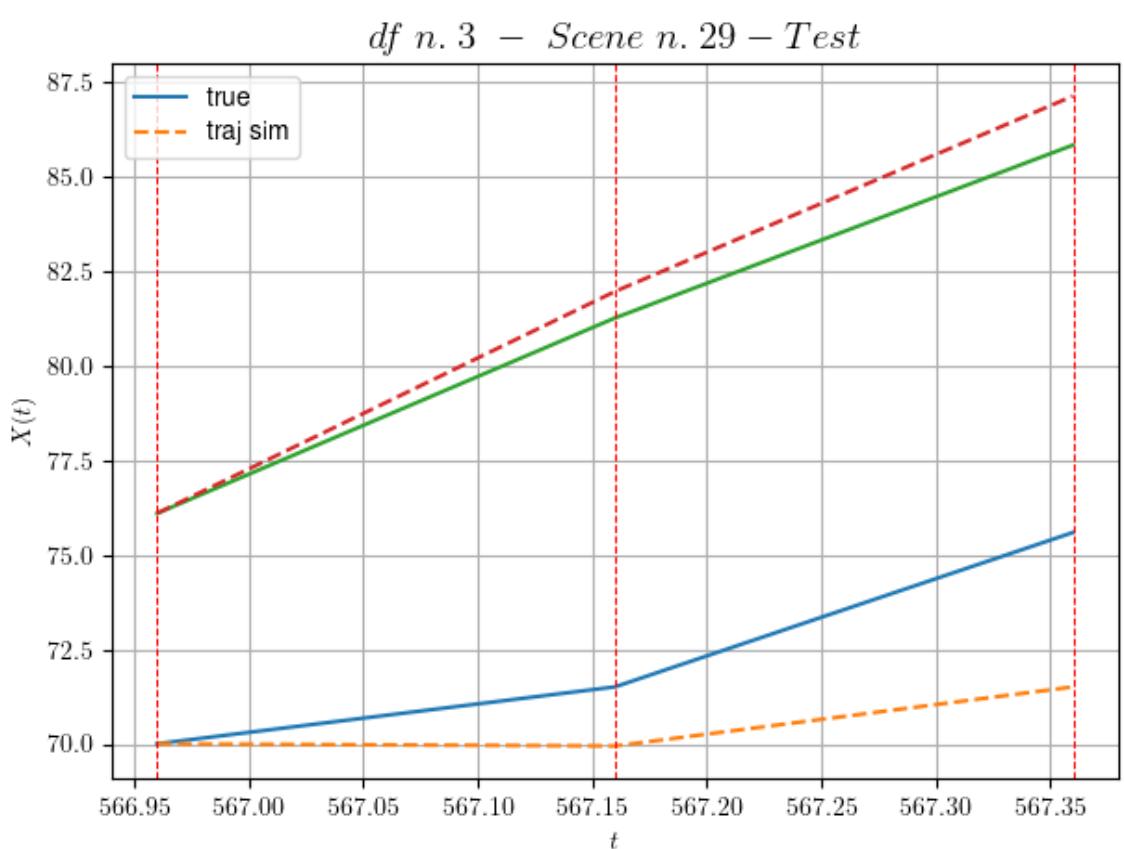


For scene 28/30:  
\* MSE = 8.8411231663572

---

---

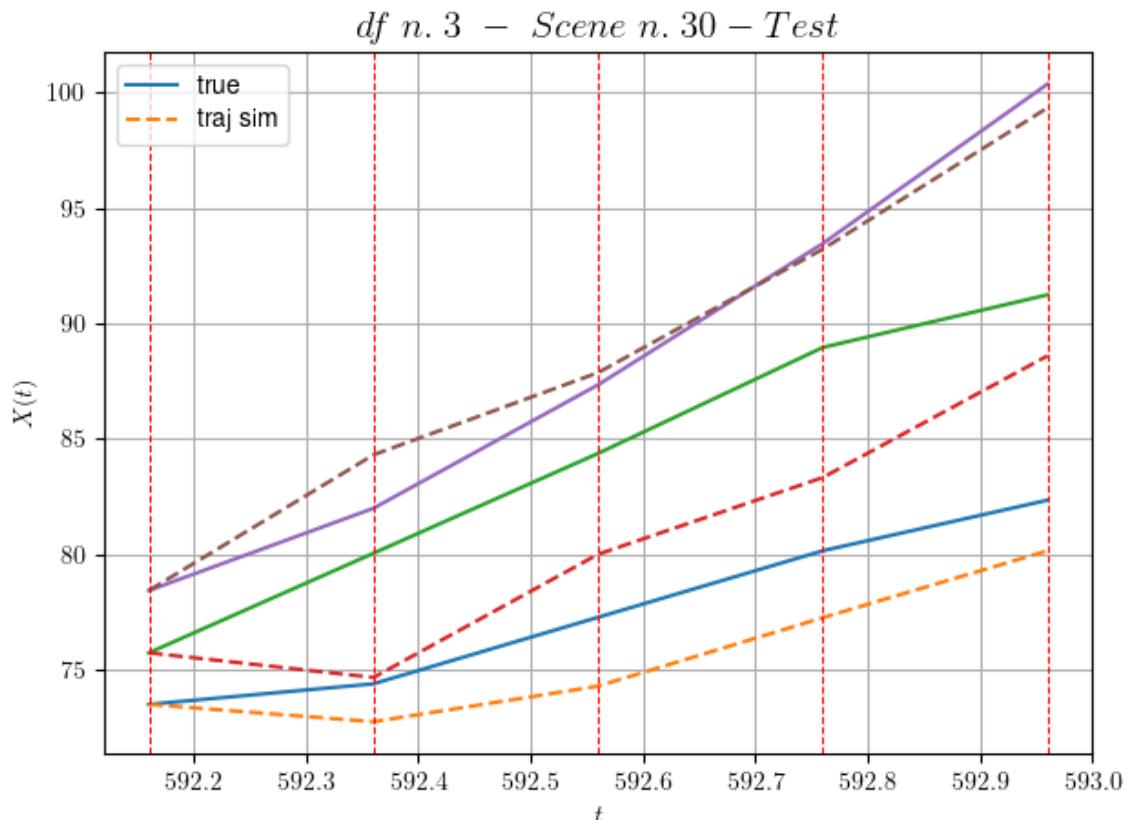
#### DataFrame n.3. Scene n.29/30



For scene 29/30:  
 \* MSE = 3.5550427513297693

---

DataFrame n.3. Scene n.30/30



For scene 30/30:  
 \* MSE = 7.880180143009622

---

MSE test: 14.800917849361229

---

Summing up:  
 \* MSE train: 6.173137419491575  
 \* MSE test: 14.800917849361229

---

Analyzing 4/10 dfs.  
 In DataFrame n.4 we have 69 scenes.

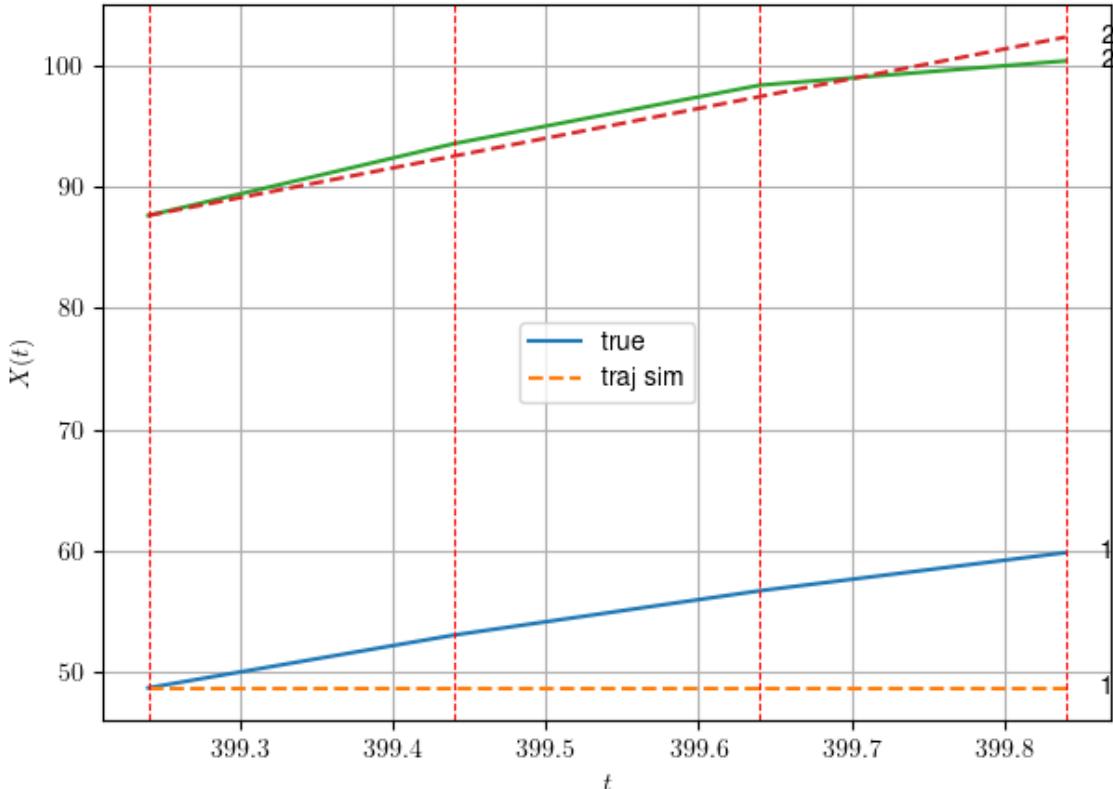
To train the model we use 46 scenes, the remaining 23 to test the model.

Training step. (46 scenes)

=====  
=====  
DataFrame n.4. Scene n.1/46

-----  
We have 3 time intervals inside [399.24,399.84]

df n. 4 – Scene n. 29, at it = 350

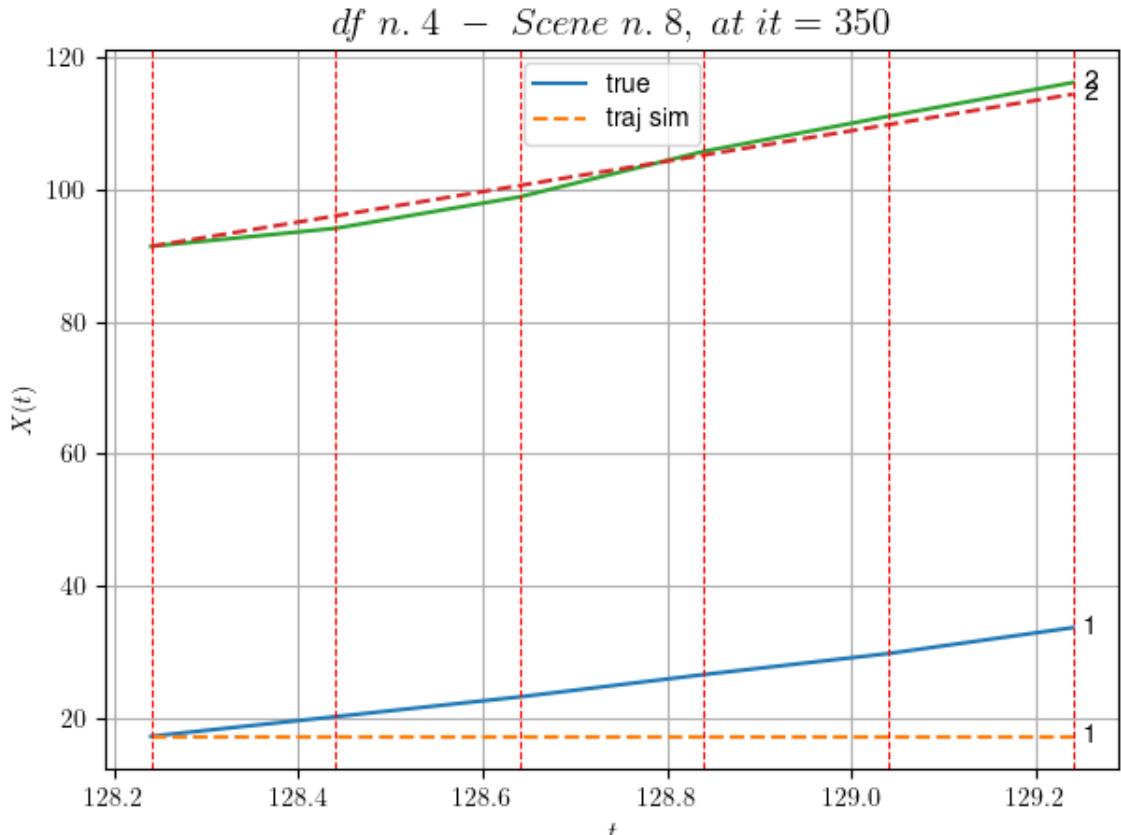


For scene 1/46:

\* After LR finder:  $LR\_NN=1e-05$  with  $mse=3.806307100659538$  at it=24  
\*  $v_0 = 24.512386567495817$   
\*  $MSE = 26.623016570278313$   
\* iterations = 350

-----  
DataFrame n.4. Scene n.2/46

-----  
We have 5 time intervals inside [128.24,129.24]



---

For scene 2/46:

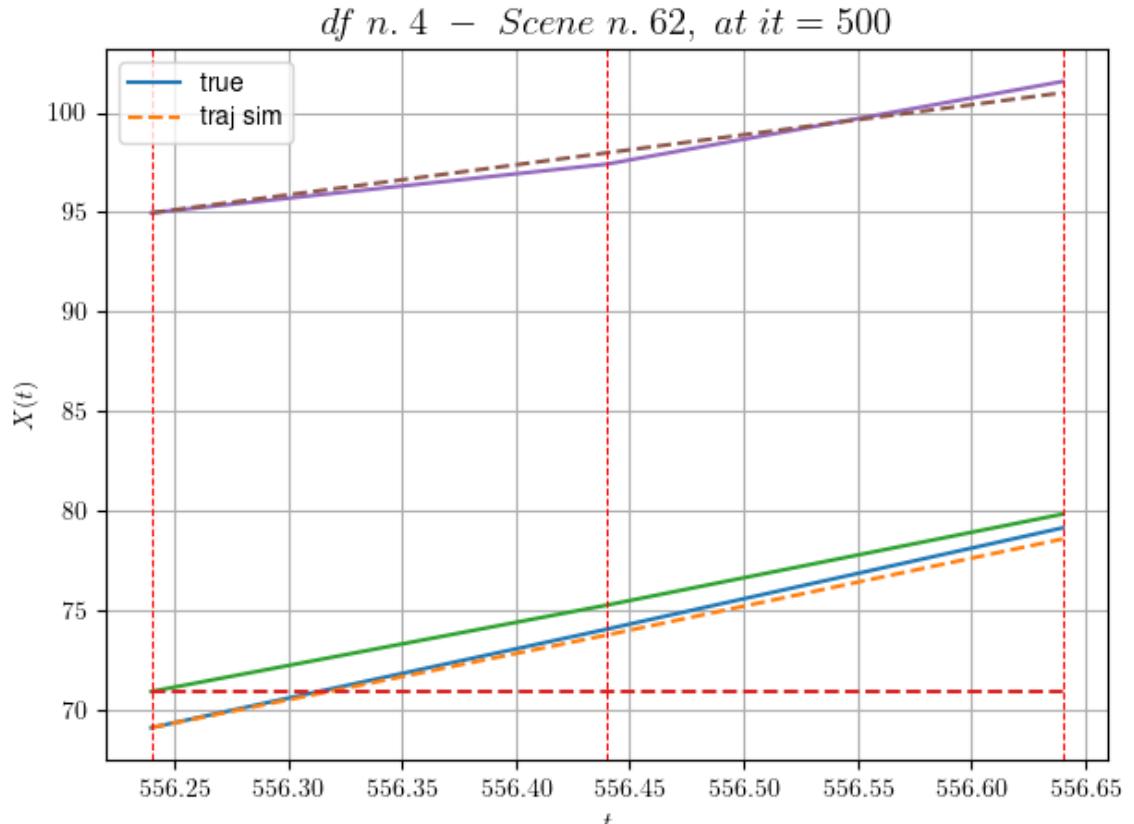
- \* After LR finder: LR\_NN=1e-05 with mse=7.620826882527282 at it=24
- \* v0 = 23.00518114624755
- \* MSE = 47.262875019614235
- \* iterations = 350

---

DataFrame n.4. Scene n.3/46

---

We have 2 time intervals inside [556.24, 556.64]

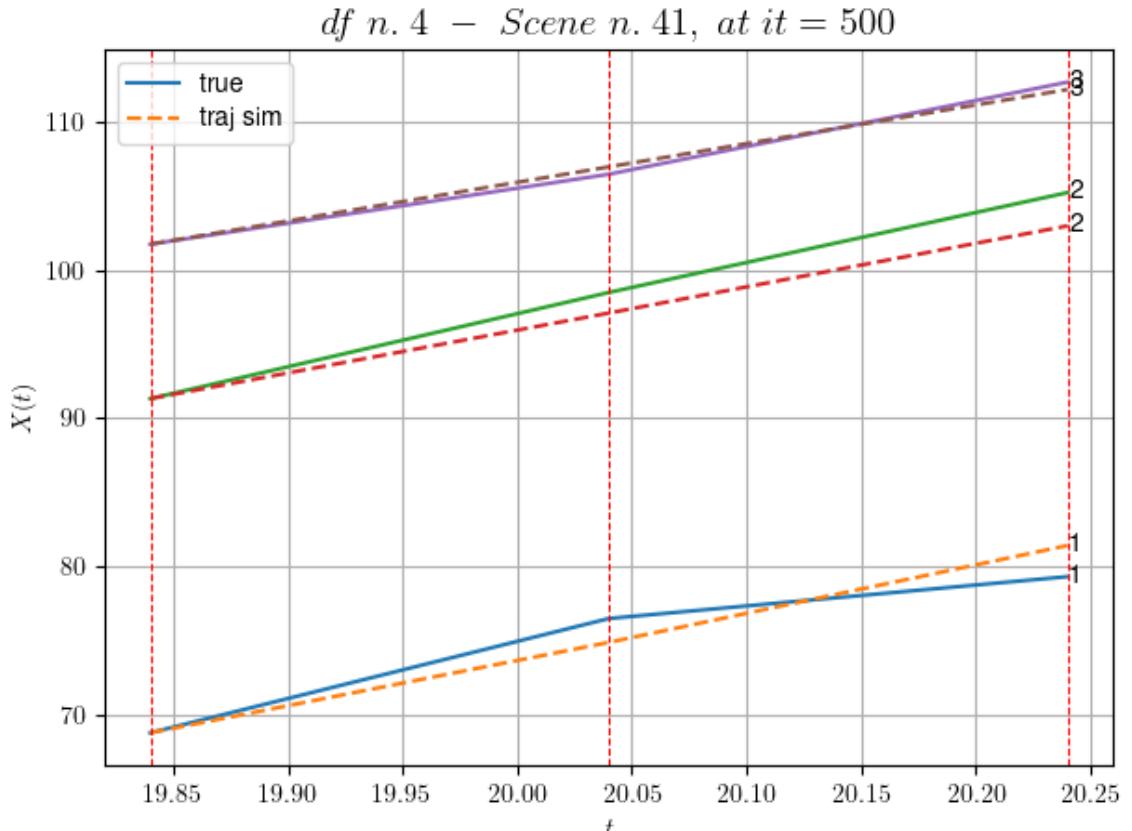


For scene 3/46:

\* After LR finder:  $LR\_NN=0.001$  with  $mse=12.057689963226933$   
at  $it=24$   
\*  $v\theta = 15.086092436632384$   
\*  $MSE = 11.031202078968123$   
\* iterations = 500

DataFrame n.4. Scene n.4/46

We have 2 time intervals inside [19.84,20.24]

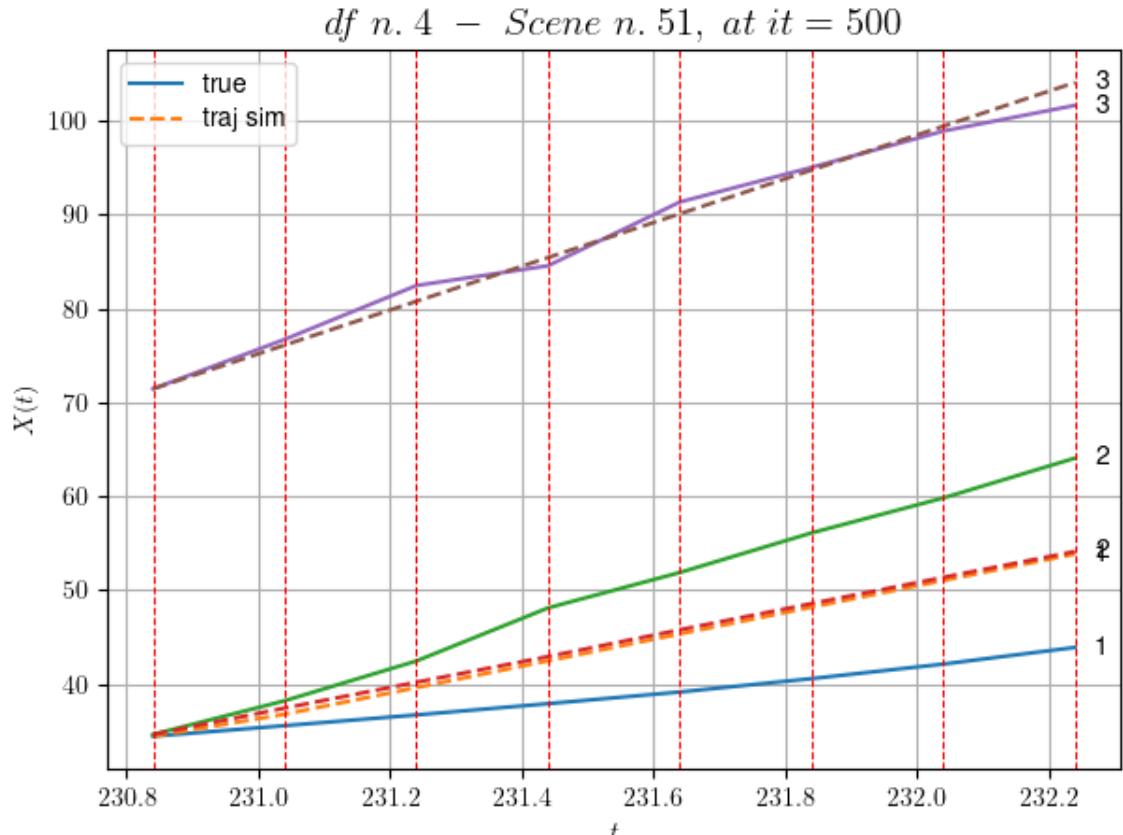


For scene 4/46:

\* After LR finder: LR\_NN=5e-05 with mse=9.893560691688323 at it=24  
\* v0 = 26.058966670570182  
\* MSE = 1.6009767449777559  
\* iterations = 500

DataFrame n.4. Scene n.5/46

We have 7 time intervals inside [230.84,232.24]



---

For scene 5/46:

- \* After LR finder:  $LR\_NN=0.0001$  with  $mse=20.43898361329907$

at  $it=24$

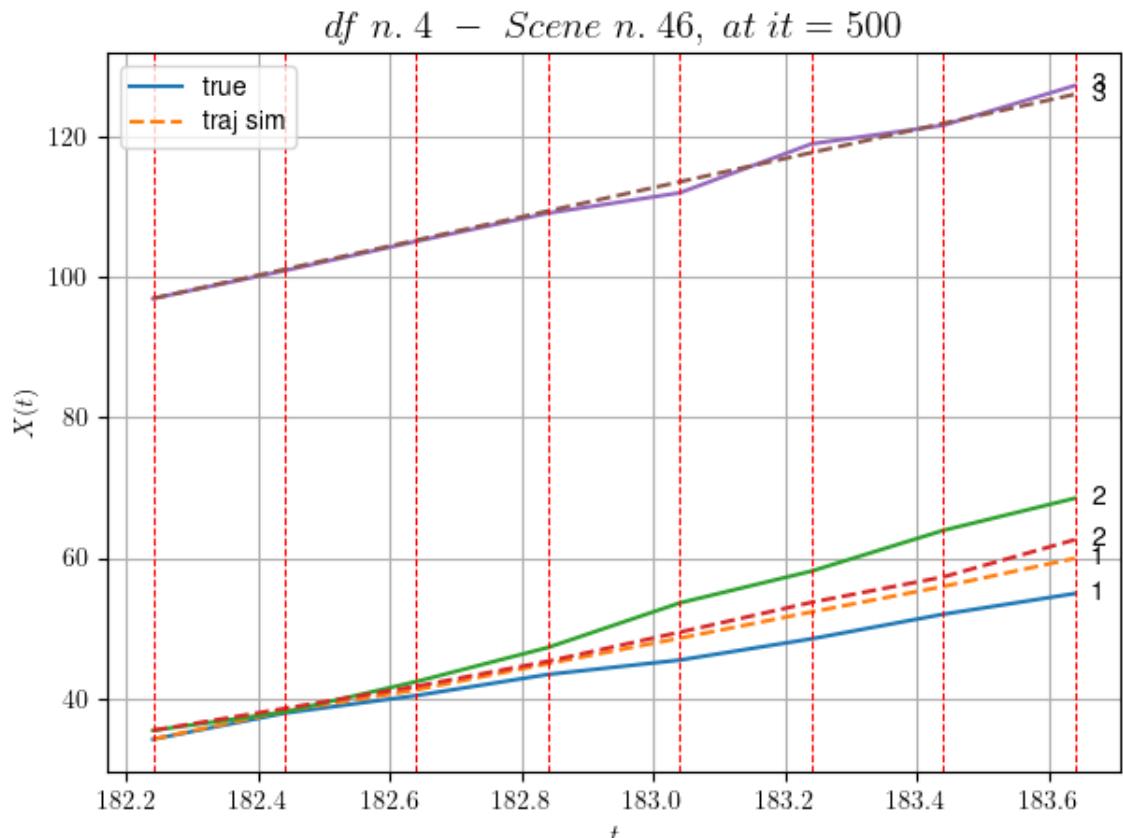
- \*  $v_0 = 23.322723002586404$
- \*  $MSE = 25.63197377195955$
- \* iterations = 500

---

DataFrame n.4. Scene n.6/46

---

We have 7 time intervals inside  $[182.24, 183.64]$



---

For scene 6/46:

- \* After LR finder:  $LR\_NN=0.0005$  with  $mse=55.60374513433998$

at it=24

- \*  $v_0 = 20.773199567272282$
- \* MSE = 3.9071522956131024
- \* iterations = 500

---

DataFrame n.4. Scene n.7/46

---

We have 11 time intervals inside [266.84, 269.04]



---

For scene 7/46:

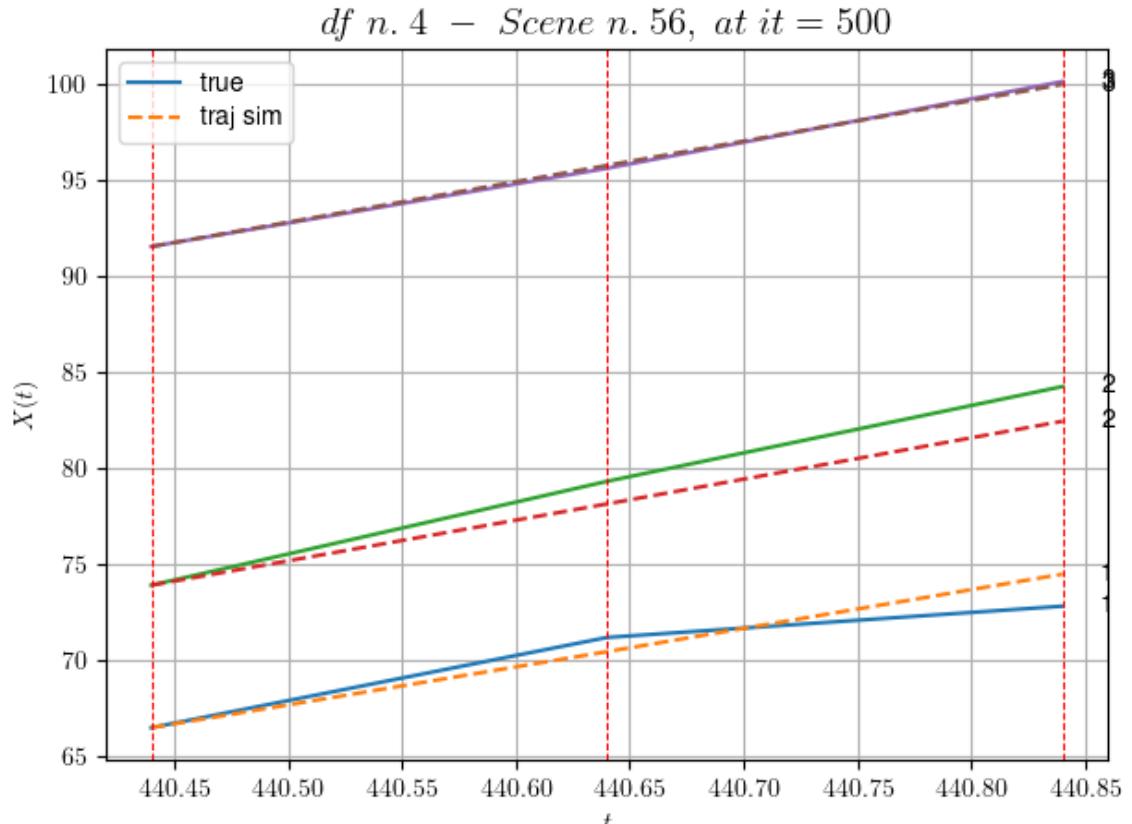
- \* After LR finder: LR\_NN=5e-05 with mse=48.643322436353586
- at it=24
- \* v0 = 22.59999558463881
- \* MSE = 1.3147228517683902
- \* iterations = 500

---

DataFrame n.4. Scene n.8/46

---

We have 2 time intervals inside [440.44,440.84]

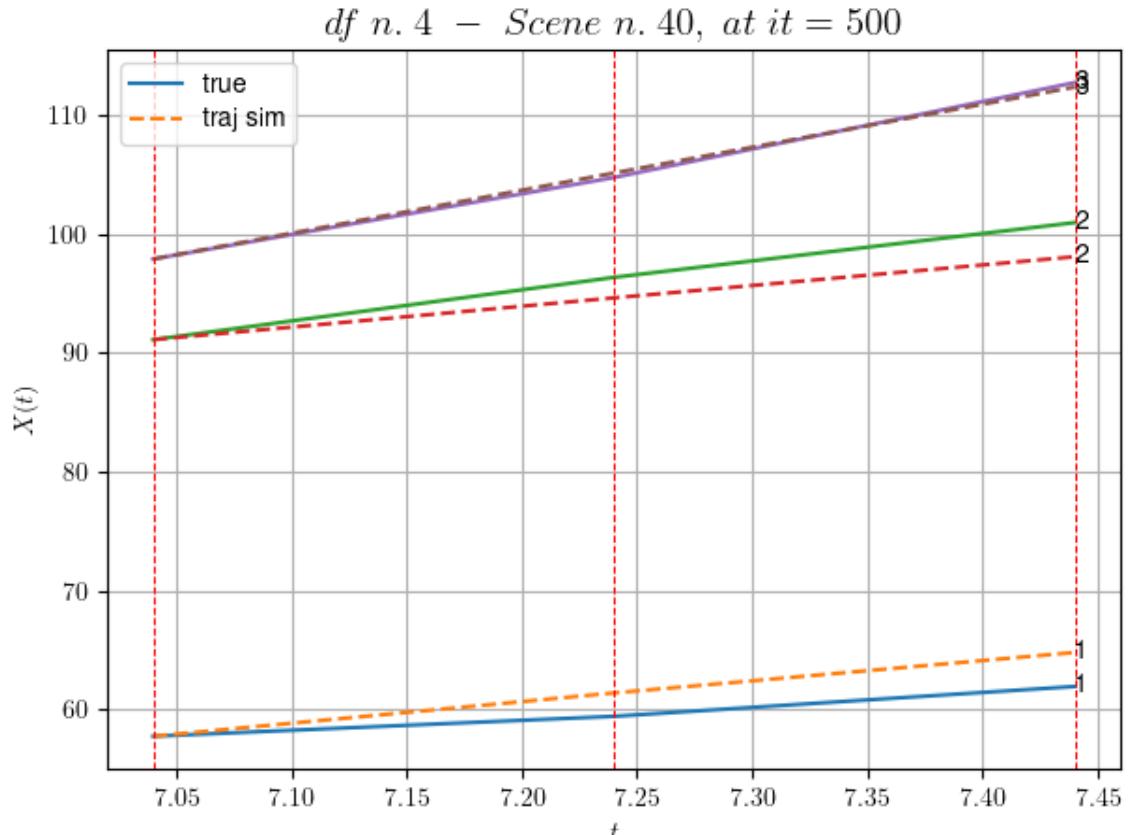


For scene 8/46:

\* After LR finder: LR\_NN=0.0001 with mse=2.7071001864936814  
at it=24  
\* v0 = 21.126994497572348  
\* MSE = 0.555392480939088  
\* iterations = 500

DataFrame n.4. Scene n.9/46

We have 2 time intervals inside [7.04,7.44]



---

For scene 9/46:

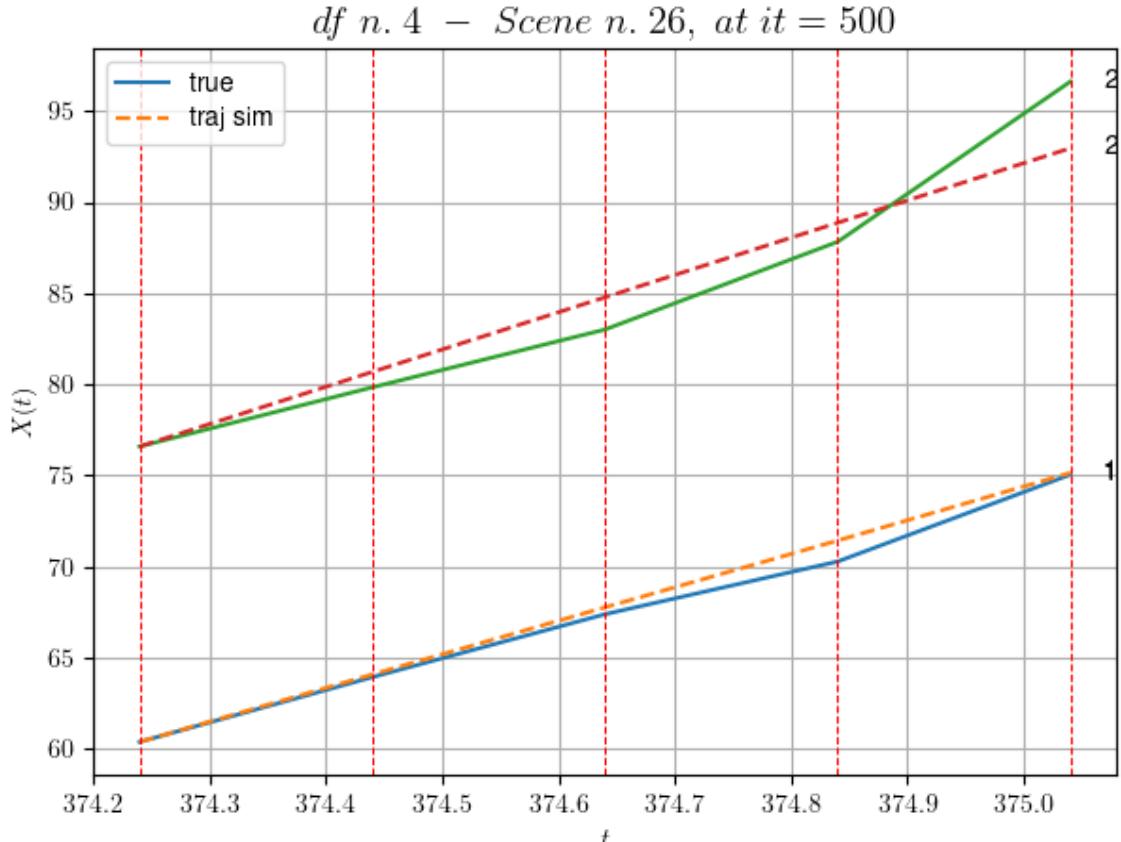
- \* After LR finder: LR\_NN=0.0005 with mse=10.190685519636 at it=24
- \* v0 = 36.15423035610226
- \* MSE = 2.6148191516928923
- \* iterations = 500

---

DataFrame n.4. Scene n.10/46

---

We have 4 time intervals inside [374.24,375.04]



For scene 10/46:

\* After LR finder: LR\_NN=5e-05 with mse=10.108282231060665

at it=24

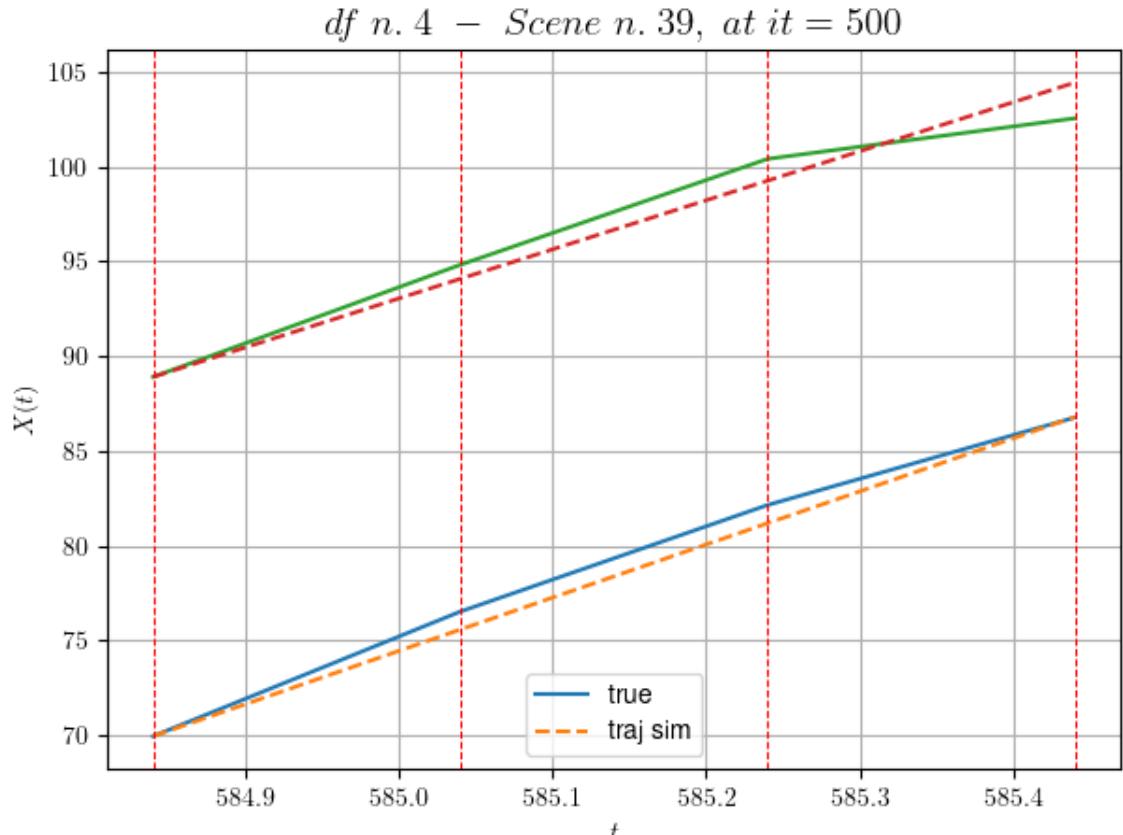
\* v0 = 20.475722036934343

\* MSE = 1.8355667183080386

\* iterations = 500

DataFrame n.4. Scene n.11/46

We have 3 time intervals inside [584.84,585.44]



---

For scene 11/46:

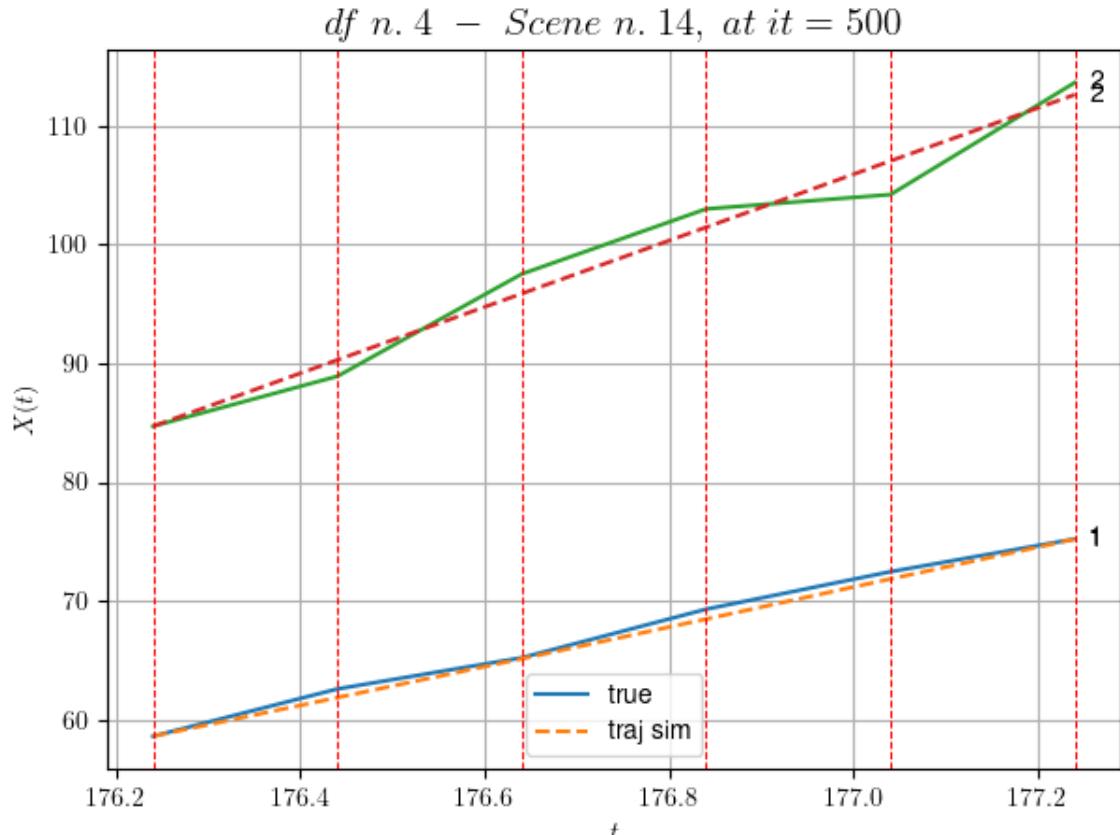
```
* After LR finder: LR_NN=5e-05 with mse=2.613909887085401 at it=24
* v0 = 25.889440529704892
* MSE = 0.9046888977121332
* iterations = 500
```

---

DataFrame n.4. Scene n.12/46

---

We have 5 time intervals inside [176.24,177.24]

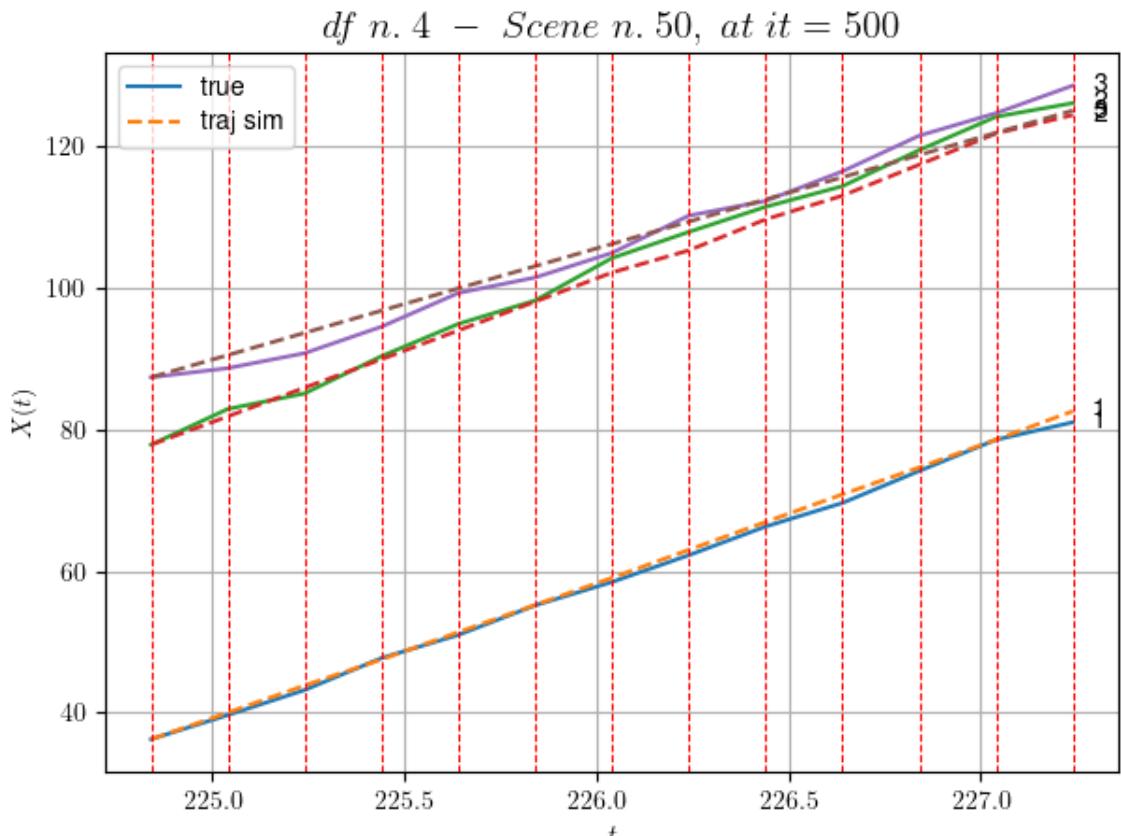


For scene 12/46:

\* After LR finder: LR\_NN=1e-05 with mse=2.552764352405862 at it=24  
\* v0 = 27.94819777081733  
\* MSE = 1.4744653644940005  
\* iterations = 500

DataFrame n.4. Scene n.13/46

We have 12 time intervals inside [224.84,227.24]



---

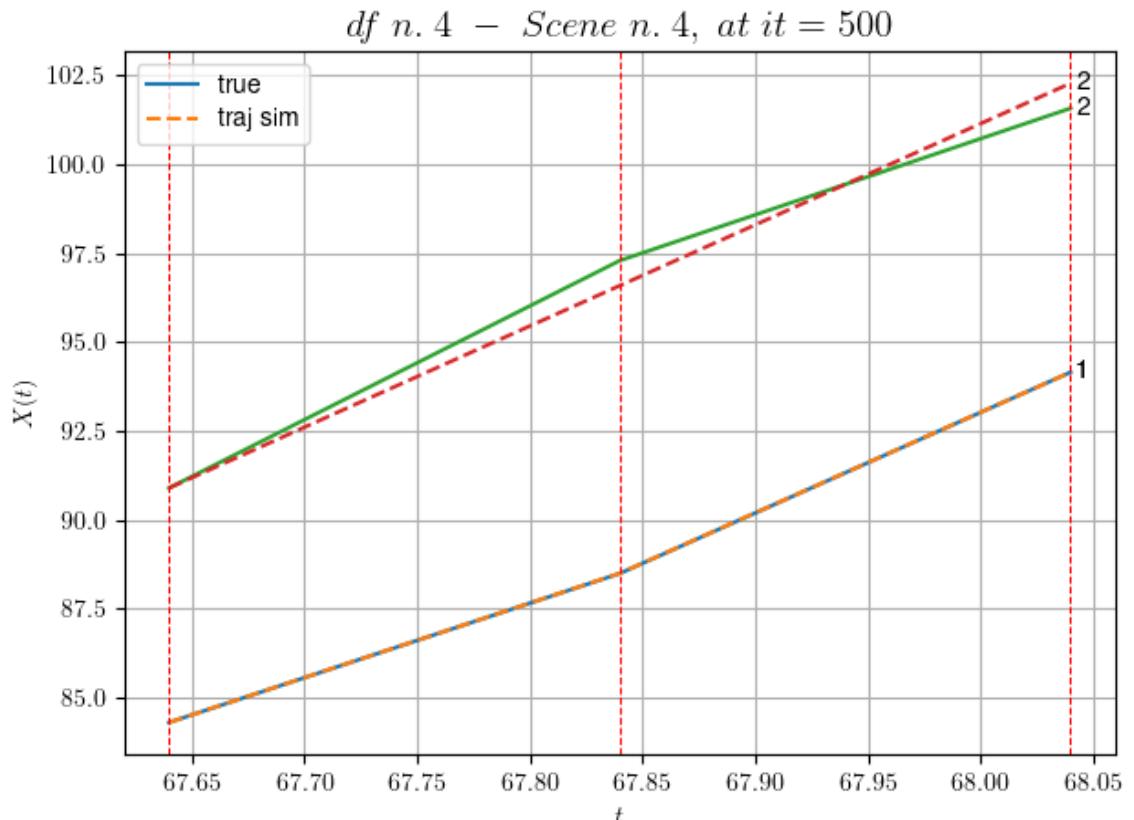
For scene 13/46:  
\* After LR finder: LR\_NN=0.0005 with mse=224.55194158025725  
at it=24  
\* v0 = 15.713677130054796  
\* MSE = 2.128391891252831  
\* iterations = 500

---

DataFrame n.4. Scene n.14/46

---

We have 2 time intervals inside [67.64,68.04]

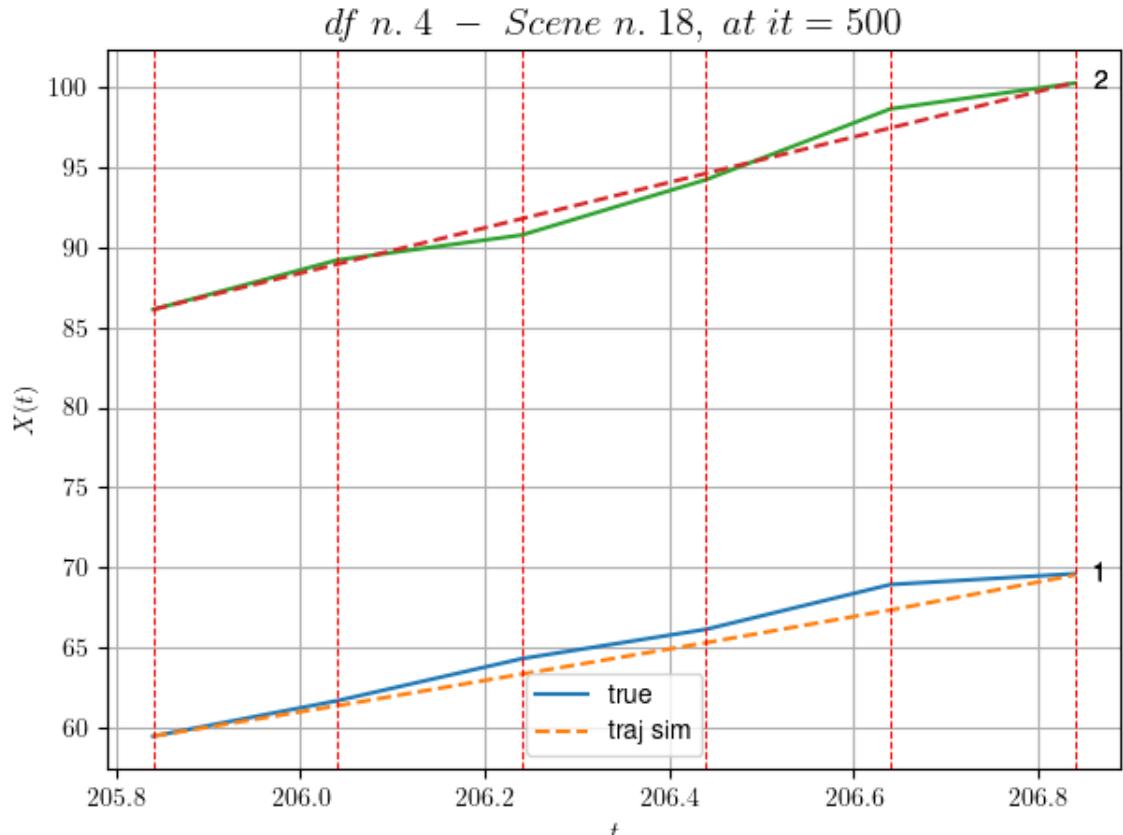


For scene 14/46:

\* After LR finder: LR\_NN=0.001 with mse=0.3159923749579836  
at it=24  
\* v0 = 28.46498000771235  
\* MSE = 0.16525499979768962  
\* iterations = 500

DataFrame n.4. Scene n.15/46

We have 5 time intervals inside [205.84,206.84]



---

For scene 15/46:

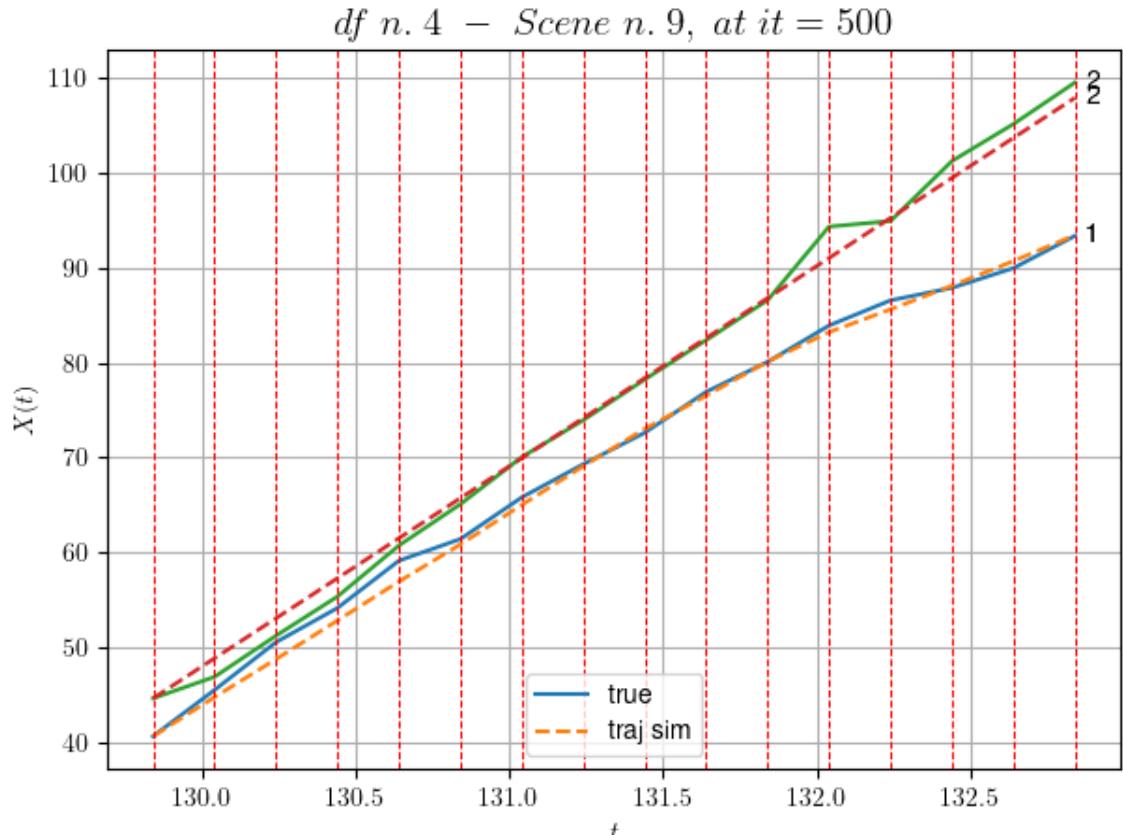
- \* After LR finder: LR\_NN=5e-05 with mse=45.561390247090145
- at it=24
- \* v0 = 14.204943221367989
- \* MSE = 0.572064765263639
- \* iterations = 500

---

DataFrame n.4. Scene n.16/46

---

We have 15 time intervals inside [129.84, 132.84]



---

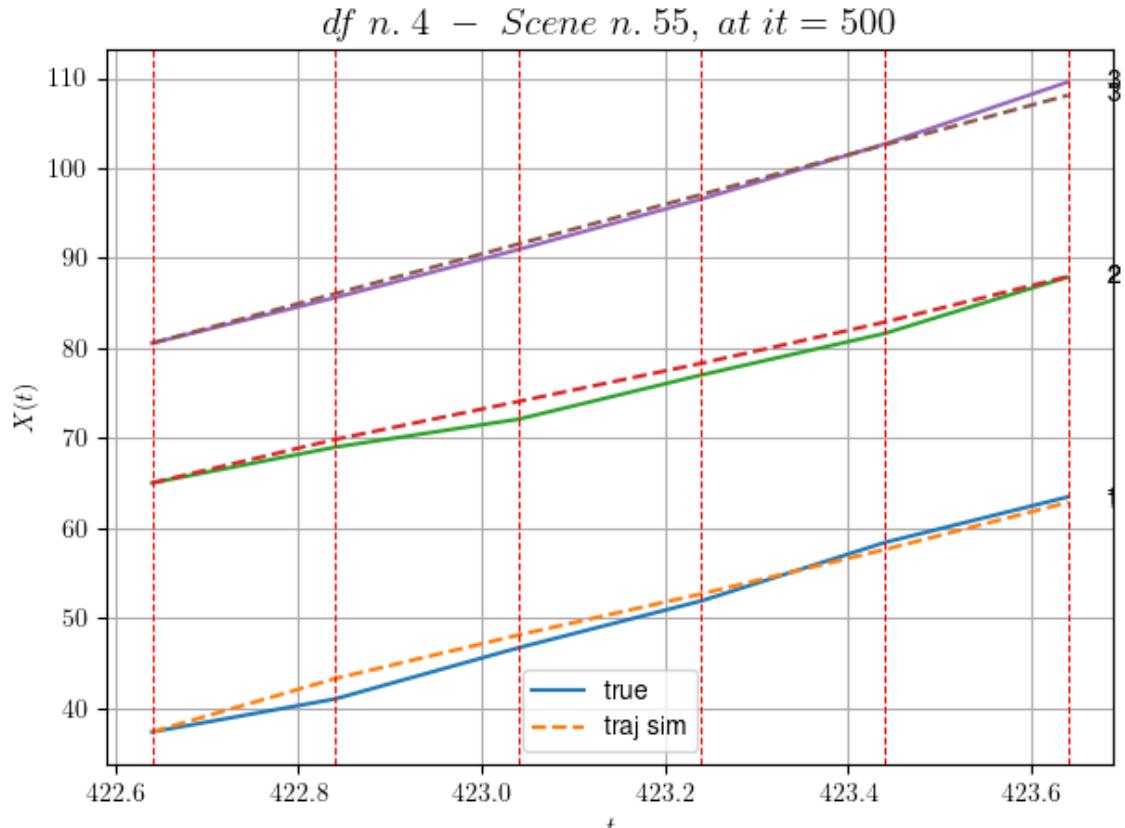
For scene 16/46:  
\* After LR finder: LR\_NN=0.001 with mse=119.77215611848115  
at it=24  
\* v0 = 21.068534244852476  
\* MSE = 1.3926665747114153  
\* iterations = 500

---

DataFrame n.4. Scene n.17/46

---

We have 5 time intervals inside [422.64, 423.64]

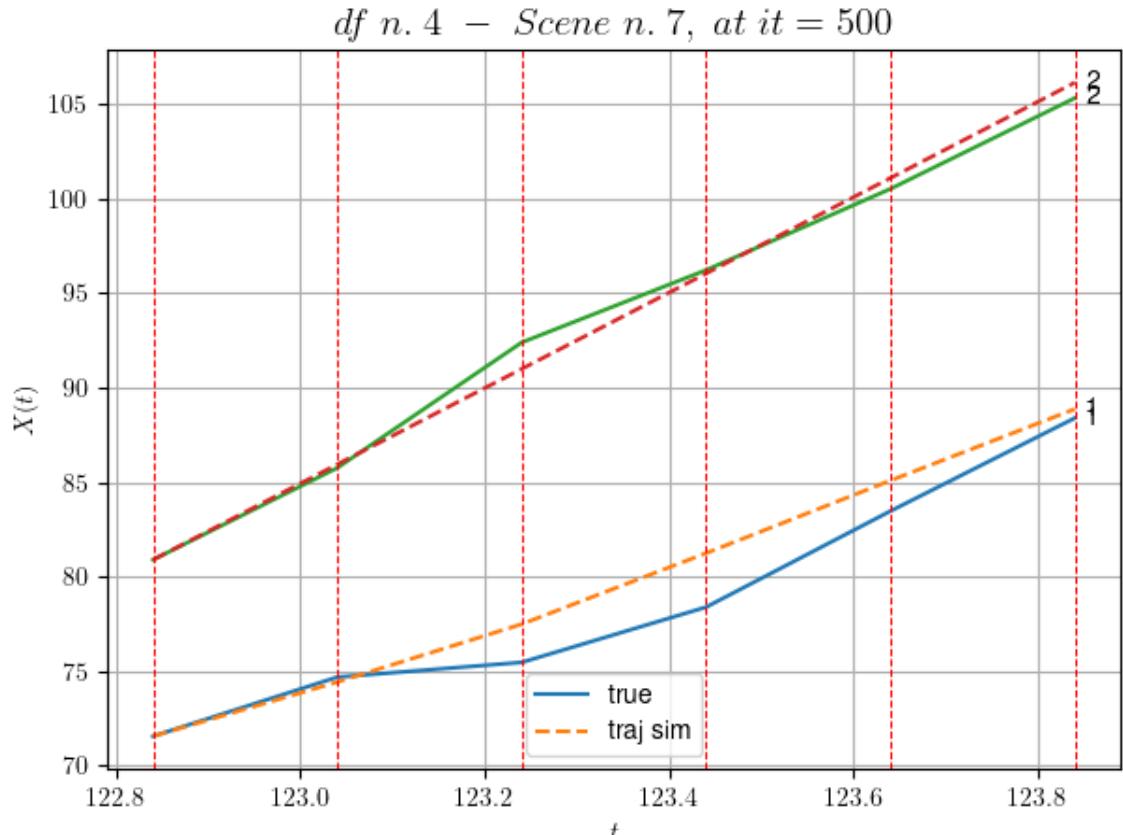


For scene 17/46:

\* After LR finder: LR\_NN=0.0005 with mse=2.6381649305266603  
at it=24  
\*  $v_0 = 27.54508960777685$   
\* MSE = 0.7888787787882438  
\* iterations = 500

DataFrame n.4. Scene n.18/46

We have 5 time intervals inside [122.84,123.84]



---

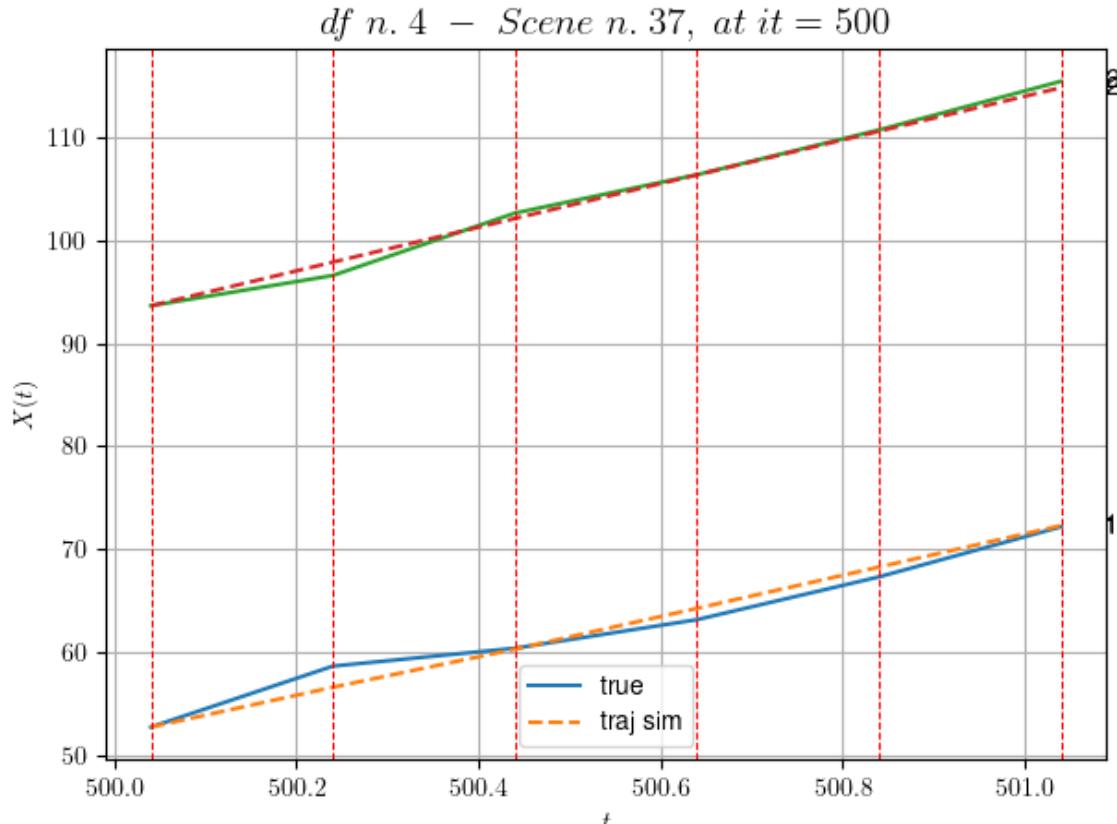
For scene 18/46:  
\* After LR finder: LR\_NN=5e-05 with mse=5.3645562949719565  
at it=24  
\* v0 = 25.259320008419433  
\* MSE = 1.5155346408630237  
\* iterations = 500

---

DataFrame n.4. Scene n.19/46

---

We have 5 time intervals inside [500.04,501.04]

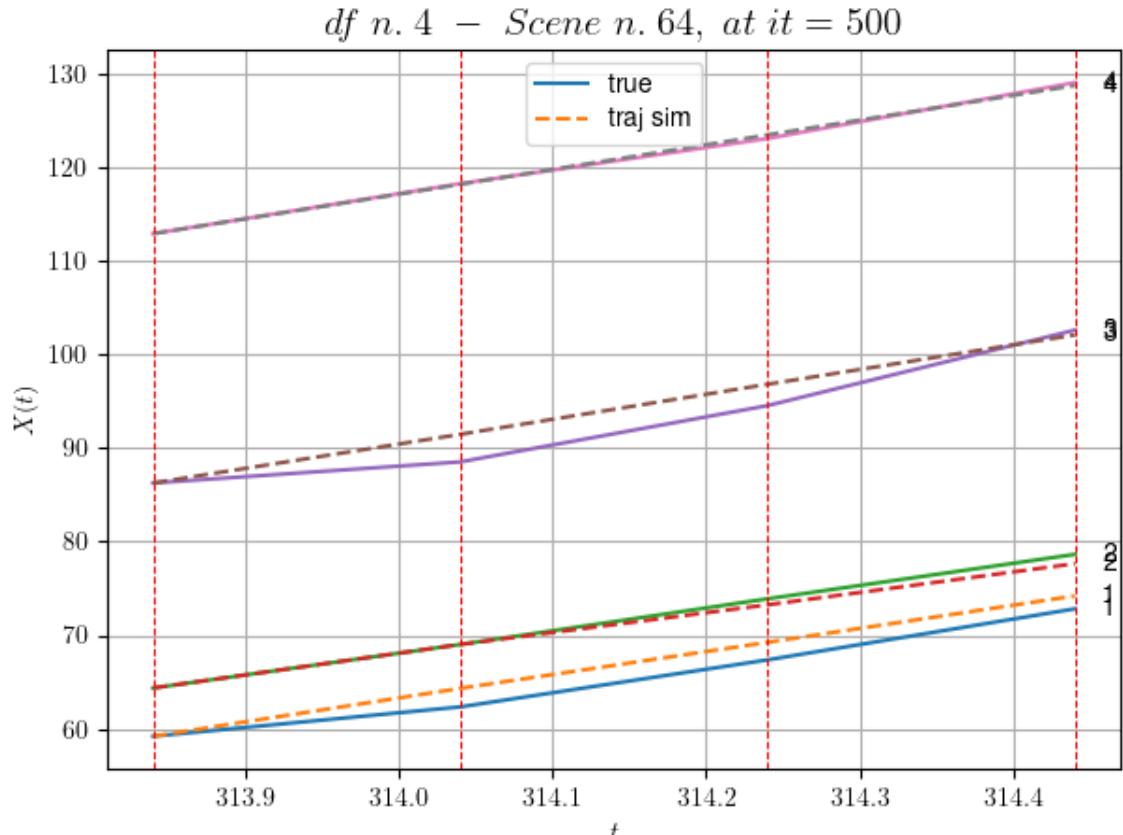


For scene 19/46:

\* After LR finder: LR\_NN=1e-05 with mse=14.00081207027682 at it=24  
\*  $v_0 = 21.189572495102716$   
\* MSE = 0.7186887903973411  
\* iterations = 500

DataFrame n.4. Scene n.20/46

We have 3 time intervals inside [313.84,314.44]




---

For scene 20/46:

- \* After LR finder: LR\_NN=0.0001 with mse=9.559043702266596

at it=24

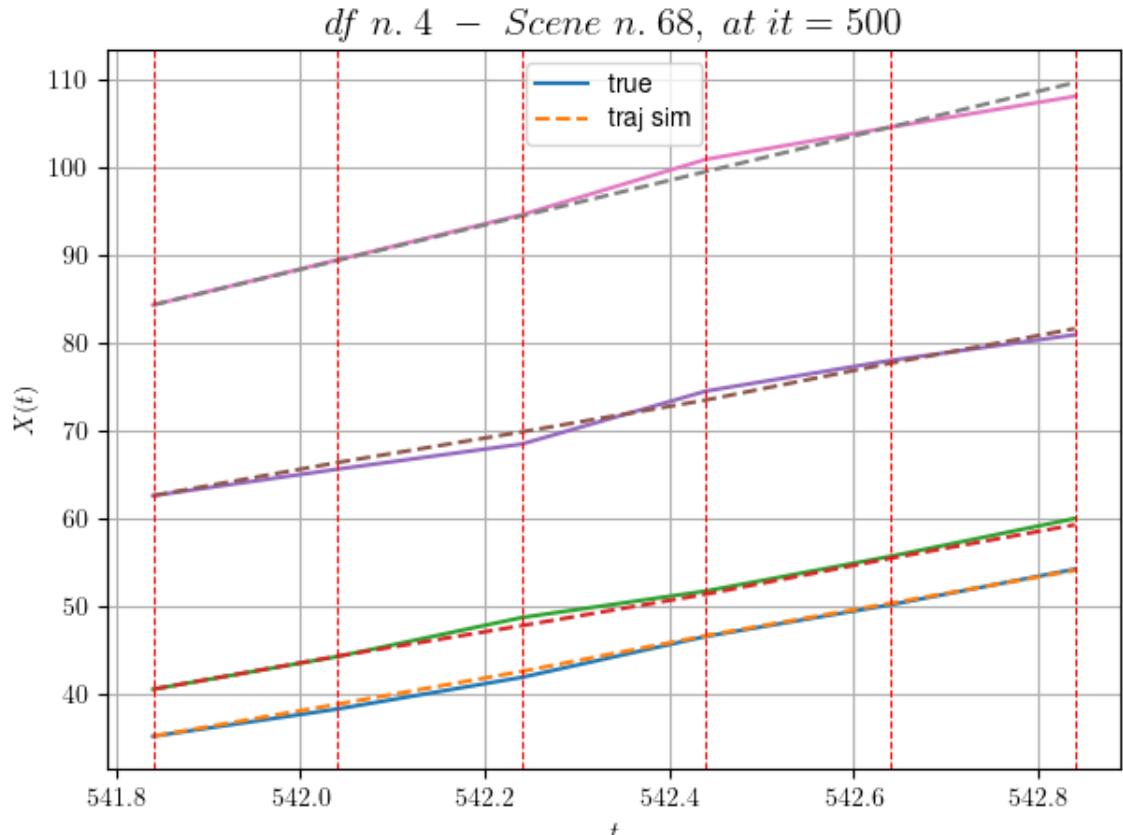
- \* v0 = 26.415529524804075
- \* MSE = 1.5257077504106575
- \* iterations = 500

---

DataFrame n.4. Scene n.21/46

---

We have 5 time intervals inside [541.84,542.84]



---

For scene 21/46:

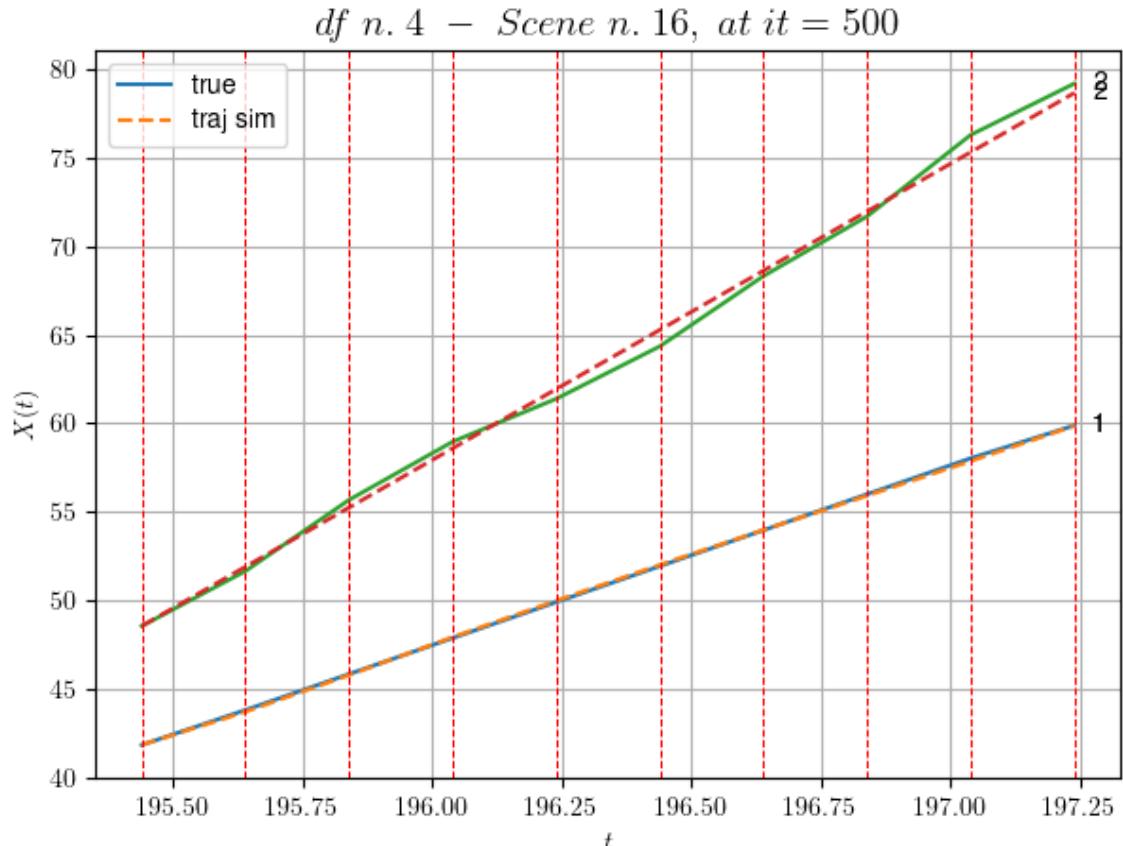
- \* After LR finder: LR\_NN=0.001 with mse=11.50895568246457 at it=24
- \* v0 = 25.311591600962856
- \* MSE = 0.45352873445065606
- \* iterations = 500

---

DataFrame n.4. Scene n.22/46

---

We have 9 time intervals inside [195.44,197.24]



For scene 22/46:

\* After LR finder: LR\_NN=5e-05 with mse=101.33566460773896  
at it=24  
\* v0 = 16.73844314065949  
\* MSE = 0.1504251867717192  
\* iterations = 500

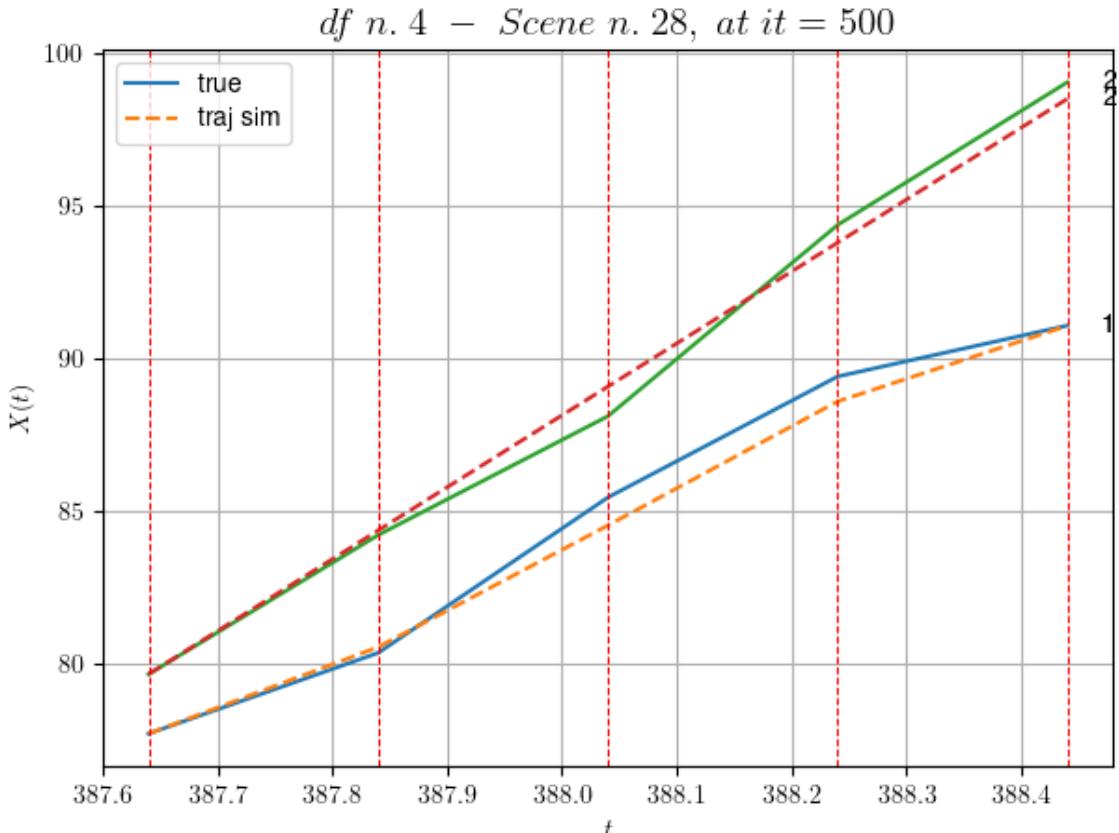
---

---

DataFrame n.4. Scene n.23/46

---

We have 4 time intervals inside [387.64,388.44]



---

For scene 23/46:

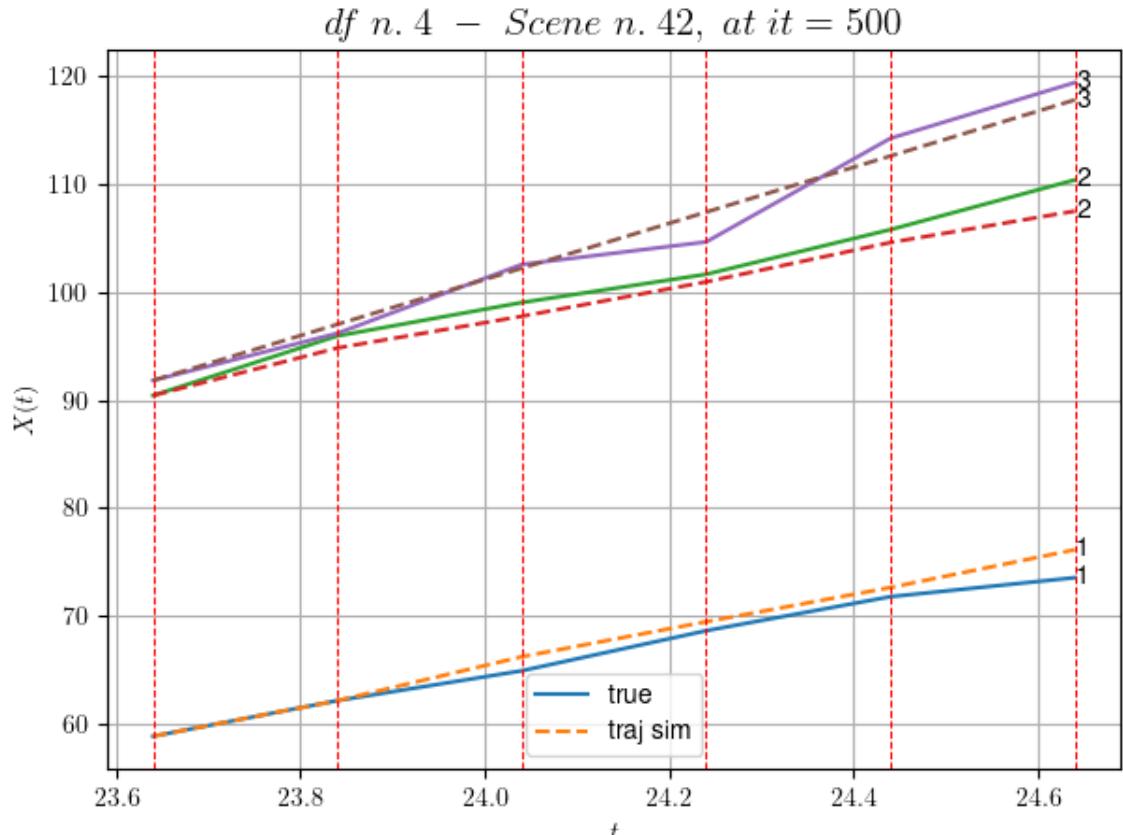
- \* After LR finder: LR\_NN=0.0005 with mse=7.28599765854993 at it=24
- \* v0 = 23.572406443207264
- \* MSE = 0.3145689978822871
- \* iterations = 500

---

DataFrame n.4. Scene n.24/46

---

We have 5 time intervals inside [23.64, 24.64]



---

For scene 24/46:

- \* After LR finder:  $LR_{NN}=0.001$  with  $mse=19.421676681832718$

at it=24

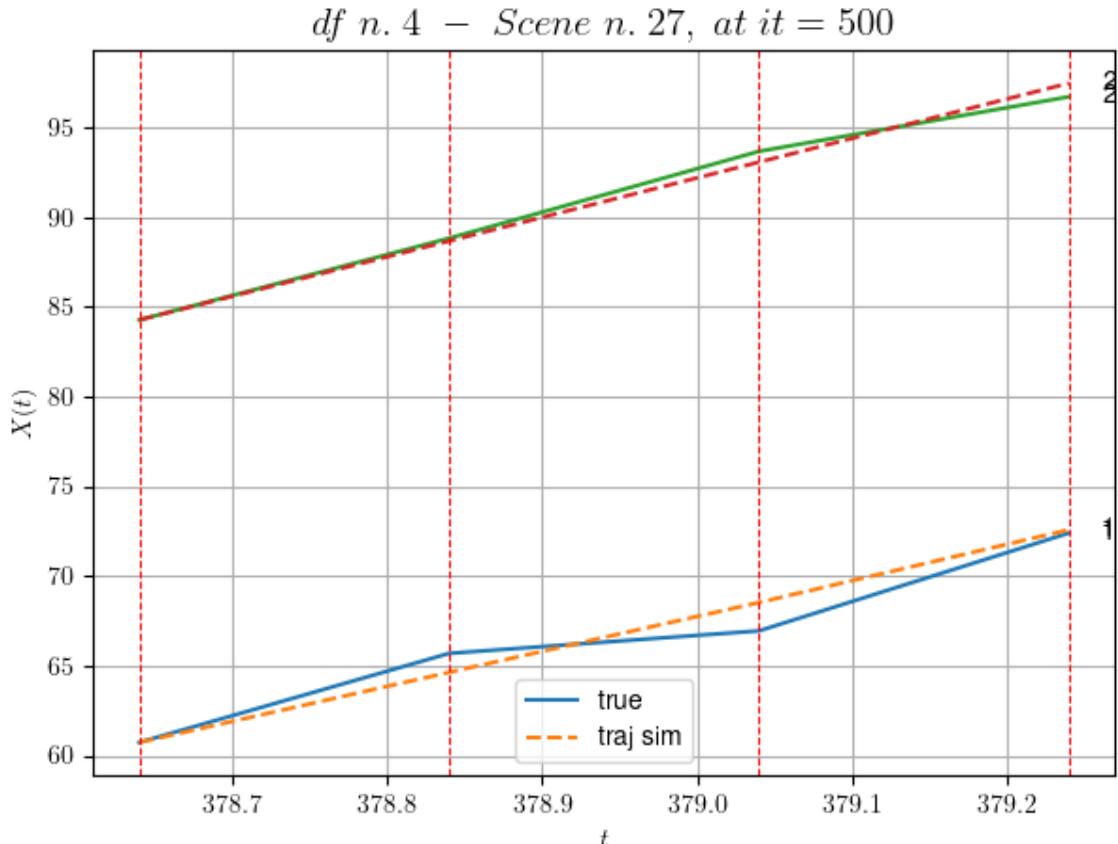
- \*  $v_0 = 25.974575559418643$
- \* MSE = 2.034477000018562
- \* iterations = 500

---

DataFrame n.4. Scene n.25/46

---

We have 3 time intervals inside [378.64, 379.24]

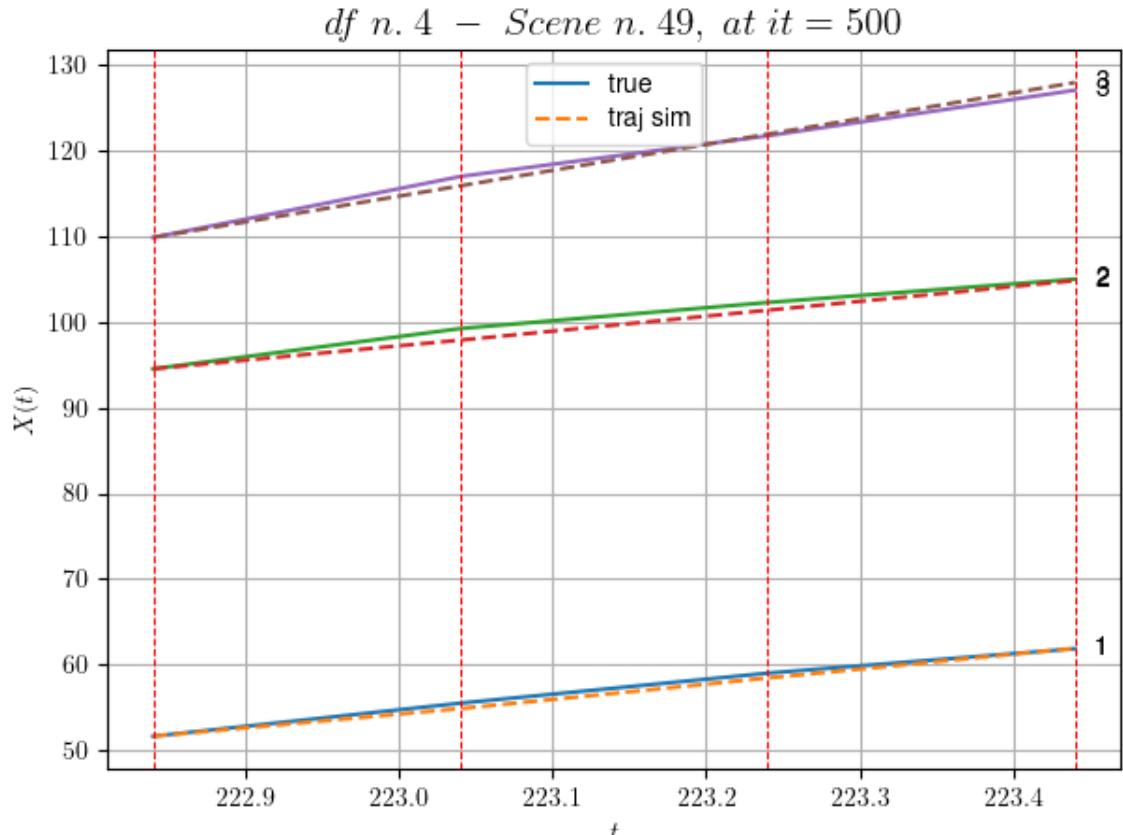


For scene 25/46:

\* After LR finder: LR\_NN=1e-05 with mse=5.424031366528124 at it=24  
\* v0 = 21.986682448764505  
\* MSE = 0.5759549010058046  
\* iterations = 500

DataFrame n.4. Scene n.26/46

We have 3 time intervals inside [222.84,223.44]



---

For scene 26/46:

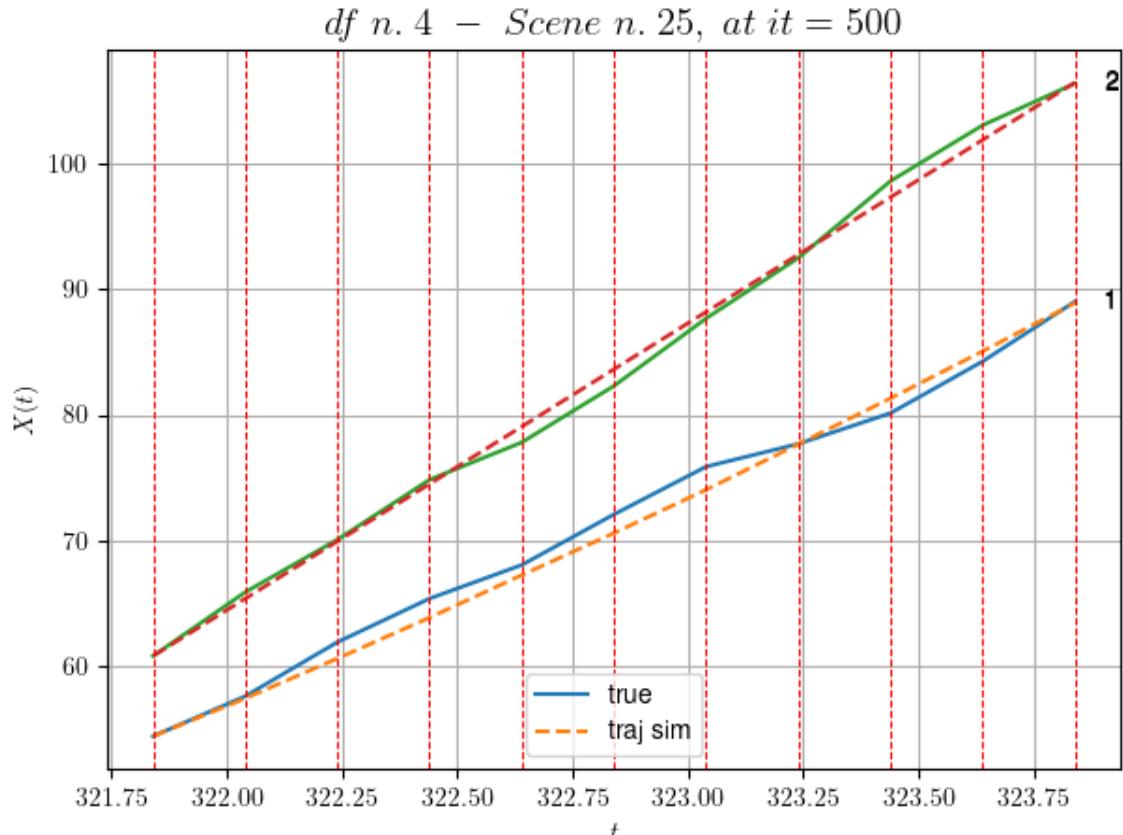
- \* After LR finder:  $LR_{NN}=0.0001$  with  $mse=5.59850541720278$  at  $it=24$
- \*  $v_0 = 30.107928662730142$
- \*  $MSE = 0.44938227858449226$
- \* iterations = 500

---

DataFrame n.4. Scene n.27/46

---

We have 10 time intervals inside [321.84, 323.84]



---

For scene 27/46:

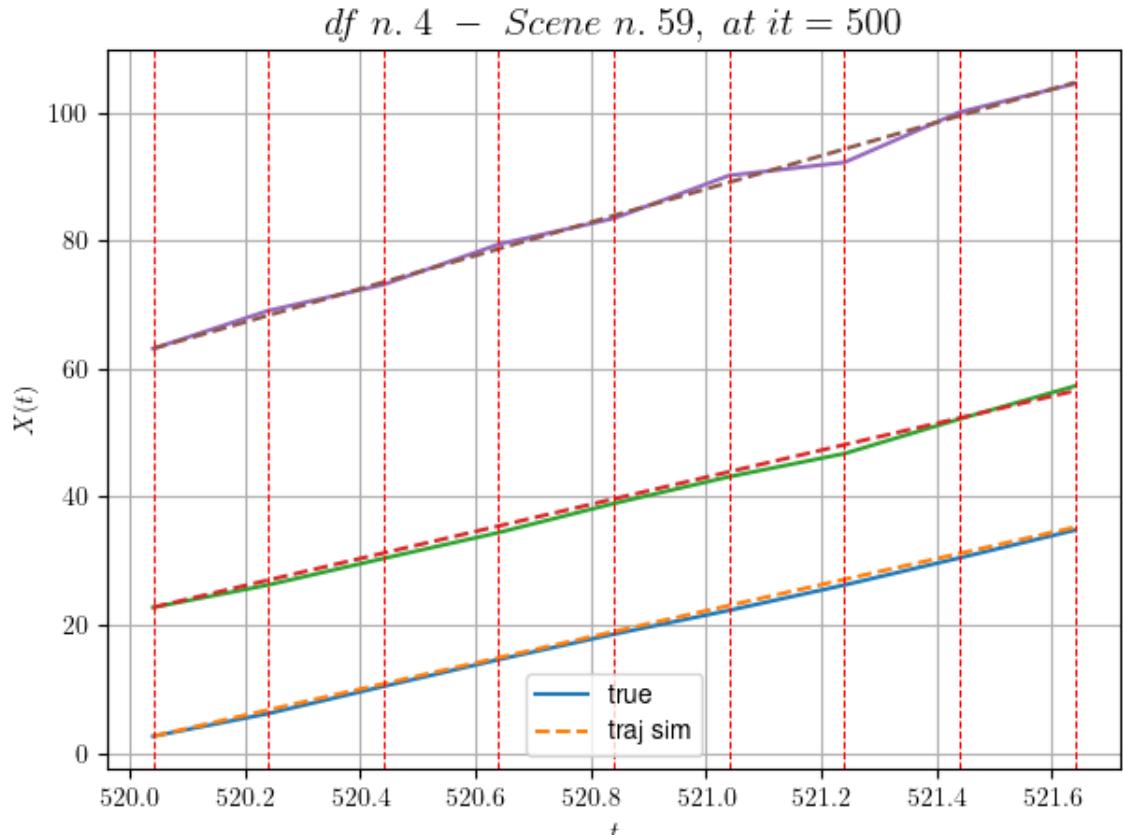
```
* After LR finder: LR_NN=0.001 with mse=37.58079513309806 at it=24
* v0 = 22.8100977335175
* MSE = 0.8054355307309271
* iterations = 500
```

---

DataFrame n.4. Scene n.28/46

---

We have 8 time intervals inside [520.04, 521.64]



---

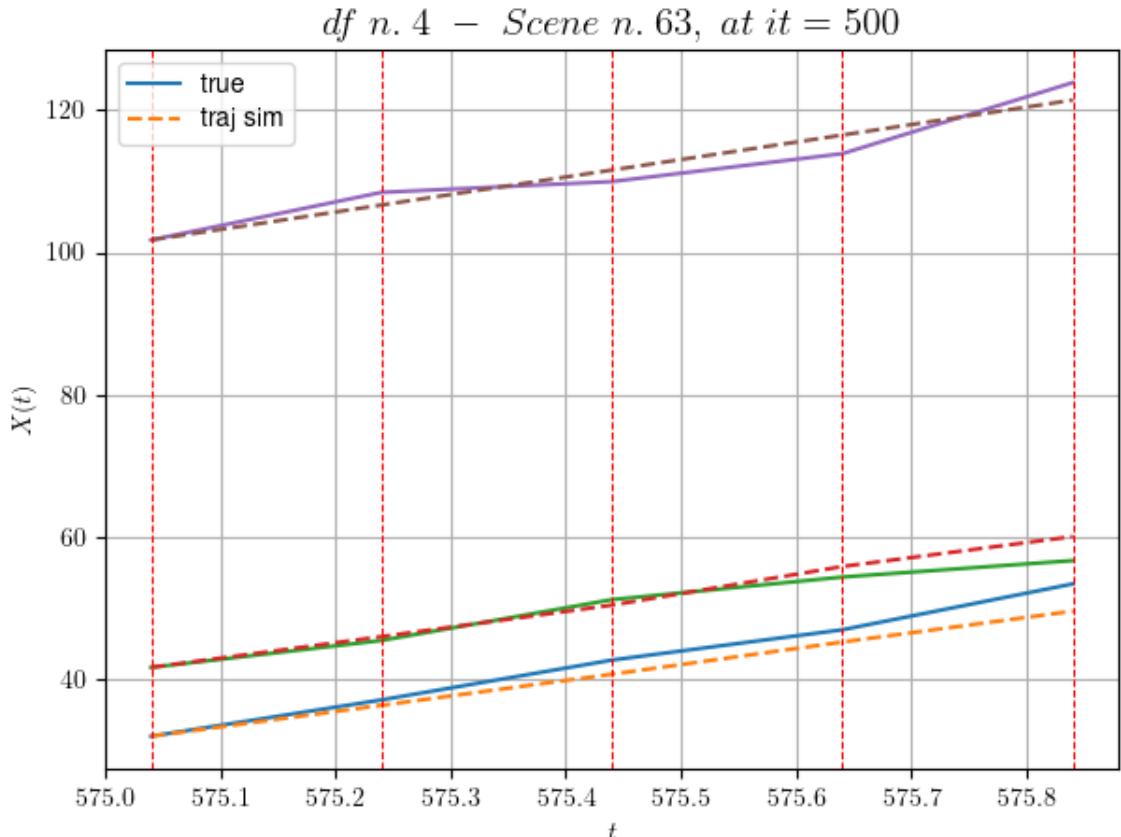
For scene 28/46:  
\* After LR finder: LR\_NN=5e-05 with mse=26.048017900904327  
at it=24  
\* v0 = 25.96280732717735  
\* MSE = 0.5625970066282647  
\* iterations = 500

---

DataFrame n.4. Scene n.29/46

---

We have 4 time intervals inside [575.04, 575.84]



---

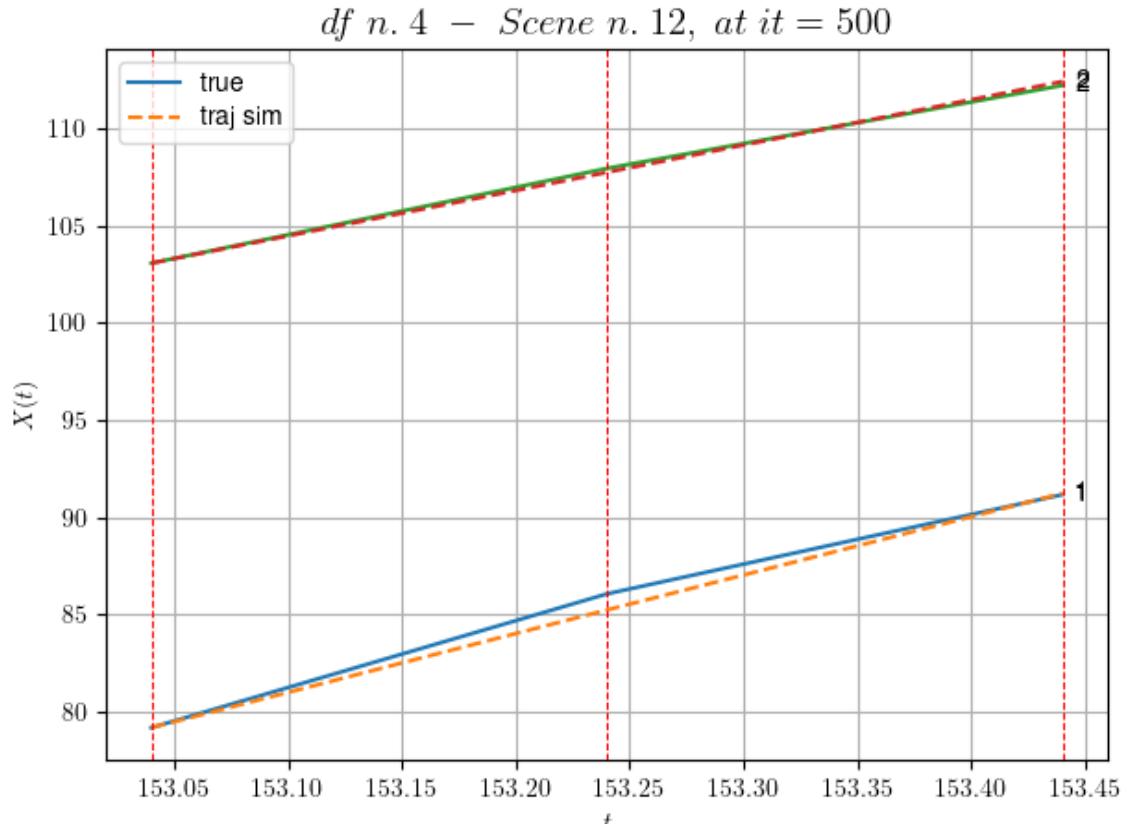
For scene 29/46:  
\* After LR finder: LR\_NN=0.0001 with mse=41.26326928254394  
at it=24  
\* v0 = 24.545621507400668  
\* MSE = 3.6778475923037575  
\* iterations = 500

---

DataFrame n.4. Scene n.30/46

---

We have 2 time intervals inside [153.04,153.44]

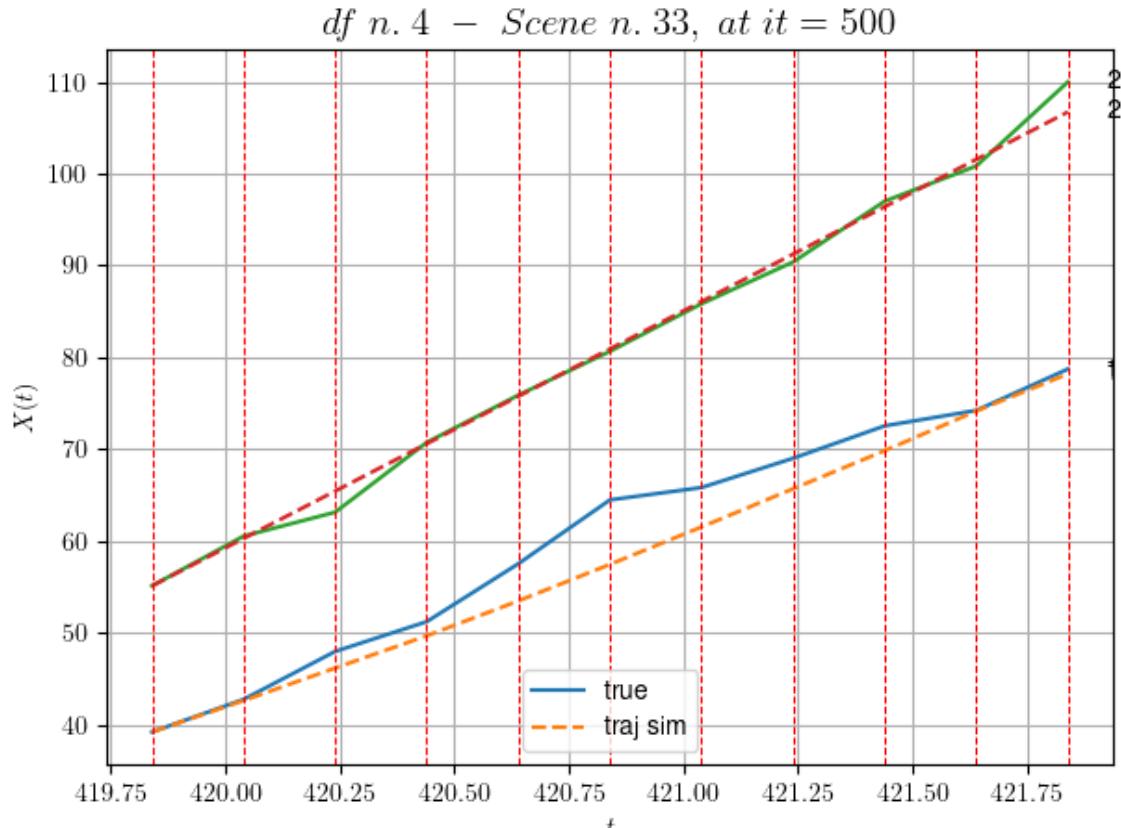


For scene 30/46:

\* After LR finder:  $LR\_NN=5e-05$  with  $mse=1.6362617782159044$   
at it=24  
\*  $v_0 = 23.385109048524004$   
\*  $MSE = 0.12876060398130718$   
\* iterations = 500

DataFrame n.4. Scene n.31/46

We have 10 time intervals inside [419.84, 421.84]

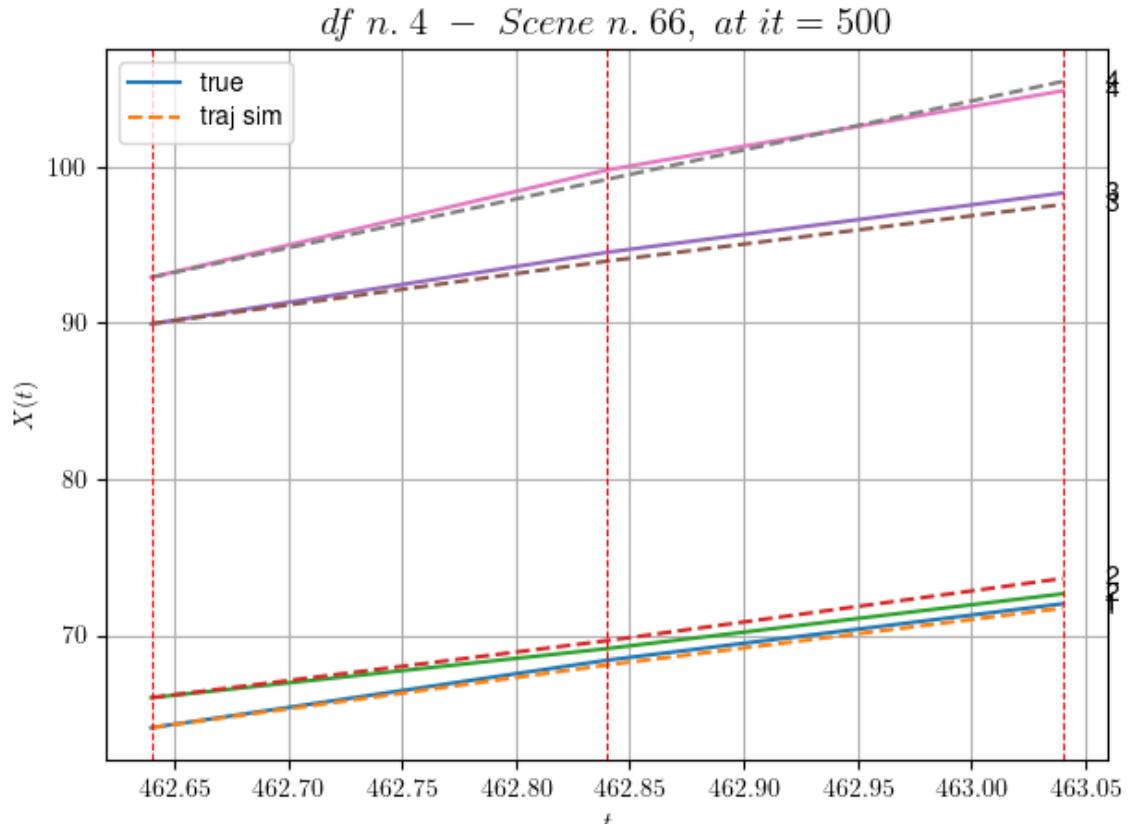


For scene 31/46:

\* After LR finder: LR\_NN=0.0005 with mse=15.661827292733607  
at it=24  
\* v0 = 25.806420226564246  
\* MSE = 3.2472507431936  
\* iterations = 500

DataFrame n.4. Scene n.32/46

We have 2 time intervals inside [462.64,463.04]

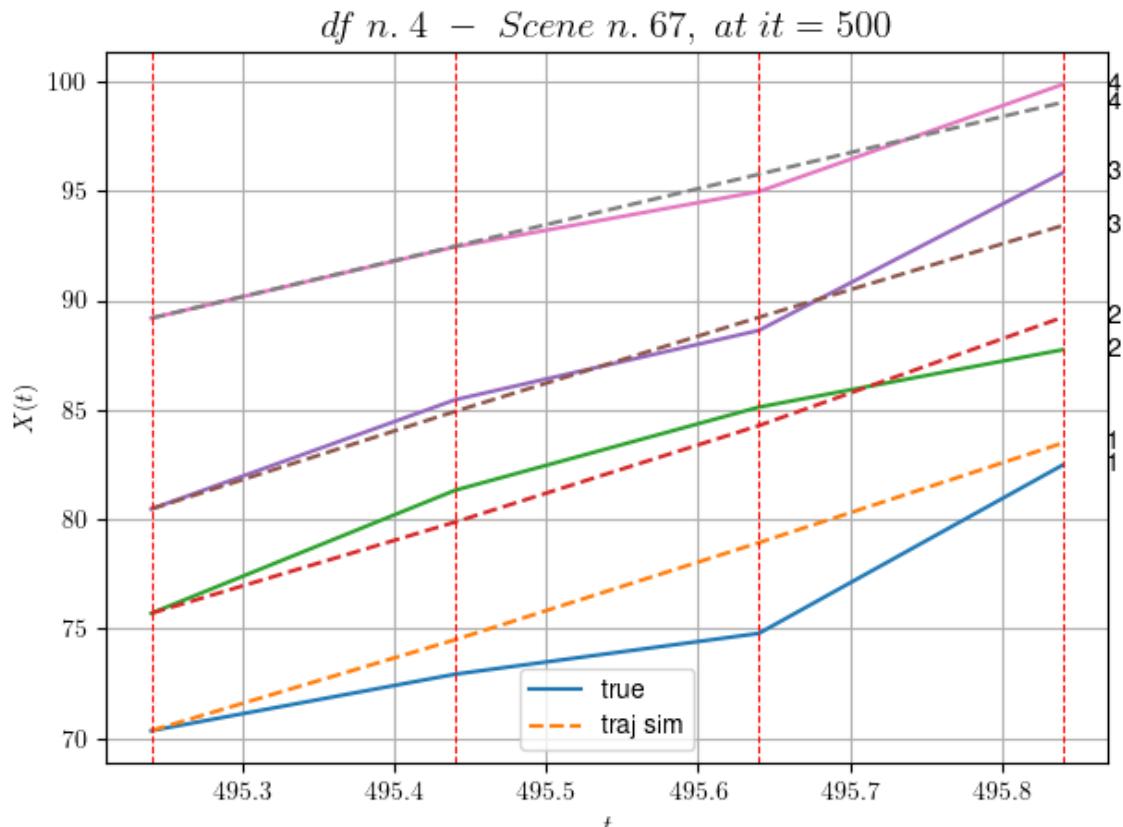


For scene 32/46:

\* After LR finder: LR\_NN=0.001 with mse=4.547496685582277 at it=24  
\* v0 = 31.352447205664888  
\* MSE = 0.238749026132408  
\* iterations = 500

DataFrame n.4. Scene n.33/46

We have 3 time intervals inside [495.24, 495.84]

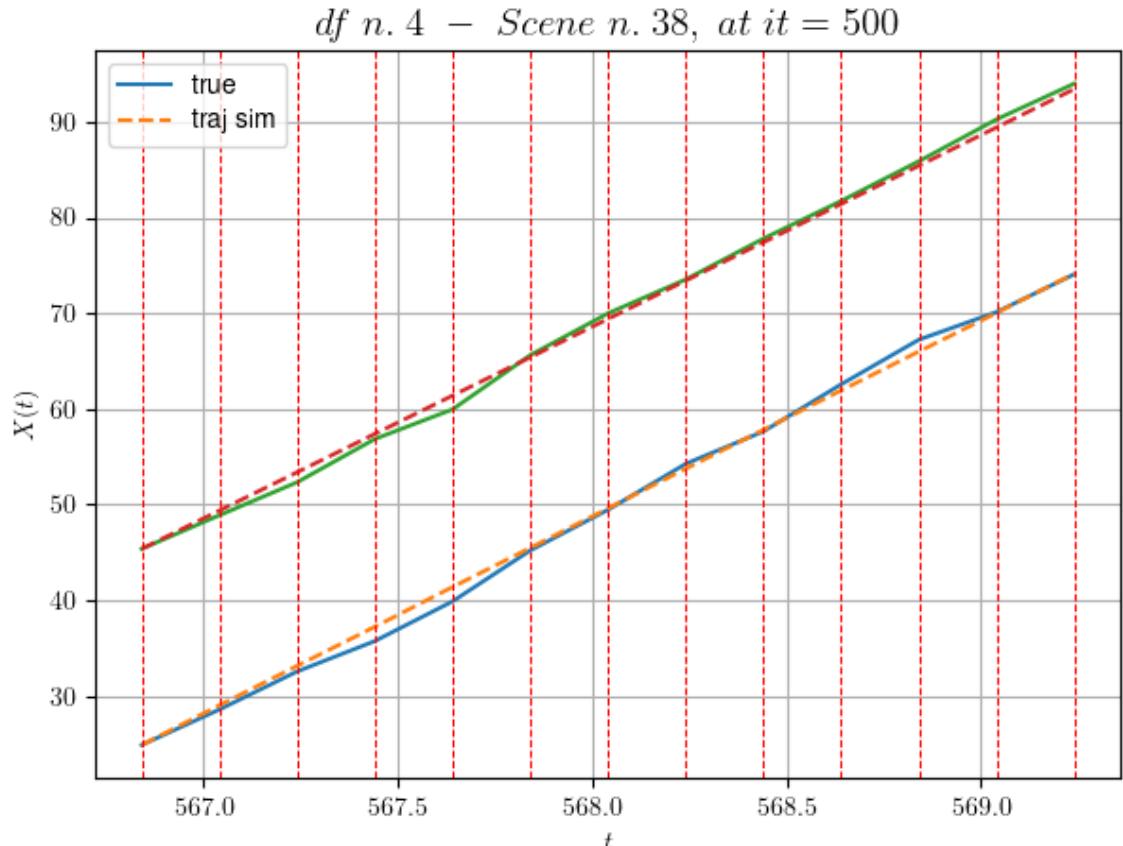


For scene 33/46:

\* After LR finder: LR\_NN=0.0001 with mse=10.25468719706702  
at it=24  
\* v0 = 16.437805482235863  
\* MSE = 2.08989222818802  
\* iterations = 500

DataFrame n.4. Scene n.34/46

We have 12 time intervals inside [566.84, 569.24]



For scene 34/46:

\* After LR finder: LR\_NN=0.0001 with mse=96.51053904897437

at it=24

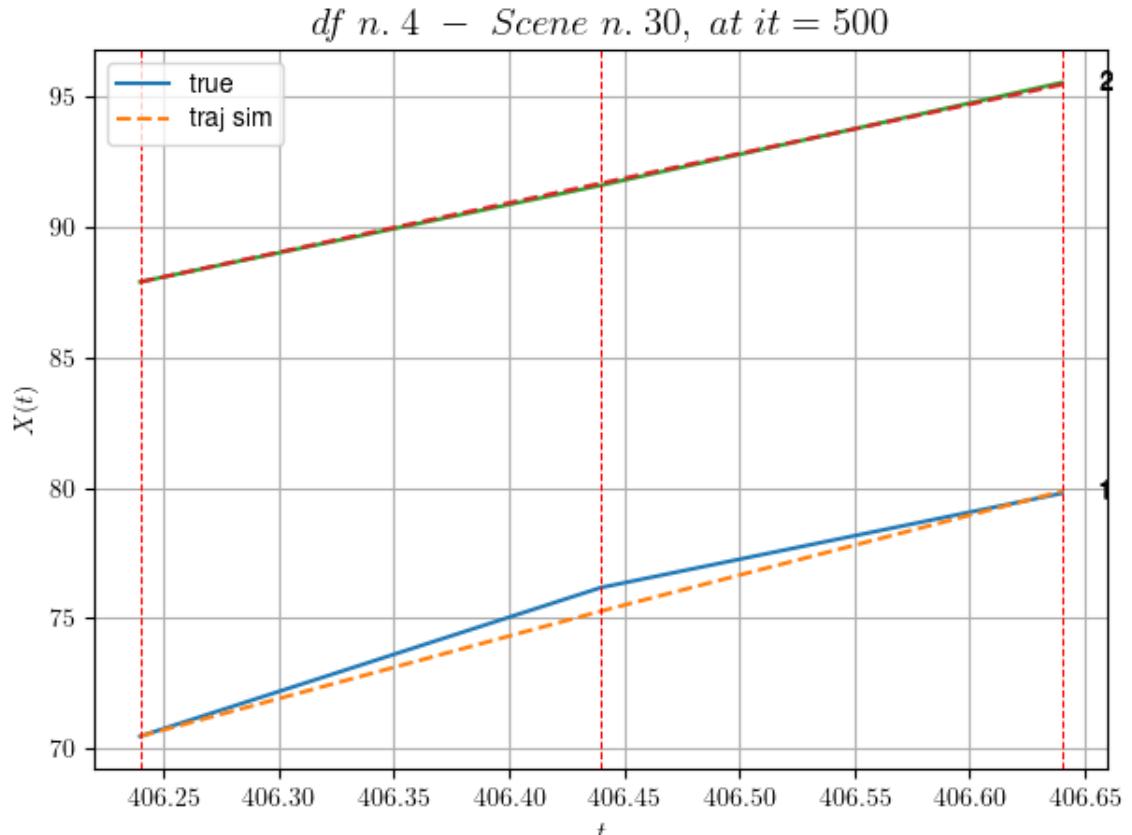
\* v0 = 20.028487582197776

\* MSE = 0.4781021015092599

\* iterations = 500

DataFrame n.4. Scene n.35/46

We have 2 time intervals inside [406.24,406.64]

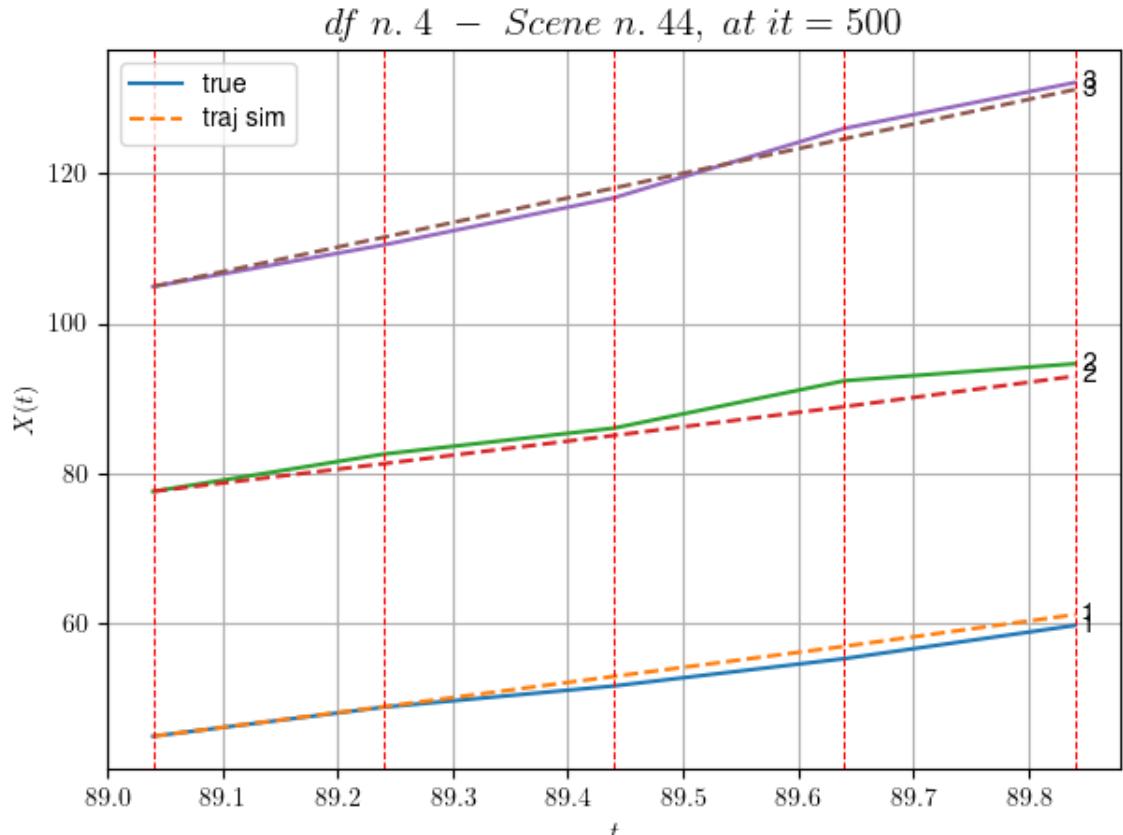


For scene 35/46:

\* After LR finder: LR\_NN=5e-05 with mse=4.133081259795009 at it=24  
\* v0 = 18.926519541434036  
\* MSE = 0.139046670303888  
\* iterations = 500

DataFrame n.4. Scene n.36/46

We have 4 time intervals inside [89.04,89.84]

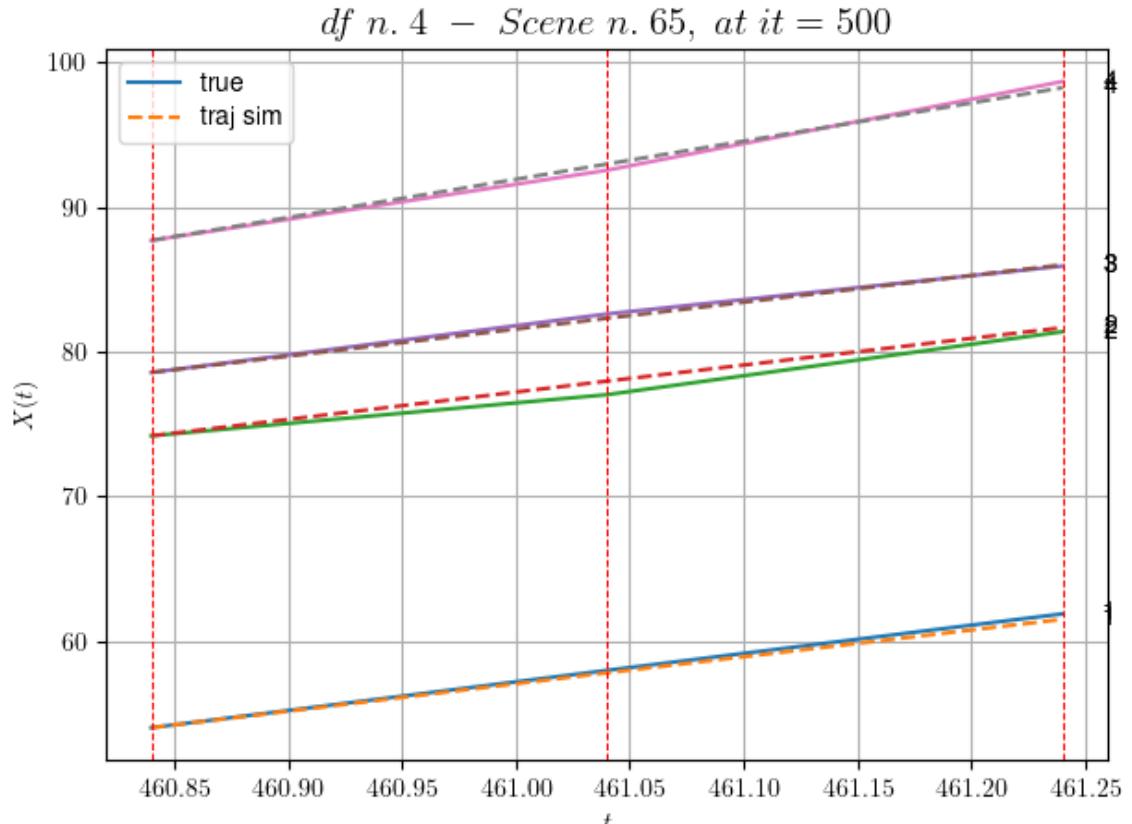


For scene 36/46:

\* After LR finder: LR\_NN=5e-05 with mse=4.196110092709634 at it=24  
\* v0 = 32.77543163260248  
\* MSE = 1.9382848314140775  
\* iterations = 500

DataFrame n.4. Scene n.37/46

We have 2 time intervals inside [460.84, 461.24]

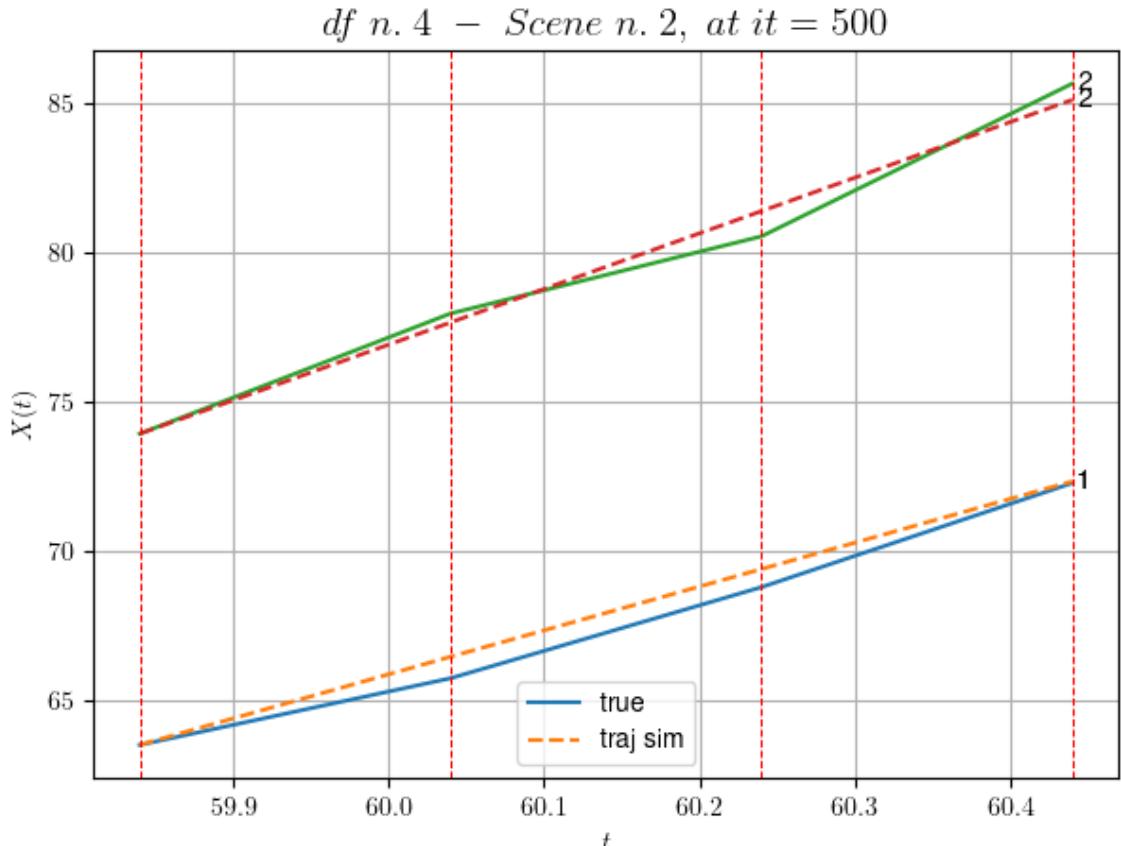


For scene 37/46:

\* After LR finder:  $LR\_NN=0.0005$  with  $mse=3.0688759824782386$   
at  $it=24$   
\*  $v\theta = 26.40431452922769$   
\*  $MSE = 0.12806544071592152$   
\* iterations = 500

DataFrame n.4. Scene n.38/46

We have 3 time intervals inside [59.84,60.44]

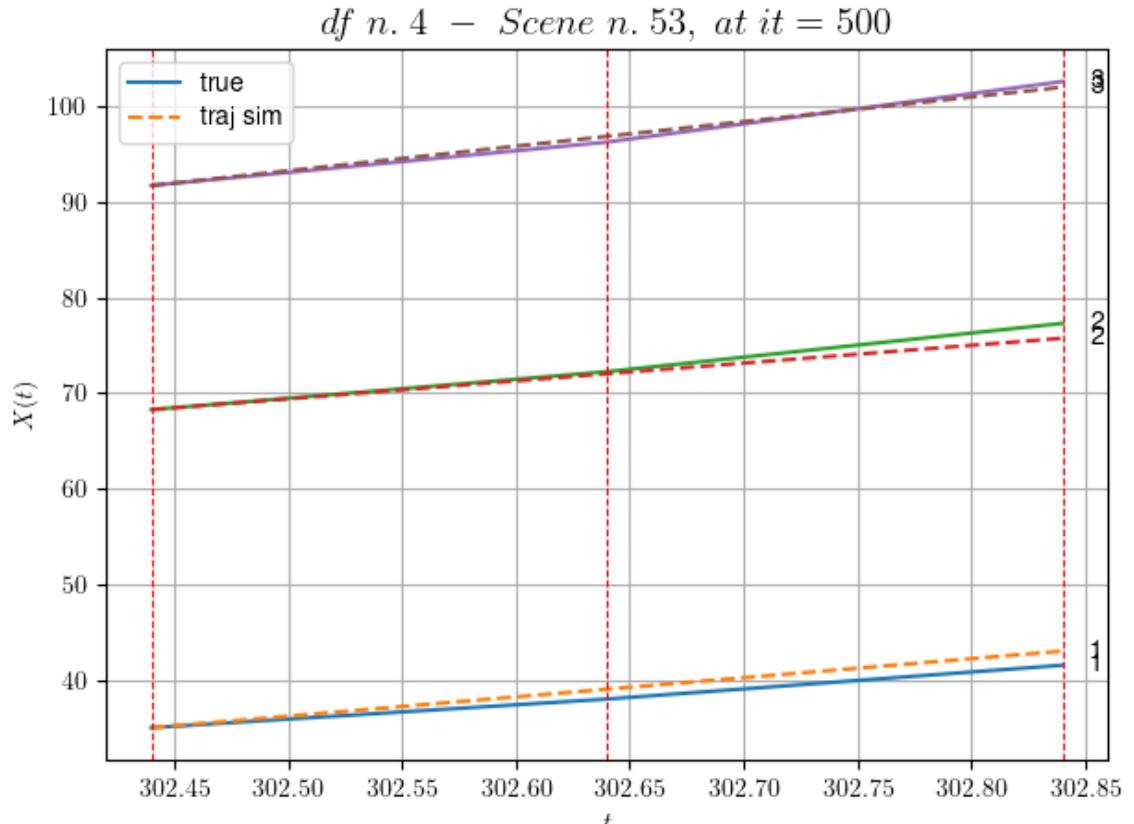


For scene 38/46:

\* After LR finder: LR\_NN=0.0001 with mse=9.11932454108125 at it=24  
\* v0 = 18.625518273300347  
\* MSE = 0.24818905022681084  
\* iterations = 500

DataFrame n.4. Scene n.39/46

We have 2 time intervals inside [302.44,302.84]

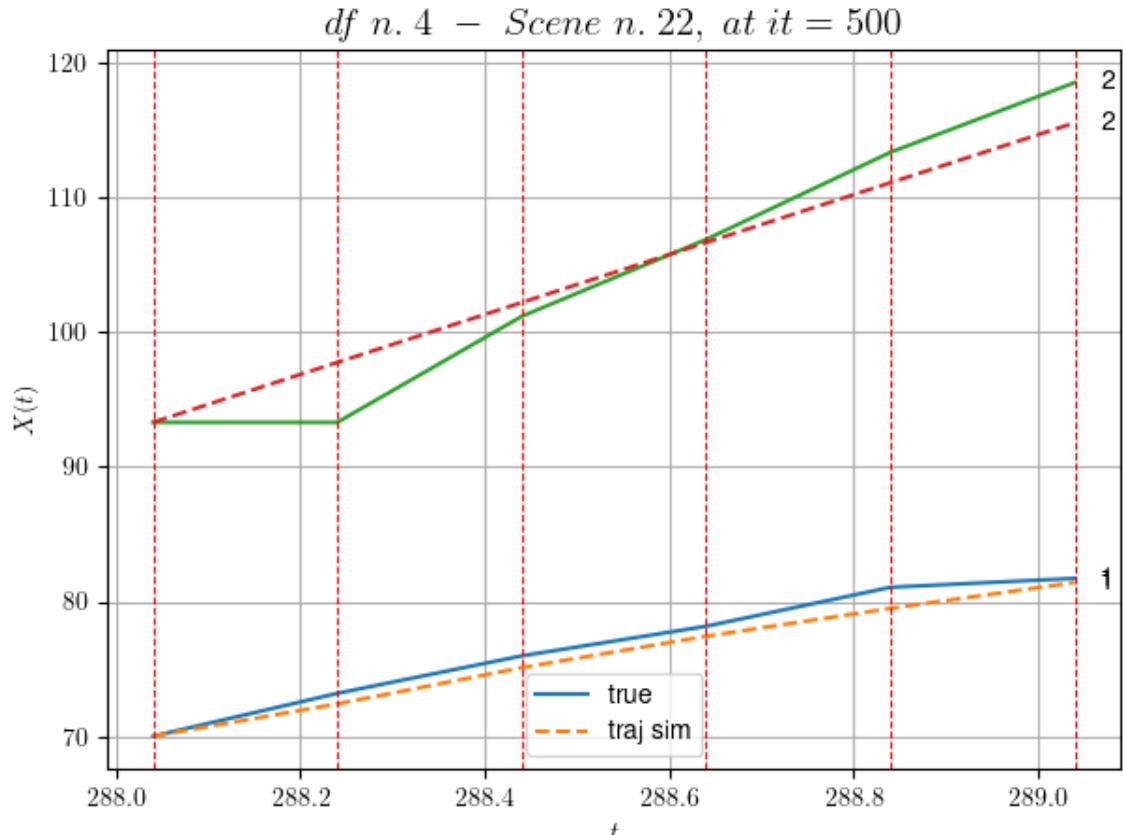


For scene 39/46:

\* After LR finder: LR\_NN=5e-05 with mse=2.1278068709085347  
at it=24  
\* v0 = 25.7445382330287  
\* MSE = 0.7214110024741673  
\* iterations = 500

DataFrame n.4. Scene n.40/46

We have 5 time intervals inside [288.04, 289.04]



---

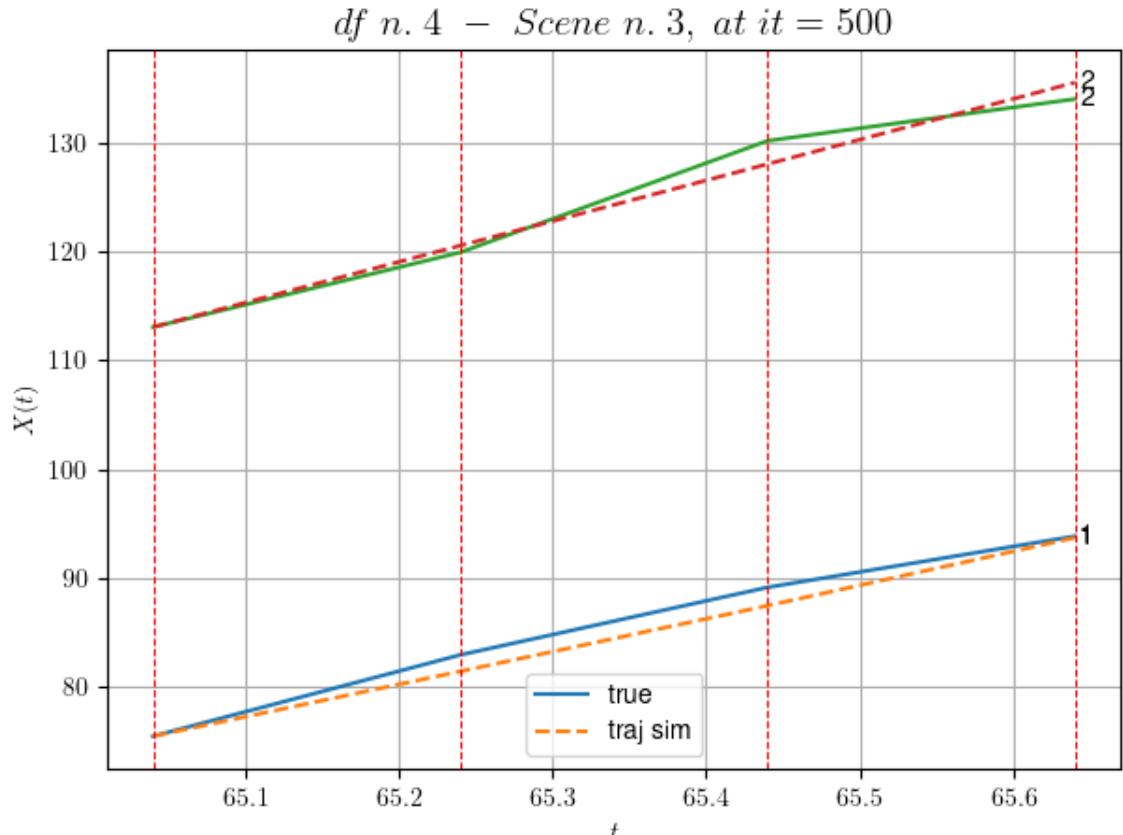
For scene 40/46:  
\* After LR finder: LR\_NN=5e-05 with mse=11.308730683536066  
at it=24  
\* v0 = 22.24789971530882  
\* MSE = 3.1332955827367375  
\* iterations = 500

---

DataFrame n.4. Scene n.41/46

---

We have 3 time intervals inside [65.04,65.64]



---

For scene 41/46:

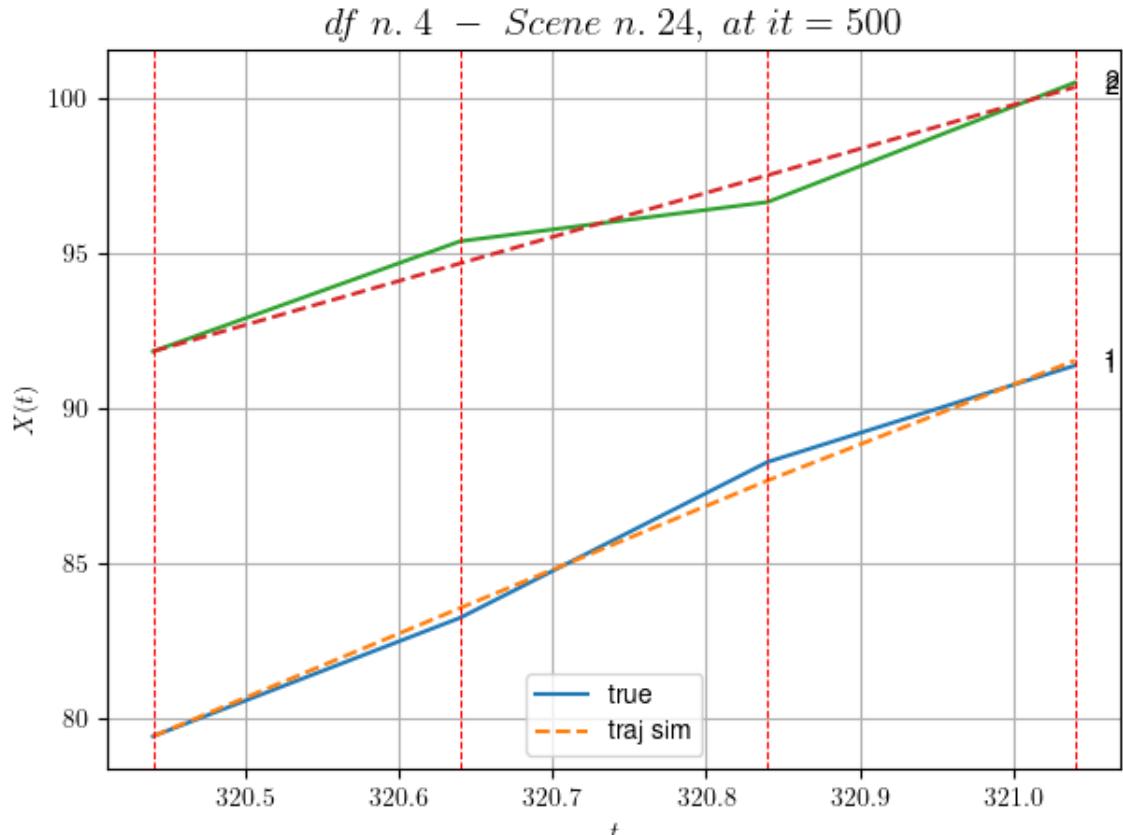
- \* After LR finder: LR\_NN=1e-05 with mse=5.326416194546947 at it=24
- \* v0 = 37.41903742148344
- \* MSE = 1.544787210230352
- \* iterations = 500

---

DataFrame n.4. Scene n.42/46

---

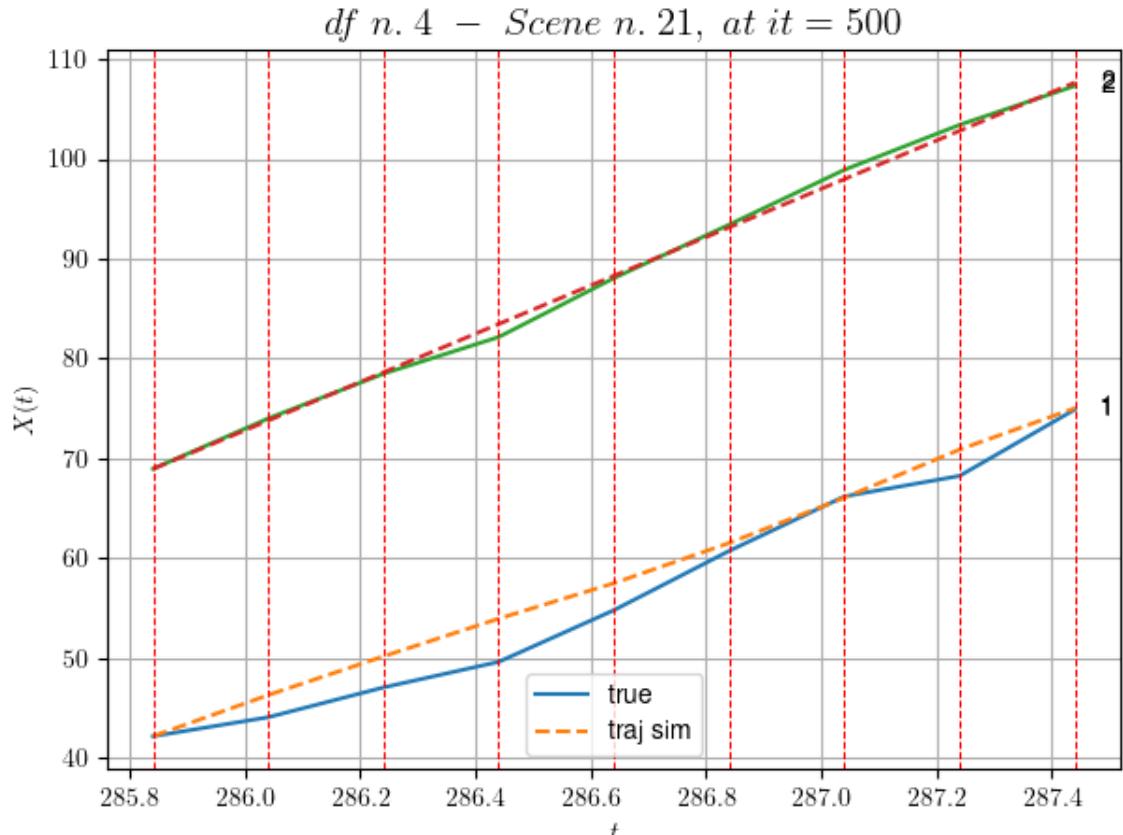
We have 3 time intervals inside [320.44,321.04]



For scene 42/46:  
\* After LR finder: LR\_NN=5e-05 with mse=18.251199345255547  
at it=24  
\* v0 = 14.16242664899228  
\* MSE = 0.21908862395480277  
\* iterations = 500

DataFrame n.4. Scene n.43/46

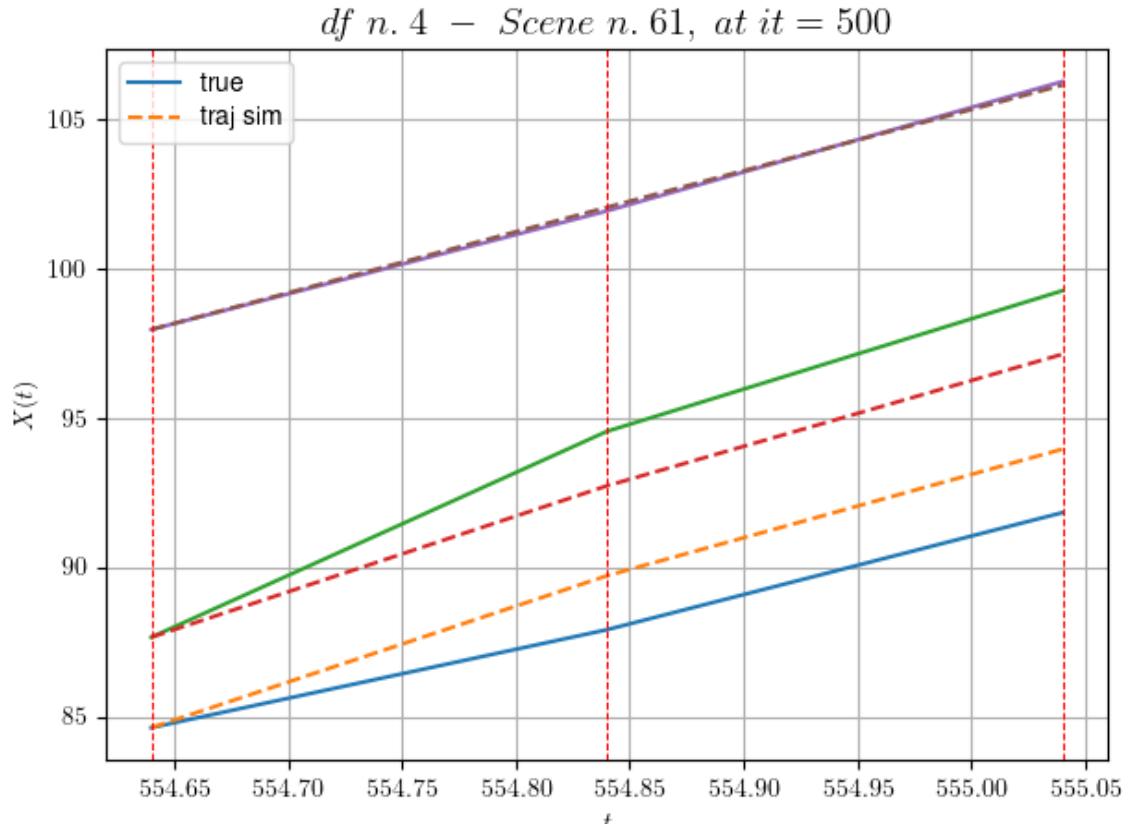
We have 8 time intervals inside [285.84,287.44]



-----  
For scene 43/46:  
\* After LR finder: LR\_NN=0.0005 with mse=16.45144797533681  
at it=24  
\* v0 = 24.20183084742255  
\* MSE = 1.7449545039851007  
\* iterations = 500  
-----

DataFrame n.4. Scene n.44/46

We have 2 time intervals inside [554.64,555.04]

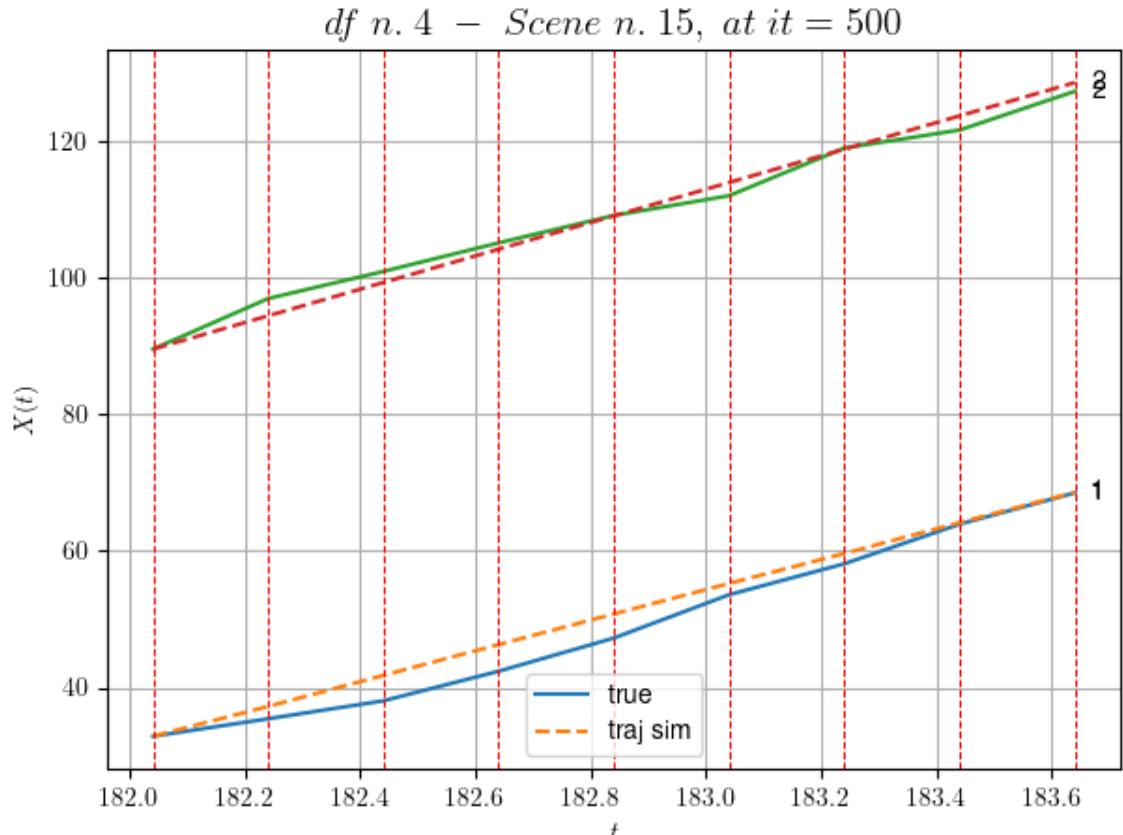


For scene 44/46:

\* After LR finder: LR\_NN=0.001 with mse=2.437145672426937 at it=24  
\* v0 = 20.440727818764856  
\* MSE = 1.7343751703531947  
\* iterations = 500

DataFrame n.4. Scene n.45/46

We have 8 time intervals inside [182.04,183.64]



---

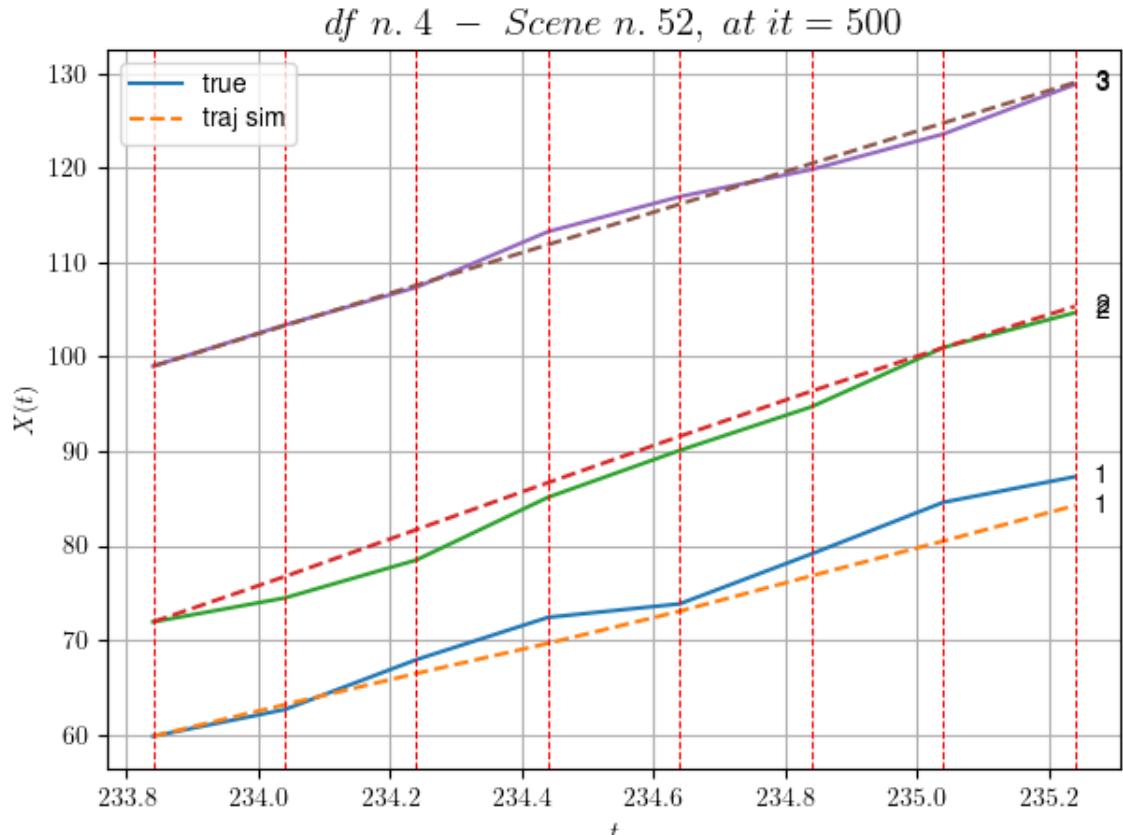
For scene 45/46:  
\* After LR finder: LR\_NN=5e-05 with mse=19.2269387596039 at  
it=24  
\* v0 = 24.38495342857972  
\* MSE = 3.5828320460360663  
\* iterations = 500

---

DataFrame n.4. Scene n.46/46

---

We have 7 time intervals inside [233.84, 235.24]




---

For scene 46/46:  
 \* After LR finder: LR\_NN=1e-05 with mse=31.987483313531722  
 at it=24  
 \* v0 = 21.462806471988504  
 \* MSE = 2.909468016335563  
 \* iterations = 500

---

MSE train: 3.6264089177816996

---

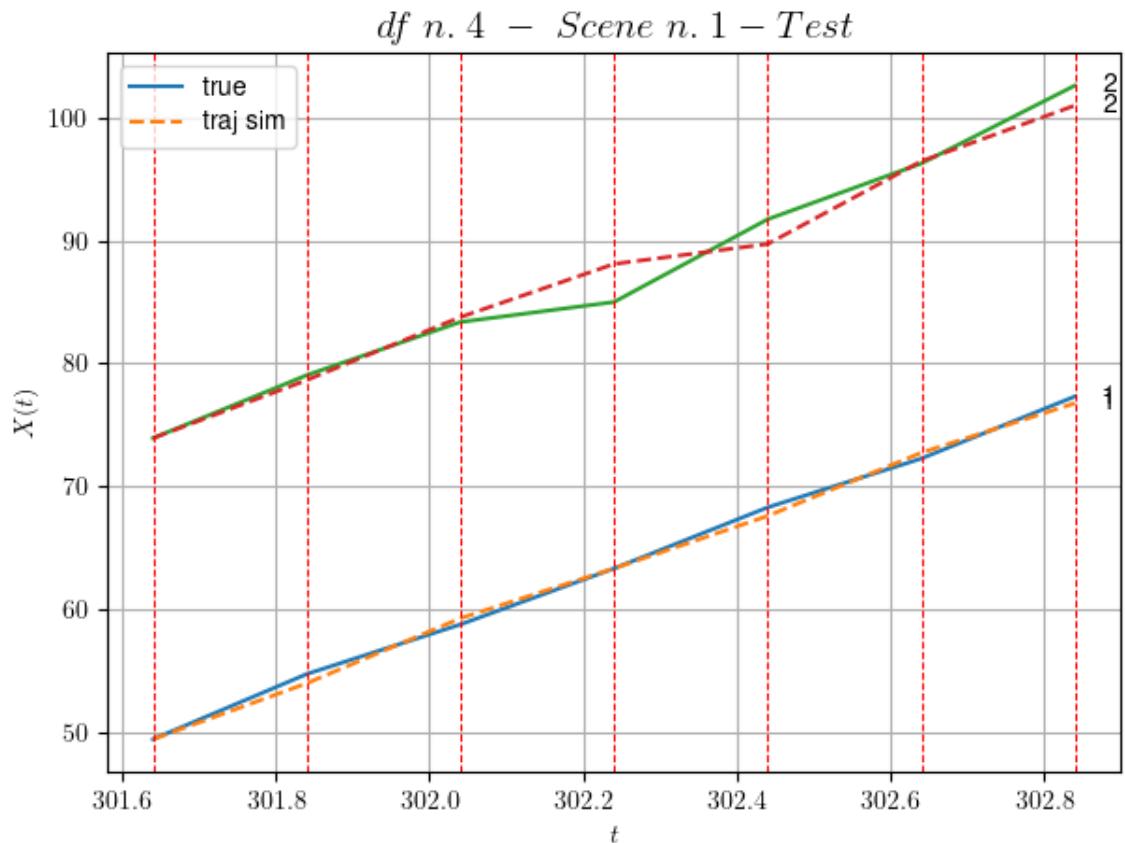
Testing step. (23 scenes)

---



---

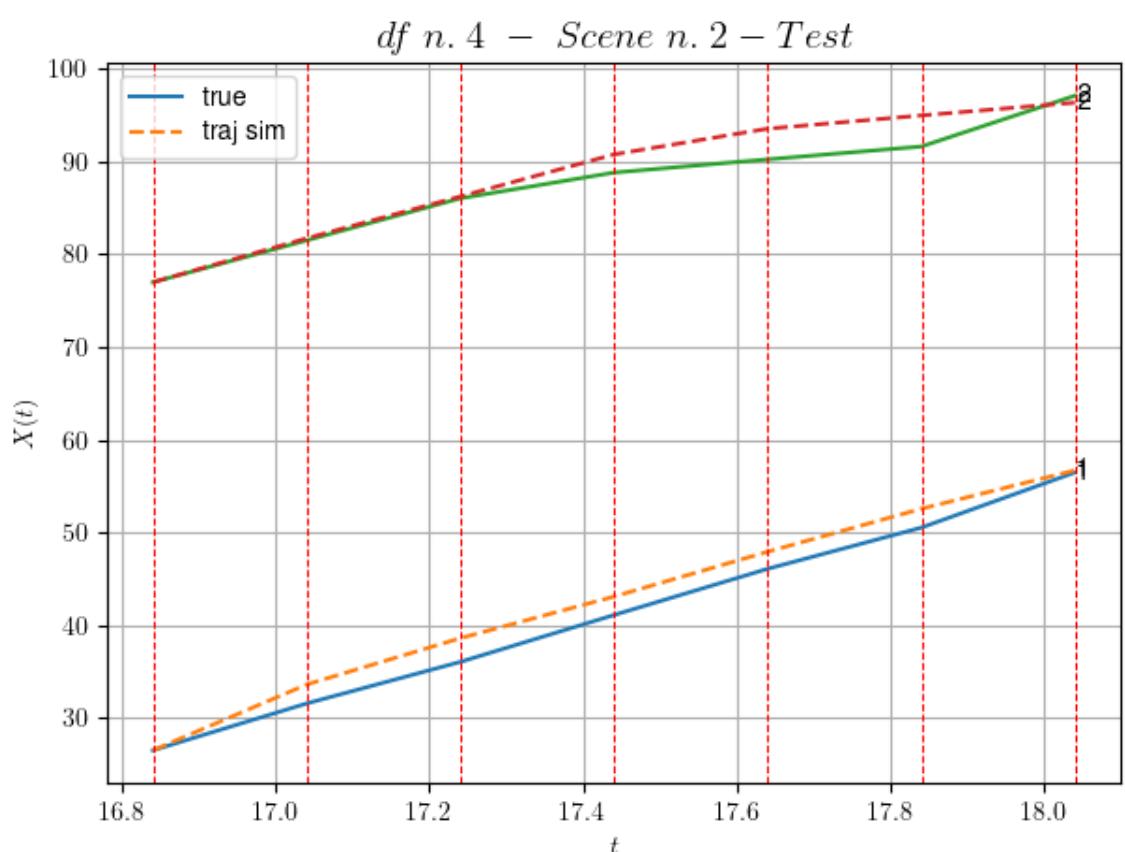
DataFrame n.4. Scene n.1/23



For scene 1/23:  
\* MSE = 1.3208160537764326

---

DataFrame n.4. Scene n.2/23

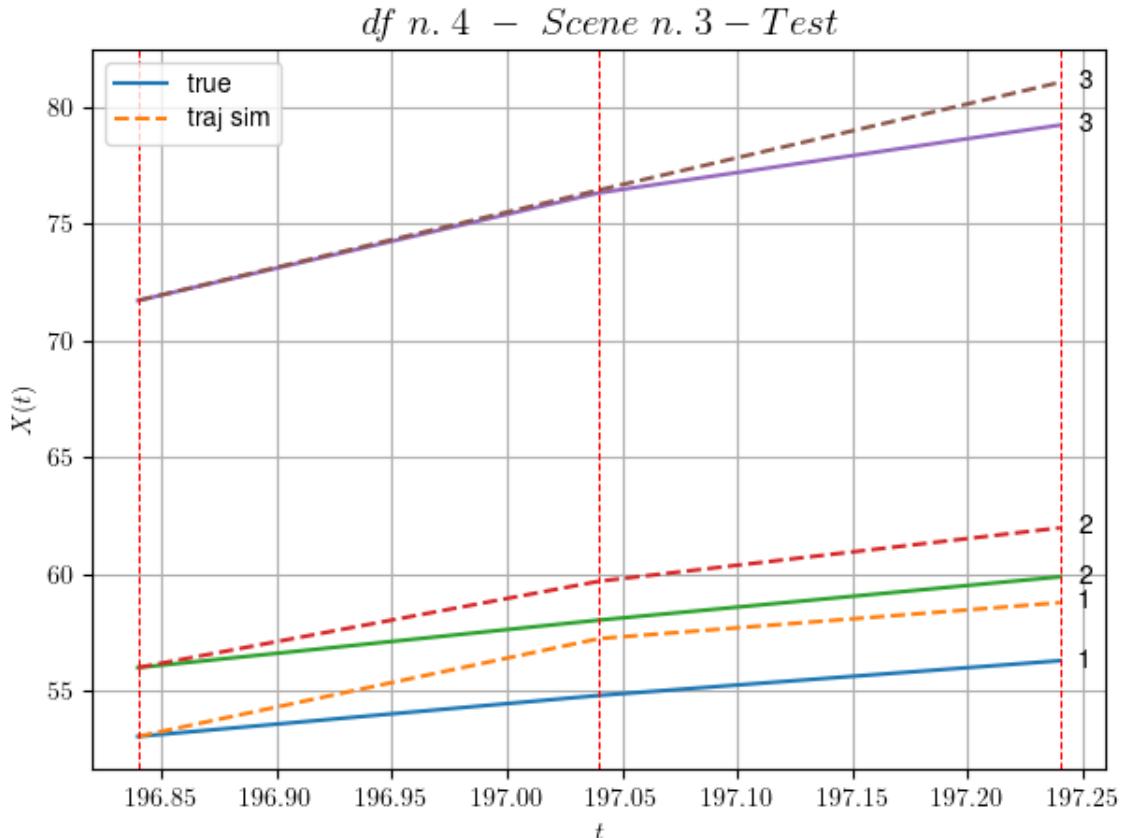


For scene 2/23:  
\* MSE = 3.483584325591565

---

---

DataFrame n.4. Scene n.3/23

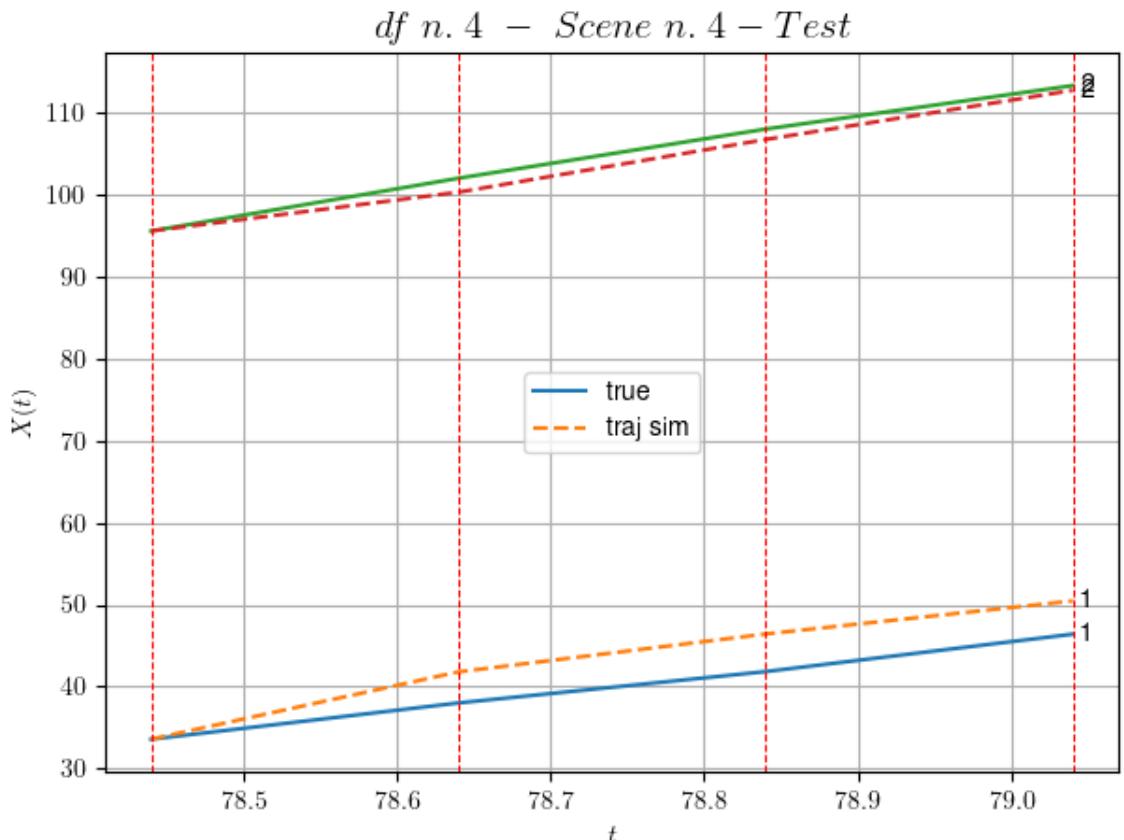


For scene 3/23:  
\* MSE = 2.5082983372354657

---

---

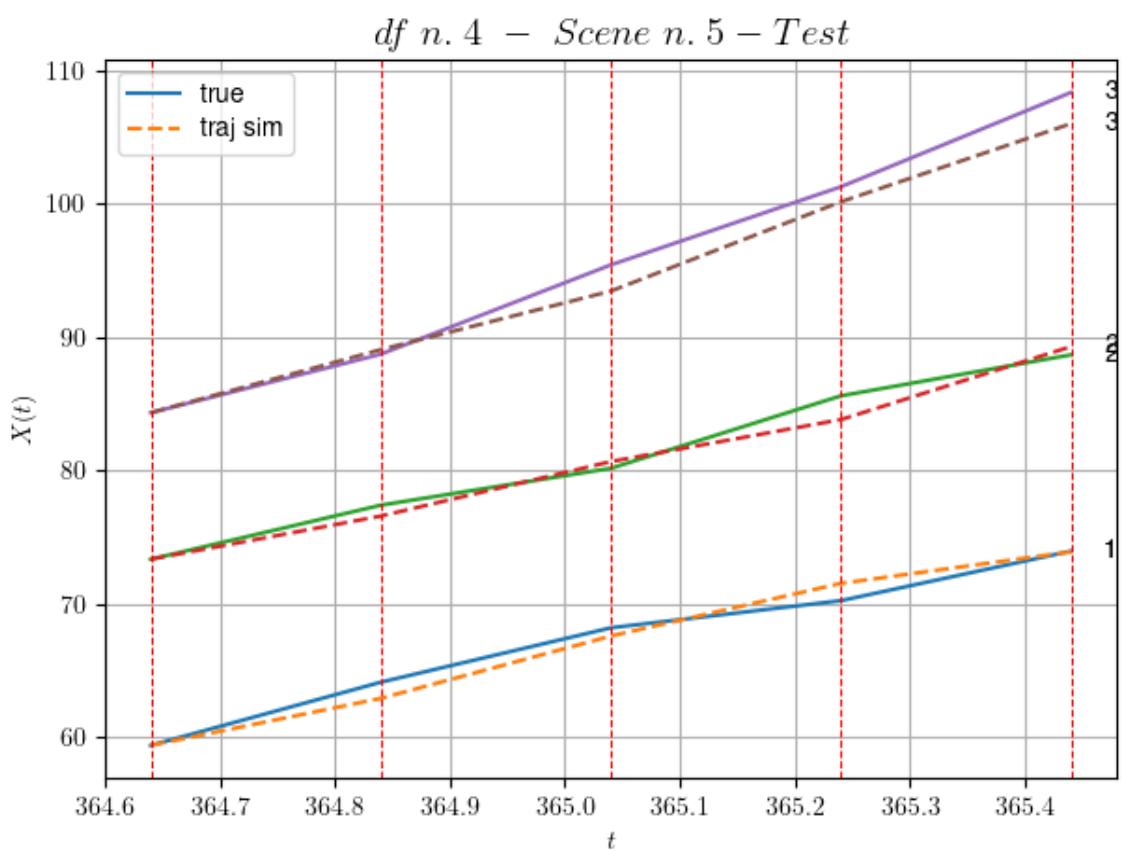
DataFrame n.4. Scene n.4/23



For scene 4/23:  
 \* MSE = 7.072778312542731

---

#### DataFrame n.4. Scene n.5/23

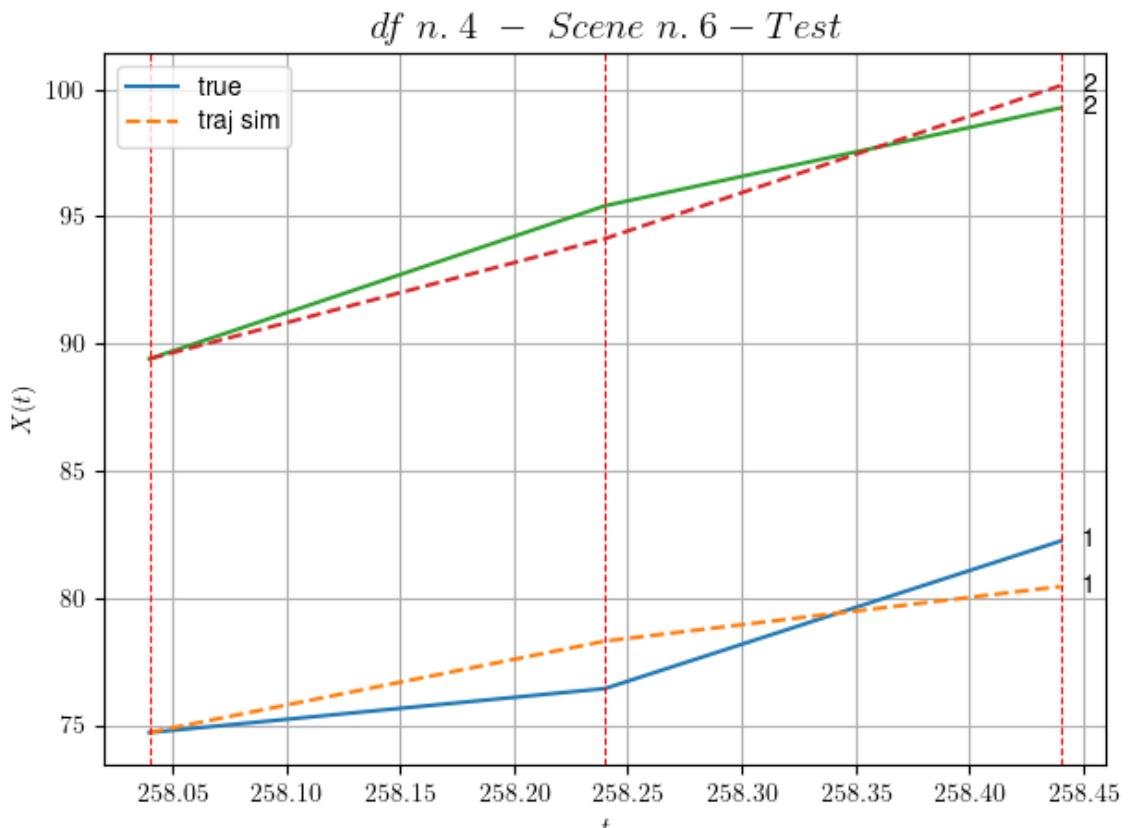


For scene 5/23:  
\* MSE = 1.2485533121650585

---

---

DataFrame n.4. Scene n.6/23

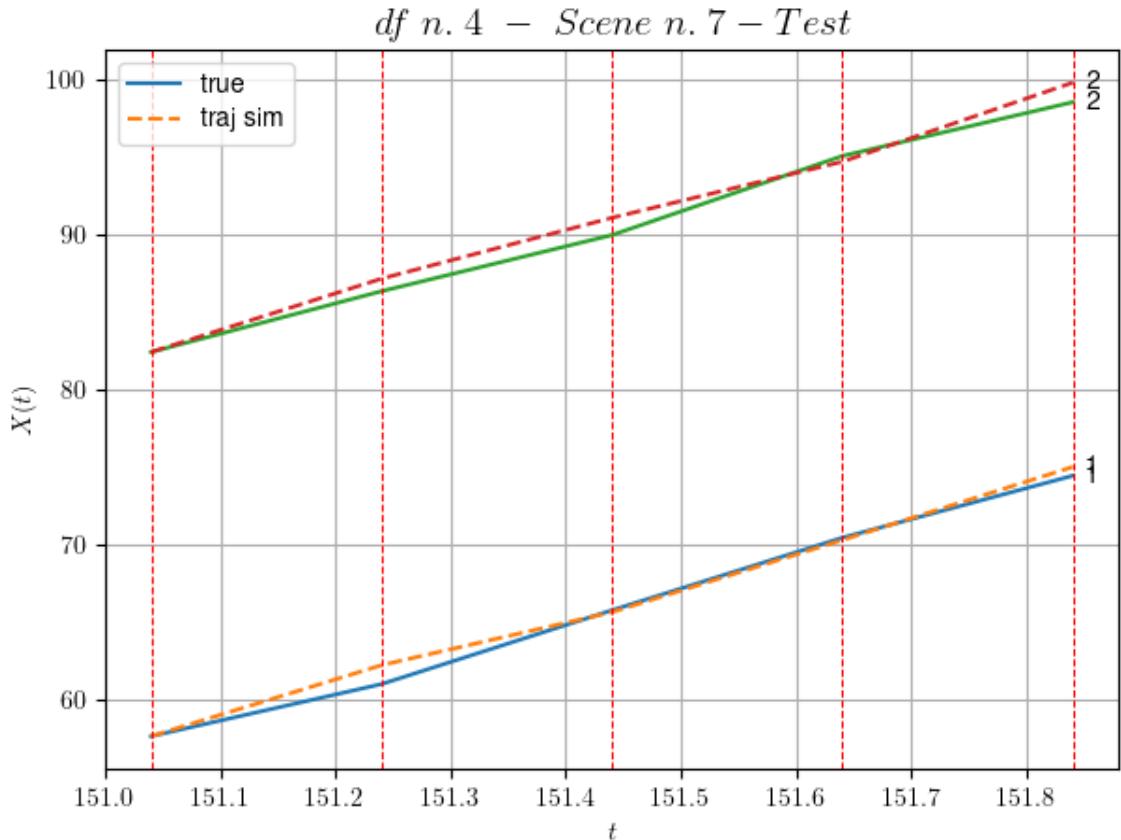


For scene 6/23:  
\* MSE = 1.518513601376623

---

---

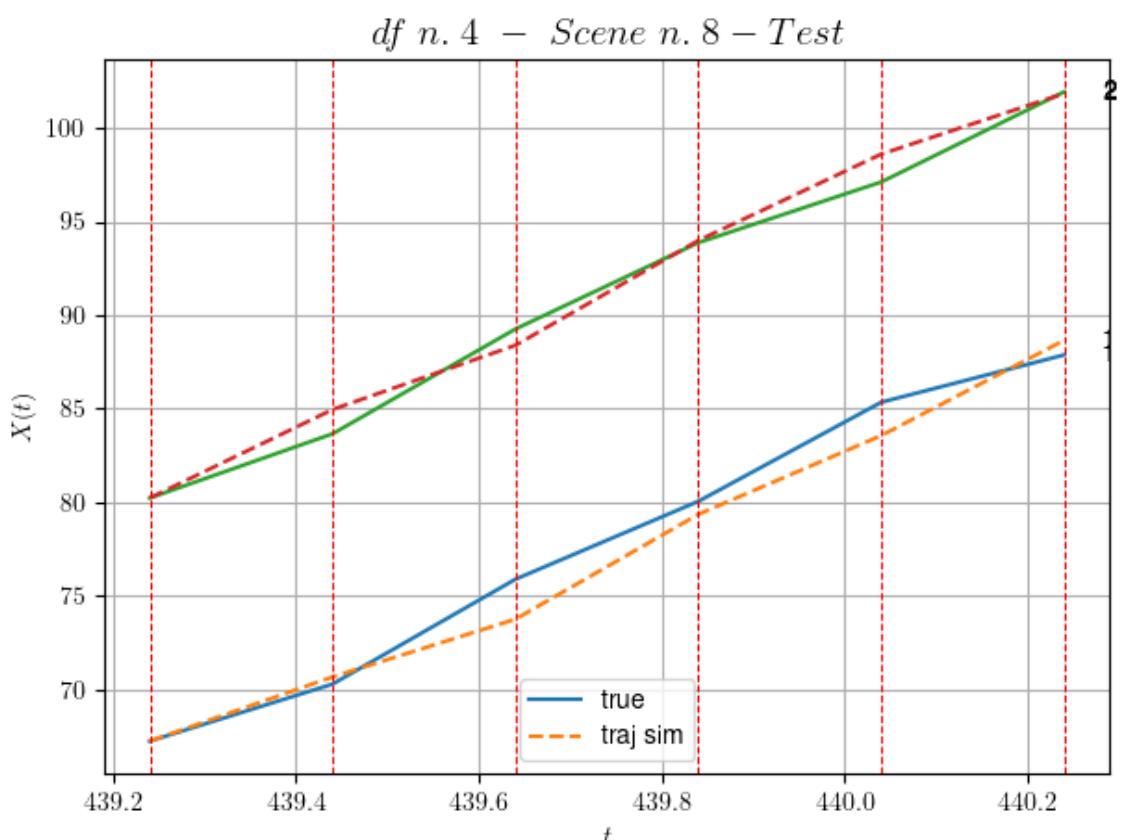
DataFrame n.4. Scene n.7/23



For scene 7/23:  
\* MSE = 0.5468030128596468

---

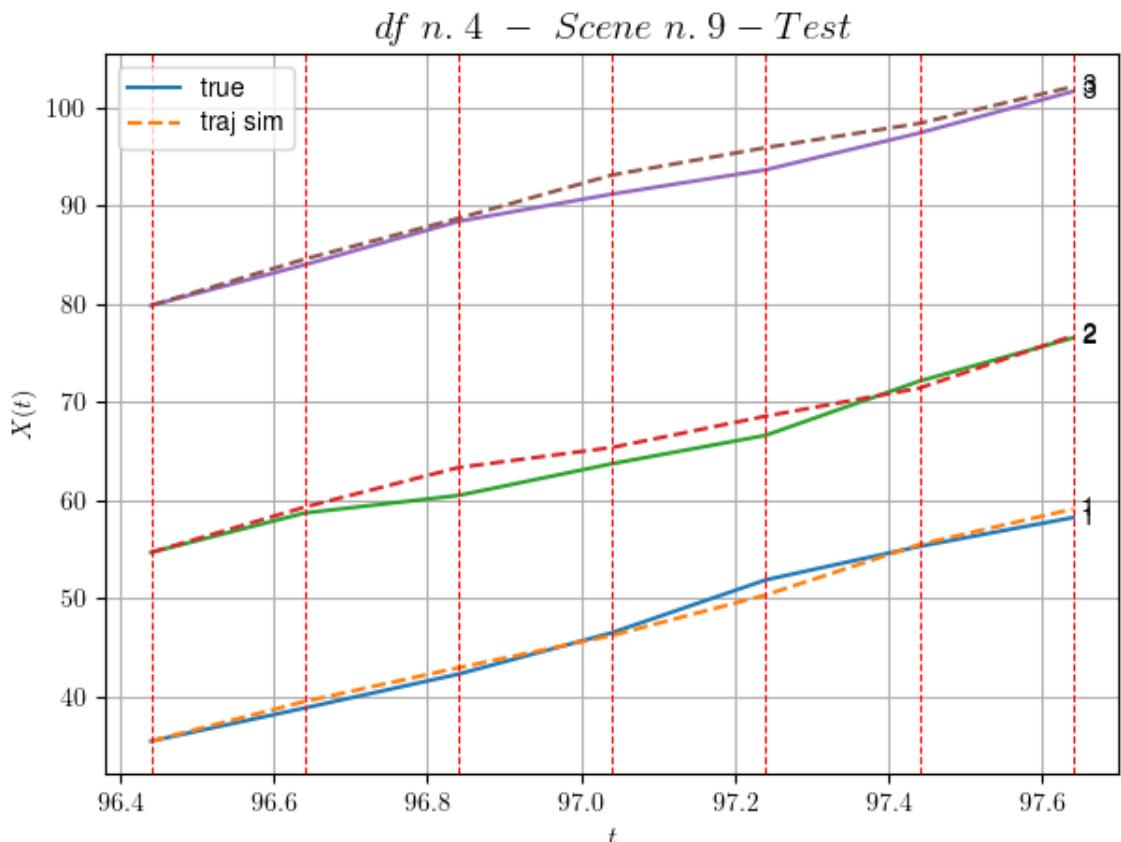
DataFrame n.4. Scene n.8/23



For scene 8/23:  
\* MSE = 1.1371574091445527

---

DataFrame n.4. Scene n.9/23

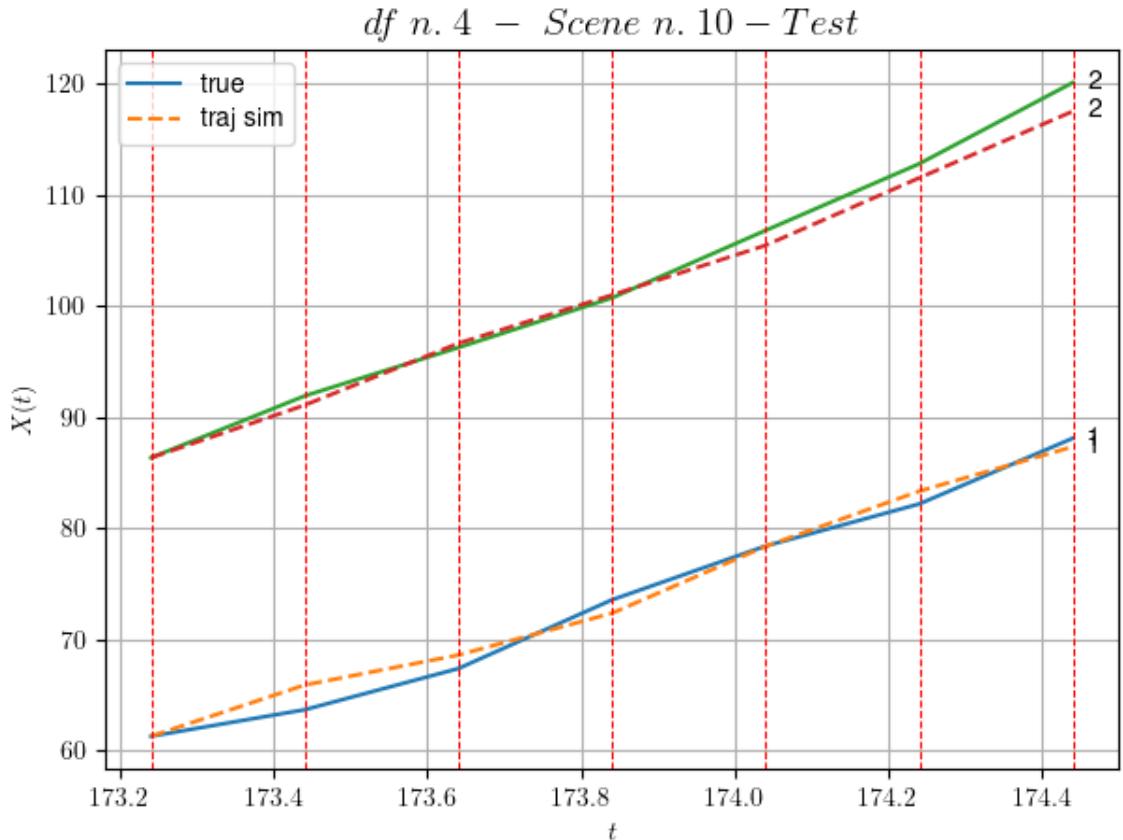


For scene 9/23:  
\* MSE = 1.436556118274072

---

---

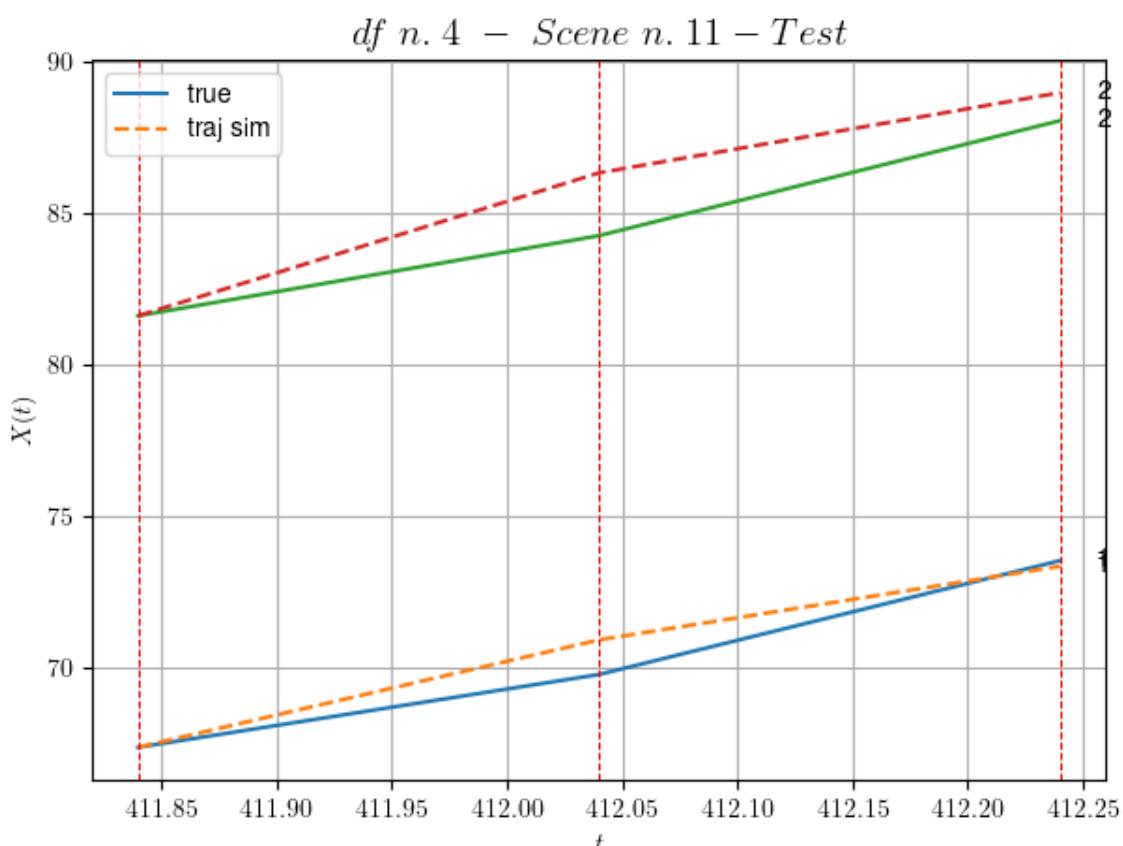
DataFrame n.4. Scene n.10/23



For scene 10/23:  
\* MSE = 1.4823617670162403

---

DataFrame n.4. Scene n.11/23

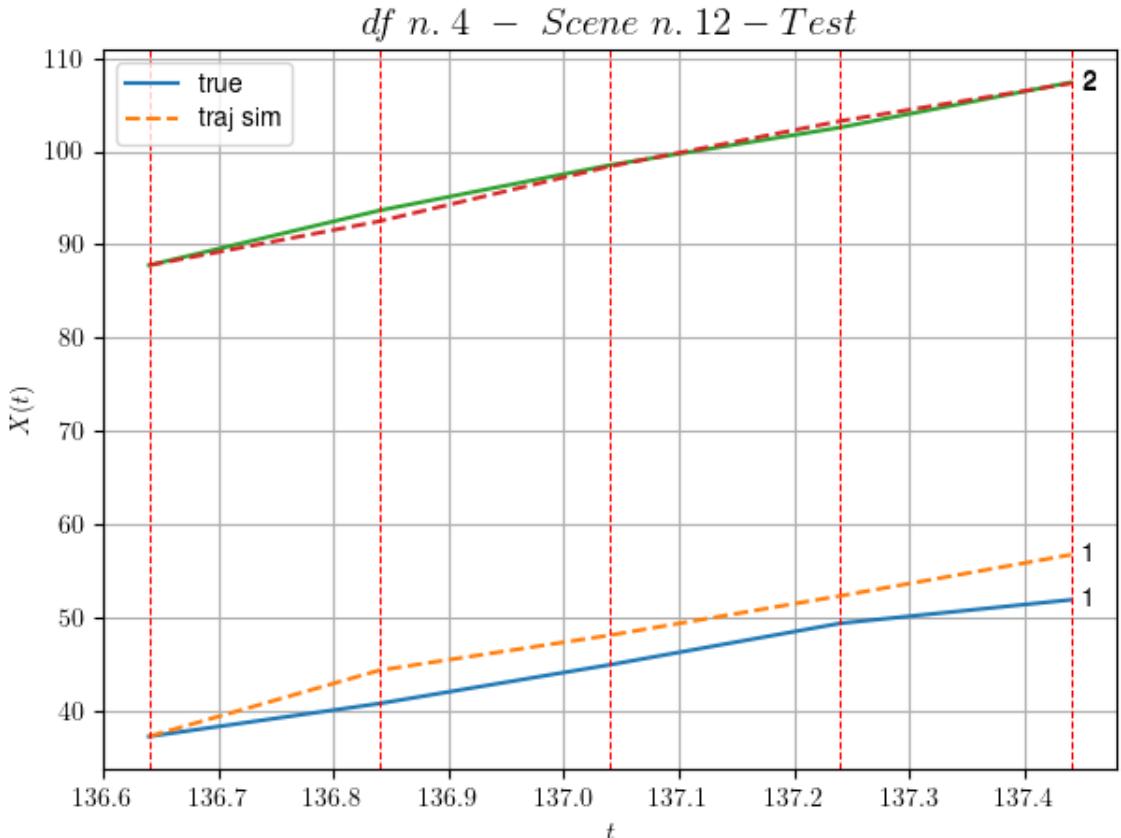


For scene 11/23:  
\* MSE = 1.0860668773720117

---

---

DataFrame n.4. Scene n.12/23

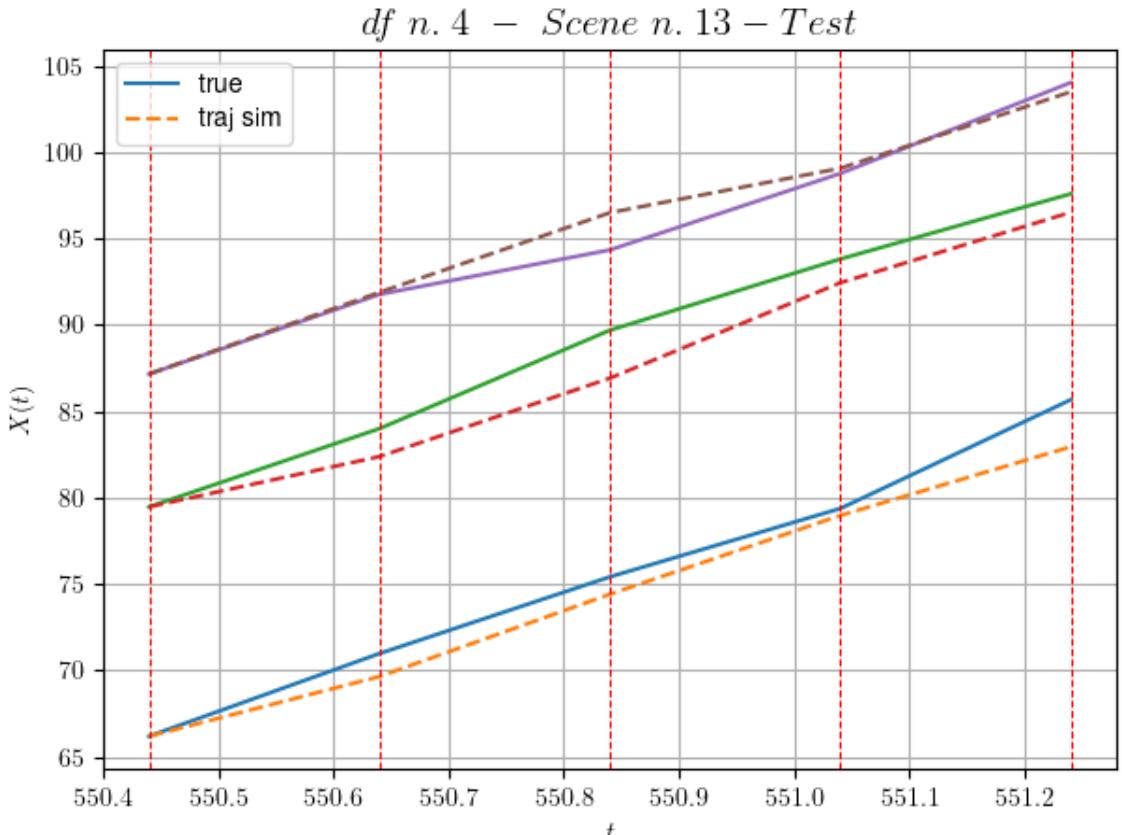


For scene 12/23:  
\* MSE = 5.6695200637169725

---

---

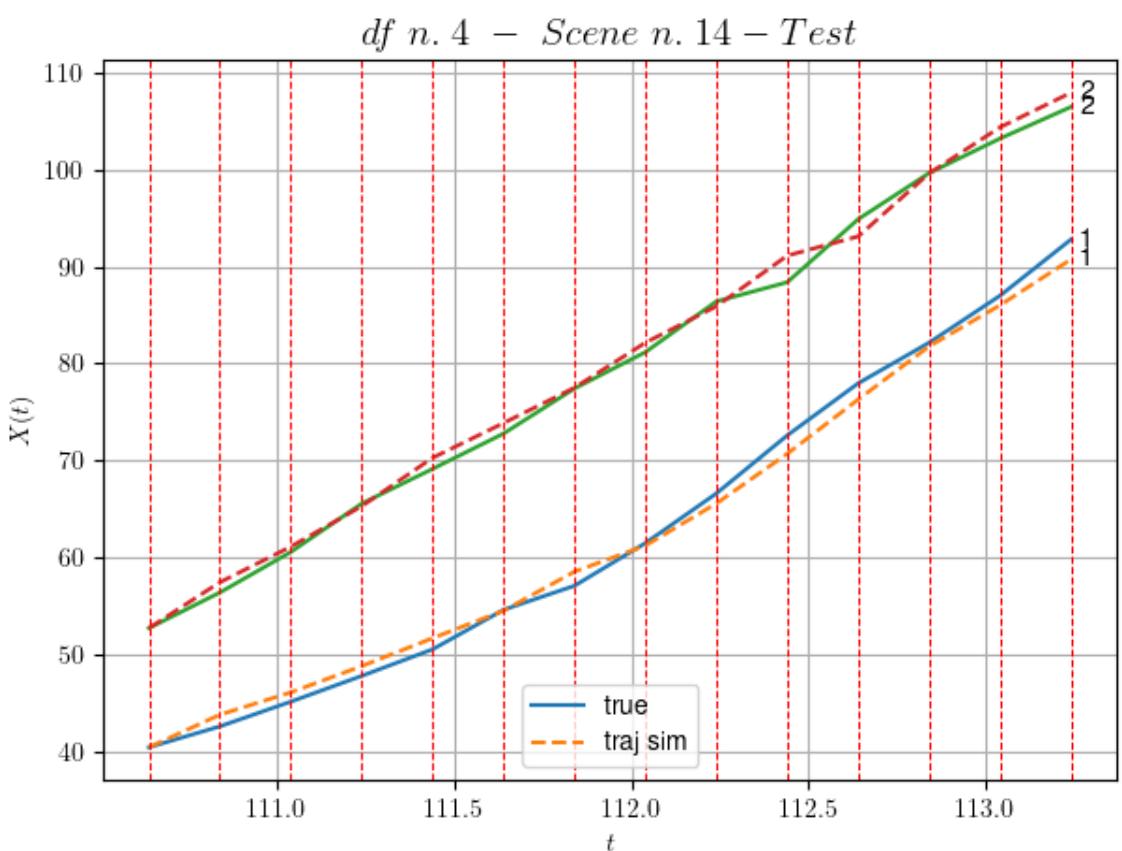
DataFrame n.4. Scene n.13/23



For scene 13/23:  
\* MSE = 1.9197521340064536

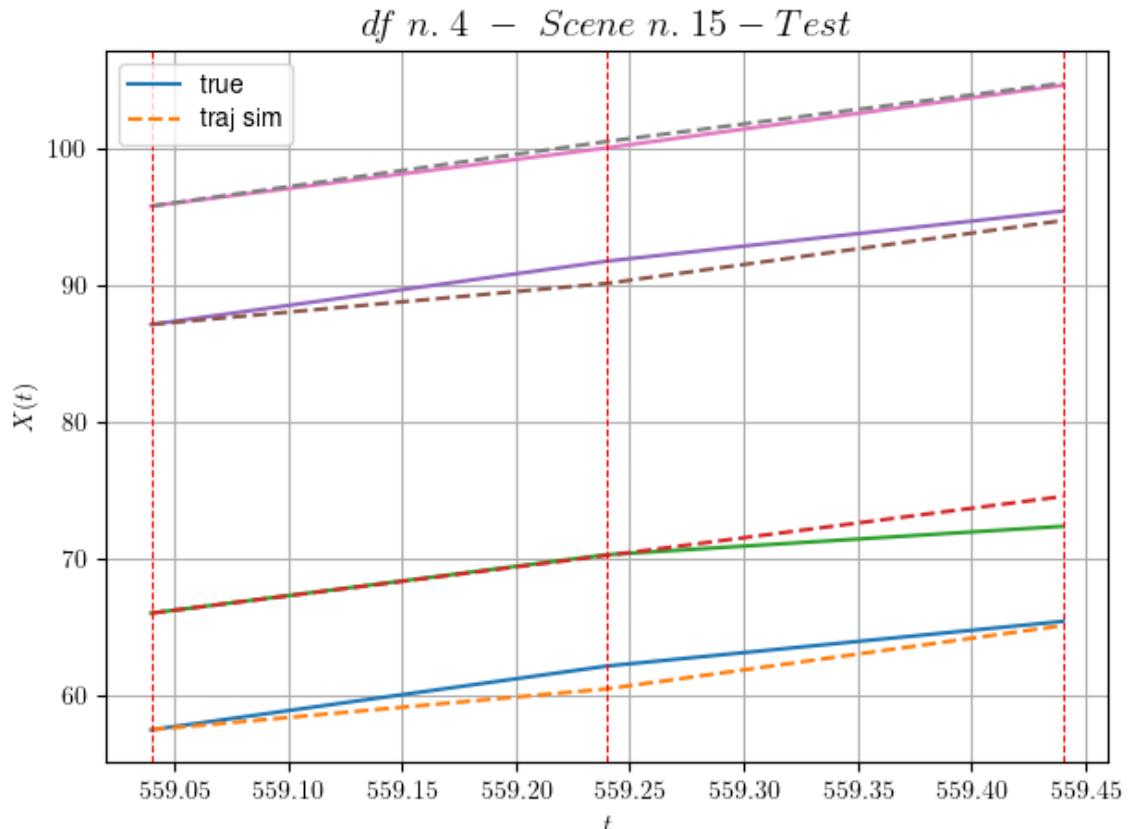
---

DataFrame n.4. Scene n.14/23



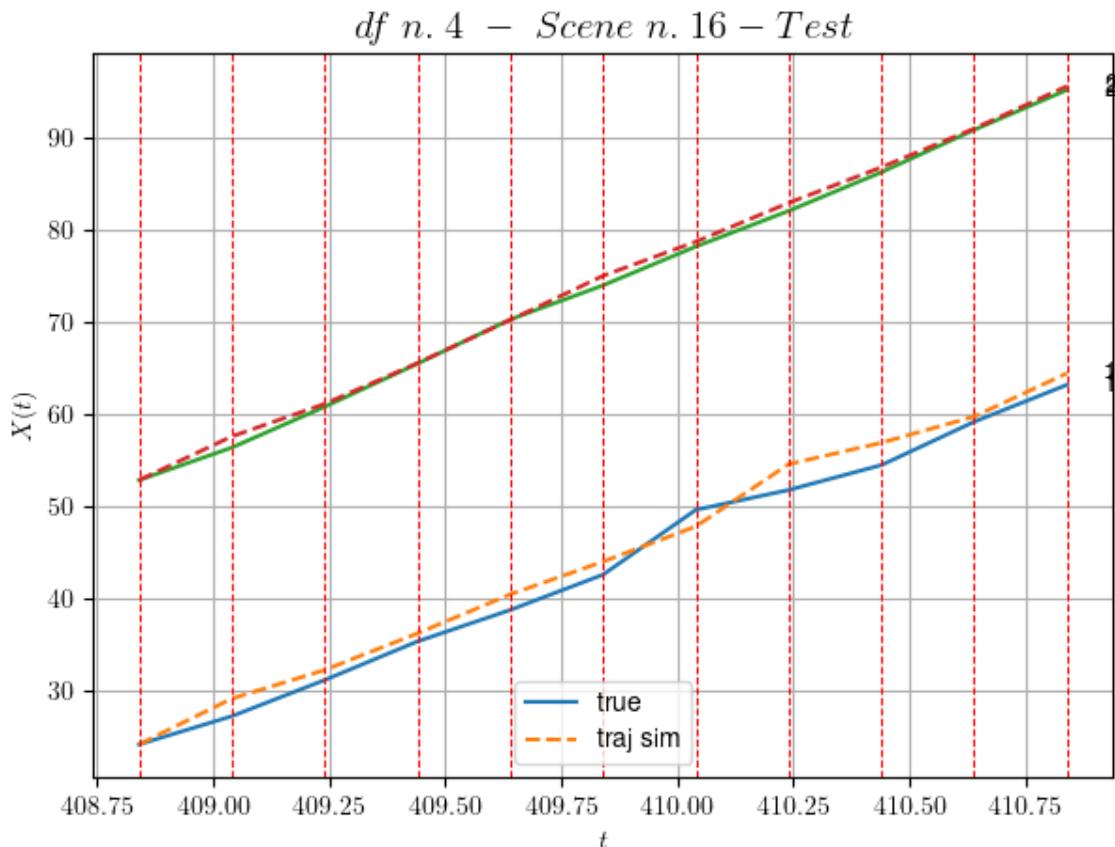
For scene 14/23:  
\* MSE = 1.396013746142044

-----  
-----  
DataFrame n.4. Scene n.15/23



For scene 15/23:  
\* MSE = 0.9167433439940257

-----  
-----  
DataFrame n.4. Scene n.16/23



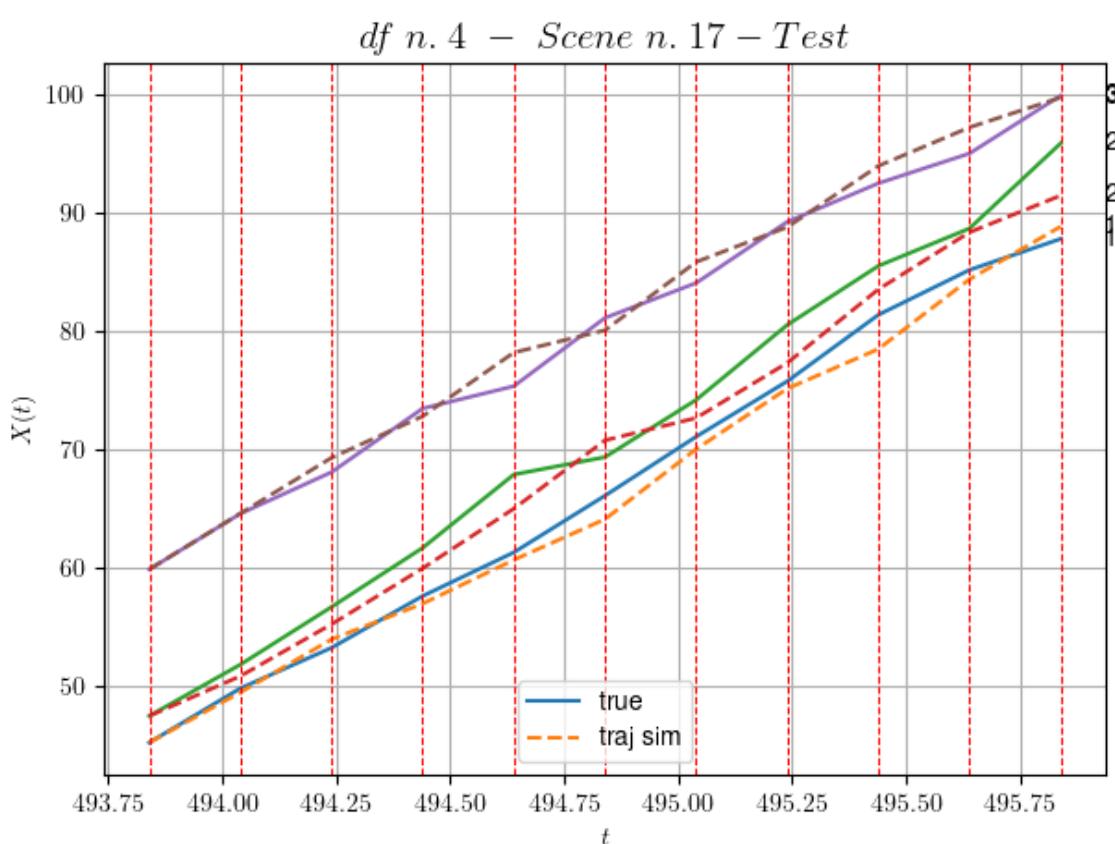
For scene 16/23:  
 \* MSE = 1.513506376622866

---



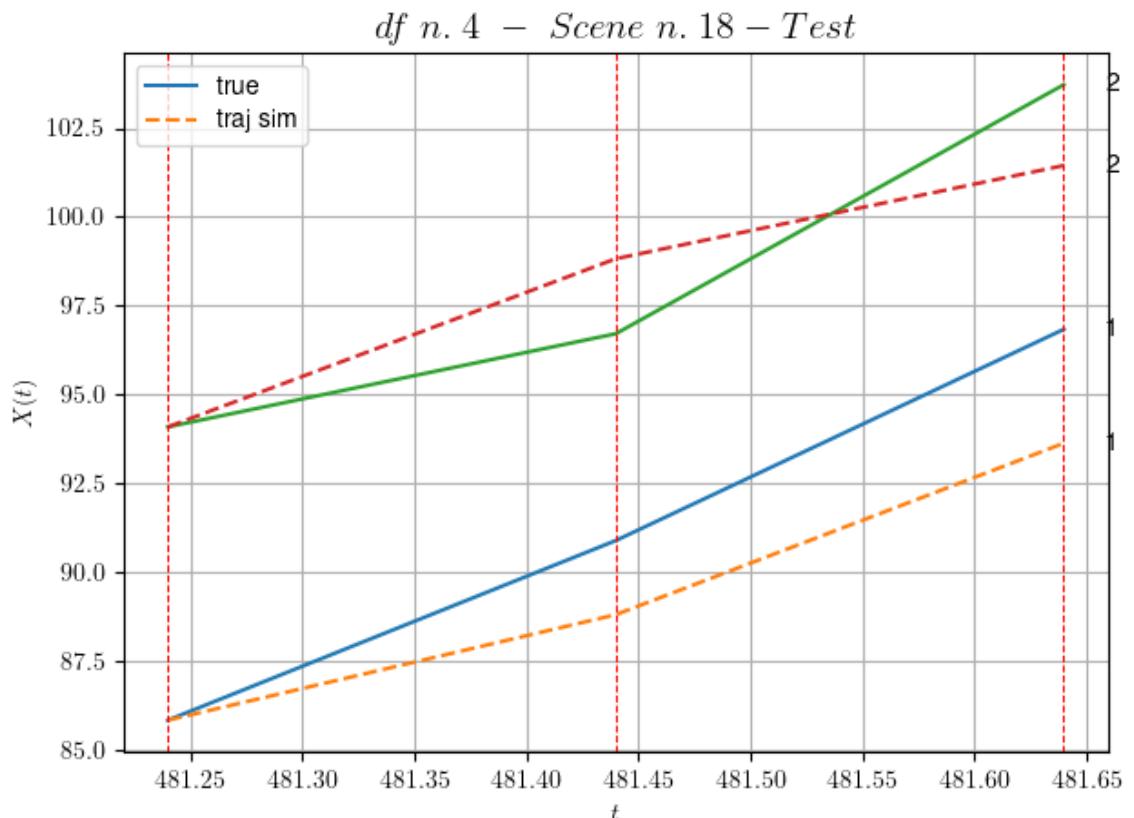
---

DataFrame n.4. Scene n.17/23



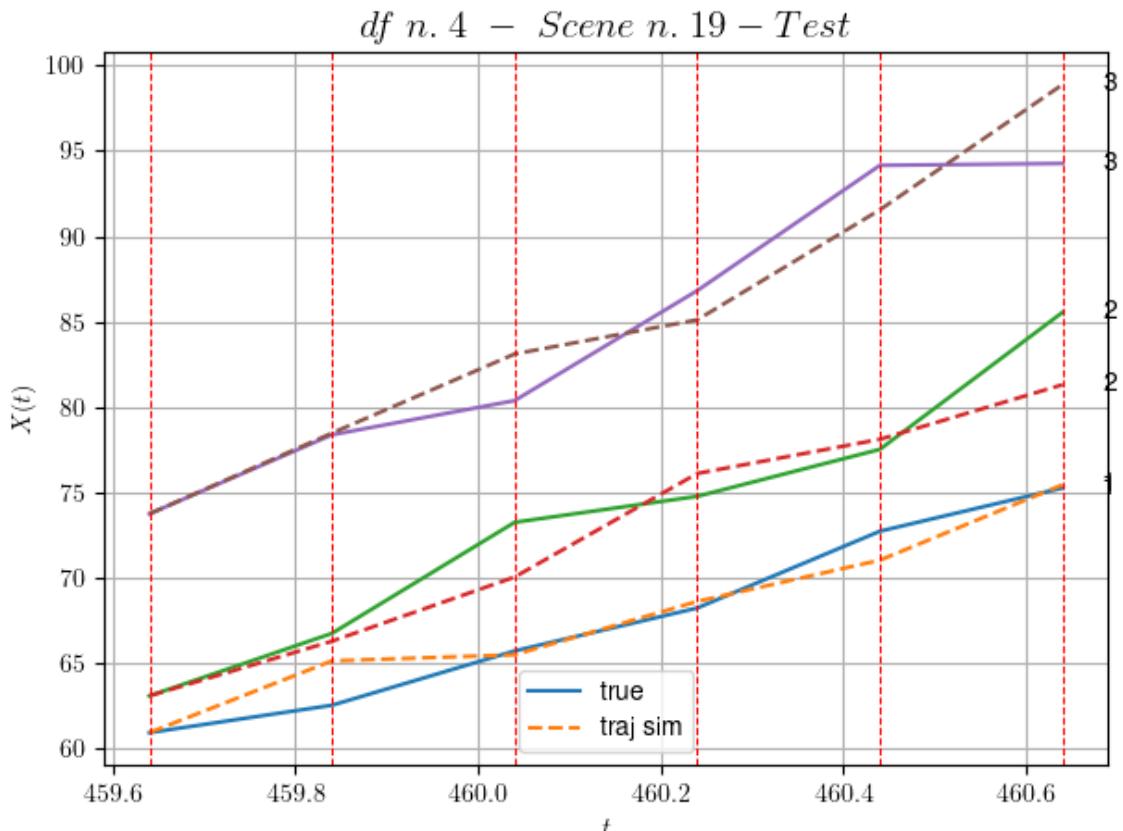
For scene 17/23:  
\* MSE = 2.7612129799774503

DataFrame n.4. Scene n.18/23



For scene 18/23:  
\* MSE = 4.036016049048303

DataFrame n.4. Scene n.19/23

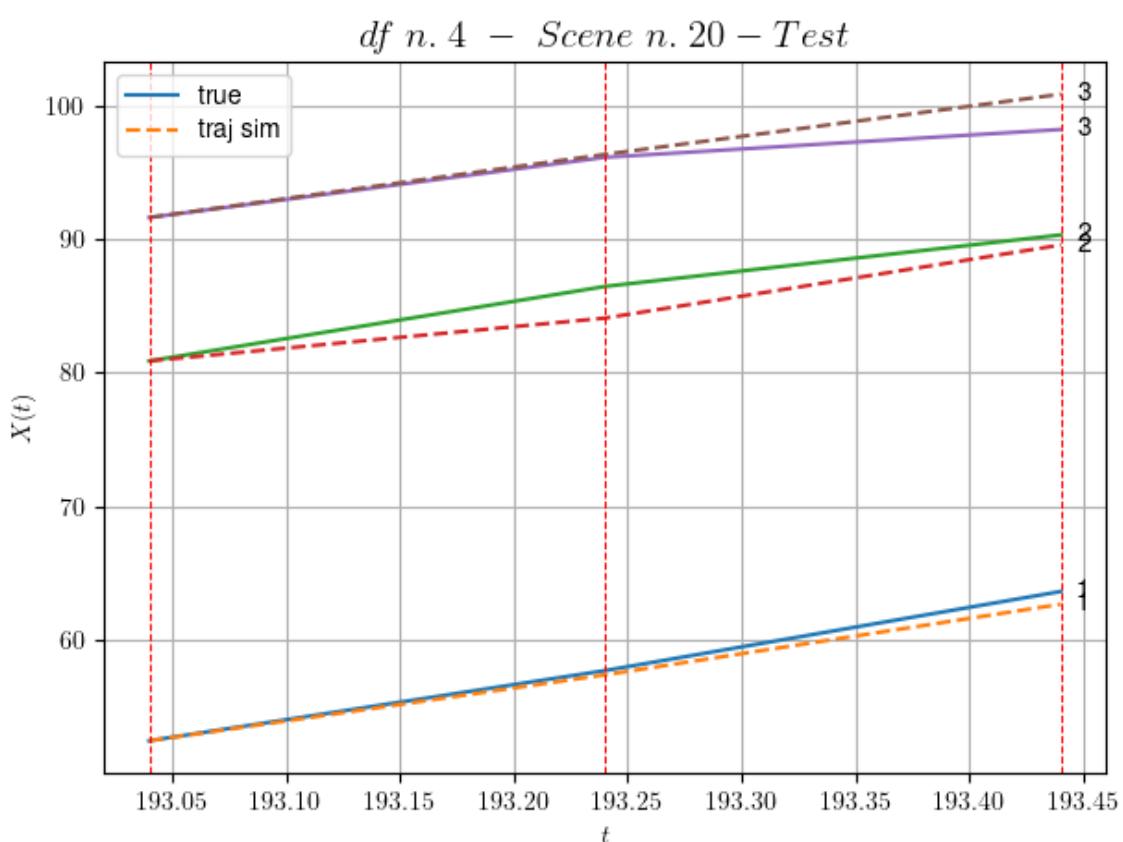


For scene 19/23:  
\* MSE = 4.383253759303071

---

---

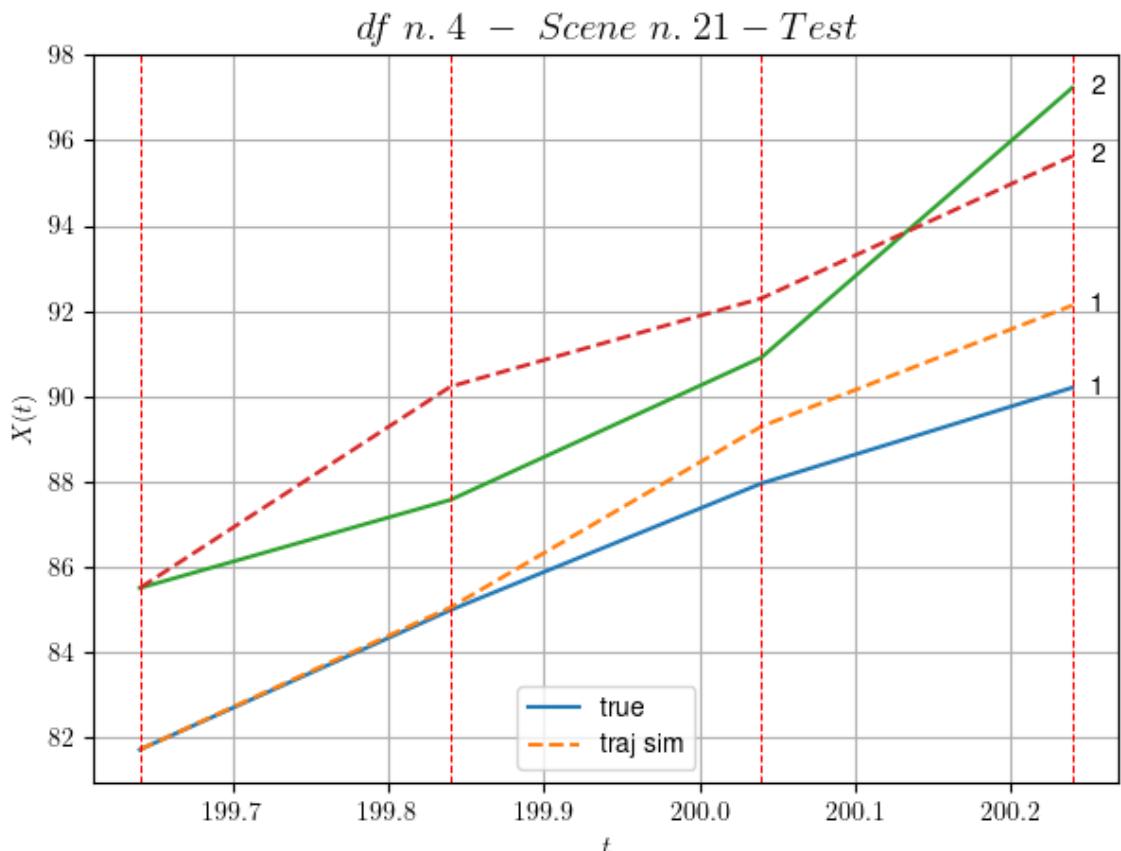
#### DataFrame n.4. Scene n.20/23



For scene 20/23:  
\* MSE = 1.5813357575566869

---

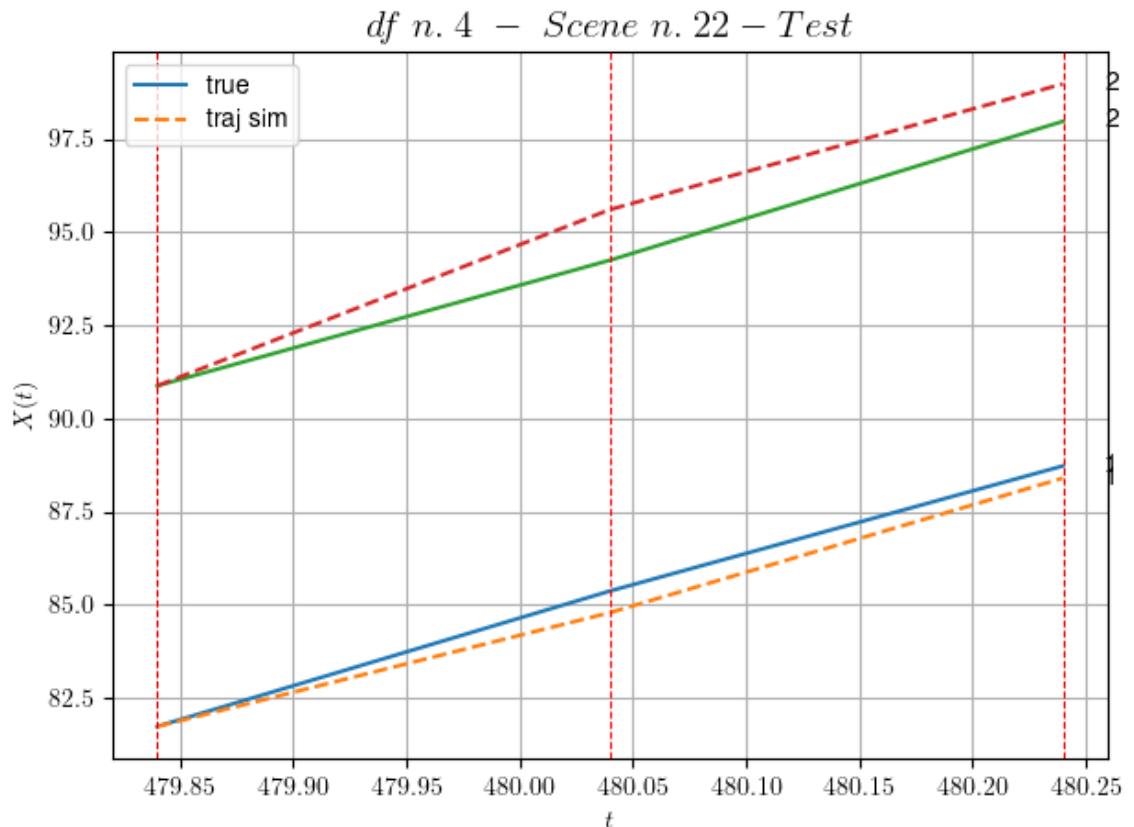
DataFrame n.4. Scene n.21/23



For scene 21/23:  
\* MSE = 2.134674268382324

---

DataFrame n.4. Scene n.22/23

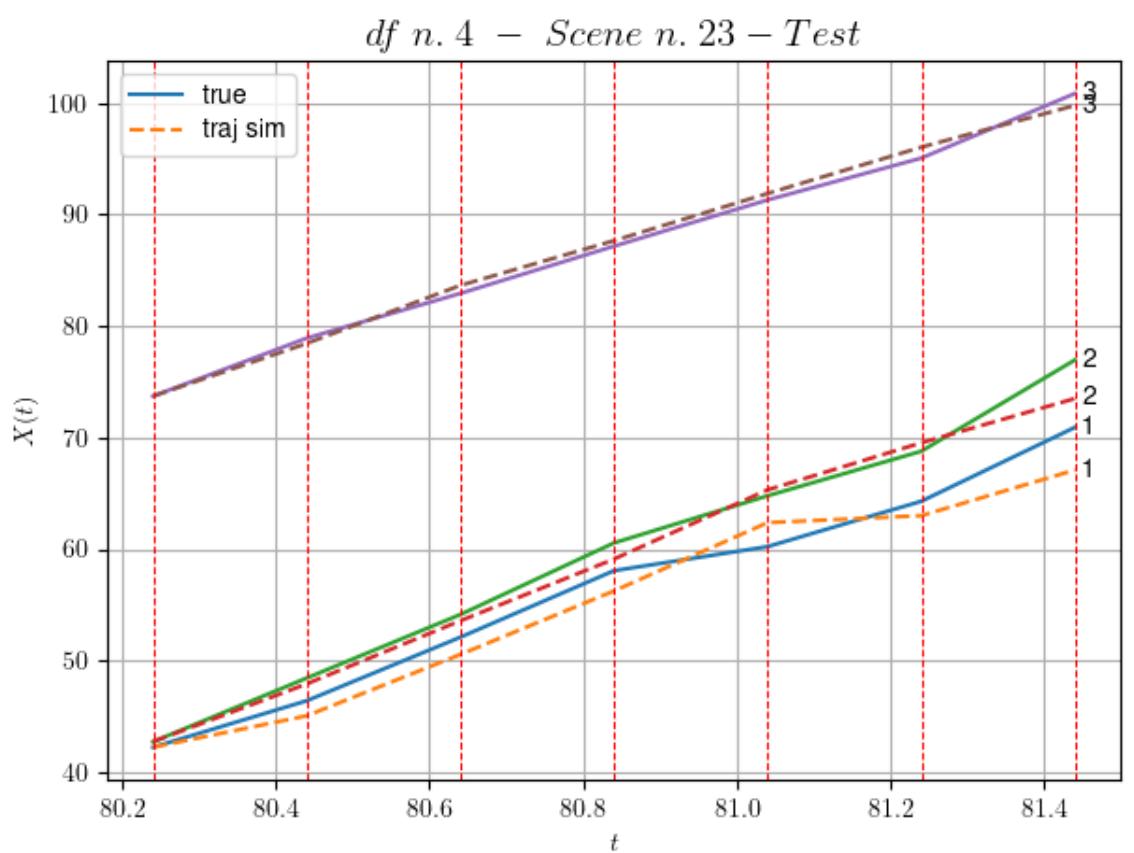


For scene 22/23:  
\* MSE = 0.5493371028956902

---

---

#### DataFrame n.4. Scene n.23/23



For scene 23/23:  
\* MSE = 2.256799009993494

MSE test: 2.2591153790866865

Summing up:  
\* MSE train: 3.6264089177816996  
\* MSE test: 2.2591153790866865

Analyzing 5/10 dfs.

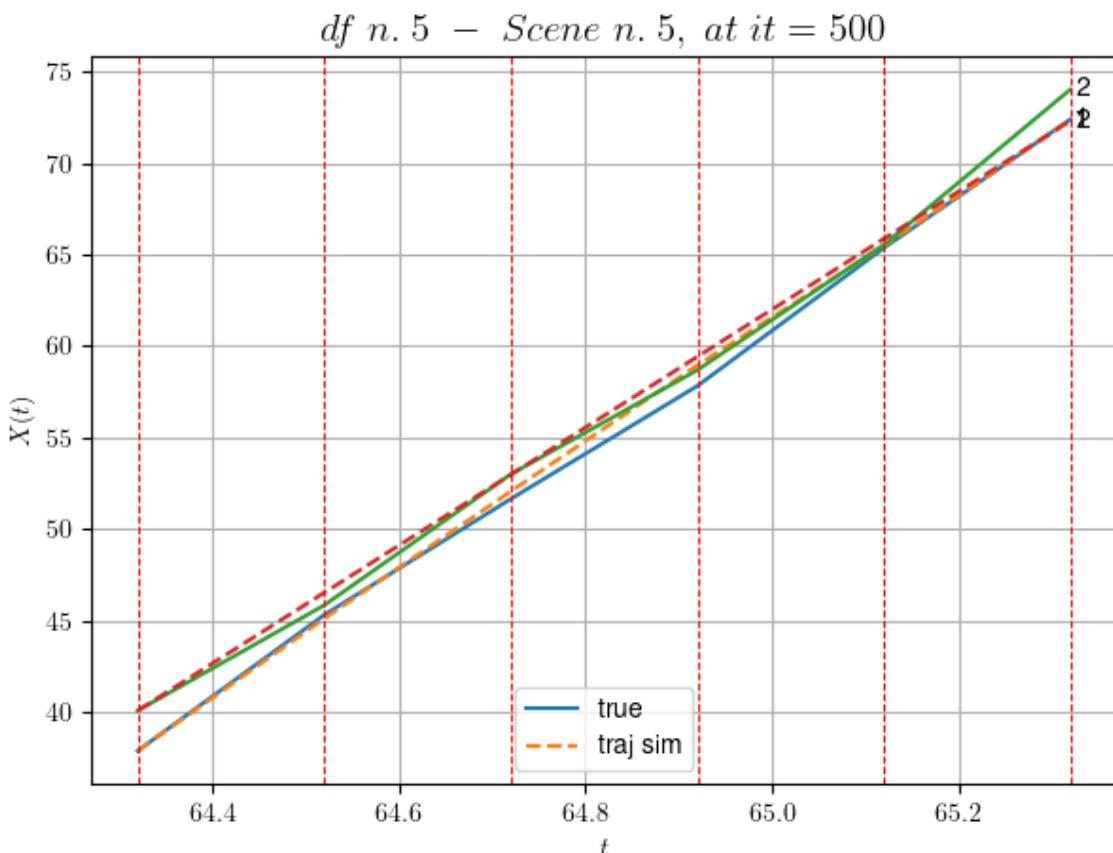
In DataFrame n.5 we have 66 scenes.

To train the model we use 44 scenes, the remaining 22 to test the model.

Training step. (44 scenes)

DataFrame n.5. Scene n.1/44

We have 5 time intervals inside [64.32,65.32]



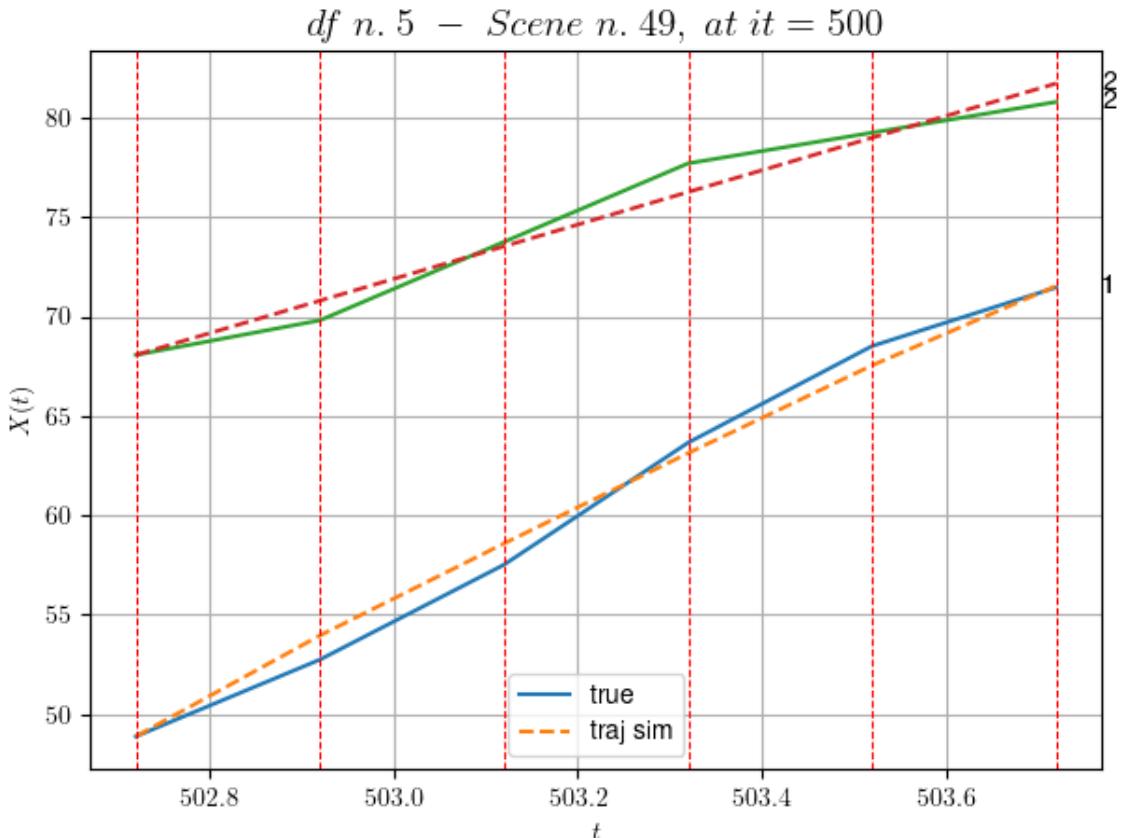
```

For scene 1/44:
* After LR finder: LR_NN=0.005 with mse=1.7581740614014836
at it=24
* v0 = 32.23387857341348
* MSE = 0.4627012629690958
* iterations = 500

```

DataFrame n.5. Scene n.2/44

We have 5 time intervals inside [502.72,503.72]



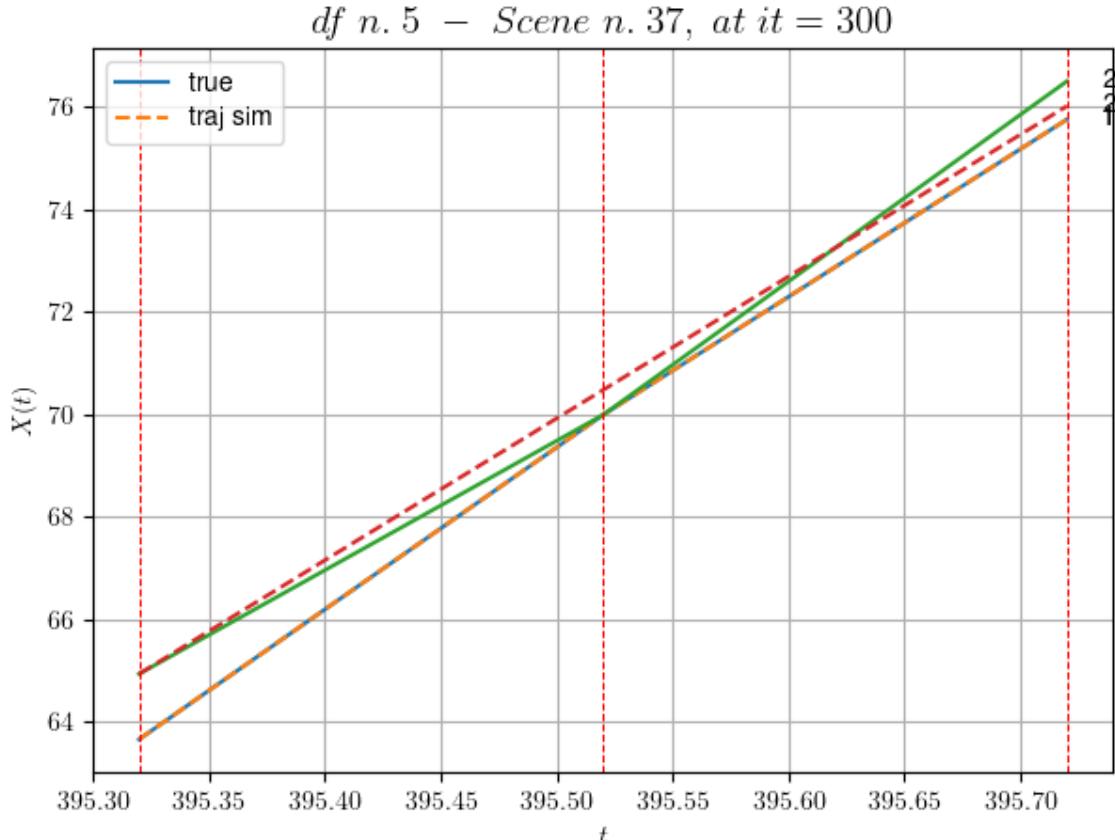
```

For scene 2/44:
* After LR finder: LR_NN=5e-05 with mse=49.81446978599438 a
t it=24
* v0 = 13.651414022050028
* MSE = 0.6545104028357802
* iterations = 500

```

DataFrame n.5. Scene n.3/44

We have 2 time intervals inside [395.32,395.72]



---

For scene 3/44:

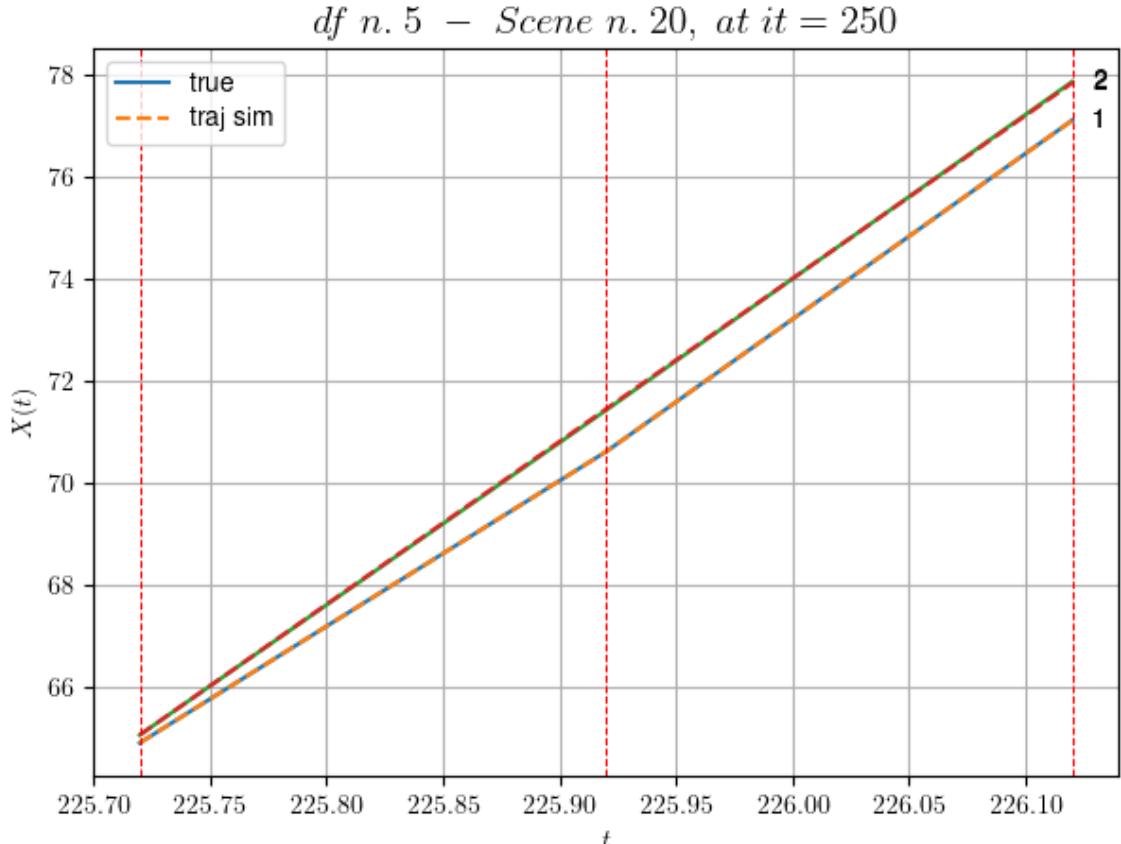
- \* After LR finder:  $\text{LR\_NN}=0.01$  with  $\text{mse}=0.1805404669286665$  at  $\text{it}=24$
- \*  $v_0 = 27.699213779675713$
- \*  $\text{MSE} = 0.07069011322563827$
- \* iterations = 300

---

DataFrame n.5. Scene n.4/44

---

We have 2 time intervals inside [225.72, 226.12]



---

For scene 4/44:

\* After LR finder: LR\_NN=0.005 with mse=0.1398941476264453  
at it=24  
\* v0 = 32.021476028863205  
\* MSE = 0.00021986920949140443  
\* iterations = 250

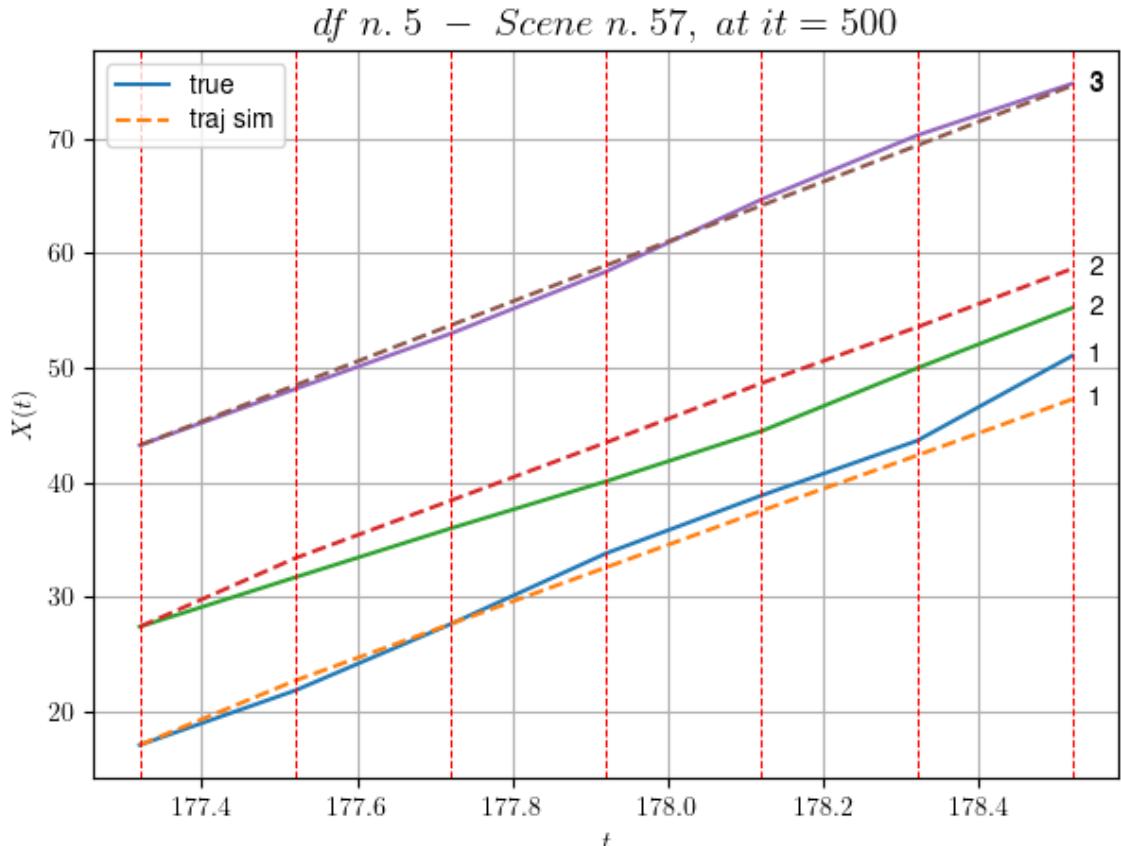
---

---

DataFrame n.5. Scene n.5/44

---

We have 6 time intervals inside [177.32,178.52]

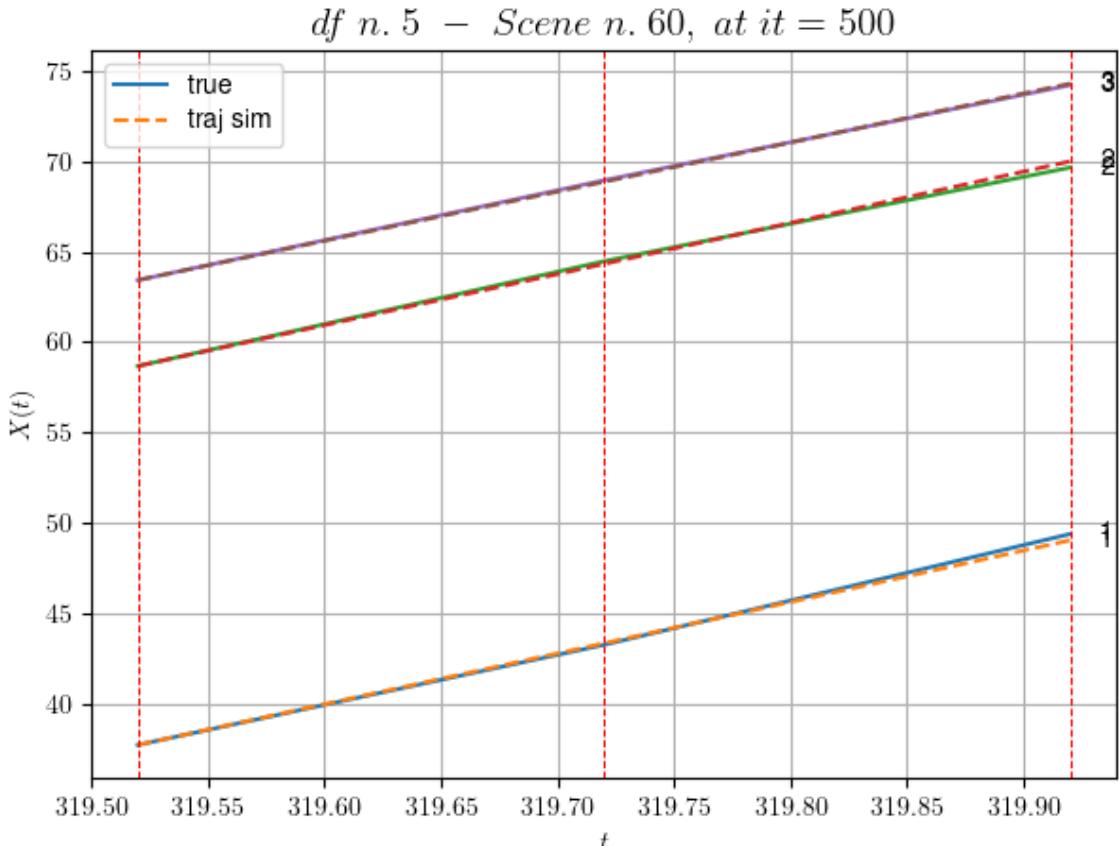


For scene 5/44:

\* After LR finder: LR\_NN=0.001 with mse=33.262773302484305  
at it=24  
\*  $v_0 = 26.18037838478653$   
\* MSE = 4.019945075732287  
\* iterations = 500

DataFrame n.5. Scene n.6/44

We have 2 time intervals inside [319.52, 319.92]



---

For scene 6/44:

\* After LR finder: LR\_NN=0.001 with mse=6.620681859045434 at it=24  
\*  $v_0 = 27.2224599404074$   
\* MSE = 0.023184188643397333  
\* iterations = 500

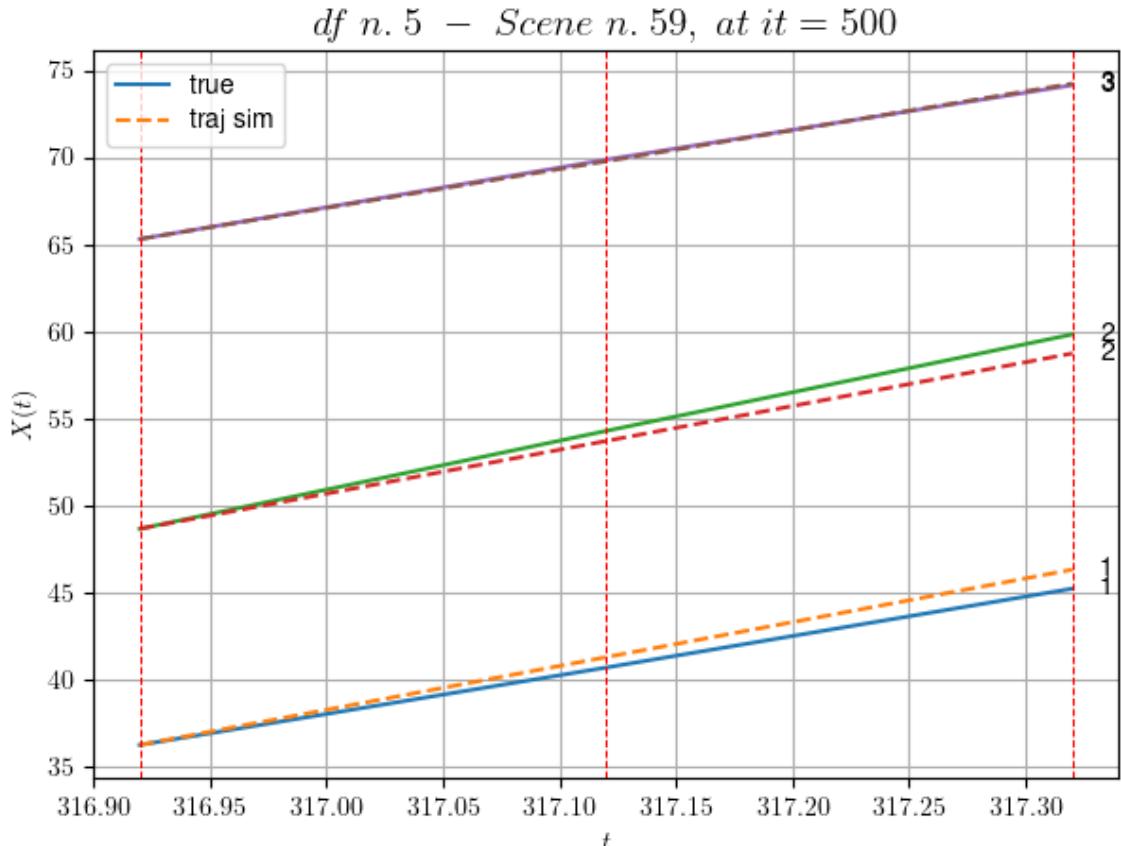
---

---

DataFrame n.5. Scene n.7/44

---

We have 2 time intervals inside [316.92,317.32]



---

For scene 7/44:

\* After LR finder: LR\_NN=0.001 with mse=1.3455542253569777  
at it=24  
\* v0 = 22.342045861210742  
\* MSE = 0.3369015527910258  
\* iterations = 500

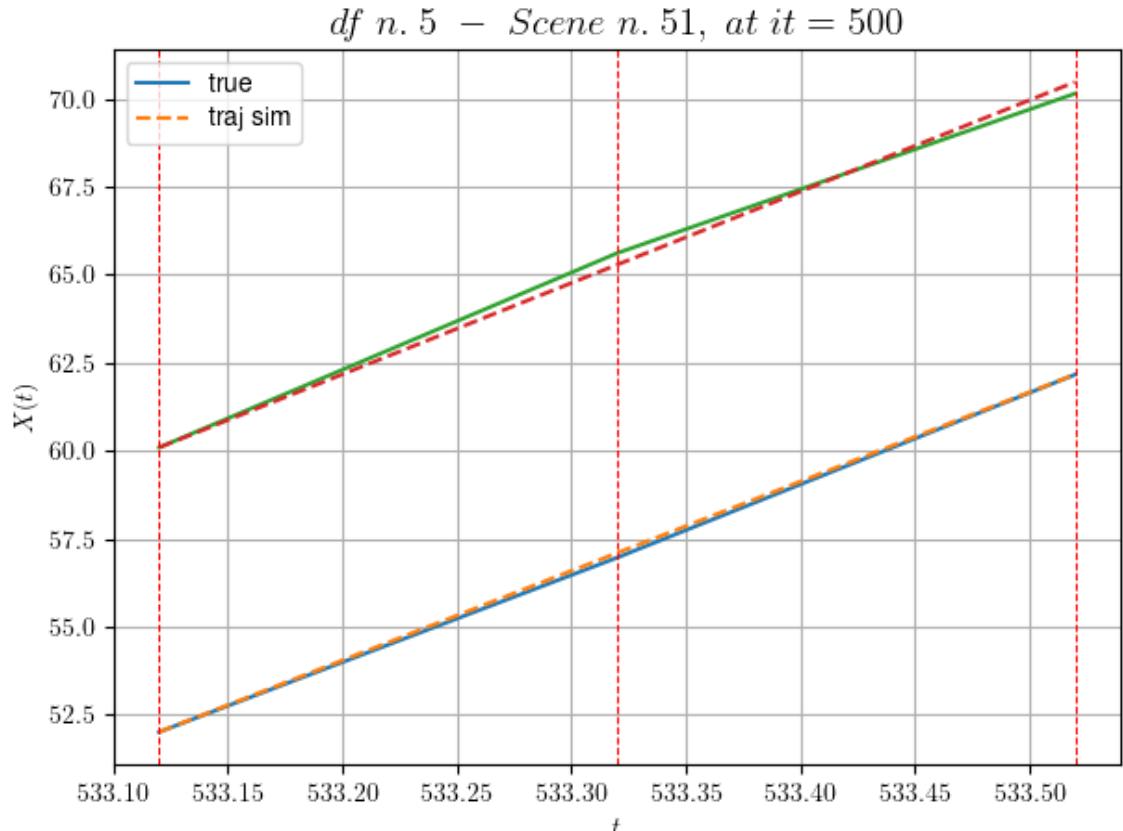
---

---

DataFrame n.5. Scene n.8/44

---

We have 2 time intervals inside [533.12,533.52]



---

For scene 8/44:

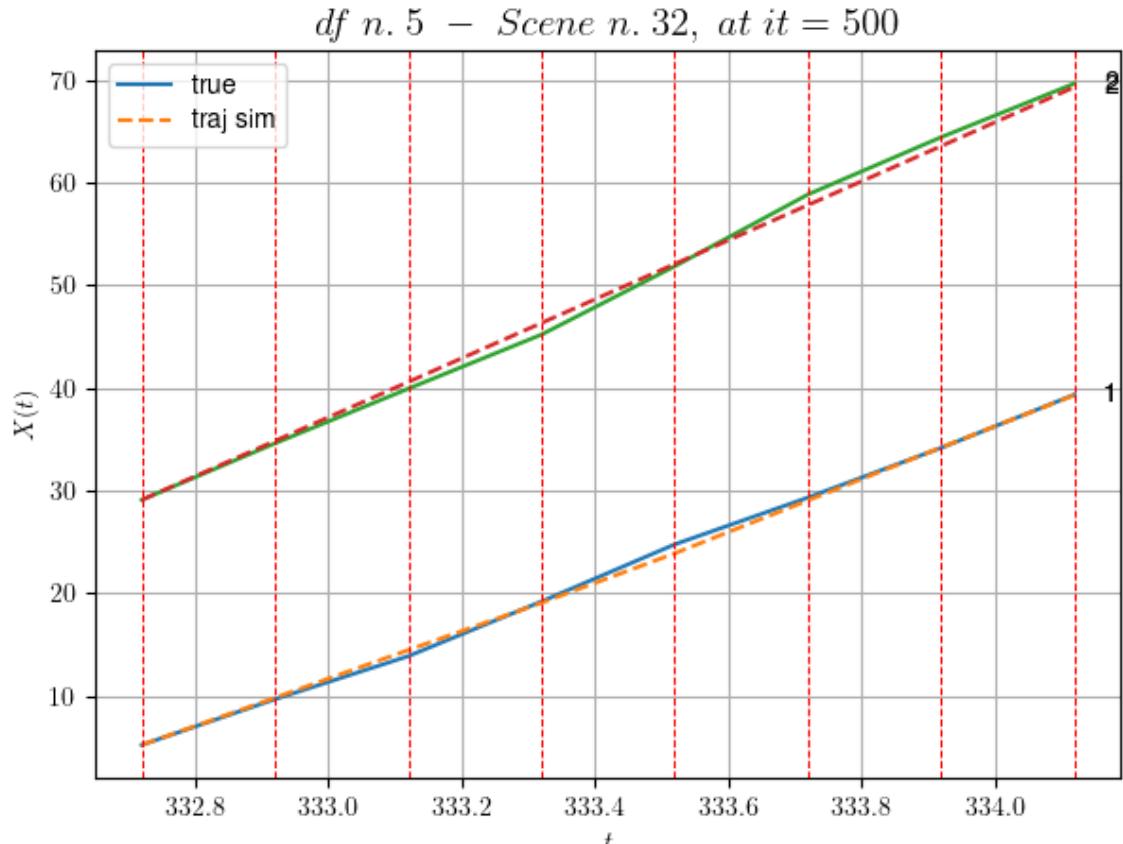
\* After LR finder: LR\_NN=0.0005 with mse=0.6724466601529039  
at it=24  
\* v0 = 25.94872029249732  
\* MSE = 0.03889345947986997  
\* iterations = 500

---

DataFrame n.5. Scene n.9/44

---

We have 7 time intervals inside [332.72,334.12]



---

For scene 9/44:

\* After LR finder: LR\_NN=0.0005 with mse=0.7134761949950399  
at it=24  
\*  $v_0 = 28.71468581675532$   
\* MSE = 0.29506559147496575  
\* iterations = 500

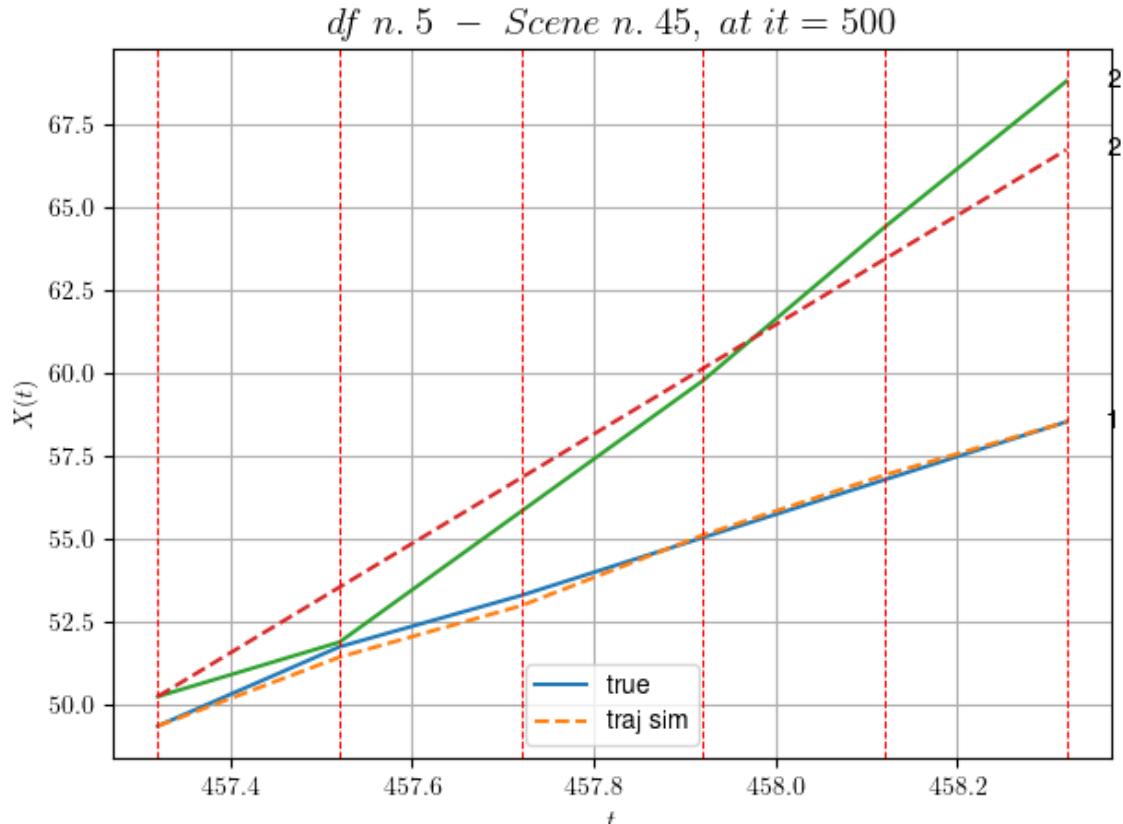
---

---

DataFrame n.5. Scene n.10/44

---

We have 5 time intervals inside [457.32,458.32]

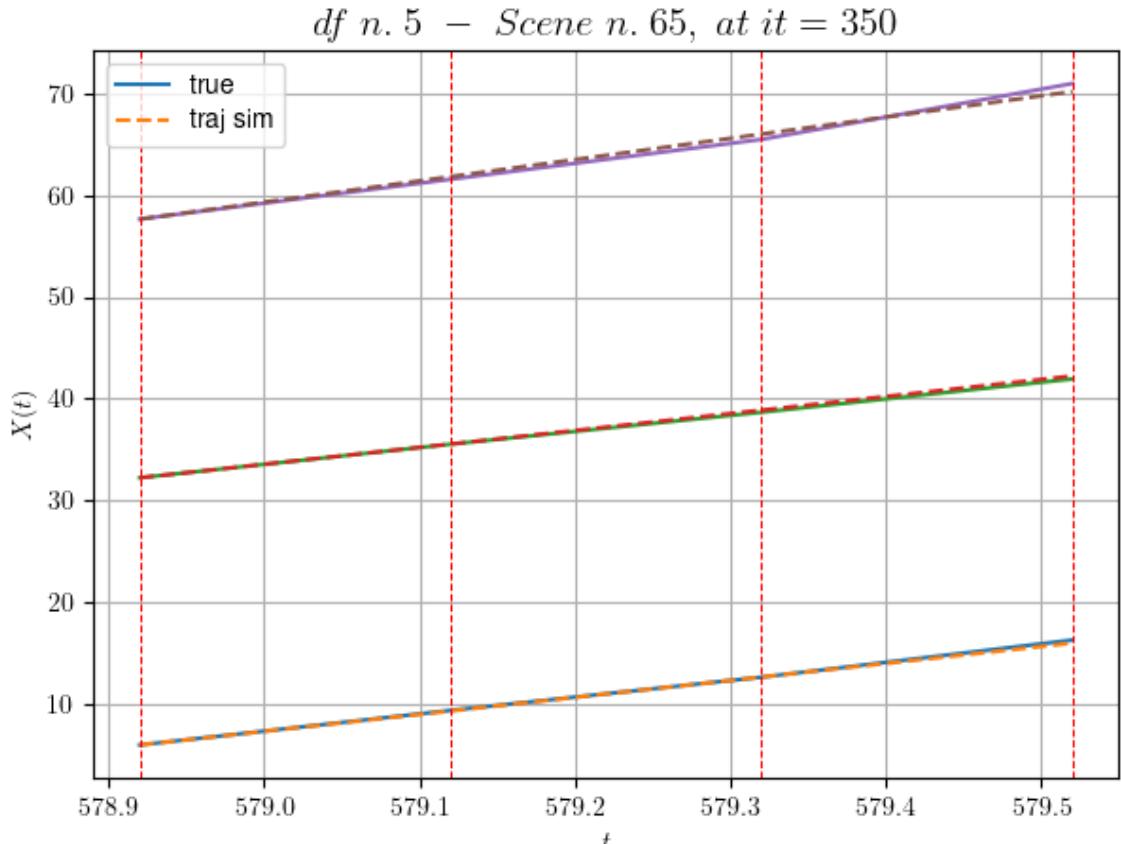


For scene 10/44:

\* After LR finder: LR\_NN=0.005 with mse=29.987579071574107  
at it=24  
\* v0 = 16.493097805853914  
\* MSE = 0.6538923095062043  
\* iterations = 500

DataFrame n.5. Scene n.11/44

We have 3 time intervals inside [578.92,579.52]

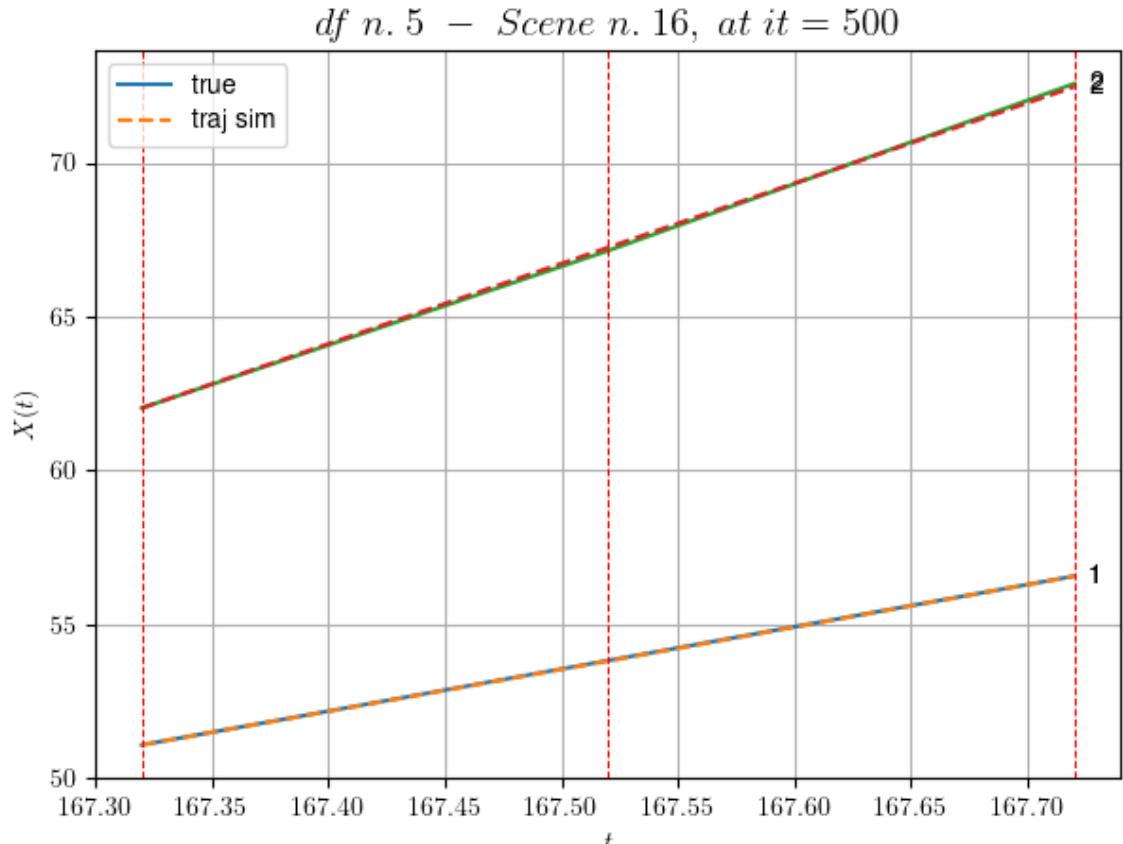


For scene 11/44:

\* After LR finder:  $\text{LR\_NN}=1e-05$  with  $\text{mse}=3.6271063452689276$   
at it=24  
\*  $v_0 = 20.91667698279349$   
\* MSE = 0.09242411166332944  
\* iterations = 350

DataFrame n.5. Scene n.12/44

We have 2 time intervals inside [167.32,167.72]



---

For scene 12/44:

\* After LR finder: LR\_NN=0.0005 with mse=0.5038258035403478  
at it=24  
\* v0 = 26.10725367471429  
\* MSE = 0.003624421458111822  
\* iterations = 500

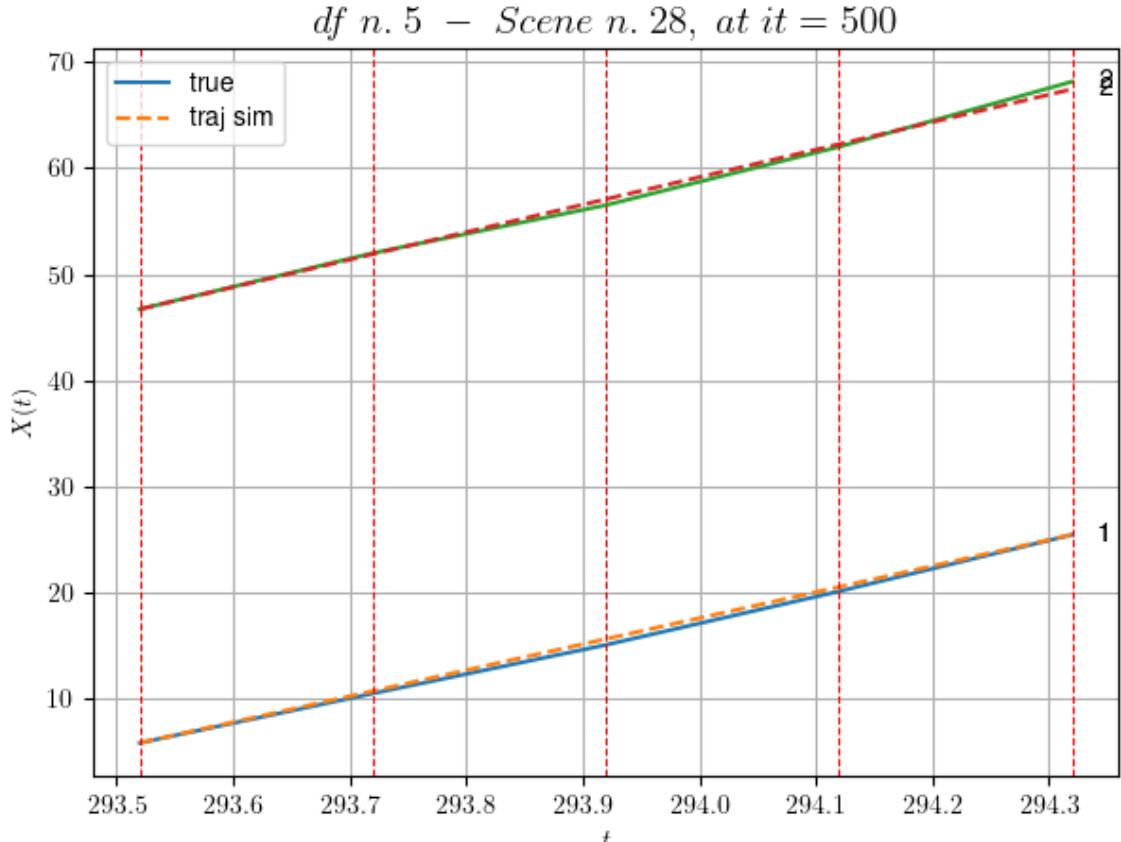
---

---

DataFrame n.5. Scene n.13/44

---

We have 4 time intervals inside [293.52,294.32]

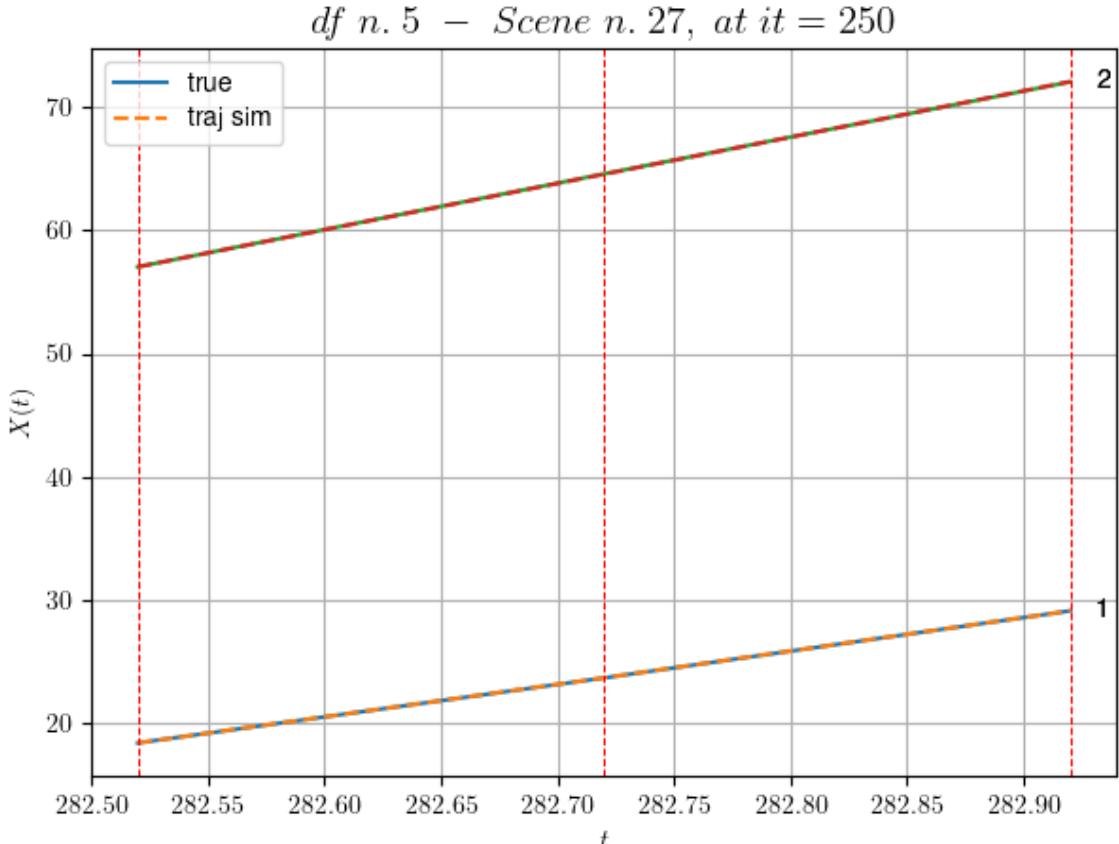


For scene 13/44:

\* After LR finder: LR\_NN=1e-05 with mse=1.9515054161123109  
at it=24  
\* v0 = 25.930527482374025  
\* MSE = 0.14064847613285028  
\* iterations = 500

DataFrame n.5. Scene n.14/44

We have 2 time intervals inside [282.52,282.92]

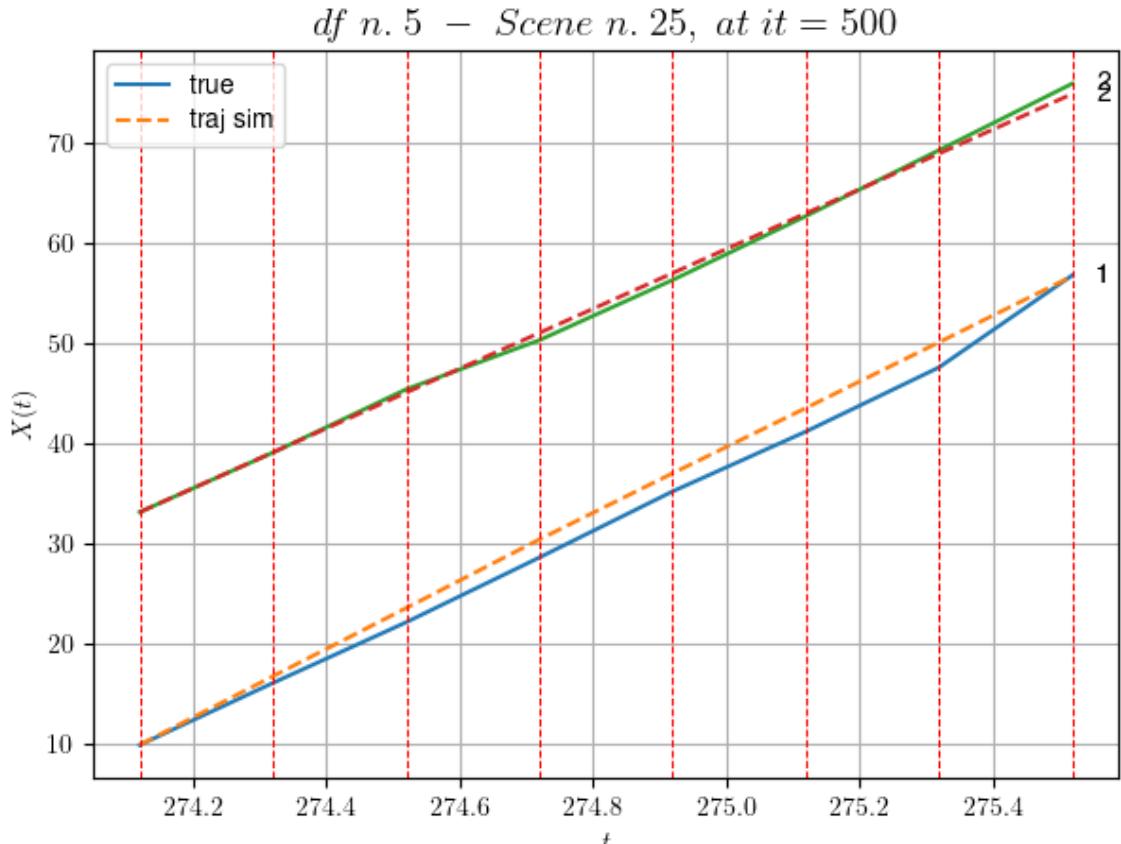


For scene 14/44:

\* After LR finder: LR\_NN=0.0001 with mse=1.8835468567175768  
at it=24  
\* v0 = 37.541185245585346  
\* MSE = 0.0002616359678238314  
\* iterations = 250

DataFrame n.5. Scene n.15/44

We have 7 time intervals inside [274.12,275.52]



For scene 15/44:

\* After LR finder: LR\_NN=1e-05 with mse=1.8435241036301733

at it=24

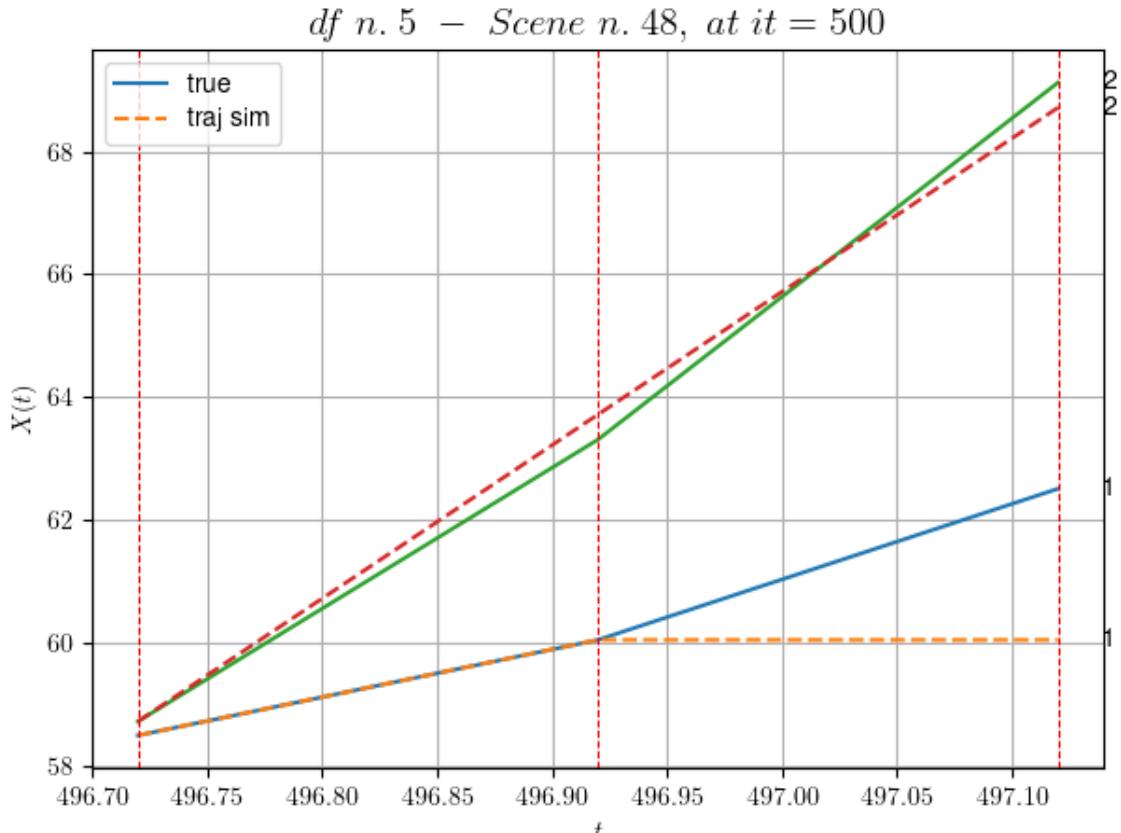
\* v0 = 29.83143625344594

\* MSE = 0.6346168924825597

\* iterations = 500

DataFrame n.5. Scene n.16/44

We have 2 time intervals inside [496.72,497.12]



---

For scene 16/44:

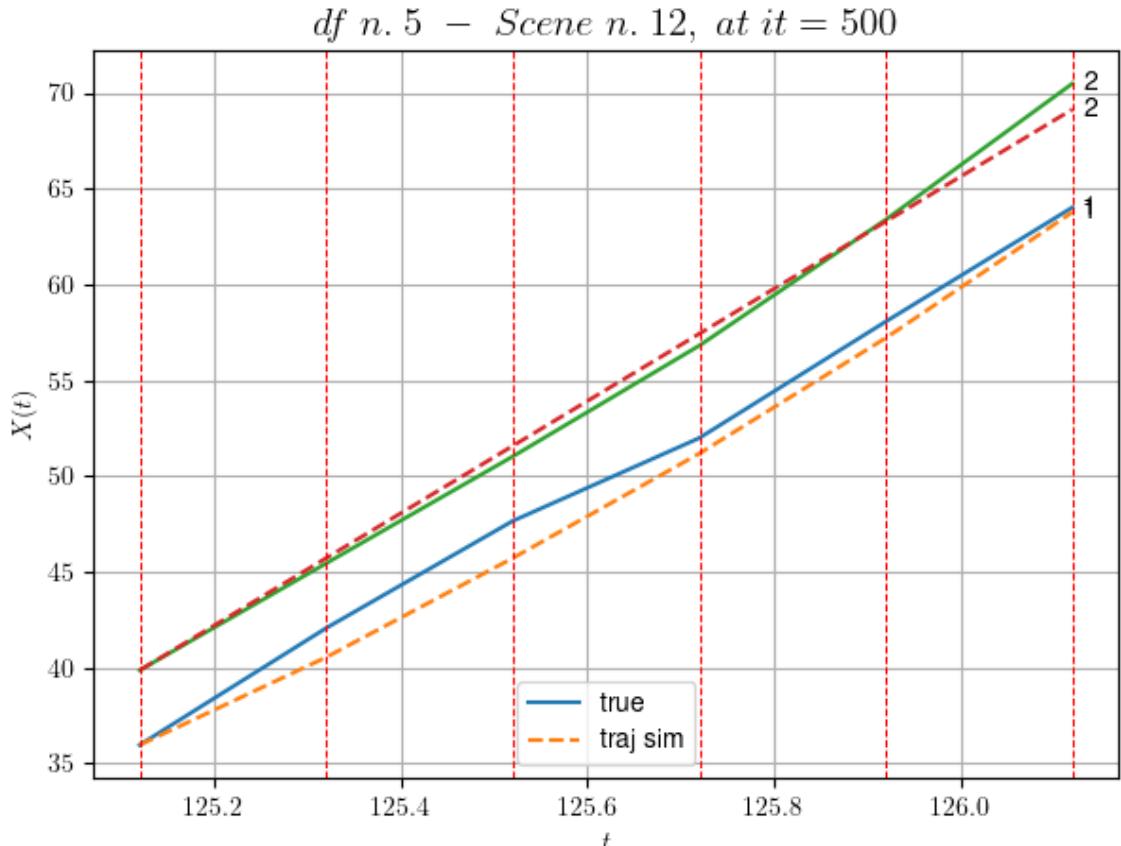
- \* After LR finder: LR\_NN=0.01 with mse=0.7494860770190961 at it=24
- \* v0 = 25.01096626444741
- \* MSE = 1.0615129218771322
- \* iterations = 500

---

DataFrame n.5. Scene n.17/44

---

We have 5 time intervals inside [125.12,126.12]

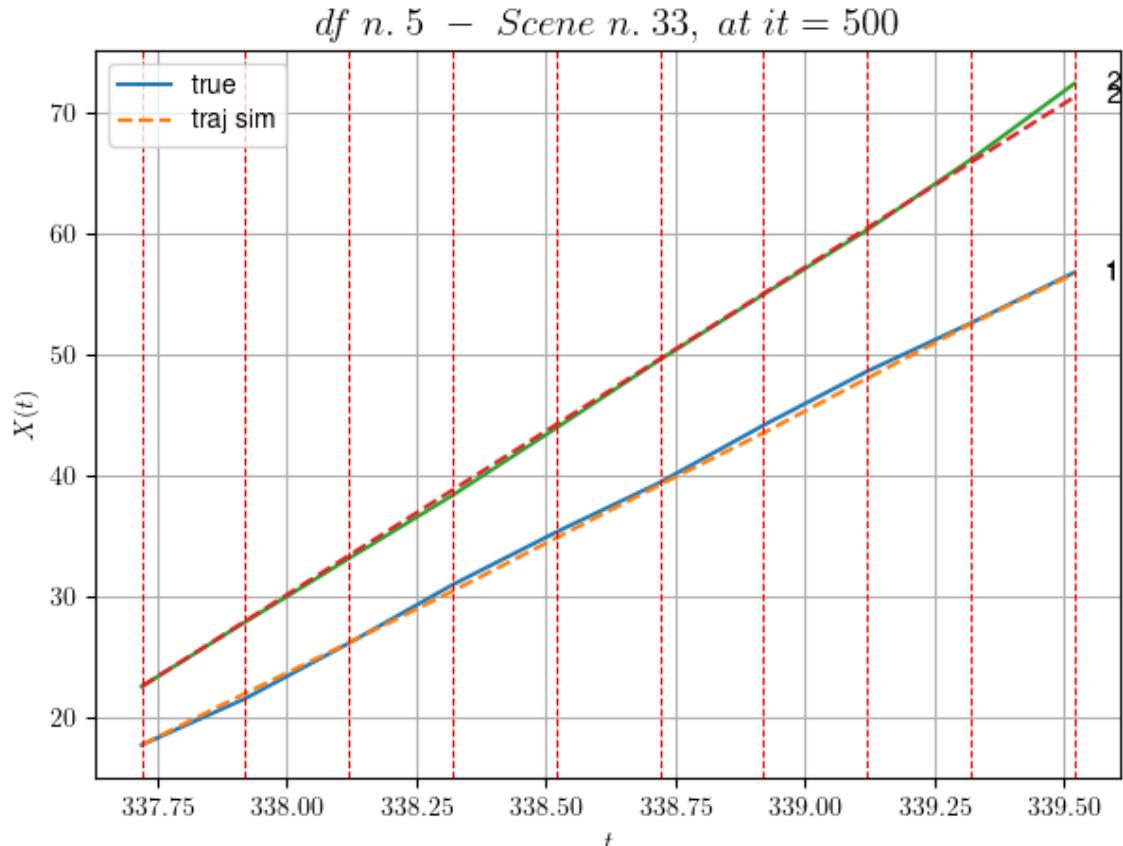


For scene 17/44:

\* After LR finder: LR\_NN=0.005 with mse=1.0867902482287286  
at it=24  
\*  $v_0 = 29.269210394723725$   
\* MSE = 0.8433275372444972  
\* iterations = 500

DataFrame n.5. Scene n.18/44

We have 9 time intervals inside [337.72,339.52]



---

For scene 18/44:  
\* After LR finder: LR\_NN=0.001 with mse=10.318371940956236  
at it=24  
\* v0 = 27.020038219088278  
\* MSE = 0.15768840069268691  
\* iterations = 500

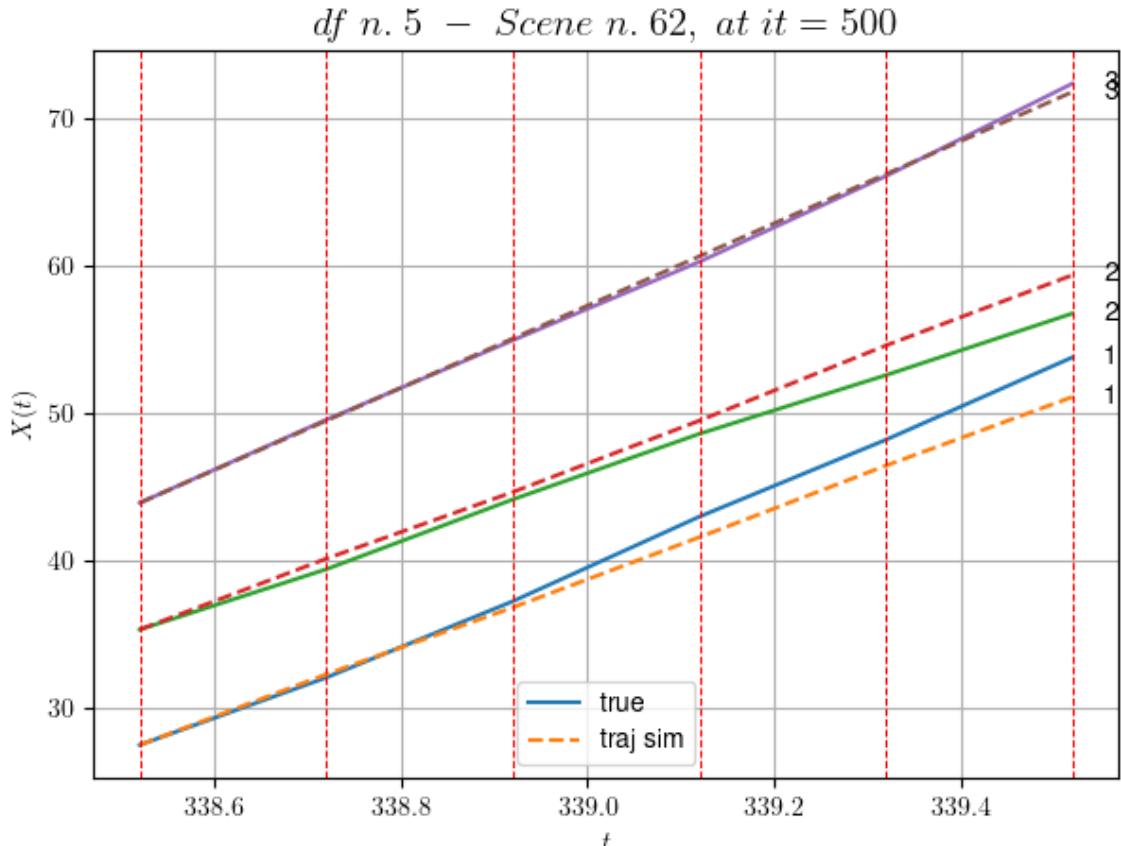
---

---

DataFrame n.5. Scene n.19/44

---

We have 5 time intervals inside [338.52,339.52]

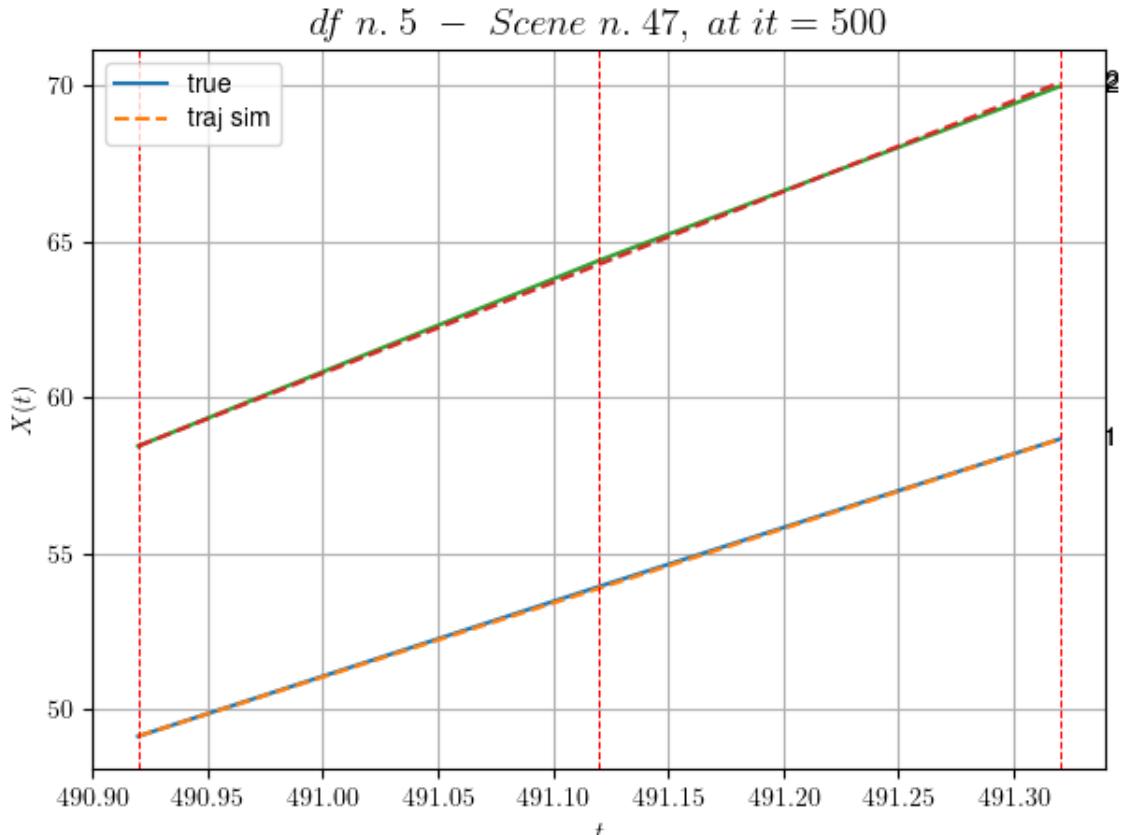


For scene 19/44:

\* After LR finder: LR\_NN=0.001 with mse=10.673908691773761  
at it=24  
\*  $v_0 = 27.853928426095617$   
\* MSE = 1.4050615105552697  
\* iterations = 500

DataFrame n.5. Scene n.20/44

We have 2 time intervals inside [490.92,491.32]



For scene 20/44:

\* After LR finder:  $LR_{NN}=0.0005$  with  $mse=0.0715500663126194$

1 at it=24

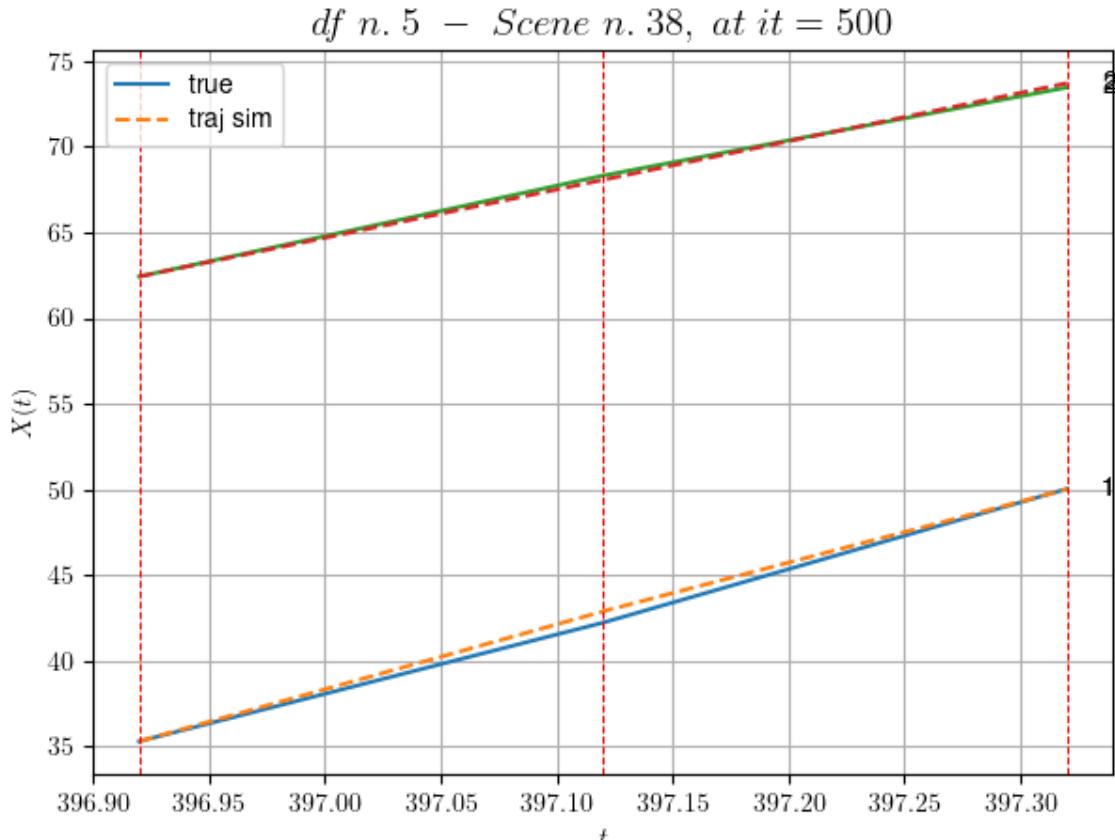
\*  $v_0 = 29.115594759201358$

\* MSE = 0.005610352994723296

\* iterations = 500

DataFrame n.5. Scene n.21/44

We have 2 time intervals inside [396.92, 397.32]



---

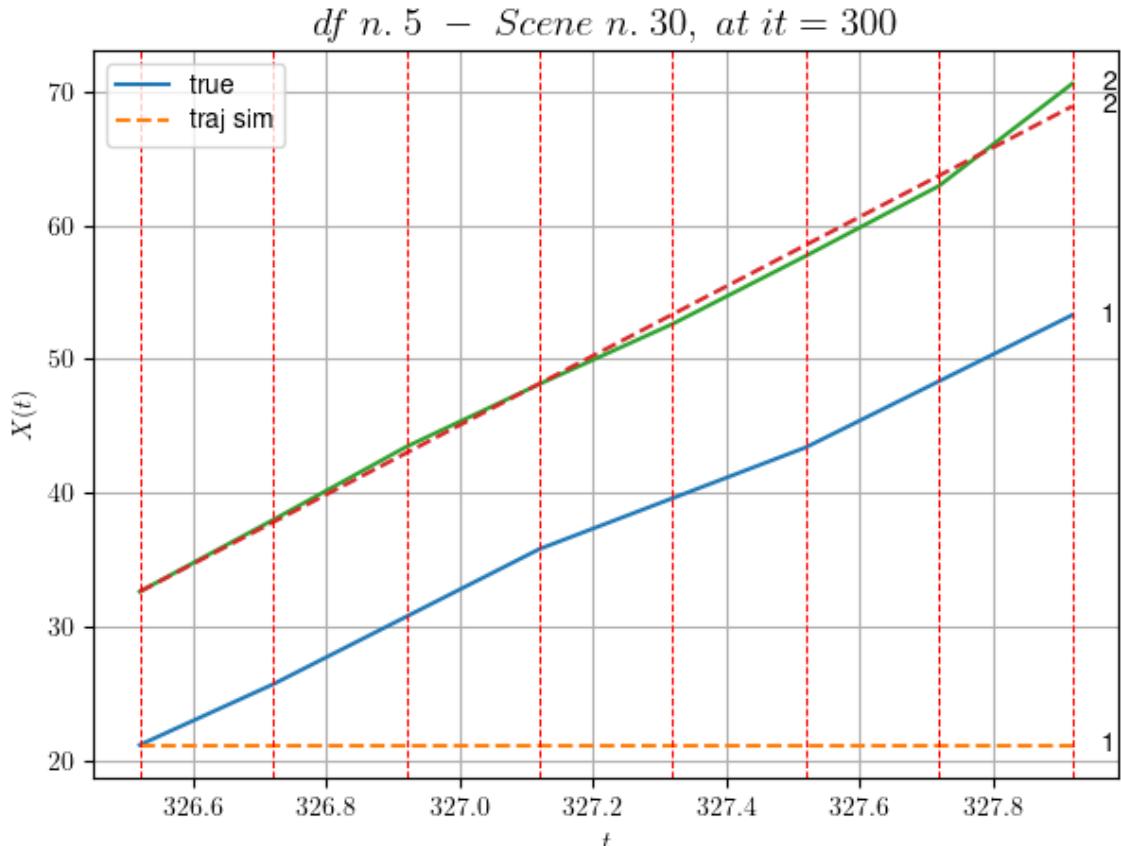
For scene 21/44:  
\* After LR finder: LR\_NN=5e-05 with mse=0.2210530591219796  
at it=24  
\* v0 = 28.239105392623376  
\* MSE = 0.09068855629686155  
\* iterations = 500

---

DataFrame n.5. Scene n.22/44

---

We have 7 time intervals inside [326.52, 327.92]

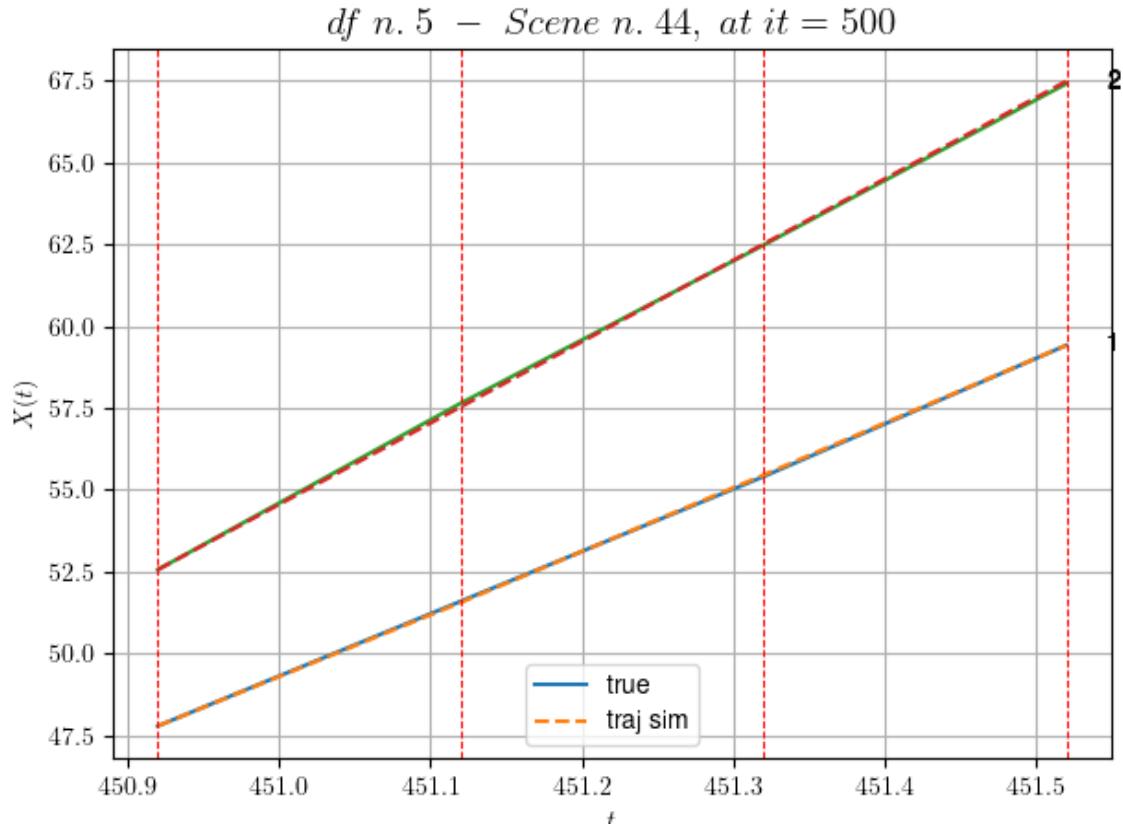


For scene 22/44:

\* After LR finder: LR\_NN=0.001 with mse=6.172509004813185 at it=24  
\*  $v_0 = 25.91021775614014$   
\* MSE = 23.447051604394254  
\* iterations = 300

DataFrame n.5. Scene n.23/44

We have 3 time intervals inside [450.92,451.52]

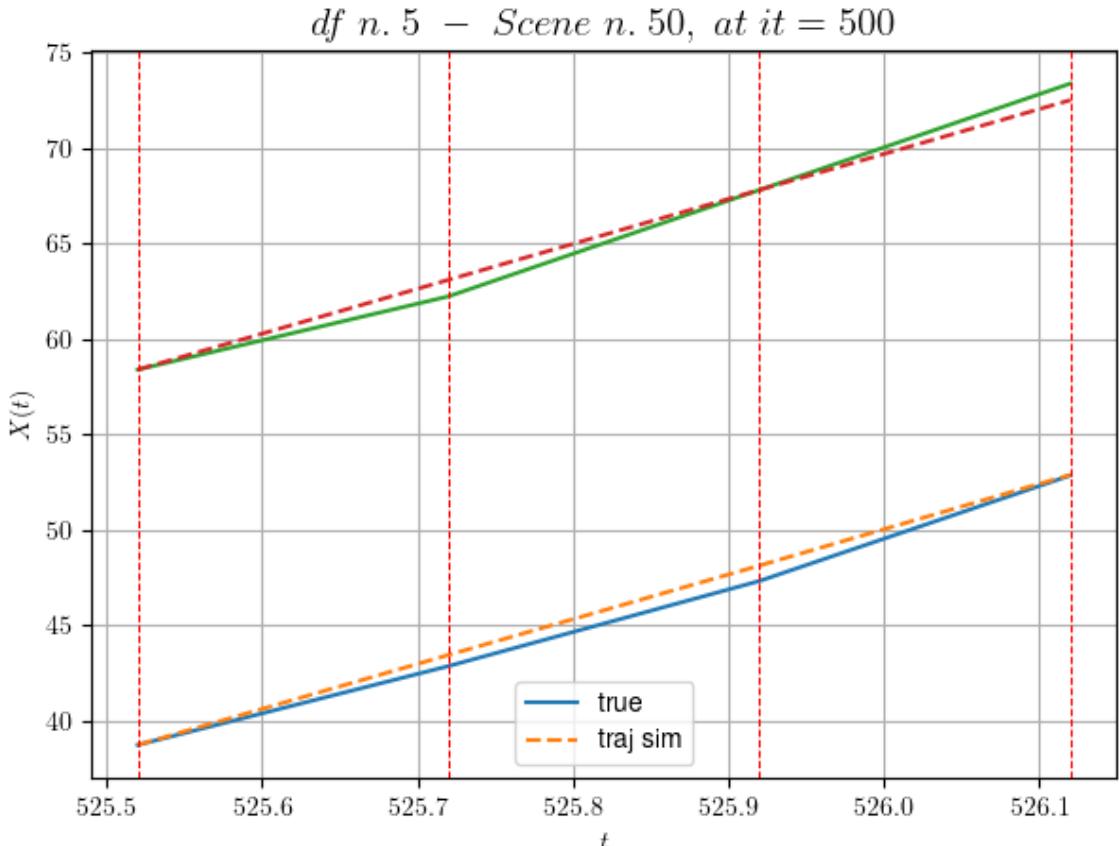


For scene 23/44:

\* After LR finder: LR\_NN=0.001 with mse=2.076804124033992 at it=24  
\*  $v_0 = 24.877482654595042$   
\* MSE = 0.002889013201980913  
\* iterations = 500

DataFrame n.5. Scene n.24/44

We have 3 time intervals inside [525.52,526.12]

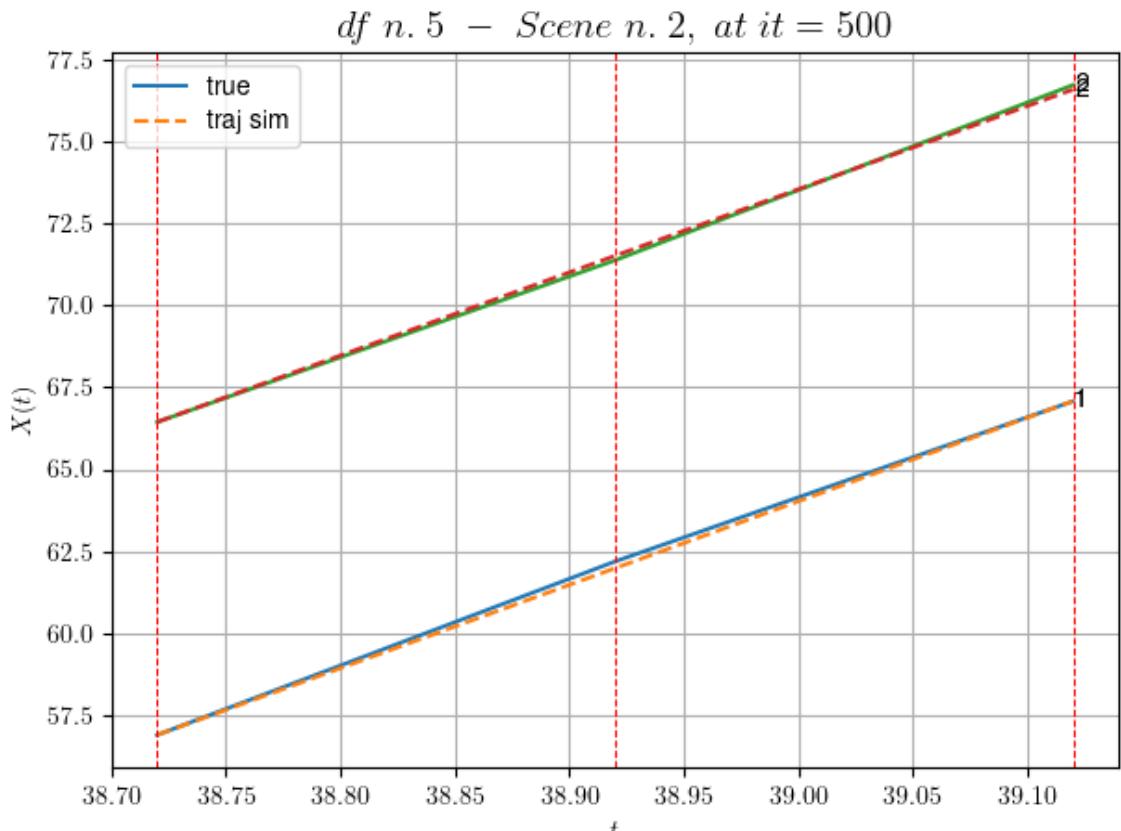


For scene 24/44:

\* After LR finder: LR\_NN=1e-05 with mse=2.6291599619264416  
at it=24  
\* v0 = 23.539355454248234  
\* MSE = 0.2886291692484252  
\* iterations = 500

DataFrame n.5. Scene n.25/44

We have 2 time intervals inside [38.72,39.12]

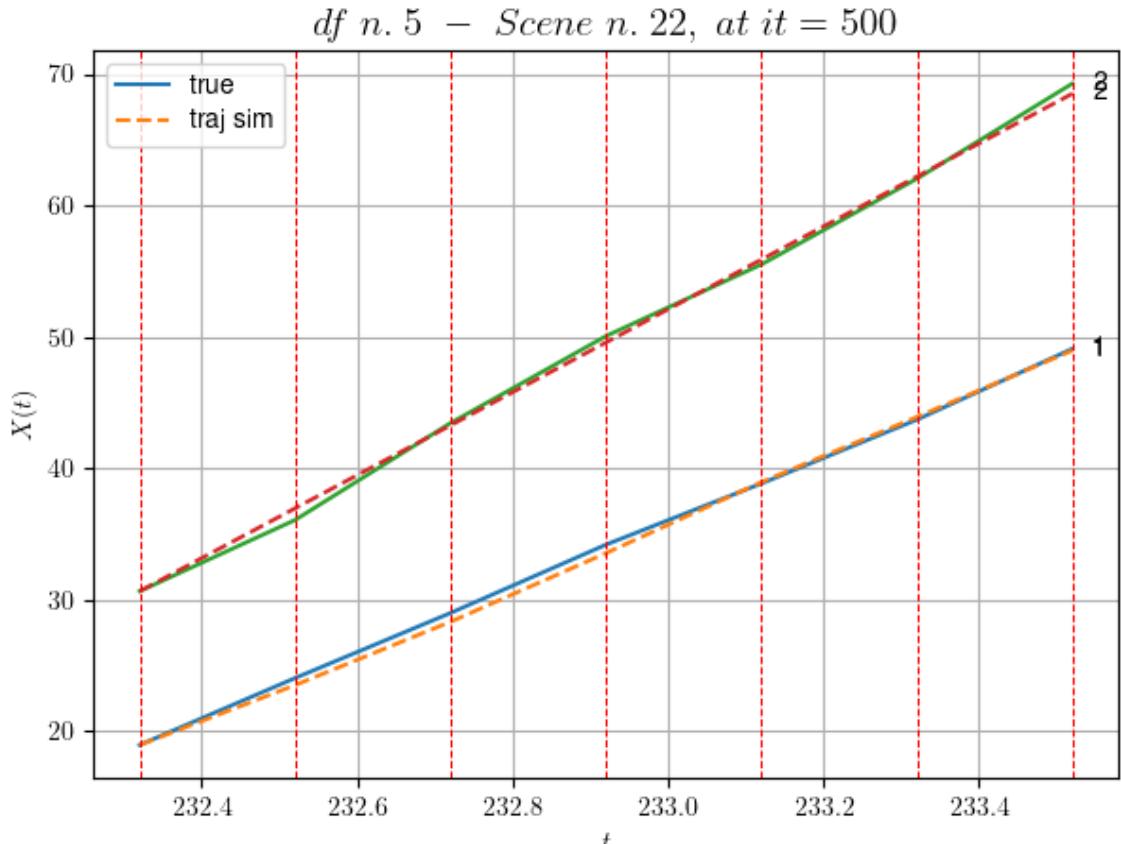


For scene 25/44:

\* After LR finder:  $\text{LR\_NN}=0.0005$  with  $\text{mse}=0.6806574254062442$   
at it=24  
\*  $v_0 = 25.372431967348998$   
\*  $\text{MSE} = 0.013253653314709807$   
\* iterations = 500

DataFrame n.5. Scene n.26/44

We have 6 time intervals inside [232.32,233.52]



---

For scene 26/44:

\* After LR finder: LR\_NN=0.001 with mse=1.4667584777879372  
at it=24  
\* v0 = 31.537257787030235  
\* MSE = 0.216811357657043  
\* iterations = 500

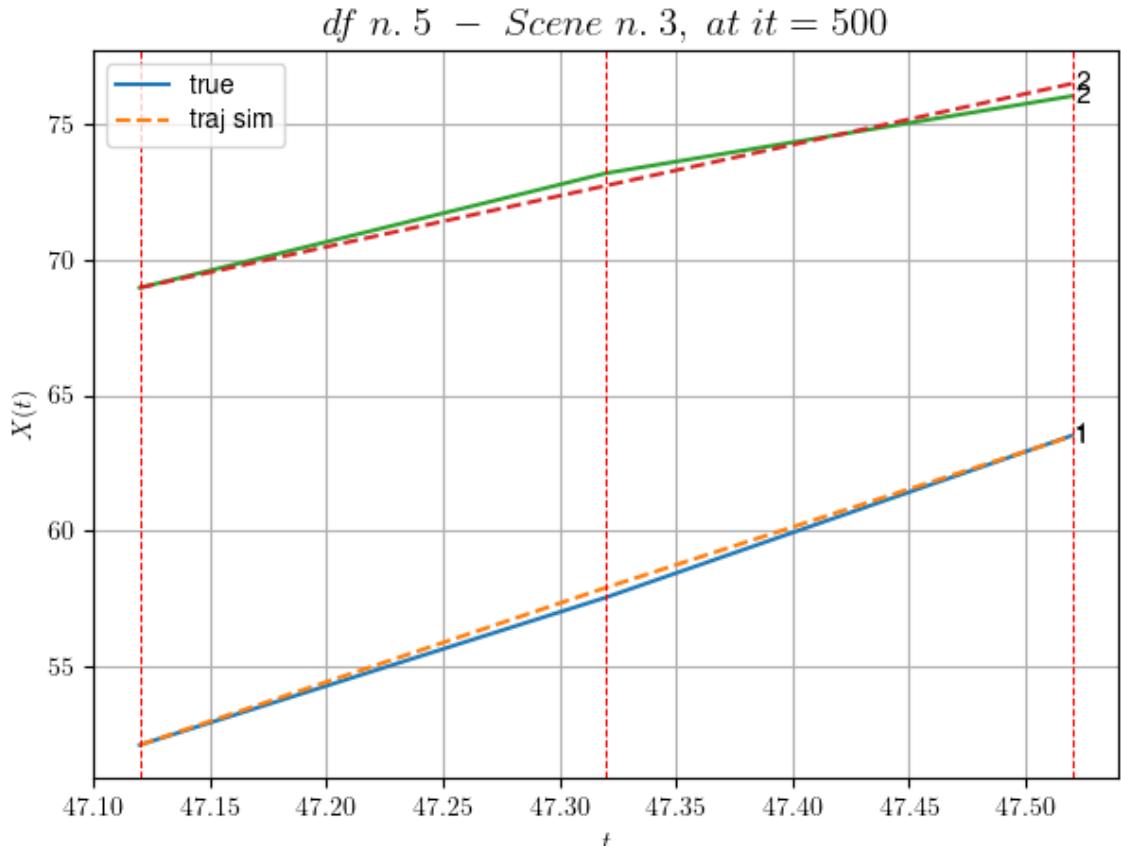
---

---

DataFrame n.5. Scene n.27/44

---

We have 2 time intervals inside [47.12,47.52]

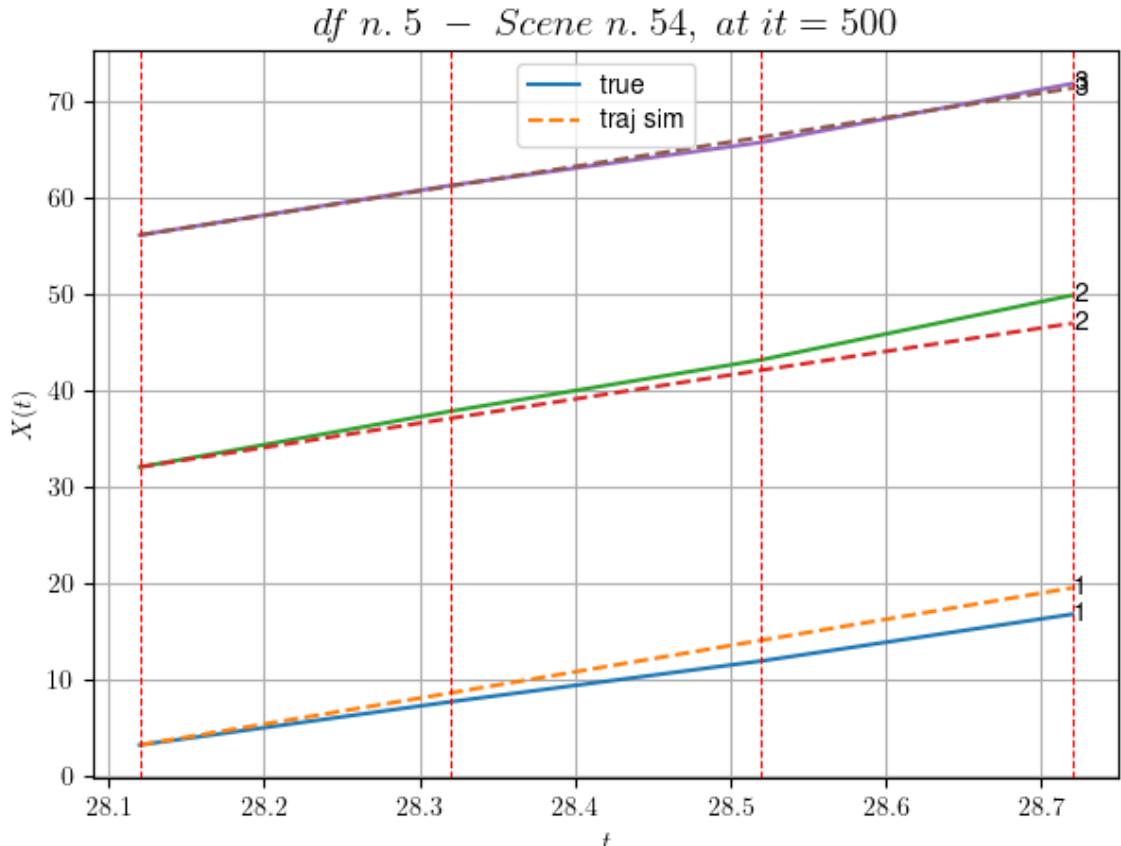


For scene 27/44:

\* After LR finder: LR\_NN=5e-05 with mse=4.650777033537798 at it=24  
\* v0 = 18.771821269963336  
\* MSE = 0.09116890763005721  
\* iterations = 500

DataFrame n.5. Scene n.28/44

We have 3 time intervals inside [28.12,28.72]

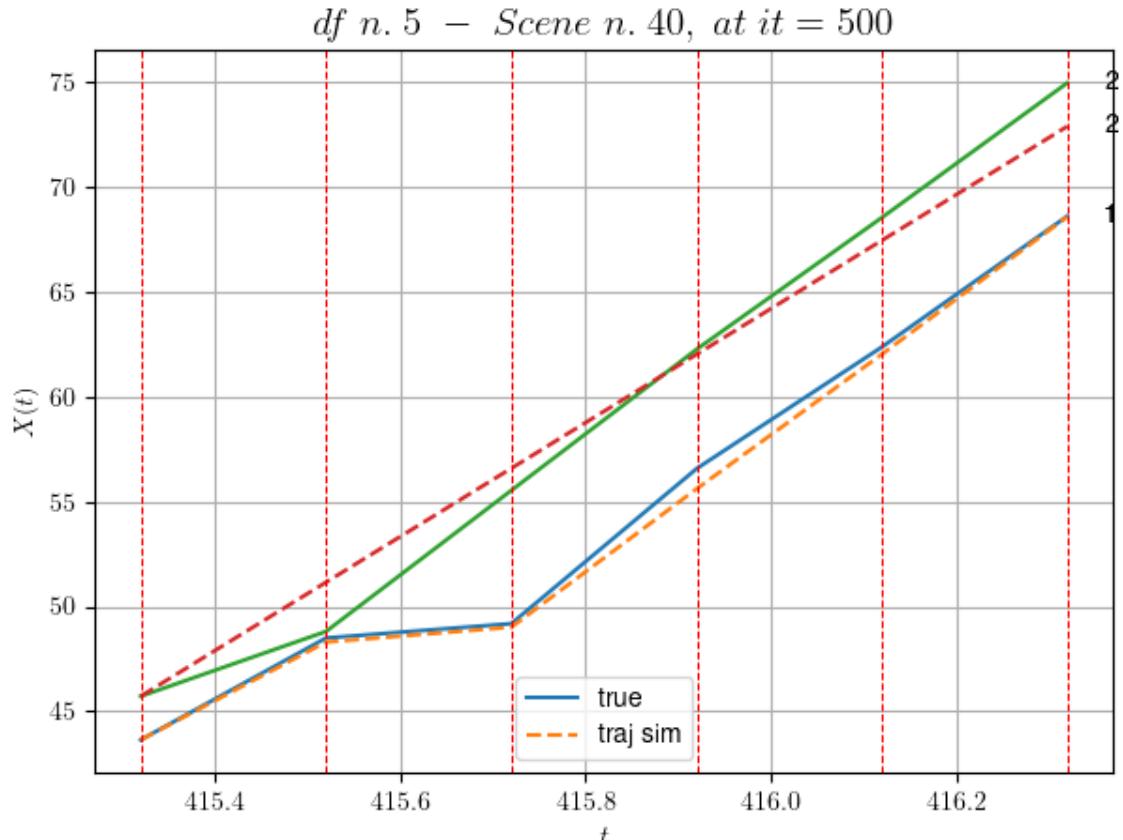


For scene 28/44:

\* After LR finder: LR\_NN=5e-05 with mse=4.650423183071001 at it=24  
\* v0 = 25.379383792483857  
\* MSE = 1.966277232279271  
\* iterations = 500

DataFrame n.5. Scene n.29/44

We have 5 time intervals inside [415.32,416.32]



---

For scene 29/44:

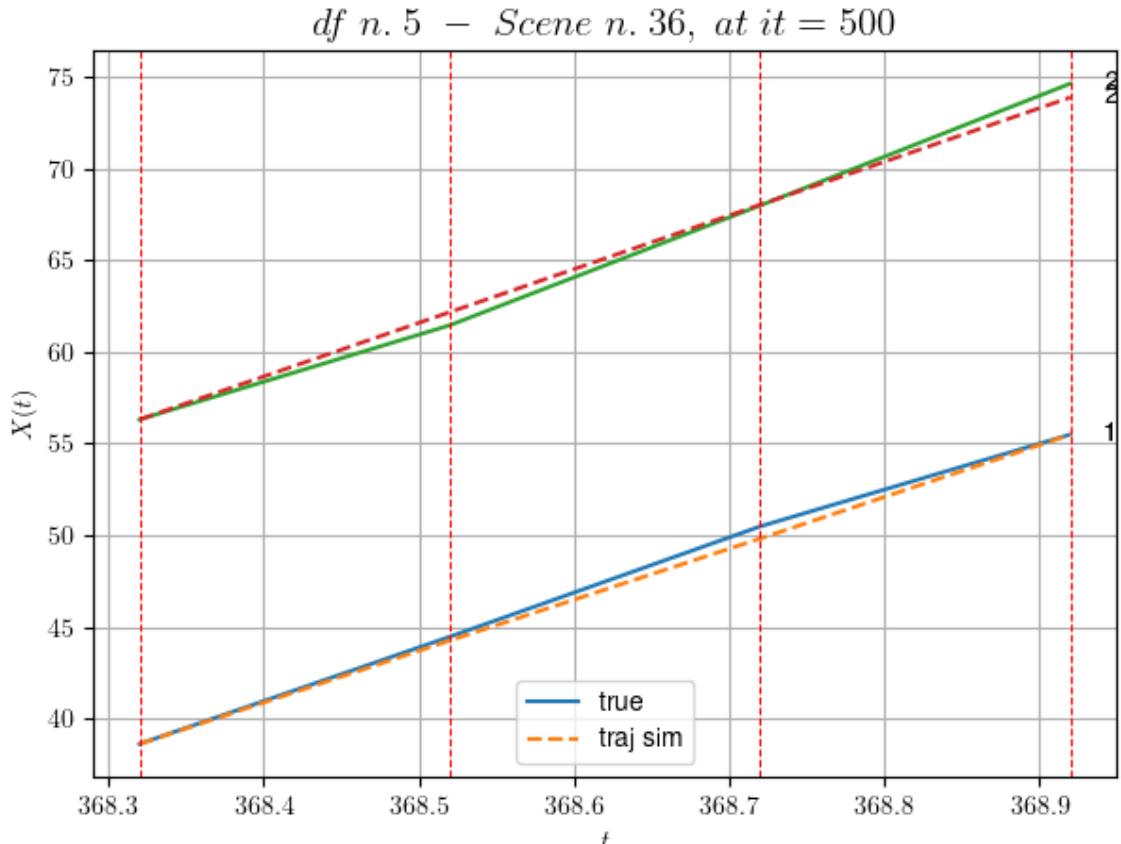
\* After LR finder:  $LR\_NN=0.0005$  with  $mse=2.517427136275637$   
at  $it=24$   
\*  $v_0 = 27.188395316740756$   
\*  $MSE = 0.959446494855564$   
\* iterations = 500

---

DataFrame n.5. Scene n.30/44

---

We have 3 time intervals inside [368.32, 368.92]

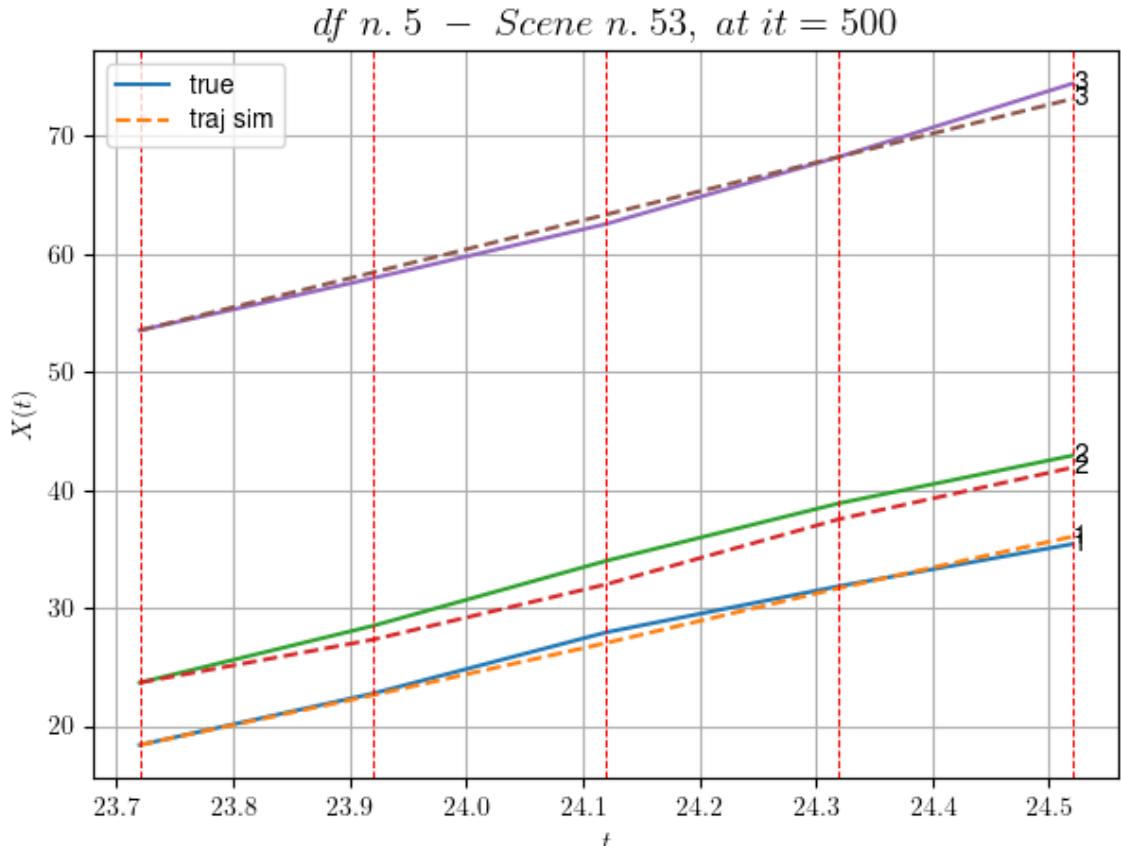


For scene 30/44:

\* After LR finder: LR\_NN=5e-05 with mse=0.18603435872711166  
at it=24  
\* v0 = 29.29813929812538  
\* MSE = 0.1561737589348441  
\* iterations = 500

DataFrame n.5. Scene n.31/44

We have 4 time intervals inside [23.72,24.52]

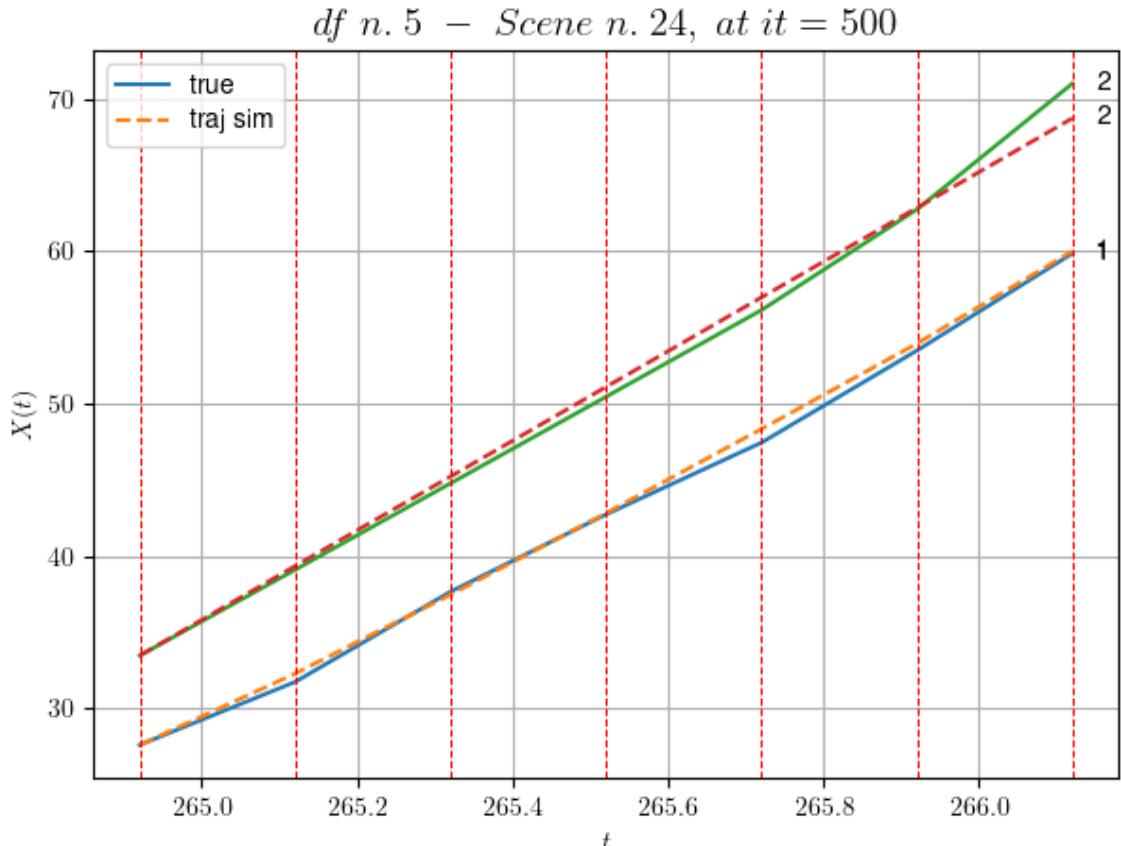


For scene 31/44:

\* After LR finder: LR\_NN=0.0005 with mse=16.07620085050455  
at it=24  
\* v0 = 24.53480373451935  
\* MSE = 0.3654342433460806  
\* iterations = 500

DataFrame n.5. Scene n.32/44

We have 6 time intervals inside [264.92,266.12]



---

For scene 32/44:

\* After LR finder: LR\_NN=0.001 with mse=0.5363335519943799

at it=24

\* v0 = 29.36678837419781

\* MSE = 0.56710896410474

\* iterations = 500

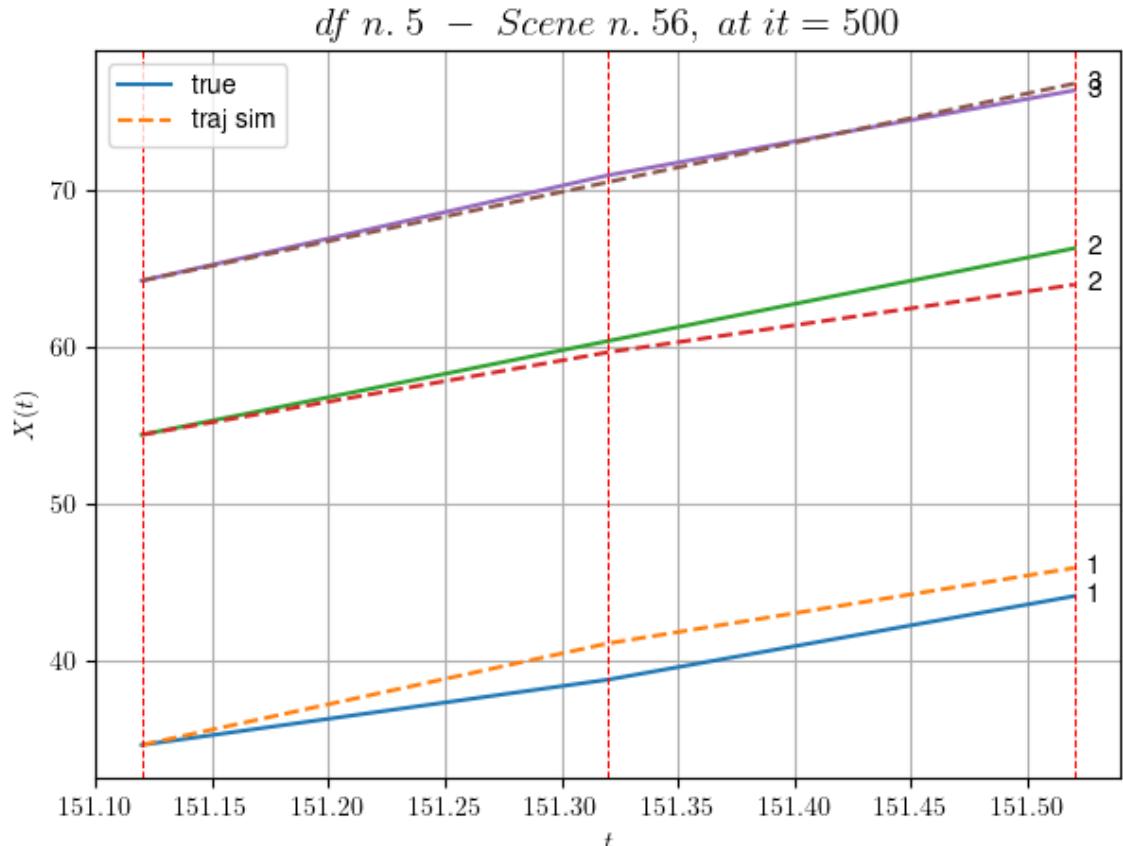
---

---

DataFrame n.5. Scene n.33/44

---

We have 2 time intervals inside [151.12,151.52]

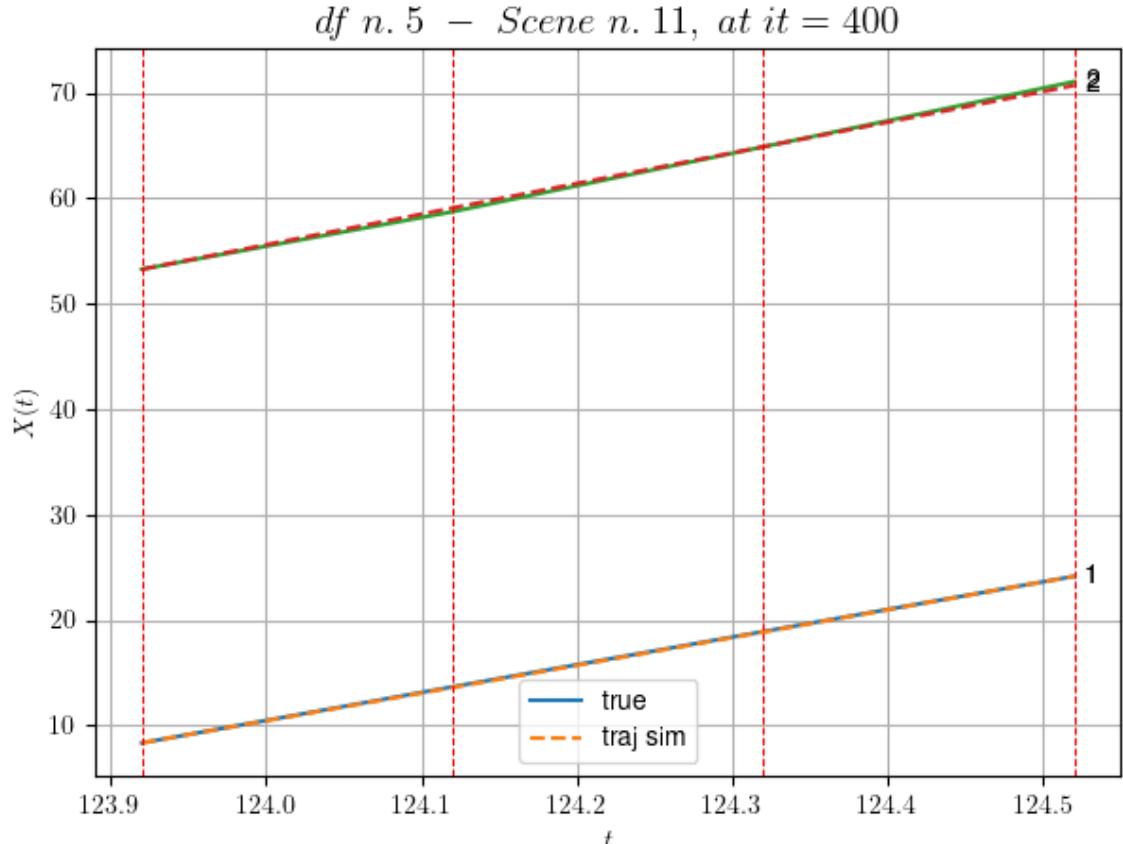


For scene 33/44:

\* After LR finder: LR\_NN=0.001 with mse=5.845564993852004 at it=24  
\* v0 = 31.51613873795846  
\* MSE = 1.6588998932594692  
\* iterations = 500

DataFrame n.5. Scene n.34/44

We have 3 time intervals inside [123.92,124.52]



For scene 34/44:

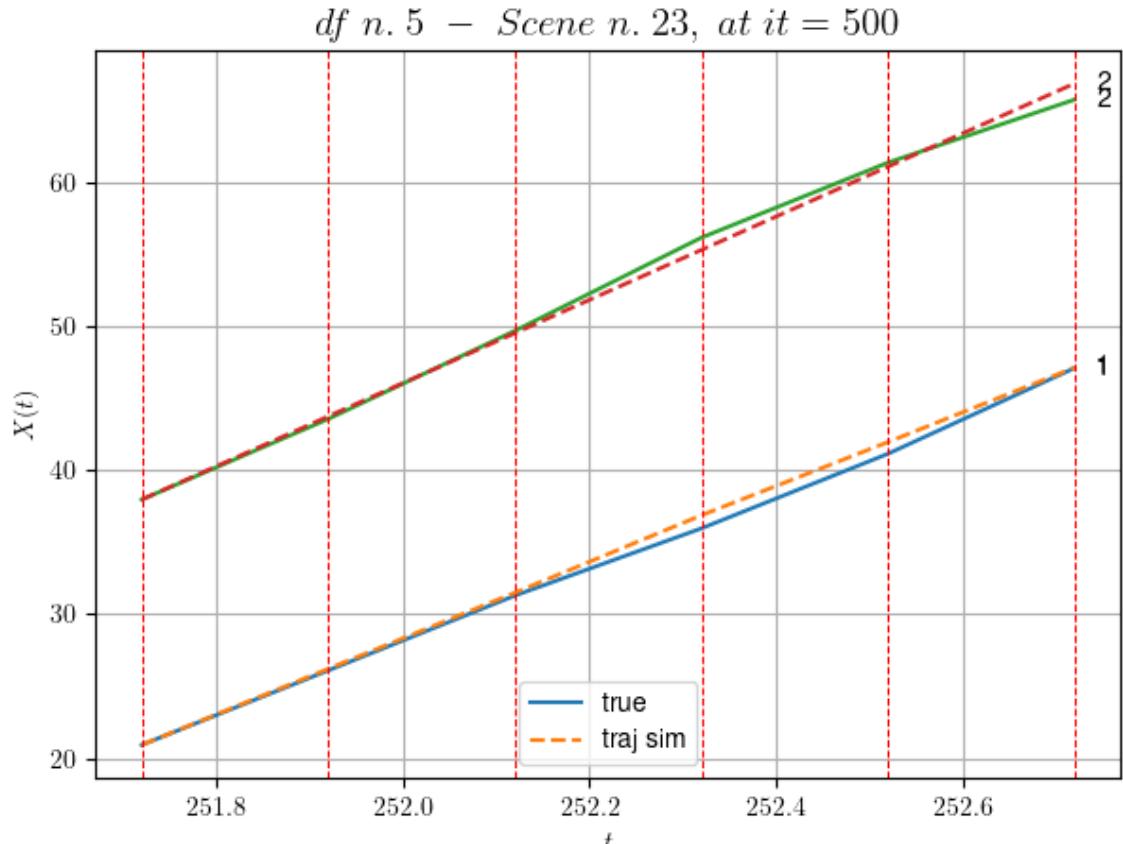
\* After LR finder: LR\_NN=1e-05 with mse=0.06429379958509297  
at it=24  
\* v0 = 29.067105023724697  
\* MSE = 0.029119954879806263  
\* iterations = 400

-----  
-----

DataFrame n.5. Scene n.35/44

-----

We have 5 time intervals inside [251.72,252.72]

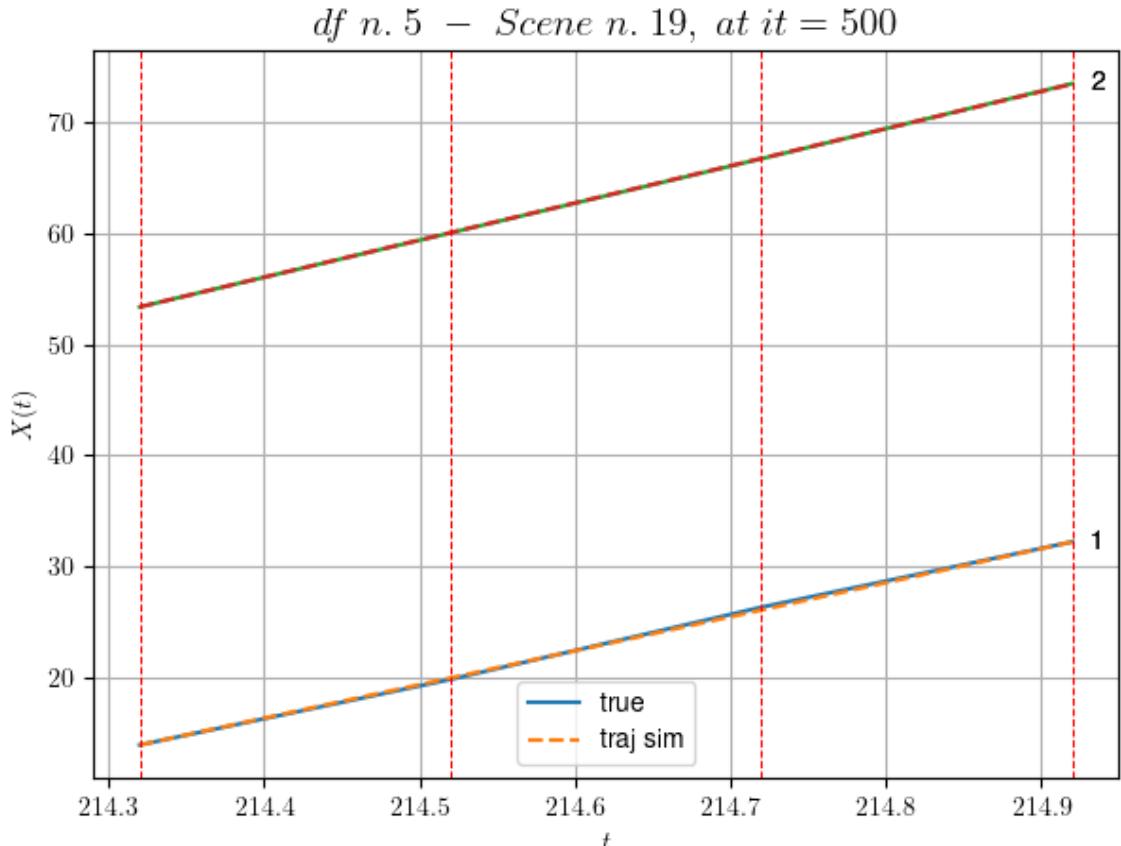


For scene 35/44:

\* After LR finder: LR\_NN=0.001 with mse=0.5091427093858539  
at it=24  
\* v0 = 28.91133195438018  
\* MSE = 0.23982828221776156  
\* iterations = 500

DataFrame n.5. Scene n.36/44

We have 3 time intervals inside [214.32,214.92]

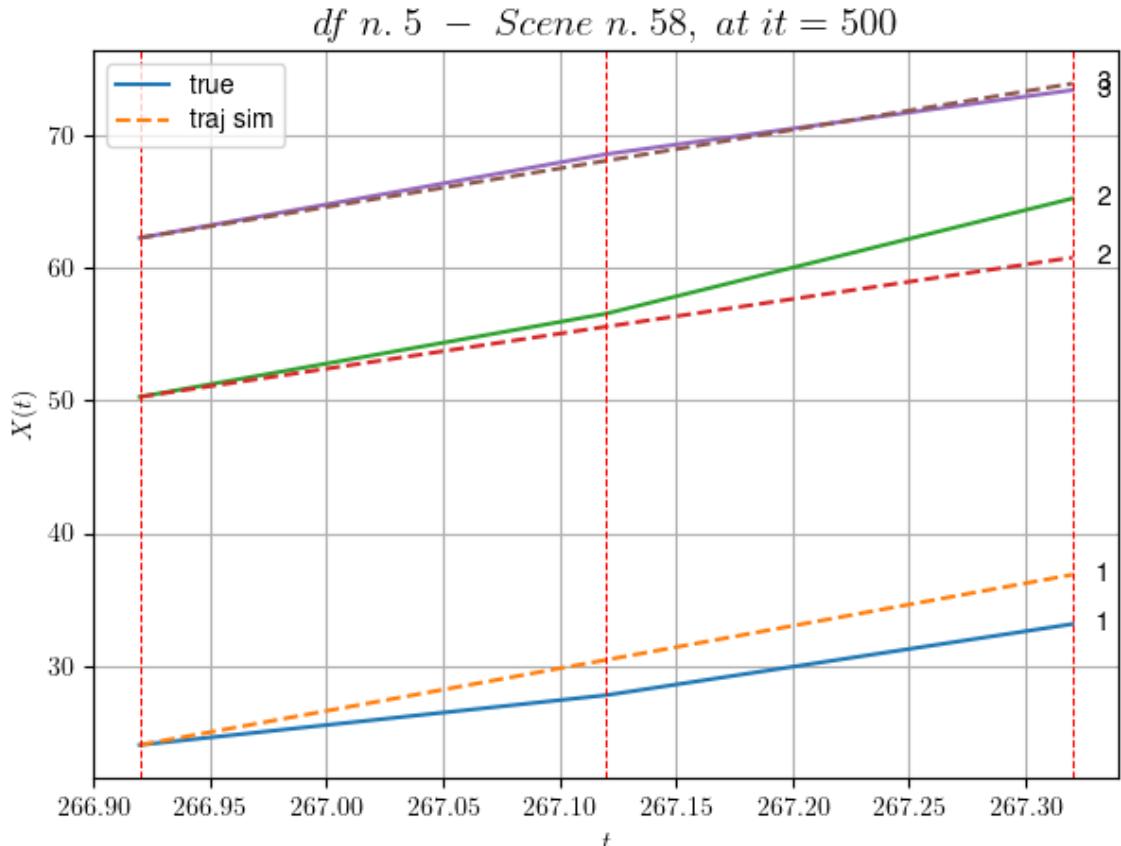


For scene 36/44:

\* After LR finder: LR\_NN=1e-05 with mse=0.8409507485924076  
at it=24  
\* v0 = 33.416651411341164  
\* MSE = 0.0106651027839392  
\* iterations = 500

DataFrame n.5. Scene n.37/44

We have 2 time intervals inside [266.92,267.32]

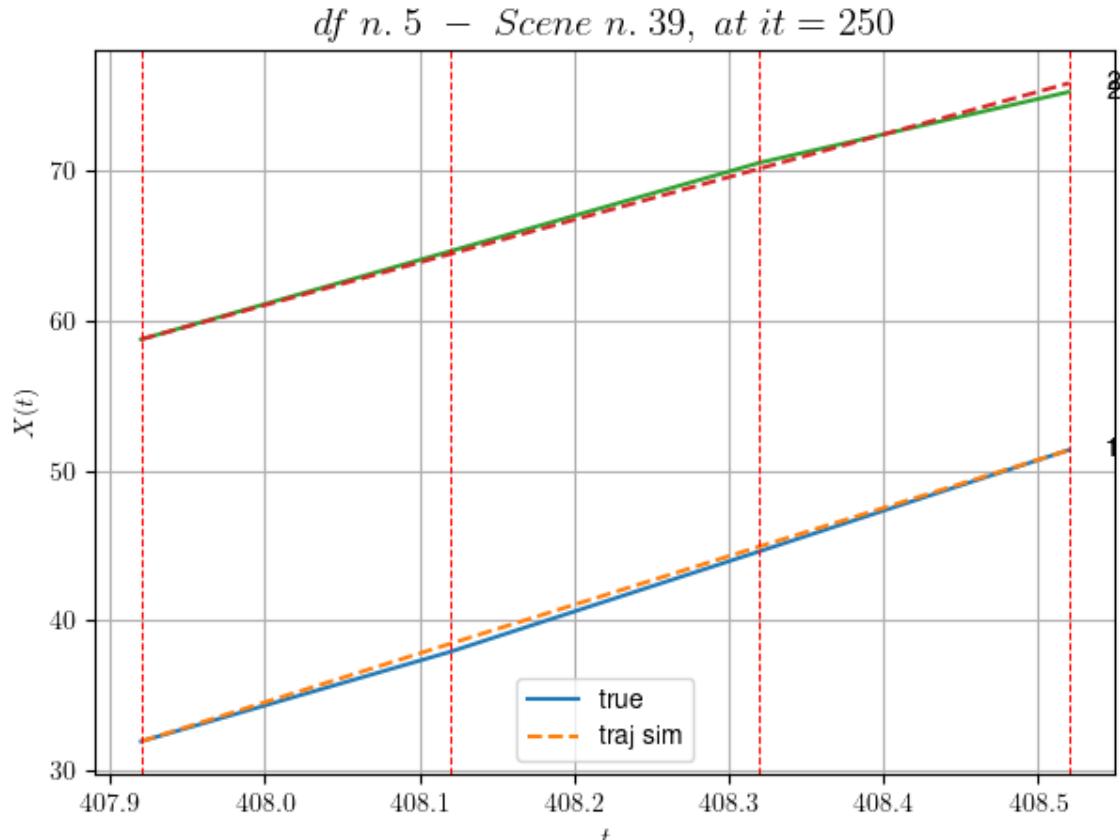


For scene 37/44:

\* After LR finder: LR\_NN=5e-05 with mse=13.965488519258086  
at it=24  
\* v0 = 29.08570162592598  
\* MSE = 4.684399227434921  
\* iterations = 500

DataFrame n.5. Scene n.38/44

We have 3 time intervals inside [407.92,408.52]



---

For scene 38/44:

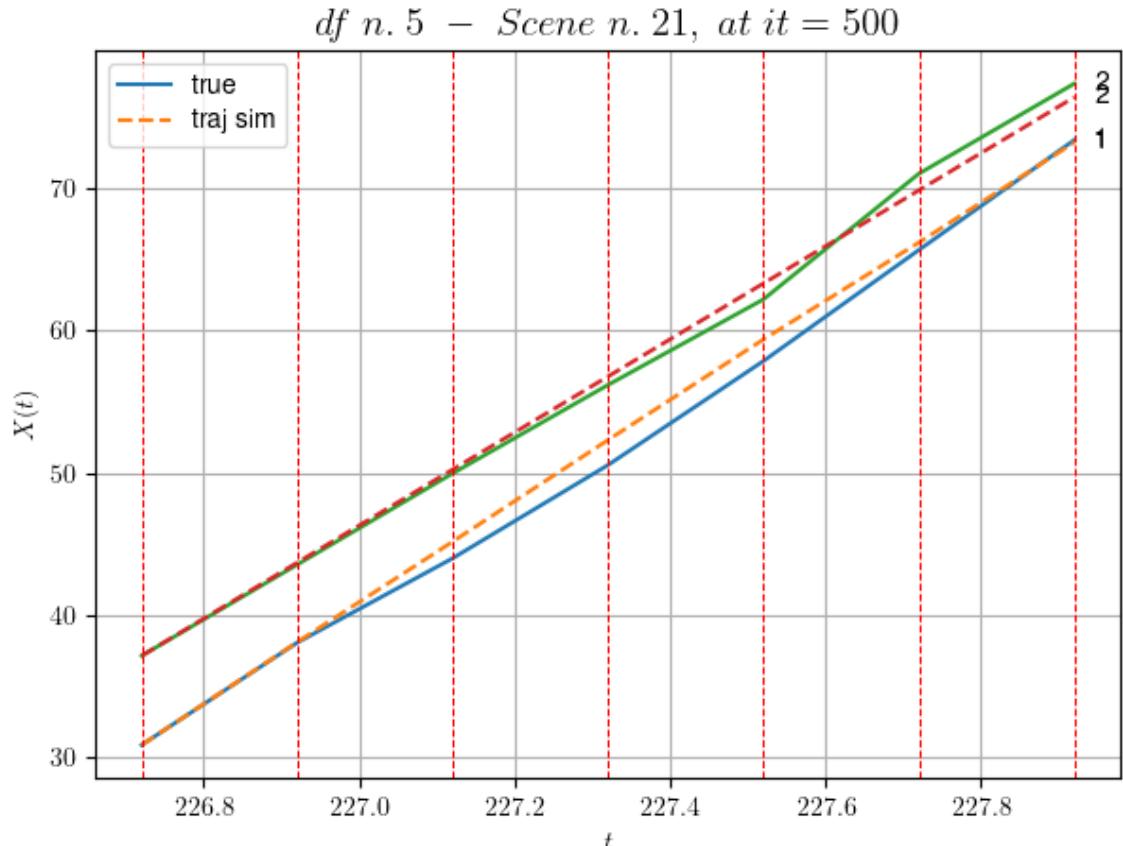
\* After LR finder: LR\_NN=1e-05 with mse=0.34748294007738967  
at it=24  
\* v0 = 28.450691760735452  
\* MSE = 0.11412451331390844  
\* iterations = 250

---

DataFrame n.5. Scene n.39/44

---

We have 6 time intervals inside [226.72, 227.92]



---

For scene 39/44:

\* After LR finder: LR\_NN=5e-05 with mse=3.604758104966417 at it=24  
\* v0 = 32.69366457961354  
\* MSE = 0.7885017712939091  
\* iterations = 500

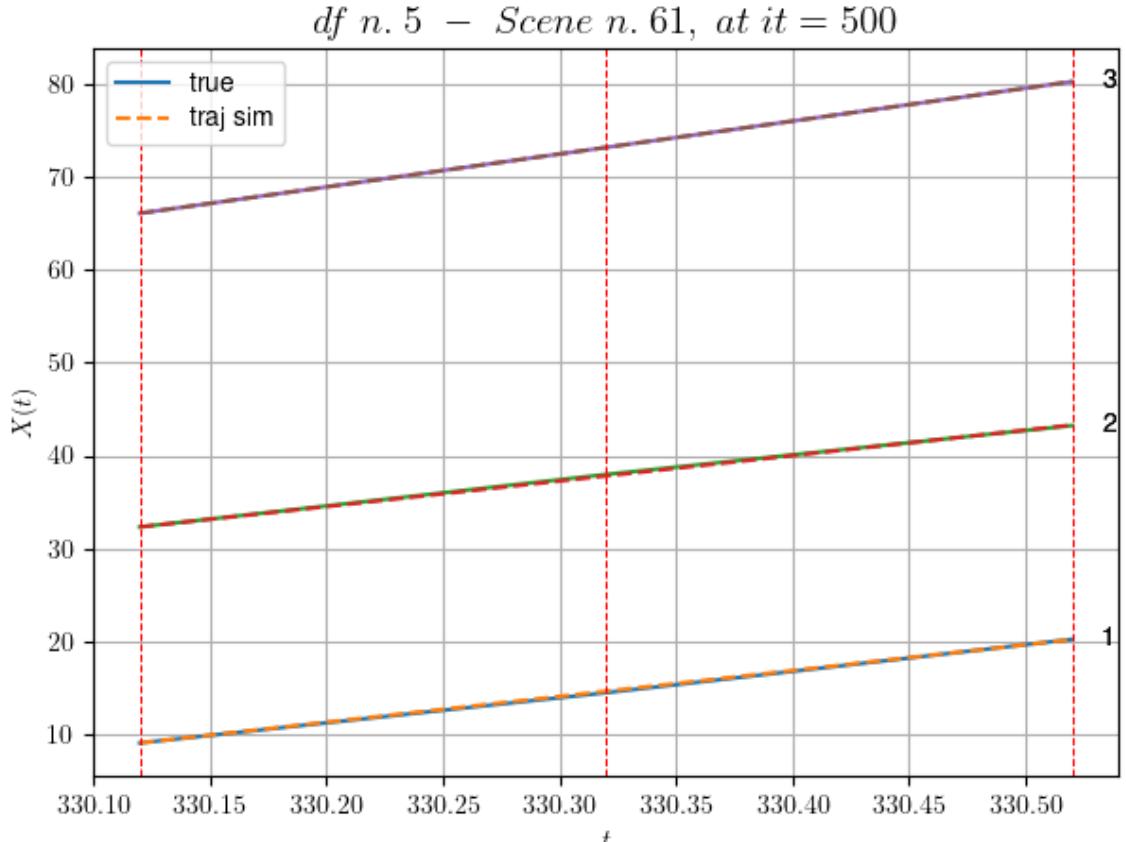
---

---

DataFrame n.5. Scene n.40/44

---

We have 2 time intervals inside [330.12,330.52]

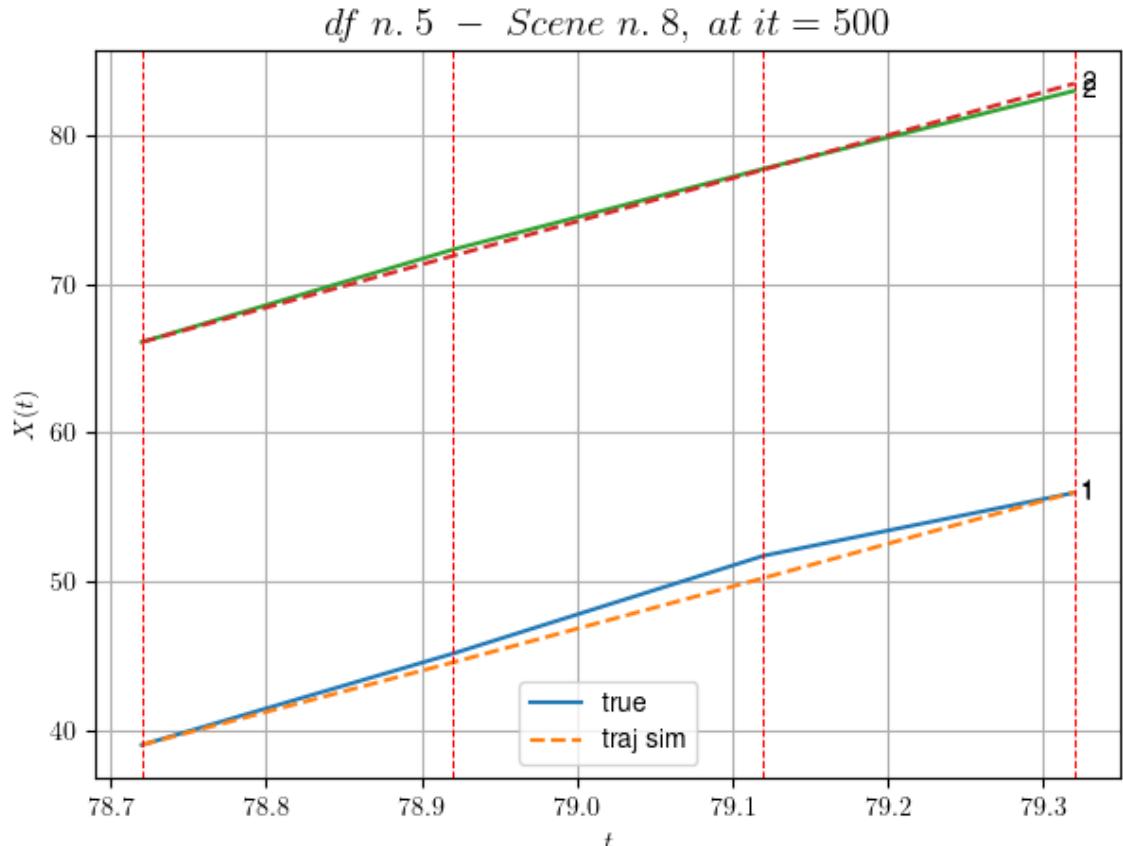


For scene 40/44:

\* After LR finder:  $\text{LR\_NN}=1e-05$  with  $\text{mse}=1.8683667178551182$   
at it=24  
\*  $v_0 = 35.47868326749177$   
\* MSE = 0.006154641571734127  
\* iterations = 500

DataFrame n.5. Scene n.41/44

We have 3 time intervals inside [78.72, 79.32]

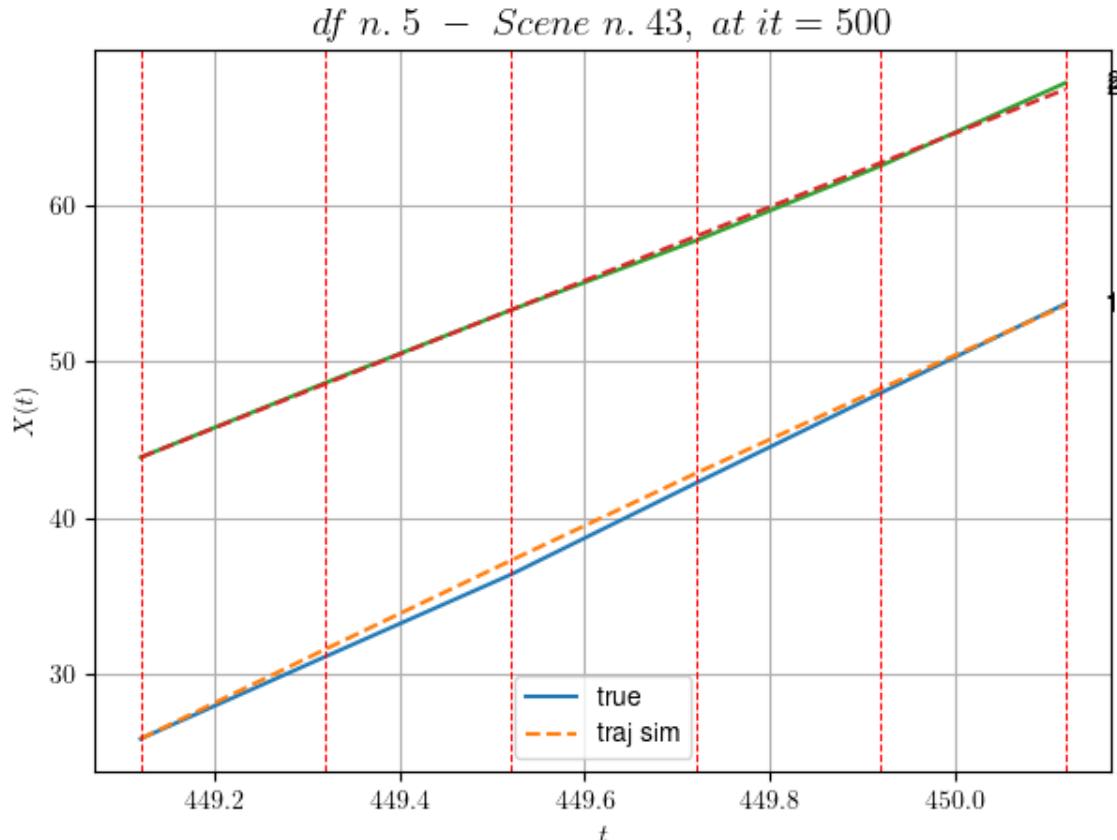


For scene 41/44:

\* After LR finder: LR\_NN=0.0001 with mse=0.4973653812842726  
6 at it=24  
\* v0 = 28.96540729561105  
\* MSE = 0.376208723913711  
\* iterations = 500

DataFrame n.5. Scene n.42/44

We have 5 time intervals inside [449.12,450.12]



---

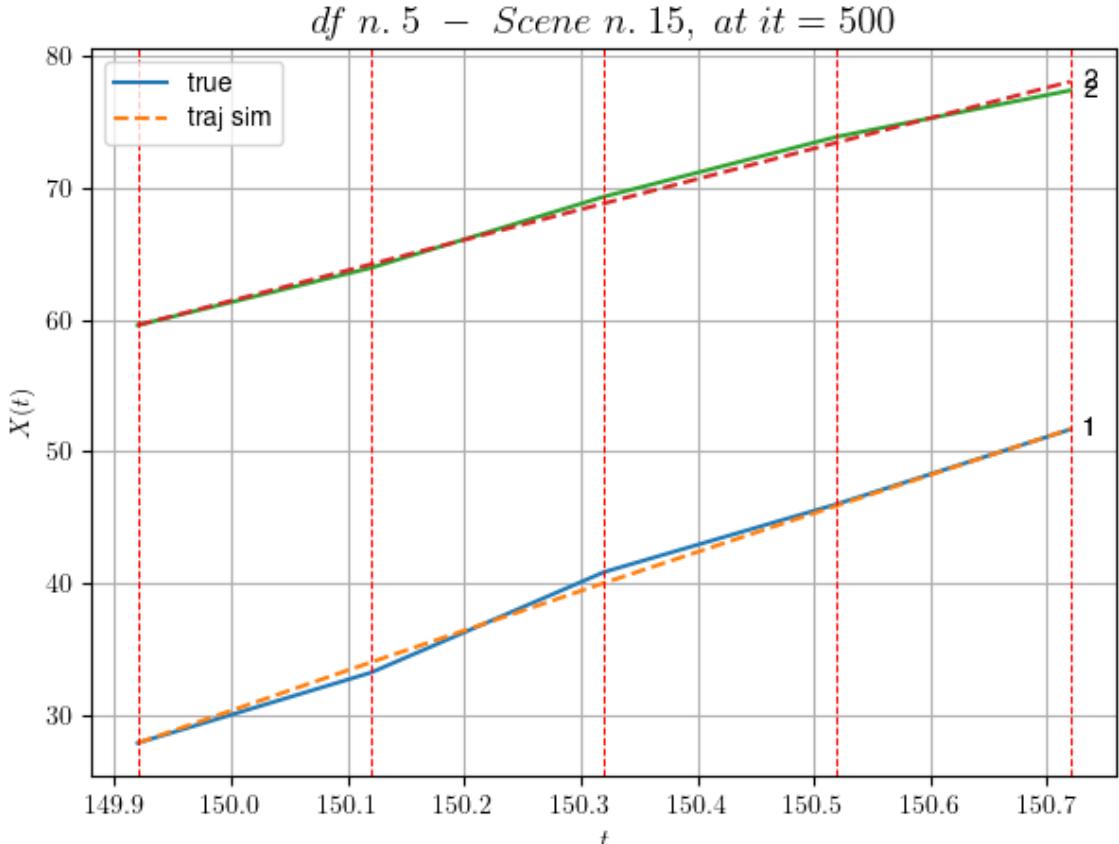
For scene 42/44:  
\* After LR finder: LR\_NN=5e-05 with mse=7.9831540010774225  
at it=24  
\*  $v_0 = 23.527604275732916$   
\* MSE = 0.14959320943387416  
\* iterations = 500

---

DataFrame n.5. Scene n.43/44

---

We have 4 time intervals inside [149.92, 150.72]

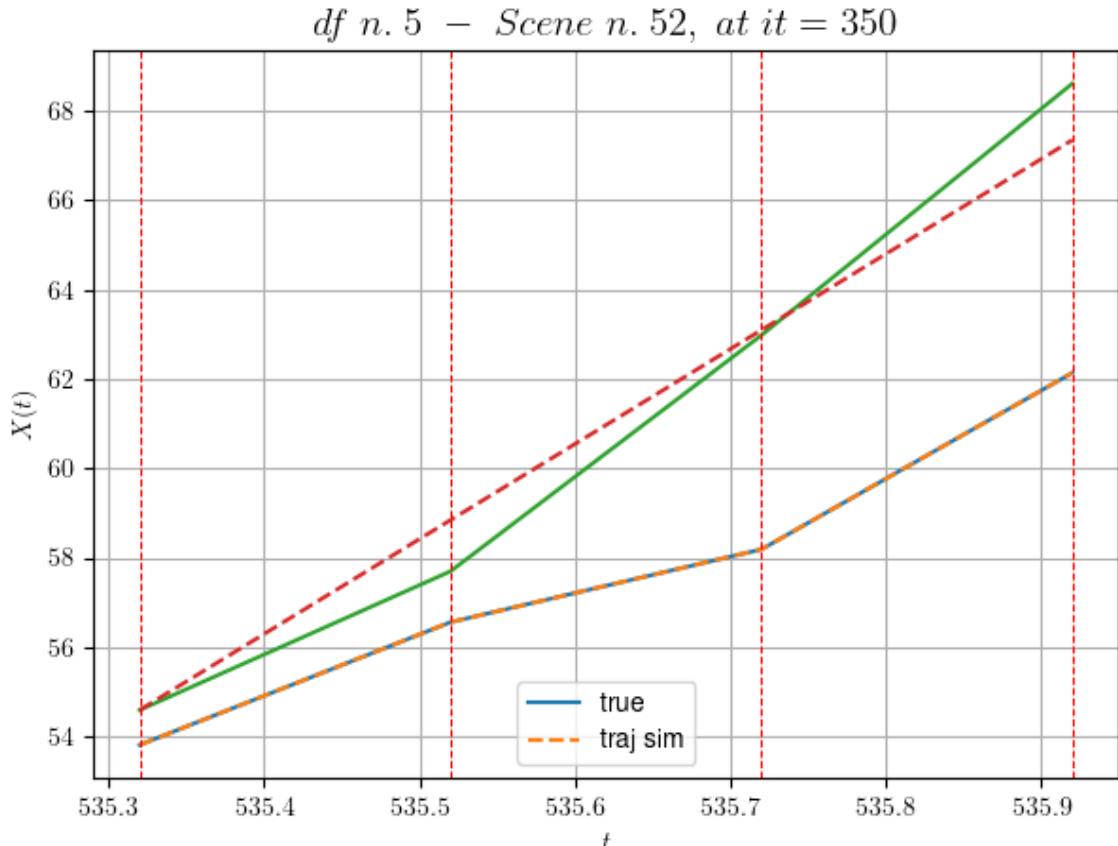


For scene 43/44:

\* After LR finder: LR\_NN=1e-05 with mse=6.114542101933273 at it=24  
\* v0 = 23.10299358436154  
\* MSE = 0.22924108748266178  
\* iterations = 500

DataFrame n.5. Scene n.44/44

We have 3 time intervals inside [535.32,535.92]



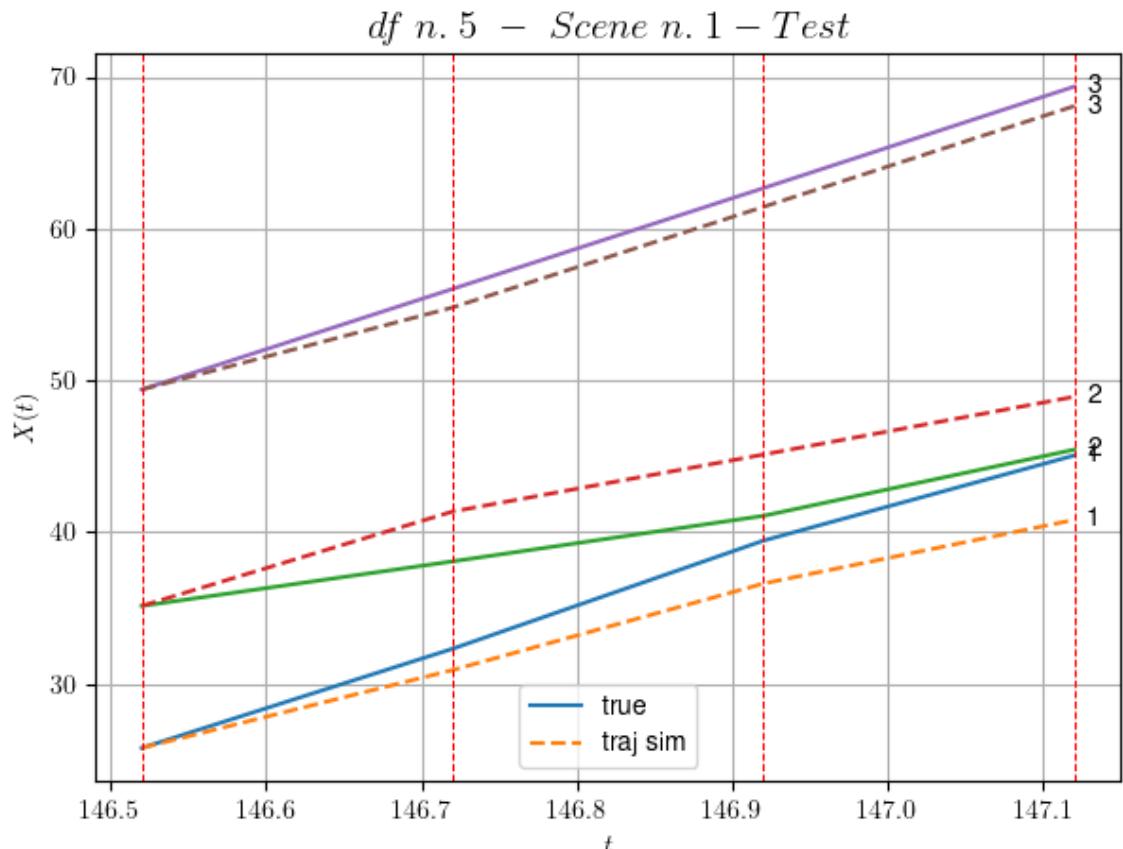
For scene 44/44:

\* After LR finder: LR\_NN=0.005 with mse=4.707853643765203 at it=24  
\* v0 = 21.278077667026533  
\* MSE = 0.3388135905785793  
\* iterations = 350

MSE train: 1.0838923418264739

Testing step. (22 scenes)

DataFrame n.5. Scene n.1/22

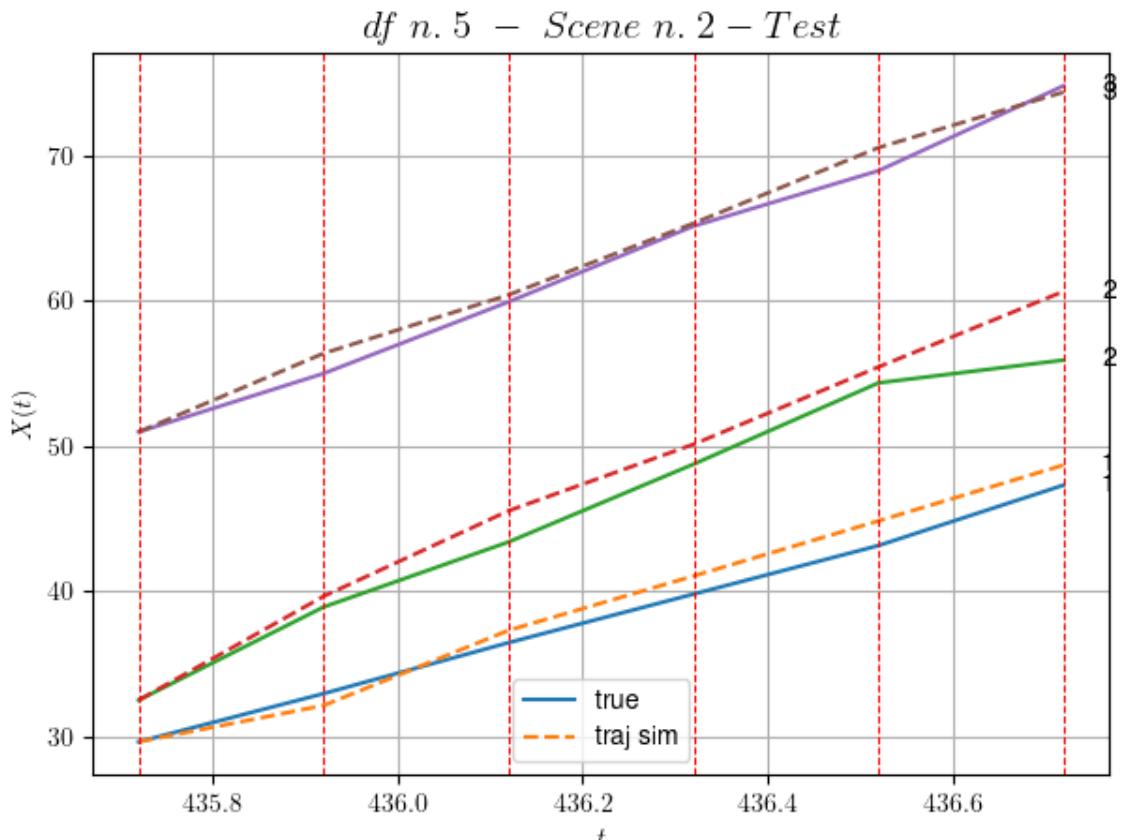


For scene 1/22:  
\* MSE = 5.995852312850116

---

---

DataFrame n.5. Scene n.2/22

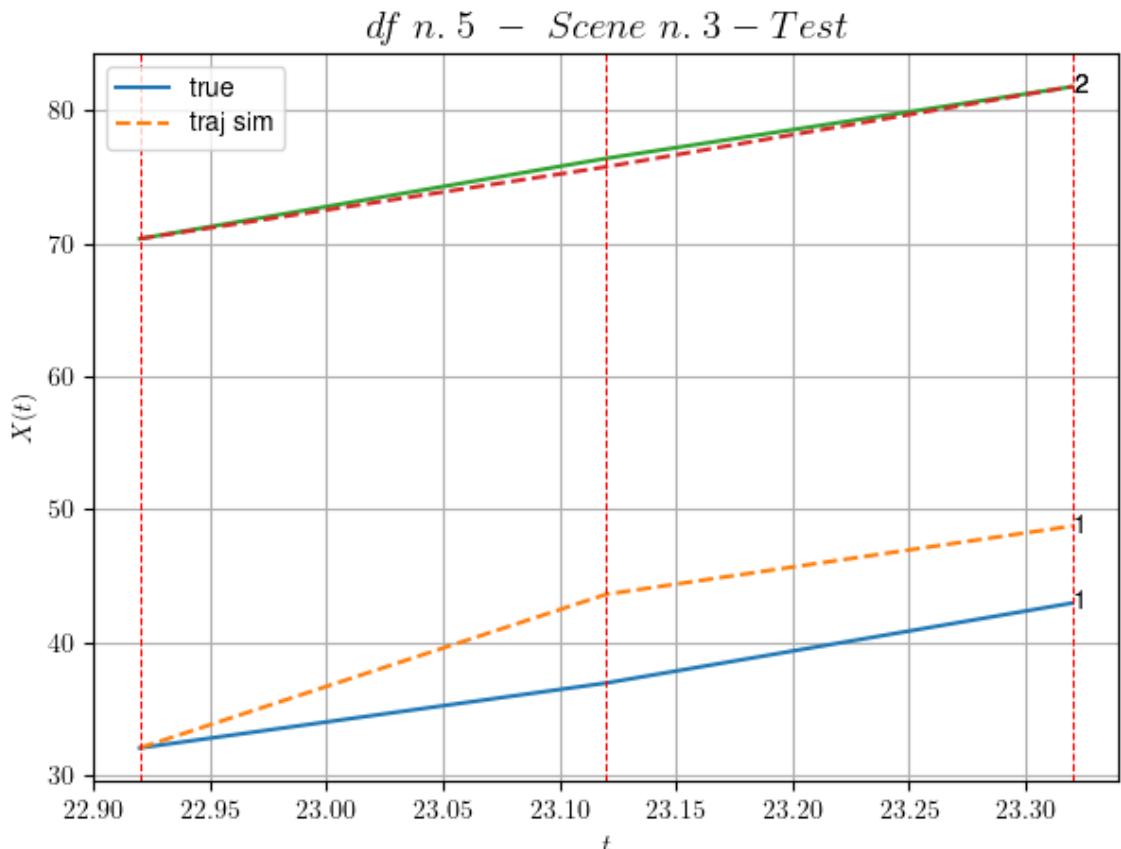


For scene 2/22:  
\* MSE = 2.4036150700149155

---

---

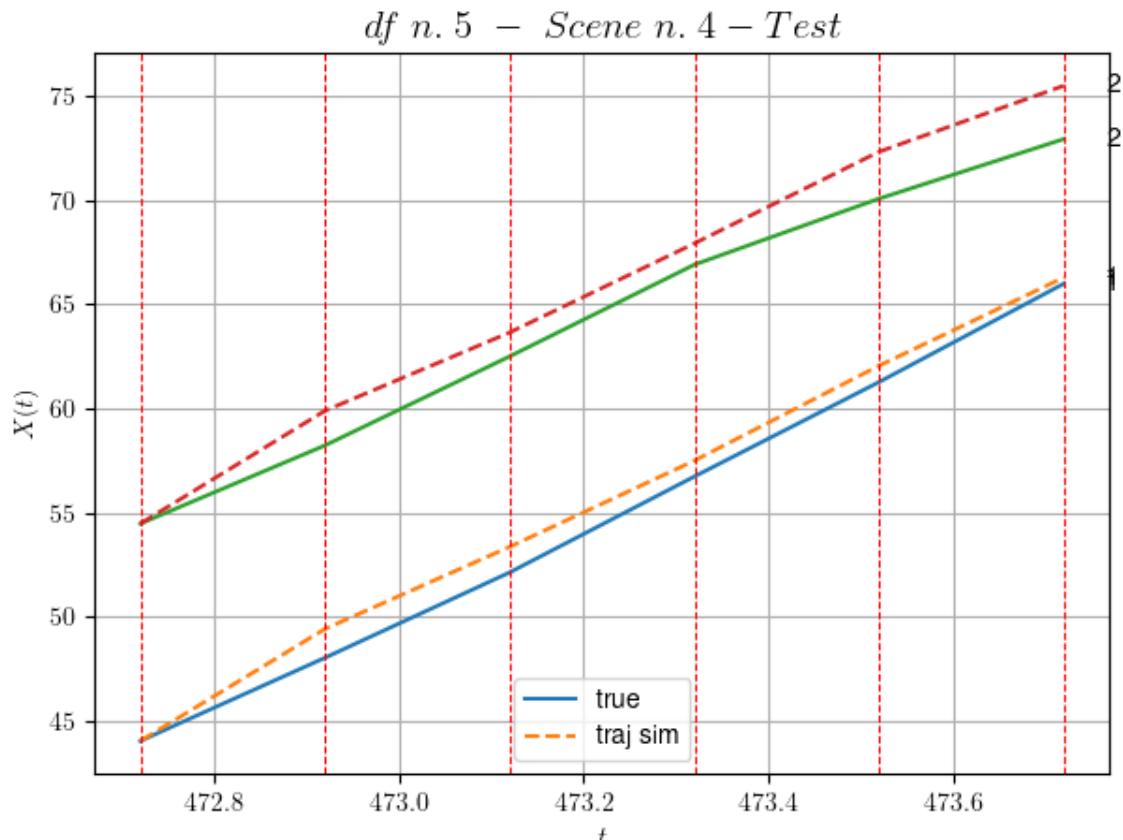
DataFrame n.5. Scene n.3/22



For scene 3/22:  
\* MSE = 13.089380726924224

---

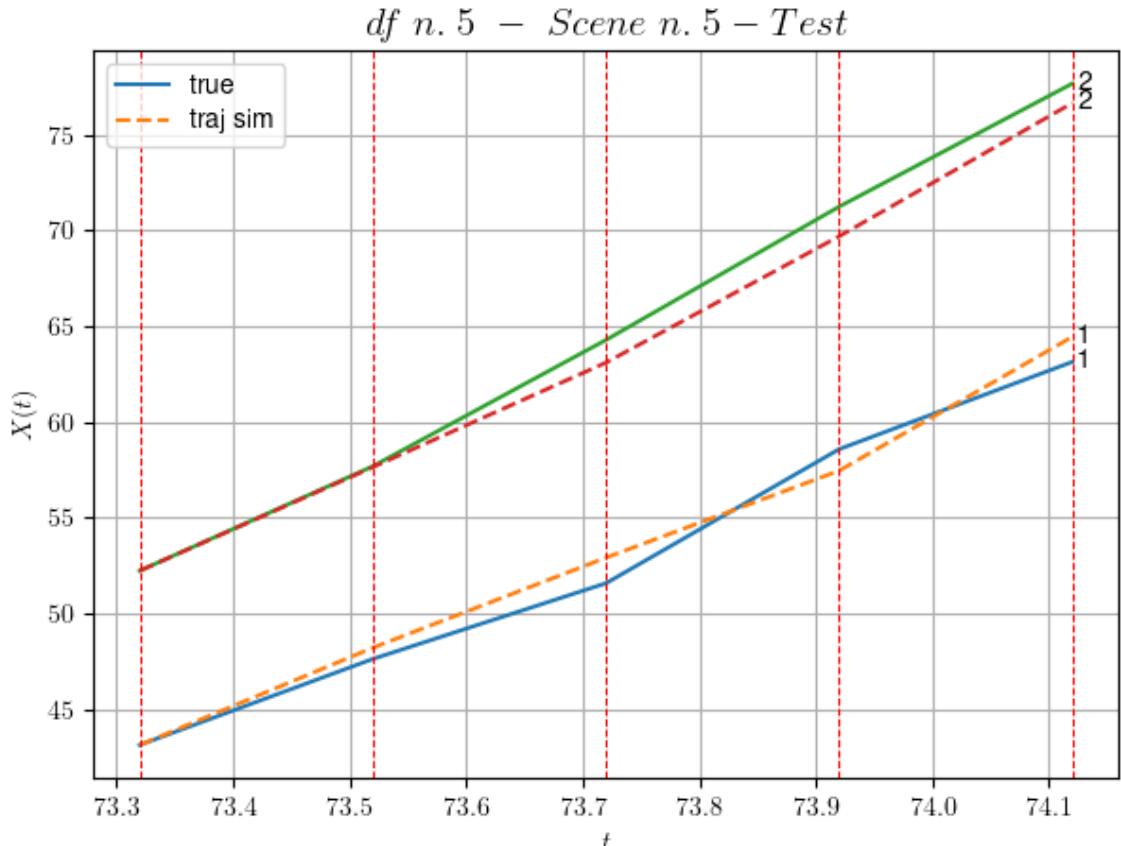
DataFrame n.5. Scene n.4/22



For scene 4/22:  
\* MSE = 1.7824656920955675

---

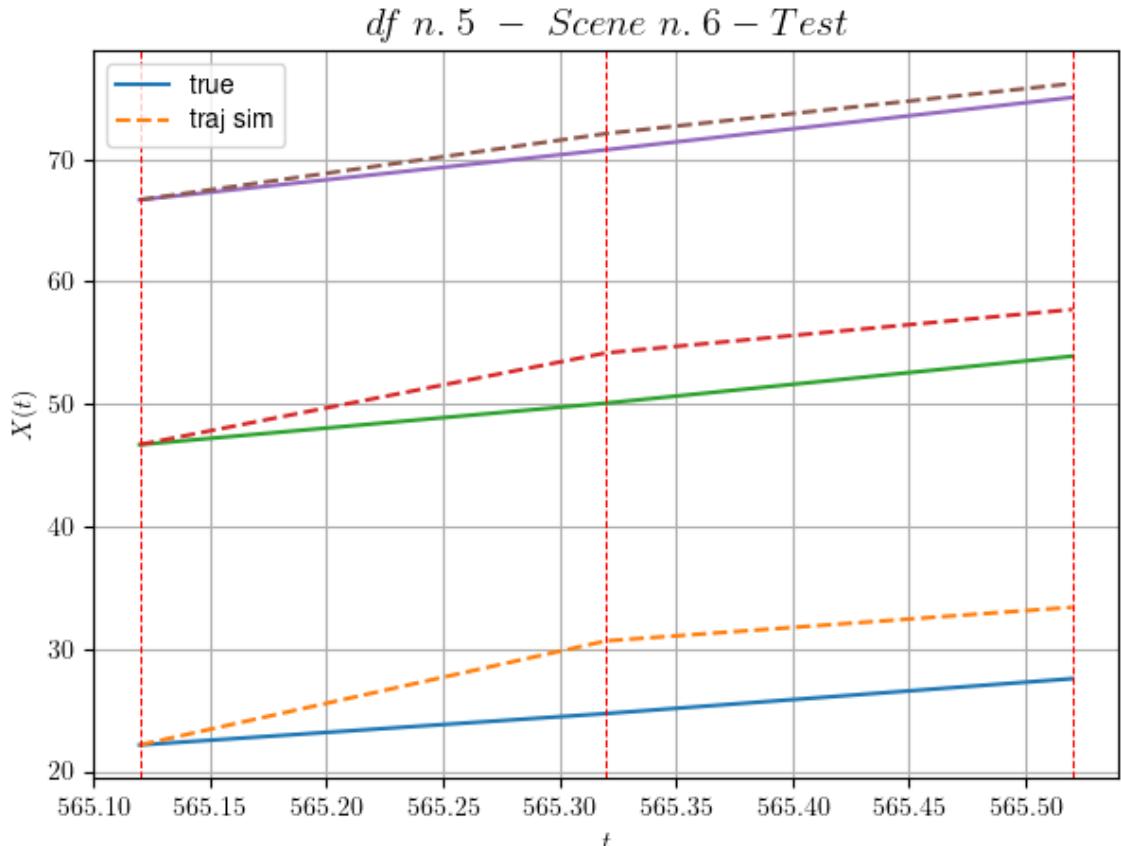
DataFrame n.5. Scene n.5/22



For scene 5/22:  
\* MSE = 0.9934362392115721

---

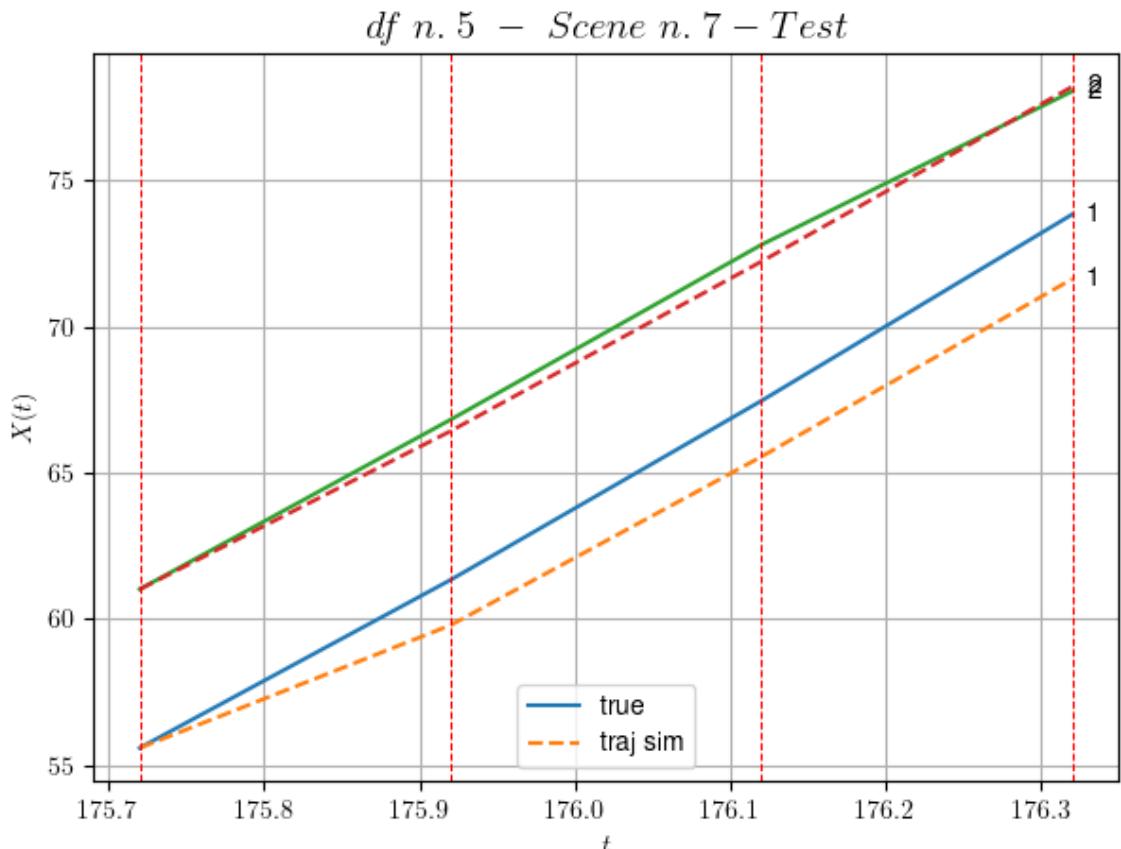
DataFrame n.5. Scene n.6/22



For scene 6/22:  
\* MSE = 11.518405696856439

---

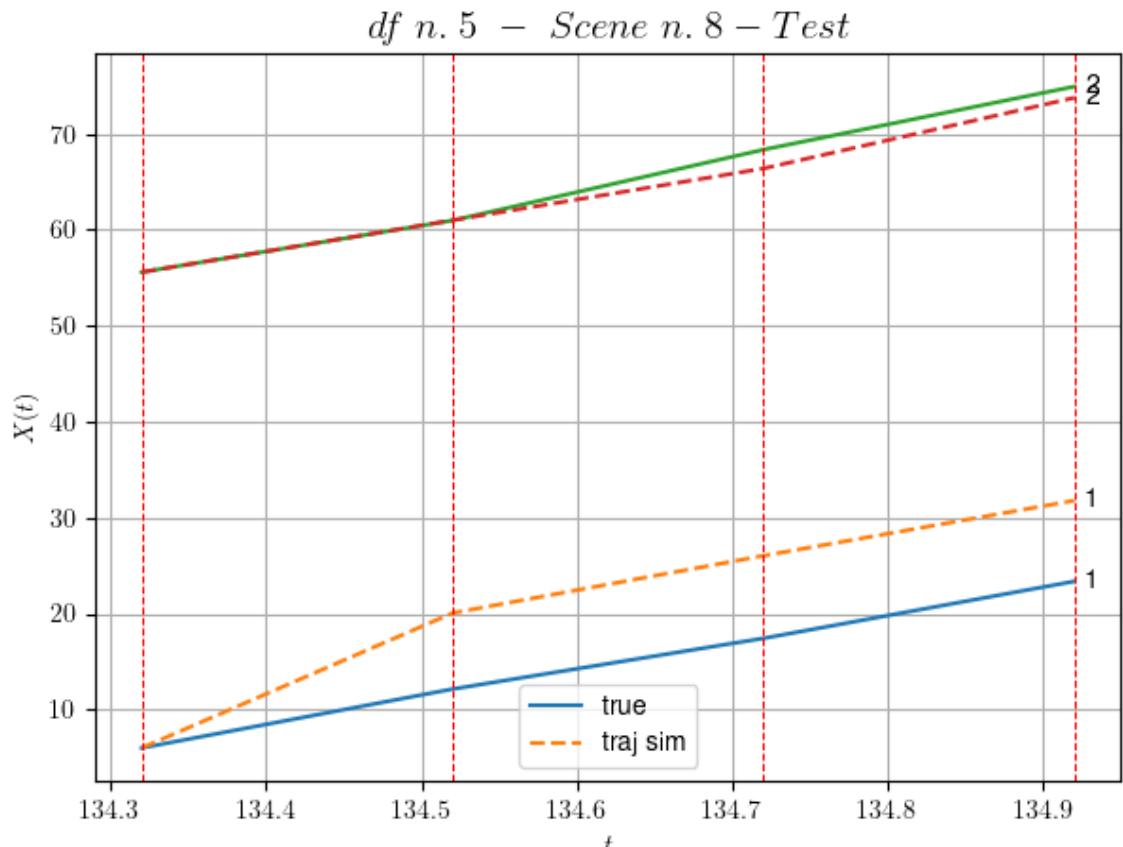
DataFrame n.5. Scene n.7/22



For scene 7/22:  
\* MSE = 1.4305324177169785

---

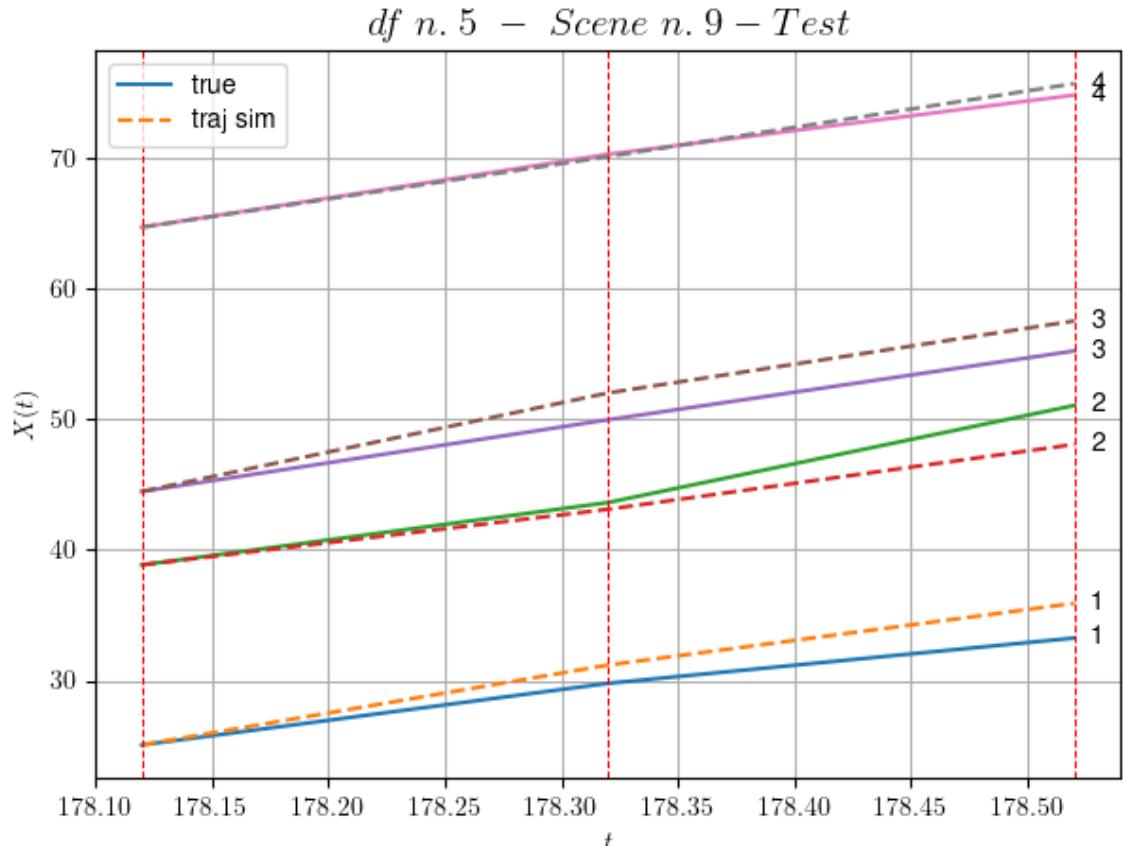
DataFrame n.5. Scene n.8/22



For scene 8/22:  
\* MSE = 26.602977046155548

---

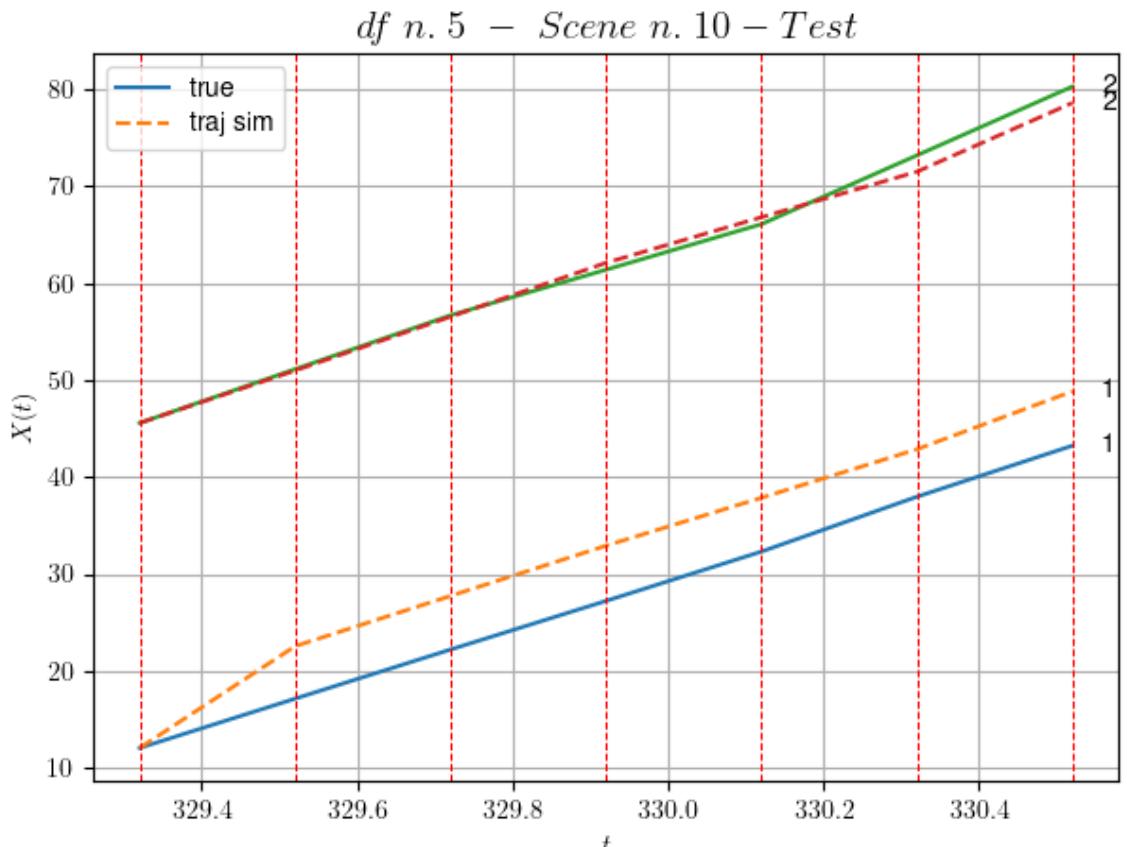
DataFrame n.5. Scene n.9/22



For scene 9/22:  
\* MSE = 2.375739351637587

---

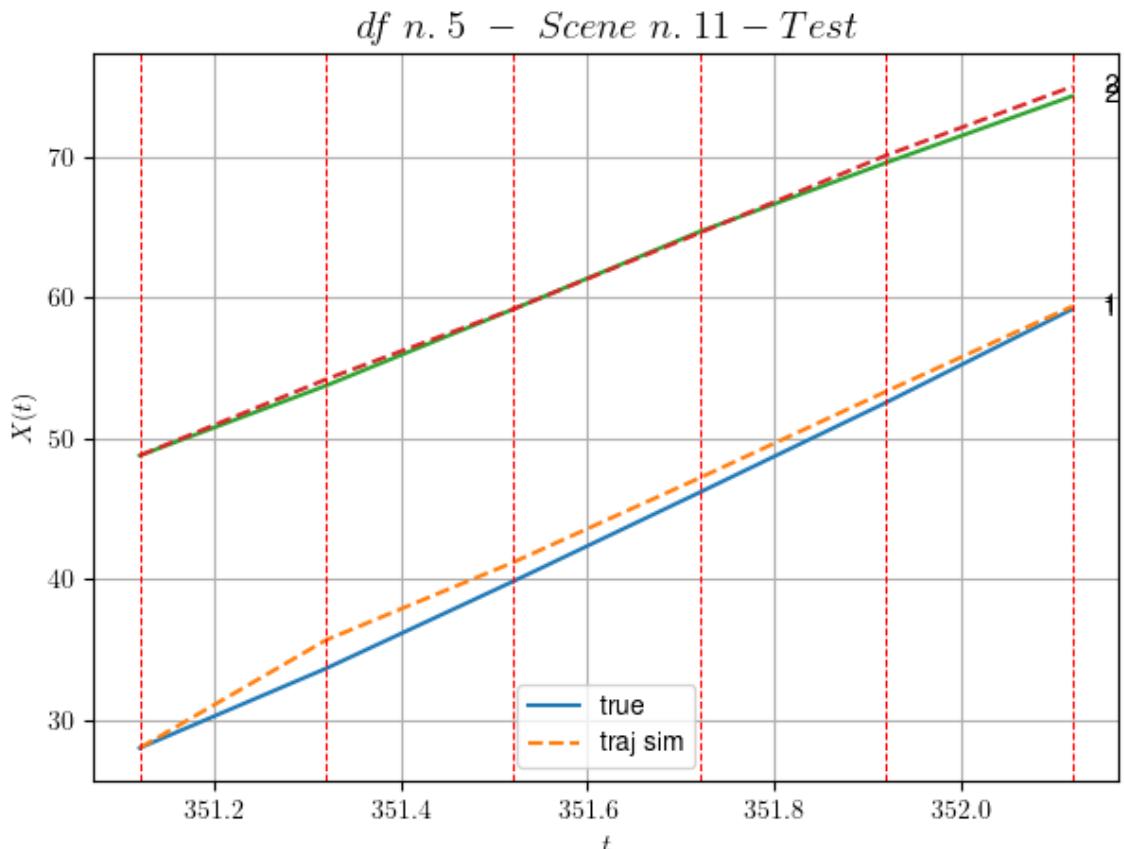
DataFrame n.5. Scene n.10/22



For scene 10/22:  
\* MSE = 13.22117563526598

---

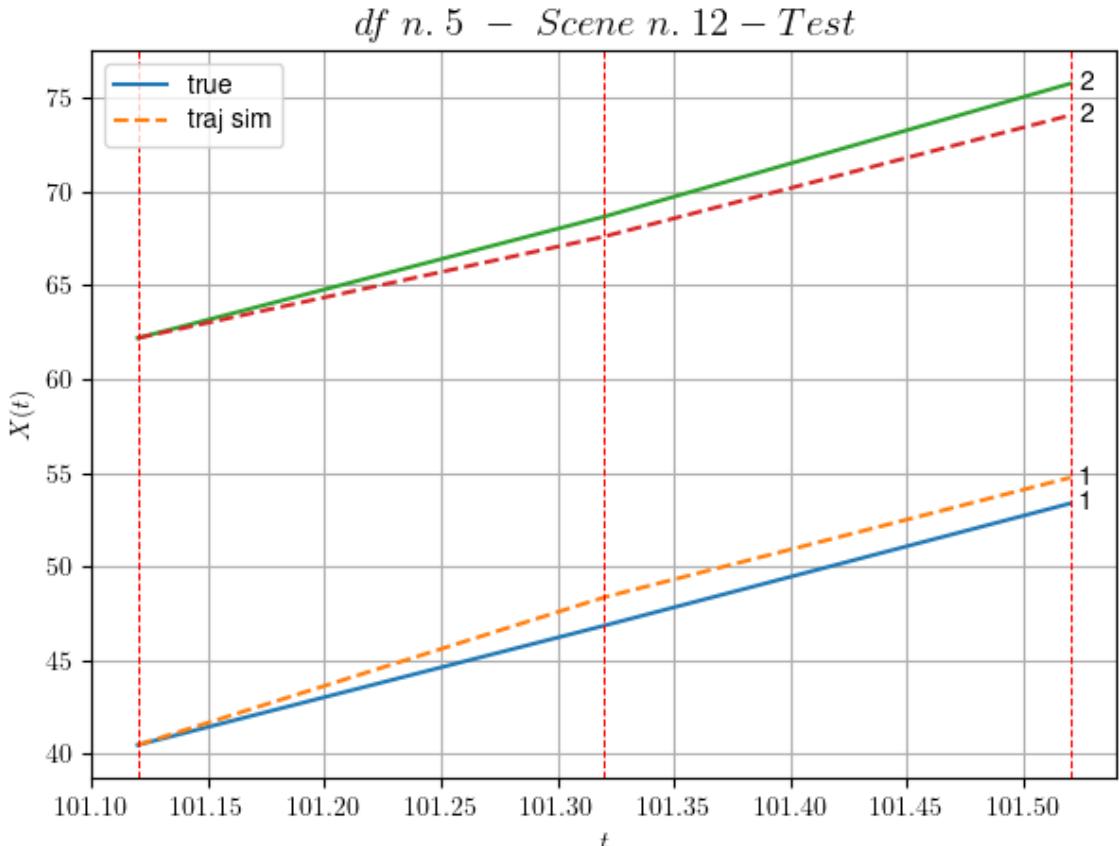
DataFrame n.5. Scene n.11/22



For scene 11/22:  
\* MSE = 0.7105267520604464

---

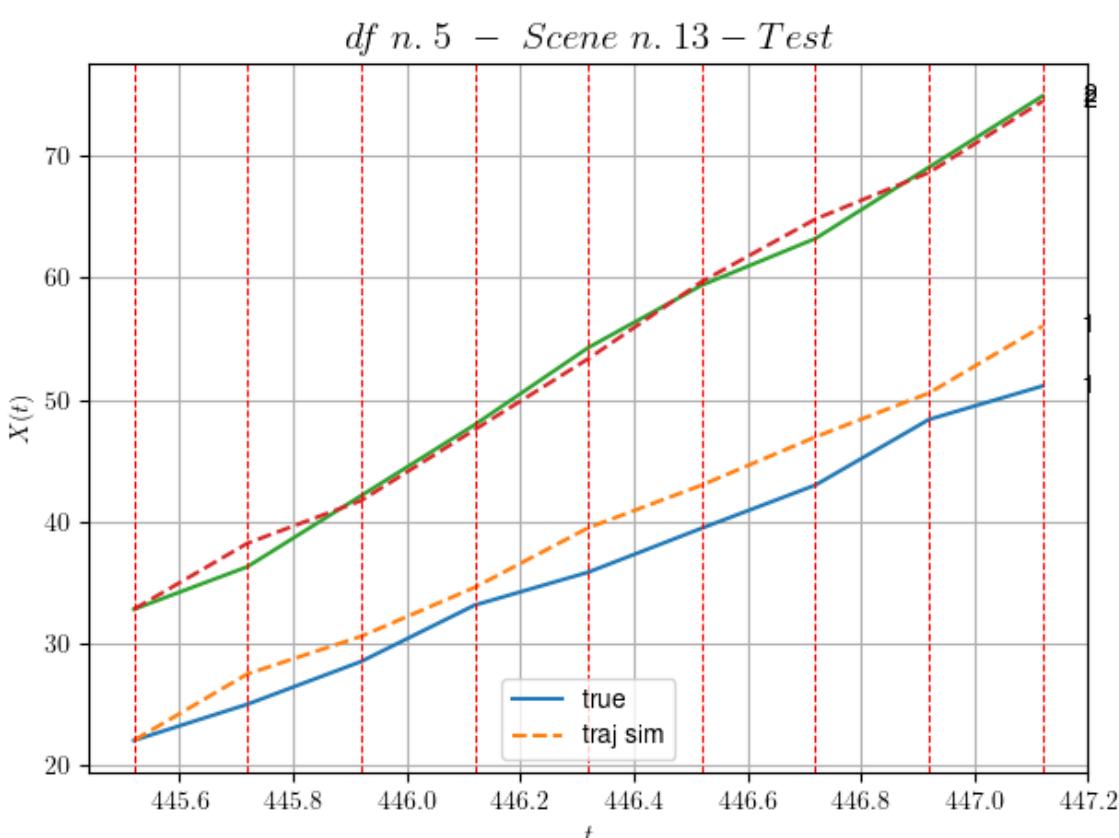
DataFrame n.5. Scene n.12/22



For scene 12/22:  
\* MSE = 1.3585643402860799

---

DataFrame n.5. Scene n.13/22

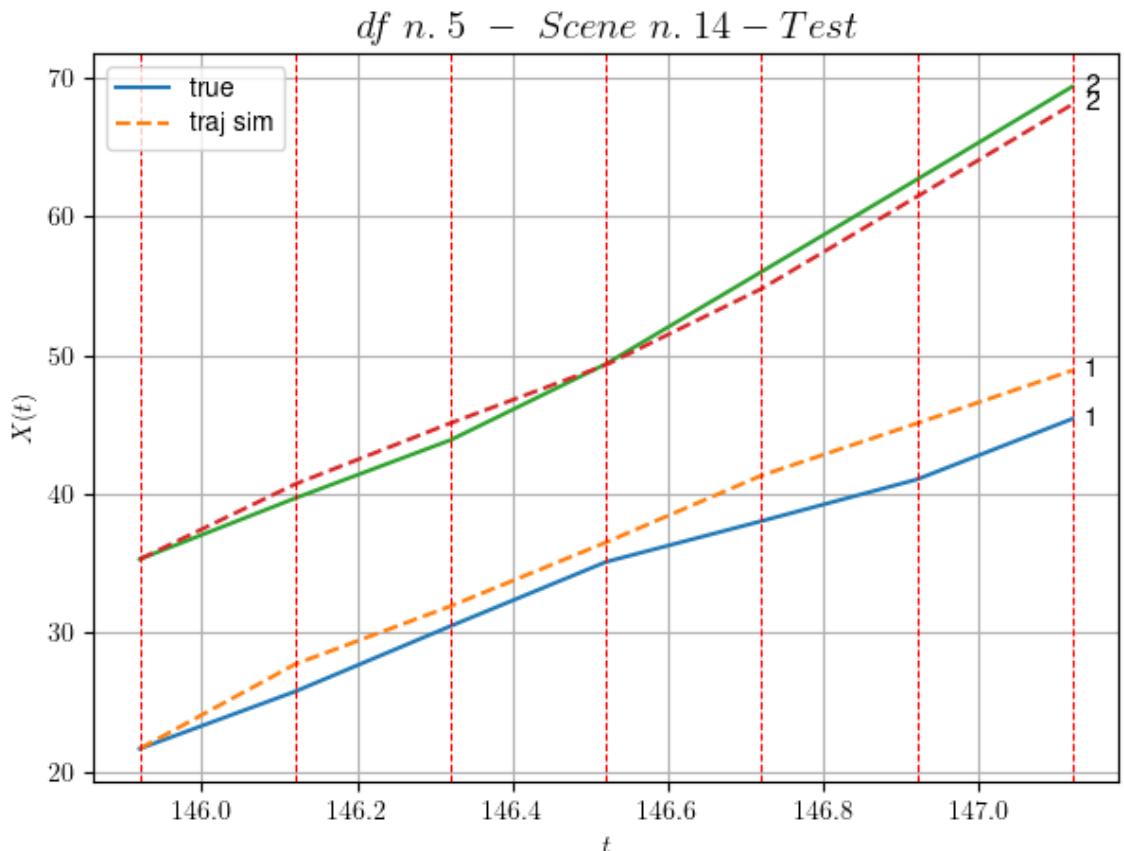


For scene 13/22:  
\* MSE = 5.018191688615687

---

---

DataFrame n.5. Scene n.14/22

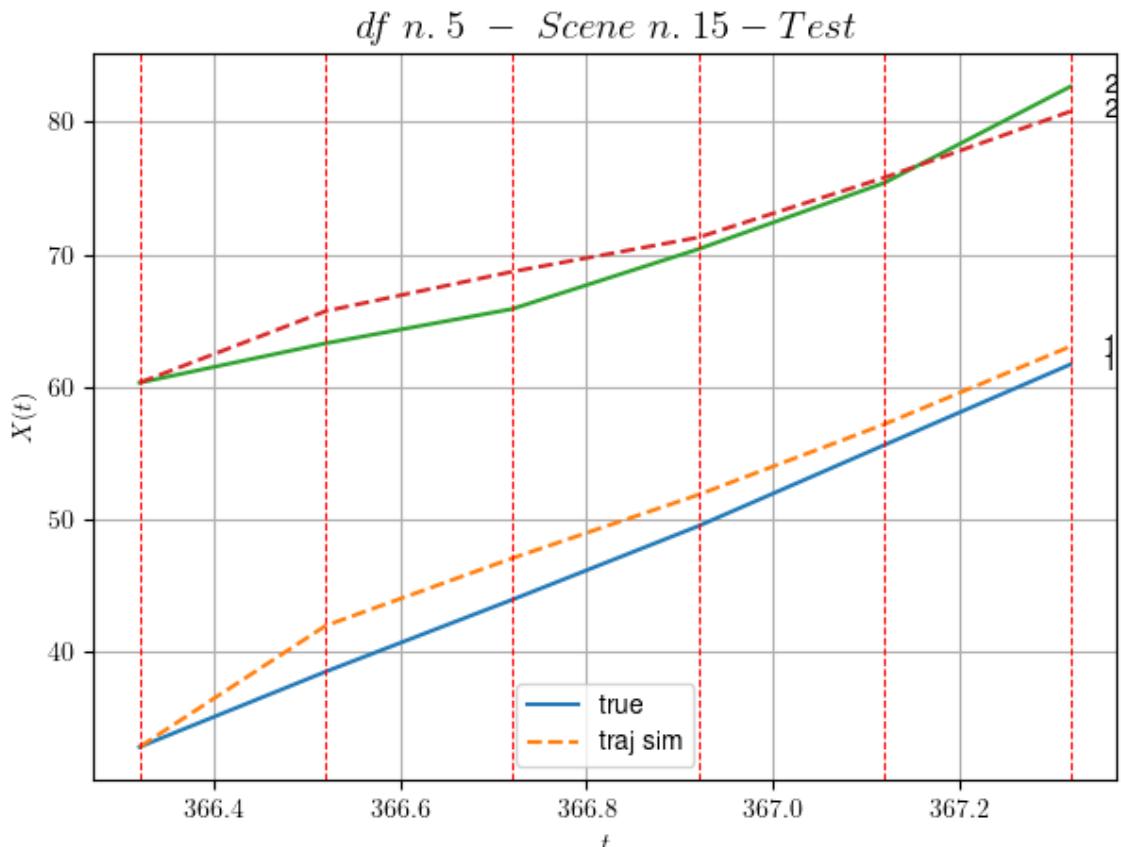


For scene 14/22:  
\* MSE = 3.88301218497097

---

---

DataFrame n.5. Scene n.15/22

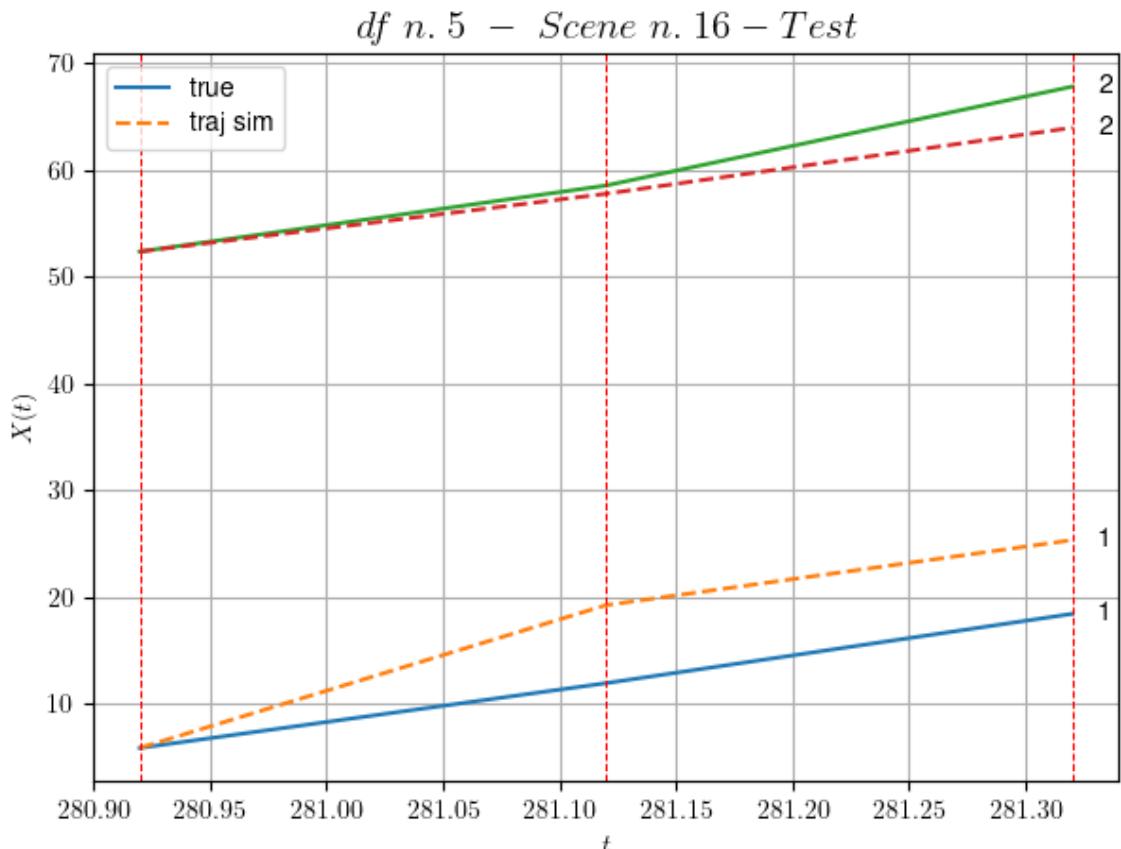


For scene 15/22:  
\* MSE = 4.1806336032970695

---

---

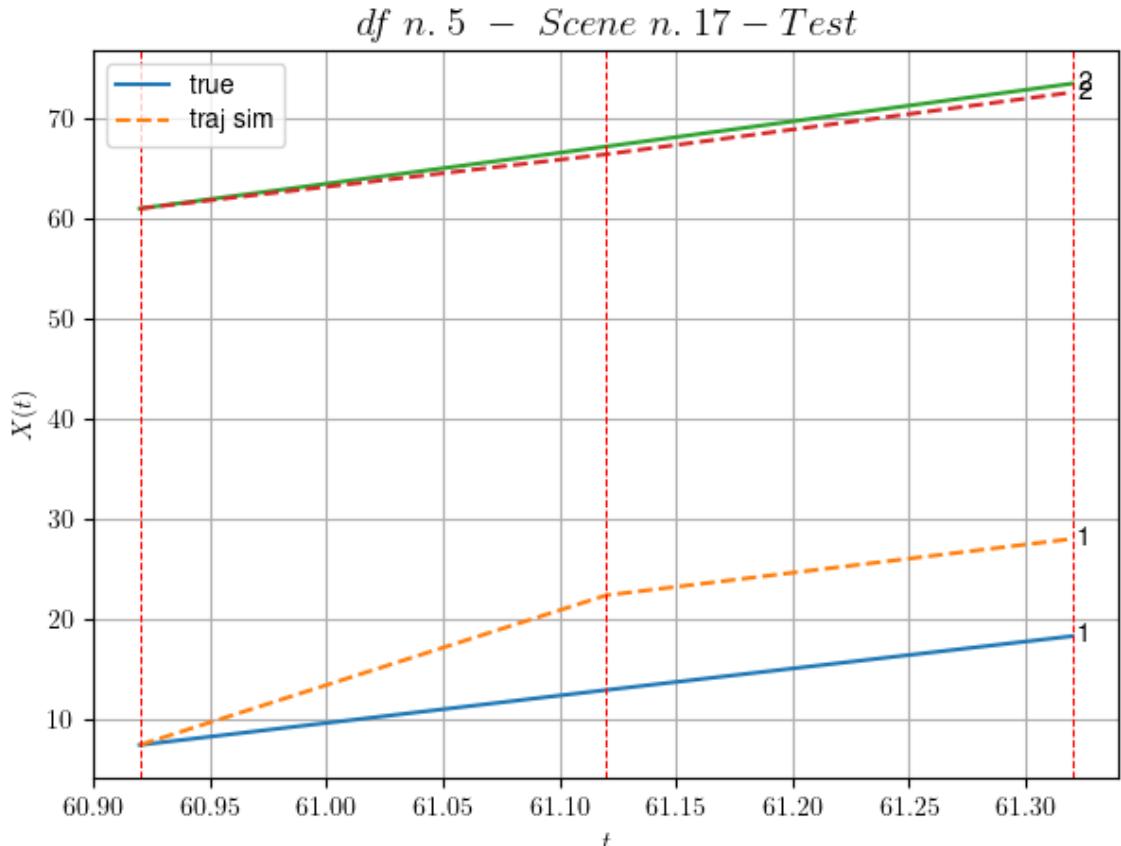
DataFrame n.5. Scene n.16/22



For scene 16/22:  
\* MSE = 19.396034163574612

---

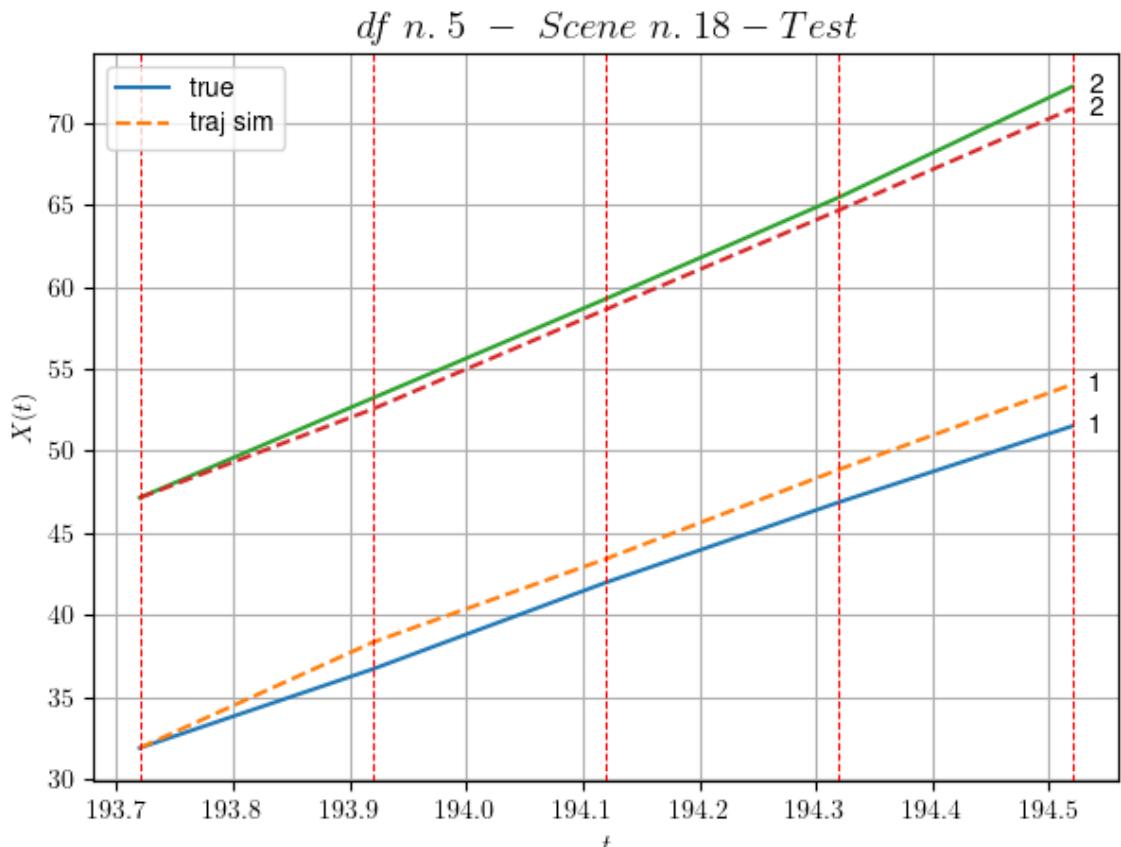
DataFrame n.5. Scene n.17/22



For scene 17/22:  
\* MSE = 30.855645076886532

---

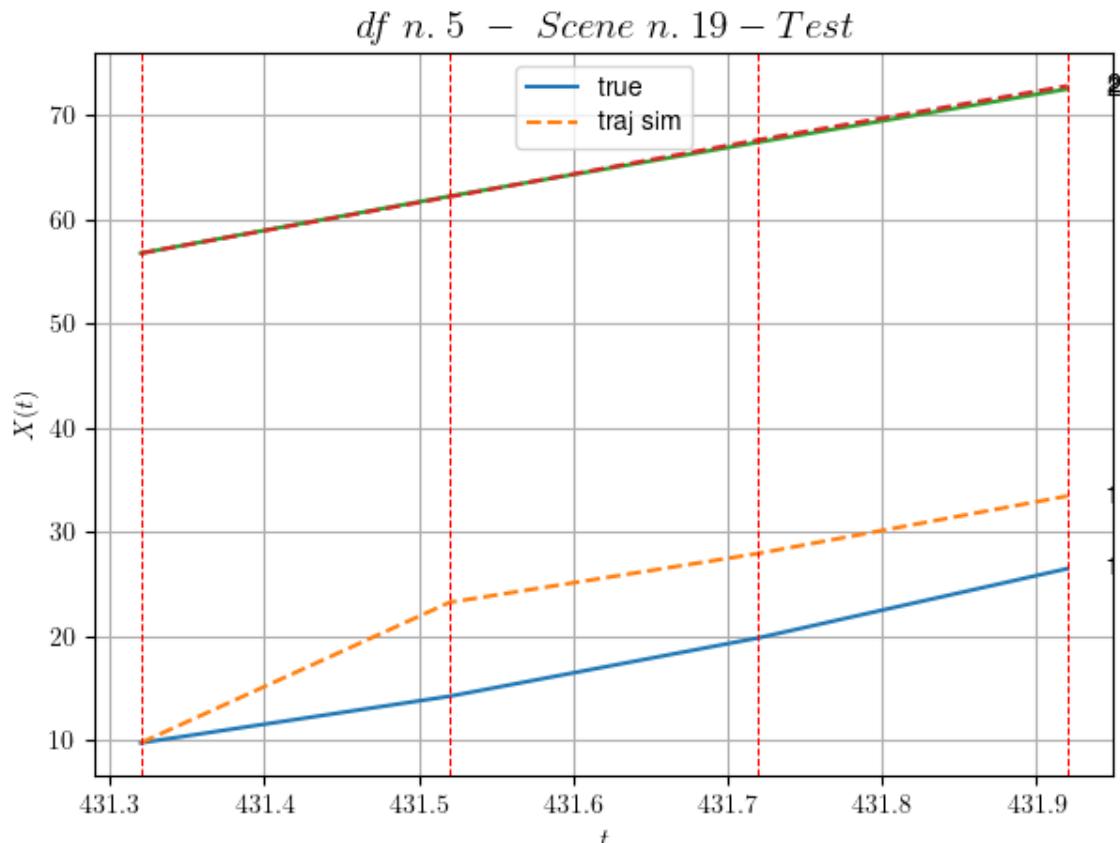
DataFrame n.5. Scene n.18/22



For scene 18/22:  
\* MSE = 1.8475684057252897

---

DataFrame n.5. Scene n.19/22

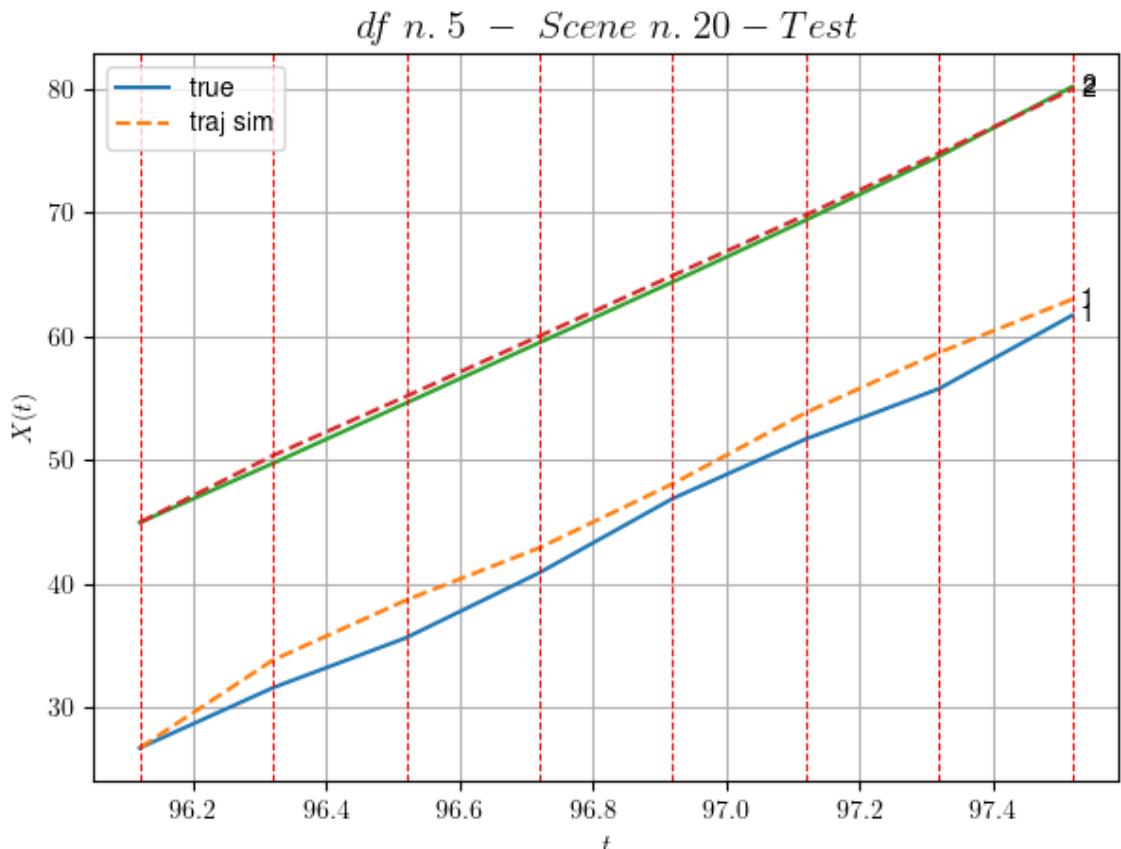


For scene 19/22:  
\* MSE = 24.463548765555448

---

---

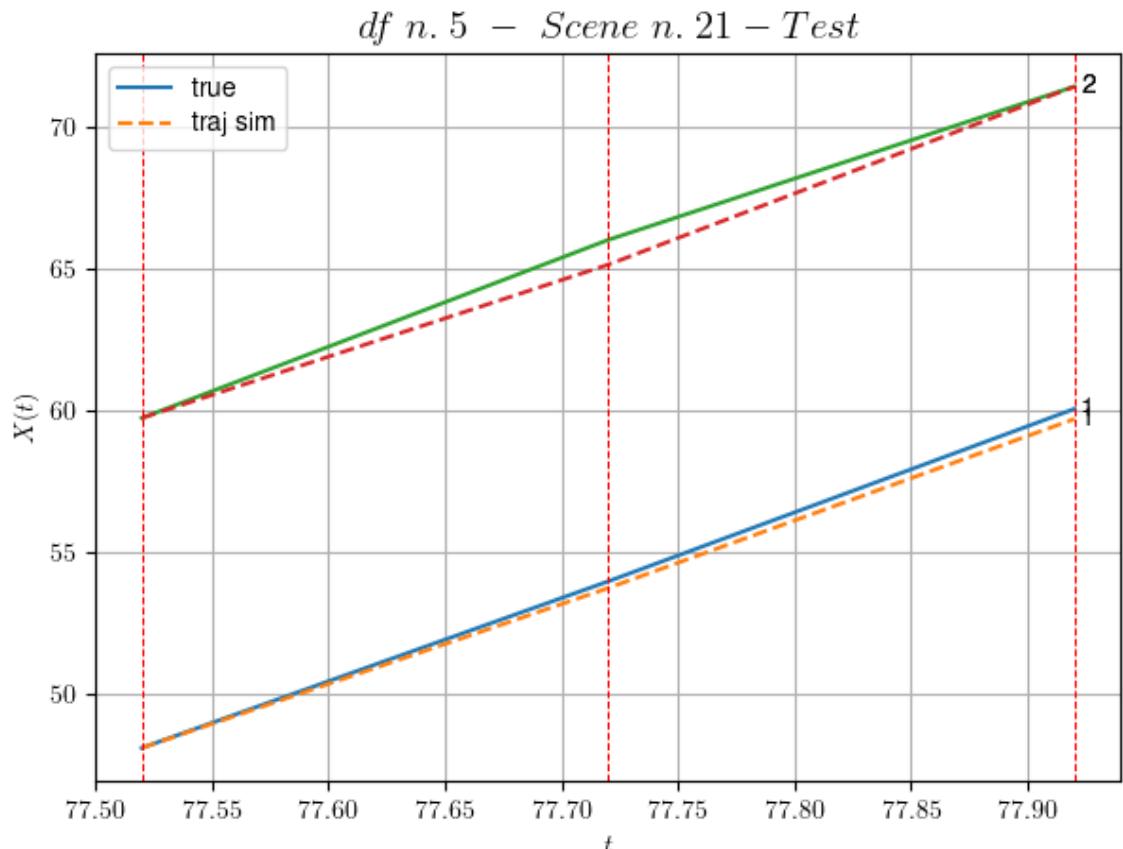
DataFrame n.5. Scene n.20/22



For scene 20/22:  
\* MSE = 2.2435080880602567

---

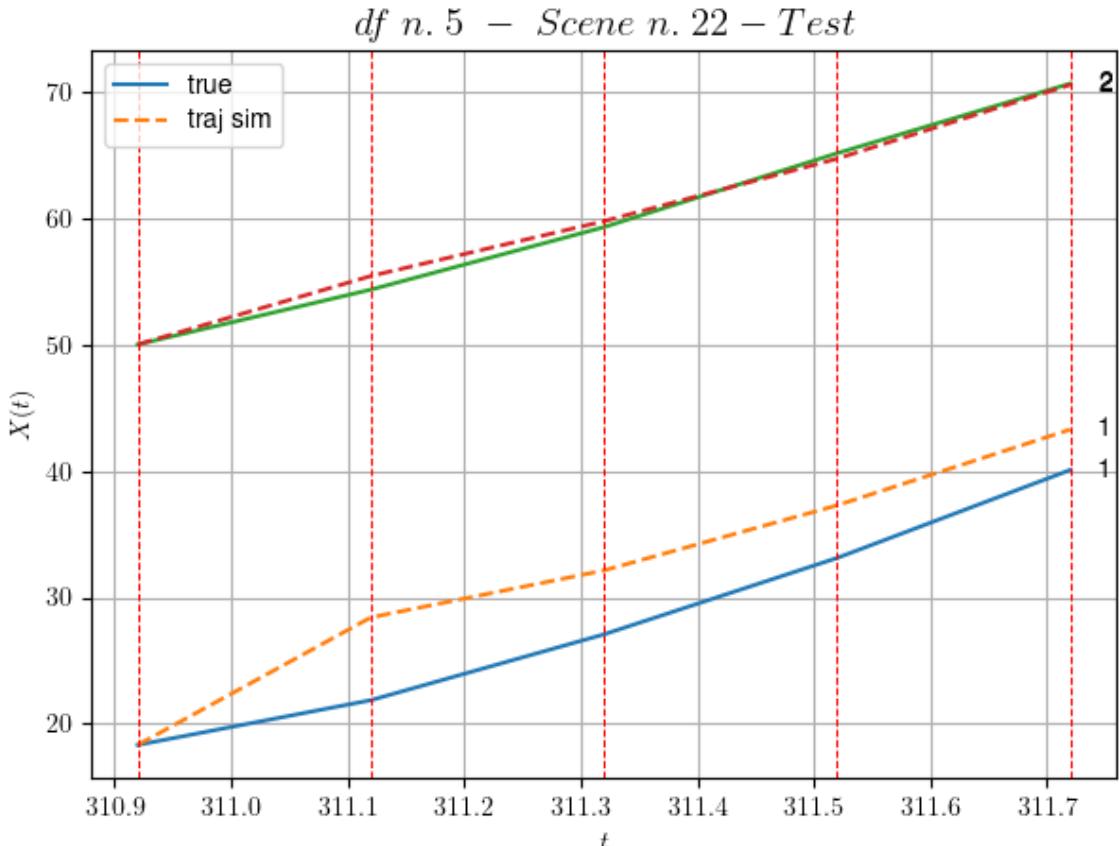
DataFrame n.5. Scene n.21/22



For scene 21/22:  
\* MSE = 0.1580022939579243

---

DataFrame n.5. Scene n.22/22



For scene 22/22:  
 \* MSE = 9.744833762198498

---



---

MSE test: 8.3306204233599

---



---

Summing up:  
 \* MSE train: 1.0838923418264739  
 \* MSE test: 8.3306204233599

---



---

Analyzing 6/10 dfs.

In DataFrame n.6 we have 52 scenes.

To train the model we use 34 scenes, the remaining 18 to test the model.

Training step. (34 scenes)

---



---

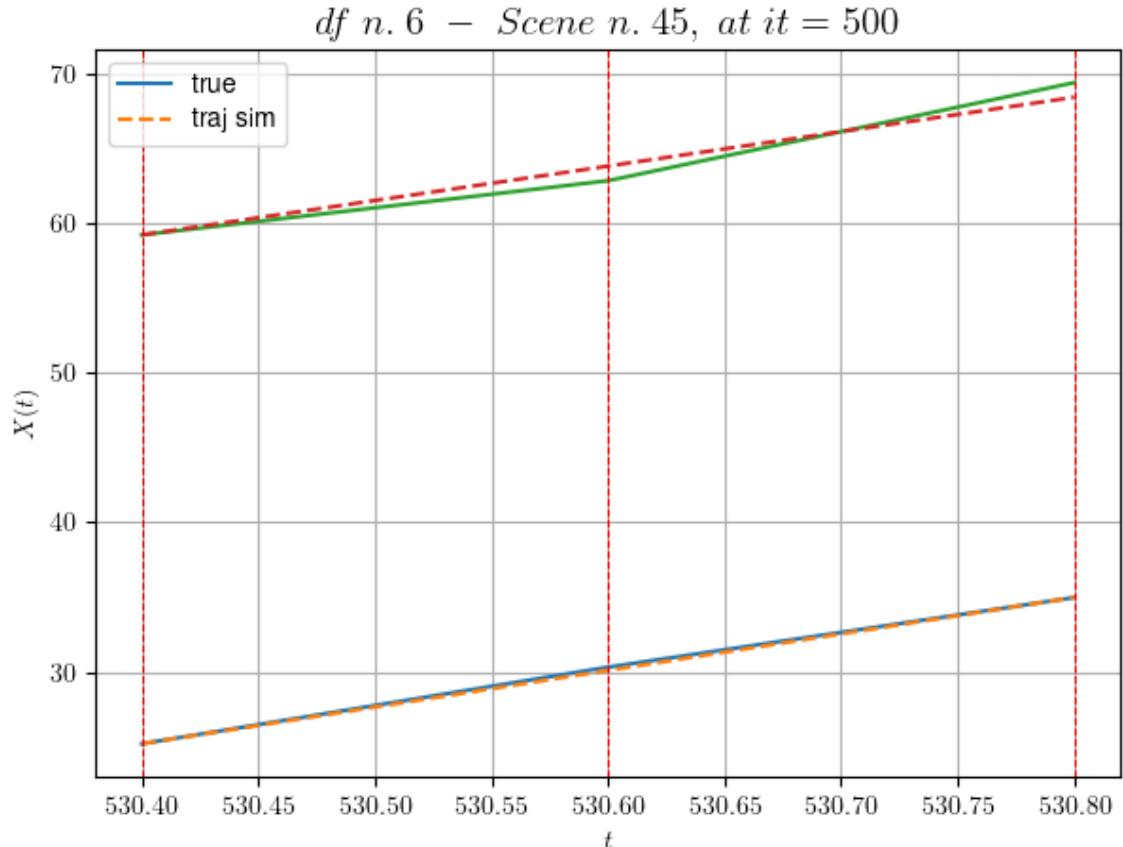
DataFrame n.6. Scene n.1/34

---



---

We have 2 time intervals inside [530.40, 530.80]



For scene 1/34:

\* After LR finder: LR\_NN=5e-05 with mse=1.5019433257190846

at it=24

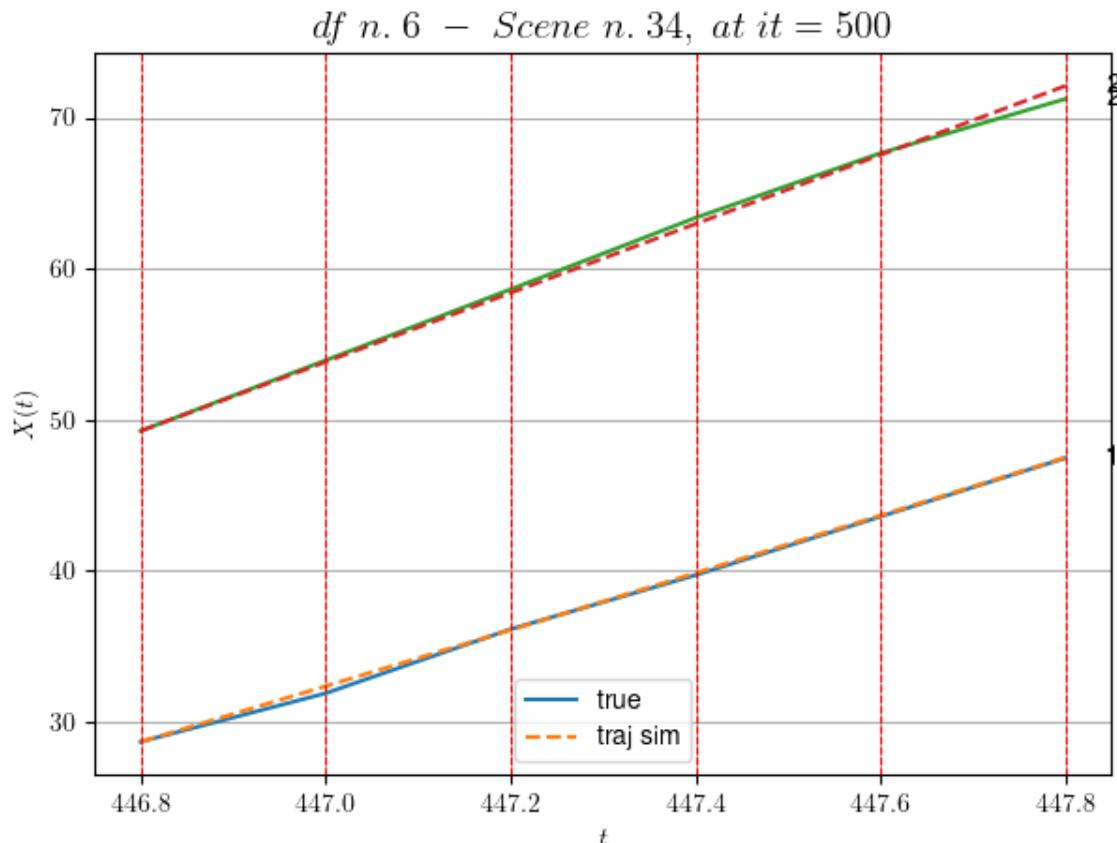
\* v0 = 22.991928031471048

\* MSE = 0.2950070958127038

\* iterations = 500

DataFrame n.6. Scene n.2/34

We have 5 time intervals inside [446.80,447.80]



---

For scene 2/34:

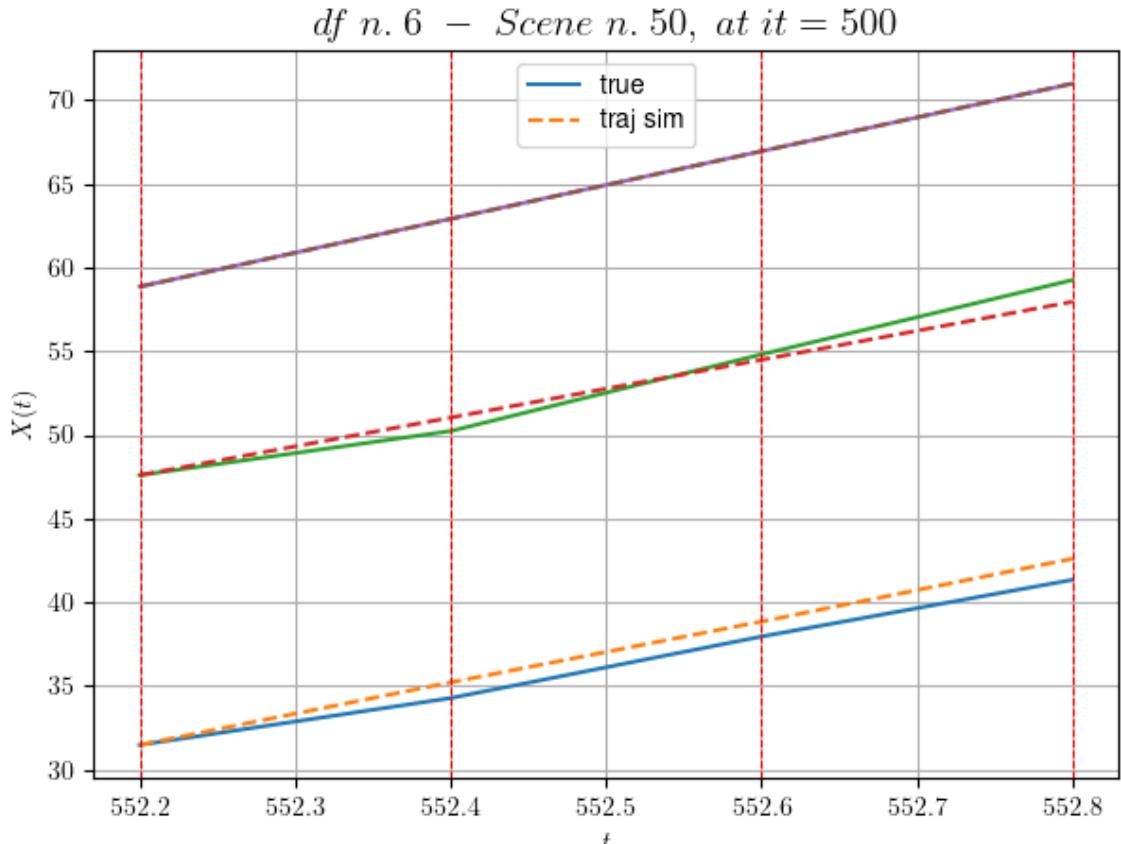
- \* After LR finder:  $\text{LR\_NN}=5\text{e-}05$  with  $\text{mse}=9.99271391701538$  at  $\text{it}=24$
- \*  $v_0 = 22.841482925266813$
- \*  $\text{MSE} = 0.10333271116074016$
- \* iterations = 500

---

DataFrame n.6. Scene n.3/34

---

We have 3 time intervals inside [552.20,552.80]

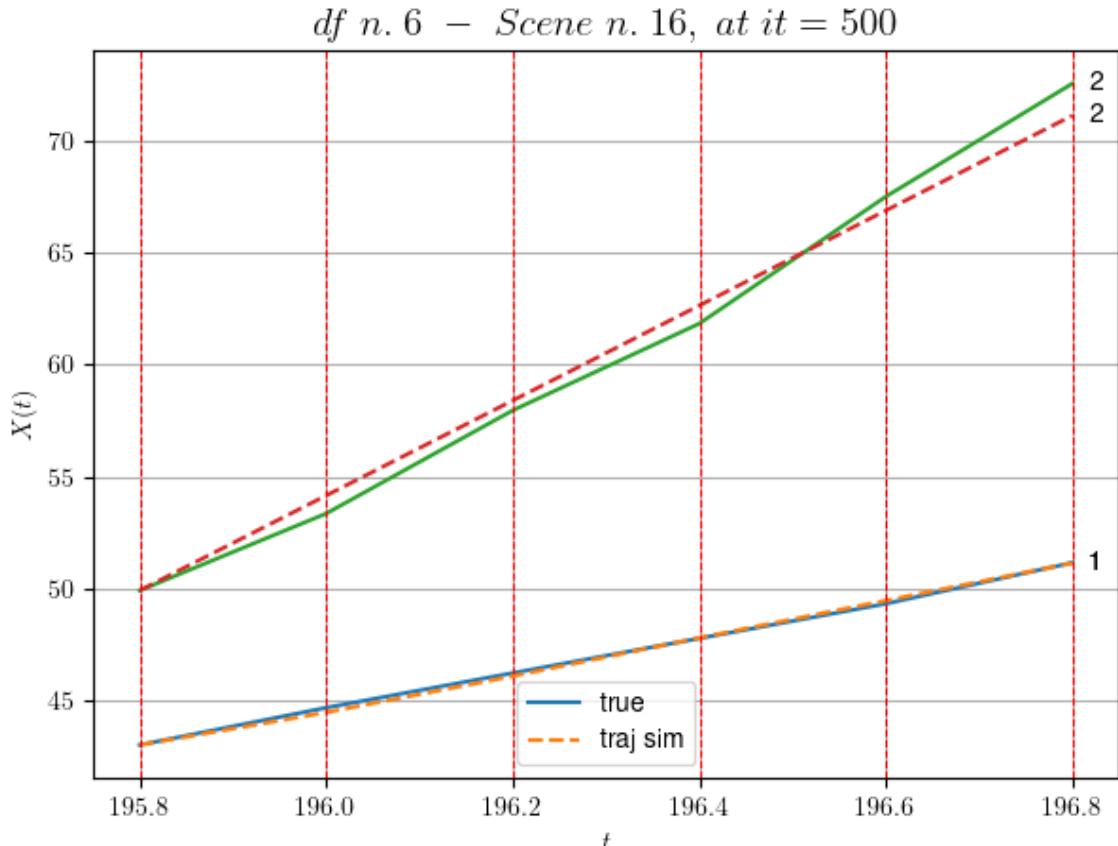


For scene 3/34:

\* After LR finder: LR\_NN=0.0001 with mse=5.864535428551574  
at it=24  
\* v0 = 20.233205039551752  
\* MSE = 0.47247794011801575  
\* iterations = 500

DataFrame n.6. Scene n.4/34

We have 5 time intervals inside [195.80,196.80]

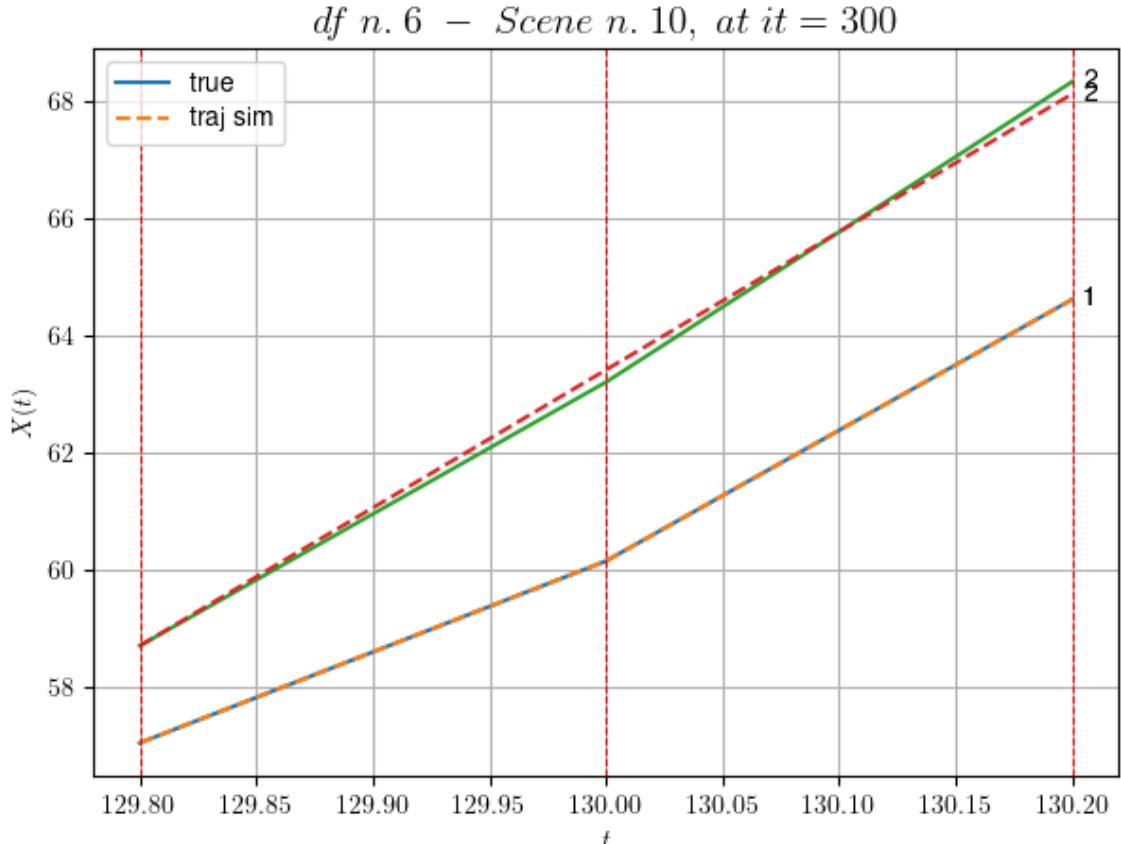


For scene 4/34:

\* After LR finder: LR\_NN=0.005 with mse=13.203674126844572  
at it=24  
\*  $v_0 = 21.237347440799663$   
\* MSE = 0.29568722449689505  
\* iterations = 500

DataFrame n.6. Scene n.5/34

We have 2 time intervals inside [129.80,130.20]



---

For scene 5/34:

\* After LR finder: LR\_NN=0.005 with mse=1.2899284489986902  
at it=24  
\* v0 = 23.601834328725797  
\* MSE = 0.013235109409541798  
\* iterations = 300

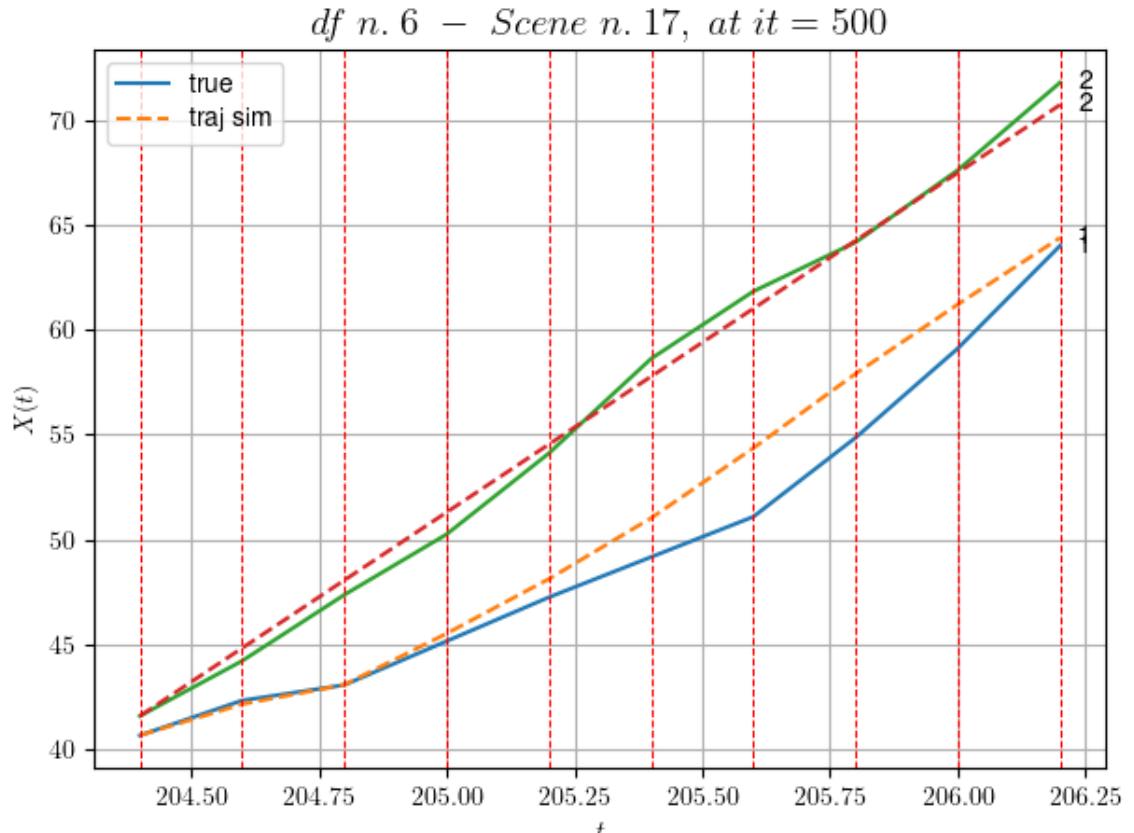
---

---

DataFrame n.6. Scene n.6/34

---

We have 9 time intervals inside [204.40,206.20]



---

For scene 6/34:

- \* After LR finder: LR\_NN=5e-05 with mse=106.11075442259553

at it=24

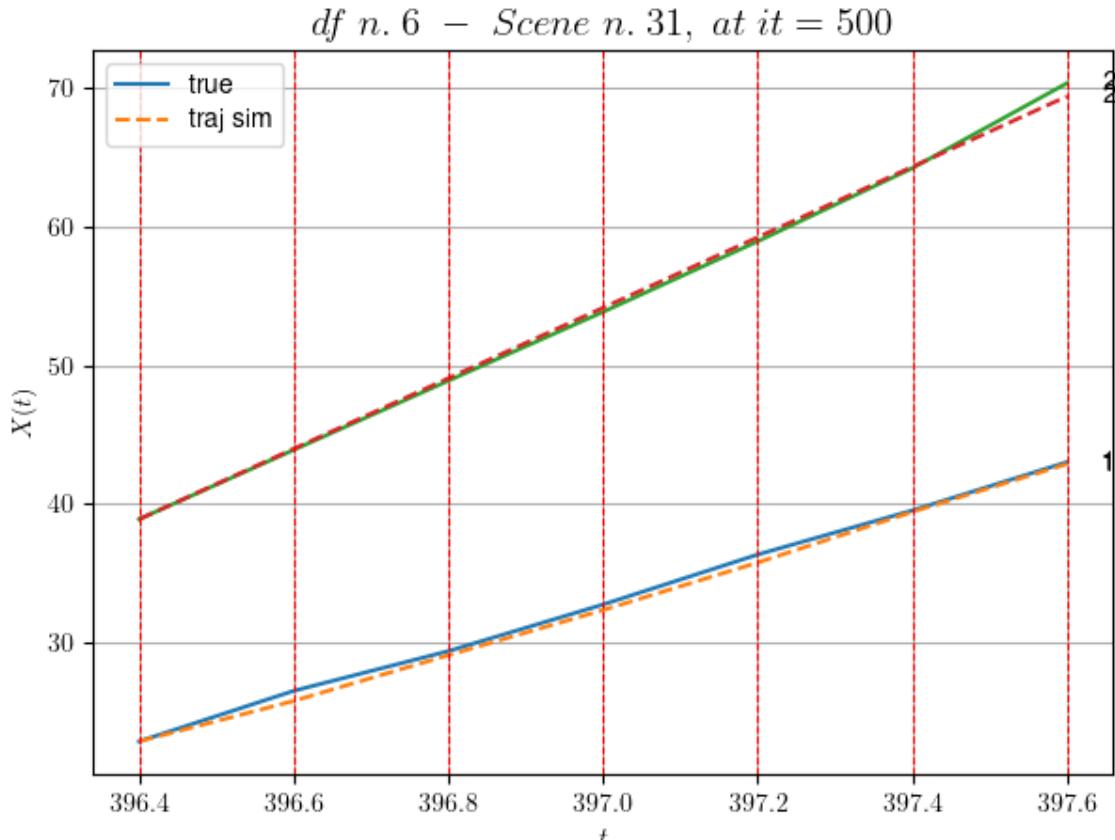
- \* v0 = 16.186070594949097
- \* MSE = 1.6805261191923213
- \* iterations = 500

---

DataFrame n.6. Scene n.7/34

---

We have 6 time intervals inside [396.40,397.60]



---

For scene 7/34:

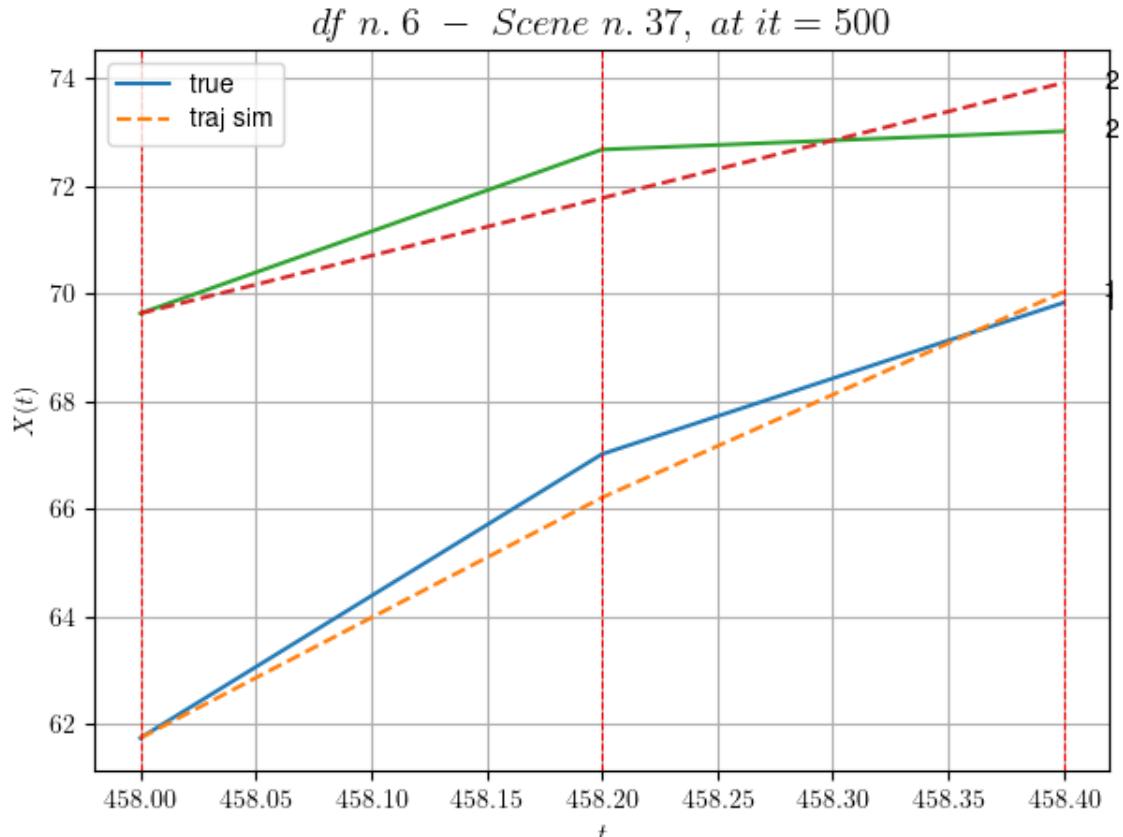
```
* After LR finder: LR_NN=0.001 with mse=5.326653708911851 at it=24
* v0 = 25.429850069096663
* MSE = 0.14954958963737308
* iterations = 500
```

---

DataFrame n.6. Scene n.8/34

---

We have 2 time intervals inside [458.00, 458.40]



---

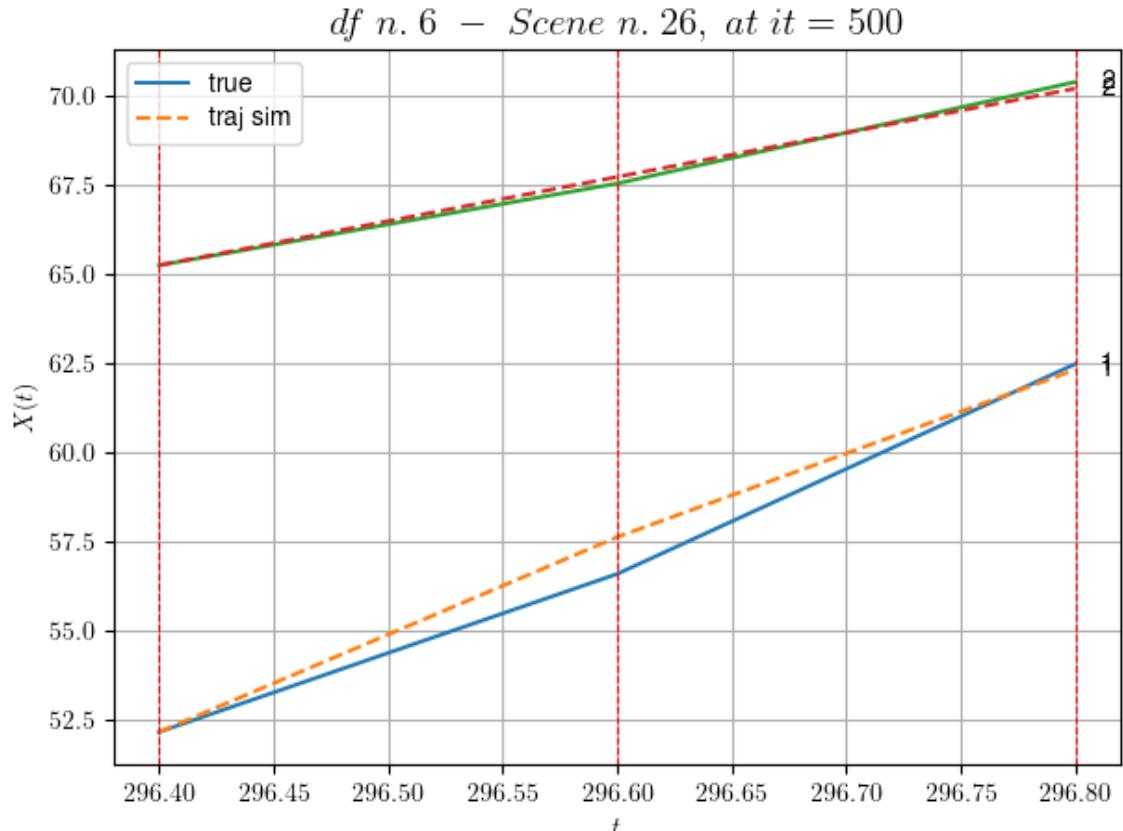
For scene 8/34:  
\* After LR finder: LR\_NN=0.0005 with mse=13.895350697760936  
at it=24  
\* v0 = 10.716650123126541  
\* MSE = 0.3855753268460511  
\* iterations = 500

---

DataFrame n.6. Scene n.9/34

---

We have 2 time intervals inside [296.40, 296.80]

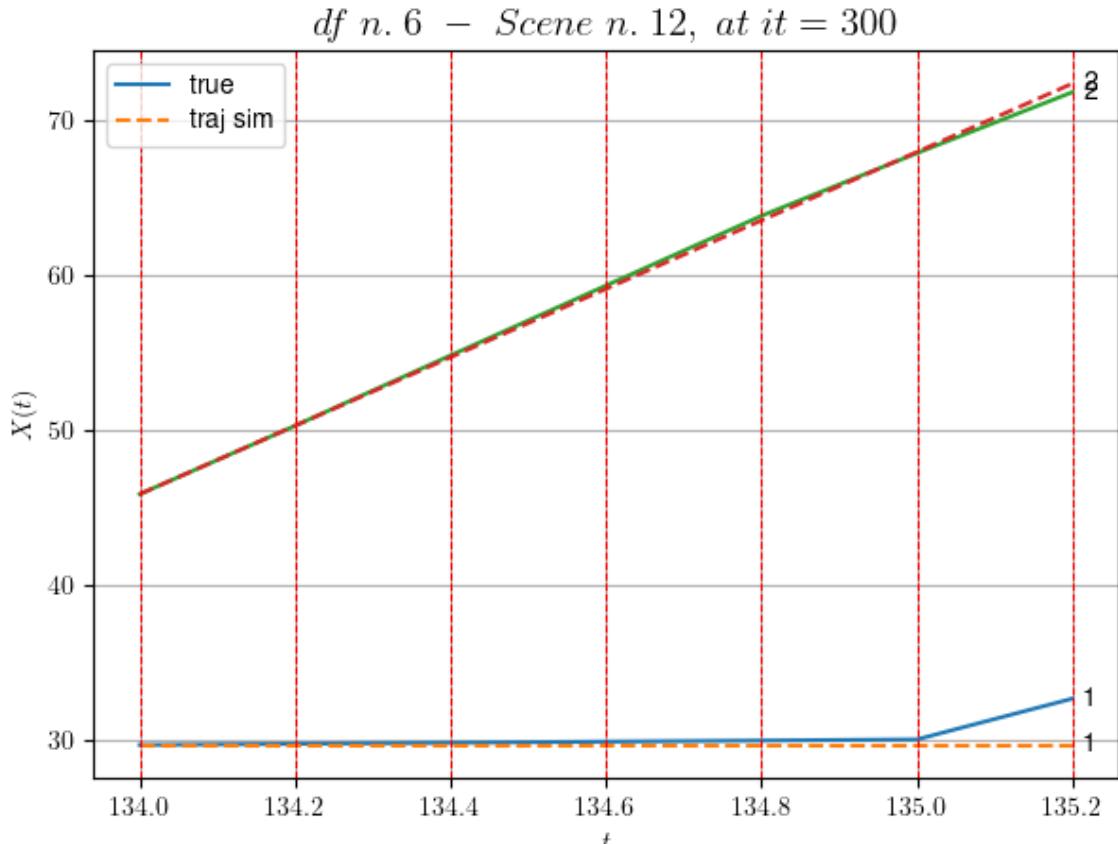


For scene 9/34:

\* After LR finder: LR\_NN=5e-05 with mse=10.324180895206945  
at it=24  
\* v0 = 12.399412488572409  
\* MSE = 0.19343648675195146  
\* iterations = 500

DataFrame n.6. Scene n.10/34

We have 6 time intervals inside [134.00,135.20]

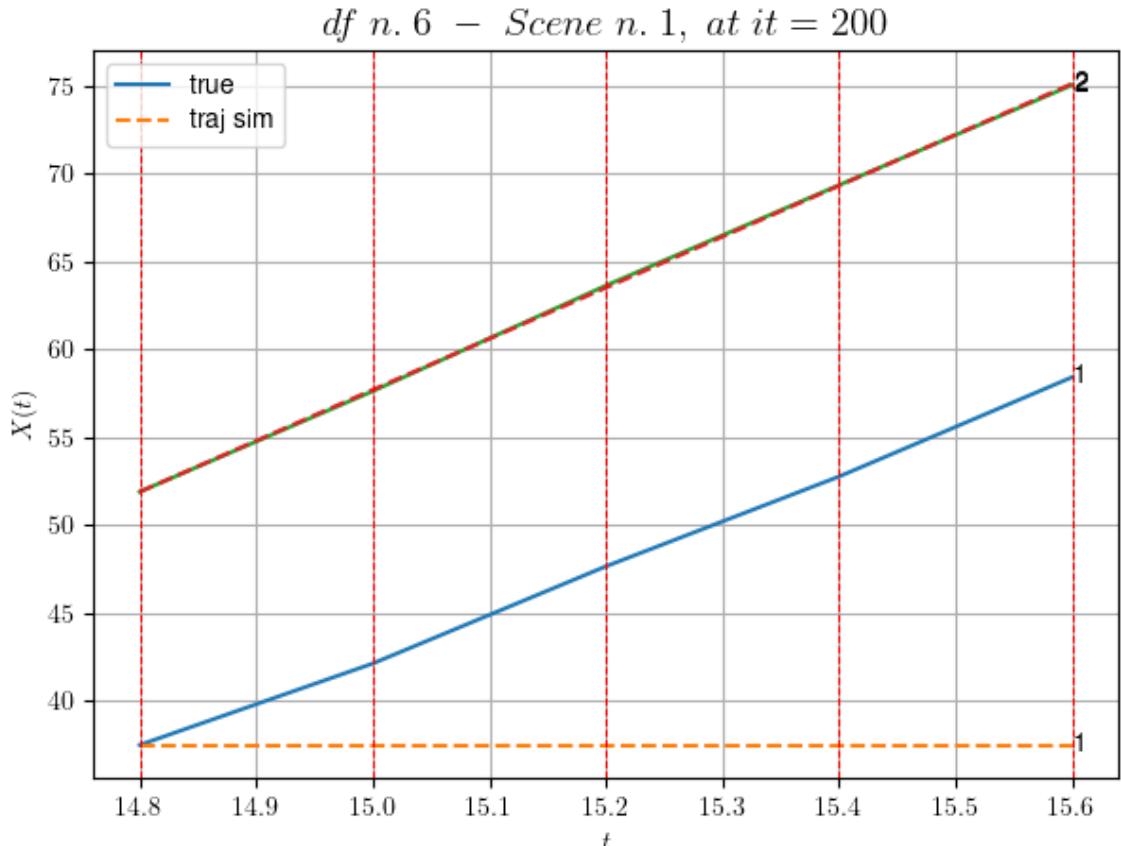


For scene 10/34:

\* After LR finder: LR\_NN=0.01 with mse=17.441120796426567 at it=24  
\* v0 = 22.063234069263405  
\* MSE = 0.6914225396416791  
\* iterations = 300

DataFrame n.6. Scene n.11/34

We have 4 time intervals inside [14.80,15.60]



---

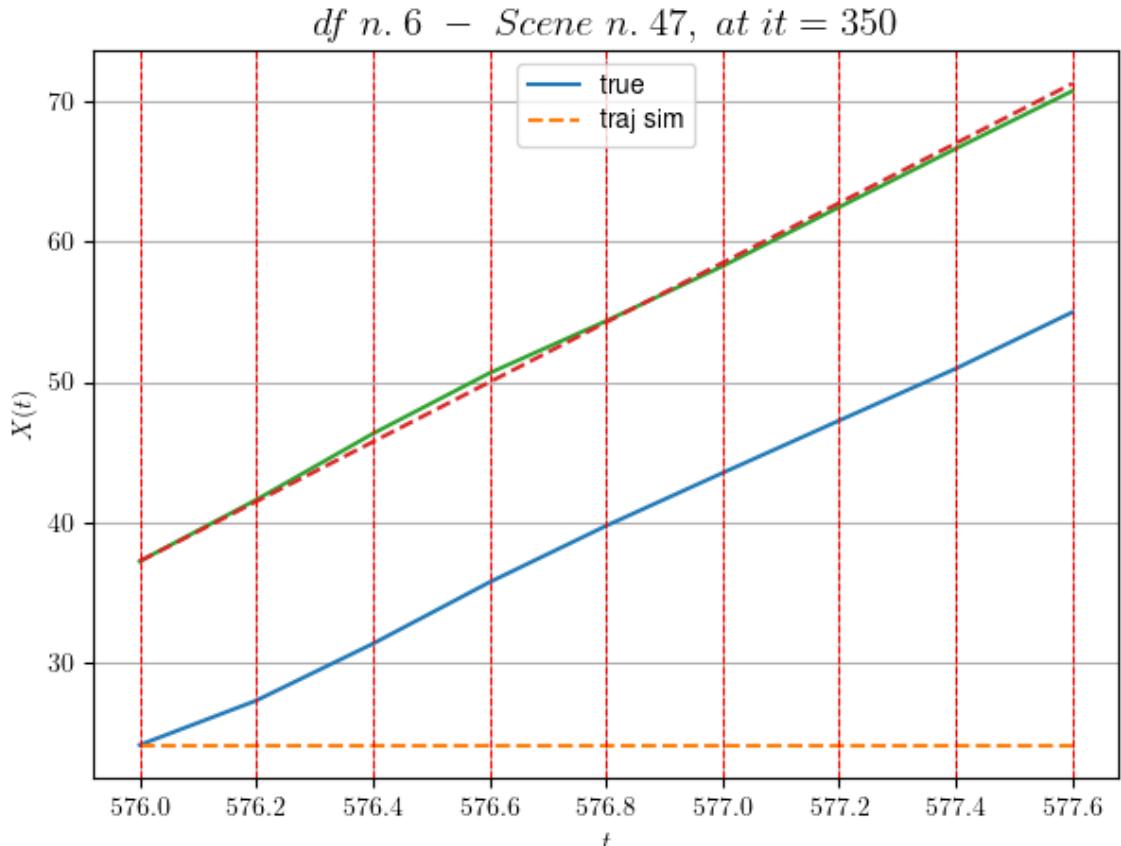
For scene 11/34:  
\* After LR finder: LR\_NN=5e-05 with mse=0.11822501447103279  
at it=24  
\* v0 = 29.05713292292848  
\* MSE = 79.74909505426614  
\* iterations = 200

---

DataFrame n.6. Scene n.12/34

---

We have 8 time intervals inside [576.00,577.60]

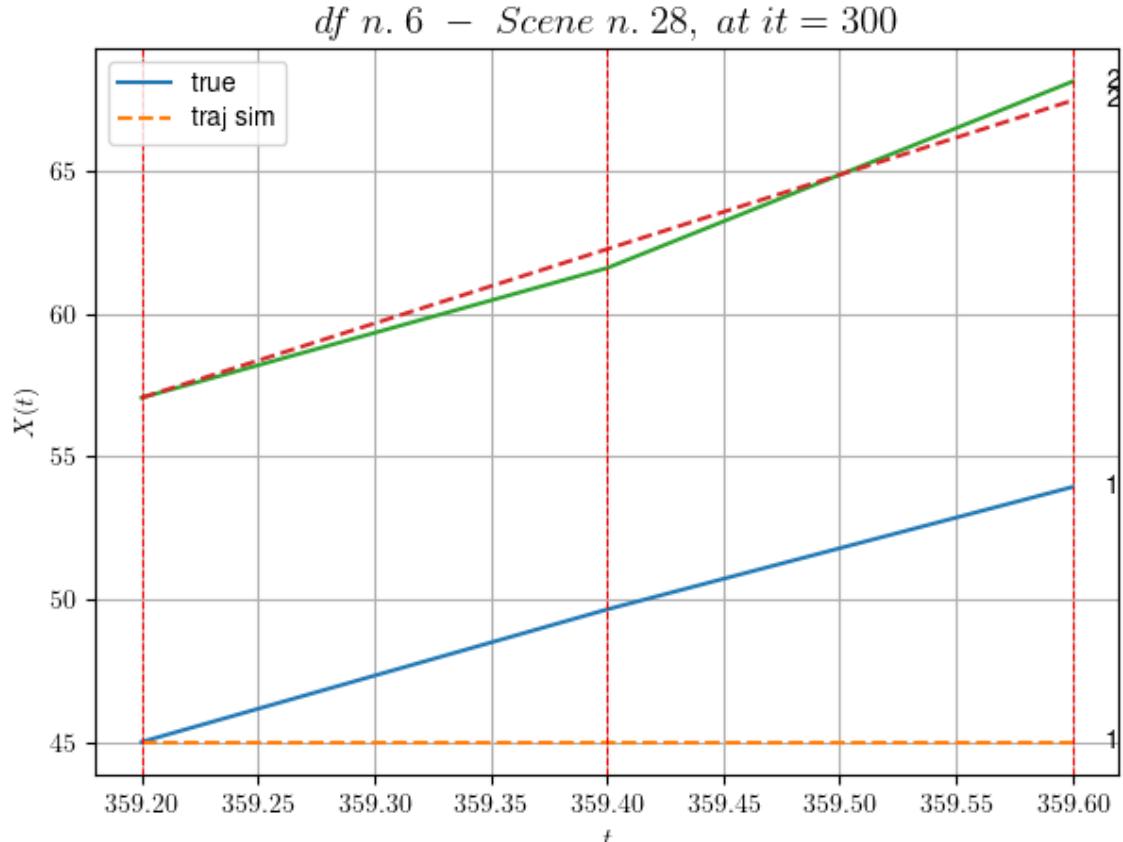


For scene 12/34:

\* After LR finder: LR\_NN=0.001 with mse=35.620659633042536  
at it=24  
\* v0 = 21.301030766395836  
\* MSE = 168.29360710818827  
\* iterations = 350

DataFrame n.6. Scene n.13/34

We have 2 time intervals inside [359.20,359.60]

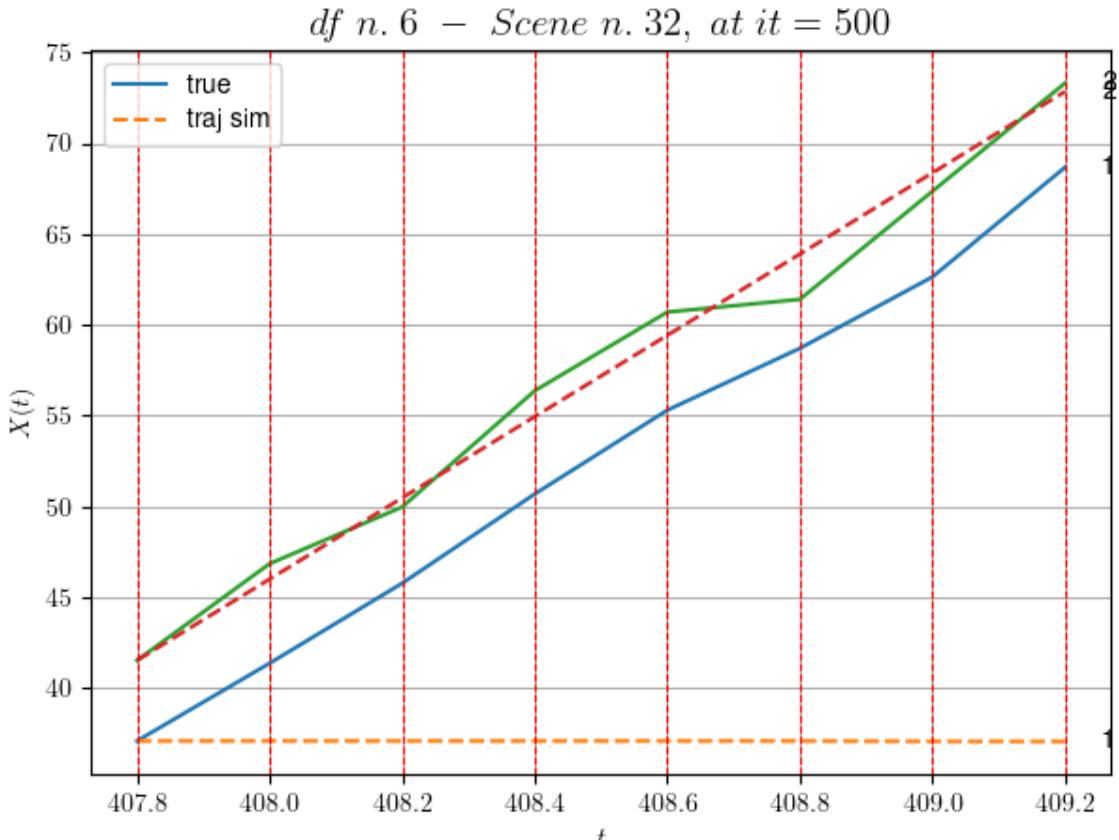


For scene 13/34:

\* After LR finder: LR\_NN=0.0001 with mse=0.5005478216112088  
at it=24  
\* v0 = 26.036962679722613  
\* MSE = 17.022014090385237  
\* iterations = 300

DataFrame n.6. Scene n.14/34

We have 7 time intervals inside [407.80,409.20]



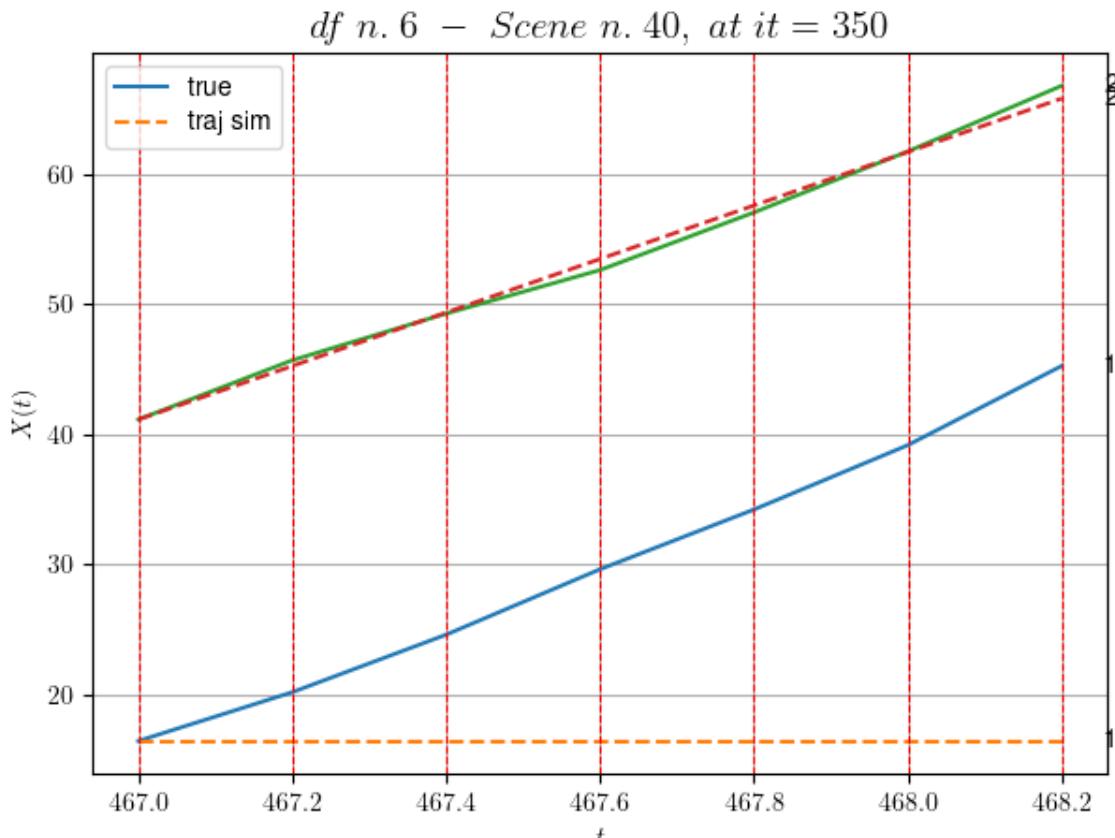
For scene 14/34:  
\* After LR finder:  $LR_{NN}=0.0001$  with  $mse=22.675148875387983$   
at it=24  
\*  $v_0 = 22.363716298521343$   
\* MSE = 171.32008689045747  
\* iterations = 500

-----  
-----

DataFrame n.6. Scene n.15/34

-----  
-----

We have 6 time intervals inside [467.00, 468.20]

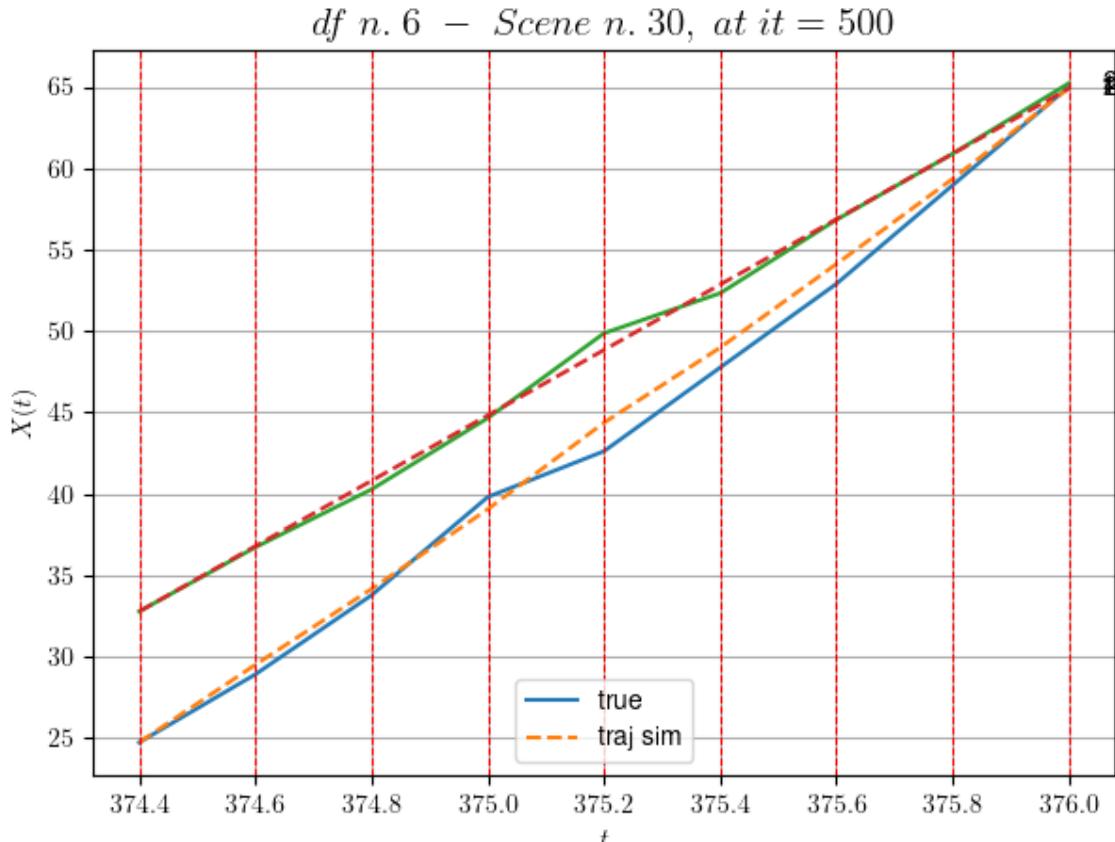


For scene 15/34:

\* After LR finder: LR\_NN=1e-05 with mse=23.719805585520618  
at it=24  
\* v0 = 20.547439360583393  
\* MSE = 137.04289294615015  
\* iterations = 350

DataFrame n.6. Scene n.16/34

We have 8 time intervals inside [374.40,376.00]



---

For scene 16/34:

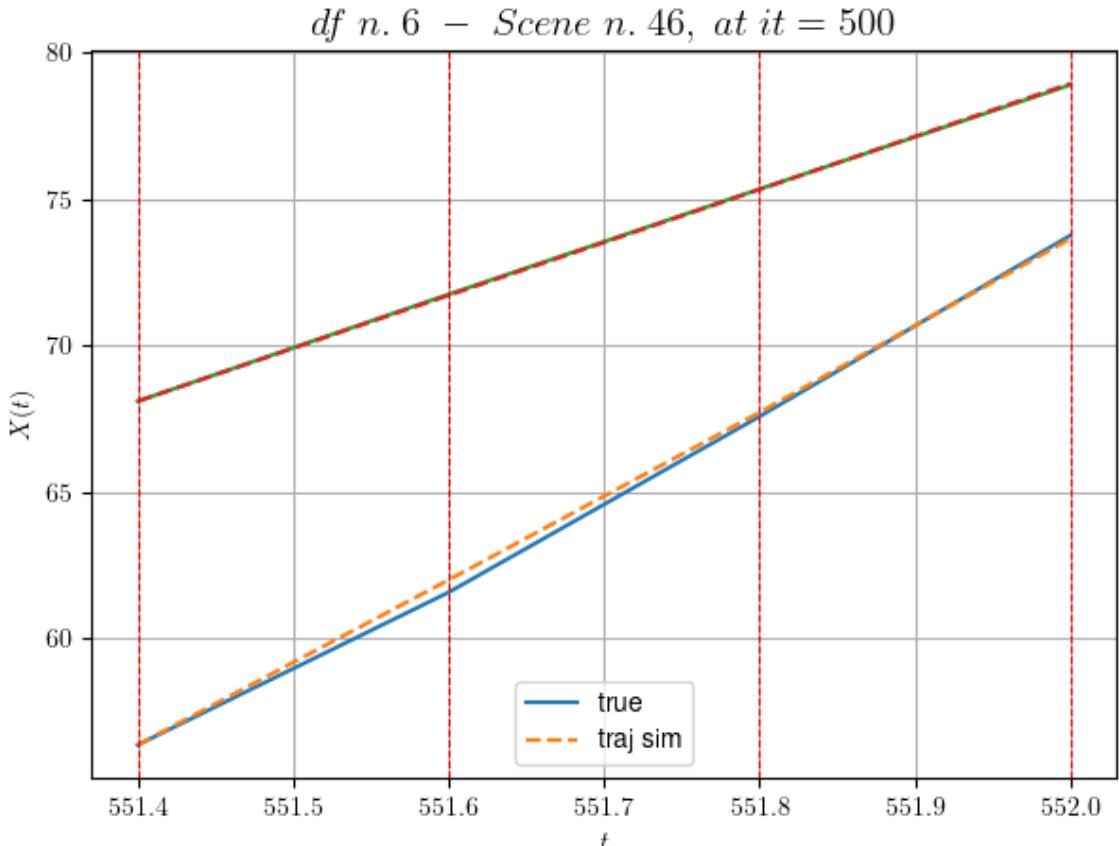
\* After LR finder:  $LR\_NN=0.001$  with  $mse=48.069813002190166$   
at it=24  
\*  $v_0 = 20.073696885977935$   
\*  $MSE = 0.49623330517244874$   
\* iterations = 500

---

DataFrame n.6. Scene n.17/34

---

We have 3 time intervals inside [551.40,552.00]

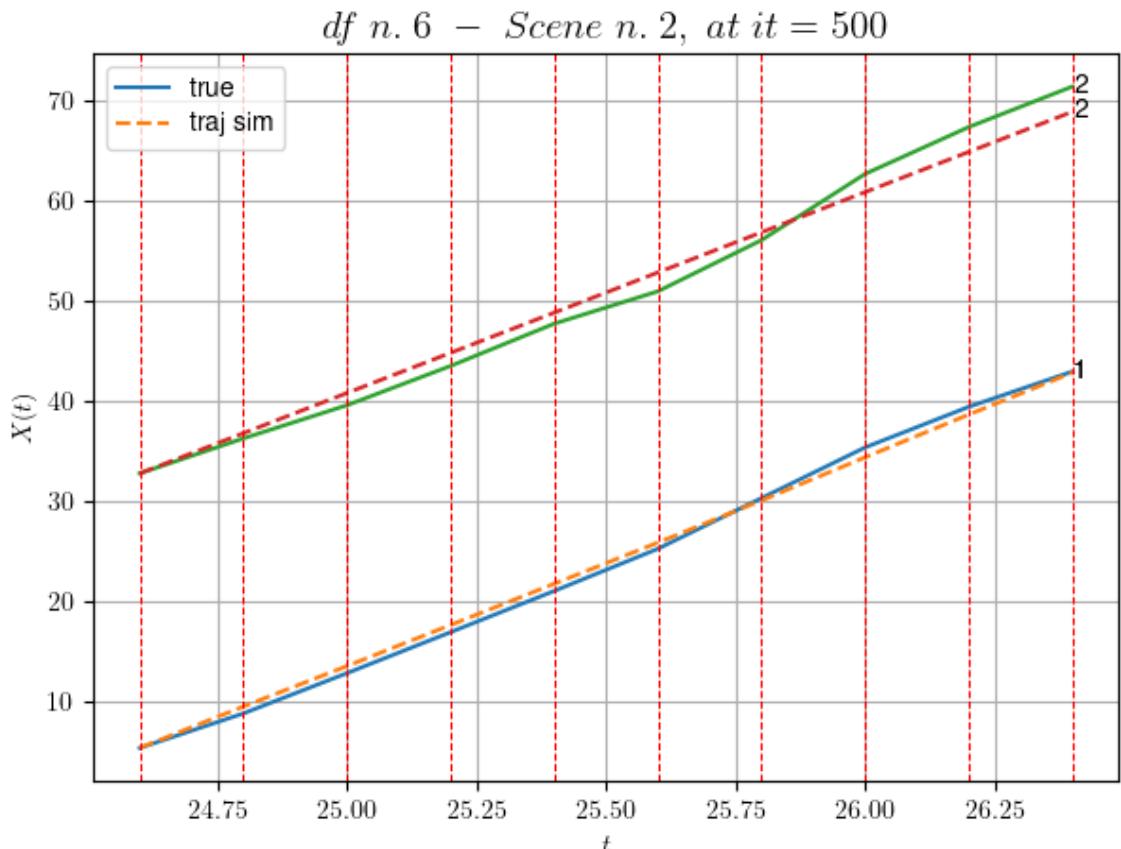


For scene 17/34:

\* After LR finder: LR\_NN=5e-05 with mse=10.371679963015051  
at it=24  
\* v0 = 18.102658549474576  
\* MSE = 0.026810981564241932  
\* iterations = 500

DataFrame n.6. Scene n.18/34

We have 9 time intervals inside [24.60,26.40]

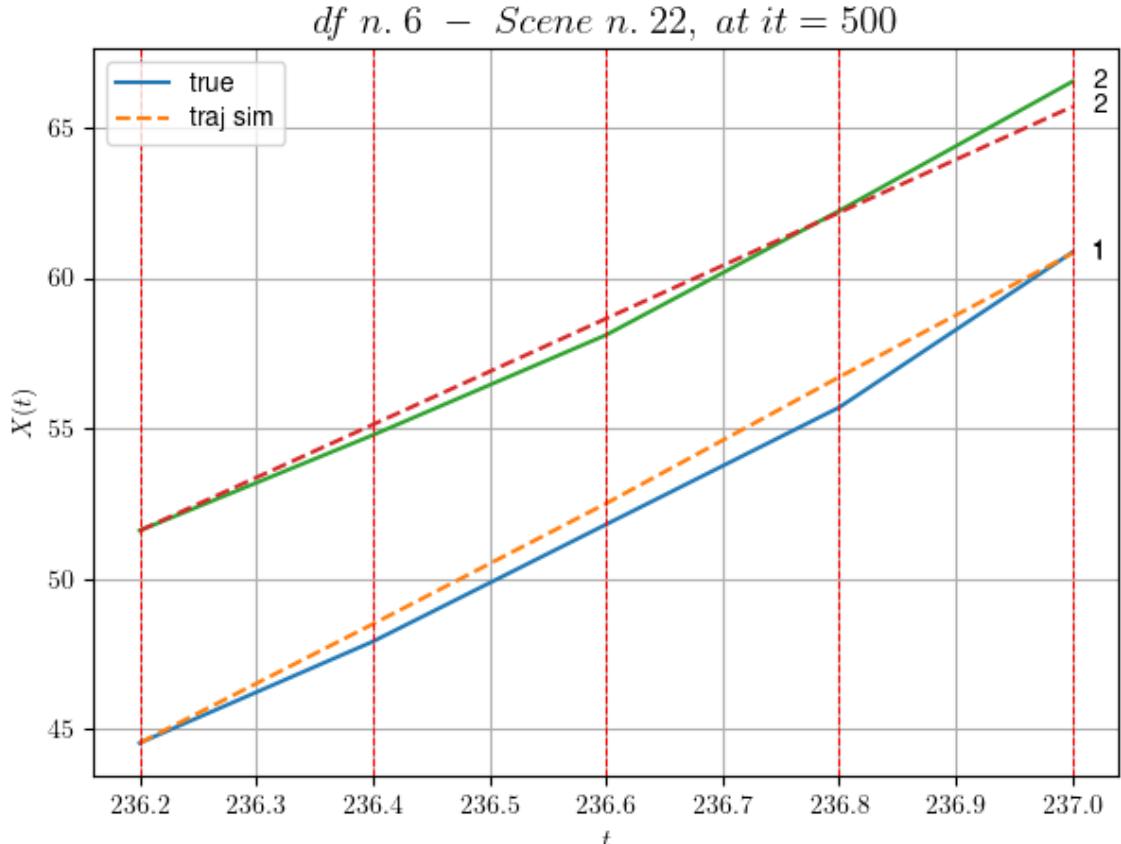


For scene 18/34:

\* After LR finder: LR\_NN=5e-05 with mse=51.86044475067128 at it=24  
\* v0 = 20.072543725791657  
\* MSE = 1.3414719285153303  
\* iterations = 500

DataFrame n.6. Scene n.19/34

We have 4 time intervals inside [236.20,237.00]



---

For scene 19/34:

\* After LR finder: LR\_NN=5e-05 with mse=17.646768387213537  
at it=24  
\* v0 = 17.63413097458819  
\* MSE = 0.28782631773233297  
\* iterations = 500

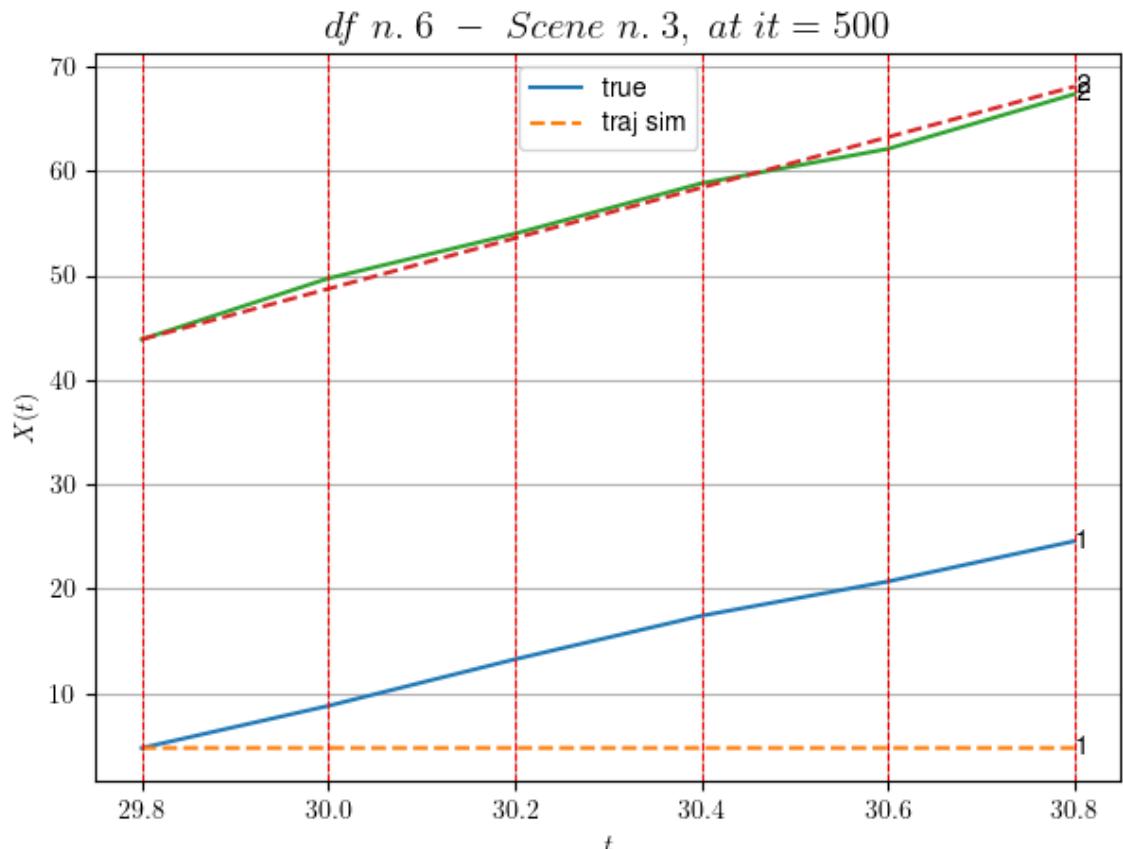
---

---

DataFrame n.6. Scene n.20/34

---

We have 5 time intervals inside [29.80,30.80]

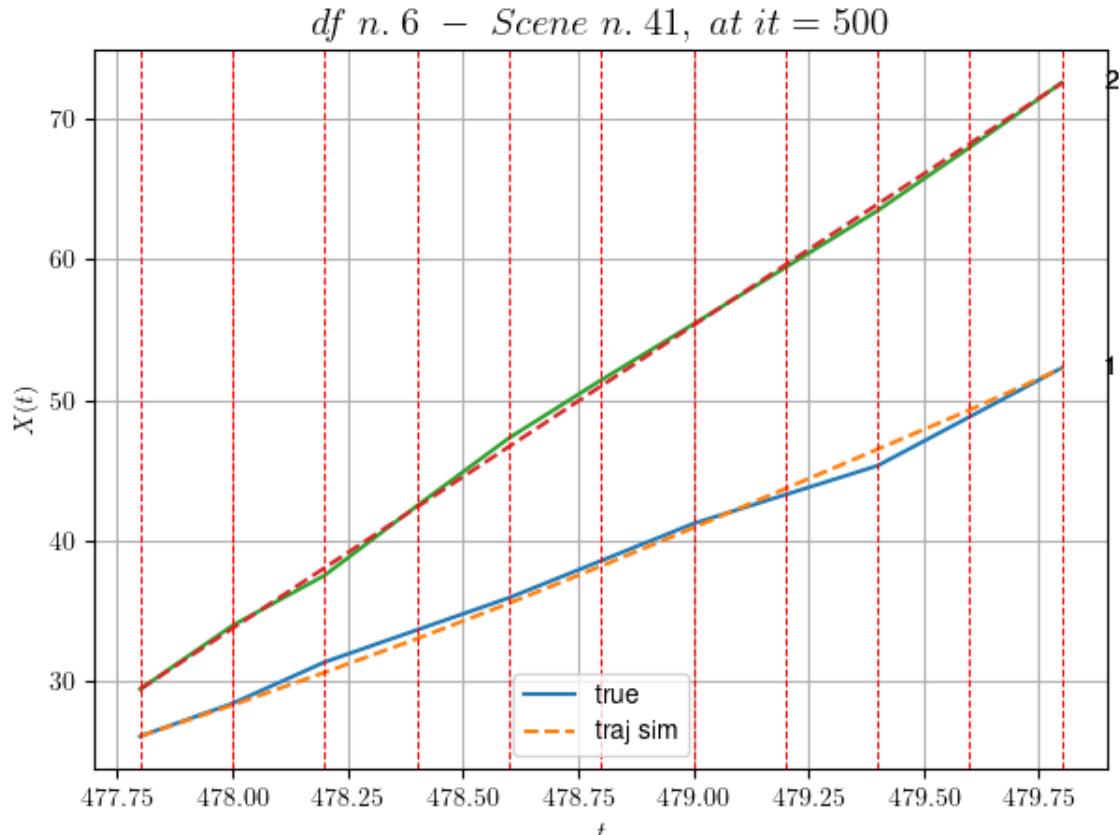


For scene 20/34:

\* After LR finder: LR\_NN=0.0005 with mse=7.4400985364460945  
at it=24  
\* v0 = 24.207929046505075  
\* MSE = 74.79223774319428  
\* iterations = 500

DataFrame n.6. Scene n.21/34

We have 10 time intervals inside [477.80, 479.80]



---

For scene 21/34:

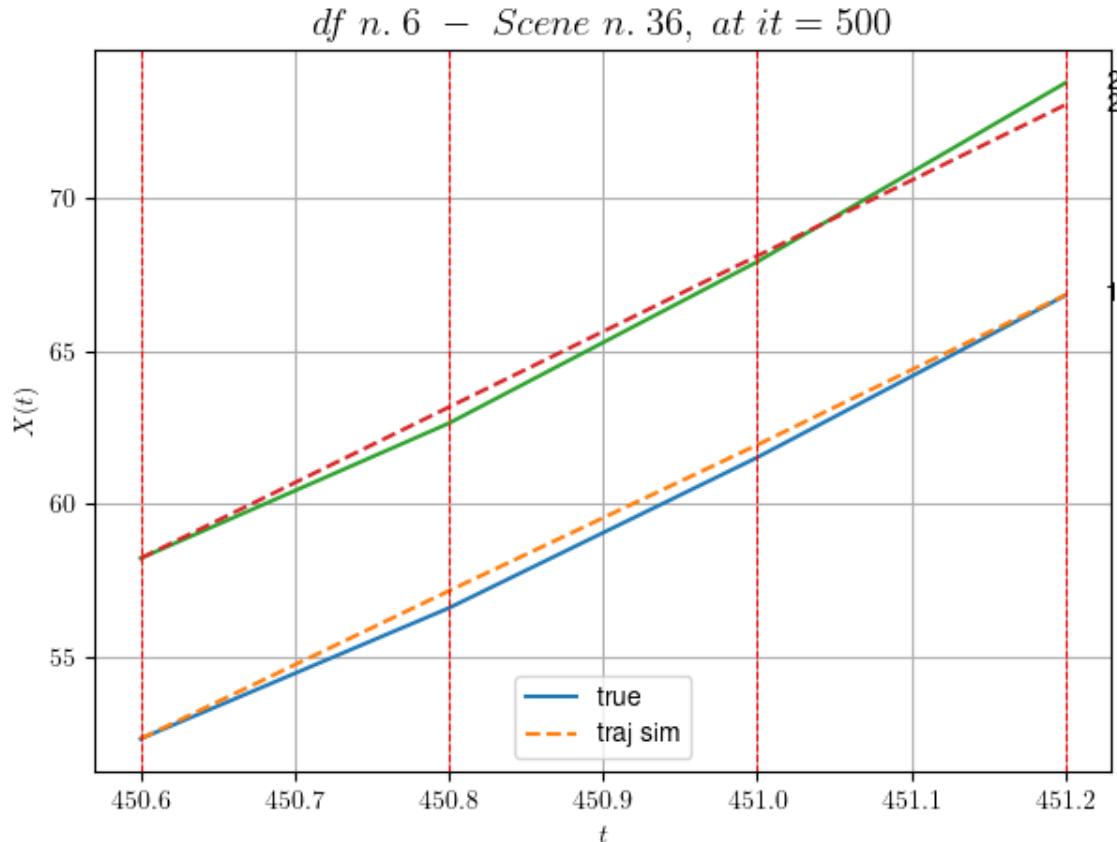
- \* After LR finder:  $LR\_NN=0.001$  with  $mse=53.01397296106903$  at  $it=24$
- \*  $v_0 = 21.601430911083135$
- \*  $MSE = 0.19734351670047373$
- \* iterations = 500

---

DataFrame n.6. Scene n.22/34

---

We have 3 time intervals inside [450.60, 451.20]

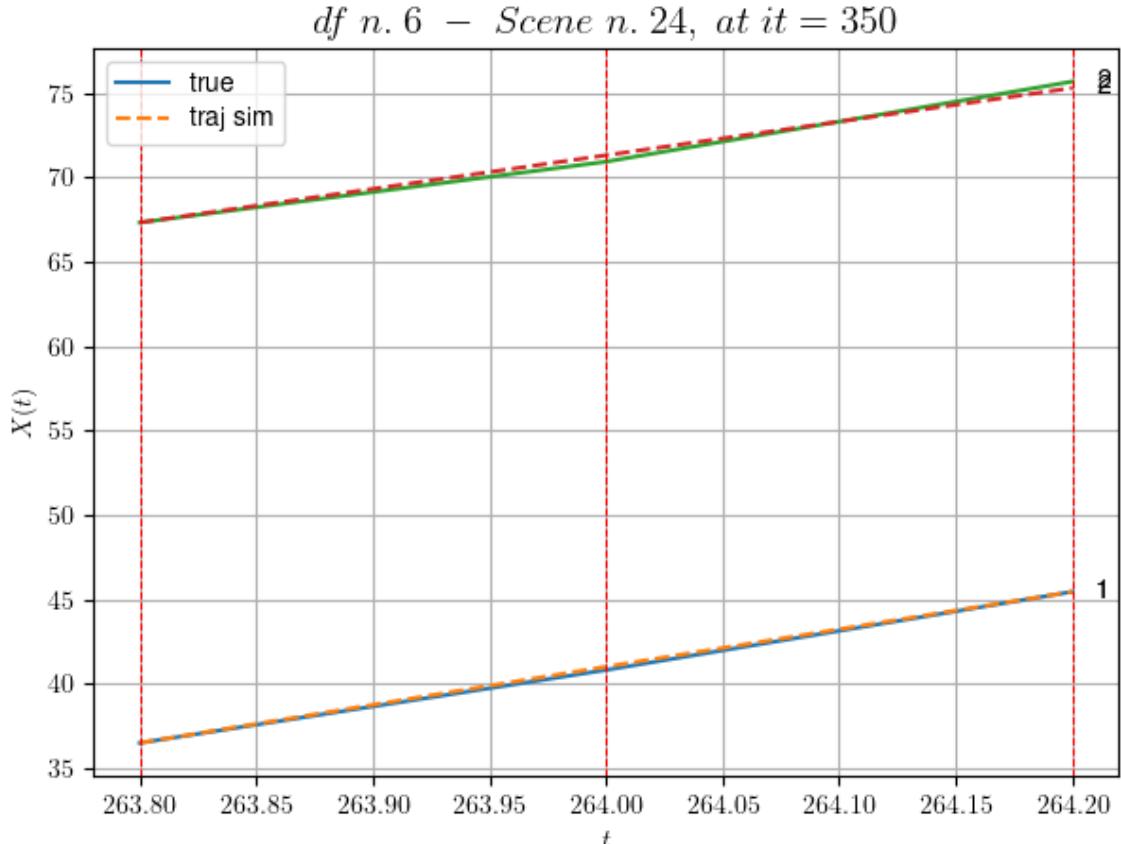


For scene 22/34:

\* After LR finder: LR\_NN=0.0005 with mse=1.7704605837990481  
at it=24  
\*  $v_0 = 24.70783812699183$   
\* MSE = 0.16013167635833447  
\* iterations = 500

DataFrame n.6. Scene n.23/34

We have 2 time intervals inside [263.80, 264.20]



For scene 23/34:

\* After LR finder: LR\_NN=5e-05 with mse=3.1800327813409313

at it=24

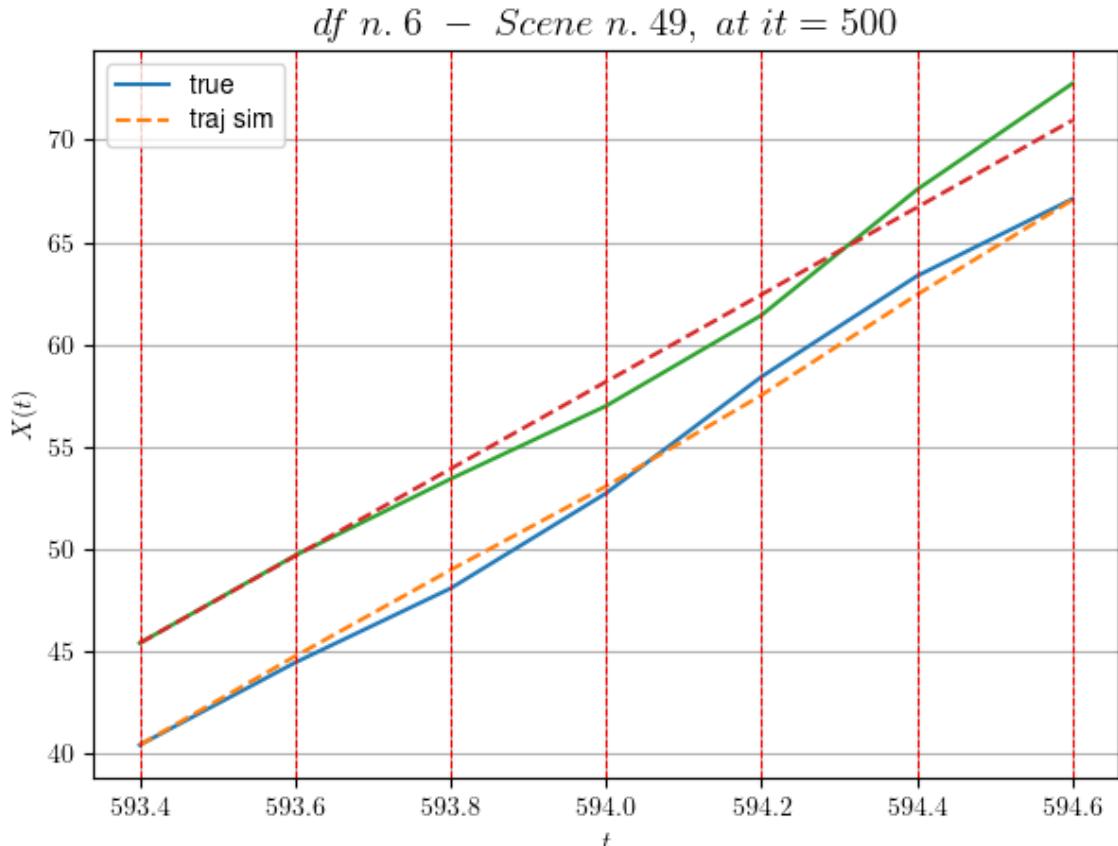
\* v0 = 19.938624229336483

\* MSE = 0.0501663077552613

\* iterations = 350

DataFrame n.6. Scene n.24/34

We have 6 time intervals inside [593.40,594.60]

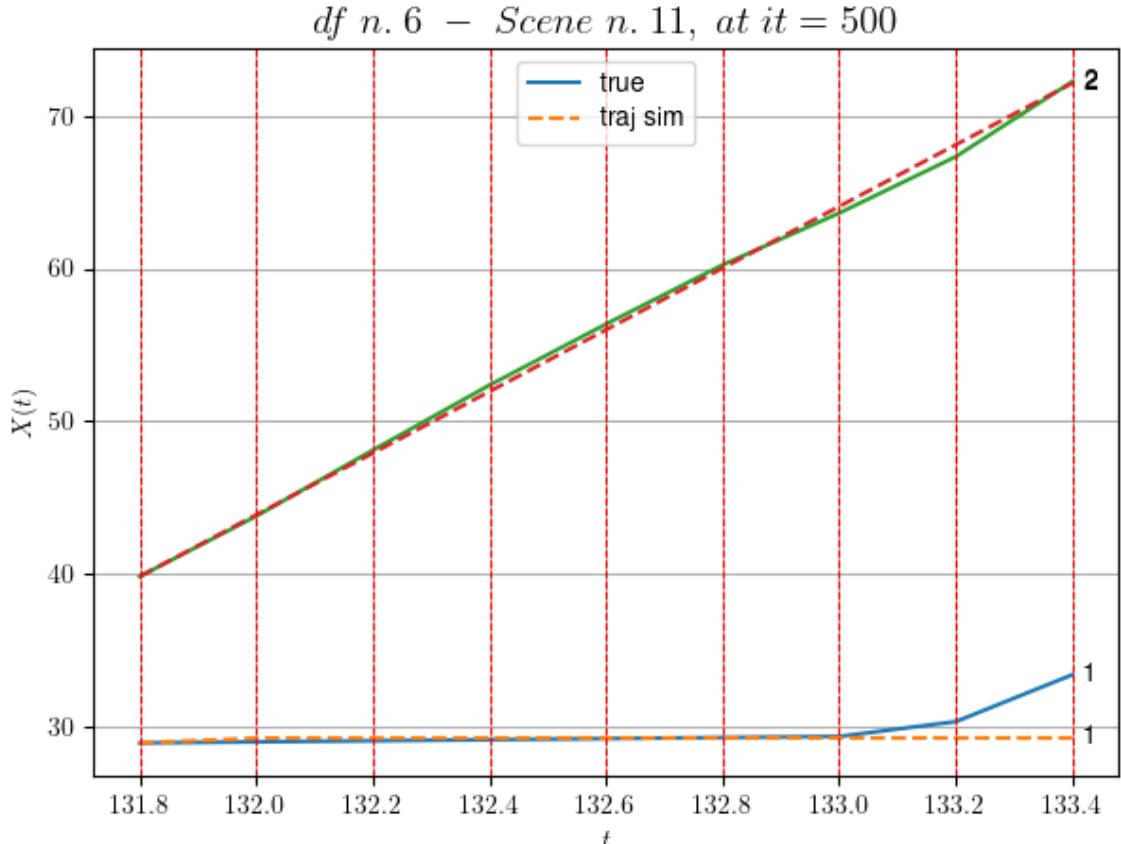


For scene 24/34:

\* After LR finder: LR\_NN=0.001 with mse=19.471937600944397  
at it=24  
\* v0 = 21.280809908316808  
\* MSE = 0.6632891142485826  
\* iterations = 500

DataFrame n.6. Scene n.25/34

We have 8 time intervals inside [131.80,133.40]



For scene 25/34:

\* After LR finder: LR\_NN=1e-05 with mse=45.20176148750415 at it=24  
\* v0 = 20.22300032377142  
\* MSE = 0.9493569163048343  
\* iterations = 500

DataFrame n.6. Scene n.26/34

We have 3 time intervals inside [252.60,253.20]

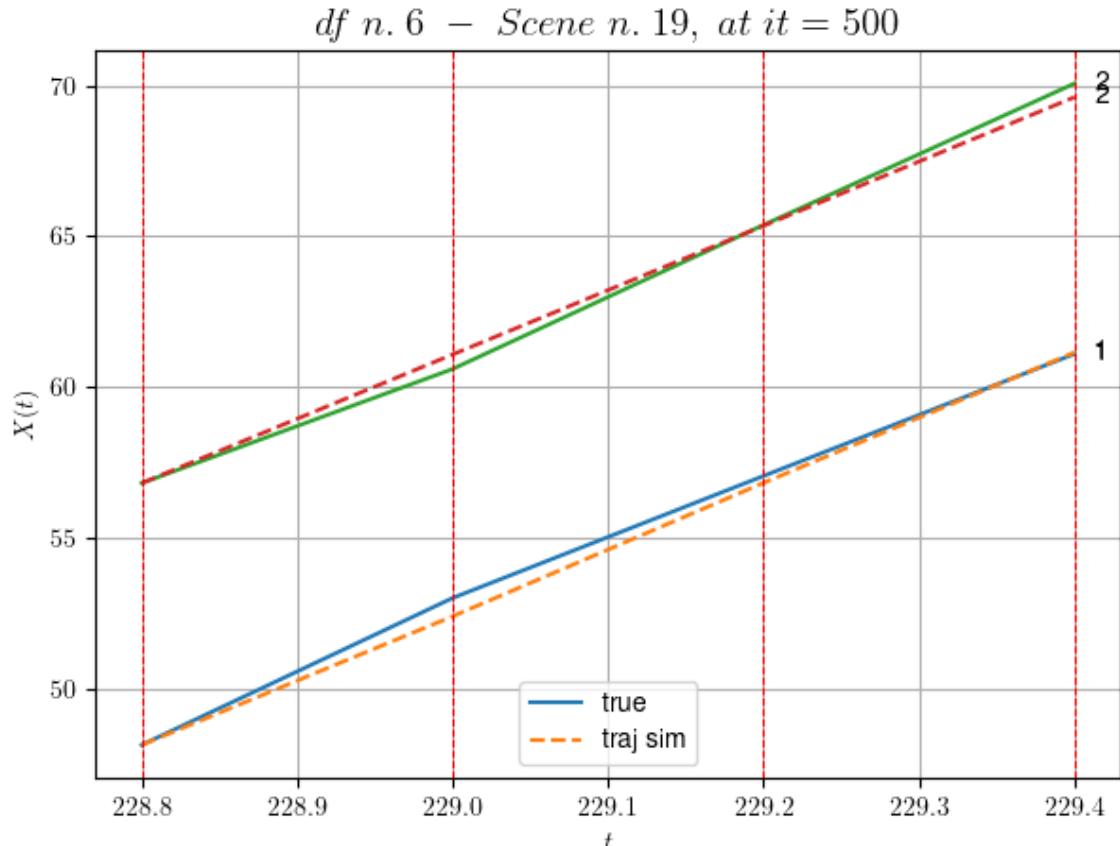


For scene 26/34:

\* After LR finder: LR\_NN=5e-05 with mse=1.9149303627198666  
at it=24  
\* v0 = 24.514205448075334  
\* MSE = 15.704917110307532  
\* iterations = 500

DataFrame n.6. Scene n.27/34

We have 3 time intervals inside [228.80,229.40]

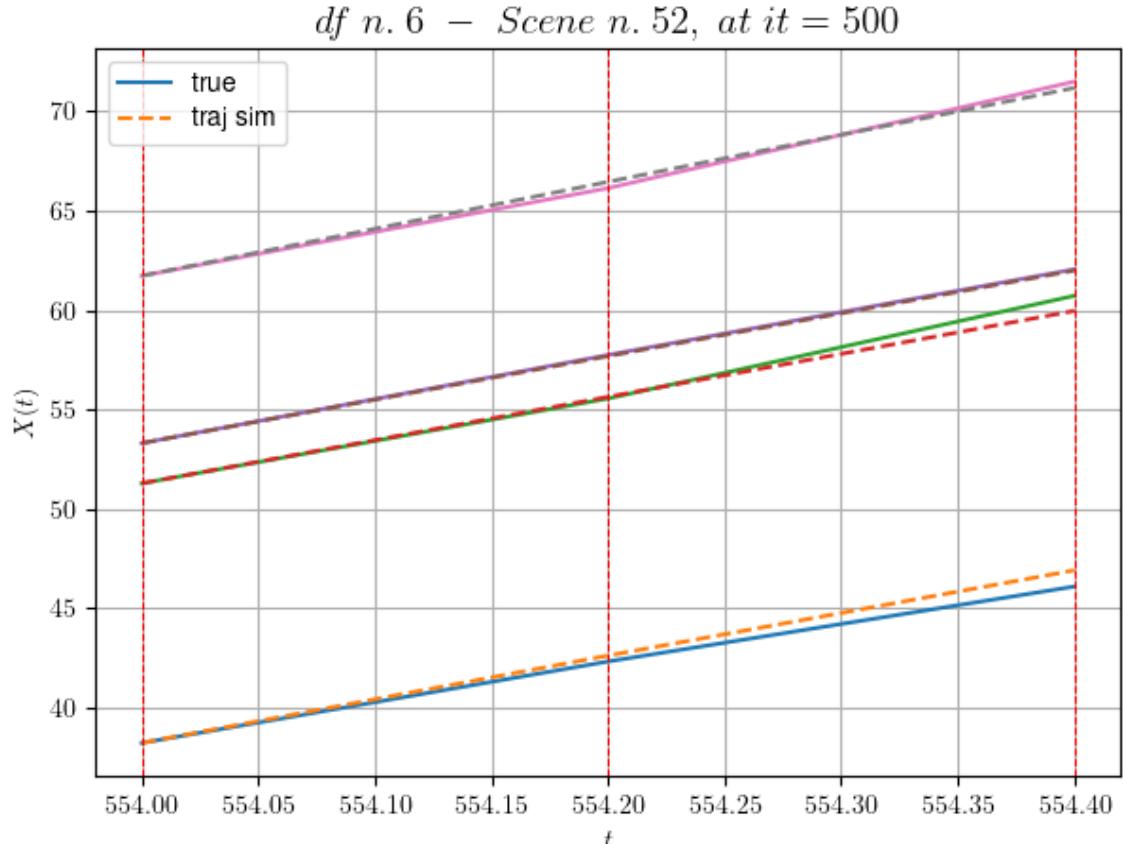


For scene 27/34:

\* After LR finder: LR\_NN=0.0001 with mse=4.952342162307236  
at it=24  
\* v0 = 21.31990483401061  
\* MSE = 0.10544831955625292  
\* iterations = 500

DataFrame n.6. Scene n.28/34

We have 2 time intervals inside [554.00,554.40]

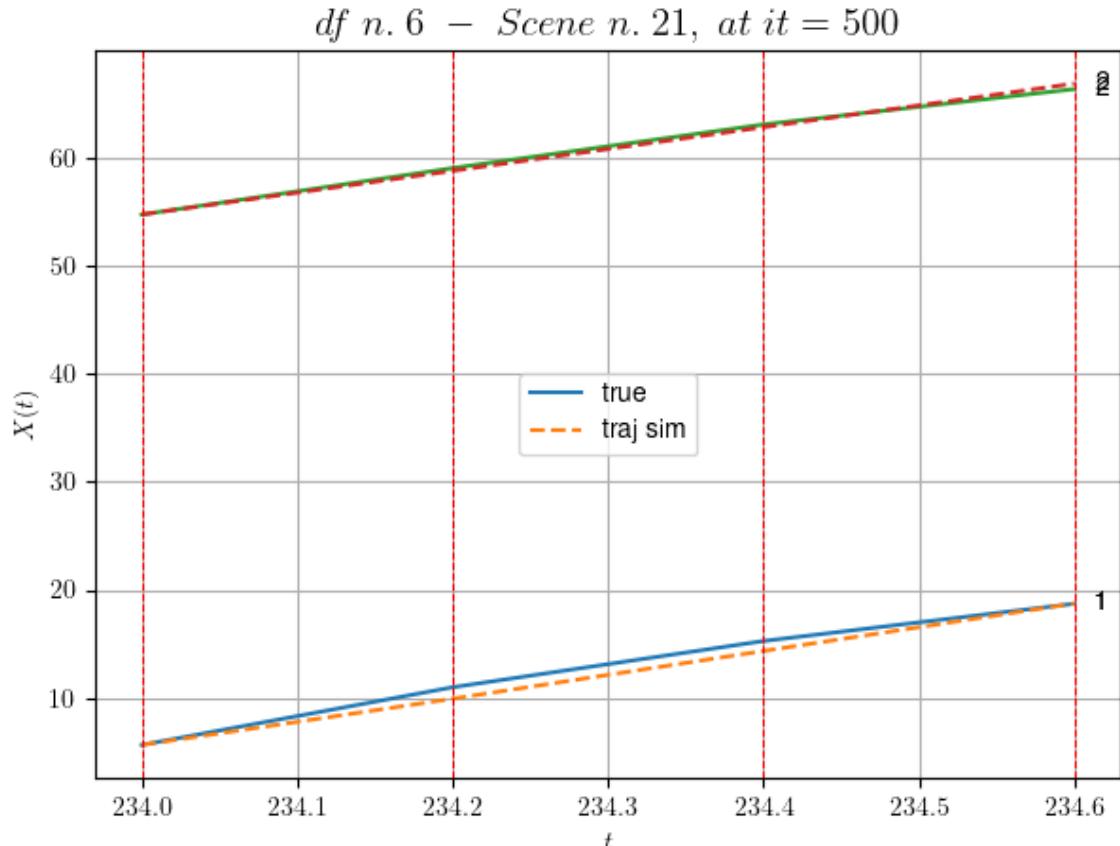


For scene 28/34:

\* After LR finder: LR\_NN=0.001 with mse=5.123661403351053 at it=24  
\* v0 = 23.647050620332713  
\* MSE = 0.12890258092571427  
\* iterations = 500

DataFrame n.6. Scene n.29/34

We have 3 time intervals inside [234.00,234.60]

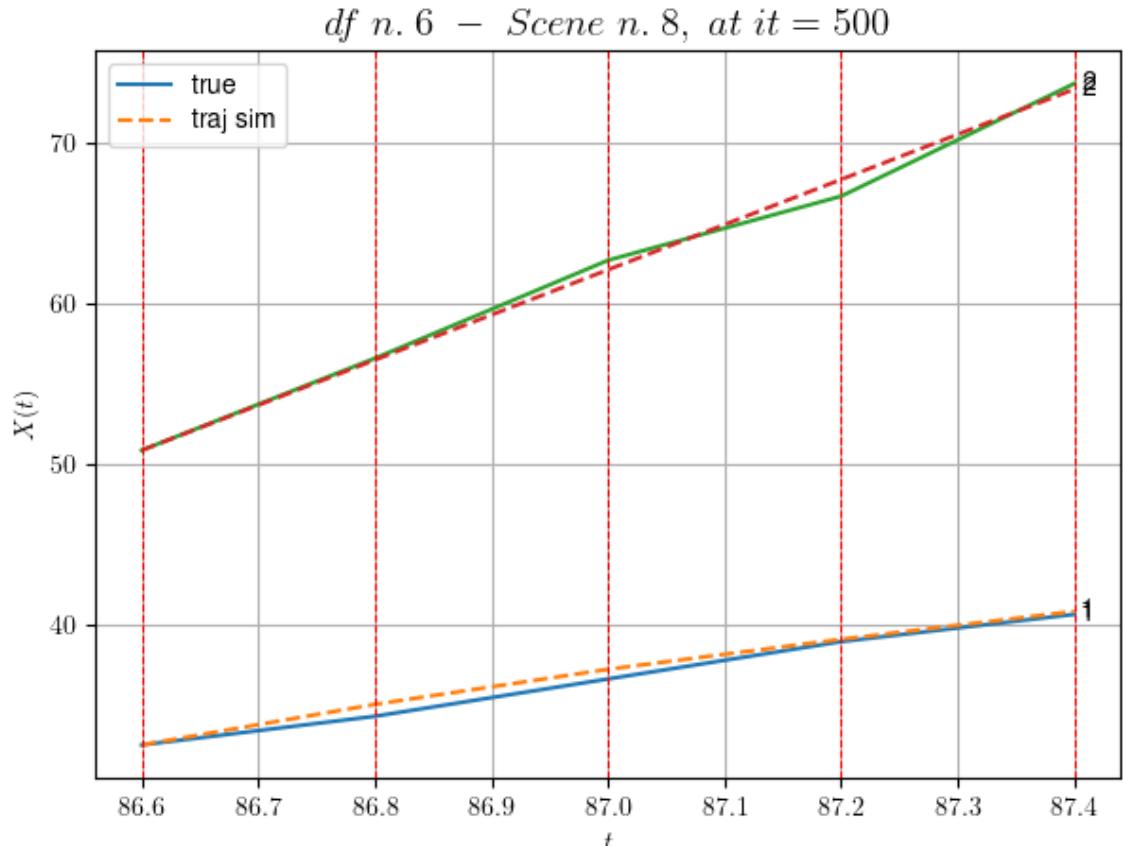


For scene 29/34:

\* After LR finder: LR\_NN=1e-05 with mse=7.363857721359487 at it=24  
\* v0 = 20.201366857274277  
\* MSE = 0.2931917125854824  
\* iterations = 500

DataFrame n.6. Scene n.30/34

We have 4 time intervals inside [86.60,87.40]



For scene 30/34:

\* After LR finder:  $LR\_NN=1e-05$  with  $mse=0.6530684141109424$

at  $it=24$

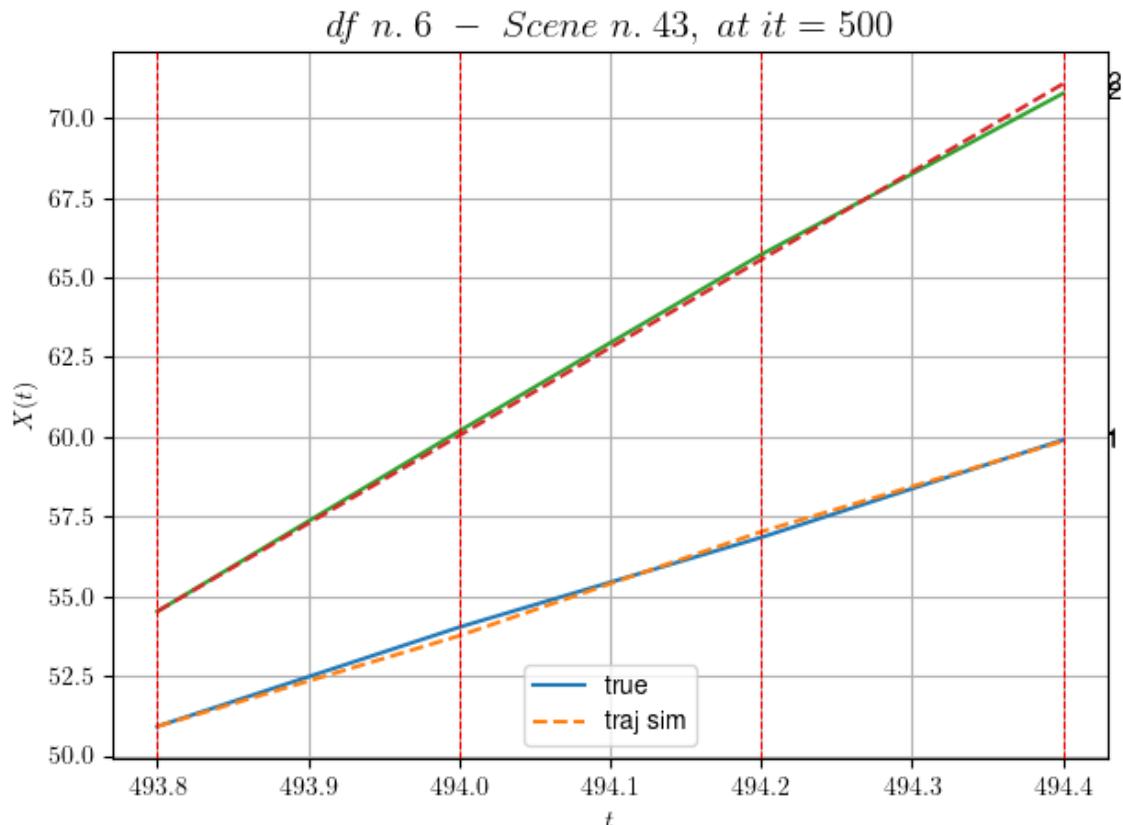
\*  $v_0 = 28.176915163685493$

\*  $MSE = 0.25471525927710514$

\* iterations = 500

DataFrame n.6. Scene n.31/34

We have 3 time intervals inside [493.80,494.40]

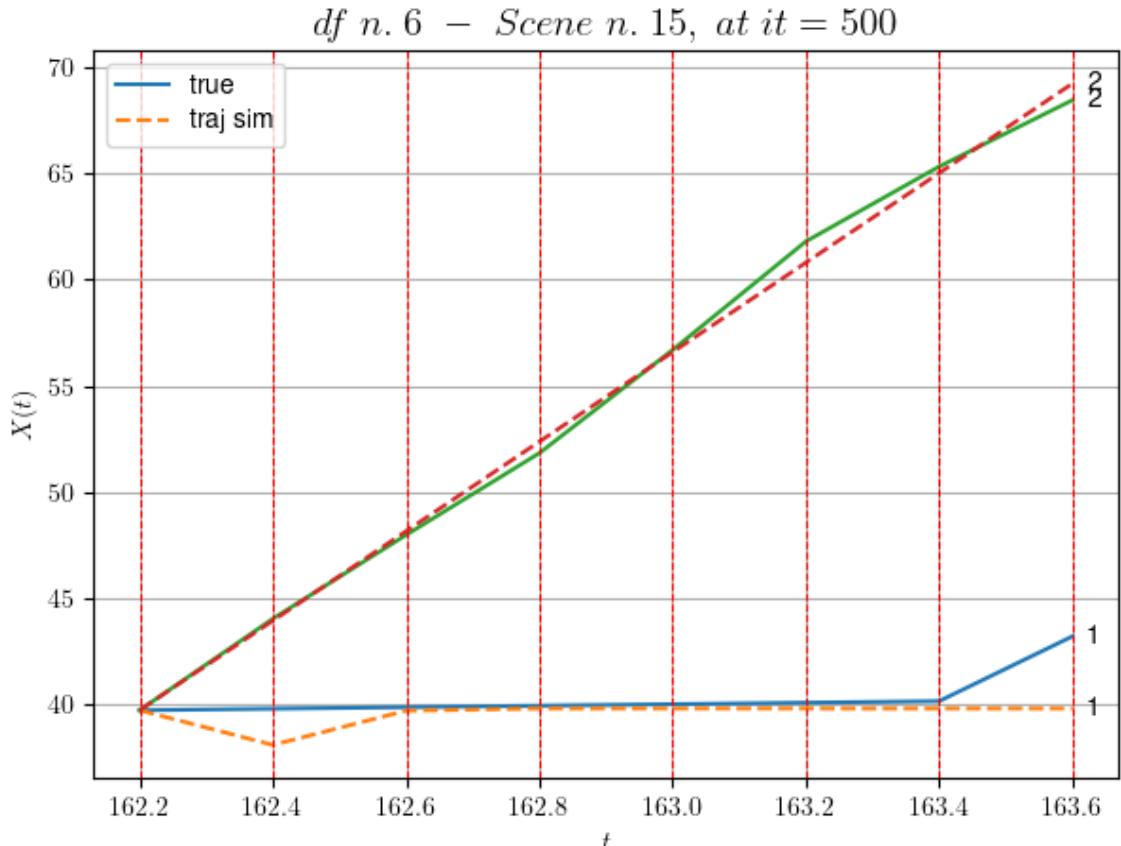


For scene 31/34:

\* After LR finder: LR\_NN=0.005 with mse=0.6461799711254053  
at it=24  
\* v0 = 27.57702754451529  
\* MSE = 0.03013148597590056  
\* iterations = 500

DataFrame n.6. Scene n.32/34

We have 7 time intervals inside [162.20,163.60]

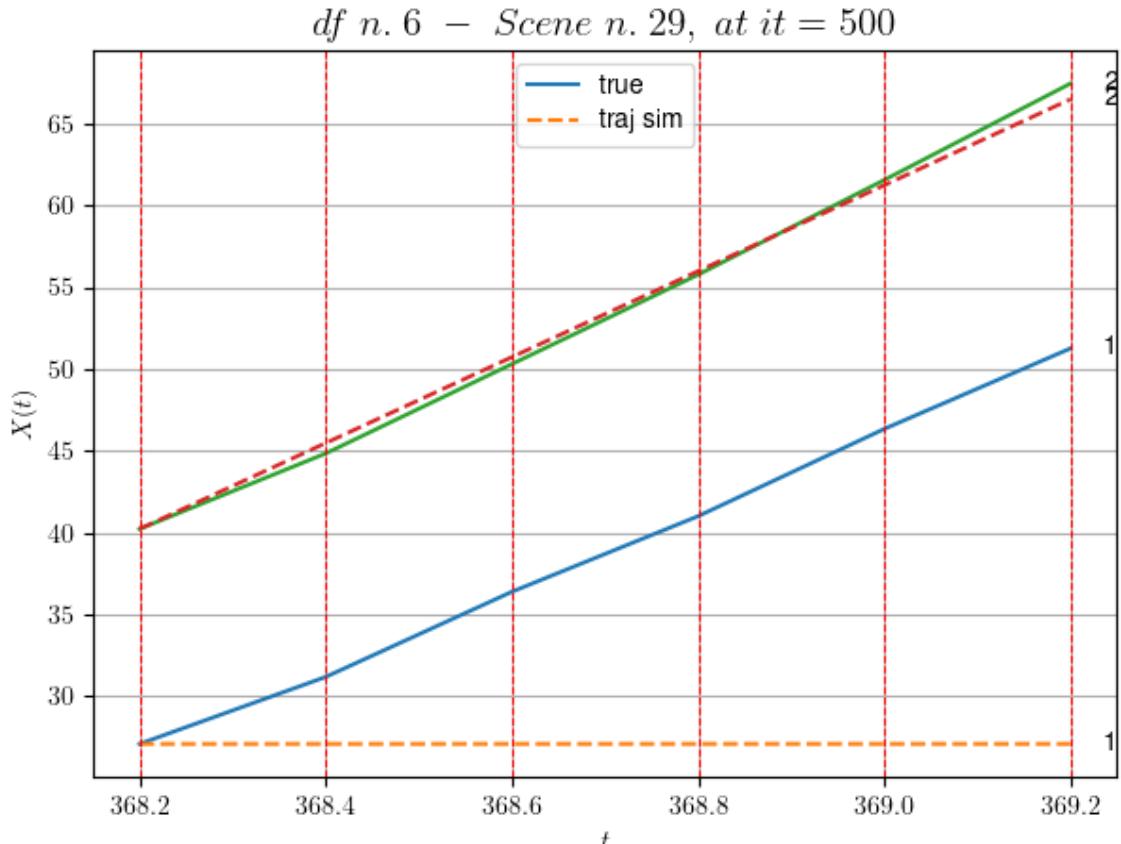


For scene 32/34:

\* After LR finder: LR\_NN=1e-05 with mse=28.467472821813416  
at it=24  
\* v0 = 21.059787487615633  
\* MSE = 1.0463398607970282  
\* iterations = 500

DataFrame n.6. Scene n.33/34

We have 5 time intervals inside [368.20,369.20]

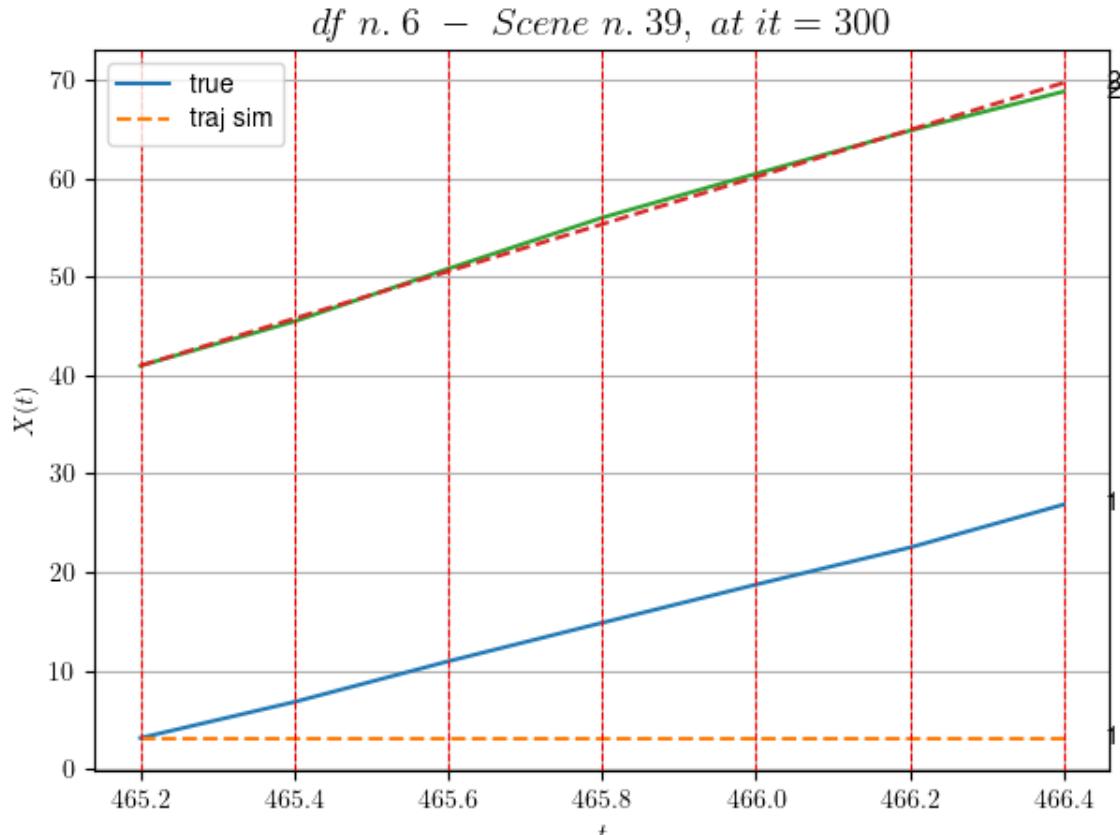


For scene 33/34:

\* After LR finder: LR\_NN=5e-05 with mse=2.2251040206961332  
at it=24  
\* v0 = 26.26965461417616  
\* MSE = 104.48186242081583  
\* iterations = 500

DataFrame n.6. Scene n.34/34

We have 6 time intervals inside [465.20,466.40]



---

For scene 34/34:  
\* After LR finder: LR\_NN=1e-05 with mse=9.992387148029083 at it=24  
\* v0 = 23.95696377887453  
\* MSE = 99.41602222868515  
\* iterations = 300

---

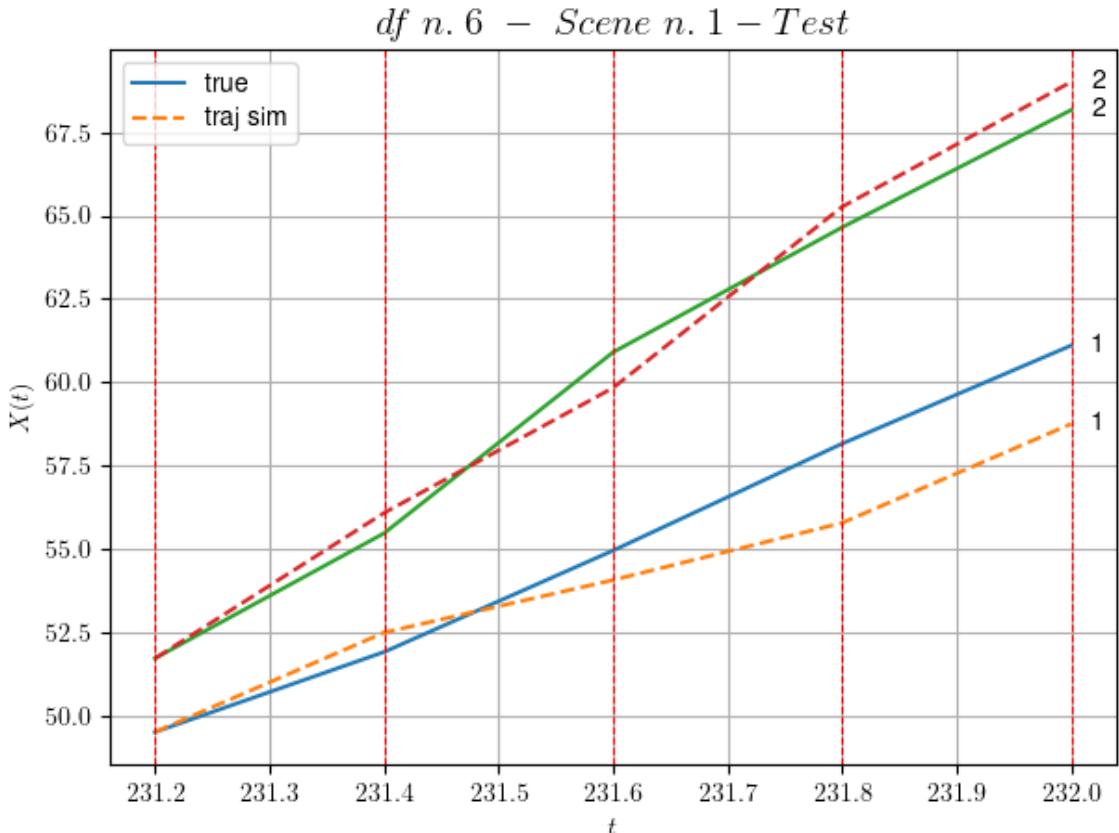
MSE train: 25.82748073585255

---

Testing step. (18 scenes)

---

DataFrame n.6. Scene n.1/18

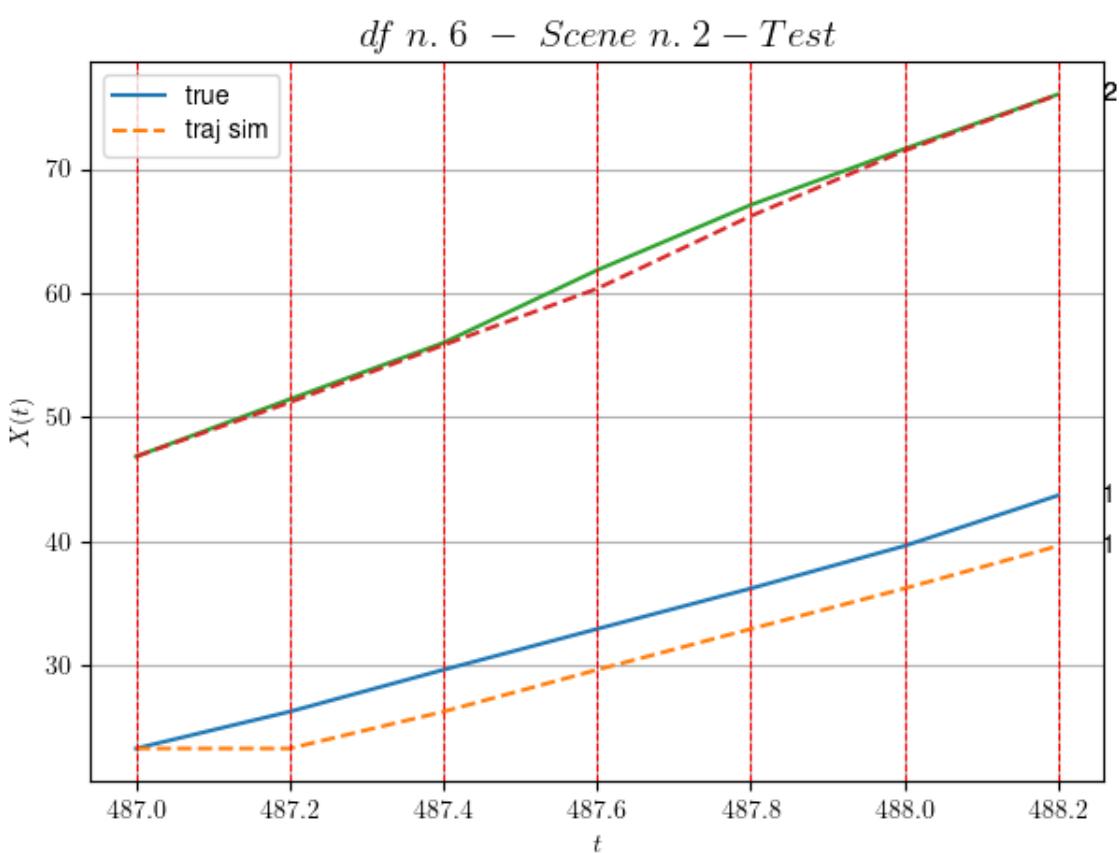


For scene 1/18:  
\* MSE = 1.4917900526996046

---

---

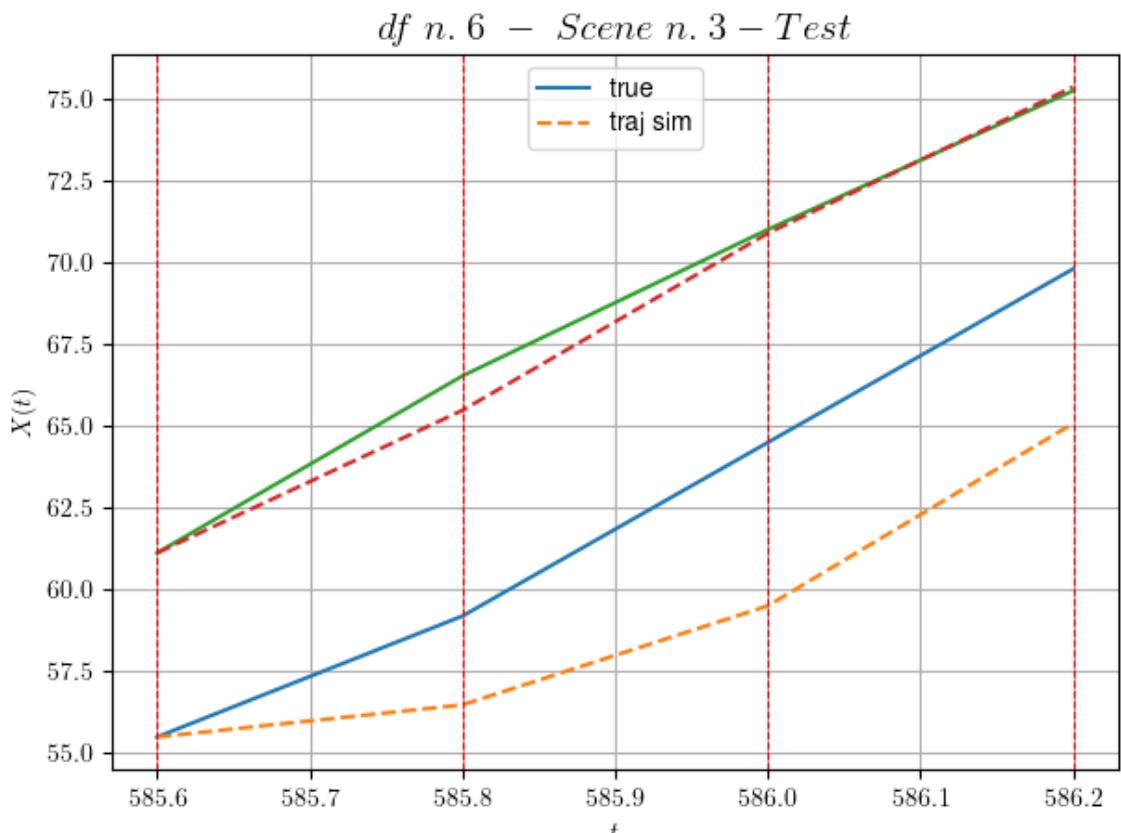
DataFrame n.6. Scene n.2/18



For scene 2/18:  
\* MSE = 5.227586975802529

---

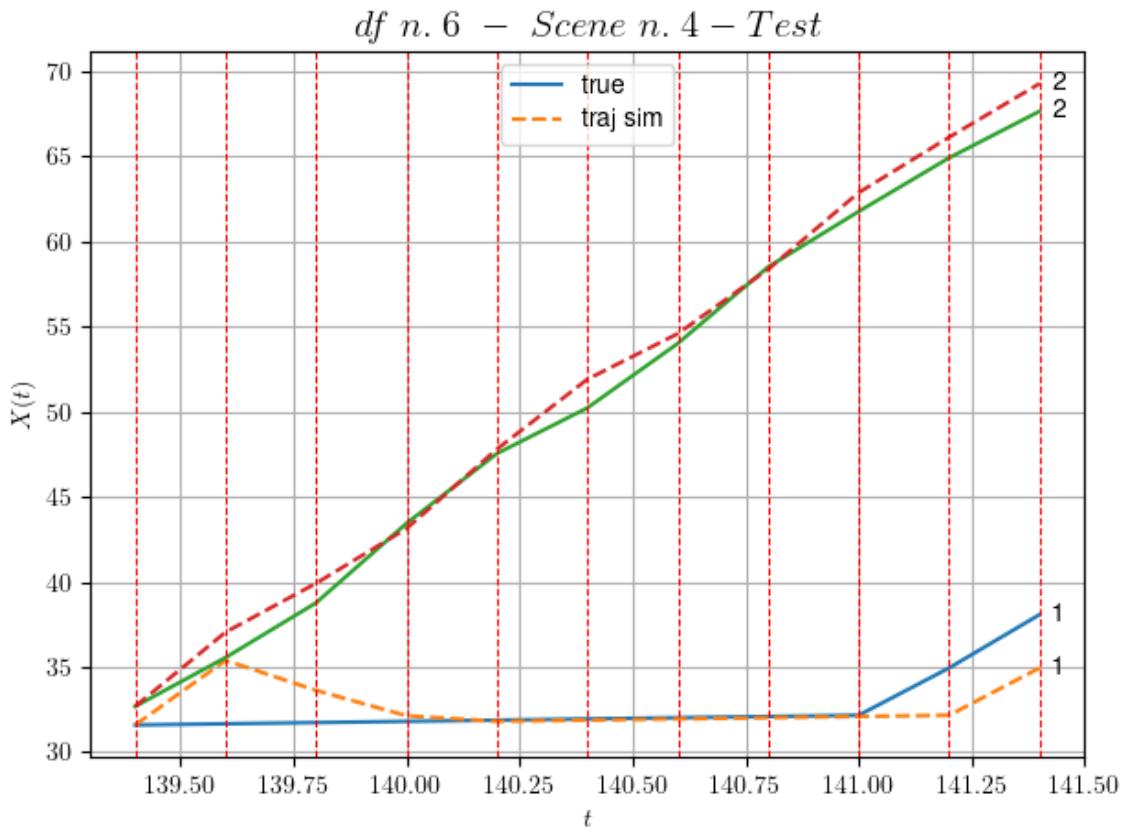
DataFrame n.6. Scene n.3/18



For scene 3/18:  
\* MSE = 6.986150257285127

---

DataFrame n.6. Scene n.4/18

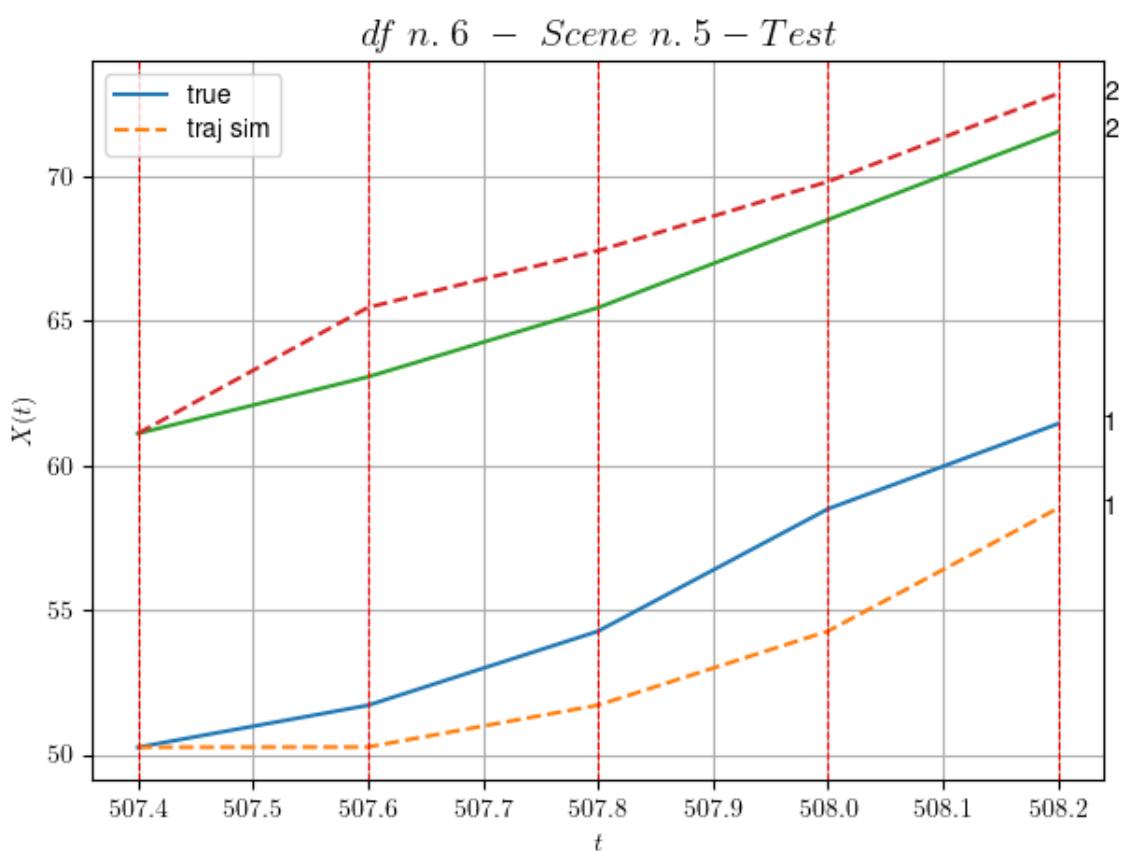


For scene 4/18:  
\* MSE = 2.153666911204406

---

---

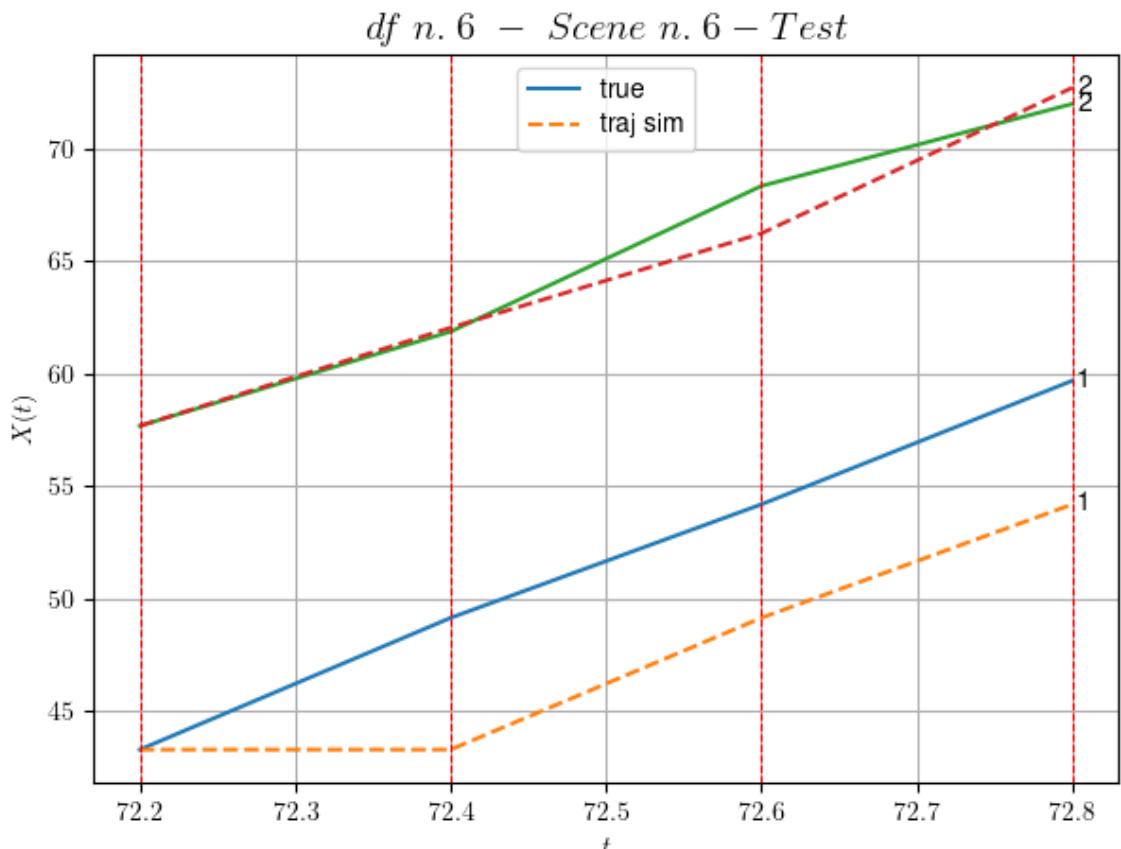
DataFrame n.6. Scene n.5/18



For scene 5/18:  
\* MSE = 4.814265539210165

---

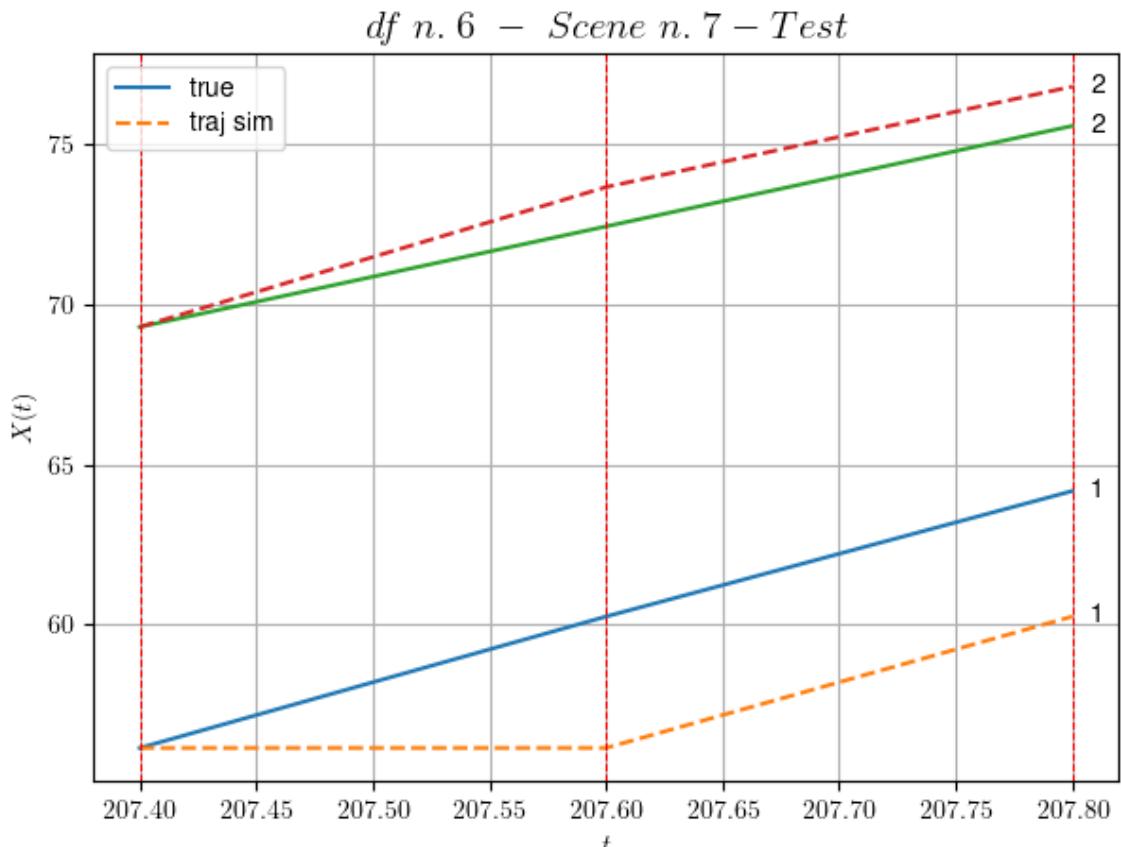
DataFrame n.6. Scene n.6/18



For scene 6/18:  
\* MSE = 11.837697527802776

---

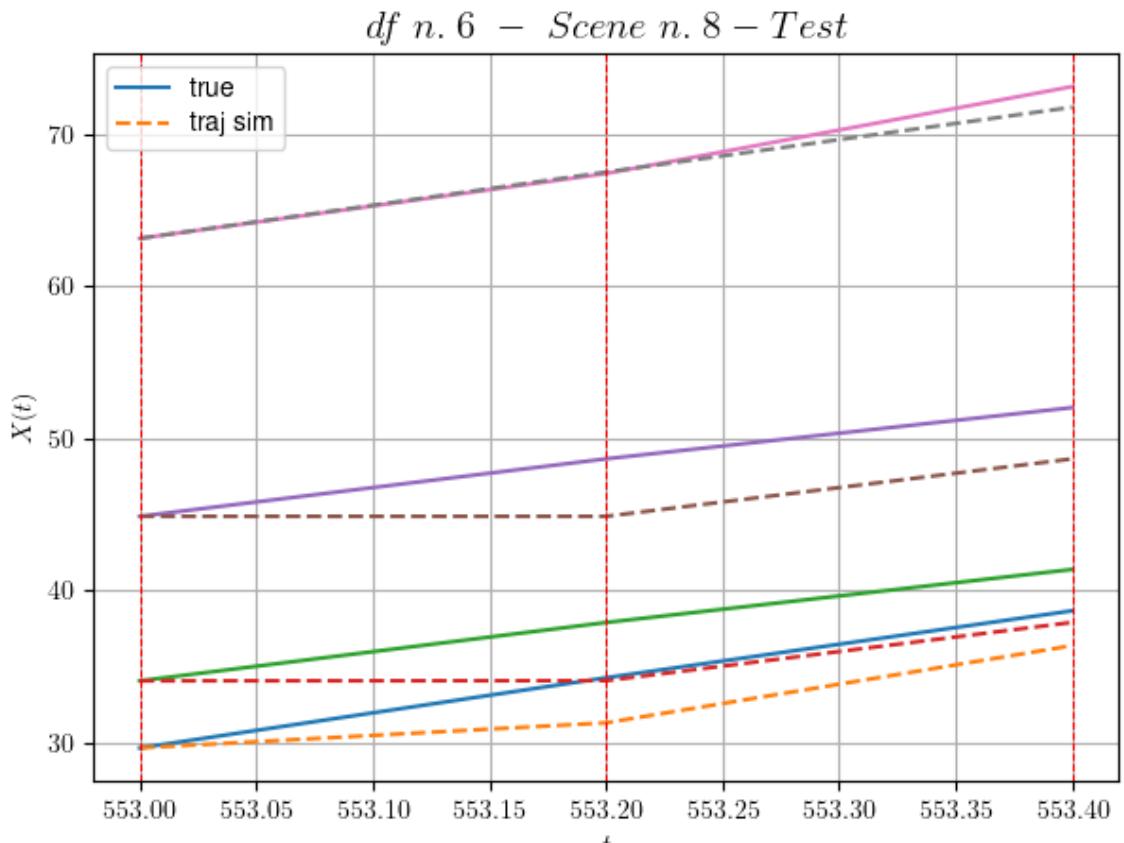
DataFrame n.6. Scene n.7/18



For scene 7/18:  
\* MSE = 5.851810132361743

---

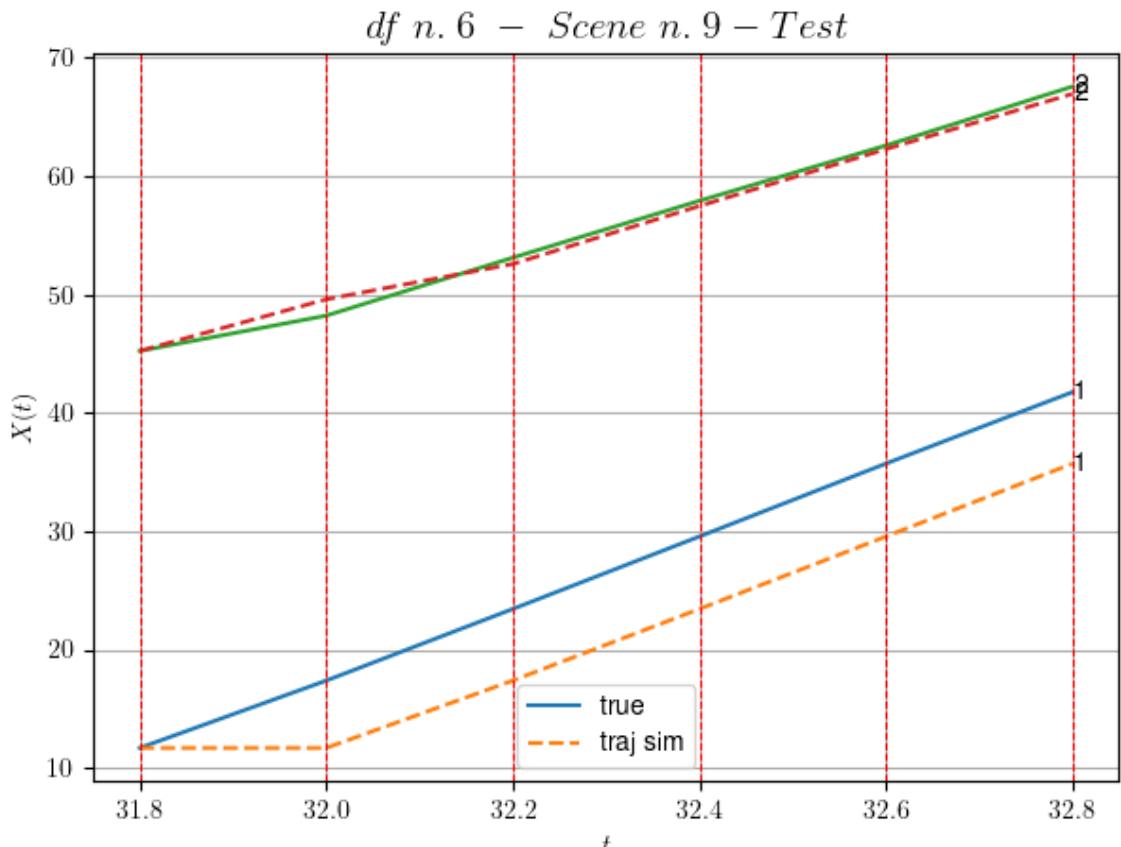
DataFrame n.6. Scene n.8/18



For scene 8/18:  
\* MSE = 5.687453039048392

---

DataFrame n.6. Scene n.9/18

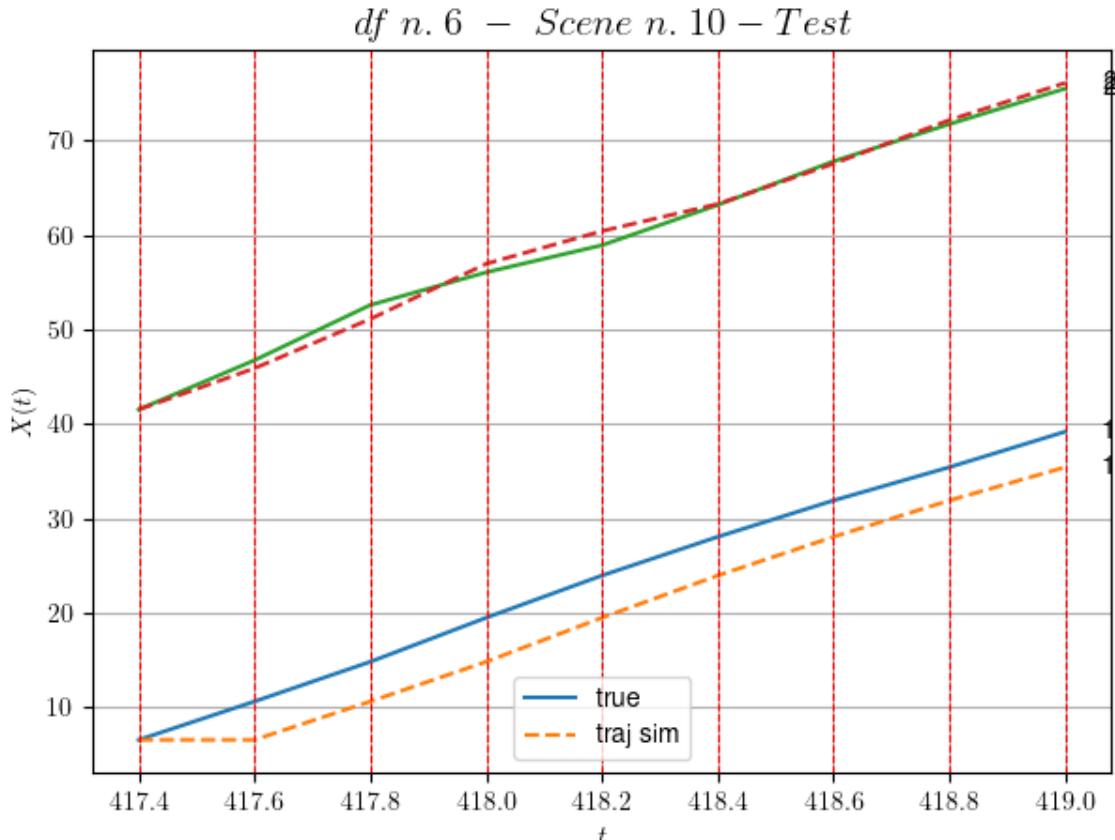


For scene 9/18:  
\* MSE = 15.310443486151275

---

---

DataFrame n.6. Scene n.10/18



For scene 10/18:  
\* MSE = 7.803124429038628

---

---

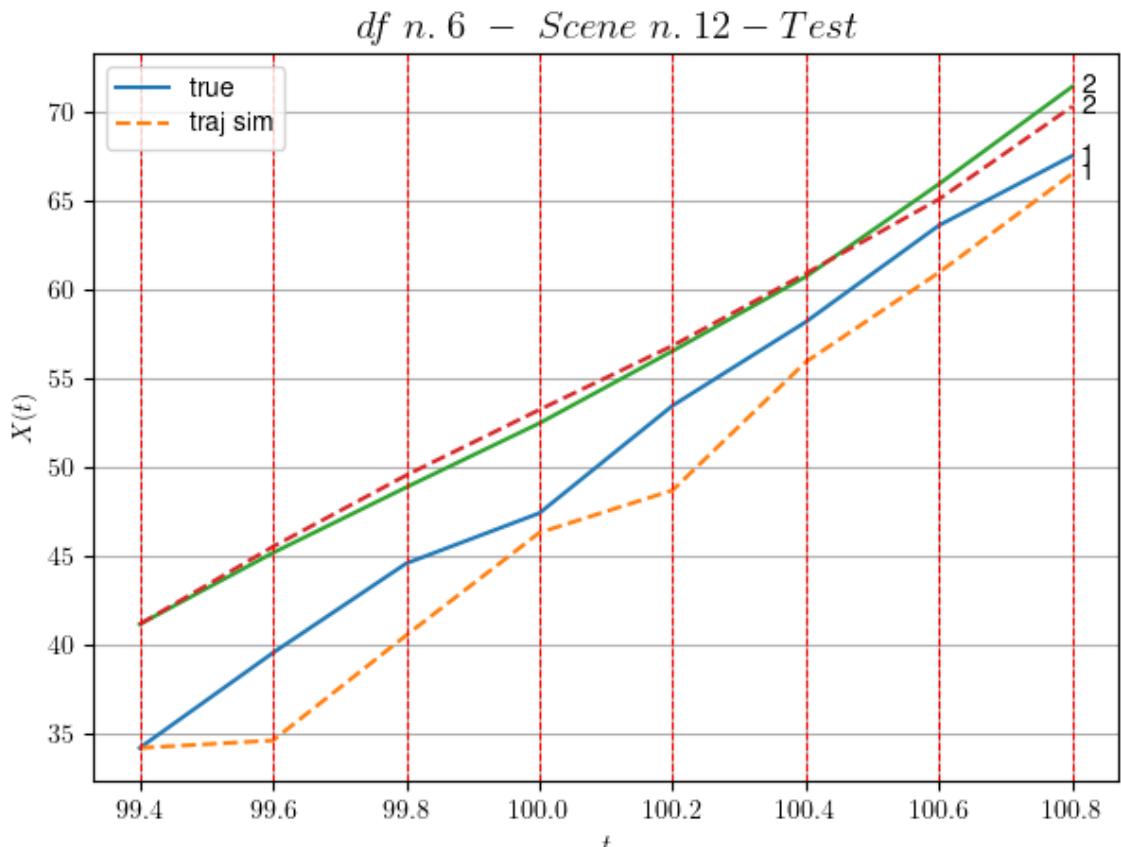
DataFrame n.6. Scene n.11/18



For scene 11/18:  
\* MSE = 2.8472331306732643

---

DataFrame n.6. Scene n.12/18

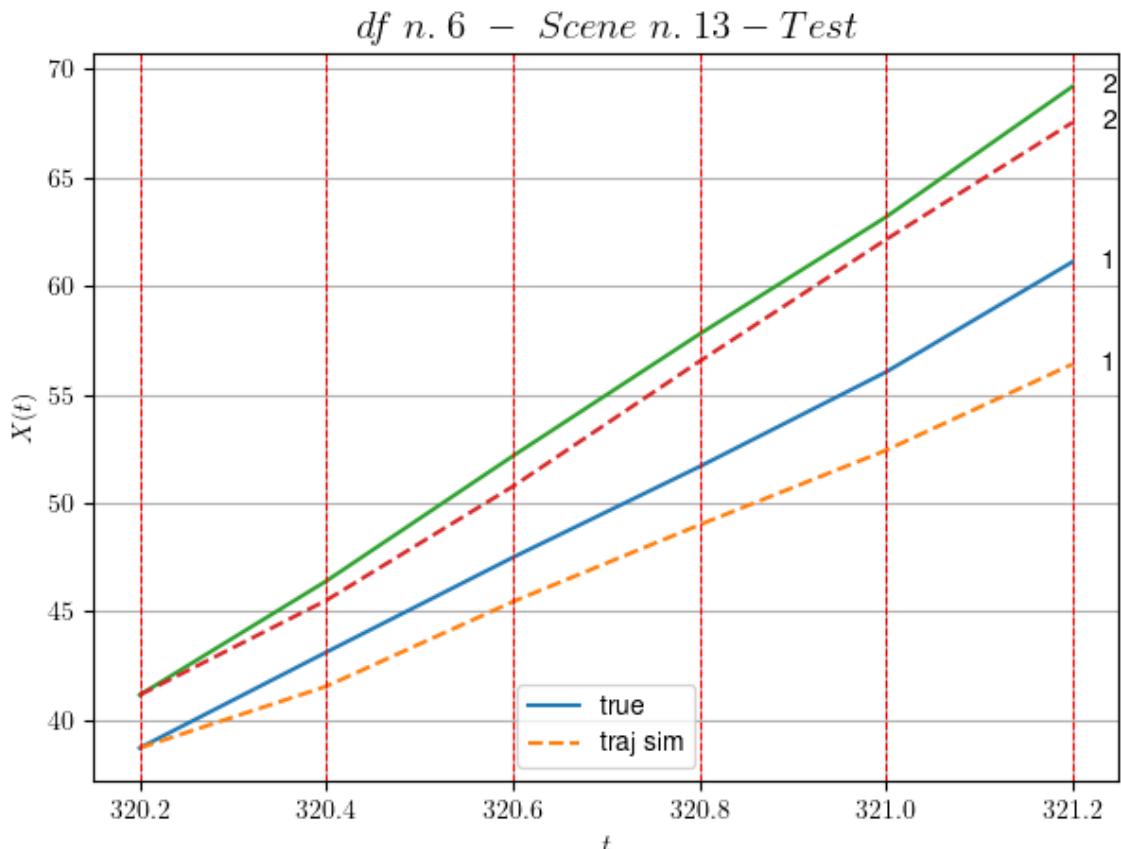


For scene 12/18:  
\* MSE = 5.05448512978007

---

---

DataFrame n.6. Scene n.13/18

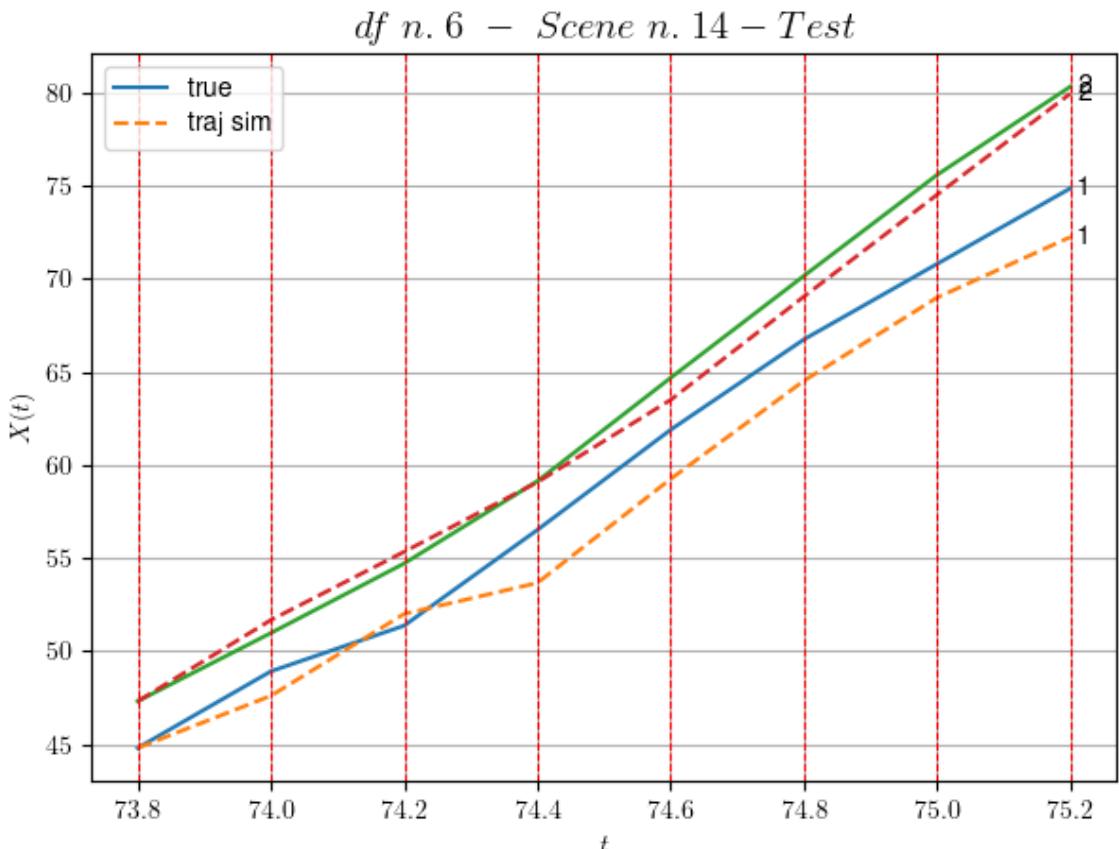


For scene 13/18:  
\* MSE = 4.7734524710157045

---

---

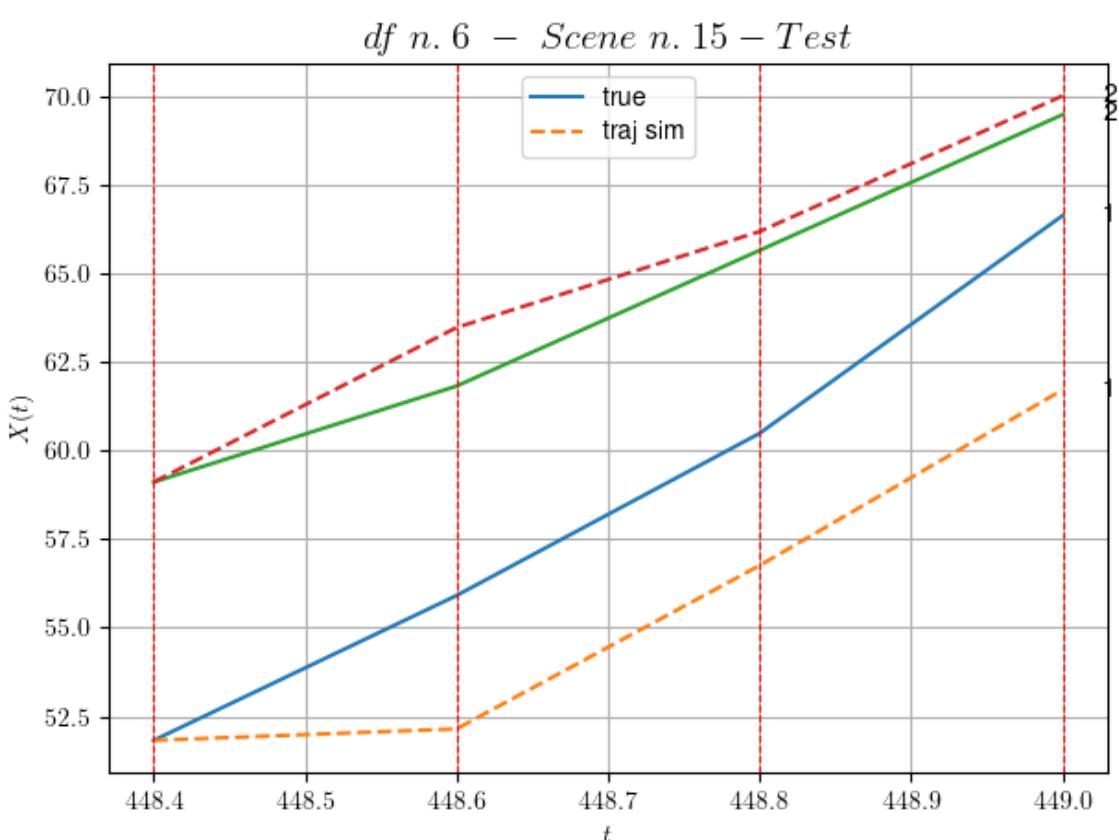
DataFrame n.6. Scene n.14/18



For scene 14/18:  
\* MSE = 2.31492302678606

---

DataFrame n.6. Scene n.15/18

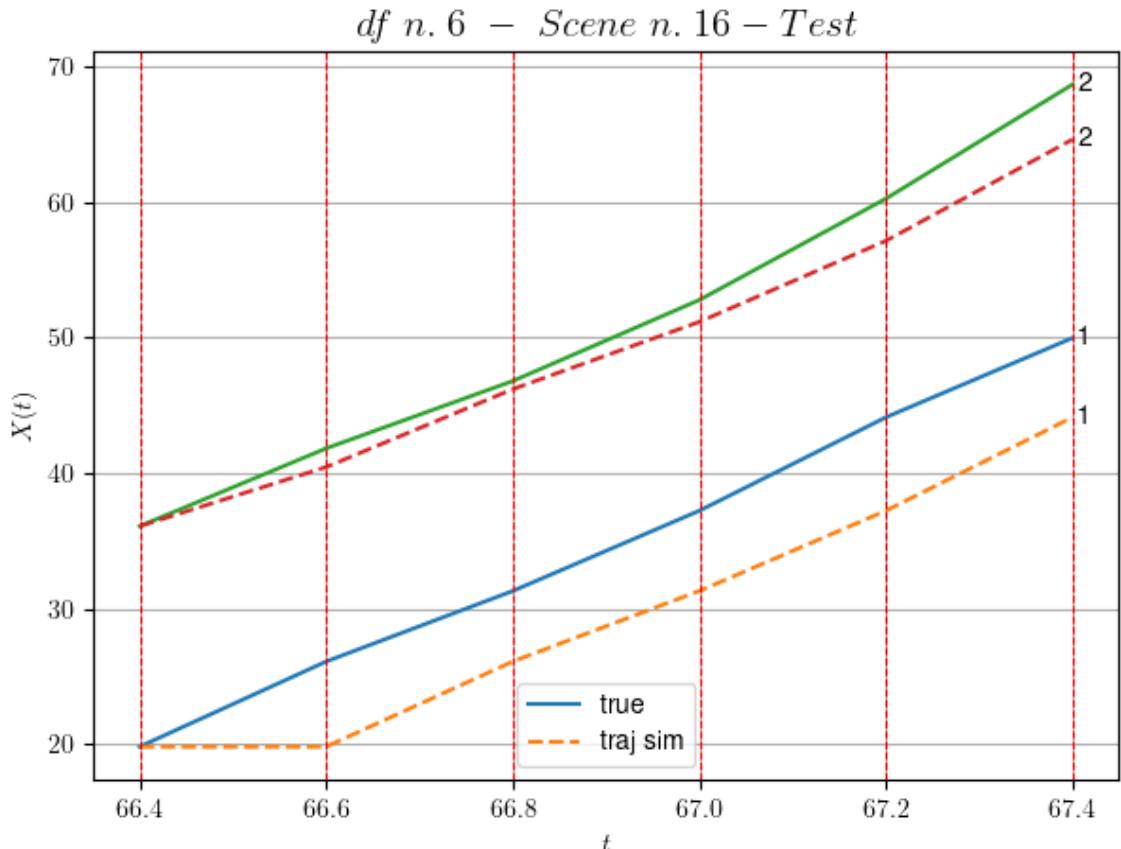


For scene 15/18:  
\* MSE = 6.948441030616182

---

---

DataFrame n.6. Scene n.16/18

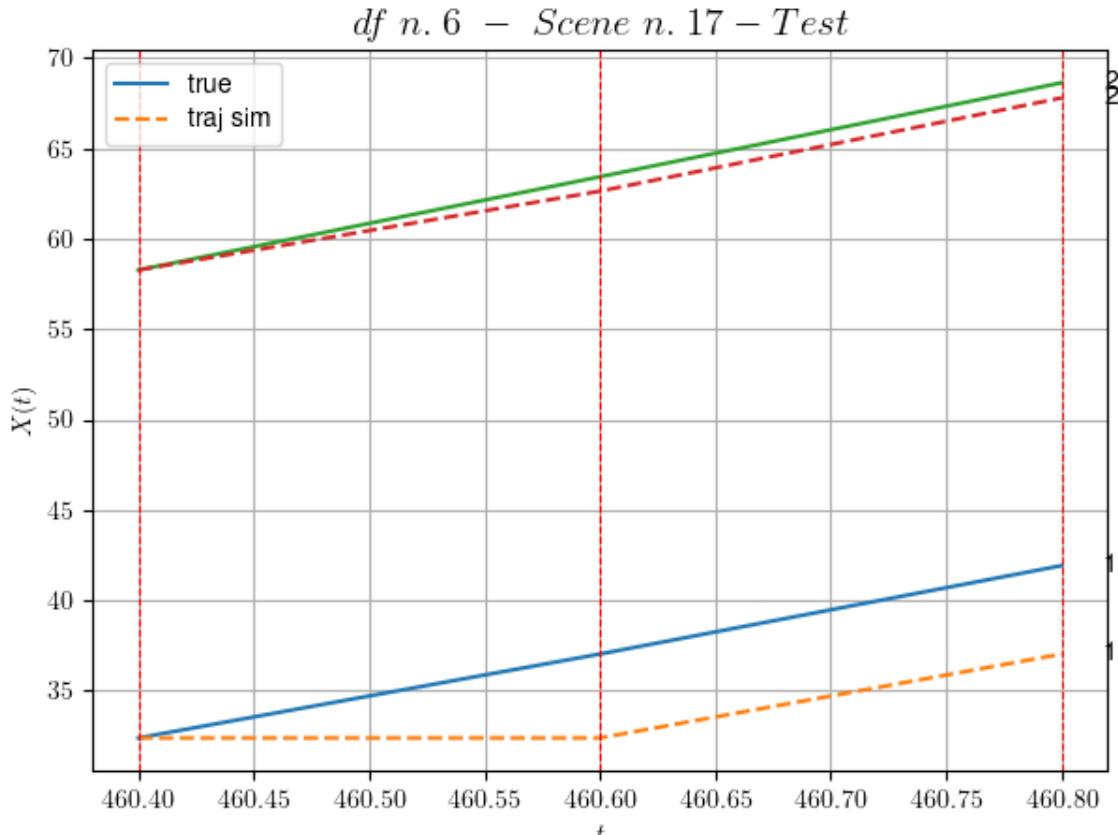


For scene 16/18:  
\* MSE = 17.8430980958926

---

---

DataFrame n.6. Scene n.17/18



For scene 17/18:  
\* MSE = 7.806773473529387

---

DataFrame n. 6. Scene n. 18/18



MSE test: 6.525411347354952

---

Summing up:  
\* MSE train: 25.82748073585255  
\* MSE test: 6.525411347354952

---

Analyzing 7/10 dfs.  
In DataFrame n.7 we have 30 scenes.  
To train the model we use 20 scenes, the remaining 10 to test the model.

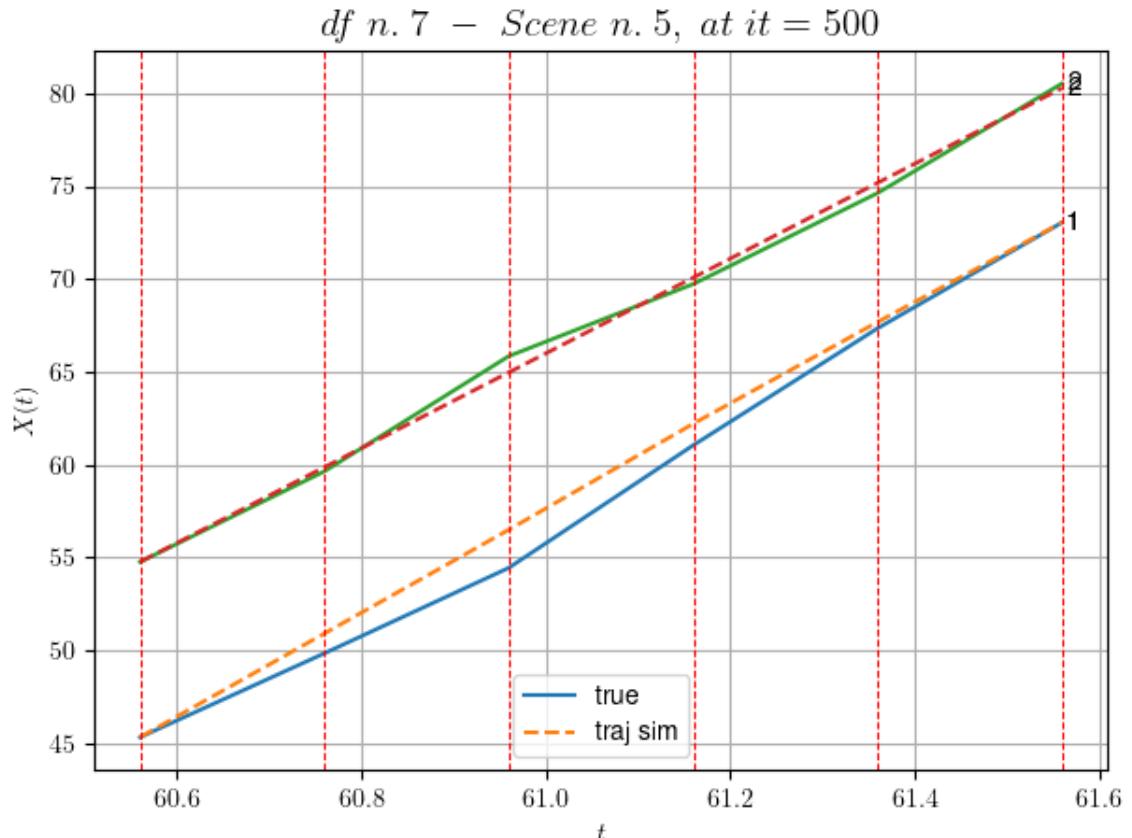
Training step. (20 scenes)

---

DataFrame n.7. Scene n.1/20

---

We have 5 time intervals inside [60.56, 61.56]



---

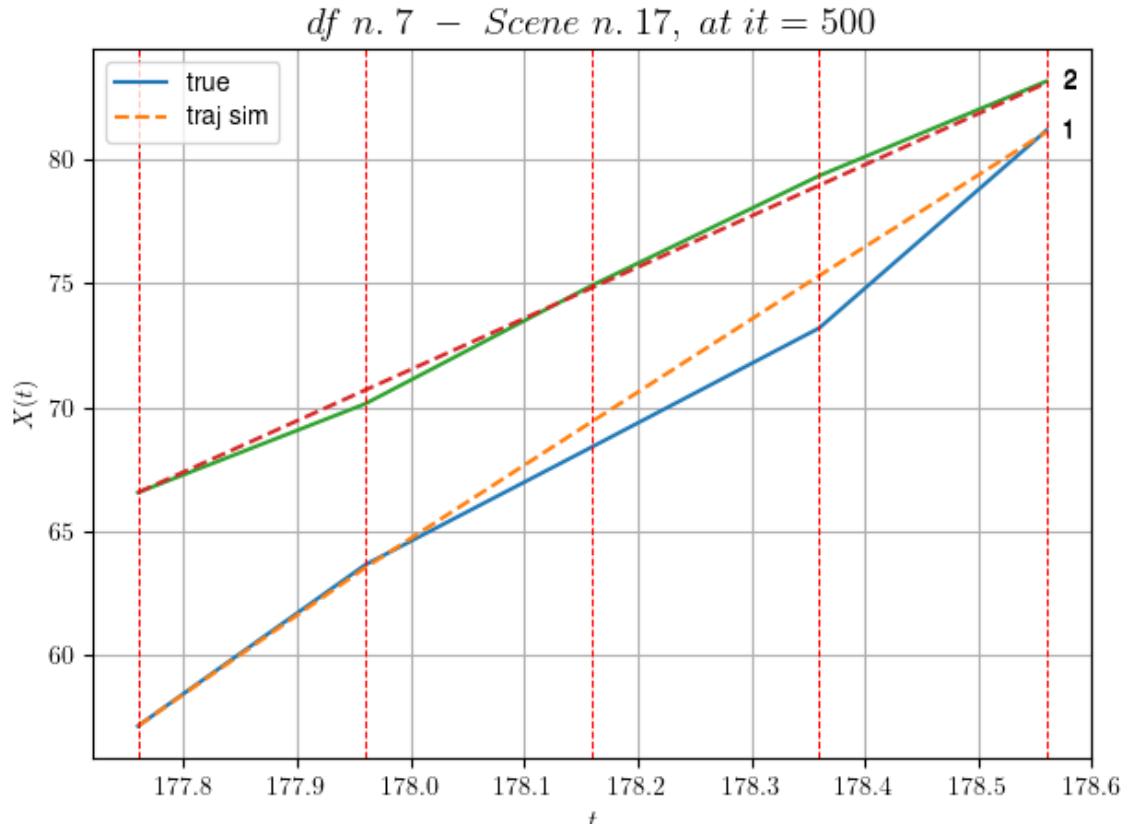
For scene 1/20:  
\* After LR finder: LR\_NN=5e-05 with mse=4.857793072245469 at  
t it=24  
\* v0 = 25.527220166442767  
\* MSE = 0.6722170692111791  
\* iterations = 500

---

DataFrame n.7. Scene n.2/20

---

We have 4 time intervals inside [177.76,178.56]



---

For scene 2/20:

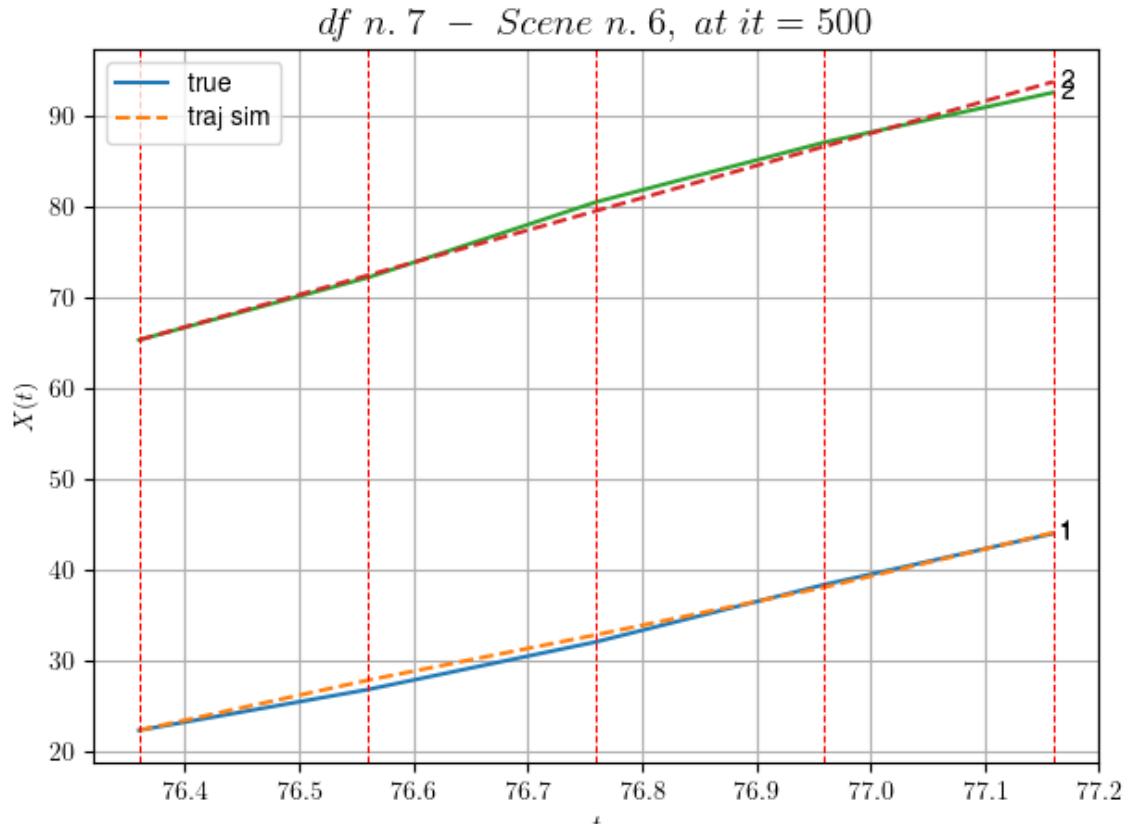
\* After LR finder: LR\_NN=5e-05 with mse=10.869414593523908  
at it=24  
\* v0 = 20.68352620370655  
\* MSE = 0.5986374254870973  
\* iterations = 500

---

DataFrame n.7. Scene n.3/20

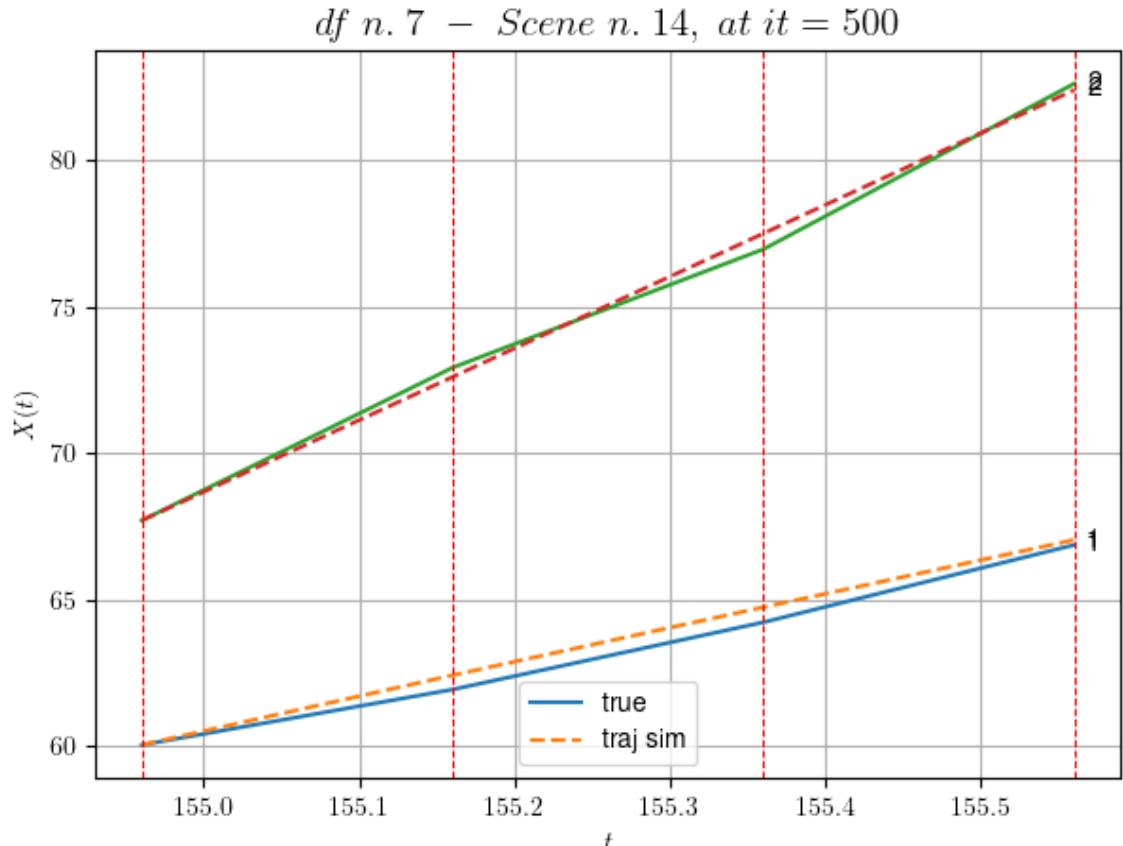
---

We have 4 time intervals inside [76.36, 77.16]



DataFrame n.7. Scene n.4/20

We have 3 time intervals inside [154.96,155.56]

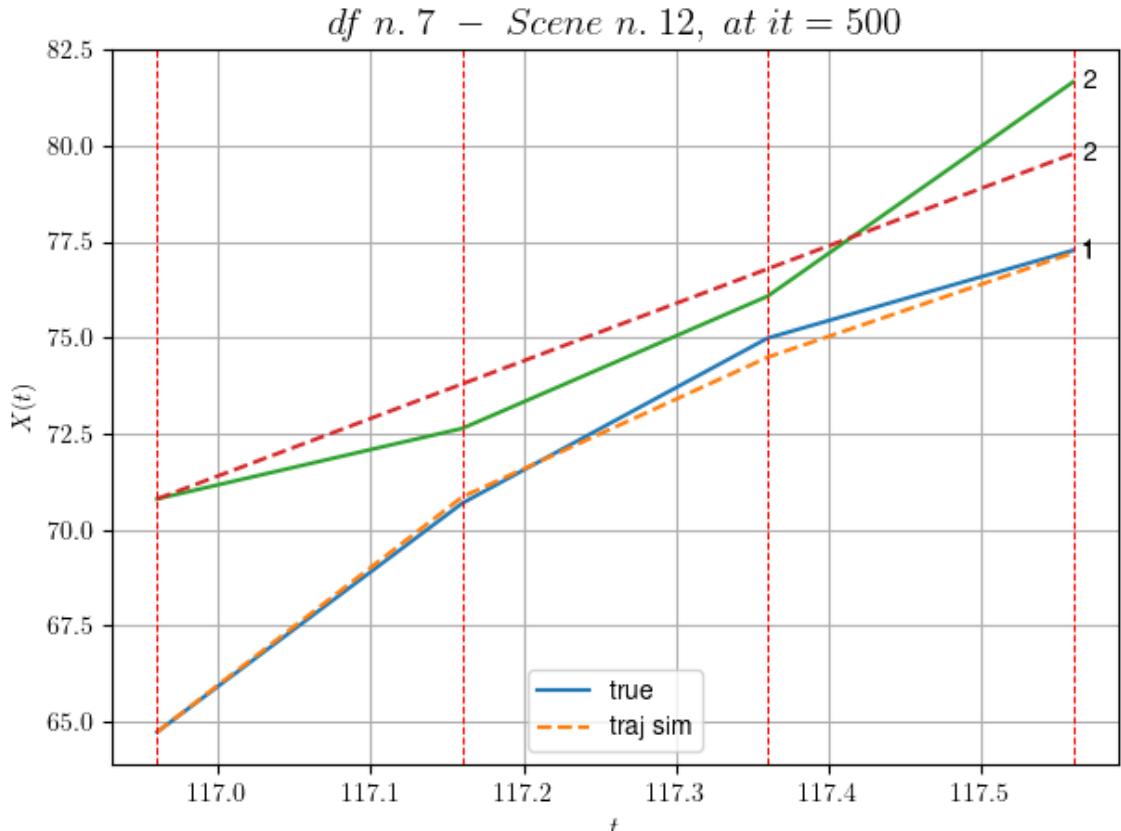


For scene 4/20:

\* After LR finder: LR\_NN=0.0001 with mse=2.1835846100668457  
at it=24  
\* v0 = 24.52487868148255  
\* MSE = 0.12143336123895308  
\* iterations = 500

DataFrame n.7. Scene n.5/20

We have 3 time intervals inside [116.96,117.56]

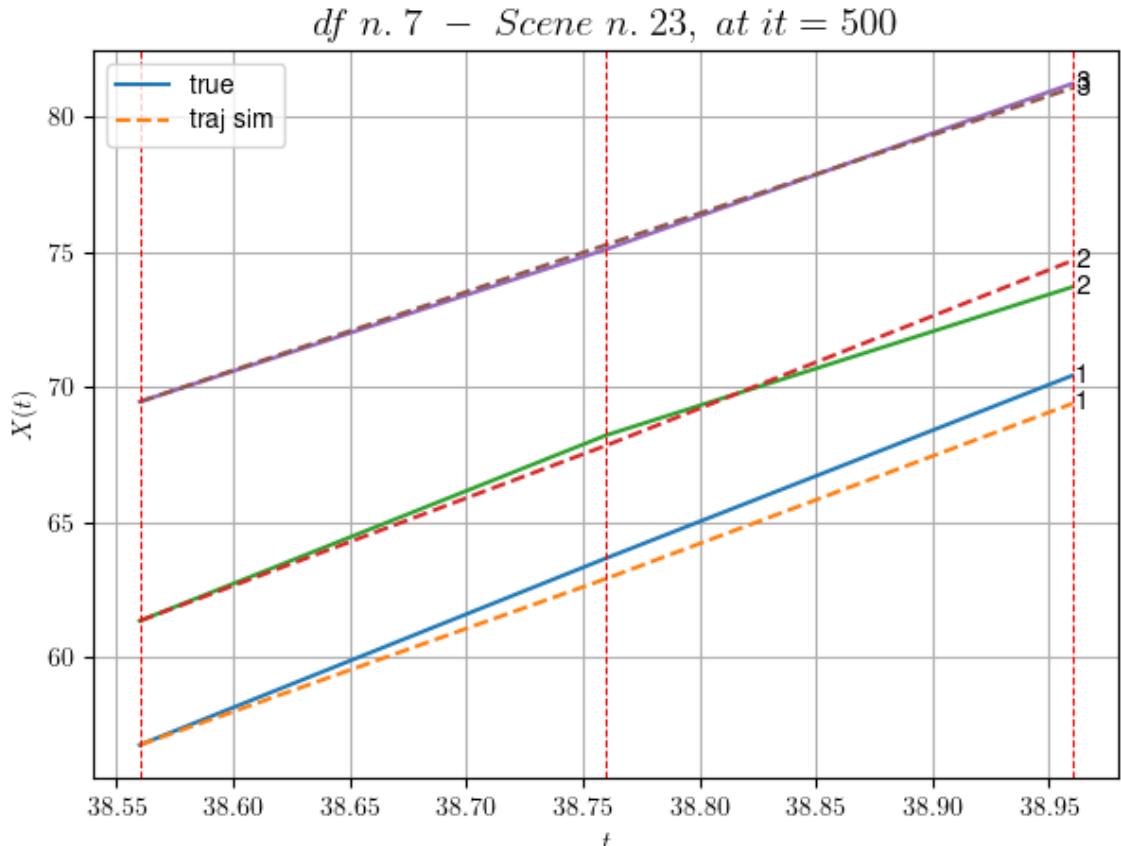


For scene 5/20:

\* After LR finder: LR\_NN=0.0005 with mse=14.529858794293428  
at it=24  
\* v0 = 14.981640724782414  
\* MSE = 0.6708585490135776  
\* iterations = 500

DataFrame n.7. Scene n.6/20

We have 2 time intervals inside [38.56,38.96]

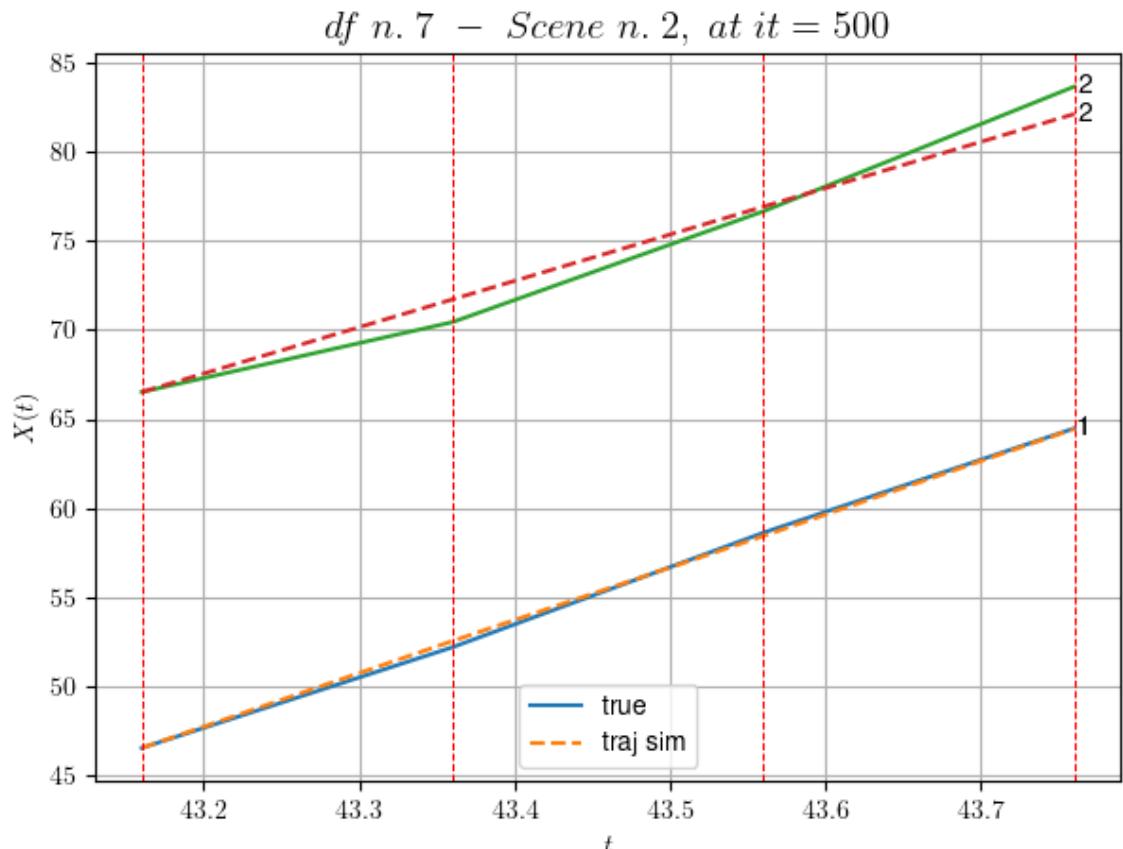


For scene 6/20:

\* After LR finder: LR\_NN=0.001 with mse=3.3312876207940008  
at it=24  
\*  $v_0 = 28.990010590084932$   
\* MSE = 0.31030177652382923  
\* iterations = 500

DataFrame n.7. Scene n.7/20

We have 3 time intervals inside [43.16,43.76]

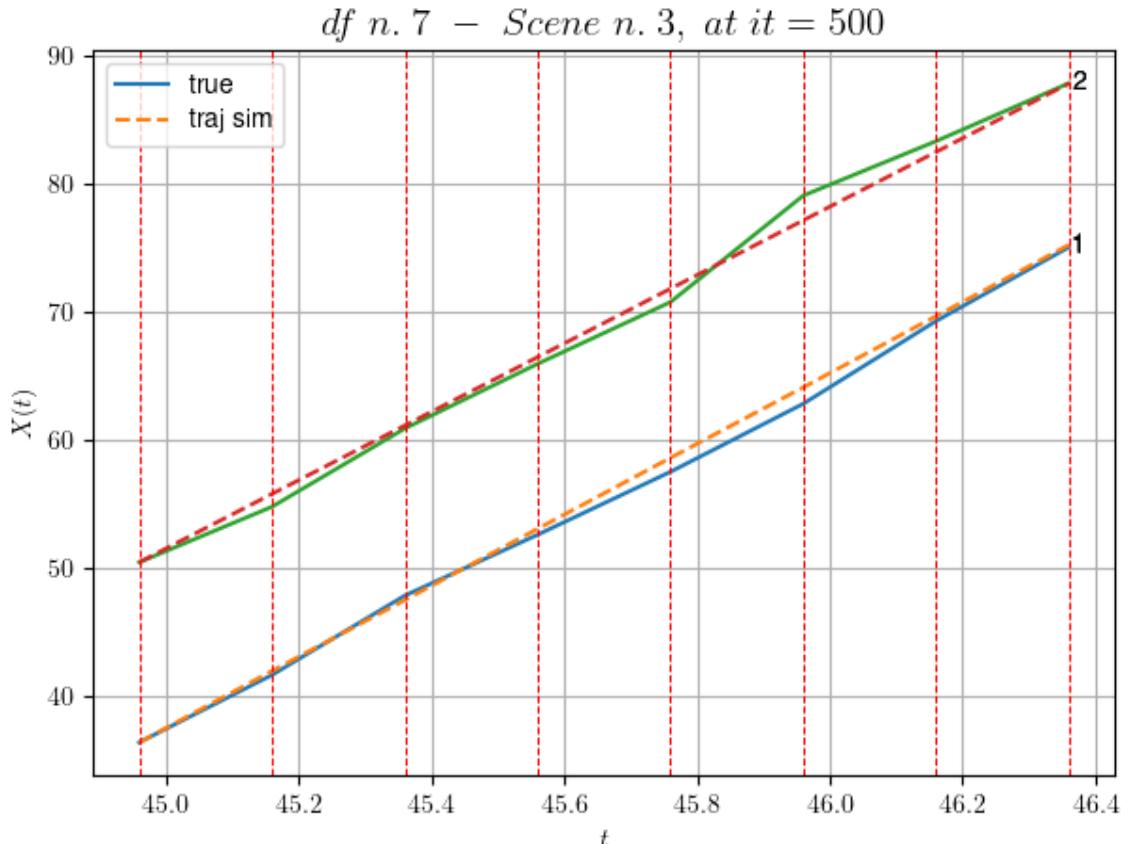


For scene 7/20:

\* After LR finder: LR\_NN=5e-05 with mse=1.153870217618044 at it=24  
\*  $v_0 = 25.959463570058308$   
\* MSE = 0.45868234693192855  
\* iterations = 500

DataFrame n.7. Scene n.8/20

We have 7 time intervals inside [44.96,46.36]



---

For scene 8/20:

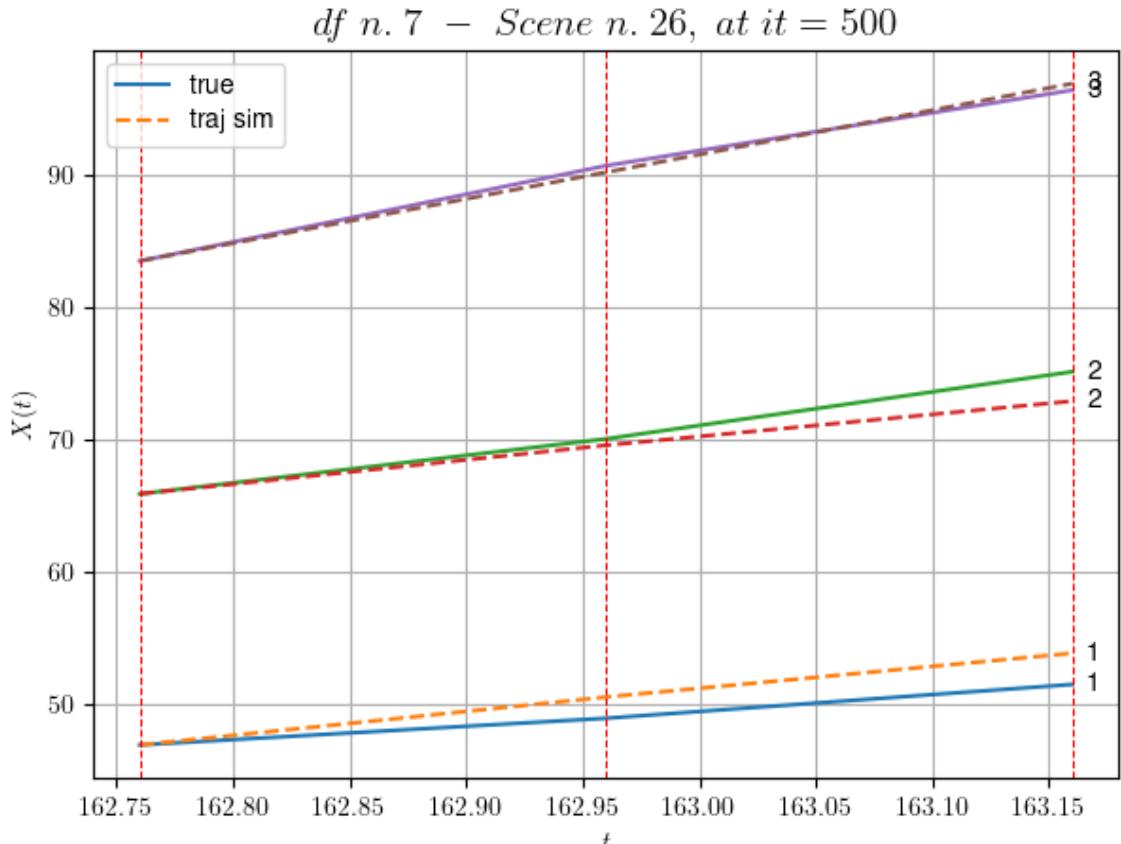
\* After LR finder: LR\_NN=5e-05 with mse=3.7389378460537057  
at it=24  
\* v0 = 26.657757035933543  
\* MSE = 0.6404574436571813  
\* iterations = 500

---

DataFrame n.7. Scene n.9/20

---

We have 2 time intervals inside [162.76,163.16]

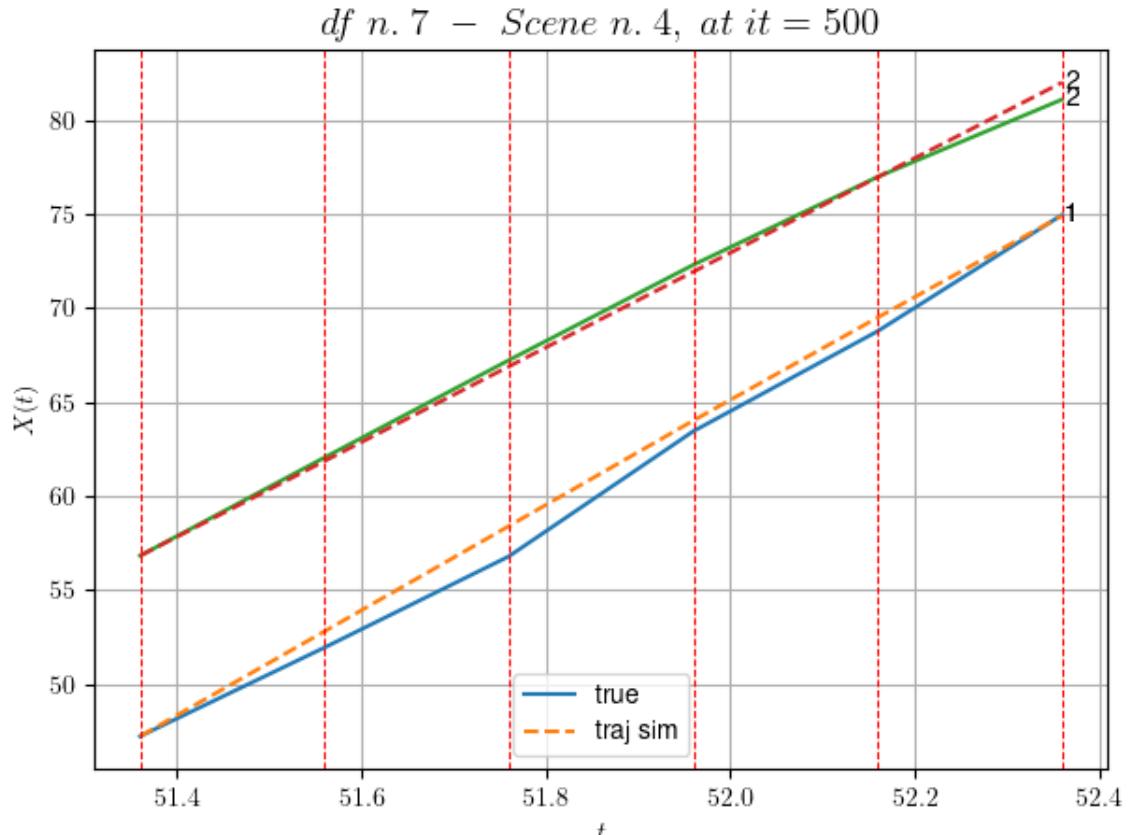


For scene 9/20:

\* After LR finder: LR\_NN=0.0001 with mse=1.9540977129222596  
at it=24  
\* v0 = 33.51455461644857  
\* MSE = 1.526768093748915  
\* iterations = 500

DataFrame n.7. Scene n.10/20

We have 5 time intervals inside [51.36,52.36]



---

For scene 10/20:

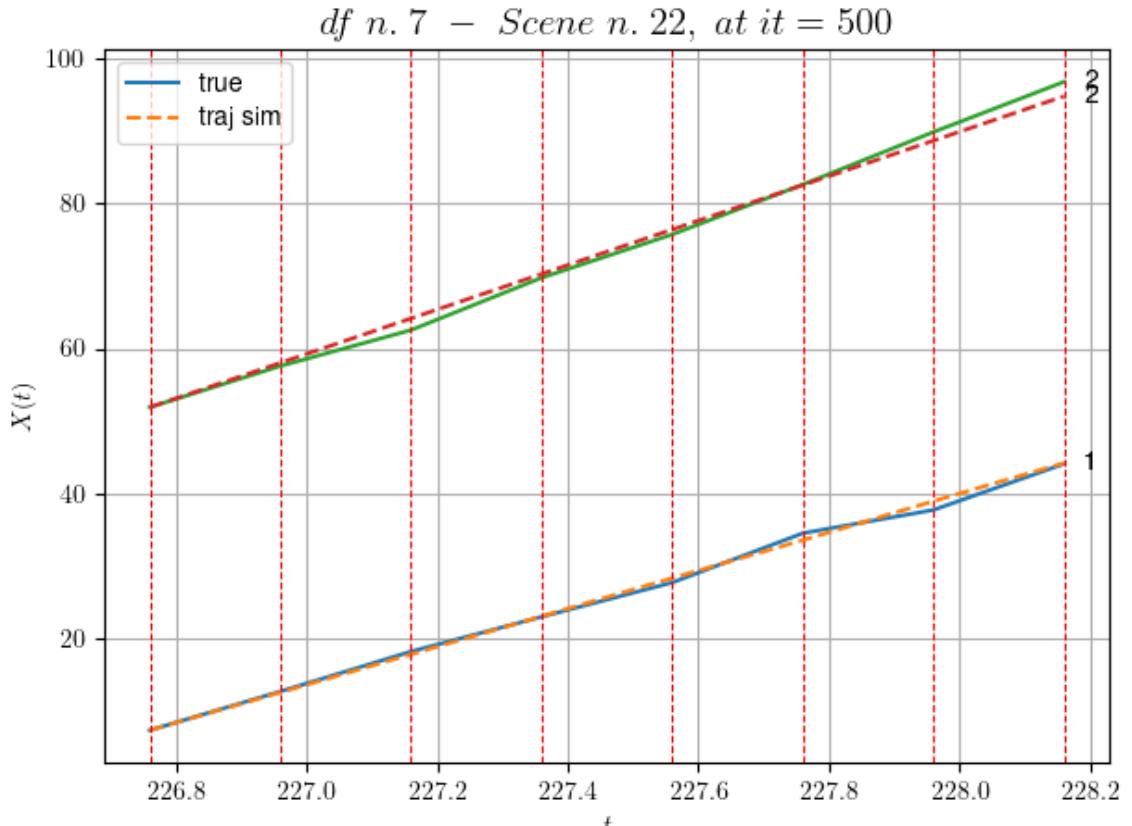
- \* After LR finder: LR\_NN=5e-05 with mse=5.499376572428387 at it=24
- \* v0 = 25.158740607132916
- \* MSE = 0.43818001918541216
- \* iterations = 500

---

DataFrame n.7. Scene n.11/20

---

We have 7 time intervals inside [226.76, 228.16]

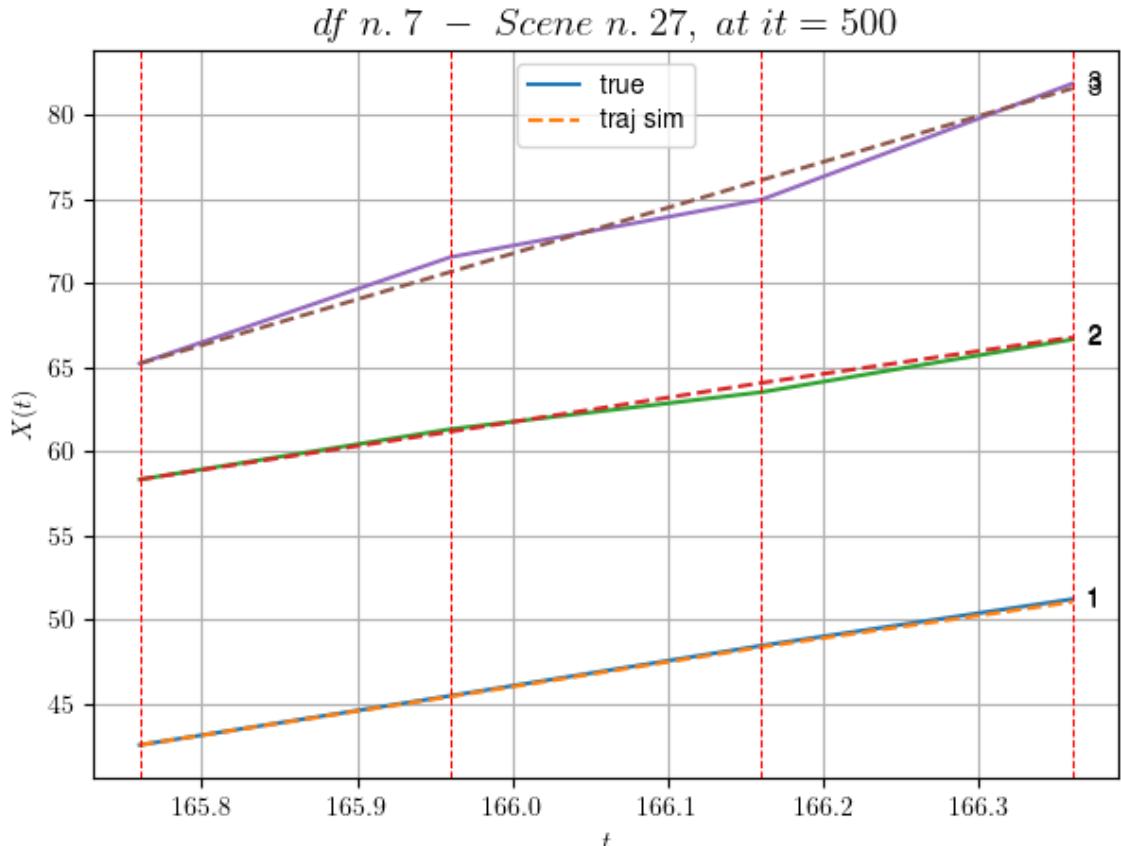


For scene 11/20:

\* After LR finder:  $LR\_NN=1e-05$  with  $mse=1.2603550621717459$   
at it=24  
\*  $v_0 = 30.69836132453341$   
\*  $MSE = 0.7406706246115461$   
\* iterations = 500

DataFrame n.7. Scene n.12/20

We have 3 time intervals inside [165.76,166.36]

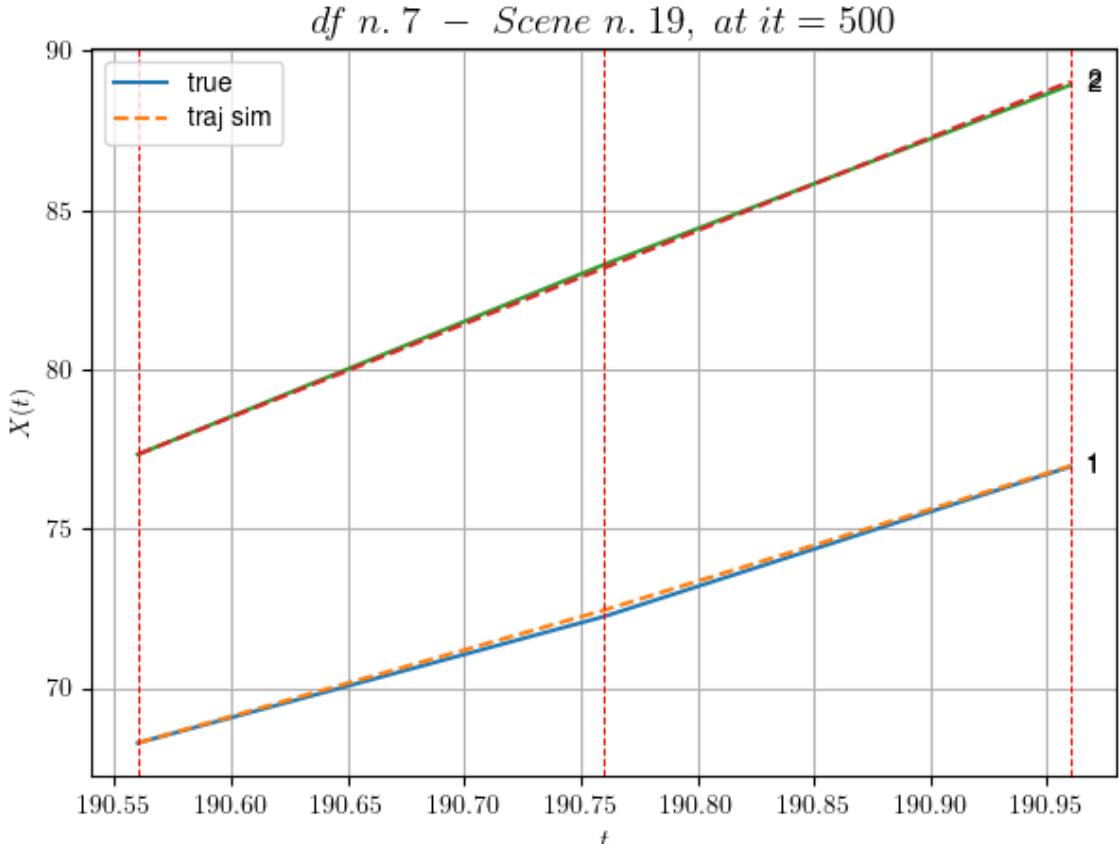


For scene 12/20:

\* After LR finder: LR\_NN=0.001 with mse=1.4412631137267955  
at it=24  
\*  $v_0 = 27.262209824915317$   
\* MSE = 0.21098486291271898  
\* iterations = 500

DataFrame n.7. Scene n.13/20

We have 2 time intervals inside [190.56,190.96]



---

For scene 13/20:

\* After LR finder: LR\_NN=0.0005 with mse=0.0280515073452380  
32 at it=24  
\* v0 = 29.283626091304654  
\* MSE = 0.01088658061224896  
\* iterations = 500

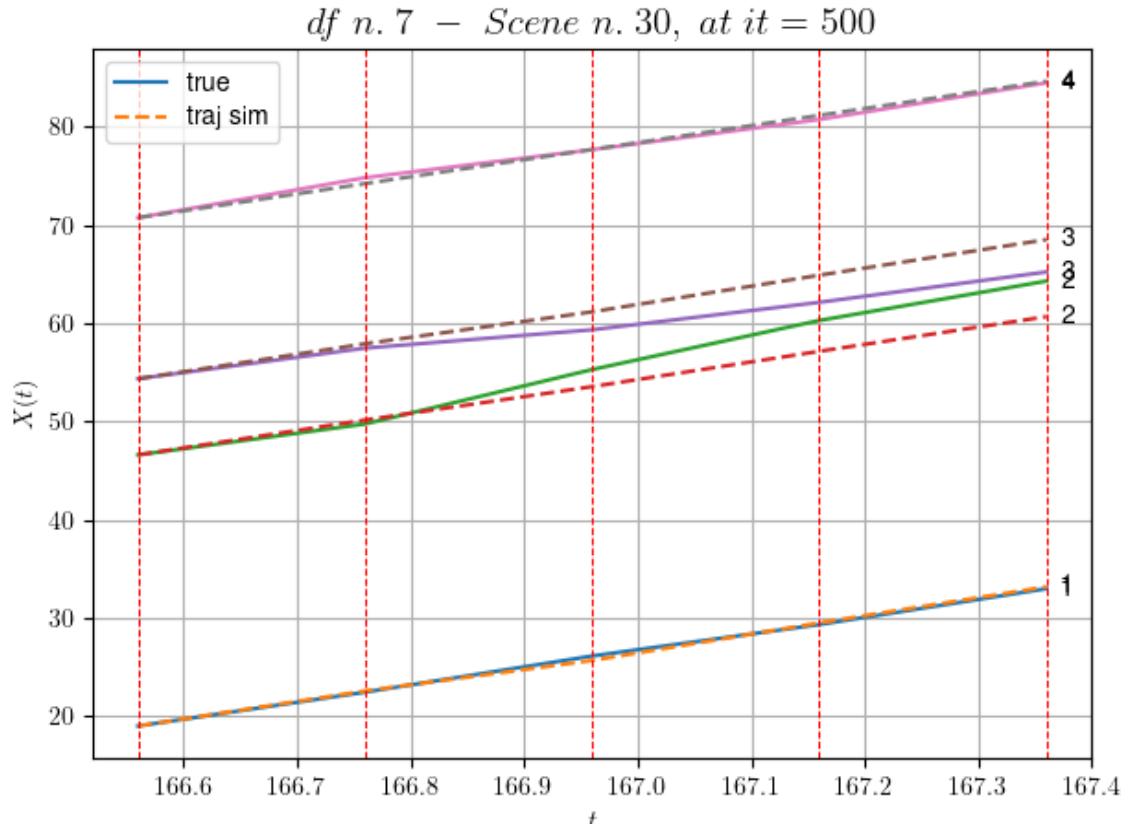
---

---

DataFrame n.7. Scene n.14/20

---

We have 4 time intervals inside [166.56,167.36]

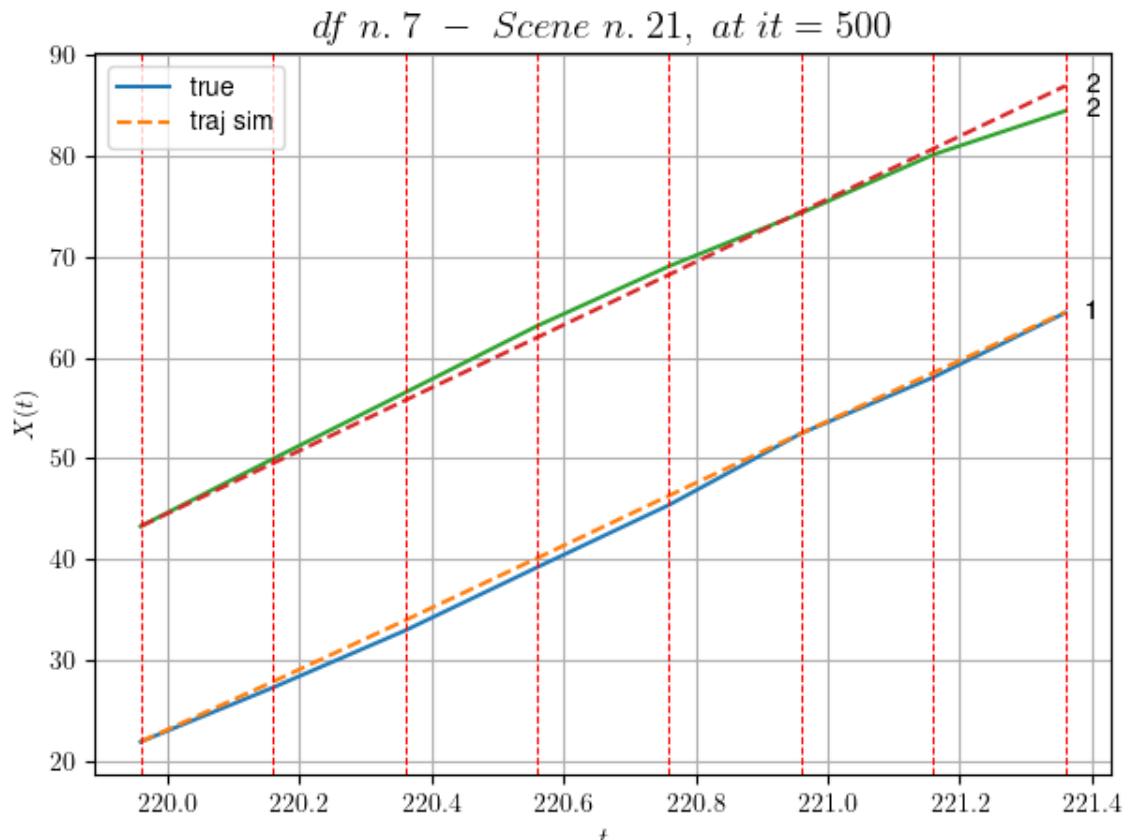


For scene 14/20:

\* After LR finder: LR\_NN=0.001 with mse=22.63878884132177 at it=24  
\* vθ = 17.368635969066222  
\* MSE = 2.451998301382546  
\* iterations = 500

DataFrame n.7. Scene n.15/20

We have 7 time intervals inside [219.96,221.36]



---

For scene 15/20:

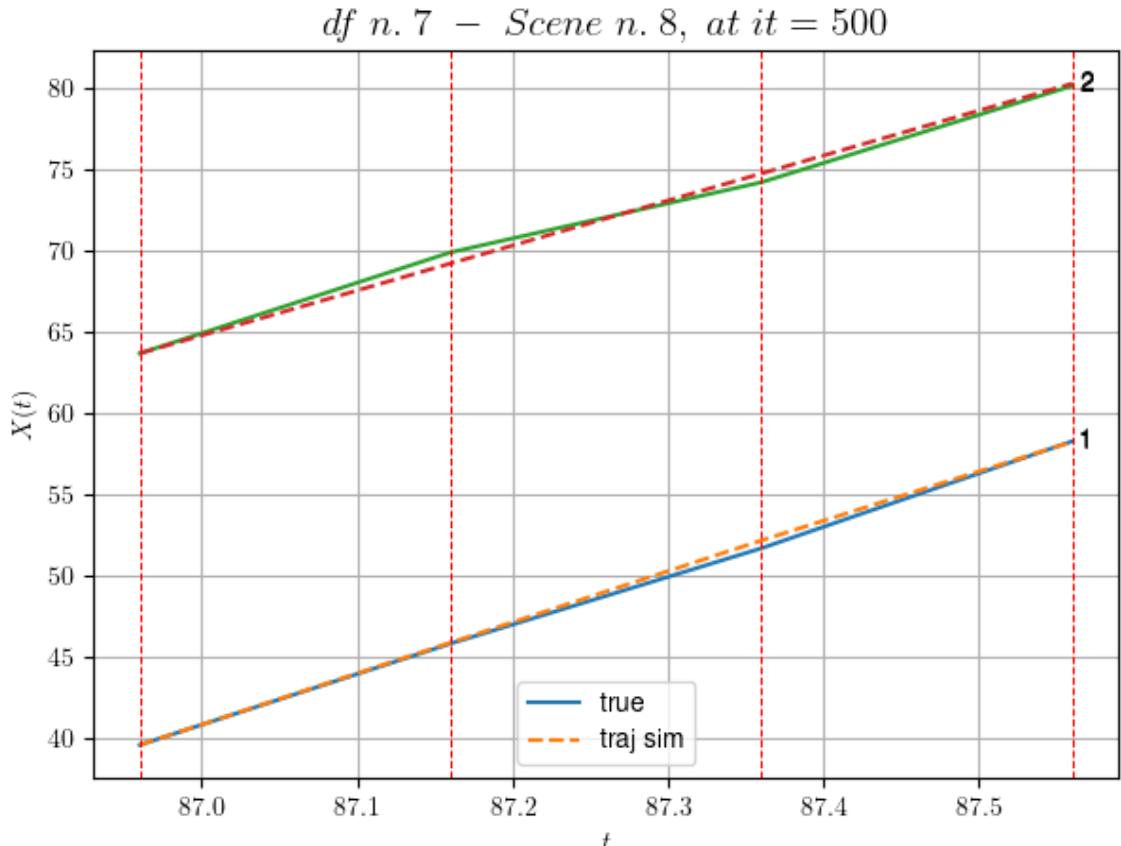
- \* After LR finder:  $LR_{NN}=1e-05$  with  $mse=0.8957017566406125$
- at  $it=24$
- \*  $v_0 = 31.22700758286242$
- \*  $MSE = 0.6583241854554306$
- \* iterations = 500

---

DataFrame n.7. Scene n.16/20

---

We have 3 time intervals inside  $[86.96, 87.56]$

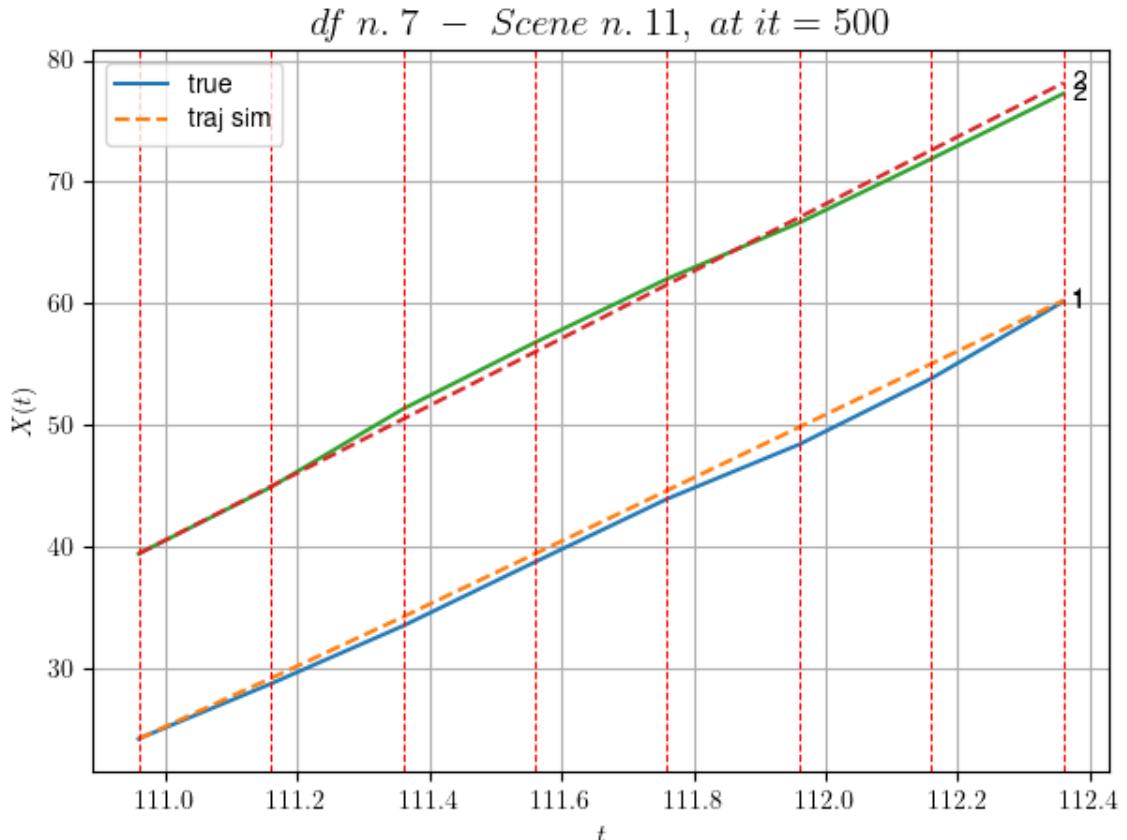


For scene 16/20:

\* After LR finder: LR\_NN=5e-05 with mse=0.6427881223022323  
at it=24  
\* v0 = 27.63329478701566  
\* MSE = 0.12578358224257802  
\* iterations = 500

DataFrame n.7. Scene n.17/20

We have 7 time intervals inside [110.96,112.36]



---

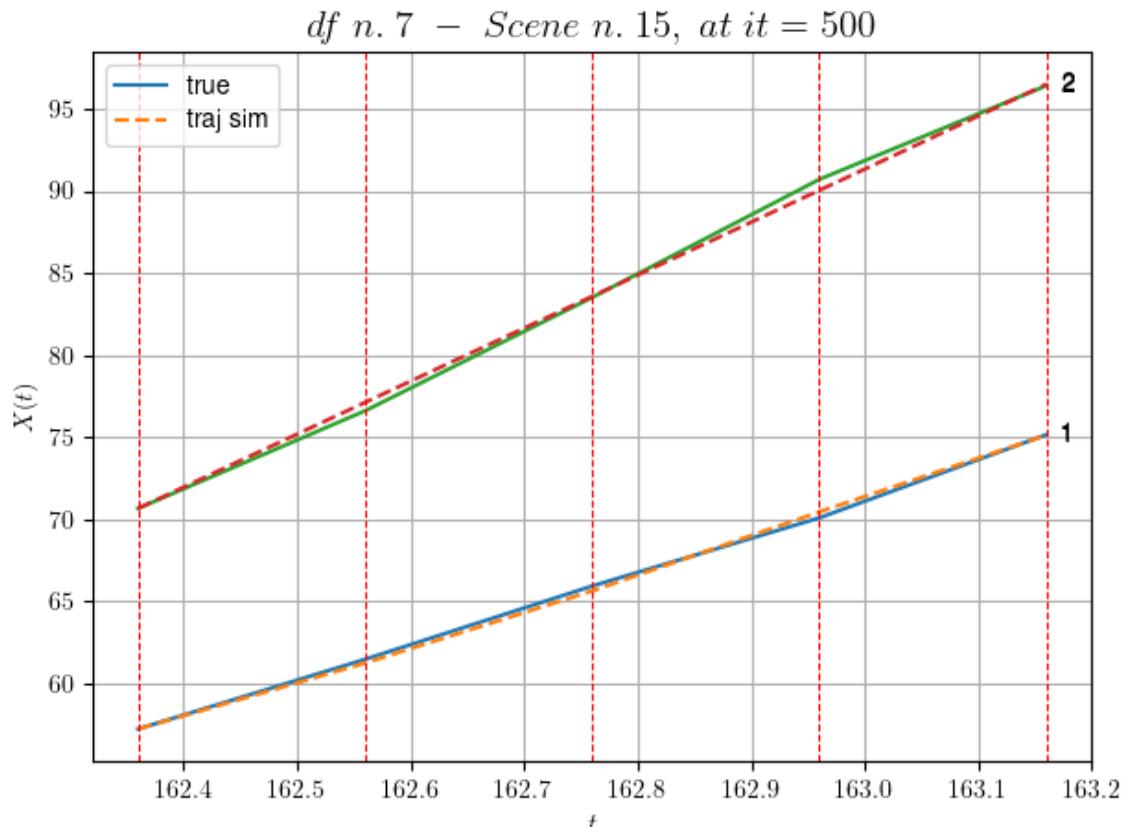
For scene 17/20:  
\* After LR finder: LR\_NN=1e-05 with mse=2.5891858013451956  
at it=24  
\* v0 = 27.676256807459307  
\* MSE = 0.5111142813817187  
\* iterations = 500

---

DataFrame n.7. Scene n.18/20

---

We have 4 time intervals inside [162.36,163.16]



---

For scene 18/20:

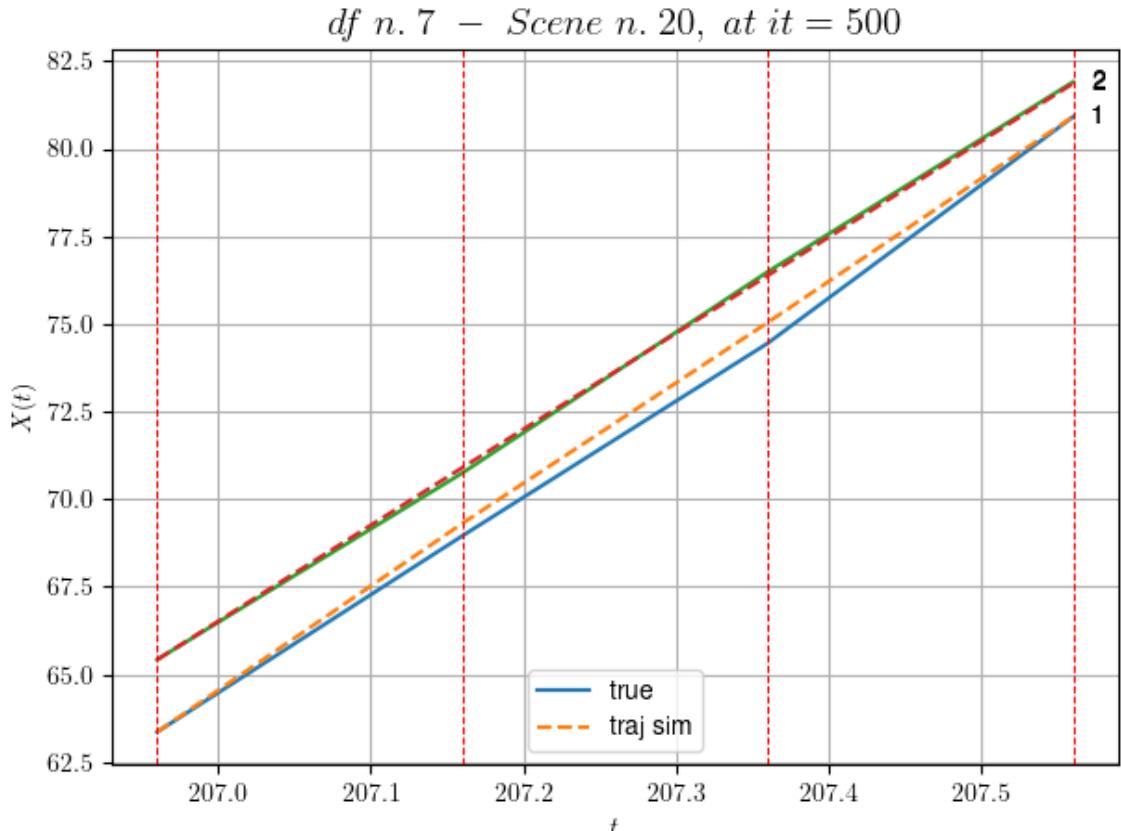
- \* After LR finder: LR\_NN=0.001 with mse=0.8950087499398193
- at it=24
  - \* v<sub>θ</sub> = 32.323787690864414
  - \* MSE = 0.09926912388771392
  - \* iterations = 500

---

DataFrame n.7. Scene n.19/20

---

We have 3 time intervals inside [206.96, 207.56]

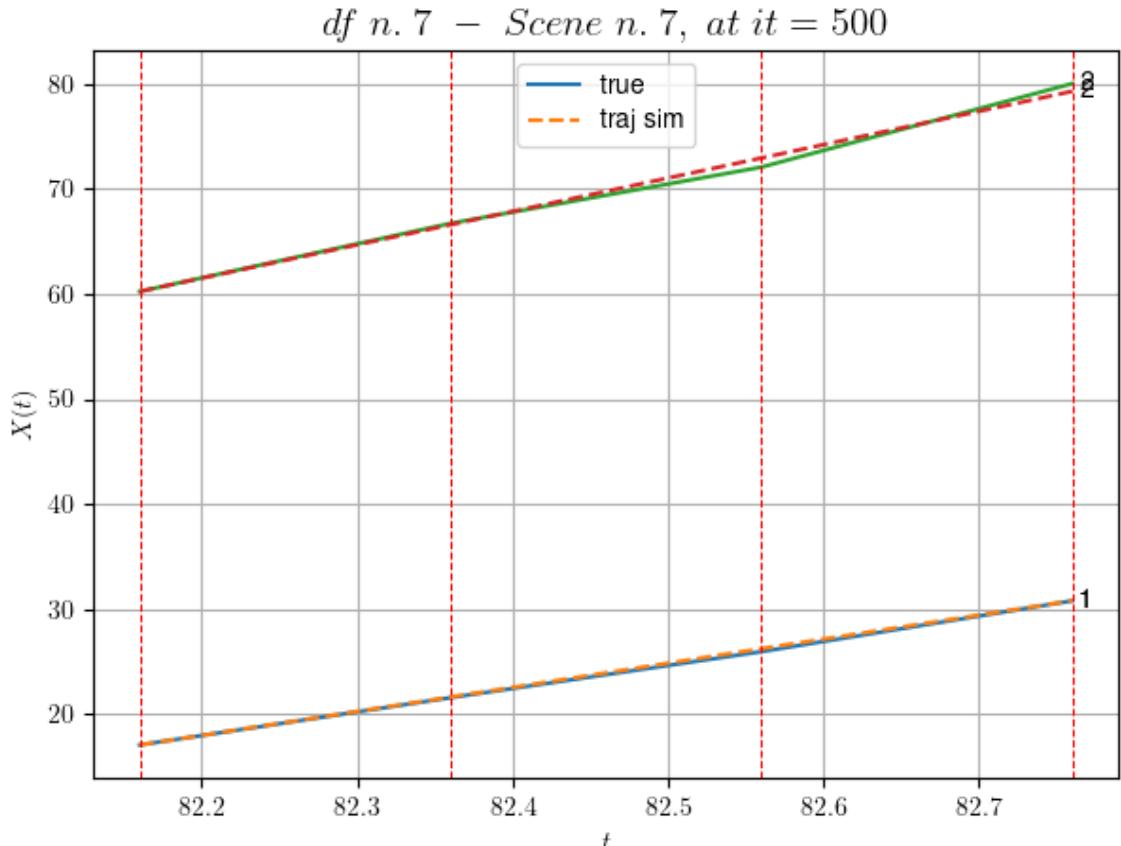


For scene 19/20:

\* After LR finder: LR\_NN=0.0005 with mse=0.5103789541360255  
at it=24  
\* v0 = 27.39925633880076  
\* MSE = 0.06384747524954368  
\* iterations = 500

DataFrame n.7. Scene n.20/20

We have 3 time intervals inside [82.16,82.76]



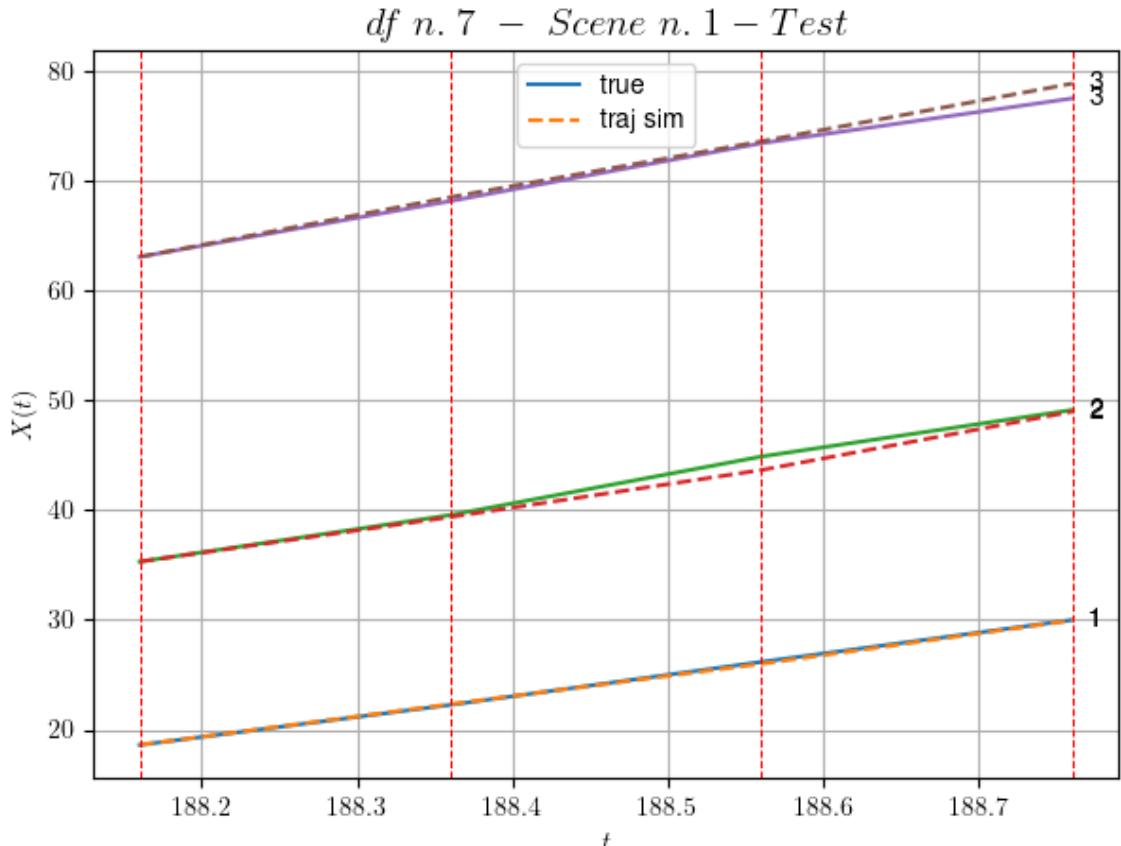
For scene 20/20:

\* After LR finder: LR\_NN=5e-05 with mse=0.4341626582538127  
at it=24  
\* v0 = 31.745431023356108  
\* MSE = 0.1741791899971999  
\* iterations = 500

MSE train: 0.544109902728033

Testing step. (10 scenes)

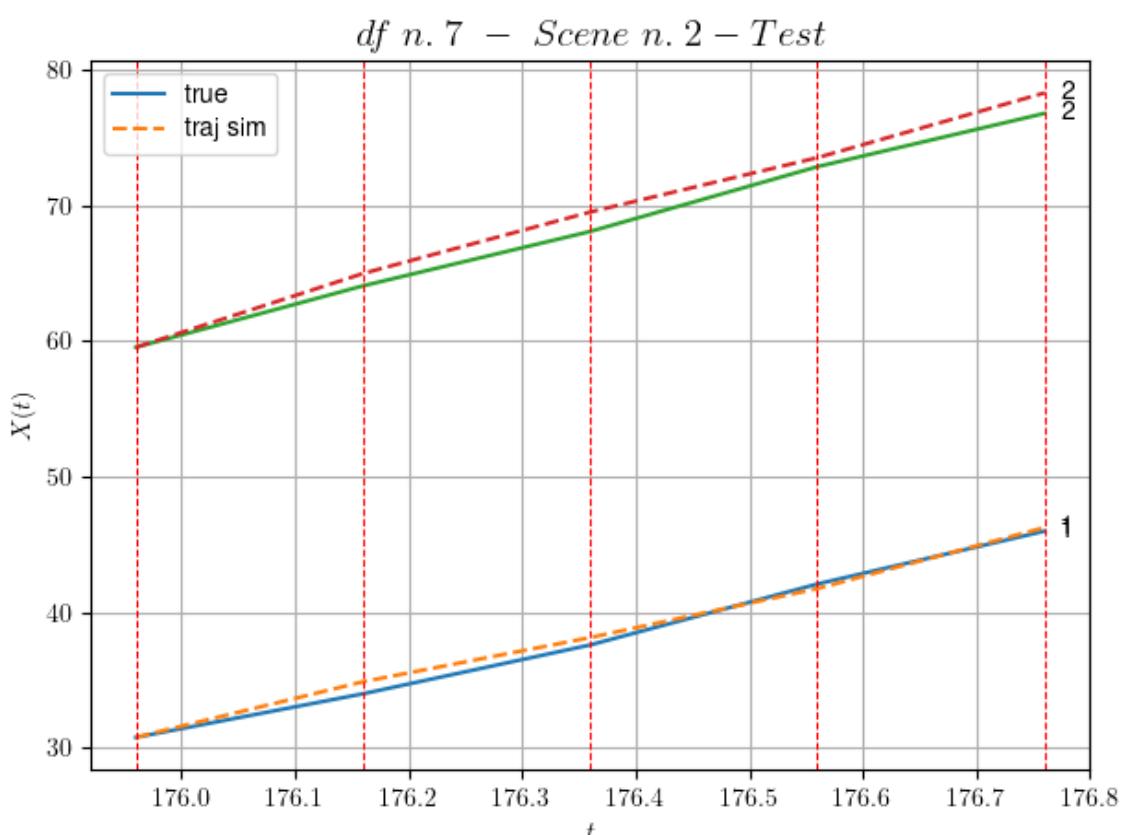
DataFrame n.7. Scene n.1/10



For scene 1/10:  
\* MSE = 0.2993550654030939

---

#### DataFrame n.7. Scene n.2/10

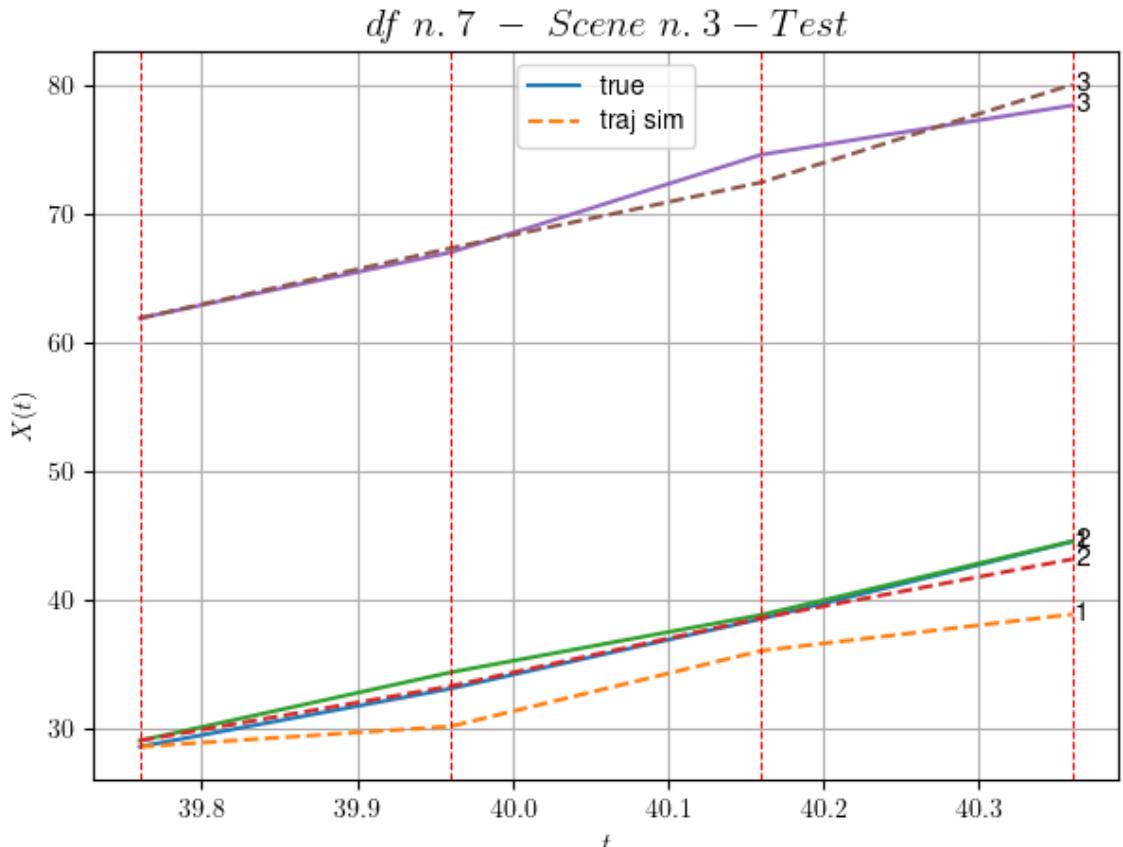


For scene 2/10:  
\* MSE = 0.6872623342158224

---

---

DataFrame n.7. Scene n.3/10

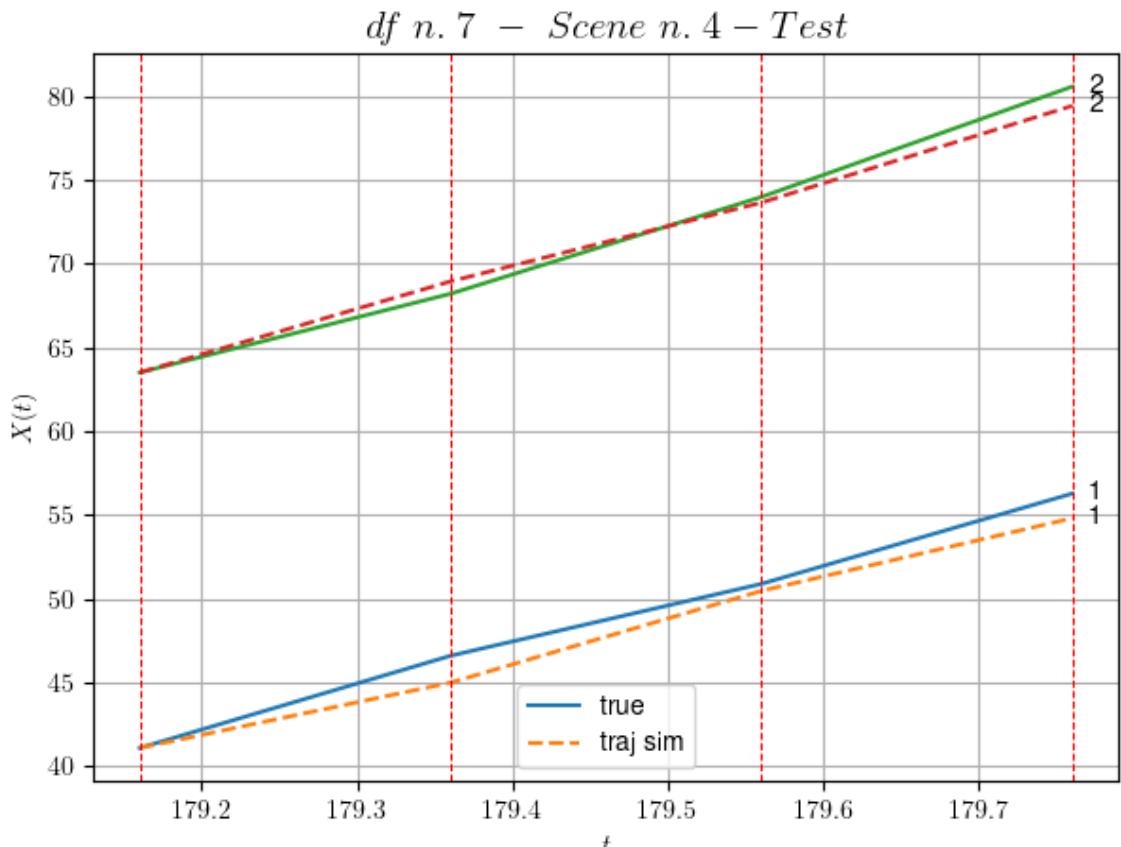


For scene 3/10:  
\* MSE = 4.757645933099668

---

---

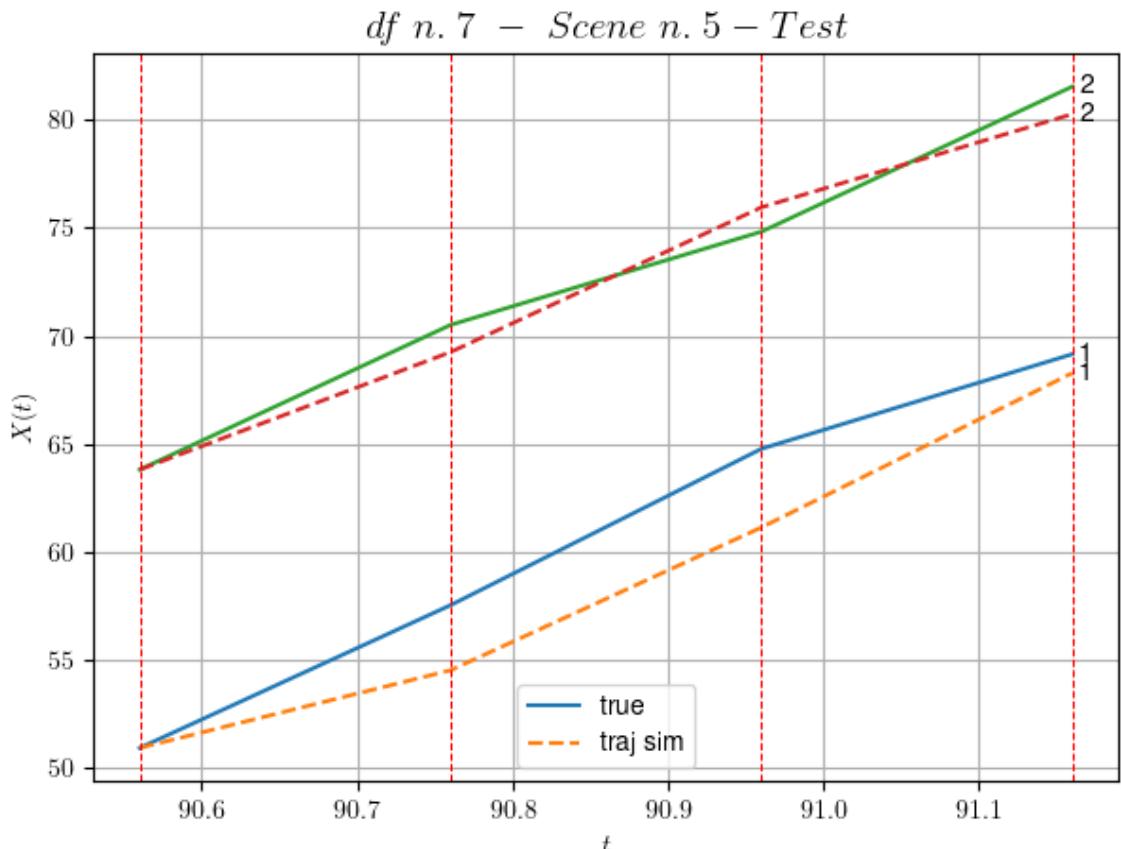
DataFrame n.7. Scene n.4/10



For scene 4/10:  
\* MSE = 0.8616977519219092

---

DataFrame n.7. Scene n.5/10

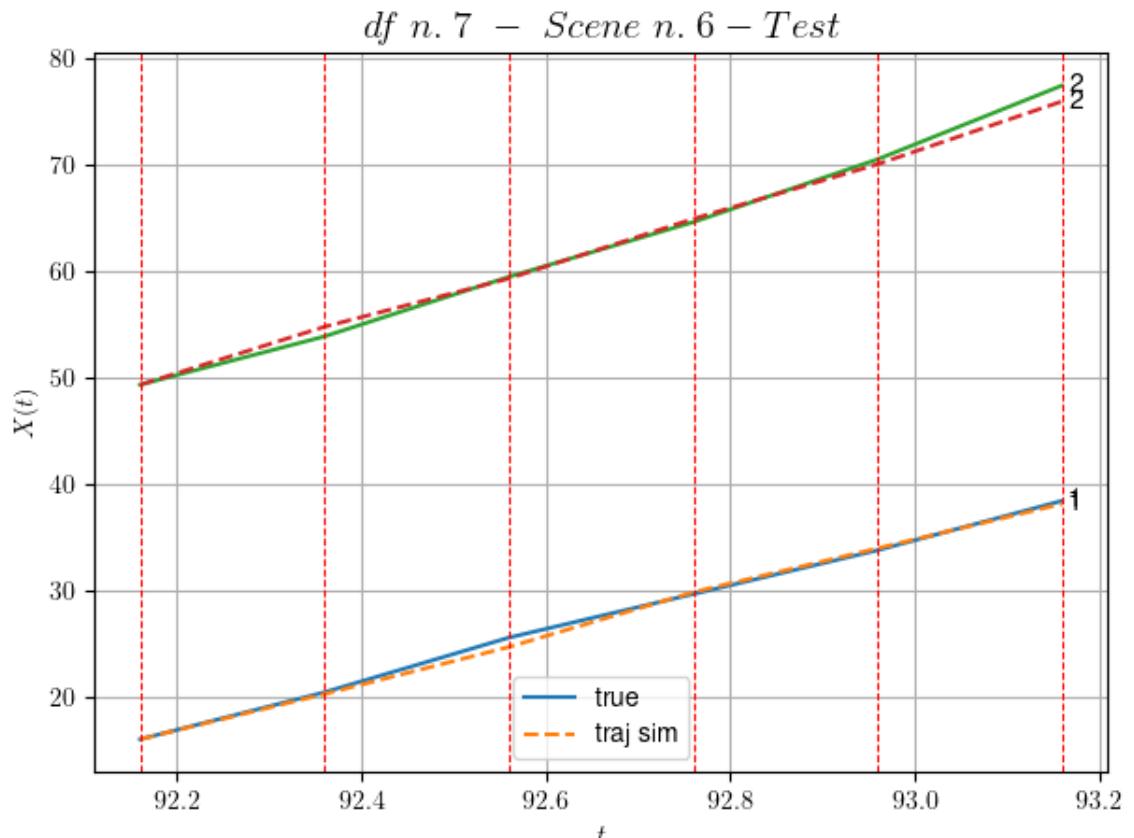


For scene 5/10:  
\* MSE = 3.4442852678350215

---

---

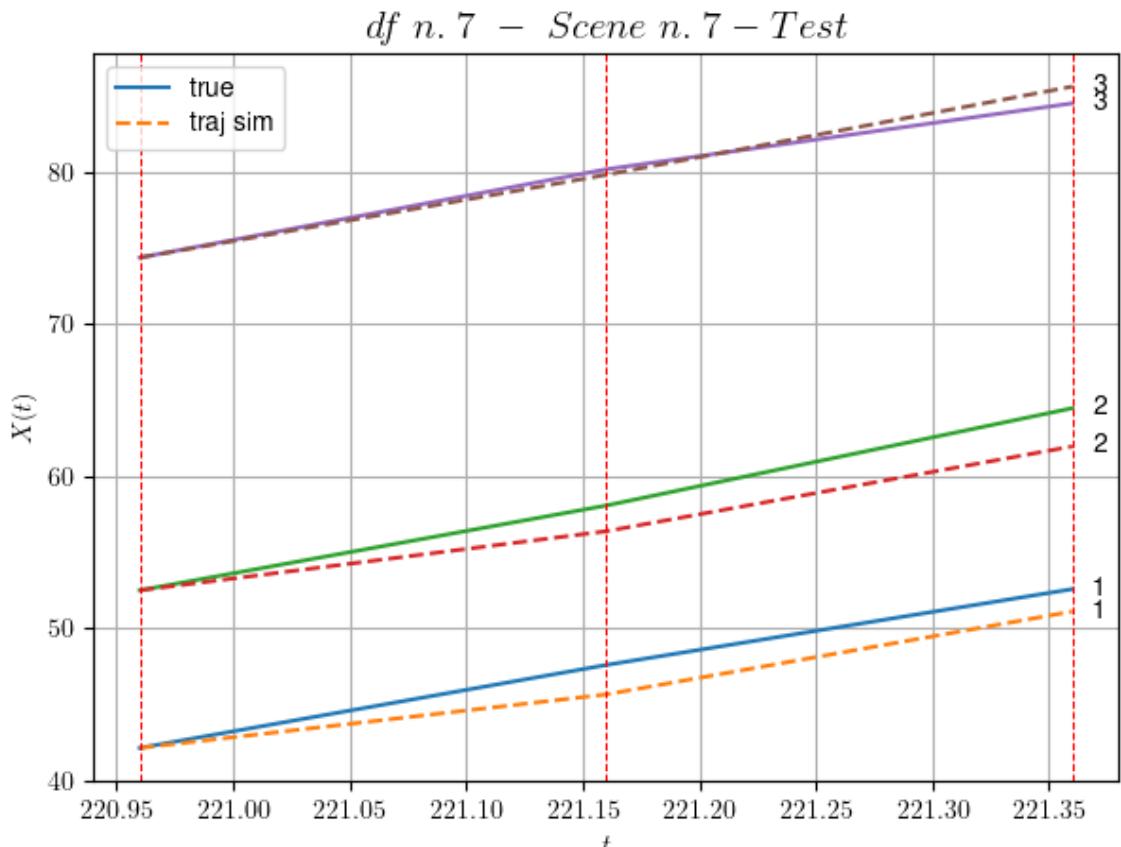
DataFrame n.7. Scene n.6/10



For scene 6/10:  
\* MSE = 0.3591905906769117

---

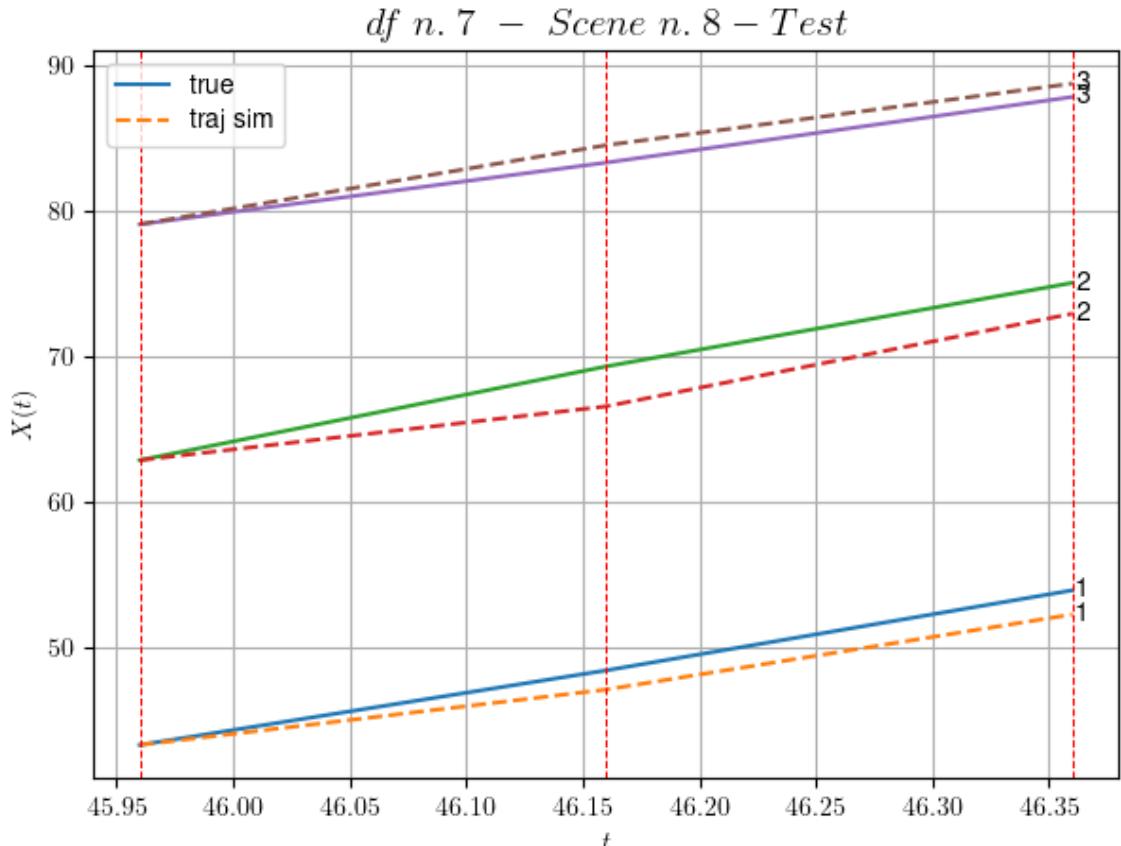
DataFrame n.7. Scene n.7/10



For scene 7/10:  
\* MSE = 1.8234191461710365

---

DataFrame n.7. Scene n.8/10

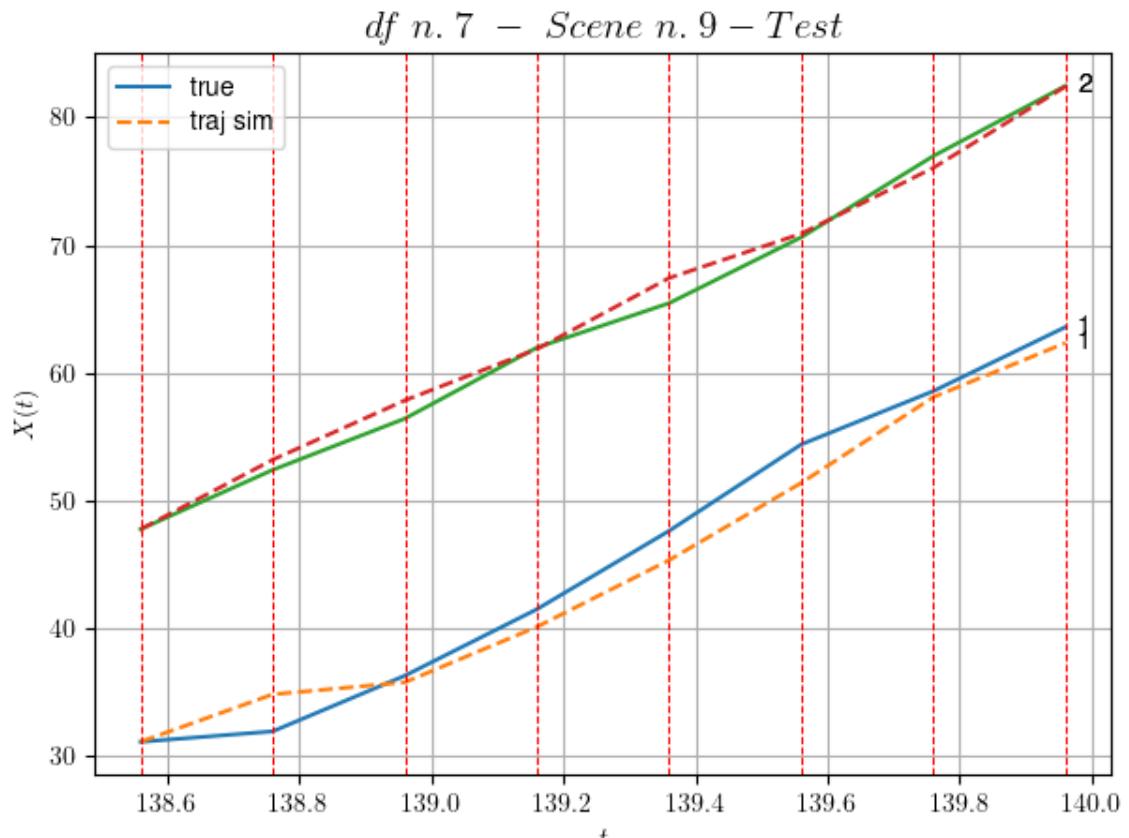


For scene 8/10:  
\* MSE = 2.0911354863337004

---

---

DataFrame n.7. Scene n.9/10

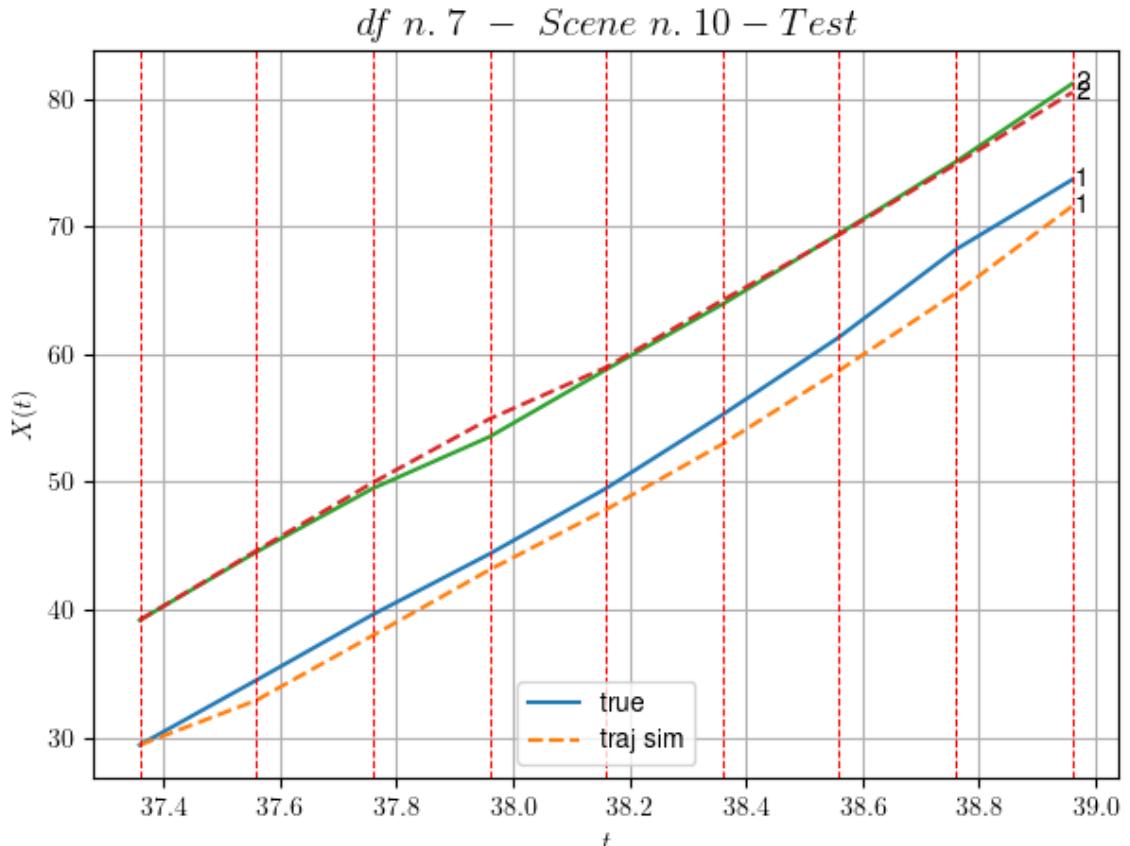


For scene 9/10:  
\* MSE = 2.1363073972550697

---

---

DataFrame n.7. Scene n.10/10



For scene 10/10:  
 \* MSE = 2.243264416527218

---



---

MSE test: 1.8703563389439453

---



---

Summing up:  
 \* MSE train: 0.544109902728033  
 \* MSE test: 1.8703563389439453

---



---

Analyzing 8/10 dfs.  
 In DataFrame n.8 we have 79 scenes.  
 To train the model we use 52 scenes, the remaining 27 to test the model.

Training step. (52 scenes)

---

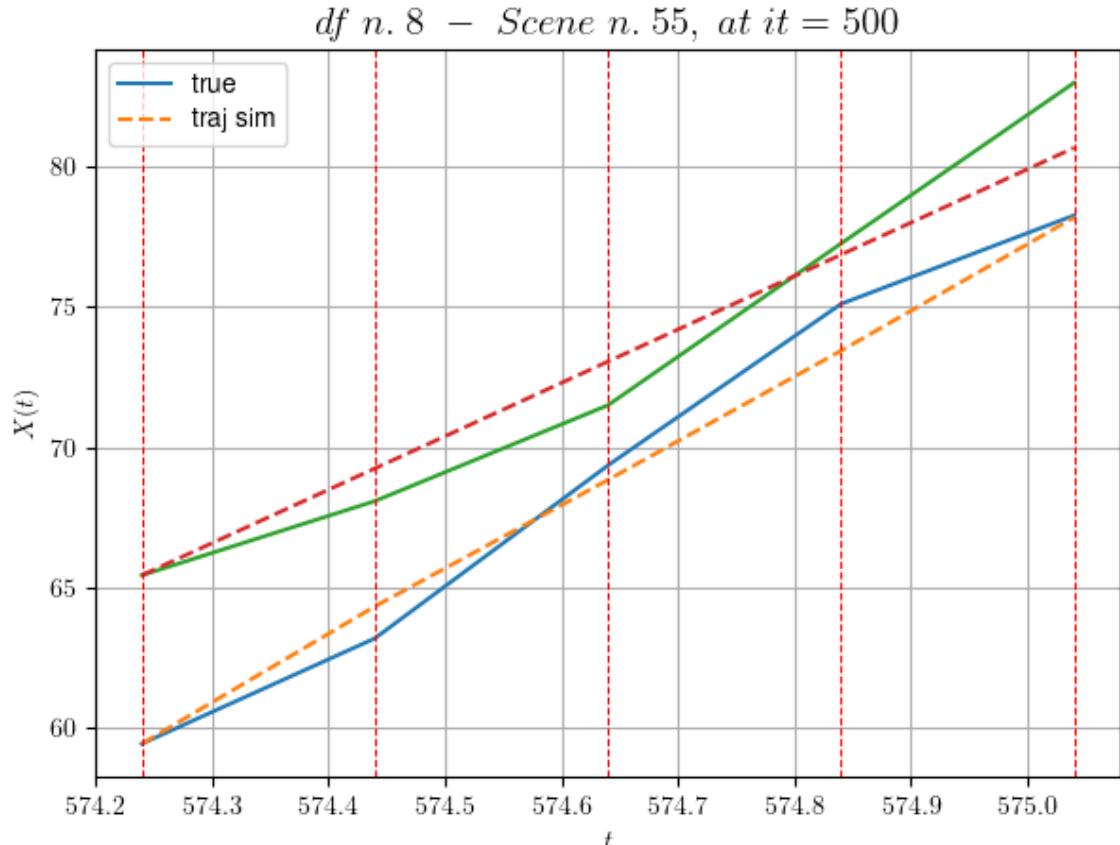


---

DataFrame n.8. Scene n.1/52

---

We have 4 time intervals inside [574.24, 575.04]



---

For scene 1/52:

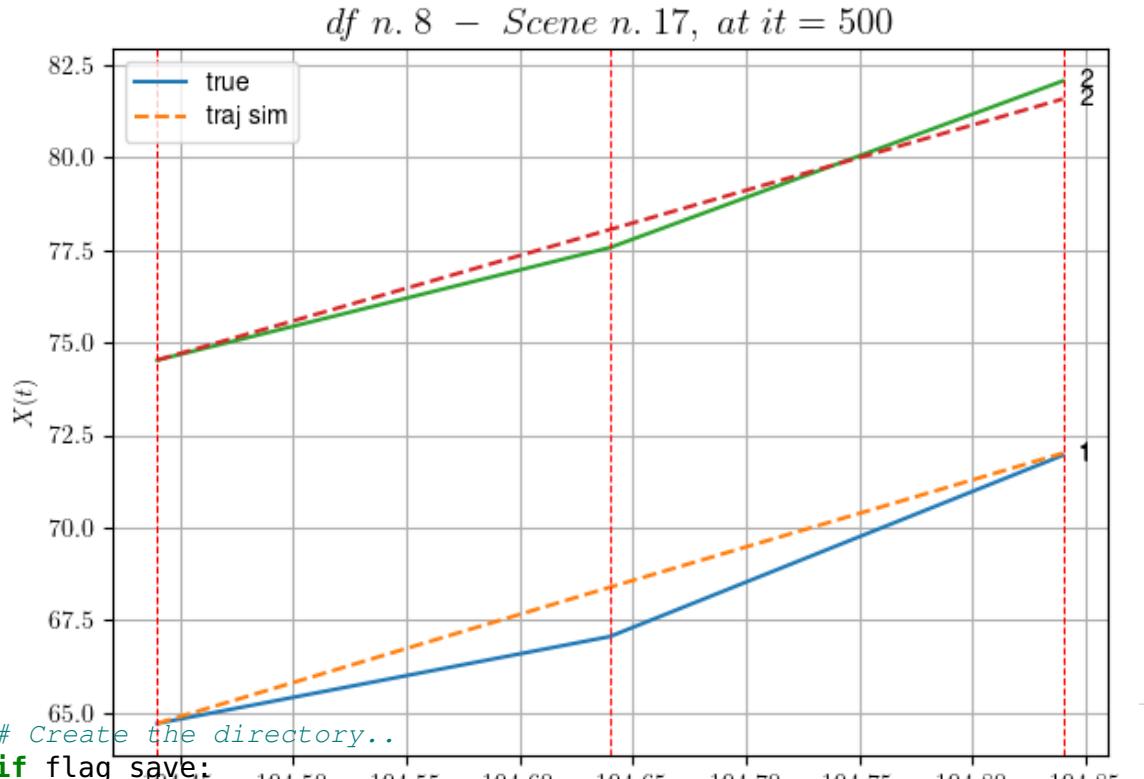
```
* After LR finder: LR_NN=0.001 with mse=14.15445818605144 at it=24
* v0 = 19.077749443551525
* MSE = 1.3712181401504313
* iterations = 500
```

---

DataFrame n.8. Scene n.2/52

---

We have 2 time intervals inside [194.44,194.84]



```
In [6]: # Create the directory..
if flag_save:
    df_seen = [df['N_file'][0] for df in dataset]
    df_seen_str = '-'.join(str(x) for x in df_seen)

    # Create directory where to save the image
    now = datetime.now()
    d = now.strftime("%Y-%m-%d-%H-%M-%S")
    df_seen_str = df_seen_str + '_' + d
    path = out_dir + df_seen_str + '_nn10'
    os.makedirs(path)
    iterations = 500

    # Save the solution in a file
    namefile = 'info_nn10.txt'

    with open(path + namefile, 'w') as output:
        DataFrame_n8_Scene_17.to_csv(path + namefile, sep=',', index=False)

    # Save model in a file
    We have 8 time intervals inside [458.64, 460.24]
    namefile_model = 'model_nn10.keras'
    model_trained.compile(optimizer='SGD', loss='MAE')
    model_trained.save(path + namefile_model) # The file needs to er
```







































































































































































































































































































































































